CHAPTER 2, ENVIRONMENTAL DESCRIPTION

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2.0 ENVIRONMENTAL DESCRIPTION

Chapter 2 describes the existing environmental conditions at the VCSNS site, the site vicinity, and the region. The environmental descriptions provide sufficient detail to identify those environmental resources that have the potential to be affected by the construction, operation, or decommissioning of the new units. The chapter is divided into nine sections:

- Site Location (Section 2.1)
- Land (Section 2.2)
- Water (Section 2.3)
- Ecology (Section 2.4)
- Socioeconomics (Section 2.5)
- Geology (Section 2.6)
- Meteorology, Air Quality, and Noise (Section 2.7)
- Related Federal and Other Project Activities (Section 2.8)
- Existing Plant Parameters (Section 2.9)

The standard for reporting elevations in the COLA is to use NAVD88 elevations. The difference between NAVD88 and NGVD29 elevations (the other system commonly used) is approximately 0.7 feet. Most of the elevations reported in Chapter 2 are for information only and may be rounded. Only in cases where precision is needed or where use of NGVD29 elevations is required (for example, to match permit limits) is the elevation system specified.

2.1 SITE LOCATION

SCE&G proposes to construct and operate two Westinghouse AP1000 reactors at the VCSNS site in Fairfield County, South Carolina. The two AP1000 reactors are referred to as Units 2 and 3 in this report.

Units 2 and 3 and supporting infrastructure would be sited in the area delineated in Figure 2.1-1. The centerline of Units 2 and 3 would be approximately 4,700 feet south and 1,800 feet west of the center of the existing Unit 1 containment building.

The center point between the Units 2 and 3 containment would be at latitude N34° 17’ 08” and longitude W81° 19’ 15”. In Universal Transverse Mercator, Zone 17 grid coordinates, the center of the reactor buildings is northing 3,793,856 and easting 470,479.

The VCSNS site is on the east side of the Broad River in western Fairfield County. The Unit 1 power block area circle (generating facilities and switchyard) is on the south shore of the Monticello Reservoir. Units 2 and 3 are approximately 1 mile south-southwest of Unit 1. An exclusion area, defined as the area within approximately 1 mile of Unit 1 combined with the area 3,390 feet from the center of Units 2 and 3 (the exclusion area boundary), would be posted and access to land portions of this area would be controlled. The current Unit 1 nuclear exclusion area boundary is not a perfect circle—its western axis is slightly longer (5,850 feet, or 1.11 mile) than its eastern axis (5,350 feet, or 1.01 mile) (SCE&G 1978). The exclusion area boundary represents the ultimate site boundary and encompasses approximately 2,560 acres. It includes the southern portion of the Monticello Reservoir and parts of the Fairfield Pumped Storage Facility. As described in Section 4.1, areas outside the ultimate site boundary would also be impacted by construction activities (Figure 2.1-1).

The VCSNS site is approximately 15 miles west of the Fairfield County seat of Winnsboro. The closest population center (*i.e.,* having more than 25,000 residents) to the site is Columbia, South Carolina, approximately 15 miles southeast of the VCSNS site (Figure 2.1-2). The closest community is Jenkinsville, approximately 3 miles southeast of the site (Figure 2.1-3).

Road access to the site is via County Road 311, which intersects with State Route (SC) 215 approximately 1.5 miles east of Unit 1 (Figure 2.1-3). A railroad spur runs to the site from the Norfolk Southern Transportation track from Columbia to Spartanburg (Norfolk Southern, undated). Figure 2.1-4 is an aerial photograph of the site.

Section 2.1 References

1. Norfolk Southern (Norfolk Southern Corporation) Undated. *Norfolk Southern Railway System in South Carolina.*

2. SCE&G 1978. *Virgil C. Summer Nuclear Station Operating License Environmental Report (Volume 1), Amendment 3,* Columbia, South Carolina, 1978.

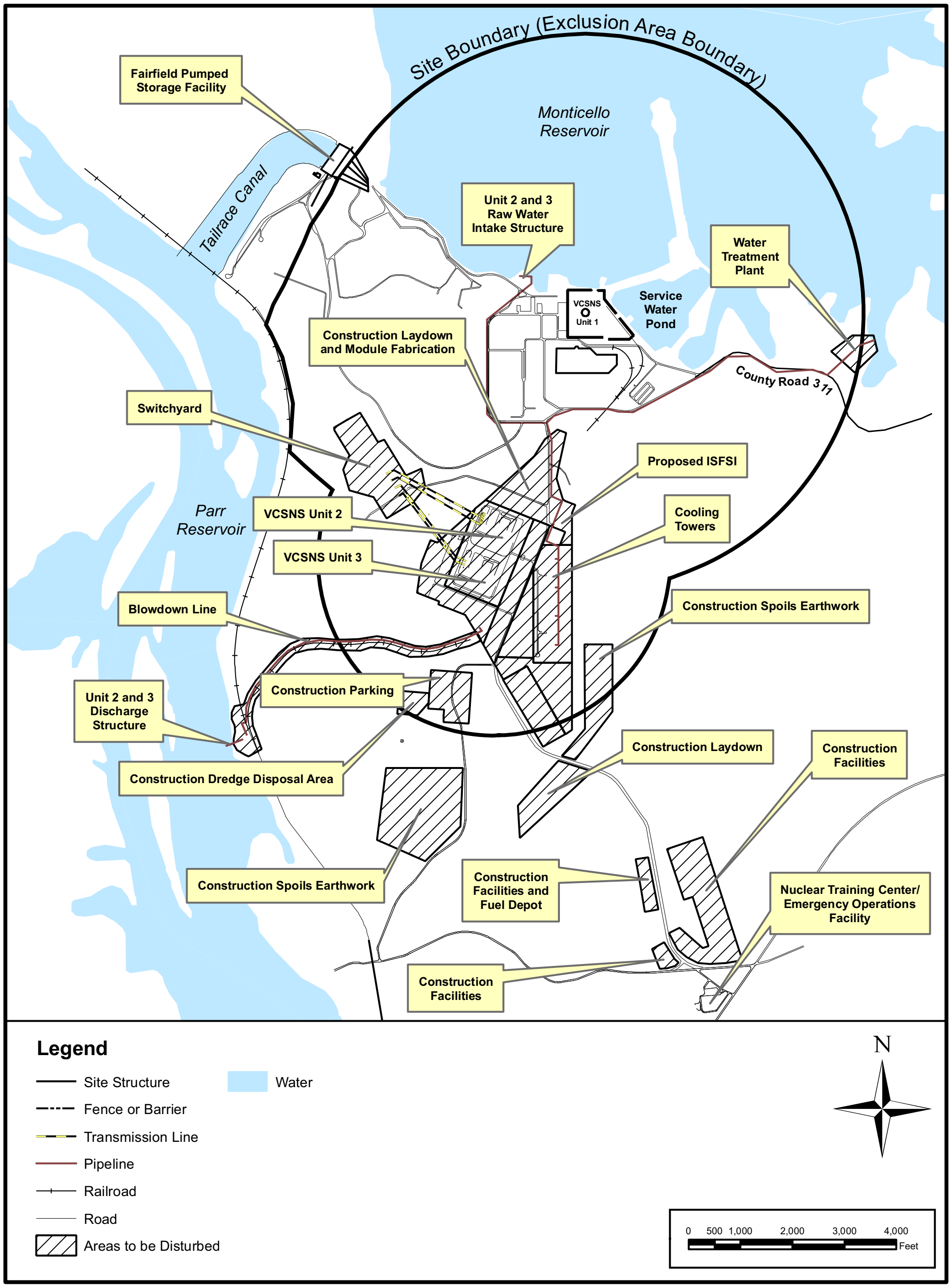

Figure 2.1-1. VCSNS Site and Proposed Plant Footprint

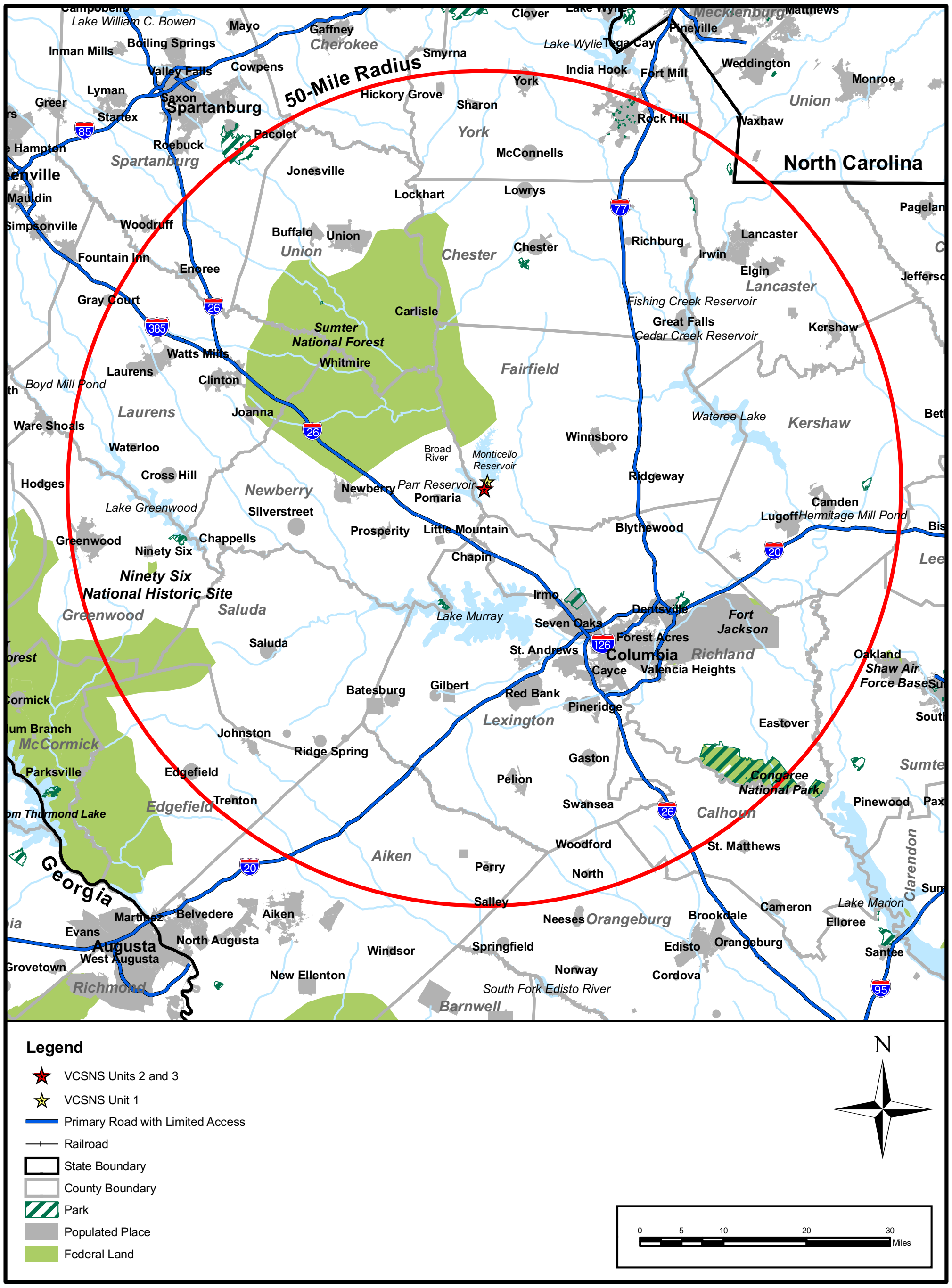

Figure 2.1-2. 50-Mile Vicinity

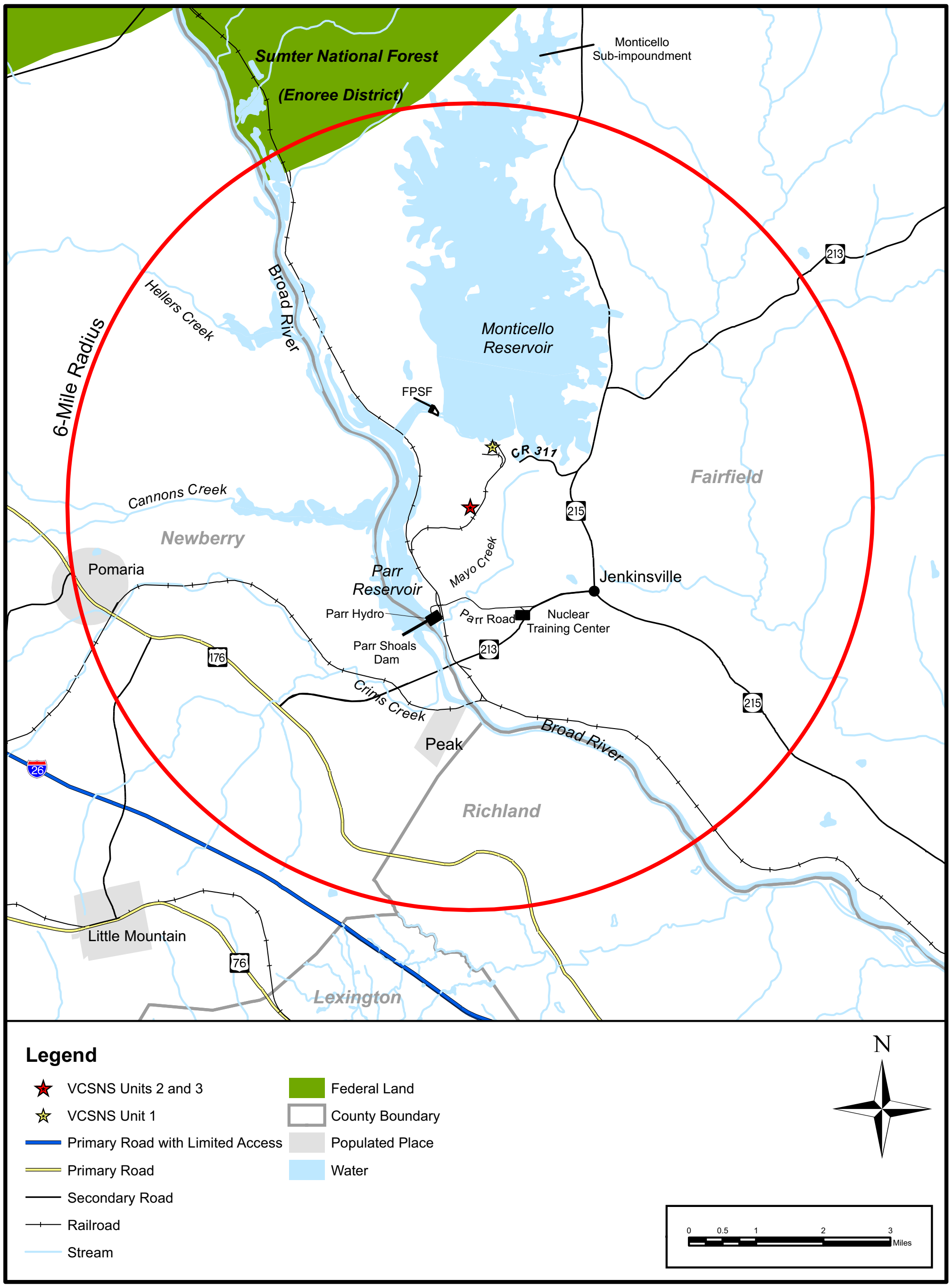

Figure 2.1-3. 6-Mile Vicinity

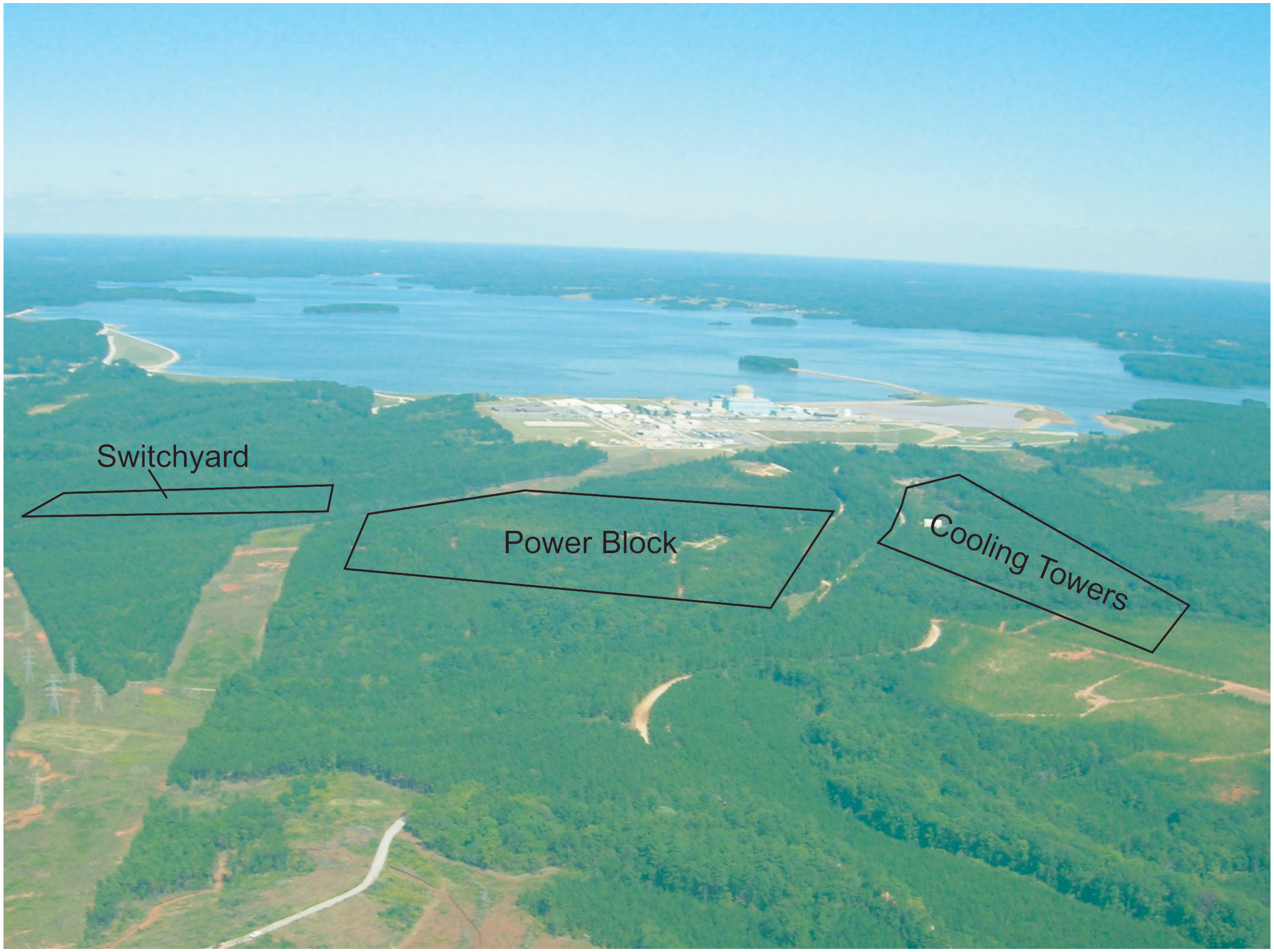

Figure 2.1-4. Oblique Aerial Photograph of VCSNS Site

2.2 LAND

An understanding of the land involved in the proposed project is essential to analyses on land use, ecology, and other disciplines in Chapters 4 and 5. Accordingly, this section describes the land characteristics of the VCSNS site and the vicinity, transmission corridors, offsite areas, and the region.

2.2.1 THE SITE AND VICINITY

2.2.1.1 The Site

The VCSNS site is defined as the approximately 2,560 acres within the site boundary (Figure 2.2-1) that include VCSNS Unit 1, the Fairfield Pumped Storage Facility, the southern portion of the Monticello Reservoir, and the location of the proposed Units 2 and 3; plus approximately 1,000 acres south of the site boundary. This additional land, for which the boundaries are not well defined, would be involved in construction activities (temporary facilities, laydown areas, and spoils disposal areas) or contain easements for the blowdown pipeline and the access road. It also contains the Nuclear Training Facility which houses the combined site Emergency Operations Facility (Figure 2.1-1). Total area for the site is approximately 3,600 acres.

Once the units begin operation, the site boundary would be identical to the exclusion area boundary depicted in Figure 2.2-1, which is the union of an approximate 1-mile radius circle (not an exact circle) centered on Unit 1 and a 3,390-foot radius circle centered on the proposed location for Units 2 and 3. The area within approximately 1 mile of Unit 1 is posted, and access to this area is controlled. SCE&G and Santee Cooper own the area inside the site boundary. As the majority owner, SCE&G controls all the land within the greater VCSNS site. SCE&G is the NRC-licensed operator for Unit 1. As described in Chapter 1, SCE&G has been authorized by Santee Cooper to act as their agent in applying for a COL for Units 2 and 3.

Based on geographical information system and aerial interpretation of the site using U.S. Geological Survey land use classifications, the largest use within the 2,560 acres enclosed by the site boundary is mixed forest, comprising 1,110 acres. Approximately 784 acres are covered by the waters of the Monticello Reservoir. A significant portion of the property (approximately 492 acres) consists of urban or built up land including: generation and maintenance facilities, laydown areas, parking lots, roads, mowed grass, and transmission line rights-of-way. Approximately 174 acres are classified as transitional areas that are barren land. Figure 2.2-1 illustrates the U.S. Geological Survey land use classifications on the VCSNS site. Table 2.2-1 tallies the site acreage by U.S. Geological Survey land use classification. Figure 2.1-4 is an oblique aerial photograph that provides a sense of site land use.

The topography of the site consists of low rolling hills carved by a creek and drainages with elevations ranging from approximately 560 feet to 210 feet above MSL(USGS 1969). The Mayo Creek crosses the VCSNS site from north to south and discharges below the Parr Reservoir. Streamside management zones at the site are protected in accordance with best management practices established by the South Carolina Forestry Commission (U.S. NRC 2004). No mineral deposits are actively mined within the VCSNS site (USGS 2005). The area is known to have deposits of clay, sand, and gravel (USGS 2003).

Forested areas within the VCSNS site are actively managed by SCANA Services' Forestry Operations group, and timber is occasionally harvested. Once timber is removed, the harvested areas are replanted with tree species appropriate to the terrain, soils, and drainage characteristics of a site.

No railroads, natural gas pipelines, or major waterways traverse the VCSNS site. A Norfolk Southern rail line runs along the east side of the Broad River just beyond the VCSNS site boundary. An existing railroad spur connects Unit 1 to this Norfolk Southern line. A natural gas pipeline serving the Parr Combustion Turbines is approximately 0.8 mile south of the site. In addition to the transmission corridors owned and operated by SCE&G (see Subsection 2.2.2), Duke Energy has two 230kV transmission lines in a right-of-way that traverses the site near the western boundary.

Access to Unit 1 is through County Road 311 (Ollie Bradham Boulevard) from SC 215 (north, south and east). Access and egress to the site by road is limited by the topographic features such as the Broad River to the west and the Monticello Reservoir to the north. SC 213 has a single two-lane bridge that crosses the Broad River and provides access and egress from the west to SC 215 and then to the site from the east.

The Broad River 100-year floodplain ranges from approximately 10 to 1,500 feet wide at the VCSNS site (FEMA 1982). The Broad River is not a wild and scenic river (NPS 2006). No prime farmland soils occur on the VCSNS site (AFT 1997). Fairfield County implemented its zoning regulations for new development in June 1999 (Stowers 2006a; Fairfield County 1997). The proposed VCSNS site will be subject to the zoning regulations.

2.2.1.2 The Vicinity

The VCSNS vicinity is roughly defined as the area within 6 miles of the site (Figure 2.1-3). It is located in the Piedmont Province. The vicinity occupies portions of Fairfield, Newberry, and Richland Counties and is rural, with a few homes and small farms, but much undeveloped land. The topography of the vicinity consists of low rolling hills with elevations ranging from approximately 560 feet to 210 feet above MSL(USGS 1999). The community of Jenkinsville is approximately 2 miles southeast of VCSNS (Figure 2.1-3). The town of Peak (population 61) is approximately 1.5 miles south and Pomaria (population 178) is approximately 7 miles to the west (SCBCB 2006).

Land uses within the vicinity are depicted in Figure 2.2-2. The largest land use type within 6 miles is forest. Approximately 56,700 acres is in forest land, followed by approximately 9,170 acres of water. Approximately, 4,460 acres of land is in agriculture and approximately 1,150 acres of land are urban or built up. The smallest land use types are barren land (approximately 467 acres) and wetlands (approximately 332 acres). Table 2.2-1 lists these land uses and acreages. The acreage figures are based on geographical information system and aerial interpretation of the site using U.S. Geological Survey land use classifications.

The 4,400-acre Parr Hydro Wildlife Management Area managed by the South Carolina Department of Natural Resources for public waterfowl hunting and fishing, is adjacent to the VCSNS site (SCDNR 2006). The Wildlife Management Area includes designated lands on the Enoree District of the Sumter National Forest, the Broad River (SC 34 to the dam at SC 16), and the Monticello and Parr Reservoirs. Camping is allowed on the Broad River within the Sumter National Forest. Other recreation activities such as boating, picnicking, and hiking can be enjoyed at select locations on the Monticello Reservoir, Parr Reservoir, and Broad River, and on the southern portion of Enoree District of the Sumter National Forest. Figure 2.1-3 shows the waterbodies and national forest land in relation to the proposed site.

As depicted on Figure 2.2-2, very few mineral deposits are actively mined in the vicinity of the VCSNS. In 2003, cement was the state's leading nonfuel mineral commodity, followed by crushed stone, construction sand and gravel, kaolin, industrial sand and gravel, and vermiculite. The closest actively mined mineral deposits are crushed stone and clay (USGS 2003). Between 1997 and 2003, the number of farms and acreage of farmland increased in both Fairfield and Newberry counties. During the same period, the number of farms and acreage of farmland decreased in Richland County. In Lexington County, the number of farms increased slightly, and the acreage of farmland decreased (USDA 2002).

Fairfield County has a comprehensive plan and established zoning classifications in 1999 (Stowers 2006b). The only industrial area within 6 miles other than VCSNS is Parr Hydro, which includes both Fairfield Pumped Storage Facility and Parr Hydro (Figure 2.2-2).

2.2.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

Existing transmission corridors (Subsection 2.2.2.1) are described, because some of the Unit 1 transmission lines may be reconnected to a new switchyard for Units 2 and 3 and proposed new transmission lines would be constructed in these corridors or adjacent to them to the extent practicable. Corridors for the proposed new transmission lines are not fully known, but termination points and counties traversed are presented in Subsection 2.2.2.2. Other than transmission corridors, there are no other offsite areas. SCE&G is considering a new combined site emergency operations facility because of considerations outside of the proposed action of this ER. This new facility could be located approximately 10 miles from the VCSNS site. The new facility is not further considered in this environmental report.

2.2.2.1 Existing Corridors

SCE&G has eight transmission lines and Santee Cooper has two transmission lines that connect the Unit 1 switchyard to the transmission system. All 10 lines operate at 230kV. There is also a line that connects Unit 1 to the 115kV transmission system. In addition, there are transmission corridors crossing SCE&G property at VCSNS that contain lines not connected to Unit 1. These is a Duke Power Company corridor running approximately northwest from Parr Hydro, and an SCE&G corridor running approximately northeast from Parr Hydro.

Beginning at the Unit 1 switchyard, the SCE&G transmission corridors generally run in a southerly direction, with four lines terminating near VCSNS, one near Edgefield, South Carolina, and three near Columbia, South Carolina. The Santee Cooper lines run approximately east and west to substations near Blythewood and Newberry, South Carolina, respectively. The following transmission lines occupy the SCE&G and Santee Cooper corridors (Figure 2.2-3).

- *VCSNS-Parr No. 1 and No. 2* — These two SCE&G lines occupy the same 240-foot corridor to the Parr Substation. The lines' lengths are each 2.3 miles. For approximately 0.5 mile, these lines share the corridor with SCE&G's Ward line and Santee Cooper's Newberry line.

- *VCSNS-Fairfield No. 1 and No. 2* — These two lines provide power to and from SCE&G's Fairfield Pumped Station Facility. The lines are 1 mile long and occupy a 170-foot, wholly owned corridor.

- *VCSNS-Lake Murray No. 1 (previously Edenwood)* — This 19.05-mile line connects Summer Station to the Edenwood Substation near Cayce, South Carolina, on the west side of Columbia. The line was built by SCE&G and occupies a 100-foot right-of-way. SCE&G has plans to reroute this line to a new Lake Murray Substation near the McMeekin and Saluda Hydro Stations at the Lake Murray dam. This rerouting will be independent of any proposed new reactors at the VCSNS site and will result in this line being renamed Summer-Lake Murray No. 1.

- *VCSNS-Pineland* — This SCE&G line provides power to the Pineland Substation 6 miles northeast of Columbia. The right-of-way width is 240 feet for the approximate 19 miles that the line shares the corridor with the Denny Terrace line and then a 100-foot corridor for the remaining 5.5 miles. Santee Cooper's Blythewood line parallels this line for approximately 17 miles.

- *VCSNS-Denny Terrace* — This SCE&G line to the Denny Terrace substation, 2 miles north of Columbia, follows the Pineland corridor for approximately 19 miles and then continues for approximately 7 miles in a 100-foot right-of-way. Santee Cooper's Blythewood line parallels this line for 17 miles.

- *VCSNS-Ward* — This SCE&G line provides power to the Ward Substation, near Edgefield, South Carolina. For the first 0.6 mile, it runs with the Newberry and Parr lines and then it parallels the Newberry line across the Broad River. For the remaining distance of the total 41 miles, it is the sole occupant of a 100-foot corridor.

- *VCSNS-Blythewood* — The Blythewood line is owned by Santee Cooper. It runs for approximately 23 miles, sharing the corridor with the Pineland and Denny Terrace lines for the first 17 miles. For the remaining 6 miles, it occupies its own 100-foot corridor.

- *VCSNS-Newberry* — This Santee Cooper line, which is approximately 17 miles long, provides power to the Newberry Substation. It follows the Ward line until the lines cross the Broad River after which it continues as the sole occupant of a 100-foot corridor.

In total, SCE&G and Santee Cooper have approximately 170 miles of transmission lines (120 miles of corridor) for Unit 1 that occupy approximately 2,060 acres of corridor. The corridors pass through land that is primarily rolling hills covered in forests or farmland. The areas are mostly remote, with low population densities. Land uses are presented in Table 2.2-2.

2.2.2.2 Proposed Transmission Corridors

The existing transmission corridors to the VCSNS site would continue to support the overall VCSNS site, but some of the Unit 1 transmission lines could be reconnected to a new switchyard for Units 2 and 3. SCE&G and Santee Cooper estimate that three additional 230kV lines would be needed for Unit 2, and three additional 230kV lines would be needed for Unit 3. However, the 16 transmission lines (existing and proposed) would be connected to the units in the most effective manner. Therefore, some of the new transmission lines could be connected to the Unit 1 switchyard. It is expected that some of the onsite corridors would be used differently than is currently done and some could be abandoned.

The specific routes for all six new lines would be determined using siting procedures developed by SCE&G and Santee Cooper that address land use, environmental impacts, and cultural resource impacts. These siting procedures are described in Subsection 4.1.2. The new transmission lines could be routed in the existing corridors described in Subsection 2.2.2.1 to the extent practicable. See Figure 2.2-4 for termination points and land uses in the affected counties.

- VCSNS-Killian — This SCE&G line would be routed to the vicinity of Winnsboro and then generally follow the I-77 corridor to connect to the existing Killian Substation near Killian, South Carolina, southeast of the plant and northeast of Columbia. The straight-line distance is approximately 34 miles.

- VCSNS-Flat Creek — This Santee Cooper line would connect to the existing Winnsboro Substation near Winnsboro, then to the existing

Richburg Switching Station near Great Falls, and finally to the existing Flat Creek Substation west of Lancaster, South Carolina. The sum of the lengths of these straight-line segments is approximately 66 miles.

- VCSNS-Lake Murray No. 2 — This SCE&G line would connect to the existing Lake Murray switchyard for the McMeekin and Saluda Hydro Stations near the eastern boundary of Lake Murray. The straight-line distance is approximately 23 miles.

- VCSNS-St. George — This double-circuit SCE&G line would connect to a new substation near St. George, South Carolina. The straight-line distance is approximately 86 miles.

- VCSNS-Varnville — This Santee Cooper line would connect to the existing Sandy Run Substation near Sandy Run, then to Orangeburg Substation in Orangeburg, then to the St. George Substation near St. George, and then to the existing Varnville Substation near Varnville, South Carolina, in Hampton County. The total straight-line distance is approximately 123 miles.

In addition to the transmission lines, SCE&G would construct three lines to connect the Unit 1 and Units 2 and 3 switchyards. Several existing transmission lines would need to be upgraded to distribute the additional power throughout the transmission system. These are identified in Table 2.2-3.

The new lines could require constructing new structures, moving existing structures, widening existing corridors, and/or constructing new corridors as determined by the siting process described in Subsection 4.1.2. SCE&G and Santee Cooper have determined the counties the lines likely would traverse. Land use in these counties, and those in which existing lines are upgraded, is presented in Table 2.2-4 and Figure 2.2-4. The land use impact analysis is addressed at a county level in Subsection 4.1.2.

2.2.3 THE REGION

All or parts of 22 counties (21 in South Carolina and one in North Carolina) are within 50 miles of the proposed VCSNS site (Figure 2.1-2). The 50-mile radius around the site is bordered by I-85 from Atlanta to Charlotte to the northwest, I-95 lies to the southeast, future I-73 from Roanoke, Virginia, to Myrtle Beach, South Carolina, lies to the northeast, and Savannah River is to the southwest. I-20, I-26, and I-77 each have mileage within 50 miles.

As a starting point in its evaluation, SCE&G reviewed impacts that Unit 1 construction and operation might have had on regional land use. During its review of Unit 1, NRC identified no regional land use impacts from construction or operation (U.S. NRC 1981). Similarly, the Federal Power Commission identified no regional land use impacts from construction and operation of the Parr Shoals Project, which included construction of the Monticello Reservoir and the Fairfield Pumped Storage Facility contemporaneously with Unit 1 (FPC 1974).

These findings are consistent with the conclusion that NRC reached in preparing its generic environmental impact statement for license renewal. The generic environmental impact statement includes the results of NRC case studies of impacts that construction and operation of seven nuclear plants had on offsite land use. Even for plants having large land use impacts (when cooling lake construction was included), land use impacts identified were limited to the site vicinity and those counties in the region that received the bulk of new residents and taxes (NRC 1996).

Therefore, Subsection 2.2.3 focuses on the four South Carolina counties: Fairfield, Newberry, Lexington, and Richland, where 95% of current Unit 1 employees reside (see Subsection 2.5.1). This is because most land use changes would be due to changes in tax revenues associated with new units at VCSNS, which would be limited to the county where the site is located (Fairfield), or population changes in counties where the greatest number of construction or operations employees lived (Fairfield, Lexington, Newberry, and Richland) (U.S. NRC 2004). These are also the same four counties that NRC analyzed for the Unit 1 construction and operation socioeconomic impacts (U.S. NRC 1981).

One additional aspect of regional land use pertinent to this ER is agricultural products that could be affected by severe accidents. Because of the narrow use of this information and the specialized manner in which it is used (input to computer modeling), SCE&G has included agricultural products in its analyses described in Section 7.2.

The state of South Carolina mandates that cities and counties have comprehensive land use plans. The following descriptions were taken from the Fairfield County (Fairfield 1997), Newberry County (Newberry 1998), Lexington County (Lexington 1999), and Richland County (Richland 1999) plans. Land use within 50 miles is depicted in Figure 2.2-5.

2.2.3.1 Fairfield County

Fairfield County contains approximately 687 square miles, making it the 18th largest county in the state. The largest land use category is forest, accounting for 87% of the total acreage. This includes public, commercial, and noncommercial forests, as well as farm woodlands. Non-forested land, including all urban or developed land, accounts for the remaining 13%. Surface water comprises 4% of the county and is represented by Lake Wateree, the Catawba River, Monticello Reservoir, the Broad River, and Parr Reservoir.

Approximately 3% of the forested land in the county is government-owned. The primary parcel is the Sumter National Forest, located in the northwestern part of the county. Privately owned forestland in the county is dominated by corporations, individuals, and the forest products industry. Only 6% of the forested land is owned by farmers, reflecting the continued decline in farming in Fairfield County since the Depression era. Table 2.2-5 provides more information about these land use patterns. Major parks, recreation, and conservation areas include: Lake

Wateree, the Catawba River, Monticello and Parr Reservoirs, Broad River, and Enoree District of the Sumter National Forest.

Developed urban land use represents less than 2% of Fairfield County. It is centered in and around the town of Winnsboro. Additional urban concentrations are found along the shores of Lake Wateree, in Ridgeway, in the Mitford community, and, to a lesser extent, around sections of the Monticello Reservoir and Jenkinsville. Elsewhere, development is characteristically sparse and rural characterizing the county's agricultural past.

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

During the 20 years since Unit 1 was constructed, Fairfield County has experienced minimal growth. The population increase from 1990 to 2000 was only about 0.5% per year. The county's economic base continues to be manufacturing, followed by government, industry, and services. Land use trends tend to be evolving with the nationwide movement away from agricultural production and toward a commerce built on the processing/production of goods and the distribution of services (U.S. NRC 2004).

2.2.3.2 Newberry County

Newberry County occupies approximately 631 square miles. According to the Comprehensive Plan for Newberry County, the land is characterized by a mixture of rural and urban uses including agricultural, residential, commercial, industrial, public and semiprivate uses, and vacant land. The Comprehensive Plan study was limited to the areas around the municipalities, the lake shores of Lake Greenwood and Lake Murray, the US-76 corridors between the town of Little Mountain and the city of Newberry, and portions of SC 773, 219, 34, and 121. The unincorporated portions of the county that fall outside the defined study area do not have land use regulations. Major parks, recreation and conservation areas include Lake Murray, Dreher Island State Park, Sumter National Forest, and Lake Greenwood.

Residential development is generally characterized by low- to medium-density single-family development. There are very few multifamily units in the unincorporated areas of the county. The option most selected for affordable housing is the manufactured home. The number of manufactured homes has increased dramatically since 1980. Most are located on individual lots, and more recently in subdivisions.

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

There is scattered agricultural use throughout the Comprehensive Plan study area; however, most of the prime agricultural land in the county is located outside the study area. There are a number of vacant lots inside and outside the study area. Most of these are located along the lake shores, where most of the neighborhood subdivisions have occurred.

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

2.2.3.3 Lexington County

Lexington County contains over 110,000 parcels located in an approximately 699-square-mile area. Farmland represents 21% of the land, as the county is a relatively strong agricultural center. However, Lexington County is encouraging the growth of residential areas by touting the quality of the school systems and the accessibility of resources. Overall, Lexington County has no specific “growth control” regulations or ordinances; however, it does have a blend of zoning styles, unrelated to growth control, that encourage a quality type of expansion characterized by a reduction in land allocations that are random and sporadic. According to the Lexington County Land Use Plan, land will continue to be available for development for a variety of uses for several decades. Major parks, recreation, and conservation areas include Lake Murray and Riverbanks Zoo and Garden.

2.2.3.4 Richland County

Richland County occupies approximately 756 square miles. Approximately 38% of the unincorporated portion of the county is developed, while the remaining 62% of the land in the county is undeveloped. The unincorporated portions of the county were divided into four separate planning areas and two subareas to facilitate planning. Major parks, recreation, and conservation areas include Congaree National Park, Harbison State Forest, Sesquicentennial State Park, Riverbanks Zoo and Garden, South Carolina State Museum, and The University of South Carolina’s Williams-Brice Stadium.

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

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

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

- Promote the idea of towns and villages — In rural areas; promote the development of compact, mixed-use development that has a distinct village edge and connection to the landscape.

- Continue preservation through the use of riparian corridors — The County Riparian Corridor network should be used to develop a sub-contiguous county-wide greenway system. The strategy is to define growth areas while preserving natural systems and rural landscapes.

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Table 2.2-1
Site and Vicinity Land Use Acreage

Land Use Category	Site	Vicinity
Urban or Built Up Land		
Residential	—	612
Commercial and Services	—	15
Industrial	492	492
Transportation, Communications and Services	—	33
Agricultural Land		
Cropland and Pastures	—	4,460
Forest Land		
Deciduous Forest	—	1,830
Evergreen Forest	—	3,780
Mixed Forest	1,040	51,000
Water		
Stream and Canals	—	773
Reservoir	784	8,400
Wetland		
Nonforested Wetlands	72	404
Barren Land		
Strip mines, Quarries and Gravel Pits-	—	125
Transitional Areas	174	342
Total	2,560	72,300

Source: U.S. EPA (1994)

Table 2.2-2
Major Land Use along Existing Transmission Corridors

	Land Use Categories[a]			
Corridor	**Agricultural**	**Forest**	**Industrial**	**Residential**
VCSNS-Parr No. 1 and No. 2				
Percent	—	59	41	—
Area (acres)	—	32	23	—
VCSNS-Fairfield No. 1 and No. 2				
Percent	—	38	31	—
Area (acres)	—	12	9	—
VCSNS-Lake Murray No. 1				
Percent	2.9	92	2.1	2.0
Area (acres)	7	218	5	4.8
VCSNS-Pineland				
Percent	5	93	2	0.1
Area (acres)	14	270	7	0.4
VCSNS-Denny Terrace				
Percent	2	91	3	2
Area (acres)	5	292	11	6
VCSNS-Ward				
Percent	37	58	3	—
Area (acres)	187	297	13	—
VCSNS-Blythewood				
Percent	2	95	2	0.05
Area (acres)	6	229	5	1
VCSNS-Newberry				
Percent	6	86	6	—
Area (acres)	12	179	12	—

(a) Other categories in smaller percentages that are not presented are water, wetland, and barren land.

Table 2.2-3
Proposed Upgrade to the Existing Transmission System

Unit 2 Upgrades
Increase conductor size for existing Denny Terrace-Lyles 230kV line
Increase conductor size for existing Saluda-McMeekin 115kV line
Increase conductor size for existing Lake Murray-McMeekin 115kV line
Increase conductor size for existing Lake Murray-Saluda 115kV line
Add a VCSNS-Winnsboro 230kV line with 230/69kV transformers at Winnsboro
Add a Winnsboro-Richburg 230kV line with 230/69kV transformers at Richburg
Add a Richburg-Flat Creek 230kV line
Unit 3 Upgrades
Connect the existing Canadys-Santee 230kV line to the St. George substation
Connect the existing Wateree-Summerville 230kV line to the St. George substation
Increase conductor size for existing Canadys-St. George 230kV line
Increase conductor size for existing St. George-Summerville 230kV line
Increase conductor size for existing Saluda-Georgia Pacific double-circuit 115kV line
Construct new 230kV switching station at St. George substation
Add a VCSNS-Sandy Run 230kV line with a 230/115kV transformer at Sandy Run
Add a Sandy Run-Orangeburg 230kV line with a 230/115kV transformer at Orangeburg
Add an Orangeburg-St. George 230kV line with a 230/115kV transformer at St. George
Add a St. George-Varnville 230kV line

Table 2.2-4
Major Land Use in Counties Affected by the Proposed New Transmission Lines

Corridor	Land Use Categories[a]			
	Agricultural	Forest	Industrial	Residential
Calhoun				
Percent	39.9	50.1	1.0	0.4
Area (acres)	100,000	126,000	2,460	1,070
Chester				
Percent	22.8	73.3	0.7	1.9
Area (acres)	85,600	275,000	2,720	7,140
Colleton				
Percent	22.2	42.2	0.6	0.7
Area (acres)	153,000	290,000	4,090	4,610
Dorchester				
Percent	20.7	47.8	0.9	1.8
Area (acres)	76,200	176,000	3,410	6,560
Fairfield				
Percent	10.7	83.8	0.5	1.3
Area (acres)	48,400	381,000	2,140	5,860
Hampton				
Percent	38.3	33.0	0.6	0.9
Area (acres)	138,000	119,000	2,180	3,070
Lancaster				
Percent	24.6	69.9	1.1	3.2
Area (acres)	87,500	248,000	3,860	11,400
Lexington				
Percent	21.3	60.0	2.4	6.0
Area (acres)	105,000	295,000	11,600	29,400
Orangeburg				
Percent	44.5	31.6	1.3	1.9
Area (acres)	321,000	228,000	9,350	13,300
Richland				
Percent	14.0	56.5	5.1	9.9
Area (acres)	71,300	287,000	25,900	50,500

(a) Other categories in smaller percentages that are not presented are water, wetland, and barren land.

Source: U.S. EPA (1994)

Table 2.2-5
Land Use in Fairfield County, 1997

	Acres	Percent of County Land
Total Area	438,425	
Forested Land (by ownership)	383,607	87
Public		
National Forest	11,560	3
Municipal, County, and State	478	<1
Private		
Forest Industries		30
Farms (farmers)		6
Corporation and Individuals		48
Nonforested Land	54,818	13
Developed (urban)	7,350	1
Water	15,416	4
Other	32,052	7

Source: Fairfield (1997)

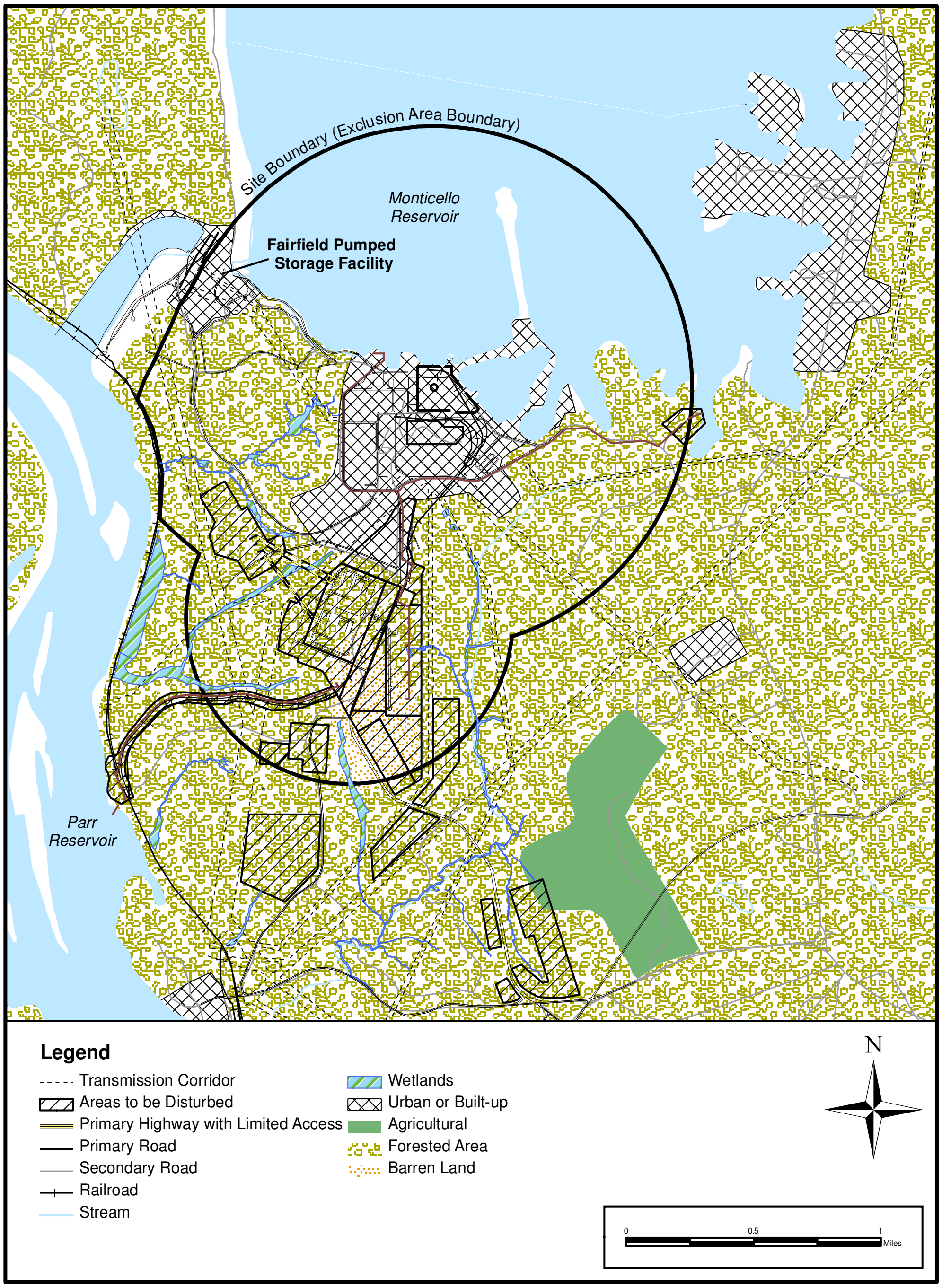

Figure 2.2-1. Land Use on the Proposed Site

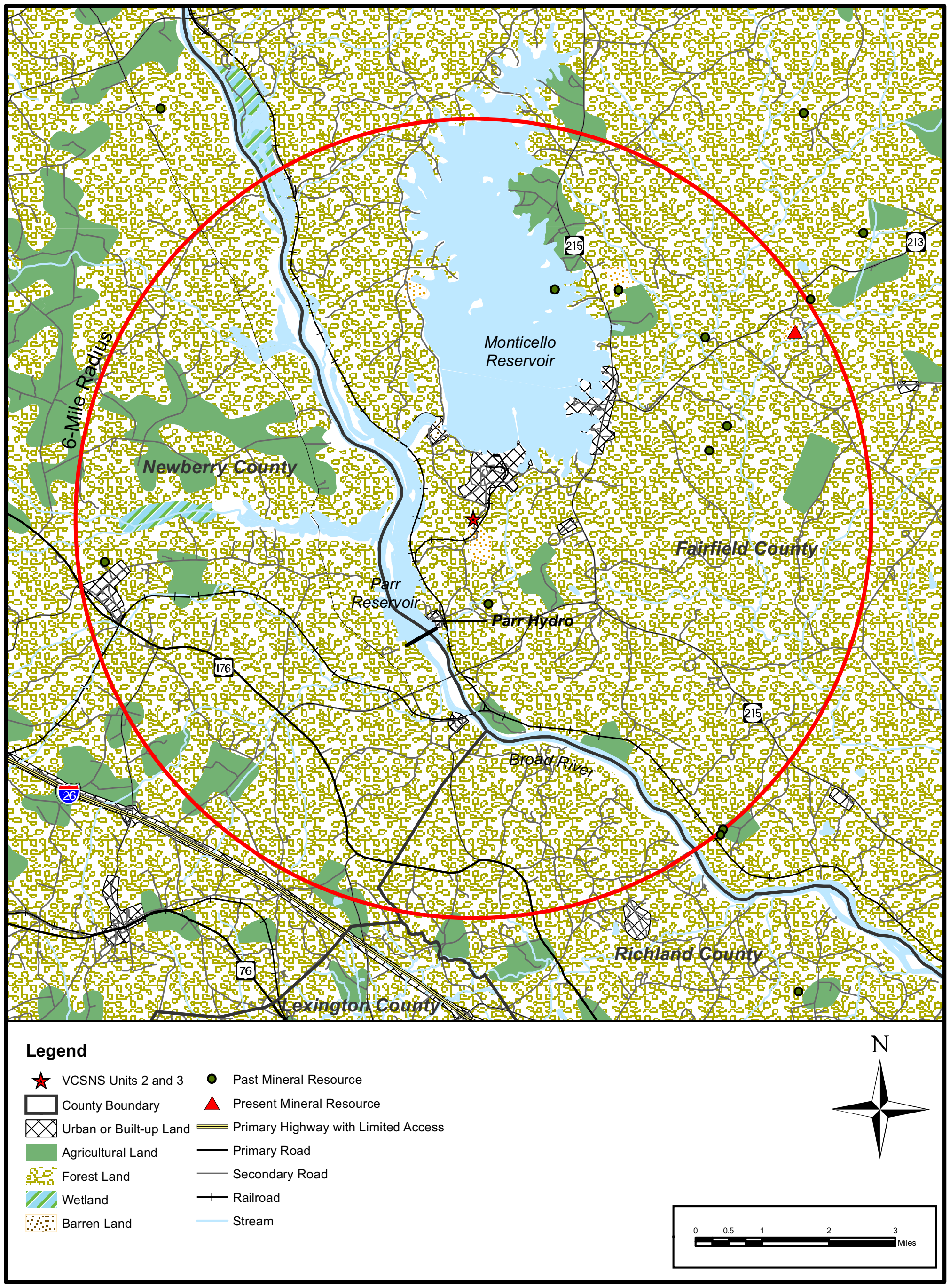

Figure 2.2-2. Land Use in the Vicinity of the Proposed Site

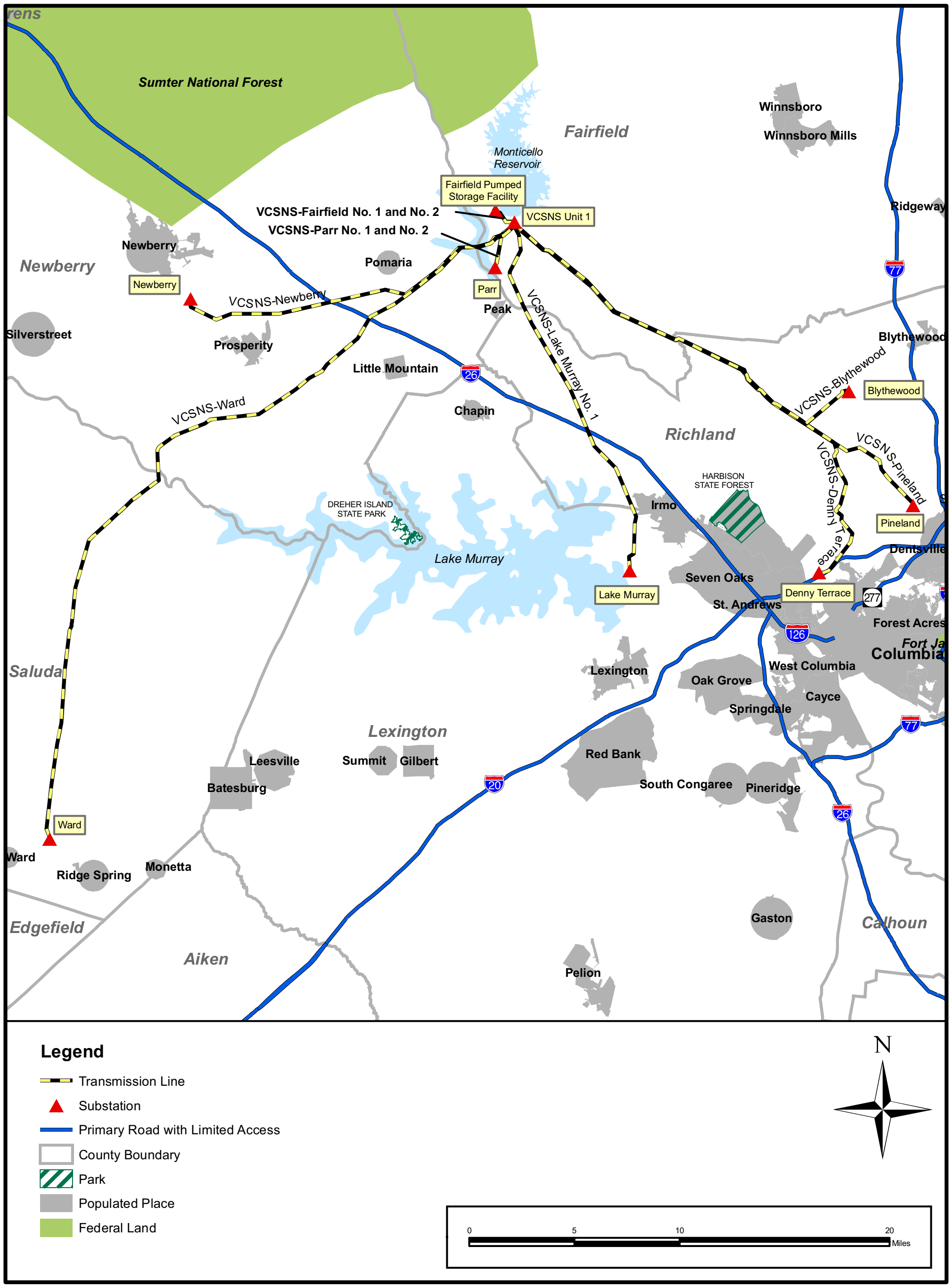

Figure 2.2-3. Existing Transmission System for VCSNS Unit 1

Figure 2.2-4. Land Uses in Counties Affected by the Proposed New Transmission Lines

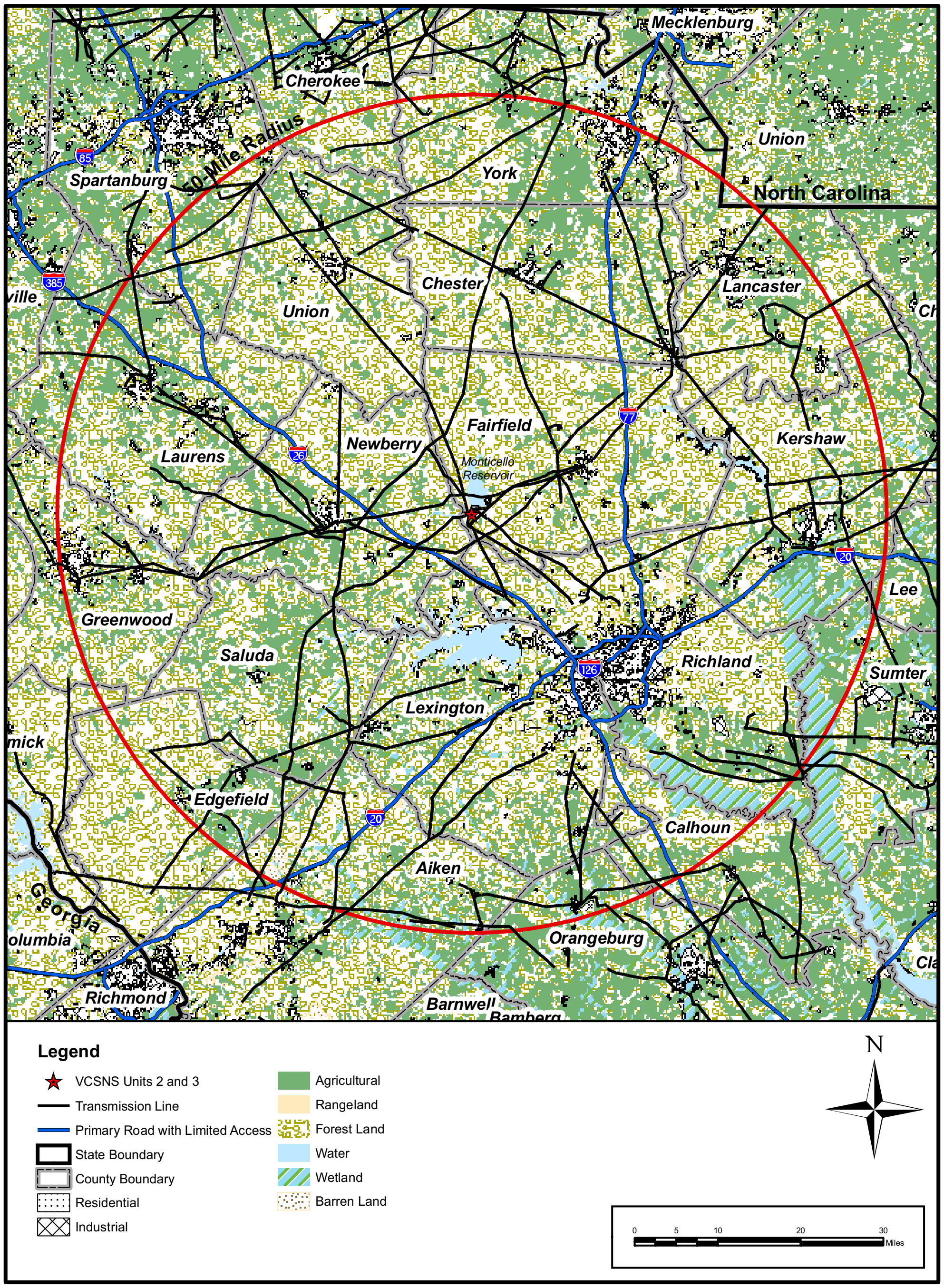

Figure 2.2-5. Land Use in the Region of the Proposed Site

2.3 WATER

This section describes the physical and hydrological characteristics of the VCSNS site and surrounding region that could affect or be affected by the construction and operation of two AP1000 units at the VCSNS site. The units will be referred to as Units 2 and 3. The potential construction and operational impacts of the project on near- and far-field water resources are discussed in Chapters 4 and 5, respectively.

Units 2 and 3 would be located in Fairfield County, South Carolina, approximately 1 mile east of the Broad River and 2 miles northeast of the Parr Shoals Dam. The site would be situated on a hilltop with a plant grade elevation of 400 feet NAVD88[a] (or 400.7 feet NGVD29), about 150 feet above the Broad River floodplain. The site is located near the Monticello Reservoir, which serves as the upper pool of the Fairfield Pumped Storage Facility and the source of cooling and makeup water for Unit 1.

2.3.1 HYDROLOGY

This subsection describes the surface water bodies and groundwater aquifers that could affect the plant water supply and effluent disposal or that could be affected by the construction or operation of Units 2 and 3.

2.3.1.1 Surface Water

Figure 2.3-1 shows the major hydrologic features within a 50-mile zone around the site. Figure 2.3-2 shows the topography at and around the site based on data from a recent aerial photogrammetric survey. Figure 2.3-3 shows in more detail the major hydrologic features within a 6-mile zone around the site.

2.3.1.1.1 Rivers and Streams

The Broad River flows in a northwest-to-southeast direction approximately 1 mile west of the proposed site of Units 2 and 3. The reach of the river near the site is impounded by the Parr Shoals Dam forming the Parr Reservoir. At the Parr Reservoir, the river is approximately 2000 feet wide, with depths ranging from a few feet to approximately 15 feet. The gradient of the Broad River near the site is about 0.0007. This is approximately the average gradient in the stretch of the Broad River between the confluence of the Enoree River, upstream of the site, and the Richtex U.S. Geological Survey (USGS) station, downstream of the site. The Broad River originates on the eastern slope of the Blue Ridge Mountains near Lake Lure in North Carolina, and drains an area of approximately 4,550 square miles upstream of Parr Shoals Dam. The drainage area of the Broad River is located between two southeast-northwest trending ridges stretching from

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a. At the VCSNS site, the difference between the NGVD29 datum and the NAVD88 is -0.696 feet. For example, EL 425 feet NGVD29 is equivalent to EL 424.304 feet NAVD88.

Columbia, South Carolina, to the headwaters of the river approximately 100 miles northwest in North Carolina. Figure 2.3-4 shows the Broad River watershed upstream of the site. 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 the Parr Reservoir. Many streams and creeks carry runoff and groundwater drainage to the Broad River. Rivers draining into the Broad River include the Enoree, the Tyger, and the Pacolet Rivers. Downstream of Parr Shoals Dam, the Broad River joins the Saluda River near Columbia, South Carolina, to form the Congaree River.

The average annual precipitation over the watershed of the Broad River upstream of Parr Shoals Dam is 45 inches with a runoff of approximately 17.8 inches, equivalent to a runoff volume over the entire watershed of 4.3 million acre-feet per year.

The USGS operates, or has operated, different gauging stream flow stations on the Broad River upstream and downstream of the Parr Reservoir. The three nearest stations to the site are located at Alston, Richtex, and Carlisle. Data from these three stations was used for the hydrologic evaluation of the Broad River near the site. Table 2.3-1 lists the key hydrologic data for the Alston, Richtex, and Carlisle gauging stations (Cooney et al. 2006, USGS 2006). Figure 2.3-4 shows the location of these stations.

The nearest downstream active stream flow gauging station on the Broad River is at Alston (USGS station 2161000), 1.2 miles downstream of Parr Shoals Dam. The Alston station has a contributing drainage area of approximately 4,790 square miles (Cooney et al. 2006), *i.e.*, about 5.2% greater than the drainage area of the Broad River at its closest point to the site. It has operated for 31 years. Stream flow measurements at this station began in October 1896; they were discontinued in December 1907, and started again in October 1980. The Alston station continues to operate to this date. The mean annual daily flow at Alston based on all available data from water years 1897–1907 and 1981–2005 is 6,302 cubic feet per second (cfs) (Cooney et al. 2006, p.224). The mean annual daily flow based on recorded flows from 1980 to 2003 is approximately 5,726 cfs. The highest annual mean flow on record was 11,750 cfs in 1903 and the lowest annual mean flow was 2,153 cfs in 2002. The annual seven-day minimum flow is 200 cfs recorded in August 2002. The maximum recorded mean daily flow was 130,000 cfs and the maximum peak flow was 140,000 cfs, both measured on June 7, 1903 (Cooney et al. 2006, p. 224).

The next nearest downstream gauging station on the Broad River is at Richtex (USGS station 2161500), located about 14 miles downstream of the Parr Shoals Dam. This station was discontinued in 1983. The Richtex station had a contributing drainage area of approximately 4,850 square miles (USGS 2006). The drainage area of the Richtex gauging station is about 6.7% greater than the drainage area of the Broad River at its closest point to the site. Stream flow data collected at this station exist from October 1925 to September 1928 and from October 1930 to September 1983. The mean annual daily flow for this period was approximately 6,155 cfs. The highest flood of record at Richtex had a peak discharge of 228,000 cfs, which occurred on October 3, 1929 (USGS 2006).

The nearest active stream flow gauging station on the Broad River upstream of the site is near Carlisle (USGS station 2156500), located approximately 21 miles upstream of the site. The Carlisle station has a contributing drainage area of approximately 2,790 square miles (Cooney et al. 2006, USGS 2006). It is located upstream of the confluence of the Tyger and Enoree Rivers with the Broad River. Its drainage area is approximately 39% smaller than the 4,550 square mile drainage area of the Broad River near the site. Historical data from this station cover a period of 68 years. Stream flow measurements at this station began in 1938 and continue to this date. The mean annual daily flow at this station from 1938 to 2005 was 3,880 cfs. The highest annual mean flow was 5,977 cfs in 1965 and the lowest annual mean flow was 1,255 cfs in 2002. The annual seven-day minimum flow was 220 cfs, recorded in August 2002. The maximum recorded mean daily flow was 114,000 cfs and the maximum peak flow was approximately 123,000 cfs, both measured on October 7, 1976 (Cooney et al. 2006).

Tables 2.3-2, 2.3-3, and 2.3-4 give the mean daily flow for each day of the year at Richtex, Alston, and Carlisle, respectively, based on the available flow data record at each station. Tables 2.3-5, 2.3-6, and 2.3-7 give the mean monthly flow at Richtex, Alston, and Carlisle, respectively, for all the years of record.

2.3.1.1.2 Historical Flooding and Peak Flows

The historical flow data indicates two flood seasons—one from January to April and the other from July to October. Floods during the latter period are generally associated with hurricanes and have usually been of greater magnitude than those occurring from January to April. Table 2.3-8 lists the major historic floods at Richtex and Alston gauging stations, their peak discharge rates and maximum water surface elevations, as well as estimates of the corresponding discharges and water levels at the Parr Shoals Dam. Discharges at the Parr Shoals Dam were estimated by multiplying the recorded flow values at Richtex and Alston stations by the ratio of the respective drainage areas.

Figure 2.3-5 shows the flood inundated areas delineated by the Federal Emergency Management Agency in the area near the VCSNS site (FEMA 1982). The map shows different flood-prone areas indicated as zones A, B, and C for flood insurance purposes. Zone A indicates areas of special flood hazard corresponding to the 100-year floodplain; zone B includes areas of moderate flood hazards, mainly representing the limits between 100-year flood and 500-year flood; and zone C areas of minimal flood hazards.

Figure 2.3-6 shows the flood frequency curve for the Broad River at the Parr Shoals Dam that was developed based on annual maximum flow data recorded at Richtex (1926 to 1983) and Alston (1984 to 2006) USGS gauging stations. Table 2.3-9 also presents the estimated flood frequency values at the Parr Shoals Dam for return periods of up to the 500-year event.

The peak probable maximum flood discharge for the Broad River watershed at the Parr Reservoir, with a drainage area of 4,750 square miles, was estimated to be equal to 1,109,520 cfs. The corresponding peak flood stage was calculated to be 25.5 feet above the top of the gates of Parr Shoals Dam, at EL 266 feet NGVD29 (or 265.3 feet NAVD88). The maximum probable maximum flood level is 265.3 + 25.5 = 290.8 feet NAVD88 (or 291.5 NGVD29).

2.3.1.1.3 Low Flows

Information on historic low flows is available at the Richtex (October 1925 to September 1983) and Alston (October 1980 to September 2003) gauging stations. The lowest observed daily mean flow at Richtex was 149 cfs on October 13, 1935, and on September 2, 1957. The lowest daily mean flow at Alston was 48 cfs on September 12, 2002. However, this value is not considered representative of natural river flows because it was influenced by the upstream flow diversion from the Parr Reservoir to Fairfield Pumped Storage Facility. Therefore, this value was not included in the low flow analysis. The next lowest flow at Alston was 156 cfs on August 13, 2002.

The *n*-day low flow for a stream is the average flow measured during the *n* consecutive days of lowest flow during any given year. Table 2.3-10 shows the 3-day, 7-day, 10-day, 30-day, 60-day, 90-day, 183-day, and 365-day average low flows for each year of record at Parr Shoals Dam.

The seven-day average low flow for the period 1929–2002 in the Broad River at Parr Shoals Dam was estimated to be 190 cfs on August 11-17, 2002. A low flow frequency analysis was performed on daily mean flows estimated at Parr Shoals Dam by plotting a best-fit curve through the annual low daily mean flows, which was extrapolated to obtain the 100-year daily mean low flow in the Broad River. This analysis showed that the 100-year daily mean low flow is about 125 cfs. A similar analysis performed on the annual minimum seven-day average flows produced the 100-year seven-day average low flow, estimated equal to 430 cfs.

An often used statistical measure of low flows is the 7Q10 low flow, defined as the lowest stream flow for seven consecutive days that occurs on average once every ten years. The USGS (USGS 2007) using the combined data at Richtex and at Alston, determined that the 7Q10 low flow at Alston is equal to 853 cfs.

2.3.1.1.4 Dams and Reservoirs

The nearest bodies of water to the site are the Parr Reservoir and the Monticello Reservoir, which serve as the lower and the upper pools, respectively, of the Fairfield Pumped Storage Facility.

The Parr Reservoir, located approximately 1 mile west of the proposed site for Units 2 and 3 on the Broad River, was created in 1914 by the construction of a dam on the Broad River at Parr Shoals, approximately 26 miles upstream of the confluence of the Broad and Saluda Rivers. The purpose of the dam was hydroelectric energy generation. Parr Hydro is a 15 MW run-of-the-river hydroelectric facility (SCE&G 2002a, p.2-3). In 1977, the level of the Parr Reservoir was raised by 9 feet with the construction of spillway crest gates mounted on top of the concrete portion of the dam, with a crest elevation of 266 feet NGVD29. This increased its surface area from 1,850 acres to approximately 4,400 acres. At EL 266 feet NGVD29, the Parr Reservoir extends approximately 13 miles upstream and has a usable storage capacity of 29,000 acre-feet. This modification was made as part of the development of the Fairfield Pump Storage Facility, which was built on Frees Creek, a small tributary to the Broad River. Figure 2.3-7 gives the elevation-area-capacity curves for the Parr Reservoir.

The retention time of the Parr Reservoir is about three days. This is based on a mean flow at Parr Shoals Dam of 5,334 cfs, estimated from flow data from the Alston station for the period October 1980 through September 2005, and adjusted by the ratio of the drainage areas at Parr Shoals Dam and Alston. The retention time varies with flow conditions in the Broad River. The range of this variability is 0.8 to 29.3 days, which was estimated based on maximum and minimum monthly flow values of 18,732 cfs to 541 cfs, respectively.

Average evaporation loss rate from the Parr Reservoir was estimated to be 50 acre-feet/day (25 cfs) based on pan evaporation data obtained from the South Carolina Department of Natural Resources (SCE&G 2007b). Seepage loss at Parr Shoals Dam is considered to be insignificant due to a relatively small hydraulic head across the dam.

Water flows out of the Parr Reservoir through the spillway and the turbines of the Parr Shoals Hydroelectric Project. The gated concrete gravity ogee spillway is approximately 2,000 feet long and 37 feet high and spans the Broad River between the non-overflow section on the east (left) and the earthen embankment on the west (right) ends of the dam. Ten bottom-hinged, bascule-type crest gates were added to the crest of the spillway to raise the Parr Reservoir approximately 9 feet, from EL 257.0 feet NGVD29 (or 256.3 feet NAVD88) to EL 266.0 feet NGVD29 (or 265.3 feet NAVD88). The spillway gates are operated by low-pressure hydraulic cylinders mounted on the downstream side of the spillway (SCE&G 2006a).

The Parr Shoals Hydroelectric Project originally had six sluice gates, located in the east section of the dam adjacent to the powerhouse. Two of the gate slots have been filled with concrete, the remaining four are not usable because of the level of siltation in the reservoir. The four unusable sluice gates are 9 x 9 feet with centerline EL 222.5 feet NGVD29 (or 221.8 feet NAVD88). There are no draft tube gates. The powerhouse has eight turbine bays. Six of the turbine bays have Francis-type turbines installed with a total authorized generation capacity of 14.88 MW, and the other two bays are empty with the original head gates being replaced with reinforced concrete arch walls. The intake passages of the six main units are 13 feet high and 25 feet wide with their centerline at EL 242.1 feet NGVD29 (or 241.4 feet NAVD88). The powerhouse also has two exciter turbine passages. The corresponding intake passages are 9.5 feet wide and 5 feet high, with their centerline at elevation approximately 250 NGVD29 (or 249.3 feet NAVD88) (SCE&G 2006a).

The hydrodynamic circulation in the Parr Reservoir is controlled by the incoming flow of the Broad River and the operation of the Fairfield Pumped Storage Facility. Under low flow conditions in the Broad River, the flow in part of the Parr Reservoir, between Parr Shoals Dam and the Fairfield Pumped Storage Facility, may be in the upstream direction during the night when the Fairfield Pumped Storage Facility pumps water from the Parr to the Monticello Reservoir. This flow pattern is reversed during the day when water from the Monticello Reservoir is released to generate power. No current measurements exist.

The Monticello Reservoir has a drainage area of approximately 17.4 square miles. It was formed by the Frees Creek dams, which include a main dam, referred to as Dam B, and three smaller saddle dams, referred to as Dams A, C, and D. These dams were constructed at the same time as Unit 1 and FPSF to create the Monticello Reservoir, which serves as the source of cooling water for Unit 1 and as the upper reservoir for the FPSF. The Monticello Reservoir is approximately six miles long, and has a surface area of approximately 6,800 acres and a storage volume of approximately 400,000 acre-feet at normal maximum water surface EL 425 feet NGVD29 (or 424.3 feet NAVD88). Figure 2.3-8 gives the elevation-area-capacity curves for the Monticello Reservoir. The average depth of the reservoir is 59 feet and its maximum depth is approximately 126 feet (SCDHEC, 1998). A part of the Monticello Reservoir, covering an area of approximately 300 acres, is used for recreational purposes. The maximum daily withdrawal for power generating purposes is 29,000 acre-feet, lowering the reservoir to EL 420.5 feet NGVD29 (or 419.8 feet NAVD88) and reducing the reservoir surface area to approximately 6,500 acres. Pumping during periods of off-peak power demand refills the reservoir. Operations vary, depending on the season and system needs. In the summer, the Fairfield Pumped Storage Facility generally pumps water from the Parr Reservoir to the Monticello Reservoir between the hours of 11 p.m. and 8 a.m. and generates power (by releasing water) between the hours of 10 a.m. and 11 p.m. In the winter, the Fairfield Pumped Storage Facility generally pumps water from the Parr Reservoir to the Monticello Reservoir between 11 p.m. and 6 a.m. and generates between the hours of 6 a.m. and 1 p.m. The level of generation varies from one generator up to the maximum output of eight, depending on demand. Maximum output may not be necessary on all days. Pumping is normally done at maximum capacity. The Fairfield Pumped Storage Facility normally operates seven days a week.

Average ambient evaporation from the Monticello Reservoir was estimated to be about 65 acre-feet/day (33 cfs) with an additional 44 acre-feet/day (22 cfs) latent evaporation from condenser water. The total evaporation rate of 55 cfs corresponds to an average daily evaporation loss of 109 acre-feet. There is no evidence of significant seepage from the Monticello Reservoir.

The main outlet of the Monticello Reservoir is the intake of the Fairfield Pumped Storage Facility. The approach channel of the intake is a flared, open concrete-lined channel 300 feet long with a maximum width of 260 feet and a minimum width of 132 feet. The intake structure is 265 feet long with a maximum width of 132 feet and a minimum width of 115 feet with an invert at 360 feet NGVD29 (or 359.3 feet NAVD 88). It has four 225-foot long water passages tapering in width from 30 feet wide by 50 feet high at the trash racks down to 17 feet 8 inches wide by 30 feet high at the gate sections. An enclosed 40-foot long section comprised of four 26-foot diameter concrete channels transitions to 26-foot diameter, 800-foot-long steel exposed surface penstocks. (SCE&G 2006a)

As a result of the Fairfield Pumped Storage Facility operations, the Parr Reservoir is subject to daily fluctuations in water level of as much as 10 feet, but the daily average is approximately 4 feet. These water level fluctuations can expose and then inundate again up to 2,550 acres of the Parr Reservoir with each cycle of pumping and generation (release of water). The amount of water pumped from and returned to the Parr Reservoir daily represents as much as 88% of its total volume. Similarly, Fairfield Pumped Storage Facility operations can cause water levels in the Monticello Reservoir to fluctuate as much as 4.5 feet daily, from 420.5 feet to 425.0 feet NGVD29 (419.8 feet to 424.3 feet NAVD88). Daily elevation changes vary, depending on system needs.

No systematic current measurements exist for the Monticello Reservoir. Near the Fairfield Pumped Storage Facility, intake flows are influenced by the operation of the storage facility, as water is discharged into the Monticello Reservoir during the night and withdrawn during the day. In the vicinity of Unit 1, flows are influenced by the operation of the cooling water intake and outfall.

In addition to the Parr and Monticello Reservoirs, a number of small reservoirs exist upstream and downstream of the site on the Broad River and its tributaries. These reservoirs are generally small, low-head dams for hydroelectric power generation and water supply. Most of these dams were constructed in the late 1800s and early 1900s.

The Monticello Reservoir will serve as the water supply for Units 2 and 3 (Figure 2.1-1). An intake structure will be constructed at the south end of the reservoir. The water outfall structure of Units 2 and 3 will be placed in the Parr Reservoir. Bathymetric surveys were conducted in 2006 in both reservoirs. Two areas were surveyed, a 1,000 by 1,000 feet area in the Monticello Reservoir in the vicinity of the water intake, and a 1,250 by 2,500 feet area in the vicinity of the outfall in the Parr Reservoir. Using a combination of hydrographic and topographic surveying techniques and procedures, three-dimensional data was acquired along transects spaced at 25 feet intervals in the intake area and at 50 feet intervals in the outfall area. Figure 2.3-9 shows the surveyed areas. The areas covered by the bathymetric survey near the intake structure are shown in Figure 2.3-9. The bathymetric contours for these two areas developed from the data collected during the surveys are presented in Figures 2.3-10 and 2.3-11.

2.3.1.1.5 Water Temperatures

The Monticello Reservoir serves as the cooling reservoir for Unit 1. Monthly water temperature profiles of Monticello Reservoir have been performed since 1991. Continuous temperature recording was conducted during the warmest months (July, August, and September) in the reservoir area of the circulating water intake from 1992 through 1994 (SCE&G 1994). Table 2.3-11 presents the daily water temperature data versus depths obtained near the plant circulating water intake during the summer months of 1994. The monitoring data collected in the summer of 1994 was compared with data from 1992 and 1993 to evaluate year-to-year reservoir conditions regarding vertical water temperature profiles. The result of comparison suggests the same pattern throughout the monitoring program that the reservoir in the area of the circulating water intake maintained a uniform temperature distribution from the surface to approximately 60 feet as a result of pumped storage activity (SCE&G 1994).

Since 1995, water quality (temperature, pH, conductivity, and dissolved oxygen) profiles were measured monthly at three locations in the Monticello Reservoir. Monthly water quality monitoring data from the years 1995, 1996, and 2006 was used to create figures and tables in this section (SCE&G 1995, SCE&G 1996, SCE&G 2007a). As shown in Figure 2.3-12, these locations are designated as "Uplake 16," "Intake 2," and "Discharge 6." These stations cover three major portions of the Monticello Reservoir:

- "Intake 2" – the area near the circulating water intake for Unit 1 that is influenced by pump back and generation operations of the Fairfield Pumped Storage Facility.

- "Discharge 6" – the area near the discharge canal that is influenced by the Unit 1 thermal discharge.

- "Uplake 16" – the northern end of the reservoir which is relatively unaffected, in terms of water quality, by either the Fairfield Pumped Storage Facility or Unit 1.

Tables 2.3-12 through 2.3-14 presents the monthly water temperature data versus depth at these three stations in the Monticello Reservoir for the years 1995, 1996, and 2006, respectively. Figures 2.3-13 and 2.3-14 show the vertical profile of water temperature for the coldest month—January—and the hottest month—August—for the year of 2006, respectively.

Water temperature data recorded at three USGS stations, Richtex (02161500), Alston (02161000), and Carlisle (02156500) on the Broad River is presented in Figure 2.3-15. This data covers the river reach that includes Parr Shoals Dam located close to Units 2 and 3. Aperiodic water temperature data was typically collected from these stations. For the Richtex Station (02161500), the available water temperature data is for the period from October 1959 to September 1960 and July 1972 to July 1973. For the Alston Station (02161000), the water temperature was recorded in November 1971 to July 1972. For the Carlisle Station (02156500), the water temperature record extends from year 1962 to 1975 except for the period of year 1965 to 1968. As shown in Figure 2.3-15, within this river reach, the minimum and the maximum recorded water temperatures were 38.3°F and 86°F, respectively, during the period from October 1959 to December 1975. Even though the data presented in the figure does not represent continuous daily records, it is indicative of water temperature in the river.

2.3.1.1.6 Erosion and Sedimentation

Sedimentation and erosion in the Broad River near Units 2 and 3 is a function of the sediment supply relative to the transport capacity of the river (Julien 1998, p. 204). While detailed measurements of the transport capacity of the Broad River have not been conducted, the potential for sedimentation and erosion near Units 2 and 3 may be assessed using previous reports, aerial imagery, and sediment samples from the Parr Reservoir. Most of the Broad River basin is located in the Southern Piedmont region, where hillside erosion increased dramatically in the 19th and early 20th centuries because of agricultural activities (Trimble 1994). However, erosion trends started reversing around 1920, and by 1967, erosion levels in the Southeastern Piedmont were only one-fifth to one-third of their peak levels (Trimble 1974). Data presented in the Broad Basinwide Water Quality Management Plan prepared in 1998 by the North Carolina Division of Water Quality Statistics suggest that there has been a statewide decline in erosion from 1982 to 1992 (NCDWQ 1998).

With respect to the availability of sediment supply, Table 2.3-15 lists the stations where sediment and other related water quality data are available from South Carolina Department of Health and Environmental Control (SCDHEC) Water Quality Monitoring Stations along the Broad River (U.S. EPA 2006). Figure 2.3-4 shows the locations of these water quality monitoring stations, as well as the locations of the USGS stream flow gauging stations. There is no information on bed load measurements at any of the six SCDHEC station locations or at any USGS gauges on the Broad River. Only two of the SCDHEC water quality monitoring stations (*i.e.*, B-047, which is located approximately 12 miles upstream of the Parr Shoals Dam, and B-046, which is located approximately 9 miles further upstream) have data on total suspended solids (mg/L) that could be used to calculate suspended load (tons/day). An order-of-magnitude estimate of bed load can be obtained using the globally averaged ratio of suspended load to bed load sediment flux for rivers of 9:1 reported by Syvitski, et al. (2003).

While data for water quality monitoring stations B-046 and B-047 includes entries from 1963 to present, only 74 records at B-046 and 26 records at B-047 of total suspended solids are reported between 1999 and 2005. This data is listed in Table 2.3-16 and Table 2.3-17 for B-046 and B-047, respectively. Daily flow values from the Carlisle gauge (USGS #02156500) and the Alston gauge (USGS # 02161000) are also presented in Table 2.3-16 and 2.3-17, respectively. The Carlisle gauge is about at the same river mile as station B-046 (Figure 2.3-4). The Alston gauge is about 13 miles downstream of station B-047. As shown in Tables 2.3-16 and 2.3-17, the suspended load is calculated using the total suspended solids and the corresponding flow values. The relationship between the suspended load and the flow rate is plotted in Figure 2.3-16.

The combination of a relatively large watershed at the Parr Shoals Dam (*i.e.*, about 4,790 square miles), high local rainfall (*i.e.*, about 45 inches per year), and hillslopes with a moderate erodibility factor (*i.e.*, 0.24) (SCDHEC, 2007) has led to relatively high suspended solids loads in the Broad River (Figure 2.3-16). The high turbidity of the Broad River has been noted in several recent water quality reports (*e.g.*, NCDWQ 1998, SCDHEC 2001). In addition, data collected in the Upper Broad River (B-042 and B-044) has shown increasing turbidity (SCDHEC 2001, p. 15), suggesting the sediment supply may be in a state of disequilibrium (*i.e.*, changing with time).

With respect to the transport capacity of the Broad River, aerial imagery of the Broad River (Figure 2.3-17) upstream of Units 2 and 3 indicates the local geomorphology is comprised of anabranching islands (*i.e.*, locations where primary and secondary channels separate and subsequently reconnect) and localized depositional bars along the channel banks (Schumm 1985). The river channel has relatively little meandering indicating a relatively stable plan form. While the slope of the Broad River is relatively steep (0.06%) relative to the peak flood discharges at the Carlisle and Alston gauges (Table 2.3-8), the Broad River near VCSNS is a predominantly aggradational regime (*i.e.*, sediment supply exceeds transport capacity) due to the presence of the Parr Shoals Dam. As noted in Parker (2007, p. 7), “the installation of a dam on a river typically blocks the downstream delivery of all but the finest sediment, creating a pattern of bed aggradation upstream. The dam raises base level, *i.e.*, the downstream water surface elevation to which the river upstream must adjust, forcing upstream-migrating deposition. This deposition is most intense near the delta at the upstream end of the reservoir. As a result, the effect is to intensify the upward concavity of the long profile of the bed upstream of the dam. The more sharply declining bed slope intensifies selective transport of fine material, setting up strong local downstream fining.” As a result, “the river bed often aggrades upstream of the dam and degrades downstream” (Parker 2007, p. 3). The backwater effects of the Parr Reservoir extend upstream by about 13 miles (Figure 2.3-17).

Several boring samples in the Parr Reservoir were taken by SCE&G in January 2007 for the possibility of dredging the reservoir (Figure 2.3-18). The sediment gradations are summarized in Table 2.3-18, and are predominantly comprised of (1) clay and clay-silt fractions and (2) sand and sand-silt fractions (*i.e.*, $0.002<D_{50}<0.409$ mm; where D_{50} is the median grain size of the sample) (Figure 2.3-19). Two of the 16 samples included gravel fractions. While these gradations are relatively fine relative to the transport capacity of the river, the high sediment load suggests future dredging will be necessary in the Parr Reservoir to preserve the longitudinal profile.

No bed load sediment transport measurements have been reported for any reach of the Broad River and cannot be easily estimated as a fraction of the suspended load because the portion of sediment that moves as bed load varies widely between rivers and on the same river over time (Keyes and Radcliffe 2002).

2.3.1.1.7 Wetlands

Wetlands within approximately a mile and a half of Units 2 and 3 site are associated with several small streams draining to the Broad River. The mapped wetlands are shown in Figure 2.3-20. Riparian wetlands have been identified along the two unnamed creeks to the north and to the south of Units 2 and 3, as well as along other small streams. Most of these streams are dry part of the year.

With the exception of a few beaver ponds, there are no natural or man-made ponds at the site or within a mile and a half of Units 2 and 3.

2.3.1.2 Groundwater Resources

2.3.1.2.1 Regional Hydrogeology

The region within a 200 miles around the Units 2 and 3 site encompasses parts of four physiographic provinces. These include, from west to east, the Valley and Ridge, Blue Ridge, Piedmont and Coastal Plain physiographic provinces. These provinces are defined on the basis of physical geography and geology. Figure 2.3-21 shows the aquifer systems associated with these provinces. Figure 2.3-22 is a schematic cross section view of these provinces. Although Figure 2.3-22 includes the Appalachian Plateau province, groundwater conditions in this province will not be addressed because of its distance from, and lack of influence on, the site. This figure shows a sharp change in topographic slope that defines the boundary between the Blue Ridge and Piedmont provinces. These provinces, however, exhibit essentially the same aquifer system characteristics and are considered together in the description provided below. Groundwater occurrence is of significance to the site of Units 2 and 3 only within the Piedmont physiographic province. However, brief discussions of groundwater within the other provinces within 200 miles of the site are presented below to provide a more complete picture of regional hydrogeologic conditions.

The Valley and Ridge aquifer system lies within the Valley and Ridge physiographic province about 190 miles west of the site (Figure 2.3-21). This aquifer is composed of Paleozoic-age folded and faulted sedimentary rock. Carbonate and sandstone layers form the principal aquifers in the system. The carbonate rocks, mainly limestone, generally form most of the more productive aquifers and underlie valleys within the province. Most of the groundwater flow is in the fractures and dissolution features in the folded and faulted strata. Typical well yields are from 10 gpm in sandstone formations to 10 to 50 gpm within the limestone units. Locally high yields are possible within highly fractured strata or solution cavities (Miller 1990).

The Piedmont and Blue Ridge physiographic provinces exhibit essentially the same aquifer system characteristics. The aquifer system associated with these provinces is combined and referred to as the Piedmont and Blue Ridge aquifer system. This system lies beneath the site and to the north and west of the site. The Piedmont and Blue Ridge provinces are composed of metamorphic rocks with igneous intrusions and overlying saprolite or residual soil with alluvial deposits along stream valleys. Groundwater occurs in the fractured portions of the bedrock and within the saprolite and alluvium. Well yields are generally low within this aquifer system (6 to 28 gpm) and mainly depend on the local fracture density of the bedrock. Localized large yielding wells are possible and are dependent on the geologic unit present and the surrounding geologic structure. Large yields of groundwater can be found in carbonate strata due to dissolution by the groundwater, which creates larger openings that allow greater flow and/or storage. (Miller 1990)

The Southeastern Coastal Plain aquifer system is the aquifer system associated with the Coastal Plain physiographic province (sometimes referred to as the Atlantic Coastal Plain physiographic province). This province lies approximately 15 miles south and east of the site. The divide between the Piedmont and Coastal Plain physiographic provinces is defined as the Fall Line. The Coastal Plain province is further divided into the Upper and Lower Coastal Plain as shown on Figure 2.3-21. The geology of the Coastal Plain province is characterized by aquifers developed in layers of sands, silts or high-permeability limestone confined by units of clay and silts or low-permeability limestone (Childress and Butler 2006).

Most of South Carolina's groundwater resources are within the Coastal Plain. In general, reliance on groundwater for irrigation, industrial uses, and public water supply increases dramatically east of the Fall Line (Figure 2.3-21) (Childress and Butler 2006).

Within South Carolina, the aquifers that make up the Southeastern Coastal Plain aquifer system include the Surficial Aquifer, Tertiary Sand/Limestone Aquifer, the Black Mingo Aquifer, the Black Creek Aquifer, the Middendorf Aquifer and the Cape Fear Aquifer as indicated in Figure 2.3-23 (Miller 1990).

2.3.1.2.2 Local Hydrogeology

The area within 6 miles of the site lies within the Piedmont and Blue Ridge Aquifer system within the Piedmont Physiographic Province (Figure 2.3-24). The bedrock underlying the site area principally consists of Paleozoic crystalline metamorphic and igneous intrusives of the Carolina Zone.

The metamorphic and igneous rocks weather to overburden soils of clayey, silty, and sandy composition. The character of the overburden is related to the type of bedrock and degree of weathering. The overburden thickness is up to 100 feet or more, but varies considerably from place to place (Miller 1990).

Groundwater in the site area occurs in two types of formations: (1) jointed and fractured crystalline bedrock, and (2) lower zones in the residual soil overburden (Figure 2.3-25). Recharge to these formations is principally by infiltration of precipitation falling on the upland areas (Figure 2.3-25). Some of the water infiltrating the surface soil evaporates, transpires from plants, or reemerges at the surface downslope at short distances from points of infiltration. A small portion of the water percolates to perched water zones, or deeper into the water table in the lower soils and the underlying jointed bedrock. The groundwater table, in general, follows the land surface but with more subdued relief. Groundwater discharges as visible seeps and springs and/or percolates through the ground into creeks and streams. Some groundwater is discharged via wells, but the amount pumped is very small because the formations generally are not pervious enough to sustain well yields greater than a few gallons per minute.

2.3.1.2.3 Site Hydrogeology

The hydrogeology of the site of Units 2 and 3 is consistent with the hydrogeology of the Piedmont Physiographic Province. Based on the interpretation of the data from the field investigation (MACTEC 2007), it was determined that the hydrogeologic profile consists of two hydrogeologic zones. These zones are the saprolite/shallow bedrock hydrostratigraphic zone, which is primarily a water table aquifer, and the deep bedrock hydrostratigraphic zone, where groundwater occurs within fractures in the bedrock. Recharge to the saprolite/shallow bedrock zone occurs locally from surface deep infiltration. There are no studies of groundwater recharge rates in the vicinity of the Units 2 and 3 site. However, there are multiple studies of groundwater recharge rates for the Savannah River Site, located about 75 miles to the south-southwest of VCSNS. Even though the Savannah River Site is located in the Costal Plain physiographic province, while VCSNS is in the Piedmont, there are similarities between the two sites in terms of precipitation, ground surface relief and slope, vegetation types, and other features. Mean annual precipitation at the Savannah River Site is 49 inches compared with 45 inches at Parr Hydro. Recharge estimates at the Savannah River Site are in the range of 8 to 17 inches per year (Geotrans 1997; Fogle and Brewer 2001; Brewer and Sochor 2002; INTERA 2003). The higher end of these recharge estimates is for lower lying flat areas and the lower end corresponds to sloping areas. Recharge rates at the VCSNS are expected to be of the same order.

The deep bedrock zone is recharged by infiltration from the saprolite/shallow bedrock zone. The deep bedrock zone flows westward off the site toward the Broad River. The Monticello Reservoir is located approximately 1 mile to the north of the Units 2 and 3 site.

2.3.1.2.3.1 Observation Well Installation and Testing Program

Thirty-one observation wells were installed at the site of Units 2 and 3 as part of a geotechnical subsurface investigation program for the FSAR (Figures 2.3-26 and 2.3-27). These wells were screened either in the saprolite/shallow bedrock zone (Figure 2.3-26) or the deep bedrock zone (Figure 2.3-27). Of the 31 observation wells installed on the site, 22 are completed in the saprolite/shallow bedrock zone and 9 are completed in the deep bedrock zone.

The wells were located to provide adequate distribution with which to determine site groundwater levels and subsurface flow directions and gradients beneath the site. Five well pairs were installed to determine if the saprolite/shallow bedrock and deep bedrock zones were hydraulically connected. Table 2.3-19 provides the well construction details for each well, including the material type in which each well was screened.

Field hydraulic conductivity testing was conducted in each observation well following the slug test procedures in ASTM D4044. In addition, field hydraulic conductivities were determined in selected deep bedrock zone boreholes based on the packer test method, as described in ASTM D4630.

Groundwater level measurements in the observation wells were taken monthly for one year from June 2006 through June 2007 (Table 2.3-20). Figure 2.3-28 shows hydrographs for all of the saprolite/shallow bedrock zone wells over the monitoring period. Observation well OW-312 was intended to be a saprolite/shallow bedrock zone well; however, during drilling, rock was encountered at a depth of 36.5 feet (EL 388.6 NAVD88) and drilling at this location could not progress deeper. A well was set at the total depth of the well; however, the total depth of the well is at a higher elevation than the groundwater table at this location, thus, the well never encountered groundwater. Figure 2.3-29 shows hydrographs for all of the deep bedrock zone wells over the monitoring period. In general, the piezometric levels do not change much over the one year of readings. This would indicate these wells have completed their recovery of groundwater levels due to well installation and that there is minimal seasonal variation in piezometric levels at the site. The exceptions to this include OW-624 in the saprolite/shallow bedrock zone and OW-233 and OW-627a within the deep bedrock zone. For both OW-624 and OW-233, the groundwater level rose quickly over the first four or five months and then stabilized. This is interpreted to be due to low permeability within the screened material causing a slow recovery to original piezometric levels within the aquifer. For OW-627a, the hydrograph indicates that piezometric levels rose between June 2006 and July 2006, and then dropped quickly at the time of the August 2006 reading. This rapid drop between July and August was due to the groundwater sampling of this well. Since August 2006, the piezometric level in OW-627a has been steadily rising, indicating that the well is still recovering to the original piezometric level.

2.3.1.2.3.2 Groundwater Levels and Flow directions

2.3.1.2.3.2.1 Horizontal Groundwater Flow

The groundwater level data for the Units 2 and 3 locations were used to determine groundwater flow patterns across the site. Piezometric level contour maps were created for the saprolite/shallow bedrock zone and the deep bedrock zone. One contour map for each zone was created for each quarter using a representative month of piezometric levels.

Figure 2.3-30 shows piezometric level contours for the saprolite/shallow bedrock zone. Figure 2.3-31 shows the piezometric level contours for the deep bedrock zone. Groundwater data collected in June 2007 were used to create these piezometric level contour maps.

Contour maps were created for each of the four quarters of the first year of piezometric level measurements. The piezometric contour maps of the saprolite/shallow bedrock zone are very similar for all four quarters. In other words, no seasonal changes were observed within the saprolite/shallow bedrock zone. The piezometric contour maps of the deep bedrock zone did change over time; however, this was because observation well OW-233 had not completed its recovery. The contours based on the June 2007 data are considered most representative of long-term conditions because they are not influenced significantly by the effect of the well development on the groundwater levels.

The piezometric level elevation contour map of the saprolite/shallow bedrock zone indicates that groundwater flows from ridgetops toward drainage swales, with the piezometric surface mimicking the topography. The drainage swales at the site all lead eventually to the west toward the Broad River. The ridge to the north of the Units 2 and 3 power block area (PBA) circle in the vicinity of OW-622 appears to be hydraulically connected to the area of Unit 1, which is connected to the Monticello Reservoir. Contour maps of the deep bedrock zone indicate groundwater flow westward within the bedrock from the PBA circle off the site toward the Broad River.

The groundwater gradient in the saprolite/shallow bedrock zone ranges from 0.001 to 0.003 foot/foot on top of the ridge and it is steeper (0.037 to 0.05 foot/foot) on the ridge flanks.

The groundwater gradient in the deep bedrock zone ranges from 0.011 to 0.012 foot/foot on top of the ridge and it is steeper (0.06 to 0.08 foot/foot) on the ridge flanks.

This groundwater flow regime is consistent with the regional conditions described in Subsection 2.3.1.2.2 and illustrated in Figure 2.3-25.

2.3.1.2.3.2.2 Vertical Groundwater Flow

Five well pairs were installed as part of the subsurface investigation to assess whether the saprolite/shallow bedrock and the deep bedrock zones are hydraulically connected. The well pairs are OW-205(a&b), OW-305(a&b), OW-401(a&b), OW-621(a&b), and OW-627(a&b). These well pairs indicate that the saprolite/shallow bedrock and the deep bedrock zones are hydraulically connected.

At ridgetops, the water levels within the two aquifers are very nearly the same [OW-305(a&b) and OW-401(a&b)], indicating that the two are directly connected. Moving away from the ridgetop toward the ridge flanks, the water levels within the two aquifers begin to diverge indicating a downward gradient, as illustrated in Figure 2.3-32. The average vertical gradient calculated at OW-205(a&b) is 0.17 feet/feet indicating a downward gradient. Closer to drainage swales, the difference between the water levels within the two aquifers becomes even greater [OW-621(a&b) and OW-627(a&b)]. The average vertical gradient calculated at each of these locations is 1.58 feet/feet and 2.07 feet/feet, respectively, indicating a larger downward vertical gradient.

2.3.1.2.3.3 Hydraulic Properties

Hydraulic conductivities of the site subsurface materials were determined in the observation wells using the slug test method and in selected geotechnical borings using the packer test method. The results of the slug tests are presented in Table 2.3-21.

Slug tests were conducted in 29 of the 31 observation wells; two wells—OW-312 and OW-501—were not tested. OW-312 was dry, and OW-501 was screened in fill and residual soil.

Of the 29 wells that were tested, 8 were assessed as providing invalid or unreliable test results because of the large ratio of theoretical head change over the submerged screen length, failure to approach asymptote, and erratic data.

The remaining 21 slug test results were analyzed and low, high, and geometric mean values were calculated for each of the hydrostratigraphic zones. The saprolite/shallow bedrock hydrostratigraphic zone tests were completed in saprolite, partially weathered rock, or a combination of both. Based on 16 slug tests, the range of hydraulic conductivity values for this zone is from 0.0017 feet/day to 18 feet/day with a geometric mean for this zone of 0.60 feet/day. The deep bedrock hydrostratigraphic zone tests were completed in sound rock. Based on five slug tests, the range of hydraulic conductivity values for the deep bedrock zone is from 0.0088 feet/day to 0.38 feet/day with a geometric mean for this zone is 0.07 feet/day.

Table 2.3-22 gives the results of packer tests conducted in selected geotechnical borings. These tests were conducted in the deep bedrock hydrostratigraphic zone. The range of hydraulic conductivity values for the deep bedrock zone from the packer tests is 0 to 1.14 feet/day, with a geometric mean value for this zone of 0.166 feet/year. Some hydraulic conductivity values are listed as zero. This is a result of a test conducted in a zone that did not take any water. This geometric mean hydraulic conductivity value of the packer tests is higher than the 0.07 feet/year geometric mean hydraulic conductivity value indicated by the slug test results. When comparing the two sets of data, it can be seen that the difference in values measured by the two tests was a result of the depths at which the tests were taken. The packer tests were generally conducted at shallower depths than the slug tests. At shallower depths, the hydraulic conductivity of the deep bedrock zone increases. When compared with just the shallow slug test results, the packer test values are in much closer agreement.

Table 2.3-23 presents porosity values derived from laboratory test results for grain size, moisture content, and specific gravity on residual soil and saprolite. The range in porosity values calculated for the residual soil is from 0.465 to 0.631 with an arithmetic mean porosity value of 0.527. The range in porosity values calculated for the saprolite material is from 0.401 to 0.632 with an arithmetic mean porosity value of 0.494. This is based on seven samples of residual soil and 23 samples of saprolite. The saprolite value is considered to be representative of the porosity value for the saprolite/shallow bedrock zone. The residual soil porosity values are considered to be representative of the unsaturated zone above the aquifer. There are no direct estimates of the specific yield at the site of Units 2 and 3. Considering the composition of the overburden soils (clayey, silty, and sandy materials), it is reasonable to expect the specific yield to be of the order of 20% to

25%. Reported average specific yield values in the literature are 18% for silt, 21% for fine sand, 26% for medium sand, and 27% for coarse (Fetter 1988). The specific yield of the saprolite should be of the same order of magnitude.

Geometric mean values for the porosity were calculated for the residual soil and saprolite material types. Both of these soil types are within the saprolite/shallow bedrock hydrostratigraphic zone. The geometric mean value for the porosity for the residual soil is 0.524 and for the saprolite is 0.492.

The effective porosity of the saprolite was estimated using Figure 2.17 of de Marsily (1986) (Figure 2.3-33). This figure plots total and effective porosity as a function of grain size. To estimate the effective porosity for the saprolite, the ratio of effective-to-total-porosity determined from Figure 2.3-33 was applied to the site-specific total porosity value for the VCSNS site. Using the median D_{50} value of 0.13 mm as a representative grain size (Table 2.3-24), a ratio of effective-to-total-porosity of about 0.8 was determined from Figure 2.3-33. Multiplying the median total porosity of 0.49 by this ratio yields an effective porosity of 0.39 for the saprolite material.

Hydraulic properties of the unsaturated zone were not measured because accidental release of liquid effluents would be through the saturated zone.

2.3.1.2.3.4 Subsurface Pathways

Units 2 and 3 would be located on a ridgetop. Piezometric contour maps developed from piezometric levels measured for one year from June 2006 through June 2007 indicate that groundwater flows in all directions from the ridgetop. Drainage swales are present to the northwest, southwest, and east of the site as can be seen from the topographic map in Figure 2.3-2. These swales drain to tributaries that eventually lead to the Broad River. The Broad River is located approximately 1 mile to the west of the site. The surface groundwater flow regime roughly mimics the topography and flows through the saprolite/shallow bedrock hydrostratigraphic zone. Groundwater from the saprolite/shallow bedrock zone recharges the deep bedrock hydrostratigraphic zone. Piezometric-level contour maps developed for the deep bedrock zone indicate a flow path that leads directly toward the Broad River.

Although groundwater flows in all directions from the ridgetop, including toward Mayo Creek to the east, the shortest subsurface pathways from the PBA circle to a release point was determined to be toward the unnamed creeks to the north and south based on the data summarized above. Figure 2.3-34 shows the expected pathways in plan view. The groundwater travel time from the PBA circle to the unnamed creek to the north was calculated to be 1.6 years. The groundwater travel time from the PBA circle to the unnamed creek to the south was calculated to be 3.1 years. The travel time in the saprolite, analyzed between the Units 2 and 3 auxiliary buildings and the nearest creek where groundwater discharges, has been conservatively determined below, and based on site-specific data. The saprolite material properties are used because they provide the shortest travel times, *i.e.*, the most conservative analysis.

For the unnamed creek to the north of the site, the average advective velocity is calculated using the following parameters:

hydraulic conductivity K = 1.7 feet/day (75th percentile hydraulic conductivity value from all slug test data in the saprolite material)

effective porosity n_e = 0.39

horizontal hydraulic gradient $\frac{dh}{dx}$ = - 0.0307 ft/ft. (Table 2.3-25)

Substituting these values in the following equation yields:

$$U = -\frac{K}{n_e}\frac{dh}{dx} = -\frac{1.7\,ft/day}{0.39}(-0.0307\,ft/ft) = 0.1338\,ft/day \approx 48.89\,ft/yr$$

The straight-line distance from the auxiliary building of Unit 2 to the nearest unnamed creek to the north is about L=850 feet, which results in a conservatively estimated groundwater travel time of:

$$t = \frac{LR}{U} = \frac{850\,ft \times 1}{48.89\,ft/yr} \approx 17.39\,yrs$$

This same methodology was also used for calculating the groundwater travel time from Unit 3. The differences are at Unit 3 the horizontal hydraulic gradient was calculated to be 0.0369 ft/ft (Table 2.3-25) and the straight-line distance from the auxiliary building of Unit 3 to the nearest unnamed creek to the south is about L=1727 feet. The estimated travel time from Unit 3 to the unnamed creek to the south-southwest was 29.35 years.

2.3.1.2.4 Summary

The VCSNS site lies within the Piedmont Physiographic Province. Geologic conditions beneath the site consist of a weathering profile of Paleozoic crystalline rock. Groundwater at the site occurs in two zones—the saprolite/shallow bedrock zone and the deeper bedrock zone. Recharge to the saprolite/shallow bedrock zone occurs by infiltration of precipitation. Discharge is to localized drainage and stream incisions. Recharge to the bedrock zone is from the overlying saprolite/ shallow bedrock zone.

Observation wells completed in the saprolite/shallow bedrock zone and deep bedrock zones were used to develop piezometric contour maps and hydraulic gradients. Hydrogeologic properties of these aquifers were determined by laboratory testing of soil samples and by in situ testing.

The U.S. EPA defines a sole-source aquifer as an underground water source that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. These areas can have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend on the aquifer for drinking water. No sole-source aquifers have been designated by the EPA within the VCSNS site region (U.S. EPA 2007).

2.3.2 WATER USE

Construction or operation of Units 2 and 3 could affect availability of surface water and groundwater near the site. This subsection describes the current uses of those water resources, including the types, locations, and quantities of the consumptive and nonconsumptive water uses.

2.3.2.1 Groundwater Use

2.3.2.1.1 Regional Groundwater Use

Groundwater use as reported to SCDHEC by each county within 50 miles is shown in Table 2.3-26. Public water supply systems are the largest users (47.7% of the total) of groundwater in the 50-mile region, followed by agricultural users (21.7%), and industrial users (14.4%) (SCDHEC 2005). Smaller amounts of groundwater are used by mining operations, thermoelectric (nuclear and fossil-fueled) power plants, golf courses, and aquaculture facilities.

Groundwater within 20 miles of the site is primarily used for individual households and for livestock. Within 2 to 20 miles of VCSNS, there are approximately 100 sites that have at least one groundwater well that has been reported for municipal, industrial, or domestic purposes.

2.3.2.1.2 Local Groundwater Use

Three counties lie within 6 miles of the proposed site: Fairfield County, Newberry County, and Richland County (Figure 2.1-3). Reported permitted groundwater uses for these counties are included in Table 2.3-26. The largest user of groundwater is Richland County, with Newberry and Fairfield following, respectively. In Richland County, industry is the largest consumer of groundwater, followed by public water suppliers. Newberry County's groundwater use is primarily for irrigation of crops and public water supply. Fairfield County's groundwater use is primarily for public water supply. (SCDHEC 2005)

Groundwater within 2 miles of the site is primarily used for domestic purposes. The nearest groundwater well is approximately 1 mile east of the VCSNS site, just outside the site boundary and the nearest large groups of wells are located approximately 1.5 miles east of the site along SC 215 and in Jenkinsville approximately 2.5 miles southeast of the site. These wells serve private residences and stores. The Jenkinsville Water Company has nine wells, three of which are located within approximately 2 miles of the site. These wells are located to the north and are separated from the VCSNS site by the Monticello Reservoir. SCDHEC projects that the population of Fairfield County will increase from the year 2000 population of 23,454 to a year 2025 population of 27,280 (SCDHEC

2005). However, the resident population within the direct vicinity of the site (2 miles) is expected to remain fairly constant through the year 2019 (see population projections in Table 2.5-1), resulting in a reasonably consistent demand for domestic groundwater in that area.

The Monticello Reservoir is the source of process and domestic water for Unit 1. However, groundwater is pumped from two wells in the protected area to lower the water table and reduce the amount of seepage from the Monticello Reservoir into below-grade portions of the buildings. The pumped water is discharged to permitted National Pollutant Discharge Elimination System (NPDES) outfalls at a total rate of approximately 26 gpm (SCE&G 2002a).

2.3.2.2 Surface Water Use

2.3.2.2.1 Regional Surface Water Use

Major hydrologic features within the 50-mile radius zone are shown in Figure 2.3-1. Permitted surface water uses within the counties located within 50 miles of the site are indicated in Table 2.3-27. With the exception of Lee, Orangeburg, and Sumter Counties, all other counties within 50 miles of the proposed site rely far more heavily on surface water than on groundwater to meet water demands. Permitted uses of surface water include hydroelectric, thermoelectric, aquaculture, golf course irrigation, industry, agricultural irrigation, mining, and public water supply. Water in the Broad River is used to generate hydroelectric power at seven hydroelectric facilities within South Carolina, including the Duke Power facilities at Gaston Shoals, and Ninety-Nine Islands, Cherokee Falls (Cherokee Falls Associates) and Lockhart (Lockhart Power), and SCE&G facilities at Neal Shoals and Parr Shoals, and the Columbia Canal (city of Columbia) (Bettinger et al. 2003). Gaston Shoals, Cherokee Falls, Ninety-Nine Islands, Lockhart, and Neal Shoals are located upstream of the proposed site. Parr Hydro (the facility at Parr Shoals) is adjacent to Columbia Canal and is downstream of the proposed site. SCE&G also operates the Fairfield Pumped Storage Facility, which is discussed in detail in Subsection 2.3.1.

Downstream of the site, surface water is withdrawn by a number of municipalities and industries. The closest large downstream surface water user is the city of Columbia, approximately 28 miles from the site.

There are numerous reservoirs and streams within 50 miles that are used for fishing, swimming, and boating (see Figure 2.1-2). More notable locations include Lake Murray to the south, Lake Greenwood to the west, and Wateree Lake to the east.

Table 2.3-28 provides a summary of other significant downstream surface water users, their location, average daily use, and source of supply.

2.3.2.2.2 Local Surface Water Use

Portions of Fairfield County, Newberry County, and Richland County all lie within 6 miles of the proposed site (Figure 2.1-3). Reported permitted surface water uses for these counties are included in Table 2.3-27. The largest user of surface water is Fairfield County, with Richland and Newberry following, respectively. In both Fairfield and Richland counties, the largest users of surface water are the hydroelectric and thermoelectric power industries, respectively. Newberry County's surface water is primarily used for public water supplies. (SCDHEC 2005)

In Fairfield County, surface water is used as a potable water supply by the town of Winnsboro and by Unit 1. Unit 1 obtains potable water from the Monticello Reservoir. The Unit 1 average daily use is 27,800 gpd and the maximum daily capacity is 1,296,000 gpd (SCE&G 2002a). The town of Winnsboro provides water to approximately 8,303 people (Devlin 2006) and gets its surface water from Sand Creek and a 192-acre reservoir located west of the town in the Jackson Mill Creek watershed (SCDHEC 2003). The reservoir contains approximately 600 million gallons of water (Fairfield County 1997).

The city of Columbia is a public water supplier in Richland County that also withdraws surface water for public use. The city pumps an average of 65 million gpd. Approximately half of the municipal water comes from the Broad River from the Columbia Canal while the other half comes from Lake Murray, a reservoir on the Saluda River (SCDNR 2005). The latter source serves approximately 263,066 people (U.S. EPA 2005).

Two public water suppliers in Newberry County are the city of Newberry and the town of Whitmire. The city of Newberry removes water from the Saluda River (SCDHEC 2003) to serve a population of approximately 10,145 (Devlin 2006). The town of Whitmire uses water from Duncan Creek and from the Enoree River (SCDHEC 2003). These sources provide water to approximately 2,755 people (SCDHEC 2003).

As shown on Figure 2.3-35, the Parr Reservoir provides a source of water for Parr Hydro and serves as a lower pool for the Fairfield Pumped Storage Facility. Monticello Reservoir, which serves as the upper pool for Fairfield Pumped Storage Facility, also provides a source of domestic, process, and cooling water for Unit 1. Currently, the Federal Energy Regulatory Commission license for the Parr project (FPC 1974) limits withdrawal of water from the Monticello Reservoir just to the activities associated with operations of Unit 1; thus, additional withdrawal of water for the proposed action will require a license amendment. Water use associated with Unit 1 also includes the evaporative losses associated with condenser cooling water system operation. Estimates for the amount of water lost to evaporation range from approximately 13 cfs (5,800 gpm) based on a withdrawal rate of 1,180 cfs (530,000 gpm) from the Monticello Reservoir (U.S. NRC 1981) to a theoretical maximum of 22 cfs (9,900 gpm) based on a withdrawal rate of 1,308 cfs (SCE&G 2002a). These estimated evaporative losses represent approximately 8.7% to 15% of the licensed minimum flow of 150 cfs

(67,300 gpm) (FPC 1974) and approximately 0.23% to 0.38% of the mean annual flow of 5,726 cfs (2,570,000 gpm) of the Broad River at Alston, South Carolina (Subsection 2.3.1).

The Monticello Reservoir has an ambient evaporation rate of 33 cfs (14,810 gpm). This represents the evaporation rate for the reservoir without the discharge of cooling water from Unit 1.

As described in Subsection 2.3.1, the lowest daily mean flow reading on record at Alston was 48 cfs (22,000 gpm) on September 12, 2002 (Cooney et al. 2006) during drought conditions in South Carolina. During this period, SCE&G's Parr Hydro facility operations were minimal, requiring only a small flow of water through the dam. This flow was further reduced because water was being pumped to the Monticello Reservoir by the Fairfield Pumped Storage Facility. The decrease in reservoir pool level lowered the head on the dam, limiting downstream river flow. When the pumping station began releasing water to Parr Reservoir, the low flow situation was corrected by increasing the head at the dam and, thus, increasing discharge from the Parr Reservoir to the river. This low flow value is not considered representative of natural river flows because it was influenced by the upstream flow diversion. The state of South Carolina uses the 7Q10 value to determine potential impacts. Based on a review of USGS data, the nearest downstream gauging station on the Broad River is the Alston station located 1.2 miles downstream of Parr Shoals Dam. The 7Q10 value at the Alston station is 853 cfs (382,800 gpm) (USGS 2007).

Locally, portions of the Monticello and Parr reservoirs and the Broad River below Parr Shoals Dam are used for fishing and boating. The Federal Energy Regulatory Commission license for the Parr project (FPC 1974) required development of recreational facilities on the Monticello Reservoir and a boat launching area adjacent to the crossing of Heller's Creek by County Road 28 on the Parr Reservoir. A park provides access to a 300-acre sub-impoundment at the north corner of the Monticello Reservoir for fishing and swimming. A boat ramp is located just north of the park. The Federal Energy Regulatory Commission license stipulates minimum flows from the Parr Shoals Dam into the Broad River. The flow is to be maintained at 1,000 cfs or at the average daily natural inflow into Parr Reservoir (less evaporative losses from the Parr and Monticello reservoirs) during the striped bass spawning season in March, April, and May to protect the fishery of the Broad River. During the rest of the year, the minimum daily average flow below the dam is to be maintained at 800 cfs or at the average daily natural inflow into Parr Reservoir (minus evaporation).

2.3.3 WATER QUALITY

This subsection describes the physical and chemical characteristics of surface water bodies and groundwater aquifers that could be affected by construction, operation, or decommissioning of new units at the VCSNS site. Subsections 4.2.3 and 5.2.3 discuss the impacts of construction and operation on water quality.

2.3.3.1 Surface Water

The surface water bodies of primary interest include the Broad River, Parr Reservoir (located on the Broad River), Monticello Reservoir (created by the damming of Frees Creek), and Mayo Creek (which flows into the Broad River just south of the Parr Shoals Dam). These water bodies are important because Units 2 and 3 would withdraw makeup water from Monticello Reservoir through a new intake structure located west of the circulating water intake structure for Unit 1. The Monticello Reservoir would also supply a new water treatment plant to serve Units 2 and 3. All cooling system discharges from the new units, including cooling tower blowdown, would be discharged to the Parr Reservoir as well as discharges from the radwaste treatment facility. A small effluent stream from the water treatment plant would be discharged to the Monticello Reservoir. Mayo Creek currently has NPDES outfalls from Unit 1 and the old Nuclear Training Center and could receive the discharge from the temporary package sewage treatment plant during construction of the new units. Mayo Creek will intercept surface runoff from a portion of the proposed site. Storm water from the proposed site will also flow directly to the Broad River along unnamed intermittent stream channels.

One important goal of SCDHEC, as well as the U.S. EPA through the Clean Water Act, is to maintain the quality of surface waters to provide for the survival and propagation of a balanced indigenous aquatic community of flora and fauna. The degree aquatic life is protected (Aquatic Life Use Support) is assessed by comparing important water quality characteristics and the concentrations of potentially toxic pollutants with numeric criteria. For aquatic life uses, the goal of the standards is the protection of a balanced indigenous aquatic community. Therefore, biological data is the ultimate deciding factor, regardless of chemical conditions. If biological data shows a healthy, balanced community, the use is considered supported even if chemical parameters do not meet the applicable criteria. Recreational Use Support is attained based on the frequency of fecal coliform bacteria excursions, meaning bacteria concentrations greater than 400 organisms per 100 milliliters for all surface water classes. (SCDHEC 2006a)

SCDHEC’s List of Impaired Waters for 2004 includes one sample location on the main stem of the Broad River. The remaining locations listed are associated with the river’s extensive tributary system. Generally, impacts along the Broad River tributaries to recreational use and to aquatic life standards were associated with fecal coliform. In these cases, recreation is not fully supported. The aquatic life use standards are also not fully supported in other locations primarily due to the lack of diversity of macroinvertebrates. The Broad River main sample location listed is at US 176 in Columbia (Richland County) where the waters were impacted by fecal coliform. The Monticello Reservoir, between the large islands (sample location B-327), was also on the 2004 list due to aquatic life standards not being fully supported due to a varying pH (SCDHEC 2004).

The 2006 List of Impaired Waters does not include the Broad River at the US 176 location in Columbia, but does include the Broad River at SC 72/215/121 near the town of Carlisle in Chester County. This location was included because of the presence of copper and its potential degradation of aquatic life use standards.

The Broad River at the rail trestle just south of SC 213 is also included on the list because of the potential degradation of aquatic life use standards. The Monticello Reservoir (sample location B-327) was again included on the 2006 draft list because of potential impact to aquatic life use standards because of pH variation. The Parr Reservoir is included on the 2006 draft list due to sampling results at two locations. One is in the forebay area near the dam at sample location B-345. Sample results indicate potential impacts to aquatic life use standards because of the presence of copper. The second location is 4.8 miles upstream of the dam (sample location B-346), upstream of the effluent from the Monticello Reservoir. The results indicate a potential impact to aquatic life use standards from total phosphorus. (SCDHEC 2006b)

The following paragraphs discuss water quality data in more detail for the water bodies of interest for the proposed site for the new units.

2.3.3.1.1 Mayo Creek

Water quality parameters (temperature, pH, dissolved oxygen, specific conductance, and turbidity) were measured at three locations (Stations 1, 2, and 3) on Mayo Creek in July 2006 as part of a Mayo Creek aquatic survey undertaken by SCE&G. Follow-up sampling/monitoring was performed in November 2006 at Stations 2 and 3. Station 4, not previously sampled/monitored, was sampled in November 2006. Mayo Creek is a small tributary of the Broad River. Its drainage area extends through the wooded eastern portion of the proposed construction area for Units 2 and 3 and into the vicinity of Unit 1's facilities. Data was collected during morning to early afternoon hours. Station 1 is located at the confluence of Mayo Creek and Broad River. Station 2 is located 100 meters upgradient of the bridge on Parr Road. Station 3 is located 300 meters upgradient of the bridge on Parr Road. Station 4 is located approximately 1,100 meters upstream of the Parr Road Bridge. Mayo Creek is a groundwater–fed stream. The stream contains many riffles and is shaded throughout most of its length. The results of the field monitoring, included in Table 2.3-29, are typical to creeks located in the Piedmont of South Carolina. The results are also typical of data collected for the Broad River drainage.

2.3.3.1.2 Unnamed Tributary to Parr Reservoir

Water quality parameters (temperature, pH, dissolved oxygen, specific conductance, and turbidity) were measured at a single location, Station 5, in an unnamed tributary to the Parr Reservoir during the November 2006 follow-up monitoring event of Mayo Creek. The results of the monitoring indicated the water temperature was 14.3°C (57.7°F), the dissolved oxygen was 3.3 mg/L, the specific conductivity was 125 micromhos per centimeter, and the pH was 6.1. Turbidity measurements were not collected.

2.3.3.1.3 Broad River

The Broad River water quality data collected from the fall of 2000 through spring of 2002 by the South Carolina Department of Natural Resources (SCDNR) determined that the water quality parameters monitored were consistent with those expected for a river located in the Piedmont of South Carolina. Dissolved oxygen ranged from 6.1 to 9.9 milligrams per liter, pH values ranged from 6.3 to 8.5, specific conductance values ranged from 85 to 262 micromhos per centimeter, and turbidity ranged from 3.2 to 24.4 nephelometric turbidity units. No seasonal or longitudinal differences in these water quality parameters were observed during the evaluation. Water temperature ranged from 11.6°C (52.9°F) to 29.6°C (85.28°F) (Bettinger et al. 2003). In 2001, SCDHEC reported the results of a study that characterized surface water quality of the Broad River Basin at 11 sites including nine assessment sites on the main stem of the river. At all but one of the sites aquatic life was fully supported. Aquatic life was not fully supported in the Columbia Water Plant diversion canal southeast and downstream of the site because of the occurrence of copper in excess of the acute aquatic life standards. Variances from aquatic life standards for dissolved oxygen and pH were less than or equal to 10%, and aquatic life standards for toxins were not exceeded (SCDHEC 2001).

Water quality collected from the Broad River at SC 34, the closest upstream sampling location to the proposed site, indicated the aquatic life uses were fully supported; however, there is an increasing trend in turbidity. South Carolina has classified the river here as freshwater. Recreational uses are only partially supported in this area because of fecal coliform bacteria excursions (SCDHEC 2001). Water quality field parameters collected by the USGS from the Broad River near Jenkinsville (just downstream of the Parr Reservoir) for 2005 indicates that temperature ranged from 5.4°C (41.7°F) to 31.2°C (88.2°F). The range of pH was from 6.3 to 7.6. Dissolved oxygen ranged from 3.8 to 12.9 milligrams per liter. Conductivity ranged from 42 to 103 micromhos per centimeter (Cooney et al. 2006). This data is consistent with stream data in the Piedmont.

2.3.3.1.4 Parr Reservoir

The Parr Reservoir water quality data was also reported in the 2001 study of the Broad River basin. Parr Reservoir is classified by South Carolina as freshwater. Aquatic life use and recreational use were fully supported (SCDHEC 2001). SCDHEC also reports water quality data annually from two locations on the Parr Reservoir—Cannon’s Creek Landing Road (Sample location B-345) and within the reservoir approximately 4.8 kilometers north of the reservoir dam (Sample location B-346). The most recent complete data available for these locations is for 2004. The results of 2004 data analysis and partial data (Sample Location B-345) for 2005 for these locations are shown in Tables 2.3-30 and 2.3-31, respectively.

2.3.3.1.5 Monticello Reservoir

The Monticello Reservoir provides once-through cooling water to Unit 1 and acts as the upper reservoir for the Fairfield Pumped Storage Facility. The Parr Reservoir, created by the damming of the Broad River, serves as the lower reservoir for the Fairfield Pumped Storage Facility. Makeup water for the Monticello Reservoir is supplied from the Parr Reservoir. As part of the Fairfield Pumped Storage Facility operations, water is released from the Monticello

Reservoir through the Fairfield Pumped Storage Facility to the Parr Reservoir to generate electricity during peak demand periods. Water is then pumped during off-peak demand periods from the Parr Reservoir to the Monticello Reservoir to maintain the level of the upper reservoir. Over time, the water quality of the Monticello Reservoir, because of the constant cycling and mixing of water, is expected to be basically that of the Broad River (U.S. NRC 1981).

Water quality monitoring data indicates that the Monticello Reservoir waters are relatively low in concentrations of common ions, low in hardness, and low in dissolved solids and conductivity. Groundwater in the vicinity of the site is highly mineralized because of prolonged contact with, and solution of, rock minerals and, as a result, is generally higher than local surface waters in hardness, dissolved solids, and conductivity. There is no indication that evaporative losses associated with operation of Unit 1 have increased concentrations of common ions, minerals, or solids in the Monticello Reservoir water, and no indication that groundwater quality in the area has been affected (SCE&G 2002a). The Monticello Reservoir is characterized by SCDHEC as freshwater (SCDHEC 2001).

SCE&G monitors water temperature and other parameters at three locations on the Monticello Reservoir—an "uplake" location (near the northern end of the Monticello Reservoir), a location near the circulating water intake, and a location just outside of the northern end of the discharge canal—as part of the Unit 1 water quality monitoring program. Measurements were taken during 2000 through 2003 and 2005 at these locations monthly during early to late-morning hours (SCE&G 2001, 2002b, 2003a, 2004a, 2006b).

Temperature readings from the Monticello Reservoir surface water at the cooling water discharge location, Discharge 6, at the southern end of the reservoir was higher than the temperature found at the other two sampling reservoir locations. The temperature at the Discharge 6 sample location ranged from 7.5°C (45.5°F) to 37.9°C (100.3°F) throughout the year, with the highest temperatures occurring in August. A thermal plume at the Discharge 6 sampling location is evident during operation of Unit 1 year-round at depths of 2 to 3 meters. During the winter months, the temperature profiles for Uplake 16 and the Intake 2 locations were similar, with temperature ranging from 7.2°C (45°F) to 14.4°C (58°F). During the August 2003 monitoring event, a thermocline was evident at the Uplake 16 location between 8 and 9 meters. During the fall months, thermal stratification breaks down, allowing a mixing of the layers (SCE&G 2001, 2002b, 2003a, 2004a, 2006b).

Dissolved oxygen in the Monticello Reservoir is relatively high throughout the year except for the deeper waters in the late summer. These deep waters, because of their lower temperatures and higher densities, do not mix with the upper layers of water and become oxygen depleted. A general decrease in oxygen occurs with depth during the summer months. During winter conditions, thorough mixing of water layers occurs, distributing oxygen from the surface to the bottom. The only exception is near Discharge 6 where the levels indicate the presence of the thermal plume from the Unit 1 discharge. The Uplake 16 sample location shows the greatest decline in oxygen with depth in winter or summer. More mixing appears to occur at the Intake 2 location due to the influence of pump-back by FPSF (SCE&G 2001, 2002b, 2003a, 2004a, 2006b).

The pH in the Monticello Reservoir (2000 through 2003 and 2005) is generally neutral, ranging from 5.8 to 8.9. Winter and summer pHs are similar at all three monitoring locations. Late winter/spring pH values are higher at the Uplake 16 location due to phytoplankton photosynthetic activity in the surface waters to depths that sunlight can penetrate. Also, the water mixing process previously discussed for the Intake 2 and Discharge 6 location keeps the values lower than the Uplake 16 location (SCE&G 2001, 2002b, 2003a, 2004a, 2006b).

Specific conductance values for the Monticello Reservoir vary only slightly (2000 to 2003 and 2005), ranging from 94 to 142 micromhos per centimeter. No data analyzed from 2000 through 2003 and 2005 indicated that the waters of the Monticello Reservoir were insufficient for the support of aquatic life (SCE&G 2001, 2002b, 2003a, 2004a, 2006b).

SCDHEC also collects water quality samples from the Monticello Reservoir. The Monticello Reservoir sample locations are 100 meters north of the large mid-lake island (sample location B-327) in the main reservoir, and at the mid-lake marker in the upper impoundment (sample location B-328). The results of the 2004 data analysis for both of these locations are shown in Table 2.3-30. Results are also available for Sample Location B-327 for 2005 (Table 2.3-31). SCE&G performed additional surface water sampling at sample location B-327 in Monticello Reservoir on August 17, 2006. The results of the sampling event are given in Table 2.3-32. These results are typical for Piedmont water bodies.

Fecal coliform bacteria are regarded as indicators of other pathogenic microorganisms, and are the organisms normally monitored by state health agencies. The NPDES permit for Unit 1 requires monitoring of fecal coliform in sewage treatment plant effluent (after discharge from the chlorine contact chamber and before mixing with other waste streams). Samples are collected for fecal coliform analysis and other parameters twice a month. The NPDES permit specifies a maximum 30-day average of 200 organisms per 100 milliliter sample, and a daily maximum of 400 organisms per 100 milliliters. From 2001 to 2005, neither of these limits were exceeded during any sampling event (SCE&G 2006c). There is public access to the Parr Reservoir and Monticello Reservoir, including recreational fishing, boating, and waterfowl hunting (SCE&G 2002a).

Maximum temperatures in the Monticello Reservoir outside of the discharge canal are below the optimal temperature range for growth and reproduction of thermophilic microorganisms. These temperatures could support limited survival of these organisms in summer months, although temperatures are generally below the range most conducive to the growth of thermophilic microorganisms (SCE&G 2002a).

Another factor controlling the survival and growth of thermophilic organisms in the Monticello Reservoir is the disinfection of the Unit 1 sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the Unit 1 discharge canal or the Monticello Reservoir. Following primary treatment in an aeration lagoon and secondary treatment through sand filters, the sewage treatment wastewater is moved to a contact chamber for chlorination. The wastewater is then dechlorinated before being mixed with other plant waste streams and eventually discharged to the discharge canal (SCE&G 2002a).

From a public health standpoint, the assessment of thermophilic organisms is more relevant for the Monticello Reservoir in the vicinity of the Unit 1 discharge canal than for the discharge canal proper. This is because there is no public access to the discharge canal. The discharge basin and canal are within the nuclear exclusion zone, land access to which is strictly controlled (see Section 2.1). Public exclusion from this discharge canal is actively enforced by Unit 1 security as well as SCDNR conservation officers (SCE&G 2002a).

Given the thermal characteristics of the Monticello Reservoir in the vicinity of the Unit 1 discharge outfall and the disinfection of sewage treatment plant effluent, SCE&G does not expect Unit 1 operations to stimulate growth or reproduction of thermophilic microorganisms. Under certain circumstances, these organisms might be present in limited numbers in the discharge bay and canal, where water temperatures can be as high as 41.7°C (107°F), but would not be expected in sufficient concentrations to pose a threat to recreational users of the Monticello Reservoir or downstream water users in the Parr Reservoir or the Broad River (SCE&G 2002a).

SCE&G submits annual Radiological Environmental Operating Reports for Unit 1 to NRC as required by Regulatory Guide 4.8 and Section 6.9.1.6 of the Unit 1 Technical Specifications. The sampling results for surface water that were submitted to NRC are summarized below for the years 2001 through 2005. During that period, measurements of surface water samples from monitoring locations did not indicate the presence of activated corrosion or fission products above the respective minimum detectable activities with the following exceptions: tritium was detected during 2002 and 2003 at levels of 778 picocuries per liter (highest minimum detectable activity 484 picocuries per liter) and 769 picocuries per liter (highest minimum detectable activity 521 picocuries per liter), respectively, at Site 21 on Parr Reservoir 2.7 miles south southwest of Unit 1. Measurements of drinking water samples collected from the city of Columbia water supply did not indicate the presence of activated corrosion or fission products above the respective minimum detectable activities with the exception that gross beta activity was measured during one event at 3.91 picocuries per liter during 2002. Tritium analysis did not indicate the presence of tritium above minimum detectable activities at the city of Columbia water supply. During 2004, iodine-131 was detected in one sample at Neal Shoals, 26 miles north northwest of Unit 1. (SCE&G 2002c, 2003b, 2004b, 2005a, and 2006d)

2.3.3.2 Groundwater

The jointed bedrock within the vicinity of the site does not provide a good aquifer for municipal and industrial water wells. The quality of groundwater is acceptable for most uses; however, high iron content was found in some supplies. The water quality is highly mineralized, due to prolonged contact with, and solution of, rock minerals. Chemical analyses (reported in Table 2.3-33) of water samples obtained from borings during the construction of Unit 1 are expected to be indicative of typical groundwater quality at the time of construction of the proposed units.

Two water wells associated with the town of Jenkinsville were sampled in 2004 as part of SCDHEC's program to monitor the state's ambient groundwater. Well AMB-60 is located approximately 5 miles north of Unit 1 just east of the Monticello Reservoir. Well AMB-57 is located at the extreme northern end of the reservoir. The results of the analysis for 2004 are shown in Table 2.3-34. The data is included as typical well data within the site vicinity.

Monitoring wells were installed as part of the geotechnical evaluation for Units 2 and 3. Nine wells were sampled and the groundwater analyzed for the parameters included in Table 2.3-35. The results of the analyses indicate that groundwater quality is similar to that of the Jenkinsville wells included in Table 2.3-34. The results reported in Table 2.3-35 are below EPA drinking water standards.

In 2007, additional groundwater quality data from eight monitoring wells were collected to establish preoperational environmental conditions. The results are provided in Table 2.3-36 for nonradiological chemicals. Two wells indicated the presence of tritium. Well OW-305a indicated 519 picocuries per liter on January 10, 2008. Well OW-305b showed 2,258 picocuries per liter on December 18, 2007 and 2,880 picocuries per liter on January 10, 2008. No other wells in the vicinity indicated tritium above the detection limit of 471 picocuries per liter. The EPA drinking water standard is 20,000 picocuries per liter.

A potential source of this low-level tritium is condensate polisher resin. This resin was disposed in this area in 1994 under an SCDHEC-approved waste disposal exemption under what was then 10 CFR 20.302(a), but is now 10 CFR 20.2002. Should SCE&G commence construction of this proposed project, it plans to remove the soils from the project area where land application was permitted.

The sampling results for groundwater that were submitted to NRC as part of the annual Radiological Environmental Operating Reports are summarized below for the years 2001 through 2005. During this period, measurements of groundwater from the site monitoring program and drinking water samples collected from the Jenkinsville water supply did not indicate the presence of activated corrosion or fission products above the respective minimum detectable activities or tritium above minimum detectable activities, with the exception that tritium was measured, at the old Nuclear Training Center 2.6 miles south southeast of Unit 1, at a level of 3.47 picocuries per liter in 2004. In 2005, tritium was also detected at monitoring location GW-9, which is 0.35 miles south southeast of VCSNS at a concentration of 1,800 picocuries per liter.

Naturally occurring radionuclides, radium-226, lead-214, and bismuth-214 were observed in the Jenkinsville water supply at levels above those found in surface water throughout the period. These elevated activity levels were also observed in the preoperational monitoring program and are attributed to several deep wells. The Jenkinsville community water supply is located more than 5 miles from VCSNS (SCE&G 2002c, 2003b, 2004b, 2005a, and 2006d).

Section 2.3 References

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Table 2.3-1
Stream Flow Gauging Stations

Station name		Alston	Richtex	Carlisle
USGS station number		2161000	2161500	2156500
Latitude		34°14'35"	34°11'05"	34°35'46"
Longitude		81°19'11"	81°11'48"	81°25'20"
Distance from Parr Dam	mi	1.2 downstream	14 downstream	21 upstream
Period of record		October 1896 to December 1907 October 1980 to current year	October 1925 to September 1983	October 1938 to current year
Remarks		Records good except for estimated daily discharges, which are poor. Records for the 1897–1908 water years are poor. Regulation at low and medium flow by power plants above station	Discontinued in 1983.	Records good except for estimated daily discharges, which are poor. Some regulation at low and medium flow by power plants above station. Capacity of reservoirs insufficient to affect monthly figures of runoff
Drainage area	sq mi	4,790	4,850	2,790
Water years of available data used in this report		1897-1906 1980-2005	1925–83	1939–2005
Annual mean	cfs	6,302	6,155	3,880
Highest annual mean	cfs	11,750	—	5,977
Lowest annual mean	cfs	2,153	—	1,255
Highest daily mean	cfs	130,000	211,000	114,000
Lowest daily mean	cfs	48	149	44
Annual 7-day minimum	cfs	200	n/a	220
Maximum peak flow	cfs	~140,000	228,000 (on 10-3-1929)	~123,000
Annual runoff	in	17.67	—	18.89

Source: Cooney et al. 2006.

Table 2.3-2 (Sheet 1 of 2)
Mean Daily Flows on the Broad River at Richtex, South Carolina (Period of Data: 1925 to 1983)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	8,100	7,250	8,380	12,400	6,510	5,490	4,150	4,290	4,020	6,070	3,870	5,420
2	8,530	7,520	8,130	12,800	6,200	5,190	3,860	4,350	3,500	7,490	4,260	4,810
3	8,160	8,560	8,180	10,900	6,280	5,190	3,750	4,260	2,990	7,970	4,330	4,660
4	8,900	9,900	9,190	9,310	6,750	5,100	3,530	4,180	3,400	5,420	4,920	5,040
5	8,540	9,940	9,740	8,830	6,390	4,810	3,590	4,380	3,740	4,650	4,530	5,460
6	8,140	9,340	10,600	9,530	5,880	4,770	4,000	4,150	3,910	4,400	3,830	5,200
7	9,050	9,850	11,000	11,200	5,420	4,680	4,670	3,850	4,120	4,480	3,830	5,570
8	9,290	9,980	11,100	12,300	5,600	4,900	4,410	4,190	4,760	4,490	4,040	5,810
9	9,360	9,180	10,000	11,700	6,090	4,930	5,060	4,120	4,490	5,270	4,070	5,920
10	9,190	8,430	8,910	10,100	5,650	4,820	4,790	3,920	4,120	6,860	3,850	5,250
11	8,920	8,620	8,040	9,140	5,330	4,890	4,950	4,000	3,820	7,800	3,560	5,010
12	8,170	8,530	8,400	8,880	4,870	4,480	5,140	4,450	3,310	6,080	4,150	5,530
13	7,670	8,130	10,100	8,910	4,790	4,520	4,700	4,110	2,940	3,910	3,910	6,320
14	7,800	8,930	10,600	8,720	5,270	4,830	4,390	4,100	3,180	3,230	4,280	6,340
15	7,400	9,990	10,800	8,520	5,720	4,580	4,430	4,750	3,770	3,290	4,040	6,420
16	7,090	9,260	10,400	9,090	6,000	5,050	4,940	5,500	4,010	3,840	4,320	7,090
17	6,910	8,580	10,200	8,740	6,200	4,820	5,190	4,320	4,440	5,790	4,000	7,450
18	6,600	9,210	10,600	8,000	5,560	4,640	5,090	3,960	4,490	7,540	4,120	6,390
19	8,410	9,370	10,500	7,430	4,980	4,550	4,570	4,540	4,740	6,730	4,550	5,750
20	10,200	9,650	10,000	7,290	4,740	4,320	4,290	4,240	4,750	4,670	4,870	5,570
21	10,500	9,440	9,780	6,780	4,610	4,420	4,440	3,860	3,720	4,730	4,900	5,360
22	9,550	9,800	10,400	6,130	5,240	4,590	4,460	3,940	3,290	4,140	4,150	5,500
23	8,620	9,860	9,950	5,980	5,810	5,150	4,300	4,050	3,080	3,740	4,040	6,090
24	8,290	9,930	9,720	5,940	5,580	4,660	4,170	4,400	2,980	3,750	4,300	5,940
25	8,520	9,730	10,200	6,530	5,130	4,150	3,970	4,750	2,890	3,790	4,240	5,240
26	8,860	9,910	10,500	6,820	5,000	3,940	4,260	4,780	2,980	3,730	4,680	6,090
27	8,220	10,100	9,710	6,570	4,960	4,280	4,300	4,130	3,100	3,820	5,070	7,400

Table 2.3-2 (Sheet 2 of 2)
Mean Daily Flows on the Broad River at Richtex, South Carolina (Period of Data: 1925 to 1983)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28	7,820	9,040	9,660	6,820	4,780	3,860	3,980	3,860	3,230	3,850	4,740	7,570
29	7,930	7,030	10,100	6,720	5,230	4,090	3,990	4,360	3,390	3,450	5,360	7,460
30	7,690	—	9,920	6,770	5,680	4,230	3,770	4,910	4,100	3,430	5,720	7,990
31	7,340	—	10,600	—	6,220	—	3,790	4,470	—	3,570	—	7,790

Table 2.3-3 (Sheet 1 of 2)
Mean Daily Flows on the Broad River at Alston, South Carolina (Period of Data: 1980 to 2005)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6,070	5,790	11,300	8,260	6,980	4,300	3,480	4,910	1,720	6,420	2,390	4,090
2	6,950	6,200	10,500	7,810	6,540	6,040	4,180	5,560	1,890	4,290	2,490	4,320
3	6,650	9,020	8,560	7,490	6,650	4,820	5,220	3,610	2,180	3,010	2,400	5,090
4	8,090	11,200	6,090	7,090	6,850	4,860	5,000	3,800	3,800	2,680	2,270	5,020
5	8,280	12,800	6,230	7,300	6,350	4,790	3,880	3,510	2,580	2,350	3,100	5,050
6	7,220	10,800	8,770	6,180	6,060	4,350	3,630	3,650	2,690	2,590	3,140	6,200
7	6,940	9,630	10,600	6,650	7,680	4,640	3,370	3,520	2,370	2,690	3,060	7,440
8	5,110	9,190	10,700	7,620	7,440	4,920	4,420	3,470	5,320	2,770	3,400	6,900
9	6,030	6,840	10,600	9,870	7,220	5,470	5,060	3,540	6,970	3,050	2,780	5,490
10	6,680	6,840	10,400	10,600	6,540	4,650	4,520	3,230	8,860	2,470	2,780	4,370
11	8,520	7,080	8,280	13,100	5,080	3,640	4,000	3,320	6,110	2,830	2,900	5,890
12	8,380	8,130	5,810	12,000	4,760	3,360	2,620	3,450	2,820	3,400	2,790	7,340
13	6,200	7,590	5,910	8,920	4,010	3,910	3,100	3,700	2,150	3,340	3,800	9,050
14	4,550	8,440	6,600	8,600	4,170	3,710	4,060	3,700	2,080	2,830	3,980	7,870
15	4,640	12,800	6,030	6,460	4,100	3,350	4,410	3,140	2,300	2,110	3,520	6,630
16	4,670	14,000	6,430	6,680	4,110	4,020	3,640	4,020	2,360	2,240	2,910	6,660
17	6,250	10,500	8,010	7,330	3,520	4,620	3,420	3,810	2,580	2,730	3,240	6,440
18	6,210	9,500	10,200	7,790	3,640	3,300	3,170	2,760	2,640	2,760	3,710	5,690
19	6,690	7,680	10,500	9,950	4,030	3,860	4,000	3,460	2,400	2,710	3,280	4,350
20	6,920	7,360	11,200	9,950	4,040	3,800	3,830	3,130	2,500	2,370	3,340	4,550
21	5,910	7,690	15,100	8,120	4,570	3,190	3,250	2,220	2,130	2,120	3,860	4,500
22	6,450	7,200	15,600	6,160	4,420	3,620	2,570	2,240	1,870	2,120	3,170	3,920
23	6,840	8,200	11,600	5,770	7,230	3,250	2,700	2,330	2,640	1,930	3,070	4,130
24	9,680	9,580	8,540	6,130	9,050	3,250	3,490	1,940	2,880	1,980	3,540	5,630
25	9,630	8,200	7,170	7,350	7,960	3,150	3,550	2,230	2,310	2,070	3,290	7,740
26	8,840	6,880	7,090	5,760	5,960	4,010	4,210	2,100	2,670	2,340	3,970	9,320
27	7,050	7,020	6,210	5,960	4,710	4,240	3,560	2,440	2,810	3,230	3,660	7,540

Table 2.3-3 (Sheet 2 of 2)
Mean Daily Flows on the Broad River at Alston, South Carolina (Period of Data: 1980 to 2005)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28	8,310	9,740	7,670	8,070	4,550	3,380	3,150	2,000	3,190	3,320	3,920	5,930
29	7,630	15,400	11,400	6,780	5,730	4,470	2,990	1,980	3,590	3,070	3,470	4,920
30	6,520	—	12,600	7,490	5,330	3,830	3,060	2,250	3,480	2,740	3,490	4,450
31	7,080	—	10,900	—	5,720	—	3,560	1,880	—	2,550	—	5,540

Table 2.3-4 (Sheet 1 of 2)
Mean Daily Flows on the Broad River at Carlisle, South Carolina (Period of Data: 1938 to 2005)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	4,360	4,480	5,890	7,910	4,370	3,400	2,530	2,930	2,420	3,830	2,690	2,960
2	4,140	5,150	5,240	6,510	4,170	3,600	2,850	2,850	2,140	3,440	2,660	2,920
3	4,110	6,000	5,360	5,340	4,400	3,450	3,030	2,800	2,090	2,730	3,190	2,890
4	4,340	6,380	5,570	5,010	4,670	3,160	2,650	3,120	2,210	2,360	3,130	2,890
5	4,270	6,210	6,060	5,360	4,470	3,230	2,630	3,100	2,340	2,630	2,800	3,290
6	4,150	5,930	6,170	5,990	3,830	3,270	2,840	2,730	2,290	3,230	2,650	3,580
7	4,530	6,690	6,630	5,990	3,840	3,190	2,880	2,700	2,650	3,190	2,810	3,860
8	4,400	6,230	5,930	6,450	4,260	3,390	3,710	2,810	3,530	2,910	2,900	4,260
9	4,580	5,310	5,870	6,320	4,100	3,380	3,920	2,610	3,770	4,170	2,560	3,760
10	4,880	4,910	5,290	5,640	3,810	3,340	3,190	2,480	3,520	4,810	2,470	3,250
11	5,190	5,330	4,860	5,760	3,510	3,280	3,280	2,850	2,390	3,730	2,550	3,750
12	4,760	4,930	5,070	6,040	3,380	3,140	3,270	2,910	2,180	2,620	2,700	4,040
13	4,180	4,990	6,030	5,610	3,630	3,210	3,100	2,810	2,020	2,250	2,710	4,580
14	4,350	5,960	6,910	5,440	3,990	3,290	3,120	3,120	2,160	2,200	2,730	4,000
15	4,150	6,450	6,680	5,350	3,990	3,510	2,990	3,960	2,510	2,320	2,640	3,680
16	4,170	5,550	6,120	5,700	4,170	3,670	3,430	3,080	2,350	2,890	2,560	4,210
17	4,390	5,550	6,010	5,650	4,140	3,540	3,580	2,640	2,790	3,890	2,480	3,890
18	4,050	5,980	6,350	5,030	3,510	3,240	3,360	3,390	3,520	3,540	2,650	3,490
19	4,440	5,850	6,000	5,250	3,460	2,900	2,830	3,440	3,640	2,790	2,870	3,550
20	4,860	5,540	6,430	5,030	3,360	2,870	2,800	2,680	2,760	2,550	3,340	3,360
21	5,160	5,520	7,400	4,280	3,450	3,180	2,870	2,550	2,400	2,610	2,990	3,370
22	5,180	5,710	7,340	4,000	3,860	3,610	2,990	2,530	2,180	2,350	2,650	3,730
23	5,050	5,810	5,810	3,990	4,430	3,650	2,700	2,770	2,410	2,250	2,700	3,670
24	5,330	5,690	6,110	4,190	4,360	3,050	2,570	3,060	2,210	2,450	2,820	3,470
25	5,280	5,560	6,360	4,090	3,720	2,810	2,540	3,140	2,270	2,680	2,930	3,740
26	5,400	6,020	5,840	4,060	3,690	3,150	2,550	3,070	2,400	2,610	3,310	4,290
27	4,980	5,800	5,680	4,300	3,610	3,050	2,480	2,360	2,410	2,730	3,150	4,390

Table 2.3-4 (Sheet 2 of 2)
Mean Daily Flows on the Broad River at Carlisle, South Carolina (Period of Data: 1938 to 2005)

Day of Month	Mean of daily mean values for each day (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28	5,120	5,510	5,640	4,570	3,450	2,940	2,590	2,650	2,420	2,430	3,220	4,130
29	5,310	5,150	6,150	4,910	3,910	3,040	2,520	3,000	2,550	2,330	3,700	4,540
30	4,430	—	6,890	4,790	4,360	2,790	2,540	2,920	3,110	2,310	3,650	4,910
31	4,440	—	7,320	—	3,960	—	2,610	2,450	—	2,710	—	4,450

Table 2.3-5 (Sheet 1 of 3)
Mean Monthly Flows on the Broad River at Richtex, South Carolina (Period of Data: 1925 to 1983)

	Monthly mean flows (cfs)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1925	—	—	—	—	—	—	—	—	—	2,180	3,640	3,548
1926	9,110	10,680	7,344	6,399	2,395	1,825	3,042	4,633	2,553	1,298	2,482	4,098
1927	3,068	7,051	6,998	3,679	2,265	3,299	5,402	2,205	2,400	1,656	1,813	9,496
1928	3,788	6,218	6,355	9,609	8,183	4,879	7,334	—	—	—	—	—
1929	—	—	—	—	—	—	—	—	—	23,500	9,945	9,040
1930	8,042	8,124	6,669	4,956	4,274	3,559	2,952	2,592	2,537	1,642	5,190	6,077
1931	6,230	3,343	4,773	7,446	6,296	2,898	4,025	5,305	1,495	1,120	1,418	11,630
1932	13,710	7,120	8,463	5,518	4,303	4,826	2,446	4,609	1,837	10,450	10,250	15,300
1933	8,360	9,377	6,491	5,534	4,935	2,757	3,575	5,664	4,964	2,379	2,273	2,718
1934	3,544	4,486	9,523	6,959	6,050	10,320	3,731	3,981	4,271	9,096	3,401	5,059
1935	8,217	6,667	7,029	7,507	4,658	3,028	4,952	5,117	5,115	1,915	4,207	2,977
1936	24,110	13,270	11,550	27,690	4,485	3,506	3,062	6,437	4,143	14,960	3,607	7,336
1937	22,010	10,610	7,012	11,090	5,715	4,801	3,754	5,432	5,600	10,610	4,571	4,738
1938	5,323	3,991	5,213	6,602	3,212	5,352	6,958	3,790	3,351	1,793	3,231	4,056
1939	5,321	17,140	12,010	5,418	4,537	2,774	3,618	6,353	2,021	1,686	1,689	2,358
1940	3,862	6,032	4,975	3,789	2,482	2,580	2,212	10,620	2,746	1,605	4,421	3,744
1941	3,741	2,747	4,410	4,325	1,918	2,317	14,500	3,570	1,836	1,339	1,883	4,708
1942	3,311	9,584	12,800	3,958	4,821	3,935	3,958	4,513	4,168	2,435	2,549	5,519
1943	14,520	7,798	8,976	7,084	4,550	4,445	9,881	3,530	2,499	1,928	2,743	3,384
1944	6,290	10,900	19,020	12,710	5,768	4,337	3,177	3,312	2,337	4,425	3,085	3,742
1945	4,552	8,580	6,449	5,890	4,101	2,135	4,433	3,323	15,300	3,073	3,062	11,950
1946	14,730	12,480	8,273	6,124	7,441	3,758	4,281	5,266	3,139	5,092	3,871	3,546
1947	13,610	4,899	8,183	6,053	3,449	4,484	3,408	2,752	2,210	6,311	11,880	5,845
1948	6,873	14,330	12,230	9,996	5,503	4,097	3,722	5,760	4,279	2,780	11,900	11,520
1949	9,324	11,370	6,100	8,030	8,119	4,190	6,401	13,510	7,538	8,598	7,495	4,848
1950	5,507	4,953	6,701	4,996	4,275	4,574	4,430	2,880	4,589	3,902	2,799	5,408
1951	3,363	4,683	6,243	6,644	3,186	3,227	2,456	2,261	2,673	1,625	2,465	9,374

Table 2.3-5 (Sheet 2 of 3)
Mean Monthly Flows on the Broad River at Richtex, South Carolina (Period of Data: 1925 to 1983)

Year	Monthly mean flows (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1952	5,203	8,773	25,340	6,839	4,297	3,111	2,377	4,781	2,819	1,937	2,160	2,668
1953	7,414	11,580	9,925	4,143	6,116	3,408	2,298	1,748	2,803	1,769	1,814	6,265
1954	13,910	5,625	8,309	7,615	3,802	2,421	2,062	1,261	767	725	1,448	2,353
1955	3,178	7,320	3,342	7,996	5,064	2,503	3,405	2,507	1,370	2,205	1,891	1,807
1956	1,864	10,330	8,017	11,440	5,125	2,119	2,030	1,078	3,074	2,179	2,331	3,381
1957	3,280	7,191	7,461	7,992	4,828	5,727	2,216	2,295	3,370	4,760	14,340	7,277
1958	8,941	7,854	8,746	16,680	11,710	4,473	6,158	3,890	2,463	2,426	2,413	4,341
1959	5,471	6,439	7,278	8,729	6,542	6,546	6,356	3,482	7,120	15,440	6,000	6,741
1960	10,300	24,520	13,370	13,010	6,727	5,039	3,922	4,059	4,083	5,289	3,541	3,714
1961	5,385	15,750	9,458	12,340	6,065	7,568	5,204	6,139	3,303	2,332	3,017	10,750
1962	12,160	10,390	12,600	15,460	4,558	6,583	4,077	3,259	3,233	2,895	4,135	4,175
1963	8,015	6,774	19,530	5,059	6,686	4,758	3,695	2,096	2,345	2,438	2,504	4,420
1964	10,820	9,997	14,290	17,520	7,022	4,782	5,720	6,122	5,295	22,480	6,435	9,985
1965	6,289	10,550	15,600	11,610	6,120	8,311	7,309	4,863	2,938	4,047	3,420	3,026
1966	5,016	13,030	12,780	4,409	5,015	3,407	2,346	2,905	4,547	3,378	3,914	3,549
1967	5,750	6,661	4,627	3,120	3,813	4,753	5,992	11,290	3,872	2,682	3,507	10,870
1968	12,220	4,680	8,880	4,632	4,740	7,165	5,765	2,210	1,863	2,505	4,162	3,577
1969	6,707	10,520	10,130	13,940	4,578	5,042	2,781	4,889	6,321	3,295	3,730	6,703
1970	4,911	7,354	7,466	6,673	3,697	2,481	2,047	6,157	1,726	2,454	5,251	3,864
1971	6,465	13,270	12,560	6,185	8,595	3,575	3,960	5,131	3,995	9,002	7,047	10,260
1972	12,220	8,700	6,710	6,450	9,820	9,557	4,998	5,163	2,633	2,872	4,274	12,570
1973	8,435	14,970	14,880	16,920	9,465	10,500	5,472	4,409	6,764	3,654	3,153	5,819
1974	12,150	11,500	6,151	11,360	6,007	4,756	4,948	5,173	3,656	2,752	3,179	6,430
1975	13,620	11,970	21,020	8,042	11,330	9,087	7,001	3,875	7,326	7,756	6,074	5,384
1976	9,076	6,369	8,553	6,646	6,738	6,921	4,622	2,727	3,657	16,510	5,456	12,660
1977	8,069	4,460	11,950	13,150	4,071	3,573	2,440	2,243	4,544	4,922	7,033	3,310
1978	14,190	4,888	10,010	5,912	8,271	4,053	2,802	5,195	3,074	2,022	2,296	3,139
1979	8,580	15,290	12,200	13,020	7,093	5,781	5,094	2,941	4,182	6,400	7,265	5,047

Table 2.3-5 (Sheet 3 of 3)
Mean Monthly Flows on the Broad River at Richtex, South Carolina (Period of Data: 1925 to 1983)

	Monthly mean flows (cfs)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	9,999	5,769	19,150	12,080	6,523	6,384	3,781	2,448	3,694	6,739	5,530	4,365
1981	3,425	8,084	4,114	5,176	3,294	3,128	2,270	2,281	3,158	1,948	1,950	5,826
1982	15,410	12,740	7,699	6,410	5,498	6,202	3,950	4,363	1,978	2,232	2,823	8,365
1983	8,651	14,250	15,660	13,470	6,951	4,234	3,388	2,128	2,127	—	—	—
Mean monthly flow	8,380	9,190	9,850	8,630	5,560	4,660	4,350	4,300	3,710	4,900	4,350	6,050
Maximum monthly flow	24,110	24,520	25,340	27,690	11,710	10,500	14,500	13,510	15,300	23,500	14,340	15,300
Minimum monthly flow	1,864	2,747	3,342	3,120	1,918	1,825	2,030	1,078	767	725	1,418	1,807
Maximum daily flow	72,200	71,100	92,500	145,000	41,800	58,400	47,400	109,000	91,000	211,000	91,900	64,200
Minimum daily flow	450	634	746	895	727	250	375	284	149	149	332	400

Table 2.3-6
Mean Monthly Flows on the Broad River at Alston, South Carolina (Period of Data: 1980 to 2005)

	Monthly mean flows (cfs)											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1980	—	—	—	—	—	—	—	—	—	4,891	4,402	3,776
1981	3,040	7,495	3,685	4,317	3,057	2,900	2,114	2,139	2,460	1,821	1,805	5,271
1982	14,630	12,200	7,269	5,992	5,035	5,724	3,549	3,888	1,740	2,142	2,782	8,292
1983	8,571	14,130	15,270	13,290	6,942	4,120	3,312	2,076	2,074	2,180	3,218	14,020
1984	11,100	14,210	13,040	11,120	12,550	4,920	6,516	6,579	2,532	—	—	—
1996	—	—	—	—	—	—	—	—	—	4,539	3,818	7,191
1997	7,862	10,880	10,980	7,763	6,370	4,903	4,815	2,445	2,064	3,115	4,121	6,391
1998	15,170	16,790	13,860	14,560	7,400	4,415	2,659	3,593	3,121	2,745	2,611	3,603
1999	6,620	6,746	4,356	3,985	3,736	2,265	2,077	1,147	1,042	3,128	2,408	2,895
2000	5,072	5,602	6,816	4,803	2,758	1,385	1,242	1,244	2,235	1,120	1,824	2,190
2001	2,517	2,537	7,171	4,063	1,783	2,167	2,084	1,023	1,434	1,059	1,276	1,894
2002	3,466	3,621	4,813	3,474	2,351	968	849	546	1,621	2,360	4,926	8,961
2003	3,814	8,244	18,890	18,040	14,830	8,909	8,006	9,795	3,710	2,999	3,655	4,519
2004	3,302	6,994	4,038	3,963	2,759	4,427	2,919	2,149	14,740	4,417	5,071	7,337
2005	5,008	5,432	10,020	7,429	3,805	6,115	8,130	4,017	1,926	—	—	—
Mean monthly flow	6,940	8,840	9,250	7,910	5,640	4,090	3,710	3,130	3,130	2,810	3,220	5,870
Maximum monthly flow	15,170	16,790	18,890	18,040	14,830	8,909	8,130	9,795	14,740	4,891	5,071	14,020
Minimum monthly flow	2,517	2,537	3,685	3,474	1,783	968	849	546	1,042	1,059	1,276	1,894
Maximum Daily flow	85,100	59,900	96,300	51,000	66,400	29,900	25,200	78,500	21,900	106,000	42,000	49,200
Minimum daily flow	1,040	1,060	1,100	1,090	1,120	242	327	156	48	541	838	991

Table 2.3-7 (Sheet 1 of 3)
Mean Monthly Flows on the Broad River at Carlisle, SC from 1938 to 2005

Year	Monthly mean flows (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1938	—	—	—	—	—	—	—	—	—	1,401	2,463	2,715
1939	3,252	9,948	7,025	3,554	3,171	2,193	2,429	4,520	1,488	1,309	1,236	1,574
1940	2,317	3,348	2,996	2,585	1,791	1,941	1,730	7,582	2,143	1,360	2,884	2,425
1941	2,501	1,887	2,843	2,940	1,509	1,647	8,092	2,507	1,386	1,038	1,395	2,845
1942	2,208	5,925	6,317	2,564	3,653	2,867	2,762	3,208	3,361	1,783	1,718	4,209
1943	8,375	4,828	5,243	4,681	3,237	3,441	6,001	2,614	1,879	1,436	1,952	2,141
1944	3,696	6,252	10,210	7,746	4,063	3,201	2,295	2,609	1,883	3,441	2,311	2,640
1945	3,031	4,926	4,052	3,735	2,803	1,547	3,373	2,261	9,885	2,292	2,264	7,549
1946	9,164	8,455	5,603	4,381	4,962	2,865	3,263	3,518	2,319	3,508	2,768	2,520
1947	7,874	3,249	4,548	3,775	2,455	3,568	2,605	2,003	1,642	4,911	7,507	3,498
1948	4,150	8,360	7,001	5,978	3,486	2,806	2,844	4,513	2,751	1,973	8,093	6,180
1949	5,492	6,373	4,244	5,629	5,468	3,561	4,931	9,495	5,329	6,926	5,559	3,627
1950	4,100	3,730	4,684	3,544	3,110	3,376	3,244	2,193	3,824	3,032	2,173	4,273
1951	2,480	3,455	4,596	4,532	2,474	2,480	2,006	1,739	1,794	1,175	1,801	6,105
1952	3,696	5,619	14,920	4,784	3,201	2,365	1,635	3,602	2,160	1,478	1,617	2,019
1953	4,837	7,793	6,413	3,094	3,677	2,587	1,572	1,288	2,318	1,248	1,263	3,921
1954	8,494	3,632	5,426	4,253	2,493	1,506	1,179	982	628	562	1,087	1,659
1955	1,997	4,330	2,433	4,699	3,457	1,836	2,424	1,621	892	1,546	1,374	1,271
1956	1,220	6,315	4,414	5,990	3,270	1,396	1,507	750	2,149	1,484	1,616	2,305
1957	2,216	5,048	4,822	5,582	3,056	4,205	1,653	1,782	2,679	3,339	8,651	4,413
1958	5,484	5,239	5,122	11,400	7,315	3,475	4,131	2,768	1,628	1,637	1,709	3,443
1959	3,696	3,613	4,305	5,950	4,639	4,177	3,695	2,627	4,493	9,120	3,945	4,468
1960	5,824	13,040	8,407	8,531	4,883	3,968	2,732	2,911	3,135	3,820	2,613	2,630
1961	3,635	8,702	5,690	7,608	4,390	6,013	3,740	4,932	2,561	1,830	2,392	7,503
1962	7,429	6,360	7,550	10,500	3,638	5,446	3,335	2,657	2,558	2,499	3,404	3,203
1963	4,855	4,107	11,680	3,643	4,235	3,213	2,659	1,711	1,840	1,601	1,798	2,634

Table 2.3-7 (Sheet 2 of 3)
Mean Monthly Flows on the Broad River at Carlisle, SC from 1938 to 2005

	Monthly mean flows (cfs)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1964	6,056	6,029	6,952	9,906	4,115	3,145	3,856	3,676	2,687	14,720	4,511	5,662
1965	4,174	6,555	8,913	6,794	4,052	4,913	5,599	3,521	2,179	3,154	2,418	2,189
1966	2,875	8,345	7,398	2,968	3,288	2,464	1,689	2,014	3,089	2,413	3,142	2,700
1967	3,654	4,115	3,251	2,149	2,601	3,647	4,775	7,226	2,727	2,241	2,374	7,546
1968	6,907	3,249	5,723	2,988	3,322	3,386	3,461	1,815	1,461	2,129	2,643	2,330
1969	3,110	6,766	6,318	7,730	3,256	3,454	2,183	3,643	4,212	2,688	3,089	4,857
1970	3,517	4,982	4,036	4,333	2,810	2,132	1,885	5,373	1,648	2,058	3,266	2,643
1971	3,890	8,033	6,542	3,935	5,688	2,480	2,951	3,297	2,968	7,076	5,302	6,953
1972	6,847	6,293	4,553	4,247	6,841	6,330	3,183	2,467	1,910	2,129	3,316	7,531
1973	5,379	9,095	9,708	9,573	6,929	6,763	3,472	3,132	3,061	2,682	2,276	4,311
1974	7,514	7,162	4,344	7,801	4,390	3,657	3,380	3,290	2,437	2,031	2,049	3,114
1975	7,184	6,549	13,070	5,205	8,534	6,435	4,324	2,622	5,021	5,873	4,413	3,765
1976	5,957	4,475	4,833	4,469	4,765	5,042	2,839	1,869	2,537	10,840	3,268	7,125
1977	4,542	2,954	7,377	7,354	2,956	2,507	1,782	1,808	3,769	3,031	5,509	3,644
1978	10,610	4,954	6,669	4,050	5,350	2,867	2,123	3,484	2,269	1,704	1,799	2,448
1979	5,597	8,865	8,033	7,423	5,063	4,141	3,559	2,409	3,712	4,955	5,338	3,414
1980	5,649	3,579	9,444	7,660	5,665	4,999	3,066	2,210	2,712	3,805	3,650	2,991
1981	2,400	4,376	2,685	2,900	2,310	2,151	1,561	1,220	1,417	1,184	1,263	2,960
1982	7,719	6,770	3,974	3,380	3,129	3,232	2,405	2,412	1,324	1,419	1,955	4,748
1983	4,451	7,512	8,407	7,999	4,666	3,030	2,388	1,609	1,548	1,836	2,405	7,498
1984	5,768	8,293	8,481	6,996	7,657	3,570	4,162	4,142	1,966	2,377	2,206	2,807
1985	3,168	6,404	2,858	2,481	2,004	1,453	1,763	4,375	1,651	—	—	—
1996	—	—	—	—	—	—	—	—	—	2,103	2,205	4,318
1997	4,108	5,601	6,415	5,079	3,963	3,239	2,478	1,634	1,462	2,049	2,257	3,376
1998	8,115	9,258	8,099	7,288	4,584	2,930	1,888	2,220	1,588	1,666	1,648	2,155
1999	3,740	3,700	2,638	2,627	2,244	1,518	1,412	722	693	1,733	1,473	1,797
2000	2,539	2,916	4,160	3,301	1,785	1,051	793	696	1,062	651	985	1,298
2001	1,393	1,546	3,865	2,421	1,314	1,364	1,533	783	1,046	743	815	1,150

Table 2.3-7 (Sheet 3 of 3)
Mean Monthly Flows on the Broad River at Carlisle, SC from 1938 to 2005

	Monthly mean flows (cfs)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	2,199	1,941	2,722	1,889	1,333	687	535	375	713	1,440	3,029	5,252
2003	2,885	4,783	10,600	11,660	10,220	6,281	5,396	6,678	2,772	2,309	2,897	3,446
2004	2,411	4,726	2,685	2,957	2,104	3,477	2,238	1,747	11,010	2,950	3,810	5,367
2005	3,686	3,381	6,119	4,743	2,783	3,615	5,800	2,854	1,486	—	—	—
Mean monthly flow	4,640	5,670	6,100	5,290	3,930	3,240	2,930	2,890	2,590	2,890	2,870	3,770
Maximum monthly flow	10,610	13,040	14,920	11,660	10,220	6,763	8,092	9,495	11,010	14,720	8,651	7,549
Minimum monthly flow	1,220	1,546	2,433	1,889	1,314	687	535	375	628	562	815	1,150
Maximum daily flow	62,800	54,000	70,400	57,400	50,400	41,000	31,200	85,500	71,200	114,000	55,600	36,500
Minimum daily flow	352	500	536	478	192	90	57	63	44	50	295	275

Table 2.3-8
Major Historic Floods and Peak flows in the Broad River near the Site

	Observed at Richtex[(a)] or Alston[(b)] Station		Estimated at Parr Shoals Dam[(c)]	
Date	Maximum Discharge (cfs)	Water Elevation (feet, NGVD29[(d)])	Maximum Discharge (cfs)	Water Elevation (feet, NGVD29[(d)])
October 3, 1929	228,000 [(a)]	215.54[(e)]	223,299	266.2
August 17, 1928	222,000 [(a)]	214.94[(e)]	217,423	266.1
April 8, 1936	157,000 [(a)]	209.80[(e)]	153,763	264.2
October 11, 1976	146,000 [(a)]	208.54	142,990	263.9
August 16, 1940	120,000 [(a)]	205.94	117,526	263.0
October 18,1964	102,000 [(a)]	204.14	99,897	262.4
October 18, 1932	101,000 [(a)]	204.04	98,918	262.4
October 14, 1990	119,000 [(b)]	238.81	118,006	263.0
March 3, 1987	108,000 [(b)]	237.51	107,098	262.7

(a) Recorded in Broad River at Richtex USGS gauging station No. 02161500 (drainage area: 4,850 square miles).
(b) Recorded in Broad River at Alston USGS gauging station No. 02161000 (drainage area: 4,790 square miles).
(c) Peak values at Parr Shoals Dam (drainage area: 4,750 square miles) are estimated based on drainage area ratios.
(d) At the VCSNS site the difference between the NGVD29 datum and the NAVD88 is –0.696 feet. For example, EL 425 feet NGVD29 is equivalent to EL 424.304 feet NAVD88
(e) Data obtained from the PSAR for the VCSNS unit 1 (SCE&G 1971).

Table 2.3-9
Flood Frequency Data for the Broad River at Parr Shoals Dam

Return Period (Year)	Exceedance Probability (%)	Peak Flood Discharge (cfs)
500.00	0.2	280,000
200.00	0.5	230,000
100.00	1.0	197,000
50.00	2.0	167,000
20.00	5.0	132,000
10.00	10.0	108,000
5.00	20.0	85,500
2.00	50.0	56,800
1.25	80.0	39,300
1.11	90.0	33,000
1.05	95.0	28,800
1.01	99.0	22,800

Table 2.3-10 (Sheet 1 of 2)
N-Day Low Flow Values for Broad River at Parr Shoals Dam

	N-day Low Flow Values (cfs)						
Year	3-day	7-day	10-day	30-day	60-day	183-day	365-day
1929	614	1,254	1,463	2,114	2,521	3,403	7,048
1930	792	947	1,061	1,412	2,012	2,787	3,923
1931	715	950	931	1,065	1,166	2,638	4,125
1932	1,355	1,678	2,029	1,808	2,173	3,508	5,494
1933	1,123	1,606	1,612	2,085	2,170	3,146	3,946
1934	927	1,773	1,848	2,500	3,475	4,778	4,906
1935	622	1,254	1,331	1,732	2,394	3,870	4,942
1936	2,158	2,707	2,640	3,260	3,774	5,394	7,793
1937	1,466	1,806	1,912	2,842	3,450	4,478	5,196
1938	1,250	1,614	1,544	1,727	1,988	3,451	4,216
1939	798	1,174	1,219	1,404	1,591	2,746	3,184
1940	1,010	1,202	1,207	1,461	1,841	3,004	3,639
1941	658	880	915	1,152	1,426	2,663	3,782
1942	1,414	1,644	1,808	2,102	2,340	3,501	4,794
1943	1,365	1,715	1,728	1,858	2,115	3,322	4,905
1944	1,515	1,570	1,667	1,984	2,592	3,263	4,169
1945	1,952	2,212	2,280	2,675	2,969	4,909	5,221
1946	1,356	1,669	1,653	2,135	2,323	3,641	5,036
1947	1,544	1,757	1,725	2,136	2,333	3,361	4,936
1948	2,004	2,392	2,363	2,553	3,094	4,224	6,539
1949	1,655	2,199	2,191	2,777	3,534	4,195	5,213
1950	1,170	1,251	1,333	1,935	2,215	3,325	3,788
1951	1,095	1,158	1,290	1,576	1,980	2,387	3,455
1952	1,123	1,203	1,341	1,653	1,818	2,725	4,505
1953	545	625	617	752	994	2,253	4,502
1954	399	580	573	633	712	1,390	2,694
1955	518	633	678	961	1,070	1,894	3,335
1956	851	1,212	1,345	1,746	2,023	2,034	3,674
1957	1,998	2,114	2,165	2,413	2,918	3,629	4,254
1958	1,792	2,073	2,081	2,264	2,344	3,285	4,794
1959	2,559	2,867	3,113	3,543	3,814	5,994	5,605
1960	2,282	2,374	2,760	3,235	3,524	4,018	6,107
1961	1,890	2,155	2,161	2,237	2,430	4,451	6,472
1962	1,355	1,539	1,637	1,797	1,959	3,514	5,706
1963	1,560	1,770	1,745	1,905	2,264	2,827	5,217
1964	2,148	2,454	2,554	2,878	3,708	6,705	7,400
1965	1,479	1,570	1,634	2,149	2,365	3,554	4,992
1966	1,671	1,887	2,055	2,672	3,081	3,241	3,899

Table 2.3-10 (Sheet 2 of 2)
N-Day Low Flow Values for Broad River at Parr Shoals Dam

	N-day Low Flow Values (cfs)						
Year	3-day	7-day	10-day	30-day	60-day	183-day	365-day
1967	1,332	1,437	1,464	1,793	1,984	4,303	4,805
1968	1,254	1,336	1,364	1,543	1,728	2,868	4,525
1969	1,031	1,302	1,283	1,591	2,082	3,721	4,580
1970	1,087	1,161	1,207	1,420	1,692	2,940	4,375
1971	2,115	2,247	2,332	2,498	3,644	4,812	6,111
1972	2,119	2,219	2,222	2,410	2,645	4,775	6,461
1973	2,693	2,751	2,779	2,934	3,142	4,682	6,350
1974	2,364	2,471	2,488	2,562	2,760	3,997	6,047
1975	1,890	1,987	2,054	2,340	2,691	5,084	6,075
1976	1,639	1,761	1,875	2,022	2,115	4,759	6,088
1977	405	1,185	1,417	2,130	3,306	3,231	5,473
1978	1,054	1,284	1,434	1,949	2,075	3,026	4,930
1979	1,234	1,581	1,969	2,273	2,471	5,043	6,636
1980	975	1,193	1,300	1,914	2,097	3,142	4,178
1981	901	967	1,141	1,317	1,787	2,284	3,406
1982	1,290	1,482	1,489	1,831	2,047	3,388	5,612
1983	1,083	1,519	1,717	1,930	1,967	2,790	6,796
1984	1,230	1,638	1,700	2,000	2,153	3,321	3,995
1985	833	894	1,025	1,169	1,409	2,671	4,204
1986	1,088	1,118	1,160	1,717	2,044	2,985	3,702
1987	787	790	795	1,010	1,123	2,116	3,075
1988	1,114	1,118	1,122	1,439	1,344	1,566	2,388
1989	1,292	1,407	1,527	2,078	2,246	3,652	4,218
1990	1,299	1,487	1,559	2,008	2,406	3,354	6,068
1991	1,249	1,748	1,802	2,164	2,322	3,062	4,605
1992	1,372	1,662	1,886	2,079	2,222	4,726	4,666
1993	1,345	1,354	1,379	1,776	1,961	2,594	4,305
1994	1,616	1,864	2,006	2,539	3,185	5,143	5,370
1995	1,636	1,905	2,111	2,462	2,996	4,805	7,437
1996	1,144	1,418	1,525	1,699	2,193	3,824	5,900
1997	1,240	1,655	1,681	2,064	1,922	3,348	5,699
1998	591	727	760	959	1,030	2,355	3,364
1999	599	681	783	1,054	1,086	1,957	3,061
2000	512	527	554	850	1,198	1,467	2,418
2001	175	198	250	475	572	1,405	2,078
2002	784	1,018	1,072	1,633	1,098	1,354	2,131
Minimum	175	198	250	475	572	1,354	2,078

Source: USGS 2006.

Table 2.3-11
Daily Average Water Temperature versus Depth Data at Monticello Reservoir Circulating Water Intake Station for Summer of 1994

Depth (feet)	Temperature (°F)					
	Jun (6/2/94)	Jun (6/30/94)	Jul (7/21/94)	Aug (8/17/94)	Aug (8/25/94)	Sep (9/8/94)
0.5	78.1	83.0	84.8	81.4	83.5	81.1
3.8	75.5	82.8	82.4	81.4	82.8	80.6
6.9	74.3	80.0	82.4	81.4	82.3	79.4
10.2	73.6	79.6	82.2	81.4	82.1	79.2
13.1	72.7	79.4	82.1	81.4	81.9	79.1
16.2	72.7	—	82.1	81.4	81.7	78.8
20.0	72.5	79.2	81.7	81.2	81.7	78.9
23.4	72.2	79.2	81.7	81.2	81.7	78.8
26.7	71.6	79.0	81.7	81.2	81.5	78.8
30.0	71.2	79.0	81.2	81.2	81.4	78.8
33.1	70.8	79.0	81.2	81.2	81.2	78.8
36.4	70.6	78.9	81.2	81.2	81.1	78.7
39.7	70.1	78.5	81.2	81.2	81.2	78.8
42.8	69.9	78.5	81.2	81.2	81.2	78.7
46.2	69.6	78.1	80.9	81.2	80.6	78.7
49.5	69.1	77.7	80.6	81.2	80.4	78.5
52.6	68.9	77.0	80.3	81.2	80.3	78.4
56.0	68.9	76.3	80.0	81.2	80.1	78.4
59.1	68.5	76.1	79.7	81.0	79.4	78.0
62.4	68.2	75.8	79.6	81.0	78.8	77.9
65.7	68.0	74.3	79.4	81.0	78.8	77.6
68.9	66.9	73.6	79.4	80.8	78.5	77.4
72.2	66.5	72.7	78.7	80.6	78.3	77.1
75.3	66.5	71.1	76.9	79.4	78.1	76.7
78.8	66.5	69.5	75.7	78.8	77.9	76.4
81.8	63.3	68.9	73.2	74.8	77.8	75.0
85.2	—	64.4	71.1	68.0	76.2	—
88.5	—	59.4	63.2	60.1	61.6	70
91.9	—	58.0	58.8	59.9	60.3	—

Table 2.3-12 (Sheet 1 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1995

	Temperature (°F)											
Depth (feet)	Jan (1/25/95)	Feb (2/22/95)	Mar (3/24/95)	Apr	May (5/22/95)	Jun (6/21/95)	Jul (7/21/95)	Aug (8/25/95)	Sep (9/20/95)	Oct (10/26/95)	Nov (11/20/95)	Dec (12/13/95)
Uplake 16												
0.0	52.0	49.3	64.3	—	76.0	79.2	88.6	84.8	80.5	73.4	63.7	59.0
3.3	51.8	49.1	62.8	—	75.6	78.8	88.2	84.8	80.3	72.9	62.8	58.1
6.6	51.1	49.0	62.3	—	75.2	78.7	87.5	84.8	79.9	72.5	62.6	57.6
9.8	51.1	48.2	61.9	—	74.9	78.5	87.1	84.8	79.9	72.5	62.5	57.2
13.1	51.1	48.1	61.7	—	73.8	77.6	86.9	84.8	79.7	72.5	62.3	57.2
16.4	51.1	48.1	61.6	—	72.2	77.4	86.6	84.6	79.7	72.5	62.1	57.2
19.7	50.9	48.1	61.6	—	71.8	76.5	82.3	84.6	79.7	72.4	61.9	57.2
23.0	50.9	48.1	61.4	—	71.3	76.1	81.9	84.6	79.7	72.4	61.7	56.3
26.2	50.9	48.1	56.9	—	70.9	75.8	81.5	84.2	79.7	72.2	61.4	56.3
29.5	50.9	48.1	55.6	—	70.6	75.8	81.4	84.2	79.7	72.0	61.4	56.3
32.8	50.9	48.1	54.0	—	69.8	75.6	81.2	84.2	79.7	72.0	61.2	56.3
36.1	50.9	47.9	53.5	—	69.3	75.4	81.2	84.2	79.7	72.0	61.2	56.3
39.4	50.9	47.9	52.9	—	69.5	75.4	80.6	84.2	79.7	71.8	61.0	56.3
42.7	50.9	47.9	52.4	—	69.1	75.2	80.6	84.2	79.7	71.8	61.0	55.9
45.9	50.9	47.9	52.2	—	68.9	75.2	80.5	84.2	79.7	71.8	61.0	55.9
49.2	50.9	47.9	52.2	—	68.9	75.2	80.1	84.1	79.7	71.8	61.0	55.9
52.5	50.8	47.9	52.0	—	68.8	75.1	79.9	84.1	79.7	71.6	60.8	55.8
55.8	50.6	47.9	51.8	—	68.4	75.1	79.9	83.9	79.7	71.6	60.8	55.8
59.1	50.6	47.9	—	—	68.2	74.9	79.7	83.9	79.7	71.6	60.8	55.8
62.3	50.4	47.9	—	—	67.9	74.5	79.6	83.7	79.7	71.5	60.5	55.8
65.6	50.2	47.9	—	—	67.5	74.2	—	83.5	79.4	71.5	60.1	55.8
68.9	—	47.7	—	—	67.1	73.8	—	83.5	79.4	71.1	59.9	55.8
72.2	—	47.7	—	—	66.8	73.1	—	83.3	79.2	70.2	—	55.8

Table 2.3-12 (Sheet 2 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1995

	Temperature (°F)											
Depth (feet)	Jan (1/25/95)	Feb (2/22/95)	Mar (3/24/95)	Apr	May (5/22/95)	Jun (6/21/95)	Jul (7/21/95)	Aug (8/25/95)	Sep (9/20/95)	Oct (10/26/95)	Nov (11/20/95)	Dec (12/13/95)
Uplake 16 (continued)												
75.5	—	47.7	—	—	65.7	71.8	—	83.2	79.0	69.8	—	55.8
78.7	—	—	—	—	64.8	70.7	—	82.8	79.0	69.3	—	55.8
82.0	—	—	—	—	63.4	68.6	—	—	—	69.1	—	55.8
85.3	—	—	—	—	60.7	—	—	—	—	—	—	55.8
Intake 2												
0.0	51.3	50.2	64.4	—	75.8	76.0	83.3	84.4	81.4	72.7	61.4	57.2
3.3	50.9	49.0	61.7	—	75.2	75.6	82.6	84.2	81.2	72.7	61.2	57.2
6.6	50.8	49.0	61.2	—	74.0	75.2	82.3	84.2	81.0	72.7	61.2	57.2
9.8	50.6	49.0	60.8	—	73.6	75.2	82.3	84.2	80.8	72.5	61.2	56.8
13.1	50.4	49.0	60.3	—	72.5	75.2	82.3	84.2	80.6	72.2	61.2	56.8
16.4	50.2	49.0	60.1	—	71.8	75.2	82.1	84.2	80.6	72.2	61.2	56.8
19.7	50.2	49.0	59.4	—	71.3	75.1	82.1	84.2	80.6	72.0	61.2	56.8
23.0	50.2	49.0	58.9	—	71.1	75.1	82.1	84.2	80.5	72.0	61.2	56.3
26.2	50.2	49.0	58.3	—	70.7	75.1	81.9	84.2	80.5	72.0	61.2	56.3
29.5	50.2	49.0	58.0	—	69.8	75.1	81.9	84.2	80.5	72.0	61.2	56.3
32.8	50.2	49.0	57.8	—	69.7	75.1	81.9	84.2	80.5	71.8	61.2	56.3
36.1	50.2	48.8	57.2	—	69.5	75.1	81.7	84.2	80.5	71.8	61.2	56.3
39.4	50.2	49.0	56.3	—	69.3	74.9	81.2	84.2	80.5	71.8	61.2	56.3
42.7	50.2	49.0	55.4	—	69.1	74.9	81.0	84.2	80.5	71.8	61.2	55.9
45.9	50.2	49.0	54.5	—	68.8	74.9	80.8	84.2	80.5	71.5	61.0	55.8
49.2	50.2	48.8	53.8	—	68.6	74.9	80.5	84.2	80.5	70.9	61.2	55.8
52.5	50.2	49.0	52.2	—	68.4	74.9	80.1	84.2	80.5	70.7	61.0	55.6
55.8	50.2	48.8	51.1	—	68.2	74.9	79.9	84.2	80.5	70.7	61.0	55.4
59.1	50.2	48.8	50.4	—	68.0	74.9	78.8	84.2	80.5	70.6	61.0	55.4
62.3	50.2	48.8	50.0	—	68.0	74.9	78.7	84.2	80.3	70.6	60.8	55.4

Table 2.3-12 (Sheet 3 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1995

Depth (feet)	Temperature (°F) Jan (1/25/95)	Feb (2/22/95)	Mar (3/24/95)	Apr	May (5/22/95)	Jun (6/21/95)	Jul (7/21/95)	Aug (8/25/95)	Sep (9/20/95)	Oct (10/26/95)	Nov (11/20/95)	Dec (12/13/95)
Intake 2 (continued)												
65.6	50.2	48.8	49.9	—	67.7	74.9	78.3	—	80.1	70.6	60.5	—
68.9	50.0	48.8	49.9	—	66.4	74.9	78.1	—	79.9	70.4	59.9	—
72.2	50.0	—	49.9	—	66.1	74.7	76.5	—	79.7	70.4	59.8	—
75.5	49.9	—	47.7	—	64.4	—	76.1	—	79.4	70.2	59.2	—
78.7	49.5	—	47.7	—	62.8	—	75.8	—	78.8	70.2	59.0	—
82.0	—	—	47.7	—	—	—	74.5	—	78.7	—	—	—
85.3	—	—	47.7	—	—	—	68.8	—	78.5	—	—	—
88.6	—	—	47.7	—	—	—	—	—	—	—	—	—
Discharge 6												
0.0	65.9	54.7	73.1	—	—	89.6	92.2	98.8	92.2	86.8	72.4	73.4
3.3	59.6	50.4	68.0	—	75.8	81.2	90.0	92.5	86.2	76.7	66.4	60.8
6.6	53.1	49.9	60.1	—	74.0	76.3	83.0	86.5	81.4	73.3	61.6	57.2
9.8	52.7	49.5	59.8	—	73.8	76.3	82.6	86.2	81.2	72.7	61.6	57.2
13.1	52.6	49.1	59.8	—	72.7	76.1	82.4	85.0	81.0	72.7	61.6	57.2
16.4	52.4	49.1	59.8	—	72.4	76.0	82.4	85.0	81.0	72.7	61.6	57.2
19.7	52.4	49.0	59.0	—	72.2	76.0	82.1	85.0	80.8	72.5	61.6	57.2
23.0	52.4	49.0	58.3	—	71.8	75.8	82.1	84.8	80.8	72.5	61.6	57.2
26.2	52.0	49.0	57.8	—	71.3	75.8	81.9	84.8	80.6	72.4	61.4	57.2
29.5	51.8	49.0	57.1	—	70.9	75.6	81.9	84.8	80.6	72.2	61.4	57.2
32.8	51.8	49.0	56.5	—	70.2	75.6	81.9	84.8	80.6	72.2	61.0	57.0
36.1	81.8	48.8	55.8	—	69.8	75.4	81.7	84.6	80.6	72.2	60.8	57.0
39.4	51.7	48.8	54.4	—	69.7	75.4	81.5	84.6	80.5	72.0	60.5	57.0
42.7	51.5	48.6	53.5	—	69.5	75.4	81.4	84.6	80.5	72.0	60.3	57.0
45.9	51.5	48.8	52.7	—	69.1	75.2	81.2	84.4	80.1	71.8	30.1	57.0
49.2	51.3	48.6	52.6	—	68.8	75.1	81.0	—	80.1	71.8	59.8	57.0

Table 2.3-12 (Sheet 4 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1995

	Temperature (°F)											
Depth (feet)	Jan (1/25/95)	Feb (2/22/95)	Mar (3/24/95)	Apr	May (5/22/95)	Jun (6/21/95)	Jul (7/21/95)	Aug (8/25/95)	Sep (9/20/95)	Oct (10/26/95)	Nov (11/20/95)	Dec (12/13/95)
Discharge 6 (continued)												
52.5	51.1	—	—	—	—	—	80.8	—	79.9	71.6	—	57.0
55.8	51.1	—	—	—	—	—	80.6	—	79.7	71.6	—	57.0
59.1	50.9	—	—	—	—	—	79.9	—	79.6	71.5	—	56.8
62.3	50.9	—	—	—	—	—	79.6	—	79.6	71.5	—	56.8
65.6	—	—	—	—	—	—	—	—	79.6	71.1	—	56.3
68.9	—	—	—	—	—	—	—	—	—	—	—	56.3

Table 2.3-13 (Sheet 1 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1996

	Temperature (°F)											
Depth (feet)	Jan (1/26/96)	Feb (2/22/96)	Mar (3/22/96)	Apr (4/18/96)	May (5/22/96)	Jun (6/19/96)	Jul (7/22/96)	Aug (8/27/96)	Sep (9/26/96)	Oct (10/24/96)	Nov (11/20/96)	Dec (12/17/96)
Uplake 16												
0.0	48.6	55.3	52.9	65.7	81.0	86.2	85.5	85.3	80.1	70.9	63.4	56.5
3.3	48.6	53.3	52.9	64.8	80.8	86.0	85.5	84.6	79.7	70.7	63.4	56.3
6.6	48.6	50.6	52.6	63.7	80.1	85.5	85.3	84.1	79.4	70.6	62.8	56.3
9.8	48.6	50.0	52.6	62.6	72.0	85.3	85.3	83.9	79.2	70.6	62.1	56.3
13.1	48.6	49.7	52.0	61.4	69.5	83.5	84.8	83.9	79.2	70.6	61.9	56.3
16.4	48.6	49.7	52.0	60.5	68.8	77.6	84.1	83.9	79.0	70.6	61.9	56.3
19.7	48.6	49.7	52.0	59.9	68.0	76.5	84.1	83.7	79.0	70.6	61.7	56.3
23.0	48.6	49.5	51.8	59.4	67.7	76.0	83.5	83.7	78.7	70.4	61.7	56.3
26.2	48.4	49.1	51.8	58.3	67.5	75.4	82.4	83.2	78.5	70.6	61.6	56.3
29.5	48.4	49.0	51.8	57.6	67.1	75.1	81.7	82.6	78.5	70.4	61.4	56.3
32.8	48.4	48.6	51.8	57.2	66.8	74.9	81.4	82.4	78.5	70.4	61.4	56.2
36.1	48.4	48.2	51.8	56.7	66.6	74.7	81.0	82.3	78.5	70.2	61.2	56.0
39.4	48.4	47.9	51.8	56.3	66.2	74.5	80.8	82.3	78.3	70.0	61.2	55.6
42.7	48.4	47.7	51.8	56.0	65.9	74.3	80.6	82.1	78.3	69.8	61.0	55.6
45.9	48.4	47.7	51.8	55.4	65.7	74.0	80.6	82.1	78.3	68.8	61.0	55.6
49.2	48.4	47.7	51.8	55.1	65.3	73.6	80.5	82.1	78.1	69.8	61.0	55.6
52.5	48.4	47.7	51.8	54.7	65.0	73.3	80.5	82.1	78.1	69.7	61.0	55.6
55.8	48.2	47.5	51.7	54.5	64.6	73.1	80.3	81.9	78.1	69.7	61.0	55.6
59.1	48.2	47.5	51.3	54.4	64.4	72.5	80.1	81.9	78.1	69.7	61.0	55.6
62.3	48.2	47.5	51.1	54.0	63.9	72.4	79.9	81.9	77.9	69.7	61.0	55.4
65.6	48.1	47.3	50.8	53.8	63.5	72.0	79.9	81.9	77.8	69.7	60.8	55.3
68.9	47.7	47.3	50.2	53.5	62.6	71.5	79.7	81.7	77.6	69.5	60.8	55.1
72.2	47.5	47.3	50.0	53.1	61.9	70.9	79.6	81.5	77.4	69.1	60.8	55.1
75.5	47.3	47.2	49.9	52.7	60.3	69.5	79.6	81.4	77.0	68.8	60.8	54.9

Table 2.3-13 (Sheet 2 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1996

	Temperature (°F)											
Depth (feet)	Jan (1/26/96)	Feb (2/22/96)	Mar (3/22/96)	Apr (4/18/96)	May (5/22/96)	Jun (6/19/96)	Jul (7/22/96)	Aug (8/27/96)	Sep (9/26/96)	Oct (10/24/96)	Nov (11/20/96)	Dec (12/17/96)
Uplake 16 (continued)												
78.7	47.3	47.2	49.7	52.4	58.0	67.7	79.4	—	76.9	68.6	60.8	54.7
82.0	47.3	—	49.7	52.4	—	65.9	78.7	—	—	68.8	60.8	54.7
Intake 2												
0.0	46.8	—	51.7	61.0	70.4	81.5	82.6	82.8	78.3	68.9	61.2	56.0
3.3	47.0	48.8	51.5	60.1	70.0	79.2	82.6	82.4	78.3	68.9	61.2	55.6
6.6	46.8	48.8	51.3	59.8	70.0	78.3	82.6	82.4	78.3	68.8	61.2	55.3
9.8	46.6	48.6	51.1	59.6	69.3	77.6	82.6	82.4	78.3	68.8	61.2	54.9
13.1	46.6	48.6	51.1	59.2	69.1	77.6	82.6	82.3	78.3	68.8	61.2	54.5
16.4	46.6	48.6	51.1	59.0	69.1	77.6	82.4	82.3	78.3	68.8	61.2	54.5
19.7	46.6	48.4	51.1	58.9	—	77.6	82.4	82.3	78.3	68.8	61.0	54.4
23.0	46.4	48.2	51.1	58.9	68.9	77.6	82.4	82.3	78.3	68.8	61.0	54.4
26.2	46.4	48.2	51.1	58.7	68.9	77.4	82.3	82.3	78.3	68.6	61.0	54.4
29.5	46.6	48.2	50.9	58.3	68.9	77.4	82.3	82.3	78.3	68.6	61.0	54.2
32.8	46.6	48.2	50.8	58.1	68.8	77.2	82.3	82.3	78.3	68.6	61.0	54.2
36.1	46.4	48.2	50.8	57.6	68.2	77.0	82.3	82.3	78.3	68.6	61.0	54.2
39.4	46.4	48.1	50.8	57.6	67.3	77.0	82.3	82.3	78.1	68.6	61.0	54.0
42.7	46.4	48.1	50.8	57.4	67.0	74.7	82.1	82.1	77.9	68.6	61.0	53.6
45.9	46.4	47.9	50.8	55.8	65.0	73.3	81.9	82.1	77.8	68.6	61.0	53.6
49.2	46.3	47.9	50.8	54.2	63.5	72.5	81.9	82.1	77.8	68.4	61.0	53.6
52.5	46.3	47.9	50.8	53.6	63.0	71.3	81.9	82.1	77.8	—	61.0	53.6
55.8	46.3	47.9	50.6	52.9	62.8	70.9	81.9	82.1	77.8	68.2	61.0	53.5
59.1	46.3	47.9	50.6	52.7	62.6	70.4	81.9	82.1	77.6	68.2	60.8	53.5
62.3	46.3	47.7	50.6	52.2	61.7	69.7	81.7	82.1	77.6	68.2	60.5	53.5
65.6	46.3	47.7	50.6	52.0	61.7	69.7	81.7	81.9	77.6	68.0	60.5	53.5
68.9	46.3	47.7	50.6	51.8	61.7	69.1	81.7	81.9	77.2	67.7	60.3	53.3
—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2.3-13 (Sheet 3 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1996

Depth (feet)	Temperature (°F) Jan (1/26/96)	Feb (2/22/96)	Mar (3/22/96)	Apr (4/18/96)	May (5/22/96)	Jun (6/19/96)	Jul (7/22/96)	Aug (8/27/96)	Sep (9/26/96)	Oct (10/24/96)	Nov (11/20/96)	Dec (12/17/96)
Intake 2 (continued)												
72.2	46.1	47.7	50.6	51.8	61.7	67.9	81.7	81.9	77.0	67.5	59.9	53.3
75.5	46.1	47.7	50.4	51.7	61.0	66.4	80.8	81.5	77.0	—	59.2	53.1
78.7	46.1	47.7	50.6	51.5	56.3	65.5	73.3	81.4	77.0	67.5	58.9	53.1
82.0	46.1	47.5	50.6	51.5	54.0	63.0	67.5	79.4	76.7	67.5	58.7	53.1
85.3	46.1	47.3	50.4	51.5		59.9	61.0		76.5	67.3		53.1
88.6	46.1	—	—	—	—	—	—	—	—	—	—	—
Discharge 6												
0.0	60.3	61.7	64.6	63.4	77.2	92.3	95.2	93.6	94.0	82.8	73.1	64.8
3.3	54.2	56.0	60.8	61.9	77.2	83.5	88.4	89.6	83.2	74.7	67.0	61.2
6.6	48.2	48.8	53.1	59.8	76.9	78.5	83.5	83.3	79.4	69.8	61.9	56.2
9.8	48.1	48.2	52.6	59.2	76.5	78.1	83.2	83.2	79.0	69.7	61.7	56.0
13.1	47.9	48.2	52.6	59.0	74.9	77.6	82.8	83.0	78.8	69.7	61.6	55.8
16.4	47.7	48.2	52.4	58.7	72.4	77.4	82.8	83.0	78.7	69.7	61.6	55.8
19.7	47.7	48.1	52.4	58.3	70.7	77.2	82.4	82.8	78.5	69.7	61.6	55.6
23.0	47.5	48.1	52.4	58.1	69.7	76.9	82.3	82.8	78.5	69.7	61.6	55.6
26.2	47.5	48.1	52.4	58.0	68.9	76.1	81.7	82.8	78.5	69.7	61.6	54.9
29.5	47.3	48.1	50.2	57.6	68.6	76.0	81.5	82.6	78.5	69.5	61.6	54.7
32.8	47.3	47.9	50.2	57.4	68.0	75.6	81.4	82.6	78.3	69.5	61.6	54.7
36.1	47.3	47.9	50.2	57.2	67.5	75.2	81.2	82.6	78.3	69.5	61.6	54.5
39.4	47.3	47.7	51.8	57.1	—	75.2	81.2	82.3	78.3	69.5	61.6	54.5
42.7	47.3	47.7	51.3	—	—	75.1	81.0	82.3	78.3	69.5	61.6	54.4
45.9	47.3	47.7	50.9	—	—	74.9	81.0	82.3	78.1	69.5	—	54.4
49.2	47.3	47.5	50.9	—	—	74.9	80.6	—	—	—	—	54.4
52.5	47.3	—	50.8	—	—	—	80.5	—	—	—	—	54.4
55.8	47.2	—	50.6	—	—	—	—	—	—	—	—	54.4
59.1	—	—	50.6	—	—	—	—	—	—	—	—	54.4

Table 2.3-13 (Sheet 4 of 4)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 1996

	Temperature (°F)											
Depth (feet)	Jan (1/26/96)	Feb (2/22/96)	Mar (3/22/96)	Apr (4/18/96)	May (5/22/96)	Jun (6/19/96)	Jul (7/22/96)	Aug (8/27/96)	Sep (9/26/96)	Oct (10/24/96)	Nov (11/20/96)	Dec (12/17/96)
Discharge 6 (continued)												
62.3	—	—	50.6	—	—	—	—	—	—	—	—	54.2
65.6	—	—	—	—	—	—	—	—	—	—	—	54.4

Table 2.3-14 (Sheet 1 of 3)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 2006

	Temperature (°F)											
Depth (feet)	Jan (1/4/06)	Feb (2/22/06)	Mar (3/29/06)	Apr (4/21/06)	May	Jun (6/8/06)	Jul (7/5/06)	Aug (8/30/06)	Sep	Oct (10/18/06)	Nov (11/10/06)	Dec (12/11/06)
Uplake 16												
0.0	53.2	56.1	59.1	71.4	—	78.7	87.2	87.3	—	72.7	65.2	57.7
3.3	53.0	56.0	58.7	71.8	—	78.6	87.2	87.3	—	73.1	64.9	57.9
6.6	52.9	54.9	58.0	71.4	—	78.2	87.2	87.2	—	73.2	64.5	57.2
9.8	52.8	53.4	57.8	70.3	—	77.8	87.0	87.2	—	73.2	64.1	56.7
13.1	52.7	53.3	57.7	69.9	—	77.2	86.8	87.2	—	73.1	63.9	56.6
16.4	52.0	53.2	57.6	68.6	—	77.1	86.8	87.1	—	73.1	63.8	56.5
19.7	51.4	53.0	57.3	67.9	—	76.8	86.6	86.6	—	73.1	63.8	56.5
23.0	51.1	52.8	57.1	65.3	—	76.7	83.4	85.6	—	73.1	63.8	56.4
26.2	50.7	52.1	56.8	64.5	—	76.1	81.3	85.0	—	73.1	63.8	56.4
29.5	50.5	51.5	56.6	64.0	—	75.3	80.9	84.5	—	73.1	63.8	56.2
32.8	50.2	51.5	56.6	63.4	—	74.9	80.5	84.5	—	73.1	63.7	56.1
36.1	50.1	51.1	56.3	63.2	—	72.4	80.4	84.3	—	73.1	63.7	56.0
39.4	50.1	50.9	55.8	62.9	—	74.2	80.2	84.2	—	73.0	63.7	55.9
42.7	49.8	50.6	55.8	62.6	—	74.0	80.1	84.1	—	73.0	63.7	55.9
45.9	49.6	50.5	55.5	62.3	—	73.9	80.0	84.0	—	73.0	63.7	55.9
49.2	49.5	50.4	55.4	61.9	—	73.7	79.8	84.0	—	73.0	63.7	55.9
52.5	49.4	50.2	55.3	61.6	—	73.6	79.7	83.9	—	73.0	63.7	55.9
55.8	49.4	50.2	55.3	61.3	—	73.5	79.6	83.9	—	73.0	63.7	55.9
59.1	49.3	50.1	55.2	61.1	—	73.5	79.4	83.8	—	73.0	63.6	55.8
62.3	49.3	50.1	55.2	60.8	—	73.4	79.3	83.7	—	72.9	63.6	55.8
65.6	49.3	50.1	55.1	60.3	—	73.3	79.2	83.7	—	72.8	63.6	55.8
68.9	49.3	50.1	55.0	60.1	—	73.1	79.0	83.6	—	72.8	63.5	55.8
72.2	49.3	50.0	55.0	59.9	—	72.9	78.8	83.5	—	—	63.5	55.7
75.5	49.3	50.0	55.0	59.5	—		78.5	83.4	—	—	63.5	55.7

Table 2.3-14 (Sheet 2 of 3)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 2006

	Temperature (°F)											
Depth (feet)	Jan (1/4/06)	Feb (2/22/06)	Mar (3/29/06)	Apr (4/21/06)	May	Jun (6/8/06)	Jul (7/5/06)	Aug (8/30/06)	Sep	Oct (10/18/06)	Nov (11/10/06)	Dec (12/11/06)
Uplake 16 (continued)												
78.7	49.2	50.0	54.9	59.3	—	—	78.3	83.4	—	—	63.5	55.7
82.0	—	—	54.9	58.9	—	—	77.8	83.2	—	—	63.6	55.7
85.3	—	—	—	—	—	—	76.7	—	—	—	—	—
Intake 2												
0.0	52.6	51.5	56.1	71.9	—	74.9	81.8	84.3	—	73.2	64.4	—
3.3	52.5	51.4	56.0	71.9	—	74.9	81.4	84.2	—	73.2	64.0	56.8
6.6	52.4	51.6	55.6	70.0	—	74.9	81.4	84.2	—	73.2	63.7	56.0
9.8	52.3	49.9	55.5	68.4	—	74.9	81.2	84.1	—	73.1	63.5	55.8
13.1	51.7	49.7	55.3	67.2	—	74.9	81.2	84.1	—	73.1	63.4	55.8
16.4	51.2	49.7	55.2	66.3	—	74.9	81.2	84.1	—	73.1	63.4	55.7
19.7	50.8	49.7	55.2	64.9	—	74.9	81.2	84.1	—	73.1	63.4	55.7
23.0	50.3	49.6	55.1	64.5	—	74.9	81.1	84.1	—	73.1	63.4	55.7
26.2	50.3	49.6	55.1	63.8	—	74.9	81.1	84.1	—	73.1	63.4	55.6
29.5	50.2	49.5	54.9	63.5	—	74.9	81.1	84.1	—	73.1	63.4	55.6
32.8	50.2	49.4	54.8	62.7	—	74.9	81.0	84.1	—	73.1	63.3	55.5
36.1	50.2	449.3	54.8	62.5	—	74.9	80.9	84.1	—	73.1	63.3	55.4
39.4	50.2	49.3	54.8	62.2	—	74.9	80.9	84.1	—	73.1	63.3	55.4
42.7	50.2	49.2	54.7	61.6	—	74.9	80.9	84.1	—	73.1	63.3	55.3
45.9	50.1	49.1	54.7	61.1	—	74.9	80.9	84.1	—	73.1	63.3	55.3
49.2	50.1	49.1	54.7	60.9	—	74.8	80.8	84.1	—	73.1	63.3	55.3
52.5	50.1	49.0	54.7	60.6	—	74.8	80.8	84.1	—	73.1	63.3	55.3
55.8	50.0	48.9	54.7	60.3	—	74.7	80.6	84.1	—	73.1	63.3	55.2
59.1	49.9	48.8	54.7	60.1	—	74.7	80.4	84.1	—	73.1	63.1	55.1
62.3	49.8	48.8	54.7	60.0	—	74.6	79.5	84.1	—	73.1	62.4	55.0
65.6	49.7	48.7	54.7	60.0	—	—	79.0	—	—	73.1	62.3	55.1
68.9	49.7	48.6	—	60.0	—	—	77.9	—	—	73.0	62.2	55.1

Table 2.3-14 (Sheet 3 of 3)
Monthly Water Temperature Data versus Depth at Three Stations in Monticello Reservoir for Year 2006

Depth (feet)	Temperature (°F)											
	Jan (1/4/06)	Feb (2/22/06)	Mar (3/29/06)	Apr (4/21/06)	May	Jun (6/8/06)	Jul (7/5/06)	Aug (8/30/06)	Sep	Oct (10/18/06)	Nov (11/10/06)	Dec (12/11/06)
Intake 2 (continued)												
72.2	49.5	48.4	—	59.3	—	—	76.1	—	—	73.0	62.1	55.0
75.5	49.4	48.2	—	58.5	—	—	74.7	—	—	73.0	61.8	—
78.7	49.4	48.2	—		—	—		—	—	72.8	61.6	—
82.0	49.3	48.5	—		—	—		—	—			—
85.3	—	—	—	—	—	—	—	—	—	—	—	—
Discharge 6												
3.3	64.3	61.0	63.5	74.3	—	80.6	89.9	89.2	—	73.1	64.6	62.7
6.6	54.9	51.0	57.5	69.4	—	76.2	83.0	85.1	—	73.2	64.2	58.3
9.8	54.2	50.3	56.4	68.2	—	75.6	81.4	84.9	—	73.2	64.0	56.2
13.1	53.7	50.2	56.0	66.7	—	75.2	81.2	84.7	—	73.1	63.9	56.1
16.4	53.1	50.1	55.9	66.1	—	75.1	81.1	84.6	—	73.1	63.8	56.0
19.7	52.9	50.0	55.8	65.9	—	74.9	80.9	84.5	—	73.1	63.8	55.9
23.0	52.7	49.9	55.8	65.3	—	74.8	80.8	84.5	—	73.1	63.7	55.9
26.2	52.0	—	55.7	64.3	—	74.8	80.7	84.4	—	73.1	63.7	55.9
29.5	51.6	—	55.7	63.9	—	74.8	80.7	84.4	—	73.0	63.7	55.9
32.8	—	—	55.7	63.5	—	74.7	80.6	84.3	—	73.0	63.7	55.8
36.1	—	—	55.6	—	—	74.7	80.4	84.2	—	—	—	55.8
39.4	—	—	—	—	—	74.6	—	—	—	—	—	55.8
42.7	—	—	—	—	—	—	—	—	—	—	—	55.8
45.9	—	—	—	—	—	—	—	—	—	—	—	55.8
49.2	—	—	—	—	—	—	—	—	—	—	—	55.8
52.5	—	—	—	—	—	—	—	—	—	—	—	55.8

Table 2.3-15
Sediment Data Availability

DHEC Water Quality Monitoring Station ID	Site Description	Station Latitude	Station Longitude	From	To	Suspended Sediment Data (Pre-1999)		Suspended Sediment Data (1999–Present)			
						Count	Parameter	Count	Parameter	Count	Parameter
B-046	Broad River at SC 72/ 215/121, 3 MI E of Carlisle	34.5949167	–81.4201389	March 18, 1963	December 5, 2005	120	Turbidity	84	Turbidity	74	Total Suspended Solids
B-047	Broad River at SC 34, 14 MI NE of Newberry	34.3939722	–81.3966944	May 17, 1963	December 6, 2004	50	Turbidity	26	Turbidity	26	Total Suspended Solids
B-075	Sandy River at SC 215, 2.5 MI Above Confluence With Broad River	34.5931389	–81.3929167	June 6, 1963	December 5, 2005	45	Turbidity	76	Turbidity	0	Total Suspended Solids
B-155	Browns Creek at S-44-86, 8 MI E of Union	34.7246389	–81.4864722	September 18, 1972	December 5, 2005	8	Turbidity	69	Turbidity	0	Total Suspended Solids
B-335	Gregorys Creek at S-44-86, 8 MI E of Union	34.7196389	–81.4824722	September 6, 1995	December 2, 2004	2	Turbidity	22	Turbidity	0	Total Suspended Solids
B-346	Parr Reservoir 4.8 KM N of Dam, Upstream of Monticello Reservoir	34.3047222	–81.3553889	May 20, 1999	December 7, 2004	0	Turbidity	18	Turbidity	0	Total Suspended Solids

Table 2.3-16
Total Suspended Solids and Daily Flows at Carlisle Station for B-046

Station ID	Date	Total Suspended Solids (mg/l)	Flow from Carlisle Station (cfs)	Station ID	Date	Total Suspended Solids (mg/l)	Flow from Carlisle Station (cfs)
B-046	1/26/99	70.0	5,960	B-046	10/21/02	66.0	1,130
B-046	2/3/99	23.0	8,690	B-046	11/7/02	22.0	2,900
B-046	4/6/99	9.9	3,240	B-046	12/3/02	97.0	1,420
B-046	6/17/99	16.0	1,990	B-046	2/5/03	36.0	3,040
B-046	7/14/99	2.4	2,180	B-046	3/11/03	18.0	3,650
B-046	9/7/99	1.6	823	B-046	4/8/03	200.0	17,500
B-046	10/13/99	110.0	4,030	B-046	5/12/03	22.0	5,610
B-046	11/3/99	6.4	2,000	B-046	6/9/03	16.0	22,400
B-046	12/7/99	2.8	1,690	B-046	7/14/03	79.0	12,200
B-046	1/20/00	4.4	2,410	B-046	8/19/03	13.0	8,050
B-046	2/24/00	9.1	2,040	B-046	9/15/03	19.0	2,180
B-046	3/23/00	140.0	7,230	B-046	10/2/03	12.0	2,450
B-046	4/24/00	7.0	2,190	B-046	11/19/03	6.3	2,390
B-046	5/9/00	4.0	1,660	B-046	1/29/04	6.0	2,520
B-046	6/15/00	2.9	1,110	B-046	2/19/04	18.0	3,750
B-046	7/13/00	7.0	912	B-046	3/10/04	160.0	2,810
B-046	8/7/00	14.0	950	B-046	4/21/04	8.4	2,440
B-046	9/20/00	20.0	724	B-046	6/15/04	22.0	3,560
B-046	10/25/00	0.6	694	B-046	7/12/04	7.2	1,800
B-046	12/28/00	2.0	1,140	B-046	8/2/04	22.0	1,850
B-046	1/9/01	5.1	1,130	B-046	9/15/04	26.0	4,880
B-046	2/7/01	3.8	902	B-046	10/11/04	7.2	2,630
B-046	4/4/01	18.0	3,410	B-046	11/8/04	18.0	3,920
B-046	5/7/01	14.0	992	B-046	12/1/04	7.0	3,290
B-046	6/19/01	38.0	1,050	B-046	1/4/05	9.0	3,020
B-046	8/8/01	30.0	1,090	B-046	2/3/05	7.3	3,360
B-046	9/10/01	110.0	854	B-046	3/3/05	30.0	5,410
B-046	10/8/01	17.0	682	B-046	4/5/05	14.0	4,550
B-046	11/13/01	1.0	729	B-046	5/9/05	5.6	2,430
B-046	12/4/01	430.0	945	B-046	6/20/05	12.0	2,810
B-046	1/9/02	36.0	1,480	B-046	7/12/05	38.0	4,980
B-046	2/13/02	8.6	2,140	B-046	8/8/05	10.0	2,360
B-046	4/24/02	14.0	1,660	B-046	9/13/05	8.1	1,330
B-046	5/21/02	2.9	1,050	B-046	10/6/05	92.0	1,630
B-046	7/17/02	0.7	529	B-046	11/1/05	130.0	1,530
B-046	8/28/02	8.6	389	B-046	12/5/05	24.0	4,000
B-046	9/23/02	2.6	637				

Table 2.3-17
Total Suspended Solids and Daily Flows at Carlisle Station for B-047

Station ID	Date	Total Suspended Solids (mg/l)	Flow from Alston Station (cfs)
B-047	1/28/1999	26.0	5,090
B-047	2/18/1999	—	5,050
B-047	3/18/1999	13.0	5,070
B-047	4/15/1999	17.0	3,330
B-047	5/20/1999	26.0	3,280
B-047	6/17/1999	53.0	1,770
B-047	7/29/1999	27.0	1,230
B-047	8/26/1999	—	2,450
B-047	9/23/1999	9.5	1,010
B-047	10/5/1999	45.0	2,290
B-047	5/18/2000	14.0	1,770
B-047	6/15/2000	9.1	639
B-047	7/12/2000	9.5	916
B-047	8/24/2000	11.0	494
B-047	9/28/2000	26.0	3,430
B-047	10/26/2000	4.4	1,190
B-047	1/20/2004	6.5	3,340
B-047	2/5/2004	15.0	5,240
B-047	3/23/2004	5.9	2,790
B-047	4/20/2004	18.0	2,890
B-047	5/11/2004	23.0	2,700
B-047	6/30/2004	51.0	4,220
B-047	7/7/2004	38.0	3,460
B-047	8/2/2004	16.0	2,480
B-047	9/21/2004	38.0	8,900
B-047	10/14/2004	10.0	4,080
B-047	11/16/2004	8.9	3,860
B-047	12/6/2004	5.2	3,630

Table 2.3-18
Gradation of Bed Materials in Parr Reservoir (January 2007 Sampling)

NO.	Depth (feet)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	D50 (mm)	D50 Material[a]
SED1	0–2	0	32.6	12.3	55.1	—	—
SED1	4–6	0	78.0	10.0	12.0	0.143	Fine Sand
SED2	0–1	0	13.2	44.6	42.2	0.008	Fine Silt
SED2	1–7	0	14.0	41.2	44.8	0.008	Fine Silt
SED3	0–8	0	11.7	40.8	47.5	0.006	Vf Silt
SED4	0.85	0	1.5	36.4	62.1	0.003	Clay
SED5	0–4	0	34.3	48.7	17.0	0.032	Clay
SED5	4–8	0	86.7	3.4	9.9	0.296	Med Sand
SED6	0–5	0	98.5	0.0	1.5	0.283	Med Sand
SED6	5–7.5	0	8.3	37.0	54.7	0.004	Vf Silt
SED7	0–4.5	0	98.9	0.0	1.1	0.294	Med Sand
SED8	0–1	0	53.7	35.0	11.3	0.076	Vf Sand
SED8	1–6	0	98.4	0.0	1.6	0.243	Fine Sand
SED8	6–7	0	33.8	28.7	37.5	0.011	Fine Silt
SED9	0–1.5	0	96.6	2.1	1.3	0.168	Fine Sand
SED9	1.5–3.0	0	24.6	54.3	21.1	0.020	Med Silt
SED9	3.0–4.0	0	94.5	3.0	2.5	0.147	Fine Sand
SED9	4.0–9.0	0	26.3	58.8	14.9	0.026	Med Silt
SED10	0–3	0	7.9	61.1	31.0	0.009	Clay
SED10	3–4	0	60.7	27.1	12.2	0.088	Clay
SED10	4–9	0	13.7	38.8	47.5	0.006	Clay
SED11	0–1.5	0	87.1	2.6	10.3	0.264	Med Sand
SED11	1.5–6.0	0	8.2	32.0	59.8	0.003	Clay
SED12	0–6	0	27.5	40.2	32.3	0.018	Med Silt
SED12	6–9	12.9	72.9	4.3	9.9	0.409	Med Sand
SED13	0–8	0	7.0	40.5	52.5	0.004	Vf Silt
SED14	0–5.5	0	98.0	0.0	2.0	0.281	Med Sand
SED14	5.5–8.0	0	6.9	25.4	67.7	0.003	Clay
SED15	0–2.5	0	84.5	6.9	8.6	0.215	Fine Sand
SED15	2.5–5.5	0	51.1	24.4	24.5	0.080	Vf Sand
SED16	0–4.5	2	60.2	13.0	24.8	0.135	Fine Silt

(a) Based on Udden-Wentworth (*i.e.*, Pettijohn, 1972) size classification

Table 2.3-19 (Sheet 1 of 2)
Observation Well Details

Well ID	Northing[a]	Easting[a]	GS Elevation[b] (feet)	Top of Casing Elevation[b] (feet)	Total Well Depth (feet bgs)	Screen Interval Depth (feet)	Screen Interval Elevation (feet)	Top of Filter Pack (feet bgs)	Top of Filter Pack Elevation (feet)	Formation of Screen Interval
OW-205a	892829.3	1903189.8	423.3	425.9	110.00	98.5–108.5	324.8–314.8	80.0	343.3	Sound Rock
OW-205b	892842.4	1903192.5	422.9	425.0	60.00	54.9–59.9	368.0–363.0	49.9	373.0	PWR[c]
OW-212	893105.1	1903036.8	396.2	399.3	68.00	56–66	340.2–330.2	53.0	343.2	Saprolite / PWR
OW-213	892975.6	1903457.3	402.1	404.5	55.25	44.75–54.75	357.3–347.3	41.5	360.6	Saprolite
OW-227	892494.0	1903408.0	422.7	425.1	84.25	71.25–81.25	351.4–341.4	67.0	355.7	Bedrock
OW-233	892786.5	1902693.4	426.2	428.3	120.00	99–119	327.2–307.2	74.0	352.2	Bedrock
OW-305a	892008.7	1902841.2	424.9	427.8	141.00	119.5–139.5	305.4–285.4	95.0	329.9	Sound Rock
OW-305b	891996.7	1902857.5	423.7	426.3	66.50	54.5–64.5	369.2–359.2	51.0	372.7	PWR / Sound Rock
OW-312	892256.5	1902709.6	425.1	427.1	36.50	30.5–35.5	394.6–389.6	26.4	398.7	Saprolite / PWR
OW-313	892167.6	1903132.5	420.9	423.8	59.00	48–58	372.9–362.9	44.1	376.8	Saprolite / PWR
OW-327	891669.2	1903084.1	410.7	413.4	66.00	55–65	355.7–345.7	51.5	359.2	PWR
OW-333	891954.4	1902319.6	394.5	397.1	71.00	60–70	334.5–324.5	52.0	342.5	Sound Rock
OW-401a	891017.8	1903595.5	404.1	406.3	92.50	80–90	324.1–314.1	76.0	328.1	Sound Rock
OW-401b	891013.1	1903585.0	404.1	406.8	66.00	60–65	344.1–339.1	57.0	347.1	Saprolite/PWR
OW-405	890180.4	1903650.2	392.6	395.4	58.50	44–54	348.6–338.6	41.0	351.6	PWR
OW-501	897817.4	1903702.3	429.5	431.9	32.00	20–30	409.5–399.5	17.5	412.0	Fill / Residual Soil
OW-612	892415.5	1904227.3	406.8	409.4	62.00	47.5–57.5	359.3–349.3	44.5	362.3	Saprolite
OW-614	891671.1	1903536.1	376.1	379.1	33.00	21.5–31.5	354.6–344.6	18.5	357.6	Saprolite
OW-617	889886.3	1902373.7	447.2	450.1	108.00	98–108	349.2–339.2	93.0	354.2	PWR
OW-618	890955.6	1901480.1	307.4	310.5	32.50	18.5–28.5	288.9–278.9	13.8	293.6	Saprolite
OW-619	892594.0	1901843.9	405.7	407.7	104.00	83–103	322.7–302.7	77.5	328.2	Bedrock
OW-620	893593.8	1903017.2	382.8	385.0	91.00	76.5–86.5	306.3–296.3	74.0	308.8	PWR
OW-621b	893742.6	1903677.8	421.2	423.6	71.00	60–70	361.2–351.2	55.0	366.2	Saprolite / PWR
OW-622	894292.2	1904118.1	438.1	440.7	62.00	48.5–58.5	389.6–379.6	44.5	393.6	Bedrock
OW-623	893819.9	1904946.1	439.6	441.8	90.00	76.5–86.5	363.1–353.1	72.0	367.6	Bedrock
OW-624	891595.7	1904623.8	359.3	361.6	62.00	48.5–58.5	310.8–300.8	45.0	314.3	Bedrock
OW-625	889895.0	1904957.3	403.2	405.9	108.00	84.5–104.5	318.7–298.7	80.5	322.7	Saprolite

Table 2.3-19 (Sheet 2 of 2) Observation Well Details

Well ID	Northing[(a)]	Easting[(a)]	GS Elevation[(b)] (feet)	Top of Casing Elevation[(b)] (feet)	Total Well Depth (feet bgs)	Screen Interval Depth (feet)	Screen Interval Elevation (feet)	Top of Filter Pack (feet bgs)	Top of Filter Pack Elevation (feet)	Formation of Screen Interval
OW-626	893202.4	1904129.9	416.4	418.8	85	71–81	345.4–335.4	63.0	353.4	Saprolite
OW-627a	891239.9	1902130.4	327.6	330.3	86	66–86	261.6–241.6	64.0	263.6	Sound Rock
OW-627b	891231.6	1902129.7	326.9	329.5	56	43–53	283.9–273.9	37.0	289.9	Saprolite / PWR

(a) South Carolina State Plane NAD 83
(b) All elevations given in this table are with respect to the NAVD88 datum
(c) PWR = partially weathered rock

Table 2.3-20 (Sheet 1 of 2)
Monthly Groundwater Level Elevations

Well ID	Formation	Hydrostratigraphic Zone	Water Level Elevation[a]												
			2006							2007					
			6-23	7-25	8-30	9-19	10-24	11-29	12-20	1-26	2-20	3-20	4-19	5-23	6-27
OW-205a	Sound Rock	Deep Bedrock	357.3	357.3	357.1	357.2	357.1	357.4	357.5	358.4	358.6	358.9	359.1	359.0	359.0
OW-205b	Partially Weathered	Saprolite/Shallow Bedrock	364.9	365.0	365.2	366.1	366.1	365.3	365.4	365.5	365.7	365.9	366.3	366.9	367.2
OW-212	Saprolite/ PWR	Saprolite/Shallow Bedrock	351.4	351.0	351.2	351.1	350.8	351.6	351.3	352.5	352.8	353.1	352.9	352.8	352.6
OW-213	Saprolite	Saprolite/Shallow Bedrock	359.1	359.1	359.1	359.1	359.0	359.1	359.2	360.3	360.6	361.0	361.1	361.0	360.8
OW-227	Bedrock	Deep Bedrock	361.5	361.3	361.3	361.3	361.3	361.3	361.3	361.4	361.7	362.0	362.3	362.6	362.8
OW-233	Bedrock	Deep Bedrock	322.5	339.9	358.6	362.4	365.2	366.2	366.4	366.9	367.1	367.1	367.3	367.2	367.4
OW-305a	Sound Rock	Deep Bedrock	368.2	368.3	368.1	368.2	368.2	368.3	368.3	368.4	368.5	368.6	368.8	369.0	369.2
OW-305b	PWR/Sound Rock	Saprolite/Shallow Bedrock	367.4	367.5	367.4	367.4	367.5	367.6	367.5	367.6	367.7	367.8	367.9	368.2	368.4
OW-312	Saprolite/ PWR	Saprolite/Shallow Bedrock	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry			
OW-313	Saprolite/ PWR	Saprolite/Shallow Bedrock	372.8	372.7	372.9	373.0	373.2	373.3	373.3	373.1	373.8	374.1	374.5	374.9	375.1
OW-327	PWR	Saprolite/Shallow Bedrock	359.2	359.1	359.2	359.3	359.4	359.6	359.7	360.0	360.2	360.4	360.8	361.1	361.4
OW-333	Sound Rock	Deep Bedrock	333.8	334.7	335.1	335.1	335.1	334.6	335.0	336.2	337.6	338.5	339.5	339.5	339.1
OW-401a	Sound Rock	Deep Bedrock	351.2	351.0	351.1	351.2	351.5	351.4	351.3	351.7	352.3	352.6	352.9	353.0	352.9
OW-401b	Saprolite/ PWR	Saprolite/Shallow Bedrock	351.0	350.9	351.0	351.0	351.4	351.2	351.1	351.5	352.1	352.4	352.7	352.9	352.7
OW-405	PWR	Saprolite/Shallow Bedrock	353.8	353.7	353.8	353.9	354.0	353.9	353.8	354.3	354.8	355.2	355.7	356.0	356.0
OW-501	Fill / Residual	Saprolite/Shallow Bedrock	—	—	419.1	419.3	418.9	418.1	419.0	418.9	418.6	418.5	418.5	418.9	418.7

Table 2.3-20 (Sheet 2 of 2)
Monthly Groundwater Level Elevations

			Water Level Elevation[a]												
			2006							2007					
Well ID	Formation	Hydrostratigraphic Zone	6-23	7-25	8-30	9-19	10-24	11-29	12-20	1-26	2-20	3-20	4-19	5-23	6-27
OW-612	Saprolite	Saprolite/Shallow Bedrock	357.3	357.2	357.3	357.3	357.4	357.3	357.3	357.6	357.9	358.2	358.6	358.7	358.8
OW-614	Saprolite	Saprolite/Shallow Bedrock	349.9	349.1	349.4	349.2	348.4	350.2	349.4	351.9	351.4	351.7	351.1	350.5	350.0
OW-617	PWR	Saprolite/Shallow Bedrock	349.3	349.2	349.2	349.1	349.0	348.9	348.9	348.9	348.8	348.7	348.7	348.7	348.7
OW-618	Saprolite	Saprolite/Shallow Bedrock	303.5	303.3	303.6	303.6	303.3	303.8	303.7	304.2	304.2	304.1	304.1	303.5	303.6
OW-619	Bedrock	Deep Bedrock	303.1	303.9	305.6	306.7	308.5	310.3	311.4	313.1	314.4	315.7	317.1	318.6	320.2
OW-620	PWR	Saprolite/Shallow Bedrock	348.1	347.8	348.0	345.1	347.7	348.2	348.0	348.8	349.0	349.0	348.9	348.7	348.6
OW-621a	Sound Rock	Deep Bedrock	325.9	327.5	328.5	329.0	330.0	330.8	331.2	331.8	332.5	333.1	333.7	334.4	335.1
OW-621b	Saprolite/ PWR	Saprolite/Shallow Bedrock	368.6	368.5	368.7	368.7	368.7	368.8	368.8	369.0	369.4	369.7	370.4	370.8	371.3
OW-622	Bedrock	Saprolite/ Shallow Bedrock	394.0	393.9	394.1	394.2	394.2	394.2	394.2	394.2	394.4	394.6	394.8	394.9	394.8
OW-623	Bedrock	Saprolite/Shallow Bedrock	369.7	369.6	369.6	369.7	369.6	369.7	369.7	369.9	370.3	370.7	371.1	371.2	371.2
OW-624	Bedrock	Saprolite/Shallow Bedrock	302.5	307.6	313.5	315.9	317.9	318.8	319.1	319.9	320.2	320.5	320.8	320.7	320.5
OW-625	Saprolite	Saprolite/Shallow Bedrock	316.9	317.1	317.6	318.0	318.4	318.3	318.2	318.7	319.1	319.1	319.3	319.2	319.2
OW-626	Saprolite	Saprolite/Shallow Bedrock	368.9	368.8	368.9	368.9	369.0	369.0	369.0	369.3	369.7	370.1	370.0	371.0	371.2
OW-627a	Sound Rock	Deep Bedrock	258.5	267.5	249.5	249.3	254.8	259.7	262.3	270.7	276.8	282.6	288.2	293.4	297.9
OW-627b	Saprolite/ PWR	Saprolite/Shallow Bedrock	317.4	317.2	317.4	317.3	316.6	317.6	317.3	318.6	318.5	318.4	318.0	317.2	317.2

(a) All water level elevations given in this table are with respect to the NAVD88 datum

Table 2.3-21
Slug Test Results

Well Number	Test Interval: Screened Interval (feet bgs)	Test Interval: Hydrostratigraphic Zone	Test Interval: Submerged Screen	Hydraulic Conductivity: Falling Head Test (cm/s)	Hydraulic Conductivity: Rising Head Test (cm/s)	Hydraulic Conductivity: Maximum Test Result (feet/day)
OW-205A	98.5–108.5	Deep bedrock	Fully submerged screen	3.1E-6	Discard	0.0088
OW-212	56–66	Saprolite/Shallow bedrock	Fully submerged screen	8.7E-4	3.6E-4	2.5
OW-213	44.75–54.75	Saprolite/Shallow bedrock	Fully submerged screen	No test	5.9E-4	1.7
OW-227	71.25–81.25	Deep bedrock	Fully submerged screen	4.5E-5	4.4E-5	0.13
OW-305A	119.5–139.5	Deep bedrock	Fully submerged screen	7.3E-6	6.2E-6	0.021
OW-313	48–58	Saprolite/Shallow bedrock	Partially submerged screen	No test	3.4E-3	9.6
OW-327	55–65	Saprolite/Shallow bedrock	Fully submerged screen	No test	7.1E-5	0.20
OW-333	60–70	Deep bedrock	Partially submerged screen	No test	1.3E-4	0.38
OW-401A	80–90	Deep bedrock	Fully submerged screen	8.2E-5	6.9E-5	0.23
OW-401B	60–65	Saprolite/Shallow bedrock	Fully submerged screen	1.7E-5	1.5E-5	0.047
OW-405	44–54	Saprolite/Shallow bedrock	Fully submerged screen	6.4E-3	4.9E-3	18
OW-612	47.5–57.5	Saprolite/Shallow bedrock	Partially submerged screen	No test	5.0E-4	1.4
OW-617	98–108	Saprolite/Shallow bedrock	Fully submerged screen	No test	5.9E-7	0.0017
OW-618	18.5–28.5	Saprolite/Shallow bedrock	Fully submerged screen	2.2E-4	4.3E-4	1.2
OW-620	76.6–86.5	Saprolite/Shallow bedrock	Fully submerged screen	1.1E-3	1.3E-3	3.6
OW-621B	60–70	Saprolite/Shallow bedrock	Fully submerged screen	2.2E-4	2.2E-4	0.61
OW-622	48.5–58.5	Saprolite/Shallow bedrock	Fully submerged screen	4.8E-4	4.8E-4	1.4
OW-623	76.5–86.5	Saprolite/Shallow bedrock	Fully submerged screen	1.8E-5	1.1E-4	0.32
OW-625	84.5–104.5	Saprolite/Shallow bedrock	Partially submerged screen	No test	4.2E-4	1.2
OW-626	71–81	Saprolite/Shallow bedrock	Fully submerged screen	3.1E-5	1.3E-5	0.087
OW-627B	43–53	Saprolite/Shallow bedrock	Fully submerged screen	5.6E-5	1.6E-5	0.16

Hydrostratigraphic Zone	Maximum Test Result: Low (feet/day)	Maximum Test Result: High (feet/day)	Maximum Test Result: Geometric Mean (feet/day)
Saprolite/Shallow Bedrock Zone	0.0017	18.00	0.60
Deep Bedrock Zone	0.0088	0.38	0.07
All	0.0017	18.00	0.36

Table 2.3-22
Packer Test Results

	Test Interval		Hydraulic Conductivity	
Boring Number	Test Section Depth (feet bgs)	Material	Feet/Year	Feet/ Day
B-201	65–75	Sound Rock	0	0.00
	86–96	Sound Rock	49	0.13
B-205	59–69	Rock/Sound Rock	417	1.14
	93–106	Sound Rock	0	0.00
B-305	62–72	Sound Rock	86	0.24
	72–82	Sound Rock	0	0.00
B-330	57–67	Sound Rock	5	0.014
	67–77	Sound Rock	92	0.25

Hydraulic Conductivity (feet/day)		
Minimum	Maximum	Geometric Mean
0	1.14	0.166

Table 2.3-23 (Sheet 1 of 2)
Summary of Laboratory Test Results for Grain Size, Moisture Content and Specific Gravity and Derived Porosity Values

Source of Sample	Sample Number	Sample Depth	USCS	Unit[(a)]	Gs	Dry Density (pcf)	Void Ratio[(b)]	Porosity[(b)]	Wet Density	Water Content
B-204	UD-2	18.5	ML	Residual Soil	2.870	95.07	0.884	0.469	112	17.8%
B-204	UD-3	28.5	ML	Saprolite	2.950	87.44	1.105	0.525	109	24.1%
B-209	UD-1	8.5	MH	Residual Soil	2.810	70.59	1.484	0.597	101	42.9%
B-209[(c)]	UD-2	18.5	SM	Residual Soil	2.795	64.38	1.709	0.631	96	48.7%
B-209	UD-4	38.5	ML	Saprolite	2.860	87.32	1.044	0.511	114	30.2%
B-210	UD-1	8.5	ML	Residual Soil	2.750	88.56	0.938	0.484	108	22.3%
B-210	UD-3	28.5	ML	Saprolite	2.730	95.85	0.777	0.437	118	23.4%
B-210	UD-4	38.5	ML	Saprolite	2.780	84.91	1.043	0.511	108	27.1%
B-215	UD-1	8.5	SM	Saprolite	2.780	85.97	1.018	0.504	112	30.5%
B-215[(c)]	UD-2	18.5	SM	Saprolite	2.820	91.17	0.930	0.482	113	24.2%
B-215[(c)]	UD-3	28.5	SM	Saprolite	2.791	86.70	1.009	0.502	108	24.2%
B-216[(c)]	UD-1	6.5	ML	Saprolite	2.791	64.05	1.719	0.632	87	35.8%
B-216[(c)]	UD-2	13.5	ML	Saprolite	2.791	81.19	1.145	0.534	108	32.6%
B-216[(c)]	UD-3	23.8	ML	Saprolite	2.791	81.55	1.136	0.532	110	35.4%
B-217[(c)]	UD-1	8.5	SM	Saprolite	2.791	87.93	0.981	0.495	112	27.8%
B-222	UD-1	8.5	ML	Residual Soil	2.710	90.49	0.869	0.465	115	26.7%
B-222	UD-2	18.5	ML	Residual Soil	2.840	89.78	0.974	0.493	110	22.3%
B-222[(c)]	UD-3	28.5	SM	Saprolite	2.791	87.10	1.000	0.500	105	20.3%
B-309[(c)]	UD-1	8.5	SM	Saprolite	2.791	87.19	0.997	0.499	107	22.4%
B-309[(c)]	UD-3	28.5	ML	Saprolite	2.791	81.45	1.138	0.532	104	27.7%
B-309[(c)]	UD-4	38.5	SM	Saprolite	2.791	88.60	0.966	0.491	108	21.7%
B-319[(c)]	UD-2	18.5	SM	Saprolite	2.791	91.60	0.901	0.474	109	19.5%
B-319	UD-3	28.5	ML	Saprolite	2.750	91.85	0.868	0.465	115	24.9%
B-319	UD-4	38.5	ML	Saprolite	2.750	102.80	0.669	0.401	123	19.6%
B-321[(c)]	UD-2	18.5	SM	Saprolite	2.791	90.79	0.918	0.479	109	19.7%

Table 2.3-23 (Sheet 2 of 2) Summary of Laboratory Test Results for Grain Size, Moisture Content and Specific Gravity and Derived Porosity Values

Source of Sample	Sample Number	Sample Depth	USCS	Unit[a]	Gs	Dry Density (pcf)	Void Ratio[b]	Porosity[b]	Wet Density	Water Content
B-321	UD-3	28.5	SM	Saprolite	2.830	102.60	0.721	0.419	120	16.7%
B-322[c]	UD-2	18.5	SM	Saprolite	2.791	88.28	0.973	0.493	102	15.2%
B-325[c]	UD-1	3.5	ML	Residual Soil	2.795	78.20	1.230	0.552	108	38.0%
B-325	UD-3	13.5	SM	Saprolite	2.77	82.91	1.085	0.520	104	25.8%
B-325	UD-8	38.5	SM	Saprolite	2.69	97.39	0.724	0.420	118	21.0%
		Min Values:		Residual Soil	2.71	64.38	0.869	0.465	96	17.8%
				Saprolite	2.69	64.05	0.669	0.401	87	15.2%
		Max Values:		Residual Soil	2.87	95.07	1.709	0.631	115	48.7%
				Saprolite	2.95	102.80	1.719	0.632	123	35.8%
		Mean Values:		Residual Soil	2.80	82.44	1.155	0.527	107.1	31.2%
				Saprolite	2.79	88.11	0.994	0.494	109.7	24.8%

(a) Unit from Table 2A of Mactec (2007)
(b) Calculated values using Equation 1.20 of Craig (1998), Page 26
(c) No Gs value was obtained for these samples. For these samples, the average value was used to calculate the void ratio and porosity values

Data summarized from Table F-1— Summary of Soil Tests, Mactec Final Data Report — Results of Geotechnical Exploration and Testing, February 2007. Values are average values per sample.

Equation 1.20
$P_d = ((G_s)/(1+e))*P_w$
This can be rearranged to show:
e = (Gs*yw/y)-1
Porosity can be derived from the void ratio by:
n = e/(1+e)
Where:
P_d = Dry Density
P_w = Density of Water
e = Void ratio
n = Porosity
Gs = Specific Gravity

Table 2.3-24
Calculation of Median D50 Size of Saprolite

Source of Sample	Sample No.	Depth (feet)	USCS Note	Gravel[a] (%)	Sand [a] (%)	Fines [a] (%)	Silt [a] (%)	0.005 mm Clay[a]	D50 (mm)
B-215	UD-3	28.5	SM	0	70	30			0.15
B-216	UD-1	6.5	ML	0	5	95	70	25	0.02
B-216	UD-2	13.5	ML	0.5	17	83	66	17	0.04
B-216[a]	UD-3	23.5	ML	0	15	84	63	21	0.03
B-217	UD-1	8.5	SM	0	65	35	25	10	0.14
B-222	UD-3	28.5	SM	0	64	36			0.12
B-309	UD-1	8.5	SM	0	65	36	26	10	0.13
B-309	UD-3	28.5	ML	0	30	70	48	22	0.03
B-309	UD-4	38.5	SM	0	51	49			0.08
B-319	UD-2	18.5	SM	1	71	28			0.17
B-321	UD-2	18.5	SM	0	66	34	25	9	0.16
B-322	UD-2	18.5	SM	0	71	29	20	9	0.16
								Median	0.13

(a) For this sample detailed data was not in Mactec (2007) Appendix F. Data interpreted from the curve.

Table 2.3-25
Hydraulic Gradient Calculation for Unit 2 and Unit 3

Unit 2 Hydraulic Gradient *Using September, 2006 GW Levels				
Boring	**Northing**	**Easting**	**Distance (feet)**	**WL Elevation (feet)**
OW-205b	892842	1903193		366.1
Groundwater discharge point at unnamed creek to the north-northwest of Unit 2 (Point A)			850	340.0
				Change in Head = 26.1
				Hydraulic Gradient = 0.0307

Unit 3 Hydraulic Gradient *Using September, 2006 GW Levels				
Boring	**Northing**	**Easting**	**Distance (feet)**	**WL Elevation (feet)**
OW-305	891997	1902858		367.4
OW-618 (Point B)	890956	1901480	1727	303.6
				Change in Head = 63.8
				Hydraulic Gradient = 0.0369

Table 2.3-26
Groundwater Use by County (Millions of Gallons) in 50-Mile Radius, 2004

County	County Total	Thermoelectric	Aquaculture	Golf Course	Industry	Irrigation	Mining	Public Water Supply
Aiken	6,870	—	—	29.9	1,450	485	29.2	4,880
Calhoun	1,260	—	—	38.2	138	854	NR	235
Cherokee	1.3	—	—	—	—	—	—	—
Chester	19.4	—	—	18	1.4	—	—	—
Edgefield	96.9	—	—	75.9	—	21	—	—
Fairfield	64.3	—	—	—	—	—	—	64.3
Greenwood	35.3	—	—	7	—	1.2	—	27.1
Kershaw	1,140	—	—	47.6	418	—	—	674
Lancaster	1.2	—	—	1.2	—	—	—	—
Laurens	—	—	—	—	—	—	—	—
Lee	694	—	—	—	—	98.4	—	596
Lexington	2,980	—	—	36.8	414	1,620	465	441
McCormick	—	—	—	—	—	—	—	—
Newberry	91.7	—	—	—	—	60.7	—	31
Orangeburg	7,050	1,660	—	20.1	701	2,280	1,710	676
Richland	1,340	—	67.3	22.2	677	7.1	236	335
Saluda	2.4	—	—	—	—	—	—	2.4
Spartanburg	46.6	—	—	5.7	15.1	NR	—	25.8
Sumter	6,870	—	—	82.7	316	797	—	5,680
Union	2.5	—	—	—	2.5	—	—	—
York	89.3	—	—	58.8	3.7	—	13.0	13.9
Total	28,700	1,660	67.3	444	4,140	6,230	2,450	13,700
Percent Use		5.8	0.2	1.5	14.4	21.7	8.6	47.7

Source: SCDHEC (2005)
— not reported

Table 2.3-27
Surface Water Use by County (Millions of Gallons) 50-Mile Radius in 2004

County	County Total	Hydroelectric	Thermoelectric	Aquaculture	Golf Course	Industry	Irrigation	Mining	Public Water Supply
Aiken	69,400	—	46,700	—	180	19,400	1,020	—	2,080
Calhoun	28,500	—	—	—	48.8	28,300	142	—	—
Cherokee	459,000	455,000	—	—	—	483	—	—	3,540
Chester	2,170,000	2,170,000	—	—	14.0	91.2	—	—	1,100
Edgefield	1,000,000	1,000,000	—	—	43.5	—	507	—	1,500
Fairfield	3,270,000	3,030,000	247,000	—	—	—	—	—	796
Greenwood	322,000	317,000	116	—	47.6	49.9	—	—	4,900
Kershaw	1,210,000	1,210,000	—	—	57.5	924	—	—	1,820
Lancaster	1,100,000	1,090,000	—	—	2.7	1,010	—	—	7,750
Laurens	1,810	149	—	—	54.6	—	—	—	1,610
Lee	8.0	—	—	—	—	—	8.0	—	—
Lexington	264,000	202,000	46,300	—	205	10,200	497	564	5,290
McCormick	462	—	—	—	39.6	—	—	—	422
Newberry	2,410	—	—	—	10.0	—	126	—	2,270
Orangeburg	4,750	—	0.3	—	93.5	155	1,500	—	3,010
Richland	677,000	473,000	170,000	13.9	341	10,300	0.3	—	23,300
Saluda	356	—	—	—	—	—	356	—	—
Spartanburg	27,700	13,800	—	35.1	120	—	100	—	13,600
Sumter	787	—	—	—	201	—	587	—	—
Union	318,000	316,000	—	—	8.8	516.	—	—	1,250
York	998,000	932,000	37,800	—	123	22,800	2.5	—	5,530
Total	11,900,000	11,200,000	547,000	49	1590	94,200	4,800	564	79,800
Percent Use		93.9	4.6	0	0	0.8	0	0	0.7

Source: SCDHEC (2005)
— = Not Reported

Table 2.3-28
Significant Downstream Surface Water Users

User	Water Body	Withdrawal Rate	
		Million Gallons Per Year	Million Gallons Per Day
Consumptive Users			
Columbia Canal Water Plant (city of Columbia)	Broad-Canal	12,587.46	34.5
W. Columbia Saluda Intake	Saluda River[(a)]	1,208.00	3.3
Martin Marietta Cayce Plant	Congaree River	415.64	1.1
City Cayce Intake #2	Congaree River	1,128.60	3.1
Eastman Chemical Voridian Div.	Congaree River	26,392.68	72.3
Santee Cooper Resort C.C.	Lake Marion	39.54	0.1
St. Julian Plantation	Lake Marion	7.06[(b)]	0.058
Santee Cooper Cross Station	Lake Moultrie	21,794.14	59.7
Ga. Pacific Russellville Plywood	Lake Moultrie (rediversion canal)	112.78	0.3
Santee Cooper Reg. Water	Lake Moultrie	5,071.40	13.9
Amoco Chemical Cooper River Plant	Back River Reservoir	1,983.41	5.4
Bayer Corp. Bushy Park (Sun Chemical)	Back River Reservoir.	876.4	2.4
Charleston CPW Bushy Park	Back River Reservoir	16,871.60	46.2
Chargeurs Wool Prouvost	Santee River	49.8	0.1
SCSPA Winyah Steam Station	North Santee River	289.7	0.8
Nonconsumptive Users			
Columbia Canal Hydro	Broad-Canal	469,660.89	1,286.7
Santee Cooper L. Marion Hydro	Lake Marion (spillway)	142,890.28	391.5
US Army / St Stephen	Lake Moultrie (rediversion canal)	2,079,847[(c)]	5,698.2
Santee Cooper Jeffries Hydro	Lake Moultrie	1,108,728.73	3,037.6
SCE&G A.M. Williams Station	Back River Reservoir	191,813.00	525.5

(a) Intake is in the confluence of the Saluda and Broad and at times does receive water from the Broad River
(b) For 4 months only
(c) Flow computed from daily mean discharge at USGS 02171645
Source: SCDHEC (2006c)

Table 2.3-29
Mayo Creek Water Quality 2006

July 2006				
Parameters	**Station 1**	**Station 2**	**Station 3**	**Station 4**
Temperature	23.8°C (74.8°F)	23.6°C (74.5°F)	24.6°C (76.3°F)	—
DO (mg/L)	5.6	7.2	7.3	—
Specific Conductance (micromhos/cm)	113	117	116	—
pH	5.4	6	6.6	—
Turbidity	0	0	0	—
November 2006				
Parameters	**Station 1**	**Station 2**	**Station 3**	**Station 4**
Temperature	—	12.5°C (54.5°F)	12.7°C (54.9°F)	13.0°C (55.4°F)
DO (mg/L)	—	8.8	8.9	8.5
Specific Conductance (micromhos/cm)	—	110	117	113
pH	—	6.5	6.4	6.2
Turbidity	—	—	—	—

Source: TtNUS (2007)
mg/L = milligrams per liter
— = Not Sampled
DO = dissolved oxygen

Table 2.3-30
Surface Water Quality Data 2004

Analyzed Parameters	Monticello Reservoir Sample Location B-327	Monticello Reservoir Sample Location B-328	Parr Reservoir Sample Location B-345	Parr Reservoir Sample Location B-346
Temperature (^oC)/(^oF)	9.3°–31.6°C 48.7°–88.9°F	8.9°–31.2°C 48°–88.2°F	8.0°–29.2° C 46.4°–84.6°F	7.0°–28° C 44.6°–82.4°F
Turbidity (NTU)	3.0–12.0	1.3–4.9	4.6–46	6.4–95
Dissolved Oxygen (mg/L)	6.38–12.72	6.99–13.25	4.95–11.50	Less than QL–11.90
BOD (mg/L)	Less than QL–2.0	All less than QL	All less than QL	All less than QL
pH	7.11–8.68	7.41–8.11	6.95–7.66	7.12–7.68
Alkalinity, Carbonate as $CaCO_3$ (mg/L)	17–25	23–24	16–26	14–25
Total Nitrogen (NH_3) (mg/L)	Less than QL–0.50	Less than QL–0.20	Less than QL–0.20	Less than QL–0.50
Total N (Kjeldahl) (mg/l)	0.22–0.60	0.38–0.74	0.23–0.48	0.14–0.61
Total N (nitrite/nitrate) (mg/L)	0.11–0.46	Less than QL–0.062	0.25–0.51	0.28–0.58
Total Phosphorous (mg/L)	Less than QL–0.039	Less than QL–0.021	Less than QL–0.052	0.030–0.13
Total Fecal Coliform (# cells/100 ml)	Less than QL–7	Less than QL–32	2 – 140	Less than QL–240
Total Organic Carbon (mg/L)	2.4–3.2	4.7–5.2	2.2–2.9	2.0–3.3
Cadmium, Total (μg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Chromium, Total (μg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Copper, Total (μg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Iron, Total (μg/L)	130–600	42–160	220–880	450–1100
Lead, Total (μg/L)	All less than QL	All less than QL	Less than QL	All less than QL
Manganese, Total (μg/L)	Less than QL–18	Less than QL–44	20–40	33–50
Mercury, Total (μg/L)	All less than QL	Less than QL–19	All less than QL	All less than QL
Nickel, Total (μg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Zinc, Total (μg/L)	Less than QL–21	All less than QL	Less than QL–48	All less than QL

Source: U.S. EPA (2006)
Note: Sample depths 0.3 meters
QL = quantification limit
< = Less than

Table 2.3-31
Surface Water Quality Data 2005

Analyzed Parameter	Monticello Reservoir Sample Location B-327 Result	Parr Reservoir Sample Location B-345 Result
Temperature (^oC)/(^oF)	11.4^o–32^{o}C 52.5^{o}F–89.6^{o}F	10.6^{o}C–29.3 C 51.1^{o}F–84.7^{o}F
Turbidity (NTU)	2.5–12	6.5–47
Dissolved Oxygen (mg/L)	5.15–10.92	4.32–10.52
BOD (mg/L)	All less than QL	All less than QL
pH (SU)	6.9–8.5	6.7–7.88
Total Nitrogen (NH_3) (mg/L)	<QL–0.2	<QL–0.25
Total N (Kjeldahl) (mg/l)	0.21–0.53	0.24–0.56
Total N (nitrite/nitrate) (mg/L)	0.14–0.59	0.27– 0.62
Total Phosphorous (mg/L)	<QL–0.038	0.027–0.083
Hardness, Ca & Mg-Total (mg/L)	14	15
Alkalinity, Carbonate as $CaCO_3$, Total (mg/L)	17–24	17–24
Cadmium, Total (µg/L)	All less than QL	All less than QL
Total Organic Carbon (mg/L)	<QL–3.2	3.0–3.9
Chromium, Total (µg/L)	All less than QL	<L–25
Copper, Total (µg/L)	All less than QL	All less than QL
Iron, Total (µg/L)	150–350	330–1800
Lead, Total (µg/L)	All less than QL	All less than QL
Nickel, Total (µg/L)	All less than QL	All less than QL
Zinc, Total (µg/L)	<QL–10	All less than QL
Total Fecal Coliform (# cells/100 ml)	<QL–100	2–480
Enterococcus Group Bacteria, Total (# cells/100 ml)	<QL–12	<QL–310

Source: U.S. EPA (2006)

Table 2.3-32
Monticello Reservoir Water Quality 2006

Analyzed Parameter	Result	Parameter	Result
Antimony (µg/L)	<QL	Nickel (µg/L)	<QL
Arsenic (µg/L)	<QL	Potassium (µg/L)	2,206
Barium (µg/L)	17.7	Selenium (µg/L)	<QL
Beryllium (µg/L)	<QL	Silver (µg/L)	<QL
Cadmium (µg/L)	<QL	Sodium (µg/L)	10,280
Calcium (µg/L)	3,425	Thallium (µg/L)	<QL
Chromium (µg/L)	<QL	Zinc (µg/L)	<QL
Copper (µg/L)	<QL	Silica (µg/L)	8,025
Iron (µg/L)	101	Sulfate (mg/L)	4.3
Lead (µg/L)	<QL	Total Dissolved Solids (mg/L)	63
Magnesium (µg/L)	1,856	Total Hardness (Calcium) (mg/L)	16.2
Manganese (µg/L)	<QL	Total Suspended Solids (mg/L)	3
Mercury (liquid) (µg/L)	<QL	Turbidity (nephelometric turbidity units)	2.3
Ammonia- N (mg/L)	0.21	Platinum-Cobalt (SU)	15
Chlorophyll a (mg/L)	0.00690	Total Organic Carbon (mg/L)	1.7
Ortho-phosphorous (mg/L)	0.034	Strontium (mg/L)	0.038
Phosphorous (mg/L)	0.021	Chemical Oxygen Demand (mg/L)	<QL
BOD 5-day (mg/L)	<QL	Cyanide (mg/L)	<QL
Fecal Coliform-MF (# cells/100 ml)	<QL		

QL = Quantification Limit
Water Sample also analyzed for Volatile Organics (Method 624), Semi-volatile Organics Method 625), and for Pesticides/PCBs (Method 608). All Parameter results were below laboratory quantitative levels.
< = Less than

Table 2.3-33
Groundwater Quality Data for Unit 1 Construction[a]

Parameters	Boring N-23	Boring 3-14	Boring 3-2
pH	6.60	6.70	7.00
Alkalinity (mg/L) (phenolphthalein)	0.00	0	0
Alkalinity (mg/L) (methyl orange)	29.00	50.00	45.00
Sodium Chloride (mg/L)	7.37	10.36	5.38
Total hardness (mg/L)	16.00	42.00	28.00
Calcium Hardness (mg/L)	12.00	30.00	16.00
Magnesium Hardness (mg/L)	4.00	12.00	12.00
Conductivity (μmho/cm)	60.00	140.00	100.00
Dissolved Solids (mg/L)	50.00	608.00	332.00
Silica (mg/L)	4.7.00	22.50	16.50
Iron (mg/L)	2.6.00	2.70	4.90
Copper (mg/L)	0.8.00	0.70	1.00

(a) As reported in SCE&G (2005b)
mg/L = milligrams per liter
μmho/cm = micromhos per centimeter

Table 2.3-34
Jenkinsville Water Wells Water Quality Data for 2004

Parameters Analyzed	Jenkinsville #11 Well AMD-057	Jenkinsville #4 Well AMD-060
pH	—	—
Conductivity (μmhos/cm)	99.4	130
Alkalinity (mg/L)	34	44
Total Dissolved Solids (mg/L)	99	110
Hardness ($CaCO_3$) (mg/L)	20	39
Lead, Total (μg/L)	<0.050	<0.050
Nitrates (NO_3) (μg/L)	0.86	2.0
Total Organic Carbon (TOC)	4.4	<2.0
Chloride (Cl) (μg/L)	3.4	4.9
Sulfate (SO_4) (μg/L)	5.8	<5.0
Sodium (Na) (μg/L)	11	7.7
Calcium (Ca) (μg/L)	6.0	10
Strontium (Sr) (μg/L)	0.070	0.070
Total Nitrogen (TNK) (μg/L)	<0.10	0.16
Manganese (Mn) (μg/L)	<0.010	<0.010
Zinc (Zn) (μg/L)	0.018	<0.010
Aluminum (Al) (μg/L)	<0.10	<0.10
Beryllium (Be) (μg/L)	<0.0030	<0.0030
Boron (B) (μg/L)	<0.10	<0.10
Cobalt (Co) (μg/L)	<0.010	<0.010
Mercury (Mg) (μg/L)	1.3	3.5
Molybdenum (Mo) (μg/L)	<0.020	<0.020
Selenium (Se) (μg/L)	<0.0020	<0.0020
Silver (Ag) (μg/L)	<0.030	<0.030
Tin (Sn) (μg/L)	<0.020	0.047
Uranium (U) (μg/L)	<0.10	<0.10
Cadmium (Cd) (μg/L)	<0.010	<0.010
Chromium (Cr) (μg/L)	<0.010	<0.010
Nickel (Ni) (μg/L)	<0.020	<0.020
Lithium (Li) (μg/L)	0.013	<0.010
Antimony (Sb) (μg/L)	<0.050	<0.050
Silicate (SiO) (μg/L)	55	42

Source: SCDHEC (2006d)
— = Not analyzed
mg/L = milligrams per liter
μg/L = micrograms per liter
μmhos/cm = micromhos per centimeter
< = less than

Table 2.3-35
Units 2 and 3 Site Evaluation Groundwater Quality Analysis 2006

		Parameters									
Sample Location	Date Sampled	Total Dissolved Solids (mg/L)	Nitrite/ Nitrate[(a)] (mg/L)	Bromide (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	Alkalinity (mg/L)
OW-227	08/23/2006	71	0.36	<0.25	2.2[(b)]	0.1	8.7	0.36	<0.02	0.077	23
OW-620	08/23/2006	82	0.53	<0.25	2.8[(b)]	0.085[c]	0.9	0.57	<0.02	<0.05	39
OW-212	08/28/2006	59	0.38	<0.25	2.3[(b)]	0.071[c]	1.1	0.33	<0.02	<0.05	31
OW-327	08/28/2006	47	0.21	<0.25	2.9[(b)]	0.080[c]	3.2	0.18	<0.02	<0.05	22
OW-333	08/28/2006	117	0.55	<0.25	4.1[(b)]	0.085[c]	1.5	1.10	<0.02	<0.05	29
OW-618	08/29/2006	140	0.30	<0.25	9.6[(b)]	0.15	3.7	0.073	<0.02	<0.05	66
OW-627A	09/01/2006	178	0.16	<0.25	7.4[(b)]	0.67	10.4	0.18	<0.02	0.093	126
OW-205A	09/01/2006	96	0.26	0.16[(c)]	7.2[(b)]	0.15	16.8	0.28	<0.02	0.05	44
OW-305A	09/01/2006	87	<0.05	<0.25	3.9[(b)]	0.25	7.4	0.038	<0.02	<0.05	48

(a) Results from nitrite/nitrate analysis represents data from second analytical series dated September 28, 2006.
(b) Analyte was detected within the method blank; actual value may be lower than reported value.
(c) Estimated result; reported result is below typical lab reporting limit but above lab method detection limit.
Source: MACTEC (2007)

Table 2.3-36 (Sheet 1 of 2)
Water Quality Monitoring

		OW-205a	OW-205b		OW-305a	OW-305b		OW-618	OW-619	OW-624			OW-672b	
Analysis	**MDL/Units**	**07/09/07**	**09/20/07**	**12/18/07**	**07/09/07**	**09/20/07**	**12/18/07**	**07/09/07**	**07/09/07**	**07/09/07**	**09/20/07**	**12/18/07**	**09/20/07**	**12/18/07**
Phosphorus	0.050 mg/L	0.115	1.95	3.42	0	1.01	0.683	0.662	0.98	0.822	1.98	1.934	0.6	0.969
Arsenic	5.0 PPB	0	0	0	0	0	0	0	0	0	0	0	0	0
Barium	10.0 PPB	52	261	81	20	76	37	215	458	59	103	95	81	65
Cadmium	1.0 PPB	0	1	0	0	0	0	5	8	1	0	0	0	0
Calcium	100.0 PPB	12525	4319	3182	14630	9607	6174	15530	150900	15382	73440	81630	10470	10490
Chromium	10.0 PPB	13	13.6	0	0	15	0	22	52	58	0	0	0	0
Copper	10.0 PPB	0	20	0	0	10	0	90	61	36	29	0	0	0
Iron	10.0 PPB	1298	17130	4092	154	4033	571	24588	37822	4458	8022	1610	5005	2749
Lead	5.0 PPB	0	0	0	0	0	0	6	8	16	0	0	0	0
Magnesium	100.0 PPB	2970	5325	2030	2058	2458	1573	10515	11250	2637	9854	9047	5427	4855
Mercury (liquid)	0.4 PPB	0	0	0	0	0	0	0	0	0	0	0	0	0
Potassium	100.0 PPB	9880	4705	2517	3259	2279	1718	4774	25680	41780	16060	1346	2714	2379
Selenium	5.0 PPB	0	0	0	0	0	0	0	0	0	0	0	0	0
Silver	10.0 PPB	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium	1000.0 PPB	5905	3777	4183	6.998	4097	4103	11210	35550	54130	78070	85720	10480	9752
Total Hardness (calc)	0.0 mg/L	44	33	16	45	34	22	83	424	49	41	242	49	47
Chlorides	0.5 mg/L	5.8	2.01	1.75	6	3.24	3.4	7.3	8.3	6.4	5.49	5.16	5.2	5.6
Conductivity	0.05 umhos	138.4	75.73	48.88	218.2	76.07	96.31	159.9	652.5	496.5	739.9	795.5	149.5	139.7
Nitrate-N	0.11 mg/L as N	0.54	0.28	0.267	0	0.23	0.212	0.36	0.99	0	1.12	1.13	0.28	0.32
Othrophosphate	0.010 mg/L	0.128	0.604	7.1	0.159	0.153	2.4	0.126	0.06	0.262	0.114	8.4	0.202	1.6
pH	0.0 S.U.	7.7	5.51	5.37	7.01	5.71	5.81	6.43	6.8	7.73	5.2	6.73	6.23	6.35
Sulfates	0.5 mg/L	13.1	0	0.9	19.5	0.82	2.4	1.98	164.4	83.3	232	292	1.29	3.1
Total Alkalinity	1.0 mg/L	44.6	18	17.55	76.1	25.8	29.25	68.3	154.9	126	123.6	146.25	74.7	67.28
Total Dissolved Solid	2.0 mg/L	111	80	132	118	83	131	141	472	427	514	788	151	221
Total Suspended Solid	1.0 mg/L	21	—	1950	5	—	431	20	1504	229	628	5519	83	63
Temperature	degrees (C)	21.6	19.8	15.1	21.9	19.9	14.9	19.4	22	20.6	19.5	13.1	20.5	16.2

Table 2.3-36 (Sheet 2 of 2)
Water Quality Monitoring

		OW-205a	OW-205b		OW-305a	OW-305b		OW-618	OW-619	OW-624			OW-672b	
Analysis	**MDL/Units**	**07/09/07**	**09/20/07**	**12/18/07**	**07/09/07**	**09/20/07**	**12/18/07**	**07/09/07**	**07/09/07**	**07/09/07**	**09/20/07**	**12/18/07**	**09/20/07**	**12/18/07**
Turbidity	0.05 NTU	33.5	898	921	35.8	294	155	15.5	744	43	547	246	142	27.9
Fecal Coliform	2.0 #/100 ml	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Coliform	Present/ Absent	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Alkalinity	10 mg/L	51	16	12	70	27	23	65	150	100	120	130	67	57
Ammonia-N (phenate)	0.10 mg/L	0	0	0	0.1	0	0.1	0	0.18	0.76	1	0	0	0
Bicarbonate alkanlinity	10 mg/L	51	16	12	70	27	23	65	150	79	120	130	67	57
BOD, 5 day	2 mg/L	0	0	0	0	4.5	0	0	0	2.4	5.3	0	3	4.6
Dissolved Oxygen	2 mg/L	—	—	9.8	—	—	9.2	—	—	—	—	9.2	—	0
COD	50 mg/L	0	53	65	0	51	0	0	560	81	160	65	0	8.3
Nitrite-N	0.020 mg/L	0.068	0.053	0.025	0.063	0.055	0.031	0.061	0.082	0.31	0.38	0.052	0.057	0.035
Platinum-cobalt color	5.0 color units	15	2800	65	5	280	15	45	35	30	500	50	80	15
TKN	0.5 mg/L	0	0	0	0	0	0	0	1.2	1.9	0.72	0.53	0	0
Silicon	1000 ug/l	15000	15000	16000	20000	11000	14000	37000	16000	8000	14000	13000	20000	23000
Silica	1.1 mg/L	32000	32	35	42000	24	31	80000	34000	17000	31	27	44	49
Boron	0.050 mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: 0 — Represents that values are less than the MDL for that particular parameter

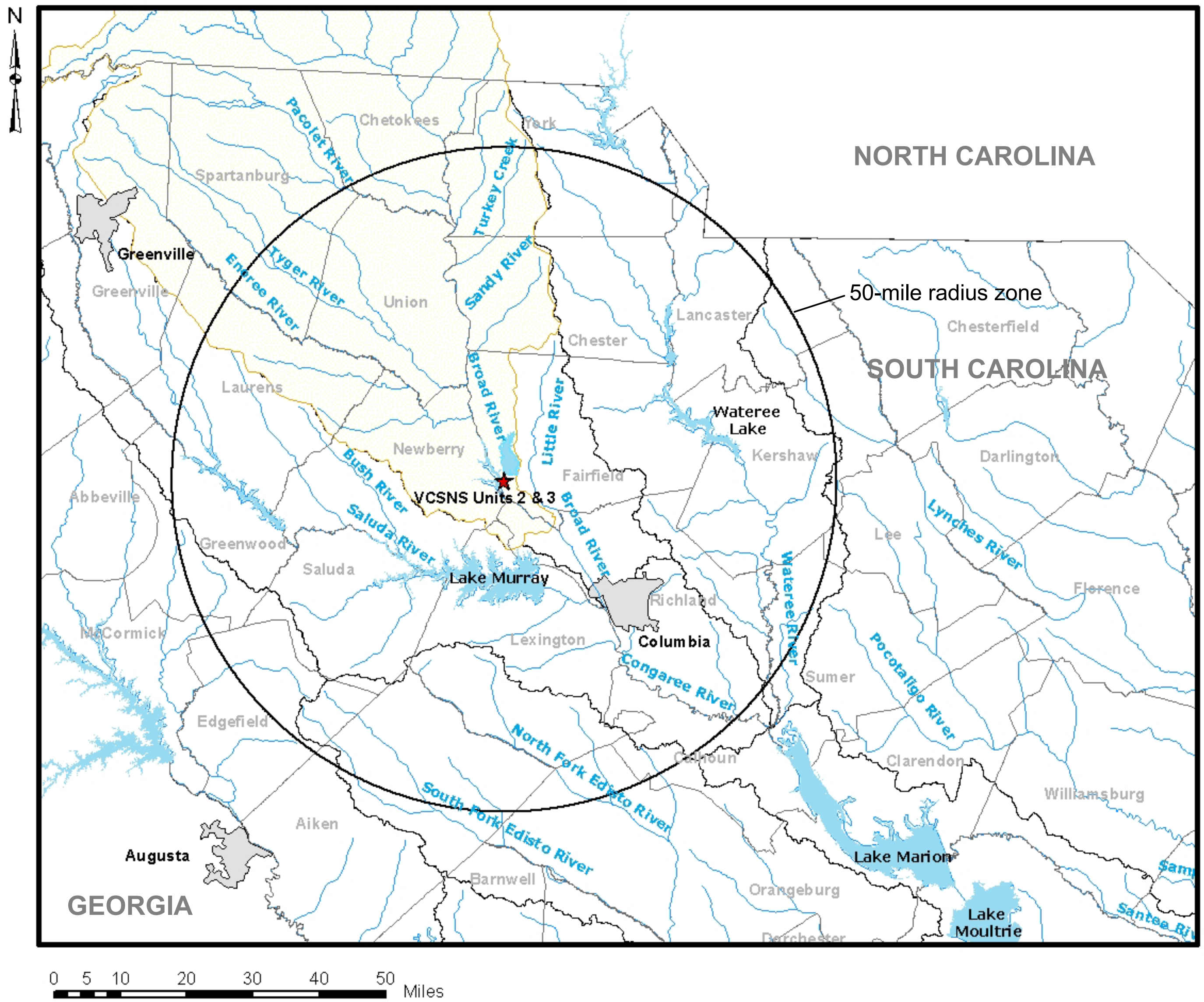


Figure 2.3-1. Major Hydrologic Features within the 50-mile Radius Zone around Units 2 and 3

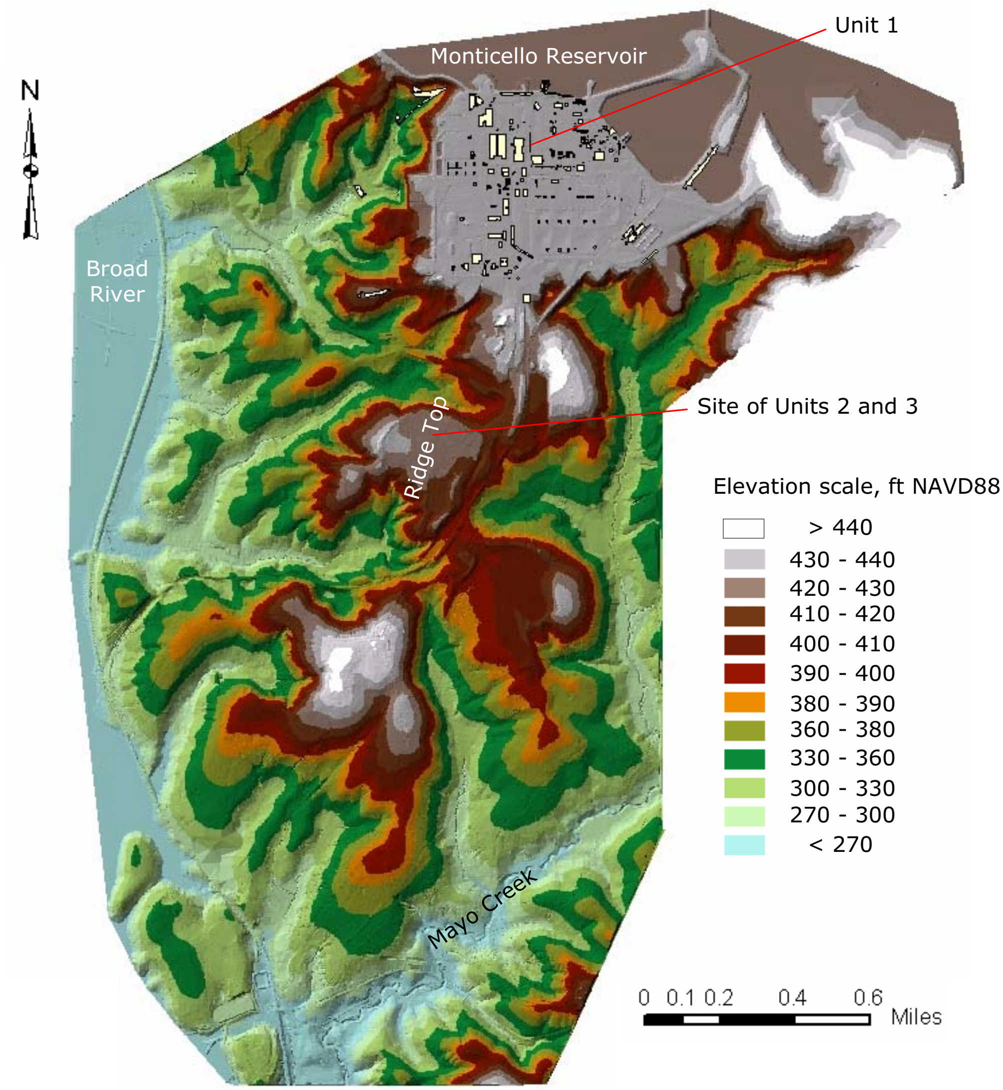


Figure 2.3-2. Topography of the Vicinity of the Units 2 and 3 and Monticello Reservoir, Based on Data from the Aerial Survey Conducted in 2006

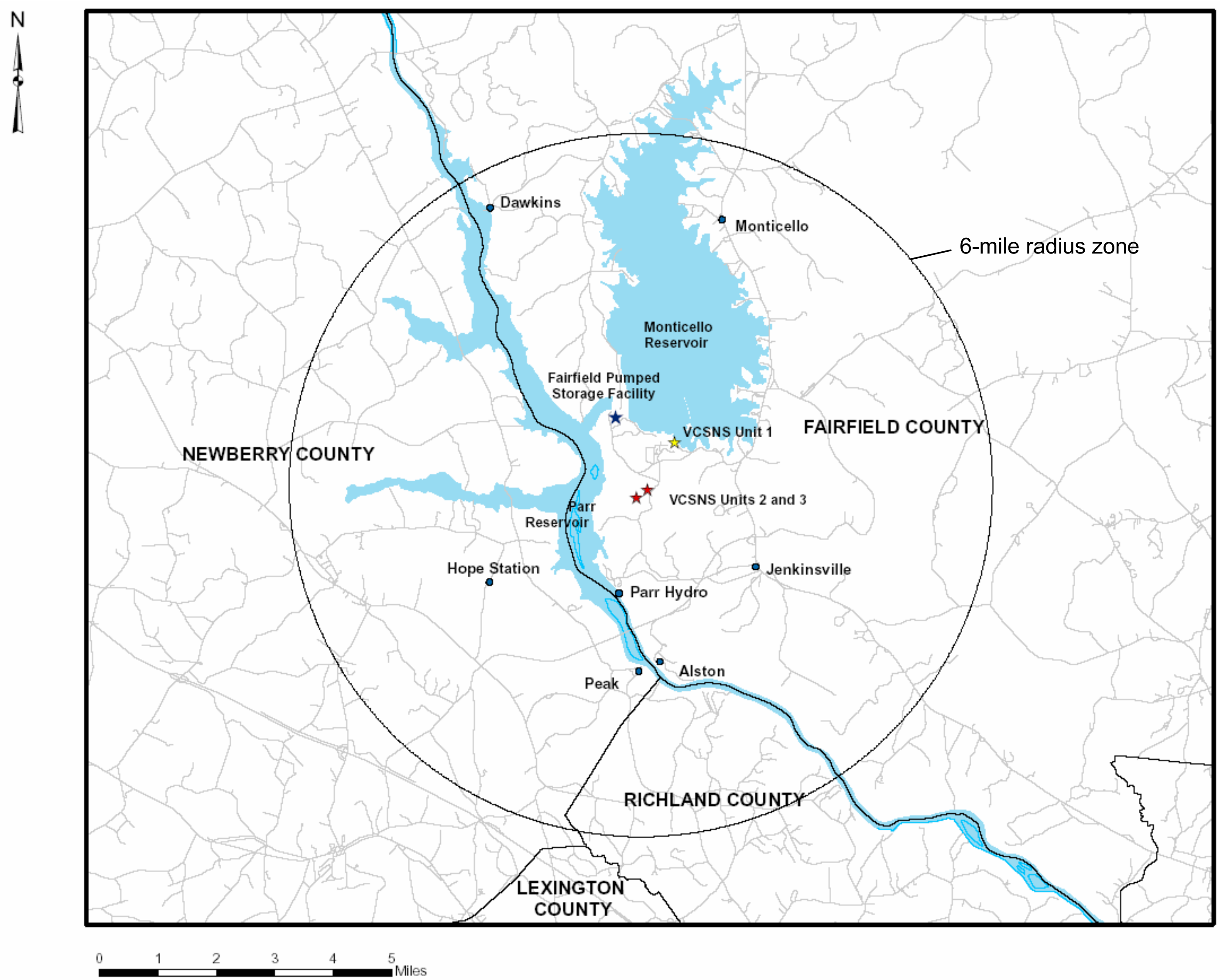


Figure 2.3-3. Major Hydrologic Features Within the 6-mile Radius Zone around Units 2 and 3

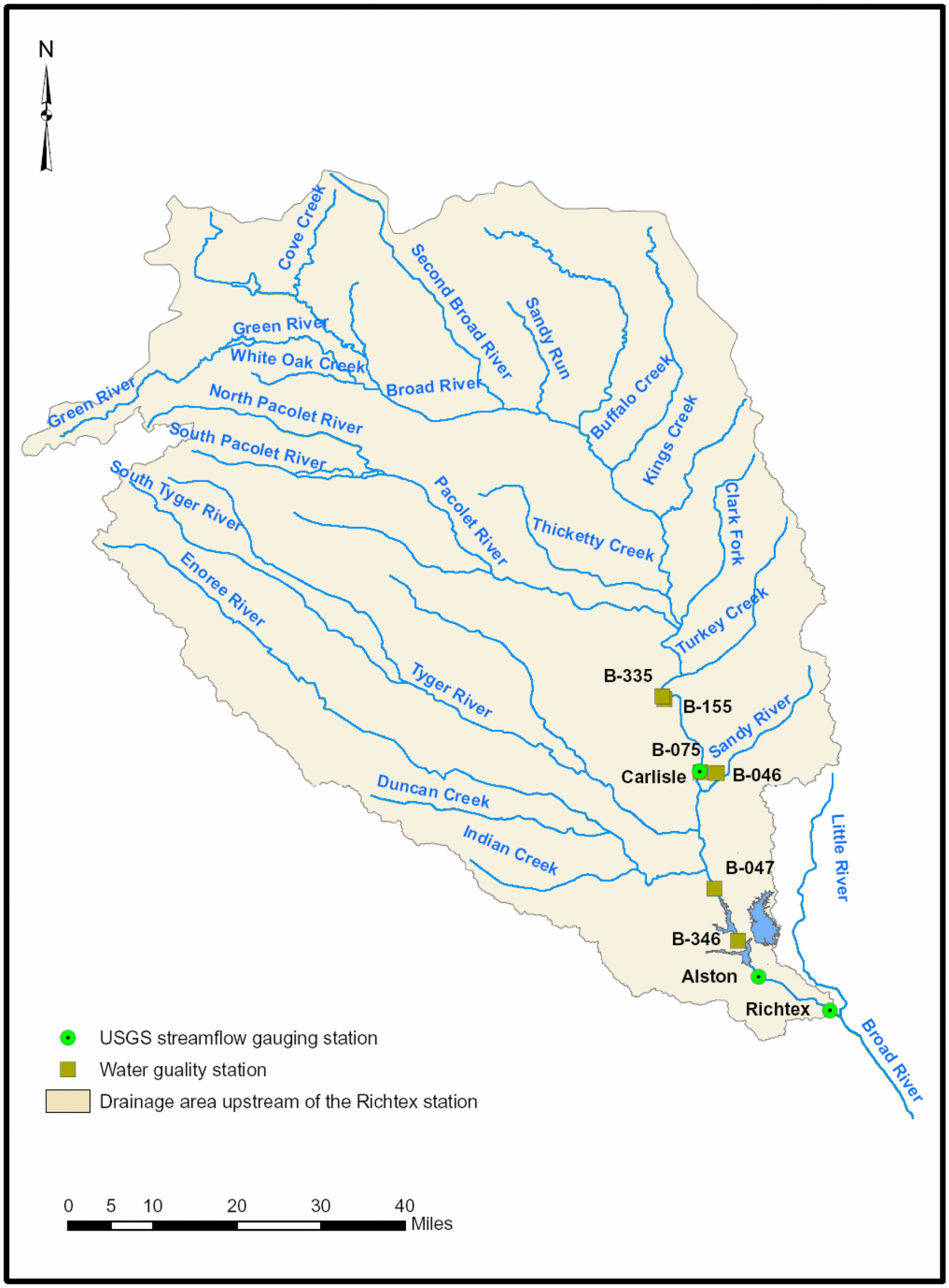


Figure 2.3-4. Broad River Watershed Upstream of the Site and Nearest Stream Flow Gauging Stations

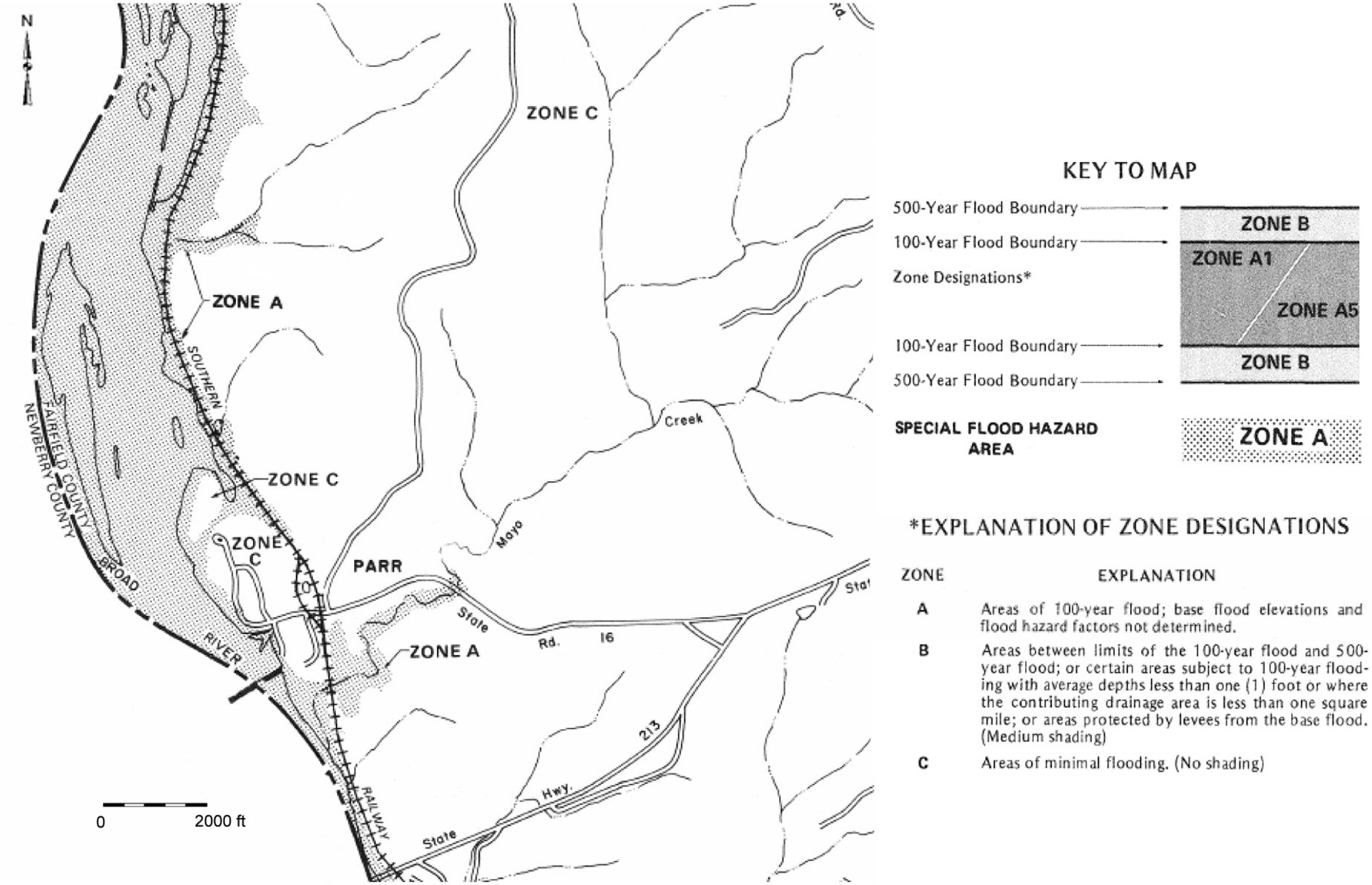


Figure 2.3-5. 100-year Floodplain Map in the Vicinity of VCSNS (Source: FEMA issued flood map, Fairfield County, South Carolina, ID 4500750175B)

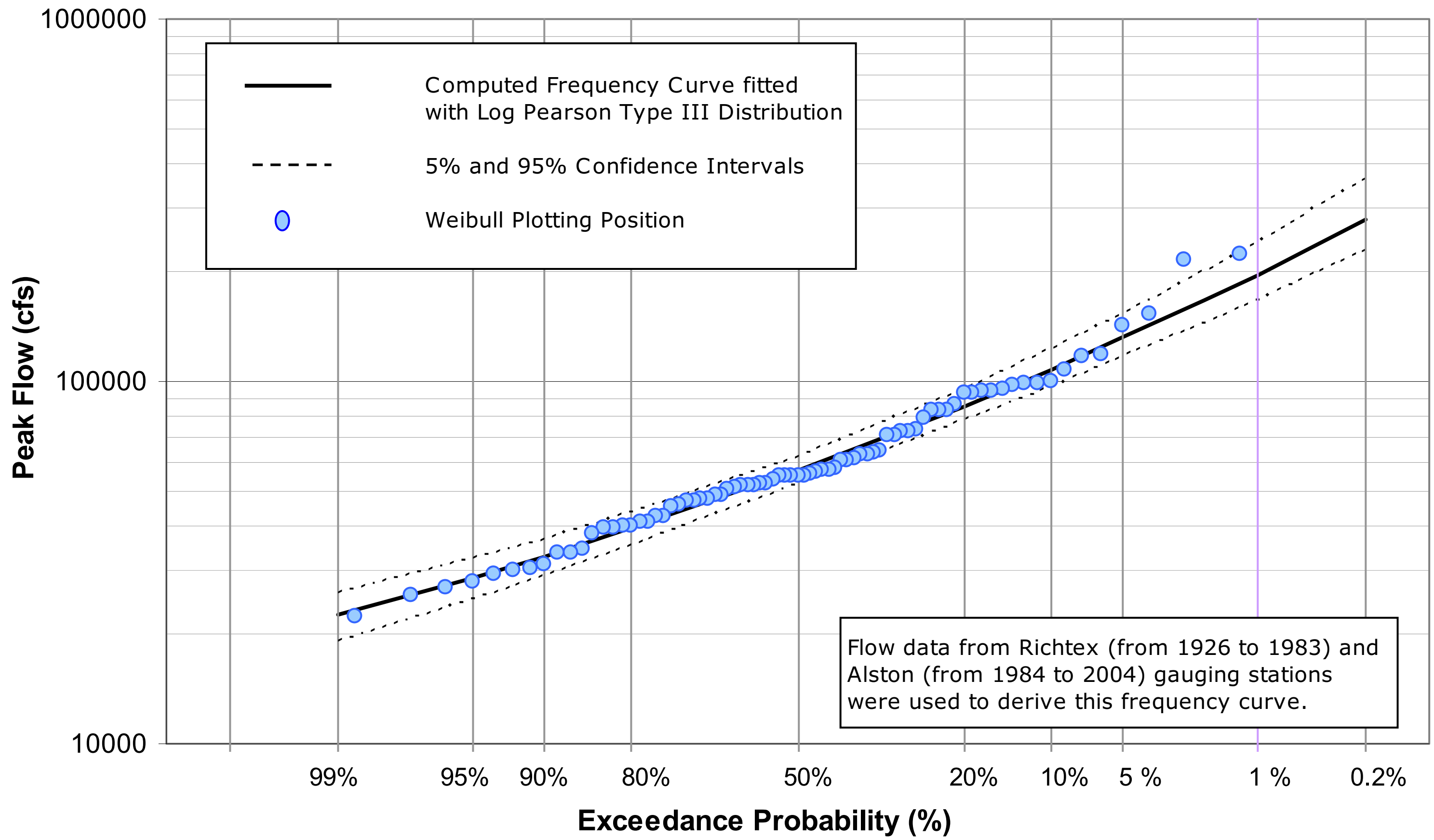


Figure 2.3-6. Flood Frequency Curve for the Broad River at Parr Shoals Dam

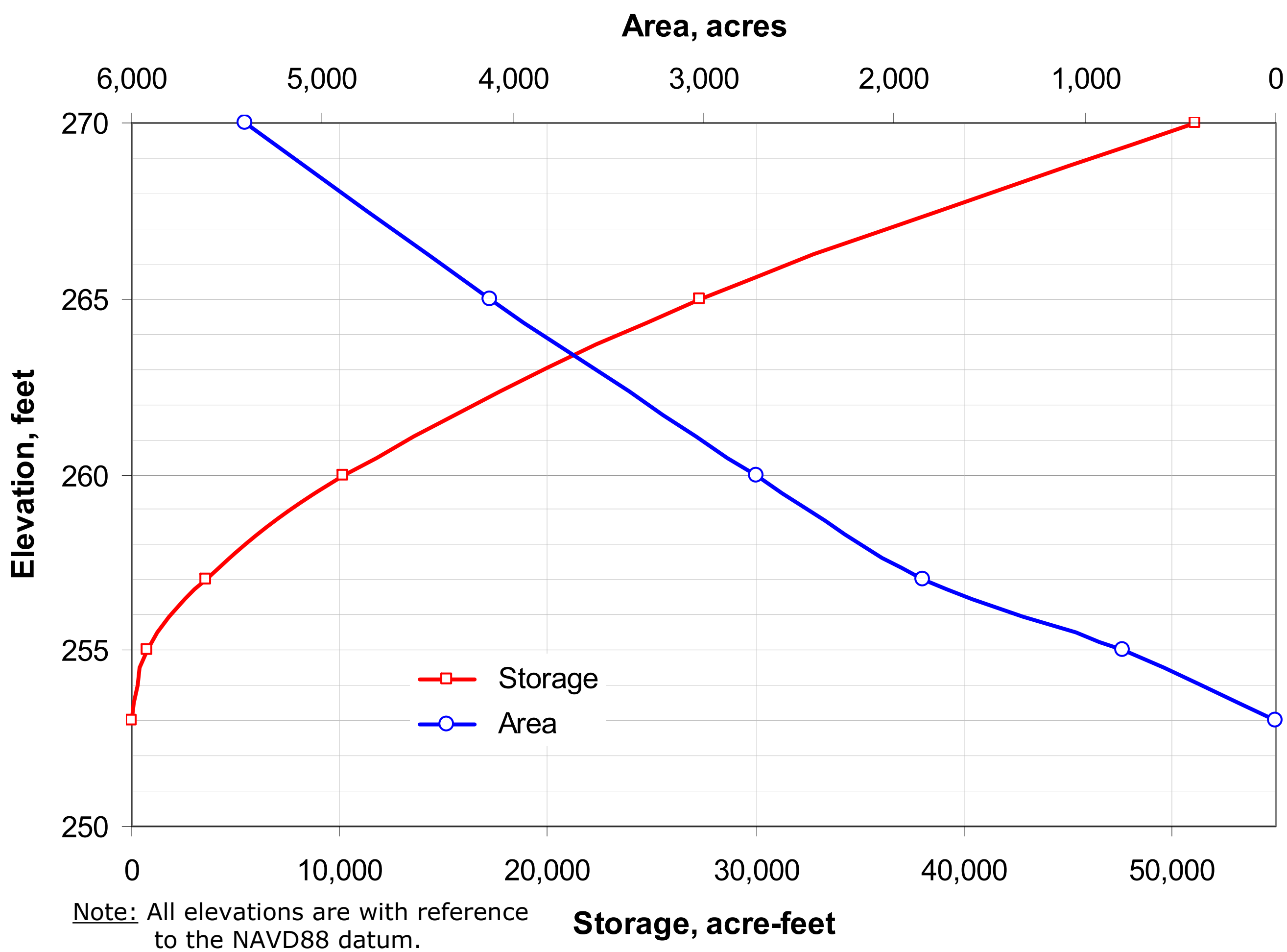
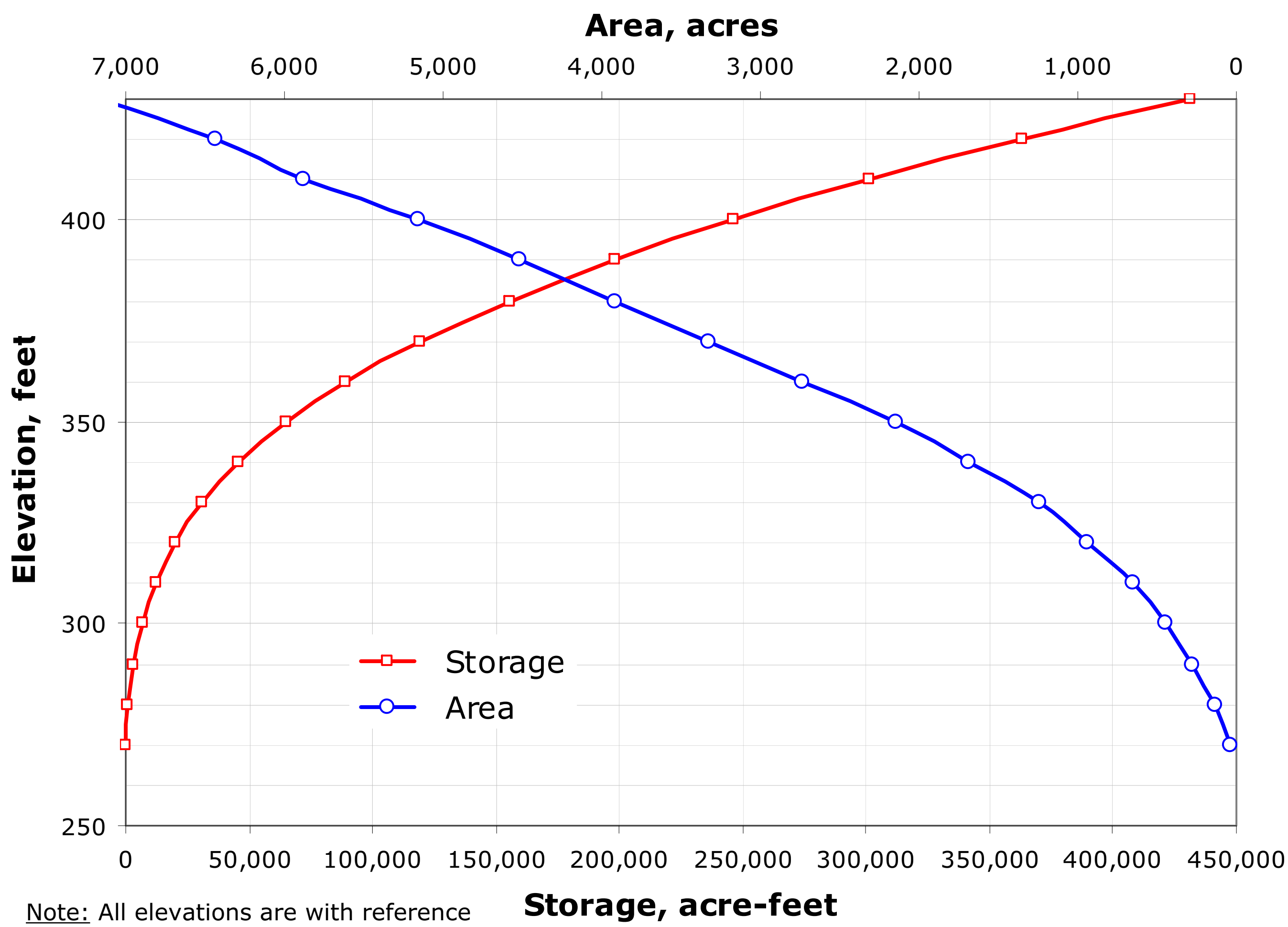


Figure 2.3-7. Parr Reservoir Area and Storage Capacity Curves



Note: All elevations are with reference to the NAVD88 datum.

Figure 2.3-8. Monticello Reservoir Area and Storage Capacity Curves

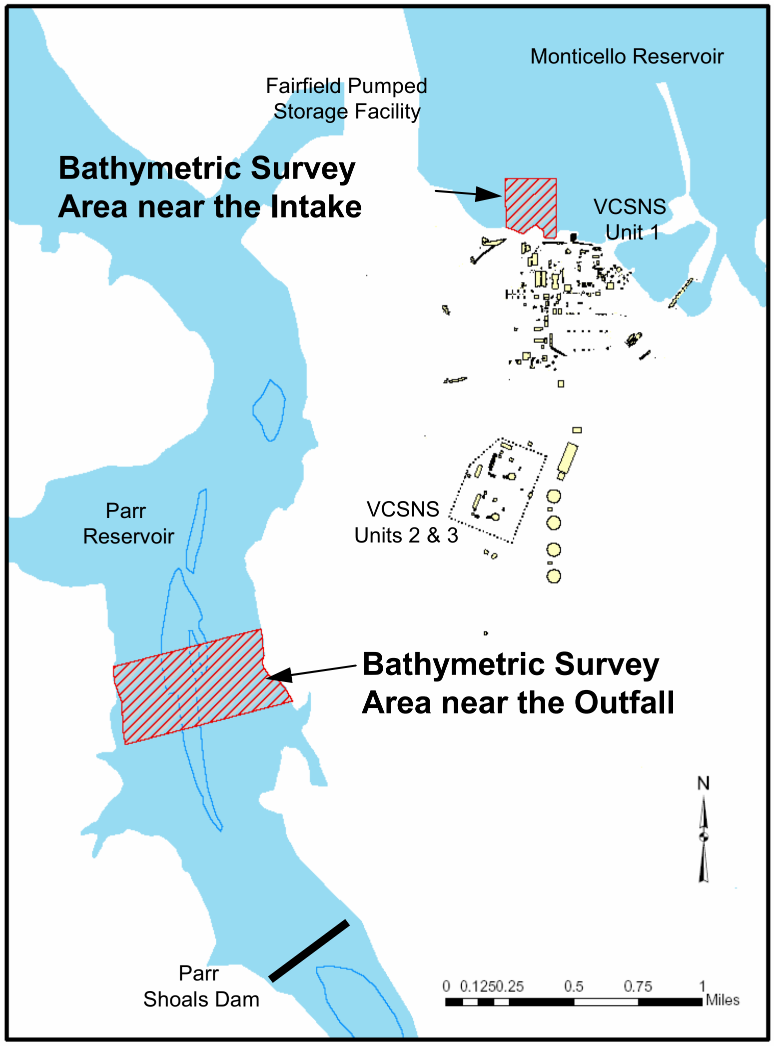
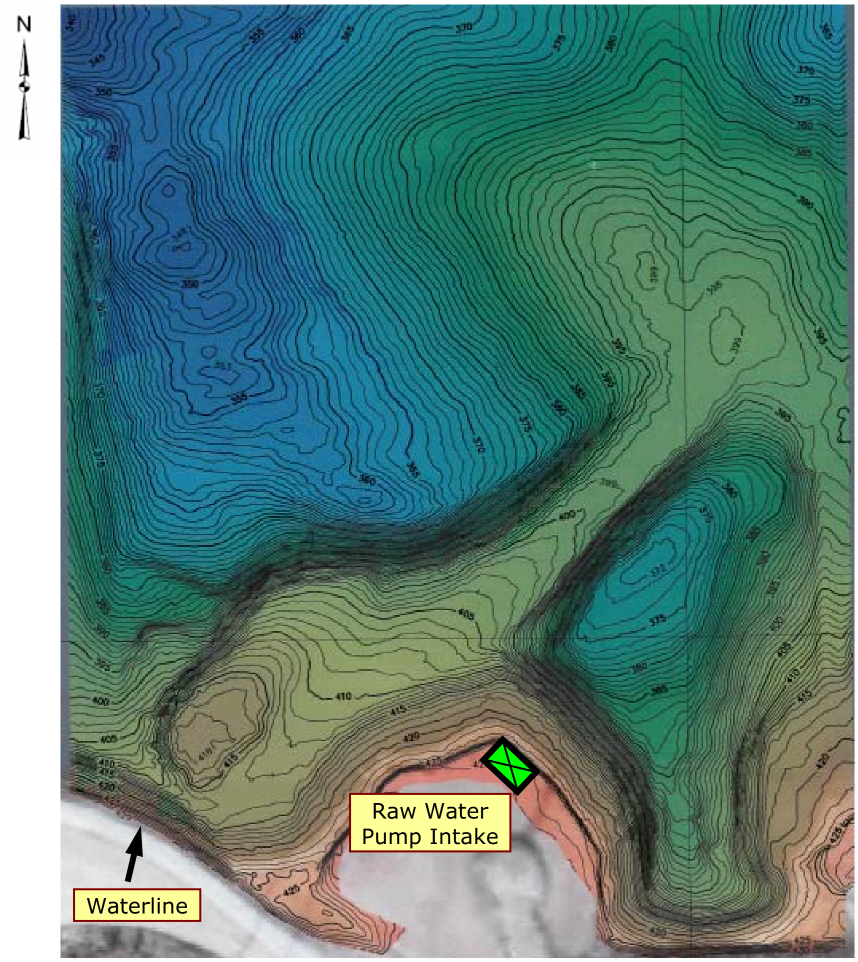


Figure 2.3-9. Location of Bathymetric Survey Areas



Note: Elevations of bathymetric contours with reference to the NAVD88 datum.

Scale, feet
100 0 100 200 300

Figure 2.3-10. Proposed Intake Location Monticello Reservoir, South Carolina

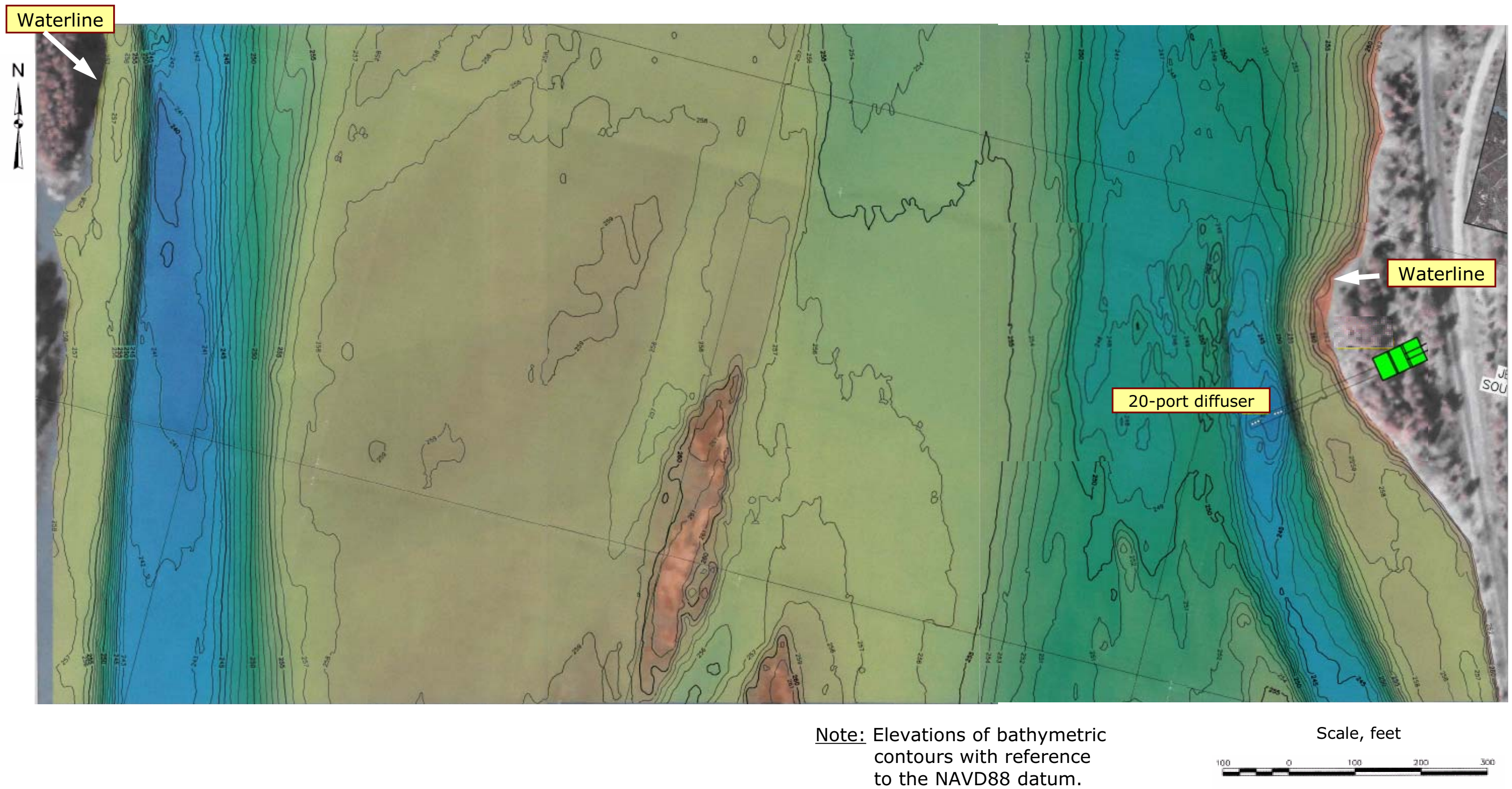


Figure 2.3-11. Proposed Discharge Location Parr Reservoir, South Carolina

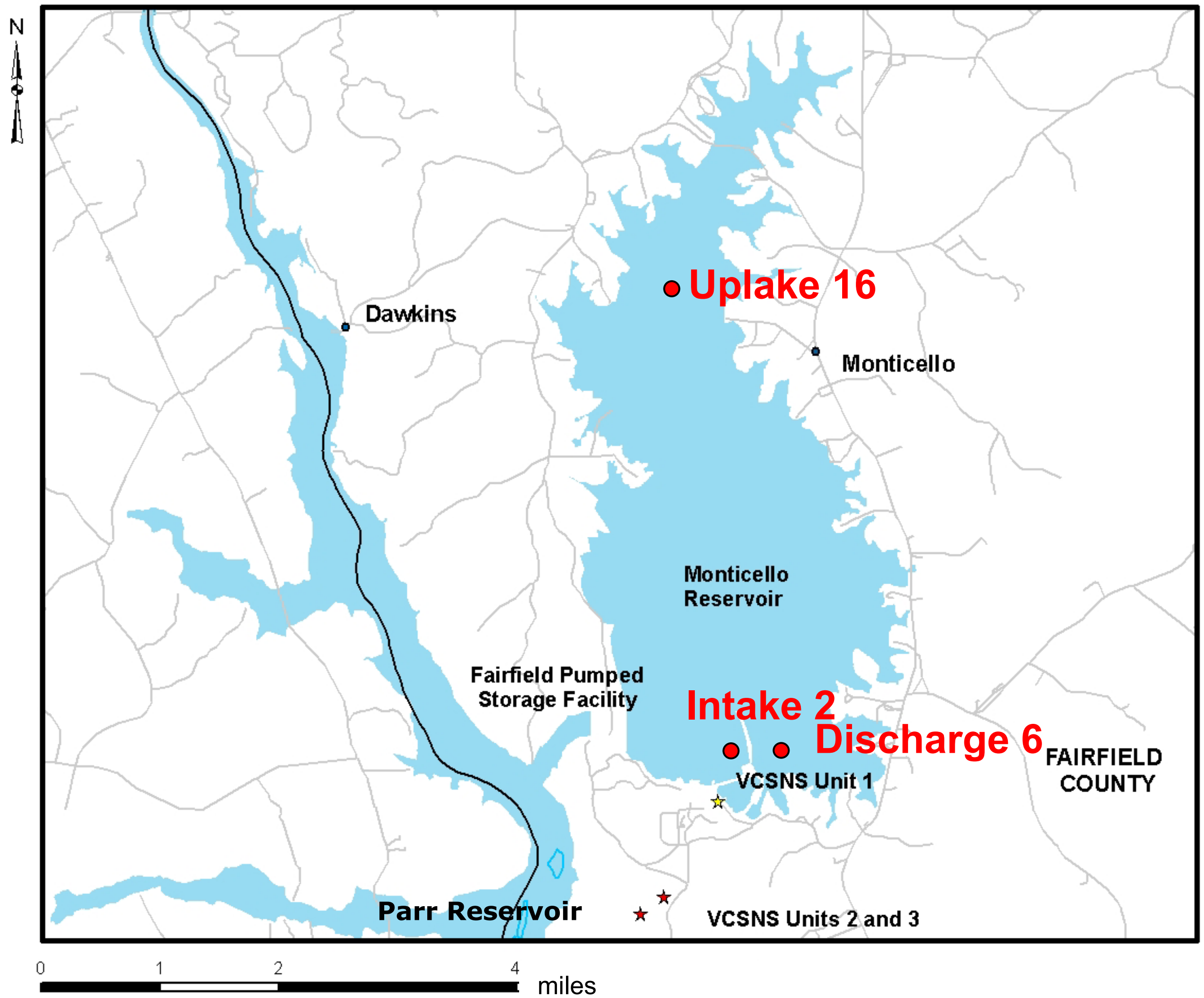


Figure 2.3-12. Locations of Water Quality Monitoring Stations in Monticello Reservoir

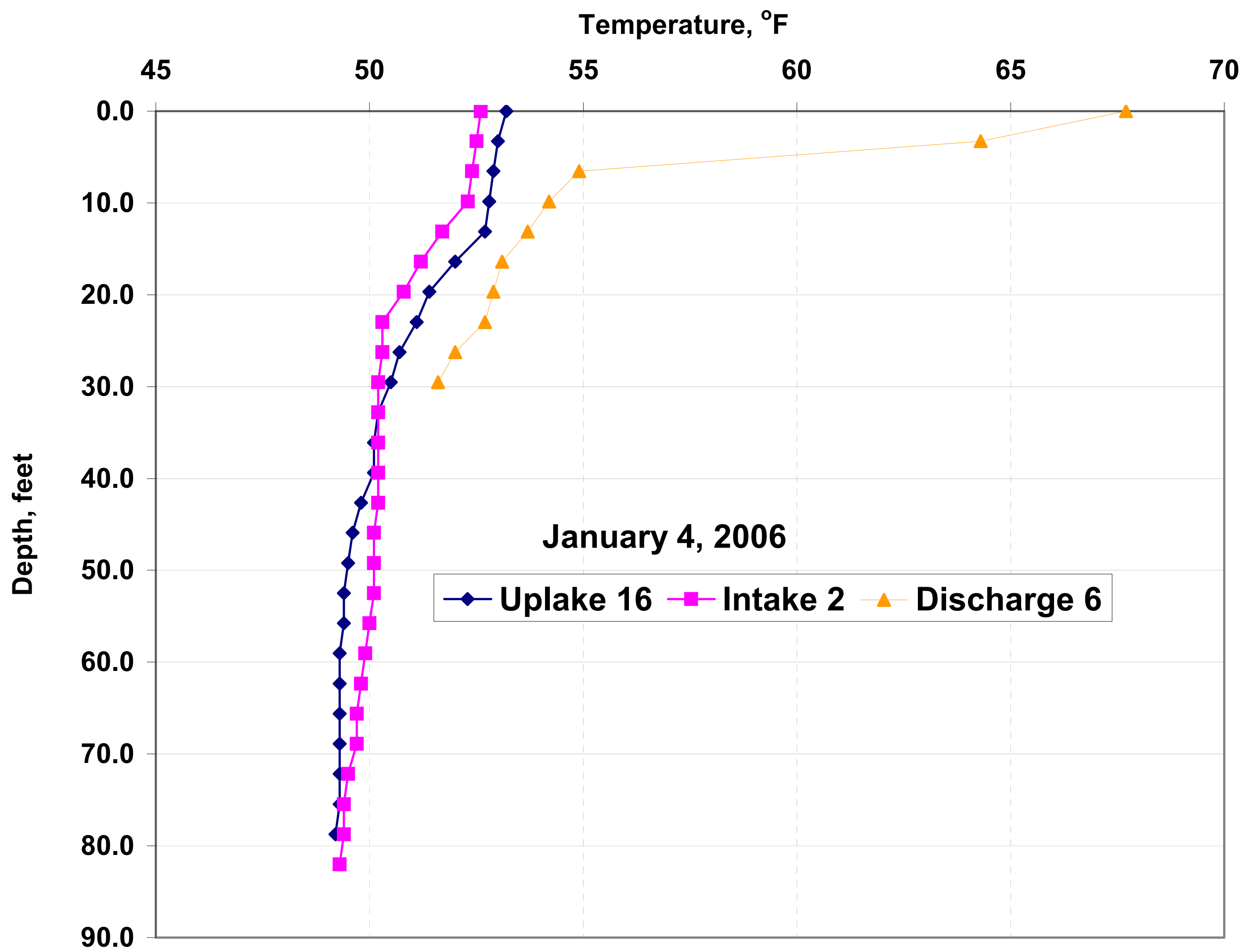


Figure 2.3-13. January Vertical Profiles for Water Temperatures in Monticello Reservoir in 2006

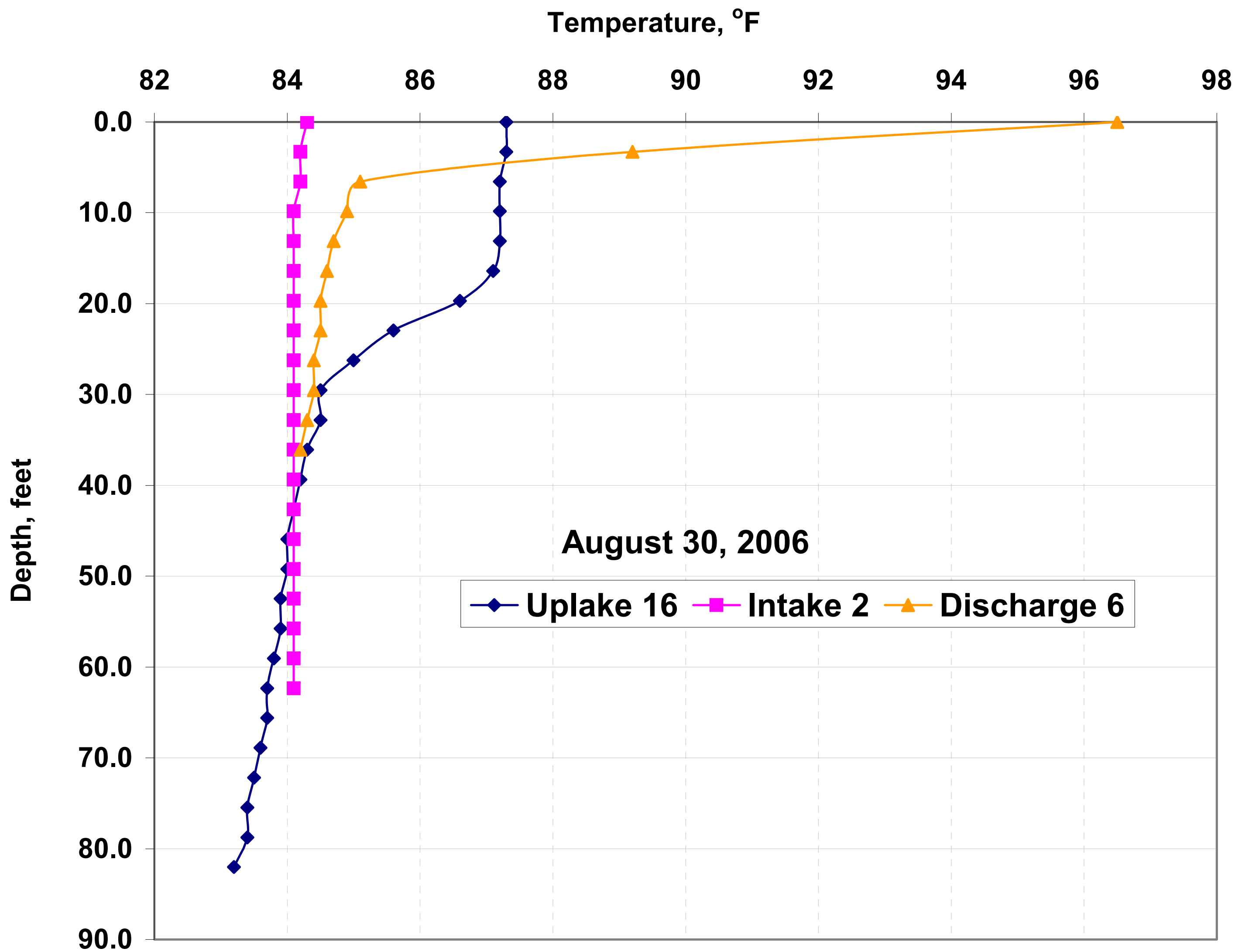


Figure 2.3-14. August Vertical Profiles for Water Temperatures in Monticello Reservoir in 2006

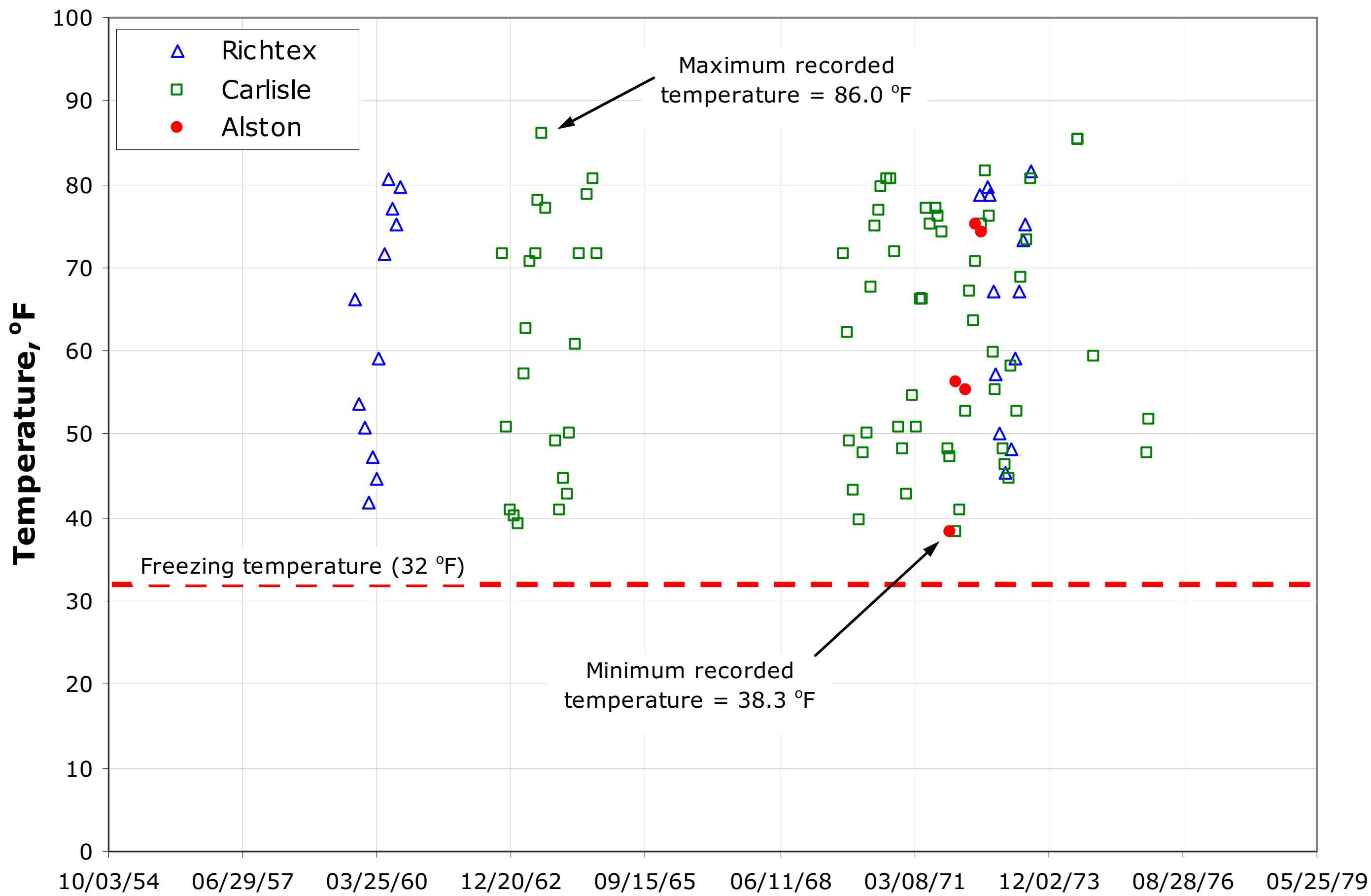
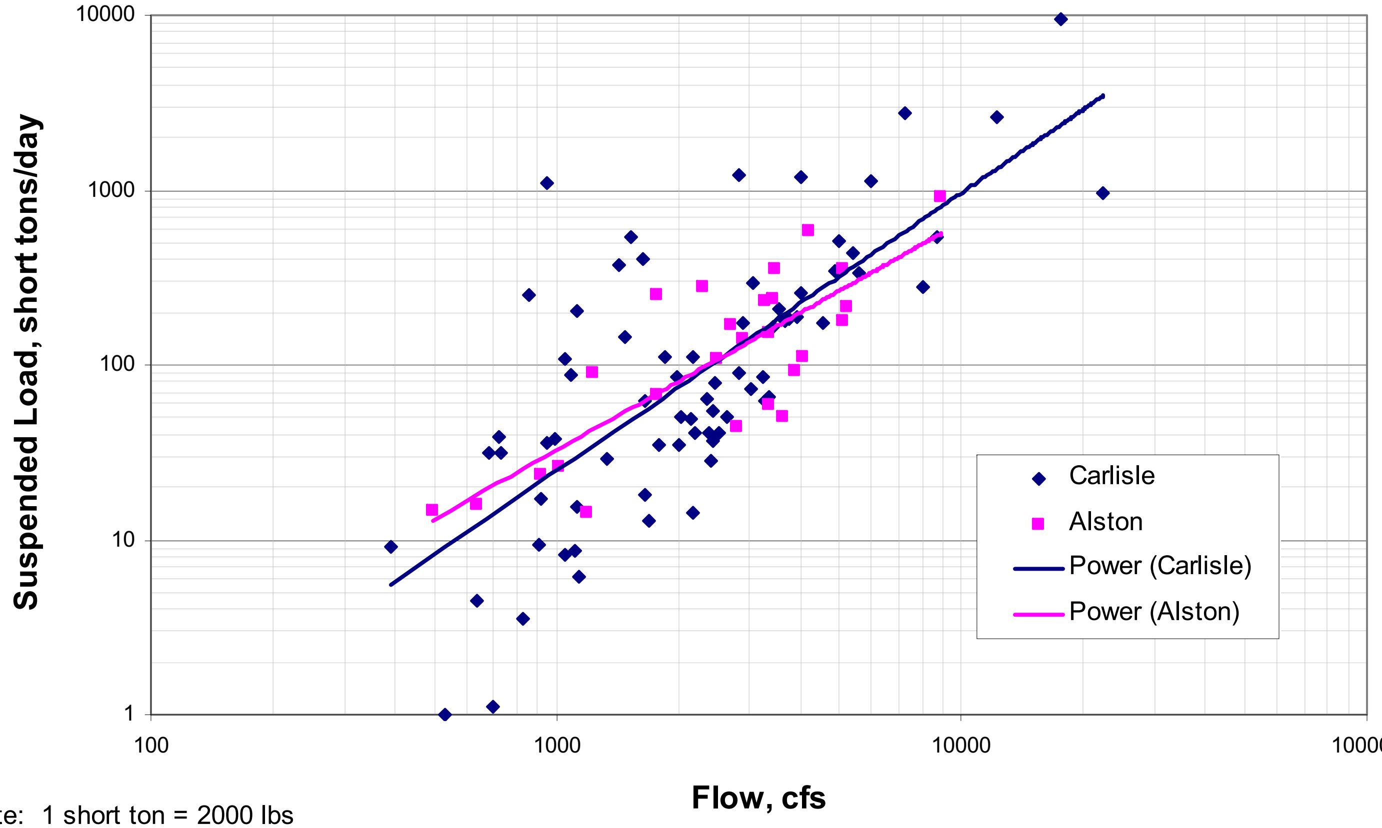


Figure 2.3-15. Recorded Water Temperatures in Broad River



Note: 1 short ton = 2000 lbs

Figure 2.3-16. Suspended Sediment in the Broad River for the Carlisle and Alston Gauges (USGS #02156500 and USGS #0216100, respectively)

Figure 2.3-17. Backwater Effects from Parr Reservoir Extend Thirteen Miles Upstream

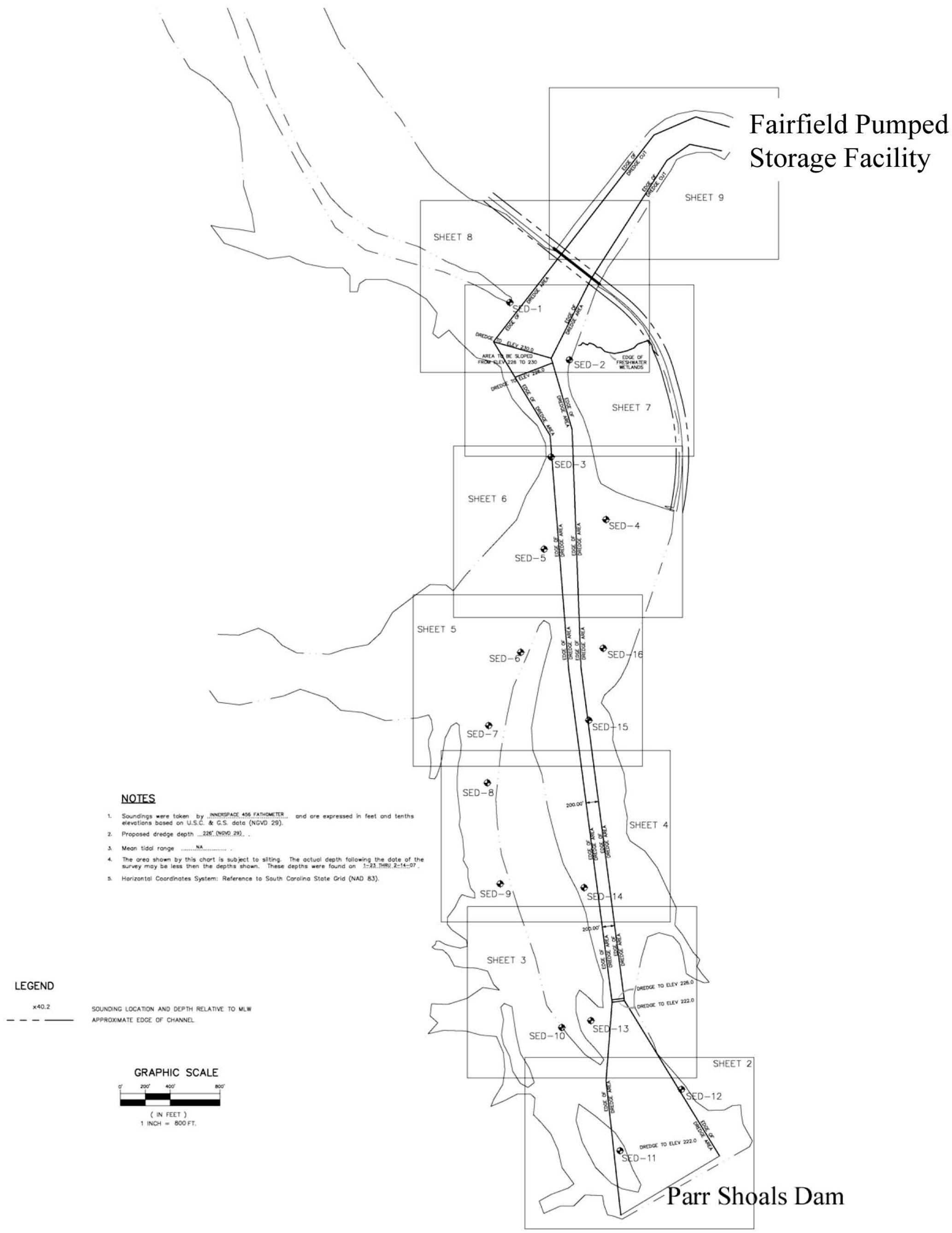
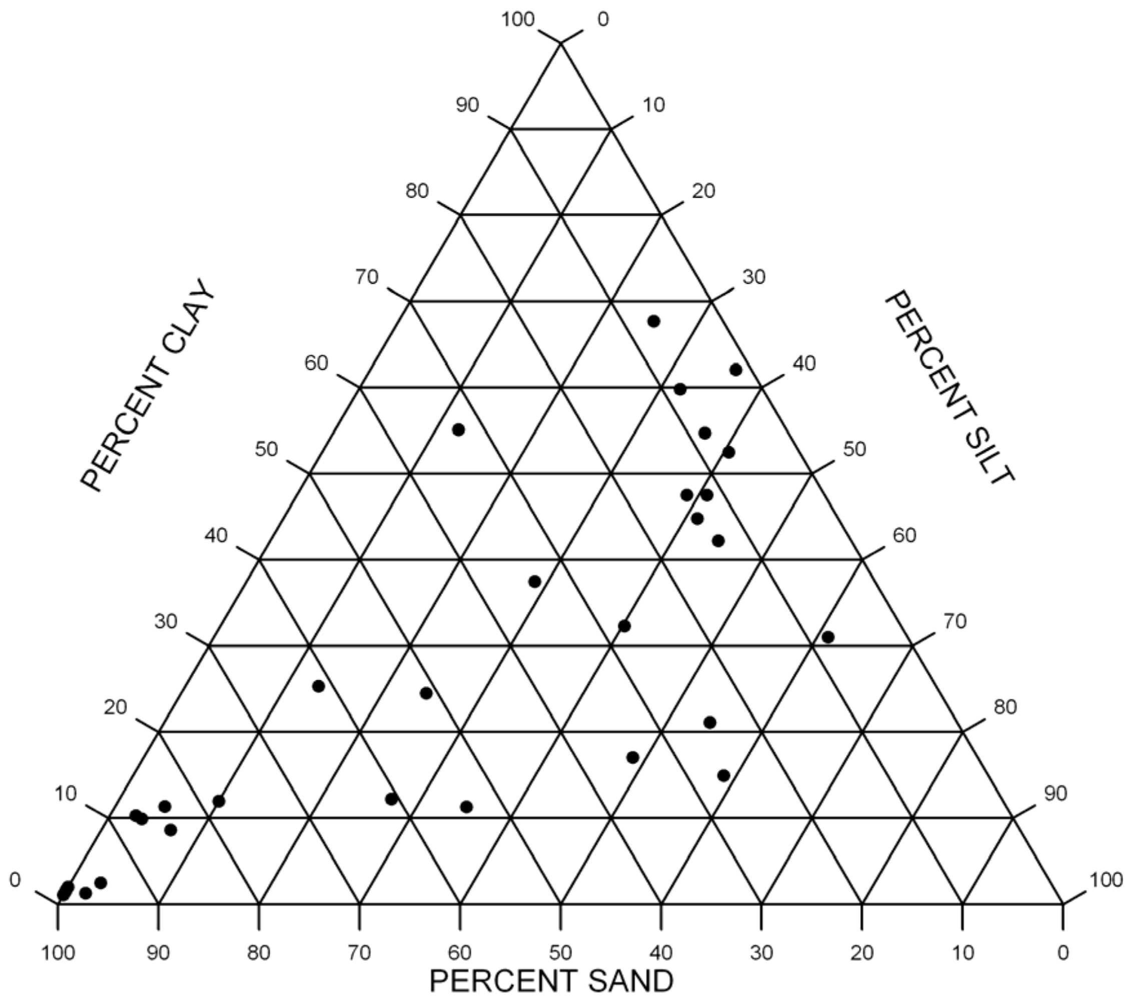


Figure 2.3-18. SCE&G Sediment Sampling Sites from January 2007



(The sediment gradations indicate the predominant sediment distribution in Parr Reservoir includes (i) clay and clay-silt fractions and (ii) sand and sand-silt fractions)

Figure 2.3-19. Ternary Diagram Showing the Sediment Gradations for Parr Reservoir Sediment Sampling

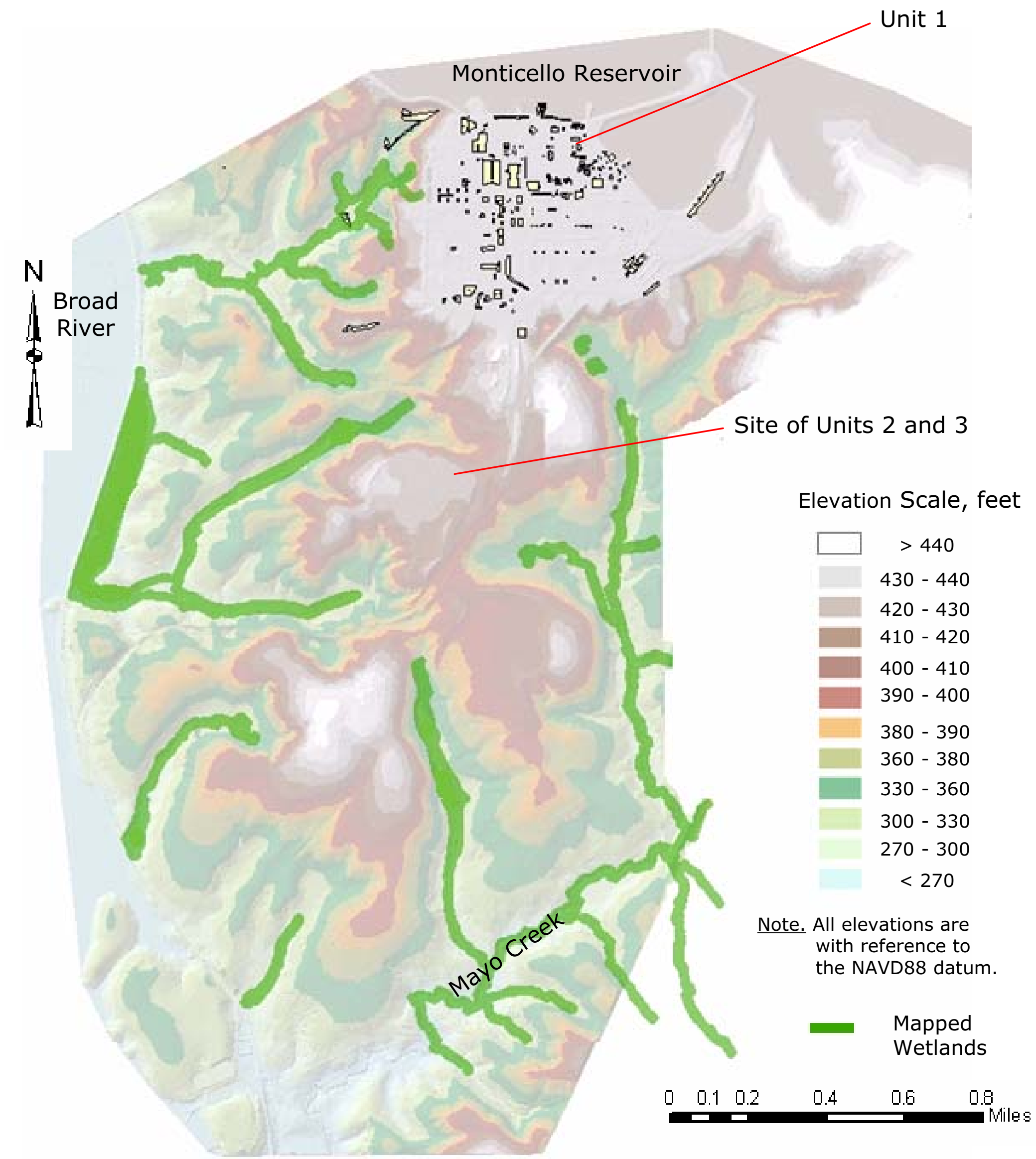


Figure 2.3-20. Mapped Wetlands

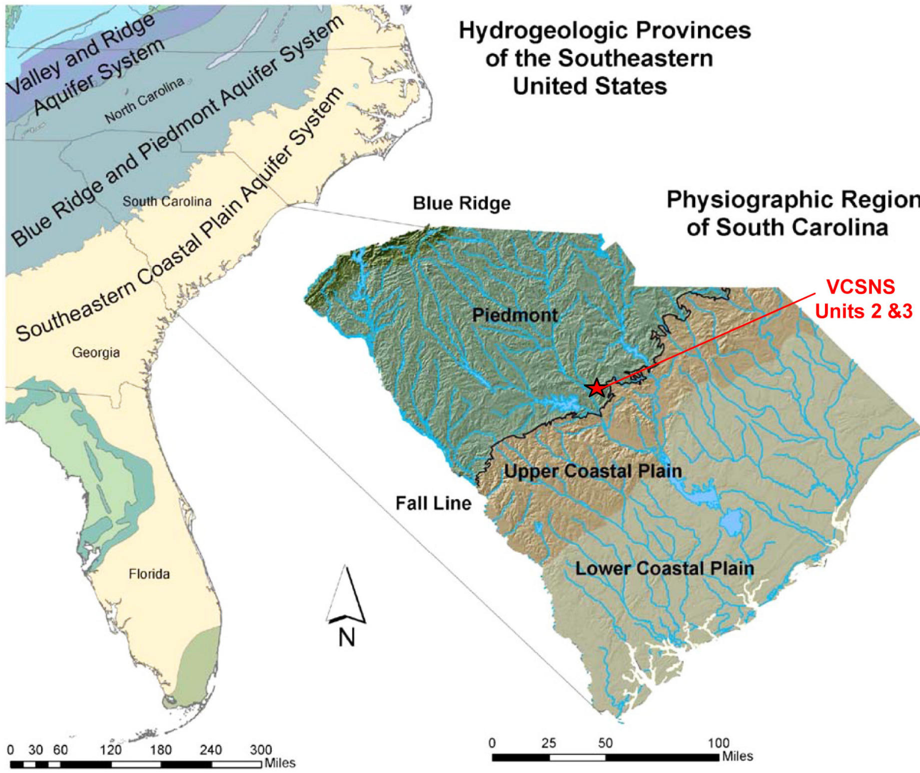


Figure 2.3-21. Hydrogeologic Provinces and Associated Physiographic Provinces in South Carolina (Childress and Butler 2006)

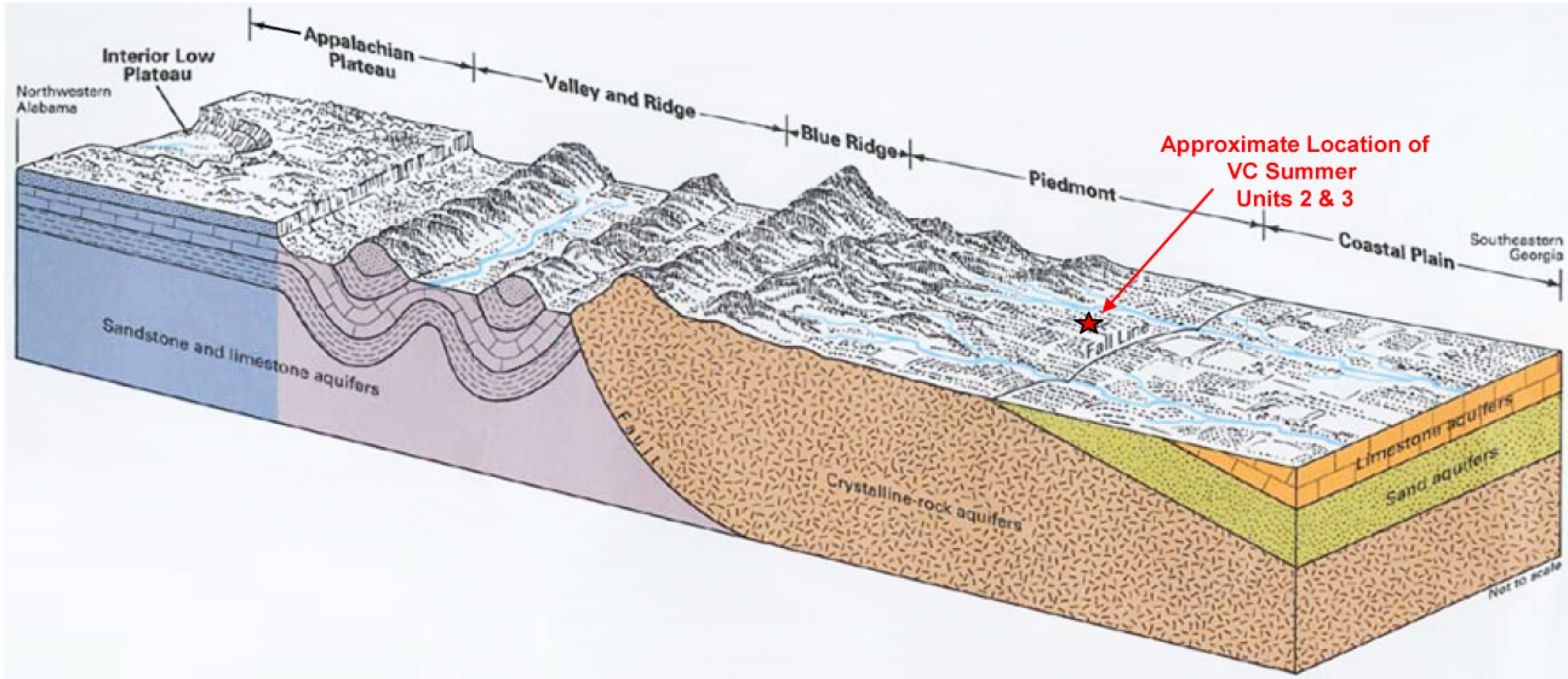


Figure 2.3-22. Geologic Cross Section of the Regional Physiographic Provinces and Associated Aquifer Systems (Miller 1990)

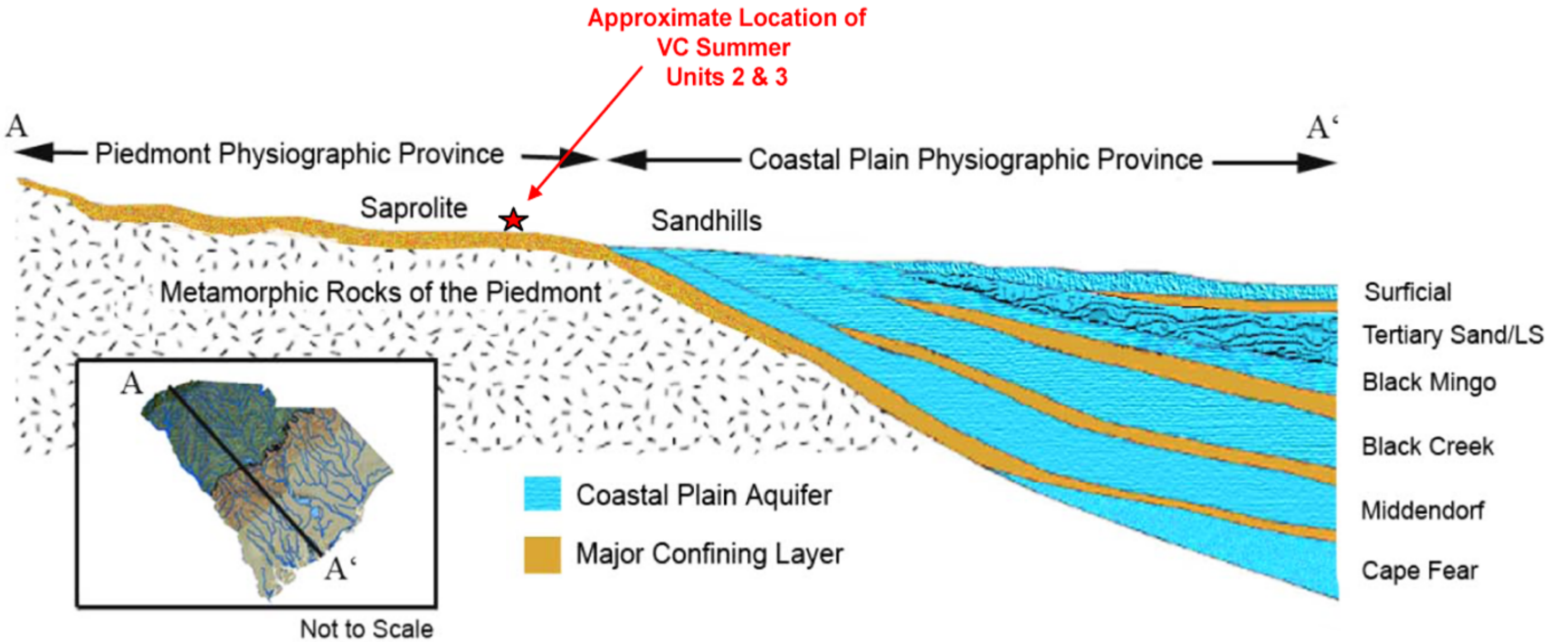


Figure 2.3-23. Hydrogeologic Cross Section of South Carolina (Childress and Butler 2006)

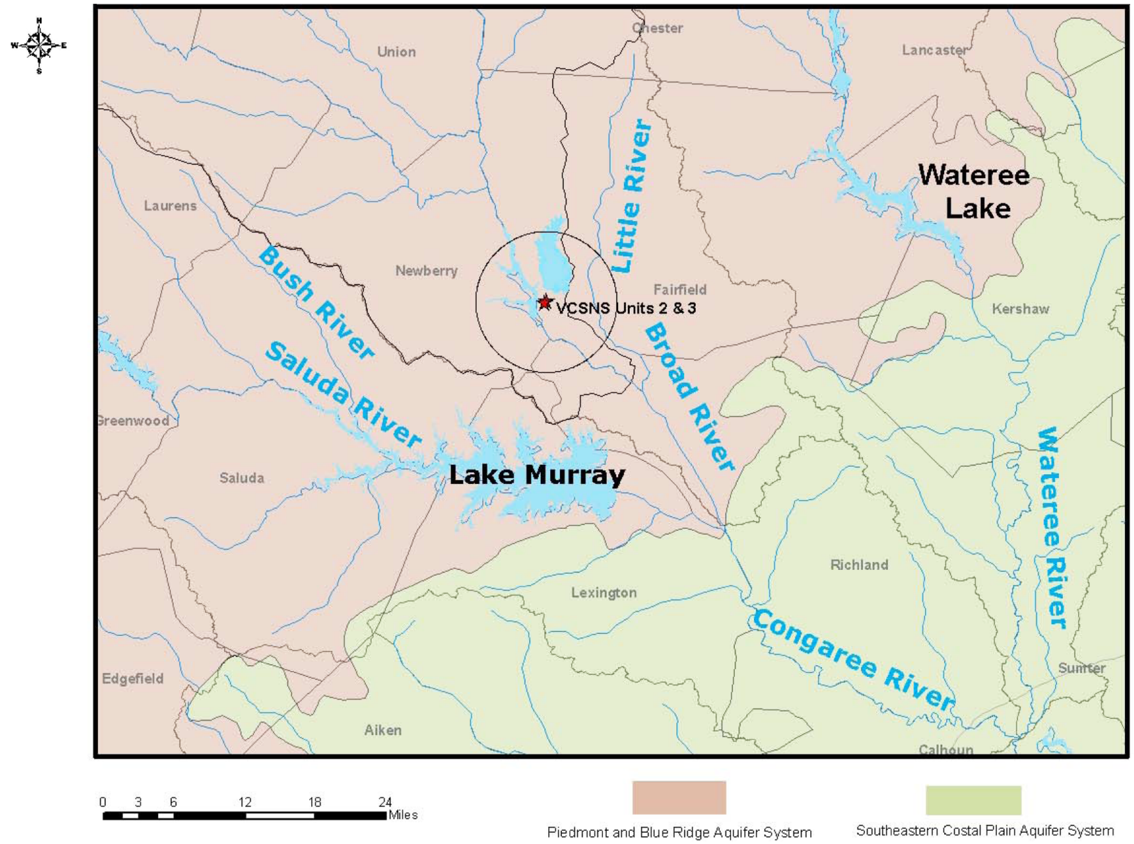


Figure 2.3-24. Regional Aquifer Systems

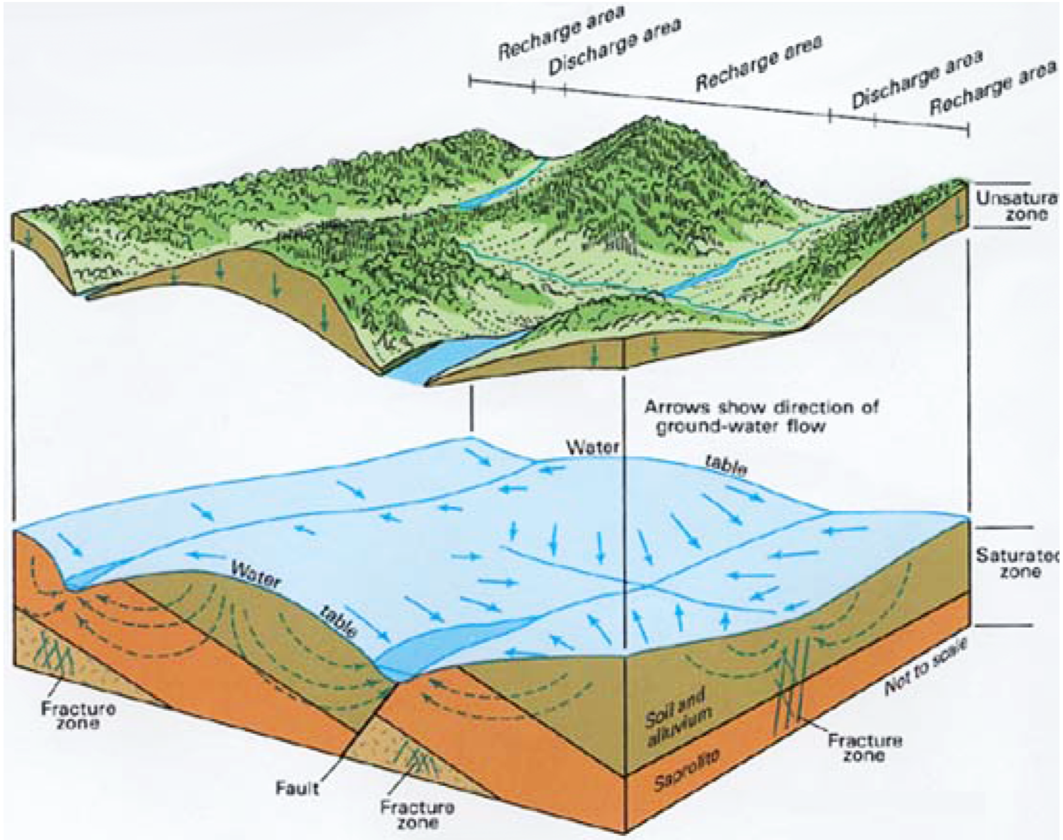


Figure 2.3-25. Groundwater Flow in the Piedmont/Blue Ridge Aquifer System (Miller 1990)

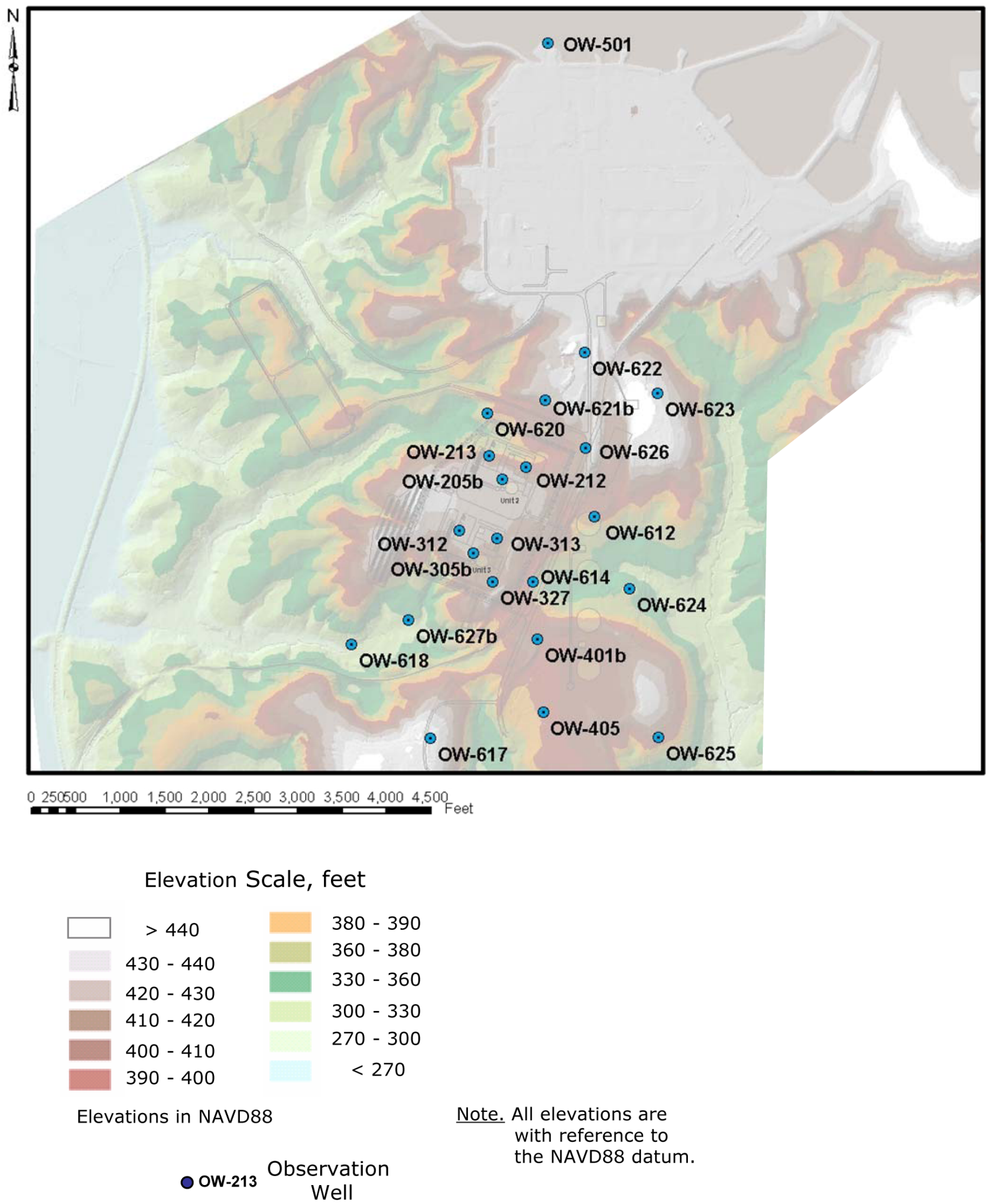


Figure 2.3-26. Observation Well Locations in the Saprolite/ Shallow Bedrock Zone

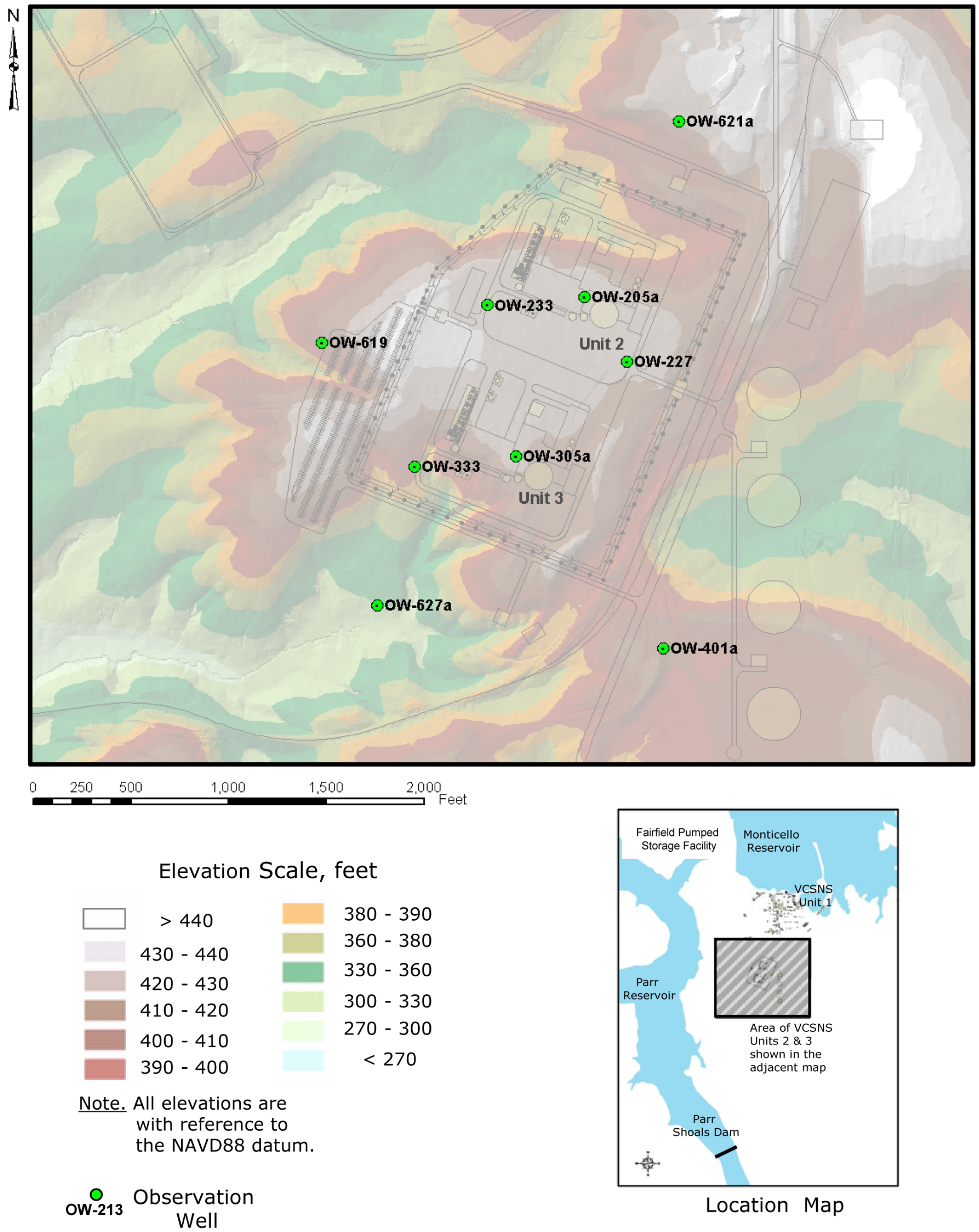


Figure 2.3-27. Deep Bedrock Zone Observation Well Locations

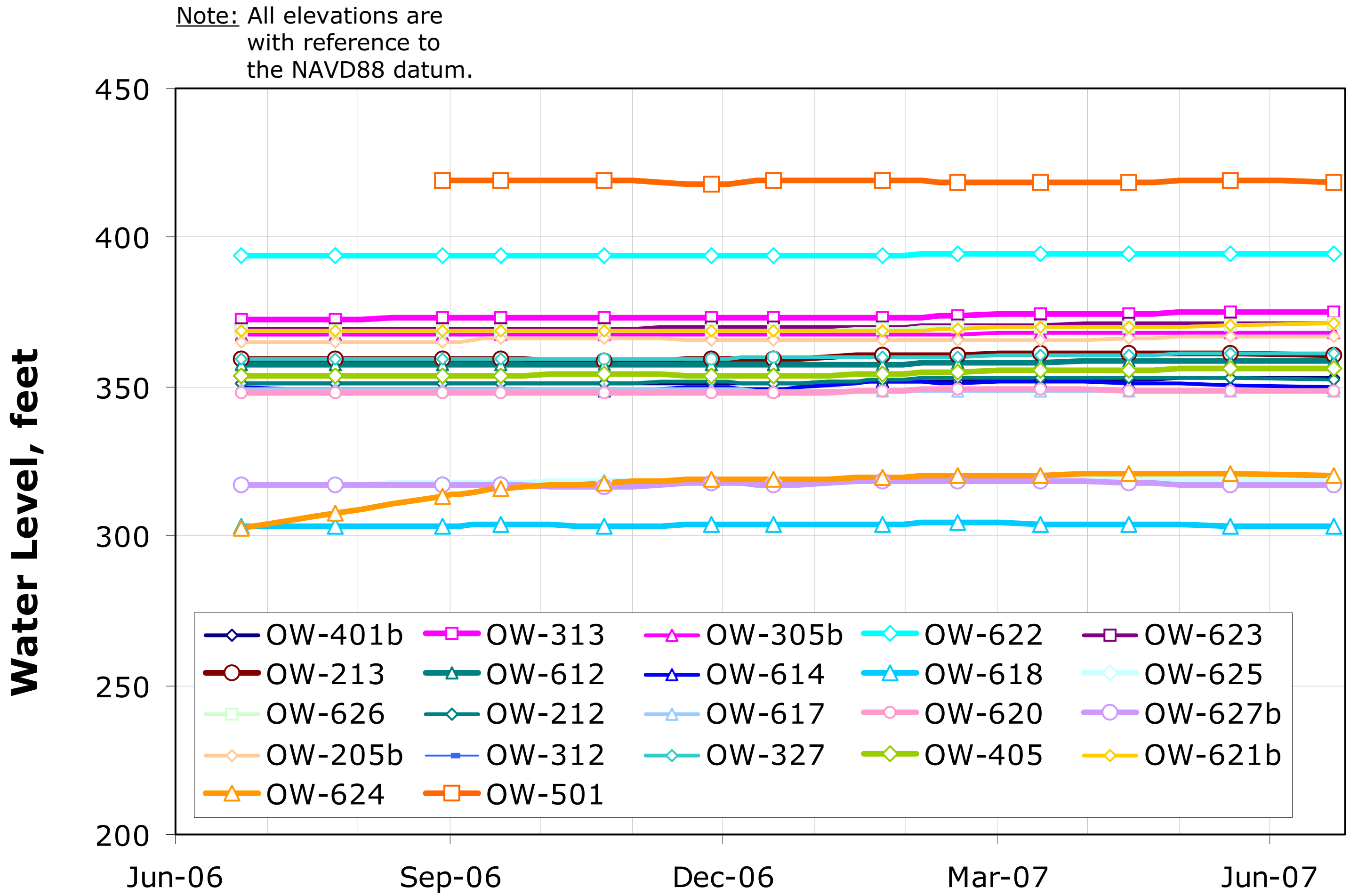


Figure 2.3-28. Hydrographs for Saprolite/Shallow Bedrock Hydrostratigraphic Zone VCSNS Observation Wells, June 2006–June 2007

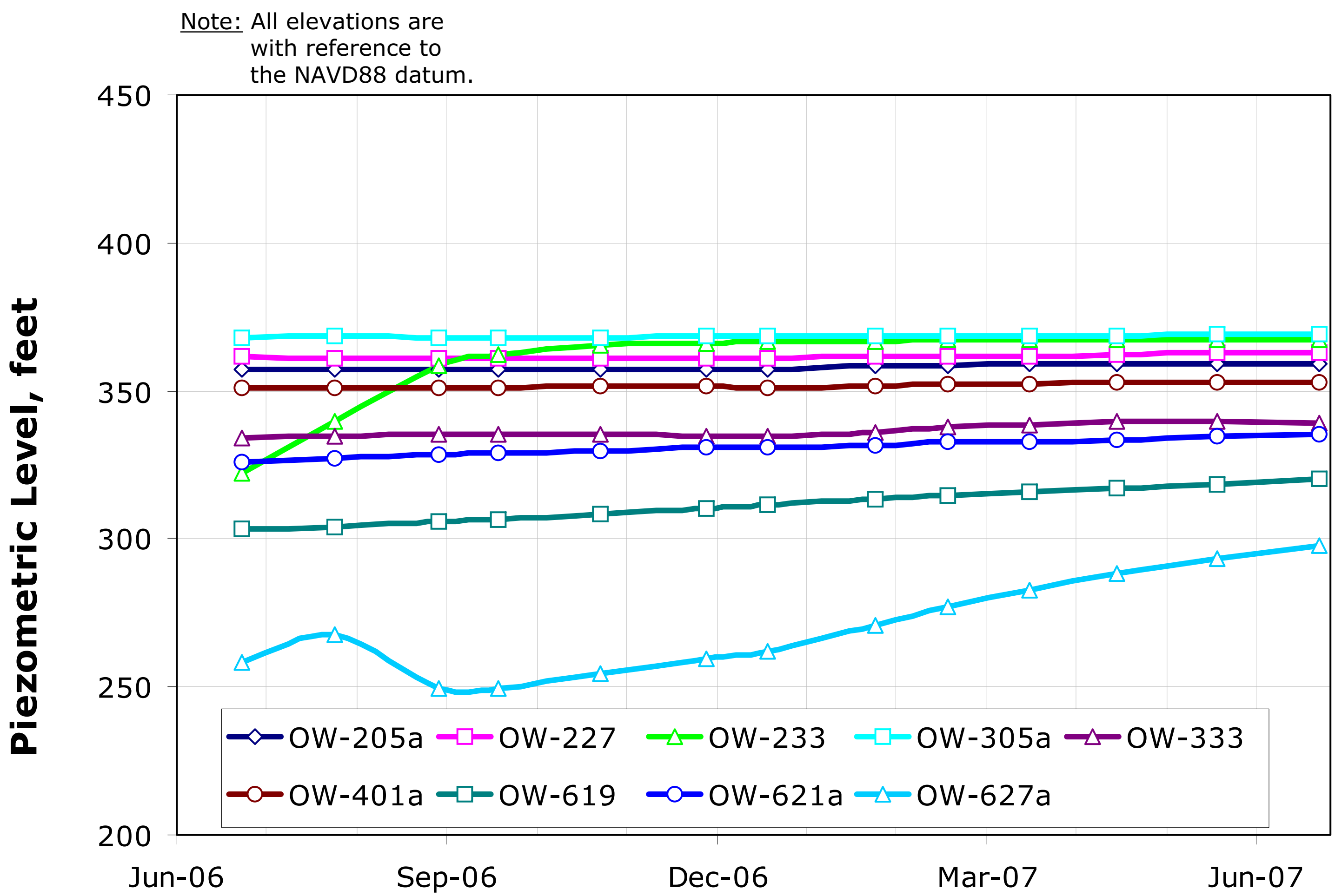


Figure 2.3-29. Hydrographs for Deep Bedrock Hydrostratigraphic Zone VCSNS Observation Wells, June 2006–June 2007

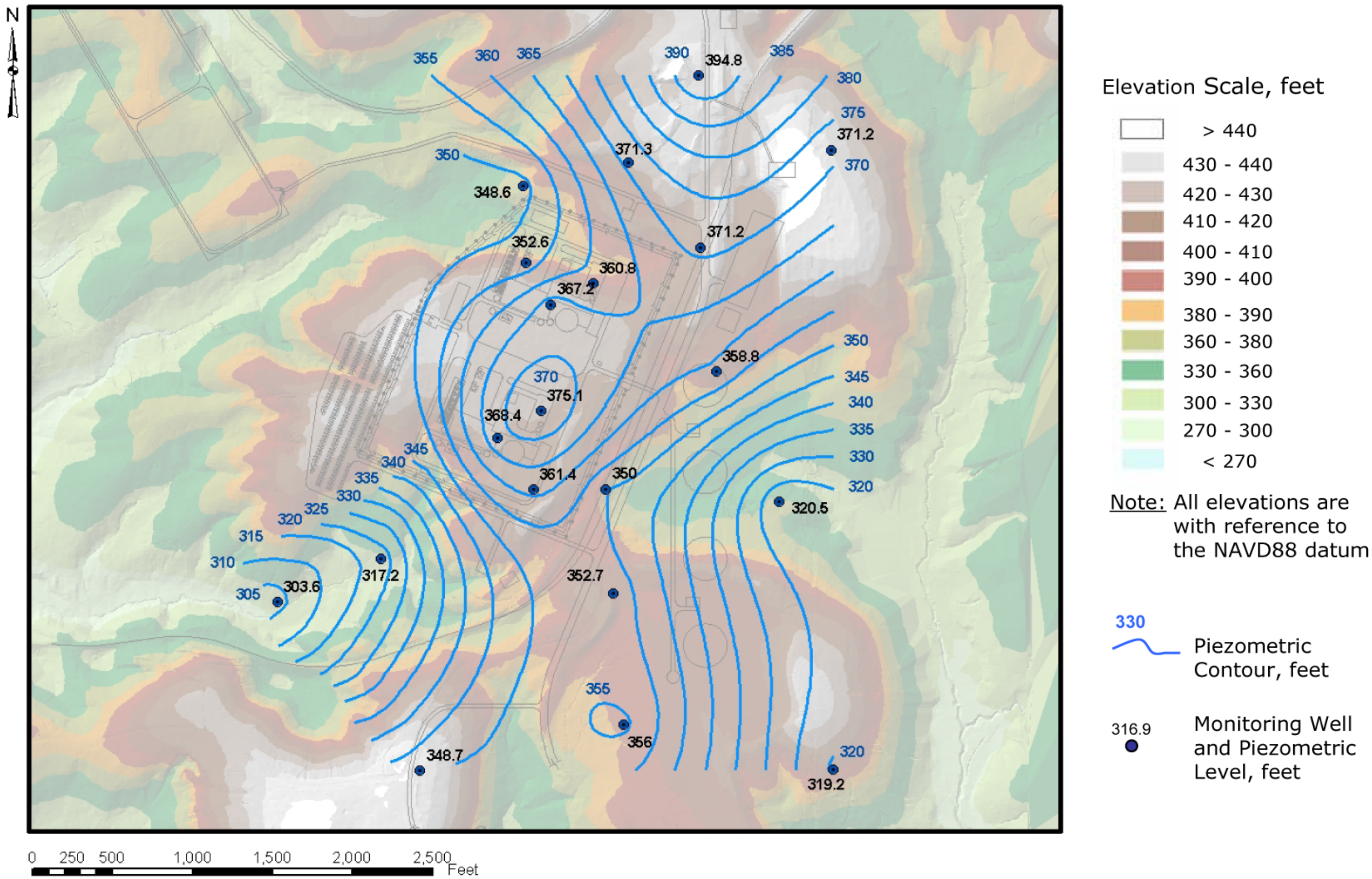


Figure 2.3-30. Piezometric Contour Map in the Saprolite/Shallow Bedrock Zone, June 2007

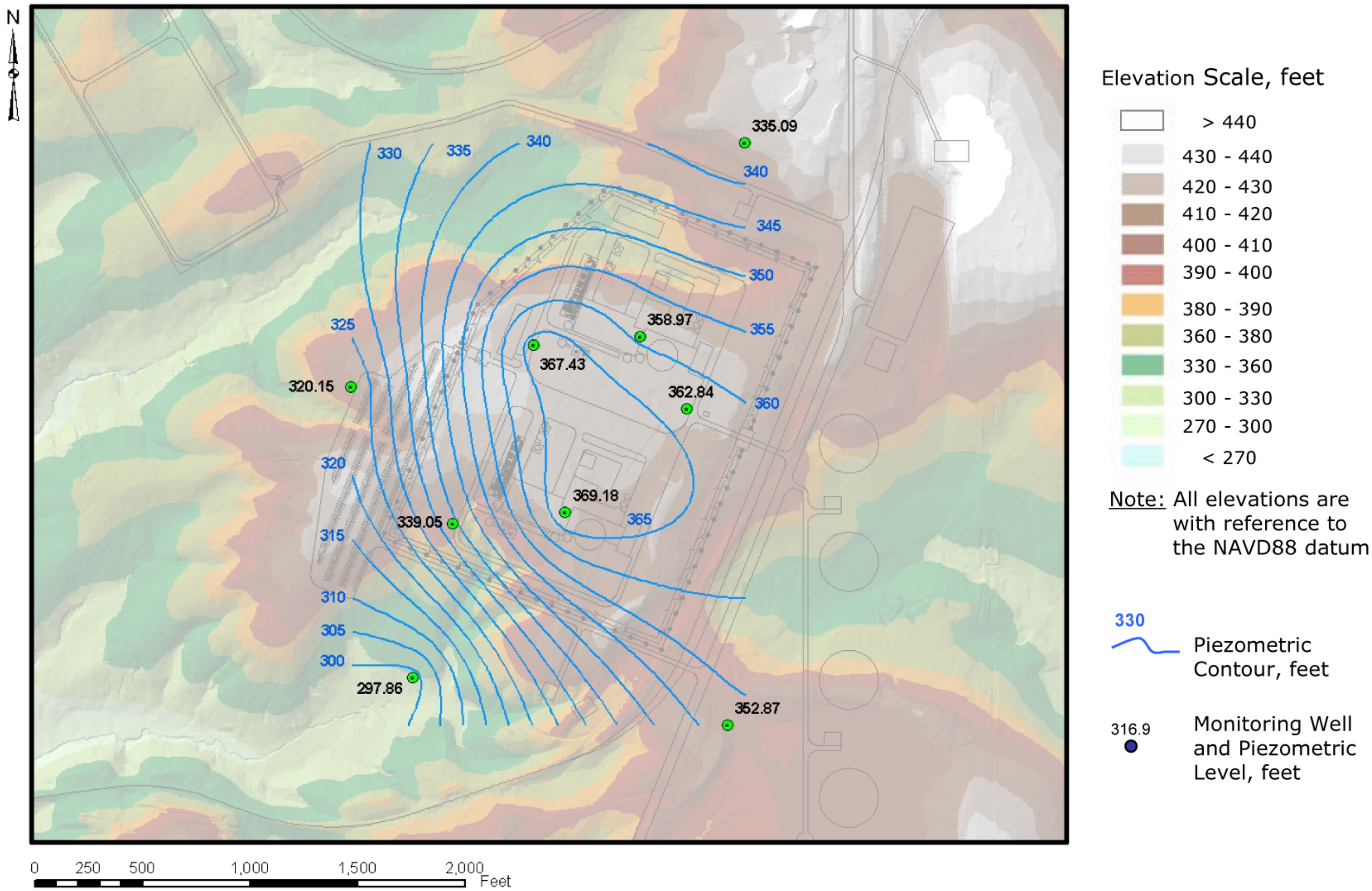


Figure 2.3-31. Piezometric Contour Map in the Deep Bedrock Zone, June 2007

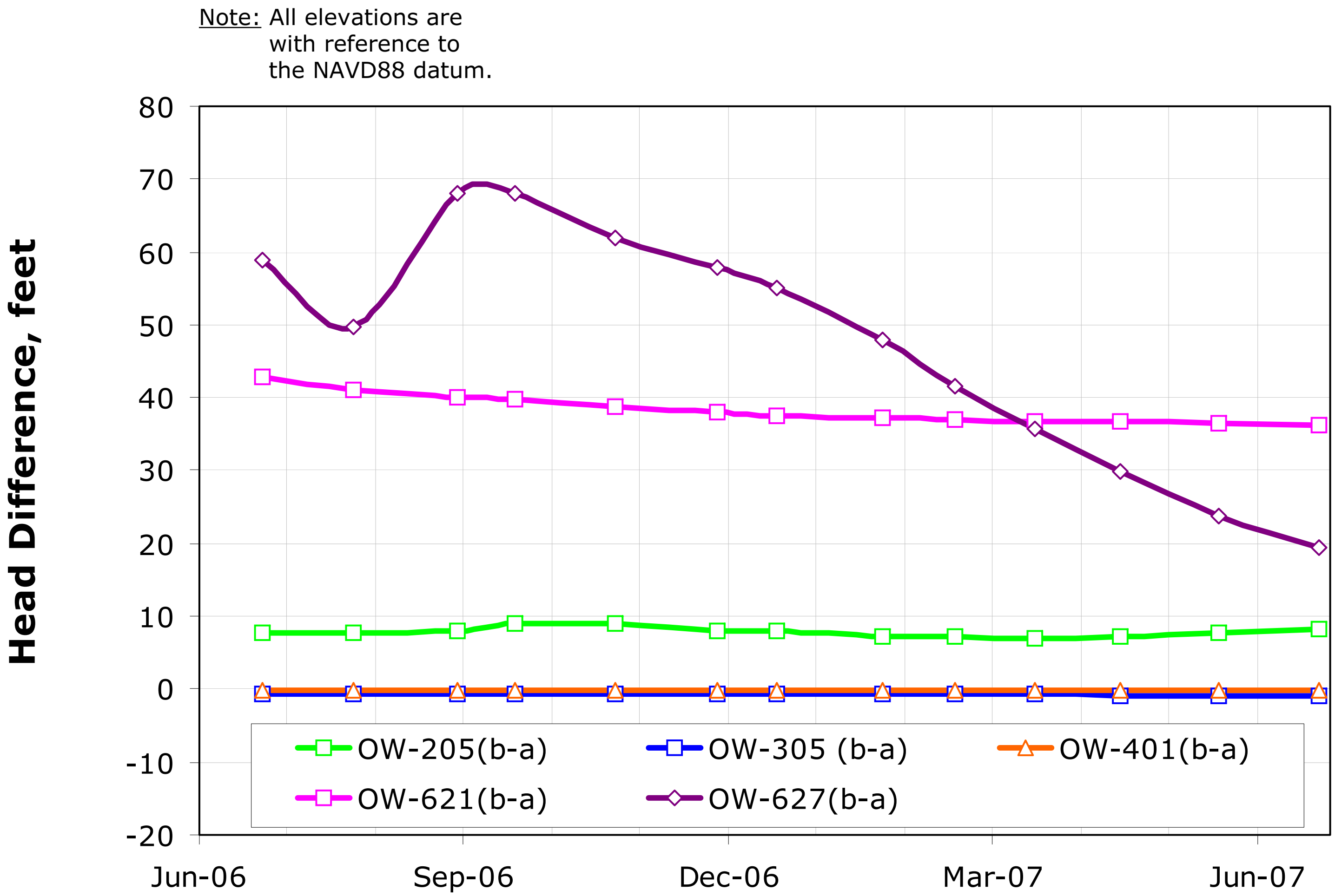


Figure 2.3-32. Head Differential between the Saprolite/Shallow Bedrock Hydrostratigraphic Zone and the Deep Bedrock Hydrostratigraphic Zone based on Well Pairs

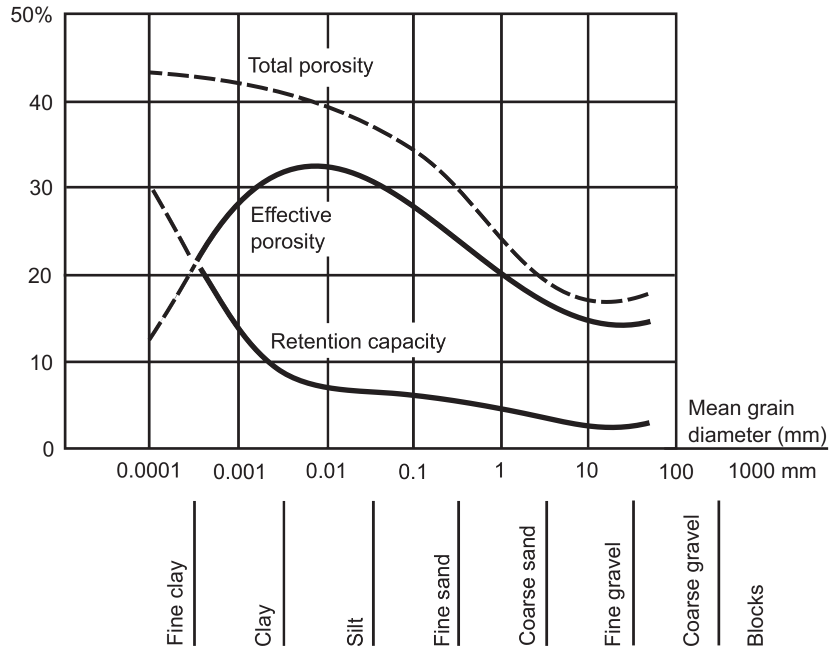


Figure 2.3-33. Porosity components as a Function of Grain Size (de Marsily, 1986)

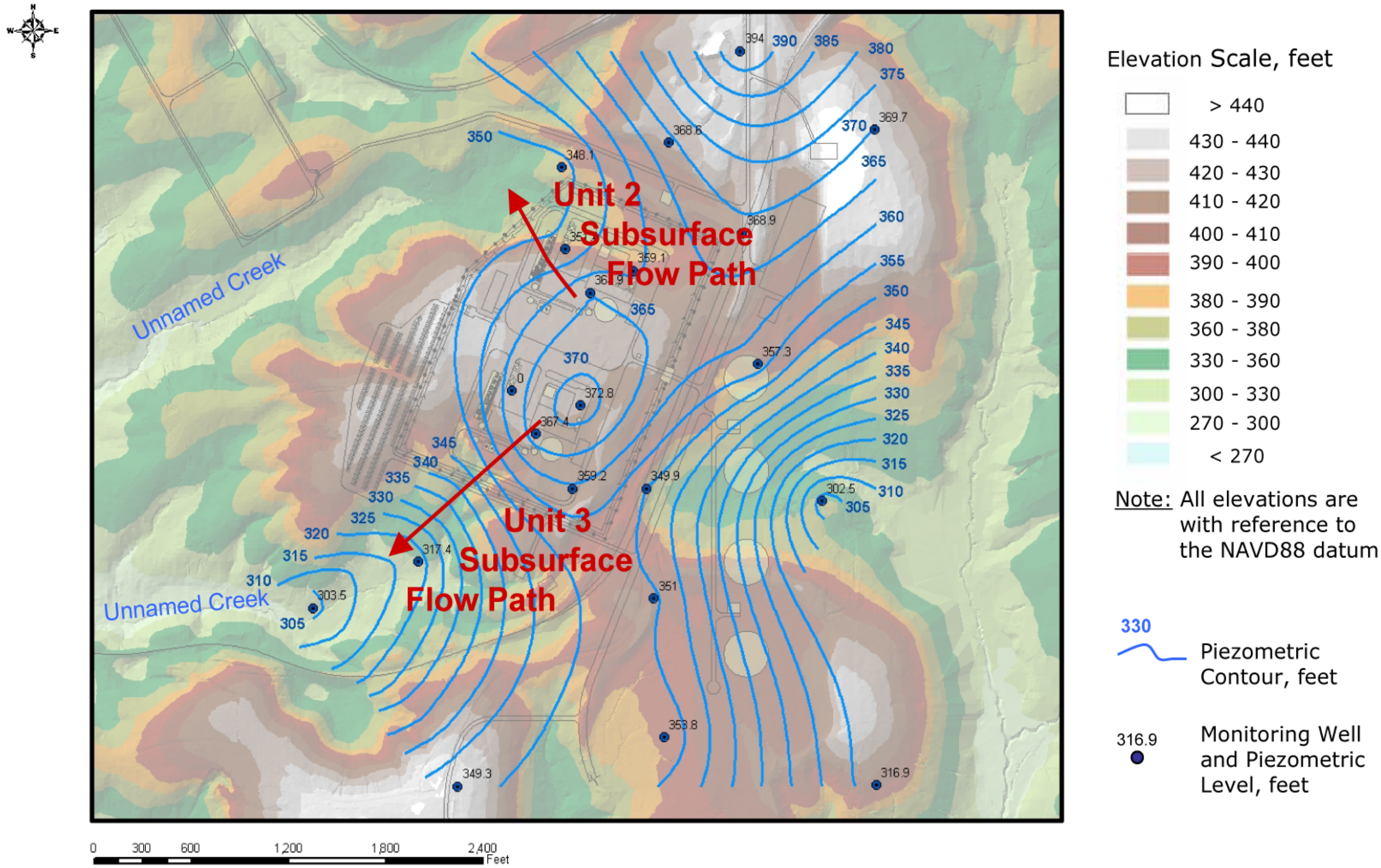


Figure 2.3-34. Plan View of Subsurface Contaminant Pathways for Units 2 and 3 (All elevations are with reference to the NAVD88 datum)

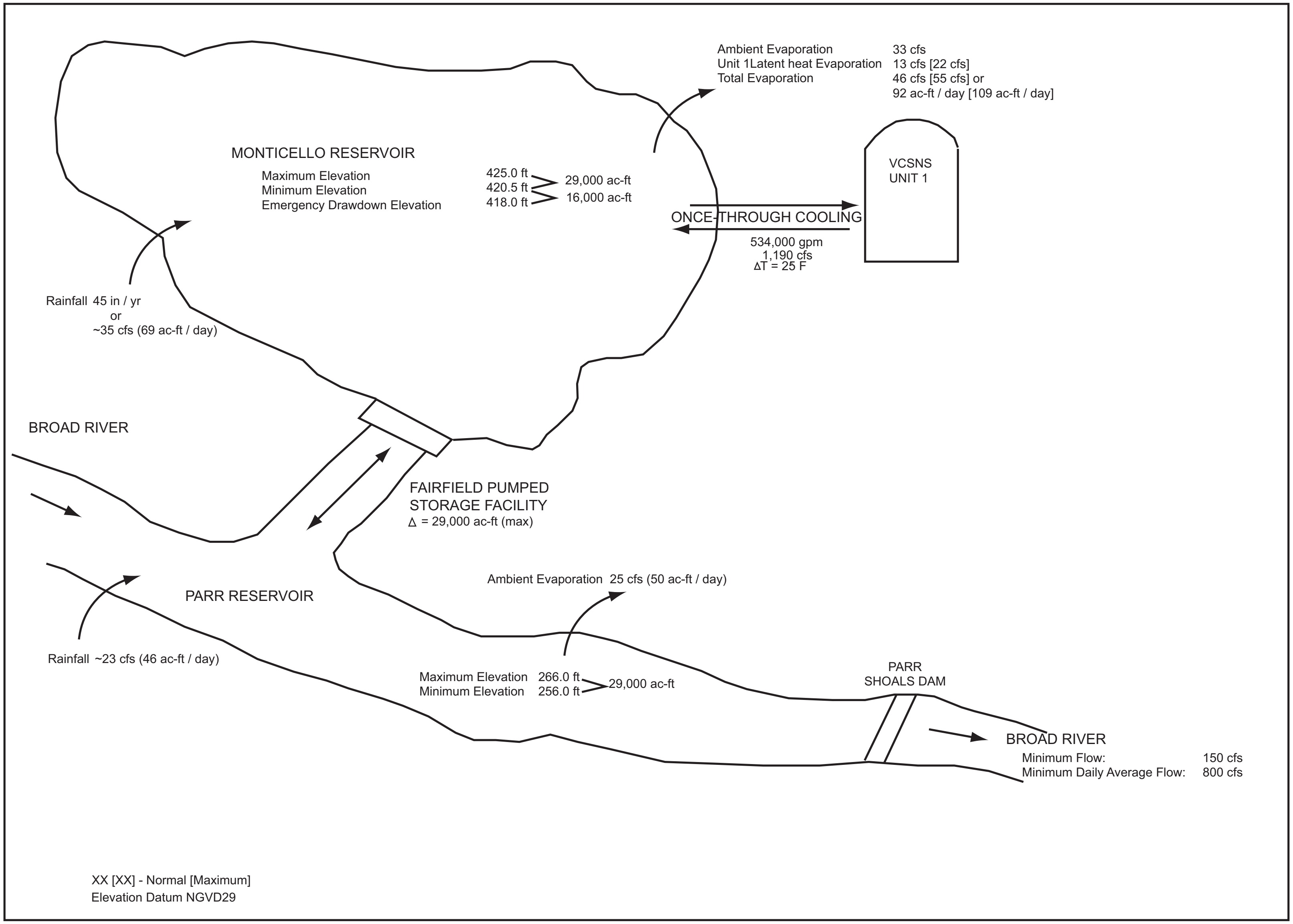


Figure 2.3-35. Diagram of Broad River, Parr Reservoir, and Monticello Reservoir System

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 Habitats and Communities

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 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.

A proposed fuel depot and 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 the Parr Reservoir (Figure 2.1-3). Other than the 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 the 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.

The 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. The 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 the Parr and Monticello Reservoirs (SCE&G 2002a).

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

Wildlife species found in the forested portions of the VCSNS site are those typically found in Piedmont forests of South Carolina. Mammals such as the whitetail deer, raccoon, opossum, gray squirrel, Eastern cottontail, and gray fox exist at the site, as do smaller mammals such as moles, shrews, and a variety of mice and voles. Various reptiles and amphibians (*e.g.,* snakes, salamanders, lizards, toads) exist at the VCSNS site. Common bird species at the site include the American crow, blue jay, Carolina chickadee, mourning dove, black vulture, turkey vulture, song sparrow, white-throated sparrow, dark-eyed junco, Northern cardinal, tufted titmouse, red-bellied woodpecker, and Northern flicker.

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). The bald eagle was the only federally or state-listed animal species observed at the site during the 2002 survey. The bald eagle is state-listed as endangered (SCDNR 2006). The USFWS removed the bald eagle from the federal list of threatened and endangered species effective August 8, 2007 (USFWS 2007a). 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 along the Fairfield Pumped Storage Facility tailrace canal. Bald eagles are commonly observed along the Monticello Reservoir, the Fairfield Pumped Storage Facility tailrace canal, Parr Reservoir, and on the Broad River downstream of Parr Shoals Dam. There are six known eagle nests within 5 miles of the VCSNS site. The nearest eagle nest is located on the north end of the jetty in the Monticello Reservoir, approximately 1.7 miles north of the proposed new reactor units. There is also an eagle nest on the west side of the 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 on the VCSNS site during the 2002 survey.

Surveys for federally and state-listed species classified as threatened or endangered were conducted in June 2006, September 2006, and April 2007 in areas that would be disturbed by proposed construction activities (Figure 2.4-2). No federally or state-listed plants or animals were found during the 2006 surveys (Nelson 2006). A juvenile bald eagle was observed along the eastern shoreline of Parr Reservoir during the April 2007 survey; no other federally or state-listed plants or animals were observed during the April 2007 survey. SCE&G will conduct additional surveys for special status species at the proposed site in fall 2007. The results of the fall survey will be provided to NRC.

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 (2006a, 2007b) 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 VCSNS site might provide refuge for special status plants or animals that escaped detection during the surveys. This is true especially for animals, some of which are mobile, secretive, and rarely observed even when present. SCE&G biologists at VCSNS are familiar with special status species in South Carolina.

Much of the VCSNS site consists of planted pines where plant species diversity is low, but it does include areas of hardwood forest and mixed pine-hardwood forest. These areas (especially the hardwood and mixed pine-hardwood forests) 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).

SCE&G has sited the proposed facilities and infrastructure so as 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 heavy haul 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.

Important species are defined in the *Standard Review Plans for Environmental Reviews for Nuclear Plants* (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 the Parr and Monticello Reservoirs during migration. With the possible exceptions of the area where the blowdown line would discharge into the Parr Reservoir, the proposed raw water intake, and the proposed water treatment plant intake and waste discharge to the 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 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.

2.4.1.2 Transmission Corridor Habitats and Communities

Precise routes for the Units 2 and 3 transmission lines will not be known until after SCE&G decides to construct the new units. The description of the ecology of the existing Unit 1 transmission corridors is representative of conditions expected in the new transmission corridors (Subsection 2.2.2). SCE&G would evaluate the ecological impacts before constructing new transmission lines (Subsection 4.1.2).

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 (2006a) 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 route of the proposed new transmission lines has not been determined, but likely will cross ten counties (Calhoun, Chester, Colleton, Dorchester, Fairfield, Hampton, Lancaster, Lexington, Orangeburg, and Richland). 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 the 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 the Parr Reservoir (Figure 2.1-3). The Parr Reservoir, a shallow (15 feet average depth) reservoir with an area of 4,400 acres, is hydraulically connected by the Fairfield Pumped Storage Facility to the 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 the Parr Reservoir and the 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 the 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, the 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, the Parr Reservoir's surface area was 1,850 acres. In 1977, the level of the 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, the Monticello Reservoir was created to serve as the upper reservoir for the Fairfield Pumped Storage Facility and the cooling water source for Unit 1. The 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 the 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 the 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 the Parr Reservoir to the Monticello Reservoir in the early morning hours when electrical demand is low.

The 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 the 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.

The 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 a 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 the 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). The 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 the 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 the 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), represent the most comprehensive information on the biotic communities of the Broad River in the vicinity of the VCSNS site.

The 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 the Parr Reservoir appeared to be largely unaffected by operations of VCSNS.

The SCDNR assessed the largemouth bass fishery in the early 1990s and determined that there were fewer largemouth bass per acre in the Parr Reservoir than other reservoirs in Fisheries Region III (Hayes 1999). Mean lengths and weights of the Parr Reservoir largemouth bass were also lower. The 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 the 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 on the reservoir make navigation difficult at times (water levels can be extremely low after pump-back operations) and appear to limit fishing pressure (Hayes 1999).

SCE&G commissioned Normandeau Associates to conduct surveys of the Parr Reservoir fish community in the fall of 2006 and spring of 2007. Three gear types (electrofishing, gill nets, hoop nets) were employed, but all (476) fish were collected by electrofishing and gill netting (Normandeau 2007). The Seventeen fish species, all relatively common Piedmont species, were collected. Samples were dominated by channel catfish (26.1% of the total) and white perch (24.8% of the total), but gizzard shad (12.6% of the total), shorthead redhorse (8.1% 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 also common in samples (Normandeau 2007).

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 nonnative species—white perch and blue catfish—made up 31.9% of all fish collected in the Parr Reservoir during the 2006–2007 Normandeau surveys. Neither species was present in the 1980s, when Dames & Moore conducted fish surveys in support of the 316(a) demonstration for Unit 1 (Dames & Moore 1985). Both species have become established in the Parr Reservoir since 1984, and appear to be flourishing. 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).

2.4.2.1.2 Monticello Reservoir Aquatic Communities

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

The 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 the 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 the 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).

The most complete source of information on the biotic resources of the 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 the Monticello Reservoir in 1983 and 1984 (Dames & Moore 1985), the last two years that sampling was conducted in support of the station's Clean Water Act, 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 the Monticello Reservoir.

Based on cove rotenone studies conducted by SCDNR in 1987, 1988, 1995, and 1996, the fish community of the 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, the 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 the Monticello Reservoir from the 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 the Monticello Reservoir, noting that the 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 the 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 the Monticello Reservoir may be associated with the corresponding decline in abundance of the native white catfish.

Although somewhat less productive than other older reservoirs in the region, the 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 the 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 the 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 the 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 stressed these fish and removed the protective slime/mucous coating, which resulted in *Aeromonas* infection.

In the late 1980s, a number of limited fish kills (generally involving small catfish) occurred in the 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 the 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 ameliorated the fish kills, but a major fish kill in August 1992 indicated that removal of the roadbed had not completely solved the problem. In September 1992, 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 (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

The 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).

The 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

The 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).

The 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.

The Mayo Creek aquatic surveys were 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 at Transects 2 and 3, a portion of the stream with a well-developed canopy and relatively stable streambanks, than at Transect 1, which had less stable streambanks and a heavier silt load.

Several species of freshwater mussel and the nonnative clam *Corbicula* are found in the lower Broad River (Bettinger, Crane, and Bulak 2003) into which the Mayo Creek flows. However, it appears that conditions in the 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 conducting surveys of Mayo Creek fish were instructed to note the presence of any bivalves and collect specimens if any were discovered. No live specimens and no shells were observed in any of the stream reaches surveyed (TtNUS 2007).

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 NMFS 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 the 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 2006b). 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 2006b). 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 (2006a) 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 2006b). 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 2006b).

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 2006b) 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
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
Vascular Plants				
Ribes echinellum	Miccosukee gooseberry	T	T	Edgefield
Trillium reliquum	Relict trillium	E	E	Aiken, Edgefield

a) Source: USFWS (2007b)
b) Source: SCDNR (2006), USFWS (2006a)

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	Calhoun, Chester, Colleton, Dorchester, Fairfield, Hampton, Lancaster, Lexington, Orangeburg, Richland
Picoides borealis	Red-cockaded woodpecker	E	E	Calhoun, Chester, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
Mycteria americana	Wood stork	E	E	Calhoun, Colleton, Dorchester, Hampton
Sterna antillarum	Least tern	—	E	Colleton
Mammals				
Corynorhinus rafinesquii	Rafinesque's big-eared bat	—	E	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	Colleton, Hampton
Dermochelys coriacea	Leatherback sea turtle	E	-	Colleton
Gopherus polyphemus	Gopher tortoise	—	E	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
Pseudobranchus striatus	Dwarf siren	—	T	Hampton, Orangeburg

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)				
Rana capito capito	Carolina gopher frog	—	E	Dorchester, Hampton, Orangeburg
Invertebrates				
Lasmigona decorata	Carolina heelsplitter	E	E	Chester, Lancaster
Fish				
Acipenser brevirostrum	Shortnose sturgeon	E	E	Calhoun, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
Vascular Plants				
Amphianthus pusillus	Pool sprite, little amphianthus	T	T	Lancaster
Aster georgianus	Georgia aster	C	—	Chester, Fairfield. Richland
Echinacea laevigata	Smooth coneflower	E	E	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

a) Source: USFWS (2007b)
b) Source: SCDNR (2006), USFWS (2006a)

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

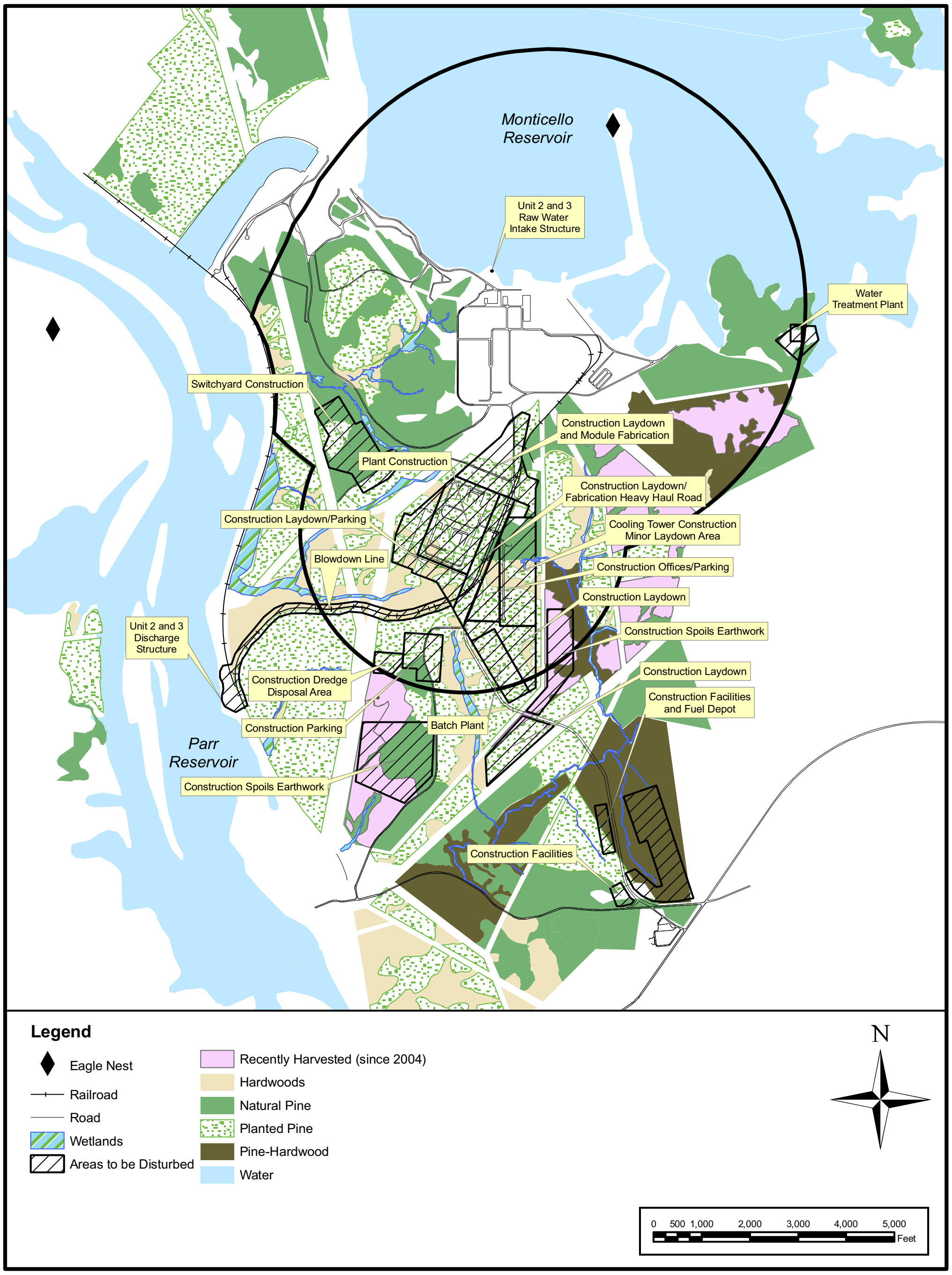

Figure 2.4-1. Habitats and Areas That Will Be Disturbed During Construction of Units 2 and 3

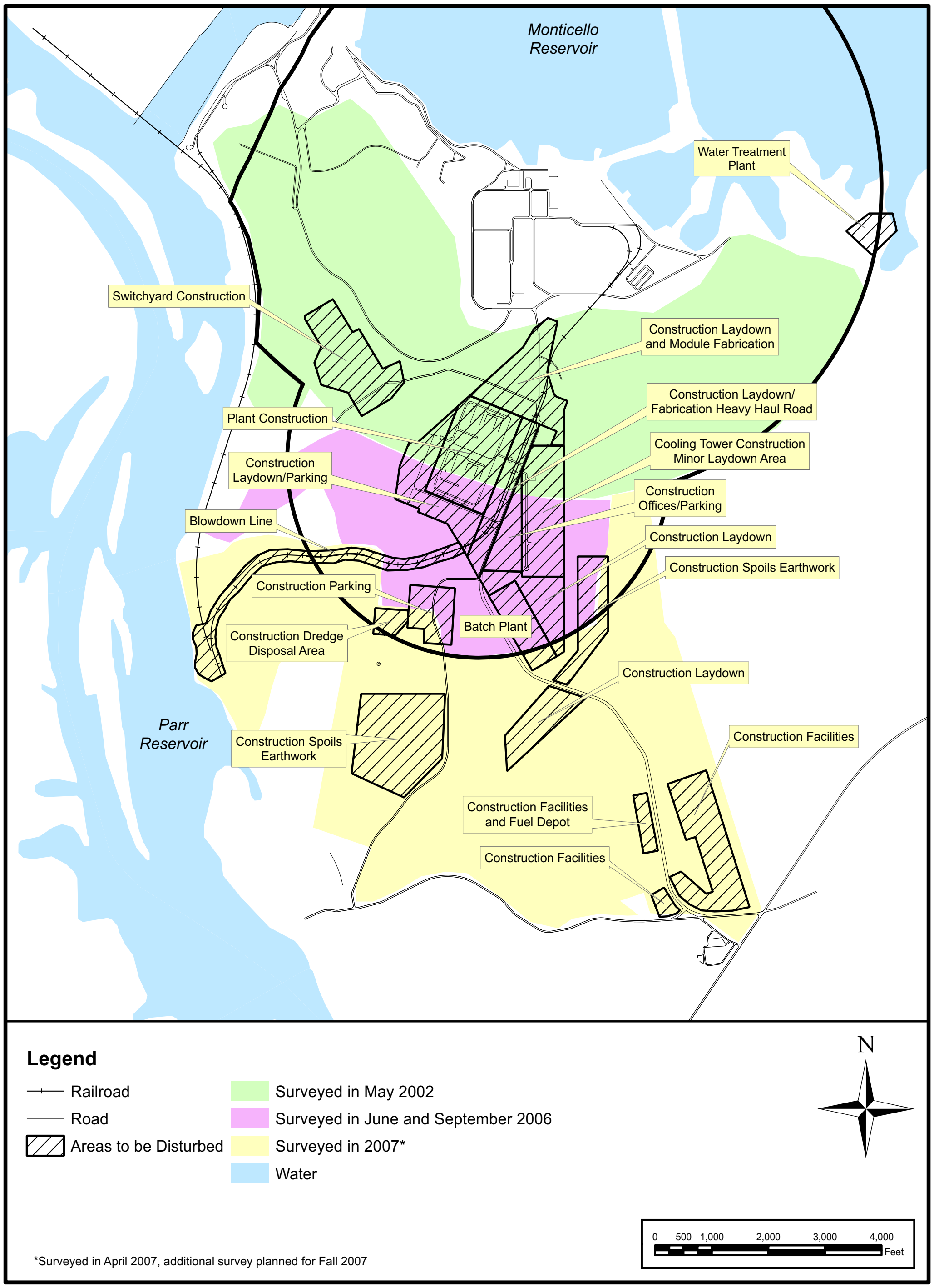

Figure 2.4-2. Areas Surveyed for Endangered and Threatened Species at VCSNS, 2002–2007

2.5 SOCIOECONOMICS

This section presents the socioeconomic resources that have the potential to be impacted by the construction, operation, and decommissioning of new nuclear units located at VCSNS. The section is divided into four subsections: demography, community characteristics, historic properties, and environmental justice. These subsections include discussions of spatial (*e.g.*, regional, vicinity, site) and temporal (*e.g.*, 10-year increments of population growth) considerations, where appropriate.

2.5.1 DEMOGRAPHY

SCE&G determined that four types of demographic information are most pertinent to support socioeconomic analyses in Chapters 4 and 5—population data by sector, population data by political jurisdiction, population density, and transient and migrant populations. The population data is for total populations, *i.e.*, not stratified into age, race, or income. Information specific to low-income and minority populations is provided in Subsection 2.5.4.

2.5.1.1 Population Data by Sector

SCE&G prepared sector charts in accordance with NRC guidance (U.S. NRC 1999). Figure 2.5-1 shows a 10-mile-radius sector chart superimposed on a VCSNS site vicinity map. On this map, the chart is centered at the midpoint between the locations of the proposed new units, with concentric circles representing radii of 1, 2, 3, 4, 5, and 10 miles. The circles are divided into 22.5° sectors, with each sector centered on one of 16 compass points (*e.g.*, north, north-northeast, northeast, and east). Figure 2.5-2 is the 50-mile-radius sector chart, divided into 10-mile radii. Each radius is divided into sectors as described for the vicinity radii. NRC guidance suggests including residential and transient populations within the sectors (U.S. NRC 1999).

SCE&G used SECPOP2000 to estimate the residential population in each sector. SECPOP 2000 is a computer code developed for the NRC by Sandia National Laboratories. After the user inputs site-specific information (primarily site latitude and longitude and sector radii distances), the code uses imbedded U.S. Census Bureau 2000 census data at the block level to calculate the resident population for each of the sectors (U.S. NRC 2003). Block level data were appointed if the block fell into more than one sector.

NUREG-1555 does not define “transient populations.” SCE&G used Regulatory Guide 4.7 for guidance on the definition and use of the data. Regulatory Guide 4.7 provides general site suitability guidance for nuclear plants and indicates that transients are people who work, reside part-time, or engage in recreational activities and are not permanent residents of the area. The term does not include people who are just passing through the area, as on a highway. The transient population should be weighted according to the fraction of time that the transients are in the area and, where the number of transients is significant, included with resident population. (U.S. NRC 1998).

One use of population data within 10 miles is in evaluating impacts from severe accidents that result in radioactive releases to the environment. Because short-term exposure is important to determining accident impacts, SCE&G determined that knowing where and how many transients might be found within 10 miles is important regardless of time weighting. U.S. Census Bureau data do not include transients, and SCE&G is unaware of any official source of information about transient locations and numbers. For this reason, SCE&G performed a survey of the transient population for each sector within 10 miles of the site. The survey included review of area maps; review of internet information on schools, hotels and motels, hospitals, nursing homes, recreational facilities, state agencies including schools and correctional facilities, and businesses; and ground reconnaissance. The survey concluded that it is reasonable to expect there to be 76 transients within 10 miles, and SCE&G added these numbers to the SECPOP2000 results. Table 2.5-1 presents this information, for year 2000, as resident and transient populations within 10 miles and resident populations between 10 and 50 miles.

The significance of transient populations to accident analysis within 10 miles does not exist between 10 and 50 miles from the site. This is because, beyond 10 miles, uptake is the more significant pathway and there is time for interdiction measures such as removing potentially contaminated foodstuffs from the food chain. After considering the transient populations within 50 miles of VCSNS (see Transient and Migrant Populations), SCE&G concluded that the numbers, when time-weighted, would not be significant. For these reasons, SCE&G did not include transients in the 10- to 50-mile sector data.

In order to estimate sector population by 10-year increments through the projected plant life, SCE&G developed growth rate projections based on state population projections that run to 2030 (SCBCB 2005a, NCSDC 2005). Because the state projections are by county and each county can have a different growth rate, SCE&G first had to estimate the percentage of each sector's land area that fell, either completely or partially, within each county. SCE&G used ArcGIS®[a] to determine this percentage. In addition, because the state projections are expressed as number of people, SCE&G had to calculate the growth rate that the state was using for each county in order to be able to apply the appropriate growth rates to each sector. If a sector fell within more than one county, SCE&G used the ArcGIS-developed input to multiply the correct percentage of the sector's population by the correct county's growth rate. SCE&G assumed that growth rates in individual counties would remain at a constant rate from 2030 to 2060. Table 2.5-1 presents population projections through 2060 for each sector. Details of the sector population and population projection calculations are included in a calculation package.

Table 2.5-1 also provides cumulative population data. SCE&G projects that the total population within 10 miles of the proposed units will increase from 12,209 in 2000 to 21,043 in 2060. Year 2060 represents a period of 40 years after the

a. ArcGIS is a registered trademark of Environmental Systems Research Institute, Inc.

anticipated start of commercial operations that also coincidences with a U.S. Census. The population within 50 miles will increase from 1,028,075 to 2,131,394 in the same time period.

2.5.1.2 Population Data by Political Jurisdiction

The area defined by a 50-mile radius from the center of the proposed units (Figure 2.5-2) includes all or part of 21 counties in South Carolina and one county in North Carolina. Table 2.5-2 lists these counties. SCE&G has assumed that the residential distribution of the new units' operational workforce would resemble the residential distribution of VCSNS's current workforce. Approximately 95% of current Unit 1 employees reside within Fairfield, Newberry, Lexington, and Richland counties. The remaining 5% are distributed across 19 other counties. Socioeconomic effects from the proposed workforces would be most evident in those four counties so SCE&G has focused its demographic characterization on those counties. These four counties are known as the region of influence.

As discussed in the previous section, SCE&G used state data for county population and population growth. Table 2.5-3 presents historical and projected population and annual percent growth rate data for the four counties of interest plus the state as a whole. The state projects that the Fairfield County year 2000 population of 23,454 will increase to 27,900, an average annual growth rate of 0.58%, by year 2030. This growth rate is less than that for the other counties (Lexington at 1.43%, Newberry at 0.63%, and Richland at 0.80%) and the state (0.98%), suggesting that Fairfield County will remain more rural than areas further away from the site.

Table 2.5-4 lists the age distributions in Fairfield, Lexington, Newberry, and Richland Counties in 2000 and compares them to the age distribution in the state of South Carolina. As shown, the county age distributions do not vary substantially from the state averages.

The nearest population center (*i.e.*, more than 25,000 residents) is Columbia, South Carolina, to the southeast of the VCSNS site. The distance between the site and the Columbia city limits is approximately 15 miles, with the distance to the center of the city being approximately 25 miles. Columbia's 2000 population was 116,278 (USCB 2006). The Columbia Metropolitan Statistical Area includes Fairfield, Lexington, and Richland Counties as well as Calhoun, Kershaw, and Saluda Counties (USCB 2003a), and has a 2000 population of 647,158 (USCB 2003b).

Table 2.5-5 identifies incorporated places in the 50-mile radius and their 2000 population. Jenkinsville, an unincorporated community, is located approximately 2 miles southeast of the site. The postal district that includes Jenkinsville had a population of 724 in 2000 (USCB 2000a).

2.5.1.3 Population Density

This subsection looks at population density two ways. The first is by the population within 20 miles of the site and the second uses an NRC method for characterizing the site as being located in a low-, medium-, or high-population area.

Regulatory Guide 4.7 indicates that, preferably, a reactor would be located so that at the time of initial site approval and within about five years thereafter, the population density averaged over any radial distance out to 20 miles does not exceed 500 people per square mile (U.S. NRC 1988). VCSNS population data is organized by census decade. SCE&G used population data for the year 2010 as the approximate time of initial site approval (*i.e.*, NRC issuance of the combined operating license) and the year 2020 to represent the start of commercial operation. As Table 2.5-6 shows, VCSNS population density is less than 500 people per square mile for all radial distances and years.

NRC has developed a method for characterizing nuclear power plant sites as being located in low-, moderate-, or high-population areas, finding that the significance of some plant impacts is influenced by the site's category. NRC used this methodology in preparing its generic environmental impact statement for plant license renewal (U.S. NRC 1996). SCE&G has found this methodology useful in characterizing VCSNS population, having used it during Unit 1 license renewal (SCE&G 2002), and is using it for analysis of the proposed new units.

The generic environmental impact statement characterizes populations based on two factors—"sparseness" and "proximity." "Sparseness" describes population density and city size within 20 miles of a site as follows:

Demographic Categories Based on Sparseness

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

Source: U.S. NRC 1996

"Proximity" describes population density and city size within 50 miles as follows:

Demographic Categories Based on Proximity

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

Source: U.S. NRC 1996

The generic environmental impact statement then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

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

Low-Population Area

Medium-Population Area

High-Population Area

Source: U.S. NRC 1996

SCE&G used 2000 census data and geographic information system software (ArcGIS) to characterize the population within 20 miles and within 50 miles of the VCSNS site.

Based on the 2000 Census Bureau information, 151,925 people lived within 20 miles of the VCSNS site resulting in a population density of 121 people per square mile within 20 miles and therefore falling into Sparseness Category 4 (greater than or equal to 120 people per square mile within 20 miles).

Approximately 1,028,075 people live within 50 miles of the VCSNS site (Table 2.5-1) resulting in a population density of 131 people per square mile within 50 miles. Applying the generic environmental impact statement proximity measures, the VCSNS site is classified as Category 3 (one or more cities with 100,000 or more people and less than 190 people per square mile within 50 miles). According to the generic environmental impact statement, sparseness and proximity matrix, (sparseness Category 4 and proximity Category 3) the VCSNS is in a high-population area.

2.5.1.4 Transient and Migrant Populations

As discussed above, SCE&G used Regulatory Guide 4.7 for guidance on the definition of “transient” and the use of transient data, and quantified the number of transients expected within 10 miles of the VSCNS site. For transients located outside of the 10-mile radius, SCE&G has prepared the discussion below.

Fort Jackson is located approximately 30 miles from the VCSNS site, in Richland County. The base has approximately 19,000 personnel on post at any one time (Global Security 2001). No other military facilities are within 50 miles.

Hospitals in the region are discussed in Subsection 2.5.2.7. Twenty-three nursing homes or personal care homes are listed in the Columbia regional telephone directory (Talking Book Undated). Schools, including colleges and universities, are discussed in Subsection 2.5.2.8. Fifteen state correctional facilities are within 50 miles (SCDOC Undated). Numerous hotels and motels exist within 50 miles; most are located in population centers such as Columbia, Lexington, West Columbia, Irmo, Camden, Saluda, Newberry, and Rock Hill. Recreation facilities and major special events are described in Subsection 2.5.2.5.

Dreher Island State Recreation Area is the state park nearest VCSNS, located approximately 15 miles to the southwest. The park had 206,948 visitors in 2004 (SCBCB 2005b).

Information on migrants is difficult to collect and evaluate. However, the 2002 Census of Agriculture collected information on migrant workers. Farm operators were asked whether any hired or contract workers were migrant workers, defined as a farm worker whose employment required travel that prevented the worker from returning to his permanent place of residence the same day. In general, the migrant population within 50 miles is expected to be low. Migrants tend to work such short-duration, labor-intensive jobs as harvesting fruits and vegetables. Table 2.5-7 provides information on farms in the region that employ migrant labor.

2.5.2 COMMUNITY CHARACTERISTICS

Information about socioeconomic characteristics of the region around the VCSNS site is important for assessing potential social or economic impacts of plant construction or operation. As indicated in Subsection 2.5.1, counties with the greatest potential to be impacted socioeconomically are Fairfield County, where the site is located. Within the four-county region of influence, 9% of the existing VCSNS employees live in Fairfield County, 34% live in Lexington County, 18% live in Newberry County, and 33% live in Richland County. Accordingly, this subsection addresses the following community characteristics for this four-county region of influence—economy, transportation, taxes, land use, aesthetics and recreation, housing, community infrastructure and public services, and education.

2.5.2.1 Economy

VCSNS lies in Fairfield County, which is part of the Central Midlands Region of South Carolina. The Central Midlands Region encompasses Lexington, Fairfield, Richland, and Newberry counties, and the state capital—Columbia—located in Richland County. The four-county region of influence includes three (Fairfield, Richland and Lexington) of the six counties that make up the Columbia Metropolitan Statistical Area.

The principal economic centers in each county are Columbia (Richland County), Winnsboro (Fairfield County), Newberry (Newberry County), and West Columbia (Lexington County). In these counties, the services sector employs the greatest number of workers (27% of employment). Other important sectors of employment shown in Table 2.5-8 include government and government enterprises (23%), retail trade (16%), finance, insurance and real estate (9%), and manufacturing (9%). From 1990 to 2000, agricultural services (6.8%), the services (3.8%), and transportation and public utilities (3.5%) sectors had the largest growth rates. Wholesale trade, retail trade and finance, construction, insurance, and real estate each experienced approximately 2% growth while manufacturing (–0.3%), mining (–0.3%), and farming (–0.9%) experienced declines.

The four-county area is characterized by two different economies. Fairfield and Newberry counties have relatively small economies with a dominant manufacturing and agriculture base followed by the service and government sectors. Lexington and Richland counties have larger economies with a dominant service base followed by the government and retail trade sectors. They also have the most people employed (Table 2.5-8).

The top ten nonfederal employers in the Central Midlands Region are listed in Table 2.5-9. Not found in the list is Fort Jackson, located on the east side of the city of Columbia. As of 2001, the fort employed some 4,000 civilian employees and 15,000 military personnel (Global Security 2001). In 2003, the economic impact of the fort was estimated to be approximately $2.08 billion dollars and approximately 33,000 direct and indirect jobs in the local economy. The estimate is based on the direct expenditures of the fort and the economic activity associated with funds injected into the local economy (Schunk 2004).

In 2005, the labor force in the four counties was 328,542, and increased at an average annual rate of 1.4% between 1995 and 2005. As indicated in Table 2.5-10, the labor force in the state of South Carolina increased at an average annual rate of 1.2% over the same time period (BLS 1995, 2005).

In 2005, 309,812 people were employed in the four counties, or 16% of state employment (BLS 2005). Employment increased at an average annual rate of 1.1% between 1995 and 2005. Employment in South Carolina increased at an average annual rate of 1.0% over the same time period (Table 2.5-10).

In 2005, 18,730 people in the four counties were unemployed. From 1995 to 2005, the four-county unemployment rate increased from 3.7% to 5.7%. In South Carolina, the number of unemployed workers increased over the same period, and the unemployment rate increased from 5.1% to 6.8% (Table 2.5-10).

Per capita personal income in 2005 ranged from a high of $31,575 in Lexington County to a low of $23,901 in Newberry County (Table 2.5-11). The South Carolina average was $28,285 (BEA 2007). From 1995 to 2005, Fairfield County's per capita personal income increased at an average annual rate of 4.2%. Lexington, Newberry, and Richland Counties' per capita personal income average annual growth rates were 3.8%, 3.6%, and 3.8%, respectively. South Carolina's rate increased 3.9% for the same period.

2.5.2.2 Transportation

VCSNS is served by a transportation network of interstate, state, and U.S. highways, as well as railroads. Figure 2.5-3 shows the road and highway transportation system in the four-county region of influence. Table 2.5-12 provides traffic information for Fairfield County roads in the immediate vicinity of the VCSNS site. One commercial airport, the Columbia Metropolitan Airport (CAE) serves the region of influence. Figure 2.5-4 presents the public airports within 50 miles of the VCSNS site.

2.5.2.2.1 Roads

Within the four counties of interest, there are three interstate highways—I-20, which runs southwest-northeast connecting Augusta, Georgia and Florence, South Carolina; I-26 which runs southeast-northwest connecting Charleston to Greenville-Spartanburg; and I-77 which runs north-south, connecting Columbia to Charlotte, North Carolina. A number of U.S. and state routes (SC) intersect these interstates and connect to the towns within the counties, providing outlying area access to the interstate system. For example, SC 202 runs east from I-26 to U.S. Highway 176, and SC 213 that provides access to VCSNS.

Most roads in South Carolina are owned and maintained by the state rather than by municipalities. The state owns 41,391 miles of roads in the state, local governments own 24,847 miles, and the federal government is responsible for 830 miles of interstate roadways. Approximately 62% of the roads in South Carolina are state-owned, and the remaining 38% are owned and maintained by municipalities. The primary access to VCSNS is via SC 213, a state-owned road (SCDOT 2007).

Workers commuting to and from VCSNS must take from one of five routes that connect to SC 213 (These routes are shown on Figure 2.5-3 and the road characteristics and traffic statistics for each route segment are provided in Table 2.5-12). Workers from the east side of greater Columbia in Richland County would likely take U.S. or state routes to I-20 and exit onto SC 215 north and then connect to SC 213. The entrance to VCSNS is approximately 1.5 miles north of the intersection of SC 213 and SC 215. Workers from the west side of greater Columbia and Lexington County would likely take U.S. or state routes to I-20 to I-26 west then exit onto U.S. Highway 176 north. From U.S. Highway 176, workers would take to SC 213 east across the Broad River to the VCSNS entrance. Workers commuting from Newberry County would likely take U.S. or state routes to I-26 east then exit on to SC 202 east to U.S. Highway 176. From SC 202, workers would take U.S. Highway 176 south to SC 213 east across the Broad River to the VCSNS entrance. Fairfield County workers would commute to the site on SC 213 from the Winnsboro area or from the north down SC 215.

Roads in Newberry County avoid the Sumter National Forest. Roads generally do not traverse Lake Murray, except for SC 6 across the Lake Murray Dam and SC 391 at the west end of the lake. Most roadways in both Lexington and Richland counties are urban. Lexington County also has rural roads, which feed into the urban roads. Fairfield County, the home of VCSNS, is a rural area and almost all the roads are farm-to-market, two lane, and state-owned/maintained roadways. Roads in Newberry County are also rural roads.

2.5.2.2.2 Railroads

Two freight rail carriers, CSX Transportation (CSXT) and Norfolk Southern, serve the four counties of interest (BTS 2002). There is no passenger rail service in Fairfield, Lexington, or Newberry Counties. Passenger rail (Amtrak) service is available in Columbia (Amtrak 2007). CSXT has several major lines from Columbia. One goes northwest to Clinton/Laurens and then north to Spartanburg; a second line goes northeast to Charlotte, North Carolina; and several other lines serve the southeast part of the state. CSXT has major rail yards in Florence and Charleston and an automobile distribution center in Columbia. From Augusta, Georgia, CSXT has three lines leading to Atlanta and Savannah, Georgia and Greenwood, South Carolina (CSX 2004a, 2004b). The Norfolk Southern Railway and its railroad operating subsidiaries serve the northern half of the state with lines from Columbia to the Greenville/Spartanburg area and to Charlotte (Norfolk Southern 2003). VCSNS has a rail spur that connects to the Norfolk Southern line on the east side of the Broad River that runs through Columbia and Spartanburg (NRC 2004a).

A high-speed rail corridor has been proposed along a northeast corridor that would link Columbia (Richland County) and Raleigh, North Carolina. A second corridor would connect Atlanta, Georgia to Greenville/Spartanburg, South

Carolina and then on to Charlotte and Greensboro, North Carolina (SCDOT 2004).

2.5.2.2.3 Waterways

The VCSNS is not on a waterway. The site is on the southern tip of the Monticello Reservoir and approximately 3 miles east of the Broad River. Neither the river, at this location nor at the Monticello Reservoir, is considered navigable by the U.S. Army Corps of Engineers. The Broad River near the site is not used for commercial transportation nor is it a part of the U.S. Inland Waterway System. The Monticello Reservoir is a 6,800-acre, man-made reservoir that includes a smaller 300-acre impoundment used for recreation on the north end of the reservoir. The reservoir provides cooling water for the Unit 1 and serves as the upper pool for the Fairfield Pumped Storage Facility. There are no deepwater seaports or freshwater ports in the region. (SCE&G 2002)

2.5.2.2.4 Airports

Twelve public airports are within 50 miles of the VCSNS site—Columbia Metropolitan Airport, Lexington County, Columbia Owens (Richland County), Newberry County, Trenton Younce Field (Edgefield County), Saluda County, Greenwood County, Laurens County, Aiken Municipal (Aiken County), Chester Catawba Regional (Chester County), Woodward Field (Kershaw County), and Fairfield County. Only the Columbia Metropolitan Airport provides commercial passenger service and it is the only one with a tower. In 2005, the airport had 10,390 air carrier operations and 52,681 air taxi operations (SCDA 2005). Table 2.5-13 and Figure 2.5-4 provide information about these airports. Restricted and/ or privately owned airports are not included in the table or the figure.

2.5.2.2.5 Evacuation Routes

VCSNS is inland. Hurricane evacuation routes from the coastal areas of South Carolina use the three interstates—I-77, I-20, and I-26—that cross through the four-county area (SCDOT 2003).

2.5.2.3 Taxes

Several tax revenue categories would be affected by the construction and operation of Units 2 and 3. These include

- Income taxes on wages, salaries and corporate profits
- Sales and use taxes on construction- and operation-related purchases and on the purchases of project-related employees
- Property taxes related to the construction and operation of new nuclear units
- Property taxes on employee owned real property.

The following sections describe several types of taxes available to governments in the region.

2.5.2.3.1 Personal and Corporate Income Taxes

South Carolina has one of the lowest per capita tax rates in the country, according to the U.S. Census Bureau (Carolina Living 2006). South Carolina has a graduated individual income tax ranging from 2.5% to a maximum rate of 7.0% on income exceeding $12,650. South Carolina's income tax structure follows federal income tax laws, allowing many of the same deductions, credits, and exemptions with only a few modifications. Employees in South Carolina pay income taxes to South Carolina if their residences are in South Carolina, they are nonresidents working in South Carolina and filing a federal return that would include income from personal services rendered in South Carolina, or they are nonresidents who have income that is derived from investments in rental property in South Carolina or are required to file a composite return for nonresident partners or shareholders (SCDR 2002).

South Carolina taxes the income of for-profit corporations at a rate of 5% based on a corporation's federal taxable net income, with some modifications. In addition, corporations and other entities taxed for income tax purposes as a corporation are subject to an annual license tax of 0.001 times their capital stock and paid-in-surplus plus $15.00 (SCDR 2006a).

2.5.2.3.2 Sales and Use Taxes

South Carolina assesses a state sales tax on the sale of goods and certain services (SCDR 2006b). In order to avoid losing tax revenues on sales transactions taking place outside of the state, South Carolina imposes a 5% use tax to purchases made outside the state including via the Internet, catalog, and television shopping network sales, when the goods are shipped or brought back to South Carolina. The sales tax on the purchase of motor vehicles, including recreational vehicles, boats, motorcycles, and airplanes, is capped at $300. Counties and other local governments or municipalities may elect to impose local sales taxes in addition to those taxes levied by the state (SCDR 2006b). The local sales and use tax is sometimes used to rollback real property taxes (SCAC 2002).

Local entities may also impose local option taxes. Fairfield County's 1% local option sales and use tax became effective May 1, 2006. As a result, all sales of merchandise made in or delivered to Fairfield County will be subject to a 6% sales and use tax, the 5% state sales tax and 1% local option tax. An 8% accommodation tax is added to lodging bills typically paid by visitors to the county. The local sales and use tax will be used to reduce the property tax burden in Fairfield County (SCDR 2006c).

2.5.2.3.3 Property Tax

South Carolina counties, cities, and school districts impose ad valorem (property) taxes on real and personal property. The tax liability on the property is determined when the local government applies its millage rate to the assessed value. The tax rate is stated in terms of “mills,” with ten mills equal to 1% of a property's assessed value. Millage rates vary, but the state average is about 289 mills to all taxing jurisdictions. Personal property taxes are collected annually on cars, trucks, motorcycles, recreational vehicles, boats, and airplanes (Carolina Living 2006).

2.5.2.3.4 Other Taxes

South Carolina law also allows counties, with voter endorsement, to establish special tax districts and then to collect special taxes. Counties may also impose impact fees and levy business taxes. Fairfield County derives income from franchise fees on cable television; Lexington County has franchise fees in addition to community and recreational special tax districts; Newberry County collects funds via franchise fees on cable television; and Richland County has business license fees, franchise fees on cable television, developer-imposed assessment fees for sewer, special fire tax districts, and community recreation special tax districts. State law allows counties to collect certain types of user fees. Fairfield County collects user fees for recreation and solid waste collection; Lexington County collects user fees for recreation; Newberry has no user fees; and Richland County assesses a road maintenance (vehicle) fee, a fee for solid waste collection, a fee for towing, and water/sewer tap fees (SCAC 2002).

Lexington County collects a 3% local accommodations tax in the unincorporated portion of the county. Within Newberry County, the city of Newberry collects a local hospitality tax and a local sales tax that is used for courthouse renovations, water, sewer, recreation, and hospital improvements. Richland County has a local accommodation tax of 3% in the unincorporated portions of the county and within the city limits of Columbia. There is also a local hospitality tax of 2% in the unincorporated area and in Columbia, Forest Acres, Arcadia Lakes, and Blythewood. Revenue sources for the four counties vary widely as discussed above. In all four counties however, revenue from property taxes dominate the county’s general fund. Table 2.5-14 summarizes property tax revenues for all taxing jurisdictions (counties, cities, school boards) for each of the four counties.

In the fiscal year ending June 30, 2005, SCE&G made annual payments of utility property taxes to Fairfield County of $12,711,250. In addition to the property taxes paid to the county itself on behalf of VCSNS, SCE&G’s payment included $7,853,550 to the Fairfield County school district, $10,198 to the city of Winnsboro, and $2,093 to the town of Ridgeway.

2.5.2.4 Land Use

All four counties have experienced growth over the last several decades and their Comprehensive Land Use Plans reflect planning efforts and public involvement in the planning process. Land use planning tools, such as zoning, guide future growth and development. All plans share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, are planned and discouraging strip development along county roads and highways.

2.5.2.4.1 Fairfield County

Fairfield County occupies about 686 square miles and is predominantly rural; however, it is being impacted by the expansion of the greater Columbia area and interstate (I-77) accessibility through the county. The Comprehensive Plan Update (Fairfield County 1997) states these changes will lead to the suburbanization of employment facilities in the county and may lead to the exurbanization of Winnsboro and Ridgeway and suburbanization of areas near Richland County. The plan was developed to promote an arrangement of land use and provide a guide to development and change to meet existing and anticipated needs and conditions and to serve as a basis for regulating land use and the development process.

The plan identifies nine issues related to development:

- Growth — To accommodate projected growth in an orderly manner, and to ameliorate its impact on existing land uses and environmental resources
- Quality Development — To foster quality development
- Economic Development — To stimulate and accelerate economic development
- Aesthetics — To present and maintain an aesthetically pleasing environment
- Transportation — To improve access to I-77 and promote highway safety on existing and proposed streets and roads
- Housing — To make decent housing and living conditions available to all residents of Fairfield County
- Infrastructure — To extend water and wastewater service and facilities to accommodate projected growth and development
- Resource Preservation and Enhancement — To conserve and protect the county’s natural and historic resources
- Recreation — To provide a comprehensive and balanced system of parks and recreation facilities

A portion of the plan was dedicated to developing generalized land use classifications. As a result of the plan, the county passed an ordinance for land development regulation in 1998.

Fairfield County adopted an ordinance that established zoning districts in the unincorporated areas of Fairfield County in May 2007. The recently adopted ordinance will provide greater land use guidance as the county develops. The ordinance imposes no constraints on the industrial district in which the VCSNS site is located. It does not allow residential development at the VCSNS site (Fairfield County 2007).

2.5.2.4.2 Lexington County

Lexington County is approximately 700 square miles. According to the Lexington County Comprehensive Plan (Lexington County 1999), the county's land use patterns are diverse, from the metropolitan urbanized areas of West Columbia and Irmo to the rural agricultural sections in the western and southern portion of the county. The existing land use was further described as predominantly rural to suburban, characterized by small pockets of commercial areas.

The plan addressed the land use patterns and future land use needs by residential, commercial, industrial, and institutional development. Agricultural land use, representing 21% of the county land use, was not specifically addressed as a category. The plan indicated farming interests would be susceptible to pressures to build homes. The primary factors that are expected to influence land use are school districts, available land, transportation, the natural beauty of the county, and a continuously growing economy. Lexington County has a mix of zoning styles that will encourage a quality of growth for years to come. As for future land use, the economic growth of the county will dictate the pace of land use.

2.5.2.4.3 Newberry County

Newberry County is approximately 650 square miles. According to the Comprehensive Plan for Newberry County, the county is characterized by a mix of rural and urban uses including agricultural, residential, commercial, industrial, public and semiprivate uses, and vacant land. The Comprehensive Plan study area was limited to the municipalities, Lake Greenwood and Lake Murray, the U.S. 76 corridor between the town of Little Mountain and the city of Newberry, and portions of SC 773, 219, 34 and 121. The unincorporated portions of the county outside the defined study area do not have land use regulations (Newberry County 1999).

The area addressed by the plan, as defined above, is a mix of rural lands, including agricultural, low-density residential, limited commercial, and limited industrial use. Residential development is generally characterized by low to medium-density, single-family development. There are very few multifamily units in the unincorporated areas of the county. Unlike a municipality where there is dense commercial development in a downtown or some other commercial district, Newberry County's commercial development is much less dense. In most cases, the commercial development is limited to stores located at the intersections of major roads. The remainder of commercial development exists in areas that serve local residents (Newberry County 1999).

Agriculture is scattered throughout the comprehensive plan study area. There are a number of vacant platted lots inside and outside the study area. Most of these are located along the lake shores, where most of the neighborhood subdivisions have occurred (Newberry County 1999).

Generally, there is ample land available for future development in the county. The locations of growth will be guided by two major constraints—natural features and infrastructure. The study area is crisscrossed with streams and rivers, so there will be areas where topography and floodplain characteristics will constrain development. Infrastructure constraints will be mitigated by the construction of additional roads and water treatment facilities as the need arises (Newberry County 1999.)

The plan recommends that to protect the existing development within the study area and to ensure orderly development in the future, the county adopt a zoning ordinance and land development regulations.

2.5.2.4.4 Richland County

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

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

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

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

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

- Continue preservation through the use of riparian corridors – The County Riparian Corridor network should be used to develop a sub-contiguous county-wide greenway system. The strategy is to define growth areas, while preserving natural systems and rural landscapes (Richland County 1999).

2.5.2.5 Aesthetics and Recreation

The VCSNS site is located in rural Fairfield County in the Piedmont area that consists of low rolling hills with elevations ranging from 560 feet to 210 feet above MSL (USGS 1999). Undeveloped areas are characterized by upland forests, forested wetlands, pine plantations, agriculture, and grasslands. The region has a temperate climate with mild winters and long summers.

A portion of the Sumter National Forest Enoree District lies within 6 miles of the site to the northwest. There are no state-owned recreational properties within 6 miles of the site. The 4,400-acre Parr Hydroelectric Wildlife Management Area (WMA) is adjacent to the site to the west and has a state easement to permit public access. The public also has access to the SCE&G Monticello Reservoir adjacent to the site to the north.

Recreational opportunities within 50 miles of VCSNS include a variety of federal and state attractions. Table 2.5-15 lists state parks and Natural Resource Heritage Preserves within 50 miles of the VCSNS site. The entire Enoree District and the eastern portion of the Long Cane District of the Sumter National Forest, the Congaree National Park, and Ninety Six National Historic Site are within 50 miles. Festivals and sporting events throughout the region bring in tourists for several days to a week throughout the year. Lake Murray hosts an annual Independence Day celebration regatta and major fishing tournaments. The Columbia Metropolitan Area has shopping, museums, and attractions such as the Riverbanks Zoo and events associated with the University of South Carolina, the Koger Center, and Colonial Center. Williams-Brice Stadium (capacity of 80,250) hosts college football and concerts (USC 2007). The South Carolina State Fair in Columbia draws 600,000 over a two-week period (State Fair 2007). The Greenwood Flower Festival draws about 20,000 people annually (SCFOF 2007). Public access waters include Broad, Congaree, Santee, Catawba and Saluda Rivers, Saluda Lake, Lake Murray, Lake Greenwood, and Lake Wateree. Lake Murray is a major recreation area for the Central Midlands Region.

The Unit 1 containment structure is the tallest structure at the site. SC 215 and the Monticello Reservoir are the closest points from which the public can glimpse the plant. Trees and terrain provide barriers to viewing the containment structure, turbine building, and support structures from the road. The containment structure is visible at a few locations on SC 215,. The only structures fully visible from the reservoir are the containment structure, turbine building, intake structure, and pumphouse. The discharge is a submerged structure. The plant uses a small cooling tower for the turbine building closed-cycle cooling water system. Steam vapor discharge is very seldom visible from off site.

2.5.2.6 Housing

Approximately 95% of current VCSNS employees reside in four South Carolina counties—Fairfield, Lexington, Newberry, and Richland.

Within 50 miles, residential areas are found in cities, towns, and smaller communities with farms, wood lots, and undeveloped land scattered throughout. Within the region of influence, rental property is scarce in the rural areas, but is available in municipalities such as Winnsboro, Newberry, West Columbia, Irmo, and Columbia. In the vicinity of the VCSNS site, residences are generally isolated, single-family homes. New residential developments are primarily associated with the municipalities in the region of influence.

Housing characteristics in the four-county area are summarized in Table 2.5-16. At the time of the 2000 census, approximately 22,000 housing units (9%) were vacant in the four-county area that tallies approximately 248,000 total housing units. Of that total, approximately 156,000 (63%) were owner-occupied and 70,500 (28%) were renter-occupied (USCB 2000b).

The weighted median value of single-family, owner-occupied houses in the region was $98,880 which was near the median value of all owner-occupied, single-family units in the state of South Carolina, $94,900. Fairfield County had the lowest median home value at $69,900 for a single-family unit, while Lexington County was the most expensive with a median value of single family units of $106,300 (USCB 2000c).

Lexington County experienced the most rapid expansion of housing in the region. The county's total housing units, 90,978 in 2000, represented a 34.7% increase over 1990 housing. Newberry County had the smallest increase between 1990 and 2000—16.3%. The state of South Carolina's housing increased 23.1% in the decade (USCB 2000b). The housing characteristics of select municipalities within 50 miles of VCSNS are summarized in Table 2.5-17.

2.5.2.7 Community Infrastructure and Public Services

Public services and community infrastructure consist of public water supplies and wastewater treatment systems, police and fire departments, medical facilities, social services, and schools. They are typically located within municipalities or near population centers. Schools are described in Subsection 2.5.2.8. The other services are described below.

2.5.2.7.1 Public Water Supplies and Waste Water Treatment Systems

Because VCSNS is located in Fairfield County and most of the current VCSNS employees reside in Fairfield, Lexington, Newberry, and Richland Counties, the discussion of public water supply systems will be limited to those four counties.

In the Central Midlands Region, water sources can be surface water (*i.e.,* rivers, lakes, and streams) or groundwater. The Fall Line, which is the transition between the Piedmont and the Coastal Plain physiographic regions, approximately follows I-20 and splits the Central Midlands. VCSNS is in the Piedmont, north of the Fall Line. Two of the four counties (Fairfield and Newberry) of interest lie entirely in the Piedmont. Approximately one-third of Lexington and Richland Counties lies in the Piedmont. The remainder of these two counties lies in the Coastal Plain.

The Piedmont is characterized by a limited groundwater supply due to the dense, crystalline rock underlying the area. Most of the large municipal systems in the Central Midlands north of the Fall Line obtain water from the Broad or Saluda Rivers or one of their impoundments. However, some smaller municipalities have wells that can adequately meet water demands.

In the Coastal Plain, south of the Fall Line, there are two major regional aquifer systems (see Section 2.3). The lower regime is referred to as the Cretaceous aquifer system and it is estimated that it can provide 5 billion gpd throughout its known extent. The upper regime is variously referred to as the water table aquifer, the Tertiary aquifer system, the principal artesian aquifer, the limestone aquifer, or the Floridan aquifer. Yields from these systems could support water systems requiring nearly 3,000,000 gpd. Consequently, counties in the Coastal Plain obtain their water from groundwater. Despite their location in the Piedmont, some Fairfield County water suppliers also obtain their water from groundwater. Table 2.5-18 details water suppliers in the four counties, their permitted capacities, and their average daily production.

According to local planning officials, water supply in the four counties is not a concern. Local communities are adequately served by the existing water supplies and planners estimate that the counties have adequate supply at least through the current planning periods. The only concern is protection of the aquifers from chemical and radiological pollutants, erosion, and sedimentary contamination.

Wastewater treatment is provided by local jurisdictions. Each municipality decides which treatment method to use based on the municipality’s needs and the technology and funds available. The most common types of treatment facilities are primary and secondary treatments. Currently, municipalities in the four counties are able to meet wastewater treatment needs. Table 2.5-19 details public wastewater treatment systems, their permitted capacities, and their average daily production. The rural areas of each county are on septic systems.

2.5.2.7.2 Police and Fire Department and Medical Facilities

Table 2.5-20 provides police and fire suppression data for the four counties. The ratios of persons-to-police-officers vary between counties in the region: Fairfield County 321:1, Lexington County 504:1, Newberry County 457:1, and Richland County 376:1. The Fairfield County Sheriff finds the current police protection to be adequate in part because of existing multi-jurisdictional response agreements (Lewis 2007). Facility upgrades and additional personnel may be needed to accommodate future population growth.

Fire suppression in the four counties is characterized by persons-per-firefighter ratios and the Public Protection Classification ratings provided by the Insurance Services Office, Incorporated. Table 2.5-20 lists the persons-per-firefighter ratios by county. Regional planners report the following Public Protection Classification ratings by county: Fairfield County, between 5 and 10; Lexington County, between 4 and 7; Newberry County, between 3 and 9 and Richland County, between 2 and 10. In each county, rural or outlying areas are typically rated 9 or 10. Public

Protection Classification insurance rates consider a rate of 1 to be the most desirable rating and 10 to be the least desirable. Multiple ratings indicate that there are different levels of protection with each county. (Fairfield County 1997; Newberry County 1999; USC 2006; Lexington County 2007; SCONFIRE 2006).

Richland County has the highest hospital bed capacity of the four counties and of any county in the 50-mile region. Richland County's hospitals include five general hospitals with a sixth under construction and one military hospital. More than 8,000 people are employed in the medical industry in Richland County. Fairfield, Lexington, and Newberry Counties have one general hospital and Lexington County is adding a second smaller hospital (CSCA 2007). Table 2.5-21 presents hospital and medical practitioner data by county.

All four counties have health departments, which are available to residents regardless of their ability to pay. Some of the services offered by health departments include child and adolescent health programs, women's health programs, immunizations, laboratory services, teen pregnancy prevention programs, scoliosis screening, parasite screening, diabetic screening, health education and counseling, homemaker services to the elderly, prenatal services, and sexually transmitted disease prevention and education. Some public schools in the region do not have a school nurse. Many rely on the health department for nursing support.

2.5.2.7.3 Social Services

Social services in South Carolina are overseen by the Department of Social Services. The mission of the Department of Social Services is to ensure the safety and health of children and adults who cannot protect themselves, and to assist those in need of food assistance and temporary financial assistance while transitioning into employment. The Department of Social Services serves South Carolina citizens through its county offices providing 22 programs and services (SCDSS 2006).

2.5.2.8 Schools

2.5.2.8.1 Public Schools – Kindergarten through 12

The public school systems in Fairfield, Lexington, Newberry, and Richland counties are organized by county, although Lexington County District Five extends into northwestern Richland County. Lexington and Richland counties provide greater public school resources because of their county's larger populations than do Fairfield and Newberry Counties. Table 2.5-22 provides information on the number of public schools in each county, enrollment, and information about student-teacher ratios.

All publicly funded South Carolina kindergarten through grade 12 schools are required to meet South Carolina Department of Education-mandated student-teachers ratios. Ratios vary depending on the grade level, subject taught, and presence or absence of a paraprofessional. A full listing of the ratios is provided in

SC Regulation 43-205 on the South Carolina Department of Education website: http://ed.sc.gov/agency/stateboard/regs/article_17/205.doc. The school districts in all four counties either meet or exceed the state-mandated student-teacher ratios. In the past, when a district failed to meet the required ratios, the South Carolina Board of Education acquired the necessary funding to either build new schools or renovate older schools to increase facility capacity. The specific methods that each county school district chose to follow are detailed below.

The school districts in the four counties each currently has some capacity for additional students. Lexington and Richland Counties are each staying ahead of their significant annual growth in enrollment. Newberry County is staying ahead of its county's modest growth in student enrollment and Fairfield County is evaluating actions to address a trend of reduction in student enrollment.

The state of South Carolina recently passed legislation that reformulates the manner in which school districts derive their funding. In the past, school districts set their millage rates and derived approximately half of their operating revenues from ad-valorem property taxes levied and collected by the county. The other half came from the state. Starting in 2008, the school districts will receive more than half of their funds from the state thorough a state-wide increase in the sales tax with indexes for annual increases in assessments for different property types and caps on increases in millage rate. The outcome of this funding change is unknown but, at a minimum, presents challenges to the current methods of budgeting and planning for school systems and the state of South Carolina (Moody's 2006).

2.5.2.8.2 Fairfield County

Fairfield County had a public school student population of 3,365 in 2005 (SCDOE 2007). The county has seven schools and no plans to build additional school capacity. The district has undergone a baseline evaluation as part of a 2005 Long Range Facility and Population Study process. Options were developed to modernize the school district's facilities. Student-teacher ratios exceed state-mandated levels. All of the county schools have some capacity for additional students as the districts' historical enrollment has decreased from historical averages 6.3% (216 students). Further, the study's moderate projections indicate an additional decrease of 8.7% (297 students) in enrollment between 2005 and 2015 (Fairfield County 2005).

The Fairfield County District is in the process of implementing its Long Range Facility and Population Study. The next steps are to engage the community about facility options and determine mechanisms to fund the modernization of the facilities (Fairfield County 2005). The district has been able to meet its annual budget from the county residential and commercial property taxes, which include the tax revenues generated by VCSNS. The future funding for school renovations and construction is being evaluated.

2.5.2.8.3 Lexington County

Lexington County had a public school student population of 49,164 in 2005 (SCDOE 2007). The county has five districts with 63 schools and plans to build five new schools primarily in the larger districts (District One and Two) to keep pace with the triple-digit growth in enrollment of between 100 and 500 students per year projected thorough 2010. District One and Two are working off $118 million and $50 million bonds, respectively, to implement capital improvements to the districts. District Five encompasses an area approximately one-half of which is situated in each of Lexington and Richland Counties. This district is currently evaluating its facilities to develop a funding for additional facilities. With a sizeable commercial, business, retail, and residential base, the Lexington County school districts have been able to meet their renovation and new construction needs from property taxes and the local option sales taxes (Lexington County 2005a, 2005b, 2005c, and 2006).

2.5.2.8.4 Newberry County

Newberry County had a public school student population of 5,451 students in 2005 (SCDOE 2007). The county has 12 schools and is currently implementing a modernization plan for the school facilities. In addition, the district is raising capital for equipment (technology) and materials to meet curriculum requirements (Newberry County 2005).

In May 2005, the Board of Trustees approved $77.5 million dollars in capital needs as a result of an independent study completed in the district in 2004. Further, the board authorized the formation of the Newberry Investing in Children's Education, a nonprofit corporation that will assist the school district with the formulation of an installment purchase plan for capital improvements. This will allow the district to complete the capital needs within a five-year construction cycle. Although the bond referendum was passed for the capital improvements, the penny sales tax funding mechanism was not. As a result, the county has been using emergency funds for the last two years to bolster the school district's budgets. Subsequently, Newberry County property taxes have been able to support funding of the school district; however, that funding could be cut by $3.4 million in 2007 because of the lack of future revenue in the county because property reassessments have not occurred since 1999 (Newberry County 2005 and The State 2006).

2.5.2.8.5 Richland County

Richland County had a public school student population of 44,434 in 2005 (SCDOE 2007). The county has three school districts but only two are completely within the county and are discussed here. Within Districts One and Two there are 70 schools. District One recently completed a phase of building under a bond referendum passed in 2002 and District Two is implementing a $175 million facility plan passed in 2004. District One has shown a slight decline in student enrollment while District Two has been the fastest growing district in the state over the last decade, reflecting the rapidly growing population in the northeast part of the county. District Two opened two elementary schools in 2006 and plans to build the district's 16th elementary school in 2008, and 6th middle school in 2007. In addition to the new school building, major renovations are underway at an existing middle school. Renovations are planned or are underway at five elementary schools and a middle school (Richland County 2005 and 2006).

Even with these new schools, Richland County exceeds the South Carolina-mandated student-teacher ratios for kindergarten through 5th grade. The addition of the middle school in 2007 should allow the county to meet the middle school student-teacher ratio.

2.5.2.8.6 Colleges/Universities

The Commission on Higher Education provides oversight to South Carolina institutions of higher education. Higher education is defined as post-secondary, or after high school, and generally refers to colleges and universities. These institutions are recognized as being public, private, or proprietary. Senior institutions offer baccalaureate degrees and sometimes higher degrees such as Master's Degrees or Doctorial Degrees. The state's 16 technical colleges offer two-year, Associate Degrees, and other short-term certificates and diplomas. South Carolina does not have public community colleges. The most widely recognized accreditation agency is the Southern Association of Colleges and Schools. A shown in Table 2.5-23, within 50 miles of VCSNS, there are three public senior institutions accredited by the Southern Association of Colleges and Schools—University of South Carolina at Columbia, Lander University, and Winthrop University. There are also two satellite campuses of the University of South Carolina, two technical colleges (York and Midlands Technical Colleges) and seven private senior institutions (SACS 2006, SCCHE 2006).

2.5.3 HISTORIC PROPERTIES

To support the COL application, SCE&G performed cultural resource surveys of the VCSNS site and the adjoining SCE&G property potentially affected by construction of Units 2 and 3. That work progressed in several phases as the scope of the potential ground disturbance associated with construction and operation of Units 2 and 3 was defined. The extent of these surveys is shown on Figure 2.5-5. In order to inventory eligible and listed historic properties, as well as other properties deemed historically significant by the local community, several sources of information were examined.

Properties listed on the National Register of Historic Places and structures and buildings that have been determined as eligible for the National Register were identified using the South Carolina Department of Archives' Cultural Resources Inventory System. This system also contains determinations of eligibility for archaeological sites and standing structures, if those determinations have been made. Background research on archaeological sites was conducted at the South Carolina Institute of Archaeology and Anthropology, which houses the state archaeological site files.

Other facilities consulted include the Fairfield County Museum and the Fairfield County Archives. In addition, U.S. Forest Service and South Carolina State Parks and Tourism personnel were consulted regarding a known Civilian Conservation Corps camp in the area. SCE&G staff members familiar with the property were also consulted.

SCE&G met with the State Historic Preservation Office in June 2006 regarding the VCSNS COL application. During the visit, past landscape alterations and current conditions were discussed, as well as any need for additional cultural resource surveys, and results of background site files and cartographic research. This visit provided an opportunity for the State Historic Preservation Office to express any concerns regarding cultural resources and the meeting prompted the New South Associates surveys of the planned project area. At this meeting SCE&G extended an invitation for an onsite tour of the study area. SCE&G has continued to consult with the State Historic Preservation Office regarding aspects of the project (Appendix A).

2.5.3.1 Historic Context

Spanish and French explorers arrived in South Carolina in the sixteenth century and found the area inhabited by many small groups of Native Americans. Although the first European settlements failed, in 1670 an English settlement on the coast near present-day Charleston was established. By 1729, the only evidence of European influence in Fairfield County was a trading path that ran beside the Wateree-Catawba River and connected to the Catawba Indian settlement in present-day York County (McMaster 1946). According to McMaster (1946), the area between the Broad River and Wateree-Catawba River was considered Catawba territory, although there were no settlements in the region. Cherokee Indians were located west of the Broad River, which was originally called Eswaw Huppeedaw or Line River, indicating the river as a territorial boundary. The Cherokees and Catawbas likely used the region as a hunting ground.

It is difficult to tell who the first permanent European settlers in Fairfield County were and when they arrived, although it appears the earliest settlement by Europeans was in the early 1740s. Most of these settlements took place along the Broad River and other rivers and near present-day Winnsboro (McMaster 1946, Nicholson et al. 1924).

In 1772, the boundary between North and South Carolina was established and the area of Fairfield County was included in South Carolina. At this time, Fairfield County was sparsely populated and there were likely only 200 or so settlements scattered throughout the county (McMaster 1946). Land was being granted as early as the 1740s, but it is unclear how many owners actually occupied their property. Fairfield County was officially formed in 1785 as part of the Camden District (Kovacik and Winberry 1987) and remained as such until 1868, when the constitution changed the districts to counties (Kovacik and Winberry 1987).

In upland South Carolina, the American Revolution resembled a civil war. Many Piedmont settlers sided with Britain because low-country planters, who favored the Patriot cause, had consistently refused to give them adequate representation in the colony's government (Mabrey 1981). After the British captured Charleston in 1780, the conflict shifted to the upcountry. The first major victory for the Patriots was the Battle of Musgroves' Mill on the Enoree River in August of 1780. The Patriots were further encouraged in October by the victory at Kings Mountain. Also, in October, General Lord Cornwallis moved his headquarters to Winnsboro. The Battle of Fish Dam Ford (November 9, 1780) on the Broad River in Chester County was a victory for General Thomas Sumter, and was quickly followed by the Battle of Blackstock on the Tyger River (November 25). Other skirmishes in the surrounding area culminated in the Battle of Cowpens (January 1781), where the Patriots under General Morgan decisively defeated the British. After the British disaster at Cowpens, Cornwallis spent the remainder of the year trying to find and defeat Generals Greene and Morgan. He moved into North Carolina, then into Virginia. From then until the British withdrew from Charleston at the end of 1782, guerrilla warfare raged all over northwestern South Carolina (Mabrey 1981).

The slave population was low in this portion of South Carolina, and it was only after about 1850 that they began to outnumber the white residents. The increase in slave population indicated the movement of the plantation economy into the interior of the state. This increase also corresponded with the planting of cotton, as the backcountry began producing almost half of the state's crop (Kovacik and Winberry 1987).

The midlands area saw a great deal of action during the Civil War. Although considered by many to be safe, the Union attacked the city of Columbia in 1865. On February 16, 1865, the two prongs of Sherman's army met on the west bank of the Congaree River at what is now West Columbia. Sherman ordered half of the army to proceed up the Saluda River about 13 miles to Zion Church, where they were to cross and move on to Winnsboro, destroying all railroads and bridges along the way. This maneuver was designed to cut off General Beauregard's evacuation, while the other half of the army captured Columbia (Lucas 1976). Plate 76 of the *Atlas of the Official Records of the Civil War* (Oliver 1999) shows General Sherman's crossing the Broad River at or very near Parr and heading towards Blackstock.

Because the Union forces ordered to occupy Columbia found the Congaree to be swifter and wider than they had thought, they went up the west side of the Saluda to a bridge near the Saluda Factory. Finding it destroyed, they crossed the Saluda on a pontoon bridge that they constructed. The Broad River bridge had also been destroyed so a ferry line was constructed to move the army across the river (Lucas 1976). On the morning of February 17, the mayor of Columbia surrendered the city to the occupying forces under the condition that the city and its inhabitants would not be harmed. However, during the occupation, Columbia was burned.

On February 18, 1865, the Union army ordered units to destroy the railroad tracks north of the city. Portions of a Confederate Cavalry Division fought a rear guard action at Killian's Mill, and then withdrew towards Winnsboro (SC Historical

Marker 40-127). On February 20, 1865, federal troops encamped north of Killian along what is now Farrow Road, on their way to Winnsboro. Upon reaching Winnsboro, they destroyed between 20 and 30 buildings in the town including homes, stores, and public edifices (Barrett 1956).

For a decade after the Civil War, the entire state suffered severely while adjusting to a new economic order, including the collapse of the Confederate government, military occupation, the freeing of slaves, the effect of four years of naval blockades, neglect of the land during the war, loss of one quarter of those men who served in the war, and deterioration of the modes of production and transportation (Kovacik and Winberry 1987).

After the war, South Carolina and most other southern states were reorganized by Reconstruction. The Black Codes that followed Reconstruction created a low wage system under which former black slaves worked in a modified form of slavery. In the upstate, cotton again became an important cash crop in the late nineteenth and early 20th centuries. The arrival of the boll weevil in the 1920s severely affected cotton farmers, causing them to either abandon farming altogether or diversify their crops. This disaster was followed by the Great Depression, which affected all areas of the state. By this time, most upstate agricultural lands were in poor condition. Much of the topsoil had washed away and continued erosion offset the benefits provided by fertilizers.

More than 150 years of poor management, exploitative land use, and continuous row cropping had depleted the soil and caused severe erosion throughout the South Carolina Piedmont. By the 1930s, this area was one of the most severely eroded in the United States. It is estimated that from the beginning of the “King Cotton Era” in the early 1800s, through the 1930s, many areas lost almost 10 inches of topsoil, and in some large areas more than 12 inches (Kovacik and Winberry 1987).

In 1933 a Civilian Conservation Corps camp called Camp Pearson was established at Parr. The camp’s number was S.C. P-66, which was a part of Company 441. An account of the camp was written in a newsletter by James McCutchen (undated). He noted that the camp was under the command of Captain W. L. Blanton. The superintendent of forestry there was Mr. J. T. McAlister. The article notes that one of the first tasks there was to bring in gravel to cover the camp and the roads because *“if it had not been for this rock the whole company would have had to live in red sticky mud and clay during the past winter. Had it not been for all this work it would have been impossible for a motor propelled vehicle of any kind to go to and from camp.”* The camp was primarily created as a soil erosion camp. It is unknown how long the camp was active. However, it does not appear on a 1938 county highway map.

By the mid-20th century, the region had a notable drop in both population and cotton acreage. One of the reasons for this decline was the demise of tenancy. Many tenants had migrated north or were pushed off the land under the New Deal crop-reduction program. There was also an overall decline in the cotton economy.

In partial compensation, manufacturing soon became an important source of employment (Kovacik and Winberry 1987).

2.5.3.2 Description of Historic Properties within 10 miles of the VCSNS Site

The 10-mile region surrounding the proposed site of Units 2 and 3 has prehistoric Native American and historic Euro and African-American resources. Several studies have occurred on or immediately adjacent to the VCSNS site. The first was a reconnaissance survey of a very large area in the vicinity of the [now extinct] village of Parr (Teague 1979) to determine the *"significance of archaeological sites which would be potentially affected by either the Fairfield Pumped Storage Facility or the VCSNS*" (SCE&G 1978). It included:

- Approximately 2,500 acres that were inundated by the raising of the Parr Shoals Dam; primarily the first and second terraces of the Broad River for about 12 miles upstream from Parr Shoals Dam, and the mouths of Cannons, Frees, Hellers, and Terrible Creeks.
- Approximately 6,800 acres that were inundated by Monticello Reservoir.
- Approximately 2,500 acres that would be rendered inaccessible by the construction and operation of the Fairfield Pumped Storage Facility and Unit 1.

Teague (1979) identified six sites near the VCSNS site (apparently the report was completed many years after the survey was conducted in 1972). None were assessed for their National Register eligibility, although the report did comment the sites were heavily damaged by factors such as erosion, cultivation, and logging. None are located within the proposed site for Units 2 and 3. Teague focused on the excavation of the McMeekin Rock Shelter (38FA41) and the Blair Mound (38FA48), both north of Unit 1 and both listed in the National Register of Historic Places.

Trinkley (1984) identified a site east-southeast of the proposed site as part of a survey for a proposed extension of SC 213. The site consisted of a lithic scatter and a single historic artifact and was recommended as ineligible for the National Register.

Historic maps from the mid-18th to early-20th centuries were examined for historic occupations near the VCSNS site. A number of house sites and one mill were found in the general area. A Civilian Conservation Corps camp (Camp Pearson) was located at Parr Reservoir, immediately adjacent to an old steam plant southeast of Unit 1.

The Mayo family cemetery is on SCE&G property, approximately 1.5 miles south of the proposed site. This small family plot contains headstones dating back to 1895. SCE&G's Forestry Operations group is familiar with this cemetery, which is marked on their timber inventory and land cover maps, and takes measures to protect it when conducting forest management activities.

According to Fairfield County Museum staff, there are two known, but unrecorded archaeological sites in the vicinity of the VCSNS site, which are not located on SCE&G property. The condition and, thus, eligibility of these sites for the National Register are unknown. The first is a prehistoric site located on Hampton Island. The second is a potential historic ferry crossing known as Hughey's or Scherer's Ferry. Its location is just north of Free's Creek on the Broad River.

Table 2.5-24 lists the 21 archaeological sites and standing structures within 10 miles of the proposed site that are currently listed on the National Register of Historic Places. None are located on SCE&G property. Table 2.5-25 lists the 53 standing structures within a 10-mile radius determined to be eligible or contributing to the eligibility of a National Register district. None of these are located on SCE&G property. No archaeological sites within the 10-mile radius have been determined eligible, although four are listed on the National Register (see Table 2.5-24).

2.5.3.3 Description of Historic Properties within the SCE&G Property

A cemetery containing approximately 30 graves including that of General John Pearson, a Fairfield County native who served with distinction in the American Revolutionary War, is partially within the proposed site boundary (see Figure 2.5-5). A monument to General Pearson was erected at the cemetery in 1934 by the Richard Winn Chapter of the Daughters of the American Revolution. The General Pearson grave and monument have been recommended as eligible for the National Register. However, at this writing, no determination has been made by the State Historic Preservation Office.

In March 2006, SCE&G delineated the boundaries of the cemetery to prevent any accidental damage during ground-disturbing activities. Although the cemetery was delineated, it was not assessed for its National Register eligibility (NSA 2006a). SCE&G has fenced this cemetery, and SCE&G's Forestry Operations group is familiar with this cemetery, which is marked on their timber inventory and land cover maps. SCE&G takes measures to protect the cemetery when conducting forest management activities.

A Phase I archaeological survey of a proposed meteorological tower site for Units 2 and 3 encompassed approximately 17.5 acres (Webb 2006). A description of survey techniques is provided in Webb (2006). One site was recorded. It contained Middle Archaic, Mississippian, and early-19th through mid-20th century artifacts. It is believed to be the home site of General Pearson and later, Major Parr. The site was severely disturbed and therefore, was recommended as ineligible for inclusion in the National Register of Historic Places. The South Carolina State Historic Preservation Office concurred with this recommendation and determined that the site is not eligible.

A Phase I survey of approximately 530 acres encompassing the areas that may be impacted by Units 2 and 3 was also conducted in the spring of 2006 (NSA 2006b). A description of the survey techniques is provided in NSA (2006b). Seven archaeological sites were recorded and assessed for their National Register eligibility. All of the archaeological sites were very disturbed and lacked integrity. All were recommended as not eligible for inclusion in the National Register of Historic Places. The General John Pearson cemetery was previously delineated but not assessed for eligibility (NSA 2006a). NSA (2006b) recommended General Pearson's grave and an associated Daughters of the American Revolution monument as eligible for inclusion in the National Register. The greater cemetery was recommended as potentially eligible. No determination of eligibility has yet been made. The cemetery has been fenced to prevent any accidental damage during construction of Units 2 and 3.

A second Phase I survey of approximately 1,300 acres encompassing other areas that may be impacted by Units 2 and 3 was conducted in early 2007 (NSA 2007a). A description of the survey techniques is provided in NSA (2007a). Nineteen newly recorded sites and one previously recorded site were assessed for their National Register eligibility. All of the sites were very disturbed and lacked integrity. All were recommended as not eligible for inclusion in the National Register of Historic Places. Although recommended as not eligible, site 38FA349, a historic tree carving, is recommended for preservation due to its association with important events in the history of Parr. The tree is marked "LHT MOV '33 CCC Camp LHT" and is associated with nearby Civilian Conservation Corps Camp Pearson established in 1933. This report is being finalized and no determinations of eligibility have yet been made.

2.5.3.4 Transmission Line Rights-of-Way

Although transmission line rights-of-way associated with Unit 1 have not been specifically systematically surveyed, no known significant archaeological sites or standing structures currently exist within them. The new transmission lines to support Unit 2 are expected to be constructed in these corridors or adjacent to them. Corridors for the proposed Unit 3 transmission lines are not known, but the termination points are identified in Subsection 2.2.2 (Figure 2.2-4). The new transmission lines would generally require new corridors, but would tend to follow existing corridors where practicable. Although the routes have not been determined, the corridors would likely pass through Calhoun, Chester, Colleton, Dorchester, Fairfield, Hampton, Lancaster, Lexington, Orangeburg, and Richland counties. In total, there are 353 properties listed on the National Register in these counties: Calhoun (16), Chester (17), Colleton (9), Dorchester (12), Fairfield (42), Hampton (8), Lancaster (22), Lexington (56), Orangeburg (35), and Richland (136). Of these properties, eight have National Historic Landmark status: Middleton Place (Dorchester County), Lancaster County Courthouse, Lancaster County Jail, the Mills Jarret Building of the South Carolina State Hospital (Richland County), Robert Mills House aka Ainsley Hall House (Richland County), First Baptist Church (Richland County), South Carolina State House (Richland County), and Chapelle Administration Building at Allen University (Richland

County). Since the transmission lines are more likely to traverse rural areas, Middleton Place would be the most likely to be visually affected (NSA 2007b).

Middleton Place was the birthplace and home, from 1742 to 1787, of Arthur Middleton, a signer of the Declaration of Independence for South Carolina, planter, politician, and soldier. The south wing, circa 1755, of the original plantation house still stands and Arthur Middleton is buried in the family cemetery near the residence. The gardens at Middleton Place are the nation's oldest extant landscaped gardens and rank among the largest and most important in the world. They contain America's oldest and largest camellias, planted about 1785. Beginning in 1916, the gardens were restored to their former beauty over a period of several decades.

2.5.3.5 Native American Sites

The Catawba Indian Nation (P.O. Box 188, Catawba, SC 29704) is the only federally recognized tribe in South Carolina. The state of South Carolina (S.C. Code Chapter 139, Section 1-31-40(A)(10)) officially recognizes the following tribes/groups as legitimate Native American Tribes and Groups (SCCMA Undated):

- The Waccamaw Indian People, P.O. Box 628, Conway, South Carolina 29528
- The Pee Dee Indian Nation of Upper South Carolina, 3814 Highway 57 N, Little Rock, South Carolina 29576
- The Pee Dee Indian Tribe of South Carolina, P.O. Box 557, McColl, South Carolina 29507
- The Santee Indian Organization, 432 Bayview St., Holly Hill, South Carolina 29059
- The Beaver Creek Indians, P.O. Box 699, Salley, South Carolina 29137
- The Eastern Cherokee, Southern Iroquois and United Tribes of South Carolina
- The Wassaamasaw Tribe of Varnertown Indians
- The Chaloklowa Chickasaw Indian People, 500 Tanner Lane, Hemingway, South Carolina 29554
- The Piedmont American Indian Association, Lower Eastern Cherokee Nation of South Carolina
- The American Indian Chamber of Commerce of South Carolina, 9377 Koester Lane, Ladson, South Carolina 29456

There are no tribal lands in the VCSNS vicinity.

2.5.4 ENVIRONMENTAL JUSTICE

2.5.4.1 Methodology

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA 2006a). Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue an Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” in 1994 to address these issues. The order directs federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Council on Environmental Quality has provided guidance for addressing environmental justice (CEQ 1997). NRC has also issued guidance on environmental justice analysis in “Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues” (U.S. NRC 2004b). SCE&G used NRC’s guidance in determining the minority and low-income composition in the environmental impact area.

NRC previously concluded that a 50-mile radius could reasonably be expected to contain potential impact sites and that the state was appropriate as the geographic area for comparative analysis. NRC’s methodology identifies minority and low-income populations within the 50-mile region and then determines if these populations could receive disproportionately high adverse impacts from the proposed action. SCE&G has adopted this approach for identifying the minority and low-income populations and associated impacts that could be affected by the proposed action. This subsection locates populations. Potential adverse impacts are identified and discussed in Chapters 4 and 5.

SCE&G used ArcGIS 9.1 software and USCB 2000 census data to determine minority and low-income characteristics by block group within 50 miles of the proposed site. SCE&G included a block group if any part of its area was within 50 miles of the proposed site. The 50-mile radius includes 803 block groups. SCE&G defines the geographic area for the proposed site as South Carolina and North Carolina, independently, for analysis of block groups in each state.

2.5.4.2 Minority Populations

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a “minority” population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; and Hispanic ethnicity (U.S. NRC 2004b). Additionally, NRC’s guidance states that “other” may be considered a separate category and requires that the multiracial and aggregate minority categories be analyzed separately. The guidance indicates that a minority population exists if either of the following two conditions exists:

- The minority population of the block group or environmental impact area exceeds 50%.
- The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

For each of the 803 block groups within the 50-mile radius, SCE&G calculated the percent of the block group's population represented by each minority. SCE&G selected the entire states of South Carolina and North Carolina as the geographic areas for comparative analysis, and calculated the percentage of each minority category for each state. If any block group minority percentage exceeded its corresponding state percentage by more than 20% or exceeded 50%, the block group was identified as containing a minority population.

Census data for South Carolina (USCB 2000d) characterizes 29.5% of the population as Black or African American; 0.3% American Indian or Alaskan Native; 0.9% Asian; 0.04% Native Hawaiian or other Pacific Islander; 1.0% some other race; 1.0% multiracial (two or more races); 32.8% aggregate of minority races; and 2.4% Hispanic ethnicity.

Census data for North Carolina (USCB 2000d) characterizes 21.6% of the population as Black or African American; 1.2% American Indian or Alaskan Native; 1.4% Asian; 0.05% Native Hawaiian or other Pacific Islander; 2.3% some other race; 1.3% multiracial (two or more races); 27.9% aggregate of minority races; and 4.7% Hispanic ethnicity.

Table 2.5-26 and Figures 2.5-6 through 2.5-11 present the results of the analysis. Two hundred thirteen census block groups within the 50-mile radius have significant Black or African American populations (Figure 2.5-6). One block group has a significant American Indian or Alaskan Native minority population (Figure 2.5-7) and one block group has a significant Asian population (Figure 2.5-8).

Two hundred thirty-four census block groups within the 50-mile radius have significant aggregate minority population percentages (Figure 2.5-9). Two census block groups within 50 miles have significant Hispanic ethnicity populations (Figure 2.5-10). Based on the "more than 20 percent" or the "exceeded 50 percent" criteria, no Native Hawaiian or other Pacific Islander; or multiracial minorities exist in the geographic area. In addition, no populations defined as "all other single minority races" exceed these criteria.

2.5.4.3 Low-Income Populations

NRC guidance defines low-income households based on statistical poverty thresholds (U.S. NRC 2004b). A block group is considered low income if either of the following two conditions is met:

- The low-income population in the census block group or the environmental impact site exceeds 50%.
- The percentage of households below the poverty level in an environmental impact site is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

SCE&G divided USCB low-income households in each census block group by the total households for that block group to obtain the percentage of low-income households per block group. Using the states of South Carolina and North Carolina as the geographical areas chosen for comparative analysis, SCE&G determined that 14.1% of South Carolina and 12.4% of North Carolina households are low income (USCB 2000e). Forty-five census block groups within 50 miles have a significant percentage of low-income households. Table 2.5-26 identifies and Figure 2.5-11 locates the low-income block groups.

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Table 2.5-1 (Sheet 1 of 5)
Current Populations and Projections to 2060

		Radii/Distances (miles)											
Sectors		0-1	1-2	2-3	3-4	4-5	5-10	0-10[a]	10-20	20-30	30-40	40-50	0-50
North	2000	0	0	0	0	7	237	244	602	4,005	5,172	17,385	27,408
	2010	0	0	0	0	7	254	261	643	4,165	5,657	21,191	31,917
	2020	0	0	0	0	8	268	276	679	4,325	6,203	25,690	37,173
	2030	0	0	0	0	8	287	295	726	4,526	6,879	31,223	43,649
	2040	0	0	0	0	9	306	315	773	4,686	7,626	37,963	51,363
	2050	0	0	0	0	10	325	335	820	4,886	8,533	46,085	60,659
	2060	0	0	0	0	10	346	356	873	5,086	9,609	56,103	72,027
North-Northeast	2000	0	0	0	7	50	336	393	446	7,416	10,583	71,500	90,338
	2010	0	0	0	7	54	360	421	436	7,726	11,147	85,629	105,359
	2020	0	0	0	8	57	380	445	472	8,032	11,741	102,277	122,967
	2030	0	0	0	8	61	407	476	513	8,416	12,481	122,730	144,616
	2040	0	0	0	9	65	433	507	553	8,731	13,177	147,505	170,473
	2050	0	0	0	10	69	460	539	598	9,115	14,034	177,331	201,617
	2060	0	0	0	10	73	491	574	651	9,504	14,976	214,038	239,743
Northeast	2000	0	0	79	17	57	106	259	1,411	2,529	9,318	37,953	51,470
	2010	0	0	85	18	61	113	277	1,510	2,673	9,775	40,927	55,162
	2020	0	0	89	19	64	120	292	1,594	2,803	10,272	44,777	59,738
	2030	0	0	96	21	69	128	314	1,707	2,973	10,822	49,501	65,317
	2040	0	0	102	22	74	137	335	1,820	3,131	11,362	55,934	72,582
	2050	0	0	108	23	78	145	354	1,933	3,301	11,953	64,663	82,204
	2060	0	0	115	25	83	155	378	2,060	3,485	12,585	77,448	95,956
East-Northeast	2000	0	35	0	13	0	543	591	8,373	982	1,397	11,472	22,815
	2010	0	37	0	14	0	581	632	8,959	1,054	1,547	12,517	24,709
	2020	0	40	0	15	0	614	669	9,461	1,120	1,718	13,721	26,689
	2030	0	42	0	16	0	657	715	10,131	1,204	1,907	15,015	28,972
	2040	0	45	0	17	0	700	762	10,801	1,290	2,125	16,512	31,490

Table 2.5-1 (Sheet 2 of 5)
Current Populations and Projections to 2060

		Radii/Distances (miles)											
Sectors		0-1	1-2	2-3	3-4	4-5	5-10	0-10[(a)]	10-20	20-30	30-40	40-50	0-50
East-Northeast (continued)	2050	0	48	0	18	0	744	810	11,471	1,378	2,360	18,099	34,118
	2060	0	51	0	19	0	793	863	12,225	1,477	2,634	19,934	37,133
E	2000	0	13	101	0	0	627	741	3,159	5,291	14,719	20,208	44,118
	2010	0	14	108	0	0	671	793	3,382	5,735	16,752	23,004	49,666
	2020	0	15	114	0	0	709	838	3,576	6,182	19,069	26,195	55,860
	2030	0	16	122	0	0	759	897	3,832	6,713	21,679	29,784	62,905
	2040	0	17	130	0	0	809	956	4,088	7,276	24,720	33,972	71,012
	2050	0	18	138	0	0	859	1015	4,347	7,877	28,047	38,553	79,839
	2060	0	19	147	0	0	915	1081	4,637	8,552	31,951	43,930	90,151
East-Southeast	2000	80	3	8	91	15	219	416	4,102	60,471	10,288	6,268	81,545
	2010	86	3	9	97	16	234	445	4,453	66,161	11,440	6,847	89,346
	2020	90	3	9	103	17	248	470	4,859	73,060	12,798	7,516	98,703
	2030	97	4	10	110	18	266	505	5,283	80,059	14,247	8,207	108,301
	2040	103	4	10	117	19	283	536	5,739	87,761	15,889	8,979	118,904
	2050	110	4	11	125	21	301	572	6,259	96,672	17,736	9,843	131,082
	2060	117	4	12	133	22	321	609	6,820	106,337	19,823	10,765	144,354
Southeast	2000	0	20	39	0	107	256	422	28,191	187,392	34,059	8,212	258,276
	2010	0	21	42	0	114	276	453	30,754	206,115	37,137	8,950	283,409
	2020	0	23	44	0	121	295	483	33,869	228,958	40,898	9,851	314,059
	2030	0	24	47	0	129	318	518	37,016	252,729	44,666	10,752	345,681
	2040	0	26	50	0	138	341	555	40,450	278,932	48,777	11,735	380,449
	2050	0	27	53	0	147	367	594	44,458	309,998	53,570	12,859	421,479
	2060	0	29	57	0	156	394	636	48,768	343,866	58,718	14,087	466,075
South-Southeast	2000	0	0	0	0	0	1886	1886	47,835	73,130	23,297	8,921	155,069
	2010	0	0	0	0	0	2056	2056	55,280	87,025	27,103	9,817	181,281
	2020	0	0	0	0	0	2263	2263	64,310	103,845	31,717	10,871	213,006
	2030	0	0	0	0	0	2470	2470	74,911	124,321	37,185	12,036	250,923

Table 2.5-1 (Sheet 3 of 5)
Current Populations and Projections to 2060

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10[(a)]	10-20	20-30	30-40	40-50	0-50
South-Southeast (continued)	2040	0	0	0	0	0	2,696	2,696	86,931	147,723	43,399	13,325	294,074
	2050	0	0	0	0	0	2,960	2,960	101,793	176,975	51,049	14,859	347,636
	2060	0	0	0	0	0	3,242	3,242	118,703	210,614	59,842	16,596	408,997
S	2000	0	4	0	73	60	1,294	1,431	12,382	19,982	10,399	7,142	51,336
	2010	0	4	0	79	65	1,479	1,627	14,687	23,779	12,331	8,081	60,505
	2020	0	5	0	85	72	1,703	1,865	17,478	28,374	14,670	9,208	71,595
	2030	0	5	0	92	78	1,962	2,137	20,864	33,969	17,503	10,478	84,951
	2040	0	5	0	100	85	2,254	2,444	24,731	40,364	20,734	11,885	100,158
	2050	0	5	0	108	93	2,613	2,819	29,560	48,356	24,763	13,573	119,071
	2060	0	6	0	117	102	3,020	3,245	35,109	57,548	29,388	15,465	140,755
South-Southwest	2000	0	0	8	29	61	1,737	1,835	7,236	12,835	6,375	6,849	35,130
	2010	0	0	9	31	65	1,971	2,076	8,391	14,912	7,262	7,808	40,449
	2020	0	0	9	33	70	2,251	2,363	9,778	17,390	8,322	8,969	46,822
	2030	0	0	10	36	75	2,577	2,698	11,437	20,371	9,537	10,268	54,311
	2030	0	0	0	0	0	2,470	2,470	74,911	124,321	37,185	12,036	250,923
	2040	0	0	11	38	81	2,949	3,079	13,332	23,782	10,900	11,703	62,796
	2050	0	0	11	41	86	3,396	3,534	15,662	27,997	12,539	13,412	73,144
	2060	0	0	12	44	92	3,907	4,055	18,332	32,814	14,385	15,326	84,912
Southwest	2000	0	0	31	6	38	1,044	1,119	3,577	3,379	7,498	12,580	28,153
	2010	0	0	33	6	41	1,117	1,197	3,822	3,582	7,968	14,290	30,859
	2020	0	0	36	7	44	1,201	1,288	4,097	3,784	8,441	16,121	33,731
	2030	0	0	38	7	47	1,284	1,376	4,372	3,987	8,921	18,309	36,965
	2040	0	0	41	8	50	1,378	1,477	4,682	4,224	9,477	20,625	40,485
	2050	0	0	44	8	54	1,472	1,578	4,993	4,460	10,042	23,417	44,490
	2060	0	0	47	9	57	1,576	1,689	5,334	4,697	10,615	26,568	48,903
West-Southwest	2000	0	24	11	0	111	662	808	4,151	2,518	3,479	5,366	16,322
	2010	0	26	12	0	119	708	865	4,442	2,677	3,712	5,861	17,557

Table 2.5-1 (Sheet 4 of 5)
Current Populations and Projections to 2060

		Radii/Distances (miles)											
Sectors		0-1	1-2	2-3	3-4	4-5	5-10	0-10[(a)]	10-20	20-30	30-40	40-50	0-50
West-Southwest (continued)	2020	0	27	13	0	128	761	929	4,774	2,845	3,947	6,369	18,864
	2030	0	29	14	0	137	814	994	5,106	3,013	4,193	6,949	20,255
	2040	0	31	15	0	147	874	1,067	5,479	3,206	4,473	7,588	21,813
	2050	0	33	16	0	157	933	1,139	5,853	3,399	4,754	8,270	23,415
	2060	0	36	17	0	168	1,000	1,221	6,268	3,601	5,059	9,065	25,214
West	2000	0	0	6	16	41	464	527	15,595	1,658	4,512	46,446	68,738
	2010	0	0	6	17	44	496	563	16,687	1,776	4,973	50,918	74,917
	2020	0	0	7	18	47	534	606	17,934	1,911	5,446	55,391	81,288
	2030	0	0	7	20	50	571	648	19,182	2,047	6,008	60,706	88,591
	2040	0	0	8	21	54	612	695	20,585	2,199	6,615	66,486	96,580
	2050	0	0	8	23	58	654	743	21,989	2,352	7,250	72,455	104,789
	2060	0	0	9	24	62	701	796	23,548	2,522	7,991	79,542	114,399
West-Northwest	2000	0	12	0	4	36	573	625	1,854	2,942	17,480	23,226	46,127
	2010	0	13	0	4	39	613	669	1,984	3,216	19,577	26,013	51,459
	2020	0	14	0	5	41	659	719	2,132	3,505	21,675	28,800	56,831
	2030	0	15	0	5	44	705	769	2,280	3,835	24,296	32,284	63,464
	2040	0	16	0	5	48	756	825	2,447	4,195	27,093	36,000	70,560
	2050	0	17	0	6	51	808	882	2,614	4,568	30,065	39,948	78,077
	2060	0	18	0	6	54	865	943	2,800	4,997	33,560	44,593	86,893
Northwest	2000	0	0	0	6	0	423	429	495	3,295	4,127	11,816	20,162
	2010	0	0	0	6	0	453	459	526	3,500	4,351	12,994	21,830
	2020	0	0	0	7	0	486	493	561	3,711	4,578	14,268	23,611
	2030	0	0	0	7	0	520	527	598	3,962	4,856	15,668	25,611
	2040	0	0	0	8	0	558	566	637	4,206	5,111	17,247	27,767
	2050	0	0	0	8	0	596	604	677	4,476	5,410	19,040	30,207
	2060	0	0	0	9	0	639	648	721	4,774	5,727	20,941	32,811

Table 2.5-1 (Sheet 5 of 5)
Current Populations and Projections to 2060

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10[a]	10-20	20-30	30-40	40-50	0-50
North-Northwest	2000	24	0	6	154	16	283	483	307	2,212	18,657	9,409	31,068
	2010	26	0	6	165	17	303	517	326	2,301	19,426	10,144	32,714
	2020	27	0	7	174	18	321	547	344	2,390	20,200	10,974	34,455
	2030	29	0	7	186	19	343	584	365	2,501	21,167	11,902	36,519
	2040	31	0	8	199	21	366	625	387	2,590	21,956	12,849	38,407
	2050	33	0	8	211	22	389	663	409	2,701	22,940	13,986	40,699
	2060	35	0	9	225	23	415	707	434	2,812	23,936	15,182	43,071
TOTAL	2000	104	111	289	416	599	10,690	12,209	139,716	390,037	181,360	304,753	1,028,075
	2010	112	118	310	444	642	11,685	13,311	156,323	436,397	200,158	344,991	1,151,180
	2020	117	127	328	474	687	12,813	14,546	175,950	492,235	221,695	390,998	1,295,424
	2030	126	135	351	508	735	14,068	15,923	198,349	554,626	246,347	445,812	1,461,057
	2040	134	144	375	544	791	15,452	17,440	223,457	624,296	273,434	510,308	1,648,935
	2050	143	152	397	581	846	17,022	19,141	253,449	708,511	305,045	586,393	1,872,539
	2060	152	163	425	621	902	18,780	21,043	287,283	802,686	340,799	679,583	2,131,394

a) Transient populations are included in population estimates and projected with the 0-10 miles only.

Table 2.5-2
Counties within 50 Miles of the Proposed Site

South Carolina	North Carolina
Aiken	Union
Calhoun	
Cherokee	
Chester	
Edgefield	
Fairfield	
Greenwood	
Kershaw	
Lancaster	
Laurens	
Lee	
Lexington	
McCormick	
Newberry	
Orangeburg	
Richland	
Saluda	
Spartanburg	
Sumter	
Union	
York	

Table 2.5-3
Annual Average Population Change

	Fairfield		Lexington		Newberry		Richland		South Carolina	
Year	Population[a]	Annual Percent Growth	Population[a]	Annual Percent Growth	Population[a]	Annual Percent Growth	Population[a]	Annual Percent Growth	Population[a]	Annual Percent Growth
1970	19,999	NA	89,012	NA	29,273	NA	233,868	NA	2,590,516	N/A
1980	20,700	0.35	140,353	4.66	31,242	0.65	269,735	1.88	3,121,820	1.88
1990	22,295	0.75	167,611	1.79	33,172	0.60	285,720	0.58	3,486,703	1.11
2000	23,454	0.51	216,014	2.57	36,108	0.85	320,677	1.16	4,012,012	1.41
2010	24,910	0.60	252,900	1.59	38,560	0.66	350,670	0.90	4,458,930	1.06
2020	26,410	0.59	291,970	1.45	41,080	0.64	378,780	0.77	4,916,870	0.98
2030	27,900	0.55	330,320	1.24	43,580	0.59	407,510	0.73	5,371,150	0.89

a) SCBCB (2005a, 2005c)

Table 2.5-4
Age Distribution of Population in 2000 for the Four Counties and State of South Carolina

	Fairfield		Lexington		Newberry		Richland		South Carolina	
Age Group	**Number**	**Percent of Population**	**Number**	**Percent of Population**	**Number**	**Percent of Population**	**Number**	**Percent of Population**	**Number**	**Percent of Population**
Under 18	6,128	26.1	56,313	26.1	8,701	24.1	77,609	24.2	1,009,641	25.2
18 to 24	2,019	8.6	17,874	8.3	3,551	9.8	44,135	13.8	407,851	10.2
25 to 44	6,520	27.8	68,334	31.6	9,977	27.6	101,459	31.6	1,185,955	29.6
45 to 64	5,693	24.3	51,504	23.8	8,556	23.7	65,999	20.6	923,232	23.0
65 and over	3,094	13.2	21,989	10.2	5,323	14.7	31,475	9.8	485,333	12.1
Totals	23,454		216,014		36,108		320,677		4,012,012	

Sources: USCB (2000f)

Table 2.5-5 (Sheet 1 of 2)
Municipalities within a 50-Mile Radius

Municipality	2000 Population[(a)]	Distance in Miles from Proposed Site[(b)]	Direction[(b)]
Batesburg-Leesville	5,517	30	SW
Blythewood	170	20	SE
Camden	6,682	40	E
Cayce	12,150	25	SE
Chapin	628	9	S
Chester	6,476	29	N
Clinton	8,091	31	NW
Columbia	116,278	15	SE
Eastover	830	46	SE
Elgin	806	31	SE
Gaston	1,304	34	SSE
Gayle Mill	1,094	28	N
Great Falls	2,194	30	NE
Greenwood	22,071	49	W
Irmo	11,039	14	SE
Johnston	2,336	41	SW
Kershaw	1,645	45	NE
Lancaster	8,177	43	NNE
Laurens	9,916	41	NW
Lexington	9,793	20	S
Little Mountain	255	9	SW
Lugoff	6,278	37	E
Newberry	10,580	15	W
Ninety Six	1,936	42	W
North	813	48	S
Oak Grove	8,183	24	SE
Peak	61	4	S
Pelion	553	37	S
Pomaria	177	6	SW
Prosperity	1,047	13	SW
Red Bank	8,811	26	S
Ridgeway	328	20	E
Rock Hill	49,765	44	NNE
Saluda	3,066	31	SW
Silverstreet	216	23	W
South Congaree	2,266	29	SE
Union, SC	8,793	33	NNW

Table 2.5-5 (Sheet 2 of 2)
Municipalities within a 50-Mile Radius

Municipality	2000 Population[(a)]	Distance in Miles from Proposed Site[(b)]	Direction[(b)]
Waterloo	203	43	W
West Columbia	13,064	24	SSE
Whitmire	1,512	22	NW
Winnsboro	3,599	14	E
Winnsboro Mills	2,263	14	NE
Woodford	196	45	SE
York	6,985	48	N

a) USCB (2000g)
b) Google Earth (2007)

Table 2.5-6
Population Density

Distance (Miles)	Population Density (per square mile)		
	Year 2010	Year 2020	Year 2060
0–1	36	37	48
0–2	18	19	25
0–3	19	20	26
0–4	20	21	27
0–5	21	22	29
0–10	42	46	67
0–20	135	152	245
0–50	147	165	271

Table 2.5-7
Farms that Employ Migrant Labor in the 50-Mile Region

County	Total Farms that Hire Labor	Farms with Migrant Labor	Percent of Farms that Hire Migrant Labor
Aiken	162	21	13.0
Calhoun	66	7	10.6
Cherokee	60	8	13.3
Chester	30	1	3.3
Edgefield	77	9	11.7
Fairfield	28	0	0.0
Greenwood	72	8	11.1

Table 2.5-7
Farms that Employ Migrant Labor in the 50-Mile Region

Kershaw	96	2	2.1
Lancaster	90	3	3.3
Laurens	146	1	0.7
Lee	87	11	12.6
Lexington	237	16	6.8
McCormick	21	0	0.0
Newberry	85	1	1.2
Orangeburg	266	17	6.4
Richland	113	1	0.9
Saluda	133	3	2.3
Spartanburg	141	31	22.0
Sumter	150	25	16.7
Union, SC	33	4	12.1
Union, NC	285	14	4.9
York	160	21	13.1

Source: USDA (2002 a, b)

Table 2.5-8 (Sheet 1 of 2)
Employment Sectors in the Four-County Region

	Fairfield		Lexington		Newberry		Richland		Four-County Region		Avg. Annual Growth%
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	
Total full-time and part-time employment	9,299	9,711	77,177	112,065	14,801	16,646	225,512	264,889	326,789	403,311	2.1%
Wage and salary employment	8,222	8,277	63,080	89,554	12,684	14,486	205,940	240,579	290,654	352,896	2.0%
Proprietors employment	1,077	1,434	14,097	22,511	2,117	2,160	19,572	24,310	36,863	50,415	3.2%
Farm proprietors employment	236	205	883	945	668	612	403	392	2,190	2,154	-0.2%
Nonfarm proprietors employment	841	1,229	13,214	21,566	1,449	1,548	19,169	23,918	34,673	48,261	3.4%
Farm employment	255	225	1,256	1,222	952	822	526	451	2,989	2,720	-0.9%
Nonfarm employment	9,044	9,486	75,921	110,843	13,849	15,824	224,986	264,438	323,800	400,591	2.2%
Private employment	7,639	7,788	65,315	96,351	11,802	13,396	159,901	190,114	244,711	307,649	2.3%
Agricultural services, forestry, fishing and other	59	77	604	1,307	162	159	903	1,804	1,728	3,347	6.8%
Mining	(a)	(a)	273	199	(b)	(b)	208	266	481	465	-0.3%
Services	(a)	1,561	16,698	27,610	2,160	3,151	55,770	75,767	74,628	108,089	3.8%
Construction	445	410	7,612	9,956	833	1,131	10,673	11,343	19,563	22,840	1.6%
Transportation and public utilities	(a)	1,026	5,026	7,745	440	400	7,686	9,302	13,152	18,473	3.5%
Wholesale trade	(a)	(a)	3,277	6,786	355	647	11,100	11,002	14,732	18,435	2.3%
Retail trade	1,137	1,006	14,016	21,294	2,429	2,325	34,545	40,213	52,127	64,838	2.2%
Finance, insurance, and real estate	210	312	3,944	8,000	445	424	24,285	26,470	28,884	35,206	2.0%

Table 2.5-8 (Sheet 2 of 2)
Employment Sectors in the Four-County Region

	Fairfield		Lexington		Newberry		Richland		Four-County Region		Avg. Annual Growth%
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	
Manufacturing	2,643	2,591	13,865	13,454	4,974	5,153	14,731	13,947	36,213	35,145	-0.3%
Government and government enterprises	1,405	1,698	10,606	14,492	2,047	2,428	65,085	74,324	79,143	92,942	1.6%

a) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
b) Less than 10 jobs, but the estimates for this item are included in the totals.
Source: BEA (2006)

Table 2.5-9
Top 10 Nonfederal Employers Located in the Central Midlands Region

Company	Product/Service
Bell South/AT&T	Utility
Blue Cross & Blue Shield of South Carolina	Insurance
Department of Corrections	State
Department of Mental Health	State
Gold Kist Inc.	Agriculture
Lexington Medical Center	Health Care
Palmetto Health Alliance	Health Care
United Parcel Service	Distribution
University of South Carolina	State
Wal-Mart	Retail

Source: CSCA (2006)

Table 2.5-10
Employment Trends 1995–2005

	Labor Force	Employed	Unemployed	Unemployment Rate
Fairfield				
1995	10,971	10,079	892	8.1
2005	11,577	10,662	915	7.9
Average Annual Percent Change	0.54	0.56	0.25	
Lexington				
1995	109,216	105,896	3,320	3.0
2005	127,570	121,336	6,234	4.9
Average Annual Percent Change	1.6	1.4	6.5	
Newberry				
1995	18,055	17,025	1,030	5.7
2005	17,934	16,681	1,253	7.0
Average Annual Percent Change	-0.07	-0.20	2.0	
Richland				
1995	148,631	143,376	5,255	3.5
2005	171,461	161,133	10,328	6.0
Average Annual Percent Change	1.4	1.2	7.0	
South Carolina				
1995	1,849,873	1,754,638	95,235	5.1
2005	2,080,519	1,938,741	141,778	6.8
Average Annual Percent Change	1.2	1.0	4.1	
ROI				
1995	286,873	276,376	10,497	3.7
2005	328,542	309,812	18,730	5.7
Average Annual Percent Change	1.4	1.1	6.0	
ROI as Percent of South Carolina				
1995	15.5	15.8	11.0	
2005	15.8	16.0	13.2	

Source: BLS (1995); BLS (2005)

Table 2.5-11
Per Capita Personal Income in the Four-County Region

County	1995	2005	Average Annual Growth Rate
Fairfield	$15,717	$23,926	4.2%
Lexington	$21,600	$31,575	3.8%
Newberry	$16,653	$23,901	3.6%
Richland	$21,524	$31,518	3.8%
South Carolina	$19,124	$28,285	3.9%

Source: BEA (2007)

Table 2.5-12
Average Annual Daily Traffic Counts for 2005

	Route and Location	Number of Lanes	SCDOT Road Classification[a]	Estimated AADT[b]	AADT Capacity[c] (passenger cars per day)[d]
1	SC 215 Richland Co. Line to SC 213	2	rural minor arterial	1,700	5,292
2	SC215 SC 213 to Chester Co. Line	2	rural minor arterial	1,250	5,292
3	SC 202 I-26 to US 176	2	rural major collector	1,000	4,214
4	US Highway 176 SC 202 to SC 213	2	rural major collector	1,500	4,214
5	SC 213 US 176 to Fairfield Co. Line	2	rural major collector	1,550	4,214
6	SC 213 Newberry Co. line to SC 215	2	rural major collector	2,400	4,214
7	SC 213 SC 215 to S-23	2	rural major collector	900	4,214
8	SC 213 S-23 to US 321	2	urban collector	2,400	4,214
9	US Highway 176 I-26 to mile marker 7.34	2	urban minor arterial	5,900	5,292
	US Highway 176 Mile marker 7.34 to Newberry Co. Line	2	rural major collector	5,900	4,214
10	US Highway 176 Richland Co. Line to SC 213	2	rural major collector	1,500	4,214

a) SCDOT (2006b), Hance (2007)
b) SCDOT (2006c)
c) SCDOT (2006d)
d) Level of Service A-the most conservative design capacity of roads classifications

Table 2.5-13
Characteristics of Unrestricted, Public Airports within 50 Miles of VCSNS

Name	Owner	Tower Presence
Aiken Municipal	Aiken County	No
Chester Catawba Regional	Chester County	No
Columbia Metropolitan	Richland/Lexington Counties	Yes
Columbia Owens	Richland County	No
Trenton Younce Field	Edgefield County	No
Fairfield County	Fairfield County	No
Greenwood County	Greenwood County	No
Laurens County	Laurens County	No
Lexington County at Pelion	Lexington County	No
Newberry County	Newberry County	No
Saluda County	Saluda County	No
Woodward Field	Kershaw County	No

Source: SCDA (2005)

Table 2.5-14
Property Taxes Revenues for the Four-County Region

Revenue Source[a]	Fairfield	Lexington	Newberry	Richland
Property Taxes	$32,381,035	$234,852,449	$28,810,741	$326,984,018

a) Property tax figures include “fees in lieu of property tax.” Taxes collected are for all taxing authorities within the county – the county itself, all municipalities, and school districts for the fiscal year ending June 30, 2005.

Source: SCORS (2005)

Table 2.5-15 (Sheet 1 of 2)
Recreation Areas within 50 Miles of VCSNS

	Acreage	Nearest City	Distance to VCSNS Site in Miles[a]	Annual Visitors [b]	Overnight Facilities[b]
U.S. National Parks and Historic Sites					
Congaree National Park	22,200[c]	Wateree	48	—	Yes
Ninety Six National Historic Site	990[d]	Ninety Six	42	50,000	No
Sumter National Forest (Enoree Ranger District)	161,216[e]	Whitmire	21	—	Yes
South Carolina Department of Parks, Recreation, and Tourism					
Andrew Jackson State Park	360[f]	Lancaster	47	64,977	Yes
Chester State Park	523[f]	Prosperity	26	29,166	Yes
Croft State Natural Area	7,054[f]	Spartanburg	50	79,628	Yes
Dreher Island State Recreation Area	348[f]	Chapin	15	206,948	Yes
Goodale State Park	763[f]	Camden	45	7,728	No
Harbison State Forest	2,177[g]	Columbia	18	—	No
Lake Greenwood State Recreation Area	914[f]	Ninety Six	37	139,152	Yes
Lake Wateree State Recreation Area	238[f]	Winnsboro	27	133,008	Yes
Landsford Canal State Park	448[f]	Lancaster	42	27,244	No
Musgrove Mill State Historic Site	360[f]	Clinton	36	9,573	No
Rose Hill Plantation State Historic Site	44[f]	Union	29	3,864	No
Sesquicentennial State Park	1,419[f]	Columbia	27	105,672	Yes
South Carolina Department of Natural Resources Heritage Preserves and Wildlife Management Areas					
Congaree Bluffs Heritage Preserve	201[h]	Sandy Run	50	—	No
Congaree Creek Heritage Preserve	627[h]	Cayce	29	—	No
Forty Acre Rock Heritage Preserve	1,567[h]	Heath Springs	50	—	No
Janet Harrison High Pond Heritage Preserve	30[h]	Monetta	37	—	No
Nipper Creek Heritage Preserve	90[h]	Richtex	16	—	No
Parr Hydroelectric Wildlife Management Area	4,400[i]	Jenkinsville	<1	—	No

Table 2.5-15 (Sheet 2 of 2)
Recreation Areas within 50 Miles of VCSNS

	Acreage	Nearest City	Distance to VCSNS Site in Miles[a]	Annual Visitors (b)	Overnight Facilities[b]
South Carolina Department of Natural Resources Heritage Preserves and Wildlife Management Areas (continued)					
Rock Hill Blackjacks Heritage Preserve	291[h]	Rock Hill	45		—
Savage Bay Heritage Preserve	110[h]	Camden	45		—
Shealy's Pond Heritage Preserve	62[h]	Pelion	30		—

a) Google Earth (2007)
b) SCBCB (2005b)
c) USGS (2006)
d) State Parks (undated)
e) USDA (undated)
f) SCDPRT (2007)
g) SCFC (updated)
h) SCDNR (2006a)
i) SCDNR (2006b)

Table 2.5-16
Housing Characteristics in the Four-County Region for 2000

	Fairfield	Lexington	Newberry	Richland	Four-Counties	South Carolina
Total Housing Units[a]	10,383	90,978	16,805	129,793	247,959	1,753,670
Total Occupied Units[a]	8,774	83,240	14,026	120,101	226,141	1,533,854
Owner-Occupied[a]	6,794	64,265	10,776	73,757	155,592	1,107,617
Renter-Occupied[a]	1,980	18,975	3,250	46,344	70,549	426,237
Total Vacant Units	1,609	7,738	2,779	9,692	21,818	219,816
Percent Total Vacant Units Median Value-owner	15.5	8.5	16.5	7.5	8.8	12.5
(Single-family owner occupied)[b]	$69,900	$106,300	$78,000	$98,700	$98,880	$94,900
Percent Change 1990 to 2000 in Total Units	18.9	34.7	16.3	18.5	23.8	23.1
Mean Travel Time to work, minutes[c]	28.3	26.0	25.3	21.7	—	24.3

a) USCB (2000b)
b) USCB (2000c)
c) USCB (2000h)
— = Not applicable

Table 2.5-17
Housing Characteristics of Select Municipalities[a] within 50 miles of VCSNS

	Total Housing Units	Occupied Housing Units	Vacant Housing Units	Owner Vacancy Rate	Renter Vacancy Rate
Batesburg-Leesville	2,446	2,167	279	3.1	7.7
Camden	3,283	2,874	409	2.4	7.8
Cayce	5,517	5,133	384	1.2	9.5
Chester	2,774	2,465	309	2.7	6.4
Clinton	3,011	2,683	328	2.3	10.2
Columbia	46,142	42,245	3,897	2.2	7.7
Great Falls	1,041	892	149	3.4	15
Greenwood	9,373	8,496	877	2.9	7.7
Irmo	4,066	3,911	155	1.6	5.7
Johnston	1,012	923	89	3.5	4.6
Lancaster	3,778	3,396	382	2.3	12
Laurens	4,396	3,952	444	2.3	9.6
Lexington	4,025	3,644	381	2.8	17.6
Lugoff	2,467	2,364	103	0.7	6.5
Newberry	4,388	3,970	418	2.8	7.7
Ninety Six	904	820	84	2.4	6.7
Oak Grove	3,626	3,368	258	1.8	14.4
Red Bank	3,498	3,281	217	2.3	14.5
Rock Hill	20,287	18,750	1,537	3.1	7.8
Saluda	1,211	1,103	108	1.6	3.9
South Congaree	1,002	890	112	1.6	21.5
Union, SC	4,240	3,791	449	3.0	8.4
West Columbia	6,436	5,968	468	1.6	8
Winnsboro	1,597	1,454	143	1.8	5.8
Winnsboro Mills	1,005	885	120	2.5	9.1
York	2,766	2,536	230	1.6	7.2

a) Municipalities within a 50-mile radius with a 2000 population of at least 2,000 persons.
Source: USCB (2000b)

Table 2.5-18 (Sheet 1 of 2)
State-Regulated Public Water Systems in the Four-County Region[a]

System Name	System Number	Treatment Capacity (MGD)	Reported Annual Average Withdrawal (MGD)	Population Served
Groundwater				
Fairfield County				
Jenkinsville Water District	2020001	—	0.15	1,969
[9 wells and purchased from Midcounty][b] Midcounty Water District #1	2020002	—	0.083	1,487
[4 wells[2] and purchased from Winnsboro][b] Town of Ridgeway	2010002	—	0.056	950
[1 well and purchased from Winnsboro][b]				
Lexington County				
Gaston Rural Water District	3220002	—	0.46	6,756
[7 wells] Gilbert Summit [7 wells and purchased from Lexington Co. Joint][b]	3220001	—	0.41	4,518
Newberry County				
Town of Prosperity [3 wells]	3610005	—	0.058	1,347
Surface Water				
Fairfield County				
Town of Winnsboro [Sand Creek and 192 Acre Lake][c]	2010001	3.1[d]	1.54	8,303
Lexington County				
Town of Batesburg-Leesville	3210002	2.4[d]	1.1	7,652
[Lightwood Knot Creek, Duncan Creek][c] City of Cayce [Congaree Creek[c] and purchased from Lexington Co. Joint, Lexington, and Columbia][b	3210003	6.0[d]	3.1	15,250
City of West Columbia [Saluda River and Lake Murray[c] and purchased from Cayce][b]	3210004	20[d]	9.8	29,763
Lexington Co. Joint Municipal Water System [Lake Murray[c] and purchased from West Columbia][b]	3220003	4.3[d]	2.3[d]	12,264[d]
Town of Lexington [purchased from West Columbia and Lexington Co. Joint][b]	3210001	4.5[d]	1.8[d]	7,659[d]

Table 2.5-18 (Sheet 2 of 2)
State-Regulated Public Water Systems in the Four-County Region[a]

System Name	System Number	Treatment Capacity (MGD)	Reported Annual Average Withdrawal (MGD)	Population Served
Surface Water (continued)				
Newberry County				
City of Newberry	3610001	8.1[d]	5.1[d]	10,145
[Saluda River][c] Town of Whitmire [Enoree River, Duncan Creek][c]	3610004	1.0[e]	0.64	2,755
Richland County				
Fort Jackson (US Army) [purchased from Columbia][c]	4010501	6.6[d]	2.2[d]	32,841[d]
City of Columbia [Lake Murray and Columbia Canal (Broad River)][c]	4010001	126[d]	65[d]	223,660[d]

a) Includes community water systems of 3 million gallons per month or greater
b) SCDHEC (2003a)
c) SCDHEC (2003b)
d) SCDNR (2005)
e) Sinclair (2007)
Sources: Devlin 2006, except as noted
— = Not Applicable

Table 2.5-19
State-Regulated Public Wastewater Systems in the Four-County Region[a]

System Name	Permit Number	Maximum Treatment Capacity (MGD)	Average Daily Waste Water Processed (MGD)
Fairfield County			
Winnsboro/Jackson Creek Plant	SC0020125	1.5[b]	Not Provided[b]
Lexington County			
Cayce WWTF	SC0024147	9.5[c]	5.5 to 6.0[c]
Town of Chapin	SC0040631	5.0[d] (proposed)	0.58[d]
Batesburg-Leesville Wastewater Treatment Facility	SC0024465	2.5[e]	1.3 to 1.5[e]
Lexington-Coventry Woods Wastewater Treatment Plant	SC0026735	1.95[f]	1.0[f]
Newberry County			
City of Newberry/Bush River Wastewater Treatment Plant	SC0024490	3.22[g]	2.5[g]
Town of Whitmire	SC0022390	1.0[h]	0.5 to 0.6[h]
Richland County			
Columbia Metro Wastewater Treatment Plant	SC0020940	60[i]	35[i]
East Richland County PSD/Gills Creek	SC0038865	16.0[j]	Not Provided[j]
Richland County/Broad River Wastewater Treatment Facility	SC0046621	6.0[k]	1.195[k]

a) Includes major facilities with a capacity of 1.0 million gpd or more (EPA 2006b)
b) Belton (2007)
c) Hare (2007)
d) Murphy (2007)
e) Atkins (2007)
f) Craft (2007)
g) Coddale (2007)
h) Carroll-Mayor (2007)
i) Columbia 2007
j) McClary (2007)
k) SCDHEC (2002)

Table 2.5-20
Police and Fire Protection in the Four-County Region

County	2000 Population	Police[a]	Ratio Persons-per-Police Officer	Firefighters (b)	Ratio Persons-per-Firefighter
Fairfield	23,454	73	321	109	215
Lexington	216,014	429	504	242	893
Newberry	36,108	79	457	198	182
Richland	320,677	852	376	541	593

a) FBI (2005)
b) Fire Department Net (Undated)

Table 2.5-21
Hospitals and Medical Personnel in the Four-County Region

County	2000 Population	Hospital Beds[a]	Hospital Beds per 1,000 population	Physicians (b)	Physicians per 1,000 population
Fairfield	23,454	50	2.1	19	0.81
Lexington	216,014	376	1.7	337	1.6
Newberry	36,108	103	2.9	52	1.4
Richland	320,677	1,533	4.8	1,330	4.2
Total	596,253	2,062		1,738	

a) CSCA (2007
b) SCBCB (2005d)

Table 2.5-22
Schools and Enrollment in the Four-County Region, 2005-2006

	Elementary Schools[(a)]		Secondary Schools[a]		Student-Teacher Ratio
District	Number	Enrollment	Number	Enrollment	
Fairfield School District	6	2,320	1	1,045	12.9
Lexington School District 1	15	13,550	4	5,354	13.9
Lexington School District 2	14	6,150	2	2,564	13.4
Lexington School District 3	3	1,476	1	610	14.6
Lexington School District 4	5	2,380	1	947	15.6
Lexington School District 5	15	11,242	3	4,891	13.8
Newberry School District	10	4,012	2	1,439	12.6
Richland School District 1	38	16,859	9	7,251	12.7
Richland School District 2	18	14,532	3	5,792	14.7
South Carolina Total		463,087		196,425	

a) Totals do not include alternate campuses or enrollment in those schools
Source: SCDOE (2003, 2007)

Table 2.5-23
Colleges and Universities within 50 miles

Institution	City	County	Highest Degree Offered
Public Senior Institutions			
University of South Carolina	Columbia	Richland County	Doctoral Degrees
Lander University	Greenwood	Greenwood County	Master's Degrees
Winthrop University	Rock Hill	York County	Master's Degrees
Other Public Institutions			
University of South Carolina — Lancaster	Lancaster	Lancaster County	Associates Degrees
University of South Carolina — Union	Union	Union County	Associates Degrees
Public Technical Colleges			
Midlands Technical College	Columbia	Richland County	Associates Degrees
York Technical College	Rock Hill	York County	Associates Degrees
Private Senior Institutions			
Allen University	Columbia	Richland County	Baccalaureate Degrees
Benedict College	Columbia	Richland County	Baccalaureate Degrees
Columbia International University	Columbia	Richland County	Doctoral Degrees
Columbia College	Columbia	Richland County	Master's Degrees
Lutheran Theological Seminary	Columbia	Richland County	Doctoral Degrees
Newberry College	Newberry	Newberry County	Baccalaureate Degrees
Presbyterian College	Clinton	Laurens County	Baccalaureate Degrees

Source: SACS (2006), SCCHE (2006)

Table 2.5-24 (Sheet 1 of 2)
National Register Listed Archaeological Sites and Standing Structures

Name	Address	City	County	Year of Significance	Level of Significance	Area of Significance	Archaeological Site Number
Davis-Plantation	S of Monticello on SC 215	Monticello	Fairfield	1845	Local	Architecture	38FA56
Ebenezer ARP Church	4.3 mi. N of Jenkinsville on SC 213	Jenkinsville	Fairfield	1788	State	Architecture	38FA57
Folk-Holloway House	Jct. of Holloway and Folk Sts.	Pomaria	Newberry	1835	Local	Architecture	
Fonti Flora Plantation	5.4 mi. NE of Monticello on SC 99	Monticello	Fairfield	1836	Local	Architecture	
Glenn, Dr. John, House	SC 215	Jenkinsville	Fairfield	1845	State	Architecture	
Hatton House	Holloway St. between Folk St. and US 176	Pomaria	Newberry	1892	Local	Architecture	
High Point	SC 215	Jenkinsville	Fairfield	1870	State	Architecture	
Kincaid-Anderson House	NE of Jenkinsville of SC 213	Jenkinsville	Fairfield	1774	State	Religion	
Lemmon, Bob, House	Off SC 213	Winnsboro	Fairfield	1910	State	Architecture	
Little Mountain Historic District	Along portions of Pomaria, Church, Main, and Mountain Streets	Little Mountain	Newberry	1880	Local	Architecture	
Little River Baptist Church	3.8 mi. N of Jenkinsville on SC 213	Jenkinsville	Fairfield	1845	Local	Architecture	38FA58
Mayfair	Off SC 215	Jenkinsville	Fairfield	1820	Local	Architecture	
McMeekin Rock Shelter	Address Restricted	Winnsboro	Fairfield		State	Prehistoric	38FA41
Monticello Methodist Church	Off SC 215	Monticello	Fairfield	1861	State	Architecture	
Monticello Store and Post Office	Off SC 215	Monticello	Fairfield	1820	State	Commerce	
Old Stone House	Off SC 34	Winnsboro	Fairfield	1784	State	Architecture	
Pomaria	SE of Pomaria on US 176	Pomaria	Newberry	1825	Local	Architecture	
Robinson-Hiller House	113 Virginia St.	Chapin	Lexington	1917	Local	Architecture	

Table 2.5-24 (Sheet 2 of 2)
National Register Listed Archaeological Sites and Standing Structures

Name	Address	City	County	Year of Significance	Level of Significance	Area of Significance	Archaeological Site Number
Rockton and Rion Railroad Historic District	S of Winnsboro from SC 34 W to SC 213	Winnsboro	Fairfield	1945	State	Industry	
St. John's Lutheran Church	SE of Pomaria	Pomaria	Newberry	1809	Local	Religion	
The Oaks	SC 213	Winnsboro	Fairfield	1850	State	Architecture	

Source: National Register of Historic Places

Table 2.5-25 (Sheet 1 of 4)
Standing Structures Determined Individually Eligible or Contributing to the Eligibility of a District within 10 Miles of the Site

Survey #	Resource Name	Approximate distance from VCSNS (miles)	Address	City	County	Eligibility	Reference
0079	Counts-Feagle House	8	308 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0080	W.B. Shealy House	8	317 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0081	Col. E.J. Locke House	8	274 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0082	J.M. Sease, MD House	8	263 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0083	J.B. Lathan House	8	229 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0084	Preacher Wessinger House	8	175 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0085	G.R. Shealy House	8	116 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0086	G.M. Shealy House	8	89 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0087	Frick House	8	69 Pomaria St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0088	CN&L Railroad Section, Master's House	8	NW corner of Church and Pomaria Sts.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0089	Brady House	8	585 Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0090	James H. Wise Store	8	810 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0092	J. M. and J. C. Sease, MD	8	824 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0094	Counts and Shealy General Merchandise	8	Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002

Table 2.5-25 (Sheet 2 of 4)
Standing Structures Determined Individually Eligible or Contributing to the Eligibility of a District within 10 Miles of the Site

Survey #	Resource Name	Approximate distance from VCSNS (miles)	Address	City	County	Eligibility	Reference
0096	Andrew Miller's Store	8	S of Main St. in alley behind Masonic Hall	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0097	Derrick Lumber Yard	8	218 Depot St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0098	Wise House	8	97 W. Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0099	Little Mtn. Oil Mill	8	199 W. Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0104	David Farr House	8	1172 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0105	Dominick-Boland House	8	1098 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0106	no name	8	1036 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0107	no name	8	1010 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0108	Matthews House	8	984 Main St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0109	Little Mtn. School	8	692 Mill St.	Little Mountain	Newberry	Eligible	Revels 2002
0112	Miller House	8	832 Mountain St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0113	Bennett Miller House	8	Mountain St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0114	Malcom Sloan House	8	724 Mountain St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0116	Mt. Zion AME School	8	Mt. Zion Cir.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0117	Olie Stoudenmire House	8	357 Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002

Table 2.5-25 (Sheet 3 of 4)
Standing Structures Determined Individually Eligible or Contributing to the Eligibility of a District within 10 Miles of the Site

Survey #	Resource Name	Approximate distance from VCSNS (miles)	Address	City	County	Eligibility	Reference
0118	no name	8	329 Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0119	no name	8	289 Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0126	Holy Trinity Lutheran Church	8	531 Church St.	Little Mountain	Newberry	Contributes to Eligible District	Revels 2002
0129	no name	5.5	120 Angella St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0130	no name	5.5	N corner of int. Main, Holloway & Angella Sts.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0131	Pomaria Post Office	5.5	N side of Angella St E of int. w/ Holloway St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0132	no name	5.5	152 Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0133	Kinard Bros. General Store	5.5	162 Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0134	no name	5.5	172 Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0135	no name	5.5	Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0136	Pinner's Pharmacy	5.5	Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0137	Bank of Pomaria	5.5	Main St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0139	Girl Scout Hut	5.5	140 Victoria St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0140	Wilson's Laundrymat	5.5	Victoria St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0141	no name	5.5	120 Victoria St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002

Table 2.5-25 (Sheet 4 of 4)
Standing Structures Determined Individually Eligible or Contributing to the Eligibility of a District within 10 Miles of the Site

Survey #	Resource Name	Approximate distance from VCSNS (miles)	Address	City	County	Eligibility	Reference
0142	Pomaria Cotton Gin and Oil Mill	5.5	108 Rest St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
0150	Old Methodist Church	5.5	Hentz St. S side East of int. w/ Holloway St.	Pomaria	Newberry	Eligible	Revels 2002
0169	no name	5.5	671 Holloway St.	Pomaria	Newberry	Eligible	Revels 2002
0176	no name	5.5	N side of int. of Hwy 176 & Holloway St.	Pomaria	Newberry	Contributes to Eligible District	Revels 2002
1139	St. Paul's Lutheran Church	8.2	2491 SC Hwy 773	Pomaria	Newberry	Eligible	Revels 2003
1293	no name	5	7443 Broad River Road	Pomaria	Newberry	Eligible	Revels 2003
1431	Suber-Dickert House	8.3	10488 Bush River Rd.	Newberry	Newberry	Eligible	Revels 2003
4979	Pet Sites House	7.5	1311 Pet Sites Road	Chapin	Richland	Eligible	Martin et al. 2002

Table 2.5-26
Summary of Minority and Low-Income Block Groups within 50 Miles of Units 2 and 3

Block Groups with minority or low-income populations more than 20% over the state average or more than 50% of the block group population.											
State	**County Name**	**Number of Block Groups**	**Black**	**American Indian or Alaskan Native**	**Asian**	**Native Hawaiian or Other Pacific Islander**	**Some Other Race**	**Multi-Racial**	**Aggregate**	**Hispanic**	**Low-Income Households**
North Carolina	Union	1	0	0	0	0	0	0	0	0	0
South Carolina	Aiken	14	3	0	0	0	0	0	3	0	0
South Carolina	Calhoun	7	4	0	0	0	0	0	4	0	0
South Carolina	Cherokee	4	0	0	0	0	0	0	0	0	0
South Carolina	Chester	31	9	0	0	0	0	0	9	0	1
South Carolina	Edgefield	12	7	0	0	0	0	0	8	0	1
South Carolina	Fairfield	19	13	0	0	0	0	0	14	0	1
South Carolina	Greenwood	45	11	0	0	0	0	0	11	1	4
South Carolina	Kershaw	40	5	0	0	0	0	0	6	0	2
South Carolina	Lancaster	44	7	0	0	0	0	0	7	0	3
South Carolina	Laurens	48	8	0	0	0	0	0	8	0	4
South Carolina	Lee	2	2	0	0	0	0	0	2	0	0
South Carolina	Lexington	135	7	0	0	0	0	0	12	0	2
South Carolina	McCormick	1	1	0	0	0	0	0	1	0	0
South Carolina	Newberry	32	3	0	0	0	0	0	3	0	2
South Carolina	Orangeburg	8	3	0	0	0	0	0	3	0	0
South Carolina	Richland	235	104	0	1	0	0	0	115	0	23
South Carolina	Saluda	16	3	0	0	0	0	0	5	1	0
South Carolina	Spartanburg	12	0	0	0	0	0	0	0	0	0
South Carolina	Sumter	8	6	0	0	0	0	0	6	0	1
South Carolina	Union	29	5	0	0	0	0	0	5	0	1
South Carolina	York	60	12	1	0	0	0	0	12	0	0
	Totals:	**803**	**213**	**1**	**1**	**0**	**0**	**0**	**234**	**2**	**45**

Highlighted counties are completely contained within the 50-mile radius.

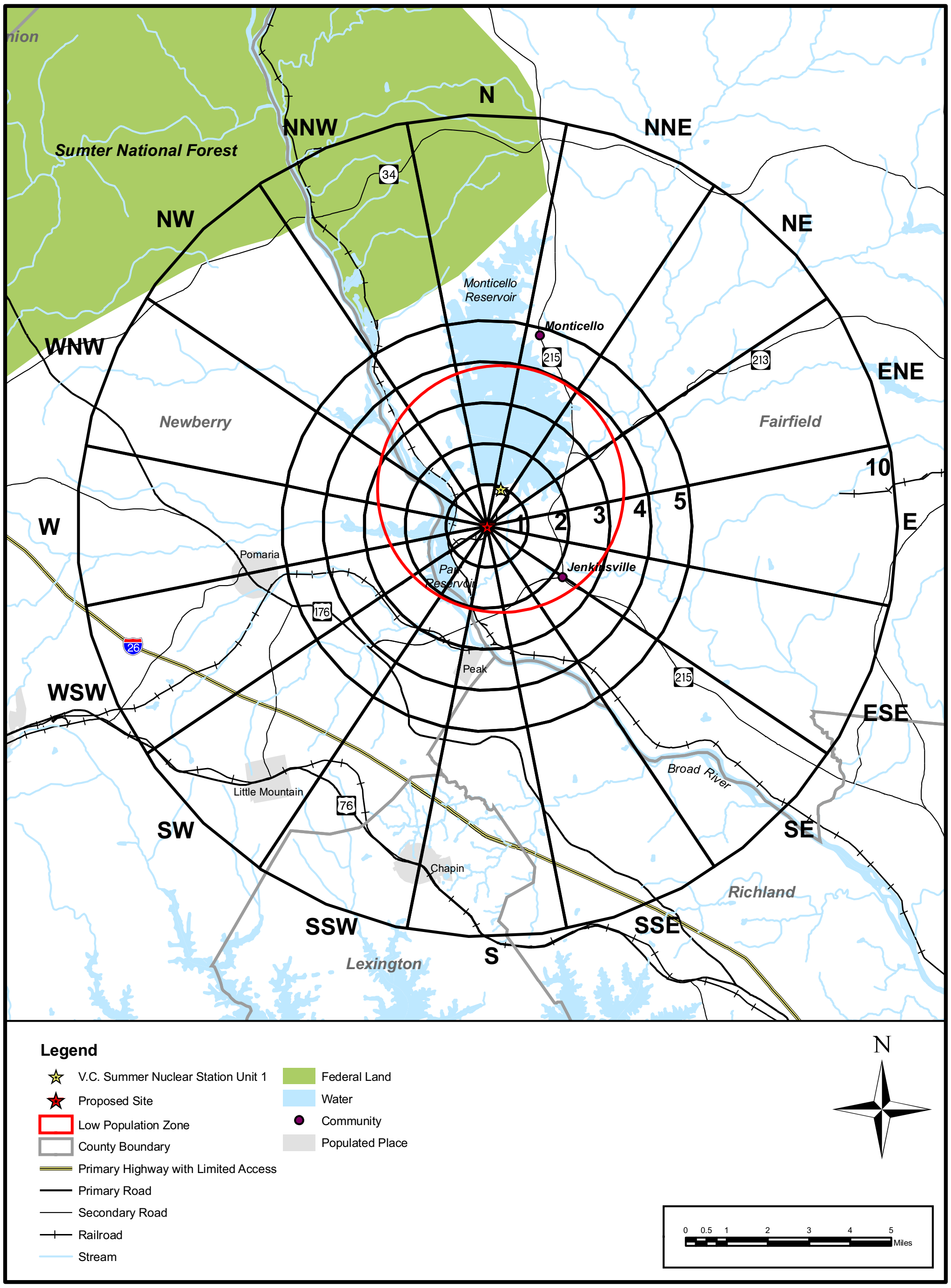


Figure 2.5-1. 10-Mile Radius Sector Chart Superimposed Over a VCSNS Site Vicinity Map

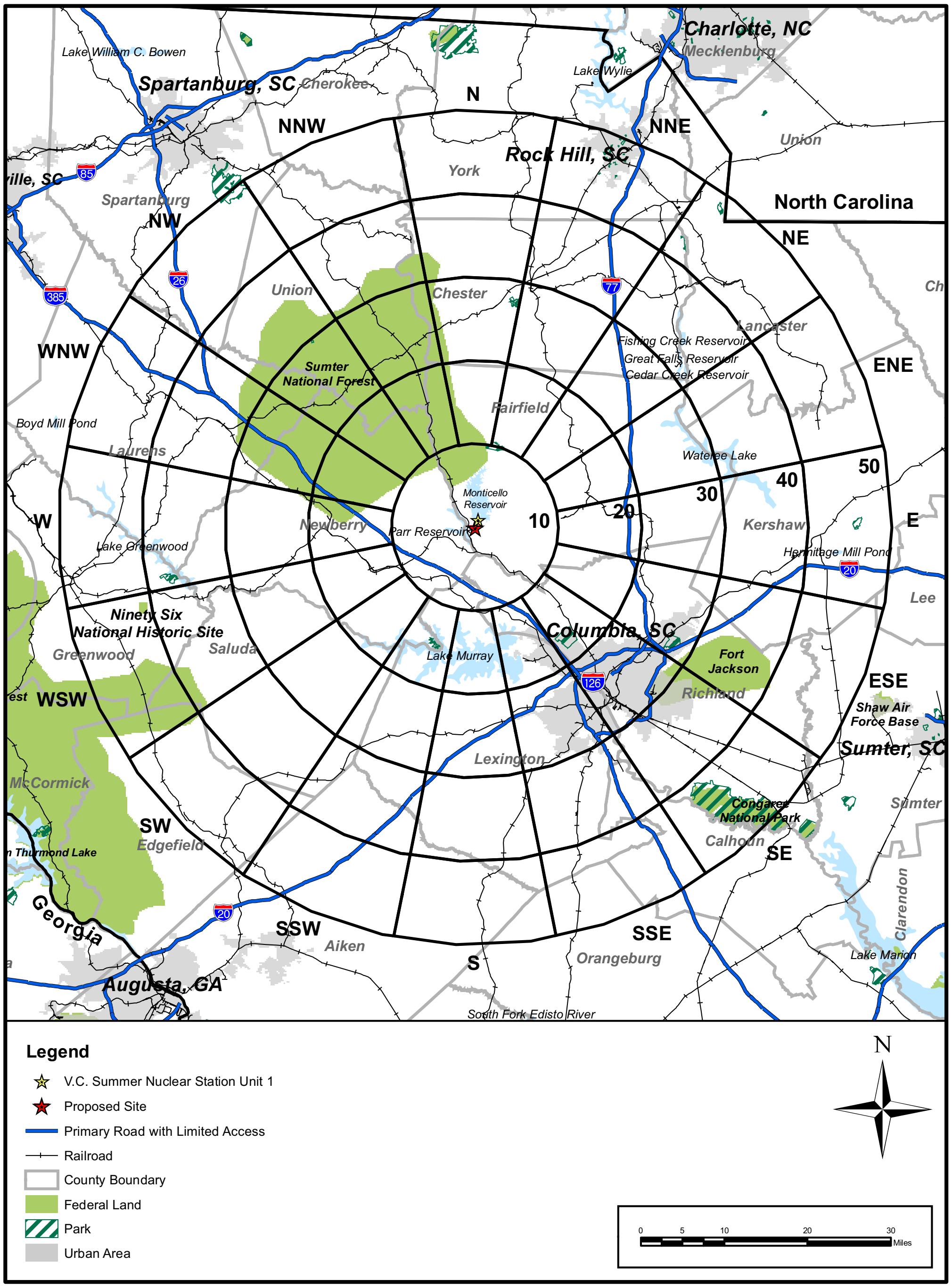


Figure 2.5-2. 50-Mile Radius Sector Chart Divided into 10-Mile Radii

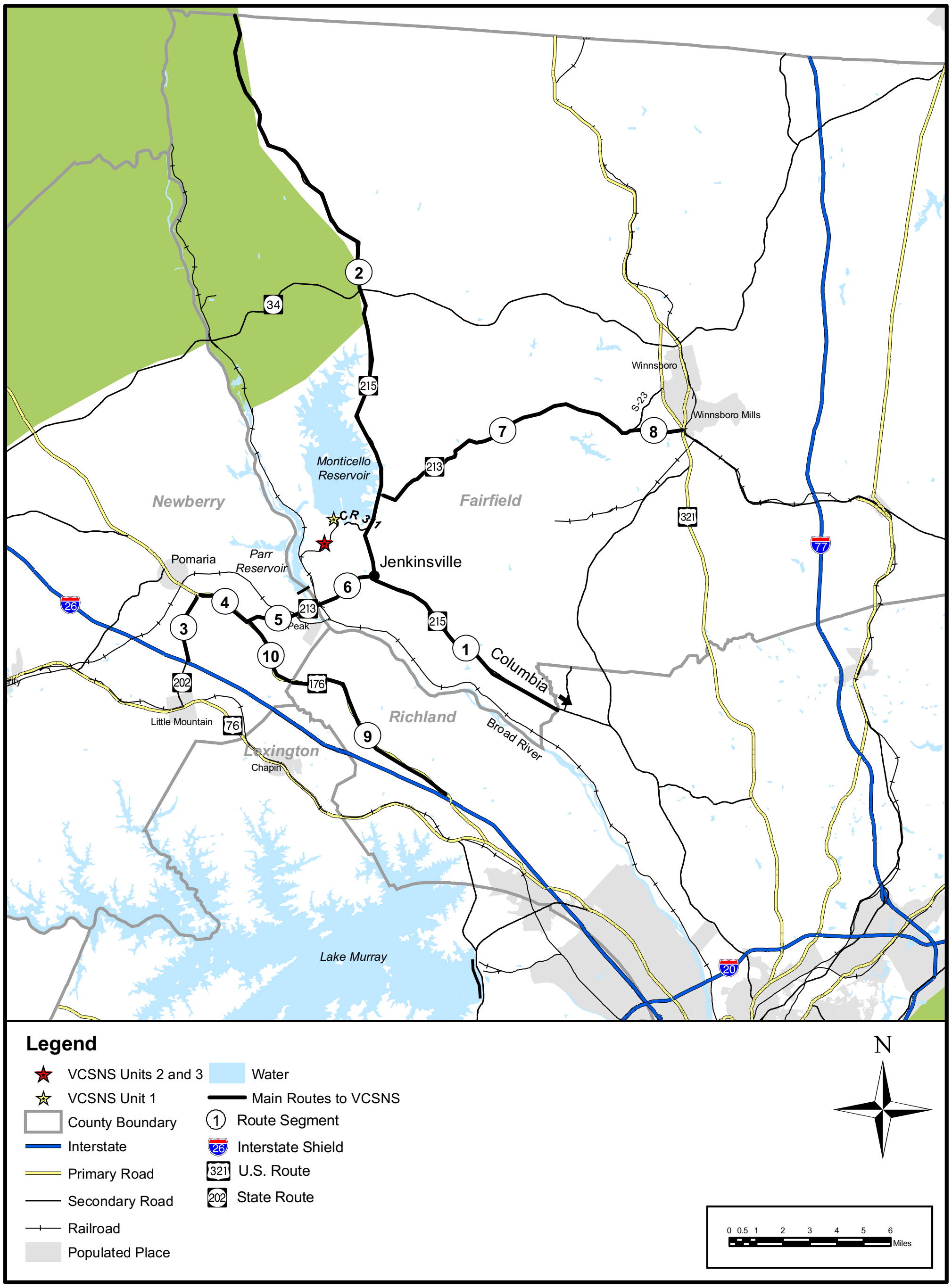


Figure 2.5-3. Road and Highway Transportation System in the Four-County Region

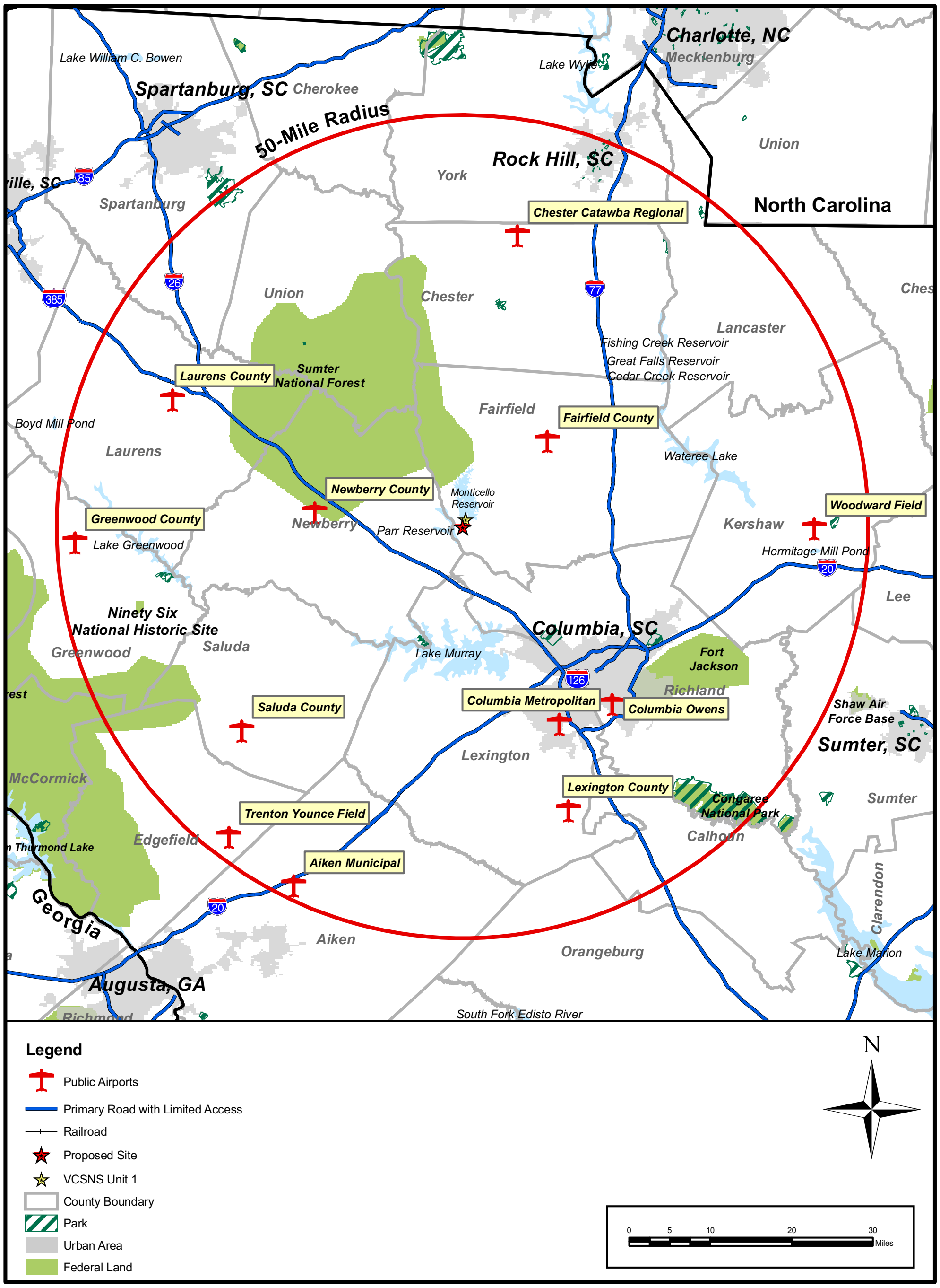


Figure 2.5-4. Public Airports and Rail System Within 50 Miles of the Proposed Site

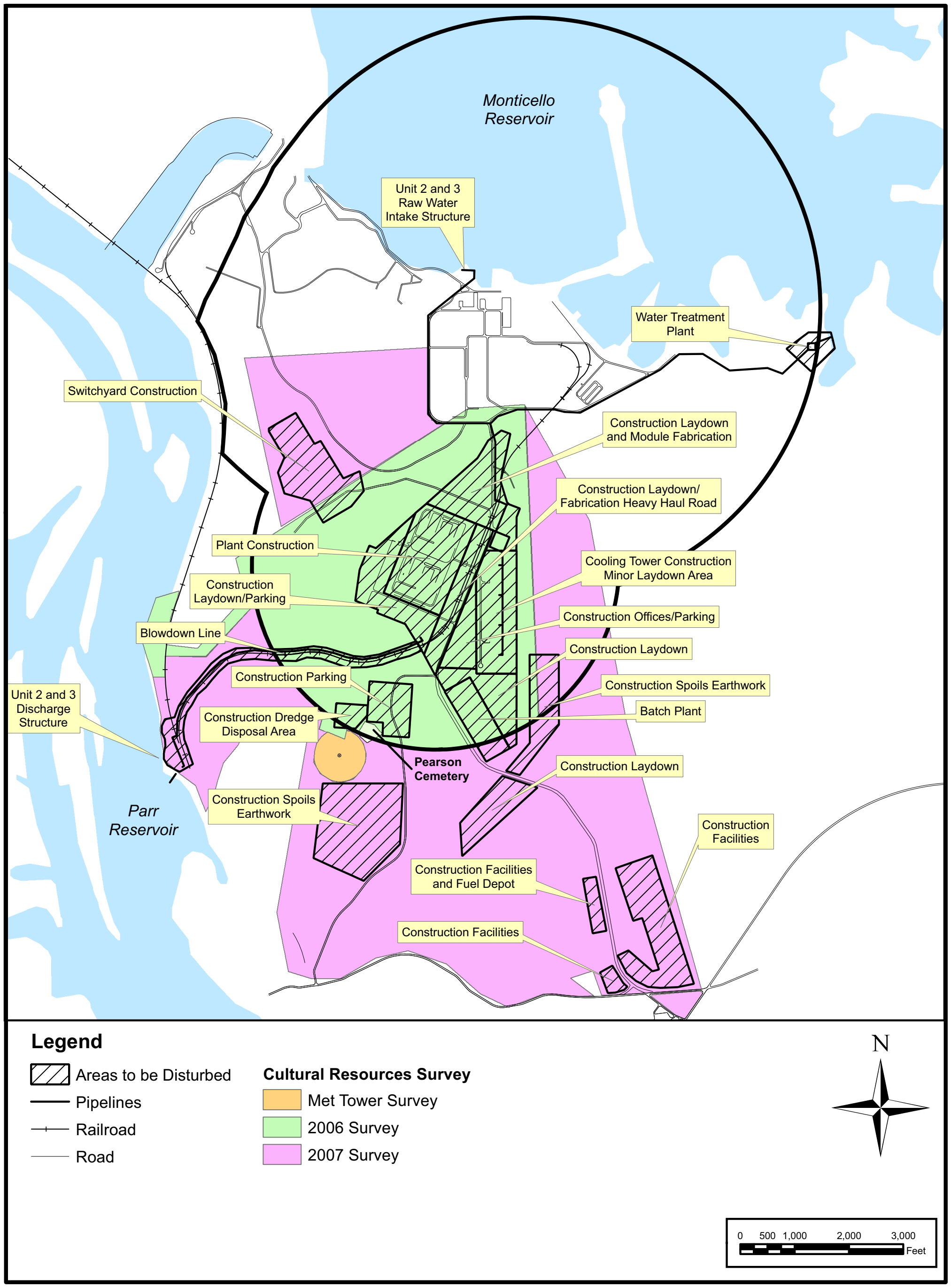


Figure 2.5-5. Areas Surveyed for Cultural Resources at VCSNS, 2006–2007

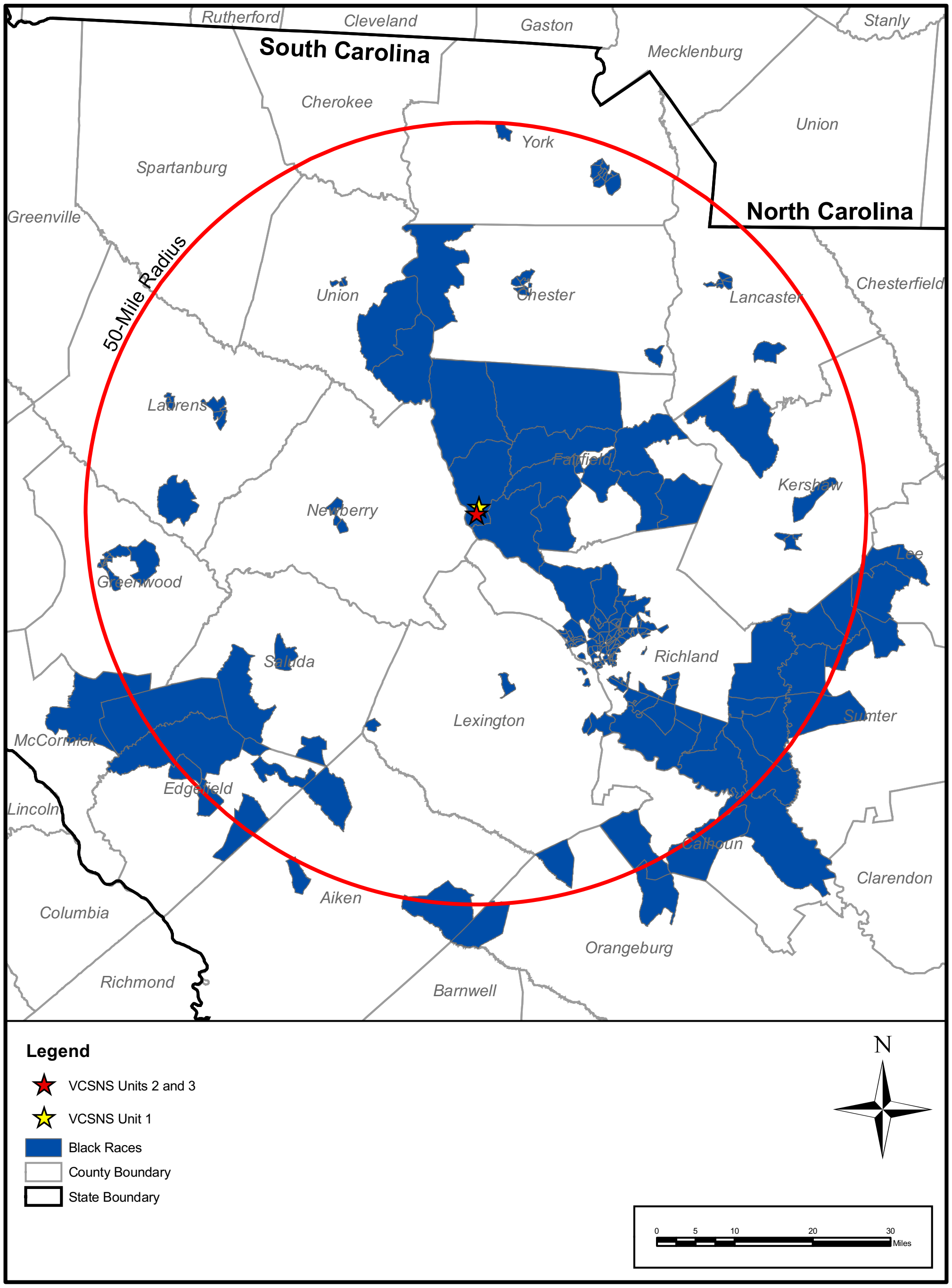


Figure 2.5-6. Black Races Block Groups Within 50 Miles

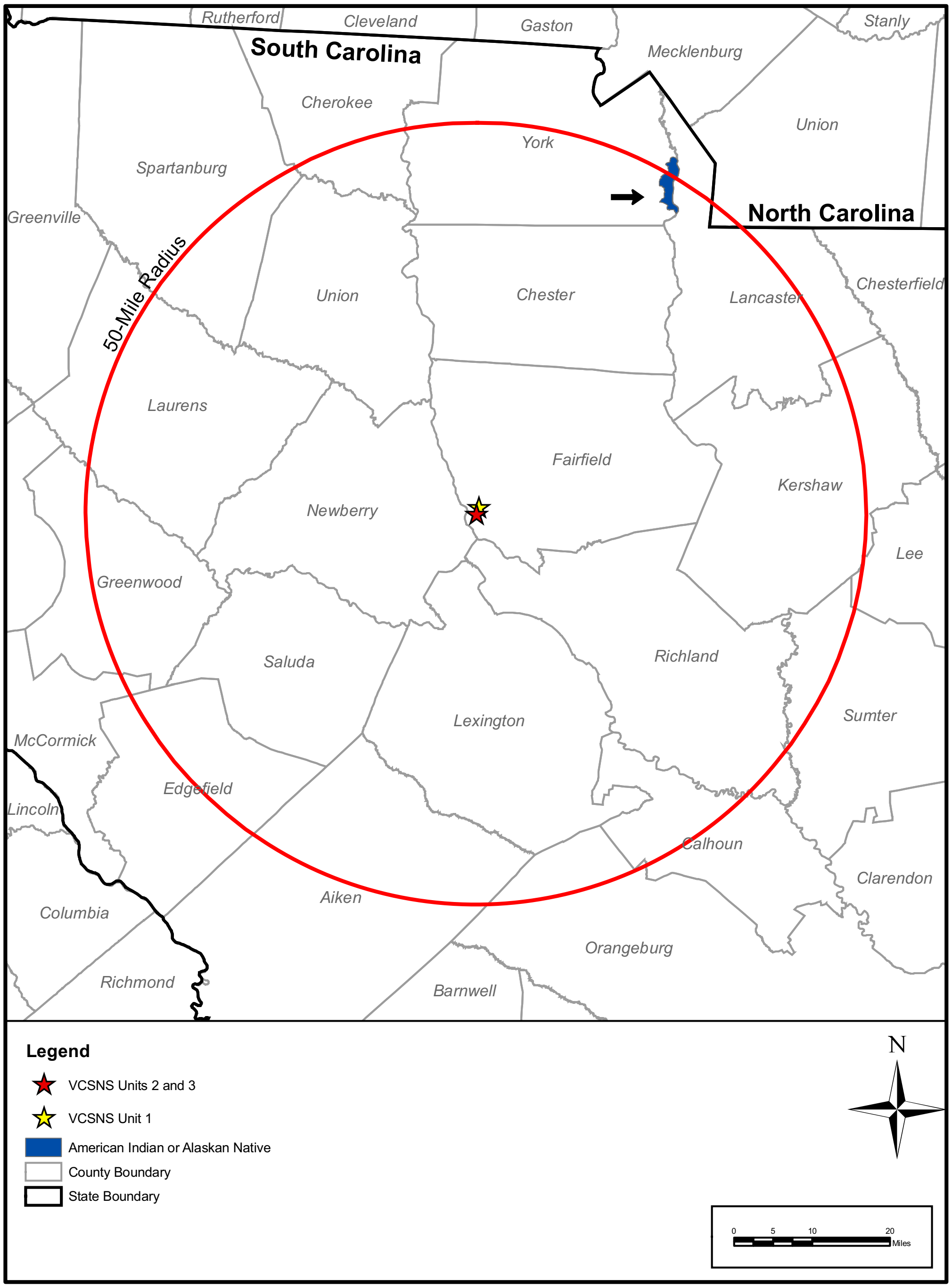


Figure 2.5-7. American Indian or Alaskan Native Block Groups Within 50 Miles

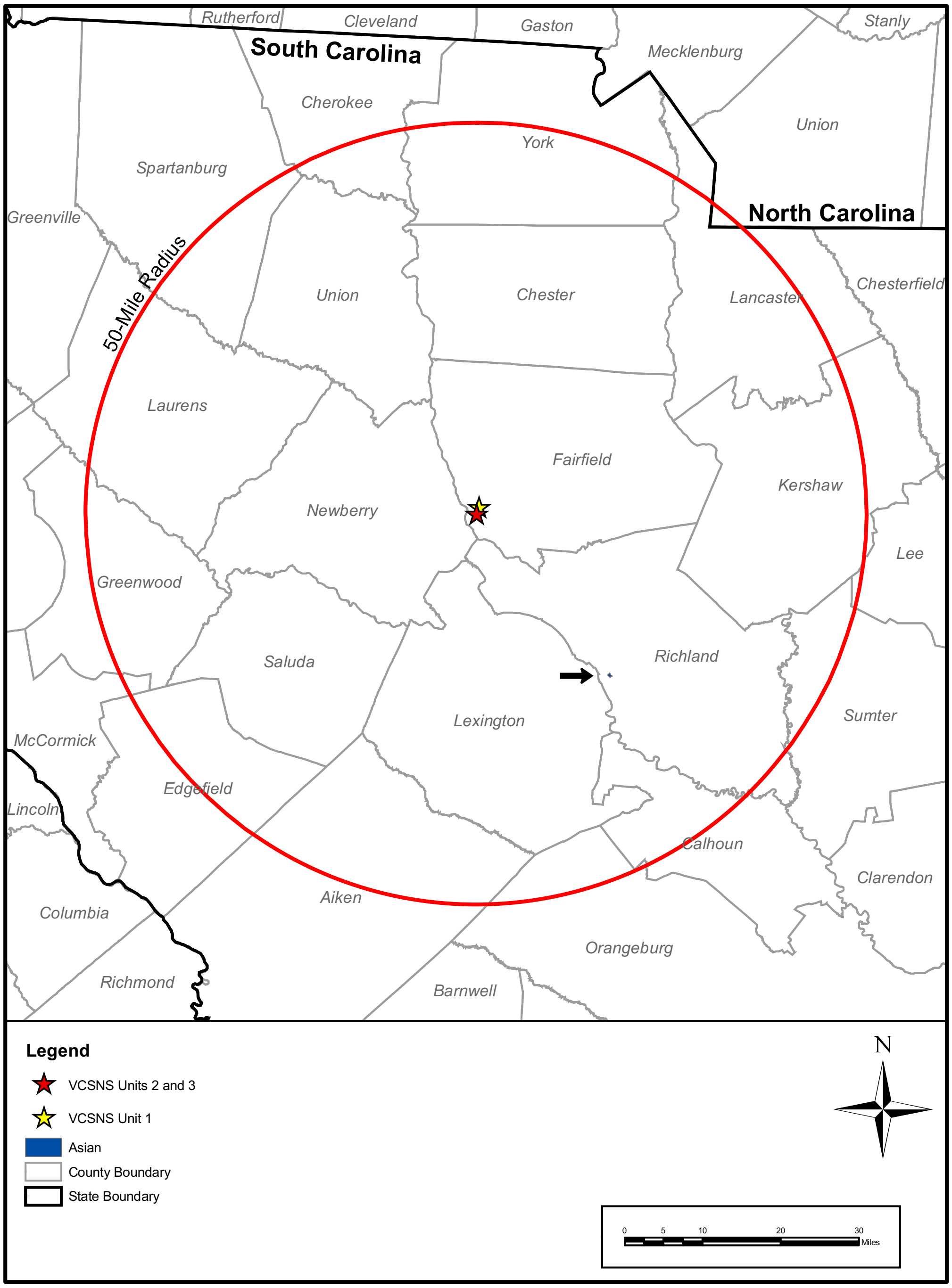


Figure 2.5-8. Asian Block Groups Within 50 Miles

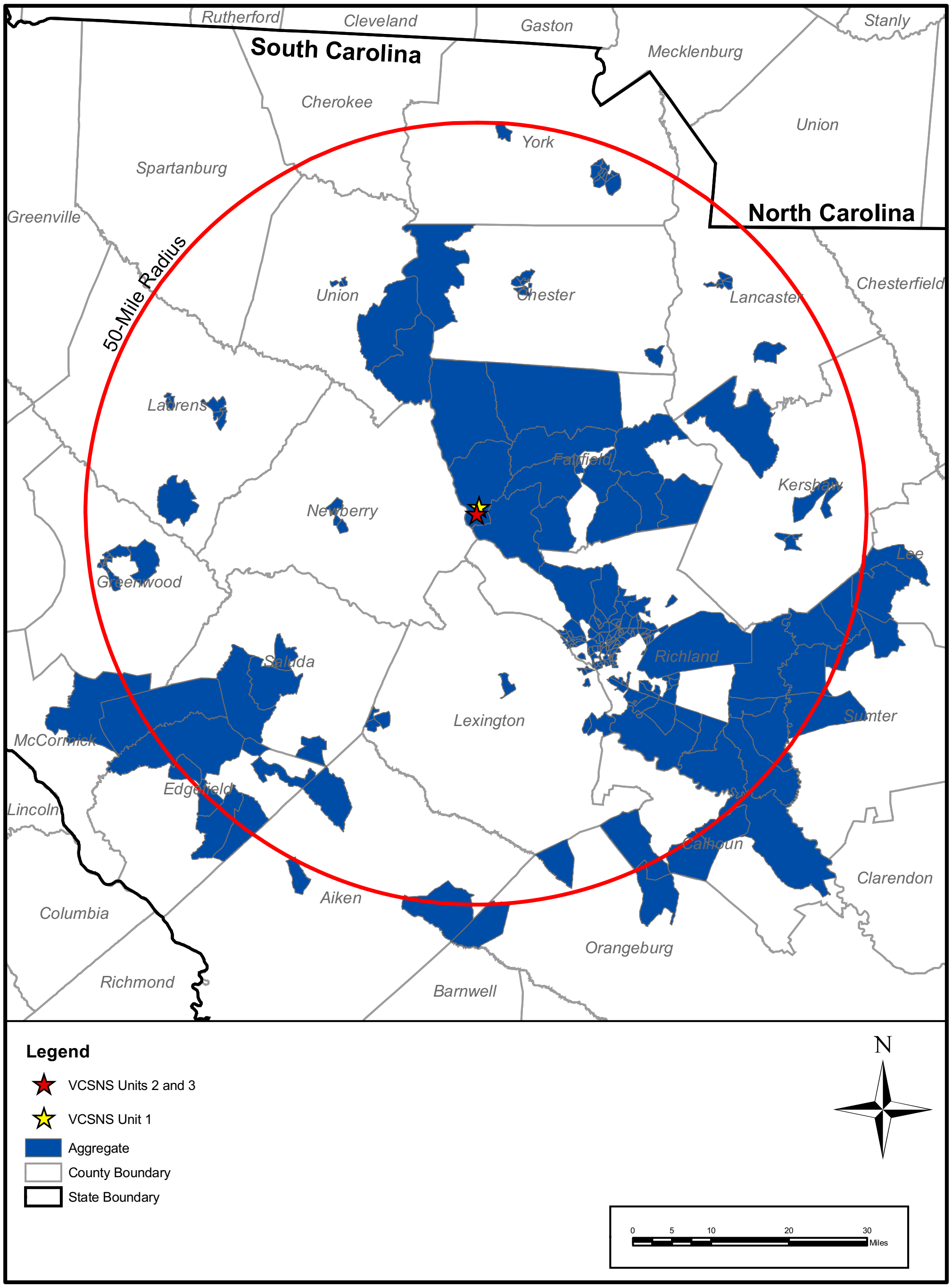


Figure 2.5-9. Aggregate Block Groups Within 50 Miles

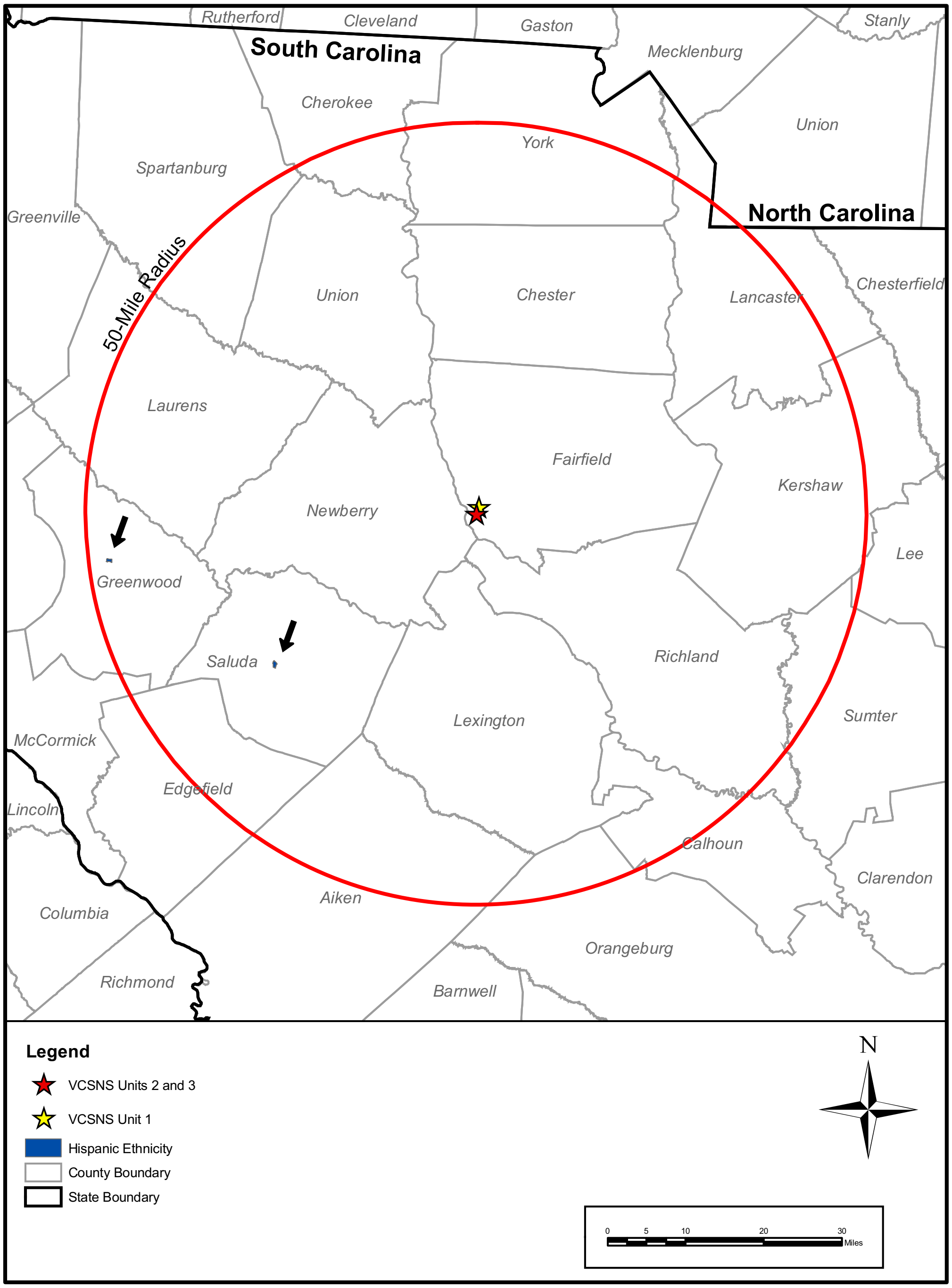


Figure 2.5-10. Hispanic Ethnicity Block Groups Within 50 Miles

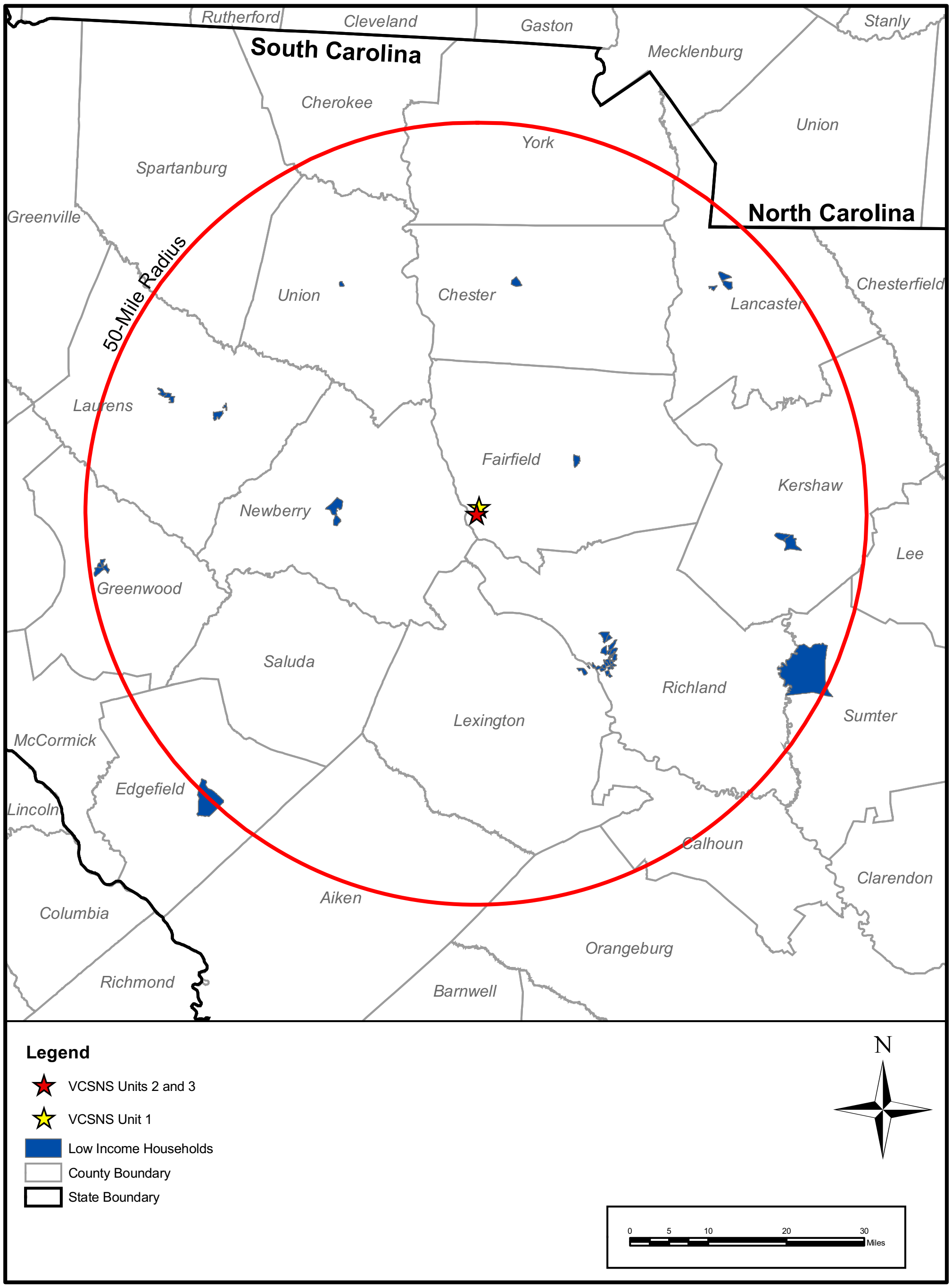


Figure 2.5-11. Low-Income Block Groups Within 50 Miles

2.6 GEOLOGY

This section presents a brief description of the geologic conditions present at and in the vicinity of the VCSNS site.

2.6.1 PHYSIOGRAPHY AND GEOMORPHOLOGY

The site is located within the Piedmont Physiographic Province of central South Carolina. The Piedmont Physiographic Province is bounded on the southeast and northwest by the Coastal Plain and Blue Ridge Physiographic Provinces, respectively (Figure 2.6-1). The site lies approximately 2 1/4 miles northwest of Jenkinsville, South Carolina, and about 1 mile east of the Broad River (Figure 2.1-3). The site topography is characteristic of the region, consisting of gently to moderately rolling hills and generally well-drained mature valleys. Within the 6-mile site area, topography ranges from about 560 feet to 210 feet MSL. All local streams drain into the Broad River. The local drainage pattern is generally dendritic; however, a subtle trellis pattern is also evident and probably a result of regional bedrock structure and joint systems. Steep gullies exist within the site area resulting from differential weathering of the basement rock and possible exacerbation by previous agricultural activity.

Most of the local terrain is mantled by residual soils and saprolite that overly igneous and metamorphic bedrock at depth. Relatively few natural bedrock outcrops are present within the site area, which is characteristic of the long weathering history and deep residual soil development of the Piedmont. The original undisturbed soils at the site typically consist of red to reddish-brown stiff clayey and silty soils with varying sand content. With depth, the soils become more yellow to reddish-brown micaceous sandy silt and/or silty sand.

2.6.2 SITE GEOLOGY

The VCSNS site lies within the Charlotte terrane, a region characterized by Neoproterozoic to Early Paleozoic plutonic rocks that intrude a suite of mainly metaigneous rocks (Hibbard et al. 2002). Within the site area, geologic units can be subdivided into three major rock categories. The first and oldest major rock category consists of amphibolite grade metamorphic rocks. The second category consists of felsic plutonic rocks that intrude the amphibolite grade metamorphic rocks. The third and youngest category consists predominantly of mafic rocks associated with Mesozoic diabase dikes that intrude the other two major rock types.

The site is located within the Winnsboro plutonic complex, a granitoid plutonic complex that includes abundant xenoliths of older surrounding greenschist- and amphibolite-facies metamorphic rocks (Secor et al. 1982; Figure 2.6-2). The felsic Winnsboro plutonic complex intruded the metamorphic country rock, which is composed primarily of interlayered and folded gneiss and amphibolite. Lithologic contacts and foliations in the metamorphic rocks exhibit a predominant northeast striking structural grain and are interpreted to represent metamorphosed rocks of igneous, volcanic, and sedimentary origin (Secor et al. 1982; Figure 2.6-2).

The Carboniferous plutonic rocks at the site are composed primarily of granodiorite, which yielded Rb-Sr and K-Ar ages of about 300 million years from unweathered samples obtained from the excavation for Unit 1 (Dames & Moore 1974). Borehole data from the area of proposed Units 2 and 3 indicates that the Winnsboro plutonic complex at the site includes a range of igneous rock compositions and textures that include granodiorite, quartz diorite, migmatite, and pegmatite dikes (MACTEC 2007).

The youngest rock type in the site area exists as a series of steeply dipping diabase dikes that were emplaced during the Mesozoic extension associated with rifting of the Atlantic Ocean (Figure 2.6-2). Individual dikes strike N15°-30°W, are several miles long, and typically a few to tens of feet thick.

A relatively thick weathering profile is developed on the bedrock units in the site area. Borehole data for proposed Units 2 and 3 reveals that the thickness of residual soil and saprolite ranges from several feet to several tens of feet (MACTEC 2007). Locally, alluvium is present along the Broad River, within Frees Creek, and in the flatter segments of smaller drainages and erosion gullies.

There are no known volcanic hazards that could impact the site. This is based on the geologic and tectonic setting of the old, stable cratonic crust in which the last documented volcanic activity occurred during Mesozoic rifting of the Atlantic Ocean. Earthquakes, however, do continue to occur within the old, stable crust, albeit at a relatively low rate of recurrence. The most significant historical earthquake to occur within the site region was the 1886 Charleston, South Carolina, earthquake. This event produced Modified Mercalli Intensity X shaking in the Charleston epicentral area and about VI-VII shaking in the site area. Small to moderate size earthquakes do occur throughout the Appalachian region and at distances much closer to the site than the 1886 Charleston earthquake. An example of this seismicity is the 1913 m_b 4.8 Union County earthquake, which was likely centered greater than 50 miles north of the site. This earthquake produced lower shaking intensities at the site than the larger, more distant 1886 Charleston earthquake.

2.6.3 GROUNDWATER

The hydrogeology of the VCSNS site is consistent with the hydrogeology of the Piedmont Province. Groundwater at the site occurs in two hydrogeologic zones—an upper zone within the residual soil, saprolite, and weathered bedrock profile and a deeper zone within the jointed and fractured crystalline bedrock. The groundwater flow regime in the upper zone roughly mimics the topography and discharges into drainage swales, whereas the deeper zone in the fractured bedrock flows westward towards the Broad River. For additional details on groundwater, refer to Subsection 2.3.1.2.

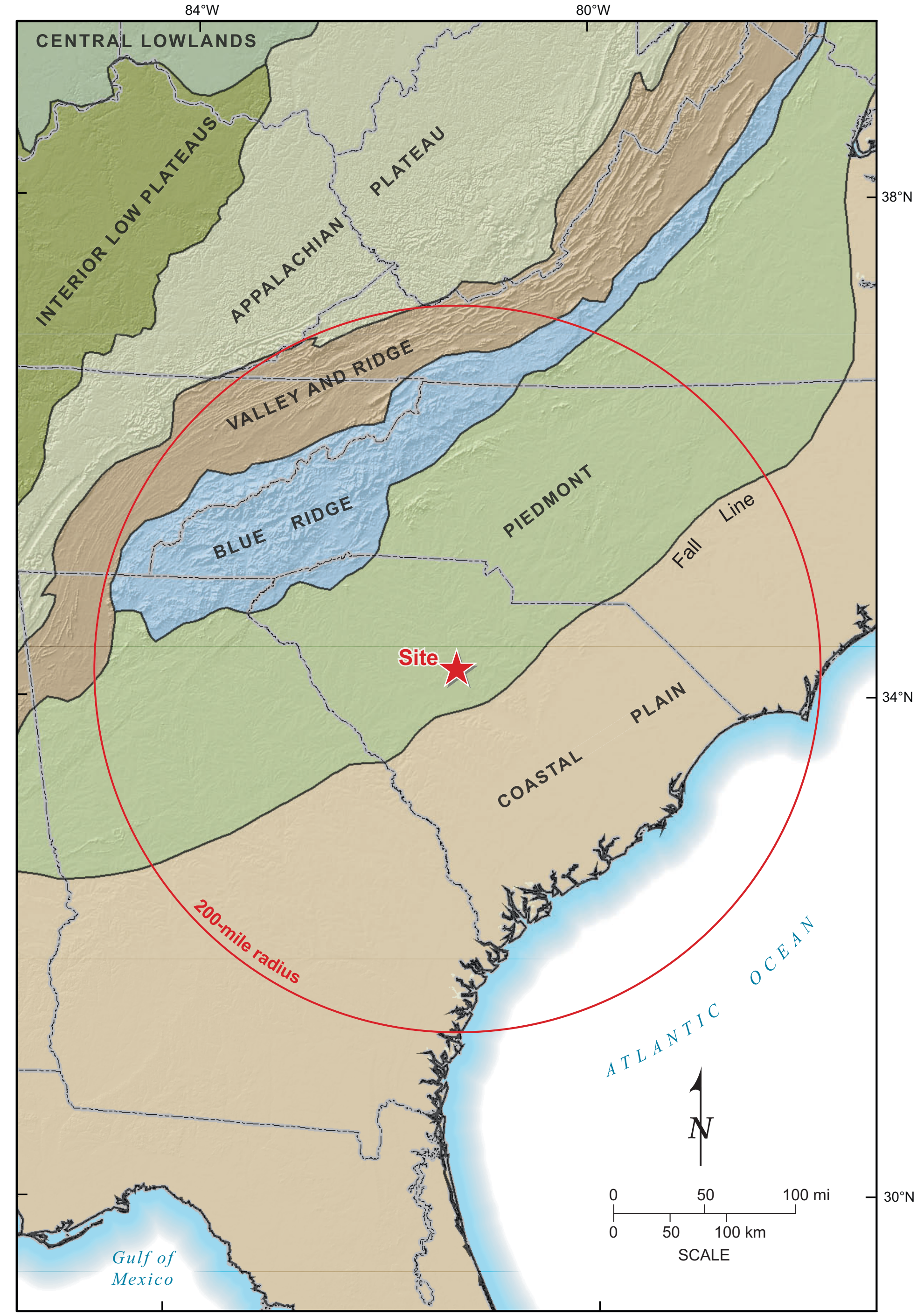
Section 2.6 References

1. Dames & Moore 1974. *Supplemental Geologic Investigation, Virgil C. Summer Nuclear Station — Unit 1*, Fairfield County, South Carolina, prepared for SCE&G, 1974.

2. Hibbard et al. 2002. Hibbard, J. P., Stoddard, E. F., Secor, D. T., and Dennis, A. J. *The Carolina Zone: Overview of Neoproterozoic to Early Paleozoic Peri-Gondwanan Terranes along the Eastern Flank of the Southern Appalachians, Earth Science Reviews,* v. 57, p. 299-339, 2002.

3. MACTEC (MACTEC Engineering and Consulting, Inc.) 2007. *Final Data Report, Results of Geotechnical Exploration and Testing,* MACTEC Project Number 6234-06-3534, 2007.

4. Secor et al. 1982. Secor, D.T., Peck, L, Pitcher, D., Prowell, D., Simpson, D., Smith, W., Snoke, A., *Geology of the area of induced seismic activity at Monticello Reservoir, South Carolina,* Journal of Geophysical Research, Volume 87, p. 6945-6957, 1982.



Modified from Fenneman and Johnson (1946)

Figure 2.6-1. Map of Physiographic Provinces

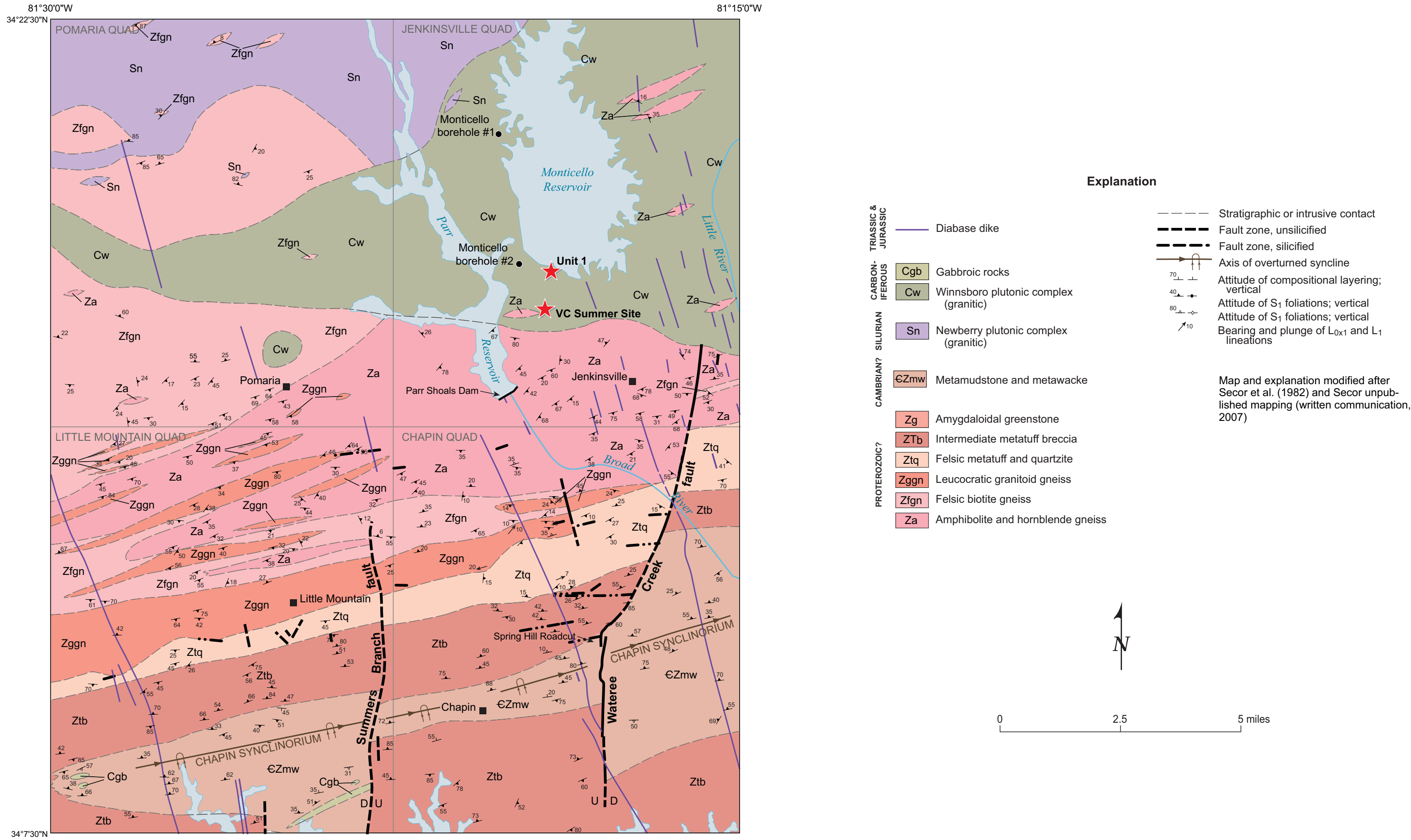


Figure 2.6-2. Geologic Map of the Jenkinsville, Pomaria, Little Mountain, and Chapin 7.5-Minute Quadrangles

2.7 METEOROLOGY, AIR QUALITY, AND NOISE

This section describes the regional and local climatological and meteorological characteristics applicable to the site for VCSNS Units 2 and 3. This section also provides site-specific meteorological information for use in evaluating construction and operational impacts. This section concludes with a brief discussion of existing noise-generating sources at the site and expected noise levels relative to measured background conditions.

2.7.1 REGIONAL CLIMATOLOGY

This subsection identifies sources of climatological data used to characterize various aspects of the climate representative of the site region and area around Units 2 and 3 (as discussed in Subsections 2.7.1 through 2.7.4), describes large-scale general climatic features and their relationship to conditions in the site area and vicinity (Subsection 2.7.1.2), and summarizes normals, means, and extremes of several standard weather elements (Subsection 2.7.1.3).

2.7.1.1 Data Sources

Several sources of data are used to characterize regional climatological conditions pertinent to the site for Units 2 and 3. This includes data acquired by the National Weather Service (NWS) at its Columbia, South Carolina, first-order station and from 13 other nearby locations in its network of cooperative observer stations, as compiled and summarized by the National Climatic Data Center (NCDC).

These climatological observing stations are located in Fairfield, Newberry, Lexington, Union, Chester, Saluda, Kershaw, Lancaster, York, and Edgefield Counties, South Carolina. Table 2.7-1 identifies the specific stations and lists their approximate distance and direction from the midpoint between the Units 2 and 3 reactors at the site. Figure 2.7-1 illustrates these station locations relative to the site for Units 2 and 3.

The objective of selecting nearby, offsite climatological monitoring stations is to demonstrate that the mean and extreme values measured at those locations are reasonably representative of conditions that might be expected to be observed at the VCSNS site. The 50-mile radius circle shown in Figure 2.7-1 provides a relative indication of the distance between the climate observing stations and the VCSNS site.

However, an approximate 31-mile (50-kilometer) grid spacing is considered to be a reasonable fine mesh grid in current regional climate modeling and this distance was used as a nominal radius for the station selection process. The identification of stations to be included was based on the following general considerations:

- Proximity to the site (*i.e.*, within the nominal 50-kilometer radius indicated above, to the extent practicable).

- Coverage in all directions surrounding the site (to the extent possible).

- Where more than one station exists for a given direction relative to the site, a station was included if it contributed one or more extreme conditions (*e.g.*, rainfall, snowfall, maximum or minimum temperatures) for that general direction or added context for variation of conditions over the site area.

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond the nominal 50-kilometer radius and that event was considered to be reasonably representative for the site area, such stations were also included, regardless of directional coverage.

Normals (*i.e.*, 30-year averages), means, and extremes of temperature, rainfall, and snowfall are based on the:

- *2004 Local Climatological Data, Annual Summary with Comparative Data for Columbia, South Carolina* (NCDC 2005a)

- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (NCDC 2005b)

- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (NCDC 2002a)

- Southeast Regional Climate Center (SERCC), *Historical Climate Summaries and Normals for South Carolina* (SERCC 2007)

- *Cooperative Summary of the* Day, *TD3200, Period of Record Through 2001, for the Eastern United States, Puerto Rico, and the Virgin Islands* (NCDC 2002d)

- *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002-2005* (NCDC 2006)

First-order NWS stations also record measurements, typically hourly, of other weather elements, including winds, several indicators of atmospheric moisture content (*i.e.*, relative humidity, dew point and wet bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (*e.g.*, fog, thunderstorms). Table 2.7-2, excerpted from the 2004 local climatological data summary for the Columbia, South Carolina, NWS station, presents the long-term characteristics of these parameters.

Additional data sources were also used in describing the climatological characteristics of the site area and region, including, among others:

- *Engineering Weather Data, 2000 Interactive Edition*, Version 1.0 (AFCCC-NCDC 1999)

- *Minimum Design Loads for Buildings and Other Structures* (ASCE 2002)
- *Historical Hurricane Tracks Storm Query*, 1851 through 2006 (NOAA-CSC 2006-2007)
- *The Climate Atlas of the United States* (NCDC 2002c)
- *Storm Events for South Carolina*, Hail Event and Snow and Ice Event Summaries for Fairfield, Newberry, Lexington, and Richland Counties (NCDC 2007)
- *Storm Data (and Unusual Weather Phenomena with Late Reports and Corrections)*, January 1959 (Volume 1, Number 1) to January 2004 (Volume 42, Number 1) (NCDC 2004)
- *Air Stagnation Climatology for the United States (1948–1998)* (Wang and Angell 1999)
- *Ventilation Climate Information System* (USDA – Forest Service 2003, 2007)
- *Climatography of the United States, No. 85, Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days 1971-2000 (and previous normal periods)* (NCDC 2002b)

2.7.1.2 General Climate Description

The site for Units 2 and 3 is located in the Piedmont region, lying between the Appalachian Mountains and the Atlantic Ocean, just north of the Fall Line that separates the Piedmont from the Coastal Plain (see Figure 2.6-1). The Appalachian Mountains, situated about 100 miles to the northwest of the site, have a general southwest-northeast orientation. The Atlantic Ocean is approximately 140 miles to the southeast.

Topographic features within 50 miles and 5 miles of the site are addressed in Subsection 2.7.4.5. Terrain in the site area generally consists of gently to moderately rolling hills. Elevations range from about 80 feet above MSL at a point approximately 50 miles to the southeast to about 920 feet above MSL at a point approximately 45 miles to the northwest.

A climate division represents a region within a state that is as climatically homogeneous as possible. Division boundaries generally coincide with county boundaries except in the western United States. The VCSNS site is located near the boundaries of three separate climate divisions within the state of South Carolina. It is physically situated in the southwestern portion of Climate Division SC-03 (North Central), but also lies directly adjacent to the eastern extent of Climate Division SC-05 (West Central), and just north of the northwestern portion of Climate Division SC-06 (Central) (NCDC 2002b).

Nevertheless, the general climate in this region is characterized by mild, short winters; long periods of mild sunny weather in the autumn; somewhat more windy but mild weather in spring; and long, hot summers.

The regional climate is predominantly influenced by the Azores high-pressure system. Because of the clockwise circulation around the western extent of the Azores High, maritime tropical air mass characteristics prevail much of the year, especially during the summer with the establishment of the Bermuda High and the Gulf High. Together, these systems govern South Carolina's summertime temperature and precipitation patterns. This macro-circulation feature also has an effect on the frequency of high air pollution potential in the site region. These characteristics and their relationship to the Bermuda High, especially in the late summer and autumn, are addressed in Subsection 2.7.2.3.

The influence of this macroscale circulation feature continues during the transitional seasons and winter months; however, it is regularly disrupted by the passage of synoptic- and mesoscale weather systems. During winter, cold air masses may briefly intrude into the region with the cyclonic (*i.e.*, counterclockwise) northerly flow that follows the passage of low-pressure systems. These systems frequently originate in the continental interior around Colorado, pick up moisture-laden air due to southwesterly through southeasterly airflow in advance of the system, and result in a variety of precipitation events that include rain, snow, sleet, and freezing rain, or mixtures, depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Subsection 2.7.3.4). Similar cold air intrusion and precipitation patterns may also be associated with secondary low-pressure systems that form in the eastern Gulf of Mexico or along the Atlantic Coast and move northeastward along the coast (also referred to as "nor'easters").

Larger and relatively more persistent outbreaks of very cold, dry air, associated with massive high-pressure systems that move southeastward out of Canada, also occasionally affect the site region. However, these weather conditions are moderated by the Appalachian Mountains to the northwest, which shelter the region in winter from these cold air masses as they sweep down through the continental interior. In general, the cold air that does reach the site area is warmed by its descent to the relatively lower elevations of the region, as well as by modification due to heating as it passes over the land.

Monthly precipitation exhibits a somewhat cyclical pattern. The predominant maximum occurs during the summer (June, July, and August), accounting for a third of the annual total rainfall. A more variable, secondary maximum period occurs during winter into early spring (January through March) (see Subsection 2.7.1.3.3). The summer maximum is due to thunderstorm activity. Heavy precipitation associated with late summer and early autumn tropical cyclones, as discussed in Subsection 2.7.3.5, is also not uncommon. The winter maximum is associated with low-pressure systems moving eastward and northward through the Gulf States and up the Atlantic Coast, drawing in warm, moist air from the Gulf of Mexico and the Atlantic Ocean. These air masses receive little modification as they move into the region. The site for Units 2 and 3 is located far enough inland that the strong winds associated with tropical cyclones are much reduced by the time that such systems affect the site area.

2.7.1.3 Normal, Mean, and Extreme Climatological Conditions

This subsection discusses normals and period-of-record means and extremes for several standard weather elements (*i.e.*, temperature, atmospheric water vapor, precipitation, and wind conditions) representative of this climate setting.

As indicated previously, Table 2.7-2 presents the more extensive set of meteorological measurements and observations made at the Columbia, South Carolina, NWS station located approximately 26 miles south-southeast of the site for Units 2 and 3. For comparison, Table 2.7-3 summarizes the annual normal daily maximum, minimum, and mean temperatures, as well as the normal annual rainfall and snowfall totals for Columbia, South Carolina, and the 13 other nearby cooperative observing stations.

With the exception of temperature measurements from Blair and Catawba, long-term periods of record for temperature and precipitation for the other climatological observing stations, as well as summaries of the latest 30-year station normals from 1971 through 2000, are readily available from the NCDC and the Southeast Regional Climate Center.

More detailed discussions of these and other climatological characteristics, including measured extremes, are addressed in Subsection 2.7.4.1.

2.7.1.3.1 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and minimum temperature values. Annual daily normal temperatures over the site area range from 59.9°F at the Camden 3W station to 63.6°F at the Columbia, South Carolina, NWS station. The lower normal temperatures at Camden 3W may be due to local topographic effects because the station elevation for this location (*i.e.,* 140 feet above MSL) is the lowest among all of the stations considered. Nevertheless, daily mean ambient temperatures are fairly similar over the site area.

Likewise, the diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are fairly comparable, ranging from 21.1°F at Little Mountain to 26.8°F at the Johnston 4SW station (NCDC 2002a). The breadth of this range also may be a reflection of the station elevation with Little Mountain 711 feet above MSL (the highest among all of the stations considered).

On a monthly basis, the local climatological data summary for Columbia, South Carolina, indicates that the daily normal temperature is highest during July (82.0°F) and reaches a minimum in January (44.6°F) (NCDC 2005a).

The highest temperature observed at the site area (111°F) was recorded on June 28, 1954, at the Camden 3W station, located about 38 miles east of the site for Units 2 and 3. The lowest temperature observed in the site area (–5°F) was recorded on December 13, 1962, at the Chester 1NW station, located about 30 miles north of the site. Refer to Table 2.7-5 for more details on temperature extremes (NCDC 2005b; SERCC 2007).

2.7.1.3.2 Atmospheric Water Vapor

Based on a 21-year period of record, the local climatological data summary for the Columbia, South Carolina, NWS station (see Table 2.7-2) indicates that the mean annual wet bulb temperature is 57.0°F, with a seasonal maximum during the summer months (June through August) and a seasonal minimum during the winter months (December through February). The highest monthly mean wet bulb temperature is 73.5°F in July (only slightly less during August); the lowest monthly mean value (40.1°F) occurs during January (NCDC 2005a).

The local climatological data summary shows a mean annual dew point temperature of 51.6°F, also reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 69.9°F in July; again, only slightly less during August. The lowest monthly mean dewpoint temperature (33.2°F) occurs during January (NCDC 2005a).

The 30-year normal daily relative humidity averages 70% annually, typically reaching its diurnal maximum in the early morning hours (around 0700 local standard time) and its diurnal minimum during the early afternoon hours (around 1300 local standard time). There is less variability in this daily pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this diurnal pattern is evident throughout the year. The local climatological data summary indicates that average early morning relative humidity levels are greater than or equal to 90% during the months of August, September, and October (NCDC 2005a).

2.7.1.3.3 Precipitation

With the exception of the Pelion 4NW station, normal annual rainfall totals for the 13 other nearby observing stations listed in Table 2.7-3 differ by about 5.7 inches (or about 12%), ranging from 43.59 inches at the Blair 1NE observing station, about 10 miles to the north-northwest, to 49.33 inches at the Newberry station, about 18 miles to the west (NCDC 2002a). The normal rainfall total for Blair 1NE is based on the current station location; other precipitation extremes and normal annual snowfall totals are based on summaries available for the previous station location referred to only as Blair. The current 30-year average for the Pelion 4NW station, about 39 miles to the south, is somewhat higher, at 51.03 inches (NCDC 2002a).

The local climatological data summary of normal rainfall totals for Columbia, South Carolina, indicates two seasonal maximums—the highest (15.94 inches) during the summer (June through August) and the second (13.09 inches) during the winter into early spring (January through March). Together, these periods account for almost 60% of the annual total for the Columbia, South Carolina, NWS station, although rainfall is greater than 2.8 inches during every month of the year. The overall maximum monthly total rainfall occurs during July (5.54 inches) (NCDC 2005a).

The overall highest 24-hour rainfall total in the site area—10.42 inches on August 18, 1986—was recorded at the Newberry station (NCDC 2005b, SERCC 2007). While Subsection 2.7.3.5 indicates that most of the individual station 24-hour rainfall records were established as a result of precipitation associated with tropical cyclones that passed within 100 nautical miles of the site for Units 2 and 3, this particular event was not. However, the region was generally unsettled as Tropical Storm Charley had formed well off the South Carolina coast moving to the northeast only a few days earlier (NCDC 2004).

The overall highest monthly rainfall total recorded in the site area—18.55 inches during August 1952 at the Kershaw 2SW cooperative observing station, about 44 miles east-northeast of the site—represents the accumulation of 13 days of measurable precipitation during that month (SERCC 2007, NCDC 2002d). Only a portion (*i.e.*, less than 25%) of that total was attributable to Hurricane (later Tropical Storm) Able, which traversed the state on August 30 and 31, 1952 (see Subsection 2.7.3.5).

Snow in the site area is not an unusual event, having occurred as early as mid-November and as late as the last week of March. However, Table 2.7-3 indicates that normal annual totals range from only 1.4 to 3.9 inches (NCDC 2005b, SERCC 2007). Heavy snows, on the other hand, generally occur infrequently as discussed in Subsection 2.7.3.4. The 24-hour snowfall record for the site area (*i.e.*, 14.0 inches) was set on February 10, 1973 at the Johnston 4SW cooperative observing station, about 46 miles southwest of the site. The overall highest monthly snowfall total (*i.e.*, 16.5 inches) was recorded during March 1960 at the Chester 1NW observing station (NCDC 2002d, 2005b; SERCC 2007).

See Subsection 2.7.4.1.3 for more details regarding these events and a discussion of other station precipitation records.

2.7.1.3.4 Wind Conditions

Based on a 33-year period of record, the local climatological data summary for the Columbia, South Carolina, NWS station (see Table 2.7-2) indicates that the annual prevailing wind direction (*i.e.*, the direction from which the wind blows most often) is from 240° (*i.e.*, west-southwest). Monthly prevailing winds are from the west-southwest or southwest during most of the year (*i.e.*, December through August) (NCDC 2005a). These characteristics are a direct effect of the presence of the Appalachian Mountains to the northwest and, in summer, are further enhanced by the establishment of the Bermuda High (see Subsection 2.7.1.2).

North-northeast winds prevail during September and October according to the local climatological data (NCDC 2005a) and, again, reflect the influence of the Appalachians, this time in conjunction with the predominant continental high-pressure pattern usually centered to the north over New England with the mountains acting as a deflecting barrier for the clockwise circulation around the high.

Based on a 49-year period of record, the local climatological data summary shows an annual mean wind speed of 6.8 mph. Seasonally, the highest average wind speeds occur during the spring (about 7.1 mph) and are lowest during the summer and autumn months (about 6.1 mph). On average, the local climatological data indicates that the highest monthly average wind speed (8.2 mph) occurs during March and April (NCDC 2005a).

Characteristics of extreme wind conditions for design basis purposes are discussed in Subsection 2.7.3.2. Wind data summaries, based on measurements from the onsite meteorological monitoring program operated in support of Unit 1, for the purpose of climatological characterization as related to the dispersion of radioactive and nonradioactive effluents released into the atmosphere, are discussed in Subsections 2.7.4.2 and 2.7.4.3.

2.7.2 AIR QUALITY

This subsection addresses current ambient air quality conditions in the site area and region (*e.g.*, the compliance status of various air pollutants) that have a bearing on plant design, construction, and operating basis considerations (Subsection 2.7.2.1), cross-references other subsections of this Environmental Report that address the types and characteristics of nonradiological emission sources associated with plant construction and operation and the expected impacts associated with those activities (Subsection 2.7.2.2), and characterizes conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion (Subsection 2.7.2.3).

2.7.2.1 Regional Air Quality Conditions

The site for Units 2 and 3 is located within the Columbia Intrastate Air Quality Control Region and includes Fairfield, Lexington, Newberry, and Richland Counties (40 CFR 81.108). Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being “better than,” “unclassifiable/attainment,” or “cannot be classified or better than” the EPA-promulgated National Ambient Air Quality Standards. Criteria pollutants are those for which the National Ambient Air Quality Standards have been established: sulfur dioxide, particulate matter (*i.e.*, PM_{10} and $PM_{2.5}$—particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone, and lead (40 CFR Part 50).

Fairfield and Newberry Counties are designated as being in attainment for all criteria air pollutants (40 CFR 81.341). Similarly, Lexington and Richland Counties, to the south and southeast of the site, are in attainment for all criteria pollutants with the exception of the 8-hour National Ambient Air Quality Standards for ozone (40 CFR 81.341). The 8-hour ozone non-attainment area comprises the Columbia, South Carolina, Metropolitan Planning Organization whose boundaries basically include the northeastern half of Lexington County, most of Richland County, and a small portion of southwestern Kershaw County (FHWA 2006). The northern extent of this Metropolitan Planning Organization in Richland County is about 3 miles to the south of the VCSNS site; the Lexington County portion is about 6 miles away from the site.

There are no pristine areas designated as “Mandatory Class I Federal Areas Where Visibility is an Important Value” that are located within 100 miles of the site for Units 2 and 3. The two closest Class I areas are both about 120 miles away—the Shining Rock Wilderness Area to the northwest and the Linville Gorge Wilderness Area to the north-northwest in North Carolina (40 CFR 81.422).

2.7.2.2 Projected Air Quality Conditions

The new nuclear steam supply system and other related radiological systems are not sources of criteria air pollutant or other air toxics emissions. Nonradiological emission-generating sources associated with routine facility operations are identified and discussed further in Subsection 3.6.3.1.

Characteristics of these emission sources and the potential effects on air quality and visibility associated with their operation are addressed in Subsections 5.8.1 and 5.3.3, respectively. Emission-generating sources and activities related to construction of Units 2 and 3, potential impacts, and mitigation measures are addressed in Subsection 4.4.1.3. Current federal and South Carolina Department of Health and Environmental Control air quality-related regulations and permits, expected to be applicable to Units 2 and 3, are identified in Section 1.2.

2.7.2.3 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of pollutants released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation and wind speed. Subsection 2.7.4.2 addresses wind characteristics for the VCSNS site vicinity based on measurements from the existing meteorological monitoring program operated in support of Unit 1. The persistence of those wind conditions is discussed in Subsection 2.7.4.3.

In general, lower wind speeds represent less-turbulent airflow, which is restrictive to both horizontal and vertical dispersion. And, although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anti-cyclones) that influence a region with light and variable wind conditions for four consecutive days or more. An updated air stagnation climatology has been published with data for the continental United States based on over 50 years of observations from 1948 through 1998. Although interannual frequency varies, the data in Figures 1 and 2 of that report indicates that, on average, the VCSNS site area can expect about 15 to 20 days per year with stagnation conditions, or about three to four cases per year, with the mean duration of each case lasting about five days (Wang and Angell 1999).

Air stagnation conditions primarily occur during an “extended” summer season that runs from May through October. This is a result of the weaker pressure and temperature gradients and, therefore, weaker wind circulations during this period (as opposed to the winter season). Based on the *Air Stagnation Climatology for the United States (1948–1998),* Figures 17 to 67, the highest incidence is recorded in the latter half of that period between August and October, typically reaching its peak in September. As the local climatological data summary for Columbia, South Carolina, in Table 2.7-2 indicates, this three-month period coincides with the lowest monthly mean wind speeds during the year. Within this “extended” summer season, air stagnation is at a relative minimum during July because of the influence of the Bermuda high-pressure system (Wang and Angell 1999).

The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. Holzworth (1972) reported mean seasonal and annual morning and afternoon mixing heights and wind speeds for the continental United States based on observations over the five-year period from 1960 to 1964 from a network of 62 NWS stations at which daily surface and upper air sounding measurements were routinely made.

However, an interactive, spatial data base developed by the U.S. Department of Agriculture–Forest Service, referred to as the Ventilation Climate Information System, is readily available and provides monthly and annual graphical and tabular summaries of relevant dispersion-related characteristics (*e.g.*, morning and afternoon modeled mixing heights, modeled surface wind speeds, and resultant ventilation indices) (USDA–Forest Service 2003). The system, although developed primarily for fire management and related air quality purposes, extends the period of record to a climatologically representative duration of 40 years.

Table 2.7-4 summarizes minimum, maximum, and mean morning and afternoon mixing heights, surface wind speeds, and ventilation indices on a monthly, seasonal, and annual basis for the VCSNS site area. Because atmospheric sounding measurements are still only made from a relatively small number of observation stations, these statistics represent model-derived values within the interactive data base for a specific location (USDA-Forest Service 2003)—in this case, the site for Units 2 and 3. The seasonal and annual values listed in Table 2.7-4 were derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest morning mixing heights occur in the autumn and are highest during the spring although, on average, morning mixing heights are only slightly lower in the winter and summer months. Conversely, afternoon mixing heights reach a seasonal minimum in the winter and a maximum during the summer (only slightly lower during the spring) (USDA-Forest Service 2007), as might be expected due to more intense summertime heating.

The wind speeds listed in Table 2.7-4 are reasonably consistent with the local climatological data summary for Columbia, South Carolina, in Table 2.7-2 in that the lowest mean wind speeds are shown to occur during summer into early autumn (USDA-Forest Service 2007, NCDC 2005a). This period of minimum wind speeds likewise coincides with the “extended” summer season described by Wang and Angell (1999) that is characterized by relatively higher air stagnation conditions.

The ventilation index is based on the product of the wind speed and the mixing height. Because it uses surface winds instead of higher trajectory winds, the index values represent conservative estimates of ventilation potential and so would be more of indicative of the dispersion potential near the ground (USDA-Forest Service 2003).

Based on the classification system for ventilation indices (USDA-Forest Service 2003), the morning ventilation indices for the VCSNS site area indicate only marginal ventilation potential on an annual average basis with conditions rated as marginal during the winter and spring and poor during the summer and autumn, again consistent with the characteristics reported by Wang and Angell (1999).

Ventilation indices markedly improve during the afternoon with conditions rated as good on an annual average basis and during the spring and summer seasons; afternoon ventilation potential is rated as fair during the autumn and winter. Because mean wind speeds do not vary significantly in the site area over the course of the year, the relatively better ventilation classifications are attributable to the higher mixing height levels, which for the summer season tends to mask the general potential for more restrictive dispersion conditions during the “extended” summer referred to by Wang and Angell (1999). Nevertheless, the transition from good to fair ventilation indices between the summer and autumn months is still evident and consistent with the monthly variations and July minimum for air stagnation discussed previously.

2.7.3 SEVERE WEATHER

This subsection addresses severe weather phenomena that affect the VCSNS site area and region and that are considered in the design and operating bases for Units 2 and 3. These include:

- The frequencies of thunderstorms and lightning (Subsection 2.7.3.1)
- Observed and probabilistic extreme wind conditions (Subsection 2.7.3.2)

- Tornadoes and related wind and pressure characteristics (Subsection 2.7.3.3)

- The frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.7.3.4)

- Tropical cyclones and related effects (Subsection 2.7.3.5)

2.7.3.1 Thunderstorms and Lightning

Thunderstorms can occur in the Unit 2 and 3 site area at any time during the year. Based on a 57-year period of record, Columbia, South Carolina, averages about 52 thunderstorm-days (*i.e.*, days on which thunder is heard at an observing station) per year. On average, July has the highest monthly frequency of occurrence—about 12 days. Annually, nearly 60% of thunderstorm-days are recorded between late spring and midsummer (*i.e.*, from June through August). From October through January, a thunderstorm might be expected to occur about one day per month (NCDC 2005a).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute, as reported by the U.S. Department of Agriculture Rural Utilities Service in the publication entitled *Summary of Items of Engineering Interest* (U.S. DOA-RUS 1998). This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$$N = 0.31T$$

Based on the average number of thunderstorm-days per year at Columbia, South Carolina (*i.e.*, 52; see Table 2.7-2), the frequency of lightning strokes to earth per square mile is about 16 per year for the VCSNS site area. This frequency is essentially equivalent to the mean of the five-year (1996 to 2000) flash density for the area that includes the site for Units 2 and 3, as reported by the NWS—4 to 8 flashes per square kilometer per year (NWS 2002)—and, therefore, is considered to be a reasonable indicator.

The power block area (PBA) circle for Units 2 and 3 is represented in Figure 2.7-17 as an area bounded by a 750-foot-radius circle with its centroid at a point between the two units. The equivalent area of the PBA circle is approximately 0.063 square miles. Given the estimated annual average frequency of lightning strokes to earth in the VCSNS site area, the frequency of lightning strokes in the PBA circle can be estimated as follows:

$$(16 \text{ lightning strokes/mi}^2\text{/year}) \times (0.063 \text{ mi}^2) = 1.01 \text{ lightning strokes/year}$$

or about once each year in the PBA circle.

2.7.3.2 Extreme Winds

Estimating the wind loading on plant structures for design and operating bases considers the “basic” wind speed, which is the “3-second gust speed at 33 feet (10 meters) above the ground in Exposure Category C,” as defined in Sections 6.2 and 6.3 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (ASCE 2002).

The basic wind speed is about 95 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1 of ASCE (2002) for that portion of the United States that includes the site for Units 2 and 3. This interpolated value is about 5% higher than the basic wind speed reported in the Engineering Weather Data summary for the Columbia, South Carolina, NWS station (*i.e.*, 90 mph) (AFCCC-NCDC 1999), which is located about 26 miles south-southeast of the site. The former value is, therefore, considered to be a reasonably conservative indicator of the basic wind speed for the Units 2 and 3 site location.

From a probabilistic standpoint, these values are associated with a mean recurrence interval of 50 years. Section C6.0 of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals (ASCE 2002). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period basic wind speed value by a scaling factor of 1.07, which yields a 100-year return period 3-second-gust wind speed for the site of about 102 mph.

Subsection 2.7.3.5 addresses rainfall extremes associated with tropical cyclones that have passed within 100 nautical miles of the site for Units 2 and 3 and concludes with a discussion of observed wind speeds and/or wind gusts accompanying several of the more intense hurricanes that have tracked through this radial area. All of these tropical cyclones—Hurricanes Hugo, Able, and Gracie—had maximum sustained wind speeds and/or peak gusts below the 100-year return period 3-second gust wind speed indicated above, although a slightly higher peak gust of 109 mph was recorded at a station about 45 miles southeast of the VCSNS site as Hurricane Hugo moved through the area.

2.7.3.3 Tornadoes

The design basis tornado characteristics applicable to structures, systems, and components important to safety include the following parameters as identified in Regulatory Guide 1.76, *Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, Revision 1*, March 2007 (NRC 2007b):

- Maximum wind speed
- Translational speed
- Maximum rotational speed
- Radius of maximum rotational speed

- Pressure drop
- Rate of pressure drop

Based on Figure 1 of Regulatory Guide 1.76, the VCSNS site is located within Tornado Intensity Region I. In confirming the applicability of this tornado intensity region to the site, information in Revision 2 of NUREG/CR-4461, *Tornado Climatology of the Contiguous United States*, (NUREG/CR-4461, Rev. 2; PNNL-15112, Rev. 1) (U.S. NRC 2007a), February 2007, was taken into consideration. That document was the basis for most of the technical revisions to Regulatory Guide 1.76.

Table 6-1 of NUREG/CR-4461 lists tornado wind speed estimates for U.S. nuclear power plant sites, including the “Summer” site. The tornado wind speed associated with a 10^{-7} exceedance probability of occurrence, based on the Enhanced Fujita Scale of wind speeds, is 208 mph. Revision 1 of Regulatory Guide 1.76 retains the 10^{-7} exceedance probability for tornado wind speeds, the same as the original version of that regulatory guide. NUREG/CR-4461 discusses the relationship between and previous use of the original Fujita scale of wind speed ranges for different tornado intensity classifications and the Enhanced Fujita Scale wind speed ranges in the revised analysis of tornado characteristics.

Consequently, the design basis tornado characteristics for Tornado Intensity Region I considered to be applicable to the site for Units 2 and 3 are:

- Maximum wind speed = 230 mph
- Translational speed = 46 mph
- Maximum rotational speed = 184 mph
- Radius of maximum rotational speed = 150 ft
- Pressure drop = 1.2 pounds per square inch (psi)
- Rate of pressure drop = 0.5 psi/sec

2.7.3.4 Hail, Snowstorms, and Ice Storms

Frozen precipitation typically occurs in the form of hail, snow, sleet, and freezing rain. The frequencies of occurrence and characteristics of these types of weather events in the Unit 2 and 3 site area are based on the current version of *The Climate Atlas of the United States* (NCDC 2002c), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and from the NCDC online *Storm Events* database (NCDC 2007).

Though hail can occur at any time of the year and is associated with well-developed thunderstorms, it has been observed primarily during the spring and early summer months (*i.e.*, April through July), reaching a peak during May, and occurring least often from late summer to late winter (*i.e.*, September through February) (NCDC 2007). The Climate Atlas indicates that Lexington, Richland, and the very southern portion of Fairfield County (which includes the VCSNS site), can expect, on average, hail with diameters 0.75 inch or greater about two to three days per year. The occurrence of hailstorms with hail greater than or equal to 1.0 inch in diameter averages about one to two days per year in Lexington and Richland Counties, the southern half of Fairfield County, and the extreme southeast portion of Newberry County (NCDC 2002c), all of which surround the site.

The NCDC cautions that hailstorm events are point observations and somewhat dependent on population density. This explains the areal extent of the higher frequencies reported above for most of Lexington and Richland Counties to the south of the site, which comprise the Columbia, South Carolina, metropolitan area, and what could be interpreted as lower frequencies of occurrence in much of Fairfield County and most of Newberry County, which are relatively less populated. The slightly higher annual mean number of hail days is considered to be a more representative indicator for the Unit 2 and 3 site.

Despite these long-term statistics, no hailstorms of note have been recorded in some years, while multiple events have been observed in this four-county area in other years, including:

- 9 events on 8 separate dates in 1988, and 7 events on 7 separate dates during 1996 in Richland County.
- 14 events on 7 separate dates in 2005, and 10 events on 7 separate dates during 2003 in Lexington County.
- 12 events on 7 separate dates in 2006 in Newberry County (NCDC 2007).

Golfball-size hail (about 1.75 inches in diameter) is not a rare occurrence, having been observed numerous times in all four counties surrounding the VCSNS site (NCDC 2007). However, in terms of extreme hailstorm events, baseball-size hail (about 2.75 inches in diameter) was reported in Richland County on May 2, 1984, about 26 miles southeast of the site, and 3.00-inch diameter hail stones were reported about 33 miles east-southeast of the site, also in Richland County.

Snow is not unusual in the Piedmont of South Carolina, where the VCSNS site is located, but heavy snowfalls occur only occasionally when a source of moist air from the Atlantic Ocean or the Gulf of Mexico interacts with a very cold air mass that penetrates across the otherwise protective Appalachian mountain range in northern Georgia and northwestern South Carolina. The Climate Atlas (NCDC 2002c) indicates that the occurrence of snowfalls 1 inch or greater in the VCSNS site area averages less than one day per year (see also Table 2.7-2). Additional details regarding extreme snowfall events in the site area are given in Subsection 2.7.4.1.3 and Table 2.7-5.

Depending on the temperature characteristics of the air mass, snow events are often accompanied by or alternate between sleet and freezing rain as the weather system traverses the VCSNS region. The Climate Atlas (NCDC 2002c) indicates that, on average, freezing precipitation occurs about 3 to 5 days per year in the area that includes the site for Units 2 and 3.

Storm event records from the winters of 1994 through 2006 for the four-county area surrounding the VCSNS site note that ice accumulations of up to 1 inch have occurred, although it is typically less than this thickness (NCDC 2007).

2.7.3.5 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical depressions, and extratropical storms, among others. This characterization considers all “tropical cyclones” (rather than systems classified only as hurricanes and tropical storms) because storm classifications are generally downgraded once landfall occurs and the system weakens, although they may still result in significant rainfall events as they travel through the site region.

NOAA’s Coastal Services Center (NOAA-CSC) provides a comprehensive historical database, extending from 1851 through 2006, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 85 tropical cyclone centers or storm tracks have passed within 100 nautical miles of the site for Units 2 and 3 during this historical period (NOAA-CSC 2006-2007). Storm classifications and respective frequencies of occurrence over this 156-year period of record are as follows:

- Hurricanes — Category 4 (1), Category 3 (1), Category 2 (3), Category 1 (7)
- Tropical storms — 37
- Tropical depressions — 22
- Subtropical storms — 1
- Subtropical depressions — 1
- Extratropical storms — 12

Tropical cyclones within this 100-nautical-mile radius have occurred as early as May and as late as November, with the highest frequency (31 out of 85 events) recorded during September, including all classifications except subtropical depressions. October and August account for 16 and 15 events, respectively, indicating that more than 70% of the tropical cyclones that affect the site area occur from midsummer to early autumn. Tropical storms and tropical depressions have occurred in all months from May to November. Two-thirds of the hurricanes (*i.e.*, 8 of the 12) that have passed within 100 nautical miles of the site occurred during September, including one Category 4 and one Category 3 storm. Only three Category 2 hurricanes have occurred—two in August and one in September. Seven Category 1 hurricanes have been recorded within this radial distance of the site—one each in July and October, and five during September (NOAA-CSC 2006-2007).

Tropical cyclones are responsible for at least 15 separate rainfall records among the 14 NWS and cooperative observer network stations listed in Table 2.7-1 — nine 24-hour (daily) rainfall totals and six monthly rainfall totals (see Subsection 2.7.4.1.3 and Table 2.7-5).

In early September 1998, rainfall associated with Extratropical Storm Earl resulted in historical 24-hour maximum totals of 10.14 inches at the Kershaw 2SW station, 7.10 inches at the Pelion 4NW station, and 7.08 inches at the Parr observing station. Two 24-hour records were established due to Tropical Storm Cindy in early July 1959, at the Winnsboro cooperative observing station and at the Columbia, South Carolina, NWS station, 7.77 and 5.79 inches, respectively. Late August 1964 saw Tropical Depression Cleo result in maximum 24-hour rainfall totals of 6.35 inches at the Johnston 4SW station, and 6.05 inches at the Saluda observing station. In October 1990, a 24-hour rainfall total of 9.62 inches was recorded at the Camden 3W station due to Extratropical Storm Marco (along with a slow-moving cold frontal system), and in July 1997 Tropical Depression Danny produced 7.77 inches of rain in a 24-hour period at the Catawba observing station (NCDC 2005b, 2002d; SERCC 2007; NOAA-CSC 2006–2007).

Monthly station records were established because of partial contributions from the following tropical cyclones (NCDC 2004, 2005b, 2002d, 2006; SERCC 2007; NOAA-CSC 2006-2007):

- Hurricane Able in August 1952 (18.55 inches at Kershaw 2SW and 14.90 inches at Winnsboro)
- Extratropical Storm Marco in October 1990 (16.93 inches at Camden 3W)
- An unnamed storm in June 1965 (15.88 inches at Johnston 4SW)
- Hurricane Gracie in September 1959 (14.96 inches at Saluda)
- Tropical Depression Jeanne in September 2004 (14.76 inches at Santuck)

As indicated above, significant amounts of rainfall can still be associated with a tropical cyclone once the system moves inland. Wind speed intensity, however, noticeably decreases as the system passes over terrain and is subjected to increased frictional forces. Examples of such effects associated with some of the more intense tropical cyclones that have passed within 100 nautical miles of the VCSNS site, are:

- Hurricane Hugo (September 1989). Hugo was still estimated to be of hurricane strength as its center passed between Shaw Air Force Base, about 45 miles southeast of the VCSNS site, and Columbia, South Carolina. A maximum one-minute average surface wind speed of 58 knots (about 67 mph) with a peak gust of 95 knots (about 109 mph) was recorded at Shaw Air Force Base. A maximum one-minute average surface wind speed of 46 knots (about 53 mph) with a peak gust of 61 knots (about 70 mph) was measured at the Columbia, South Carolina, NWS station. At another location in the Columbia area, designated Columbia AT&T, a peak gust of 86 knots (about 99 mph) was observed (NCDC 2004).

- Hurricane Able (August 1952). Able passed through central South Carolina, having been downgraded from a Category 2 to a Category 1 hurricane. It remained so during much of its overland track within the state, being further downgraded to tropical storm status in the northern part of South Carolina before exiting into west-central North Carolina. Category 1 hurricanes are characterized by maximum sustained surface (10 meters) wind speeds of 74 to 95 mph. NOAA Coastal Services Center records indicate a wind speed of 70 knots (about 81 mph) associated with this Category 1 status (NOAA-CSC 2006-2007).

- Hurricane Gracie (September 1959). Gracie traversed central South Carolina, retaining a Category 3 hurricane designation for about 75 miles of its initial overland track, losing strength as it continued to move inland, and being downgraded to tropical storm status by the time it passed through the center of the state and exiting into western North Carolina. Tropical storms are characterized by maximum sustained surface (10-meter) wind speeds of 39 to 73 mph. NOAA Coastal Services Center records indicate a wind speed of 60 knots (about 69 mph) associated with this tropical storm status (NOAA-CSC 2006-2007).

Subsection 2.7.3.2 discussed the wind speeds associated with Hurricane Hugo in relation to the other design basis wind speed characteristics developed for the Unit 2 and 3 site area.

2.7.4 LOCAL METEOROLOGY

Data acquired by the NWS at its Columbia, South Carolina, first-order station and from 13 other nearby locations in its network of cooperative observer stations, as compiled and summarized by the NCDC and the Southeast Regional Climate Center, are used to characterize normals, and period-of-record means and extremes of temperature, rainfall, and snowfall in the vicinity of the site for Units 2 and 3. Subsection 2.7.1.1 identifies the sources of these climatological summaries and other data resources. The approximate distances and directions of these climatological observing stations relative to the site are listed in Table 2.7-1; their locations are shown in Figure 2.7-1.

As indicated in Subsection 2.7.1.1, first-order NWS stations also record measurements, typically every hour, of other weather elements including winds, relative humidity, dew point and wet bulb temperatures, barometric pressure, and other observations when those conditions occur (*e.g.*, fog, thunderstorms).

Besides using data from these nearby climatological observing stations, measurements from the tower-mounted meteorological monitoring system that currently supports the operation of Unit 1 is also used to characterize dispersion conditions in support of this COL Application for Units 2 and 3. Refer to Subsection 6.4.2 for a discussion of relevant details about this preoperational monitoring program, including: tower location; terrain features and elevations at the existing tower and in the vicinity of Units 2 and 3; instrumentation and measurement levels; data recording and processing; and system operation, maintenance, and calibration activities.

Subsection 6.4.2.5 addresses whether the measurements from the Unit 1 monitoring program are representative of dispersion conditions at and near the site for Units 2 and 3 considering that the Unit 1 meteorological tower is situated about 190 feet from the southern shore of the Monticello Reservoir and that Units 2 and 3 are located about a mile farther inland. An evaluation of the potential influence that the reservoir may have on dispersion-related measurements and calculations concluded that dispersion-related effects attributable to airflow off the reservoir occur only a small percentage of the time during the year such that the data from the Unit 1 monitoring program is considered to be representative of dispersion conditions applicable to Units 2 and 3.

2.7.4.1 Normal, Mean, and Extreme Values

Subsection 2.7.1.3 summarizes normals and period-of-record means and extremes for several standard weather elements (*i.e.*, temperature, atmospheric water vapor, precipitation, and wind conditions).

To substantiate that mean and extreme values at these stations, based on their long-term records of observations, are representative of conditions that might be expected at the site for Units 2 and 3, this subsection provides additional details regarding the individual station records from which the values presented in Subsection 2.7.1.3 were obtained.

Historical extremes of temperature, rainfall, and snowfall are listed in Table 2.7-5 for the 14 NWS and cooperative observing stations in the Unit 2 and 3 site area.

2.7.4.1.1 Temperature

Characteristics of the normal daily maximum and minimum temperatures, the daily mean temperatures, and the diurnal temperature ranges for the 12 nearby climatological observing stations that make such measurements are discussed in Subsection 2.7.1.3.1 and presented in Table 2.7-3. The overall maximum and minimum temperature extremes observed in the VCSNS site area are summarized in Subsection 2.7.1.3.1 as well.

Extreme maximum temperatures recorded in the vicinity of the site for Units 2 and 3 have ranged from 106°F to 111°F, with the highest reading observed at the Camden 3W cooperative station on June 28, 1954. The station record high temperature for the Columbia, South Carolina, NWS station (*i.e.*, 107°F) has been reached on five separate occasions; three times within a period of seven days in July 1952. As Table 2.7-5 and the accompanying notes show, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (*e.g.*, Winnsboro, Camden 3W, Kershaw 2SW, and Columbia on June 27 and 28, 1954; Columbia, Newberry, Chester 1NW, and Parr on August 21 and 22, 1983; Little Mountain and Columbia July 23 and 24, 1952; and Columbia and Santuck on July 29, 1952 (NCDC 2005b, SERCC 2007).

Extreme minimum temperatures in the vicinity of the site for Units 2 and 3 have ranged from –1°F to –5°F, with the lowest reading on record observed at the Chester 1NW cooperative station on December 13, 1962. Station record low temperatures were also set at Parr and Winnsboro on December 12 and 13, 1962. More noteworthy, though, Table 2.7-5 and the accompanying notes indicate that record low temperatures were established at 10 of the nearby cooperative observing stations on January 21 and 22, 1985 (NCDC 2005b, SERCC 2007).

The extreme maximum and minimum temperature data indicates that synoptic-scale conditions responsible for periods of record-setting excessive heat as well as significant cold air outbreaks tend to affect the overall VCSNS site area. The similarity of the respective extremes and their dates of occurrence suggests that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the site for Units 2 and 3.

2.7.4.1.2 Atmospheric Water Vapor

Annual, seasonal, and monthly characteristics of the wet bulb and dew point temperatures, along with relative humidity (including diurnal variations), based on measurements at the nearby Columbia, South Carolina, NWS station, are discussed in Subsection 2.7.1.3.2.

2.7.4.1.3 Precipitation

Characteristics of the normal annual rainfall and snowfall totals for the 14 nearby climatological observing stations, listed in Table 2.7-1, are discussed in Subsection 2.7.1.3.3 and presented in Table 2.7-3. The overall maximum daily and monthly totals observed in the VCSNS site area for these forms of precipitation are summarized in Subsection 2.7.1.3.3 as well.

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm event, or daily or cumulative monthly totals, typically vary from station to station. Assessing the variability of precipitation extremes over the site area, in an effort to evaluate whether the available long-term data is representative of conditions at the site for Unit 2 and 3, is largely dependent on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.7-5 for these same 14 observing stations. Maximum recorded 24-hour rainfall totals range from 5.79 inches at the Columbia, South Carolina, NWS station, about 26 miles south-southeast of the site for Units 2 and 3, to 10.42 inches at the Newberry cooperative observing station about 18 miles to the west (NCDC 2005b, 2002d, SERCC 2007). Maximum monthly rainfall totals range from 12.00 inches at Blair, about 10 miles to the north-northwest, to 18.55 inches at the Kershaw 2SW observing station about 44 miles to the east-northeast (NCDC 2005b, 2002d, 2006; SERCC 2007).

As indicated in Subsection 2.7.3.5, most of the individual station 24-hour rainfall records (and to a lesser extent the monthly record totals) were established as a result of precipitation associated with tropical cyclones that passed within 100 nautical miles of the site for Units 2 and 3. However, the overall highest 24-hour rainfall total in the site area—10.42 inches (see above), recorded on August 18, 1986 (NCDC 2005b; SERCC 2007)—was not directly associated with a tropical cyclone, although the region was generally unsettled as Tropical Storm Charley had formed well off the South Carolina coast moving to the northeast only a few days earlier (NCDC 2004).

Similarly, the overall highest monthly rainfall total in the site area—18.55 inches at the Kershaw 2SW station (see above), recorded during August 1952 (SERCC 2007, NCDC 2002d)—represents the accumulation of 13 days of measurable precipitation during that month (NCDC 2002d) with less than 25% of that total attributable to Hurricane (later Tropical Storm) Able, which passed through South Carolina on August 30 and 31 (see Subsection 2.7.3.5).

When a 24-hour rainfall record was established at a given observing station, significant amounts of rain were frequently measured at other stations in the site area on the same date (NCDC 2002d), particularly when associated with the passage of a tropical cyclone. Greater variability among concurrent 24-hour station totals is seen for station records associated with more local-scale events such as thunderstorms. Monthly station rainfall totals concurrent with individual station monthly records are generally more variable (NCDC 2002d) primarily because of the length of time and varying synoptic conditions over the time interval that these totals are accumulated.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in the Piedmont of South Carolina, storms that produce large amounts of snow occur only occasionally. Among the 14 nearby observing stations listed in Table 2.7-5, six of the 24-hour maximum snowfall records were established as a result of the storm on February 10, 1973, the highest—14.0 inches—being measured at the Johnston 4SW cooperative observing station about 46 miles to the southwest of the site for Units 2 and 3. Other station records on this date range from 7.5 inches at Parr, about 1 mile to the southwest, to 12.3 inches at the Columbia, South Carolina, NWS station (NCDC 2005b, SERCC 2007).

Record 24-hour snowfall totals, greater than or equal to 10 inches, on other dates include:

- 13.5 inches at the Catawba observing station on February 27, 2004, about 45 miles to the north-northeast of the site for Units 2 and 3 (SERCC 2007, NCDC 2006)
- 12.0 inches at both the Kershaw 2SW station on December 12, 1958 and the Blair observing station on February 26, 1969 (SERCC 2007, NCDC 2002d)
- 10.0 inches at the Little Mountain observing station on December 11, 1958, about 8 miles to the southwest of the site (SERCC 2007, NCDC 2002d)

Seven of the maximum monthly snowfall totals in the VCSNS site area were also due to the early February 1973 storm, ranging from 7.5 inches at the Parr observing station to 16.0 inches at the Columbia, South Carolina, NWS station (NCDC 2005b, 2002d; SERCC 2007). However, the overall highest monthly snowfall total (*i.e.*, 16.5 inches) was recorded in March 1960 at the Chester 1NW station, about 30 miles to the north of the site for Units 2 and 3 as a result of two smaller snow events—the first occurring on March 2 and 3, and the second on March 9 and 11 (SERCC 2007, NCDC 2002d). Monthly snowfall totals ranging from 3.2 to 10.0 inches were measured during March 1960 at 10 of the other cooperative observing stations in the VCSNS site area; three of the 14 stations did not record snowfall during that month (NCDC 2002d).

Based on the maximum 24-hour and monthly precipitation totals recorded among these 14 climatological observing stations in the VCSNS site area and, more importantly, the areal distribution of these stations around the site, the data suggests that these statistics are reasonably representative of the extremes of rainfall and snowfall that might be expected to be observed at the site for Units 2 and 3.

2.7.4.1.4 Fog

The closest station to the site for Units 2 and 3 at which observations of fog are made and routinely recorded is the Columbia, South Carolina, NWS station about 26 miles to the south-southeast. The 2004 local climatological data summary for this station (Table 2.7-2) indicates an average of about 26 days per year of heavy fog conditions, based on a 56-year period of record. The NWS defines heavy fog as fog that reduces visibility to 1/4 mile or less. (NCDC 2005a)

On a seasonal basis, heavy fog conditions occur most often during the autumn and winter months, reaching a peak frequency in November and December, averaging about three days per month. Heavy fog conditions occur least often from mid-spring to early summer (*i.e.*, April to June), averaging less than 1.5 days per month (NCDC 2005a).

The frequency of heavy fog conditions at the site for Units 2 and 3 would be expected to be somewhat greater than at Columbia, South Carolina, because of the site's nearness to the Monticello and Parr Reservoirs, its location near the Broad River, and gradually increasing elevations towards the northwest. This is consistent with the higher frequency of occurrence reported in *The Climate Atlas of the United States* which indicates an annual average frequency of 31 to 35 days per year in the area that includes the VCSNS site and a lower annual frequency of 26 to 30 days in the area that includes Columbia, South Carolina. The seasonal variation is similar to that in the 2004 local climatological data for the Columbia NWS station, although peak months are December and January (NCDC 2002c).

Enhancement of naturally occurring fog conditions because of operation of the mechanical draft cooling towers associated with Units 2 and 3 is addressed in Subsection 5.3.3.1.

2.7.4.2 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macroscales and synoptic scales (*i.e.*, on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macroscale and by large-scale topographic features (*e.g.*, mountain ranges). These characteristics are addressed in Subsections 2.7.1.2 and 2.7.1.3.4.

Site-specific or microscale (*i.e.*, on the order of 2 kilometers or less) wind conditions, while they may reflect these larger-scale circulation effects, are influenced primarily by local and, to a lesser extent (in general), by mesoscale or regional-scale (*i.e.*, up to about 200 kilometers), topographic features. Wind measurements at these smaller scales are currently available from the meteorological monitoring program operated in support of Unit 1 and, for comparison, from data recorded at the nearby Columbia, South Carolina, NWS station.

Section 6.4 includes a summary description of the preoperational monitoring program that provides the onsite meteorological data used in this COL Application. Wind direction and wind speed measurements were made at two levels on a 61-meter instrumented tower (*i.e.*, the lower level at 10 meters and the upper level at 61 meters). A tower replacement and upgrade occurred during the three-year period over which these onsite measurements were made (see Subsection 6.4.2 for details).

Figures 2.7-2 through 2.7-6 present annual and seasonal wind rose plots (*i.e.*, graphical distributions of the direction from which the wind is blowing and wind speeds for each of sixteen, 22.5° compass sectors centered on north, north-northeast, northeast, etc.) for the 10-meter level based on measurements over a period of 3 consecutive annual cycles from July 1, 2003 through June 30, 2006.

The wind direction distribution at the 10-meter level generally follows a southwest-northeast orientation annually (see Figure 2.7-2). The prevailing wind (*i.e.*, defined as the direction from which the wind blows most often) is from the southwest, with about 40% of the winds blowing from the south-southwest through west sectors. Conversely, winds from the north-northeast through east-southeast sectors occur about 20% of the time.

Seasonally, winds from the southwest quadrant predominate during the spring and summer months (see Figures 2.7-4 and 2.7-5). This is also the case during the winter, although westerly winds prevail and the relative frequency of west-northwest winds during this season is greater (see Figure 2.7-3) because of increased cold frontal passages. Winds from the northeast quadrant predominate during the autumn months (see Figure 2.7-6). Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.7-7 (Sheets 1 to 12).

Wind rose plots based on measurements at the 61-meter level are shown in Figures 2.7-8 through 2.7-13. By comparison, wind direction distributions for the 61-meter level are fairly similar to the 10-meter level wind roses on composite annual and seasonal bases in terms of the predominant directional quadrants and variation over the course of the year. Prevailing winds differ between the two levels by one adjacent direction sector, generally veering (*i.e.,* turning clockwise) with height as might be expected. Plots of individual monthly wind roses at the 61-meter measurement level are presented in Figure 2.7-13 (Sheets 1 to 12).

Wind information summarized in the local climatological data for the Columbia, South Carolina, NWS station (see Table 2.7-2) indicates a prevailing west-southwesterly wind direction annually (NCDC 2005a). Subsection 2.7.1.3.4 discusses the variation of the prevailing winds at this station throughout the year and their relationship to regional-scale influences. Differences between the two wind direction distributions are attributable to many factors (*e.g.*, topographic setting, sensor exposure, instrument threshold and accuracy, length of record). Nevertheless, these large-scale circulation effects are evident in the 10-meter level wind flow at the VCSNS site.

Table 2.7-6 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the meteorological tower operated in support of Unit 1 over the three-year period of record from July 1, 2003 through June 30, 2006, and from wind instrumentation at the Columbia, South Carolina, NWS station based on a 49-year period of record (NCDC 2005a). The elevation of the wind instruments at the Columbia NWS station is nominally 20 feet (about 6.1 meters) (NCDC 2005a), comparable to the lower (10-meter) level measurements at the VCSNS site.

Annually, mean wind speeds at the 10- and 61-meter levels are 3.2 and 4.6 meters per second, respectively, at the VCSNS site. The annual mean wind speed at Columbia (*i.e.*, 3.0 meters per second) is similar to the 10-meter level at the VCSNS site, differing by only 0.2 meter per second. Seasonal average wind speeds at Columbia are similar throughout the year except during autumn when speeds are about 0.8 meter per second lower than at the VCSNS site. Seasonal mean wind speeds for both locations follow the same pattern discussed in Subsection 2.7.2.3 in relation to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

There was only one occurrence of calm wind conditions recorded by the meteorological monitoring system for Unit 1 over the three-year period from July 1, 2003, through June 30, 2006, and that for the 61-meter level. Minimal incidence of calm conditions can be attributed to the very low measurement threshold of the sonic anemometers that were in place over this three-year period of record (see Subsection 6.4.2).

2.7.4.3 Wind Direction Persistence

Wind direction persistence is a relative indicator of the duration of atmospheric transport from a specific sector-width to a corresponding downwind sector-width that is 180° opposite. Atmospheric dilution is directly proportional to the wind speed (other factors remaining constant). When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relatively more or less dilution potential (*i.e.*, higher or lower wind speeds, respectively) associated with a given transport wind direction.

Tables 2.7-7 and 2.7-8 present wind direction persistence/wind speed distributions based on measurements from the Unit 1 monitoring program for over a period of 3 consecutive years from July 1, 2003 through June 30, 2006. The distributions account for durations ranging from 1 to 48 hours for wind directions from 22.5° upwind sectors centered on each of the 16 standard compass radials (*i.e.*, north, north-northeast, northeast, etc.) and for wind speed groups greater than or equal to 5, 10, 15, 20, 25, and 30 mph. Distributions are provided for wind measurements made at the lower (10-meter) and the upper (61-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is 30 hours for winds from the northeast sector. This duration appears only in the lowest two wind speed groups (*i.e.*, for wind speeds greater than or equal to 5 and 10 mph). Persistence periods lasting for at least 18 hours are indicated for several direction sectors for wind speeds greater than or equal to 5 mph, including winds from the east-northeast, east, and south sectors; periods of 24 hours duration are also indicated from the west sector for this wind speed group. For wind speeds greater than or equal to 20 mph, maximum persistence is limited to four hours.

At the 61-meter level, the longest persistence period is 18 hours and occurs for winds from eight different direction sectors (see Table 2.7-8) for wind speeds greater than or equal to 5 mph, from six different sectors for wind speeds greater than or equal to 10 mph, and from two sectors (*i.e.*, east and west-southwest) for wind speeds greater than or equal to 15 mph. For wind speeds greater than or equal to 20 mph, maximum persistence periods are limited to eight hours with the exception of 12-hour duration periods for winds from the west sector.

2.7.4.4 Atmospheric Stability

Atmospheric stability is a relative indicator for the potential diffusion of pollutants released into the ambient air. Atmospheric stability, as discussed in this Environmental Report, was based on the vertical temperature difference ($\Delta\mathbf{T}$) method defined in Table 1 of Proposed Revision 1 to Regulatory Guide 1.23, *Meteorological Programs in Support of Nuclear Power Plants*, September 1980 (U.S. NRC 1980), and in Draft Regulatory Guide DG-1164, *Meteorological Monitoring Programs for Nuclear Power Plants*, Third Proposed Revision 1 to Regulatory Guide 1.23 (Safety Guide 23), October 2006 (DG-1164) (U.S. NRC 2006). These are the same numerical range limits in Table 1 of the recently promulgated Revision 1 to Regulatory Guide 1.23 (dated March 2007) (U.S. NRC 2007c) of the same name as DG-1164.

The approach classifies stability based on the temperature change with height (*i.e.*, the difference in °C per 100 meters, or $\Delta\mathbf{Z}$). Stability classifications are assigned according to the following criteria:

- Extremely Unstable (Class A): $\Delta\mathbf{T}/\Delta\mathbf{Z} \leq -1.9°C$
- Moderately Unstable (Class B): $-1.9°C < \Delta\mathbf{T}/\Delta\mathbf{Z} \leq -1.7°C$
- Slightly Unstable (Class C): $-1.7°C < \Delta\mathbf{T}/\Delta\mathbf{Z} \leq -1.5°C$
- Neutral Stability (Class D): $-1.5°C < \Delta\mathbf{T}/\Delta\mathbf{Z} \leq -0.5°C$
- Slightly Stable (Class E): $-0.5°C < \Delta\mathbf{T}/\Delta\mathbf{Z} \leq +1.5°C$
- Moderately Stable (Class F): $+1.5°C < \Delta\mathbf{T}/\Delta\mathbf{Z} \leq +4.0°C$
- Extremely Stable (Class G): $+4.0°C < \Delta\mathbf{T}/\Delta\mathbf{Z}$

The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral stability, and stable classifications.

Over the period of 3 consecutive annual cycles from July 1, 2003 through June 30, 2006 for the monitoring program operated in support of Unit 1, $\Delta\mathbf{T}$ was determined from the difference between temperature measurements made at the 61- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.7-9.

The data indicate a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, ranging from about 56% to 62% of the time for these stability classes combined. Extremely unstable conditions (Class A) are more frequent during the summer and occur least often during the winter months owing, in large part, to greater and lesser solar insolation, respectively, and relatively lower (summertime) and, generally, relatively higher (wintertime) mean wind speeds. Extremely and moderately stable conditions (Classes G and F, respectively) are most frequent during the winter (about 21% of the time), owing in part to increased radiational cooling at night, and occur least often during the summer months.

Joint frequency distributions of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-meter and 61-meter wind measurement levels are presented in Tables 2.7-10 and 2.7-11, respectively, based on the three-year period of record from July 1, 2003 through June 30, 2006 for the monitoring program operated in support of Unit 1. The 10-meter level joint frequency distributions are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Subsection 2.7.5) and long-term diffusion estimates of routine releases to the atmosphere (see Subsection 2.7.6).

2.7.4.5 Topographic Description and Potential Modifications

The site for Units 2 and 3 lies within the larger VCSNS site property that encompasses about 2,560 acres. The area for Units 2 and 3 covers about 870 acres, within which the PBA circle takes up about 32 acres. Section 2.1 and Subsection 2.2.1 provide additional details about the general site location.

The site for Units 2 and 3 is about one mile inland (to the south) of the southern shore of the Monticello Reservoir, and, at its closest approach, approximately 0.75 mile east of the Parr Reservoir along the Broad River. Unit 2 is located about 4,600 feet to the south-southwest of Unit 1; Unit 3 is situated about 900 feet south-southwest of Unit 2 (see Figure 2.1-1).

Terrain features within 50 miles of the site for Units 2 and 3, based on digital map elevations, are illustrated in Figure 2.7-14. Terrain elevation profiles along each of the sixteen standard 22.5° compass radials out to a distance of 50 miles from the site are shown in Figure 2.7-15 (Sheets 1 through 6). Because Units 2 and 3 are located relatively close to one another and because of the distance covered by these profiles, the locus of these radial lines is the center point between the Unit 2 and 3 shield buildings.

The nominal plant grade elevation for Units 2 and 3 is around 400 feet above MSL. Located within the Piedmont, terrain within 50 miles of the site for Units 2 and 3 is gently rolling to hilly with elevations decreasing to the east through the southeast beyond about 15 to 20 miles. Figure 2.7-14 indicates that the lowest elevation within 50 miles of the site, 80 feet above MSL (NAVD 88), is to the southeast near the confluence of the Congaree and Wateree Rivers above Lake Marion (see Figure 2.3-1).

Relief of up to about 300 feet is found along headings to the south-southwest through the west starting at distances of about 20 to 25 miles from the site for Units 2 and 3. Terrain elevations tend to increase to the west-northwest through to the north-northeast beyond about 20 miles from the site with relief of up to about 400 feet relative to nominal plant grade. Figure 2.7-14 indicates that the highest elevation within 50 miles of the site is 920 feet above MSL (NAVD 88). This spot elevation does not fall along one of the 16 standard direction radials presented in Figure 2.7-15.

More detailed topographic features within 5 miles of the site for Units 2 and 3, also based on digital map elevations, are shown in Figure 2.7-16. Terrain within this radial distance of the site primarily consists of gentle, low rolling hills with relief, relative to nominal plant grade, up to about 150 feet higher (towards the south-southwest), and to about 200 feet lower in a number of direction headings primarily due to the Broad River, which traverses this area from the north-northwest to the south-southeast (see Figure 2.7-16) and to the Little River (see Figure 2.3-1) along the eastern perimeter of this radial area. The closest topographic feature of note is the 6,800-acre Monticello Reservoir located about one mile to the north of the site as mentioned previously.

While there will be site clearing, grubbing, excavation, leveling, and landscaping activities associated with the construction of the new units (see Section 3.9), these alterations to the existing site terrain would be localized and will not represent a significant change to the gently rolling topographic character of the site vicinity or surrounding site area. Neither the mean and extreme climatological characteristics of the site area nor the meteorological characteristics of the site and vicinity would be affected as a result of plant construction. Potential impacts to air quality associated with construction activities are addressed in Subsection 4.4.1.3.

The dimensions and operating characteristics of the Units 2 and 3 and existing Unit 1 facilities and the associated paved, concrete, or other improved surfaces are considered to be insufficient to generate discernable, long-term effects to local- or microscale meteorological conditions.

Wind flow will be altered in areas immediately adjacent to and downwind of larger site structures. However, these effects will likely dissipate within ten structure heights downwind of the intervening structure(s). Similarly, while ambient temperatures immediately above any improved surfaces could increase, these temperature effects will be too limited in their vertical profile and horizontal extent to alter local-, let alone area- or regional-scale mean or extreme ambient temperature patterns.

Units 2 and 3 use mechanical draft cooling towers as a means of heat dissipation during normal operation (see Section 3.4). Potential meteorological effects due to the operation of these cooling towers could include enhanced ground-level fogging and icing, cloud shadowing and precipitation enhancement, and increased ground-level humidity. These effects and other potential related environmental impacts (*e.g.*, solids deposition, visible plume formation, transport and extent) are addressed in detail in Subsections 5.3.3.1 and 5.3.3.2.

2.7.5 SHORT-TERM DIFFUSION ESTIMATES

2.7.5.1 Basis

To evaluate potential health effects for AP1000 design basis accidents, Section 7.1 of NUREG-1555, *Environmental Standard Review Plan, Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, October 1999 (NUREG-1555) (U.S. NRC 1999), specifically requires the applicant to account for the 50 percentile X/Q (relative concentration) values at appropriate distances from the release points of effluents to the atmosphere. These 50 percentile X/Q values are to be determined using onsite meteorological data and represent more realistic dispersion conditions for the Unit 2 and 3 site vicinity and area.

The NRC-sponsored PAVAN model (NUREG/CR-2858, *PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations*, PNL-4413, November 1982 [NUREG/CR-2858]) (U.S. NRC 1982b) has been used to generate these 50 percentile X/Q values.

Recent data from the Unit 1 meteorological monitoring program, for a period of three consecutive annual cycles from July 1, 2003 through June 30, 2006, has been used for the quantitative evaluation of a hypothetical accident at the Unit 2 and 3 site. The use of a recent three-year data set for dispersion analyses involving accidental releases satisfies the requirement of Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Power Stations*, Rev. 2, April 1998 (Regulatory Guide 4.7) (U.S. NRC 1998).

The PAVAN program implements the guidance provided in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Rev. 1, November 1982 (Reissued February 1983) (Regulatory Guide 1.145) (U.S. NRC 1983). Mainly, the code computes X/Q values at the exclusion area boundary (EAB) and the boundary of the low population zone (LPZ) for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (*i.e.*, north, north-northeast, northeast, etc.). The X/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector (*i.e.*, 180° opposite). The X/Q values are also ranked independently of wind direction into a cumulative frequency distribution for the entire site.

The following input data and assumptions were used in the PAVAN modeling analysis:

- Meteorological data: three-year (July 1, 2003 to June 30, 2006) composite onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability
- Wind sensor height: 10 meters

- Vertical temperature difference: (61 meters–10 meters)
- Number of wind speed categories: 11
- Type of release: Ground-level
- Release height: 10 meters (default height)
- Minimum building cross-sectional area: 2,636 square meters
- Shield building equivalent height: 60.9 meters
- Distances from release point to EAB: 805 meters, for all sectors
- Sector-specific distances from release point to LPZ boundary

The three-year composite joint frequency distributions of wind speed, wind direction, and atmospheric stability class, input to the PAVAN dispersion modeling analysis, are presented in Table 2.7-10 (see also Subsection 2.7.4.4 for additional information). The joint frequency distributions in Table 2.7-10 include 12 wind speed classes; however, only 11 were input to the model because there were no occurrences of winds greater than 18.0 meters per second. Similarly, there were no occurrences of calm wind conditions at the 10-meter measurement level during the three-year period of record to be distributed (see Subsection 2.7.4.2). Subsection 6.4.2 provides details regarding the meteorological monitoring program operated in support of Unit 1.

The EAB for Units 1, 2, and 3 is entirely contained within the site property line and is represented in Figure 2.1-1. No residential areas are located within this overall EAB. The LPZ boundary for Units 2 and 3 is the same as the LPZ boundary for Unit 1 and consists of the area within a 3-mile radius of Unit 1 (see Figure 2.5-1).

For the purpose of determining X/Qs input to subsequent radiation dose analyses, Units 2 and 3 were treated as being encompassed within an area referred to as the PBA circle. The PBA circle has a radius of 750 feet from a point centered between the two units — 450 feet (138 meters) from each unit's shield building. To ensure conservatism in the X/Q dispersion modeling, an accidental release was assumed to have occurred at any point on the PBA circle instead of occurring at the actual location of Unit 2 or Unit 3 (thus minimizing the travel distance for any direction sector). As a result, the estimated X/Qs and subsequent radiation doses are conservatively higher.

One of the downwind distances for estimating X/Qs is referred to as the *dose evaluation periphery* and is illustrated in Figure 2.7-17, along with the PBA circle. This dose evaluation periphery is a concentric circle around the PBA circle located at a distance equal to the minimum radial distance between the PBA circle and the actual site boundary/EAB (*i.e.*, 2,640 feet or 805 meters downwind). The distance to the dose evaluation periphery and site boundary/EAB is the same for the east-southeast clockwise through the west-northwest direction radials evaluated by the PAVAN model.

For the northwest clockwise through the east direction radials, the distance to the dose evaluation periphery is less than the distance between the PBA circle and the actual site boundary/EAB (see Figure 2.7-17). So, an additional level of conservatism (*i.e.*, due to a shorter travel distance) is reflected in the modeled X/Q values for these direction radials.

As NUREG/CR-2858 indicates, ground-level releases include all release points or areas that are lower than 2.5 times the height of adjacent solid structures. The tallest structures within the PBA circle are the Unit 2 and Unit 3 shield buildings with an elevation of 228 feet 9 inches (69.7 meters) above grade for the roof high point (Westinghouse 2007); for dispersion purposes, the equivalent structural height is 199.8 feet (60.9 meters). Because the AP1000 design does not include a plant stack, there will be no releases above the 2.5 times threshold height. Consequently, all accidental releases were assumed to be at ground level and were assigned the default release height of 10 meters. Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors due to less dilution from shorter traveling distances.

The PAVAN model was also configured to calculate X/Q values assuming both wake credit allowed and wake credit not allowed. Obstructions to airflow have a wake region that extends 10 times the obstruction height downwind. For a shield building, the structural wake extends about 1,998 feet (609 meters) downwind. The dose evaluation periphery is 2,640 feet (805 meters) away from the PBA circle in all directions. As a result, the entire dose evaluation periphery is located beyond the wake influence zone induced by either of the shield buildings. Furthermore, the LPZ boundary is a 3-mile (4,828-meter)-radius circle centered at the Unit 1 reactor building. Because the LPZ boundary is located beyond the dose evaluation periphery, the “wake credit not allowed” scenario of the PAVAN modeling results was used for the X/Q analyses at both the dose evaluation periphery and the LPZ boundary.

The distance between the dose evaluation periphery and the PBA circle (*i.e.*, 805 meters) for Units 2 and 3 was entered as the receptor distance for each downwind sector in calculating the X/Q values at the dose evaluation periphery. On the other hand, because the LPZ boundary is centered on Unit 1, the shortest distance between the PBA circle for Units 2 and 3 and the LPZ boundary was determined for all direction sectors; these distances are listed in Table 2.7-12. Each of these distances was input to the PAVAN model and evaluated as separate model runs with the same distance assigned to all 16 direction sectors within a given model run.

2.7.5.2 PAVAN Modeling Results

A relatively conservative approach was followed in determining the bounding 50 percentile X/Q value at the dose evaluation periphery. The highest 50 percentile value was selected from among the upper envelopes of the ordered distributions of sector-specific X/Q values, rather than the 50 percentile value taken from the upper envelope of the ordered 5% overall site limit X/Q values.

The bounding 50 percentile X/Q value at the dose evaluation periphery occurred for the north (downwind) sector. The upper envelope of the ordered distribution for this sector is shown in Table 2.7-13. The bounding 50 percentile X/Q for the dose evaluation periphery is estimated to be 7.65 x 10^{-5} sec/m^3.

A similarly conservative approach was used to determine the bounding 50 percentile X/Q value for the LPZ boundary by considering the results of the distance-specific, separate model runs discussed in the preceding subsection. The highest X/Q value was associated with the shortest distance between the PBA circle and the LPZ boundary (*i.e.*, 3,057 meters to the south-southwest), occurring for the north sector at that distance. The upper envelope of the ordered distribution, taken from the PAVAN modeling results, for that sector is shown in Table 2.7-14. The bounding 50-percentile X/Q at the LPZ boundary is estimated to be 1.37 x 10^{-5} sec/m^3.

These model-predicted X/Q values represent a 0- to 2-hour time interval with no credit taken for building wake effects as indicated previously. To estimate X/Qs for longer time intervals, the program calculates sector-dependent and overall site limit annual average X/Q values using the procedure described in NUREG/CR-2858. The values for intermediate time periods (*i.e.*, 8 hours, 16 hours, 72 hours, and 624 hours) were determined by logarithmic interpolation between the 50 percentile, 0- to 2-hour X/Qs at the dose evaluation periphery and the LPZ boundary, and the corresponding annual average X/Qs.

Annual average X/Q values were chosen as the end point for the interpolation. The annual average X/Q used for the dose evaluation periphery was a sector-dependent value for the east (downwind) sector. This corresponds to the sector associated with the limiting, safety-related, 0.5% X/Q value. The highest annual average X/Q at the LPZ boundary was an overall site limit value. These results, along with the 50 percentile, 0- to 2-hour and the annual average X/Q values, are summarized below.

Summary of Interpolated X/Q Values for Intermediate Time Periods

Source Location	Receptor Distance	50 Percentile 0–2 hr	0-8 hours (8 hours)	8-24 hour (16 hours)	1–4 days (72 hours)	4-30 days (624 hours)	Annual Average
PBA Circle	Dose Evaluation Periphery	7.65E-05	6.45E-05	5.92E-05	4.93E-05	3.78E-05	2.73E-05
PBA Circle	LPZ Boundary	1.37E-05	9.63E-06	8.07E-06	5.50E-06	3.17E-06	1.62E-06

The PAVAN modeling results presented in Subsection 2.7.5.2 meet the requirement in DCD Tier 2, Subsection 2.3.6.4 with regard to supporting the assessment of the postulated impact of an accident on the environment.

2.7.6 LONG-TERM (ROUTINE) DIFFUSION ESTIMATES

2.7.6.1 Basis

The NRC-sponsored XOQDOQ computer program (NUREG/CR-2919, *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, PNL-4380, September 1982 [NUREG/CR-2919]) (U.S. NRC 1982a), was used to estimate X/Q values due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average X/Q values and annual average relative deposition (*D*/Q) values at receptors of interest (*e.g.*, the EAB, the nearest milk cow, residence, garden, meat animal). X/Q and *D*/Q values due to intermittent releases, which occur during routine operation, may also be evaluated using the XOQDOQ model.

The XOQDOQ dispersion model implements the assumptions outlined in Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*, Rev. 1, July 1977 (U.S. NRC 1977). The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

The following input data and assumptions were used in the XOQDOQ modeling analysis:

- Meteorological data: three-year (July 1, 2003 to June 30, 2006) composite onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Wind sensor height: 10 meters
- Vertical temperature difference: (61 meters–10 meters)
- Number of wind speed categories: 11
- Type of release: Ground level
- Release height: 10 meters (default height)
- Minimum building cross-sectional area: 2,636 square meters
- Shield building equivalent height: 60.9 meters (see below)
- Distances from the release point to the nearest meat animal, milk animal, residence, vegetable garden, site boundary (dose evaluation periphery), and nearby reactor (see Table 2.7-15)

The XOQDOQ and PAVAN dispersion models use the same meteorological data summary (*i.e.*, 10-meter wind level joint frequency distributions). The characteristics of this data have been described previously in Subsection 2.7.5.1 including the number of wind speed classes input to the model (*i.e.*, 11) in relation to the number of wind speed classes in the joint frequency distribution (*i.e.*, 12), and the absence of calm wind conditions at the 10-meter level during the three-year period of record used in the analyses.

The AP1000 reactor design has been used to calculate the minimum building cross-sectional area, a required input to the model, as called for in NUREG/CR-2919. The shield building is a tapered-shape structure of smaller area at the top. The height of the Unit 2 and Unit 3 shield buildings is about 228 feet 9 inches (69.7 meters) above grade (Westinghouse 2007). Because of the shape of the shield building, the midpoint between the roof high point (*i.e.*, 69.7 meters) and the point at which the building begins to taper (*i.e.*, 170.84 feet or 52.1 meters) was used as the equivalent structural height in determining the building cross-sectional area. This midpoint has a height of 199.8 feet (60.9 meters). The resulting cross-sectional area was determined by multiplying the calculated equivalent height by the diameter of the shield building (142 feet or 43.3 meters) (Westinghouse 2007).

Compared to an elevated release, a ground-level release usually results in higher concentrations at downwind receptors located at ground level due to less dilution from shorter traveling distances. Consequently, as a conservative approach, only ground-level releases were assumed in the XOQDOQ modeling analysis.

Potential releases were assumed to occur at any point on the PBA circle as a conservative approach to minimizing the travel distance of any release to all receptors of interest (with one exception as noted below). Distances from a potential release point to the nearest meat animal, milk animal, residence, vegetable garden, and dose evaluation periphery, in each of the 16, 22.5° compass sectors (*i.e.*, north, north-northeast, northeast, etc.), are listed in Table 2.7-15.

The downwind distance from the PBA circle to the dose evaluation periphery is 0.5 mile (805 meters) and is discussed in Subsection 2.7.5.1 and illustrated in Figure 2.7-17. The distance between this dose evaluation periphery and the PBA circle is uniform in all directions. Distances and directions to other sensitive receptors (*i.e.*, meat animals, milk animals, residences, and vegetable gardens) considered as part of Unit 1 operations were adjusted in relation to the PBA circle for Units 2 and 3 because location information was relative to existing Unit 1. These adjusted receptor distances and directions are reflected in the respective entries in Table 2.7-15.

One other set of receptors of interest was identified in order to estimate X/Q and *D*/Q values at Unit 3 with the primary release point being located at Unit 2. This scenario was considered in order to evaluate the impact on Unit 3 when Unit 2 is operational and Unit 3 is still under construction. Because of the relative orientation of the two units, only three sectors were considered.

2.7.6.2 XOQDOQ Modeling Results

Among all of the modeled receptors of interest, the overall maximum annual average X/Q value, 8.5 x 10^{-6} sec/m^3 (no decay, undepleted), occurred at Unit 3 due to an assumed routine release from Unit 2, as discussed above. The maximum annual average X/Q values (along with the downwind sectors and corresponding receptor distances relative to the PBA circle) for the other sensitive receptor types are:

- 4.7 x 10^{-6} sec/m^3 at the dose evaluation periphery in the northeast sector at a receptor distance of 0.50 mile (805 meters)
- 1.0 x 10^{-6} sec/m^3 for the nearest residence in the east sector at a receptor distance of 1.23 miles (1,978 meters)
- 5.4 x 10^{-7} sec/m^3 for the nearest meat animal in the northeast sector at a receptor distance of 2.14 miles (3,436 meters)
- 3.5 x 10^{-8} sec/m^3 for the nearest milk animal in the west sector at a receptor distance of 4.74 miles (7,625 meters)
- 1.0 x 10^{-6} sec/m^3 for the nearest vegetable garden receptor in the east sector at a receptor distance of 1.23 miles (1,978 meters)

Table 2.7-16 summarizes the maximum X/Q and *D*/Q values estimated by the XOQDOQ dispersion model for various radioactive decay and plume depletion scenarios at sensitive receptors of interest around the VCSNS site. Table 2.7-17 presents annual average X/Q and *D*/Q values for the northeast sector at the 22 standard radial distances between 0.25 and 50 miles downwind and for the model's 10 standard distance-segment boundaries between 0.5 and 50 miles downwind. Among the 16, 22.5° compass sectors (centered on north, north-northeast, northeast, etc.) that are evaluated by the model, the results for the northeast sector are provided in Table 2.7-17 because the highest relative concentrations and relative deposition values occur within that sector at all downwind distances.

Detailed annual average X/Q and *D*/Q estimates generated by the XOQDOQ model for the receptors of interest, at the 22 standard radial distances, and for the 10 standard distance-segment boundaries, are also provided in Tables 2.7-18 through 2.7-26.

Table 2.7-18 presents X/Q and *D*/Q estimates at all of the modeled receptors of interest identified in Table 2.7-15. Tables 2.7-19 and 2.7-20 list X/Q estimates with no radioactive decay and no plume depletion for each of the 16 22.5° compass sectors at the 22 standard radial distances and for the 10 standard distance-segment boundaries, respectively. Tables 2.7-21 and 2.7-22 contain X/Q estimates that include radioactive decay with a half-life of 2.26 days for short-lived noble gases and no plume depletion. Tables 2.7-23 and 2.7-24 show X/Q estimates that include radioactive decay with a half-life of eight days for all iodines released to the atmosphere, as well as incorporation of plume depletion. Finally, Tables 2.7-25 and 2.7-26 list modeled estimates of long-term average relative deposition at the 22 standard radial distances and for the 10 standard distance-segment boundaries, respectively.

The XOQDOQ modeling results presented in Subsection 2.7.6.2 meet the requirement in DCD Tier 2, Subsection 2.3.6.5 with regards to environmental assessment by providing estimates of annual average X/Q values for 16 radial sectors to a distance of 50 miles from the plant. Note, however, that the maximum annual average X/Q value at the dose evaluation periphery, presented above, is a direct counterpart to the “Site Boundary (annual average)” Atmospheric Dispersion Factor in DCD Tier 1, Table 5.0-1 and to the “Site Boundary (annual average)” Atmospheric Dispersion Value in DCD Tier 2, Table 2-1.

2.7.7 NOISE

The only sources of man-made noise at the Units 2 and 3 location are railroad operations approximately 1 mile to the west, Unit 1 operations approximately 1 mile north, and occasional noise (during times of peak electrical demand) from the Parr Combustion Turbines 1.4 miles to the south-southeast. Railroad operations are subject to federal noise regulations. Moving locomotives are required to operate at less than 90 decibels and railcar noise should not exceed 93 decibels (40 CFR 201.12 and 201.13).

SCE&G does not have noise measurements for the VCSNS site. Sources of noise from Unit 1 include transformers and other electrical equipment, circulating water pumps, steam blowdown, and the public address system. However, noises generated by Unit 1 operations are mitigated by the undeveloped land surrounding the plant and the distance to the Units 2 and 3 project and to the site boundary (also approximately one mile). Also, most equipment is located within the plant buildings, which serves to dampen noises. These noise sources are sufficiently distant from the Units 2 and 3 site and the VCSNS site boundary that the noise generated diminishes to near ambient levels before reaching receptors outside the Unit 1 site boundary.

NRC considered noise impacts when reviewing the license renewal application for Unit 1. NRC stated in Supplement 15 to the Generic Environmental Impact Statement (U.S. NRC 2004) for license renewal that noise from the plant was “generally not an issue because the actual facilities are within exclusion and buffer zone and front the reservoir.” However, because the plant fronts the Monticello Reservoir, recreational boaters may be within a distance that noise from operations could be heard.

In the absence of VCSNS noise data, SCE&G reviewed the noise determinations made by NRC with regard to similar nuclear power plants (*i.e.*, those using a cooling lake or other body of water, operating water pumps, and without cooling towers). These NRC determinations are discussed below.

NRC's determination regarding operations noise near the Point Beach Nuclear Plant was, "Noise from operations at the PBNP site is barely noticeable, except very close to the reactor containment buildings…no noise from normal plant operations reaches the residential areas around the town of Two Creeks." (U.S. NRC 2005). Two Creeks is approximately one mile from the plant.

During a license renewal application review, NRC assessed noise levels at the North Anna Power Station in rural Louisa County, Virginia. NRC stated that "Noise from plant operations is not noticeable. The exception is boiler blowdown, which lasts for only a short time" (U.S. NRC 2002a).

NRC also reviewed noise levels at the Surry Power Station located on the James River in Virginia and stated, "There is no noise other than from minimal onsite traffic and from materials-handling and construction equipment, when these are in use" (U.S. NRC 2002b).

SCE&G assumes that the noise from Unit 1 is not greater than the normal operations noise occurring at these other nuclear power plants. From NRC's statements that "noise is not noticeable" and "no noise," the noise level emitting from the plant sites appear to not be above background. Background or ambient sound levels at VCSNS with its rural setting would compare to the ambient sound level of a quiet wilderness area, 20 to 30 decibels, or farm, 44 decibels (U.S. EPA 1974). The exception could be when the public address system is used and warning sirens are tested, which are both very short-lived occurrences. Also, just as NRC indicated for the North Anna plant, the blowdown of steam from the relief valves at VCSNS would generate louder noises, but for a short period of time.

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Table 2.7-1
NWS and Cooperative Observing Stations Near the Site for Units 2 and 3

Station[a]	County	Climate Division	Approximate Distance (miles)	Direction Relative to Site	Elevation (feet)
Parr	Fairfield	3	1	SW	258
Little Mountain	Newberry	5	8	SW	711
Blair	Fairfield	3	10	NNW	280
Winnsboro	Fairfield	3	14	ENE	560
Newberry	Newberry	5	18	W	476
Columbia Metro Airport (WSFO)	Lexington	6	26	SSE	213
Santuck	Union	2	26	NNW	520
Chester 1NW	Chester	3	30	N	520
Saluda	Saluda	5	32	SW	480
Camden 3W	Kershaw	3	38	E	140
Pelion 4NW	Lexington	6	39	S	450
Kershaw 2SW	Lancaster	3	44	ENE	500
Catawba	York	3	45	NNE	560
Johnston 4SW	Edgefield	5	46	SW	620

a) Numeric and letter designators following a station name (*e.g.*, Chester 1NW) indicate the station's approximate distance in miles (*e.g.*, 1) and direction (*e.g.*, northwest) relative to the place name (*e.g.*, Chester).

Table 2.7-2
Local Climatological Data Summary for Columbia, South Carolina

NORMALS, MEANS, AND EXTREMES

COLUMBIA, SC (CAE)

LATITUDE: 33° 56′ 31″ N LONGITUDE: 81° 07′ 05″ W ELEVATION (FT): GRND: 240 BARO: 243 TIME ZONE: EASTERN (UTC + 5) WBAN: 13883

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	55.1	59.5	67.4	75.7	83.1	89.1	92.1	90.0	84.8	75.8	66.7	57.8	74.8
	MEAN DAILY MAXIMUM	57	56.3	60.3	67.5	76.5	83.9	89.5	92.3	90.6	85.2	76.4	67.1	58.3	75.3
	HIGHEST DAILY MAXIMUM	57	84	84	91	94	101	107	107	107	101	101	90	83	107
	YEAR OF OCCURRENCE		1975	1997	1974	1986	2000	1954	1952	1983	1954	1954	1961	1978	AUG 1983
	MEAN OF EXTREME MAXS.	57	74.2	77.3	84.0	89.8	94.0	98.7	99.7	98.5	94.7	88.2	81.5	75.6	88.0
	NORMAL DAILY MINIMUM	30	34.0	36.3	43.5	50.7	60.0	67.9	71.8	70.6	64.6	51.5	42.6	36.1	52.5
	MEAN DAILY MINIMUM	57	33.6	35.8	42.3	50.2	59.3	66.8	70.7	69.6	63.6	50.8	41.4	34.9	51.6
	LOWEST DAILY MINIMUM	57	-1	5	4	26	34	44	54	53	40	23	12	4	-1
	YEAR OF OCCURRENCE		1985	1973	1980	1983	1963	1984	1951	1969	1967	1952	1970	1958	JAN 1985
	MEAN OF EXTREME MINS.	57	16.6	19.7	25.0	33.1	43.5	54.8	62.7	60.7	49.3	33.9	24.5	18.0	36.8
	NORMAL DRY BULB	30	44.6	47.9	55.4	63.2	71.6	78.5	82.0	80.3	74.7	63.7	54.7	47.0	63.6
	MEAN DRY BULB	57	45.0	47.9	55.0	63.5	71.7	78.1	81.5	80.2	74.5	63.8	54.3	46.6	63.5
	MEAN WET BULB	21	40.1	43.6	49.0	55.2	63.7	70.3	73.5	72.4	67.4	57.8	49.8	41.7	57.0
	MEAN DEW POINT	21	33.2	36.5	41.6	47.9	58.1	66.2	69.9	69.2	63.6	53.5	44.6	35.4	51.6
	NORMAL NO. DAYS WITH:														
	MAXIMUM ≥ 90°	30	0.0	0.0	0.1	1.6	6.2	15.8	22.9	18.1	8.9	0.6	0.0	0.0	74.2
	MAXIMUM ≤ 32°	30	0.4	0.2	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7
	MINIMUM ≤ 32°	30	15.5	12.0	5.7	1.0	0.0	0.0	0.0	0.0	0.0	0.8	7.0	13.6	55.6
	MINIMUM ≤ 0°	30	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	628	485	321	131	23	0	0	0	8	121	325	552	2594
	NORMAL COOLING DEG. DAYS	30	2	4	20	69	211	390	519	467	296	76	15	5	2074
RH	NORMAL (PERCENT)	30	70	66	65	62	68	70	72	76	75	73	73	71	70
	HOUR 01 LST	30	78	77	77	77	83	85	86	89	89	88	85	81	83
	HOUR 07 LST	30	83	82	84	84	85	86	88	92	92	90	89	84	87
	HOUR 13 LST	30	55	50	48	43	48	50	53	56	55	50	51	54	51
	HOUR 19 LST	30	65	58	54	50	56	61	65	69	72	73	71	69	64
S	PERCENT POSSIBLE SUNSHINE	45	55	59	64	70	68	67	66	66	64	67	63	59	64
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY≤1/4 MI)	56	2.7	2.4	1.8	1.3	1.4	1.4	1.6	2.3	2.6	2.6	2.9	2.9	25.9
	THUNDERSTORMS	57	0.9	1.5	2.5	3.6	6.1	9.4	12.3	9.4	3.7	1.4	0.9	0.4	52.1
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	1					2.4	4.0							
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR	1	2.0	4.0	5.0		12.0	8.0							
	PARTLY CLOUDY	1		2.0	3.0		5.0	8.0							
	CLOUDY	1	5.0	3.0	8.0		4.0	4.0							
PR	MEAN STATION PRESSURE(IN)	32	29.90	29.89	29.80	29.80	29.79	29.80	29.80	29.80	29.80	29.90	29.90	29.89	29.84
	MEAN SEA-LEVEL PRES. (IN)	19	30.13	30.12	30.06	30.00	30.00	29.99	30.03	30.02	30.03	30.10	30.13	30.15	30.06
WINDS	MEAN SPEED (MPH)	49	7.1	7.6	8.2	8.2	6.9	6.5	6.3	5.6	6.1	5.9	6.2	6.6	6.8
	PREVAIL.DIR(TENS OF DEGS)	33	24	24	25	24	24	24	23	23	03	03	27	25	24
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	9	36	38	45	44	47	47	39	48	35	29	33	41	48
	DIR. (TENS OF DEGS)		28	28	31	28	28	27	05	30	18	27	27	26	30
	YEAR OF OCCURRENCE		2000	2003	2000	1997	1999	2001	2002	2002	2004	2001	2004	2000	AUG 2002
	MAXIMUM 5-SECOND:														
	SPEED (MPH)	9	47	45	52	56	71	58	63	64	46	35	43	49	71
	DIR. (TENS OF DEGS)		27	27	26	25	36	27	03	29	18	27	33	26	36
	YEAR OF OCCURRENCE		2000	1999	1999	1997	1999	2000	2002	2002	2004	2003	1999	2000	MAY 1999
PRECIPITATION	NORMAL (IN)	30	4.66	3.84	4.59	2.98	3.17	4.99	5.54	5.41	3.94	2.89	2.88	3.38	48.27
	MAXIMUM MONTHLY (IN)	57	9.26	8.68	10.89	6.85	9.39	14.81	17.46	16.72	8.78	12.09	7.20	8.54	17.46
	YEAR OF OCCURRENCE		1978	1961	1973	1979	2002	1973	1991	1949	1953	1959	1957	1981	JUL 1991
	MINIMUM MONTHLY (IN)	57	0.84	0.87	0.56	0.29	0.29	0.49	0.57	0.22	0.07	T	0.41	0.32	T
	YEAR OF OCCURRENCE		1981	1976	1985	1994	1951	2002	1977	1997	1985	1963	1973	1955	OCT 1963
	MAXIMUM IN 24 HOURS (IN)	57	3.15	3.69	3.59	3.66	5.57	5.44	5.81	7.66	6.23	5.46	2.60	3.18	7.66
	YEAR OF OCCURRENCE		1993	1962	1960	1956	1967	1973	1959	1949	1953	1964	1986	1970	AUG 1949
	NORMAL NO. DAYS WITH:														
	PRECIPITATION ≥ 0.01	30	11.0	9.1	10.0	7.7	8.6	10.3	11.5	10.3	8.1	6.4	7.5	9.6	110.1
	PRECIPITATION ≥ 1.00	30	1.3	1.2	1.3	0.8	0.8	1.4	1.9	1.9	1.4	0.9	1.0	0.9	14.8
SNOWFALL	NORMAL (IN)	30	0.6	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.1	2.1
	MAXIMUM MONTHLY (IN)	56	4.3	16.0	4.1	T	T	0.0	0.0	T	0.0	0.0	T	9.1	16.0
	YEAR OF OCCURRENCE		1988	1973	1980	1992	2001			1993			1976	1958	FEB 1973
	MAXIMUM IN 24 HOURS (IN)	56	4.3	15.7	4.1	T	T	0.0	0.0	T	0.0	0.0	T	8.8	15.7
	YEAR OF OCCURRENCE		1988	1973	1980	1992	2001			1993			1976	1958	FEB 1973
	MAXIMUM SNOW DEPTH (IN)	55	4	14	4	0	0	0	0	0	0	0	0	8	14
	YEAR OF OCCURRENCE		2000	1973	1980									1958	FEB 1973
	NORMAL NO. DAYS WITH:														
	SNOWFALL ≥ 1.0	30	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4

published by: NCDC Asheville, NC 3

Source: NCDC 2005a

Table 2.7-3
Climatological Normals (Means) at Selected NWS and Cooperative Observing Stations in the Unit 2 and 3 Site Area

Station	Normal Annual Temperatures (°F)[a]			Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily Mean	Rainfall[a] (inches)	Snowfall[b] (inches)
Parr	74.6	48.7	61.6	45.75	2.0
Little Mountain	72.0	50.9	61.5	48.27	2.6
Blair	—	—	—	43.59	2.5[c]
Winnsboro	72.8	50.0	61.4	45.84	2.8
Newberry	74.1	48.6	61.4	49.33	2.1
Columbia Metro Airport (WSFO)	74.8	52.5	63.6	48.27	2.1
Santuck	72.9	51.0	62.0	46.20	3.9
Chester 1NW	72.2	48.0	60.1	47.87	3.4
Saluda	74.3	49.5	61.9	47.79	2.8
Camden 3W	71.8	47.9	59.9	46.65	2.4
Pelion 4NW	75.2	51.1	63.2	51.03	1.4
Kershaw 2SW	73.2	48.2	60.7	47.97	1.5
Catawba	—	—	—	46.51	3.7[d]
Johnston 4SW	73.9	47.1	60.5	48.65	2.1

a) NCDC 2002a
b) NCDC 2005b
c) SERCC 2007, based on available Period of Record (1948–1982); represents sum of individual monthly means
d) SERCC 2007, based on available Period of Record (1948–2006); represents sum of individual monthly means

Table 2.7-4
Morning and Afternoon Mixing Heights, Wind Speeds, and Ventilation Indices for the VCSNS Site Area

		Mixing Height (m, above ground level)		Wind Speed (m/sec)		Ventilation Index (m2/sec)[b]			
Period	Statistic[a]	AM	PM	AM	PM	AM	AM Class.	PM	PM Class.
January	Min	262	667	3.0	2.7	773	P	1,832	M
	Max	544	1,034	4.0	4.0	2,095	M	3,490	F
	Mean	398	844	3.3	3.3	1,359	M	2,718	F
February	Min	252	841	2.7	2.7	847	P	1,945	M
	Max	582	1,322	4.2	4.1	2,299	M	4,821	G
	Mean	421	1,081	3.4	3.4	1,537	M	3,586	G
March	Min	322	956	2.9	2.9	1,000	P[c]	3,259	F
	Max	552	1,676	3.9	3.9	2,400	F[d]	5,922	G
	Mean	428	1,360	3.4	3.4	1,600	M[d]	4,457	G
April	Min	269	1,414	2.7	2.9	928	P	4,193	G
	Max	546	2,078	3.8	3.7	2,249	M	6,440	G
	Mean	401	1,665	3.3	3.2	1,488	M	5,245	G
May	Min	211	1,383	2.4	2.6	626	P	3,734	G
	Max	570	2,243	4.0	3.5	1,992	M	7,279	G
	Mean	393	1,745	3.0	3.0	1,302	M	5,137	G
June	Min	281	1,439	2.5	2.4	752	P	3,679	G
	Max	480	2,105	3.4	3.4	1,681	M	5,940	G
	Mean	389	1,725	2.9	2.8	1,177	M	4,742	G
July	Min	265	1,369	2.5	2.3	731	P	3,466	F
	Max	619	2,153	3.4	3.2	1,846	M	6,433	G
	Mean	398	1,673	2.8	2.8	1,183	M	4,597	G
August	Min	207	1,392	2.3	2.1	523	P	3,294	F
	Max	594	2,012	3.4	3.0	1,799	M	5,450	G
	Mean	386	1,592	2.7	2.6	1,099	P	4,138	G
September	Min	251	1,044	2.3	2.2	602	P	2,974	F
	Max	621	1,654	3.4	3.3	2,237	M	4,620	G
	Mean	370	1,431	2.9	2.7	1,144	P	3,773	G
October	Min	193	1,047	2.4	2.3	510	P	2,722	F
	Max	435	1,676	3.5	3.2	1,644	M	5,204	G
	Mean	313	1,265	3.0	2.8	1,020	P	3,440	F
November	Min	210	708	2.6	2.7	690	P	2,144	M
	Max	477	1,187	3.8	3.5	1,966	M	3,673	G
	Mean	344	1,039	3.1	3.0	1,194	M	3,054	F
December	Min	253	701	2.6	2.7	785	P	2,164	M
	Max	469	945	4.0	4.3	1,807	M	3,172	F
	Mean	374	831	3.2	3.2	1,282	M	2,678	F
Winter	Mean	397	913	3.3	3.3	1,388	M	2,974	F
Spring	Mean	407	1,589	3.2	3.2	1,463	M	4,943	G
Summer	Mean	391	1,663	2.8	2.7	1,153	P	4,490	G
Autumn	Mean	342	1,245	3.0	2.8	1,118	P	3,423	F
Annual	Mean	384	1,355	3.1	3.0	1,280	M	3,964	G

a) Monthly minimum, maximum and mean values are based directly on summaries available from USDA - Forest Service Ventilation Climate Information System (VCIS) (USDA 2007). Seasonal and annual mean values represent weighted averages based on the number of days in the appropriate months.

b) Classifications of ventilation potential from Ventilation Index: P = Poor (0 to 1175 m^2/sec); M = Marginal (1176 to 2350 m^2/sec); F = Fair (2351 to 3525 m^2/sec); G = Good (>3525 m^2/sec).

c) The mixing height is set to an arbitrary “free height” by VCIS when the mixing height for a given location, as interpolated by the VCIS from observed mixing heights, is mapped to be at or below local ground level elevation.

Sources: USDA-Forest Service 2003; 2007

Table 2.7-5
Climatological Extremes at Selected NWS and Cooperative Observing Stations in the Units 2 and 3 Site Area

Station	Maximum Temperature[a] (°F)	Minimum Temperature[a] (°F)	Max 24-Hr Rainfall[a] (inches)	Max Monthly Rainfall[a] (inches)	Max 24-Hr Snowfall[a] (inches)	Max Monthly Snowfall[a] (inches)
Parr	107[b] [c] [d] (07/20/86)	-1[b] [c] (12/12/62)	7.08[b] [c] (09/04/98)	12.20[b] [e] (06/89)	7.5[b] [c] (02/10/73)	7.5[b] [e] [f] (02/73)
Little Mountain	108[b] [c] [g] (07/24/52)	-2[b] [c] (01/21/85)	6.46[b] [c] (08/18/86)	15.70[b] [e] (08/86)	10.0[c] [e] (12/11/58)	11.0[c] [e] (02/69)
Blair	—	—	7.14[c] [e] (08/23/67)	12.00[c] [e] (03/80)	12.0[c] [e] (02/26/69)	12.5[c] [e] (02/69)
Winnsboro	107[b] [c] (06/28/54)	-1[b] [c] [h] (01/22/85)	7.77[b] [c] (07/10/59)	14.90[c] [e] (08/52)	12.0[b] [c] (02/10/73)	12.0[b] [e] (02/73)
Newberry	108[b] [c] (08/21/83)	-1[b] [c] [i] (01/21/85)	10.42[b] [c] (08/18/86)	17.04[b] [e] (08/86)	8.0[b] [c] [e] (01/25/00)	8.0[b] [c] [e] [j] (01/00)
Columbia Metro Airport (WSFO)	107[b] [c] [k] (08/21/83)	-1[b] [c] (01/21/85)	5.79[b] [c] (07/09/59)	17.46[b] [e] (07/91)	12.3[b] [c] (02/10/73)	16.0[b] [e] (02/73)
Santuck	108[b] [c] (07/29/52)	-4[b] [c] (01/21/85)	6.14[b] [c] (08/23/67)	14.76[c] [l] (09/04)	9.5[c] [e] (12/29/35)	12.9[b] [e] (01/00)
Chester 1NW	106[b] [c] (08/21/83)	-5[b] [c] (12/13/62)	8.40[b] [e] (08/23/67)	15.23[c] [e] (08/67)	7.5[c] [e] (02/09/67)	16.5[c] [e] (03/60)
Saluda	109[b] [c] (07/14/80)	-2[b] [c] [m] (01/22/85)	6.05[b] [c] (08/30/64)	14.96[c] [e] (09/59)	8.0[c] [e] (12/11/58)	10.0[b] [c] [e] [n] (02/73)
Camden 3W	111[b] [c] (06/28/54)	-3[b] [c] (01/22/85)	9.62[b] [c] (10/11/90)	16.93[b] [e] (10/90)	9.0[b] [c] (02/10/73)	12.0[b] [e] (02/73)
Pelion 4NW	107[b] [c] [o] (08/01/80)	-2[b] [c] (01/21/85)	7.10[b] [c] (09/04/98)	14.61[c] [l] (07/03)	9.0[b] [c] (02/10/73)	15.5[b] [e] (02/73)
Kershaw 2SW	107[b] [c] (06/28/54)	-4[b] [c] [m] (01/22/85)	10.14[b] [e] (09/04/98)	18.55[c] [e] (08/52)	12.0[c] [e] (12/12/58)	12.0[c] [e] (12/58)
Catawba	—	—	7.77[c] [e] (07/24/97)	18.26[c] [e] (08/67)	13.5[c] [l] (02/27/04)	14.1[c] [l] (02/04)
Johnston 4SW	107[b] [c] [p] (08/25/02)	-2[b] [c] [m] (01/22/85)	6.35[b] [c] (08/30/64)	15.88[c] [e] (06/65)	14.0[b] [c] (02/10/73)	14.0[c] [e] (02/73)

a) Most recent date of occurrence shown in table
b) NCDC 2005b
c) SERCC 2007
d) Occurs on multiple dates: 07/20/86; 08/22/83
e) NCDC 2002d
f) Occurs for multiple months: 02/73; 12/58
g) Occurs on multiple dates: 07/24/52; 07/21/52
h) Occurs on multiple dates: 01/22/85; 01/21/85; 12/13/62
i) Occurs on multiple dates: 01/21/85; 03/03/80
j) Occurs for multiple months: 01/00; 03/60
k) Occurs on multiple dates: 08/21/83; 07/29/52; 07/24/52; 07/23/52; 06/27/54
l) NCDC 2006
m) Occurs on multiple dates: 01/22/85; 01/21/85
n) Occurs for multiple months: 02/73; 12/58
o) Occurs on multiple dates: 08/01/80; 07/13/80
p) Occurs on multiple dates: 08/25/02; 08/15/99; 07/14/80

Table 2.7-6
Seasonal and Annual Mean Wind Speeds for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) and the Columbia, South Carolina, NWS Station

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (61 meters) (m/sec)	Unit 1 Site	5.0	5.1	3.8	4.7	4.6
Lower Level (10 meters) (m/sec)	Unit 1 Site	3.3	3.3	2.9	3.5	3.2
Single Level (6.1 meters) (m/sec)	Columbia Metro Airport WSFO[(a)]	3.2	3.5	2.7	2.7	3.0

a) NCDC 2005a

Winter = December, January, February
Spring = March, April, May
Summer = June, July, August
Autumn = September, October, November

Table 2.7-7 (Sheet 1 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 10-Meter Level

Site Name: Summer | **Start Date: 7/1/2003 00:00** | **End Date: 6/30/2006 23:00**

Number of Sectors Included: 1 | **Width in Degrees: 22.5**

Measurement Height, m: 10 | **Speed Sensor: 1** | **Direction Sensor: 1**

Speed Greater than or Equal to: 5.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	666	1078	2039	1534	939	441	587	1022	1206	1523	1713	1552	1512	524	591	517
2	248	483	1214	835	483	161	225	485	611	761	890	736	834	191	250	189
4	60	163	586	315	177	39	43	150	214	255	287	238	360	38	79	48
8	7	30	230	68	35	1	5	19	38	37	43	25	113	1	11	4
12	2	9	114	29	13	0	1	0	9	6	5	3	43	0	0	0
18	0	0	41	8	2	0	0	0	1	0	0	0	13	0	0	0
24	0	0	20	0	0	0	0	0	0	0	0	0	3	0	0	0
30	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 10.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	264	568	1238	745	200	48	56	85	196	179	130	132	256	47	132	204
2	110	321	814	421	107	17	18	43	114	94	60	50	151	15	66	109
4	30	127	442	180	46	3	3	18	50	32	14	10	61	1	26	34
8	5	24	190	57	12	0	0	1	14	1	0	0	14	0	2	2
12	1	6	85	29	4	0	0	0	0	0	0	0	6	0	0	0
18	0	0	22	8	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 15.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	80	223	283	118	21	4	7	12	41	18	0	2	23	2	24	79
2	32	121	144	63	13	1	4	7	28	8	0	0	8	0	13	44
4	6	42	60	26	6	0	1	3	16	2	0	0	4	0	5	13
8	0	5	8	6	2	0	0	0	2	0	0	0	0	0	0	0
12	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7(Sheet 2 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 10-Meter Level

Site Name: Summer **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 23:00**

Number of Sectors Included: 1 **Width in Degrees: 22.5**

Measurement Height, m: 10 **Speed Sensor: 1** **Direction Sensor: 1**

Speed Greater than or Equal to: 20.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	16	29	18	6	0	0	0	0	7	1	0	0	1	0	4	14
2	6	14	4	2	0	0	0	0	4	0	0	0	0	0	1	6
4	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	1
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 25.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 30.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 1 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 61-Meter Level

Site Name: Summer **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 23:00**

Number of Sectors Included: 1 **Width in Degrees: 22.5**

Measurement Height, m: 61 **Speed Sensor: 2** **Direction Sensor: 2**

Speed Greater than or Equal to: 5.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	620	1010	1864	1999	1174	734	815	1087	1419	1546	2702	3077	1716	681	677	651
2	244	472	1099	1221	643	356	389	593	780	796	1636	1989	976	282	310	290
4	66	152	497	564	246	131	114	217	298	267	680	936	423	70	97	87
8	8	29	133	167	59	24	10	46	52	41	138	264	113	3	18	11
12	0	12	47	54	20	11	0	13	10	2	34	90	32	0	0	0
18	0	0	8	2	2	4	0	0	1	0	3	13	1	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 10.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	291	538	1230	1294	601	297	357	646	855	835	1524	1999	1107	191	285	354
2	126	293	779	823	343	152	161	354	490	430	888	1312	657	65	134	177
4	38	111	388	381	150	59	44	130	192	139	355	647	284	19	50	59
8	4	28	122	121	43	8	4	21	34	16	63	192	78	1	5	8
12	0	12	41	46	19	0	0	3	8	0	13	70	25	0	0	0
18	0	0	8	2	2	0	0	0	1	0	0	9	1	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 15.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	94	219	459	395	132	62	61	129	228	176	353	732	356	27	61	125
2	33	116	269	226	77	26	20	52	112	78	164	462	199	7	23	61
4	5	45	113	116	41	5	7	16	33	19	41	219	89	1	9	12
8	0	11	27	43	24	0	1	1	6	0	5	58	19	0	0	0
12	0	5	6	17	12	0	0	0	0	0	0	16	6	0	0	0
18	0	0	0	0	1	0	0	0	0	0	0	4	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 2 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 61-Meter Level

Site Name: Summer **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 23:00**

Number of Sectors Included: 1 **Width in Degrees: 22.5**

Measurement Height, m: 61 **Speed Sensor: 2** **Direction Sensor: 2**

Speed Greater than or Equal to: 20.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	25	48	67	38	19	7	10	14	43	21	34	150	95	2	17	38
2	9	27	34	19	9	2	5	8	28	4	7	66	55	0	7	19
4	0	10	17	5	2	0	2	4	15	0	0	19	25	0	2	2
8	0	1	2	0	0	0	0	0	2	0	0	0	10	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 25.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	4	6	7	6	1	0	0	2	10	1	3	17	24	0	1	1
2	1	1	3	2	0	0	0	0	7	0	0	4	10	0	0	0
4	0	0	0	0	0	0	0	0	4	0	0	0	5	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to: 30.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	0	1	1	0	0	0	0	0	0	1	0	0	5	0	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-9
Seasonal and Annual Vertical Stability Class and Mean 10-Meter Level Wind Speed Distributions for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Period	Vertical Stability Categories[a]						
	A	B	C	D	E	F	G
Winter							
Frequency (%)	4.12	4.15	8.51	37.82	24.28	10.74	10.40
Wind Speed (m/sec)	4.10	4.30	4.50	4.00	2.70	2.20	1.90
Spring							
Frequency (%)	11.39	7.40	9.20	30.05	26.12	10.70	5.15
Wind Speed (m/sec)	3.90	3.90	4.00	3.90	2.70	2.20	1.90
Summer							
Frequency (%)	15.05	9.11	9.56	32.95	23.89	7.57	1.87
Wind Speed (m/sec)	2.90	3.10	3.20	3.30	2.30	2.10	1.80
Autumn							
Frequency (%)	6.58	6.44	8.74	42.30	18.19	8.64	9.10
Wind Speed (m/sec)	3.50	4.00	4.40	4.20	2.50	2.10	1.70
Annual							
Frequency (%)	9.24	6.76	8.99	35.80	23.12	9.42	6.66
Wind Speed (m/sec)	3.50	3.70	4.00	3.90	2.60	2.20	1.80

a) Vertical stability based on temperature difference (T) between 61-meter and 10-meter measurement levels.

Table 2.7-10 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: A Delta Temperature Extremely Unstable

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	0	0	0	8	25	37	6	9	2	0	0	0	87
NNE	0	0	0	6	35	37	14	13	4	1	0	0	110
NE	0	0	0	5	24	48	29	29	7	1	0	0	143
ENE	0	0	0	3	5	30	45	15	10	0	0	0	108
E	0	0	0	0	3	16	25	1	0	0	0	0	45
ESE	0	0	0	1	1	10	20	2	0	0	0	0	34
SE	0	0	0	0	1	21	20	3	0	0	0	0	45
SSE	0	0	0	1	7	20	31	7	0	0	0	0	66
S	0	0	0	2	4	13	42	10	5	0	0	0	76
SSW	0	0	0	1	4	61	75	13	1	0	0	0	155
SW	0	0	1	8	26	199	134	11	0	0	0	0	379
WSW	0	0	0	5	44	212	263	34	0	0	0	0	558
W	0	0	1	4	20	46	148	29	1	0	0	0	249
WNW	0	0	0	4	7	35	48	4	0	0	0	0	98
NW	0	0	0	5	7	28	53	8	2	0	0	0	103
NNW	0	0	0	2	20	28	15	5	6	1	0	0	77
Totals	0	0	2	55	233	841	968	193	38	3	0	0	2333

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	2333
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: B Delta Temperature Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	0	6	19	25	22	12	7	0	0	0	91
NNE	0	0	0	6	10	37	13	24	17	2	0	0	109
NE	0	0	0	3	7	37	57	37	18	1	0	0	160
ENE	0	0	0	2	8	23	53	18	8	0	0	0	112
E	0	0	0	2	3	17	30	11	3	0	0	0	66
ESE	0	0	0	1	2	7	16	5	1	0	0	0	32
SE	0	0	0	0	1	17	13	1	0	0	0	0	32
SSE	0	0	1	1	2	14	25	4	1	0	0	0	48
S	0	0	0	1	1	23	50	15	3	0	0	0	93
SSW	0	0	0	4	8	57	64	13	2	0	0	0	148
SW	0	0	0	8	22	85	59	4	0	0	0	0	178
WSW	0	0	0	9	14	90	65	6	0	0	0	0	184
W	0	0	2	3	17	45	61	35	5	0	0	0	168
WNW	0	0	0	2	8	31	45	4	0	0	0	0	90
NW	0	0	0	1	8	34	44	12	9	0	0	0	108
NNW	0	0	0	9	13	23	21	12	7	1	0	0	86
Totals	0	0	3	58	143	565	638	213	81	4	0	0	1705

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	1705
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: C Delta Temperature Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	0	0	9	27	47	39	28	15	2	0	0	167
NNE	0	1	0	7	17	50	43	67	52	1	1	0	239
NE	0	0	0	7	22	65	109	142	62	0	0	0	407
ENE	0	0	0	4	5	28	79	59	22	0	0	0	197
E	0	0	0	1	5	30	30	16	5	0	0	0	87
ESE	0	0	0	1	3	17	24	3	0	0	0	0	48
SE	0	0	0	0	4	25	19	3	0	0	0	0	51
SSE	0	0	0	2	5	26	33	4	2	0	0	0	72
S	0	0	0	1	9	45	50	13	5	0	0	0	123
SSW	0	0	0	4	11	49	53	11	0	0	0	0	128
SW	0	0	0	6	23	71	50	14	0	0	0	0	164
WSW	0	0	1	10	34	66	50	7	1	0	0	0	169
W	0	0	0	4	12	45	70	13	0	0	0	0	144
WNW	0	0	0	6	14	31	35	4	0	0	0	0	90
NW	0	0	0	6	8	32	29	14	3	0	0	0	92
NNW	0	0	0	10	14	28	20	9	11	0	0	0	92
Totals	0	1	1	78	213	655	733	407	178	3	1	0	2270

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	2270
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 4 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: D Delta Temperature Neutral

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	0	1	7	32	50	107	140	95	34	4	0	0	470
NNE	0	1	2	31	55	136	211	217	89	2	0	0	744
NE	1	0	3	19	39	159	508	573	108	3	0	0	1413
ENE	0	0	1	7	21	157	564	319	49	1	0	0	1119
E	0	0	1	8	29	179	310	91	8	0	0	0	626
ESE	0	0	0	5	16	119	118	16	1	0	0	0	275
SE	0	0	0	8	26	138	113	16	1	0	0	0	302
SSE	0	1	3	24	32	166	165	21	7	0	0	0	419
S	0	0	3	28	43	128	184	44	21	0	0	0	451
SSW	0	0	5	30	62	165	198	56	5	1	0	0	522
SW	0	2	9	43	70	253	216	29	0	0	0	0	622
WSW	0	5	11	46	84	215	170	18	0	0	0	0	549
W	0	2	9	54	65	188	232	64	3	0	0	0	617
WNW	0	4	11	37	52	93	61	13	0	0	0	0	271
NW	0	1	6	20	35	108	103	33	5	1	0	0	312
NNW	0	3	7	24	18	74	102	58	36	1	0	0	323
Totals	1	20	78	416	697	2385	3395	1663	367	13	0	0	9035

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	9035
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: E Delta Temperature Slightly Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	1	4	21	23	49	38	5	2	0	0	0	143
NNE	0	1	1	16	22	64	28	1	1	0	0	0	134
NE	0	2	4	15	23	49	31	9	0	0	0	0	133
ENE	0	0	2	14	20	41	47	3	0	0	0	0	127
E	0	0	2	10	30	103	88	3	0	0	0	0	236
ESE	0	0	2	14	29	75	38	0	0	0	0	0	158
SE	0	1	2	14	28	126	58	5	2	0	0	0	236
SSE	0	0	4	23	91	250	88	3	0	0	0	0	459
S	0	4	10	70	85	259	127	8	2	0	0	0	565
SSW	1	2	10	77	129	434	173	7	1	0	0	0	834
SW	0	2	13	119	213	467	120	2	0	0	0	0	936
WSW	1	3	9	99	145	301	104	2	0	0	0	0	664
W	0	2	11	69	90	361	123	7	0	0	0	0	663
WNW	1	6	10	54	53	110	15	0	0	0	0	0	249
NW	0	2	8	26	30	72	29	1	0	0	0	0	168
NNW	0	0	6	15	14	49	40	5	2	0	0	0	131
Totals	3	26	98	656	1025	2810	1147	61	10	0	0	0	5836

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	5836
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 6 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: F Delta Temperature Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	1	0	4	9	15	3	0	0	0	0	0	32
NNE	0	0	1	5	6	12	0	0	0	0	0	0	24
NE	0	2	0	2	6	11	1	0	0	0	0	0	22
ENE	0	0	0	5	5	7	0	0	0	0	0	0	17
E	0	0	1	5	7	5	1	0	0	0	0	0	19
ESE	0	1	0	4	4	2	3	0	0	0	0	0	14
SE	0	1	1	16	11	41	13	0	0	0	0	0	83
SSE	1	1	5	26	57	177	54	0	0	0	0	0	321
S	0	6	7	56	72	195	33	0	0	0	0	0	369
SSW	1	0	8	36	71	171	19	0	0	0	0	0	306
SW	0	5	9	60	119	186	5	0	0	0	0	0	384
WSW	0	1	21	49	83	115	2	0	0	0	0	0	271
W	1	4	11	63	52	122	6	0	0	0	0	0	259
WNW	0	4	10	46	34	55	3	0	0	0	0	0	152
NW	0	0	6	14	23	30	2	0	0	0	0	0	75
NNW	0	1	2	13	5	6	3	0	0	0	0	0	30
Totals	3	27	82	404	564	1150	148	0	0	0	0	0	2378

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	2378
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Stability Class: G Delta Temperature Extremely Stable

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	0	4	0	1	0	0	0	0	0	0	5
NNE	0	0	1	3	1	4	0	0	0	0	0	0	9
NE	0	0	0	0	1	3	0	0	0	0	0	0	4
ENE	0	0	2	1	1	0	0	0	0	0	0	0	4
E	0	0	0	4	0	5	1	0	0	0	0	0	10
ESE	0	1	1	3	2	3	0	0	0	0	0	0	10
SE	0	2	3	3	1	7	0	0	0	0	0	0	16
SSE	0	0	2	15	13	58	7	0	0	0	0	0	95
S	0	4	9	51	41	86	4	0	0	0	0	0	195
SSW	0	2	9	63	37	83	2	1	0	0	0	0	197
SW	1	4	23	98	54	101	1	0	0	0	0	0	282
WSW	0	2	27	138	82	105	0	0	0	0	0	0	354
W	1	5	17	126	81	92	1	0	0	0	0	0	323
WNW	1	1	11	48	25	33	0	0	0	0	0	0	119
NW	0	1	8	11	10	16	0	0	0	0	0	0	46
NNW	0	0	2	4	1	5	0	0	0	0	0	0	12
Totals	3	22	115	572	350	602	16	1	0	0	0	0	1681

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	1681
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-10 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

Summary of All Stability Classes Delta Temperature

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	3	11	84	153	281	248	149	60	6	0	0	995
NNE	0	3	5	74	146	340	309	322	163	6	1	0	1369
NE	1	4	7	51	122	372	735	790	195	5	0	0	2282
ENE	0	0	5	36	65	286	788	414	89	1	0	0	1684
E	0	0	4	30	77	355	485	122	16	0	0	0	1089
ESE	0	2	3	29	57	233	219	26	2	0	0	0	571
SE	0	4	6	41	72	375	236	28	3	0	0	0	765
SSE	1	2	15	92	207	711	403	39	10	0	0	0	1480
S	0	14	29	209	255	749	490	90	36	0	0	0	1872
SSW	2	4	32	215	322	1020	584	101	9	1	0	0	2290
SW	1	13	55	342	527	1362	585	60	0	0	0	0	2945
WSW	1	11	69	356	486	1104	654	67	1	0	0	0	2749
W	2	13	51	323	337	899	641	148	9	0	0	0	2423
WNW	2	15	42	197	193	388	207	25	0	0	0	0	1069
NW	0	4	28	83	121	320	260	68	19	1	0	0	904
NNW	0	4	17	77	85	213	201	89	62	3	0	0	751
Totals	10	96	379	2239	3225	9008	7045	2538	674	23	1	0	25238

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1066
Number of Valid Hours for this Table	25238
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 1 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: A Delta Temperature Extremely Unstable

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	0	11	22	17	9	5	2	1	0	0	67
NNE	0	0	3	14	28	22	12	7	5	2	0	0	93
NE	0	0	1	22	29	21	20	26	14	1	0	0	134
ENE	0	0	0	6	21	25	41	28	10	3	0	0	134
E	0	0	0	5	8	14	29	10	3	1	0	0	70
ESE	0	0	0	1	1	11	21	11	0	0	0	0	45
SE	0	0	0	0	0	20	29	9	2	0	0	0	60
SSE	0	0	0	0	5	13	20	19	4	0	0	0	61
S	0	0	0	1	2	13	31	15	9	2	0	0	73
SSW	0	0	1	3	6	38	51	20	8	0	0	0	127
SW	0	0	0	7	14	106	175	65	28	1	0	0	396
WSW	0	0	1	4	29	103	214	190	101	21	0	0	663
W	0	0	0	4	8	17	57	65	35	11	1	0	198
WNW	0	0	0	5	9	12	42	11	3	0	0	0	82
NW	0	0	0	3	10	21	38	13	4	0	0	0	89
NNW	0	0	0	6	14	12	14	14	3	3	0	0	66
Totals	0	0	6	92	206	465	803	508	231	46	1	0	2358

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	2358
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: B Delta Temperature Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	0	3	10	13	18	14	15	8	2	0	0	83
NNE	0	0	2	7	18	17	11	15	13	3	0	0	86
NE	0	0	1	14	7	26	52	29	30	3	0	0	162
ENE	0	0	0	2	5	14	46	37	17	0	0	0	121
E	0	0	0	1	6	17	33	23	8	2	0	0	90
ESE	0	0	1	0	0	7	19	9	1	0	0	0	37
SE	0	0	0	0	3	8	16	5	0	0	0	0	32
SSE	0	0	1	2	2	11	28	9	3	1	0	0	57
S	0	0	0	1	2	18	32	23	10	2	0	0	88
SSW	0	0	0	1	8	19	54	26	9	1	0	0	118
SW	0	0	0	4	10	58	84	32	8	0	0	0	196
WSW	0	0	0	8	19	45	73	45	43	4	0	0	237
W	0	0	0	5	12	21	35	32	29	10	4	0	148
WNW	0	0	1	0	6	18	42	15	1	0	0	0	83
NW	0	0	1	3	8	19	32	20	15	1	0	0	99
NNW	0	0	1	8	10	12	12	13	7	3	0	0	66
Totals	0	0	11	66	129	328	583	348	202	32	4	0	1703

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	1703
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: C Delta Temperature Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	1	13	20	15	32	20	16	1	0	0	118
NNE	0	0	0	14	35	36	43	39	45	5	1	0	218
NE	0	0	1	14	23	38	78	119	89	4	0	0	366
ENE	0	0	0	7	16	22	98	90	58	1	0	0	292
E	0	0	0	6	7	30	28	19	9	0	0	0	99
ESE	0	0	1	1	5	13	36	10	3	0	0	0	69
SE	0	0	0	1	2	13	22	7	2	0	0	0	47
SSE	0	0	0	3	12	19	35	12	2	1	0	0	84
S	0	0	0	0	7	27	41	22	11	2	1	0	111
SSW	0	0	1	5	4	30	45	14	11	0	0	0	110
SW	0	0	0	9	11	41	60	35	19	1	0	0	176
WSW	0	0	0	5	15	48	69	40	40	3	0	0	220
W	0	0	0	3	7	17	31	32	17	5	0	0	112
WNW	0	0	0	5	15	21	30	11	2	0	0	0	84
NW	0	0	1	4	12	21	20	13	5	2	0	0	78
NNW	0	0	0	8	8	10	20	13	17	1	0	0	77
Totals	0	0	5	98	199	401	688	496	346	26	2	0	2261

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	2261
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 4 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: D Delta Temperature Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	1	11	27	40	46	96	87	33	8	0	0	349
NNE	0	4	10	40	55	74	168	175	96	7	0	0	629
NE	0	5	8	41	37	105	350	490	203	11	1	0	1251
ENE	0	2	6	17	25	109	463	552	188	12	0	0	1374
E	0	0	3	9	32	87	318	239	71	3	0	0	762
ESE	0	0	2	6	19	78	152	79	31	0	0	0	367
SE	0	0	2	10	19	69	158	78	15	2	0	0	353
SSE	0	0	3	13	18	41	140	108	23	8	0	0	354
S	0	2	4	13	16	64	143	126	48	17	0	0	433
SSW	0	4	4	22	28	56	139	91	63	2	1	0	410
SW	0	0	9	18	28	79	227	179	99	4	0	0	643
WSW	0	2	9	30	32	83	208	182	169	22	0	0	737
W	0	4	9	15	28	60	139	145	105	21	1	0	527
WNW	0	4	7	27	44	51	68	23	11	0	0	0	235
NW	0	1	12	23	24	45	79	51	20	0	1	0	256
NNW	1	2	11	30	17	32	91	75	56	6	0	0	321
Totals	1	31	110	341	462	1079	2939	2680	1231	123	4	0	9001

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	9001
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: E Delta Temperature Slightly Stable

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	1	3	6	11	19	25	38	20	4	0	0	0	127
NNE	0	1	11	15	17	30	55	24	2	0	0	0	155
NE	0	3	3	20	19	27	35	12	2	0	0	0	121
ENE	1	2	5	18	17	30	67	44	4	0	0	0	188
E	0	2	1	19	20	26	87	75	5	0	0	0	235
ESE	0	3	3	7	14	39	84	66	10	0	0	0	226
SE	0	0	4	14	14	46	86	90	12	1	0	0	267
SSE	0	2	0	12	18	38	123	154	22	1	0	0	370
S	1	2	2	9	22	48	156	179	41	2	0	0	462
SSW	0	4	7	17	13	56	244	212	23	2	0	0	578
SW	0	1	8	15	26	67	407	366	68	1	0	0	959
WSW	2	4	5	13	19	59	358	372	169	4	0	0	1005
W	2	2	10	23	18	62	206	231	39	2	0	0	595
WNW	1	3	8	22	17	56	104	25	1	0	0	0	237
NW	1	3	4	16	21	39	65	32	4	0	0	0	185
NNW	1	3	4	13	8	19	49	46	8	0	0	0	151
Totals	10	38	81	244	282	667	2164	1948	414	13	0	0	5861

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	5861
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 6 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: F Delta Temperature Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	0	2	1	2	23	30	4	1	0	0	0	63
NNE	0	3	3	3	6	19	29	5	0	0	0	0	68
NE	0	1	3	14	7	22	20	1	0	0	0	0	68
ENE	0	2	6	11	14	20	8	4	0	0	0	0	65
E	2	4	2	6	9	16	12	3	0	0	0	0	54
ESE	0	0	2	5	5	20	20	5	0	0	0	0	57
SE	1	1	2	5	9	16	39	29	6	0	0	0	108
SSE	1	0	3	2	3	26	66	91	18	0	0	0	210
S	0	1	2	2	11	23	85	99	23	0	0	0	246
SSW	0	1	1	8	4	24	89	105	5	0	0	0	237
SW	1	2	2	6	9	25	139	171	20	0	0	0	375
WSW	1	0	2	0	5	31	104	148	12	0	0	0	303
W	0	1	1	5	9	28	88	82	6	0	0	0	220
WNW	0	1	3	7	7	22	65	10	0	0	0	0	115
NW	0	1	1	7	7	28	50	21	0	0	0	0	115
NNW	0	2	0	4	7	9	49	15	1	0	0	0	87
Totals	6	20	35	86	114	352	893	793	92	0	0	0	2391

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	2391
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Stability Class: G Delta Temperature Extremely Stable

	Wind Speed (m/s)												
Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	1	3	12	8	23	35	5	0	0	0	0	87
NNE	1	0	5	5	14	38	52	1	1	0	0	0	117
NE	0	2	5	10	14	41	37	0	1	0	0	0	110
ENE	0	0	1	10	15	19	7	0	0	0	0	0	52
E	0	3	5	5	8	23	3	0	1	0	0	0	48
ESE	2	0	3	4	10	13	15	3	0	0	0	0	50
SE	0	5	1	7	7	21	32	6	2	0	0	0	81
SSE	1	1	6	7	2	12	36	13	9	0	0	0	87
S	0	3	3	3	9	21	47	61	5	0	0	0	152
SSW	2	1	4	3	10	17	63	33	3	1	0	0	137
SW	1	0	0	6	11	30	71	62	4	0	0	0	185
WSW	1	2	2	1	11	18	74	73	7	0	0	0	189
W	1	0	0	3	9	29	64	34	3	0	0	0	143
WNW	3	0	2	5	11	23	40	4	3	0	0	0	91
NW	1	1	3	9	9	22	41	4	2	0	0	0	92
NNW	1	1	4	4	6	23	37	6	2	0	0	0	84
Totals	14	20	47	94	154	373	654	305	43	1	0	0	1705

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	1705
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-11 (Sheet 8 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

Hours at Each Wind Speed and Direction

Period of Record: 07/01/03 0:00 - 06/30/06 23:00 Total Period

Elevation: **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

Summary of All Stability Classes Delta Temperature

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
						Wind Speed (m/s)							
N	1	5	26	85	124	167	254	156	64	12	0	0	894
NNE	1	8	34	98	173	236	370	266	162	17	1	0	1366
NE	0	11	22	135	136	280	592	677	339	19	1	0	2212
ENE	1	6	18	71	113	239	730	755	277	16	0	0	2226
E	2	9	11	51	90	213	510	369	97	6	0	0	1358
ESE	2	3	12	24	54	181	347	183	45	0	0	0	851
SE	1	6	9	37	54	193	382	224	39	3	0	0	948
SSE	2	3	13	39	60	160	448	406	81	11	0	0	1223
S	1	8	11	29	69	214	535	525	147	25	1	0	1565
SSW	2	10	18	59	73	240	685	501	122	6	1	0	1717
SW	2	3	19	65	109	406	1163	910	246	7	0	0	2930
WSW	4	8	19	61	130	387	1100	1050	541	54	0	0	3354
W	3	7	20	58	91	234	620	621	234	49	6	0	1943
WNW	4	8	21	71	109	203	391	99	21	0	0	0	927
NW	2	6	22	65	91	195	325	154	50	3	1	0	914
NNW	3	8	20	73	70	117	272	182	94	13	0	0	852
Totals	31	109	295	1021	1546	3665	8724	7078	2559	241	11	0	25280

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1023
Number of Valid Hours for this Table	25280
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

Table 2.7-12
Sector-Specific Downwind Distances Between the PBA Circle and LPZ Boundary

Direction Sector	Distance to LPZ Boundary (feet)	Distance to LPZ Boundary (meters)
South	10,270	3,130
South-Southwest	10,028	3,057
Southwest	10,326	3,147
West-Southwest	11,165	3,403
West	12,542	3,823
West-Northwest	14,365	4,378
Northwest	16,431	5,008
North-Northwest	18,356	5,595
North	19,702	6,005
North-Northeast	20,151	6,142
Northeast	19,592	5,972
East-Northeast	18,163	5,536
East	16,208	4,940
E-Southeast	14,155	4,315
Southeast	12,363	3,768
South-Southeast	11,050	3,368

Table 2.7-13
PAVAN Output — Bounding 50 Percentile X/Q Value at the Dose Evaluation Periphery (Building Wake Credit Not Included)

```
N SECTOR     BOUNDARY DISTANCE =  805.0 METERS

          X/Q PERCENTILES
(BASED ON THE UPPER ENVELOPE OF THE
ORDERED X/Q-FREQUENCY VALUES, AND AS
PLOTTED ON A LOG-NORMAL GRAPH.)
PERCENT OF TIME CHI/Q IS EQUALED OR EXCEEDED
        CHI/Q          WITH RESPECT TO     WHEN THE WIND BLOWS
 SEC/CUBIC METER       THE TOTAL TIME      INTO THIS SECTOR ONLY

     3.402E-04               .074               1.000
     2.743E-04               .223               3.000
     2.462E-04               .371               5.000
     2.050E-04               .742              10.000
     1.682E-04              1.113              15.000
     1.452E-04              1.483              20.000
     1.291E-04              1.854              25.000
     1.144E-04              2.225              30.000
     1.017E-04              2.596              35.000
     9.163E-05              2.967              40.000
     8.340E-05              3.338              45.000
     7.654E-05              3.709              50.000
     7.072E-05              4.080              55.000
     6.571E-05              4.450              60.000
     5.696E-05              4.821              65.000
     4.838E-05              5.192              70.000
     4.147E-05              5.563              75.000
     3.582E-05              5.934              80.000
     2.632E-05              6.305              85.000
```

Table 2.7-14
PAVAN Output — Bounding 50 Percentile X/Q Value at the LPZ Boundary (Building Wake Credit Not Included)

```
N SECTOR     BOUNDARY DISTANCE = 3057.0 METERS

          X/Q PERCENTILES
(BASED ON THE UPPER ENVELOPE OF THE
ORDERED X/Q-FREQUENCY VALUES, AND AS
PLOTTED ON A LOG-NORMAL GRAPH.)
PERCENT OF TIME CHI/Q IS EQUALED OR EXCEEDED
        CHI/Q         WITH RESPECT TO     WHEN THE WIND BLOWS
 SEC/CUBIC METER       THE TOTAL TIME      INTO THIS SECTOR ONLY

     9.665E-05              .074              1.000
     7.352E-05              .223              3.000
     6.412E-05              .371              5.000
     5.261E-05              .742             10.000
     4.174E-05             1.113             15.000
     3.442E-05             1.483             20.000
     2.948E-05             1.854             25.000
     2.554E-05             2.225             30.000
     2.129E-05             2.596             35.000
     1.812E-05             2.967             40.000
     1.567E-05             3.338             45.000
     1.373E-05             3.709             50.000
     1.190E-05             4.080             55.000
     1.008E-05             4.450             60.000
     8.494E-06             4.821             65.000
     6.931E-06             5.192             70.000
     5.656E-06             5.563             75.000
     4.652E-06             5.934             80.000
```

Table 2.7-15
Shortest Distances Between the Units 2 and 3 PBA Circle and Receptors of Interest by Downwind Direction Sector[a]

Downwind Direction Sector[b]	Meat Animal	Milk Animal	Residence	Vegetable Garden	Dose Evaluation Periphery	Unit 3 Reactor
North	6,756	—	7,264	—	805	—
North-Northeast	9,313	—	5,980	6,480	805	—
Northeast	3,436	—	3,436	3,703	805	—
East-Northeast	—	—	2,094	2,647	805	—
East	—	—	1,978	1,978	805	—
East-Southeast	—	—	—	7,931	805	—
Southeast	6,855	—	2,703	2,703	805	—
South-Southeast	—	—	—	—	805	—
South	6,403	—	4,099	4,099	805	274
South-Southwest	5,793	—	3,234	4,296	805	274
Southwest	5,955	—	3,719	3,719	805	274
West-Southwest	6,570	—	—	—	805	—
West	—	7,625	3,541	3,696	805	—
West-Northwest	2,795	—	3,597	3,973	805	—
Northwest	7,682	—	6,801	7,682	805	—
North-Northwest	5,656	—	5,656	5,656	805	—

a) Distances shown are in meters.
b) Not all direction sectors included receptors of interest.

Table 2.7-16
XOQDOQ-Predicted Maximum X/Q and D/Q Values at Receptors of Interest

Type of Location	Direction from Site	Distance (miles)	X/Q (sec/m^3) (No Decay)	X/Q (sec/m^3) (2.26-Day Decay)	X/Q (sec/m^3) (8-Day Decay)	D/Q ($1/m^2$)
Residence	East	1.23	1.0E-06	9.9E-07	8.6E-07	—
	East-Northeast/East	1.30	—	9.9E-07	—	4.3E-09
Dose Evaluation Periphery	Northeast	0.50	4.7E-06	4.7E-06	4.3E-06	2.3E-08
Meat Animal	Northeast	2.14	5.4E-07	5.4E-07	4.4E-07	1.9E-09
Milk Animal	West	4.74	3.5E-08	3.5E-08	2.6E-08	1.7E-10
Vegetable Garden	East	1.23	1.0E-06	9.9E-07	8.6E-07	4.2E-09
Unit 3 Reactor	Southwest	0.17	8.5E-06	8.5E-06	8.1E-06	9.2E-08

Table 2.7-17 (Sheet 1 of 2)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay Undepleted	DISTANCE IN MILES FROM THE SITE									
Northeast	0.25	0.5	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.592E-5	4.733E-6	2.450E-6	1.576E-6	8.873E-7	5.925E-7	4.352E-7	3.418E-7	2.788E-7	2.337E-7	2.001E-7
	DISTANCE IN MILES FROM THE SITE										
Northeast	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.742E-7	1.025E-7	7.058E-8	4.186E-8	2.900E-8	2.185E-8	1.735E-8	1.429E-8	1.208E-8	1.042E-8	9.139E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
Northeast	0.5–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
X/Q (s/m^3)	2.569E-6	9.094E-7	4.398E-7	2.796E-7	2.004E-7	1.043E-7	4.253E-8	2.196E-8	1.432E-8	1.044E-8	
2.26-Day Decay, Undepleted	DISTANCE IN MILES FROM THE SITE										
Northeast	0.25	0.5	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.590E-5	4.725E-6	2.443E-6	1.571E-6	8.827E-7	5.884E-7	4.314E-7	3.382E-7	2.753E-7	2.304E-7	1.969E-7
	DISTANCE IN MILES FROM THE SITE										
Northeast	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.711E-7	9.982E-8	6.808E-8	3.965E-8	2.697E-8	1.995E-8	1.556E-8	1.258E-8	1.044E-8	8.850E-9	7.619E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
Northeast	0.5–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
X/Q (s/m^3)	2.563E-6	9.048E-7	4.360E-7	2.762E-7	1.973E-7	1.016E-7	4.033E-8	2.006E-8	1.262E-8	8.867E-9	
8.0-Day Decay, Depleted	DISTANCE IN MILES FROM THE SITE										
Northeast	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.506E-5	4.320E-6	2.181E-6	1.379E-6	7.525E-7	4.897E-7	3.517E-7	2.707E-7	2.168E-7	1.787E-7	1.506E-7

Table 2.7-17 (Sheet 2 of 2)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

	DISTANCE IN MILES FROM THE SITE										
Northeast	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.292E-7	7.174E-8	4.694E-8	2.563E-8	1.659E-8	1.178E-8	8.870E-9	6.956E-9	5.620E-9	4.645E-9	3.909E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
Northeast	0.5–1	1–2	2–3	3–	4–5	5–10	10–20	20–30	30–40	40–50	
X/Q (s/m^3)	2.300E-6	7.748E-7	3.561E-7	2.177E-7	1.510E-7	7.348E-8	2.635E-8	1.190E-8	6.994E-9	4.662E-9	

Relative Deposition/ Area	DISTANCE IN MILES FROM THE SITE										
Northeast	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
D/Q (1/m^2)	6.756E-8	2.285E-8	1.173E-8	7.203E-9	3.591E-9	2.178E-9	1.473E-9	1.067E-9	8.114E-10	6.392E-10	5.175E-10
	DISTANCE IN MILES FROM THE SITE										
Northeast	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
D/Q (1/m^2)	4.281E-10	2.098E-10	1.316E-10	6.653E-11	4.027E-11	2.700E-11	1.935E-11	1.453E-11	1.129E-11	9.022E-12	7.364E-12
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
Northeast	0.5–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
D/Q (1/m^2)	1.219E-08	3.766E-09	1.498E-09	8.189E-10	5.205E-10	2.236E-10	6.932E-11	2.748E-11	1.467E-11	9.081E-12	

Table 2.7-18
Long-Term Average X/Q and D/Q Values for Routine Releases at Specific Receptors of Interest

Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) 2.26 Day Decay Undepleted	X/Q (Sec/m^3) 8.00 Day Decay Depleted	D/Q (1/m^2)
Residential	South	2.55	4,099	7.7E-08	7.7E-08	6.2E-08	4.8E-10
Residential	South-Southwest	2.01	3,234	1.3E-07	1.3E-07	1.0E-07	1.0E-09
Residential	Southwest	2.31	3,719	1.4E-07	1.4E-07	1.1E-07	1.3E-09
Residential	West	2.20	3,541	1.1E-07	1.1E-07	8.8E-08	6.8E-10
Residential	West-Northwest	2.24	3,597	6.7E-08	6.7E-08	5.5E-08	3.5E-10
Residential	Northwest	4.23	6,801	4.3E-08	4.2E-08	3.2E-08	1.5E-10
Residential	North-Northwest	3.51	5,656	1.3E-07	1.3E-07	1.0E-07	4.0E-10
Residential	North	4.51	7,264	1.3E-07	1.3E-07	1.0E-07	3.3E-10
Residential	North-Northeast	3.72	5,980	1.9E-07	1.9E-07	1.5E-07	5.7E-10
Residential	Northeast	2.14	3,436	5.4E-07	5.4E-07	4.4E-07	1.9E-09
Residential	East-Northeast	1.30	2,094	9.9E-07	9.9E-07	8.5E-07	4.3E-09
Residential	East	1.23	1,978	1.0E-06	9.9E-07	8.6E-07	4.2E-09
Residential	Southeast	1.68	2,703	1.8E-07	1.8E-07	1.5E-07	9.1E-10
Meat	South	3.98	6,403	4.0E-08	3.9E-08	3.1E-08	2.2E-10
Meat	South-Southwest	3.60	5,793	5.3E-08	5.2E-08	4.1E-08	3.6E-10
Meat	Southwest	3.70	5,955	6.8E-08	6.7E-08	5.2E-08	5.7E-10
Meat	West-Southwest	4.08	6,570	4.8E-08	4.7E-08	3.6E-08	3.5E-10
Meat	West-Northwest	1.74	2,795	9.7E-08	9.6E-08	8.1E-08	5.4E-10
Meat	Northwest	4.77	7,682	3.6E-08	3.6E-08	2.7E-08	1.2E-10
Meat	North-Northwest	3.51	5,656	1.3E-07	1.3E-07	1.0E-07	4.0E-10
Meat	North	4.20	6,756	1.5E-07	1.4E-07	1.1E-07	3.7E-10
Meat	North-Northeast	5.79	9,313	1.1E-07	1.0E-07	7.7E-08	2.6E-10
Meat	Northeast	2.14	3,436	5.4E-07	5.4E-07	4.4E-07	1.9E-09
Meat	Southeast	4.26	6,855	4.9E-08	4.9E-08	3.8E-08	1.8E-10
Vegetable	South	2.55	4,099	7.7E-08	7.7E-08	6.2E-08	4.8E-10
Vegetable	South-Southwest	2.67	4,296	8.2E-08	8.2E-08	6.6E-08	6.1E-10
Vegetable	Southwest	2.31	3,719	1.4E-07	1.4E-07	1.1E-07	1.3E-09
Vegetable	West	2.30	3,696	1.0E-07	1.0E-07	8.3E-08	6.3E-10
Vegetable	West-Northwest	2.47	3,973	5.8E-08	5.8E-08	4.7E-08	2.9E-10
Vegetable	Northwest	4.77	7,682	3.6E-08	3.6E-08	2.7E-08	1.2E-10
Vegetable	North-Northwest	3.51	5,656	1.3E-07	1.3E-07	1.0E-07	4.0E-10
Vegetable	North-Northeast	4.03	6,480	1.7E-07	1.7E-07	1.3E-07	4.9E-10
Vegetable	Northeast	2.30	3,703	4.9E-07	4.8E-07	4.0E-07	1.7E-09
Vegetable	East-Northeast	1.64	2,647	7.1E-07	7.0E-07	6.0E-07	2.9E-09
Vegetable	East	1.23	1,978	1.0E-06	9.9E-07	8.6E-07	4.2E-09
Vegetable	East-Southeast	4.93	7,931	7.4E-08	7.3E-08	5.5E-08	1.6E-10
Vegetable	Southeast	1.68	2,703	1.8E-07	1.8E-07	1.5E-07	9.1E-10
Milk	West	4.74	7,625	3.5E-08	3.5E-08	2.6E-08	1.7E-10
EAB	South	0.50	805	8.9E-07	8.9E-07	8.1E-07	7.7E-09
EAB	South-Southwest	0.50	805	1.0E-06	1.0E-06	9.3E-07	1.1E-08
EAB	Southwest	0.50	805	1.4E-06	1.4E-06	1.3E-06	1.8E-08
EAB	West-Southwest	0.50	805	1.1E-06	1.1E-06	1.0E-06	1.3E-08
EAB	West	0.50	805	9.5E-07	9.5E-07	8.6E-07	8.4E-09
EAB	West-Northwest	0.50	805	6.0E-07	6.0E-07	5.5E-07	4.4E-09
EAB	Northwest	0.50	805	9.3E-07	9.3E-07	8.5E-07	5.9E-09
EAB	North-Northwest	0.50	805	2.2E-06	2.2E-06	2.0E-06	1.1E-08
EAB	North	0.50	805	3.1E-06	3.1E-06	2.9E-06	1.5E-08
EAB	North-Northeast	0.50	805	3.5E-06	3.5E-06	3.2E-06	1.8E-08
EAB	Northeast	0.50	805	4.7E-06	4.7E-06	4.3E-06	2.3E-08
EAB	East-Northeast	0.50	805	4.5E-06	4.4E-06	4.1E-06	2.1E-08
EAB	East	0.50	805	4.1E-06	4.1E-06	3.7E-06	1.9E-08
EAB	East-Southeast	0.50	805	2.0E-06	2.0E-06	1.8E-06	8.3E-09
EAB	Southeast	0.50	805	1.1E-06	1.1E-06	1.0E-06	7.0E-09
EAB	South-Southeast	0.50	805	7.4E-07	7.4E-07	6.7E-07	5.8E-09
Unit 2 to 3	South	0.17	274	5.5E-06	5.5E-06	5.3E-06	4.0E-08
Unit 2 to 3	South-Southwest	0.17	274	6.3E-06	6.3E-06	6.1E-06	5.5E-08
Unit 2 to 3	Southwest	0.17	274	8.5E-06	8.5E-06	8.1E-06	9.2E-08

Note: The term “Dose Evaluation Periphery” means the same as the term “EAB” as input to and output by the XOQDOQ dispersion model. See Subsections 2.7.6.1 and 2.7.5.1 for additional details.

Table 2.7-19
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, No Decay, Undepleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
NO DECAY, UNDEPLETED
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	2.803E-06	8.886E-07	4.789E-07	3.101E-07	1.699E-07	1.107E-07	7.936E-08	6.057E-08	4.822E-08	3.959E-08	3.328E-08
SSW	3.196E-06	1.024E-06	5.532E-07	3.581E-07	1.953E-07	1.267E-07	9.064E-08	6.904E-08	5.487E-08	4.498E-08	3.777E-08
SW	4.292E-06	1.404E-06	7.645E-07	4.950E-07	2.683E-07	1.732E-07	1.232E-07	9.334E-08	7.382E-08	6.027E-08	5.040E-08
WSW	3.385E-06	1.107E-06	6.066E-07	3.947E-07	2.152E-07	1.395E-07	9.957E-08	7.565E-08	5.998E-08	4.907E-08	4.111E-08
W	2.955E-06	9.479E-07	5.219E-07	3.424E-07	1.894E-07	1.240E-07	8.927E-08	6.833E-08	5.452E-08	4.485E-08	3.776E-08
WNW	1.913E-06	6.013E-07	3.284E-07	2.155E-07	1.198E-07	7.884E-08	5.703E-08	4.391E-08	3.521E-08	2.909E-08	2.458E-08
NW	3.010E-06	9.289E-07	4.977E-07	3.240E-07	1.828E-07	1.216E-07	8.874E-08	6.883E-08	5.554E-08	4.613E-08	3.917E-08
NNW	7.166E-06	2.167E-06	1.134E-06	7.312E-07	4.171E-07	2.802E-07	2.062E-07	1.613E-07	1.311E-07	1.096E-07	9.360E-08
N	1.051E-05	3.144E-06	1.621E-06	1.039E-06	5.887E-07	3.947E-07	2.907E-07	2.286E-07	1.867E-07	1.566E-07	1.342E-07
NNE	1.158E-05	3.470E-06	1.813E-06	1.172E-06	6.608E-07	4.414E-07	3.240E-07	2.540E-07	2.068E-07	1.731E-07	1.480E-07
NE	1.592E-05	4.733E-06	2.450E-06	1.576E-06	8.873E-07	5.925E-07	4.352E-07	3.418E-07	2.788E-07	2.337E-07	2.001E-07
ENE	1.508E-05	4.455E-06	2.272E-06	1.451E-06	8.087E-07	5.377E-07	3.945E-07	3.109E-07	2.542E-07	2.137E-07	1.834E-07
E	1.377E-05	4.104E-06	2.103E-06	1.346E-06	7.505E-07	4.992E-07	3.662E-07	2.885E-07	2.359E-07	1.982E-07	1.701E-07
ESE	6.706E-06	2.012E-06	1.035E-06	6.628E-07	3.715E-07	2.475E-07	1.816E-07	1.426E-07	1.163E-07	9.746E-08	8.343E-08
SE	3.747E-06	1.141E-06	5.970E-07	3.838E-07	2.137E-07	1.413E-07	1.029E-07	8.005E-08	6.476E-08	5.392E-08	4.590E-08
SSE	2.366E-06	7.369E-07	3.927E-07	2.536E-07	1.399E-07	9.170E-08	6.615E-08	5.083E-08	4.071E-08	3.359E-08	2.837E-08

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	2.853E-08	1.585E-08	1.048E-08	5.898E-09	3.960E-09	2.913E-09	2.270E-09	1.840E-09	1.536E-09	1.310E-09	1.136E-09
SSW	3.233E-08	1.787E-08	1.177E-08	6.590E-09	4.409E-09	3.235E-09	2.516E-09	2.036E-09	1.696E-09	1.445E-09	1.252E-09
SW	4.300E-08	2.343E-08	1.527E-08	8.422E-09	5.581E-09	4.065E-09	3.141E-09	2.529E-09	2.097E-09	1.779E-09	1.537E-09
WSW	3.512E-08	1.924E-08	1.258E-08	6.964E-09	4.610E-09	3.354E-09	2.590E-09	2.083E-09	1.726E-09	1.463E-09	1.263E-09
W	3.239E-08	1.801E-08	1.191E-08	6.683E-09	4.459E-09	3.263E-09	2.532E-09	2.044E-09	1.700E-09	1.445E-09	1.250E-09
WNW	2.116E-08	1.193E-08	7.962E-09	4.529E-09	3.051E-09	2.250E-09	1.756E-09	1.426E-09	1.191E-09	1.016E-09	8.823E-10
NW	3.385E-08	1.937E-08	1.306E-08	7.537E-09	5.123E-09	3.803E-09	2.985E-09	2.434E-09	2.040E-09	1.747E-09	1.522E-09
NNW	8.129E-08	4.735E-08	3.234E-08	1.897E-08	1.303E-08	9.756E-09	7.707E-09	6.319E-09	5.322E-09	4.576E-09	3.999E-09
N	1.169E-07	6.889E-08	4.745E-08	2.816E-08	1.951E-08	1.470E-08	1.167E-08	9.609E-09	8.125E-09	7.009E-09	6.144E-09
NNE	1.287E-07	7.541E-08	5.173E-08	3.053E-08	2.108E-08	1.584E-08	1.255E-08	1.032E-08	8.711E-09	7.506E-09	6.572E-09
NE	1.742E-07	1.025E-07	7.058E-08	4.186E-08	2.900E-08	2.185E-08	1.735E-08	1.429E-08	1.208E-08	1.042E-08	9.139E-09
ENE	1.600E-07	9.497E-08	6.577E-08	3.935E-08	2.744E-08	2.077E-08	1.656E-08	1.369E-08	1.161E-08	1.004E-08	8.826E-09
E	1.483E-07	8.794E-08	6.083E-08	3.634E-08	2.530E-08	1.913E-08	1.524E-08	1.258E-08	1.067E-08	9.222E-09	8.099E-09
ESE	7.265E-08	4.277E-08	2.945E-08	1.748E-08	1.212E-08	9.135E-09	7.259E-09	5.981E-09	5.060E-09	4.368E-09	3.830E-09
SE	3.977E-08	2.302E-08	1.566E-08	9.156E-09	6.290E-09	4.709E-09	3.722E-09	3.053E-09	2.573E-09	2.214E-09	1.936E-09
SSE	2.442E-08	1.379E-08	9.227E-09	5.275E-09	3.574E-09	2.648E-09	2.075E-09	1.690E-09	1.416E-09	1.212E-09	1.055E-09

Table 2.7-20
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, No Decay, Undepleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
NO DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE .5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.949E-07	1.747E-07	8.019E-08	4.846E-08	3.339E-08	1.628E-08	6.055E-09	2.935E-09	1.847E-09	1.312E-09
SSW	5.711E-07	2.010E-07	9.162E-08	5.515E-08	3.789E-08	1.837E-08	6.772E-09	3.260E-09	2.043E-09	1.448E-09
SW	7.869E-07	2.764E-07	1.246E-07	7.424E-08	5.058E-08	2.415E-08	8.681E-09	4.100E-09	2.539E-09	1.784E-09
WSW	6.237E-07	2.214E-07	1.006E-07	6.030E-08	4.125E-08	1.981E-08	7.167E-09	3.383E-09	2.092E-09	1.467E-09
W	5.368E-07	1.943E-07	9.016E-08	5.478E-08	3.787E-08	1.850E-08	6.856E-09	3.290E-09	2.052E-09	1.448E-09
WNW	3.389E-07	1.229E-07	5.760E-08	3.536E-08	2.465E-08	1.222E-08	4.635E-09	2.266E-09	1.431E-09	1.018E-09
NW	5.163E-07	1.870E-07	8.955E-08	5.575E-08	3.926E-08	1.979E-08	7.692E-09	3.828E-09	2.441E-09	1.751E-09
NNW	1.184E-06	4.260E-07	2.080E-07	1.316E-07	9.379E-08	4.822E-08	1.930E-08	9.811E-09	6.336E-09	4.583E-09
N	1.701E-06	6.026E-07	2.936E-07	1.872E-07	1.344E-07	7.003E-08	2.860E-08	1.477E-08	9.633E-09	7.019E-09
NNE	1.896E-06	6.768E-07	3.273E-07	2.074E-07	1.483E-07	7.673E-08	3.104E-08	1.592E-08	1.034E-08	7.517E-09
NE	2.569E-06	9.094E-07	4.398E-07	2.796E-07	2.004E-07	1.043E-07	4.253E-08	2.196E-08	1.432E-08	1.044E-08
ENE	2.392E-06	8.311E-07	3.992E-07	2.550E-07	1.837E-07	9.644E-08	3.993E-08	2.087E-08	1.372E-08	1.006E-08
E	2.211E-06	7.711E-07	3.706E-07	2.366E-07	1.704E-07	8.931E-08	3.687E-08	1.922E-08	1.261E-08	9.234E-09
ESE	1.087E-06	3.811E-07	1.836E-07	1.166E-07	8.359E-08	4.349E-08	1.775E-08	9.180E-09	5.995E-09	4.374E-09
SE	6.232E-07	2.193E-07	1.040E-07	6.500E-08	4.601E-08	2.347E-08	9.328E-09	4.736E-09	3.061E-09	2.217E-09
SSE	4.074E-07	1.438E-07	6.684E-08	4.089E-08	2.846E-08	1.413E-08	5.397E-09	2.666E-09	1.696E-09	1.214E-09

0XOQDOQ SCE&G

Table 2.7-21
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, 2.26-Day Decay, Undepleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
2.260 DAY DECAY, UNDEPLETED
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	2.801E-06	8.873E-07	4.779E-07	3.091E-07	1.692E-07	1.100E-07	7.876E-08	6.002E-08	4.770E-08	3.911E-08	3.283E-08
SSW	3.194E-06	1.022E-06	5.522E-07	3.572E-07	1.946E-07	1.261E-07	9.004E-08	6.849E-08	5.436E-08	4.451E-08	3.732E-08
SW	4.290E-06	1.403E-06	7.632E-07	4.939E-07	2.674E-07	1.724E-07	1.225E-07	9.270E-08	7.323E-08	5.971E-08	4.988E-08
WSW	3.383E-06	1.106E-06	6.056E-07	3.939E-07	2.146E-07	1.389E-07	9.905E-08	7.517E-08	5.954E-08	4.865E-08	4.072E-08
W	2.954E-06	9.468E-07	5.209E-07	3.416E-07	1.887E-07	1.234E-07	8.874E-08	6.785E-08	5.407E-08	4.442E-08	3.735E-08
WNW	1.912E-06	6.004E-07	3.277E-07	2.149E-07	1.193E-07	7.839E-08	5.662E-08	4.352E-08	3.485E-08	2.875E-08	2.426E-08
NW	3.007E-06	9.275E-07	4.965E-07	3.230E-07	1.820E-07	1.209E-07	8.808E-08	6.821E-08	5.495E-08	4.557E-08	3.863E-08
NNW	7.161E-06	2.164E-06	1.131E-06	7.291E-07	4.152E-07	2.785E-07	2.047E-07	1.599E-07	1.298E-07	1.083E-07	9.236E-08
N	1.050E-05	3.138E-06	1.617E-06	1.036E-06	5.857E-07	3.921E-07	2.883E-07	2.263E-07	1.845E-07	1.545E-07	1.321E-07
NNE	1.157E-05	3.464E-06	1.809E-06	1.168E-06	6.576E-07	4.386E-07	3.214E-07	2.515E-07	2.044E-07	1.708E-07	1.458E-07
NE	1.590E-05	4.725E-06	2.443E-06	1.571E-06	8.827E-07	5.884E-07	4.314E-07	3.382E-07	2.753E-07	2.304E-07	1.969E-07
ENE	1.507E-05	4.447E-06	2.265E-06	1.446E-06	8.043E-07	5.337E-07	3.909E-07	3.074E-07	2.510E-07	2.105E-07	1.803E-07
E	1.376E-05	4.097E-06	2.097E-06	1.341E-06	7.464E-07	4.955E-07	3.629E-07	2.854E-07	2.329E-07	1.953E-07	1.672E-07
ESE	6.699E-06	2.007E-06	1.032E-06	6.600E-07	3.692E-07	2.455E-07	1.797E-07	1.408E-07	1.146E-07	9.582E-08	8.185E-08
SE	3.743E-06	1.139E-06	5.954E-07	3.825E-07	2.125E-07	1.403E-07	1.020E-07	7.919E-08	6.395E-08	5.315E-08	4.515E-08
SSE	2.364E-06	7.356E-07	3.918E-07	2.528E-07	1.392E-07	9.108E-08	6.560E-08	5.032E-08	4.022E-08	3.314E-08	2.794E-08

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	2.810E-08	1.549E-08	1.016E-08	5.629E-09	3.721E-09	2.695E-09	2.068E-09	1.650E-09	1.356E-09	1.139E-09	9.728E-10
SSW	3.190E-08	1.751E-08	1.145E-08	6.324E-09	4.172E-09	3.019E-09	2.315E-09	1.847E-09	1.517E-09	1.275E-09	1.089E-09
SW	4.250E-08	2.302E-08	1.491E-08	8.125E-09	5.320E-09	3.827E-09	2.922E-09	2.324E-09	1.905E-09	1.597E-09	1.362E-09
WSW	3.475E-08	1.893E-08	1.231E-08	6.734E-09	4.406E-09	3.168E-09	2.418E-09	1.922E-09	1.574E-09	1.319E-09	1.125E-09
W	3.200E-08	1.769E-08	1.162E-08	6.441E-09	4.243E-09	3.067E-09	2.349E-09	1.873E-09	1.538E-09	1.291E-09	1.103E-09
WNW	2.085E-08	1.166E-08	7.723E-09	4.325E-09	2.867E-09	2.081E-09	1.599E-09	1.277E-09	1.050E-09	8.817E-10	7.534E-10
NW	3.333E-08	1.892E-08	1.266E-08	7.186E-09	4.805E-09	3.510E-09	2.710E-09	2.174E-09	1.793E-09	1.511E-09	1.294E-09
NNW	8.010E-08	4.631E-08	3.140E-08	1.814E-08	1.228E-08	9.057E-09	7.050E-09	5.695E-09	4.727E-09	4.005E-09	3.449E-09
N	1.149E-07	6.714E-08	4.584E-08	2.673E-08	1.820E-08	1.347E-08	1.051E-08	8.508E-09	7.070E-09	5.995E-09	5.164E-09
NNE	1.266E-07	7.356E-08	5.004E-08	2.905E-08	1.972E-08	1.457E-08	1.135E-08	9.179E-09	7.621E-09	6.459E-09	5.562E-09
NE	1.711E-07	9.982E-08	6.808E-08	3.965E-08	2.697E-08	1.995E-08	1.556E-08	1.258E-08	1.044E-08	8.850E-09	7.619E-09
ENE	1.570E-07	9.234E-08	6.334E-08	3.719E-08	2.544E-08	1.890E-08	1.479E-08	1.199E-08	9.983E-09	8.476E-09	7.310E-09
E	1.456E-07	8.550E-08	5.858E-08	3.433E-08	2.345E-08	1.740E-08	1.360E-08	1.101E-08	9.160E-09	7.771E-09	6.697E-09
ESE	7.112E-08	4.142E-08	2.821E-08	1.639E-08	1.112E-08	8.210E-09	6.388E-09	5.154E-09	4.270E-09	3.609E-09	3.100E-09
SE	3.905E-08	2.239E-08	1.509E-08	8.660E-09	5.838E-09	4.289E-09	3.327E-09	2.678E-09	2.216E-09	1.871E-09	1.606E-09
SSE	2.401E-08	1.344E-08	8.912E-09	5.006E-09	3.332E-09	2.426E-09	1.868E-09	1.495E-09	1.231E-09	1.036E-09	8.861E-10

Table 2.7-22
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, 2.26-Day Decay, Undepleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
2.260 DAY DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.939E-07	1.740E-07	7.959E-08	4.795E-08	3.294E-08	1.592E-08	5.788E-09	2.718E-09	1.657E-09	1.142E-09
SSW	5.700E-07	2.003E-07	9.103E-08	5.464E-08	3.744E-08	1.802E-08	6.507E-09	3.045E-09	1.855E-09	1.278E-09
SW	7.856E-07	2.755E-07	1.239E-07	7.365E-08	5.006E-08	2.374E-08	8.386E-09	3.863E-09	2.335E-09	1.601E-09
WSW	6.228E-07	2.208E-07	1.001E-07	5.986E-08	4.086E-08	1.950E-08	6.938E-09	3.198E-09	1.931E-09	1.322E-09
W	5.359E-07	1.937E-07	8.963E-08	5.433E-08	3.746E-08	1.817E-08	6.616E-09	3.093E-09	1.881E-09	1.294E-09
WNW	3.382E-07	1.224E-07	5.719E-08	3.500E-08	2.433E-08	1.195E-08	4.432E-09	2.098E-09	1.282E-09	8.839E-10
NW	5.152E-07	1.862E-07	8.888E-08	5.516E-08	3.872E-08	1.934E-08	7.345E-09	3.535E-09	2.182E-09	1.514E-09
NNW	1.182E-06	4.242E-07	2.065E-07	1.302E-07	9.255E-08	4.719E-08	1.848E-08	9.114E-09	5.713E-09	4.013E-09
N	1.697E-06	5.997E-07	2.912E-07	1.850E-07	1.324E-07	6.828E-08	2.718E-08	1.355E-08	8.533E-09	6.006E-09
NNE	1.892E-06	6.736E-07	3.247E-07	2.051E-07	1.461E-07	7.489E-08	2.957E-08	1.466E-08	9.207E-09	6.471E-09
NE	2.563E-06	9.048E-07	4.360E-07	2.762E-07	1.973E-07	1.016E-07	4.033E-08	2.006E-08	1.262E-08	8.867E-09
ENE	2.386E-06	8.266E-07	3.956E-07	2.517E-07	1.806E-07	9.383E-08	3.778E-08	1.900E-08	1.203E-08	8.491E-09
E	2.205E-06	7.670E-07	3.672E-07	2.336E-07	1.675E-07	8.689E-08	3.488E-08	1.749E-08	1.105E-08	7.785E-09
ESE	1.083E-06	3.788E-07	1.817E-07	1.149E-07	8.202E-08	4.215E-08	1.668E-08	8.258E-09	5.169E-09	3.616E-09
SE	6.216E-07	2.182E-07	1.031E-07	6.419E-08	4.526E-08	2.285E-08	8.835E-09	4.317E-09	2.688E-09	1.875E-09
SSE	4.064E-07	1.431E-07	6.628E-08	4.041E-08	2.802E-08	1.378E-08	5.130E-09	2.445E-09	1.501E-09	1.038E-09

0XOQDOQ SCE&G

Table 2.7-23
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, 8.00-Day Decay, Depleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
8.000 DAY DECAY, DEPLETED

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	2.652E-06	8.111E-07	4.265E-07	2.712E-07	1.441E-07	9.147E-08	6.415E-08	4.799E-08	3.751E-08	3.029E-08	2.507E-08
SSW	3.024E-06	9.345E-07	4.927E-07	3.133E-07	1.657E-07	1.048E-07	7.328E-08	5.471E-08	4.270E-08	3.443E-08	2.846E-08
SW	4.062E-06	1.282E-06	6.809E-07	4.330E-07	2.277E-07	1.432E-07	9.965E-08	7.400E-08	5.747E-08	4.614E-08	3.800E-08
WSW	3.203E-06	1.011E-06	5.403E-07	3.453E-07	1.826E-07	1.154E-07	8.053E-08	5.998E-08	4.671E-08	3.758E-08	3.100E-08
W	2.797E-06	8.654E-07	4.648E-07	2.995E-07	1.607E-07	1.026E-07	7.219E-08	5.417E-08	4.244E-08	3.433E-08	2.846E-08
WNW	1.810E-06	5.488E-07	2.925E-07	1.885E-07	1.016E-07	6.518E-08	4.610E-08	3.479E-08	2.739E-08	2.225E-08	1.852E-08
NW	2.848E-06	8.479E-07	4.432E-07	2.834E-07	1.550E-07	1.005E-07	7.173E-08	5.453E-08	4.320E-08	3.529E-08	2.950E-08
NNW	6.781E-06	1.978E-06	1.010E-06	6.395E-07	3.538E-07	2.316E-07	1.667E-07	1.278E-07	1.020E-07	8.387E-08	7.050E-08
N	9.940E-06	2.869E-06	1.443E-06	9.090E-07	4.993E-07	3.262E-07	2.349E-07	1.811E-07	1.452E-07	1.198E-07	1.010E-07
NNE	1.096E-05	3.167E-06	1.614E-06	1.025E-06	5.604E-07	3.648E-07	2.619E-07	2.012E-07	1.608E-07	1.324E-07	1.114E-07
NE	1.506E-05	4.320E-06	2.181E-06	1.379E-06	7.525E-07	4.897E-07	3.517E-07	2.707E-07	2.168E-07	1.787E-07	1.506E-07
ENE	1.427E-05	4.066E-06	2.023E-06	1.269E-06	6.857E-07	4.443E-07	3.187E-07	2.462E-07	1.977E-07	1.633E-07	1.380E-07
E	1.303E-05	3.746E-06	1.872E-06	1.177E-06	6.364E-07	4.125E-07	2.959E-07	2.285E-07	1.834E-07	1.515E-07	1.280E-07
ESE	6.345E-06	1.836E-06	9.219E-07	5.795E-07	3.150E-07	2.045E-07	1.467E-07	1.129E-07	9.034E-08	7.446E-08	6.274E-08
SE	3.545E-06	1.042E-06	5.316E-07	3.357E-07	1.812E-07	1.168E-07	8.315E-08	6.339E-08	5.035E-08	4.122E-08	3.454E-08
SSE	2.239E-06	6.726E-07	3.497E-07	2.218E-07	1.187E-07	7.579E-08	5.346E-08	4.026E-08	3.166E-08	2.569E-08	2.136E-08

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	2.118E-08	1.110E-08	6.979E-09	3.619E-09	2.272E-09	1.577E-09	1.166E-09	9.007E-10	7.186E-10	5.875E-10	4.898E-10
SSW	2.401E-08	1.252E-08	7.847E-09	4.050E-09	2.535E-09	1.755E-09	1.296E-09	9.997E-10	7.968E-10	6.509E-10	5.422E-10
SW	3.195E-08	1.643E-08	1.019E-08	5.184E-09	3.215E-09	2.211E-09	1.623E-09	1.246E-09	9.892E-10	8.052E-10	6.687E-10
WSW	2.610E-08	1.350E-08	8.402E-09	4.289E-09	2.658E-09	1.826E-09	1.339E-09	1.028E-09	8.153E-10	6.633E-10	5.505E-10
W	2.406E-08	1.263E-08	7.947E-09	4.113E-09	2.568E-09	1.774E-09	1.307E-09	1.007E-09	8.010E-10	6.533E-10	5.435E-10
WNW	1.571E-08	8.354E-09	5.303E-09	2.780E-09	1.751E-09	1.218E-09	9.017E-10	6.975E-10	5.569E-10	4.556E-10	3.799E-10
NW	2.512E-08	1.356E-08	8.700E-09	4.624E-09	2.938E-09	2.057E-09	1.531E-09	1.190E-09	9.535E-10	7.826E-10	6.545E-10
NNW	6.034E-08	3.317E-08	2.155E-08	1.165E-08	7.485E-09	5.286E-09	3.963E-09	3.097E-09	2.495E-09	2.057E-09	1.727E-09
N	8.671E-08	4.821E-08	3.157E-08	1.725E-08	1.117E-08	7.933E-09	5.975E-09	4.686E-09	3.786E-09	3.130E-09	2.634E-09
NNE	9.549E-08	5.279E-08	3.443E-08	1.872E-08	1.208E-08	8.559E-09	6.434E-09	5.038E-09	4.066E-09	3.357E-09	2.823E-09
NE	1.292E-07	7.174E-08	4.694E-08	2.563E-08	1.659E-08	1.178E-08	8.870E-09	6.956E-09	5.620E-09	4.645E-09	3.909E-09
ENE	1.186E-07	6.642E-08	4.372E-08	2.408E-08	1.568E-08	1.119E-08	8.460E-09	6.656E-09	5.393E-09	4.469E-09	3.769E-09
E	1.100E-07	6.150E-08	4.043E-08	2.223E-08	1.446E-08	1.030E-08	7.781E-09	6.117E-09	4.952E-09	4.100E-09	3.456E-09
ESE	5.383E-08	2.988E-08	1.954E-08	1.067E-08	6.907E-09	4.903E-09	3.691E-09	2.894E-09	2.337E-09	1.931E-09	1.624E-09
SE	2.949E-08	1.610E-08	1.041E-08	5.604E-09	3.596E-09	2.537E-09	1.901E-09	1.485E-09	1.196E-09	9.852E-10	8.269E-10
SSE	1.812E-08	9.652E-09	6.138E-09	3.232E-09	2.046E-09	1.429E-09	1.062E-09	8.241E-10	6.598E-10	5.411E-10	4.522E-10

Table 2.7-24
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, 8.00-Day Decay, Depleted

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
8.000 DAY DECAY, DEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.430E-07	1.490E-07	6.497E-08	3.775E-08	2.517E-08	1.151E-08	3.767E-09	1.598E-09	9.071E-10	5.902E-10
SSW	5.111E-07	1.714E-07	7.426E-08	4.298E-08	2.858E-08	1.300E-08	4.220E-09	1.779E-09	1.007E-09	6.539E-10
SW	7.043E-07	2.358E-07	1.010E-07	5.788E-08	3.817E-08	1.710E-08	5.421E-09	2.243E-09	1.256E-09	8.092E-10
WSW	5.582E-07	1.889E-07	8.160E-08	4.702E-08	3.114E-08	1.404E-08	4.478E-09	1.853E-09	1.036E-09	6.665E-10
W	4.804E-07	1.657E-07	7.308E-08	4.270E-08	2.857E-08	1.309E-08	4.278E-09	1.799E-09	1.014E-09	6.564E-10
WNW	3.032E-07	1.047E-07	4.666E-08	2.755E-08	1.858E-08	8.632E-09	2.883E-09	1.233E-09	7.023E-10	4.576E-10
NW	4.621E-07	1.593E-07	7.253E-08	4.342E-08	2.959E-08	1.397E-08	4.780E-09	2.082E-09	1.197E-09	7.858E-10
NNW	1.060E-06	3.630E-07	1.684E-07	1.025E-07	7.070E-08	3.404E-08	1.200E-08	5.343E-09	3.115E-09	2.065E-09
N	1.523E-06	5.134E-07	2.377E-07	1.458E-07	1.013E-07	4.937E-08	1.773E-08	8.013E-09	4.712E-09	3.141E-09
NNE	1.697E-06	5.767E-07	2.651E-07	1.615E-07	1.117E-07	5.412E-08	1.926E-08	8.648E-09	5.067E-09	3.370E-09
NE	2.300E-06	7.748E-07	3.561E-07	2.177E-07	1.510E-07	7.348E-08	2.635E-08	1.190E-08	6.994E-09	4.662E-09
ENE	2.142E-06	7.081E-07	3.232E-07	1.984E-07	1.383E-07	6.793E-08	2.471E-08	1.130E-08	6.690E-09	4.483E-09
E	1.980E-06	6.570E-07	3.000E-07	1.841E-07	1.283E-07	6.291E-08	2.282E-08	1.040E-08	6.148E-09	4.114E-09
ESE	9.728E-07	3.246E-07	1.486E-07	9.072E-08	6.291E-08	3.061E-08	1.097E-08	4.953E-09	2.910E-09	1.938E-09
SE	5.579E-07	1.869E-07	8.422E-08	5.060E-08	3.465E-08	1.655E-08	5.780E-09	2.565E-09	1.494E-09	9.889E-10
SSE	3.646E-07	1.225E-07	5.413E-08	3.184E-08	2.144E-08	9.972E-09	3.351E-09	1.447E-09	8.295E-10	5.433E-10

0XOQDOQ SCE&G

Table 2.7-25
Long-Term Average D/Q Values ($1/m^2$) for Routine Releases at Distances Between 0.25 and 50 Miles

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

******************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DIRECTION	DISTANCES IN MILES										
FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	2.283E-08	7.719E-09	3.963E-09	2.434E-09	1.213E-09	7.359E-10	4.975E-10	3.605E-10	2.741E-10	2.160E-10	1.748E-10
SSW	3.141E-08	1.062E-08	5.453E-09	3.348E-09	1.669E-09	1.012E-09	6.845E-10	4.960E-10	3.772E-10	2.972E-10	2.406E-10
SW	5.235E-08	1.770E-08	9.090E-09	5.582E-09	2.783E-09	1.688E-09	1.141E-09	8.269E-10	6.287E-10	4.953E-10	4.010E-10
WSW	3.863E-08	1.306E-08	6.708E-09	4.119E-09	2.053E-09	1.245E-09	8.420E-10	6.102E-10	4.640E-10	3.655E-10	2.959E-10
W	2.498E-08	8.448E-09	4.338E-09	2.664E-09	1.328E-09	8.054E-10	5.445E-10	3.946E-10	3.000E-10	2.364E-10	1.914E-10
WNW	1.310E-08	4.430E-09	2.274E-09	1.397E-09	6.963E-10	4.223E-10	2.855E-10	2.069E-10	1.573E-10	1.239E-10	1.003E-10
NW	1.755E-08	5.935E-09	3.047E-09	1.871E-09	9.328E-10	5.658E-10	3.825E-10	2.772E-10	2.108E-10	1.661E-10	1.344E-10
NNW	3.395E-08	1.148E-08	5.895E-09	3.620E-09	1.805E-09	1.095E-09	7.400E-10	5.363E-10	4.078E-10	3.212E-10	2.601E-10
N	4.295E-08	1.452E-08	7.457E-09	4.579E-09	2.283E-09	1.384E-09	9.360E-10	6.783E-10	5.158E-10	4.063E-10	3.290E-10
NNE	5.254E-08	1.777E-08	9.122E-09	5.601E-09	2.792E-09	1.694E-09	1.145E-09	8.298E-10	6.309E-10	4.971E-10	4.024E-10
NE	6.756E-08	2.285E-08	1.173E-08	7.203E-09	3.591E-09	2.178E-09	1.473E-09	1.067E-09	8.114E-10	6.392E-10	5.175E-10
ENE	6.307E-08	2.133E-08	1.095E-08	6.724E-09	3.352E-09	2.033E-09	1.375E-09	9.961E-10	7.574E-10	5.967E-10	4.831E-10
E	5.559E-08	1.880E-08	9.652E-09	5.926E-09	2.955E-09	1.792E-09	1.212E-09	8.779E-10	6.676E-10	5.259E-10	4.258E-10
ESE	2.452E-08	8.293E-09	4.258E-09	2.615E-09	1.304E-09	7.906E-10	5.345E-10	3.873E-10	2.945E-10	2.320E-10	1.878E-10
SE	2.074E-08	7.013E-09	3.601E-09	2.211E-09	1.102E-09	6.686E-10	4.520E-10	3.276E-10	2.491E-10	1.962E-10	1.589E-10
SSE	1.723E-08	5.826E-09	2.991E-09	1.837E-09	9.158E-10	5.554E-10	3.755E-10	2.721E-10	2.069E-10	1.630E-10	1.320E-10

0DIRECTION	DISTANCES IN MILES										
FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.446E-10	7.088E-11	4.447E-11	2.248E-11	1.360E-11	9.122E-12	6.536E-12	4.908E-12	3.816E-12	3.048E-12	2.488E-12
SSW	1.990E-10	9.752E-11	6.119E-11	3.093E-11	1.872E-11	1.255E-11	8.993E-12	6.753E-12	5.250E-12	4.194E-12	3.423E-12
SW	3.317E-10	1.626E-10	1.020E-10	5.155E-11	3.120E-11	2.092E-11	1.499E-11	1.126E-11	8.752E-12	6.991E-12	5.706E-12
WSW	2.448E-10	1.200E-10	7.527E-11	3.804E-11	2.303E-11	1.544E-11	1.106E-11	8.306E-12	6.458E-12	5.159E-12	4.211E-12
W	1.583E-10	7.757E-11	4.867E-11	2.460E-11	1.489E-11	9.983E-12	7.154E-12	5.372E-12	4.177E-12	3.336E-12	2.723E-12
WNW	8.300E-11	4.067E-11	2.552E-11	1.290E-11	7.807E-12	5.235E-12	3.751E-12	2.817E-12	2.190E-12	1.749E-12	1.428E-12
NW	1.112E-10	5.449E-11	3.419E-11	1.728E-11	1.046E-11	7.013E-12	5.025E-12	3.773E-12	2.934E-12	2.344E-12	1.913E-12
NNW	2.151E-10	1.054E-10	6.615E-11	3.343E-11	2.024E-11	1.357E-11	9.722E-12	7.300E-12	5.676E-12	4.534E-12	3.701E-12
N	2.721E-10	1.333E-10	8.367E-11	4.229E-11	2.560E-11	1.716E-11	1.230E-11	9.234E-12	7.180E-12	5.735E-12	4.681E-12
NNE	3.329E-10	1.631E-10	1.024E-10	5.173E-11	3.131E-11	2.099E-11	1.504E-11	1.130E-11	8.783E-12	7.016E-12	5.726E-12
NE	4.281E-10	2.098E-10	1.316E-10	6.653E-11	4.027E-11	2.700E-11	1.935E-11	1.453E-11	1.129E-11	9.022E-12	7.364E-12
ENE	3.996E-10	1.958E-10	1.229E-10	6.210E-11	3.759E-11	2.520E-11	1.806E-11	1.356E-11	1.054E-11	8.422E-12	6.874E-12
E	3.522E-10	1.726E-10	1.083E-10	5.474E-11	3.313E-11	2.221E-11	1.592E-11	1.195E-11	9.293E-12	7.423E-12	6.059E-12
ESE	1.554E-10	7.615E-11	4.778E-11	2.415E-11	1.462E-11	9.800E-12	7.022E-12	5.273E-12	4.100E-12	3.275E-12	2.673E-12
SE	1.314E-10	6.439E-11	4.040E-11	2.042E-11	1.236E-11	8.287E-12	5.938E-12	4.459E-12	3.467E-12	2.769E-12	2.261E-12
SSE	1.092E-10	5.350E-11	3.357E-11	1.697E-11	1.027E-11	6.885E-12	4.933E-12	3.704E-12	2.880E-12	2.301E-12	1.878E-12

Table 2.7-26
Long-Term Average D/Q Values ($1/m^2$) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

0************************ RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ************************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.118E-09	1.272E-09	5.063E-10	2.767E-10	1.758E-10	7.553E-11	2.342E-11	9.283E-12	4.957E-12	3.068E-12
SSW	5.666E-09	1.751E-09	6.966E-10	3.807E-10	2.419E-10	1.039E-10	3.223E-11	1.277E-11	6.820E-12	4.222E-12
SW	9.445E-09	2.918E-09	1.161E-09	6.345E-10	4.033E-10	1.732E-10	5.372E-11	2.129E-11	1.137E-11	7.037E-12
WSW	6.970E-09	2.153E-09	8.569E-10	4.682E-10	2.976E-10	1.278E-10	3.964E-11	1.571E-11	8.390E-12	5.193E-12
W	4.507E-09	1.392E-09	5.541E-10	3.028E-10	1.925E-10	8.267E-11	2.563E-11	1.016E-11	5.425E-12	3.358E-12
WNW	2.363E-09	7.301E-10	2.905E-10	1.588E-10	1.009E-10	4.334E-11	1.344E-11	5.327E-12	2.845E-12	1.761E-12
NW	3.166E-09	9.782E-10	3.893E-10	2.127E-10	1.352E-10	5.807E-11	1.801E-11	7.137E-12	3.811E-12	2.359E-12
NNW	6.125E-09	1.892E-09	7.531E-10	4.115E-10	2.616E-10	1.123E-10	3.484E-11	1.381E-11	7.373E-12	4.564E-12
N	7.748E-09	2.394E-09	9.525E-10	5.205E-10	3.308E-10	1.421E-10	4.407E-11	1.746E-11	9.326E-12	5.773E-12
NNE	9.478E-09	2.928E-09	1.165E-09	6.367E-10	4.047E-10	1.738E-10	5.390E-11	2.136E-11	1.141E-11	7.062E-12
NE	1.219E-08	3.766E-09	1.498E-09	8.189E-10	5.205E-10	2.236E-10	6.932E-11	2.748E-11	1.467E-11	9.081E-12
ENE	1.138E-08	3.515E-09	1.399E-09	7.644E-10	4.858E-10	2.087E-10	6.471E-11	2.565E-11	1.370E-11	8.477E-12
E	1.003E-08	3.098E-09	1.233E-09	6.737E-10	4.282E-10	1.839E-10	5.704E-11	2.261E-11	1.207E-11	7.472E-12
ESE	4.424E-09	1.367E-09	5.439E-10	2.972E-10	1.889E-10	8.115E-11	2.516E-11	9.973E-12	5.326E-12	3.296E-12
SE	3.742E-09	1.156E-09	4.600E-10	2.514E-10	1.598E-10	6.862E-11	2.128E-11	8.434E-12	4.504E-12	2.788E-12
SSE	3.108E-09	9.603E-10	3.821E-10	2.088E-10	1.327E-10	5.701E-11	1.768E-11	7.007E-12	3.742E-12	2.316E-12

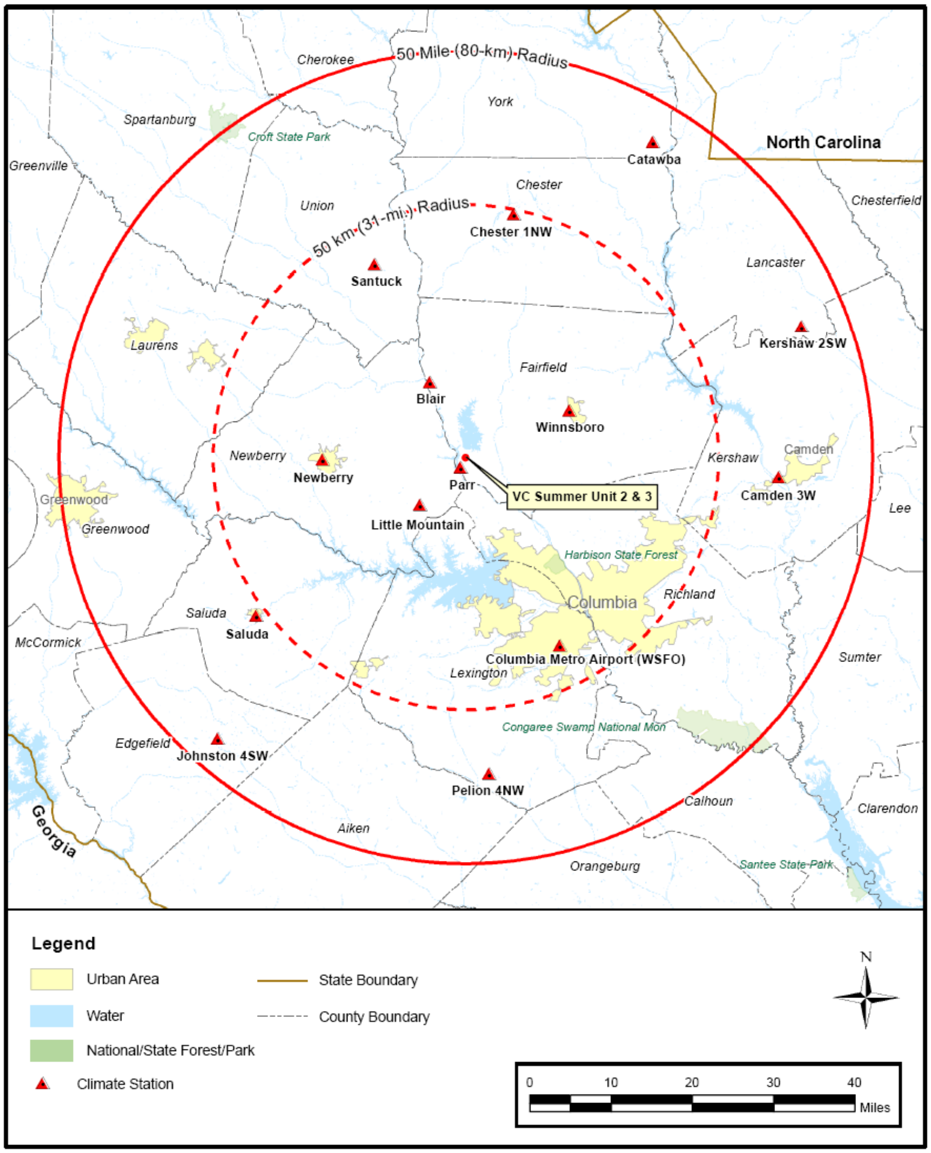


Figure 2.7-1. Climatological Observing Stations near the VCSNS Site

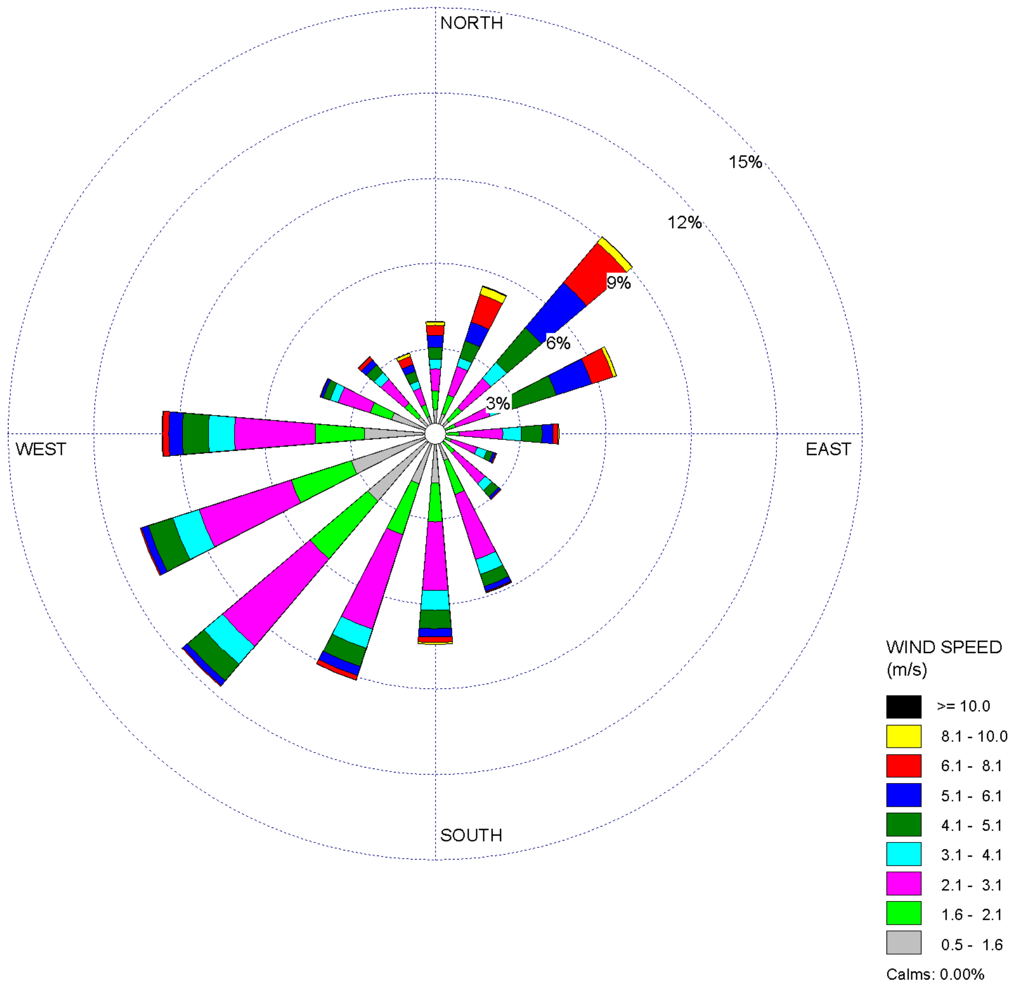


Figure 2.7-2. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Annual

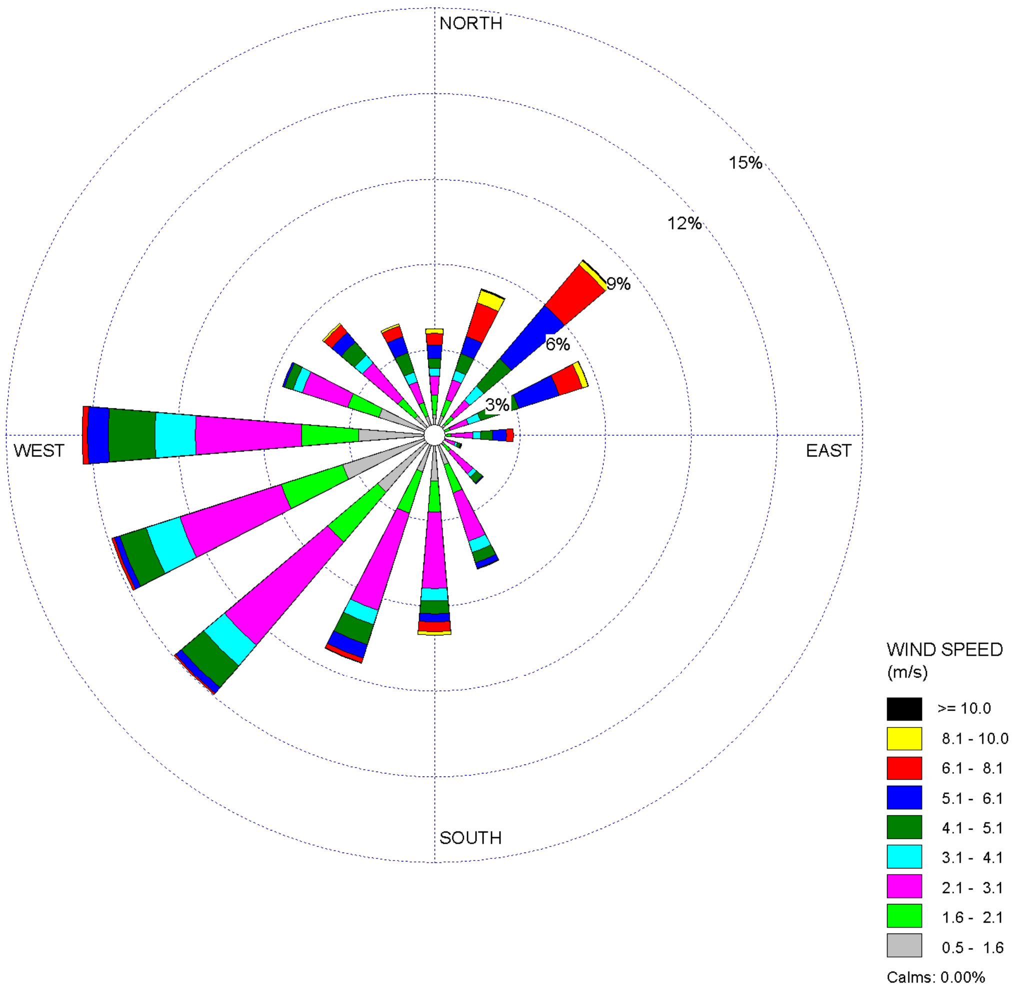


Figure 2.7-3. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Winter

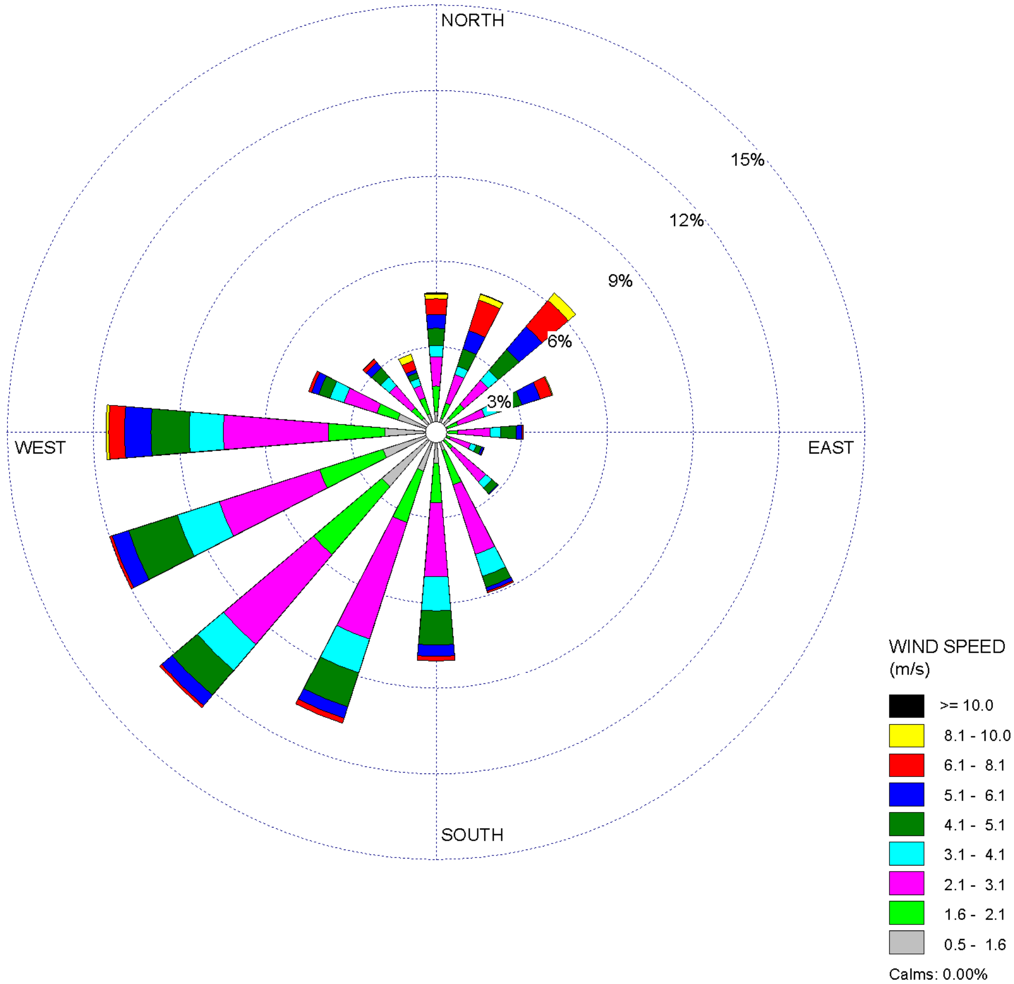


Figure 2.7-4. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Spring

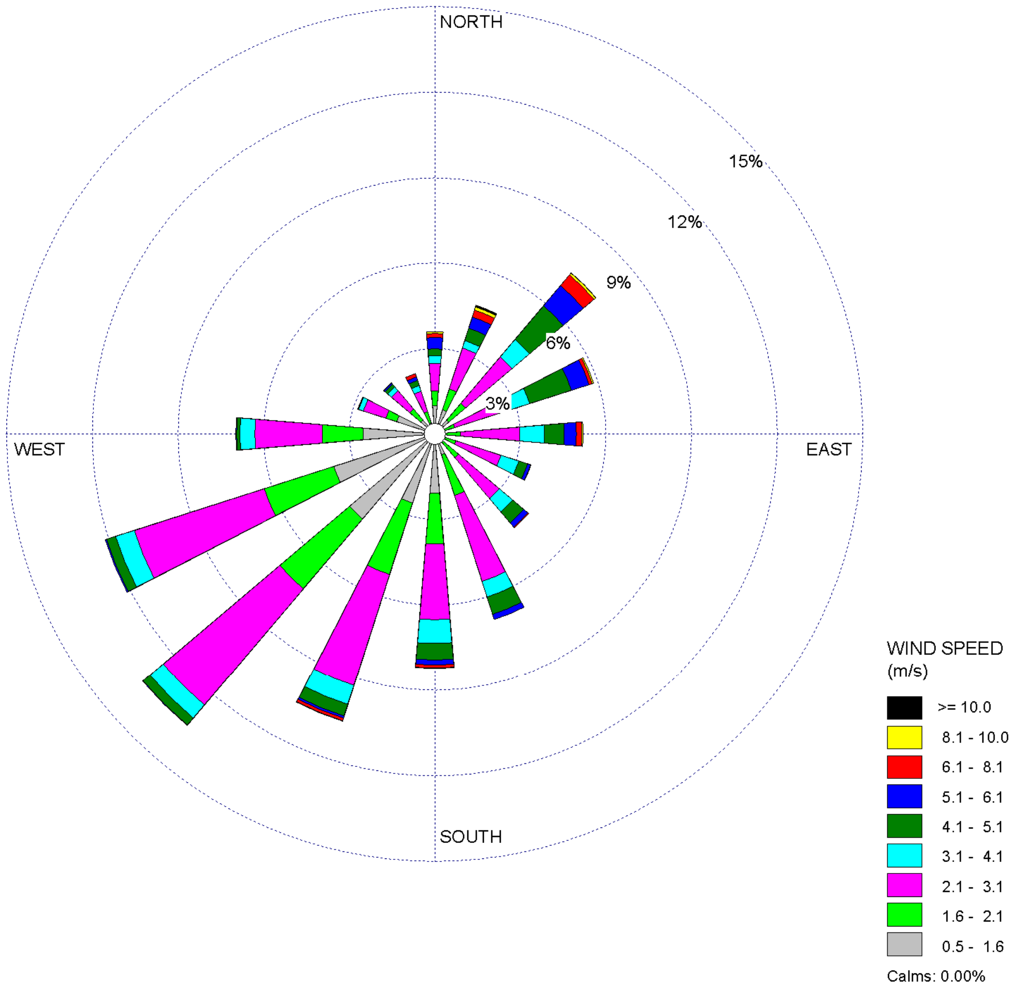


Figure 2.7-5. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Summer

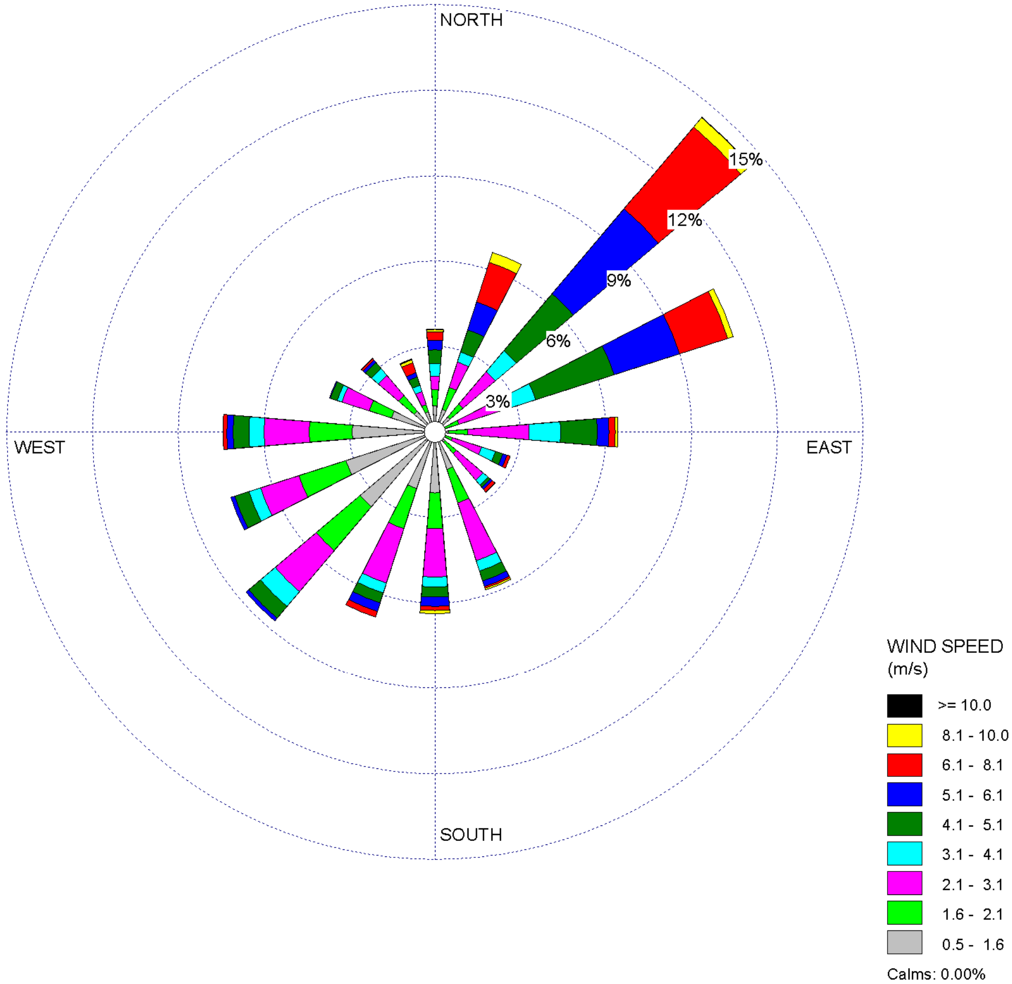


Figure 2.7-6. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Autumn

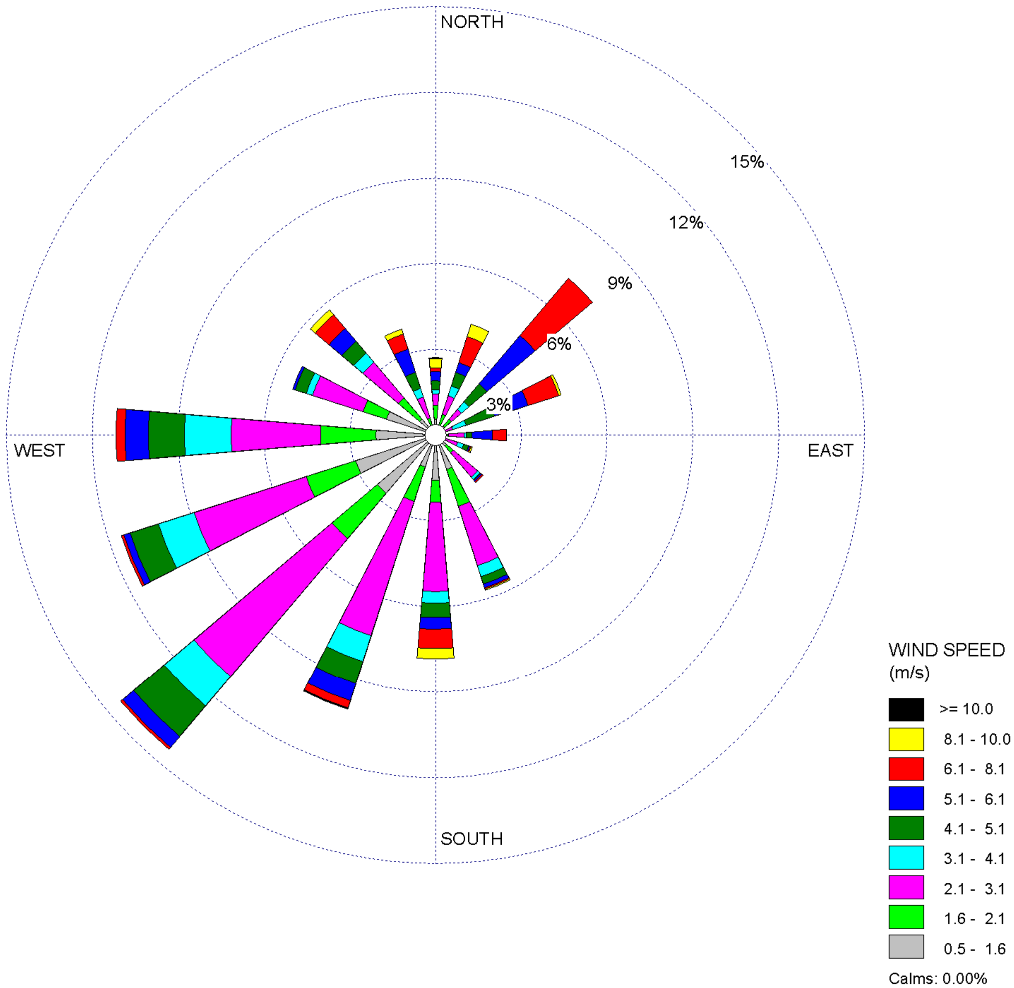


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — January (Sheet 1 of 12)

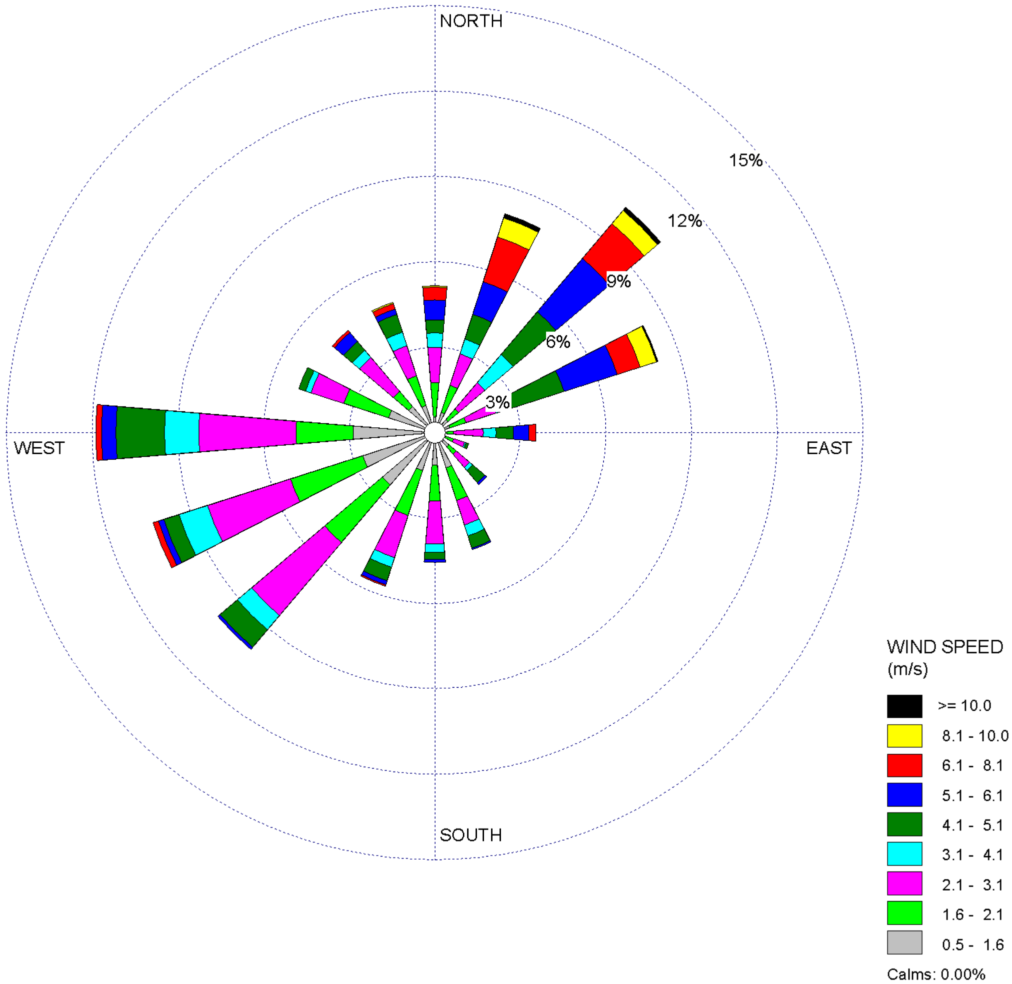


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — February (Sheet 2 of 12)

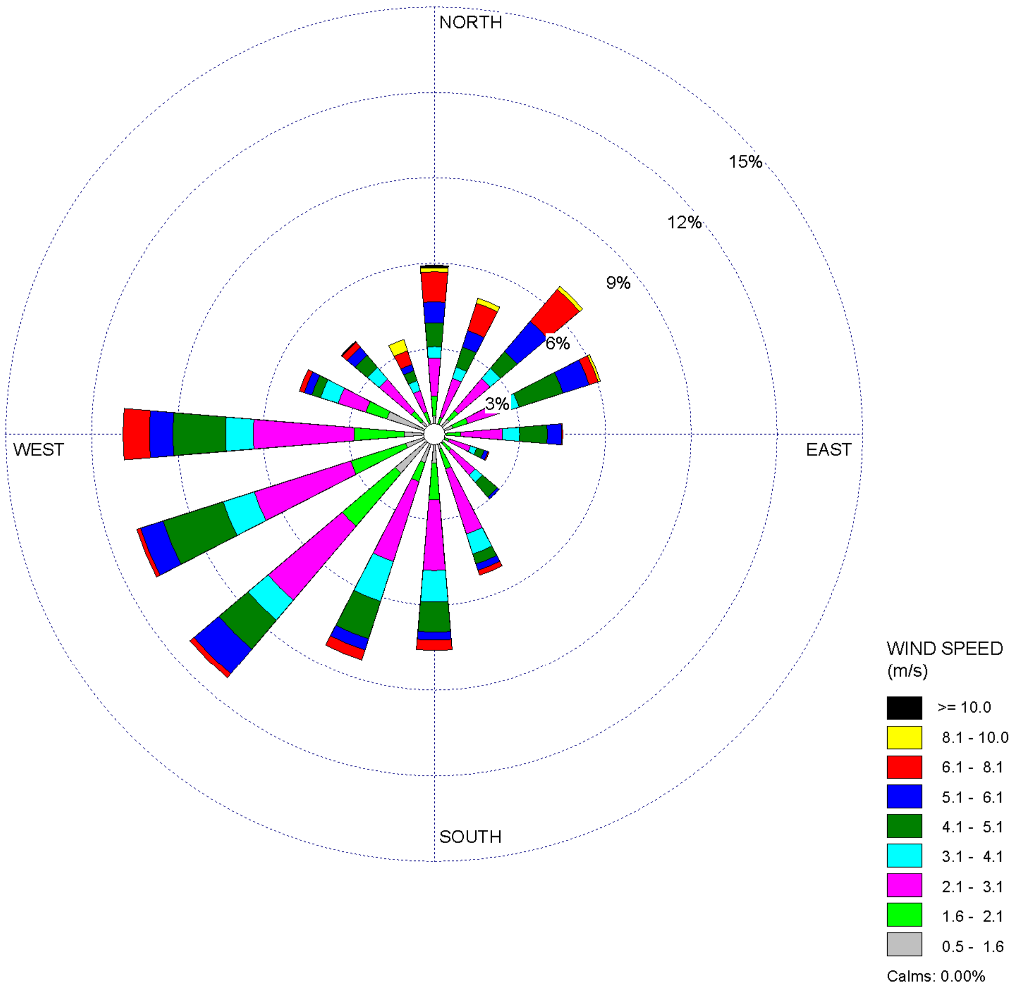


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — March (Sheet 3 of 12)

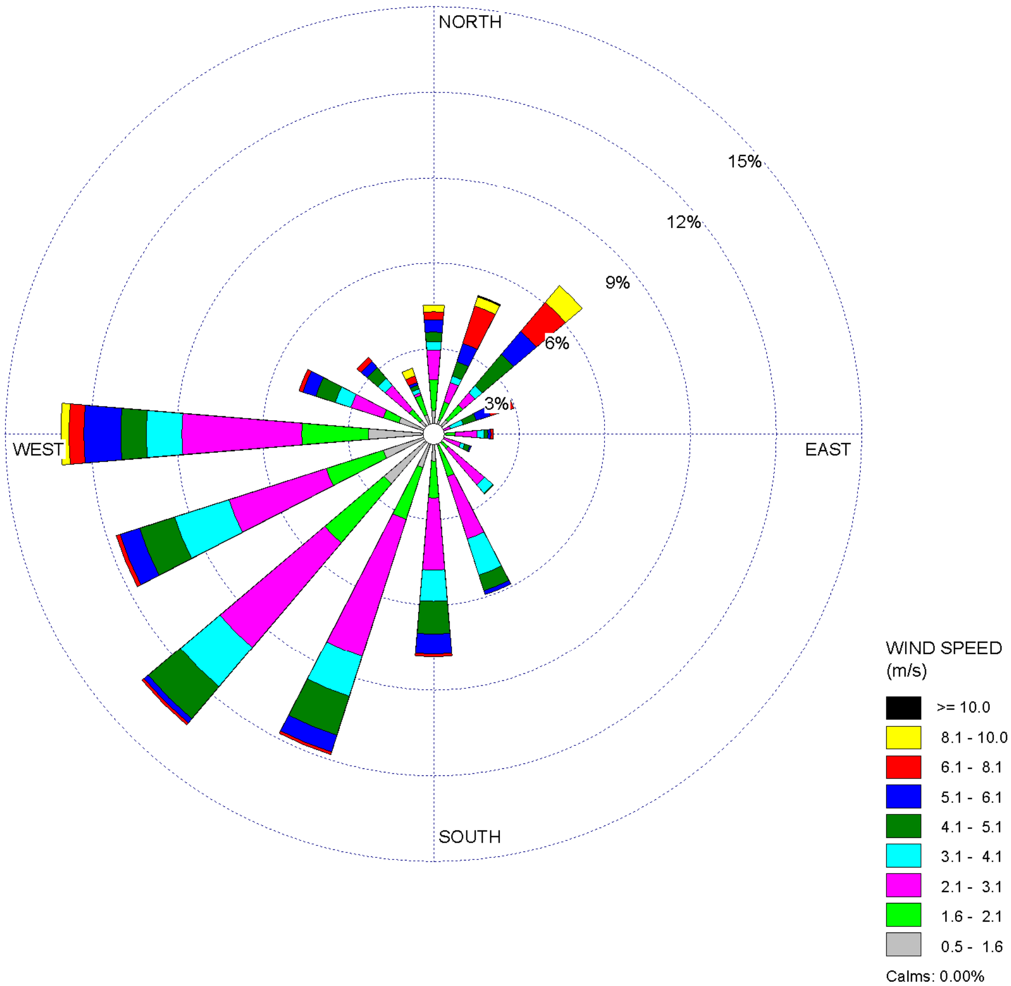


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — April (Sheet 4 of 12)

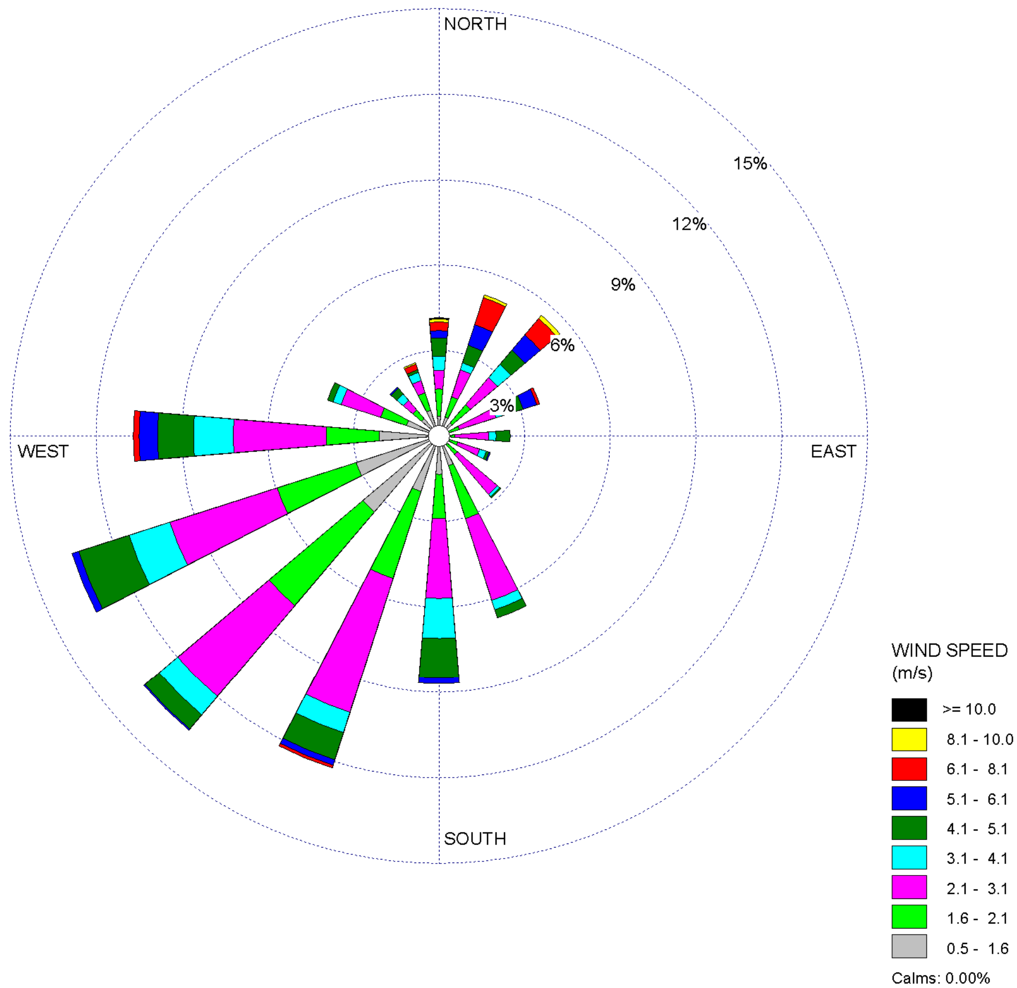


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — May (Sheet 5 of 12)

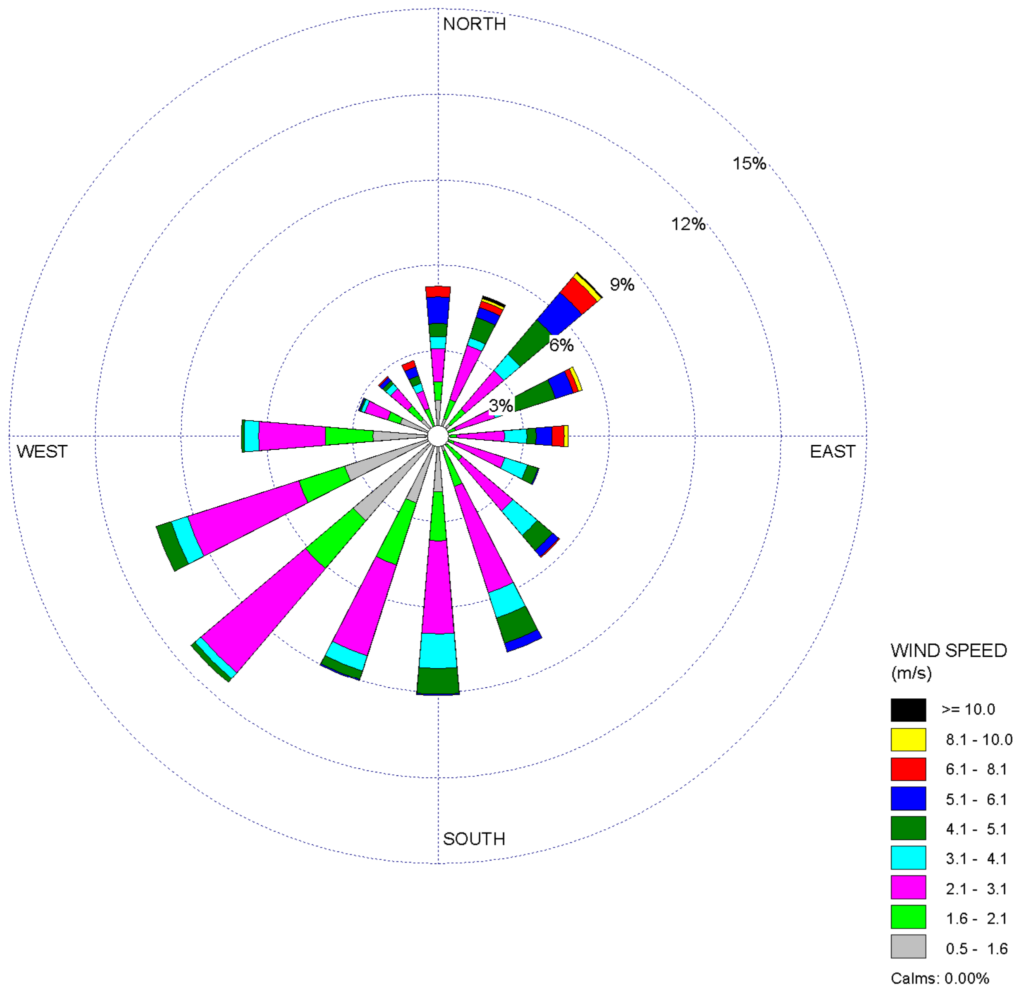


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — June (Sheet 6 of 12)

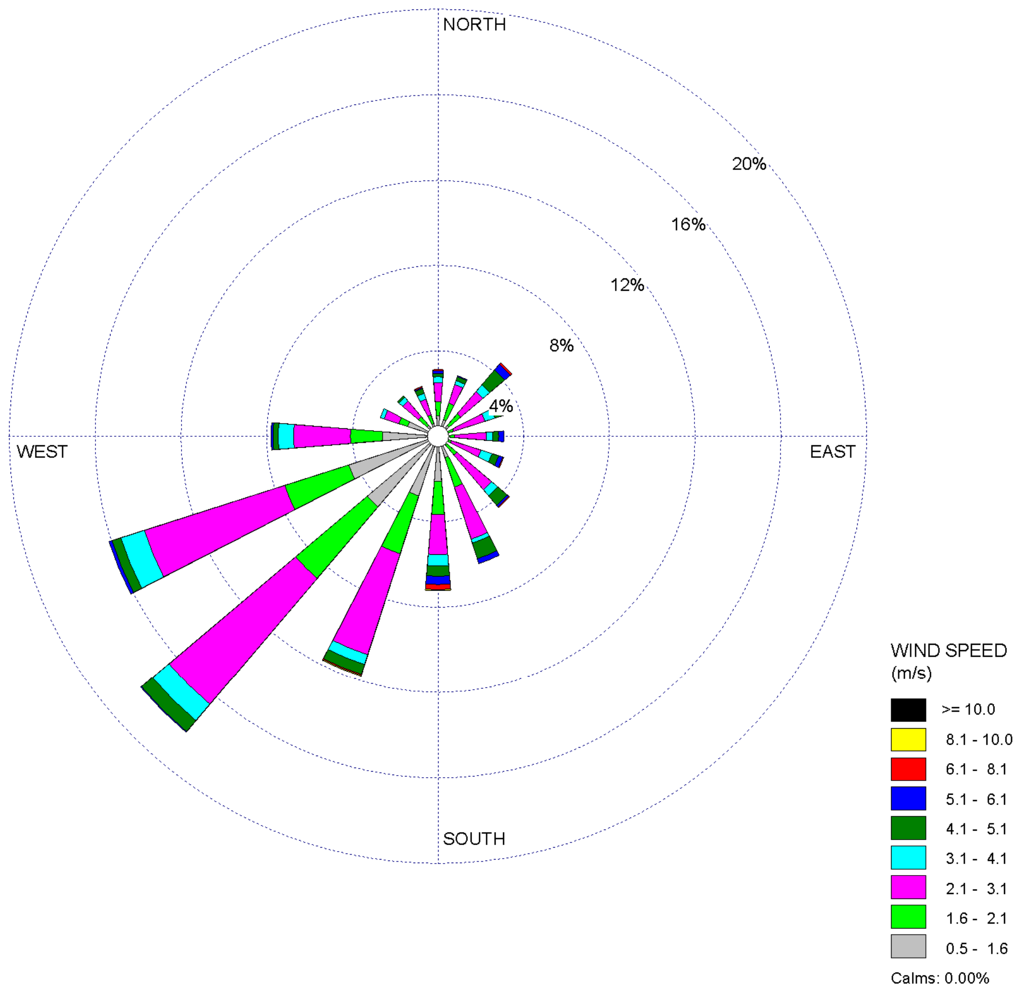


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — July (Sheet 7 of 12)

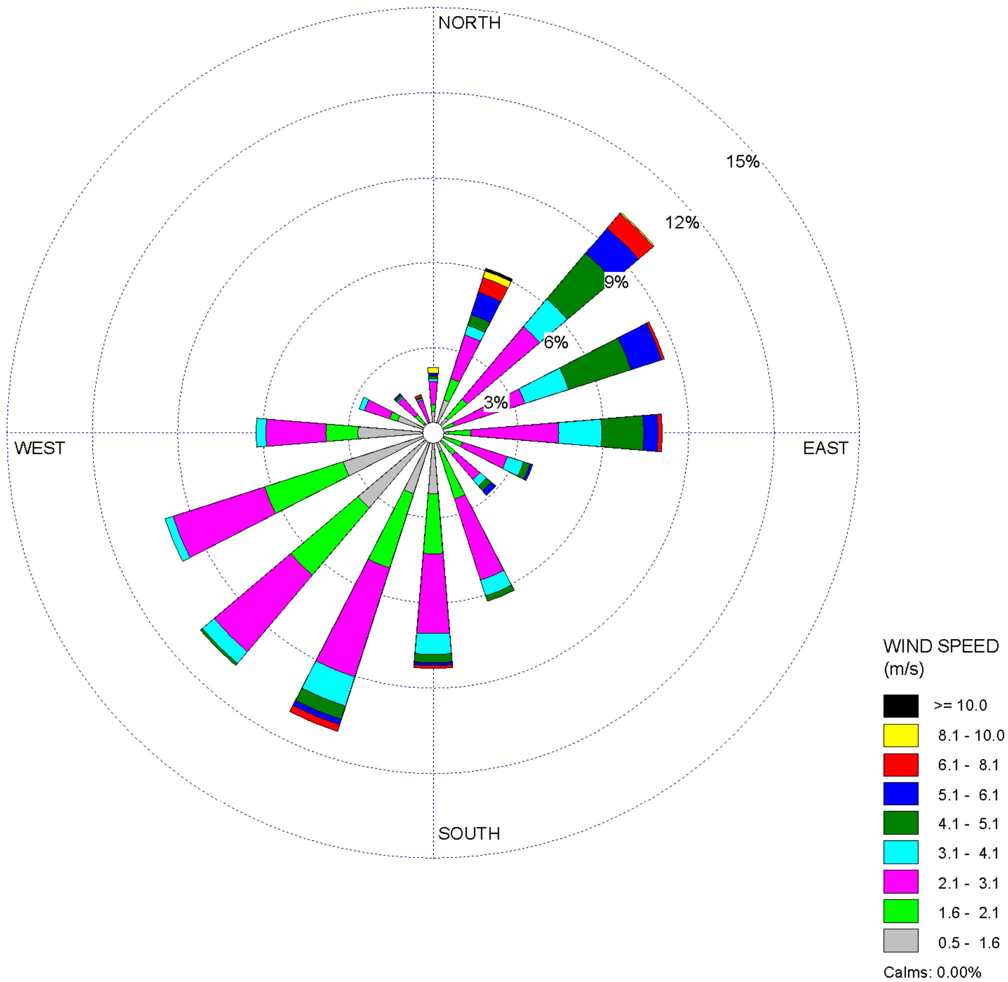


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — August (Sheet 8 of 12)

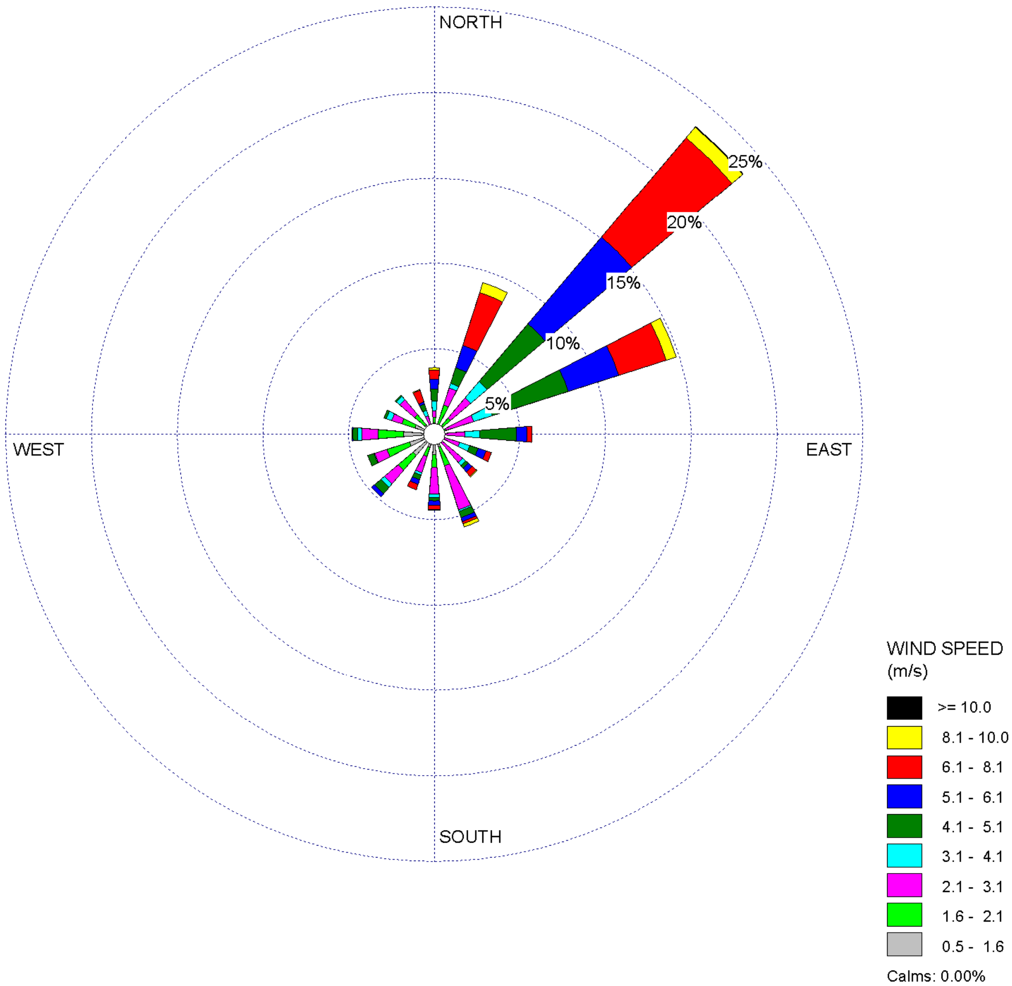


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — September (Sheet 9 of 12)

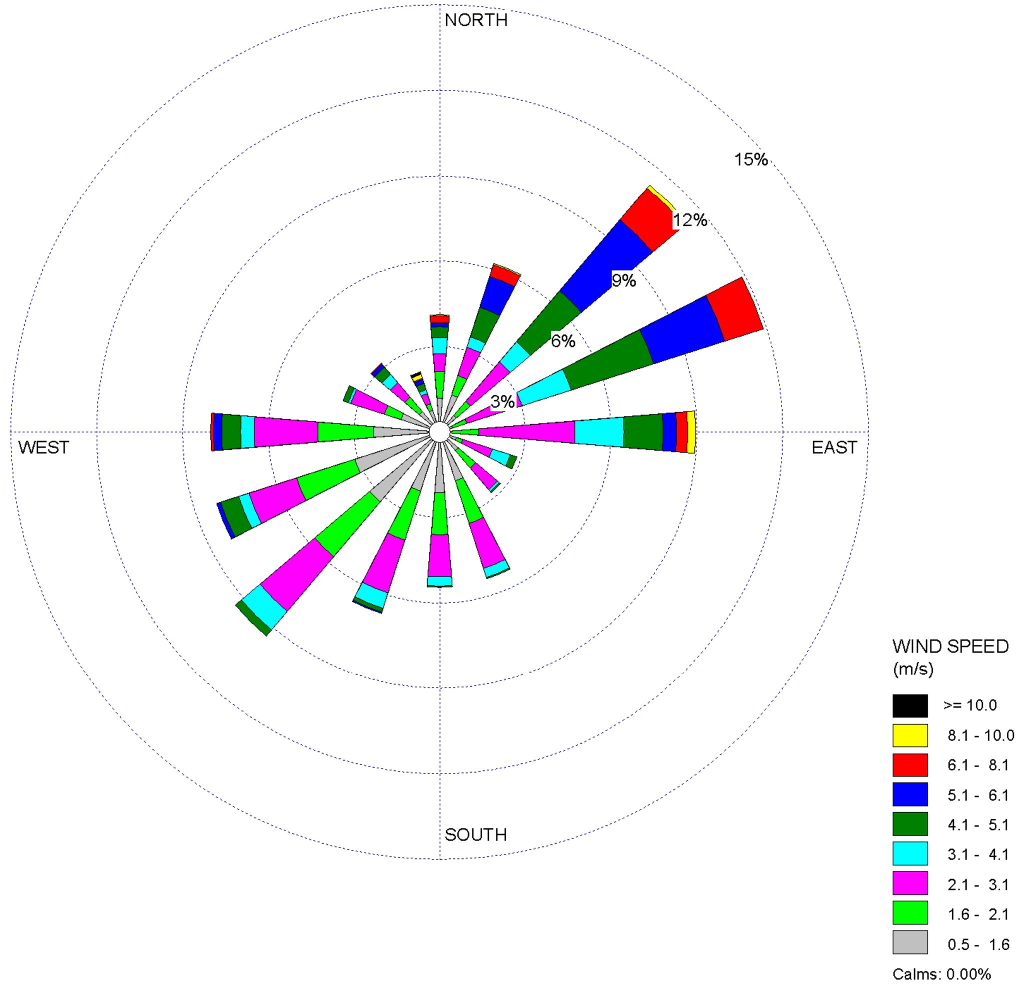


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — October (Sheet 10 of 12)

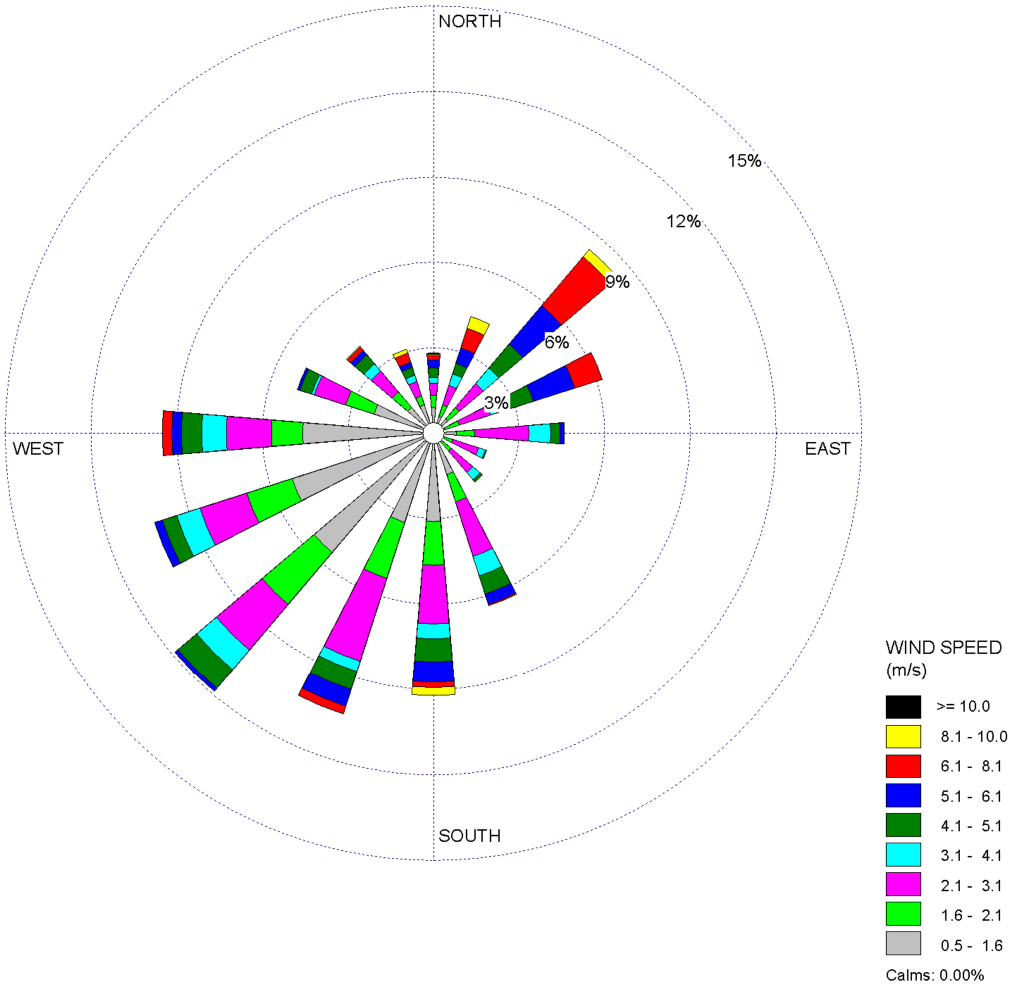


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — November (Sheet 11 of 12)

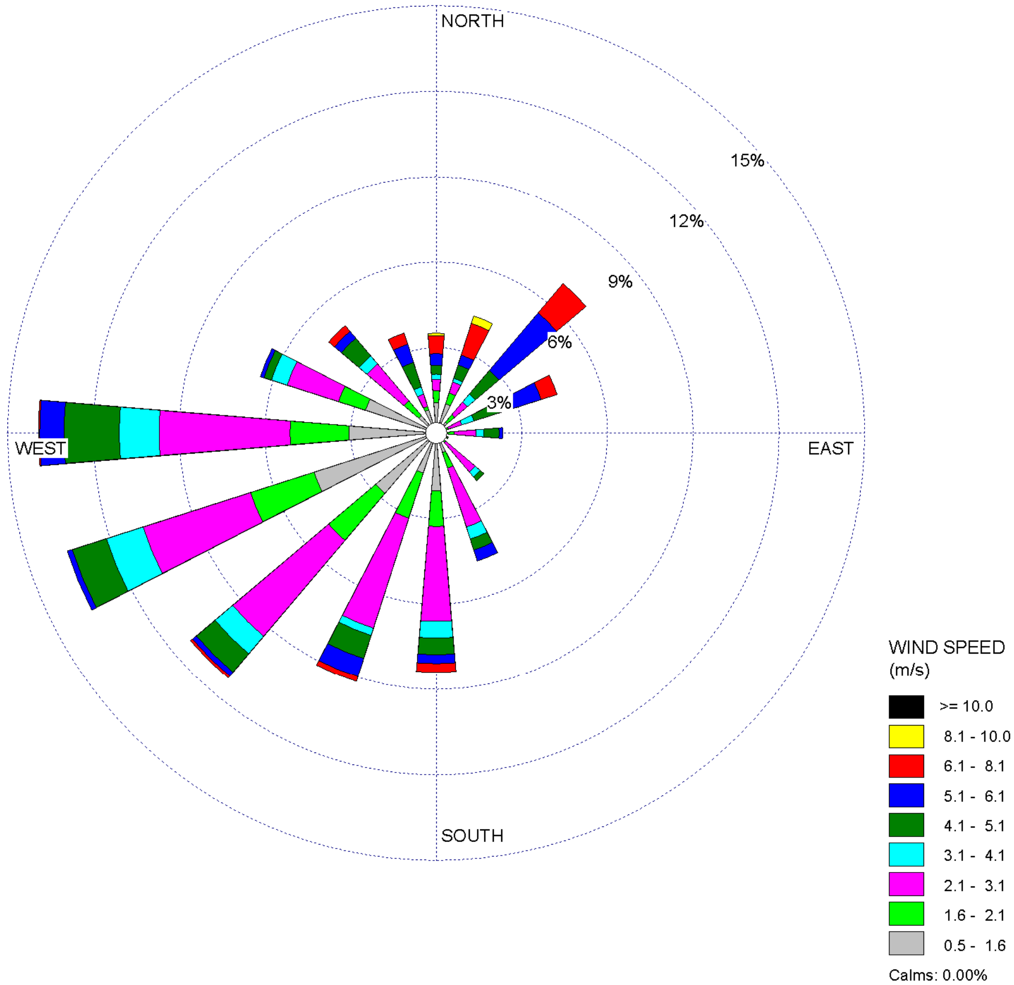


Figure 2.7-7. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — December (Sheet 12 of 12)

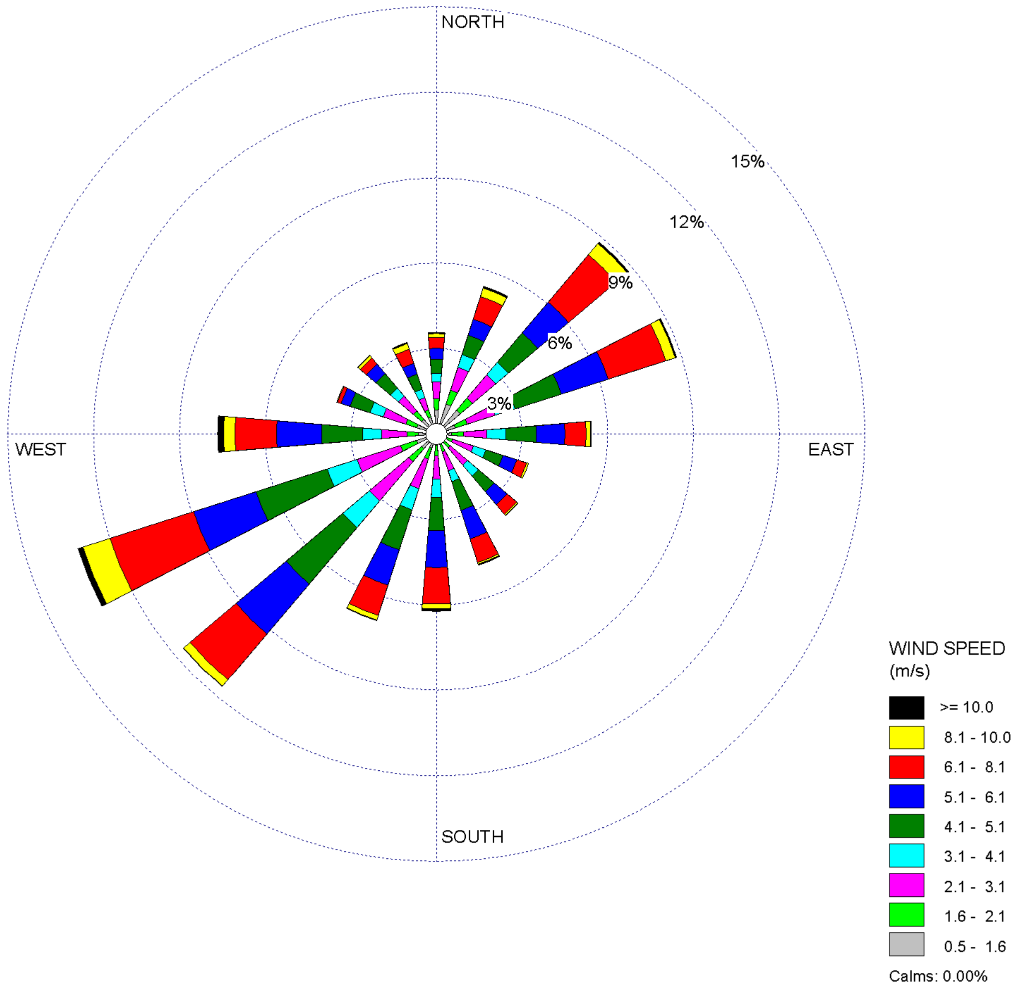


Figure 2.7-8. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Annual

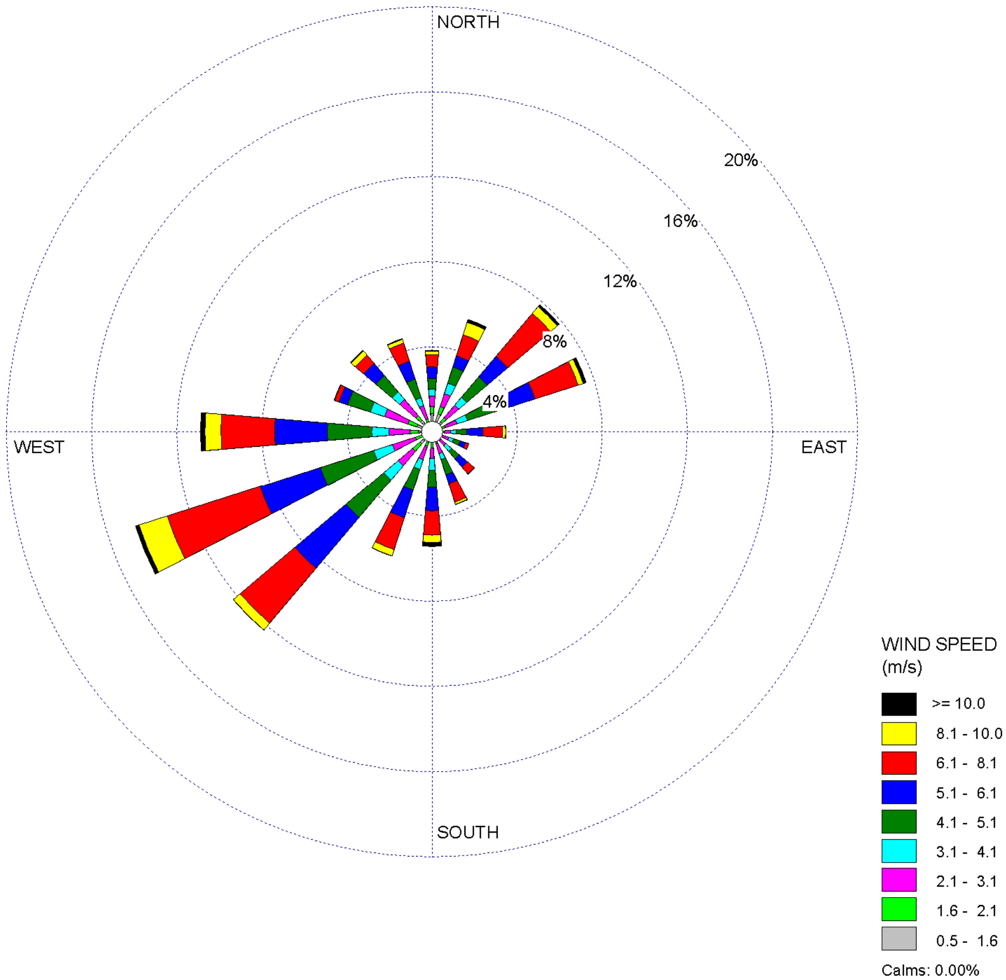


Figure 2.7-9. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Winter

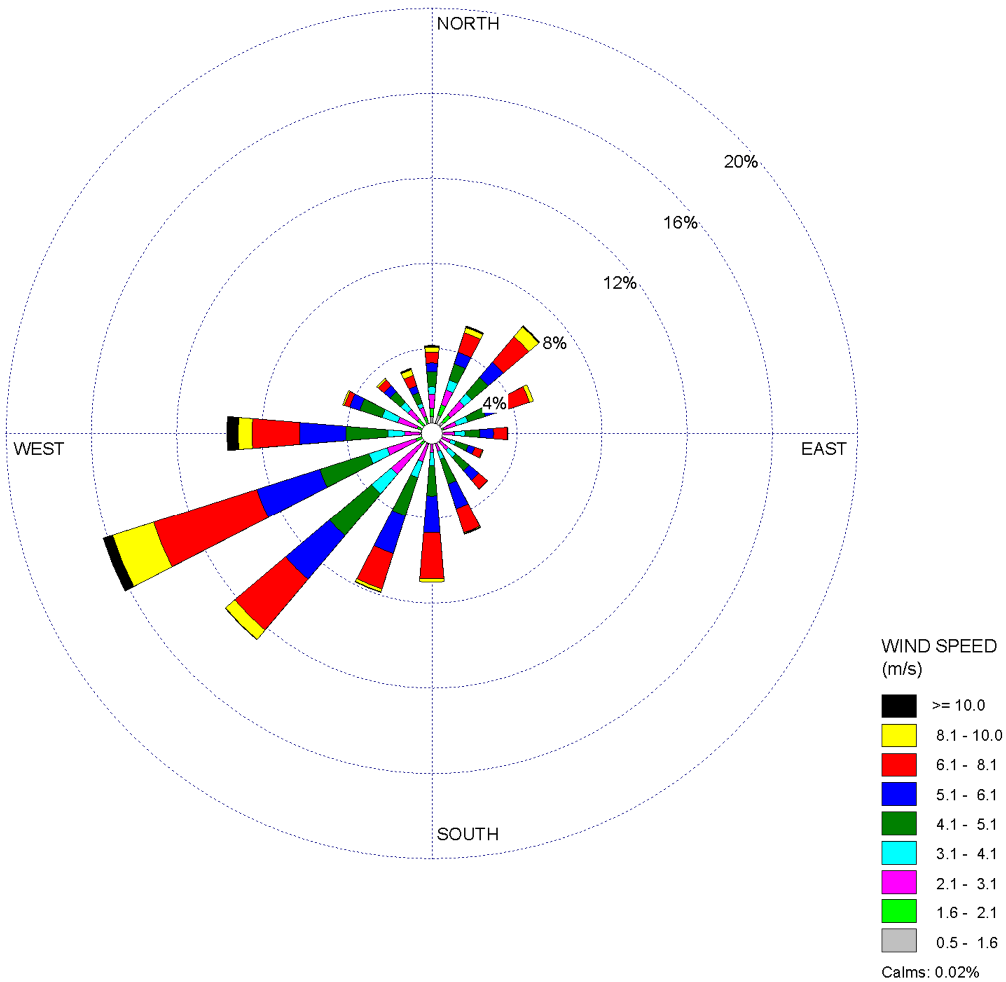


Figure 2.7-10. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Spring

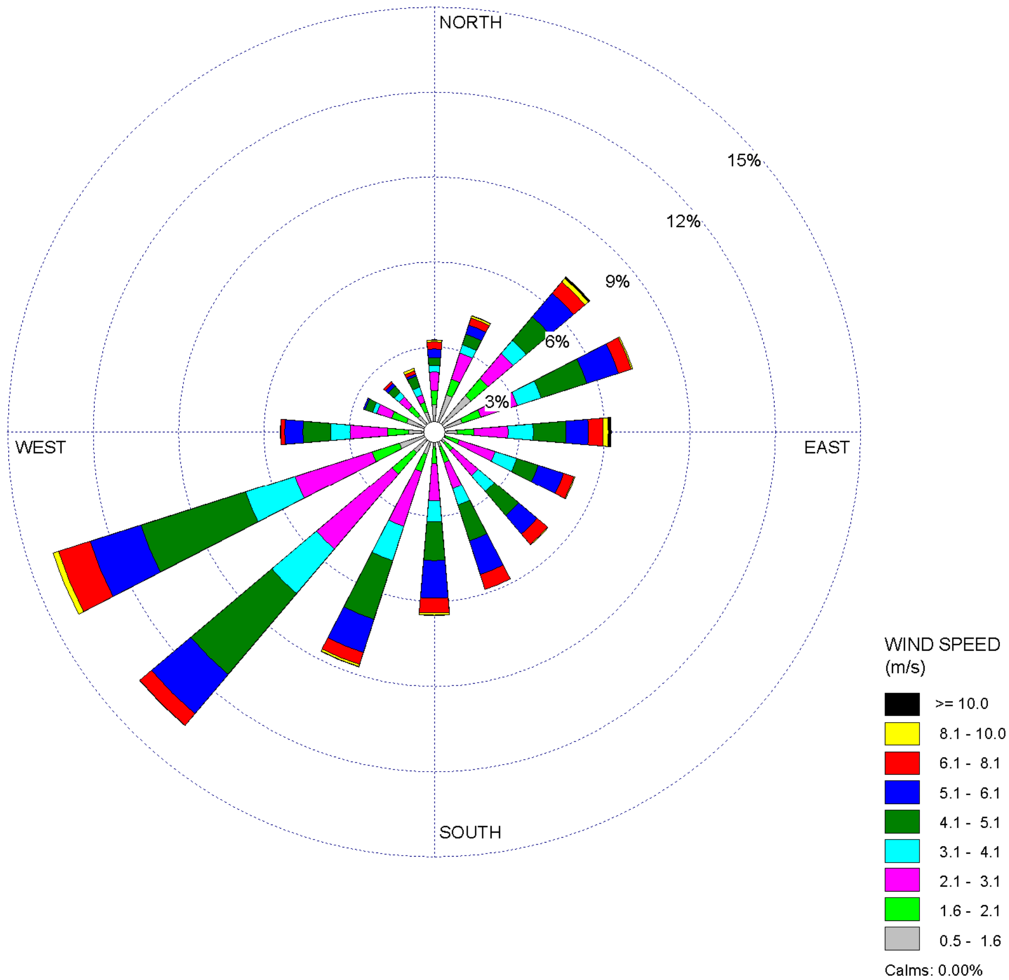


Figure 2.7-11. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Summer

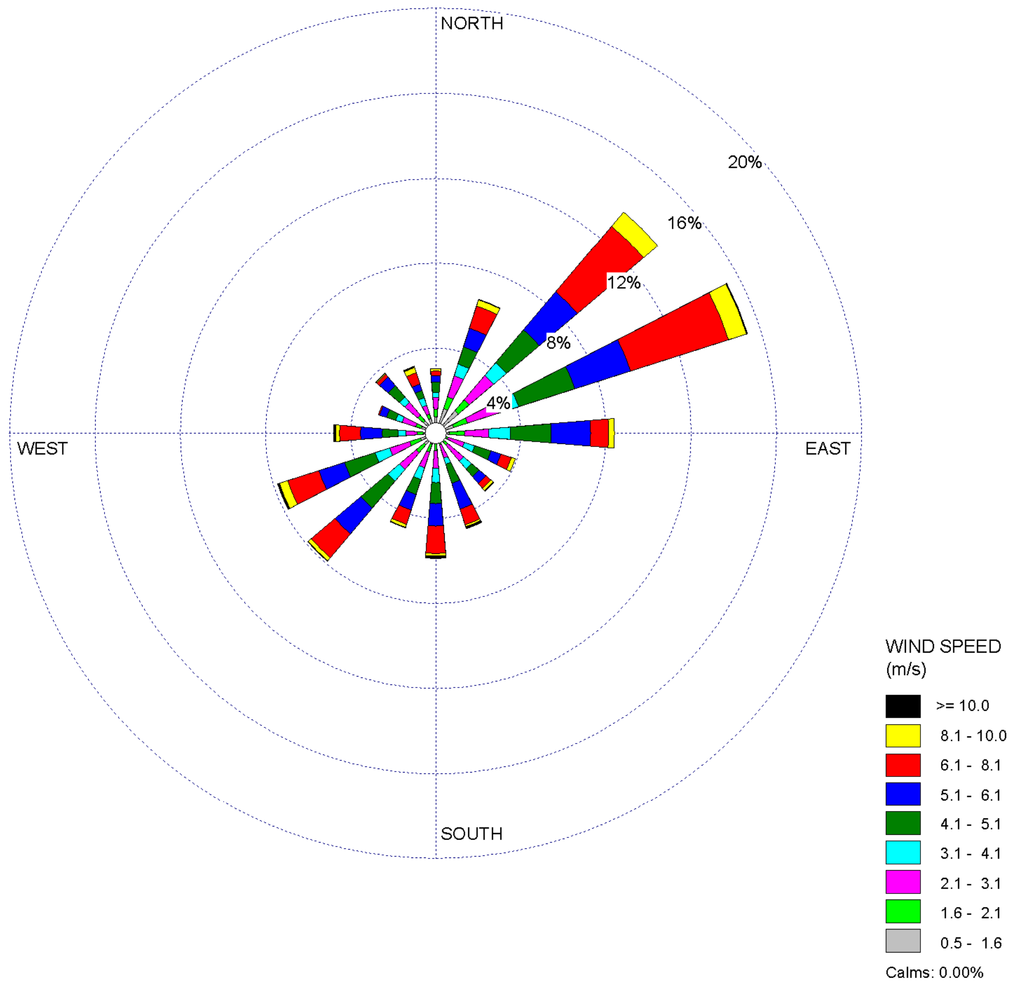


Figure 2.7-12. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Autumn

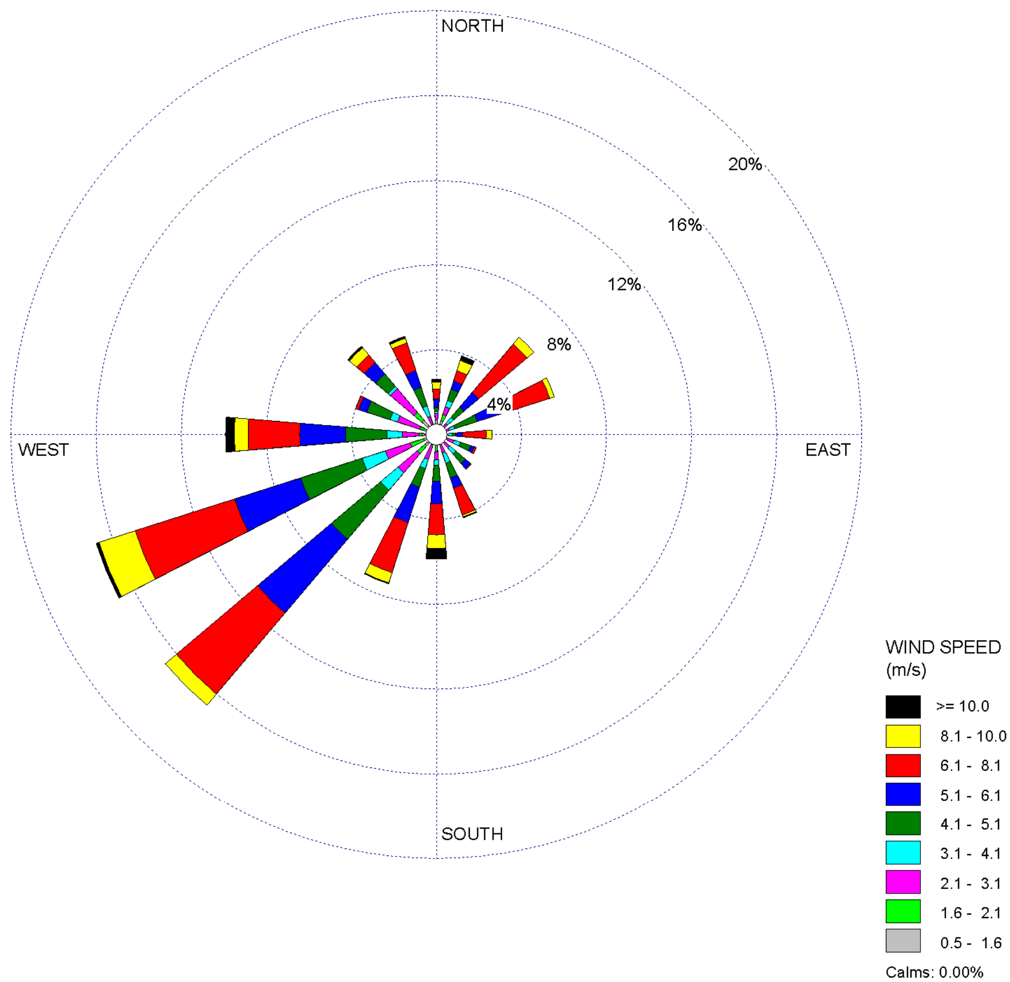


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — January (Sheet 1 of 12)

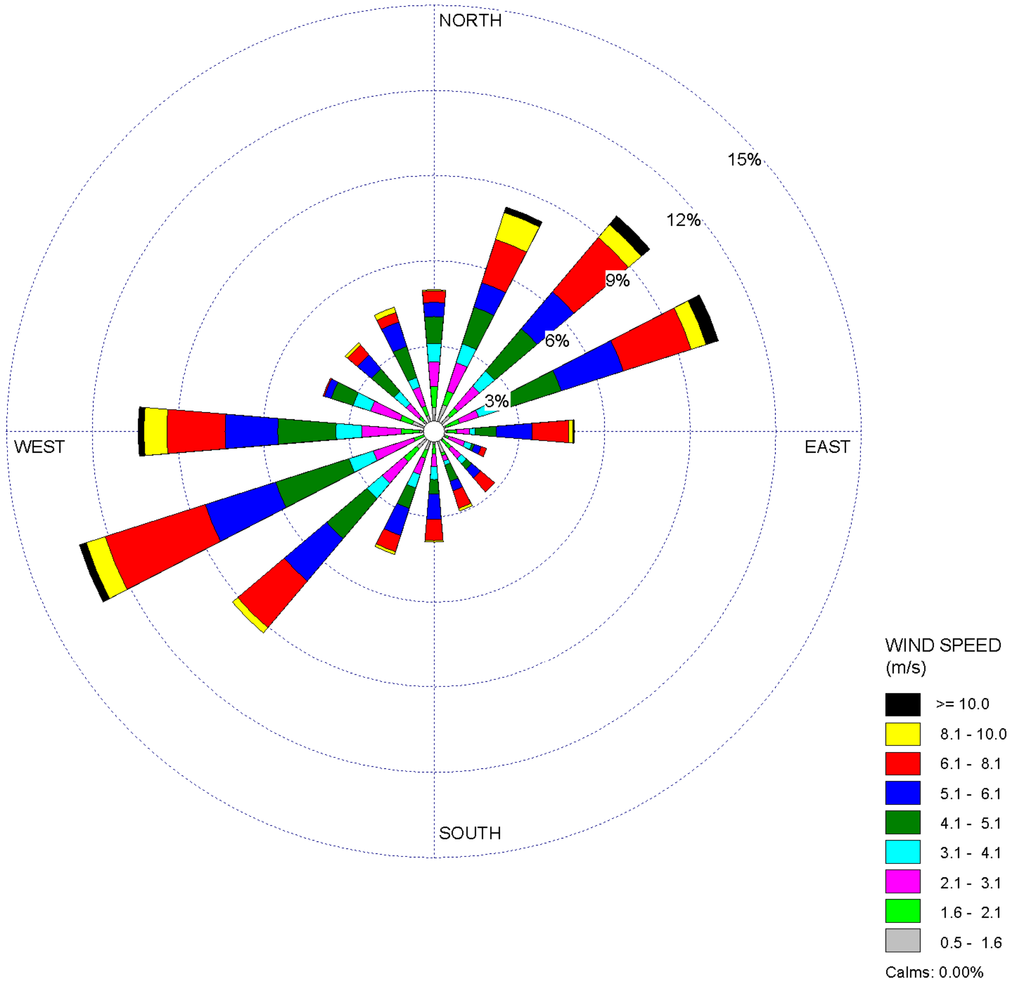


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — February (Sheet 2 of 12)

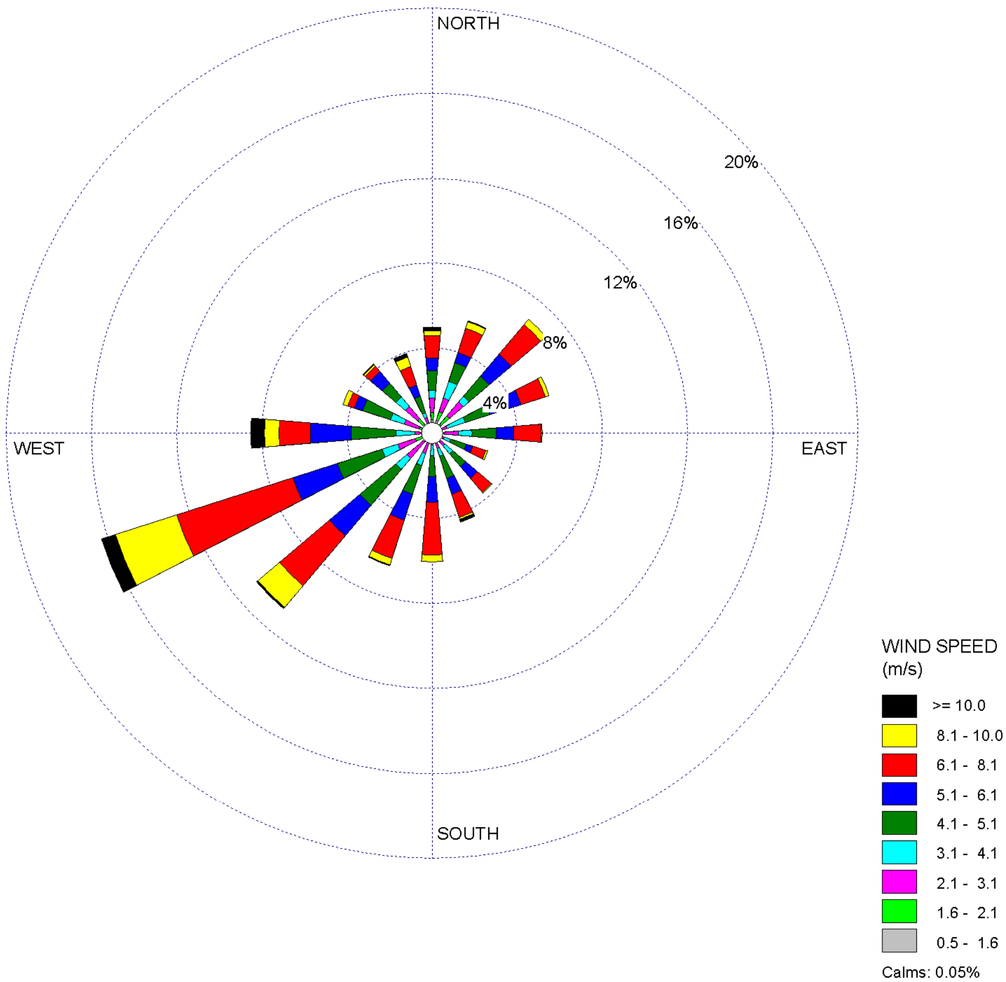


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — March (Sheet 3 of 12)

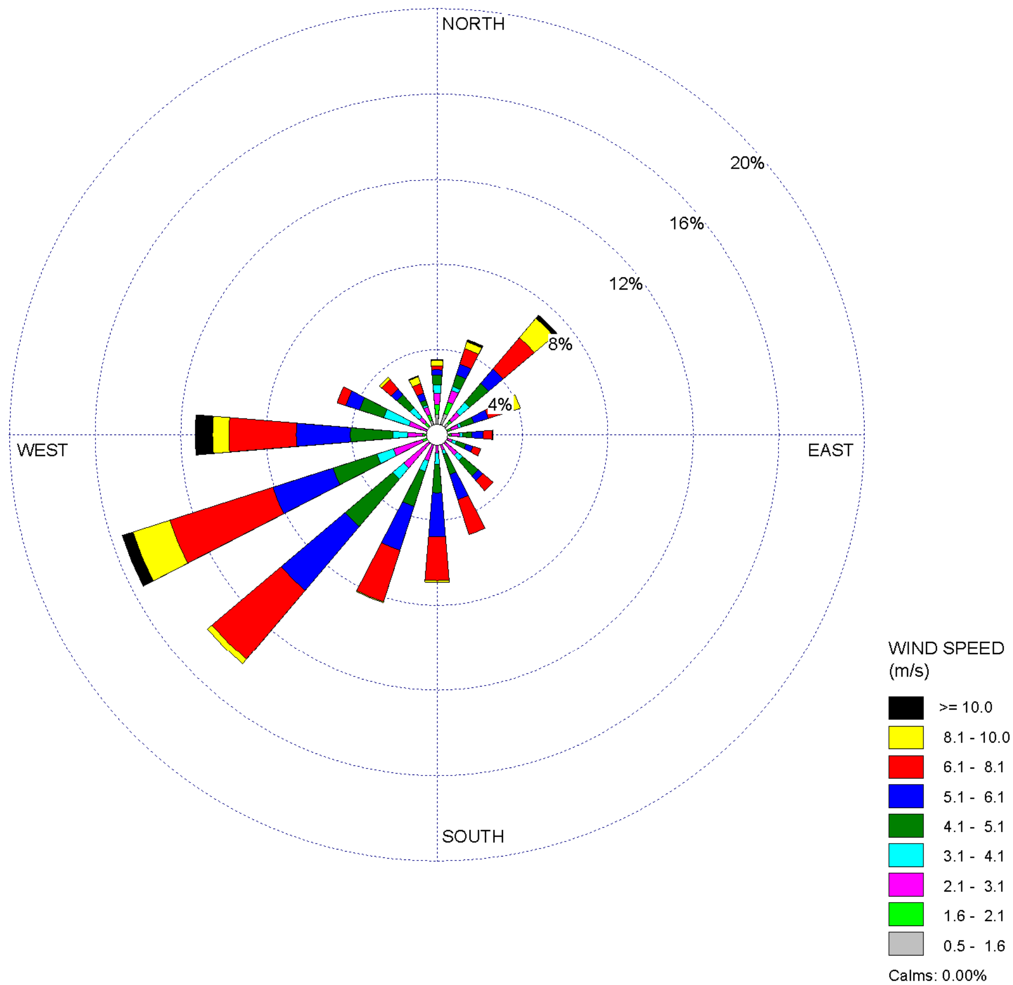


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — April (Sheet 4 of 12)

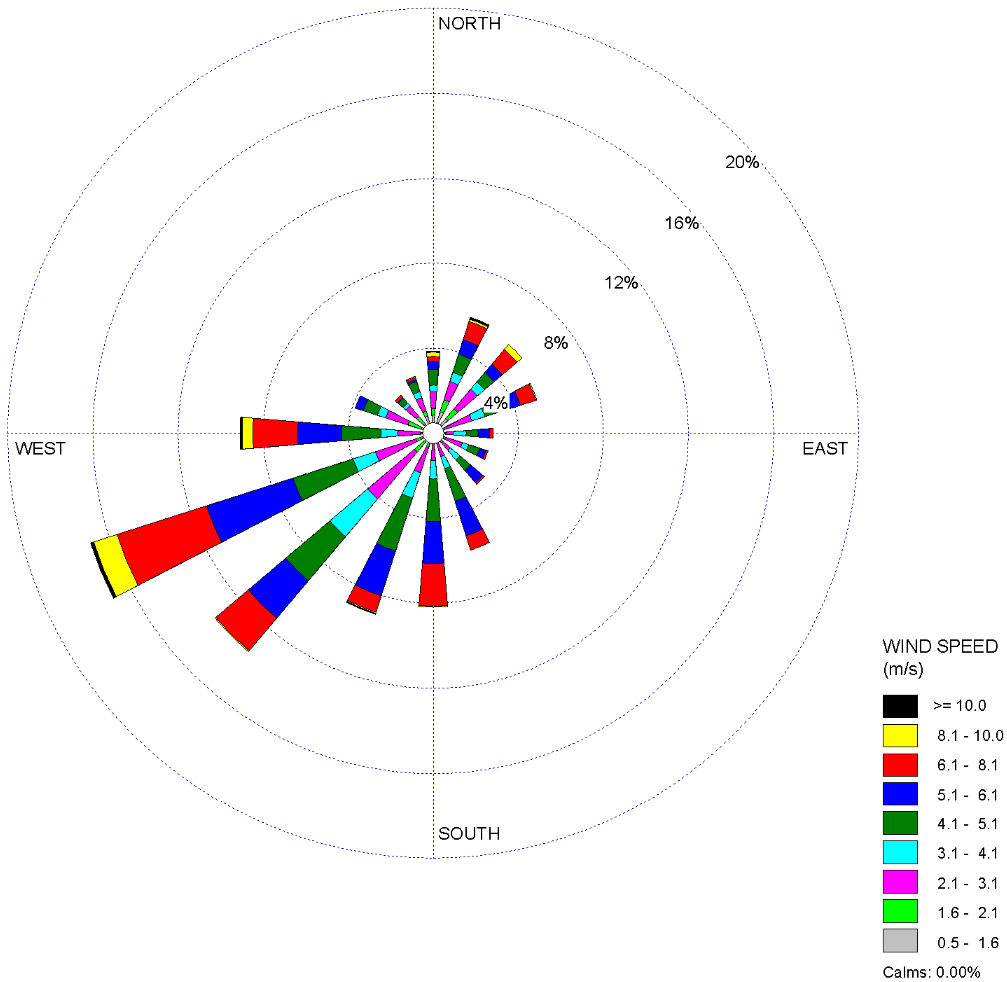


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — May (Sheet 5 of 12)

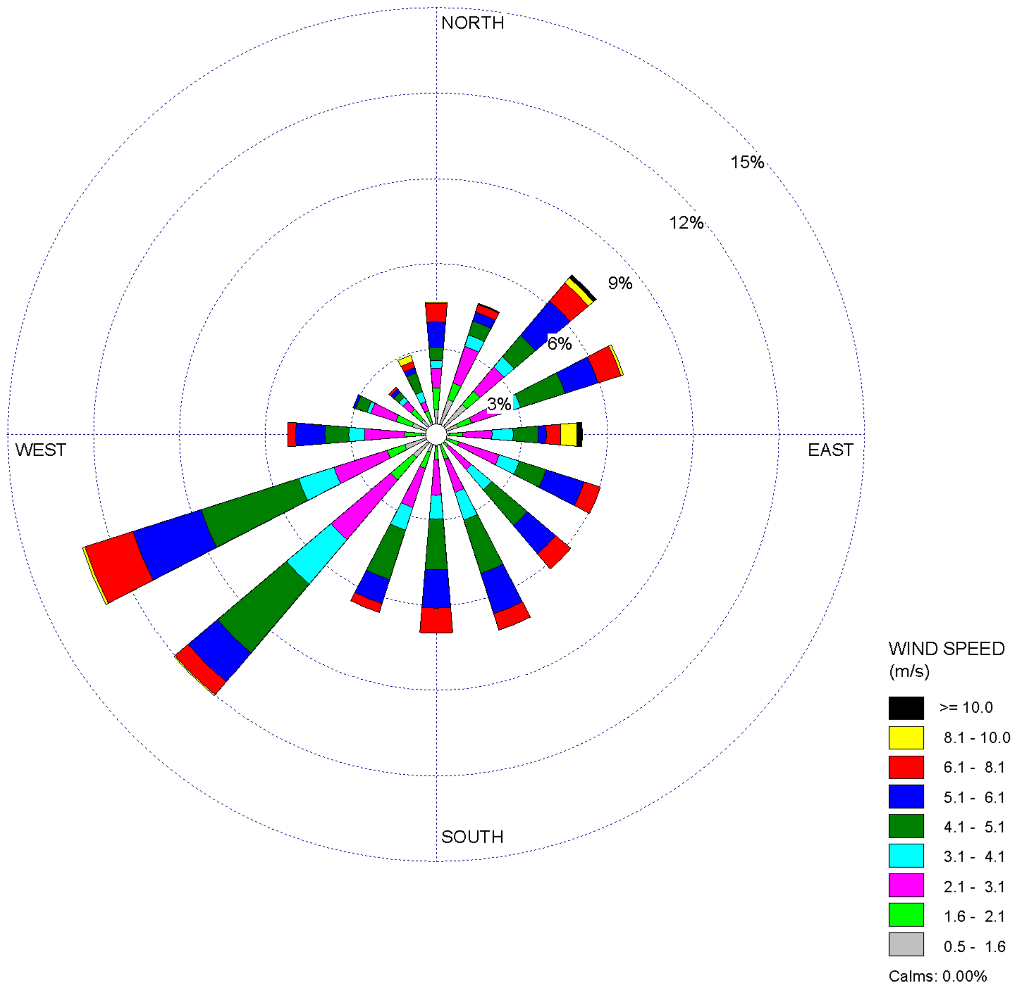


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — June (Sheet 6 of 12)

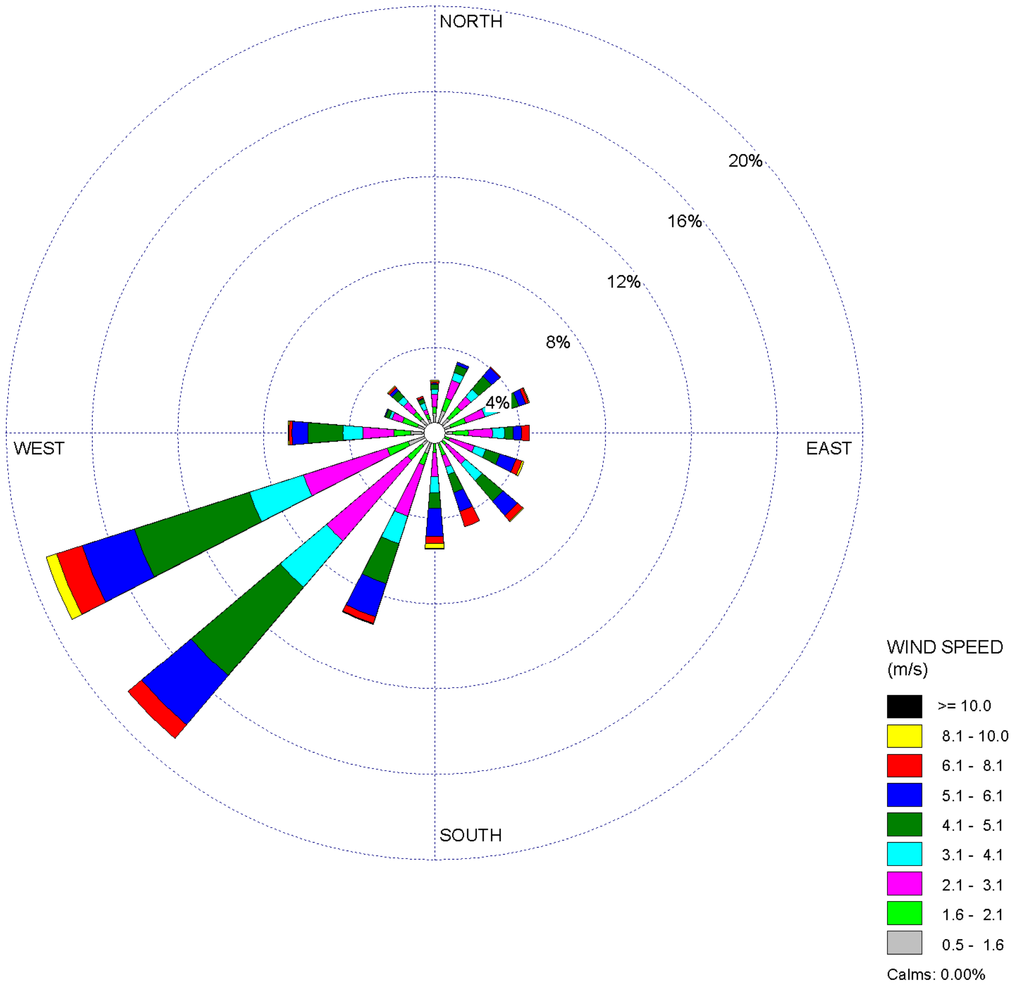


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — July (Sheet 7 of 12)

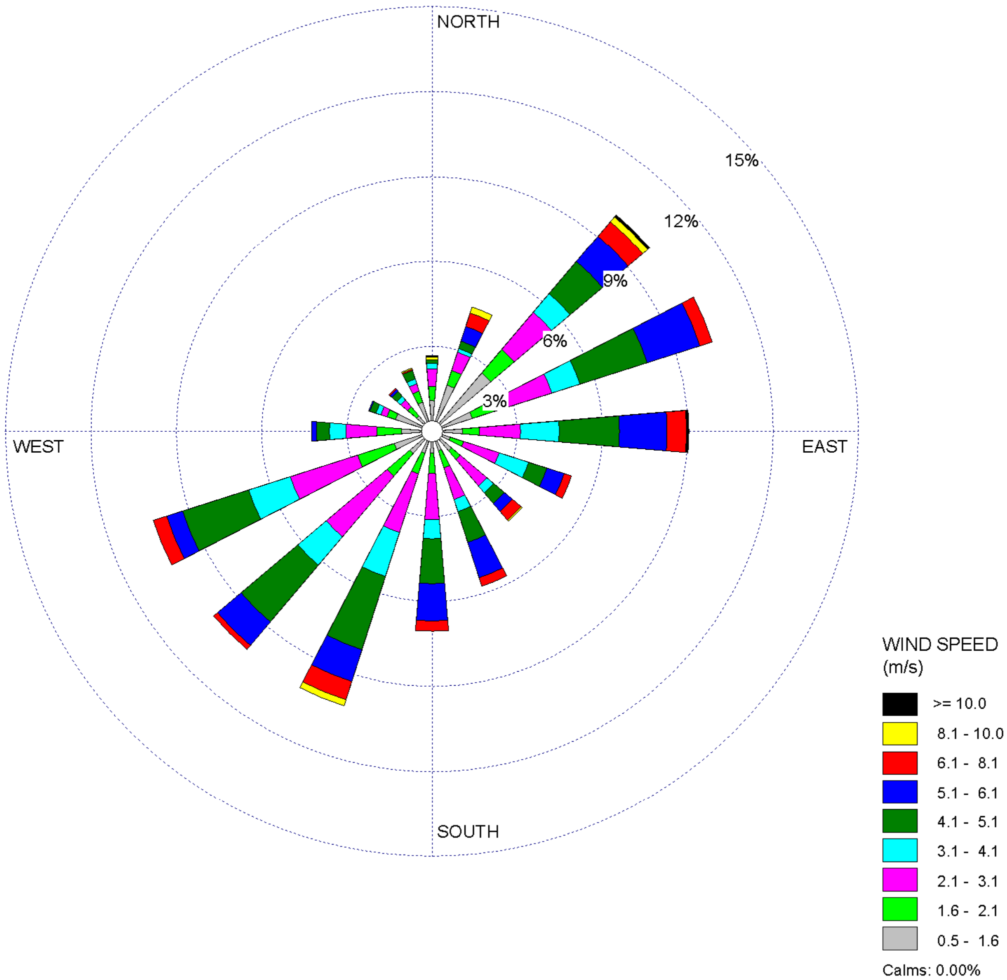


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — August (Sheet 8 of 12)

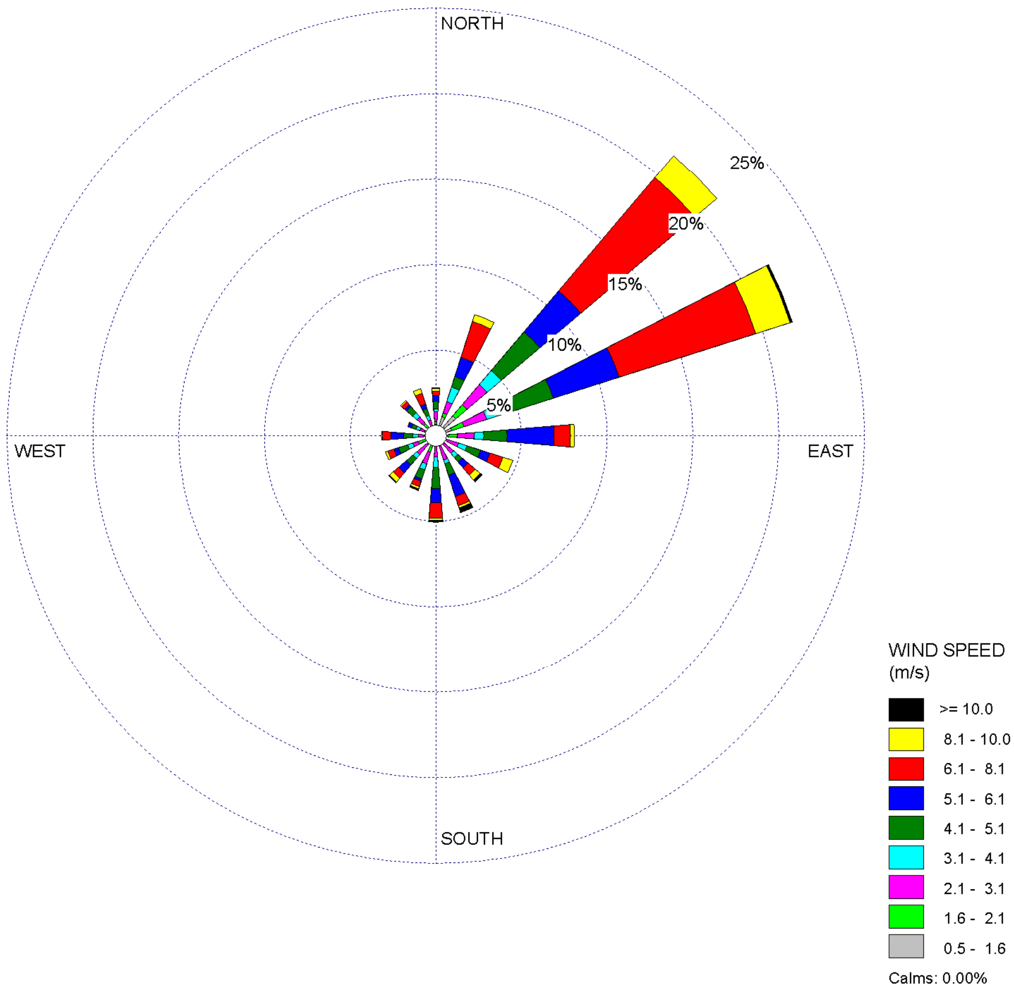


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — September (Sheet 9 of 12)

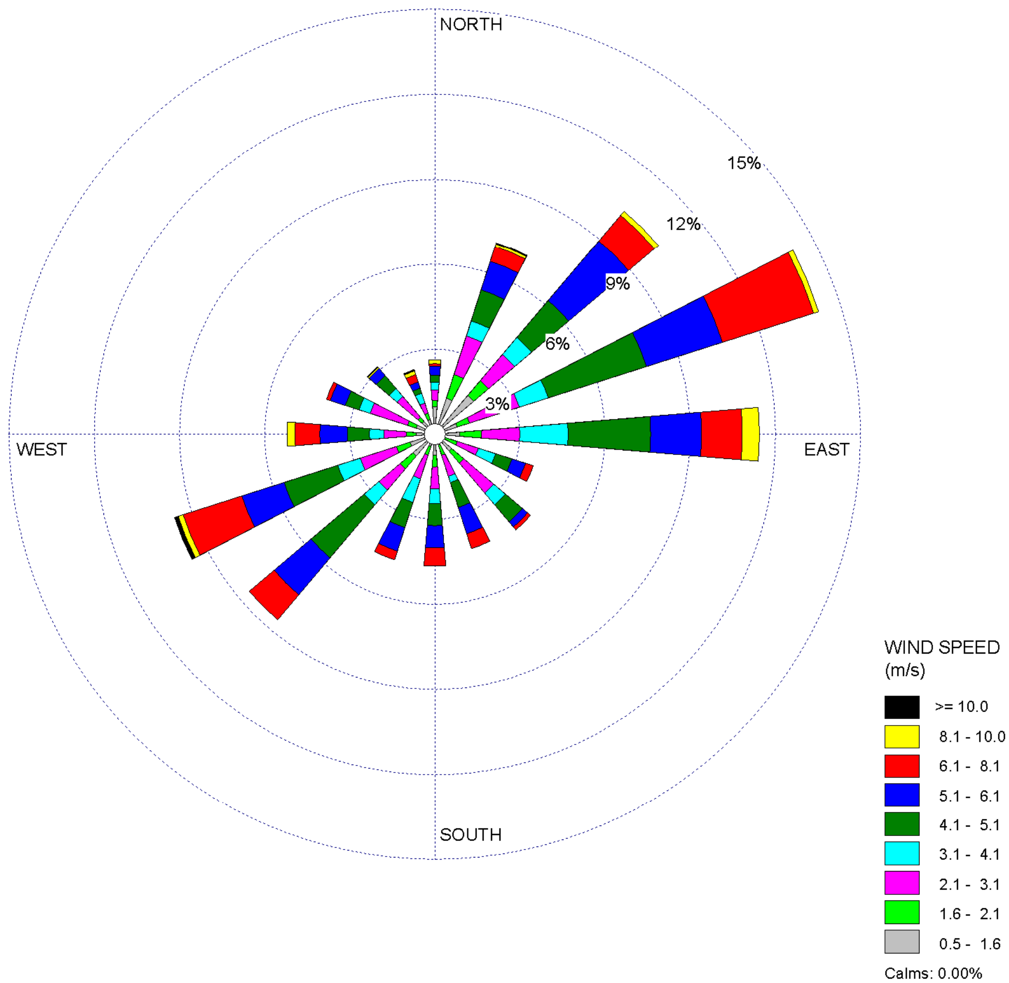


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — October (Sheet 10 of 12)

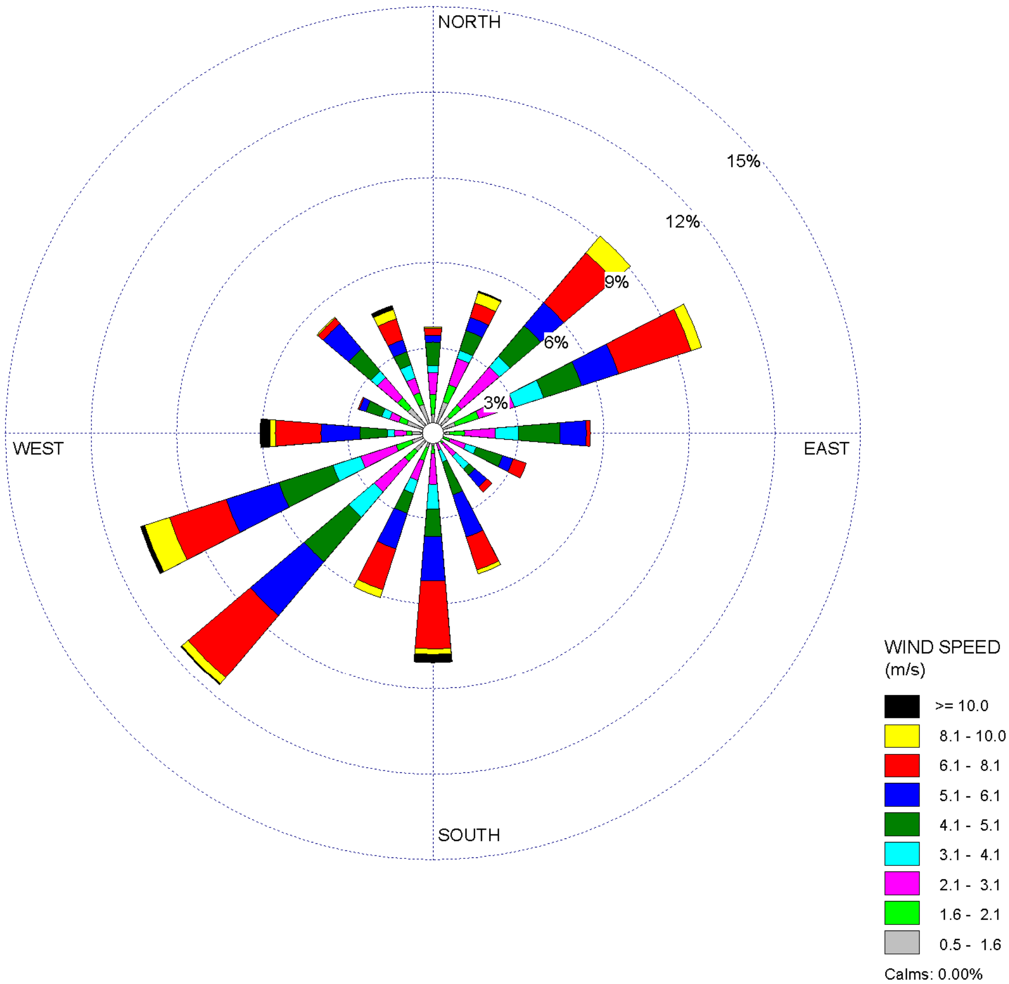


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — November (Sheet 11 of 12)

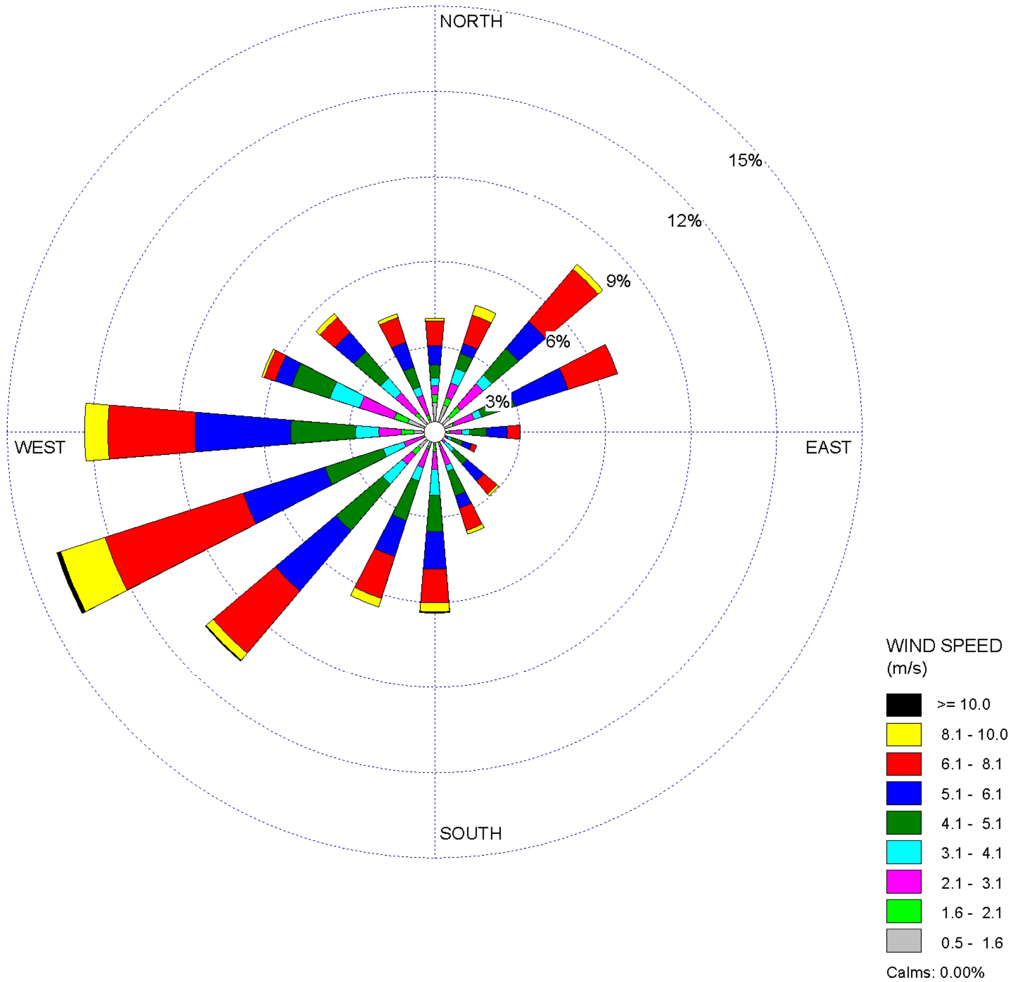


Figure 2.7-13. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — December (Sheet 12 of 12)

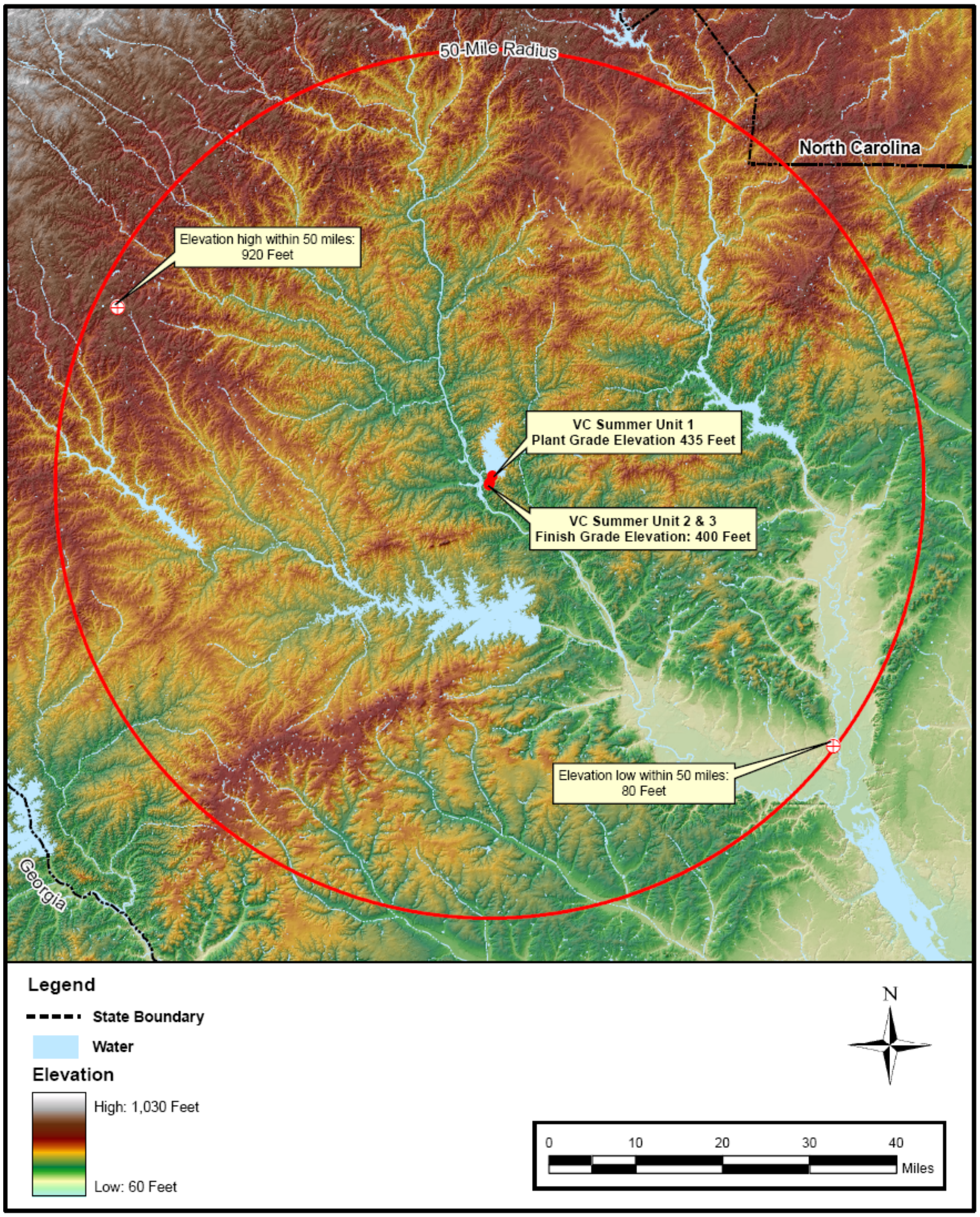
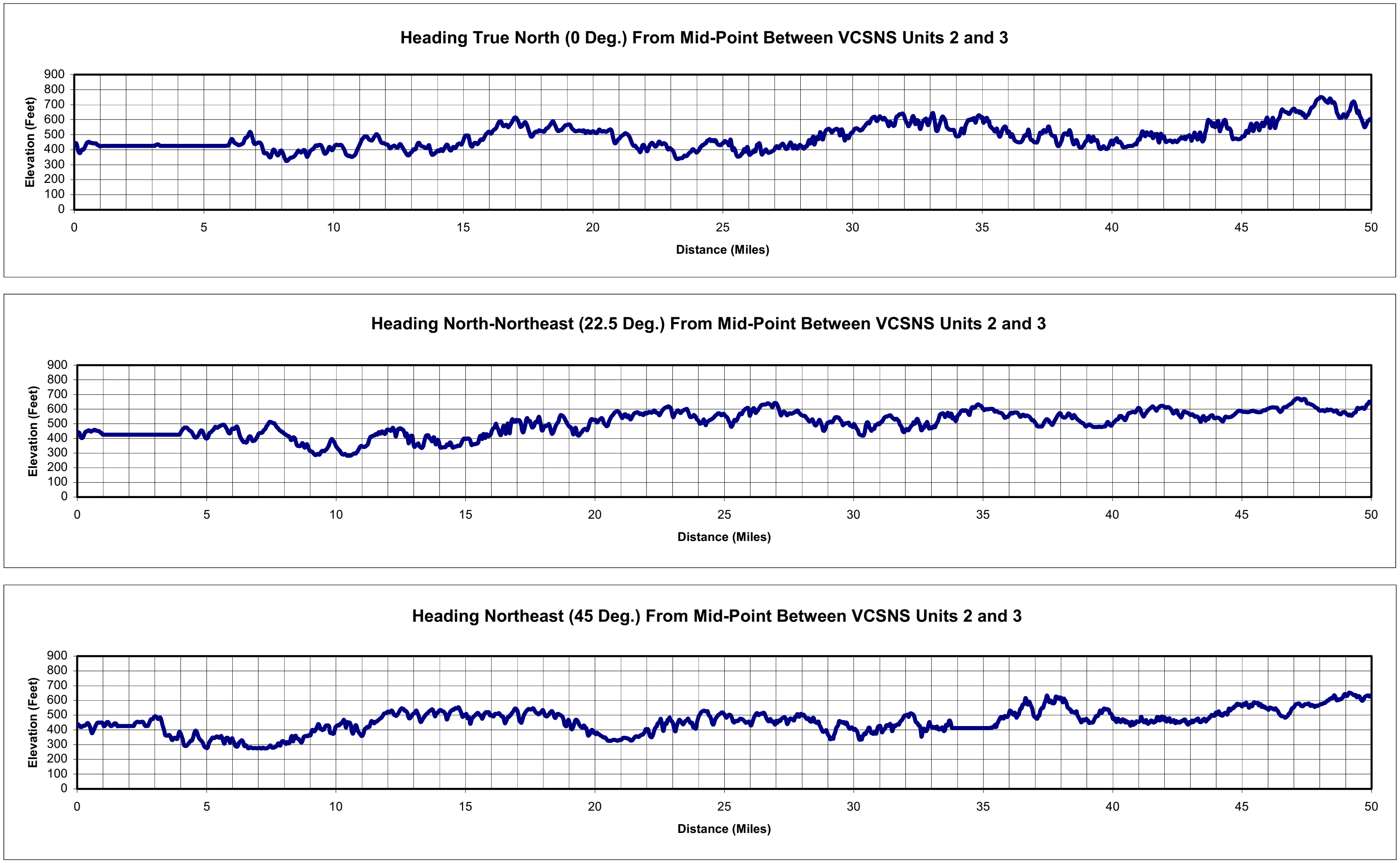
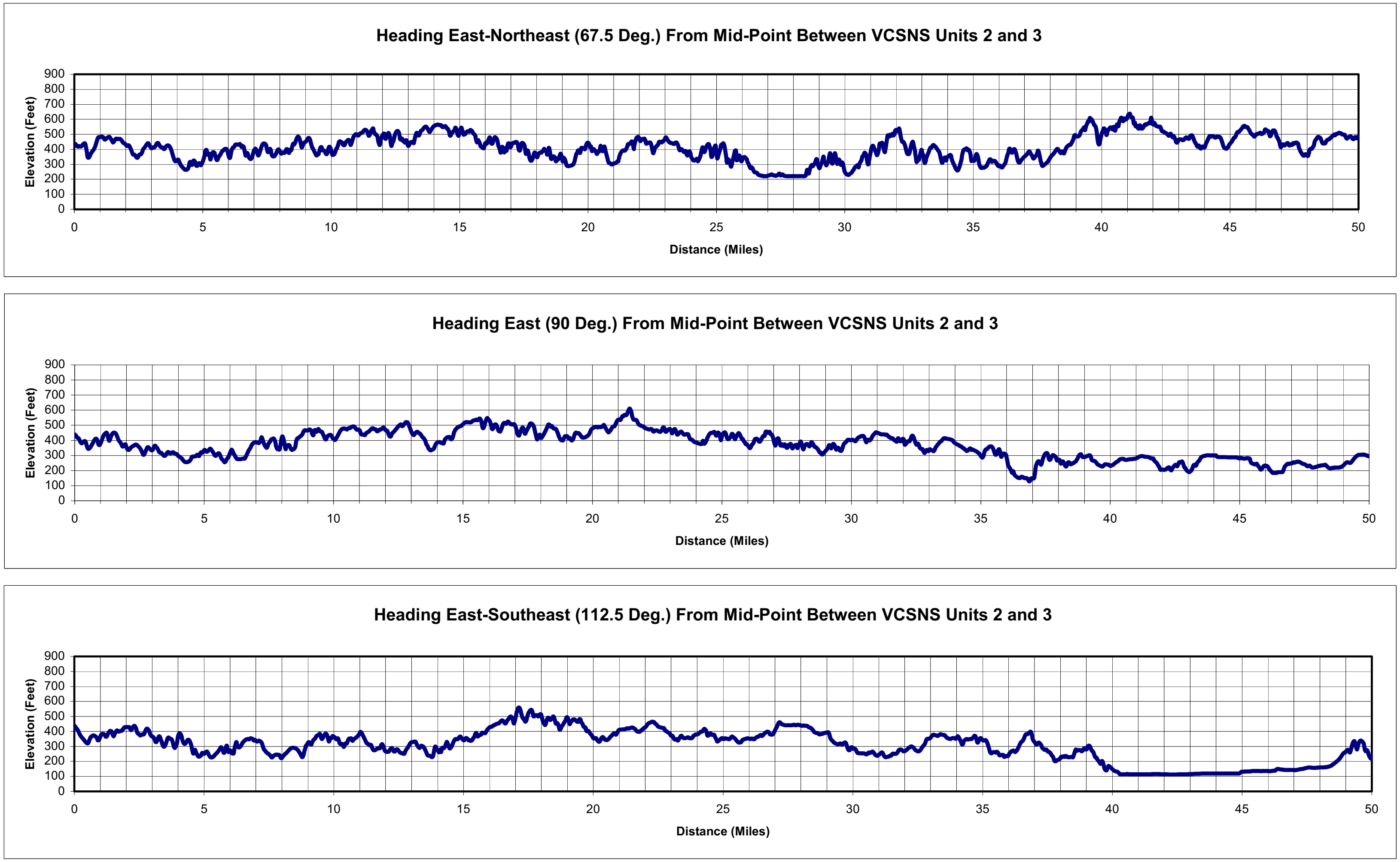


Figure 2.7-14. Site Area Map (50-Mile Radius)



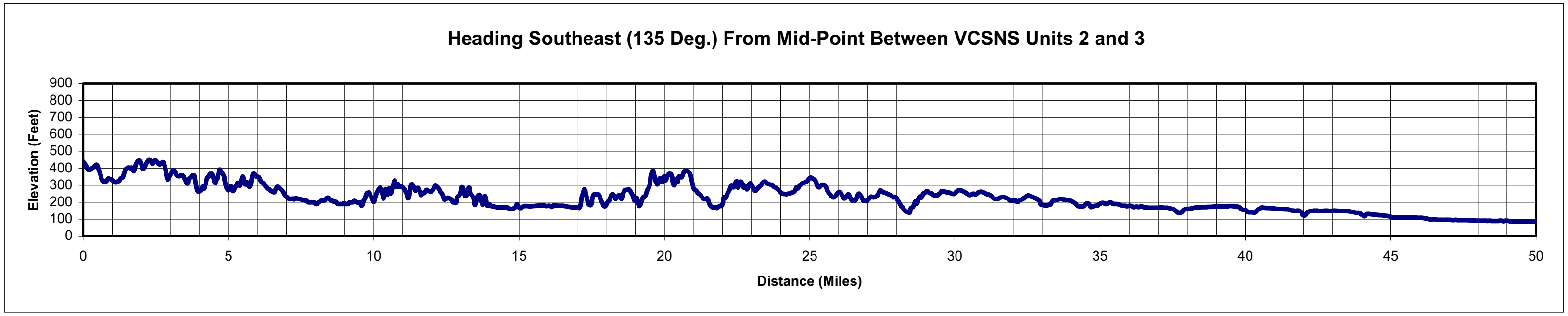
Nominal Plant Grade Elevation = 400 Feet

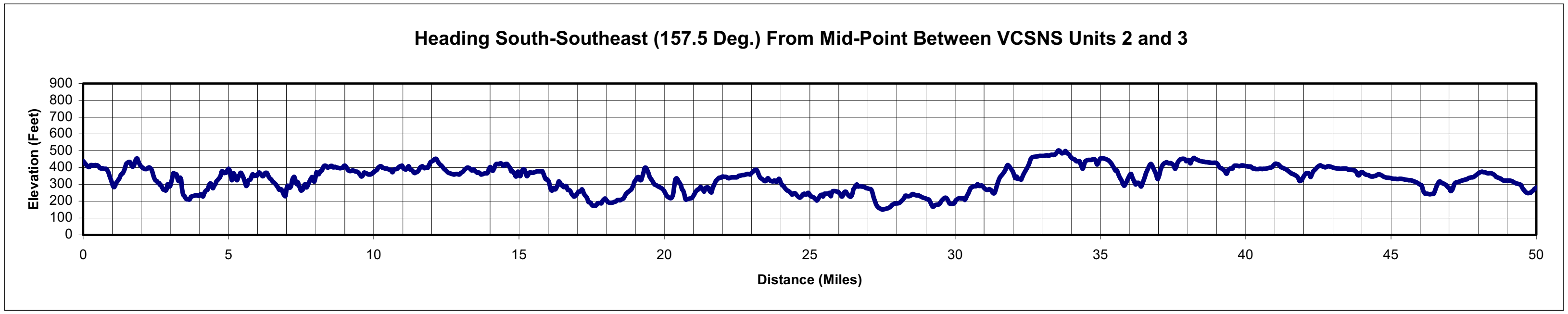
Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 1 of 6)

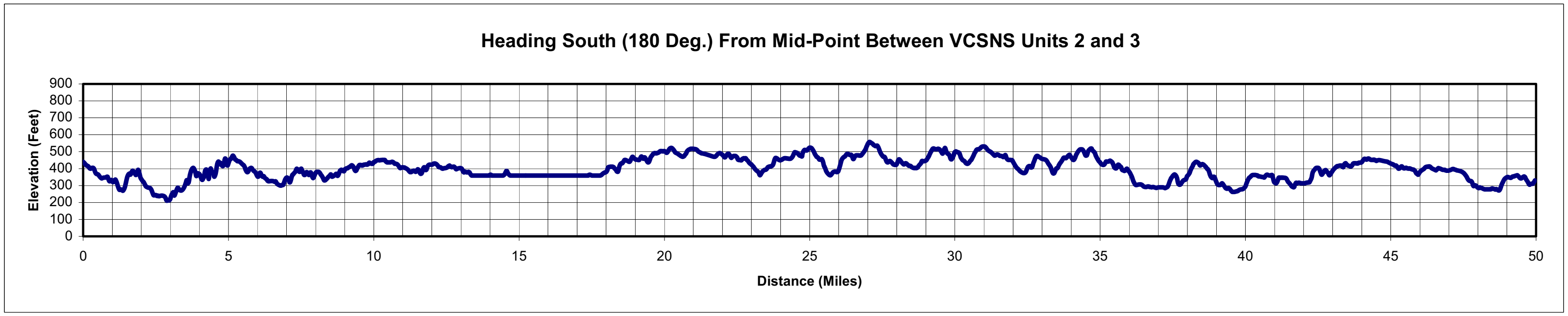


Nominal Plant Grade Elevation = 400 Feet

Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 2 of 6)

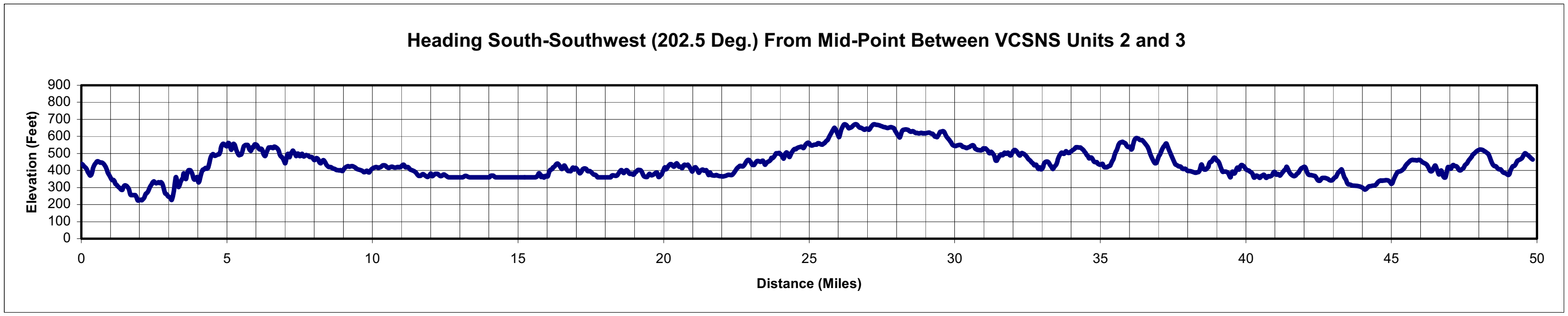


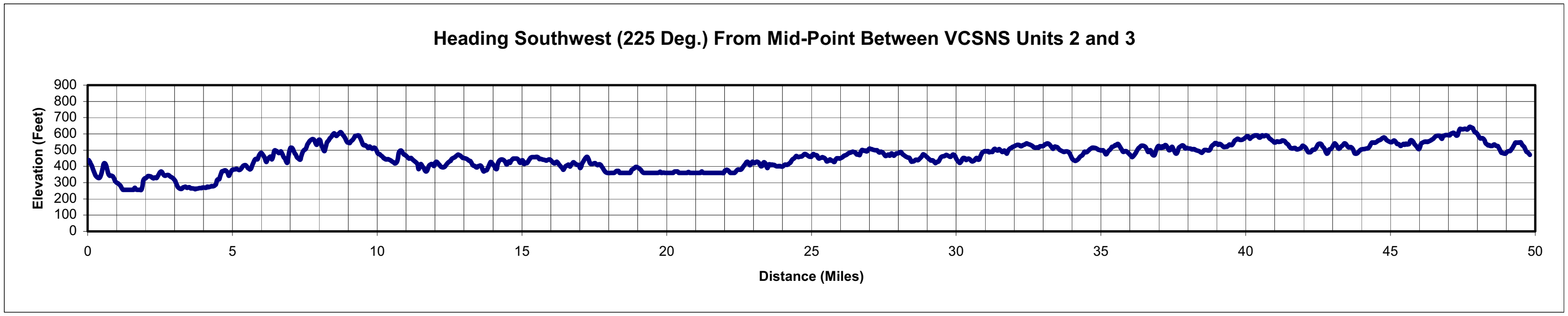


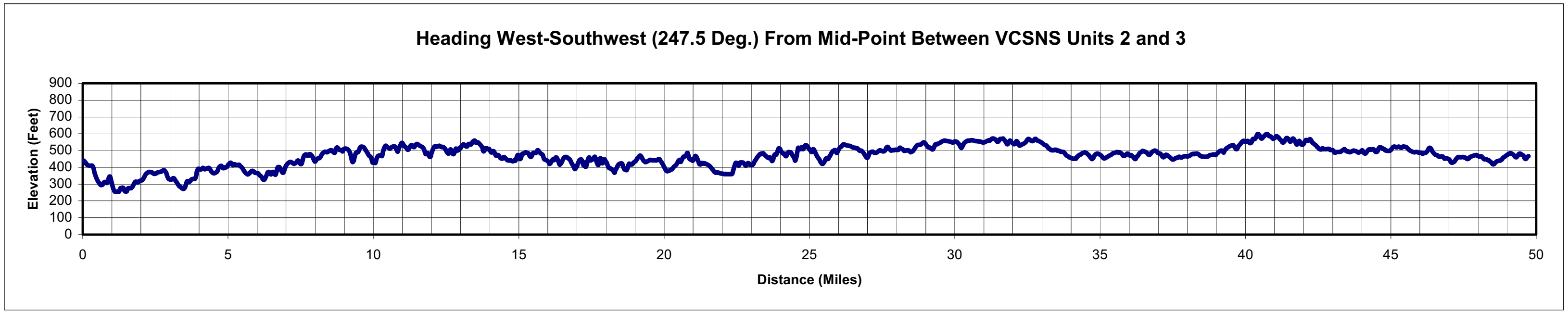


Nominal Plant Grade Elevation = 400 Feet

Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 3 of 6)

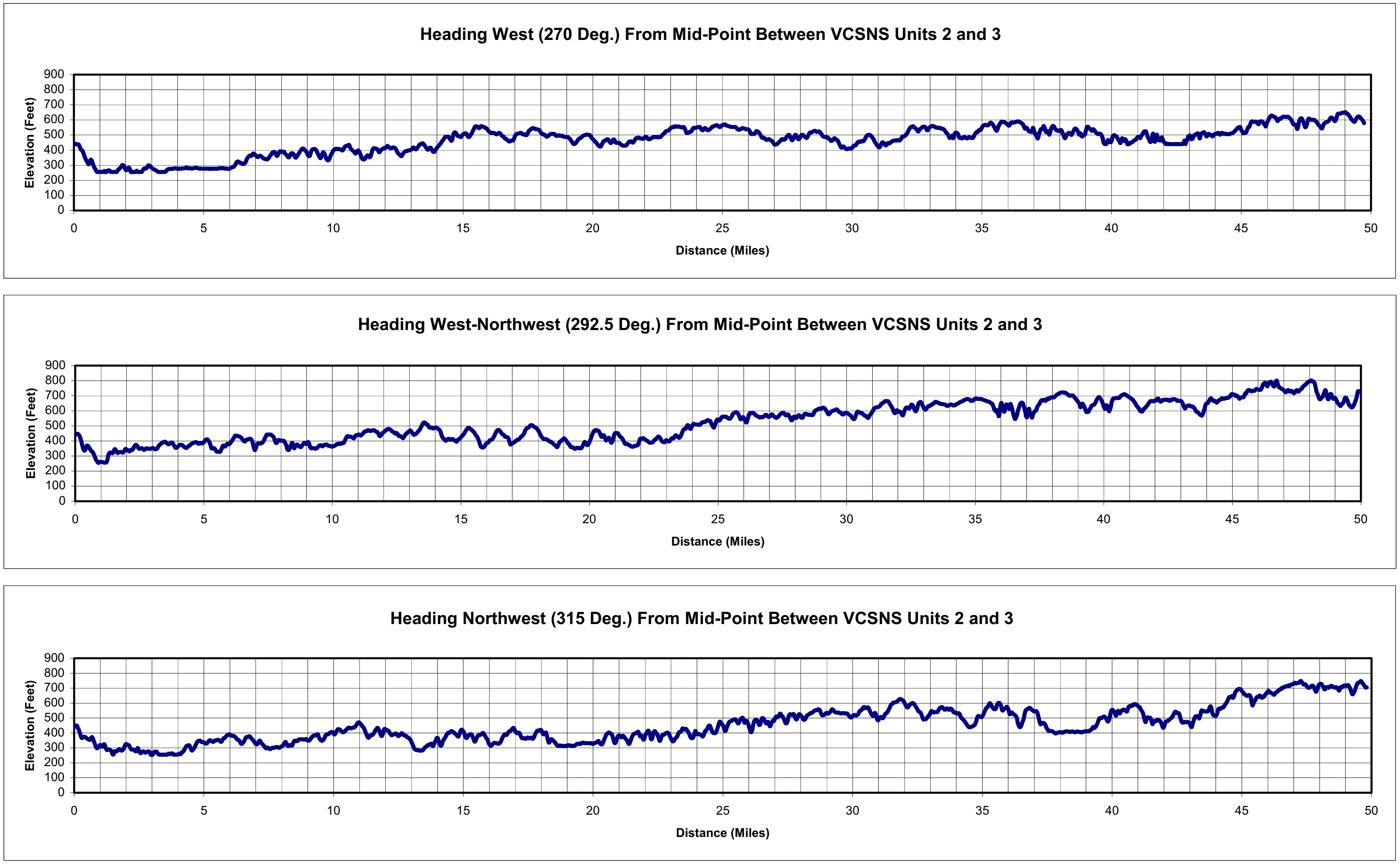






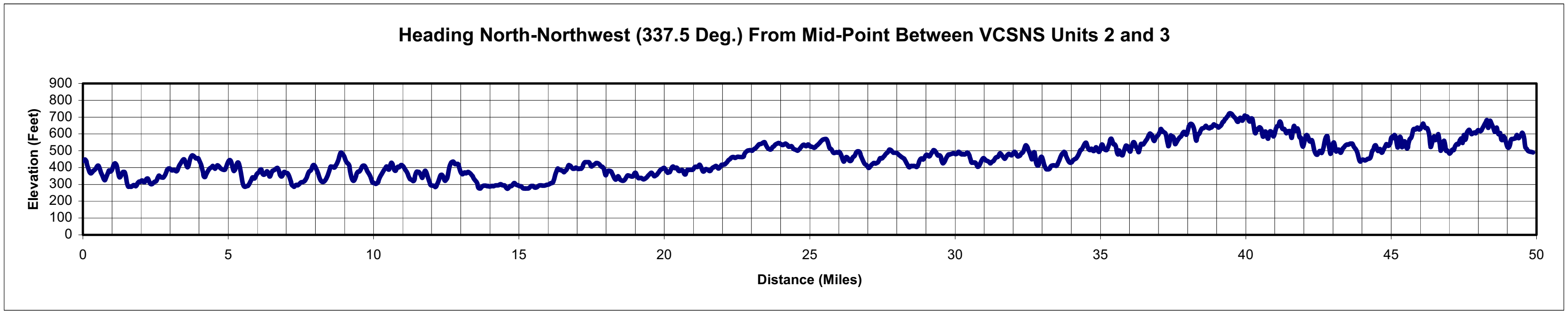
Nominal Plant Grade Elevation = 400 Feet

Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 4 of 6)



Nominal Plant Grade Elevation = 400 Feet

Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 5 of 6)



Nominal Plant Grade Elevation = 400 Feet

Figure 2.7-15. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 6 of 6)

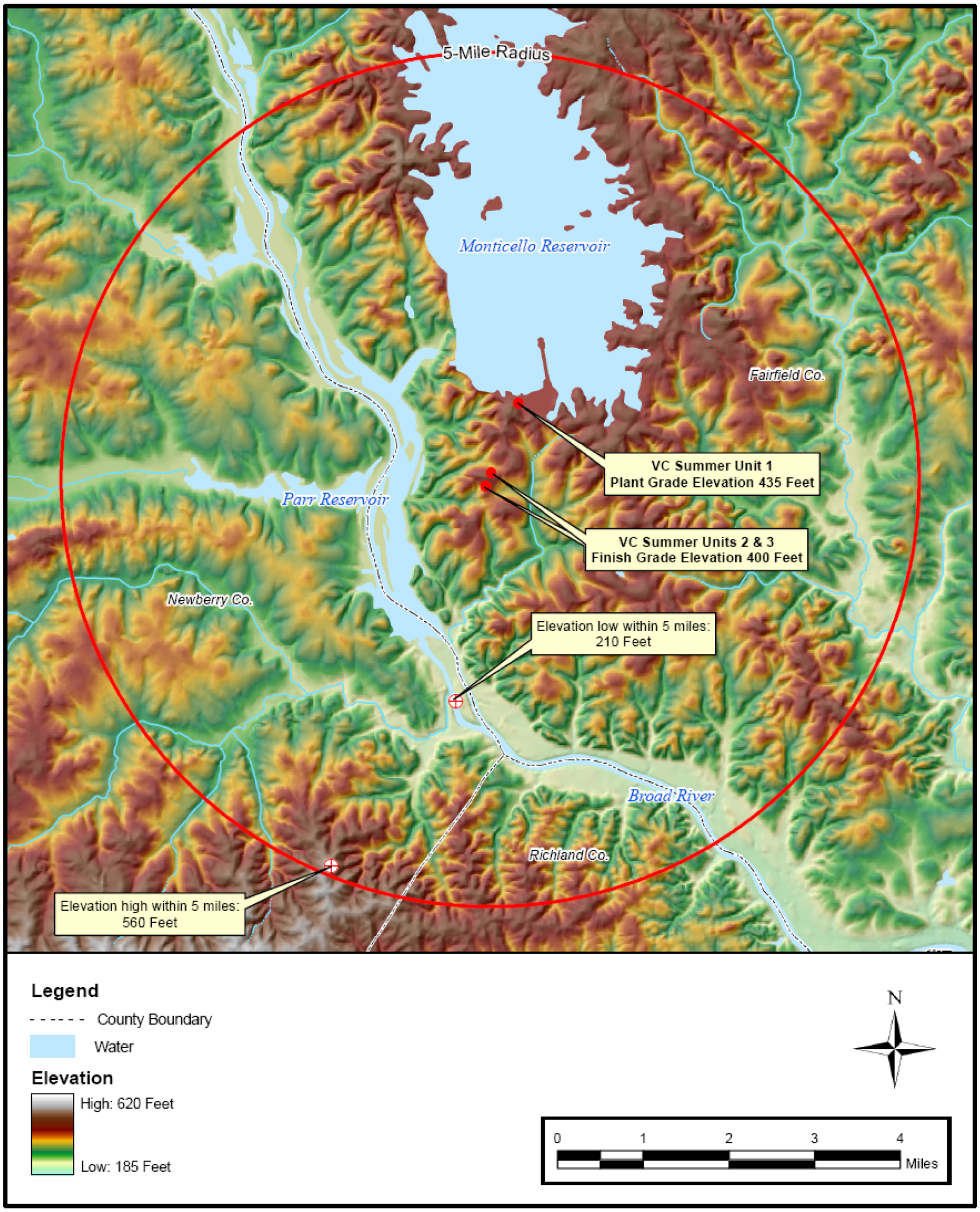


Figure 2.7-16. Site and Vicinity Map (5-Mile Radius)

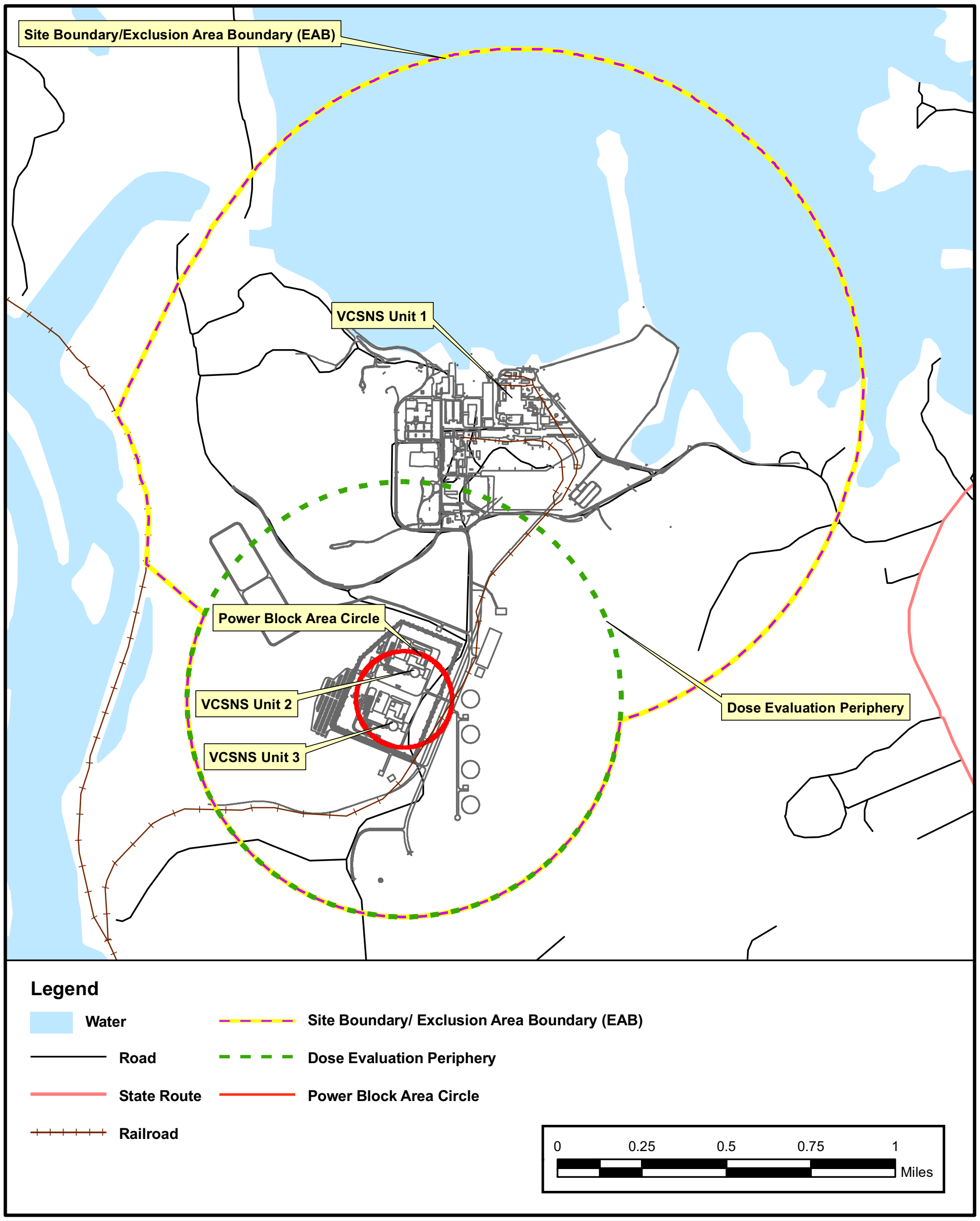


Figure 2.7-17. Site Boundary/Exclusion Area Boundary, Dose Evaluation Periphery, and PBA Circle

2.8 RELATED FEDERAL AND OTHER PROJECT ACTIVITIES

It is NRC's policy to take account of the regulations of the Council on Environmental Quality that implement the National Environmental Policy Act [10 CFR 51.10(a)]. The Council on Environmental Quality Regulation 40 CFR 1508.25(c) requires that environmental impact statements implementing the National Environmental Policy Act address impacts that may be cumulative, defining "cumulative impact" at 40 CFR 1508.7 as follows:

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

NRC uses material in an applicant's environmental report in preparing an environmental impact statement to meet its obligations under the National Environmental Policy Act. SCE&G has identified in Section 2.8 activities that, in combination with the proposed action, Units 2 and 3 may have cumulative impacts. SCE&G identified candidate activities through review of South Carolina Project Notification and Review System bulletins, internet research of the nearby localities, county government and planning organizations and military installations, and a tour of the local area. The review sought activities having impacts that could be similar to those anticipated from the new units and concentrated on those projects and activities that would most likely contribute to cumulative impacts in the areas of water consumption, water quality, radiological emissions, transportation infrastructure, and socioeconomic resources, anticipated to be the most significant impacts from the proposed action.

2.8.1 FEDERAL PROJECTS/ACTIONS

Related federal actions include the permitting of the Parr Hydro facility and Fairfield Pumped Storage Facility by the Federal Energy Regulatory Commission These facilities currently hold a Federal Energy Regulatory Commission permit that must be renewed periodically. The current permit expires June 30, 2020 (FPC 1974). The water source for Parr Hydro is Parr Reservoir, which is an impoundment on the Broad River. Parr Reservoir serves as the lower pool for Fairfield Pumped Storage Facility. The Monticello Reservoir serves as the upper pool. The Monticello Reservoir is also the water source for the existing Unit 1 and would be the water source for Units 2 and 3. Thus, all these existing facilities and the proposed units are interrelated with regard to water sources (see Subsections 2.3.2.2 and 2.8.3 for more detail). Furthermore, the Federal Energy Regulatory Commission must approve the proposed units' water usage from the Monticello Reservoir and discharge to Parr Reservoir.

Other related federal actions in the vicinity are the existing NRC license for Unit 1 and the planned independent spent fuel storage installation that would require an NRC license. The old and new units would share some infrastructure, including transmission line rights-of-way and the independent spent fuel storage installation. The independent spent fuel storage installation would be licensed under NRC regulation 10 CFR 72.

SCE&G's review of existing and planned activities in the vicinity of VCSNS first identified federal facilities in the vicinity of the project including the Department of Energy's Savannah River Site located more than 50 miles from VCSNS and three federal military bases located within 50 miles of VCSNS. These are Fort Jackson, approximately 25 miles southeast; Shaw Air Force Base, approximately 50 miles southeast; and North Air Field, approximately 47 miles south-southeast. North Air Field is designated as a "bare base" and is listed as closed on aeronautical charts. It is used for limited military training functions. Other federal facilities within the 50-mile vicinity of VCSNS include Moncrief Army Community Hospital located at Fort Jackson, the William Jennings Bryan Dorn Veterans Affairs Medical Center in Columbia, South Carolina, and various federal government buildings with administrative functions located in the Columbia area. A federal prison in Edgefield County is near the edge of the 50-mile radius. The Sumter National Forest is adjacent to the Monticello Reservoir and Congaree National Park is located about 40 miles south in Hopkins, South Carolina.

Existing and planned federal projects and actions were reviewed with regard to any connections to the proposed project based on the following criteria provided in NUREG 1555.

- Acquisition and/or use of the proposed site
- Providing or ensuring adequate cooling water supply
- Requiring the completion of any federal project before construction and operation of the proposed project
- Significant new power purchases by federal projects within the proposed project service area
- Contingency of any federal projects on construction and operation of the proposed project

The property where Units 2 and 3 would be located is currently owned by SCE&G and is contiguous with the Unit 1 site. No offsite property would be needed for the proposed AP1000 reactors and supporting infrastructure. However, the proposed transmission lines would involve offsite property and may require some land acquisition. The proposed transmission lines would not extend outside South Carolina, therefore, the Federal Energy Regulatory Commission would not be involved in approvals and permitting of transmission lines. As noted above, the proposed project would use an existing water makeup source and would be subject to federal action (i.e., approval by the Federal Energy Regulatory Commission of the water usage). The proposed project is contingent on the continued operation by SCE&G of the Parr Hydro facility and Fairfield Pumped Storage Facility to provide a water supply (see Subsections 2.3.2.2 and 2.8.3). No federal projects or activities are contingent on the construction and operation of the proposed project. The need for power (Chapter 8) that would be provided by Units 2 and 3 does not require any planned federal project or activity as justification.

2.8.2 COOPERATING AGENCIES

NRC regulations (10 CFR 51.10(b)(2)) state that the Commission will follow the Council on Environmental Quality regulations at 40 CFR 1501.6 related to cooperating agencies. The Council's regulations require that any other federal agency beyond the lead agency that has jurisdiction by law be a cooperating agency. The regulations further allow the lead agency to request other federal agencies that have special expertise with respect to any environmental issue that should be addressed in the environmental impact statement to become a cooperating agency. NRC goes beyond the Council's regulation on cooperating agency by seeing the possible need to involve a state or local agency or an Indian Tribe, when a reservation is involved (10 CFR 51.14(a)).

SCE&G and Santee Cooper, the co-owners of the proposed units, are regulated by NRC. There is no other federal agency that has jurisdiction by law. As discussed in Subsection 2.8.1, some interdependent SCE&G facilities are permitted by the Federal Energy Regulatory Commission. As to special expertise with regard to environmental impacts, NRC can choose to request another federal agency or a state or local agency to serve as a cooperating agency if it sees the need for such assistance. However, SCE&G has not identified any environmental impacts from the proposed units that it believes warrant the inclusion of a cooperating agency for the purpose of evaluating impacts. The proposed site for Units 2 and 3 does not involve an Indian reservation. The siting of the transmission lines has not been determined, so the proximity of tribal lands to the transmission lines has not been ascertained.

2.8.3 PROJECTS AND ACTIVITIES IN THE REGION WITH POTENTIAL TO CONTRIBUTE TO CUMULATIVE IMPACTS

Units 2 and 3 would be located at the VCSNS site, which already has one pressurized water commercial nuclear reactor (Figure 2.1-1). SCE&G also operates two nearby hydroelectric plants—the Fairfield Pumped Storage Facility and the Parr Hydro facility (Figure 2.1-3). These generating facilities depend on the Broad River, Parr Reservoir, and/or Monticello Reservoir. As described more fully in Section 2.3, the Broad River was impounded to create the Parr Reservoir for the purpose of siting the Parr Hydro station. In 1977, the Parr Reservoir was enlarged to support the development of the Fairfield Pumped Storage Facility, which was constructed on Frees Creek. At this time, the Monticello Reservoir was created in the Frees Creek Valley to serve as the upper pool for the Fairfield Pumped Storage Facility and as the cooling water source for Unit 1. Water flow to support these facilities is as follows: Parr Hydro draws water from the Parr Reservoir and returns water to Broad River. During pumpback operation, the Fairfield Pumped Storage Facility draws water from the Parr Reservoir and discharges it to the Monticello Reservoir. Unit 1 withdraws cooling water from the

Monticello Reservoir, the heated water leaving the plant via the discharge bay and canal is returned to the Monticello Reservoir.

In addition to these users of water in the Broad River, there are six hydroelectric plants that use waters of the Broad River. Five are upstream of the proposed units and one is downstream. Another large user of the Broad River is the city of Columbia, which withdraws an average of approximately 32.5 million gpd. A detailed discussion of area surface water usage is presented in Subsection 2.3.2.2.

Pending upstream users of the Broad River include two proposed nuclear generating reactors. Duke Energy has proposed to construct two AP1000 reactors (to be known as Lee Nuclear Station) upstream from VCSNS on the Broad River in Cherokee County, South Carolina (Figure 2.8-1). The reactors would not be colocated with an existing, operating nuclear plant. Duke Energy estimates that the two units would come into service by 2016 (Duke Energy 2007).

Numerous locations within South Carolina and close to its borders manage and may ship anthropogenic radiological materials. These are shown on Figure 2.8-1, with the exception of area hospitals. These managers of radiological materials are mentioned here with regard to the potential for cumulative impacts in the 50-mile radius from radiological emissions, transportation of radiological materials, and socioeconomic resources (*e.g.,* sources of radiological workers).

Anthropogenic sources of radiological emissions in the 50-mile vicinity include the existing Unit 1 reactor, the decommissioned Carolinas-Virginia Tube Reactor, which is at the east end of Parr Shoals Dam, and decommissioned steam generators at the onsite old steam generator recycle facility vault. SCE&G also has plans to construct an independent spent fuel storage installation onsite for dry spent fuel storage. Other sources of anthropogenic radiation in the 50-mile vicinity include a Westinghouse fuel fabrication facility south of Columbia and hospitals using medical isotopes in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens, Greenwood, and Camden.

Beyond the 50-mile vicinity, but within South Carolina borders, lie six other nuclear reactors (U.S. NRC 1999, 2002a, 2003). Other operating nuclear plants located in South Carolina are the Catawba Nuclear Station (two reactors) located in York County, the H. B. Robinson Steam Electric Plant (one reactor) in Darlington County, and the Oconee Nuclear Station (three reactors) located in Oconee County. The 50-mile radii of these reactors overlap the 50-mile radii of Units 2 and 3.

North Carolina and Georgia have nuclear plants that are near the border with South Carolina (Figure 2.8-1) (U.S. NRC 1985 and 2002b). The McGuire Nuclear Station (two reactors) is located in Mecklenburg County, North Carolina, north of Charlotte. Vogtle Electric Generating Plant (two reactors) in Burke County, Georgia is just across the Savannah River from Barnwell County.

The U.S. DOE's Savannah River Site is adjacent to the Savannah River in Aiken, Barnwell, and Allendale Counties (Figure 2.8-1). Defense radiological materials and wastes are manufactured, stored, and disposed of at the Savannah River Site and transported to and from the site. Construction of additional radiological handling facilities is anticipated with construction beginning in 2007 and continuing until 2020 (Lanigan 2006, Patterson 2006a, 2006b, 2006c). The construction workforce for these projects would require an estimated 600 to 1,850 workers, with the peak workforce year of 2010 (Lanigan 2006, Patterson 2006a, 2006b, 2006c). Adjacent to the eastern side of the Savannah River Site in Barnwell County is a commercial radioactive waste disposal facility operated by Energy Solutions (formerly Chem-Nuclear) (Figure 2.8-1). The Barnwell facility is the only state-owned facility currently available to most of the nation for the disposal of commercially generated low-level radioactive waste. Radiological material is also managed at the Charleston Naval Weapons Station.

Section 2.8 References

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8. U.S. NRC 1999. *Generic Environmental Statement for License Renewal of Nuclear Power Plants Regarding the Oconee Nuclear Station*. NUREG 1437 Supplement 2, December 1999.

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10. U.S. NRC 2002b. *Generic Environmental Statement for License Renewal of Nuclear Power Plants Regarding the McGuire Nuclear Station, Units 1 and 2*. NUREG 1437 Supplement 8, December 2002.

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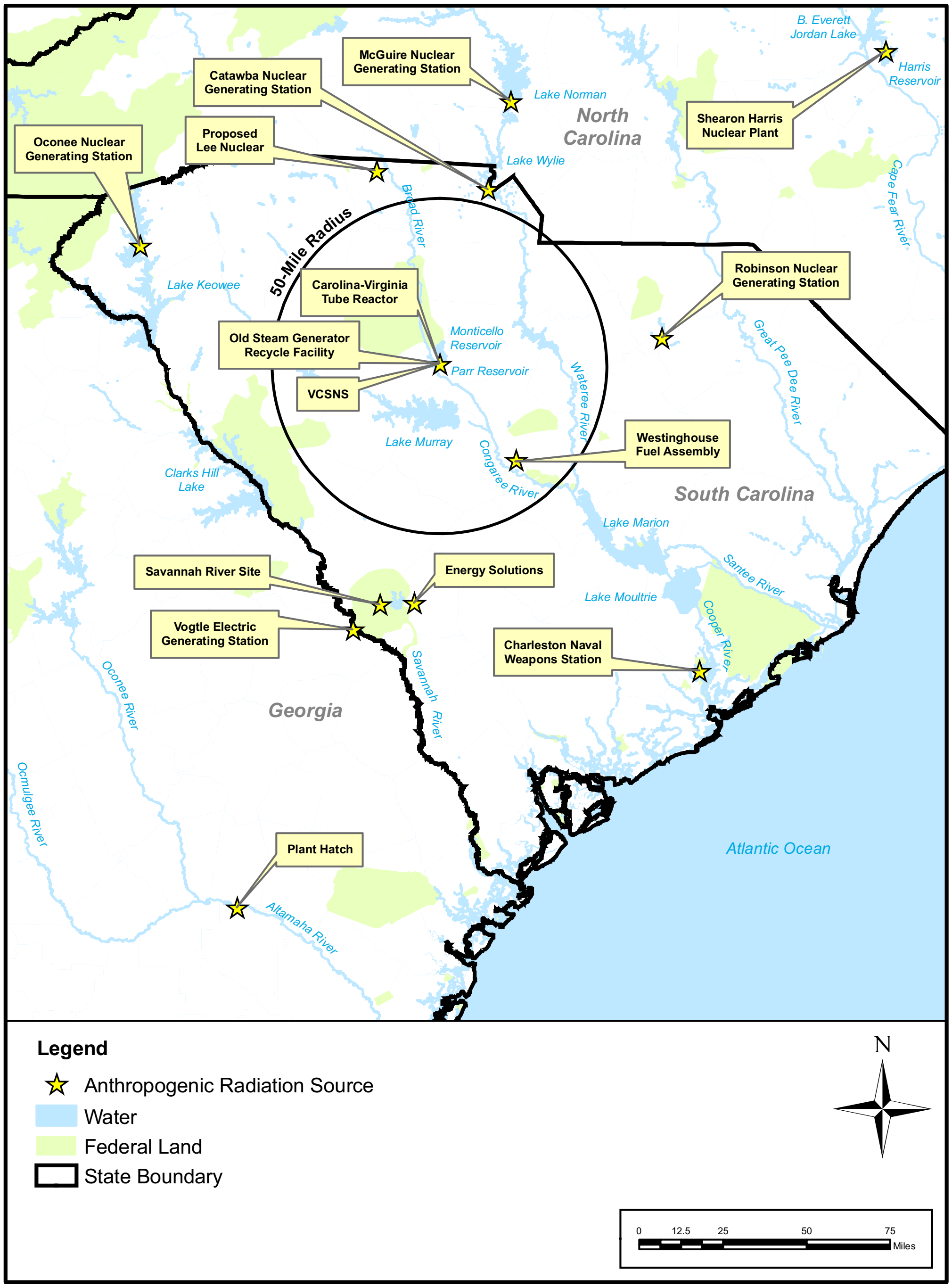

Figure 2.8-1. Anthropogenic Radiation Sources

2.9 EXISTING PLANT PARAMETERS

VCSNS Unit 1 is part of the environment that would be affected by the construction and operation of Units 2 and 3. Therefore, parameters describing the existing plant comprise a baseline against which parameters for the new reactors can be compared. Additionally, the impacts of the proposed reactors are cumulative with the impacts of the existing plant. Accordingly, Table 2.9-1 presents Unit 1 parameters that are important for assessing the environmental impacts of constructing and operating Units 2 and 3. The table is organized into the resource or impact topics discussed in Chapters 2, 4, and 5, as appropriate: land use, water, socioeconomics, radiological impacts, and nonradiological impacts. The ecology resource area is not listed, because plant parameters that affect this resource are identified under other topics.

Table 2.9-1 (Sheet 1 of 2)
Plant Parameters for Unit 1

Parameter	Quantity and Units
Land Use	
Developed acreage	2,245 acres; Plant facilities occupy 370 acres with remaining 890 acres primarily in forest, 860 acres are covered by Monticello Reservoir, and 125 acres are used for transmission lines
Exclusion Area Boundary	Site boundary (western axis is 5,850 feet and eastern axis is 5,350 feet)
Low Population Zone Boundary	3 miles
Water	
Monticello Reservoir water consumptive use	VSCNS: 13 cubic feet per second
Parr Reservoir water use	Fairfield Pumped Storage Facility 9.5 billion gallons per day pumped from Parr Reservoir to Monticello Reservoir and then returned to Parr Reservoir
Groundwater withdrawal	2 dewatering wells approximately 26 gallons per minute average total
Socioeconomics	
Permanent plant workforce	635
Outage workforce	2003: 695 2005: 780 2006: 464 prime contractor + approximately 200 other contract employees
Population within 10 miles	12,209 residents and transients
Population within 50 miles	1,028,075 residents
Radiological Impacts	
Airborne emissions	Fission/Activation Products: 110 curies Radioiodines: 1.85×10^{-3} curies Particulates: 1.44×10^{-5} curies Tritium: 3.12 curies
Airborne pathway collective dose	0.0356 millirem

Table 2.9-1 (Sheet 2 of 2)
Plant Parameters for Unit 1

Parameter	Quantity and Units
Radiological Impacts (continued)	
Liquid discharges (curies/yr)	Fission/Activation Products: 0.0758 curies Tritium: 466 curies Dissolved/Entrained Gases: 0.850 curies Gross Alpha: 0 curies
Liquid pathway collective dose	4.76×10^{-3} millirem
Solid radiological waste volume	77.40 cubic meters
Solid radiological waste radioactivity	229.43 curies
Worker collective dose	Year Dose 2003: 71 person-rem 2004: 10 person-rem 2005: 73 person-rem
Nonradiological Impacts	
Criteria pollutants emitted	NOx = <100 tons per year (permit limit) Annual SO_2 = 41.2 μg/m^3 ozone = not modeled per SCDHEC Annual PM_{10} = 27.56 μg/m^3 8-hour CO = 7518.9 μg/m^3 Annual TSP = 26.6 μg/m^3
Noise	Ambient: Not available Operating plant: one time measurement of 45.9 dBA measured at drive entrance (outside rock barrier)
Building height	containment dome: 166 feet above grade
Other	
MWt	Core thermal rating of 2,900 megawatts thermal
MWe capacity	Maximum dependable electrical capacity: 966 MW