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 VCSNS 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 Columbia, South Carolina, to the headwaters of the river approximately 100 miles

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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.

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 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 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 Coastal 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 0.62 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/day. 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/day 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. Cross sections were developed roughly along these groundwater pathways as shown in Figures 2.3-36, 2.3-37, and 2.3-38. The shortest subsurface pathways from Unit 2 and 3 to the nearest groundwater discharge point are shown in Figures 2.3-37 and 2.3-38, respectively. 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:

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

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.

Owner	Facility
SCE&G	Neal Shoals Parr Shoals
Duke Power	Gaston Shoals Ninety-Nine Islands
Cherokee Falls Associates	Cherokee Falls
Lockhart Power	Lockhart
City of Columbia	Columbia Canal

Source: Bettinger et al. 2003

Gaston Shoals, Cherokee Falls, Ninety-Nine Islands, Lockhart, and Neal Shoals are located upstream of the proposed site. Columbia Hydro 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). In accordance with the FERC license requirements, should the Broad River flow from the Parr Shoals Dam be less than the stipulated minimum flow, daily operation of the Fairfield Pumped Storage Facility would cease or be limited. The supply of water required to support normal operations at VCSNS is maintained by the inventory available in the Monticello Reservoir. With the unavailability of the Fairfield Pumped Storage Facility to provide makeup to the Monticello Reservoir, inflow would only be from natural runoff or precipitation.

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).

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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)

	Monthly mean flows (cfs)											
Year	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

	Monthly mean flows (cfs)											
Year	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

Date	Observed at Richtex[(a)] or Alston[(b)] Station		Estimated at Parr Shoals Dam[(c)]	
	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

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)
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

	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)
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

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)
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

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-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-4	1.1E-4	0.52
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	0.62
Deep Bedrock Zone	0.0088	0.38	0.07
All	0.0017	18.00	0.37

Table 2.3-22
Packer Test Results

Boring Number	Test Interval: Test Section Depth (feet bgs)	Test Interval: Material	Hydraulic Conductivity: Feet/Year	Hydraulic Conductivity: 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		Parr Reservoir	
	Sample Location B-327	Sample Location B-328	Sample Location B-345	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

Sample Location	Date Sampled	Parameters									
		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

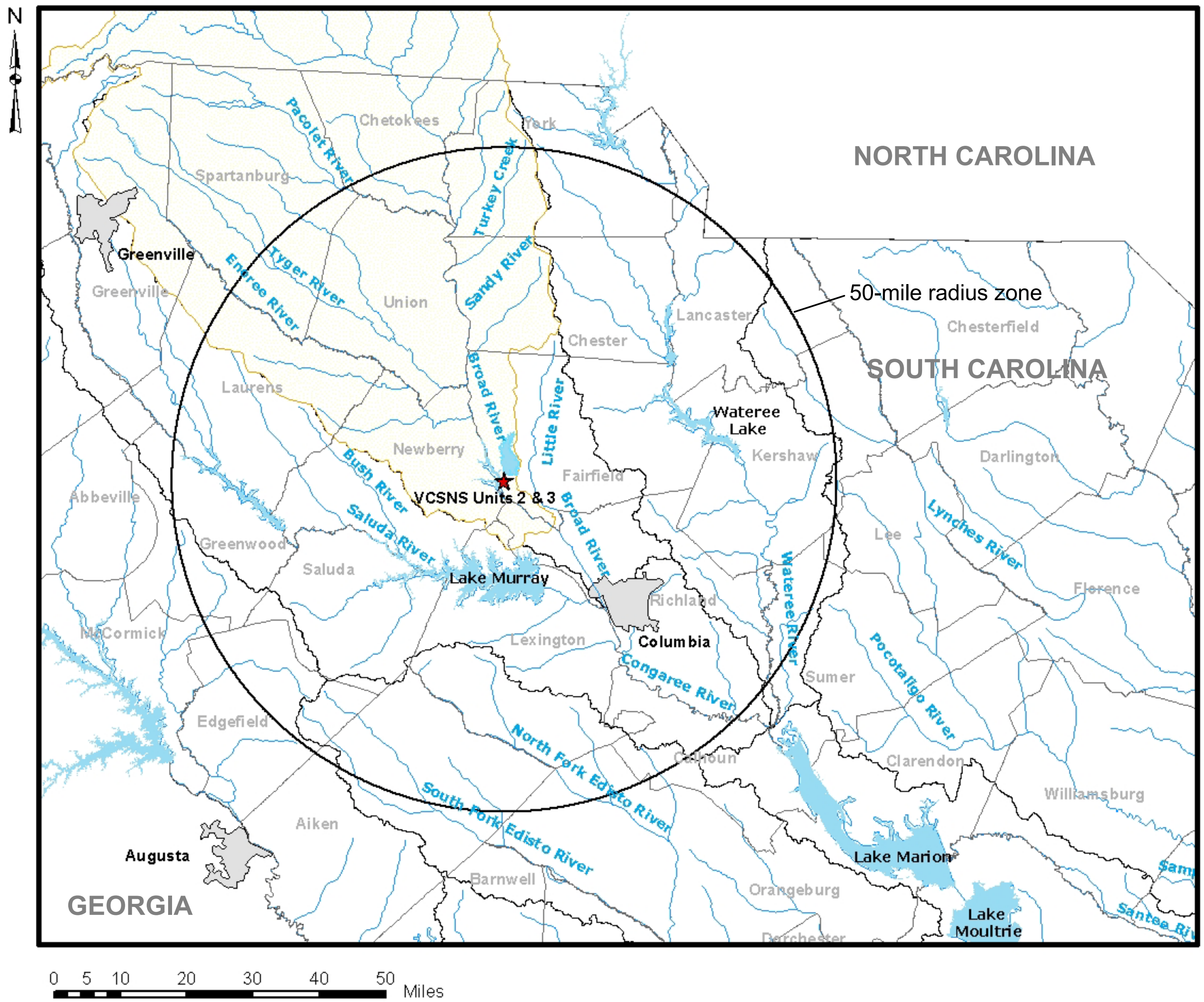


Figure 2.3-1. Major Hydrologic Features within the 50-mile Radius Zone around Units 2 and 3

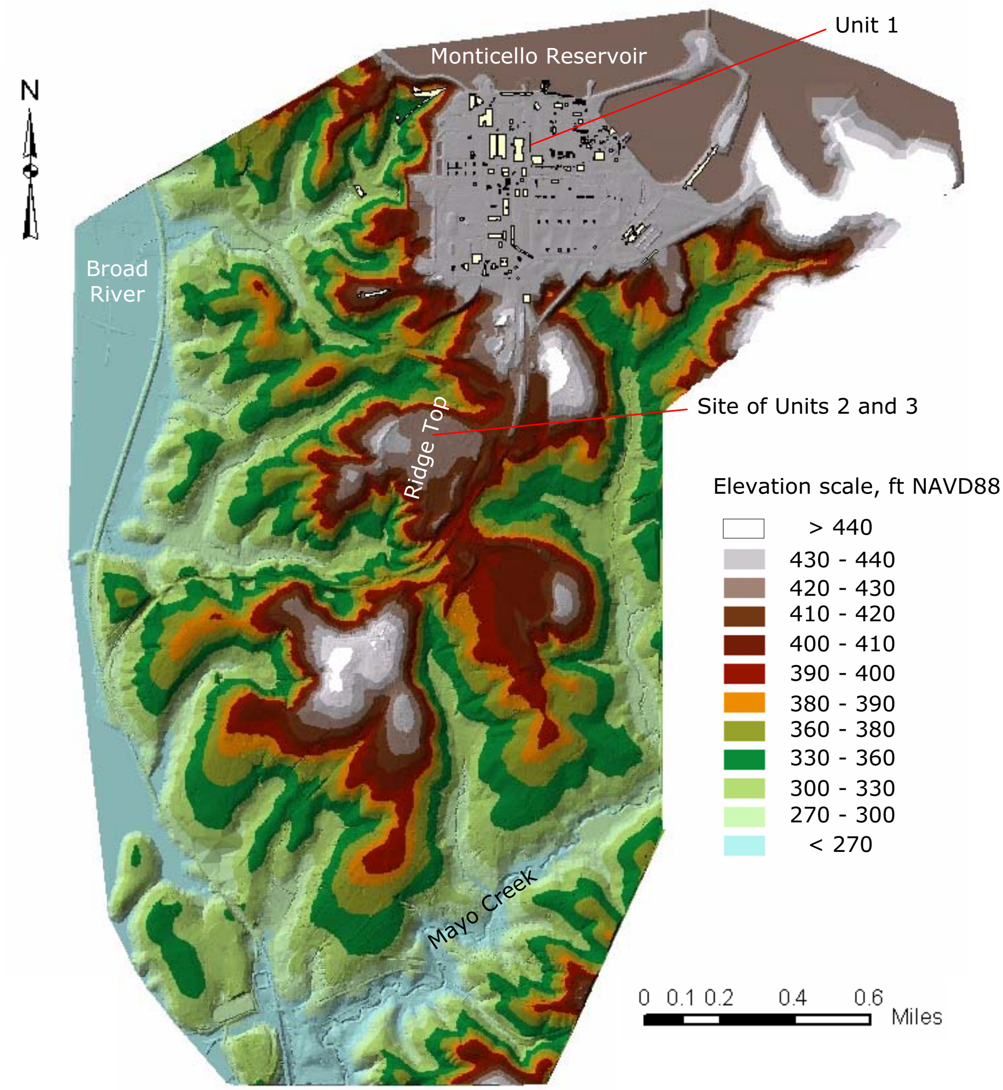


Figure 2.3-2. Topography of the Vicinity of the Units 2 and 3 and Monticello Reservoir, Based on Data from the Aerial Survey Conducted in 2006

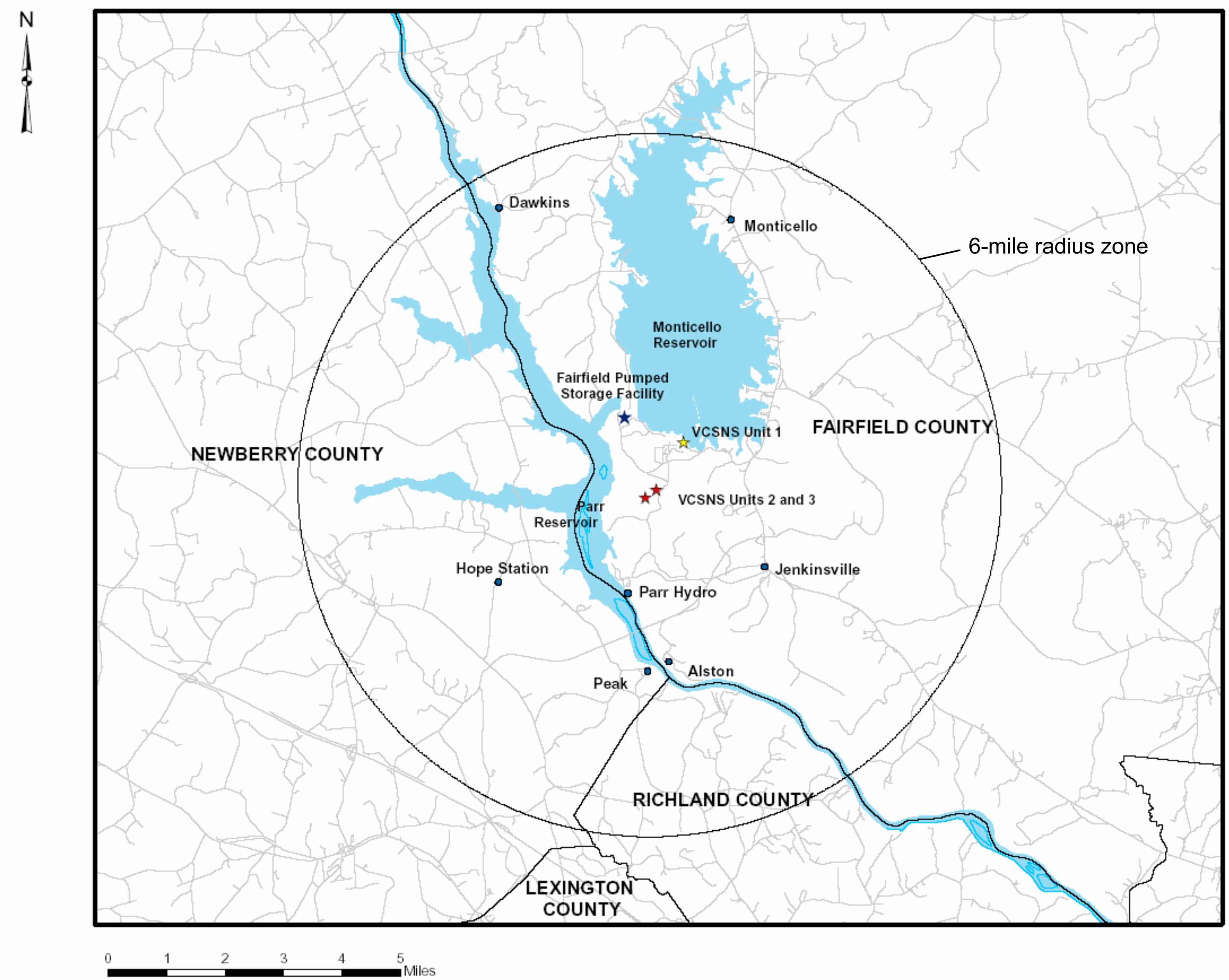


Figure 2.3-3. Major Hydrologic Features Within the 6-mile Radius Zone around Units 2 and 3

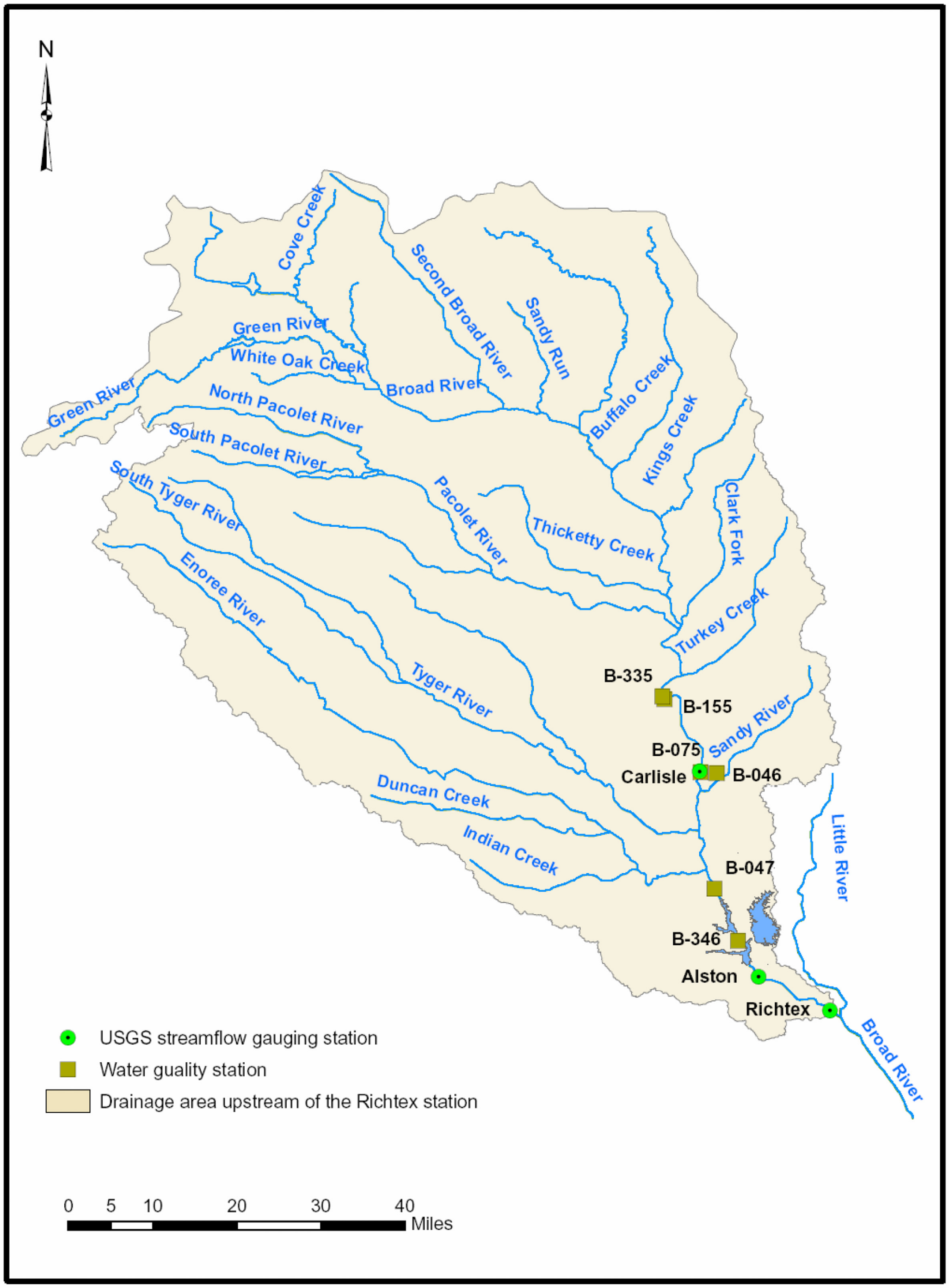


Figure 2.3-4. **Broad River Watershed Upstream of the Site and Nearest Stream Flow Gauging Stations**

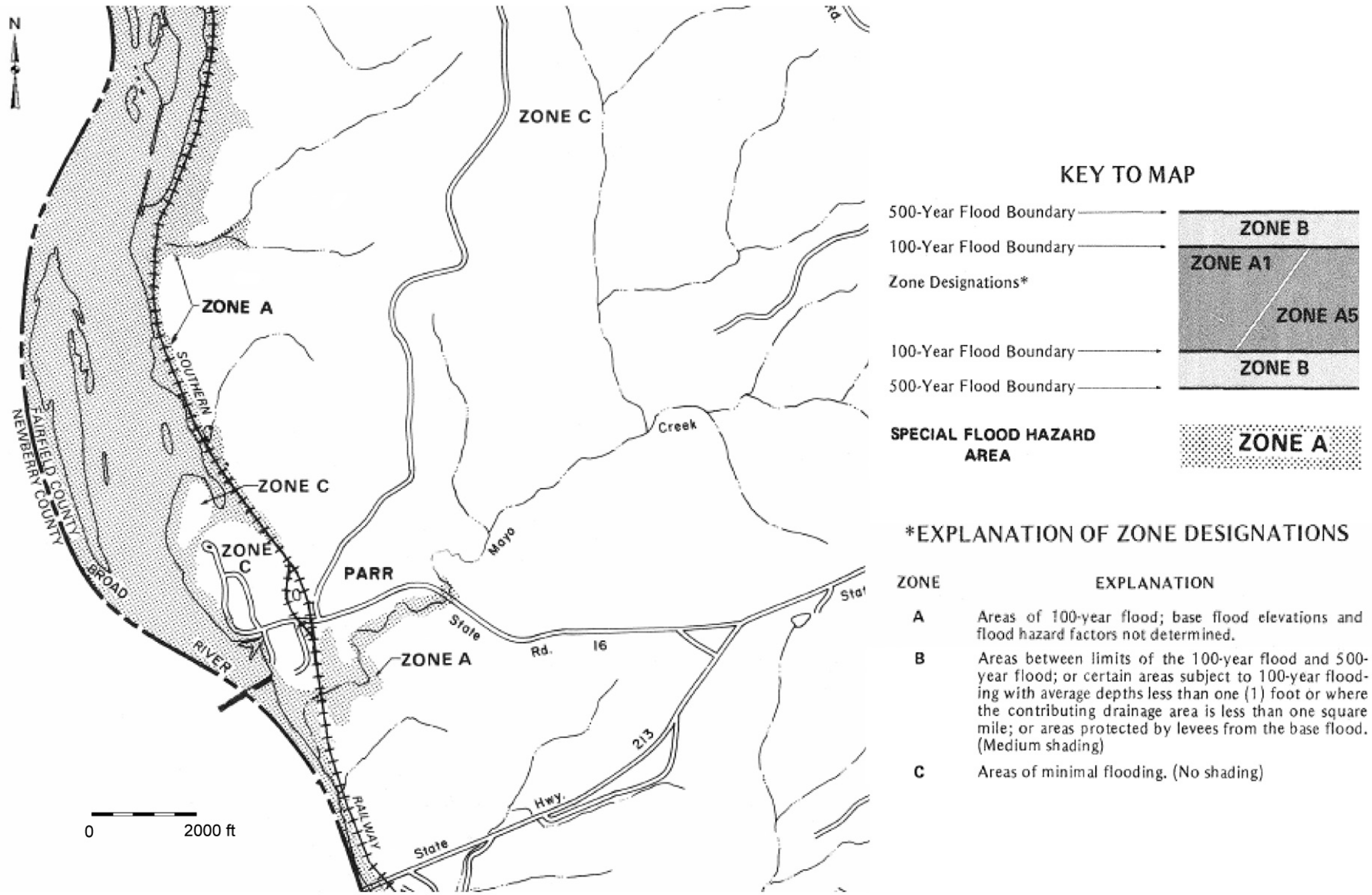


Figure 2.3-5. 100-year Floodplain Map in the Vicinity of VCSNS (Source: FEMA issued flood map, Fairfield County, South Carolina, ID 4500750175B)

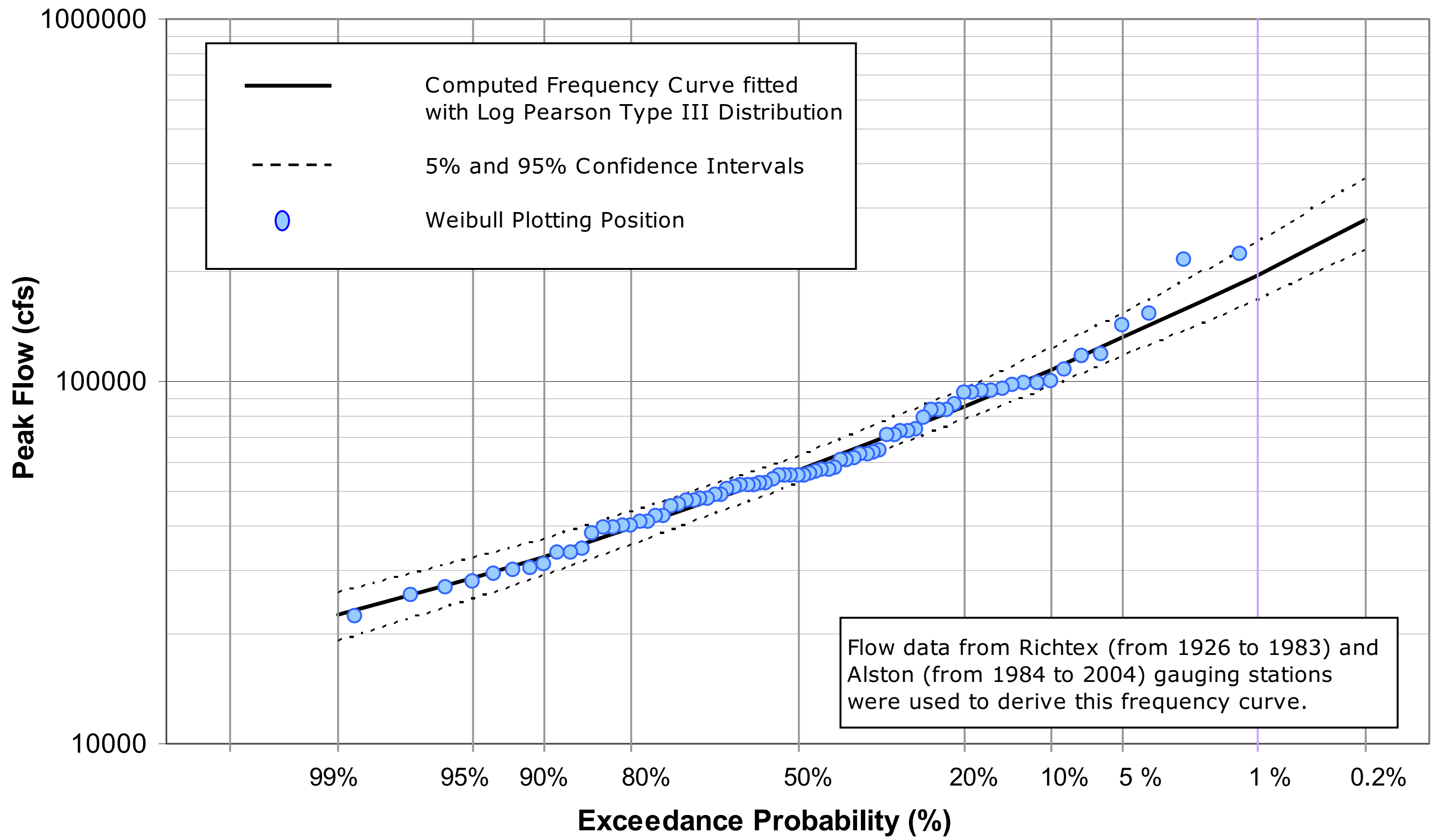
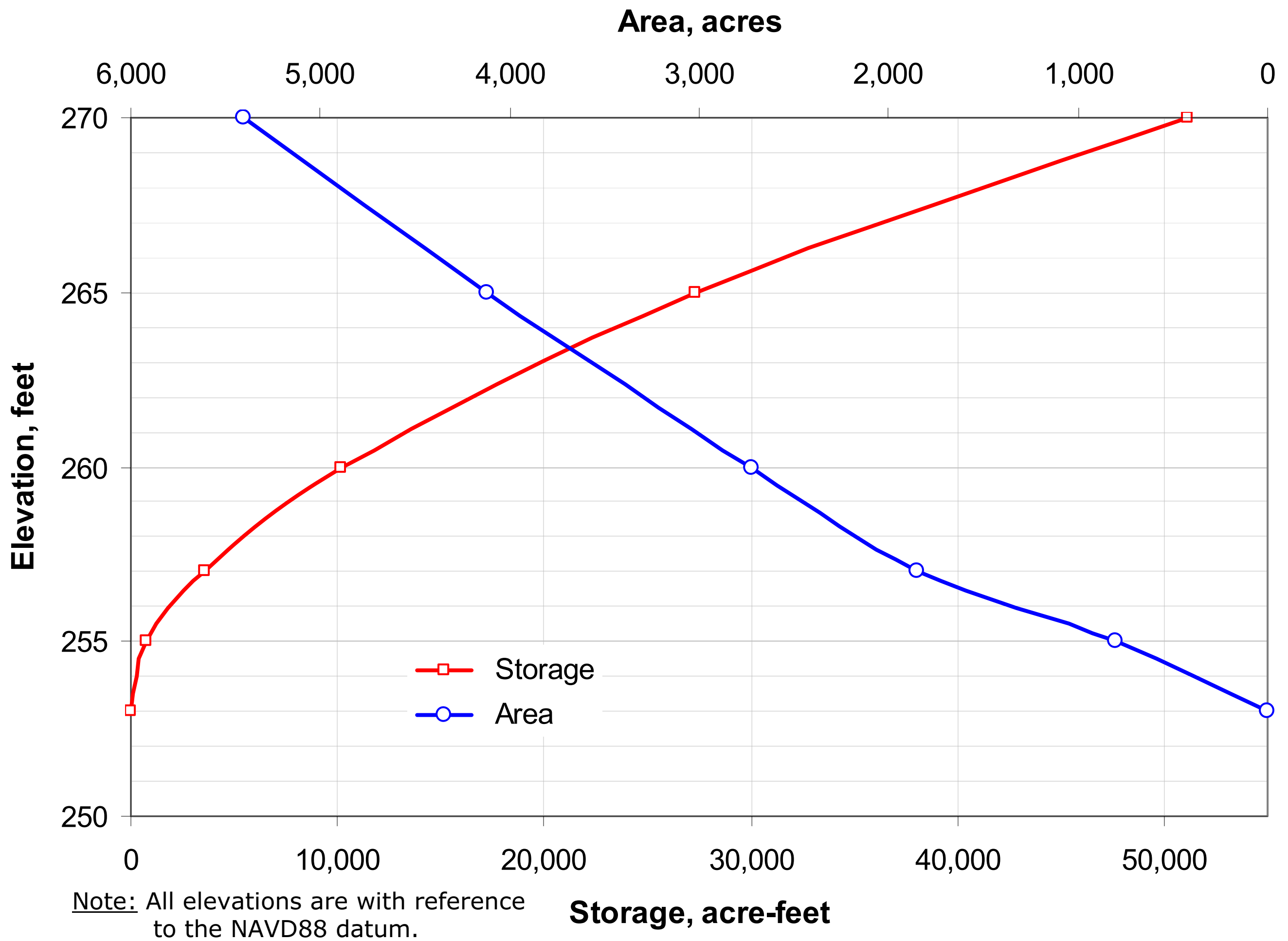
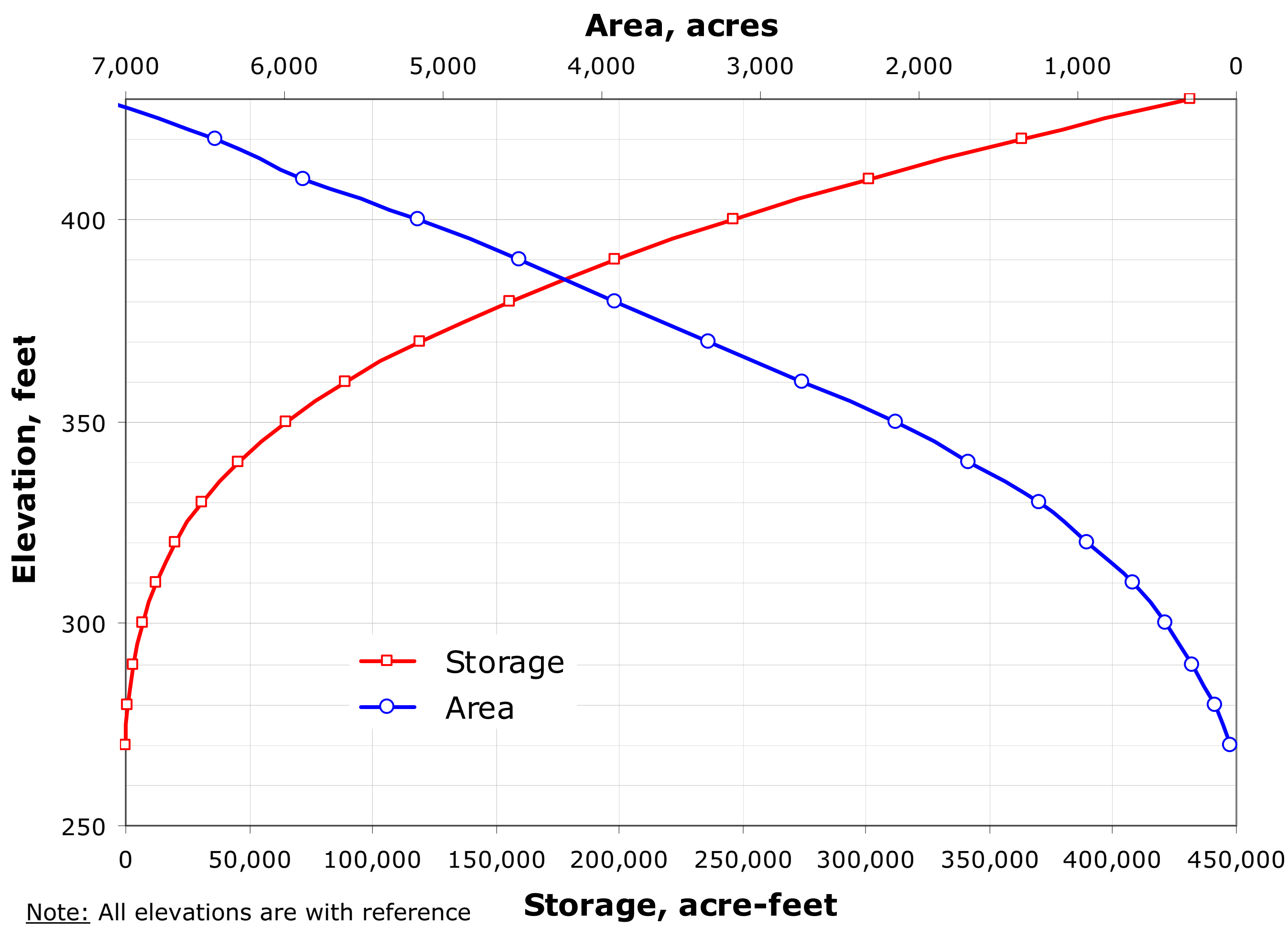


Figure 2.3-6. Flood Frequency Curve for the Broad River at Parr Shoals Dam



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

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

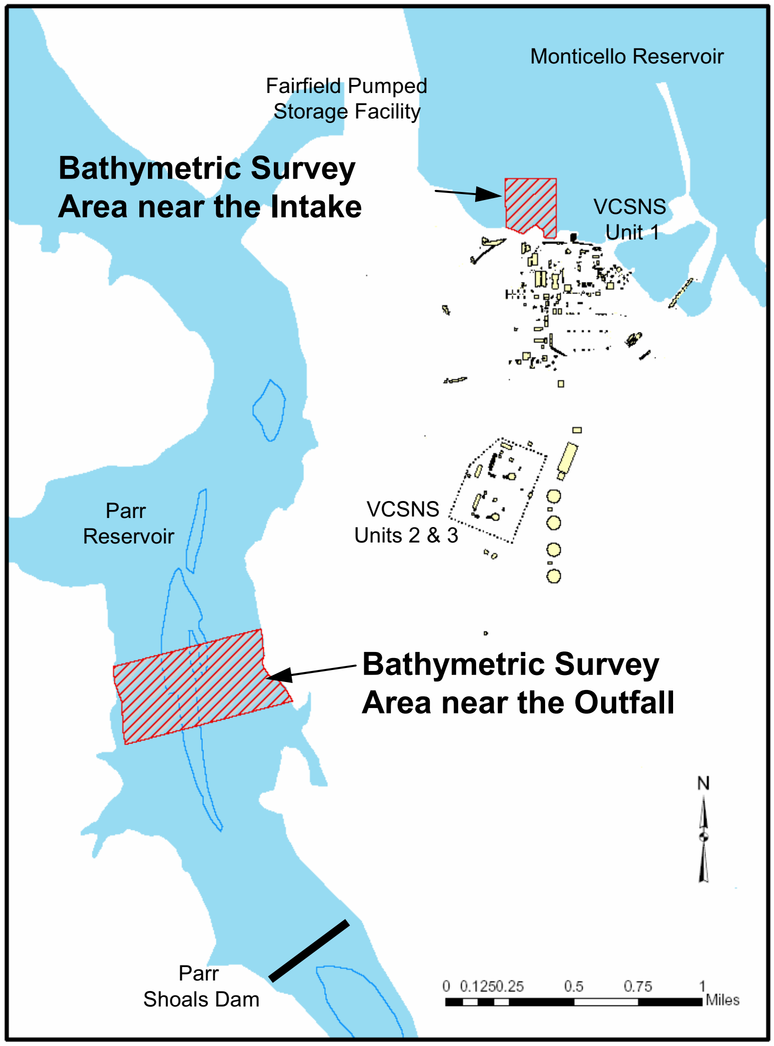
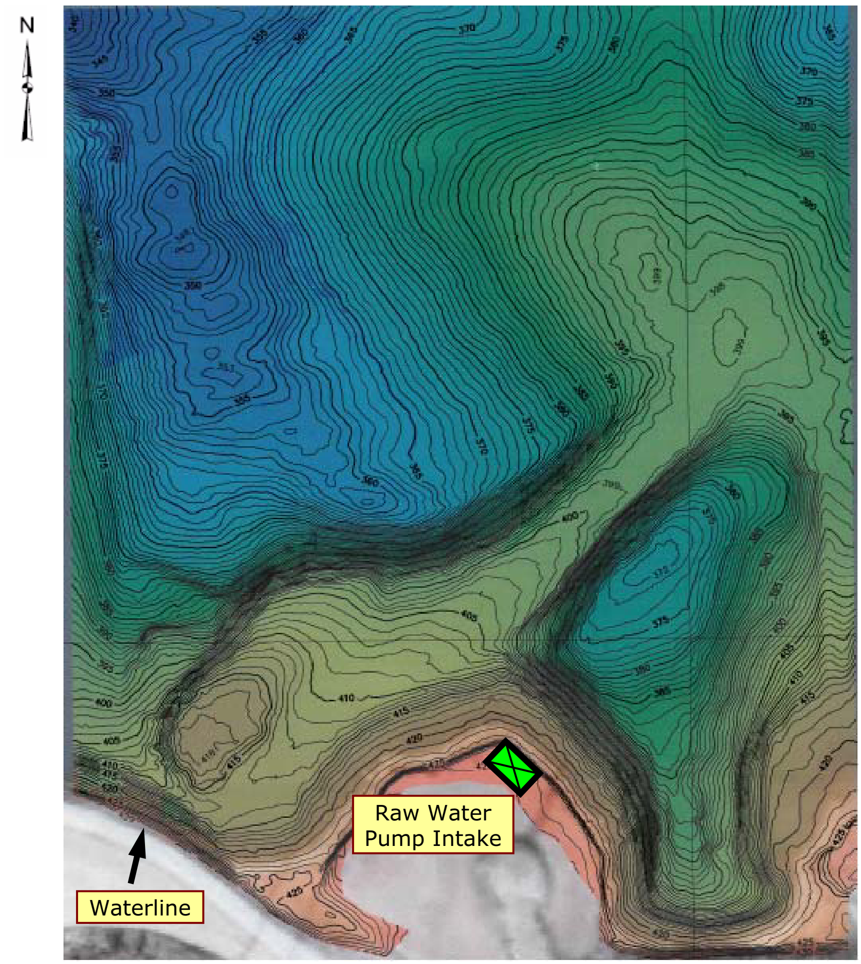


Figure 2.3-9. Location of Bathymetric Survey Areas



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

Scale, feet

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

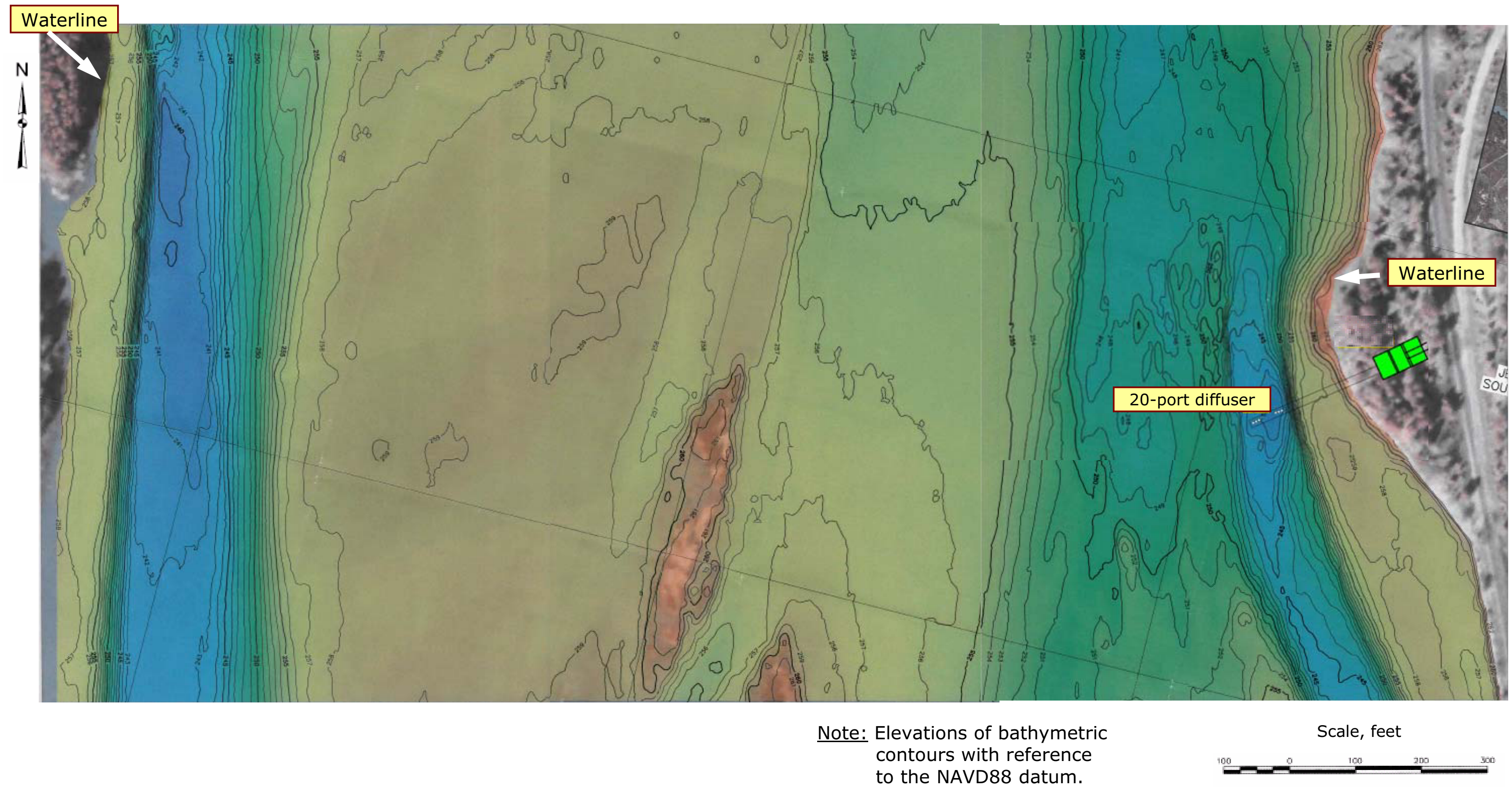


Figure 2.3-11. Proposed Discharge Location Parr Reservoir, South Carolina

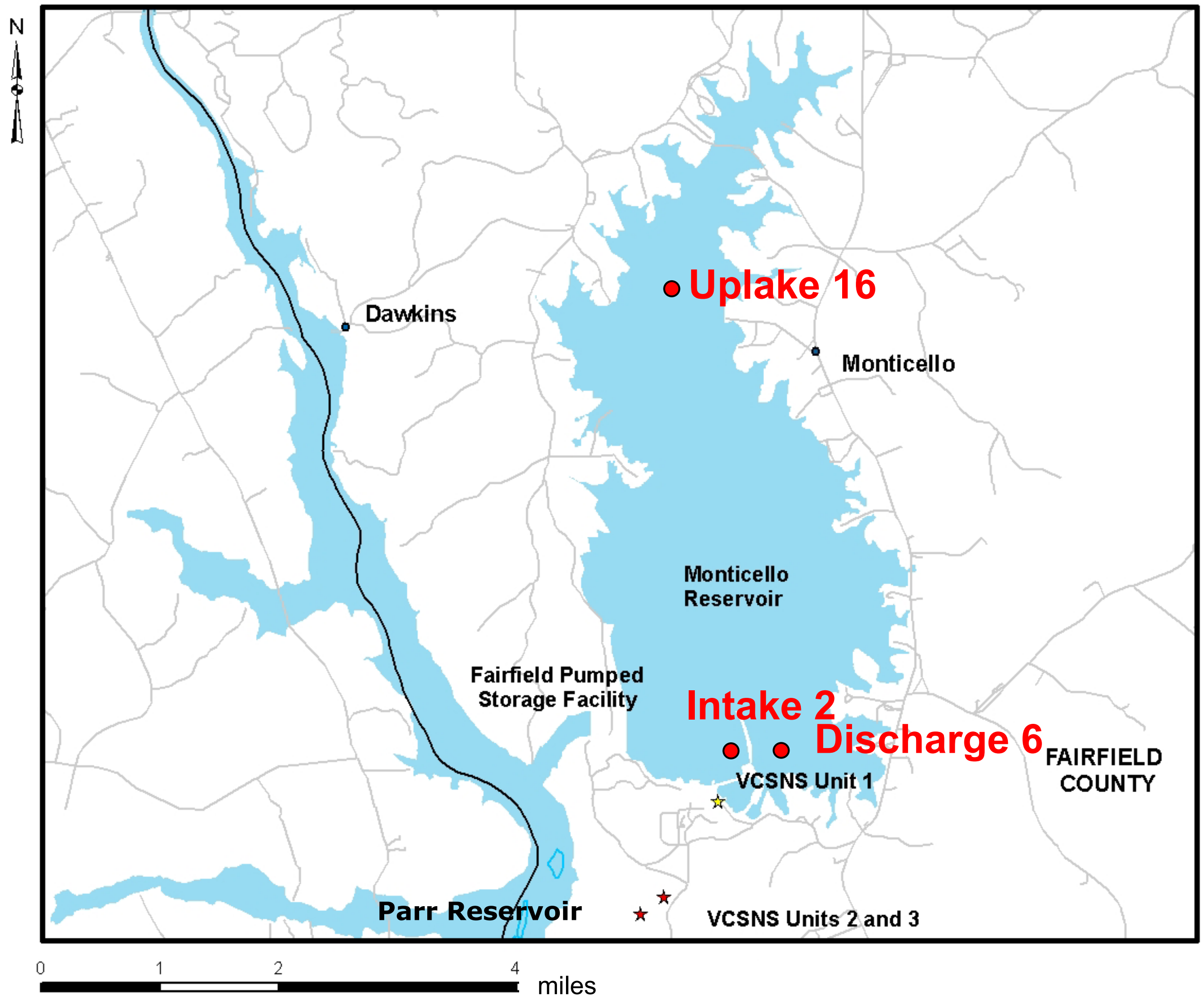


Figure 2.3-12. Locations of Water Quality Monitoring Stations in Monticello Reservoir

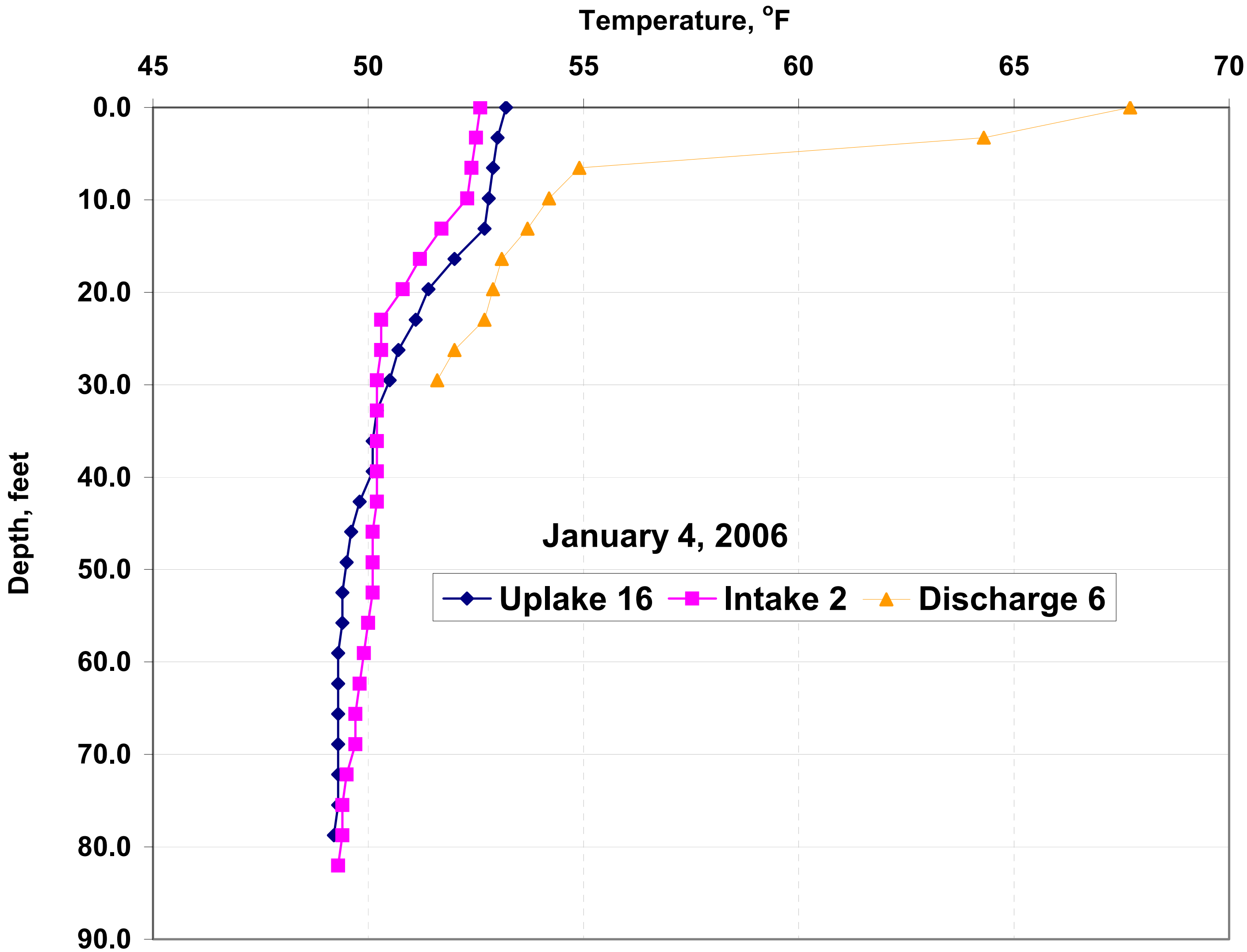


Figure 2.3-13. January Vertical Profiles for Water Temperatures in Monticello Reservoir in 2006

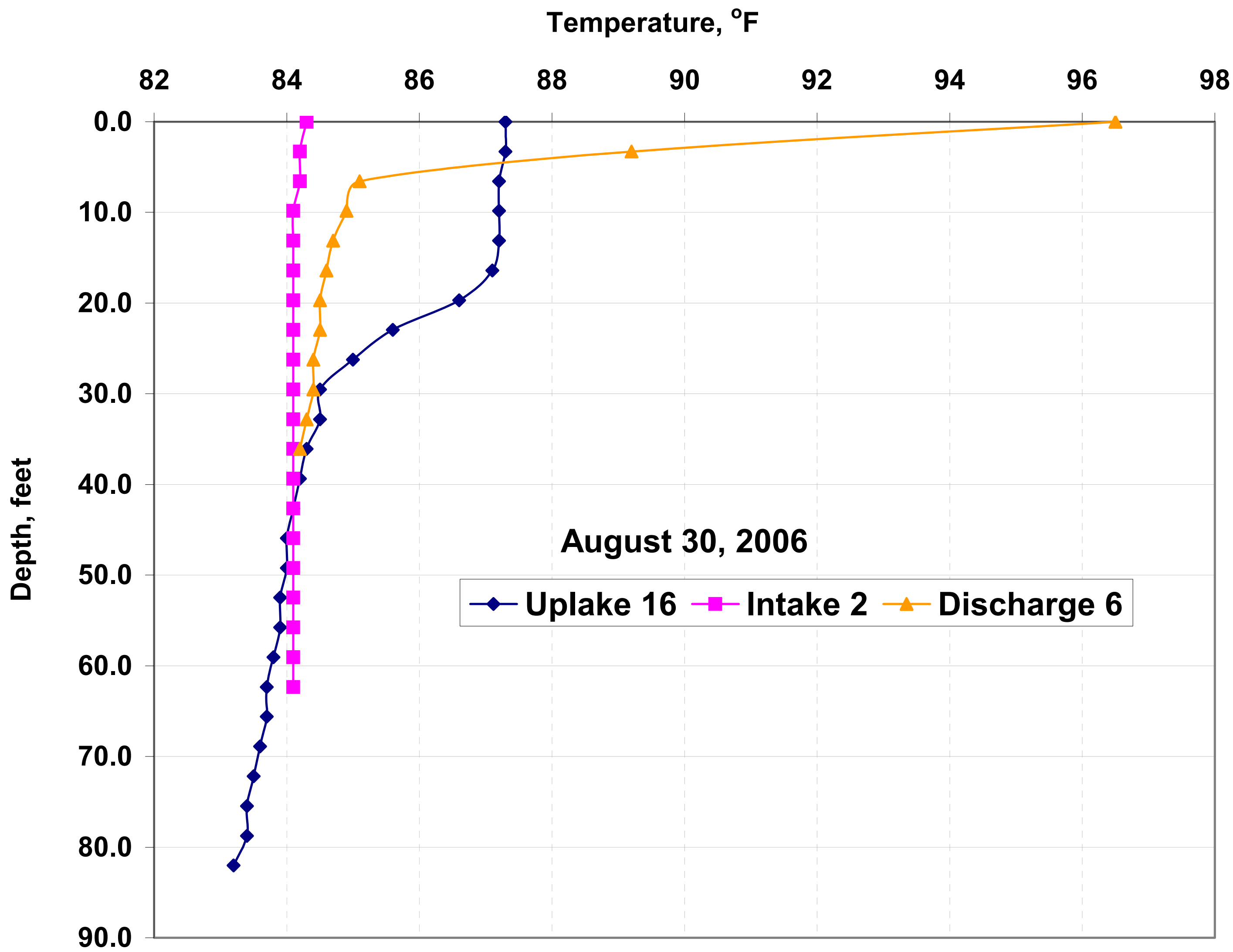


Figure 2.3-14. August Vertical Profiles for Water Temperatures in Monticello Reservoir in 2006

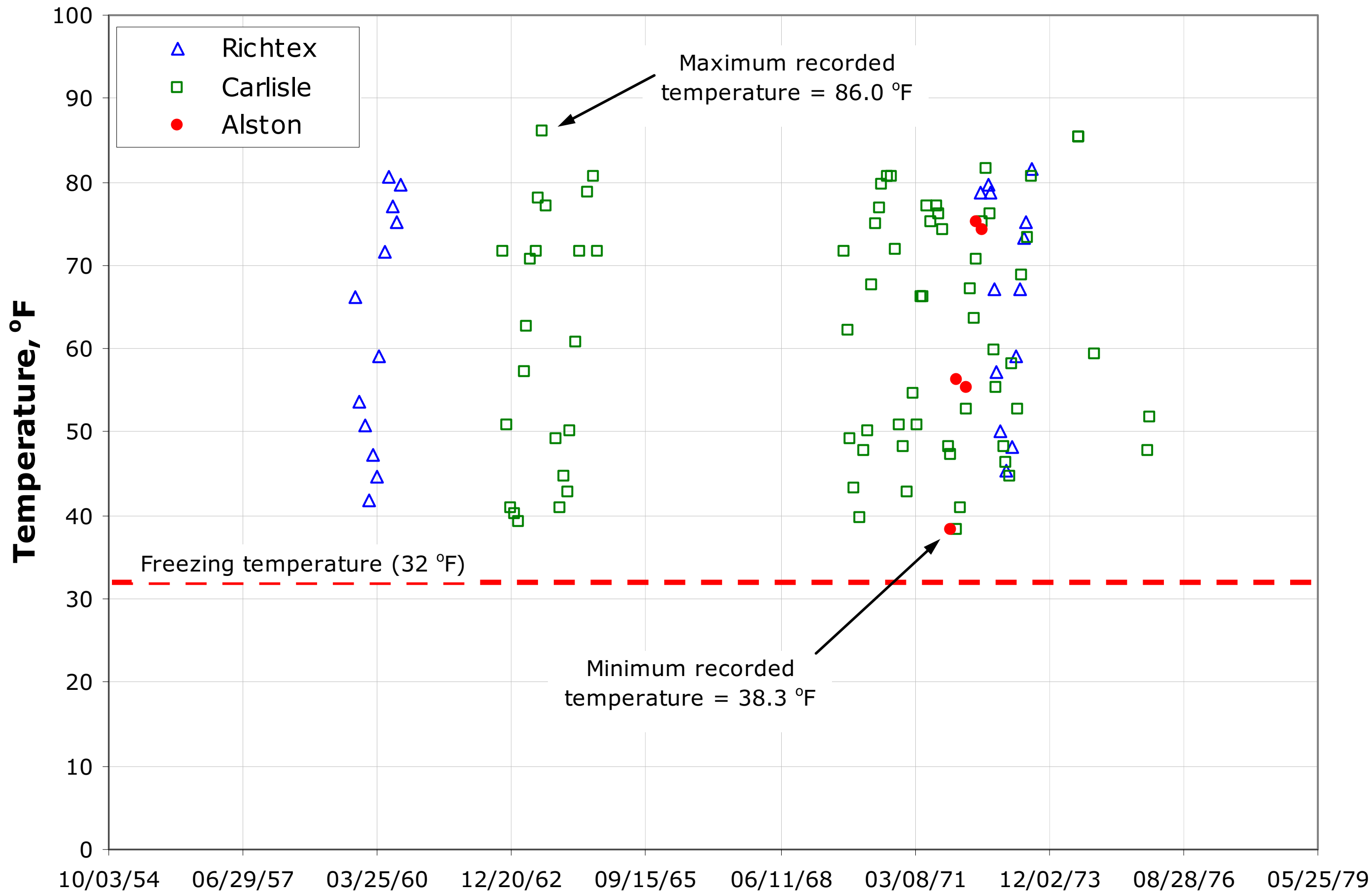


Figure 2.3-15. Recorded Water Temperatures in Broad River

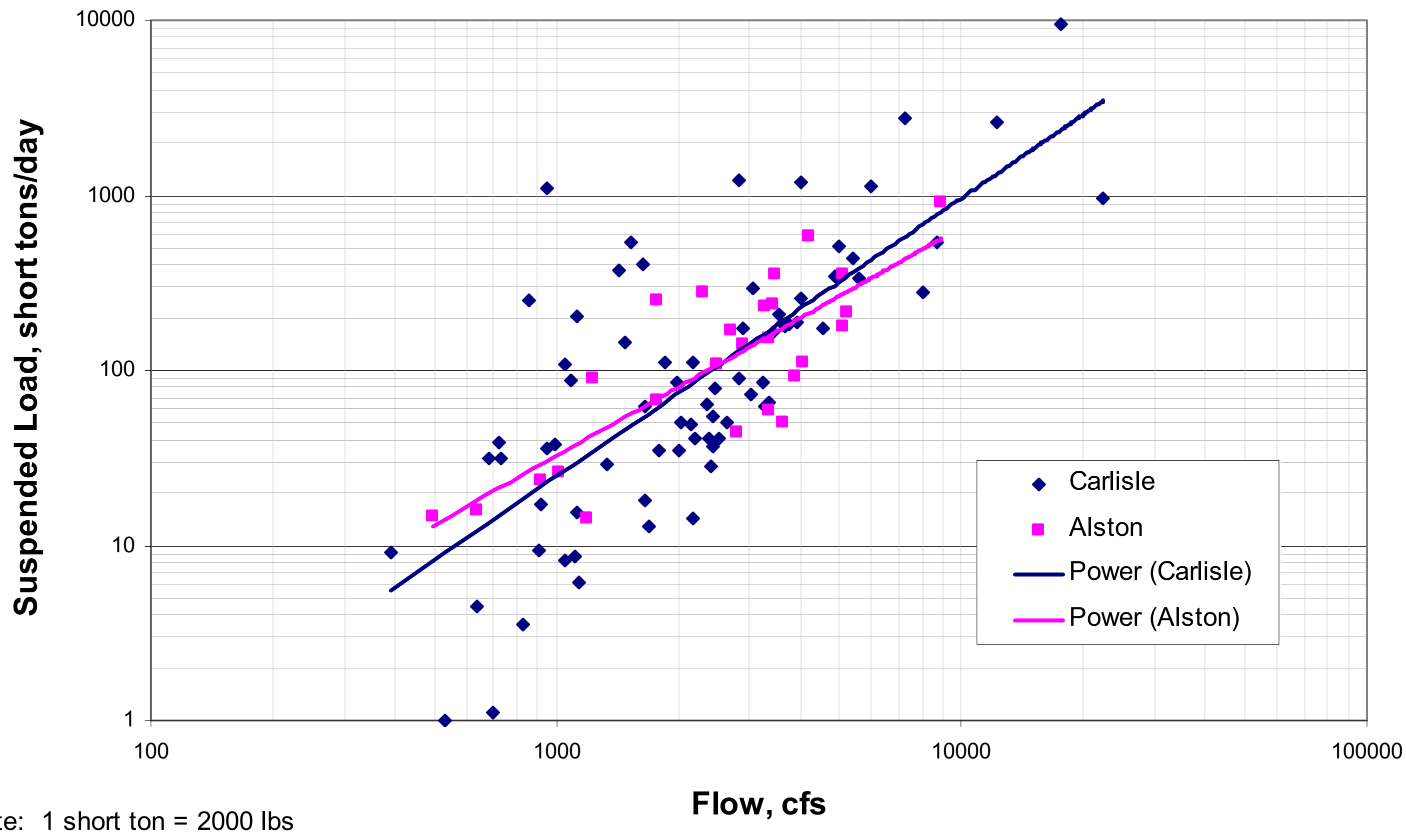


Figure 2.3-16. Suspended Sediment in the Broad River for the Carlisle and Alston Gauges (USGS #02156500 and USGS #0216100, respectively)

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

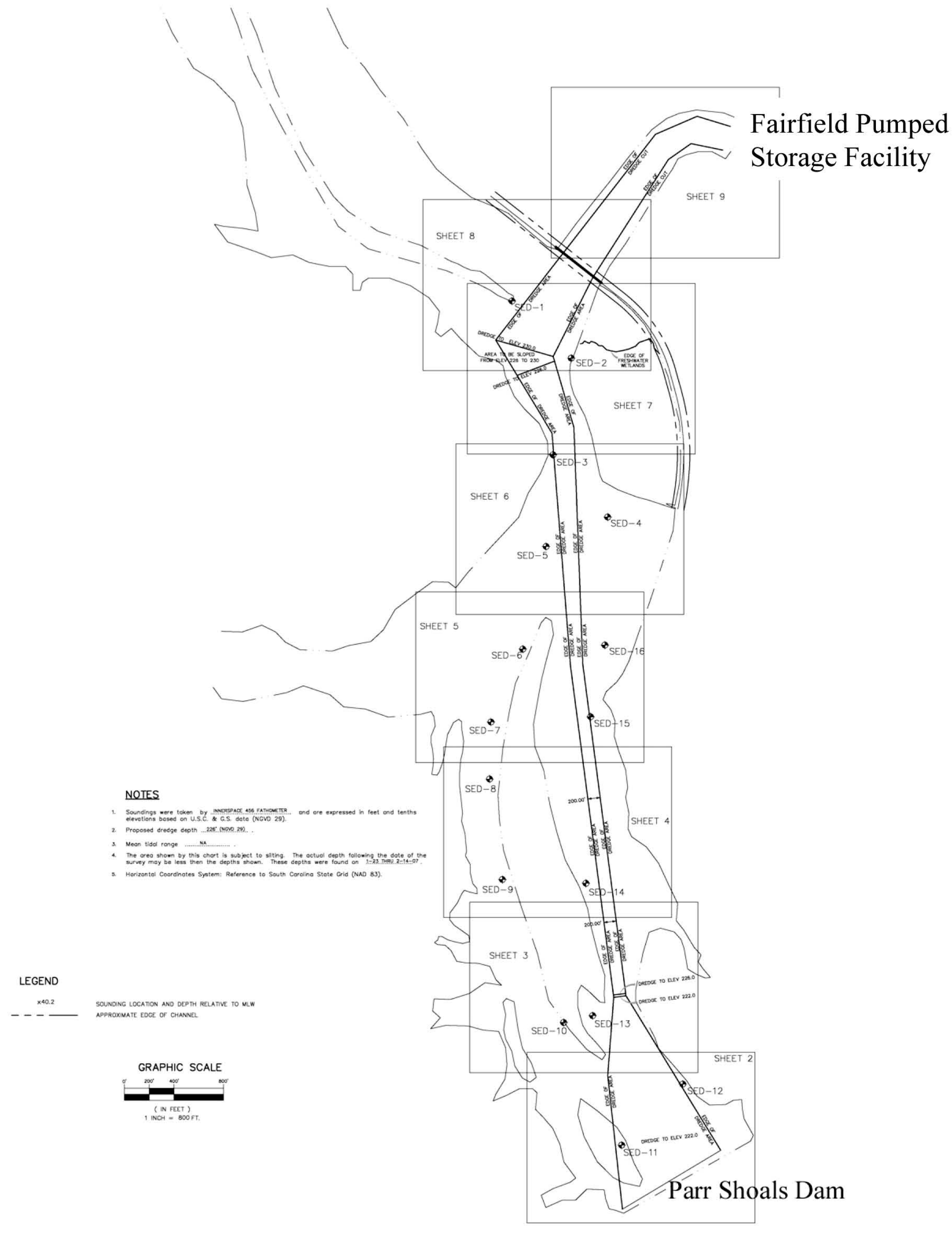
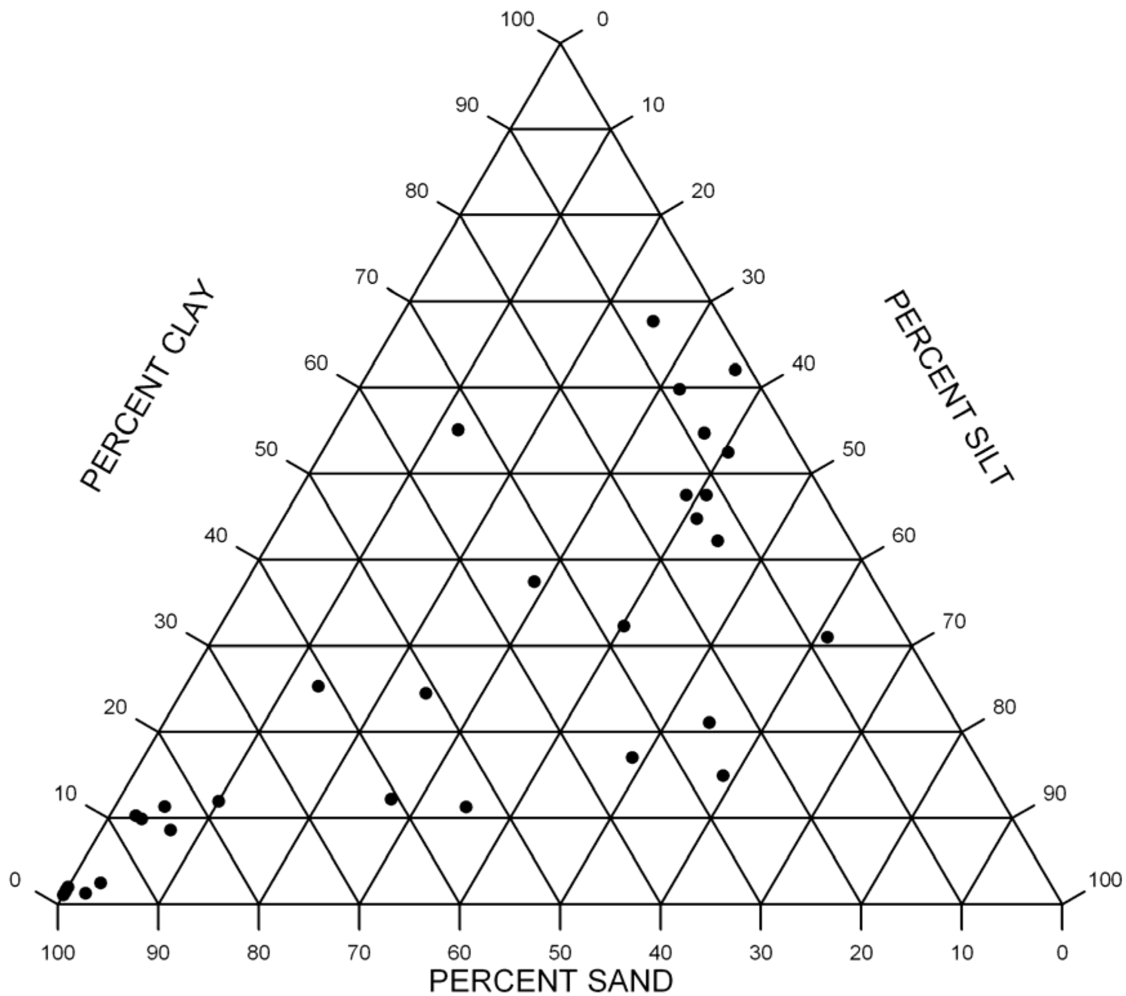


Figure 2.3-18. SCE&G Sediment Sampling Sites from January 2007



(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

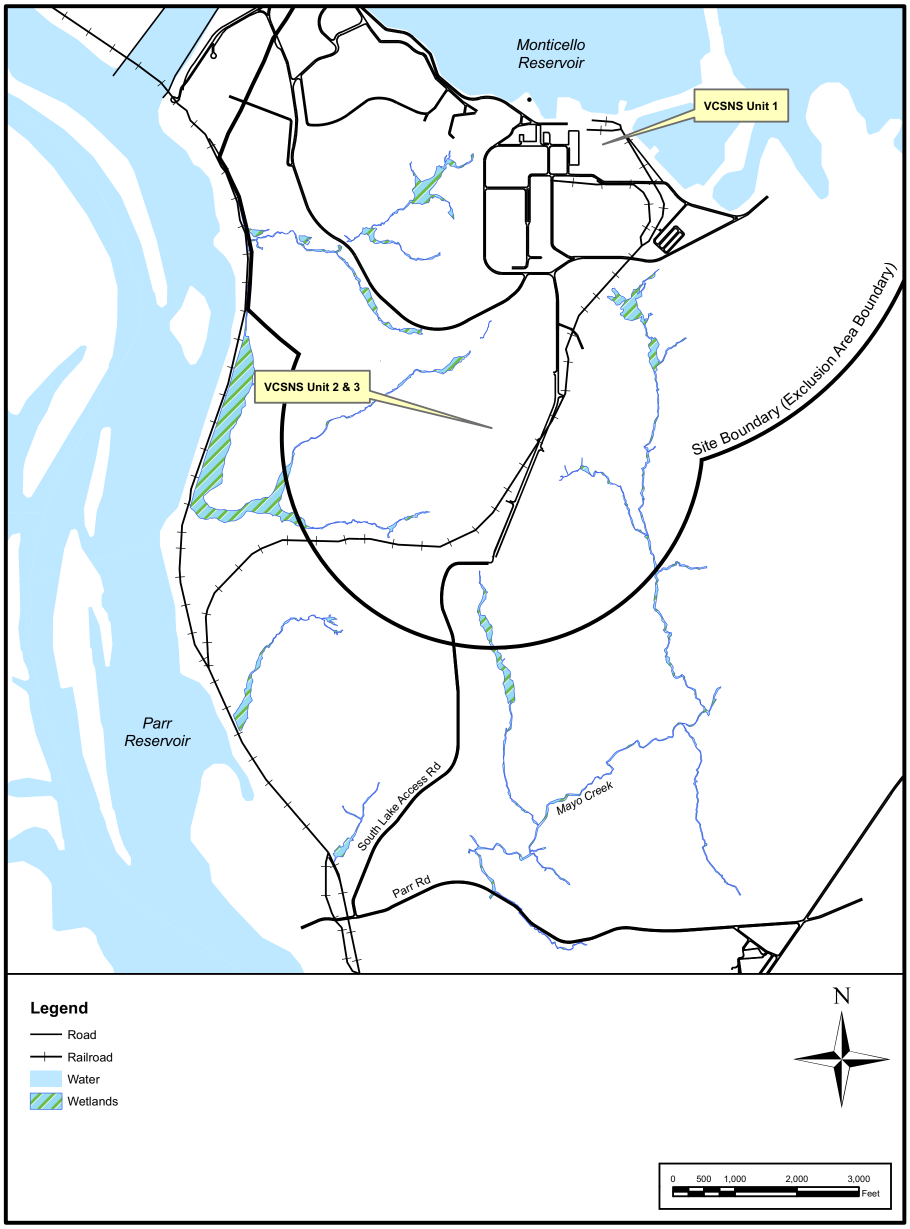


Figure 2.3-20. Mapped Wetlands

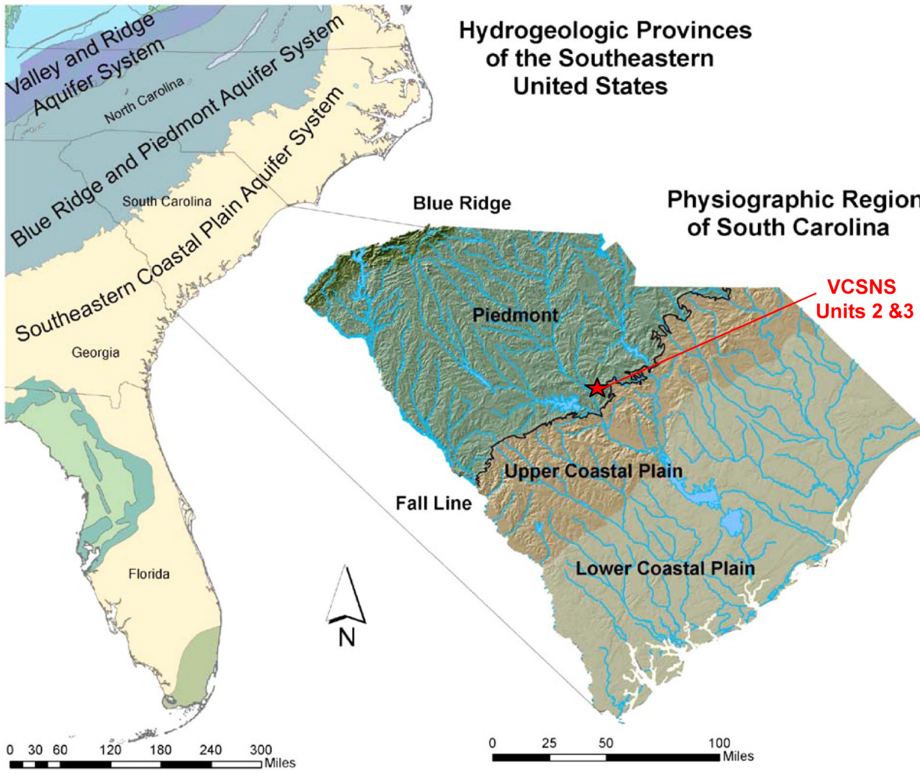


Figure 2.3-21. Hydrogeologic Provinces and Associated Physiographic Provinces in South Carolina (Childress and Butler 2006)

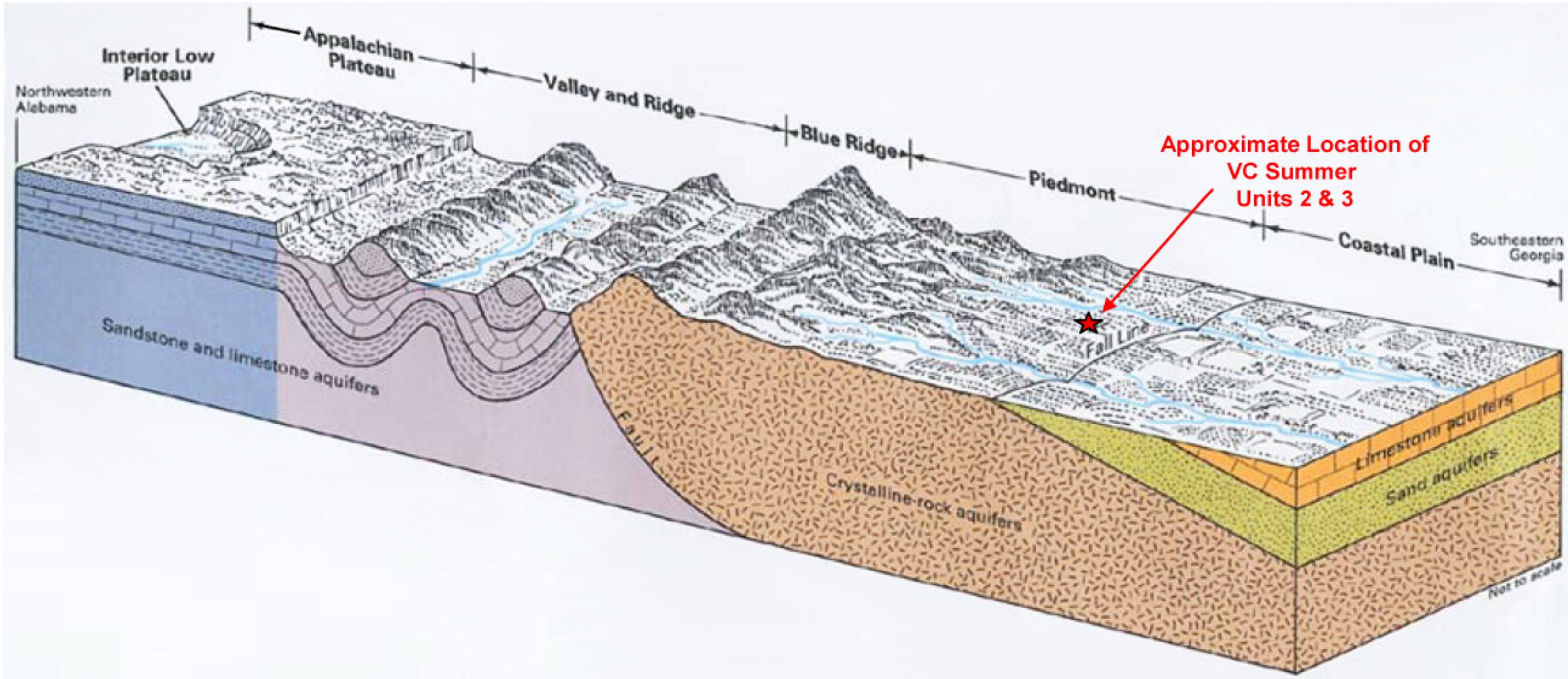


Figure 2.3-22. Geologic Cross Section of the Regional Physiographic Provinces and Associated Aquifer Systems (Miller 1990)

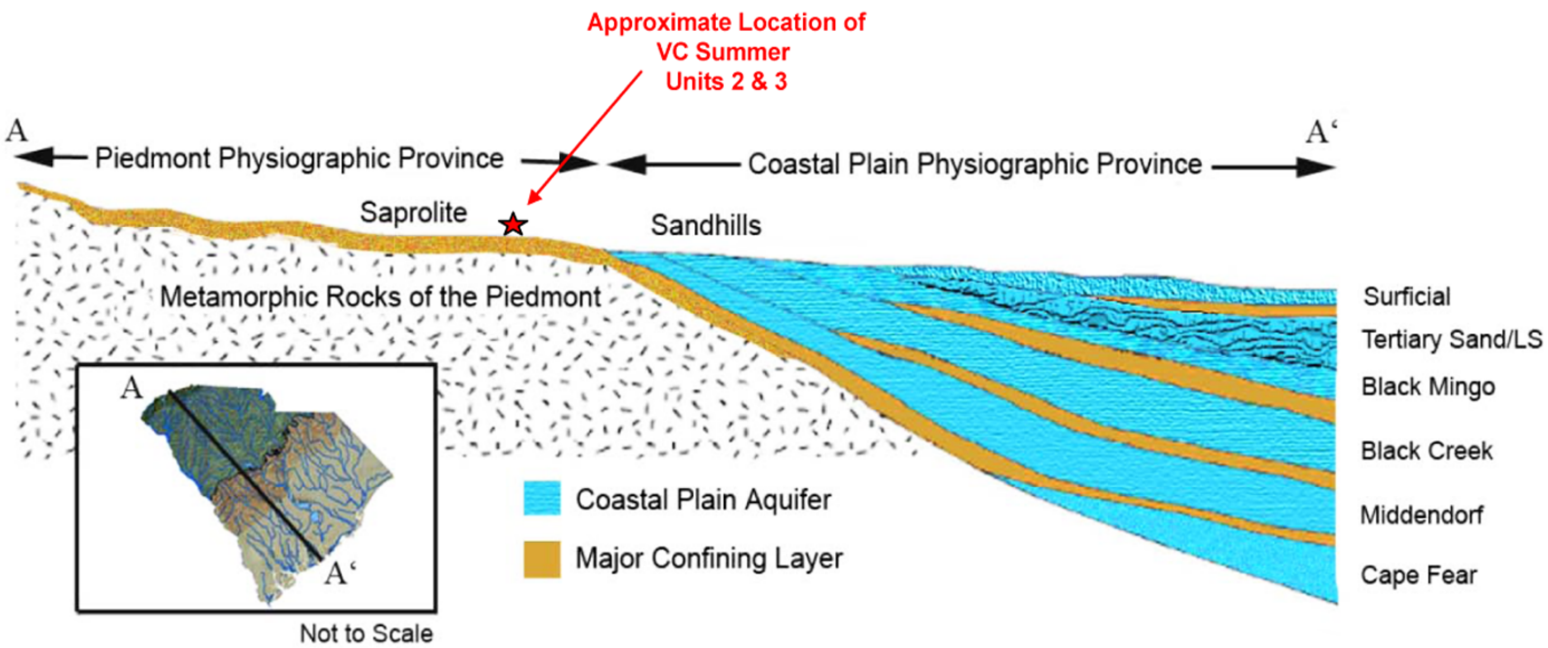


Figure 2.3-23. Hydrogeologic Cross Section of South Carolina (Childress and Butler 2006)

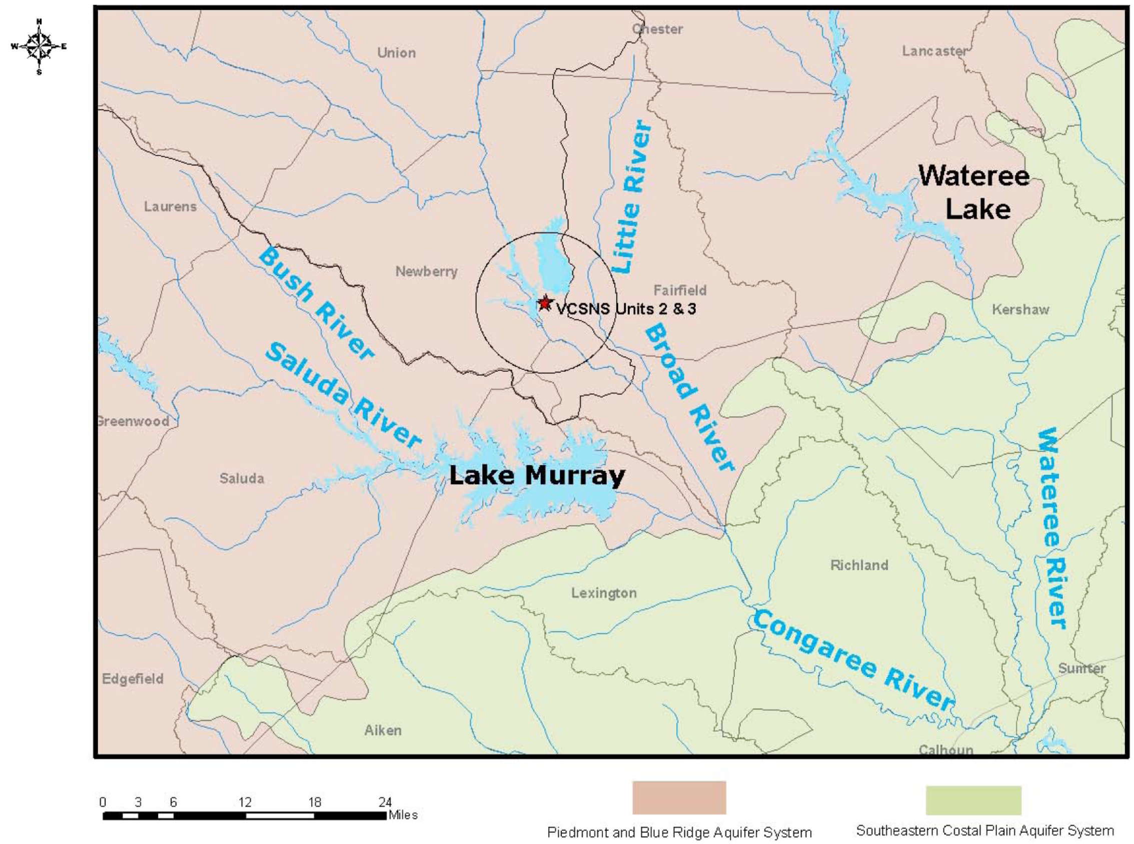


Figure 2.3-24. Regional Aquifer Systems

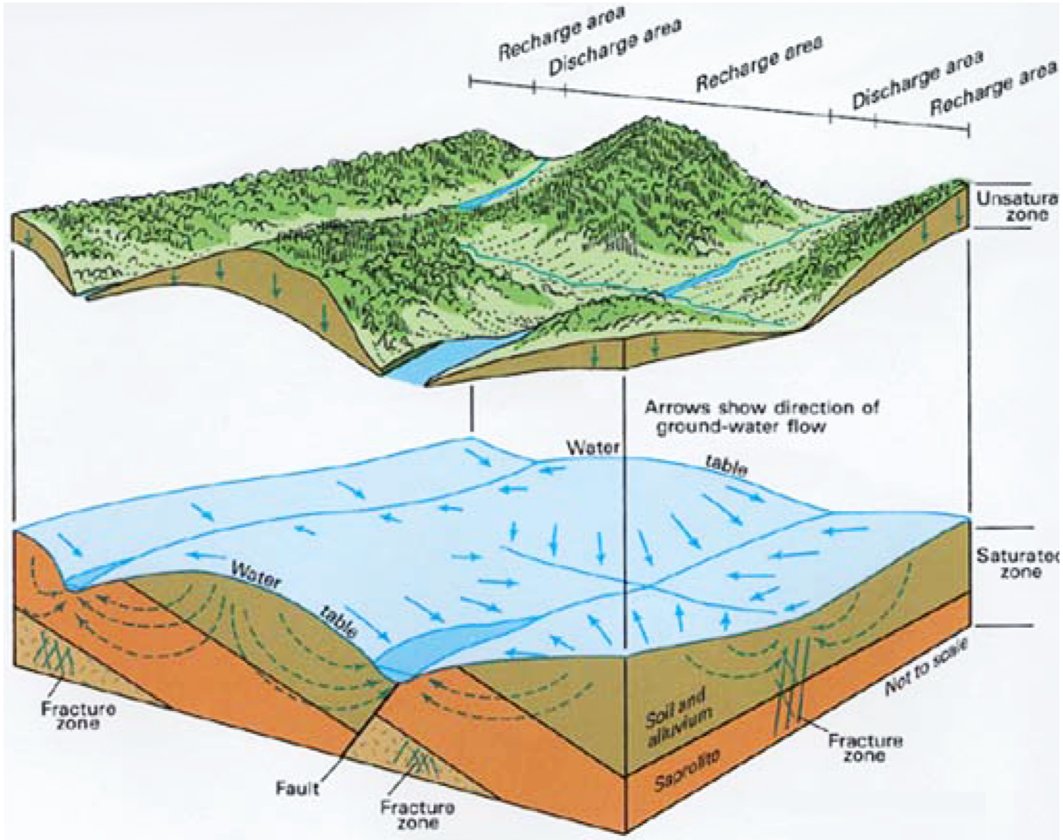


Figure 2.3-25. Groundwater Flow in the Piedmont/Blue Ridge Aquifer System (Miller 1990)

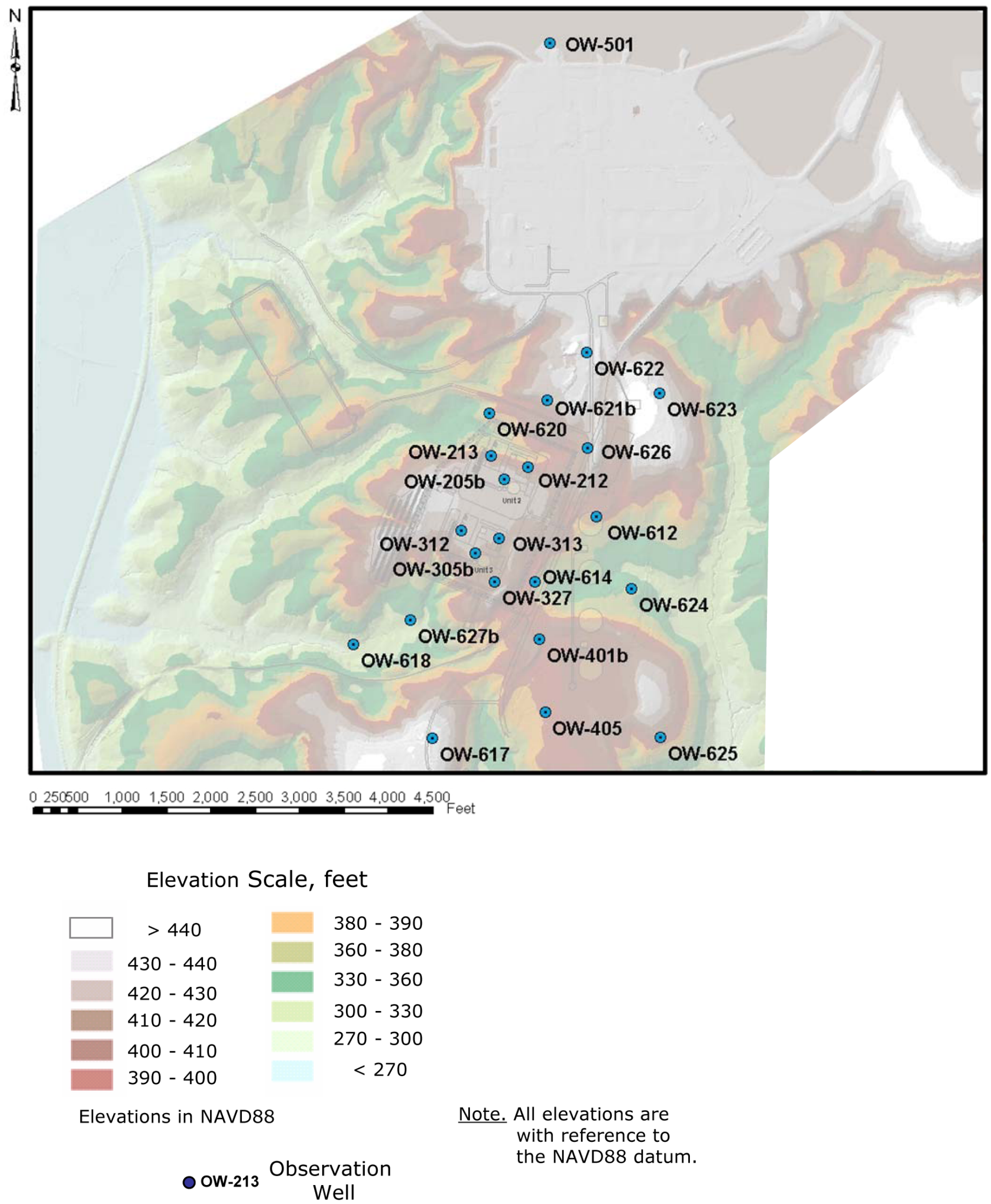


Figure 2.3-26. Observation Well Locations in the Saprolite/ Shallow Bedrock Zone

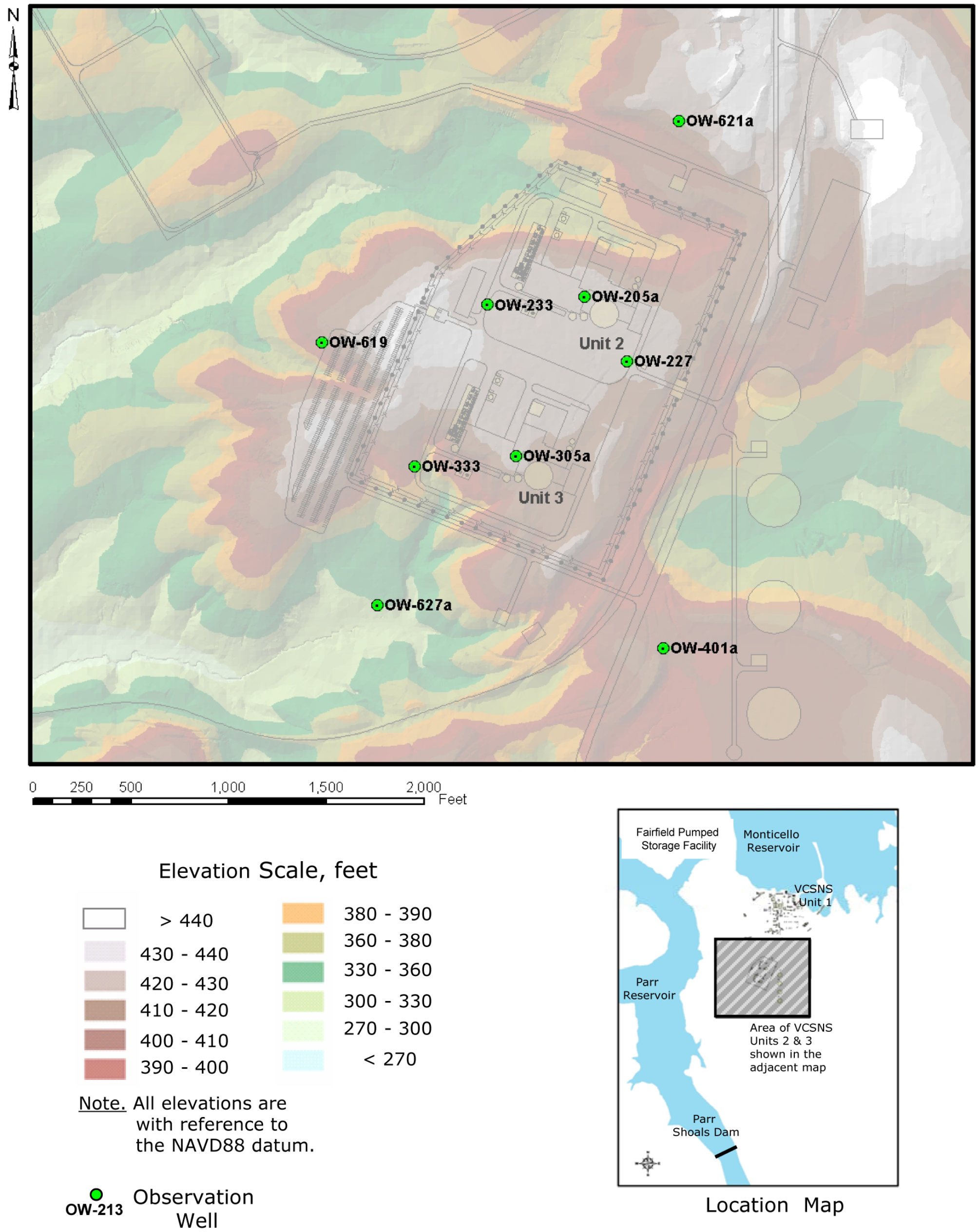


Figure 2.3-27. Deep Bedrock Zone Observation Well Locations

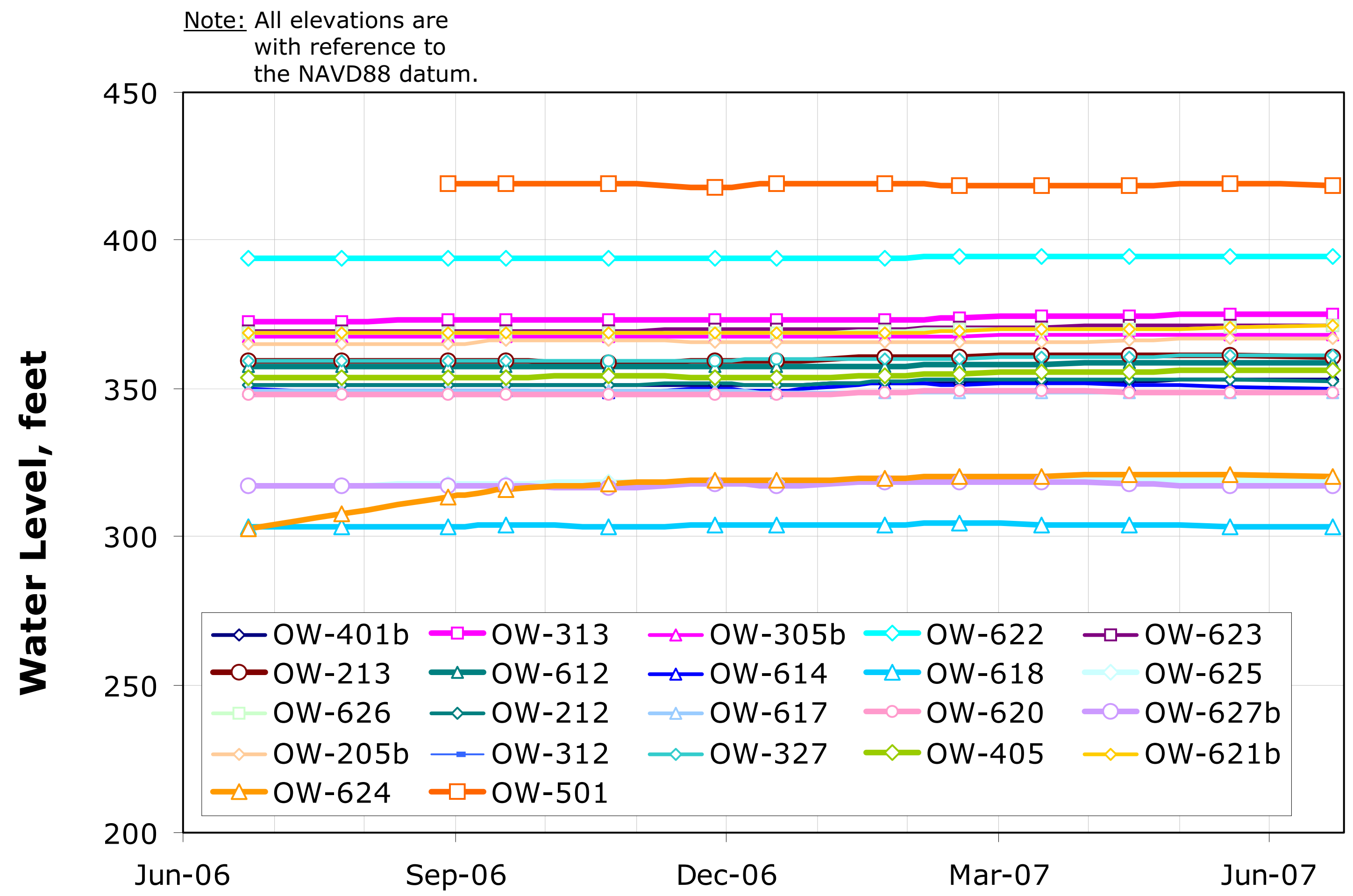


Figure 2.3-28. Hydrographs for Saprolite/Shallow Bedrock Hydrostratigraphic Zone VCSNS Observation Wells, June 2006–June 2007

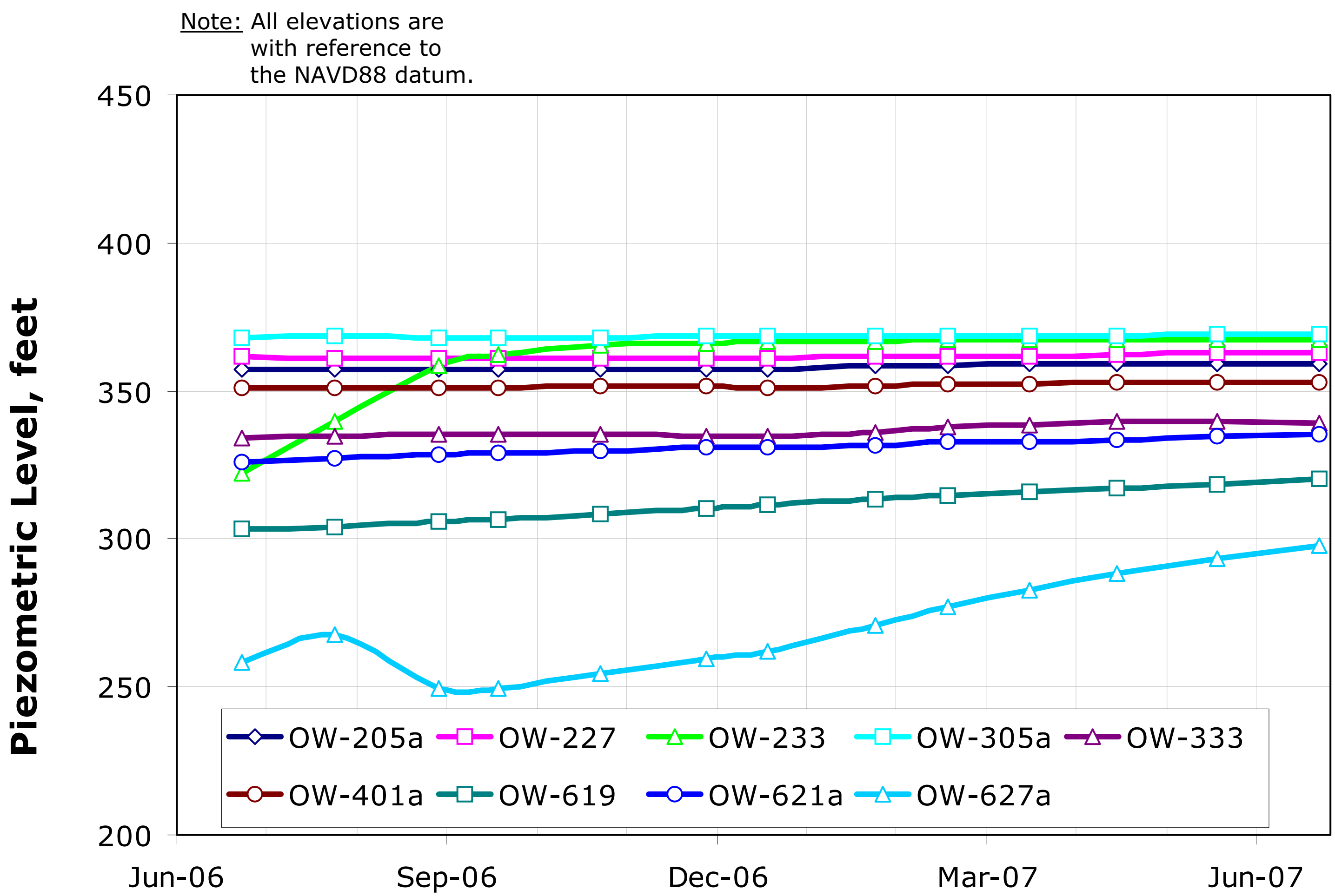


Figure 2.3-29. Hydrographs for Deep Bedrock Hydrostratigraphic Zone VCSNS Observation Wells, June 2006–June 2007

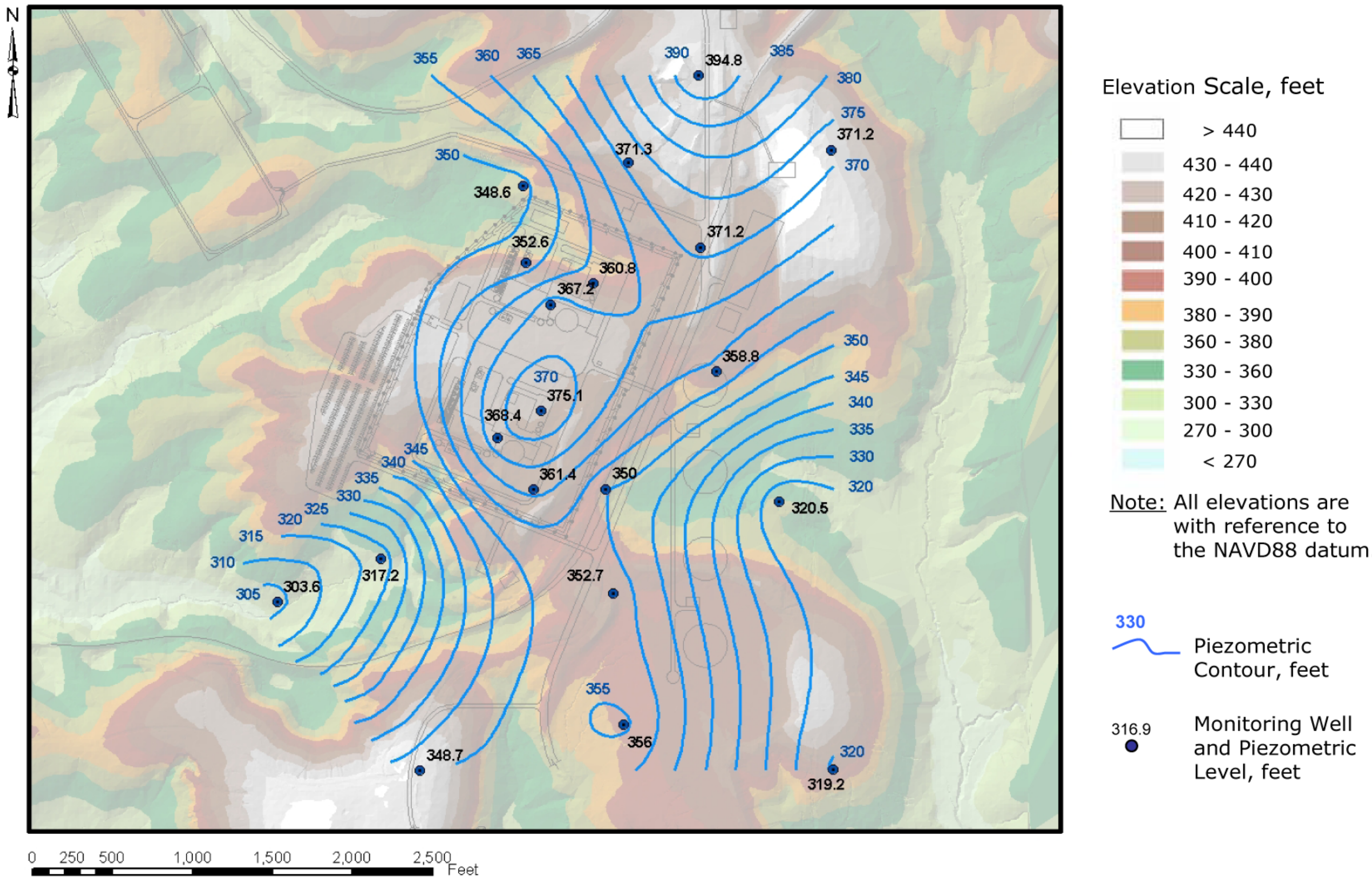


Figure 2.3-30. Piezometric Contour Map in the Saprolite/Shallow Bedrock Zone, June 2007

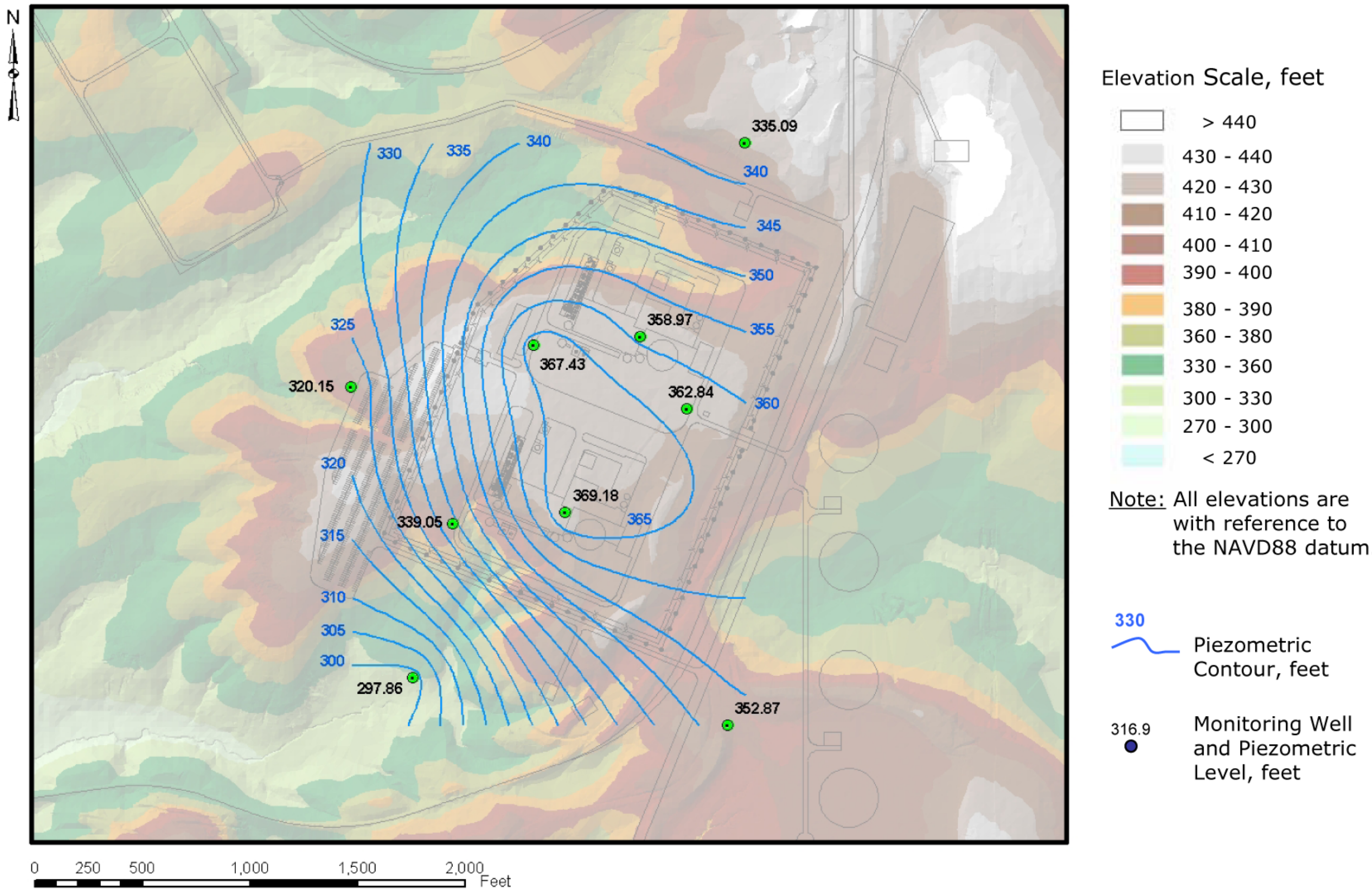


Figure 2.3-31. Piezometric Contour Map in the Deep Bedrock Zone, June 2007

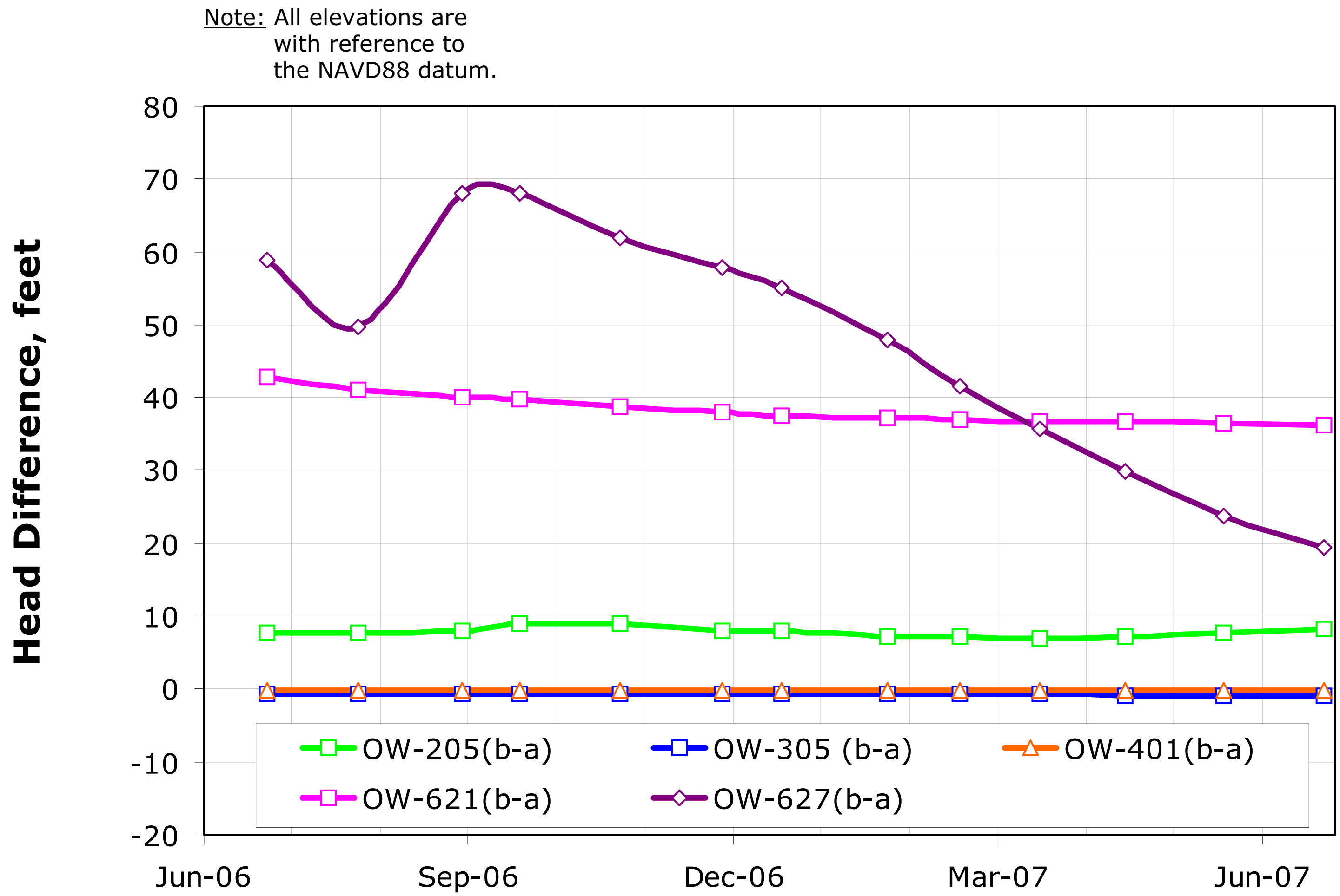


Figure 2.3-32. Head Differential between the Saprolite/Shallow Bedrock Hydrostratigraphic Zone and the Deep Bedrock Hydrostratigraphic Zone based on Well Pairs

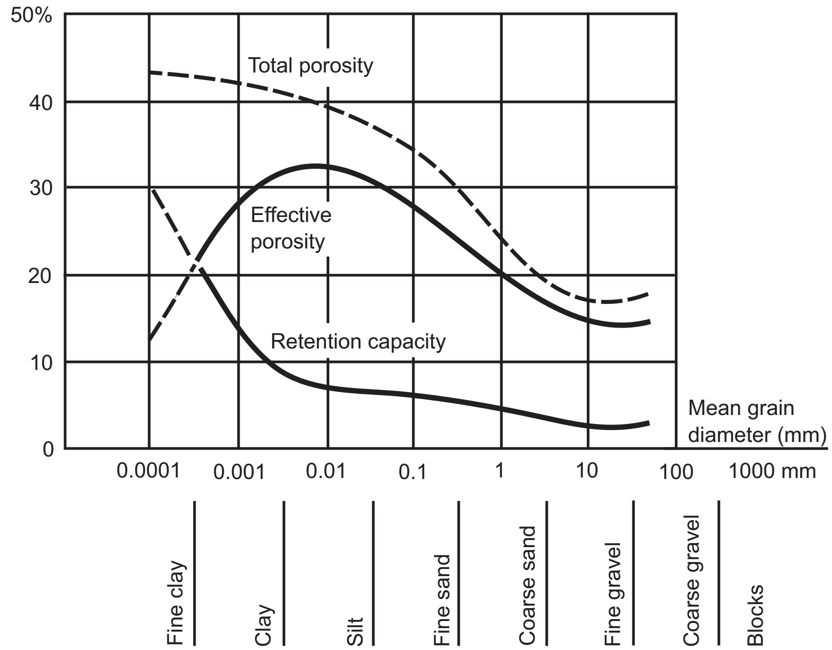


Figure 2.3-33. Porosity components as a Function of Grain Size (de Marsily, 1986)

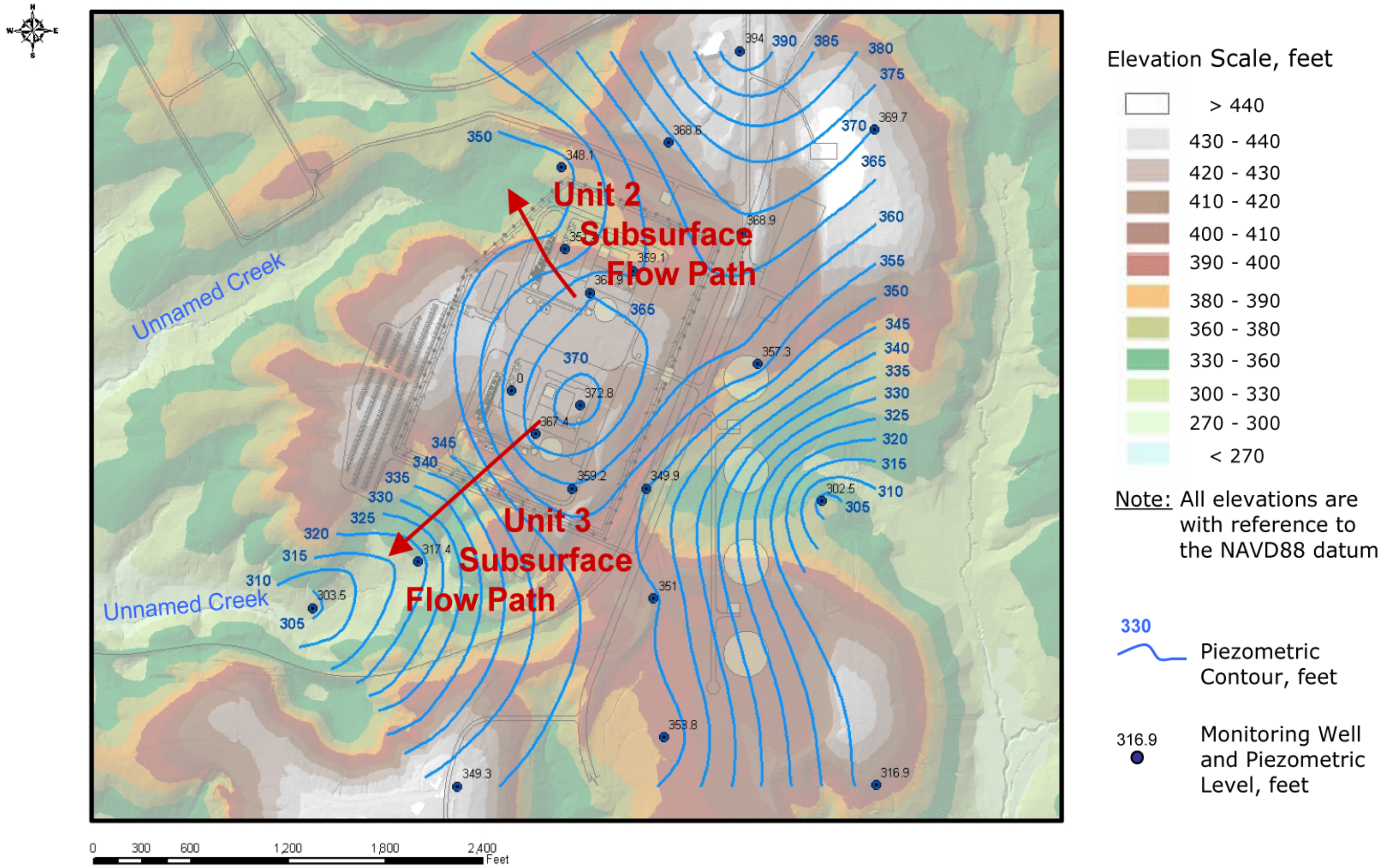


Figure 2.3-34. Plan View of Subsurface Contaminant Pathways for Units 2 and 3 (All elevations are with reference to the NAVD88 datum)

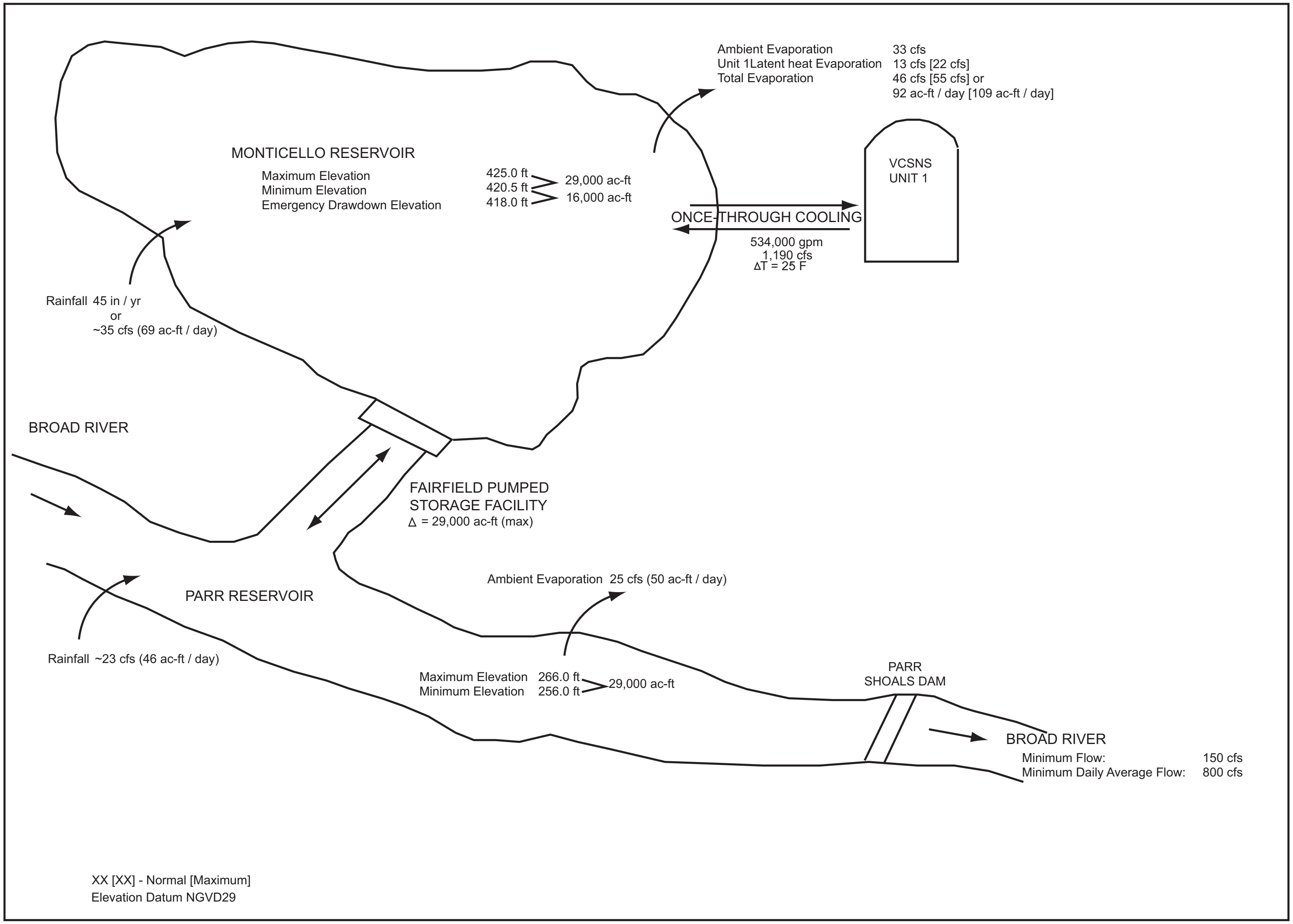


Figure 2.3-35. Diagram of Broad River, Parr Reservoir, and Monticello Reservoir System

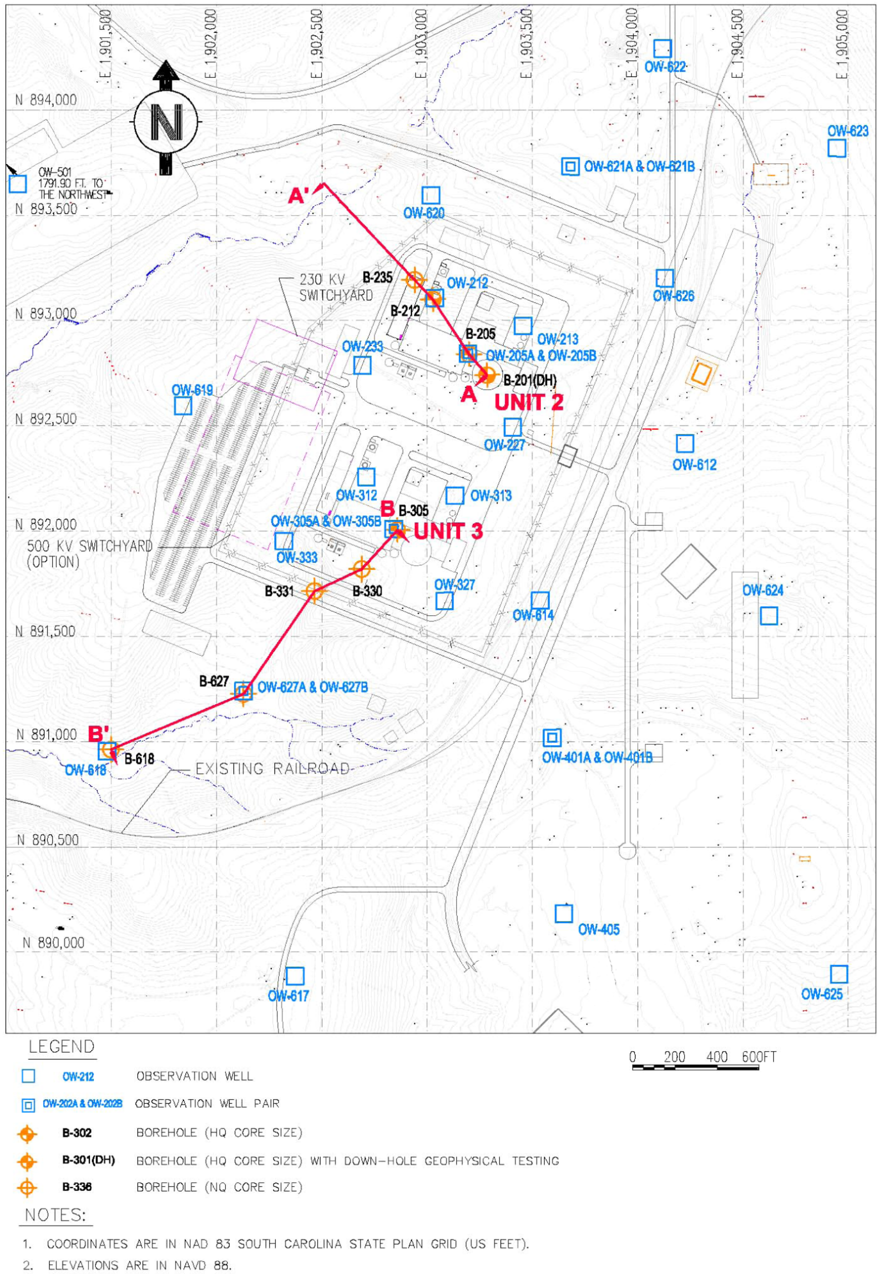
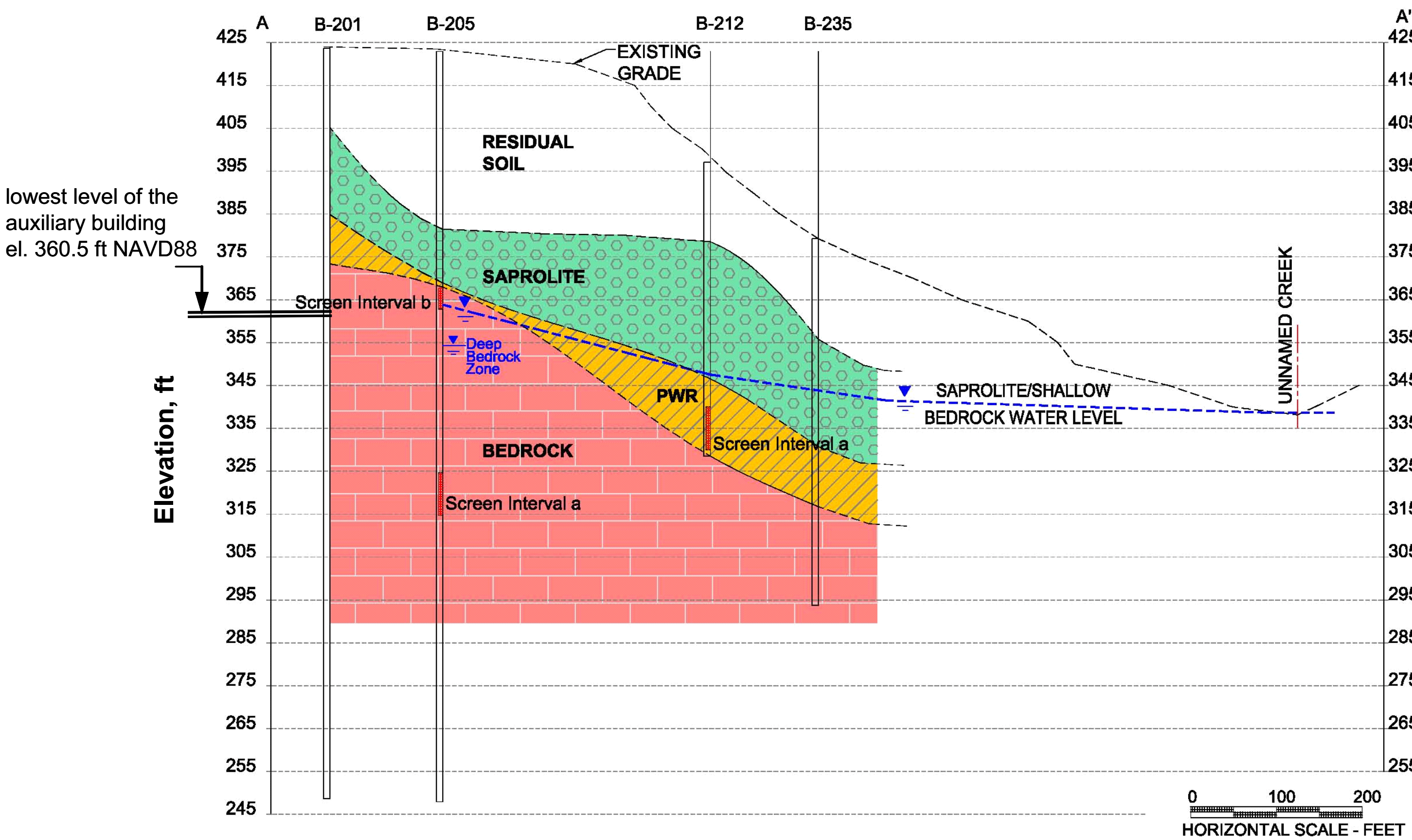
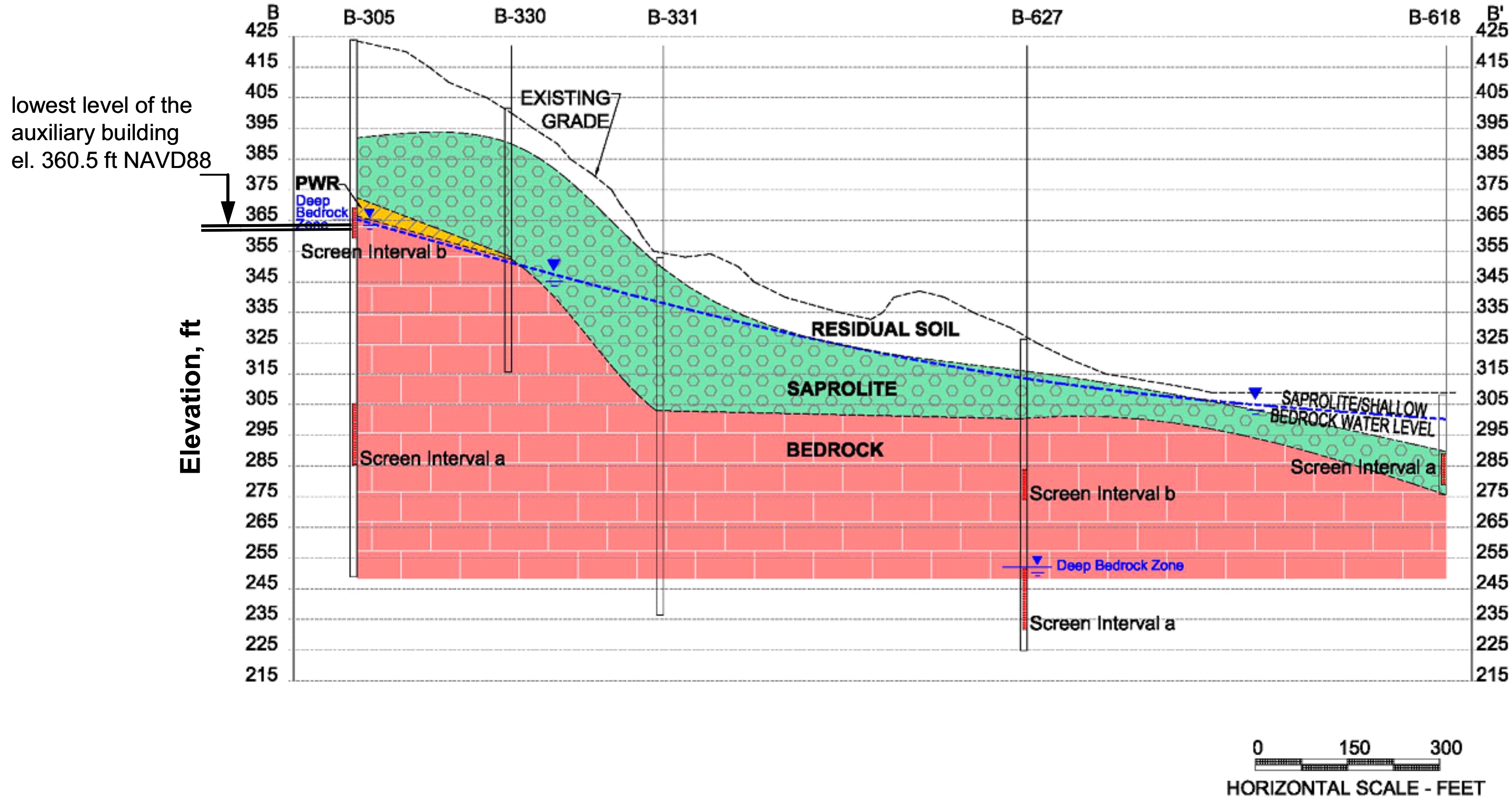


Figure 2.3-36. Plan View Showing Locations of Cross Sections for Unit 2 and Unit 3 Pathways



Note: PWR — Partially Weathered Rock

Figure 2.3-37. Cross Section Along the Subsurface Contaminant Pathway for Unit 2



Note: PWR — Partially Weathered Rock

Figure 2.3-38. Cross Section Along the Subsurface Contaminant Pathway for Unit 3