SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC PROJECT NO. 516

ENVIRONMENTAL REPORT

EXHIBIT E

AUGUST 2008

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

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VOLUME I

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GLOSSARY

acre-foot (feet)	The amount of water it takes to cover one acre to a depth of one foot, 43,560 cubic feet or 1,233.5 cubic meters
active storage	The volume of water in a reservoir between its minimum operating elevation and its maximum normal operating elevation.
anadromous fish	Fish that live in saltwater habitats most of their lives, but periodically migrate into freshwater to spawn and develop to the juvenile stage (e.g., alewife).
anticline	A fold with strata sloping downward on either side.
aquatic life	Any plants or animals which live at least part of their life cycle in water.
argillic horizon	The horizon of clay accumulation shows evidence of clay illuvation.
baseline	A set of existing environmental conditions upon which comparisons are made during the NEPA process.
benthic	Associated with lake or river bottom or substrate.
benthic macroinvertebrates	Animals without backbones, which are visible to the eye and which live on, under, and around rocks and sediment on the bottoms of lakes, rivers, and streams.
bypass reach	The original water channel of the river that is directly affected by the diversion of water though the penstocks to the generating facilities. This portion of the river, the "bypassed reach" may remain watered or become dewatered.
capacity	The load for which an electric generating unit, other electrical equipment or power line is rated.
Clean Water Act (CWA)	The Federal Water Pollution Control Act of 1972 and subsequent amendments in 1977, 1981, and 1987 (commonly referred to as the Clean Water Act). The Act established a regulatory system for navigable waters in the United States, whether on public or private land. The Act set national policy to eliminate discharge of water pollutants into navigable waters, to regulate discharge of toxic pollutants, and to prohibit discharge of pollutants from point source without permits. Most importantly, it authorized EPA to set water quality criteria for states to use to establish water quality standards.

creel census	Counting and interviewing anglers to determine fishing effort and catch. Usually conducted by a census clerk on systematic regularly scheduled visits to significant fishing areas.
cubic feet per second (cfs)	A measurement of water flow representing one cubic foot of water moving past a given point in one second. One cfs is equal to 0.0283 cubic meters per second and 0.646 mgd.
cultural resources	Includes items, structures, etc. of historical, archaeological, or architectural significance.
dam	A structure constructed across a water body typically used to increase the hydraulic head at hydroelectric generating units. A dam typically reduces the velocity of water in a particular river segment and increases the depth of water by forming an impoundment behind the dam. It also generally serves as a water control structure.
demand	The rate at which electric energy is delivered to or by a system at a given instant or averaged over a designated period, usually expressed in kilowatts or megawatts.
diabase	Dark, fine-textured, igneous rock.
dike	A raised bank, typically earthen, constructed along a waterway to impound the water and to prevent flooding.
dike (geologic term)	A mass of igneous rock that protrudes across the formation of adjacent rock structures.
dissolved oxygen (DO)	Perhaps the most commonly employed measure of water quality. Low DO levels adversely affect fish and other aquatic life. The total absence of DO leads to the development of an anaerobic condition with the eventual development of odor and aesthetic problems.
distribution lines	Power lines, like those in neighborhoods, used to carry moderate voltage electricity which is "stepped down" to household levels by transformers on power poles.
drawdown	The distance the water surface of a reservoir is lowered from a given elevation as the result of releasing water.
energy	Average power production over a stated interval of time, expressed in kilowatt-hours, megawatt-hours, average kilowatts and average megawatts.
EPT Taxa Richness	Taxa richness of a stream or river determined by the number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichopera (caddisfly) taxa in a study sample. Generally, EPT taxa richness is an indicator of watershed disturbance.

eutrophic/eutrophication	Waters with a high concentration of nutrients and a high level of primary production.
exotic species	Those species which are not native to a particular area.
fault	A crack or fracture in the earth's surface.
Federal Energy Regulatory Commission (FERC)	The governing federal agency responsible for overseeing the licensing/relicensing and operation of hydroelectric projects in the United States.
Federal Power Commission (FPC)	Predecessor to FERC.
flow	The volume of water passing a given point per unit of time.
flow duration curve	A graphical representation of the percentage of time in the historical record that a flow of any given magnitude has been equaled or exceeded.
forebay	That portion of a hydroelectric project impoundment immediately upstream of the intake to the turbines (see also headwaters).
generation	The process of producing electricity from other forms of energy, such as steam, heat, solar, wind or water. Refers to the amount of electric energy produced, expressed in kilowatt hours.
gross storage	The sum of the dead storage and the live storage volumes of a reservoir, the total amount of water contained in a reservoir at its maximum normal operating elevation.
habitat	The locality or external environment in which a plant or animal normally lives and grows.
head	The distance that water falls in passing through a hydraulic structure or device such as a hydroelectric plant. Gross head is the difference between the headwater and tailwater levels; net head is the gross head minus hydraulic losses such as friction incurred as water passes through the structure; and rated head is the head at which the full-gate discharge of a turbine will produce the rated capacity of the connected generator.
headwater	The waters immediately upstream of a dam. For power dams, also referred to as the water in the impoundment which supplies the turbines (see also forebay).
hydraulic	Relating to water in motion.

hydroelectric plant	A facility at which the turbine generators are driven by falling water.
hydroelectric power	Capturing flowing water to produce electrical energy.
hydroelectric project	The complete development of a hydroelectric power site, including dams, reservoirs, transmission lines, and accessories needed for the maintenance and operation of the powerhouse and any other hydroelectric plant support facilities.
hypolimnetic	The deeper cooler portions of a reservoir or lake that result from stratification.
igneous rock	Rock formed from the cooling and solidification of molten mineral matter.
impoundment	The body of water created by a dam.
Initial Consultation Document (ICD)	A document containing detailed information on a hydroelectric project; the document is used to describe the project and its resources and to start the applicant's consultation process with resource agencies and the public.
kilowatt (kW)	A unit of electrical power equal to 1,000 watts.
lacustrine	Related to standing water, (e.g., a lake).
lapilli	Small, round to angular rock fragments which may have been volcanically ejected in a solid or molten state.
license	FERC authorization to construct a new project or continue operating an existing project. The license contains the operating conditions for a term of 30 to 50 years.
littoral	Associated with shallow (shoreline area) water (e.g., the littoral zone of an impoundment).
load	The total customer demand for electric service at any given time.
lotic	Flowing or actively moving water including rivers and streams.
megawatt (MW)	A unit of electrical power equal to one million watts or 1,000 kW.
metamorphic rock	Rock formed by alterations of igneous and sedimentary rocks under intense heat and pressure.
normal operating conditions	The reservoir elevation approximating an average surface elevation at which a reservoir is kept.

nutrification	The process by which nutrients are added to water or soil that thus results in a reduction in oxygen.
outage	The period during which a generating unit, transmission line, or other facility is out of service.
palustrine forested wetland	Dominated by woody vegetation less than 20 ft tall (i.e., willows, dogwood).
palustrine scrub/shrub wetlands	Comprised of woody vegetation that is 20 ft tall or greater (i.e., American elm, swamp white oak).
peaking operations	A power plant that is scheduled to operate during peak energy demand.
pegmatite	Coarse-grained granite.
penstock	The tube or conduit by which water flows to the turbine.
phytoplankton	Algae floating in the water column. These are mostly microscopic single-celled and colonial forms.
piezometer	A device that measures water pressure.
plutonic structures	Large igneous intrusions that are formed deep within the earth's crust.
pool	Refers to the reservoir (impounded body of water).
powerhouse	The building that typically houses electric generating equipment.
probable maximum flood (PMF)	A statistical formula used to calculate a hypothetical flood event that could occur on a particular river basin over a particular duration. This is derived from the probable maximum precipitation over time.
project	One or more hydroelectric plants collectively included in a single Federal Energy Regulatory Commission license. Projects typically consist of a dam, reservoir, powerhouse and appurtenant facilities.
project area	Lands and waters within the project boundary.
project boundary	A line established by the FERC to enclose the lands, waters and structures needed to operate a licensed hydroelectric project.
project vicinity	Lands and waters within which studies were conducted for baseline environmental data. These lands and waters include the project area.

recreation area	An area which people use for leisure activities, designated formally or informally.
relicensing	The administrative proceeding in which FERC, in consultation with other federal and state agencies, decide whether and on what terms to issue a new license for an existing hydroelectric project at the expiration of the original license.
reserve capacity	"Electric power generating capacity in excess of the system load projected for a given time period. It consists of two sources: spinning reserve and supplemental reserve. **Spinning Reserve**—Ancillary service that provides additional capacity from electricity generators that are on line, loaded to less than their maximum output, and available to serve customer demand immediately should a contingency occur. **Supplemental Reserve**—Ancillary service that provides additional capacity from electricity generators that can be used to respond to a contingency within a short period, usually 10 minutes." As quoted from the National Transmission Grid Study published in 2002 by the Department of Energy.
reservoir	An artificial lake into which water flows and is stored for future use.
resident fishery	Fish that spend their entire life cycle in freshwater, such as trout and bass.
resource agency	Federal, state, or interstate agency with responsibilities in the areas of flood control, navigation, irrigation, recreation, fish or wildlife, water resource management, or cultural or other relevant resources of the state in which a project is or will be located.
riparian area	A specialized form of wetland with characteristic vegetation restricted to areas along, adjacent to or contiguous with rivers and streams. Also, periodically flooded lake and reservoir shore areas, as well as lakes with stable water.
sediment oxygen demand (SOD)	The demand for dissolved oxygen from the surrounding water column by sources such as anaerobic compounds in the riverbed sediments as well as the decomposition of organic matter that settle out of the water column.
seepage	The amount of water that leaks through a structure, such as a dam.
spawn	The act of fish releasing and fertilizing eggs.
spillway	The section of a dam that is designed to pass water over or through it.

stakeholder	Any individual or organization (government or non-governmental) with an interest in a hydroelectric project.
state 303(d)	Waters listed by the State of South Carolina as being impaired for their designated uses under the Clean Water Act (CWA)
stock	The existing density of a particular species of fish in an aquatic system.
stratification	A physical and chemical process that results in the formation of distinct layers of water within a lake or reservoir (i.e., epilimnion, metalimnion, and hypolimnion).
streamflow	The rate at which water passes a given point in a stream, usually expressed in cubic feet per second (cfs).
submerged aquatic vegetation	Plants with rigid stems and/or leaves rooted in substrate and generally covered by deep water (greater than 6.6 ft depth), with all of the plant parts covered by water.
synclinal fold axis	A fold in rocks layers, where rock from both sides dips inward towards a center axis
tailrace	The channel located between a hydroelectric powerhouse and the river into which the water is discharged after passing through the turbines.
tailwater	The waters immediately downstream of a dam. For power dams, also referred to as the water discharged from the draft tubes.
tainter gate	A gate with a curved skin or face plate connected with steel arms to an axle. It is usually lifted or lowered by a cable connected to a hook at the top of the gate rotating on the axle as it is moved.
total maximum daily load (TMDL)	The total maximum daily load is definined by the EPA as a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources
transformer	Equipment vital to the transmission and distribution of electricity designed to increase or decrease voltage.
transmission	The act or process of transporting electric energy in bulk from one point to another in the power system, rather than to individual customers.

transmission lines	Power lines normally used to carry high voltage electricity to substations which then is "stepped down" for distribution to individual customers.
tuff	Rock formed of pyroclastic material.
turbidity	A measure of the extent to which light passing through water is reduced due to suspended materials.
turbine	A machine for generating rotary mechanical power from the energy in a stream of fluid (such as water, steam, or hot gas). Turbines covert the energy of fluids to mechanical energy through the principles of impulse and reaction, or a mixture of the two.
volt	The unit of electromotive force or electric pressure, akin to water pressure in pounds per square inch.
warmwater fish	Species tolerant of warm water (e.g., bass, perch, pickerel, sucker).
watershed	An entire drainage basin including all living and nonliving components of the system.
wetlands	Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; 3) the substrate is on soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

ACRONYMS

ACOE	US Army Corps of Engineers
ADA	Americans With Disabilities Act
APE	Area of Potential Effect
AR	American Rivers
AVM	Avian Vacuolar Myelinopathy
AW	American Whitewater
CCL	South Carolina Coastal Conservation League
CNP	Congaree National Park
CWA	Clean Water Act
DLA	Draft License Application
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
EPT	Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichopera (caddisfly)
ESA	Environmentally Sensitive Area
ESWM	Ecologically Sustainable Water Management
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
FPA	Federal Power Act
HIP	High Inflow Protocol
HPMP	Historic Properties Management Plan
HSI	Habitat Suitability Index
ICD	Initial Consultation Document
ICRC	Irmo Chapin Recreation Commission
IFIM	Instream Flow Incremental Methodology
LIP	Low Inflow Protocol
LMA	Lake Murray Association
LMHC	Lake Murray Homeowners Coalition
LSR	Lower Saluda River
LSSRAC	Lower Saluda Scenic River Advisory Council
LW	Lake Murray Watch
L2UB	Lacustrine Littoral Wetlands with Mostly Unconsolidated Bottoms
MOU	Memorandum of Understanding

Acronyms (Cont'd)

NAVD	North American Vertical Datum
NGO	Non-Governmental Organization
NIP	Non-Internet Public
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NWI	National Wetlands Inventory
PA	Programmatic Agreement
PD	Plant Datum
PEM	Palustrine Emergent Wetland
PFO(1)	Palustrine Forested Wetland
PSS	Palustrine Scrub-shrub Wetland
RCG	Resource Conservation Group
REA	Ready for Environmental Assessment
SCDHEC	South Carolina Department of Health and Environmental Control
RD	Ranger District
RT&E	Rare, Threatened, and Endangered
RSSL	Rocky Shoals Spider Lily
SCDNR or DNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCPRT	South Carolina Department of Parks, Recreation and Tourism
SCWF	South Carolina Wildlife Federation
SHPO	South Carolina State Historic Preservation Office
SMP	Shoreline Management Plan
THPO	Tribal Historic Preservation Officer
TPGT	Trout Put, Grow and Take Waters
TMDL	Total Maximum Daily Load
TU	Trout Unlimited
TWC	Technical Working Committee
USC	University of South Carolina
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

Acronyms (Cont'd)

USGS	United States Geological Survey
WUA	Weighted Usable Area
YOY	Young of the Year

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

ENVIRONMENTAL REPORT

EXHIBIT E

1.0 INTRODUCTION

The Saluda Hydroelectric Project (Saluda Hydro or Project) (FERC Project No. 516) is an existing licensed hydroelectric project, owned and operated by South Carolina Electric & Gas Company (SCE&G). The Project is located on the Saluda River, in the counties of Lexington, Richland, Newberry and Saluda, South Carolina. The Project consists of an earth fill embankment Dam (Saluda Dam) impounding a 48,000 acre reservoir (at elevation 356.5'[1]), a gated emergency spillway, a back-up Dam, a powerhouse, five concrete intake towers and associated penstocks. Construction of the Project was completed in 1930, and construction of the back-up dam was completed in 2005. A description of Project features is described in detail in Exhibit A.

The original project license was issued by the Federal Power Commission in 1927. The currently effective license was issued by the Federal Energy Regulatory Commission ("FERC" or "Commission") on June 1, 1984 retroactive to 1977, and was due to expire on August 31, 2007. SCE&G requested an extension of the term of the license by letter dated October 3, 2002 and the Commission issued an Order on November 18, 2003 extending the term of the license until August 31, 2010.

Although SCE&G initiated robust pre-licensing public outreach, educational, and informal scoping efforts in 2004, SCE&G began the official, formal relicensing process on April 29, 2005 by the timely filing for the Notice of Intent to the Commission and with the transmittal of its Initial Consultation Document (ICD) to resource agencies and other interested stakeholders for review and comment. Since that date, SCE&G has worked cooperatively with agencies and

[1] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

stakeholders through numerous resource group meetings to do the following: scope studies needed to address issues raised at the Project and develop study reports, conduct agreed upon studies, provide draft copies of study reports to agencies and stakeholders for review and comment, revise study reports to reflect agency comments, and complete follow-up studies deemed necessary to accomplish study goals. Resource group meetings have also served to provide a forum for discussion of Project related concerns among stakeholders. Additional discussions among resource groups will be necessary to facilitate development of enhancement proposals and issue resolution agreements.

1.1 General Description of the Locale

1.1.1 Climate

The Project Area experiences a moderate climate year-round with long hot summers and short mild winters. July and August are typically the hottest months, with temperatures reaching above 90 degrees on an average of 40 days during those two months. Annually, temperatures may reach above 90 degrees 73 days out of the year. Temperatures may reach 100 degrees or more on about four or five days. Summer is typically the wettest season, with 1/3 of the total annual rainfall occurring during this time. This is due to the frequent occurrence of showers and thunderstorms throughout the season. Masses of warm, fairly unstable, maritime tropical air typically persist in the atmosphere during the summer. However, the daily weather during the winter, fall, and spring is greatly influenced by the west to east motion of fronts and air masses (USDA, 1976).

Fall is characteristically the driest season, with warm, comfortable weather. Typically, only 19 percent of the total annual rainfall occurs during this time. However, occasionally, tropical storms and hurricanes travel through the area during this season. The earliest killing frost may occur in late October, but occurs more frequently in early November. On about 60 percent of winter days, temperatures reach 32 degrees, and usually fall to 20 degrees or less on about 6 days out of the year (USDA, 1976). Soils occasionally freeze to a depth of 3-5" (USDA, 1962). Significant amounts of snowfall in the Project Area occur infrequently. When they do occur, the snow seldom remains longer than 1 day. Winter rainfall accounts for about 22 percent of the annual total (USDA, 1976).

Winter brings about heavy rains that gradually fade into a dry period that lasts from late April to June. Thunderstorms occur frequently during the spring, adding to a yearly average rainfall of 46 to 48". The average date of the last freezing temperature in the spring is March 22 (USDA, 1976).

1.1.2 Topography and Geology

The Project is located on the Saluda River in the Piedmont of South Carolina. Steep to moderate slopes and rolling hills with well-drained valleys are predominant features of the regional landscape.

The geologic setting in which the Project is located is described in Paul Rizzo's Foundation Design Basis and Geologic Mapping Report generated in 2005 for the safety remediation of the Saluda Dam. The following section describing geology is quoted from the above referenced report:

"Saluda Dam is located along the Eastern Piedmont Fault zone (Hatcher, 1977) in west central South Carolina. This Fault Zone extends from Western Georgia through Virginia. The foundation bedrock at Saluda Dam is composed of metamorphosed mid to upper-level amphibolite grade facies rocks. The foundation lies along the Modoc Shear Zone, a 4-5 km wide fault zone characterized by a steep metamorphic gradient, indication of intense plastic strain, and presence of lenticular granitic bodies (Snoke and Frost, 1990). The fault zone occurs between the southern flank of the Carolina Slate Belt, a zone of greenschist facies metasedimentary and metavolcanic rocks deposited during late Precambrian to Cambrian (630ma), and the northwestern flank of the Kiokee Belt, also known as the Dreher Shoals Terrane (Hibbard et al., 2002). The latter has amphibolite facies metasedimentary and metavolcanic rocks with stratiform masses of plutonic orthogneiss (Secor and Snoke, 1978). The Carolina Slate Belt borders the northeastern terminus of the Dreher Shoals/Kiokee belt outcrop to the east of Lake Murray. Major lithologies mapped in the foundation of the Saluda Dam are:

- *mylonitized quartzo-feldspathic microcline gneiss, or the Lake Murray Gneiss (MGN);*

- *mylonitized quartz biotite plagioclase schist (QMS);*
- *hornblende schist (HBS);*
- *kyanite schist (KS);*
- *leucocratic schist (LS);*
- *biotite schist (BS);*
- *garnetiferous schist (GT);*
- *quartz biotite plagioclase schist-gneissic phase (GP);*
- *alkali feldspar granite intrusive (AFG);*
- *deformed amphibolite (AMP);*
- *potassium and two-feldspar pegmatites (P);*
- *mafic (MD) and felsic dikes (FD) (previously mapped as lamprophyre or camptonite dikes by others);*
- *aplite (A); and*
- *anatectic granite/plagio-granitic sheets (GS).”*

1.1.3 Seismicity and Geologic Stability

Faults and shear zones of various sizes are found around the Project area and tend to run in a northeasterly direction. A number of shear zones have been mapped where gneiss and schist contact each other along the Saluda Dam spillway. There are several significant fault zones that occur in the Project area. These include the Brevard fault zone, and the Towaliga, Goat Rock, Gold Hill, and Jonesboro faults. Furthermore, a series of small faults have been identified along the southeastern edge of Lake Murray in an area of gneissic terrain. These small faults are thought to be a part of the Goat Rock fault system. Most seismic activity takes place along an extension of the Towaliga and Goat rock fault systems; however, there is no remarkable sediment or inclusion displacement (Stone and Webster Engineering Corporation, 1995).

Pertinent seismotectonic regions in the Eastern United States can be broken up into three sectors: the New Madrid faulted zone, the Piedmont and Upper Coastal Plain, and the Charleston Epicentral area. All of these sectors have experienced significant historic earthquakes that have affected the area near the site. The largest earthquake to historically hit the southeastern region was near

Charleston, South Carolina on August 31, 1886. This earthquake had an epicenter located approximately 110 miles southeast of the Saluda Dam and a recorded epicentral intensity of X MM and a magnitude of 7.3 on the Richter Scale. Typically, earthquakes that have occurred in the Piedmont have occurred in clusters; however, none of these have been centered near the Project (Stone and Webster Engineering Corporation, 1995).

There is considerable evidence for the presence of ancient faults in the site area. These faults have been dated at about 300 million years old due to the presence of inclusions that cross the faults and Cretaceous sediments that show no marked offset over time (Stone and Webster Engineering Corporation, 1995).

Sinkhole activity in the state of South Carolina is localized due to the geologic composition of the state. The sedimentary limestone that typically causes sinkholes is absent from the Piedmont of South Carolina altogether (SCDNR 2002). Borings that were made in the 1970's show that the most common rock types at the Saluda Dam are biotite gneiss and chlorite biotite schist. None of the rock types encountered while making these borings were soluble in nature. Subsequently, due to the lack of soluble materials, sinkholes are not present in the site area (Stone and Webster Engineering Corporation, 1995).

1.1.4 Soils

The soils of the Project Area are predominantly Ultisols of the Carolina Slate Belt. These soils are described as the highly weathered soils of humid regions, with very low fertility, and a great deal of leeching. Their low fertility makes Ultisols well suited for pasture or forest use (Mead and Hunt, 2000). Due to a subsurface accumulation of illuvial clay, these soils are often reddish or yellowish in nature. The Ultisols of this region generally have an argillic horizon. Due in part to weathering and climatological influences, Ultisols have a low base saturation, usually less than 35 percent in the lower part of the soil profile.

The predominant soil association of the Project area is the Georgeville-Herndon-Almance association. These soils were mainly developed in residuum, from the fine-grained slate rock of the Carolina Slate Belt (USDA, 1962). They generally have moderate permeability with medium to high available water capacity and medium amounts of runoff (USDA, 1976). The predominant texture class is a silt-loam surface soil, with clayey subsoil (USDA, 1962). These gently sloping upland soils are highly dissected with drainage ways (Mead and Hunt, 2000; USDA, 1962). Wave action on the exposed shorelines of Lake Murray contributes to soil erosion in some areas, and in areas where bedrock is located close to the surface, soil slumping may occur. However, over the past 20 years, shoreline stabilization projects have been put in place to reduce the effects of such erosion on Project Areas (Mead and Hunt, 2000).

1.1.5 Wetlands

In March 2000, the SCE&G staff delineated wetlands in 31 different locations immediately downstream of the Project dam comprising approximately 55 acres within the Project boundary. The hydrology of these areas varies from an intermittent or seasonal inundation to perennial flow. These are the only wetlands downstream of the Project dam to be delineated.

Maps for the Project Area compiled as part of the National Wetlands Inventory (NWI) depict wetlands within the Project boundary. Wetlands upstream of the Project dam, specifically those around the Lake Murray shoreline, consist primarily of lacustrine fringe communities and submerged aquatic vegetation (SAV). Approximately 363 acres of emergent wetland exist below the 358.5-foot contour (360 Plant Datum [PD]) around the lake, with nearly ninety percent of them occurring in the headwater region of the lake along the Saluda River (Mead and Hunt, 2002a). Wetlands are discussed in further detail in Section 5.1.2.

1.1.6 Vegetative Cover

The Project is located in the Appalachian oak ecosystem. The botanical and forestry resources of the Project Area consist mainly of the dominant woody pioneer or climax species of the southern Piedmont hardwood forests. Forested areas of the Project function mostly in support of forestry, wildlife or game management, and recreational or aesthetic values (Mead and Hunt, 2002a). Further discussion on vegetative cover is discussed in Section 5.1.

1.1.7 Land Development

The Watershed Water Quality Assessment for the Saluda River Basin provides a good description of development around the Project Area. It is explained that items contributing to the considerable growth in the area include the widening of both U.S. Route 378 and I-26 toward the Chapin\Pomeria exit, and the continued installation of water and sewer in areas surrounding Lake Murray. Both residential and industrial growth occurs in the region and is expected to persist. Several US and state highways serve the Project Area (Bureau of Water, 1998) Further information on land use within the Project Area is included in Section 8.0 of this document.

1.1.8 Demographics

A summary of the demographic profile of Lexington, Newberry, Richland, and Saluda Counties is provided in (Table 1-2). Population figures from the U.S. Bureau of the Census (2002) indicate that, in 2000, the combined population of the counties was approximately 592,000. This represents a change of about 89,000 people since 1990, or an increase during the 1990s of 17.7 percent (Table 1-1). The rest of South Carolina grew by about 436,000 people or 14.6 percent between 1990 and 2000. In 2002, Lexington, Newberry, Richland and Saluda Counties ranked 5th, 27th, 2nd and 42nd, respectively, in population in the state (out of 46 counties). Furthermore, the population of Richland, Newberry, Saluda, and Lexington counties increased by 4.1 percent between 2000 and 2005 and is projected to increase by another 24.0 percent by the year 2030 (SCBCB, 2005b). Lexington County is projected as having the fastest population growth of the area, at 41.6 percent from 2005 to 2030 (SCBCB, 2005b).

Table 1-1: Study Area Population Trends, 1990-2000: Average Annual Percent Change

COUNTY	1990	2000	PERCENT CHANGE
Lexington	167,611	216,014	28.9
Newberry	33,172	36,108	8.85
Richland	285,720	320,677	12.2
Saluda	16,357	19,181	17.3
TOTAL	**502,860**	**591,980**	**17.7**
Rest of South Carolina	2,983,843	3,420,032	14.6

Source: U.S. Bureau of Census, 2002, reported in FERC 2002.

Table 1-2: Demographic Characteristics of Residents of Lexington, Newberry, Richland and Saluda Counties and South Carolina in 2000

STATISTIC	SOUTH CAROLINA	LEXINGTON	NEWBERRY	RICHLAND	SALUDA
Percent Male	48.6	48.6	48.2	48.3	49.6
Percent 18 - 64	62.7	63.7	61.2	66.0	60.6
Percent High School Graduates[a]	30.0	29.5	33.5	22.8	38.6
Percent College Graduates[a]	27.1	32.7	21.3	39.2	17.8
Persons per Occupied Housing Unit (1990)	2.53	2.56	2.5	2.44	2.65
Percent Urban	60.5	66.3	33.1	87.2	18.7
Percent Rural	39.5	33.7	66.9	12.8	81.3

Sources: U.S. Bureau of Census, 2002 and South Carolina Office of Research and Statistics, 2004, Reported in FERC, 2002.

[a] This information pertains to persons in 2000 over the age of 25

1.1.9 Flooding and Floodplains

Discussion on floodplains is included in Section 5.1.2.

2.0 WATER USE AND QUALITY

When compared to natural lakes of similar size, Lake Murray has a much greater shoreline and a very irregular form. Lake Murray covers approximately 78 square miles and is approximately 41 miles long, with a maximum width of 14 miles and a mean depth of 42 ft (Figure 2-2). Fed primarily by the Saluda River (approximately 68 % mean annual inflow), Lake Murray has a maximum depth of 189 feet at an elevation of 356.5'[2]. The original Saluda River channel offers no significant features and is rather small when compared to the size of Lake Murray.

Characterized by numerous varying size coves and embayments, Lake Murray has 17.7 times as much shore length as a circular lake of the same area (ERC, 1976). Because of its size and the hydrology of the system, Lake Murray has a long retention time - approximately 417 days. Due to its extensive depth, the lake thermally stratifies each year and is considered a warm monomitic water body. This, in turn, affects water quality conditions in Lake Murray and potentially the lower Saluda River (LSR). These water quality conditions have been extensively studied and monitored, as discussed below.

The LSR originates at the base of Saluda Dam and consists of a 10-mile stretch of free flowing river before merging with the Broad River and forming the Congaree River which serves as the boundary between downtown Columbia on the east bank and West Columbia and Cayce on the west bank. Through cooperation with and assistance of SCE&G, a significant portion of the lower Saluda River was designated as a State Scenic River Segment in 1991. This was the first such designation in the State of South Carolina. In 1997, SCE&G donated a Scenic River easement to the State of South Carolina over much of the property it owns along the LSR. Through this donation, a 100 ft wide strip of land is conserved along approximately six miles of riverbank (LSSRAC, 2005). Water depths in the LSR are highly variable and dependent upon streambed morphology and water releases from the Saluda Project, but typically range from 3 to 15 feet. As with depth, stream flow is highly influenced by releases from the Saluda powerhouse.

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[2] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

2.1 Water Uses

Lake Murray and the LSR provide an exceptional source of high quality water that can be used for both consumptive and non-consumptive uses. The reservoir serves as a source of drinking water and water for industrial uses for the cities of Columbia, West Columbia, Newberry and Saluda, as well as surrounding areas. The maximum amounts of water allowed by the FERC for withdrawal by each city are as follows (Exhibit C):

- City of Columbia – 100 MGD
- City of West Columbia – 48 MGD
- City of Newberry – 10 MGD
- Saluda County Water and Sewer Authority – 15 MGD

The Saluda Hydroelectric Project primarily functions as a reserve capacity plant, meaning it runs on an "as needed basis." The McMeekin Station[3] consumptively uses an insignificant amount of water, normally only about 35 gallons/minute. Spillway discharges are very infrequent, and with rare exception since 1930, have been only the result of testing the spill gates. There is water loss due to the natural occurrences of evaporation and ground water uptake. The agricultural developments around Lake Murray generally meet their water demands through the uses of farm ponds. However, there is a small amount of water taken up by these operations. There are also small volumes of water withdrawn from Lake Murray by a few landowners for domestic uses. These water withdrawals are allowed by SCE&G's Lake Management Department.

The reservoir and the LSR are used extensively by the public for recreation. Fishing accounts for much of the recreational use of the reservoir and LSR. Like many of the waterways in the State, there have been fish consumptive advisories issued by SCDHEC for the lower Saluda. A current fish consumptive advisory is in effect for largemouth bass, bluegill and bowfin (SCDHEC, 2007). Recreational uses are discussed in further detail in the recreation Section 7.0 of this document.

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[3] As described in Exhibit A, the McMeekin Station is a coal fired power plant located adjacent to the Saluda Hydro powerhouse on the north side of the lower Saluda River. It is owned and operated by SCE&G, but is not part of the Project.

2.2 Water Quality

2.2.1 Water Quality Standards

2.2.1.1 Lake Murray

All waters entering and within Lake Murray are classified as "freshwaters (FW)" (SCDHEC, 2004). FW waters are considered suitable for primary and secondary contact, recreation, and as a drinking water supply, using conventional treatment (based on requirements set forth by SCDHEC). FW waters are also suitable for industrial and agricultural uses, fishing, and the survival and propagation of a balanced indigenous aquatic community of flora and fauna.

SCDHEC water quality standards for FW waters (all waters entering and within Lake Murray) include (SCDHEC, 2004):

DO	Daily average not less than 5.0 mg/L with a low of 4.0 mg/L
Fecal Coliform	Not to exceed a geometric mean of 200/100mL, based on five consecutive samples during any 30-day period; nor shall more than 10% of the total samples during any 30-day period exceed 400/100mL
pH	Between 6.0 and 8.5
Temperature	Not to vary from levels existing under natural conditions, unless determined that some other temperature shall protect the classified uses
Turbidity	Not to exceed 50 Nephelometric Turbidity Units (NTUs) (25 NTUs for lakes) provided existing uses are maintained

In addition to the above standards, numeric nutrient criteria exist for lakes of 40 acres or larger, and are based on an ecoregional approach that takes into account the geographic location of the lake within the state (SCDHEC, 2004). Lake Murray is situated in the Piedmont and Southeastern Plains ecoregions of the state. Nutrient criteria for this ecoregion include the following (SCDHEC 2004):

Total Phosphorous	Shall not exceed 0.06 mg/L
Chlorophyll ***a***	Shall not exceed 40 µg/L
Total Nitrogen	Shall not exceed 1.50 mg/L

2.2.1.2 Lower Saluda River

Since 1990, the LSR has been classified by SCDHEC as Trout Put, Grow and Take Waters (TPGT), which are defined as freshwaters suitable for supporting the growth of stocked trout populations and a balanced, indigenous aquatic community of fauna and flora (SCDHEC, 2004).

Until 2002, a site-specific DO standard for the LSR existed, which was a daily average of 5.0 mg/l with no instantaneous minima. In that same year, the SCDHEC proposed changes to the existing DO site-specific standard for the LSR downstream of the Saluda Dam/Lake Murray. To facilitate development of an effective and attainable standard, SCE&G, worked cooperatively with the SCDHEC, SCDNR, and the EPA to develop and implement a number of site-specific studies. These studies were aimed at establishing a scientifically based alternate DO standard for the LSR and included:

- An in-situ trout growth study (conducted during 2002-2003).
- Turbine venting modeling.
- Hydrodynamic tailwater water quality modeling.
- Fish bio-energetics modeling.

Upon completion of the identified studies, a detailed report was prepared providing the results of scientific investigations necessary to formulate the proposed site-specific standard, which are summarized below.

The fish growth study found that, despite DO concentrations that on occasion fall below 2 mg/L for brief periods, LSR trout grow at a rate that exceeds many other southeastern tailwater trout fisheries (average 0.7 in/month) (Kleinschmidt et al., 2003). The fish growth model suggested that the good trout growth is due in part to the relatively high average DO concentrations that have occurred in the river due to the aeration system (implemented by SCE&G in 1999), in conjunction with the reduced incidence of high flows due to recent drought years, and a favorable temperature regime. The study estimated that the fishery would do nearly as well during normal hydrologic years using the current aeration system; however, in wet years or in years when the *pool* level of Lake Murray is drawn down for special purposes in September or October, the difference in fish growth might be measurable (i.e., a difference greater than 1/2 ounce or 1/16 inch was considered measurable for fish weighing over 2 pounds and having a length of about 18 inches).

In order to estimate the range of DO conditions the fishery might be exposed to in the future, a turbine aeration model was also developed to predict the effects of using various aeration alternatives (Kleinschmidt et al., 2003). This model was then used to predict DO conditions in the river for the years 1990 (wet), 1992 (normal), 1996 (normal with a special drawdown of Lake Murray), and 1999 (dry). The results of the turbine aeration model were summarized as DO metrics (e.g., minimum daily DO, average daily DO, 30-day average DO, etc.) that represented potential measures of DO that could be considered for setting DO standards.

The tailwater hydrodynamic water quality model was calibrated using actual onsite water quality data (Kleinschmidt et al., 2003). A fish bioenergetics model was then calibrated using the trout growth and tailwater hydrodynamic water quality model results. The fish bioenergetics model was then used to estimate trout growth for various aeration scenarios for each of the years. The results showed that growth was best correlated to the moving 30-day average DO, a finding consistent with the recommendations in the EPA criteria document for DO (EPA, 1986).

A central concern was found to be the minimum DO level that occurs with the current aeration system. A minimum DO of 3 mg/L is considered to be protective for trout survival (Raleigh et al., 1984; Raleigh et al., 1986), and this same level likely would be sufficient for other aquatic life that serves as food supply for the fishery. However, a minimum of 4 mg/L had been set by SCDHEC (2004) for application to all waters of the State, and SCDHEC made it clear that nothing less than that standard would be accepted. As such, SCE&G had little choice but to propose 4 mg/L as the minimum DO for the site-specific standard.

The results of the scientific studies, in addition to SCDHEC's insistence regarding an acceptable minimum, supported the following site-specific standard for the LSR:

- Instantaneous DO — 4 mg/L minimum
- Daily average DO — 5 mg/L minimum
- 30 day average DO — 5.5 mg/L minimum

These levels of DO were shown to be protective of the fishery and would achieve trout growth objectives equivalent to those that would result from application of the DO standard previously proposed by SCDHEC. After going through extensive state and federal regulatory review, as well as legislative processes, the above site specific DO standard was adopted for the LSR in 2004.

In addition to DO, SCDHEC water quality standards for TPGT waters (section of Saluda River downstream of the Saluda Dam) include (SCDHEC, 2004):

Fecal Coliform	Not to exceed a geometric mean of 200/100mL, based on five consecutive samples during any 30-day period; nor shall more than 10% of the total samples during any 30-day period exceed 400/100mL
pH	Between 6.0 and 8.0
Temperature	Not to vary from levels existing under natural conditions, unless determined that some other temperature shall protect the classified uses
Turbidity	Not to exceed 10 Nethelometric Turbidity Units (NTUs) or 10% above natural conditions, provided existing uses are maintained

2.2.2 Past and Ongoing Water Quality Studies

2.2.2.1 Lake Murray

A significant effort has been placed on collecting water quality data in Lake Murray for the past 60 years. A number of agencies, including the South Carolina Pollution Control Authority (SCPCA), SCDHEC and U.S. Geological Survey (USGS), collected water quality measurements for the reservoir during the 1950s, 1960s, and early 1970s for various purposes. SCDHEC has continued to monitor water quality in both the lake and its tributaries on a monthly basis since 1973. In 1974, EPA included Lake Murray in the National *Eutrophication* Survey, which collected data from specific lakes and reservoirs throughout the U.S. (ERC, 1976). Most recently, SCE&G coordinated with USGS to collect data on Lake Murray from 1990 to 1996, using 13 water quality monitoring stations (12 are located on Lake Murray and one is downstream from the Saluda Dam). SCE&G has continued the water quality monitoring effort since 1996, collecting monthly field samples at all 13 locations and chemical samples twice a year at seven of the stations (REMI, 2005).

2.2.2.1.1 Comprehensive Assessment of Lake Murray (1974-1975)

In preparation of relicensing for the current FERC license, a comprehensive assessment of Lake Murray was conducted from September 1974 through August 1975 (ERC, 1976). Using a total of 33 stations in and around the lake, 24 physical and chemical factors were sampled and tested during a one-year period. The comprehensive study determined the following:

1. Total alkalinity levels in Lake Murray were low;
2. pH levels were rarely outside of the Class A limits for waters of 6.0 to 8.0 (SCPCA), with pH levels ranging from 5.3 to 9.1 during the 12-month study period;

3. The highest chlorophyll ***a*** levels were found in the upper lake tributary stations;
4. Total phosphorous concentrations were highest in the upper lake, near the inflows/tributaries, and lowest near the Dam, with a mean concentration for the lake of 0.10 mg/L;
5. Fecal and total coliform levels were occasionally high in the lake, exceeding the standards at some of the upper lake stations on occasion, specifically after periods of heavy run-off in the watershed (storm events);
6. 12 of the 24 trophic status determinations classified the lake to be mesotrophic and 11 of the 24 determinations classified the lake as eutrophic. The comprehensive assessment report stated that, because of the potential for increased shoreline development and additional nutrient inputs from the watershed and septic systems, Lake Murray will show signs of greater eutrophication.

2.2.2.1.2 Comprehensive Water Quality Report (1974-1998)

SCE&G has worked with SCDHEC and USGS for a number of years monitoring the water quality in Lake Murray. Data collected as a result of this water quality monitoring effort, from 1974 to 1998, was recently compiled into a database prepared to evaluate historical trends in water quality of Lake Murray and its drainage area up to Lake Greenwood (REMI, 2005). Water quality information was compiled using a specialized computer software program and then put together into a comprehensive water quality report. This report and the underlying database serve as pertinent sources of information about present and past water quality trends. Since Lake Murray serves as an important regional economic and recreational resource, the water quality parameters that have the greatest effect on these economic and recreational activities are considered the most important. Various plots and charts were generated and included in a summary report to aid in the assessment and understanding of the results from these studies. The summary report was contained in the ICD and is included as Appendix E-1.

2.2.2.1.3 SCDHEC Saluda River Basin Water Quality Reports

The SCDHEC published two reports related to the water quality in the Saluda River basin, including:

1. Watershed Water Quality Management Strategy - Saluda-Edisto Basin, Technical Report No. 003-95, June 1995, Bureau of Water Pollution Control.
2. Watershed Water Quality Assessment - Saluda River Basin, Technical Report No. 005-98, December 1998, Bureau of Water.

In these reports, seasonal trends and changes in water quality over the entire length of Lake Murray were evaluated. Generally, material differences between upper and lower stations in the lake were apparent. Concentrations of nitrates, phosphates, fecal coliforms, and biochemical oxygen demand (BOD) were typically higher at the upstream lake stations compared to the lower stations (closer to the Dam). This condition could be attributed to the faster flowing waters in the upper lake (convergence of several of the main tributaries into the *headwater*s of the lake) in contrast to the slower moving waters in the lower part of the lake. In addition, sedimentation was most prominent in the upper part of the lake, specifically between Rocky Creek and Black's Bridge, which are located 19 to 25 miles upstream of the Saluda Dam. This seven-mile stretch of the lake was shown to contain a higher percentage of small particle sediments compared to other sections of the lake, with the exception of the lower portion of the Little Saluda embayment (near the Highway 391 bridge).

While both SCDHEC reports were similar, the 1998 report identified a greater number of locations in Lake Murray “not supporting” or “partially supporting” their designated uses, according to the use-based criteria. Specifically, water quality criteria for aquatic life and unrestricted recreation were noted as not being fully and continuously met. The extent to which various sampling locations in the lake, embayments, inflows, and tailwater met various water uses during the 1995 and 1998 assessments is summarized in (Table 2-2). Within the Lake Murray watershed, 18 locations were labeled as fully supporting their designated uses in 1995, compared to only 9 locations in 1998. Based on the 1998 report, SCDHEC found 7 of the 12 stations on Lake Murray to be either “not ”supporting' or “partially-supporting” their respective water uses. Metals were listed as the cause for 6 of the 7 stations not meeting their designated uses, while nutrients were listed as the cause for 2 of the 7 stations (one station was listed for both metals and nutrients). Generally, improvements in Lake Murray water quality have occurred over the years since 1998. Tighter water quality standards and greater attention to land use practices within the watershed have made significant contributions in decreasing impairments to many areas of Lake Murray. Nutrification impairments from point source discharges continue to be of concern in some areas of the lake including Bush River, Ninety - Six Creek and the Little Saluda Embayment.

2.2.2.1.3.1 Pathogens

Fecal coliform was identified as the cause for impacted recreation (6 locations in 1995 and 8 locations in 1998) in the inflows/tributaries to the lake and in the tailwater of Saluda Dam. These conditions were all attributed to point and/or non-point sources in the watershed. However, all locations in Lake Murray were found to fully support the recreational use designation based on fecal coliform data.

Fecal coliform levels have triggered the implementation of TMDLs at three sites in the Lake Murray watershed, including two sites on Bush River and one site on Rawls Creek, which discharges into the LSR downstream of the Dam. Another eight sites are designated as potential TMDL sites, with six of the site designations attributed to fecal coliform. There are a total of 51 TMDL-designated sites in the watershed listed on the state 303(d) list. Fecal coliform is the most significant water quality indicator and is responsible for TMDL designation for 21 of the sites. Most of these 21 sites indicate a significant potential concern to recreation where the streams enter Lake Murray or the Saluda River. Lake recreational uses are potentially impacted at the inflow areas from these sites following significant rainfall/runoff events.

2.2.2.1.3.2 Phosphorus

Two Lake Murray sites are listed on the state 303(d) list due to elevated phosphorous levels: the Bush River arm and the Rocky Creek area of Lake Murray. However, neither site is listed as a potential TMDL site despite the high priority listing. Total phosphorous concentrations in Lake Murray tend to be highest in the upstream section of the lake, near the main tributaries/inflows. The downstream part of the lake, near the Dam *forebay* has historically had the lowest concentrations of total phosphorous (Figure 2-3). In the lower lake, it is assumed that most of the phosphorous is either utilized by the plants and algae in the lake or settles out onto the lake bottom. In general, total phosphorous concentrations have shown a decreasing trend in the lake since the mid-1980s (Ruane, 2004).

2.2.2.1.3.3 Trophic Status

Eutrophication refers to the level of nutrients in a lake (i.e. phosphorous and nitrogen), and the resulting level of productivity by the organisms such as plants and *phytoplankton*. A lake that has low concentrations of nutrients and low levels of productivity (*i.e.* limited algal blooms and plant growth) is referred to as oligotrophic. On the other hand, a lake that is high in nutrients and has high levels of productivity (significant algal blooms and plant growth, resulting in poor water clarity) is classified as eutrophic. The mesotrophic classification falls in the middle of oligotrophic and eutrophic, characterizing a lake containing moderate levels of nutrients and moderate productivity.

Lake Murray is what is generally considered to be an olgio-mesotrphic water body. In the SCDHEC 1995 and 1998 reports, a multiple parameter index was used to assess eutrophication in Lake Murray. The multiple parameter index is based on measurements of water clarity, total phosphorous, total inorganic nitrogen, chlorophyll ***a***, and DO. Compared to a baseline assessment in 1980-1981, conditions in the upper lake had improved, with the exception of Rocky Creek and the Bush River sections of the lake, which were stated as some of the most eutrophic sites on large lakes in South Carolina. The 1998 report indicated that two upstream locations, the Saluda River and Little Saluda River arms, improved to intermediate trophic status (*i.e.* mesotrophic). The 1998 report also indicated that all locations between Rocky Creek and the Saluda Dam were among the least eutrophic sites in the state, with decreased levels of total phosphorous and decreasing trends of nitrogen and BOD. Based on the recent 2005 305(b) report issued by the SCHDEC, the trophic status of Lake Murray has generally remained consistent.

2.2.2.1.3.4 DO and Temperature

Extensive water quality profiles, including DO and temperature, were performed in Lake Murray throughout the 1990s. As an example, Figure 2-4 through Figure 2-9 illustrate longitudinal contour plots of DO in Lake Murray during the months from May to October of 1998. The plots use DO profiles from seven different locations in the lake, which are plotted at their location relative to the Dam (x-axis) versus elevation or meters above sea-level.

Lake Murray thermally stratifies each year, forming three different layers in the water column during the months of approximately May through October. The water column stratifies because of the change in temperature and associated density of each layer. The epilimnion is the upper layer of the lake, which remains in contact with the surface and is characterized by high DO and temperature levels. The hypolimnion is the bottom layer of the lake that remains isolated from the atmosphere during the stratification period. The hypolimnion contains the coolest waters (down to 11˚C in 1996) and some of the lowest DO waters, even having anoxic conditions (no DO) during September and October. The metalimnion is the middle layer of the water column, which contains the controlling region known as the thermocline. The thermocline is referred to as the waters having the greatest temperature change over depth. This layer is basically the transition layer between the epilimnion and hypolimnion. In Lake Murray, this layer can have the lowest DO levels, depending on flows entering the lake (REMI, 2005).

The magnitude of flows (i.e., hydrology) for each year controls the level of nutrients, algae, and other organic matter that enters the lake. The nutrients, algae, and other organic matter contribute significantly to DO demand, which relates to the amount of oxygen required to decompose the organic matter that is ultimately produced by the nutrients and algae. In addition, *sediment oxygen demand* can contribute to the DO demand in the lake bottom waters. Sediment oxygen demand can result from several things, one of which is from the deposition of organic matter on the lake bottom.

The water column in the lake becomes thermally stratified during the summer months when the bottom waters do not come into contact with the surface to replenish DO levels, thus eventually becoming void of oxygen or anoxic, depending on annual flows. In a low flow year, for example, the magnitude of nutrient input to the lake would be lower, resulting in a limited DO demand and higher DO levels in the bottom waters of the lake, particularly downstream towards the Dam. Higher flow years would result in an increased loading of nutrients, algae, and organic matter to the lake that would create a high DO demand and lower DO conditions in the bottom of the lake, specifically during the summer months. These effects were most recently noticed in 2003. DO levels at the upstream portion of the lake, where most of the inflows enter, are less dependent on flow conditions. Water quality in the upper portions of the lake is primarily controlled by flow conditions in the watershed.

Referencing Figure 2-4 through Figure 2-9, it is readily apparent that DO levels start to decrease in the upper part of the lake in May and June of each year. DO levels are less than 2.0 mg/L in the metalimnion and near the bottom in the upper part of the lake by June of each year.

However, DO levels are often lower at different points in the water column compared to near the bottom, which indicates a high DO demand in the water (*e.g.*, nutrients, algae). As previously noted, low DO conditions in the upper lake are caused by the decomposition of algae and other organic matter entering the lake as well as the effects of sediment oxygen demand in the lake bottom. Depending on flow conditions, this poor water quality may cause the same low DO conditions in the metalimnion and hypolimnion throughout the lake, down to the Dam.

In July, DO levels generally become more dependent on the annual hydrology, particularly in the Dam forebay. In low flow years, the DO was typically greater than 5.0 mg/L at all depths in the Dam forebay, while normal flow years are marked by reduced DO levels, normally less than 5.0 mg/L at most depths in the forebay. The pattern for DO levels in the Dam forebay during the month of August is similar to July. In low flow years, the DO is normally greater than 3.0 mg/L at all depths, while normal flow years have DO levels less than 3.0 mg/L at nearly all depths of the Dam forebay. This pattern of DO behavior, based on flow conditions, for the months of July and August, indicates that water displacement within the reservoir affects the DO distribution in the reservoir.

In September, the DO in the forebay area is typically 0.5 mg/L or less at most depths during normal flow years. In low flow years, the DO is usually greater than 1.5 mg/L at all depths in the forebay. Finally, in October, the DO in the hypolimnion of the lake is normally less than 0.5 mg/L at all locations.

2.2.2.1.4 CE-QUAL-W2

As previously stated, in 2002 SCDHEC issued a formal notice that the DO standard for the LSR would be revised. From the comprehensive water quality report prepared for the Saluda Hydro relicensing, data reflecting the trend in the level of phosphorous indicates potential problems with nutrient loading into Lake Murray. In order to comply with a new DO standard, SCE&G decided to evaluate the potential effects that nutrient reduction would have on the DO levels in Lake Murray and the releases from Saluda Hydro. SCE&G proposed a series of industry accepted models and studies, including a two-dimensional water quality model, CE-QUAL-W2 (Ruane, 2004). The CE-QUAL-W2 model has been shown to be quite accurate in predicting water quality conditions. It is an extremely useful tool when analyzing the effects that inflow water quality has on the receiving lake water quality, as well as the releases from the lake. After an extensive review of the water quality data gathered for Lake Murray and its inflows by SCDHEC, USGS and SCE&G, a CE-QUAL-W2 model was developed for Lake Murray (Ruane, 2004).

Data was combined and used in the calibration of the model for the year 1996. This calibration year was chosen based upon available data and hydrologic conditions. Moreover, this year does not reflect the effects of the aeration system implemented by SCE&G in 1998, which would hinder the comparison of Lake Murray inflow and outflow data. Temperature, DO, algal levels, and phosphorus were the primary water quality constituents studied using this modeling technique. The model was tested using statistical and graphical analyses, which subsequently showed that it was extremely well calibrated for this year and conditions. The model was then tested for the years 1992 and 1997. Even though the model was not calibrated for these years, the results were still considered very good. Phosphorus modeling data from the CE-QUAL-W2 model provided more precise and detailed results than did the data from the previous phosphorus studies (Ruane, 2004).

When predicting water quality conditions in Lake Murray using the CE-QUAL-W2 model, results were achieved assuming that phosphorus concentrations occurring in inflows to Lake Murray contained the maximum allowable concentrations in compliance with SCDHEC standards. When reducing the phosphorus loads to these maximum allowable levels, the model showed substantial improvements in water quality conditions in Lake Murray. The DO levels in the turbine releases from Saluda Hydro were also shown to increase to such an extent that alternative aeration of the water may not be needed for the DO in the turbine releases to consistently meet state standards for the LSR. Furthermore, it is inferred that, as a result of phosphorus reductions, striped bass habitat would be greatly improved, as well as the pH levels on the LSR (Ruane, 2004).

Results from the Lake Murray study were compared to results achieved by modeling projects similar to Saluda Hydro. Data derived from the CE-QUAL-W2 model predicted that the most likely cause for water quality problems in Lake Murray stem from the point source discharges of phosphorus into Ninety-Six Creek and the Bush River (See Table 2-1). The discharge of phosphorus at these locations is very high. The Saluda River is responsible for 68% of the mean *streamflow* into Lake Murray; however, it only contributes 15% of the total phosphorus load. Strikingly, the smaller tributaries together only make up 32% of the mean streamflow into Lake Murray, but contribute 85% of the total phosphorus load Table 2-3. This means that, for the Saluda River inflow, the phosphorus to flow ratio is 0.22, while for the smaller tributaries, the phosphorus to flow ration is 2.66, or more than twelve times as great. Another indication that point source pollution is a major contributor to water quality issues in Lake Murray is that phosphorus discharges from Lake Greenwood are relatively low due to tertiary waste treatment upstream. In turn, model results estimated that 60% of the phosphorus input into Lake Murray occurs as a result of discharge from point sources outside of the Project boundary. As a result, although point sources of pollution may be meeting their NPDES permit limits, these limits are not sufficiently restrictive to prevent degradation of the water quality within Lake Murray. Additionally, if the NPDES permit limits for those point sources of pollution were set at, or more restrictive than, the water quality standards for Lake Murray, the phosphorus discharges into Lake Murray would be reduced by about 66% (Ruane, 2004).

Reducing phosphorus levels in point source discharges into Lake Murray may be an effective and practical way of improving the overall water quality of the lake. A review of projects similar to Saluda Hydro indicated that a reduction in lake phosphorus levels contributed to an increase in the DO levels. The CE-QUAL-W2 model accurately indicates that most of the water quality problems could be solved by implementing point source phosphorus controls (Ruane, 2004).

2.2.2.2 Lower Saluda River

SCE&G began monitoring DO and temperature in the releases from the Project turbines in 1989 and continues the effort to the present day. These monitoring efforts have determined that nutrient loading from the tributaries and the thermal stratification of Lake Murray from May through approximately October of each year result in the depletion of DO levels in the metalimnion and hypolimnion layers of the lake. These anoxic conditions during the summer months in the lake can translate into low DO concentrations in the water released through the Project turbines. The anoxic conditions and low alkalinity levels in the bottom waters of the lake can also result in moderately low pH conditions (pH < 7.0), because of the lack of oxygen and the production of carbon dioxide from the various decomposition processes.

2.2.2.2.1 SCDHEC Reports

The 1995 and 1998 SCDHEC reports concluded that the SCDHEC sampling station immediately downstream of the Saluda Dam (i.e. the Project tailwater) was either “not supporting” or “partially supporting” for aquatic life uses. The listed cause for this impairment was low DO levels measured in the Project releases from the turbines. Conditions at the downstream station were reported to have improved (1998 report) based on a lower percentage of the DO data that were less than the standards. Lower pH levels were also reported as a cause for the 'not supporting' conditions for the aquatic life use in the tailwater.

2.2.2.2.2 DO Enhancement of the Project Turbine Releases

In an effort to increase the DO levels in the releases from the Project turbines, SCE&G installed turbine vents and modified operations starting in 1999. Table 3-10 illustrates how turbine venting in conjunction with modified operational patterns have improved the project release DO levels since 1999. The median DO concentration of the Project release has increased from 2.7 mg/L (before implementing turbine venting) to 7.2 mg/L (with turbine venting - 1999 to present). Ultimately, this has resulted in less frequent occurrences of DO levels in the release below 5.0 mg/L, from 88% to about 12% of the time. The percentage of time the DO levels from the Project releases were below 3.0 mg/L has decreased from 55% to 3% since turbine venting and modified operations were implemented in 1999.

Daily average DO levels in the Project releases from 1999-2007 were periodically below 4.0 mg/L, particularly on days when flows through the turbines were high (Figure 2-10). The amount of water that passes through the turbines controls the amount of air drawn into the turbine system. A lower flow or gate setting will allow more air to be aspirated into the turbine system resulting in a greater degree of DO increase in the Project release.

In May 2005, installation of hub baffles was completed on all 5 Saluda Hydro units in an effort to further enhance turbine aeration, and ultimately, DO conditions in the Project tailrace. Extensive testing of turbine aeration efficiency during Fall 2005 and 2006 yielded variable results; some units demonstrated considerable aeration potential while other resulted in only marginal DO improvements. During the summer of 2007, larger hub baffles were added to unit 5 to aid in increasing the oxygenation of water releases. Failure of some units to achieve additional aeration was attributed to failed or poor head cover seals. Repair of the failed head cover seals on Units 2 and 3 was completed during early-summer 2007, and additional aeration efficiency testing was conducted during the fall of 2007.

In 2005, SCE&G implemented operational protocols that further assist in maintaining enhanced DO levels in the LSR. Specifically, "look up" tables, depicting best operational scenarios to optimize aeration capacity, were developed based on a detailed turbine venting model. These tables provide SCE&G operations and dispatch personnel with detailed information regarding unit combinations and gate settings that optimize aeration efficiency while meeting power demands. To ensure continuing enhancement of DO levels, this model is reviewed on an annual basis and the "look up" tables updated accordingly based on any new pertinent testing or operational data.

2.3 Agency and Public Recommendations Concerning Water Uses and Water Quality

2.3.1 Initial Stage Consultation

On April 29, 2005, SCE&G sent the Initial Consultation Document (ICD) for the Saluda Hydro Project in electronic format to the consulting agencies and various stakeholders for review. The Notice of Intent (NOI) was filed with the Commission simultaneously with the issuance of the ICD. The ICD is included in

Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

In addition to Issue Identification workshops held October 26-28, 2004, a joint public and agency meeting was held on June 16th, 2005, following the issuance of the ICD (meeting transcripts provided in Volume II). The primary goal of this meeting was to review the upcoming relicensing process with the group, briefly review the background of the Project, and to scope out any initial study requests or discussion topics the group felt should be addressed as a part of the Saluda Hydro relicensing. Many of the comments received during the June meeting were formalized in subsequent letters and during Resource Group meetings.

Supplementing the comments received on the ICD, SCE&G hosted a series of Resource Conservation Group meetings (RCG)'s to discuss the method and scope of the studies necessary for the Saluda Project relicensing (See meeting notes in Volume II). The resource groups were separated by genre, and in-depth issue discussions were limited to those that had a Project nexus.

Summarized below, are the remarks and study requests regarding Water Quality that were provided by stakeholders in comment letters following the issuance of the ICD.

The entities listed in the following paragraphs note their general concern for water quality in the Project area; more specific water quality study requests are listed in the subsequent paragraphs.

In their August 12, 2005 ICD comment letter, South Carolina Parks Recreation and Tourism (SCPRT) requested improved water quality for the lake and river to meet various recreational needs around the Project Area. Similarly, Lower Saluda Scenic River Advisory Council (LSSRAC) recommended in their comment letter, dated August 12, 2005, that studies be performed on Project releases to characterize temperature and DO under various operational scenarios. They also recommended that the extent of impact the Project has on downstream water quality be determined, as well as provide for a plan for a long term monitoring of water quality downstream of the Project.

The U.S. Fish and Wildlife Service (USFWS) recommended (letter dated August 1, 2005) existing water quality data be reviewed for the reservoir, tailrace, and downstream of the reservoir. The USFWS noted that it should be determined based on existing data if additional studies are necessary. Additionally, the Coastal Conservation League (CCL) and American Rivers requested in a joint letter, dated August 10, 2005, that the effects Project operations have on water quality and its relation to the recruitment of fishes (diadromous and riverine) be studied. In their ICD comment letter dated August 1, 2005, the National Marine Fisheries Service (NMFS) requested that water quality information be gathered and a determination be made on the need for additional data collection and analysis.

The South Carolina Wildlife Federation (SCWF) recommended that water quality studies be performed in the Project area in order to relate shoreline uses to water quality (comment letter dated August 15, 2005). The League of Women Voters expressed their concern for water quality in Lake Murray in their ICD comment letter (dated August 14, 2005). They specifically requested that studies be performed on the effect of power boats and jet skis on drinking water quality, and noted that it may be necessary that aforementioned boat usage be curtailed.

The request by the League of Women Voters for a study to evaluate the impacts of jet skis and power boats on drinking water quality was reviewed by the Water Quality TWC on February 21, 2006 (meeting notes attached in Volume II). Several meeting attendees noted that they were unsure of exactly what is being requested and the project nexus. It was noted that some individuals pump drinking water directly from the lake to their homes, and it was assumed that this is what is being referred to in the request, since all water withdrawn for public consumption is treated prior to distribution. The group discussed the fact that SCE&G does not issue permits for individual water withdrawals for consumptive use as part of its current lake use permitting process, nor does SCE&G have the regulatory authority to regulate watercraft usage on the lake.

Other letters that expressed the general concern for the water quality of the Project area include: University of South Carolina (USC)(dated August 12, 2005), the National Park Service (NPS)(dated August 11, 2005), TU (letter dated August 15, 2005), the Lake Murray Association (LMA) (dated August 12, 2005), City of

Columbia Parks and Recreation (dated August 11, 2005), and SCDNR (August 11, 2005), American Whitewater (dated August 12, 2005).

Resource Conservation Groups[4] are currently working to resolve agency and stakeholder concerns as they relate to the water quality of the Project area and surrounding areas. They have recently performed a number of studies that directly address different aspects of lake and river water quality that include: temperature, DO, water allocation, nutrients and other pollutants. Specific studies are mentioned in the responses below.

SCPRT recommended in their August 12, 2005 ICD comment letter that water quality concerns as they relate to the trout and striped bass fishery should be considered. Similarly, the USFWS requested in their August 1, 2005 comment letter that studies be performed with respect to the effect that project operations may have on the striped bass fishery in the reservoir. This study request includes the evaluation of current operational scenarios on habitat, and any additional enhancements in habitat by the modification of operational scenarios. This study request is also made with the recommendation of an evaluation of the spawning activities of the striped bass within the reservoir.

In a joint letter filed by CCL and American Rivers (letter dated August 10, 2005), these groups also recommended that studies be performed on water quality in the forebay area of Saluda Hydro to help determine the cause of periodic fish kills. SCDNR noted in their ICD comment letter (dated August 11, 2005) that they are interested in investigating whether Project operations could be modified in order to provide cooler water for the late summer months to the river fishery. They also requested that information be developed on how striped bass habitat reductions in the Lake can be forecasted or alleviated by project operations. The

[4] The Resource Conservation Groups (RCG) and Technical Working Committees (TWC) are comprised of interested stakeholders committed to working with each other and with SCE&G to identify project issues and to develop recommendations for addressing/resolving the issues. The RCG's and TWC's stakeholders include SCE&G, state and federal agencies, local governments, consultants, non-governmental organizations, homeowner and boat owner groups, and individual private citizens who share a concern for the resources of the Project. Specific details regarding the roles of RCGs and TWCs can be found in the Operating Procedures developed for the Enhanced Traditional Relicensing Process of the Saluda Hydroelectric Project (http://www.saludahydro relicense.com/documents/OperatingProceduresforRelicensing2005-December14unsh..pdf).

Midlands Striper Club noted in their ICD comment letter (dated August 15, 2005) concern for the lake striped bass fishery, as well.

Since its inception, the Water Quality Technical Working Committee (TWC) has been developing a Water Quality Model that directly addresses the striped bass habitat issues of the Lake. This W2 model (discussed further in section 2.2.2.1.4) was originally developed to address water quality in the reservoir, however has been utilized to help determine contributing factors to fish kills and the effects of operational changes on fishery habitat. During TWC meetings, group members reviewed data from the model and evaluated how operations could be changed in order to preserve higher quality habitat. The group found, using model simulations, that alternating the use of project units during specific summer and early fall months may directly conserve fish habitat in the forebay area. Optimally resulting in more infrequent striped bass die-offs. More discussion on this is included in section 2.4.2.

The recommendation is made in the ICD comment letter of the LSSRAC (letter dated August 12, 2005) that a Total Maximum Daily Load (TMDL) be established for Lake Murray. Similarly, Lake Watch requested that an Assimilative Capacity Assessment be performed on Lake Murray to address non-point pollution sources in the creek in cove areas of the Lake. An Assimilative Capacity Assessment is also requested by the Lake Murray Homeowners Coalition (LMHOC) (ICD comment letter dated August 15, 2005). The Lake Murray Association (ICD comment letter dated August 12, 2005) also recommended that a TMDL study be performed on areas not meeting current water quality standards and testing of other areas around Lake Murray.

The issue of a TMDL has been, and continues to be, intermittently discussed by the Water Quality TWC. SCDHEC is the regulating authority charged with establishing TMDLs on State waters. As such, SCDHEC has indicated that any recommendations from the TWC with regards to a TMDL would need to be consistent with their internal schedules and basin planning efforts. Based on SCDHEC's role and authority in developing TMDLs, it appears this will not be feasible, nor will it occur in the foreseeable future, at the Project (Water Quality TWC meeting notes dated May 3, 2006). The group has recognized that they could provide useful information and public awareness that in the future may *have an influence on ensuring that point source contributors are in line with current standards.*

CCL and American Rivers requested in a joint letter (dated August 10, 2005) that studies should be performed to evaluate the effectiveness of newly implemented oxygenation measures at the Saluda Hydro Project.

SCE&G has been conducting annual meetings with American Rivers, the Coastal Conservation League and resource agencies. The group develops an annual operating plan to optimize DO levels when the Project generates electricity. The operating plan is based on the operations reports for the previous years along with relevant operating and/or testing data acquired during the previous operating season. This plan incorporates the results of DO testing performed in the Project tailrace in the years of 2005, 2006, and 2007. As noted previously, SCE&G has re-sealed several of the units and added larger hub baffles to Unit 5 to aid in the oxygenation of water releases.

The USFWS recommended in their ICD comment letter, dated August 1, 2005, performing a Temperature Analysis of the effects of Project releases. The USFWS recommended that the following components be included in this study: "travel distance downstream to effectuate completion of temperature mixing in the Congaree River, and evaluation of the affects [*sic*] to species and habitats within the downstream Congaree National Park, an evaluation of the affects [*sic*] to upstream migrating diadromous fish". It was also recommended by CCL and American Rivers (letter dated August 10, 2005) that the affects that LSR water quality and temperature have on mussel species in the lower Saluda and Congaree rivers be evaluated.

The Water Quality RCG and TWC were involved in conducting a temperature study of the lower Saluda and upper Congaree river reaches. Collectively the group agreed upon a study plan and periodically reviewed updates on findings. A full analysis of temperature results was issued in draft report form to the TWC on May 13, 2008. There is further discussion of results in Section 2.4.1 of this document.

CCL and American Rivers jointly requested (letter dated August 10, 2005) that a study be performed on the sediment regimen in the Project area, as well as the Project effects on the sediment regimen of the LSR.

It was proposed, and the group agreed during the February 21, 2006 Water Quality RCG (meeting notes are attached in Volume II), that the sediment regime and sediment transport studies should be discussed in the Fish and Wildlife TWC, namely under the IFIM Analysis. As discussed in section 3.10.6, during the IFIM study, the relative quantity and spatial distribution of mesohabitat types from the Project tailrace to the confluence with the Broad River was field delineated as a precursor to study site and transect selection. The study team defined each mesohabitat a type of interest, and assigned specific attributes to each type. The upstream and downstream boundary of each mesohabitat within the study area was delineated and geo-referenced in the field, and the information transferred to a GIS format

In their comments to the ICD (letter dated August 12, 2005) the SCPRT requested that flows be provided at the appropriate time for the Congaree National Park. SCDNR explained that they are also interested in the effects the Project has on the Congaree National Park floodplain (comment letter dated August 11, 2005). It is further explained in their comment letter that they would like the unregulated hydrology of the system to be compared to the current hydrologic record. The NPS also noted their interest in the potential Project effects on the Congaree National Park floodplain in their comment letter (dated August 11, 2005); NPS also requested the participation of SCE&G in an "Ecologically Sustainable Water Management" (ESWM) process.

The NPS has opted to evaluate floodplain inundation through their ESWM process, outside of the Saluda Relicensing. SCE&G has been invited to participate in the ESWM Process. The request of the NPS to compare unregulated (Pre-project) hydrology to the current hydrologic record conflicts with what is considered "baseline" with respect to the relicensing of Project No. 516. A n Applicant's baseline for addressing Project impacts is considered "conditions as the Project currently exists" and is not required to assess project impacts on a Pre-project baseline case. However in the spirit of a Cooperative Enhanced Licensing Process, SCE&G will continue to exchange information through the

ESWM Process and will evaluate through the use of the Operations Model flow recommendations provided by the NPS. Further discussion on this is included in section 5.6 of this document, and below under second stage consultation.

In their August 12, 2005 comment letter, American Whitewater requested that a minimum flow be established for the project that is seasonally variable to support the various needs of the river system. They also noted that minimum flows should support navigational needs of the river, in particular recreational boating.

Minimum flows at the Saluda Hydro Project have been determined in consultation with appropriate agencies during this relicensing process. Such studies as the IFIM, performed in 2007, have aided in the determination of a minimum flow at Saluda. Further discussion on instream flows is included in section 3.10.6.

American Whitewater recommended (ICD comment letter dated August 12, 2005) that the process of ramping (described as the gradual staged rise of water levels) should be utilized during high use times of the year.

Discussions on ramping have occurred under the Safety and Recreation RCG's. Information on this topic is discussed in more detail under Second Stage Consultation (Section 2.3.2).

Lake Watch noted that the installation of the new back-up dam could allow more freeboard with regards to lake level operations (comment letter dated August 15, 2005). They further requested that SCE&G provide information on the facility that may affect the operation of the Project. Lake Watch further requested that information be provided on the weather model and how it is utilized by the company.

In addition, Lake Watch requested that information be provided on the spillway gates (letter dated August 15, 2005); it is noted that information is needed on the conditions required for operation and any requirements with regard to the use of the spillway gates. Lake Watch suggested that a summary of the Probable Maximum Flood Study also is necessary.

The Generation Review TWC was formed to discuss such information requests as those on the weather model, Probable Maximum Flood Study, and back-up dam. Meeting notes from these discussions can be viewed in Volume II.

There were several requests by stakeholders for the development of a hydrologic/hydraulic operations model for the Project. The Lower Saluda Scenic River Advisory Council (LSSRAC) requested in its comments to the ICD (letter dated August 12, 2005) that a computer simulation model be developed for the Project that analyzes inflows, outflows and balances the various interests involved in the Project. This request was also made during initial stage consultation by the following parties: Lake Watch (letter dated August 15, 2005), City of Columbia Parks and Recreation (letter dated August 11, 2005), SCDNR (letter dated August 11, 2005), SCWF (letter dated August 15, 2005).

The CCL and American Rivers (letter dated August 10, 2005) recommended that a study be developed in order to evaluate the effects that alternative reservoir levels have on various resource areas including boating activities, aquatic habitat interactions, and downstream flows. Additionally, the CCL and American Rivers also recommended an assessment of downstream flow needs for incremental inundation of the Congaree National Park.

The CCL and American Rivers further suggested in their letter that a Low Inflow Protocol Study be performed. They noted that this study would be used to determine how to balance water uses during periods of low inflow. In the letter, they recommended that the study observe fisheries and wildlife resources, public water intakes functionality, water quality in the reservoir and LSR, and power generation for potential impacts from low inflow. The LSSRAC noted in their August 12, 2005 letter that water quality within the Project area should be evaluated under extreme low flow scenarios in order to help identify and address inflows that may be causing water quality impairments. It is suggested that this may also help identify critical minimum flows. The City of Columbia Parks and Recreation also requested in their ICD comment letter (dated August 11, 2005) that a Low Inflow Protocol study be performed as a part of the Hydrologic/Hydraulic model.

The City of Columbia Parks and Recreation further requested that evaluations be made of target lake elevations for the Saluda Project. This request is also echoed in the comment letters of the LSSRAC (dated August 12, 2005), LMA (dated August 12, 2005), and a joint letter issued by CCL and American Rivers (dated August 10, 2005). CCL and American Rivers elaborated that this study should include an evaluation of stakeholder interests with regard to lake levels and that the study should evaluate the effects of reservoir levels on recreational boating, near-shore aquatic habitat, and downstream flow needs. The LMHOC made a similar request in their August 15, 2005 comment letter. They requested that impacts relating to reservoir drawdowns at Lake Murray be studied in order to determine effects on safety, economics, recreation, erosion, and sedimentation. The SCDNR (comment letter dated August 11, 2007) explained that they are interested in reservoir level fluctuations as they have a correlation to available reservoir habitat for fish species that are shallow water nest builders.

In their ICD comment letter dated August 12, 2005 American Whitewater recommended that “pre-project flows and project inflows should be studied and used to inform decisions on flow regulation”.

A hydraulic/hydrologic model has been developed as a part of relicensing by the Operation TWC. This model has been, and is currently being, utilized to evaluate the balancing of power generation, lake and river user interests and aquatic life needs in terms of water availability, water allocation and delivery. Analyses have taken into account varying inflow conditions, including low inflow years. Inputs to the model were determined in the RCG's/TWC's and submitted in late 2007 and 2008. Further discussion on modeling results and group discussion is included in Volume II.

2.3.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of Water Quality during these meetings is described below. Many items that were requested in the ICD comment letters were also requested during the resource group meetings. This is noted in the responses under Section 2.3.1, Initial Stage Consultation.

The stakeholder requests associated with the initial consultation package were discussed in the forum of the Water Quality RCG/TWC. Along with these issues, the request was also made for cooperation with an evaluation of cove water quality on Lake Murray (see meeting notes dated February 21, 2006 in Volume II).

It was explained that the Lake Murray Association (LMA) is in the process of implementing a cove water quality monitoring program and several coves were selected for sampling. Information on the locations where SCE&G conducted water quality sampling were provided to LMA and SCE&G works in cooperation with LMA in their water quality sampling efforts. Several group members expressed the need for a comparative evaluation of water quality in coves before and after marinas are installed.

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to water quality are provided below.

Within the DLA comments provided by Lake Watch and LMHOC (letter dated March 14, 2008), there is the request for additional water quality testing that includes a assimilative capacity study, as well as additional testing in coves likely impacted by storm-water runoff.

Through the W2 model, SCE&G has evaluated a suite of water quality issues and their effect on Lake Murray. The W2 model provides information on the nutrification of Lake Murray through both point and non-point sources. As far as cove water quality is considered, SCE&G has implemented shoreline management procedures designed to minimize water quality impacts to the extent that SCE&G has control over.

In American Rivers and the Coastal Conservation League's comments on the DLA (letter dated March 14, 2008), they reiterate the water quality study requests made in their ICD comments. They also request that the applicant perform a peer-reviewed study on the effects of sedimentation in the LSR and, subsequently, on water quality.

Development in the area of the LSR has been increasing in magnitude in the past decades. Subsequently, there has been a greater sediment content impacting tributaries to the LSR. SCE&G currently maintains a 100 ft buffer along the river channel on land that they own in order to protect water quality and the scenic values of the river. Anthropogenic impacts outside the Project boundary are beyond the realm of what SCE&G can control. Therefore, SCE&G defers to the state and county permitting agencies that are tasked with reducing sedimentation outside of the project's area of influence.

In comments submitted by LMA (submitted via email) they address the Water Quality TWC's discussion on lowering winter lake levels during specific years to benefit water quality. LMA notes their opposition to the proposed periodic drawdowns and makes the following statements explaining such: "Coves that have no stream inflows would not benefit from scouring, especially where the inflow terrain is fairly flat and the velocity of water movement would be insufficient for sediment scouring. Unless there is torrential, high volume rainfall, any scouring will be confined to narrow stream beds and will be of insignificant benefit; Scouring benefits occur at the interface of stream entry to the lake. This dynamic occurs whether the lake level is at 350 msl or at 354 msl. There is no available data that supports a greater benefit of scouring when lake levels are 350 msl versus when lake levels are at 354 msl. There has been no data presented that shows that the recent multi-year draw-down associated with dam remediation provided any benefit that reduced the chances for fish kills. In fact, despite the recent extended drawdown, there was a fish kill in 2007".

The Midlands Striper Club also submitted comments in response to the DLA (letter dated March 12, 2008) that made specific reference to periodic drawdowns for water quality benefits. They note that consensus was reached among the members of the Midlands Striper Club that a periodic winter drawdown for water quality benefits, as discussed by the TWC, should be incorporated into the new license. DNR also references this issue in their DLA comment letter (dated March 14, 2008). DNR notes that they will support operational activities that are deemed necessary to improve water quality within the reservoir.

The Midlands Striper Club also notes in their DLA comment letter that they recommend additional water quality studies be conducted at Lake Murray. They note that additional water quality studies may help identify sources of pollution from Lake Murray tributaries. They also add that there should be coordination with local and state agencies and stakeholder groups to encourage a TMDL for these tributaries.

Discussions with SCDHEC, as mentioned above, indicate that the agency lacks the ability to perform and implement a TMDL at this time. SCE&G will cooperate with DHEC should they decide to pursue a TMDL process for Lake Murray.

In its letter commenting on the DLA (dated March 14, 2008), the National Park Service stated that there may be a misperception regarding the intent of the ESWM process (See initial stage comments, page 2-27). They noted that the NPS has never requested that pre-project hydrology be compared to the current hydrologic record. They further note that "ESWM requires an in depth investigation of the ecological and societal needs of the river and its hydrology".

As discussed above, in the spirit of a Cooperative Enhanced Licensing Process, SCE&G will continue to exchange information through the ESWM Process and will evaluate through the use of the Operations Model flow recommendations provided by the NPS. Further discussion on this is included in section 5.6 of this document.

2.4 Results of Recommended Studies

2.4.1 Lower Saluda River/Congaree River Temperature Study

In comments issued in response to the ICD, the United States Fish and Wildlife Service (USFWS) requested a study to document the extent of downstream influence of coldwater releases from Saluda Hydro (letter dated August 1, 2005). A study plan was developed and approved by the Water Quality TWC on March 13, 2006 (Appendix E-1). The study objective was to characterize the effects of water releases from the Project Dam on the temperature regime of the LSR and Congaree River, including downstream extent of temperature alteration, timing and duration of temperature alteration, and mixing characteristics.

Paired temperature sensors (left and right side of the channel) were deployed at 7 locations along an approximately 55 mile reach of the LSR and Congaree River downstream of Saluda Hydro (extending from the Riverbanks Zoo on the LSR to the Highway 601 Bridge on the Congaree). Sensors also were deployed directly downstream of the Project Dam (to verify data from USGS Gage #02168504) and on the Broad River upstream of the Columbia Diversion Dam. Downstream temperature data were collected from late-March/early-April 2006 through October 2007, as prescribed in the study plan.

Project releases were found to result in cross-sectional differences in water temperature in the Congaree River downstream of the confluence, with the LSR side of the channel being significantly cooler than the Broad River side. Study results suggested that temperature patterns on both banks generally follow a pattern similar to the Broad River, except during periods of generation at Saluda Hydro, during which temperature alterations were detectable throughout the study area. Additional details regarding the findings of this study are provided in the draft report, included as Appendix E-1.

2.4.2 CE-QUAL-W2 Water Quality Modeling of Lake Murray Summer Striped Bass Habitat

Lake Murray has experienced periodic striped bass mortalities in the vicinity of the Saluda Dam during late-summer and early-fall since at least the early 1970’s. This is similarly observed at other reservoirs in the southeastern states, including Lake Norman (NC), J. Strom Thurmond Reservoir (GA), Lake Gaston (VA), and Cherokee Reservoir (TN). Since the SCDNR began tracking the magnitude of these episodes in the early 1980’s, striped bass “die-offs” have been reported in 1989, 1990, 1991, 1993, 1998, 2005, and 2007 (R. Ahle, SCNDR, Memorandum dated March 24, 2006; SCDNR, Press Release #07-255, September 10, 2007). These die-offs have been attributed to water quality impacts associated with stratification of the lake during the summer months. Specifically, striped bass are a coolwater species and thus during the summer months are often restricted to thermal refuge habitat in deeper hypolymnetic waters. During the summer and early fall, DO levels slowly decline in the hypolimnion thus reducing the amount of thermal refuge habitat for striped bass. DO stresses associated with this phenomenon, known as the “temperature-oxygen squeeze,” have been cited as the primary cause for the striped bass mortality events in Lake Murray (Hayes, 1994).

Following the largest documented striped bass kill in 1991 (3,139 fish), the SCDNR speculated that operation of the Saluda Unit 5 may be a contributing factor to the mortality events. Specifically, it was postulated that operation of Unit 5 might reduce the size of thermal refuge areas and increase stress levels on striped bass due to the mid-column depth of the Unit 5 intake (approximately 80ft below typical summer pool of 353.5ft (+/- 3 ft)). In the mid 1990's, SCDNR and SCE&G subsequently agreed to a "last on, first off" operational scenario for Unit 5 aimed at reducing its use during the late summer and early fall. While originally designed to prevent blueback herring entrainment events, it was theorized that the "last on, first off" Unit 5 scenario would also help preserve striped bass refuge habitat and minimize the potential risk of die-offs.

During the current relicensing effort, the SCDNR and other stakeholder groups requested an evaluation of the factors contributing to observed declines in striped bass summer refuge habitat and resulting fish kills, as well as an analysis of the effectiveness of operational measures undertaken to reduce such events (i.e. the "last on, first off" operating regime for Unit 5). The Water Quality TWC subsequently determined that use of the CE-QUAL-W2 water quality model, which had been previously developed and calibrated to the Lake Murray system (Ruane, 2004), would be the best tool for this purpose.

CE-QUAL-W2 water quality modeling results suggested that striped bass fish kills are likely related to high reservoir inflows, in particular high inflows during the months of March through August (Ruane, 2008b). Higher inflows presumably cause the bottom of the lake to warm, which in turn increases the rate of DO depletion. Modeling efforts also suggested that operating Unit 5 in "first on, last off" mode, rather than the current "last-on, first off" mode, could potentially help preserve colder bottom water under some scenarios, resulting in increased available refuge habitat for striped bass (i.e. water with temperature <27°C and DO >2.5 mg/L) during some years. Further, maintenance of the Lake Murray summer pool at elevation 356.5 ft was found to marginally enhance or have no effect on preservation of coolwater refuge habitat, with four of the eight years modeled demonstrating slightly increased volumes of water with temperature

<27°C and DO >2.5 mg/L. Modeling of the combined effects of the Unit 5 "first on, last off" scenario and the 356.5 ft summer pool elevation yielded similar results, with increased refuge habitat observed in three of the eight years modeled. Additional detail regarding the CE-QUAL-W2 water quality modeling efforts aimed at increasing summer refuge for striped bass is provided in the final report (Ruane, 2008b), which is included in Appendix E-1.

2.4.3 Increasing Target Winter Minimum Pool Levels for Normal Operations of Lake Murray

SCE&G commissioned a qualitative risk analysis of the potential effects of increasing the target winter minimum pool level of Lake Murray. The product of that analysis was a whitepaper dated June 3, 2008 (Ruane, 2008a) (Appendix E-1). Over the past 28 years the normal winter minimum pool elevation at Lake Murray has varied between 346.5' and 353.5'. In general, it has reached near 348.5' for about half the years and near 352.5' the remaining years. The summarization of the analysis contained here focuses on the postulated likely effects of consistently increasing the minimum pool elevation to 352.5' or higher every year during the late fall and winter months. In particular, this discussion highlights the author's conclusions relative to the effects of such lake management on inflow sediment deposition, especially in the upper areas of the lake and the resulting impacts to water quality in the lake.

In performing the qualitative analysis, the author applied fundamental principles of sediment settling and scouring, hydrology, and nutrient loading and cycling processes to what is currently known about water quality and sedimentation within Lake Murray and the surrounding watershed. Based on readily available information, the author used observations regarding conditions and operations of other similar reservoirs.

The analysis suggested five probable consequences of increasing minimum winter pool levels, two direct and three derivative. The two direct impacts would be (1) a decrease in sediment scouring and (2) an increase in sediment deposition, particularly in the upper one to two miles of the lake - in the inflow area. Impacts that would derive from this increased sediment accumulation would likely include (1) a decrease in water quality in the lake and Project discharges, (2) an increase in upstream backwater problems leading to more frequent and higher magnitude flooding, and (3) an increase in aquatic plant colonization within the lake. Sediment scour and deposition are described below. That description is followed by a discussion of how increased minimum pool levels likely would affect these processes and lead to negative impacts on water quality, to backwater flooding, and to increasingly problematic aquatic plant invasions.

Sediment Scour

Two distinctly different processes affect the volume of sediment accumulated at the inflow regions to Lake Murray, namely sediment scour and sediment deposition. Sediment scour occurs when water levels are lowered, allowing sediment at the mouth of the tributaries of the lake to be scoured by inflows and re-deposited in deeper regions of the lake. Historically, water level lowering has occurred each year starting in October. The main inflows areas with lower bank gradients are most susceptible to scouring, including the Saluda River, Little Saluda River, Bush Rivers, and Clouds Creek. Inlets areas at tributaries with narrow stream beds closer to the lower end of the lake experience scouring mostly only under high volume rainfall and heavy flow events.

The process of sediment scour is proportional to the amount of flow entering the lake and is influenced by how much and for how long the lake water level is lowered. The most easily scoured material is newly-deposited sediment. The older the sediment is, the more resistant it becomes to scour and erosion (see Golterman, 1975). Once deposition occurs and remains in place for a period of time (i.e., years), there is a limit to how much of it can later be scoured and re-deposited to deeper areas. This has been shown at Brownlee Reservoir (Snake River, ID and OR state line) where the pool level is dropped about 90 feet about every five years. Sediment deposition that occurs for four years is only partly scoured every fifth year when the pool level drops, allowing some to remain and causing constricted flow to the scoured channel. A similar phenomenon occurs at the upper end of Parksville Lake (TN) that has experienced large amounts of exposed sediment deposition over the past 100 years from erosion of the Copperhill basin but is only partly scoured by large inflows each year.

Sediment Deposition

The second process that affects distribution and accumulation of lake sediment is deposition of new material. Sediment loads vary from year to year, depending on the amount and timing of runoff; however, according to a 1974-1975 study, the vast majority of new sediment entering Lake Murray originates from the Saluda River between January and April (January 18, 2008 QPM Presentation, Volume II). The sediment load from the Saluda River to Lake Murray from January to April was estimated to be 161,000 tons, whereas, it was estimated to be only 5,100 tons during the remaining months.

As sediment is transported into Lake Murray from inflow, it begins to settle out as water velocities decrease. This settling point occurs where the faster, shallower river flows meet the stagnant waters of the lake environment. Under current conditions, there are indications that sediment mounds are forming in the Saluda River inflow region of the lake. This accumulation has been observed by SCE&G personal as well evidenced by comparing historic and current lake-bottom elevation levels (Tommy Boozer Pers. Comm. to J. Ruane)(ERC,1976; January 18, 2008 QPM Presentation, Volume II). Measurements of lake-bottom elevations recorded in 1975 and again in 2007 documented a sizable delta of sediment, upwards of 15 feet deep, that has accumulated between four and eight miles below the Saluda River inflow point (Figure 2-1). This deposit and its location are consistent with the sediment load volume estimates from the 1974-1975 study.

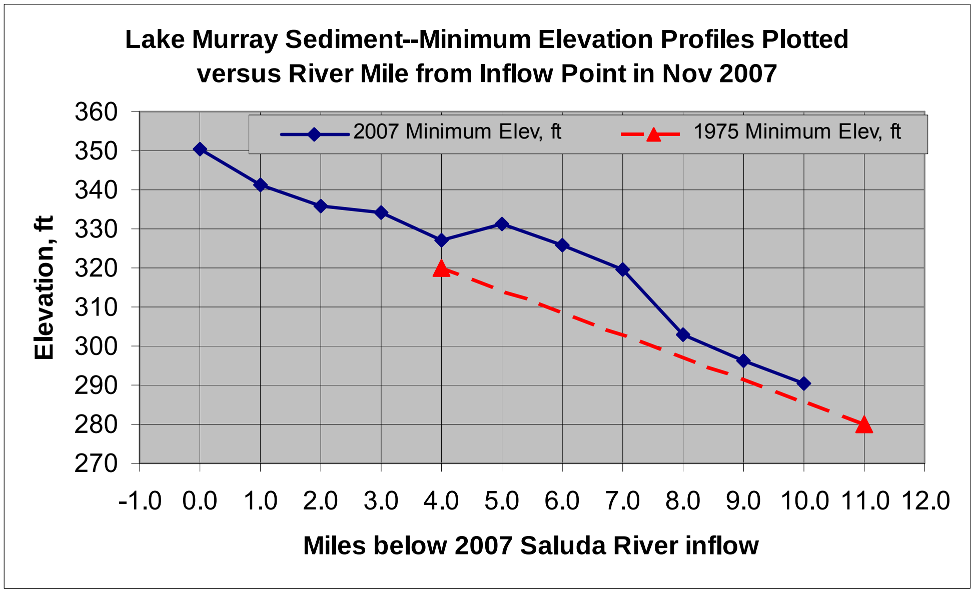


Figure 2-1: Elevation Measurements in 1975 and 2007 in the Upper 11-12 Miles of the Main Channel of Lake Murray Showing the Amount of Sediment Accumulation Over the 32 Year Period
Source (Ruane, 2007 unpublished)

Affect of Increased Minimum Pool on Scour and Deposition Process

Increasing minimum pool elevations during the winter months inescapably will affect both the scouring and deposition process in such a way as to increase sedimentation of the upper end of the lake. When pool levels are increased, water velocities in the inflow region are reduced in regions closer to the point of inflow - as the river flow contacts the pooled water sooner. Slower water has less scouring power and so newly-deposited sediment would accumulate each year the water level is maintained at this higher level.

This occurrence has been recently documented at Smith Mountain Reservoir. Smith Mountain is lowered only five feet each year and it experiences significant problems with sediment deposition that can be attributed to winter minimum pool elevation (Kleinschmidt, 2008).

In addition to less scouring, there would be increased deposition of new sediment under an increased pool-level scenario. Suspended sediment starts settling, and inflowing bedload (sediment that moves along the riverbed) starts depositing, at the first opportunity of lower water velocities. At higher pool levels, lower velocity waters would occur closer to the point of inflow thereby causing sedimentation closer to the upper ends of the lake instead further into the lake. This is in contrast to what occurs when lake levels are brought to lower elevations during the winter months: the sediment-laden inflows travel deeper into the lake body before slowing down enough to allow sediment to settle out. According to the 2007 sediment study conducted by Ruane, the water depth in November at the point of inflow from Saluda River was 1.6 ft deep with pool elevation at 350.7'. If pool elevation had been 352.5' instead, the water velocity would have been about half the speed at this same point. Raising the pool level to 352.5' or 354.5' at the same location would cause a drop in water velocity to 14-33 % of that velocity that had occurred with the pool elevation at 358.5'.

Conditions causing reduced scouring and increased deposition could be further exacerbated under certain management scenarios at Greenwood Pool (Lake Greenwood – FERC Project No. 1267), located upstream on the Saluda River. If Greenwood pool is filled in February, then high inflows to Lake Murray would be postponed, thereby increasing the sediment loading to Lake Murray. Operational changes at the Greenwood project combined with earlier full-pool conditions at Lake Murray (March 1 versus the current April 1 target date) would lead to a significant increase in sediment deposition in the first couple miles of the upper end of Lake Murray.

Based on fundamentals of sediment scour and deposition and relevant case studies, the analysis of effects concludes that raising minimum pool elevation substantially above 348.5' is likely to result in increased sediment deposits in the first one to two miles of the upper end of the lake and for some distance upstream from the lake. However, the precise magnitude and rate of accumulation is uncertain. Should the resulting increase in sedimentation be significant, as is predicted, however, it would result in conditions that contribute to negative impacts including impaired water quality, increased backwater flooding, and increased nuisance aquatic vegetation growth.

Water quality effects of increased sediment in inflow regions

As discussed in Section 2.2.2.13.4, the inflow regions of Lake Murray currently experience impaired water quality due to excess nutrient loading. A primary culprit is the inputs of total phosphorus (TP) from the watershed. Lake water quality is materially affected by sediment transport, especially in shallow water (less than 30 feet deep). Thus, raising the minimum pool level would exacerbate water quality impairment forces within the lake by increasing sedimentation, particularly in shallow water areas in the upper end of the lake. This increase in sediments will in turn contribute to expanding shallow water areas which become water quality impaired, and so on and so on. The risk and fear is that it becomes a self sustaining and expanding process.

Problems with eutrophication[5] in the upper end of Lake Murray arises from nutrient loading and cycling, primarily from Ninety-Six Creek, Bush River, Little Saluda, and Clouds Creek. The process of nutrient cycling occurs as nutrients are taken up by algae, which proliferate then die and decompose. The nutrients and anoxic by-products of the decomposition process are released into the water column and the cycle continues. Shallow water conditions can facilitate this process by providing ample solar radiation and higher water temperatures, leading to increased algal growth. Water quality effects of sedimentation also occur at the sediment/water interface. Sediment 'ooze' contains organic matter such as algae and bacteria. The respiration and decomposition of such organisms release products including ammonia, phosphorus, and methane to the overlying water. These organisms also consume oxygen from the water column (through sediment oxygen demand - SOD). Oxygen exhaustion of the water in turn weakens the ability of sediments to retain nutrients, and so there is an associated release of nutrients back into the water column in response to eutrophication. Thus, internal nutrient cycling can be a significant source of low DO levels and increased nutrient, particularly phosphorus, loading of the water.

[5] The process by which a lake, pond, or stream becomes eutrophic, typically as a result of mineral and organic runoff from the surrounding land. The increased growth of plants and algae that accompanies eutrophication depletes the dissolved oxygen content of the water and often causes a die-off of other organisms.

By raising the minimum pool elevation, more sediment ooze is distributed within the upper reaches of the reservoir. This contributes to increased nutrient releases to the water column and decreased DO levels. Associated decreases in water depth from sediment deposition provides less water to dilute the by-products of nutrient cycling thus, causing proportionally greater impacts to water quality than if water were deeper.

Further, because sediment ooze is sensitive to changes in water velocity, nutrients may be released from the sediment when disturbed by power pulse inflows from Lake Greenwood. Such pulses are cooler than the surface water causing upwelling that could contribute additional P and N (i.e., NH_3) into the surface water layer.

Decreases in water quality in the upper one or two miles of Lake Murray should be anticipated eventually to translate to far-field effects in the deeper regions of the lake where they will have negative impacts upon striped bass habitat and the water quality of tailwater discharges. Impairments of tailrace waters are caused in significant part by eutrophication in the inflow regions of the lake. Organic matter in the upper reaches of Lake Murray also is believed to be a significant contributor to low DO and anoxic products documented at the dam. Therefore, potential accumulation of sediment and organic matter in the upper levels of the lake can impact water quality of striped bass habitat near the dam and water releases from Saluda Hydro.

Backwater effects of increased sediment inflow regions

Constriction of the inflow channel and the resulting restriction of the flushing effects of flood flows are additional probable effects of increasing winter pool level. As explained, suspended solids as well as bedload from watershed erosion would settle and accumulate as they enter the lake closer to the point of inflow. Larger, heavier particles would settle first, making the thalweg (deepest path of the channel) shallower and narrower.

Constriction of the channel due to sediment accumulation would increase elevation of backwaters upstream from Lake Murray as flood flows are restricted at the inflow (compared to current conditions). Increases in the magnitude and frequency of backwater flooding would result. This process would occur at the inflow points of all the major tributaries to Lake Murray. Backwater flooding increases caused by sediment deposition would be proportional to the size of the watershed draining to Lake Murray, and would be particularly notable within the Saluda River.

The phenomenon of increased elevation of backwater curves due to sediment deposits and channel constriction has been documented for the Brownlee Reservoir (Snake River, ID and OR state line) and Parksville Lake (TN).

Affects on aquatic vegetation

As discussed in Section 5.1.13, aquatic weeds periodically cause recreational access issues around the Lake Murray shoreline. One of the strategies employed in the past by SCE&G for combating the spread of invasive aquatic plants has been to lower the lake level below the point of rooting during the winter so that plants freeze and desiccate during cold temperatures. Maintaining an elevated lake level during the winter months will allow unwanted plants to remain submerged and insulated, and thus, protected from extreme temperatures. This in turn contributes to a more abundant aquatic plant population during the primary recreations season.

In addition, shallower water at the inflow areas with more stable sediment deposits compared to the current "shifting sediment" conditions under periodic scouring conditions, could facilitate additional spread of invasive plants. With the potential increase in plant growth, more sediment may accumulate as the vegetation catches sediment from passing water.

Summary

According to the qualitative analysis documented in the whitepaper by Ruane (included in Appendix E-1), there is considerable risk in changing the current operating policy for Lake Murray to raise the winter minimum pool elevation. Data for 1980 through 2007 revealed winter pool level was down to about 350 ± 2' (PD) level about half the time during this time. Analysis of current conditions regarding sediment deposition in the lake, and water quality issues of eutrophication and watershed loading already reveal problems that Ruane believes would be further exacerbated by increasing minimum winter pool levels. The whitepaper recommends maintaining the current schedule and frequency of lake level draw downs in order to avoid increased sedimentation that would lead to further declines in water quality (including deterioration of striped bass habitat), backwater flooding, and invasive species issues.

2.5 Existing Measures to be Continued and New Measures Proposed by the Applicant

SCE&G proposes to install new runners and other associated upgrades to all five units as described in Exhibit A. Until these upgrades are complete, the Applicant proposes to continue with turbine aeration measures (i.e. turbine venting and hub baffles) and operational modifications implemented since 1999 aimed at optimizing DO in Project releases until the Project unit upgrades are determined to sufficiently achieve the DO in-stream standard compliance. Further, SCE&G proposes to meet annually with state and federal resource agency staff, NGO representatives, and other interested stakeholders to review the status of water quality enhancement efforts, and if deemed necessary, to update the "look up" tables based on any new pertinent testing or operational data. As previously noted, the "look up" tables were developed in recent years to provide guidance to SCE&G System Operators regarding the unit and gate setting combinations that provide the greatest DO enhancement under various operating scenarios.

Finally, SCE&G proposes to change the operation of Unit 5 from the current "last on, first off" scenario to a "first on, last off" scenario for much of the year to aid in preservation of coolwater refuge habitat for striped bass in the reservoir during summer months when the lake is stratified. This proposed change in operation will take effect upon completion of runner upgrades to unit 5, anticipated to be completed within 3 years after issuance of the new license. For generation flows (flows in excess of minimum flows), SCE&G proposes to operate Unit 5 preferentially as "first on, last off" from November 1 through July 31 of each year and the bottom-oriented units preferentially as "first on, last off" during the months of August through October. The Unit 5 withdrawal zone is located at mid-column (at a depth of approximately 80 ft below typical summer pool), while the remaining units have near-bottom withdrawal zones. Water quality modeling conducted in support of relicensing suggests that preferential operation of Unit 5 would help preserve the volume of cool, hypolymnetic water available during the summer months, resulting in more available coolwater refuge habitat for striped bass (<27°C and DO >2.5 mg/L). Conversely, modeling results also suggest that use of the bottom oriented units (1, 3 & 4) during the late-summer and fall for generation flows would ensure temperatures protective of the LSR trout and reduce the possibility of blueback herring entrainment issue since they congregate in front of Unit 5 around the August/September time period. Additional details regarding water quality modeling are provided in Section 2.4.2.

As SCE&G moves forward with the proposed upgrades of the Unit 5 runner, the scenario of using Unit 5 for minimum flows at any time during the year will not be proposed in order to avoid potential damage to the new generating equipment. This is due to hydraulic modeling that has suggested the potential for significant unit cavitation at certain gate settings should Unit 5 be used for minimum flow conditions. For further information on upgrades to Unit 5, please refer to Exhibit H.

SCE&G proposes to maintain the summer pool elevation at 356.5 ft for a longer period, from March 1 through the beginning of September (after Labor Day), to achieve the enhancements of preservation of the coolwater refuge habitat. SCE&G proposes to implement these proposed changes after issuance of a new FERC license for the Project. Furthermore, the Applicant is considering an increase in the winter minimum pool level for normal operations of Lake Murray.

2.6 Anticipated Effects

Lake Murray will continue to experience thermal and chemical stratification during the summer months, resulting in periods of low hypolymnetic DO and high surface temperatures. These conditions have been shown to result in reduced availability of thermal refuge habitat for striped bass (i.e., temperature <27°C and DO >2.5 mg/L), particular during high inflow years (Ruane, 2008; Section 2.4.2). This phenomenon, known as the “temperature/DO crunch”, resulted in striped bass fish kills in the Lake Murray forebay during some years (1989, 1990, 1991, 1993, 1998, 2005, and 2007). While periods of reduced summer refuge habitat for striped bass will undoubtedly occur again in the future, SCE&G’s proposal to operate unit 5 in a preferential “first on, last off” scenario, rather than the current “last-on, first off” mode, will likely aid in minimizing the potential for future impacts under certain scenarios. The Unit 5 withdrawal zone is located at mid-column (at a depth of approximately 80 ft below typical summer pool), while the remaining units have near-bottom withdrawal zones. Water quality modeling conducted in support of relicensing suggests that preferential operation of Unit 5 would help preserve the volume of cool, hypolymnetic water available during the summer months, resulting in more available coolwater refuge habitat for striped bass. Conversely, modeling results also suggest that use of the bottom oriented units (1,3 & 4) during the late-summer and fall, for both minimum and generation flows, would ensure temperatures protective of the LSR trout. Additional detail regarding the water quality modeling and proposal are provided in Sections 2.4.2 and 2.5, respectively.

Stratification of the Lake Murray during the summer months will likely continue to result in periodic hypolymnetic releases to the LSR that are low in DO. However, recent installation of aeration equipment on Project turbines (hub baffles and turbine venting) and development of operating scenarios that optimize the aeration efficiency of the turbines (“look up” tables) have drastically reduced the magnitude, frequency and duration of such episodes. SCE&G’s proposal to continue turbine aeration and to continue to further refine operating scenarios that optimize the turbine aeration is expected to result in continued improvements in DO, which will undoubtedly enhance habitat for aquatic biota and aid in ensuring that the site-specific water quality standard for the LSR is met. Finally, implementation of minimum flows in the LSR will likely result in improved DO due to natural aeration associated with increased turbulence in shoal areas.

As discussed in detail in Section 2.4.3, SCE&G has commissioned a qualitative risk analysis of the potential effects of increasing the target winter minimum pool level of Lake Murray. Results from this analysis postulated that maintaining a winter minimum pool elevation on a consistent basis at 352.5’ has the potential to result in detrimental effects to water quality. It is explained within the analysis that an assessment of current water quality conditions in the lake, such as sediment deposition, eutrophication and watershed loading, is revealing problems that may be further exacerbated by stabilizing minimum winter pool levels. Furthermore, the analysis notes that an increase of winter minimum pool levels would likely result in an overall decrease in sediment scouring, thus increasing highly organic sediment deposition , especially in the upper reaches of Lake Murray. As a result of increased sediment deposition in the upper regions, a degradation of water quality, specifically dissolved oxygen levels, in Lake Murray potentially could occur and therefore in the Saluda Hydroelectric releases into the LSR. Other probable effects of increased sediment deposition would include an increase in upstream backwater problems leading to more frequent and higher magnitude flooding, and potential impacts to recreational use.

2.7 401 Water Quality Certification

SCE&G's is planning to file its application for 401 Water Quality Certification with SCDHEC within 60 days of the date that the FERC issues public notice (the REA notice) that the Application is ready for environmental analysis.

2.8 Comprehensive Plans

South Carolina Department of Health and Environmental Control. 2004. Water Classifications and Standards Regulation 61-68. Columbia, South Carolina. June 2004. 60 pp.

The 2006 version of the South Carolina Regulation 61-69 Classified Waters (DHEC, 2006) which provides site specific standards, was also reviewed in relation to the Project. Both of these documents have applicability to the Project as there is a specific interest in maintaining the water quality criteria explained in the 2004 document and listed site specifically for the LSR and Lake Murray in the 2006 document. SCE&G strives through the operation of the Project and the installation of additional dissolved oxygen enhancement measures, occurring in approximately 1998, to maintain the water quality standards set up by DHEC in the LSR. SCE&G also seeks to maintain water quality in Lake Murray to the extent that they can reasonably affect through the implementation of vegetated setbacks and education through the SMP.

South Carolina Department of Health and Environmental Control. 1994. Statewide water quality assessment, FY 1992-1993: a report to Congress pursuant to Section 305(b) of the Clean Water Act. Columbia, South Carolina. March 1994. 165pp.

This report contains information on pollution control programs in South Carolina and an evaluation of data collected over a five year period. The report notes that between 1992 and 1993, 87% of all waters in the state of South Carolina had water quality that fully or partially supported their classified uses. Lake trophic status ratings are listed, and at this time Lake Murray, near the dam, received a III and an index of 393 which can be interpreted as the highest water quality classification given. However, this report lists the headwaters of Lake Murray and the Little Saluda River arm of Lake Murray a II, and the Bush River arm of Lake Murray a I. Although SCE&G has no control over waters outside of the Project boundary, SCE&G seeks to reduce non-point source pollution input within the Project through implementation of vegetated setbacks and the SMP on SCE&G owned lands. SCE&G has also employed the use of the previously discussed W2 model to determine if Project operations could be altered (i.e. periodic drawdowns to elevation 348.5' (350' PD) in order to prevent further water quality degradation in the upper reaches of the reservoir. Should SCDHEC require, as a condition of the water quality certificate issued under section 401 of the Clean Water Act, periodic drawdowns for water quality maintenance, SCE&G would comply with those requests. This issue has been discussed in the TWC, and several entities (including resource agencies) have expressed their support if the Applicant would propose a periodic water quality drawdown be incorporated into the new license.

South Carolina Department of Health and Environmental Control. 2006. SC Non-point source management program, 2006 Annual Report. Columbia, South Carolina. 44 pp.

This document provides a comprehensive approach to addressing non-point source pollution affecting the waters of the state of South Carolina. Specific long-term goals for a reduction or the prevention of non-point source pollution are identified, as well as an action plan for achieving these goals. As discussed above, although SCE&G has no control over waters outside of the Project boundary, SCE&G seeks to reduce non-point source pollution within the Project through implementation of vegetated setbacks and the SMP on SCE&G owned lands.

South Carolina Department of Natural Resources. 2004. South Carolina Water Plan – Second Edition. Columbia, South Carolina. January 2004

The South Carolina State Water Plan serves as a guide for the management of both the surface and ground water supply of South Carolina, while ensuring the protection of water resources for future use. More specifically relating to the Saluda Project, the Water Plan outlines specific goals for FERC licensed reservoirs and their operations during drought situations through water-sharing strategies. The Water Plan notes the importance of the involvement of DHEC and DNR during project relicensings so that reservoir release schedules, lake levels and management guidelines may be discussed.

The Water Plan further emphasizes the importance of the flexibility of reservoir operations in the FERC license. It notes that resource managers are better able to react to changes in water availability or demand when flexibility is incorporated into reservoir operations. Through the current relicensing of the Saluda Project, members from both DNR and DHEC have been highly involved in issue discussions and resource meetings. Input on proposed guide curves, Low Inflow Protocol (LIP), minimum flows, and operations have been received and taken into account from both agencies.

South Carolina Water Resources Commission. National Park Service. 1988. South Carolina Rivers Assessment. Columbia, South Carolina. September 1988. 249 pp.

The purpose of this report is to analyze the significance of South Carolina rivers and river segments as they relate to natural, economic, cultural and recreational values. In this assessment the Saluda River was found to possess 11 of the 14 resource values analyzed. SCE&G seeks to maintain the resource values to the extent it has control over through provision of adequate recreation sites and the protection of scenic qualities through the implementation of a 100 foot vegetated buffer on SCE&G owned LSR properties.

National Park Service. 1982. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. January 1982.

The Nationwide Rivers Inventory was reviewed for applicability to the Project. Similar to the South Carolina Rivers Assessment, this plan is a listing of river segments that are found to possess specific significant natural or cultural resource values. This plan describes the LSR as providing “scenic wilderness experience in urban areas; diversified flora and fauna”. As discussed above, SCE&G seeks to maintain the resource values to the extent it has control over through provision of adequate recreation sites and the protection of scenic qualities through the implementation of a 100 foot vegetated buffer on SCE&G owned LSR properties. Further, SCE&G is proposing preliminary minimum flows which are consistent in meeting the goals set forth in the Plan.

2.9 Water Use and Quality Tables

Table 2-1: Major Wastewater Dischargers and Number of Minor Dischargers in the Watersheds of Lake Murray (Downstream from Greenwood Dam) and dischargers in the LSR

	MILLION GALLONS/DAY	NUMBER OF MINOR DISCHARGES
Discharges Into the Lake Murray Watershed		
Ninety-Six Creek Watershed		12
City of Greenwood/Wilson Creek Plant	12.0	
Bush River Watershed		2
City of Newberry/Bush River Plant	3.22	
Laurens County WRC/Clinton	2.75	
Little River Watershed		10
City of Laurens	4.5	
Little Saluda River Watershed		3
Lake Murray Watershed		3
Dischargers Into the LSR		
Woodland Utilities, Inc.	n/a	n/a
Carolina Water Service, Inc.	1.2	n/a
Bush River Utilities	n/a	n/a

Table 2-2: Number of Locations and How Water Uses were Supported Based on the 1995 and 1998 SCDHEC Reports

	1995		1998	
	Aquatic Life	**Recreation**	**Aquatic Life**	**Recreation**
Lake Murray				
Fully supporting	5	6	1	6
partially supporting	1, M[*]		2, M[*]	
Not supporting			3, M[*]	
Embayments				
Fully supporting	6	6	4	6
partially supporting				
Not supporting			2, M[*], N[**]	
Selected Inflows				
Fully supporting	6	3	4	3
partially supporting	3, DO	2, FC[***]	2, M[*], DO	2, FC[***]
Not supporting		4, FC[***]	3, M[*]	4, FC[***]
Tailwater				
Fully supporting	1	2		1
partially supporting		1, FC[***]	1, DO	2, FC[***]
Not supporting	2, DO		2, DO, pH, M[*]	
SUMMARY OF USES & CAUSES				
Fully supporting	18	17	9	16
partially supporting	4	3	5	4
Not supporting	2	4	10	4
Metals	1		11	
Fecal Coliform		7		8
DO	5		3	
Nutrients			1	

[*] M indicates metals are the cause
[**] N indicates nutrients are the cause
[***] FC indicates fecal coliform were the cause

Table 2-3: Percent Contributions to the Upper Regions of Lake Murray of Total Phosphorus Loadings and Mean Stream Flows Found Conducting CE-QUAL-W2 Model (Ruane, 2004)

LAKE MURRAY TRIBUTARY	MEAN STREAMFLOW (percent)	PHOSPHORUS LOAD (percent)	RATIO OF PHOSPHORUS LOAD TO FLOW (percent)
Bush River	4	18	4.5
Little Saluda River	7	12	1.7
Clouds and West Creeks	4	9	2.2
Ninety-Six Creek	5	34	6.8
Little River	7	6	0.9
Saluda River	68	15	0.2
All Other Flows	5	6	1.2

2.10 Water Use and Quality Figures

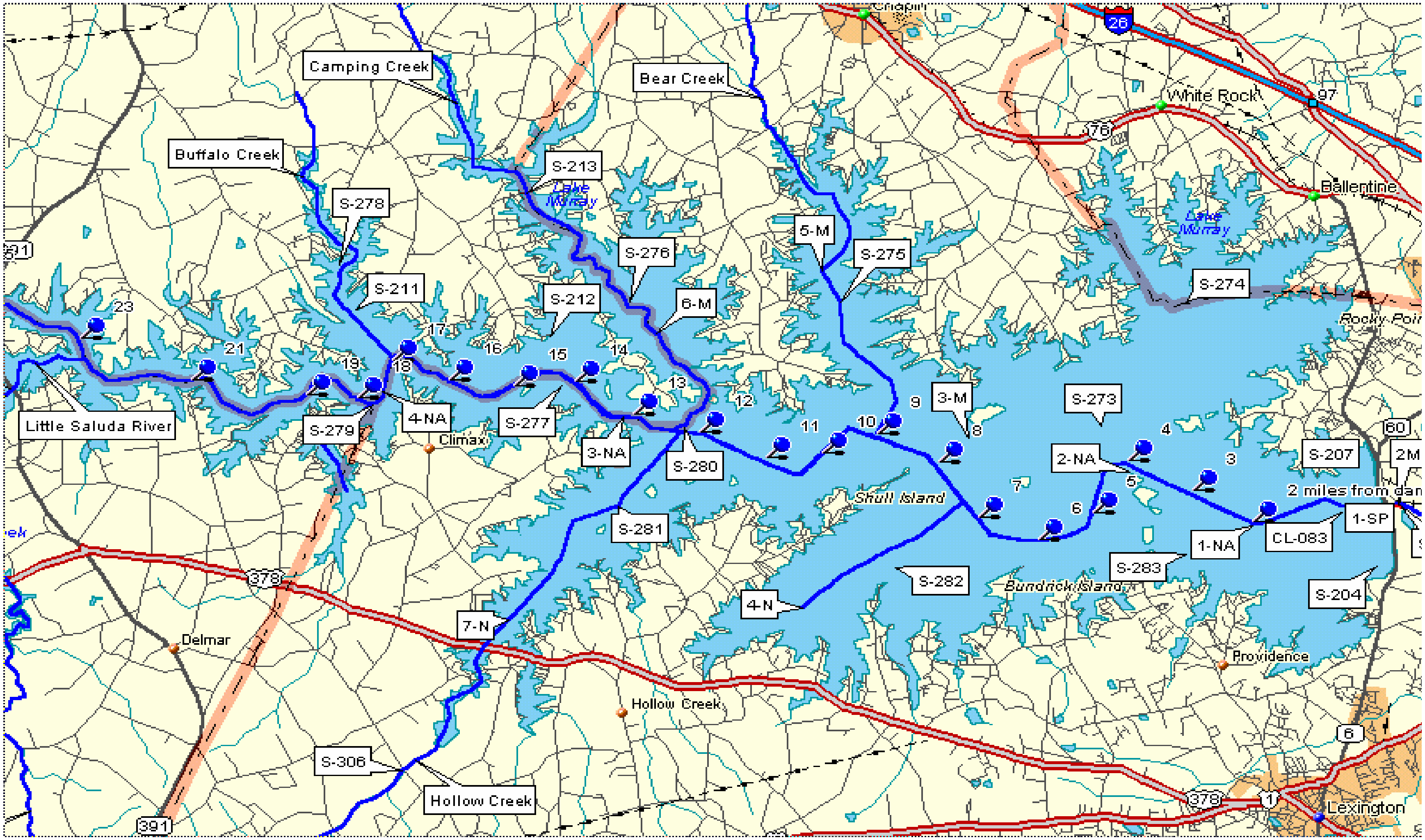


Figure 2-2: Saluda River from its Confluence with the Little Saluda River to the Saluda Hydroelectric Project Dam, Including Lake Murray and Mile Markers Showing Distance Upstream from Dam

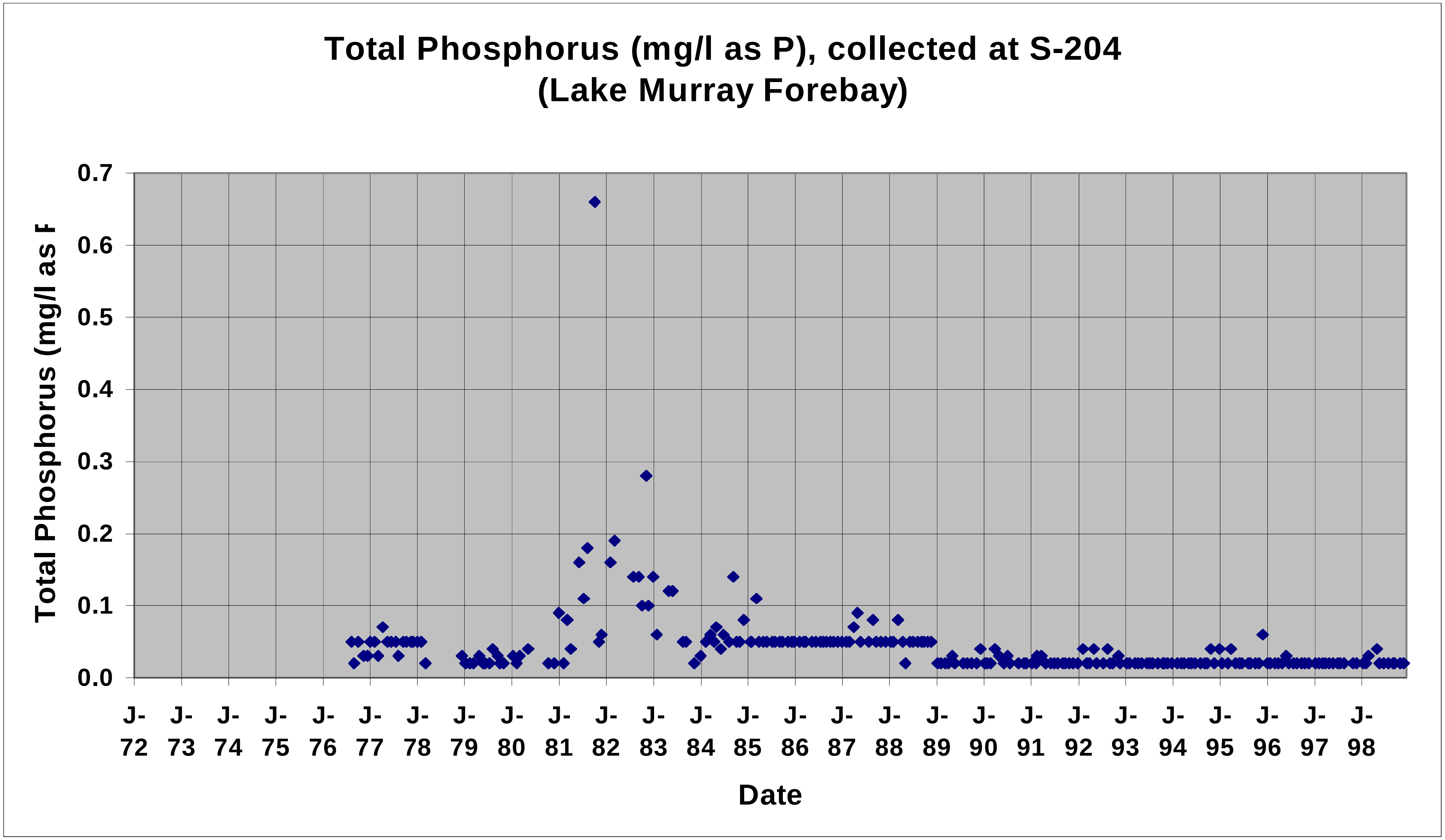


Figure 2-3: Total Phosphorous Concentrations at the Dam Forebay of Lake Murray – 1972 To 1998

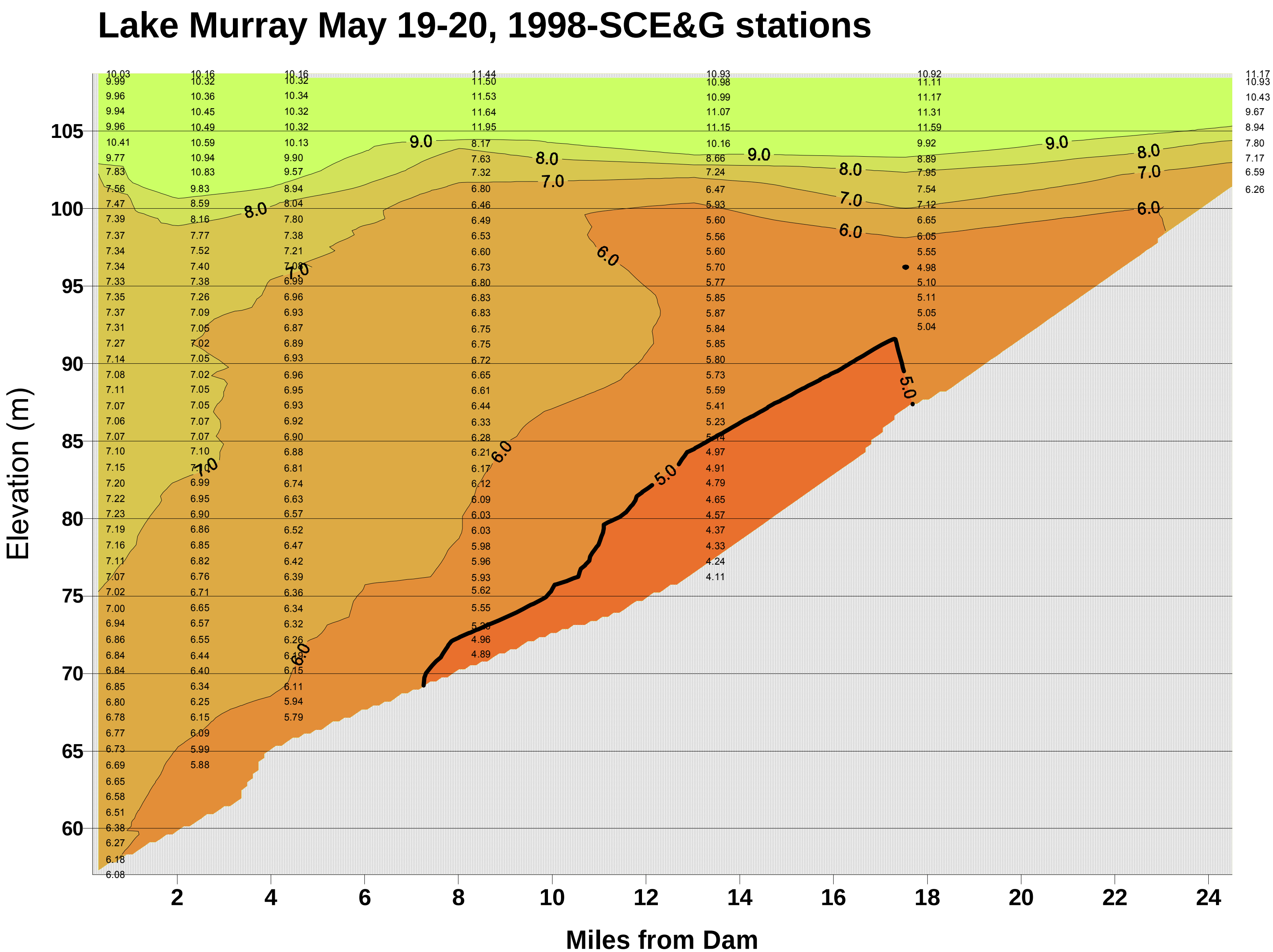


Figure 2-4: Longitudinal Contour Plot of DO in Lake Murray for May 1998

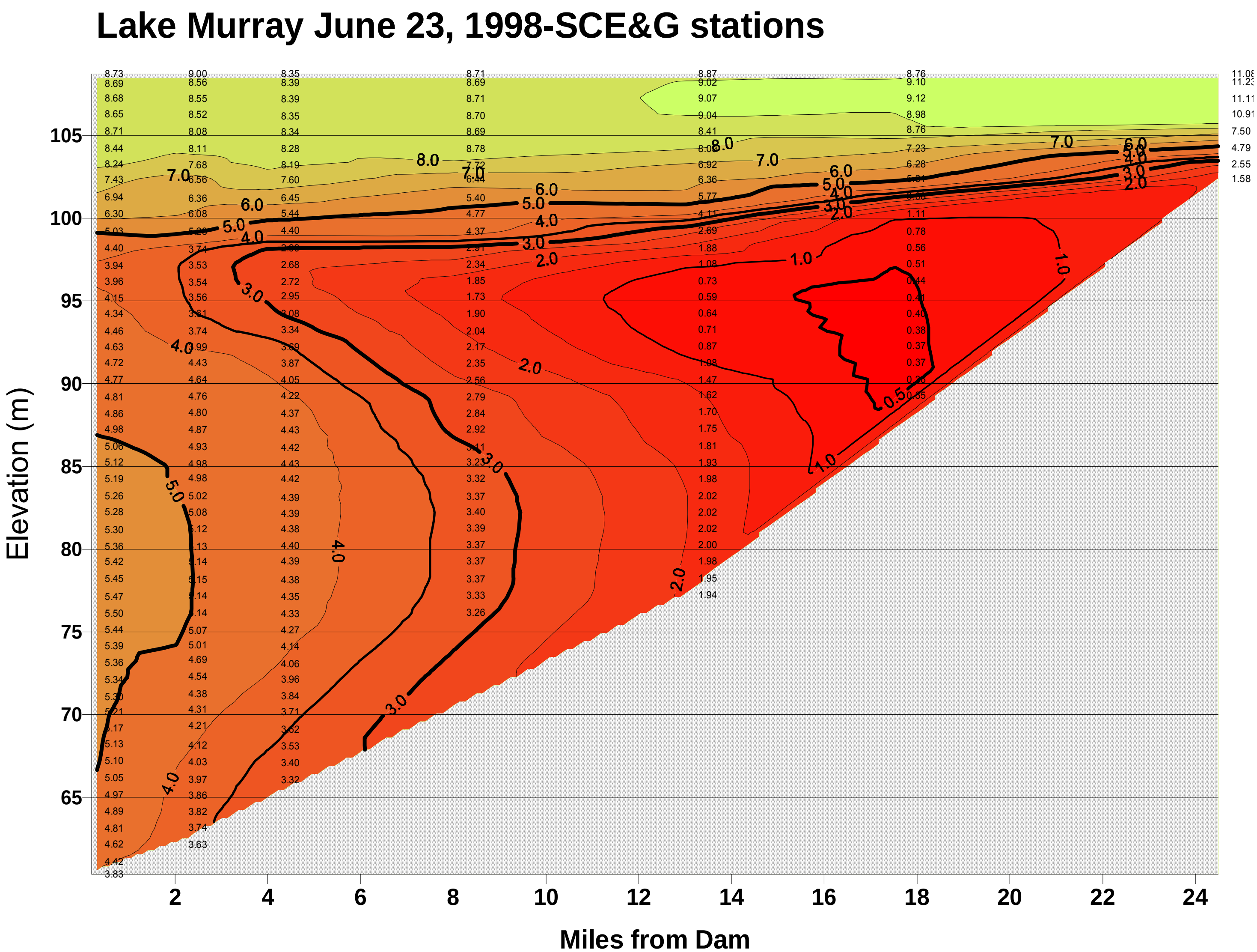


Figure 2-5: Longitudinal Contour Plot of DO in Lake Murray for June 1998

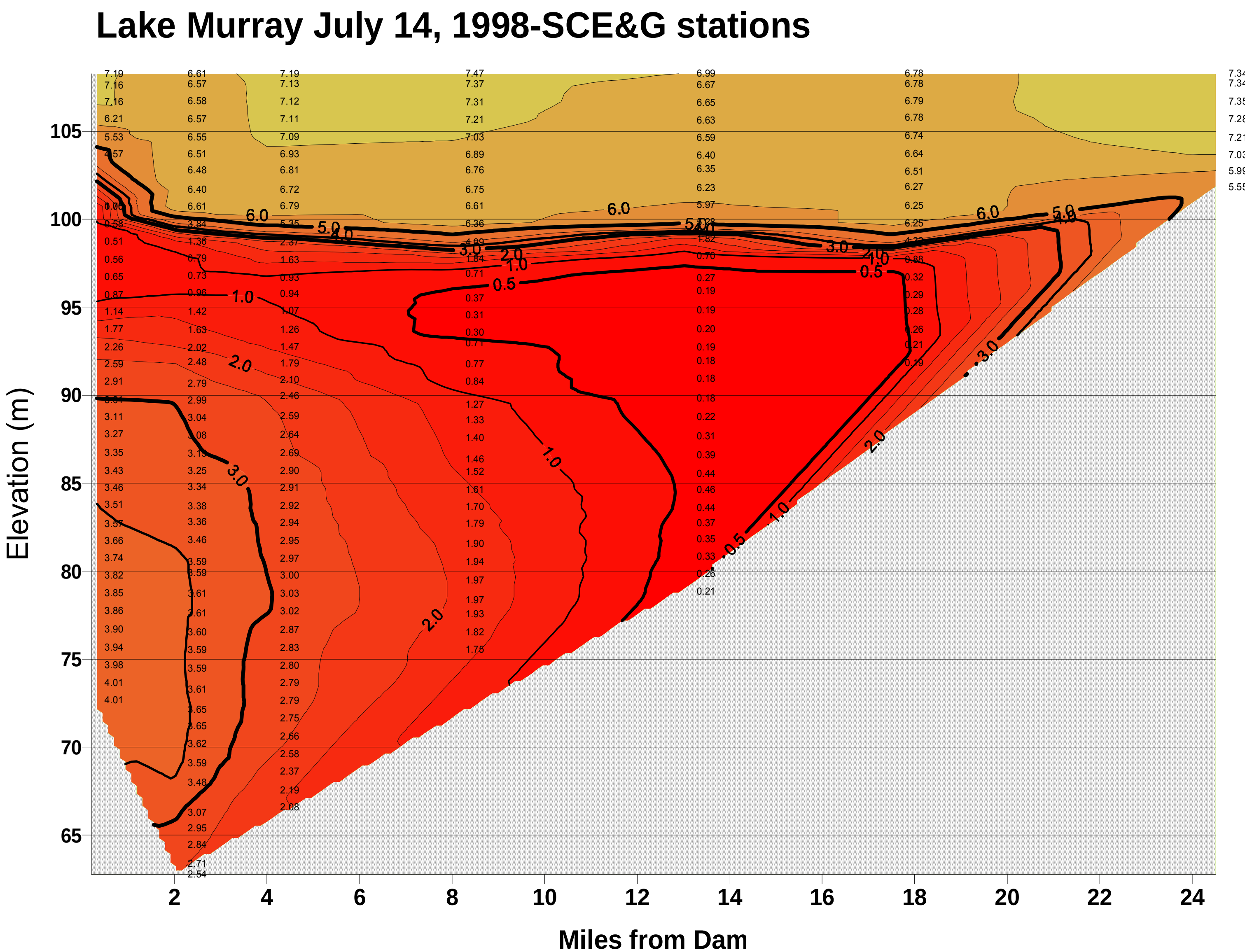


Figure 2-6: Longitudinal Contour Plot of DO in Lake Murray for July 1998

Lake Murray August 11, 1998-SCE&G stations

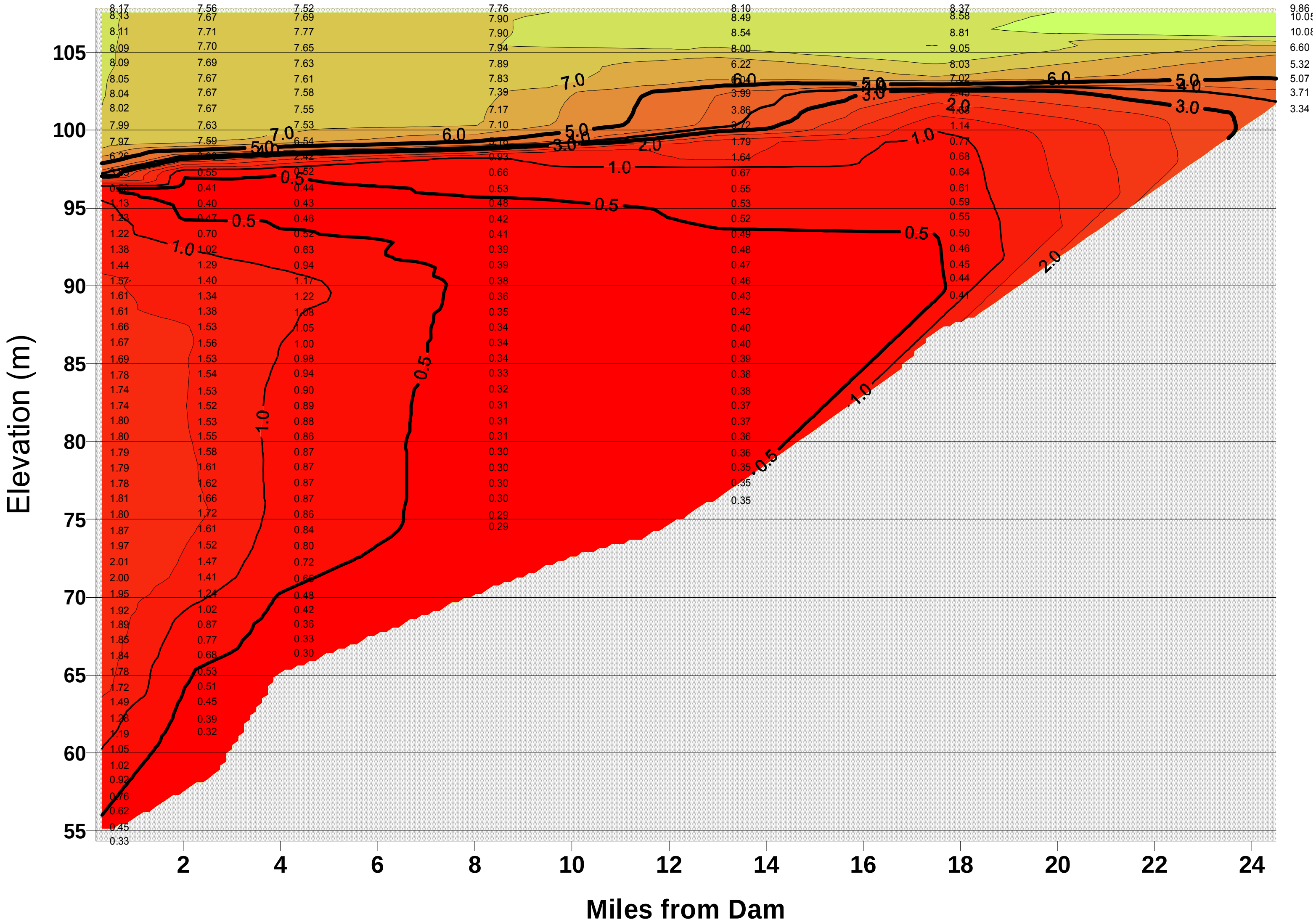


Figure 2-7: Longitudinal Contour Plot of DO in Lake Murray for August 1998

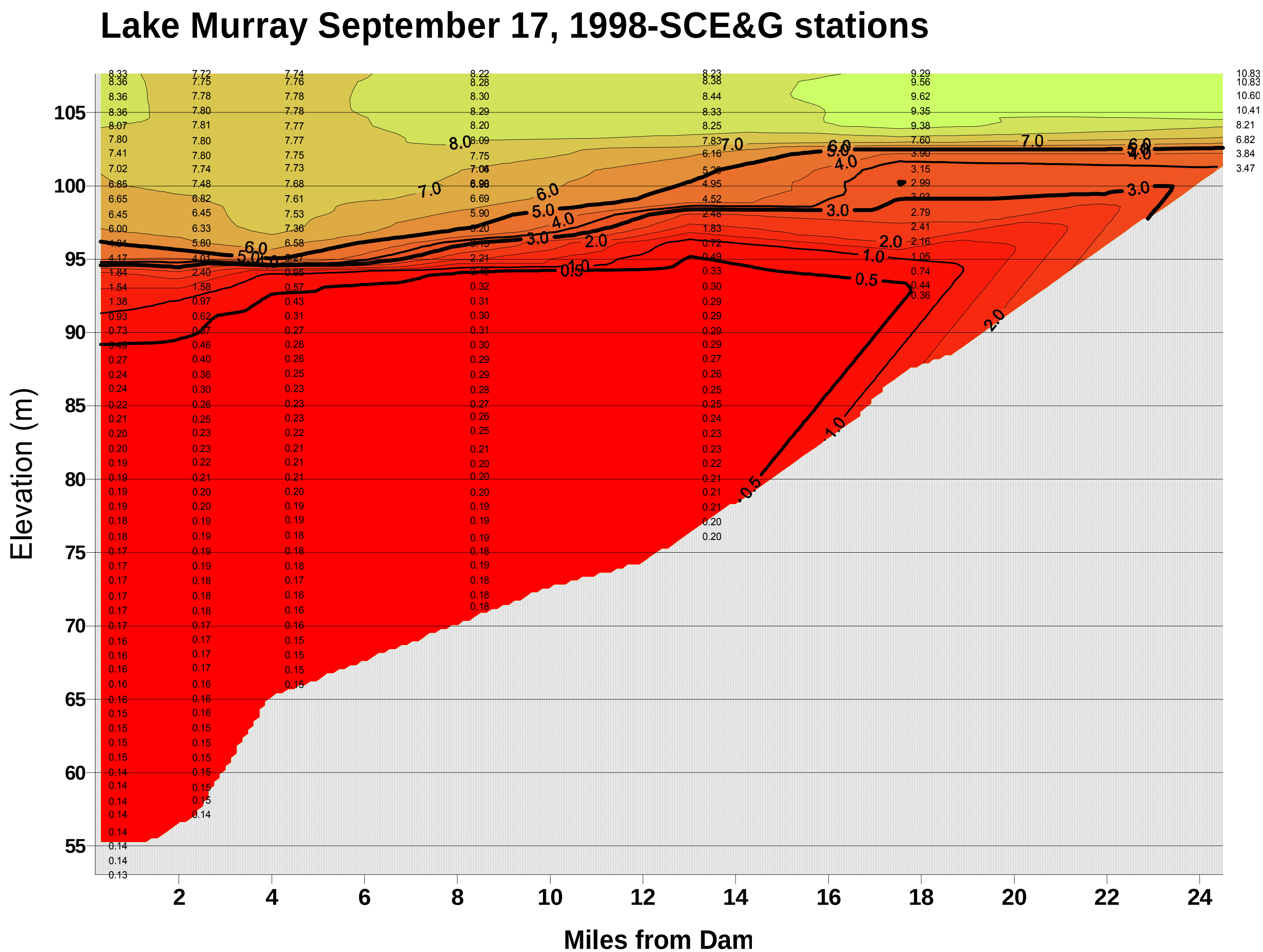


Figure 2-8: Longitudinal Contour Plot of DO in Lake Murray for September 1998

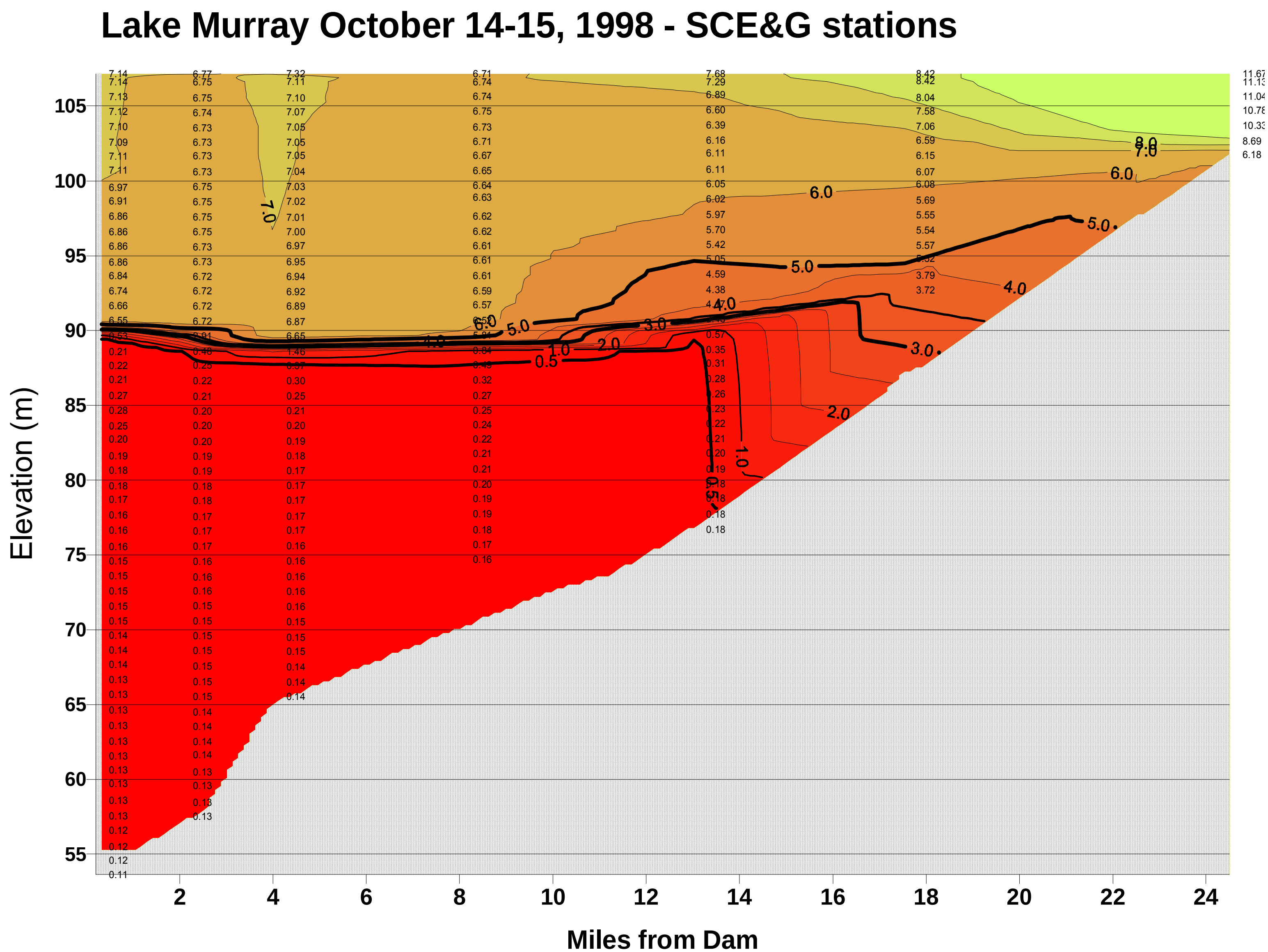
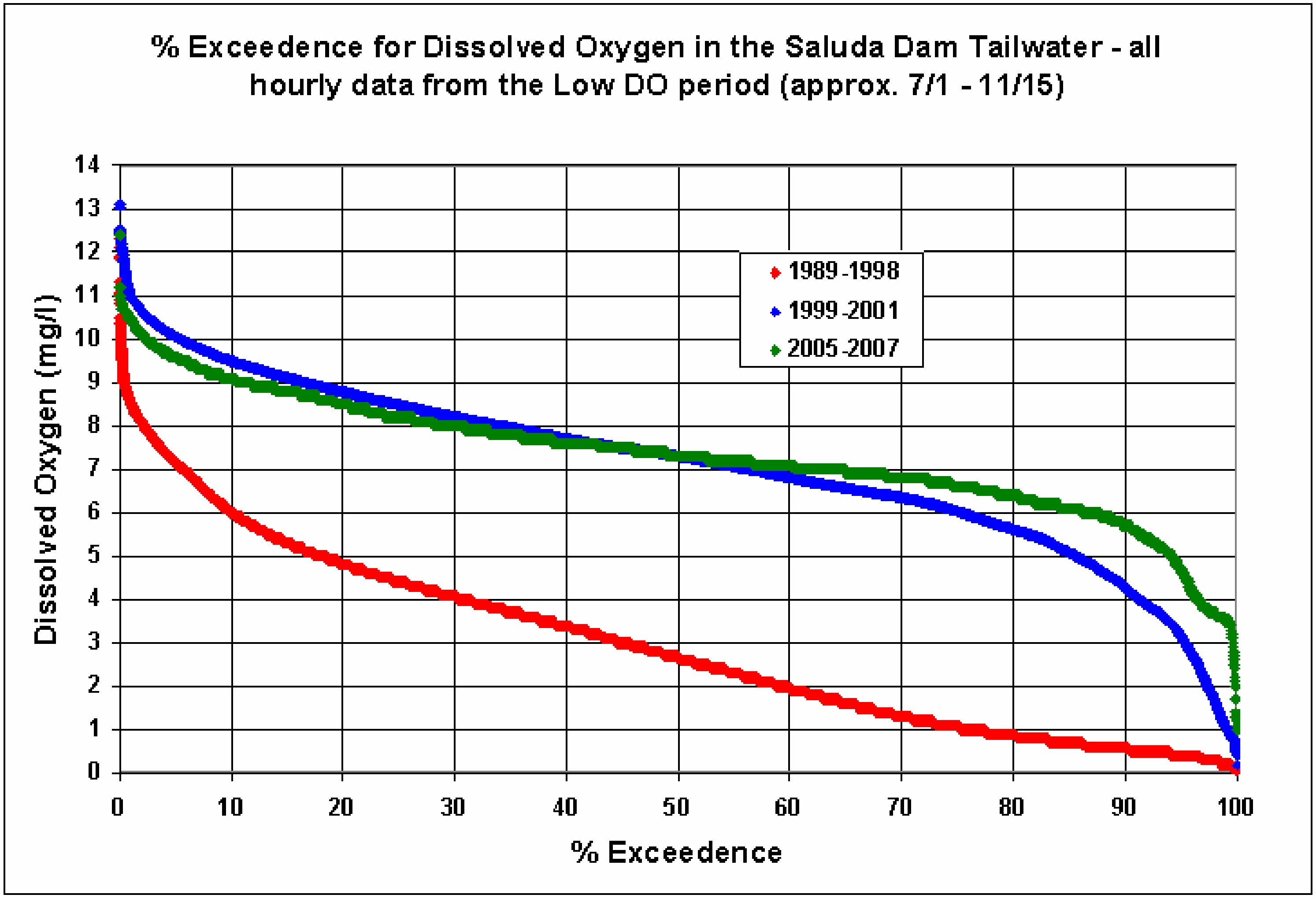


Figure 2-9: Longitudinal Contour Plot of DO in Lake Murray for October 1998



* The 2005-2007 frequency plot does not include data for the turbine venting test periods or when the monitor was fouled

Figure 2-10: Percent Exceedance for DO in the Saluda Dam Tailwater – All Hourly Data from the Low DO Period (Approximately July 1 – November 15 of Each Year)

3.0 AQUATIC RESOURCES

The Project area provides an abundance of aquatic habitat. Habitat in Lake Murray varies substantially from shallow coves and *wetlands* to vast open water with an abundance of diverse structure. The lake has a maximum depth of 189 ft at an elevation of 356.5'[6], but also has an extensive, shallow *littoral* fringe (See Descriptions of Environmentally Sensitive Areas, Section 5.1.3, for additional detail). This varied habitat within the Project boundary, including both Lake Murray and the LSR, supports a diverse aquatic community and popular and valuable sport fisheries.

The LSR flows southeasterly through a river corridor that gradually shifts from rural to suburban to urban land uses, and, in general, the river banks and riparian zones are forested. Overall, the river is relatively straight, with gentle bends and little sinuosity. The upper segment of the LSR is dominated by well-defined banks, relatively low-gradient pools and glides periodically segmented by short shoals and alluvial riffles. The lowermost segment also contains pools, glides and runs, but exhibits higher gradient, more pronounced riffles, and features ledge and boulder substrates, which reflect down cutting through the piedmont terrace at the fall line. There is some evidence of localized bank erosion and ephemeral alluvial shoaling. Beginning downstream of Riverbanks Zoo, the LSR becomes highly braided, with the lowermost mile becoming backwatered by the Broad River (Isely, et. al, 1995). There are a few scattered islands with pronounced side channels and/or braids in both the upper and lower reaches of the LSR.

3.1 Lake Murray Fishery Resources

The fisheries community of Lake Murray is typical of many reservoirs in the southeastern United States. Approximately forty species representing 12 families have been documented in Lake Murray, seven of which are considered game fish (Hayes and Penny, 1993; ERC, 1976;

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[6] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

Table 3-3). The most sought after game fish include largemouth bass, striped bass, white perch, black crappie, and redear and bluegill sunfish (Hayes et al., 2001; Hayes et al., 2002; Hayes, 1994). At least 16 resident species of forage fish occur in the Lake Murray waters, with 10 of these species belonging to either the minnow family (Cyprinidae) or perch family (Percidae). Fish growth in these waters is generally considered to be excellent and has produced fish of large size setting state records (Mead and Hunt, 2002).

Threadfin shad are the primary prey species and dominate the clupeid prey base in Lake Murray (Hayes, 1994). The importance of this species as a food source for striped bass has been documented by the SCDNR in food habit studies (Hayes and Penny, 1991). Since threadfin shad are relatively small (rarely exceeding 3 inches) and very prolific, they provide a stable and readily available food source for most predatory species in Lake Murray. Ichthyoplankton studies conducted in the 1990's suggest that threadfin shad make up approximately 80 % of the lake's larval fish densities (Hayes, 1994).

Gizzard shad is the second most abundant clupeid found in Lake Murray and has historically comprised a significant portion of total fish biomass in cove rotenone studies by SCDNR (Hayes and Penny, 1992). Due to the rapid growth rates of gizzard shad, only the larger predatory species can use this species as prey.

Blueback herring have also been documented in Lake Murray since the mid-1980's (Hayes, 1986) and likely contribute significantly to the prey base. Blueback herring are used extensively as bait for striped bass, and a significant commercial bait fishery has developed, although, the SCDNR reports that this fishery is seasonal and does not meet the demand of the market (Hayes, 1990). During the summer months, blueback herring tend to congregate near the Saluda (Lake Murray) Dam searching out coolwater habitats. In September 1990, a significant entrainment event of blueback herring occurred at the Saluda Hydro Plant (Hayes, 1994). This entrainment event was attributed to the species' water quality preferences, which placed them in the vicinity of the intake tower for Unit 5. In an effort to prevent future entrainment events, SCE&G installed hydroacoustic transducers near intake tower number 5 during July 1992 to monitor late season movements of blueback herring. When acoustics indicate that blueback herring are congregated near the Unit 5 intake, SCE&G ceases operation of the unit except for emergency operating situations. Since its installation, no significant blueback herring entrainment events have been reported by the SCDNR.

Since its original stocking in 1960, Lake Murray has come to support a significant striped bass fishery. In fact, the striped bass fishery has developed into one of the premier fisheries on the lake, with approximately 1/3 of the angling effort and more than $1.4 million directed towards the species when the last creel survey was conducted in 2000 (Hayes et. al., 2000). Currently, SCDNR limits the number of fish that can be taken from Lake Murray to 5 fish per day per angler, with a minimum length of 21 inches (SCDNR, 2007). The striped bass fishery in Lake Murray is not a self sustaining fishery and must be maintained through stocking efforts. Since 1971, over 30 million striped bass have been stocked in Lake Murray at rates varying from a low of 8,800 in 1986 to a high of 1,771,761 in 1983. Studies by SCDNR in 1999 found increased striped bass densities despite recent decreases in stocking rates (Hayes et al., 2000).

As previously noted, striped bass die-offs occasionally occur in Lake Murray. Results of the recent water quality modeling efforts, as well as potential alternative operating scenarios aimed at maximizing summer striped bass refuge habitat, are detailed in the Section 2.4.2 (Water Quality).

3.2 Lower Saluda River Fishery Resources

The LSR fishery community is unique in that it provides fishing opportunities for both resident warmwater species, as well as stocked coldwater species (trout). The LSR currently supports a tailrace trout fishery for rainbow and brown trout that is managed by the SCDNR as a Put, Grow and Take fishery. This management approach, which has been employed since the 1960's, is appropriate where trout habitat is marginal but can provide the acceptable growth and survival of enough sub-adult trout to support a fishery (D. Christie, SCDNR, Pers. Comm.). Similarly, the LSR is classified by the SCDHEC for regulatory purposes as Put, Grow, and Take Trout Waters, which are defined as freshwaters suitable for supporting the growth of stocked trout populations and a balanced, indigenous aquatic community of fauna and flora (SCDHEC, 2004).

Trout are not native to the LSR, and the fishery is maintained through stocking of sub-adult rainbow and brown trout. Presently, the SCDNR stocking program runs from early December until mid-April. The total number of trout stocked annually typically averages around 35,000, but varies annually based primarily on availability of fish from the Walhalla State Fish Hatchery. Approximately two-thirds of the trout stocked annually are rainbow trout (typically 9-10 inches in length), with the remainder being 7-8 inch brown trout (H. Beard, SCDNR, unpublished data). Angler creel surveys conducted in 1995-97 indicated a pronounced seasonal fishery that coincides with the stocking season (H. Beard, SCDNR, Pers. Comm.).

A growth study conducted in 2003 in support of establishment of a site-specific DO standard for the LSR found that growth of trout in the LSR exceeds many other southeastern tailwaters (0.7 percent weight gain per day, 0.67 inches per month) (Kleinschmidt et al., 2003). Further, the study found that 74 of 441 brown and rainbow trout collected during 2003 were greater than 16 inches in length, suggesting a significant number of carryovers from previous stocking years. The study concluded that the high growth rates and large number of carryovers observed in 2003 could potentially be attributed to higher DO levels since the inception of SCE&G's turbine venting program (Kleinschmidt et al. 2003). Conversely, a recent study begun by SCDNR to evaluate the annual mortality of the stocked trout in the LSR documented slightly less carryover of trout during the spring and summer of 2007 (H. Beard, SCDNR, Pers. Comm.). Disparity between study results suggests that there may be significant annual variability in carryover.

The LSR resident warmwater fish community is typical of many southern tailwater systems, and includes an assortment of resident game and non-game species (Crane, 1987; Jöbsis, 1991). Studies conducted as early as 1991 detected approximately 50 species of fish, 48 of which are considered endemic to the region (Jöbsis, 1991). Redbreast sunfish were the most abundant game species collected in the 1991 study. Bluegill were also typically collected in relatively high abundance but abundance was highly variable based on specific habitat types (Jöbsis, 1991). Redbreast sunfish were dominant in the upper sections but not the lower and middle sections. LSR redbreast sunfish exhibited slower growth rates when compared to growth rates of other rivers in the southeast (Jöbsis, 1991); however, this is not surprising since coldwater temperatures have been shown to limit growth of warmwater fish in similar watersheds (Ruane et al., 1986).

In 1995, SCE&G implemented a fish sampling program to characterize the fishery resource of the LSR; data gathered by SCE&G suggests several noteworthy trends in fish community structure. Total catch in 1995 and 1996 was dominated by gizzard shad, with the species representing approximately 25% of the total catch (SCE&G, unpublished data). After 1997, which corresponds approximately to the onset of

SCE&G's turbine venting program, a marked decline was observed in the occurrence of gizzard shad in the LSR, while increases in sportfish species were noted (SCE&G, unpublished data). Recent sampling conducted in 2001 - 2002 by the SCDNR support similar trends as those observed in the SCE&G data. Of special note, the SCDNR data suggest a significant increase in the chain pickerel population. The SCDNR theorized that these increases are due to a significant increase in the aquatic macrophyte community in the LSR over the last few years (personal communication. H. Beard, 2003).

A significant striped bass fishery also exists in the LSR during the late-summer and early-fall months, with angler reports of individual striped bass exceeding 50 pounds (personal Communication, Hal Beard, SCDNR, 2002). Currently, the SCDNR is conducting a striped bass telemetry study to document striped bass movements in the Congaree River, Broad River and LSR. Result to date suggest that 50% or more of the Santee-Cooper Lakes tagged striped bass population potentially utilizes the LSR for thermal refuge during the summer months (D. Christie, SCDNR, Pers. Comm.). Telemetry data suggest that the majority of striped bass move into the LSR during mid- to late-May and depart abruptly during mid-September (J. Bettinger, SCDNR, Pers. Comm.). Additional detail regarding the status of striped bass in the LSR is provided below in the Diadromous Fish Section (Section 3.3).

A fishery management plan for the LSR is currently being revised by the SCDNR. However, a recent SCDNR creel census suggested that the fishery resources of the LSR generate approximately 1.8 million dollars annually to the South Carolina State economy, with the trout fishery being responsible for the majority of the revenues (Beard, 2000).

3.3 Diadromous Fish

Historically, a number of anadromous species occurred in the Saluda River including American shad, striped bass, and Atlantic and shortnose sturgeon (Welch 2000, Newcomb and Fuller 2001). With the exception of three American shad collected by SCE&G in the Spring of 1993 (S. Summer, SCANA Services, Inc., Pers. Comm.), this species has not been detected in the LSR in recent history. Similarly, a gillnetting survey performed as part of the current relicensing (Isely, 2005; 2006), which targeted American shad and blueback herring, yielded no captures of either of these species in the LSR, suggesting that these species do not occur regularly in the LSR or are present in extremely low densities. The reasons for the observed absence or extremely low densities of American shad and blueback herring remain unclear; however, the potential for inmigrating fish to choose the warmer waters of the Broad River over the hyplominetically-influenced cooler waters of the LSR are one obvious explanation. Recent monitoring efforts in support of the newly opened fish passage facility at the Columbia Hydro Project (FERC Project No. 1895) have documented upstream migration of the American shad into the Broad River, although passage numbers have been extremely low (Kleinschmidt, 2007e). Additional detail regarding the American shad/blueblack herring gillnetting study are provided in Section 3.10.1.1.

Shortnose sturgeon are known to occur in the upper Congaree River, and are highly mobile with specific habitat use patterns and requirements. The Atlantic sturgeon has not been documented to occur upstream from the Santee-Cooper Dams since the 1970s. The upper Congaree, Broad and lower Saluda Rivers contain the best available remaining habitat with physical habitat characteristics suitable for spawning of shortnose sturgeon (NMFS DLA comment letter, dated March 12, 2008). The NMFS considers those remaining sections of river to be important for further recovery of shortnose sturgeon in the Santee River Basin. The Saluda Project is thought to be within the historic range of the shortnose sturgeon (Welch 2000, Newcomb and Fuller 2001); however, the species has not been documented in the Saluda River in recent history. Based on comments from the NMFS, it was noted that hypolimnetic water releases from the Saluda Hydro Dam, and consequent water temperatures below seasonal ambient conditions, may adversely affect shortnose sturgeon behavior, movements and use of available spawning habitat in the lower Saluda River and portions of the Congaree River below the Broad River confluence. Additional details regarding shortnose sturgeon status in the Project vicinity, as well as sturgeon studies performed in support of relicensing, are provided in Section 3.10.1.4 and Section 3.8

Striped bass are the only known anadromous fish to consistently use the LSR. Individuals from the dam-locked populations in the Santee-Cooper Lakes migrate upstream in early spring and use areas of the LSR in late summer as thermal refuges. LSR anglers have reported catching individuals exceeding 50 pounds (personal Communication, Hal Beard, SCDNR, 2002). SCE&G's 1995–2003 spring electrofishing sampling revealed only sporadic catches of striped bass.

The American eel is the only known catadromous fish reported to inhabit Project waters (Beard, 2002). Electrofishing by SCE&G and SCDNR has yielded only sporadic captures of adult eels (Kleinschmidt, 2005b; Kleinschmidt, 2006c; personal communication, H. Beard, SCDNR, 2006; S. Summer, SCANA Services, Inc., 2006), which suggests that eel density in the LSR is low. Recent eel pot sampling for adult eels, conducted during 2005 and 2006 as part of the current relicensing effort resulted in capture of only one eel (Kleinschmidt, 2005b; 2006c). Experimental eel ladders designed to capture juvenile in-migrating eels (elvers) were installed at the Project spillway and downstream of the dam and likewise yielded no captures of American eel (Kleinschmidt, 2007a). Additional detail regarding the American eel studies performed as part of relicensing is provided in Section 3.10.1.2.

Anadromous fish restoration efforts for the Santee Basin appear to focus on restoring runs of anadromous fish primarily up the Congaree and Broad Rivers. The Santee Cooper Basin Diadromous Fish Passage Restoration Plan reports that the Broad River and its tributaries are the highest priority for diadromous fish restoration (USFWS, 2001). The Saluda along with Catawba and Wateree sub-basins are listed as next in priority. The Plan states that the cold hypolimnetic water released through the Saluda Project turbines significantly reduces the ambient LSR water temperature, and thus migrating fish may choose to use the warmer waters of the Broad rather than the Saluda (USFWS, 2001). Furthermore, alteration of the existing thermal regime of the LSR would be an engineering challenge and would likely adversely affect the coldwater trout fishery in the tailwater.

To investigate ongoing recovery efforts of diadromous fish in the Santee-Congaree basin, SCE&G is a participant of the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement, which is a collaborative approach among utilities with licensed hydroelectric projects (SCE&G and Duke Energy Carolinas, LLC) and federal and state resource agencies (SCDNR, USFWS and NCWRC) that will address diadromous fish protection, restoration and enhancement in the Santee River Basin through implementation of a 10-year action plan. Pursuant to the Accord, reservoir elevation limitations, required flow releases, low inflow protocols or high inflow protocols to be developed in a relicensing agreement for the Saluda Hydro Project among the USFWS, SCDNR and SCE&G along with reservation by the USFWS of any fishway prescriptions for this project will be filed with the FERC for the term of the new Saluda Hydro Project license. It is an understanding that any diadromous fish study needs will be addressed through the Accord. The Accord shall terminate for SCE&G at the end of the term of the new FERC license for the Saluda Hydro Project (expected to be issued by the FERC in 2010).

3.4 Essential Fish Habitat

By letter dated March 12, 2008, the NMFS indicated that no Essential Fish Habitat (EFH) occurs within areas influenced by the Project; therefore, no EFH consultation pursuant to Section 305 (B) of the Magnuson-Stevens Act or the EFH regulations (50 CFR 600.920) would be required.

3.5 Macroinvertebrates

The benthic macroinvertebrate community of the LSR downstream of Saluda Hydro has been assessed regularly by SCE&G over the past decade (Shealy, 1996a; 1996b; 2001; 2004; 2005; Carnagey Biological, 2006; 2007). Recent assessments have shown that biotic conditions (based on metrics such as taxa richness and abundance, EPT Index, EPT abundance, and dominant taxa) improved with increased distance from the Project dam (Shealy, 2004; 2005; Carnagey Biological, 2006; 2007). Similarly, North Carolina Biotic Index (NCBI) scores from these studies have generally ranged from “good” to “fair” for lower sites near the Riverbanks Zoo, to “poor” at sites directly below the dam (Shealy, 2004; 2005; Carnagey Biological, 2006). The most recent assessment (Carnagey Biological, 2007), conducted in 2007 as part of the current relicensing, is described in greater detail in Section 3.10.4.

3.6 Freshwater Mussels

Twenty-four recognized freshwater mussel species have been documented as occurring in the Santee River Basin (Alderman, 2006). However, prior to relicensing, little information was available regarding their distribution in the Saluda Project vicinity. A freshwater mussel survey of the LSR, the upper Congaree River, Lake Murray, and selected tributaries was subsequently developed by SCE&G under the direction of the Freshwater Mussels/Macroinvertebrate TWC (See Freshwater Mussel Study Plan; Appendix E-2). The field study documented 15 native freshwater mussel species as occurring in Lake Murray, its tributaries, and the upper Congaree River; no mussels were documented directly downstream of the Project in the LSR (Table 3-2). None of the species documented in the study area are federally or state listed as threatened or endangered; although 6 are federal species of concern. Additional detail regarding the mussel surveys conducted as part of relicensing is provided in Section 3.10.5.

3.7 Fish Consumption Advisories

Currently, there are no fish consumption advisories issued by SCDHEC for Lake Murray. Due to methylmercury bioaccumulation in fish tissues, there is currently a fish consumptive advisory for the LSR in effect for largemouth bass, bluegill and bowfin (SCDHEC, 2007).

3.8 Threatened and Endangered Species

Under direction of the Rare, Threatened and Endangered (RT&E) Species TWC, SCE&G developed an RT&E Assessment (Kleinschmidt, 2008) to assess the potential for occurrence of RT&E species within the Project Area. The assessment included a number of aquatic species of conservation concern including: shortnose sturgeon (federally endangered), Atlantic sturgeon (candidate for federal listing), alewife (federal species of concern), blueback herring (federal species of concern), Carolina heelsplitter (federally endangered) and robust redhorse sucker (federal species of concern). Of these, only shortnose sturgeon was deemed as potentially occurring with the Project or within influence of the Project. As such, detailed information for shortnose sturgeon is provided below. Additional information regarding the other species is provided in the RT&E Assessment, which is included in Appendix E-2.

Shortnose Sturgeon

Much of the Santee Basin, including the portion of the Saluda Basin encompassed by the Saluda Project, is thought to be within the historic range of the federally endangered shortnose sturgeon (Welch 2000, Newcomb and Fuller 2001). Populations of shortnose sturgeon are known to inhabit downstream of the Santee-Cooper dams (lakes Marion and Moultrie) in the lower reaches of the Santee Basin (Collins et al. 2003). An additional dam-locked population of shortnose sturgeon has been documented within and upstream of the Santee-Cooper Lakes, with Lake Marion and its tributaries harboring the most significant population (Collins et al. 2003).

Radio-telemetry studies conducted by the SCDNR have documented migration of Lake Marion shortnose sturgeon as far upstream as the Gervais Street Bridge on the Congaree River, which is adjacent to the City of Columbia and just downstream of the confluence of the Broad and Saluda rivers (J. Gibbons, SCDNR, Pers. Comm.). Additionally, in 2006-2007, SCE&G assisted SCDNR with placing sonic receivers in the LSR downstream of the Project. Based on tracking information provided by the SCDNR, no sturgeon were monitored moving into the LSR during the 2007 migration season (J. Gibbons, SCDNR, Pers. Comm.).

A gillnetting study targeting shortnose sturgeon was performed by SCE&G as part of the current relicensing effort. Sampling at 4 locations in the LSR and upper Congaree River yielded no captures of shortnose sturgeon adults, juveniles, or eggs/larvae (Kleinschmidt, 2007d). Additional detail regarding this study is provided in Section 3.10.1.4.

3.9 Agency Public Recommendations Concerning Fishery Resources

3.9.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) also was filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below are the remarks and study requests regarding fishery resources that were provided by stakeholders in comment letters following the issuance of the ICD.

The USFWS (August 1, 2005) and the LSSRAC (August 12, 2005) requested a survey of freshwater mussels in the reservoir, the upper and LSR, and significant tributaries to document the distribution, relative abundance, and reproductive success of populations. They noted that additional targeted surveys should be conducted to determine the presence/absence of federally listed mussels and species of concern. Similarly, the SCDNR (in a letter dated August 16, 2005) requested an evaluation of the present status of mussels in the Project area, including an assessment of their habitat needs and any potential project-related impacts on habitat identified. In addition, the AR/CCL (August 10, 2005) requested a study to evaluate the effects of Project operations on water temperatures and dissolved oxygen, and freshwater mussel populations in the Saluda and Congaree Rivers downstream of the Project. They also suggested that this study should include cumulative impacts analysis of the Saluda Project on mussel stocks of the Santee-Cooper Basin.

As part of the relicensing process, SCE&G in consultation with agencies and NGO's, developed a study plan and performed a mussel survey in the Project Area. Details and results of the survey are included in *Section 3.10.5.*

The USFWS (August 1, 2005) and the NMFS (August 8, 2005) requested that a comprehensive habitat assessment be included in the License Application. In particular, they were interested in qualitative and quantitative data in GIS format of the available and potential spawning, rearing, and foraging habitats (i.e., riffles, shoals, open water, shallow coves, littoral zones) in Lake Murray and the Saluda River (including the lower river reach below the Project) for diadromous and resident fish species. Trout Unlimited (TU) (August 15, 2005) specifically requested that the assessment should include the needs of rainbow and brown trout in this coldwater habitat, in order to be a self sustaining fishery. In addition, the SCDNR (August 16, 2005) requested that a model be developed which describes the decrease in cold-water habitat during particular times of the year, and the contributing factors responsible for this seasonal habitat decline. A summary of water level fluctuations in Lake Murray during March, April, and May (spring spawning season) was also requested by SCDNR for the period of the current license.

The AR/CCL (August 10, 2005) expressed an interest in evaluating the effects of reservoir level fluctuations on near-shore fish habitat. They noted that aerial photography and GIS mapping should be used to determine the total area of near-shore habitat affected by incremental levels of drawdown. Additionally, they requested that habitat maps for the reservoir and Saluda River headwaters be developed by evaluating transects perpendicular to the shoreline.

Near-shore fish habitat was evaluated by agencies and stakeholders during the land rebalancing exercise in the Lake and Land Management TWC. SCE&G has also, through the implementation of the SMP and proposed a new operating guide curve, protected shallow coves and shorelines containing ESAs, in part as a protective measure for near-shore fish habitat. In reference to the LSR trout fishery, a White Paper to assess the potential for a self sustaining trout fishery in the LSR has been submitted to the TWC and is discussed in section 3.10.3.

The USFWS (August 1, 2005), the NMFS (August 8, 2005), TU (August 15, 2005) and the LSSRAC (August 12, 2005) requested that a macroinvertebrate survey be conducted at sites directly below the dam, downstream of the dam, in the Saluda River above the dam, and in major tributaries. It is explained that the goal of the study would be to identify and evaluate macroinvertebrate assemblages, including crayfish and EPT's (*Ephemeroptera*, *Plecoptera*, and *Trichoptera* sp.) to describe and evaluate potential project related effects on benthic resources. A similar request from the SCDNR (August 16, 2005) was made during initial stage consultation in which they were interested in whether invertebrate fauna have increased in either numbers or species diversity as a result of turbine venting, as well as how far downstream invertebrates are potentially impacted. The USFWS suggested that sampling be conducted during the spring and summer.

SCE&G, in consultation with stakeholders and agencies, developed and performed a Macroinvertebrate Survey on the LSR. The study plan and study report can be viewed in Appendix E-2. Details regarding the results of this survey are discussed in section 3.10.4.

The USFWS (August 1, 2005) and the NMFS (August 8, 2005) presented the need for an assessment of project related factors influencing resident and diadromous fish populations due to out-migration and entrainment mortality. It was noted that, "Out-migration (spillway and turbine passage) may be significant in terms of recruitment for river basin populations." USFWS suggested that an out-migration study should include the frequency and characteristics of spillway water releases with respect to potential out-migration by target resident and diadromous fish species at the Project. Further, the SCDNR requested a summary of emergency spillway gate testing protocol to include the frequency, time of year, and any adaptive measures that are employed to reduce fish mortality. In addition, it is recommended that multiple-year limnological studies also be conducted to document monthly changes in dissolved oxygen, temperature, conductivity, turbidity, thermocline development and overturn during normal hydropower operations.

To address the issue of fish entrainment and mortality, the USFWS, the NMFS and the AR/CCL (August 10, 2005) suggested conducting a literature-based study summarizing data collected at similar facilities. It was noted by USFWS that as long as sufficient information is available in the literature, then a site-specific study may not be required. A similar study request from the SCDNR (August 16, 2005) defines the objectives of the desktop study would be to (1) quantify the numbers and sizes of species susceptible to entrainment; (2) estimate associated mortality rates by species; and (3) provide reasonable recommendations for project design and operation upgrades to prevent or minimize fish entrainment and the associated injury/mortality. The USFWS suggested that at a minimum, the entrainment evaluation should also include the top and bottom elevation of the trash racks, as well as the width or spacing of the trash racks, and the mean velocity in front of the intakes across the full range operating scenarios.

As a result of these study requests, a desktop entrainment study was performed at the Project in consultation with resource agencies and stakeholders. Study results are summarized in *Section 3.10.2**, and the study report is attached in Appendix E-2. In reference to the request by the USFWS, it is noted above that an out-migration study, including the frequency and characteristics of spillway water releases with respect to potential out-migration by target resident and diadromous fish species at the Project, was requested. The spillway is a man-made structure, constructed for the purpose of releasing excess water from the reservoir under emergency situations. The spillway is only operated in the event of an emergency and for testing purposes, and is not an option to pass fish.*

The USFWS (August 1, 2005) and the NMFS (August 8, 2005), as well as the SCDNR (August 16, 2005) AR/CCL (August 10, 2005), and the LSSRAC (August 12, 2005), requested a comprehensive list and location map detailing all rare, threatened, and endangered species occurring within the Project area. In addition, they explained that management plans need to be developed for all federally protected species (such as the robust redhorse sucker, Carolina redhorse, highfin carpsucker, and shortnose sturgeon) that occur within the Project. They suggested conducting surveys to compare habitat requirements for these species with the available habitat types found within the action area of the Project. Should this comparison reveal overlapping habitat requirements with availability at the site, then, they noted, field surveys should be conducted to confirm presence or absence at the Project.

Consultation on rare, threatened and endangered species was undertaken by the RT&E resources group in consultation with USFWS and other agencies. As a result, a RT&E report was developed and included in Appendix E-2.

The USFWS (August 1, 2005) requested fish community surveys (including small non-game species) be conducted in the Saluda River above and below the reservoir, and in Lake Murray, to supplement and update existing data. Target sampling to confirm the presence or absence of the robust redhorse sucker, Carolina sucker, and highfin carpsucker in the LSR also was requested. The AR/CCL (August 10, 2005) also requested a thorough analysis of historic and current fish populations, and their habitats, in the Saluda and Congaree Rivers and their tributaries. It was noted that the analysis should include an evaluation of diadromous fish habitat lost due to inundation behind the Project dam and an assessment of potential future habitat in the river and its tributaries.

A comprehensive fishery description encompassing approximately 15 years of data of the LSR is presented in Section 3.2. SCE&G and SCDNR continue to collect bi-annual fisheries data in the LSR. In reference to the request for an analysis of habitat lost due to inundation behind the Project dam, SCE&G considers this request to involve the evaluation of pre-Project conditions, not required under current relicensing guidelines.

The USFWS requested an evaluation of the striped bass population in the reservoir to provide information (1) on the effectiveness of current turbine operations; (2) on potential additional enhancements in association with summer thermocline near the powerhouse; and (3) to determine striped bass spawning behaviors and movements in the spring. The AR/CCL (August 10, 2005) also requested an evaluation of project operations on summer habitat for striped bass in the reservoir forebay. They further suggested that mitigative measures should be determined to reduce or avoid future striped bass kills.

An evaluation of Project operations as it relates to fishery habitat in the reservoir was undertaken by the Water Quality TWC (meeting notes dated November 13, 2006, March 26, 2007, May 22, 2007, August 7, 2007, November 6, 2007, and January 16, 2008 located in Volume II). Changes in project operations were suggested during group meetings and were analyzed for implementation.

The USFWS (August 1, 2005) and the NMFS (August 8, 2005) recommended the continuance of diadromous fish surveys in the LSR during the spring 2006 spawning migrations as described in the *2005 Diadromous Fish Studies* plan. They noted that sampling should be conducted for a minimum of two seasons to accurately identify the status of diadromous fish utilization in the LSR. The SCDNR (August 16, 2005) requested information to quantify the present diadromous fish utilization, by numbers and species, in and immediately below the Project. Spawning and nursery habitat for diadromous species in the river and the lake should be identified and quantified. Further, AR/CCL (August 10, 2005) requested that the effects of Project operations on water temperature, and spawning and recruitment of diadromous and riverine fish in the Saluda and Congaree Rivers should be studied. They suggested a cumulative impacts analysis of Project operations on diadromous fish stocks in the Santee-Cooper Basin be conducted. The AR/CCL further requested a study of upstream and downstream diadromous fish passage feasibility (such as fishways, trap & haul facilities, dam removal, spill gates, collection & bypass facilities, turbine intake screens, and reservoir operations) at the Project dam, the use of hatchery operations to augment existing stocks, and how to meet the flow and water quality requirements for these diadromous species. The LSSRAC also recommends an evaluation of options for diadromous fish restoration to the Project waters. They identified target anadromous species to also study including American shad, hickory shad, blueback herring, striped bass, shortnose sturgeon, and Atlantic sturgeon.

Diadromous fish surveys were contracted by SCE&G for 2005 and 2006. Details regarding the results of these surveys are included in Section 3.10.1. Study reports and study plans are included in Appendix E-2.

Instream flow studies are requested for the LSR and confluence area by the following agencies: AR and CCL (letter dated August 10, 2005), City of Columbia Parks and Recreation (letter dated August 11, 2005), SCDNR (letter dated August 11, 2005), LSSRAC (letter dated August 12, 2005), NMFS (letter dated August 1, 2005), TU (letter dated August 15, 2005), USFWS (letter dated August 1, 2005). It is noted that the purpose of these studies would be to determine which flow regimens would best meet the needs of the aquatic biota.

In consultation with the agencies and stakeholders involved in the Instream Flows TWC, a study plan was developed and IFIM study was performed on the LSR in May and June of 2007. The final report is included in Appendix E-2. Further, discussion on the IFIM is detailed in Section 3.10.6.

3.9.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of fishery resources during these meetings is described below.

During the Diadromous Fish TWC meeting held on February 22, 2006, the sampling regime for American eels was discussed. The USFWS recommended the use of an eel ramp to sample for elvers due to ineffectiveness of the eel pot sampling. It was noted that water temperatures would stipulate when the ramp needs to be utilized, and discussions continued as to an appropriate location for the ramp. It was agreed that a site-visit was necessary to investigate the potential locations suitable for ramp placement.

Details regarding the placement and results of the eel ramp are included in Section 3.10.1.3.

In regard to the requests for a mussel survey mentioned above, at the March 8, 2006 Mussels TWC meeting, the USFWS suggested a reconnaissance survey be completed for mussels in Lake Murray and the LSR. In addition, the USFWS further requested for a map depicting sampling sites for the mussel survey, as well as the inclusion of the numbers of alive and dead specimens into the final report.

As part of the relicensing process, SCE&G in consultation with agencies and NGO's, developed a study plan and performed a mussel survey in the Project Area. Details and results of the survey are included in Section 3.10.5.

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to aquatic resources are provided below.

In reference to rare, threatened and endangered species, the USFWS notes (DLA comment letter dated June 3, 2008) that management plans should be developed for these species and included in the FLA.

In response to the DLA, NMFS noted in their comment letter dated March 12, 2008 that although the 2005 and 2006 diadromous fish sampling provides useful information, they believe it is inadequate for determining presence and abundance of the target species in such a large river. NMFS concludes that future monitoring of diadromous species, with an emphasis on shortnose sturgeon, should be considered.

As part of consultation with the appropriate agencies with regards to RT&E species, SCE&G proposes to develop and implement a shortnose sturgeon management program in the LSR. The Program will be developed in coordination with NMFS and the TWC working group and filed with the FERC. Furthermore, as discussed in section 3.3, SCE&G is a participant in the Santee Basin Accord which is designed to address diadromous fish protection, restoration and enhancement in the Santee River Basin through implantation of a 10-year action plan

In an email sent in response to the issuance of the DLA (email dated February 29, 2008), individual, and Midlands Striper Club member, Mr. Barnes notes concern regarding the outbreak of a parasitic copepod in Lake Murray. Although the copepod does not typically cause harm to the fish or to humans, Mr. Barnes notes trepidation that its presence could be an indicator of other environmental issues. He asks that as a part of relicensing that the occurrence of this species be investigated.

During the April 3, 2008 Quarterly Public Meeting, SCE&G invited SCDNR representative Ron Ahle to come and present on the parasitic copepod. The presentation can be viewed in Volume II. During his presentation he noted that DNR was continuing to investigate this species and its presence in Lake Murray. However, he did note that the parasite was not unique to Lake Murray and likely was not related to operation of the Saluda Project.

DNR notes in their DLA comment letter dated March 14, 2008, that results of the 2006 macroinvertebrate community survey indicates that macroinvertebrate populations are depressed in the vicinity of the dam. They note that although instream flows that are implemented as a part of the relicensing may help restore populations near the dam, mitigation may be necessary.

As discussed in section 3.10.6, benthic macroinvertebrates were included as target species in the instream flow study and associated phabsim modeling. Modeling results suggested that the proposed minimum flow would likely significantly enhance habitat in the LSR for macroinvertebrates, thus providing at least 80% of maximum WUA. SCE&G proposes to develop a program for monitoring changes in the macroinvertebrate community until the SCDHEC in-stream water quality standard for DO in the LSR is consistently maintained. It is anticipated the final macroinvertebrate monitoring program will be submitted to FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project.

Additionally, as noted in their DLA comment letter (dated March 14, 2008), DNR points out that mitigation or restoration may be necessary for mussel species on the LSR. They noted that results of mussel surveys performed as a part of the relicensing indicate that habitat in the LSR has been impacted by Project operations. The USFWS, in their DLA comment letter dated June 3, 2008, suggests that in light of the results of the mussel survey, mitigation should be preformed for mussel populations in the LSR.

As discussed in section 3.12, SCE&G is proposing the implementation of a freshwater mussel restoration program upon the issuance a new FERC license. The proposed program is currently being developed in consultation with the TWC and will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

The USFWS, in their June 3, 2008 DLA comment letter, suggests that mitigation measures be proposed in the FLA for the annual loss of fisheries resources at the Saluda Project from turbine induced entrainment and mortality. SCE&G is currently evaluating a proposal from the SCDNR mitigate for fish mortality at the Project. Any agreements developed with regard to unavoidable Project impacts will be submitted to FERC. At present it is uncertain whether this mitigation will be contained in the Final Relicensing Settlement Agreement. If not, the mitigation program will be developed outside of the Relicensing Agreement but still filed with the FERC for informational purposes.

In response to the DLA, in letter dated March 14, 2008, DNR notes that they concur with both seasonal flow recommendations and low flow recommendations developed as a part of the Instream Flow TWC. They explain that both recommendations are consistent with objectives developed by DNR management and with the State Water Plan. The USFWS in its DLA comment letter dated June 3, 2008 also explains that it would like to see the identification of an Instream/Minimum Flow Regime, Low Inflow and Drought Protocol, and a Project Maintenance Drawdown Protocol in consultation with the TWC's.

Exhibit B includes a preliminary Low Inflow Protocol (LIP) proposal, however, work within the TWC is currently underway to address this issue. It is anticipated the final LIP program will be submitted to FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

3.10 Results of Recommended Studies

3.10.1 Diadromous Fish Sampling

In anticipation of diadromous fish issues related to the upcoming Project relicensing, SCE&G hosted a meeting on November 10, 2004 with several State and Federal resource agencies, NGOs and other stakeholders to identify relicensing study needs. A diadromous fish study plan was subsequently developed and approved by the agencies on February 1, 2005 (Appendix E-2). The purpose of the study plan was to document the relative abundance, distribution, and evidence of spawning of historically present diadromous fish species on the LSR and the Upper Congaree. Study Plan target species included the anadromous American shad, hickory shad, and blueback herring, and the catadromous American eel. A separate study plan was prepared that focused on shortnose sturgeon (Appendix E-2).

SCE&G implemented the approved diadromous fish study plans beginning in the spring of 2005 and extending through 2007. The objective of the diadromous fish studies were to:

- Document presence / absence of target diadromous fish species in the LSR and the upper Congaree River during the spring migratory periods;
- Determine the relative abundance and spatial and temporal distributions of species found to be present in the reach; and
- Document spawning of these species in the Saluda River relative to the Congaree River.

The geographic scope for each diadromous fish study focused on the LSR, from downstream of the Saluda Hydro Dam to the confluence with the Broad River; and the upper Congaree River from its origin at the confluence of the Saluda and Broad Rivers to Rosewood Boat Landing. The one exception was the American eel studies, which focused solely on the LSR.

3.10.1.1 2005/2006 Fish Surveys – American Shad, Hickory Shad, and Blueback Herring

Diadromous fish collections were conducted in the spring of 2005 and 2006 (approximately February 1 to June 1 each year) to determine the presence (or absence) of American shad, hickory shad, and blueback herring. The survey utilized a 50 foot by 6 foot sinking gillnet with 2 and 5 inch stretch mesh. The nets were fished for a combined total of 816 net hours. During the 2005 and 2006 spring fish collections, no American shad, hickory shad, or blueback herring were collected. However, a combined total of 3 striped bass were collected in the vicinity of the Rosewood Boat Landing on the Congaree River.

Ichthyoplankton nets were fished in conjunction with gillnets using a 0.5 m plankton net, equipped with a flowmeter. A total of 24,250 m^3 of water was sampled during the 2005 and 2006 spring fish collections. However, no larvae or juvenile diadromous fish were collected (Isely, 2005; 2006). The 2005 and 2006 Diadromous Fish Summary Reports are presented in Appendix E-2.

3.10.1.2 2005/2006/2007 American Eel Surveys

State and federal agencies also requested studies to document the presence or absence of the American eel in the LSR. SCE&G conducted a two year study to provide insight into the current American eel population for the LSR. Eel pots were baited and allowed to fish undisturbed for two consecutive days each week from February through May of 2005 and 2006. Eel pots were deployed at the following locations to document presence/absence and relative abundance of adult and juvenile American eels:

- LSR downstream of the Saluda Hydro Dam in the vicinity of the USGS gage (gage # 02168504);
- LSR at the mouth of the Saluda Hydro Dam spillway;
- LSR at the mouth of Rawls Creek adjacent to Saluda Shoals Park;
- The mouth of Twelvemile Creek as it enters LSR;
- LSR in the vicinity of the USGS gage (gage # 02169000); and
- The Broad River below the Columbia Diversion Dam.

Eel pots were fished in the LSR for a collective total of 25,215 trap hours during the 2005 and 2006 sampling period, however no American eels were captured (Kleinschmidt 2005b; 2006c). The 2005 and 2006 American eel survey are presented in Appendix E-2.

Although no eels were captured during this study, SCE&G and the SCDNR have captured American eels along the LSR during standardized fish collections. Hal Beard of SCDNR indicated that during his 2005 fall sampling, he collected three American eels total while electrofishing at ten sites along the LSR (H. Beard, SCDNR, Pers. Comm.). Similarly, Steve Summer of SCANA Services, Inc., noted that he captured one eel during standardized electrofishing conducted during April of 2005 (S. Summer, SCANA Services, Inc., Pers. Comm.). This suggests that the abundance of American eels in the LSR is fairly low (Kleinschmidt 2006c).

3.10.1.3 Saluda Eel Ramp Survey

To determine the presence/absence of in-migrating juvenile American eels in the LSR, the USFWS recommended (Meeting Notes – February 22, 2006, Volume II) the installation of an experimental eel sampling ramp at the Saluda Hydro spillway and at the USGS gage located on the LSR's mainstem downstream of the Saluda Hydro Dam (gage # 02168504). Eel ramps were constructed of corrugated plastic pipe. A continuous flow was provided using a pump and gravity feed to provide an attraction flow and to protect ascending eels from desiccation. The experimental eel ramps were fished continuously from September 2006 through the end of

October 2007 with an approximate total of 10,176 sampling hours. No American eel were caught during the year long study period in the LSR. Additional study detail is provided in the final report, “Evaluation of Usage of the LSR by Inmigrating Juvenile American Eels by Use of An Eel Ramp,” which is included in Appendix E-2.

3.10.1.4 2007 Shortnose Sturgeon Survey

Also as part of the approved Study Plan to address diadromous fish species, SCE&G conducted sampling for shortnose sturgeon in the LSR and Upper Congaree Sub-basin. Specific study objectives included:

- To document whether or not shortnose sturgeon are utilizing areas of the Saluda and Congaree rivers downstream of the Saluda Hydro Project;
- If sturgeon are found to be present, to document their relative abundance and spatial and temporal patterns;
- If shortnose sturgeon are present determine whether or not spawning is taking place downstream of the Saluda Hydro Project;
- If possible, characterize usage of this reach of the Saluda and Congaree relative to water quality and habitat data; and
- Cooperate, to the extent feasible, with population genetics and other studies being conducted by the SCDNR to determine the status of shortnose sturgeon in the Santee River Basin.

Gillnetting and ichthyoplankton sampling was conducted during late-winter and spring of 2007 when shortnose sturgeon would be expected to migrate into the Piedmont rivers to spawn. The following sites were sampled:

- Downstream of the Saluda Hydro Dam in the vicinity of the USGS gage (#02168504);
- The vicinity of SCE&G’s Gardendale canoe landing on the LSR;
- Upstream of the old Granby Lock and Dam on the Congaree River; and

- The vicinity of the Rosewood Boat Landing on the Congaree River.

These four sample locations were sampled weekly (one day per week) for adult and juvenile shortnose sturgeon. A 100 ft-long monofilament net, with alternating 25 ft-long panels of 5-inch and 7-inch stretch mesh and were fished for approximately eight hours a day for a total sampling effort of 344 net hours. No adult shortnose sturgeon were captured during the three month study period from February through April 2007 in the lower Saluda and Congaree Rivers. During ichthyoplankton sampling, a total of 37,054 m^3 of water was sampled during the three month study period. No eggs or juvenile shortnose sturgeon were captured while sampling with the ichthyoplankton nets.

Absence of shortnose sturgeon in the LSR seems to be consistent with their spawning requirements. Adult shortnose sturgeon are known to commence spawning when water temperatures increase to 15˚C. The maximum water temperature recorded during the course of this study was 14˚C and this occurred during late April near the end of the sampling period and near the end of the typical sturgeon spawning period. These data suggests that water temperature conditions in the LSR are unsuitable for shortnose sturgeon spawning (Kleinschmidt 2007d). The 2007 Shortnose Sturgeon Report is presented in Appendix E-2.

3.10.1.5 <u>American Shad Telemetry Study</u>

On November 2, 2006 SCE&G and Kleinschmidt Associates hosted a Diadromous Fish Technical Working Committee meeting to discuss the diadromous fish studies conducted on the lower Saluda, Broad, and Congaree Rivers in 2005 and 2006. It was agreed that because gillnetting efforts did not capture any shad or herring, a telemetry study would be performed. The “American Shad Telemetry Study for the Lower Saluda, Congaree and Broad Rivers” was submitted and accepted by the Diadromous Fish Technical Working Committee on January 23, 2007.

The objective of the American Shad telemetry study is to characterize the movements of migrating American shad in the LSR, Congaree, and Broad Rivers for purposes of determining usage of the LSR downstream of the Saluda Hydro Dam.

Due to low numbers of shad passed at the downstream dams (Pinopolis and St. Stephens), the study was not conducted during 2007. Several attempts were made to locate American shad in the lower portions of the Congaree River, but only six American shad were detected in the vicinity of the HWY 601 Bridge. Due to the low numbers of American shad migrating up the Congaree River, the telemetry study was postponed until spring 2008 (Kleinschmidt, 2007b).

Similarly, due to low numbers of shad passed at the downstream dams (Pinopolis and St. Stephens), the study was also not conducted during the 2008 shad run. Several attempts were made to locate American shad in the lower portions of the Congaree River. Approximately 6 American shad were detected by boat electrofishing in the vicinity of the HWY 601 Bridge again in 2008. However, only one American shad was tagged and released in 2008, but was not detected by the array of receivers deployed in the Congaree, Wateree, Broad and LSR. SCE&G is proposing to coordinate further tagging efforts as part of the Diadromous Fish Accord.

3.10.2 Saluda Fish Entrainment and Turbine Mortality Analysis

During the first stage consultation of the Saluda relicensing process, the USFWS, SCDNR, and NMFS requested studies to determine the potential impact of project operation on the fishery resources, and recommended that SCE&G assess potential fish entrainment effects on the fishery resources due to project operation. In response to resource agency requests for studies in support of relicensing, SCE&G proposed to develop an entrainment estimate for the project, which would be based on the extensive entrainment database that currently exists from previous hydroelectric relicensing studies. Resource agencies agreed with SCE&G's proposal to determine potential fish entrainment effects through a "desktop analysis" (meeting notes dated February 22, 2006). SCE&G prepared a draft entrainment study plan, which was submitted to the resource agencies on April 17, 2006 and was approved on May 9, 2006. The Saluda Hydro Fish Entrainment Desktop Study Plan is presented in Appendix E-2.

The objective of this study was to characterize and provide an order-of-magnitude estimate of fish entrainment using existing literature and site specific information to:

- develop an entrainment database, applicable to the Saluda Hydro Project;
- calculate and estimate fish entrainment rate(s) (seasonal);
- characterize the anticipated species composition of fish entrainment;
- apply physical and/or biological filters that may affect entrainment; and
- estimate the annual entrainment for the Saluda Hydro Project.

Specifically, resident fish entrainment studies were selected from the entrainment database that was most applicable to the Saluda Hydro Project. Entrainment rate information from the selected studies was consolidated to describe fish entrainment rates on a monthly basis. The entrainment rates were presented in fish per volume of water passed through project turbines (fish/million cubic feet). The data were then grouped by season to determine the entrainment density for each season of the year. The seasonal data from each entrainment study was averaged to develop the seasonal mean entrainment estimate for the Saluda Hydro Project (Kleinschmidt, 2006d).

Species composition data from the accepted entrainment studies was analyzed and compiled to determine the general species of fish typically entrained at other hydroelectric projects. Accepted species composition data was grouped to yield predicted seasonal estimates of species-specific data for entrained fish at the Saluda Hydro Project. Total fish entrainment for the Saluda Hydro Project was estimated on an annual basis to provide an order-of-magnitude entrainment estimate. (Kleinschmidt, 2006d).

Due to certain water quality (specifically dissolved oxygen) site-specific characteristics of Lake Murray, entrainment estimates were adjusted by applying a “stratification” filter. Lake stratification when compared with the Saluda Project’s intake depth could have an influence on entrainment estimates. Intakes for Units 1-4 are located approximately 190 ft. deep and Lake Murray is typically stratified with very little dissolved oxygen in the hypolimnion from July through November. Thus entrainment rates for Units 1-4 were adjusted to for these months (Kleinschmidt, 2006d).

Turbine mortality rate data available from source studies for several fish species were used to develop average mortality rates for family/genus-groups. The mortality rates were applied to the entrainment figures to estimate impacts for the Saluda Hydro Project (Kleinschmidt, 2006d).

The Saluda Hydro Fish Entrainment and Turbine Mortality Analysis draft report was distributed to the Fish Entrainment Technical Working Committee for review and comment on January 29, 2007; the TWC concurred that the report and its approach met the study plan guidelines and was scientifically sound. The entrainment estimate provided for the Saluda Hydro Project was considered to be an order of magnitude estimate. The estimate was generated using 24 years of flow data and should account for worst and best case scenarios. The report estimated that, on average, approximately 371,089 fish (without the stratification filter) pass through the turbines on an annual basis and approximately 131,117 fish were estimated to be killed by the Saluda Hydro Project turbines. With the stratification filter, it was estimated that, on average, approximately 232,716 fish pass through turbines on an annual basis and approximately 82,252 fish were estimated to be killed by the Saluda Hydro Project turbines. For detailed information refer to the Final Saluda Hydro Fish Entrainment and Turbine Mortality Analysis in Appendix E-2.

3.10.3 <u>Lower Saluda River Trout White Paper</u>

In comments issued in response to the ICD, the Saluda River Chapter of Trout Unlimited requested that SCE&G evaluate the potential for establishment of a self-sustaining and/or reproducing trout fishery on the lower Saluda River downstream of the Project. The Instream Flow/Aquatic Habitat TWC subsequently drafted a technical white paper summarizing the spawning requirement of the two trout species currently stocked in the lower Saluda (rainbow and brown trout), and comparing those requirements to conditions in the lower Saluda River. The white paper found that, while existing habitat and water quality in the Saluda River generally provide suitable growing conditions for much of the year for adult brown and rainbow trout, the area is unlikely to support a self-sustaining fishery due to a number of factors, including:

- insufficient spawning and nursery habitat to allow for sufficient recruitment to compensate for mortality;
- limited survivorship of potential spawning adult to age II and above, potentially due a variety of biotic and abiotic factors including predation, competition, angling exploitation and environmental conditions; and
- marginal spawning and incubation water temperature (brown trout), limited amount and quality of gravel spawning beds for both species, and discontinuous and limited fry and juvenile nursery habitat.

The assessment concluded that pursuing a goal of establishing a self-sustaining trout population is likely not an appropriate management strategy for the lower Saluda River due these factors. The assessment also recommended that focus be placed on maximizing the potential for the river to maintain a put-grow and take trout fishery in a manner that will increase (a) the abundance of LSR fishable trout, and (b) growth in fish size. The Lower Saluda River Trout White Paper is available for review in Appendix E-2.

3.10.4 Macroinvertebrate Assessment of the Lower Saluda River

The SCDNR, LSSRAC, NMFS, TU, and USFWS requested a study to evaluate the status of the macroinvertebrate community in the LSR, following turbine venting at the Project. The Macroinvertebrate Assessment of the lower Saluda River Study Plan (Appendix E-2) was subsequently developed and approved by the Freshwater Mussels/Benthic Macroinvertebrate TWC on August 24, 2006. The study plan calls for sampling of the macroinvertebrate community in 2006 and 2007 during late-summer/early-fall when dissolved oxygen conditions downstream of the Saluda Hydro dam are typically at their most critical.

During 2006, Macroinvertebrate fauna were sampled at five locations in the LSR. Three replicate Hester-Dendy multi-plate samplers were deployed at each location and allowed to colonize for approximately eight weeks. A multi-habitat assessment, following the USEPA *Rapid Bioassessment Protocols for the Use in Streams and Wadeable Rivers* (Barbour et. al. 1999), was also performed at the closest wadeable habitat to each of the Hester-Dendy deployment locations at the beginning and end of the colonization period (Carnagey Biological, 2006). As in previous sample years, regression analysis of the Hester-Dendy data confirmed that biotic factors improved as distance from the Saluda Hydro dam increased. Due to rapid velocity and water level fluctuations from the Project, these results were expected; studies have shown that operation of hydroelectric dams may decrease diversity by reducing habitat availability (Death, 1995; Death and Winterbourn, 1995; Ward and Stanford, 1995; Valentin *et al*., 1995). Analysis of the rapid bioassessment data detected no trends in taxa richness, total abundance, EPT abundance, or percentage of dominant taxon. Detailed information for each sample location is described in the 2006 Macroinvertebrate Assessment Final Report (Carnagey Biological, 2006), which is included as Appendix E-2.

Findings of the 2007 assessment (Carnagey Biological, 2007) were similar to 2006, with regression analyses of Hester Dendy data suggesting improved biotic conditions with increased distance from the dam. For the rapid bioassessment data, regression analysis showed no detectable trends in taxa richness, total abundance, or in percentage of the dominant taxon as a function of distance from the dam in July or September. The July samples suggested a significant increase in the EPT indices as distance from the dam increased. The September samples showed a significant increase in EPT index and EPT abundance values as distance from the dam increased. The September samples also showed a significant decrease in NCBI values as distance from the dam increased.

3.10.5 Freshwater Mussel Survey of Lake Murray and the Lower Saluda and Upper Congaree Rivers

In comments issued in response to the ICD, the SCDNR, USFWS, and other stakeholders requested that a freshwater mussel survey of the Project vicinity be conducted as part of relicensing. A study plan was subsequently developed to determine whether freshwater mussels occur in the Saluda Hydroelectric Project vicinity, and if so, to provide qualitative measure of species diversity, spatial distribution, and abundance. The Freshwater Mussel Study Plan was accepted by the Freshwater Mussel/Aquatic Macroinvertebrate TWC on May 25, 2006 (Appendix E-2).

A total of 65 sites were surveyed for the presence of freshwater mussels during the Summer of 2006: 25 in Lake Murray, 23 in the Lake Murray tributaries, and 17 downstream of the Project dam in the LSR and upper Congaree River (from the confluence to the Interstate 77 Bridge) (Alderman, 2006). Visual, tactile, snorkel, and SCUBA surveys revealed 15 species to be extant in the study area (Table 3-2). None of the species documented from the study area are federally listed as threatened or endangered, although 6 are federal species of concern.

The study detected differences in mussel assemblages between areas upstream and downstream of the Project dam (Alderman, 2006). In Lake Murray and its tributaries, 11 native freshwater mussel species were identified (Table 3-2), with the sample area dominated by backwater-adapted species such as Eastern floater and paper pondshell. No mussels were collected in the LSR downstream of the Saluda Dam. However, 9 native species were documented in the upper Congaree River and the confluence area of the Broad and Saluda Rivers. Riverine species such as Carolina slabshell and Roanoke slabshell were dominant in these two areas. Several of the species collected in the upper Congaree River and the confluence area were not collected upstream of the Saluda Dam, which could suggest the need for an anadromous host and or the lack of species specific habitat as a limiting factor. Also noted was the greater abundance of mussels on the Broad River side of the confluence area than on the Saluda River side indicating a limiting factor in this area also.

Additional detail regarding the surveys performed as part of relicensing is provided in the Freshwater Mussel Reconnaissance Survey Final Report (Alderman, 2006), included in Appendix E-2.

3.10.6 Lower Saluda River Instream Flow Study

During the Project relicensing process, the USFWS, SCDNR, NMFS, and several Non-governmental Organizations (NGO's) requested an Instream Flow Incremental Methodology Study for the lower Saluda River downstream of the Project (Described in Section 3.9.1). These agencies and NGO's participated in a Technical Working Committee (TWC) to govern relicensing studies, and were interested in using study data to explore alternatives for protection of instream habitat in the LSR below the Saluda Project. The TWC identified the following issues that this study would provide data for:

1. altering the existing regulated flow in the LSR;
2. assist in identifying minimum flows that are protective of aquatic habitat;
3. provide data that can be used to weigh the effects of managing Lake Murray water levels on downstream habitat; and
4. provide data that can be used to weigh the effects of reserve operations on downstream habitat.

The TWC elected to use a Physical Habitat Simulation (PHABSIM) model to quantify these relationships. The model quantified flows that meet habitat requirements to support a balanced aquatic community based on model results representing targeted diadromous and resident fish, and other aquatic biota (*i.e.* habitat use guilds and macroinvertebrates). Details were collaboratively scoped between October 2006 and May 2007 through a series of TWC meetings and site visits (see Volume II).[7]

The study area comprised the LSR between Lake Murray and the confluence with the Broad River, (Figure 3-1). Flow in this reach is primarily influenced by releases from the Saluda Project powerhouse, although there are contributions from several small tributaries, which collectively contribute approximately 100 square miles of additional drainage area. Details about the fishery resources, hydrology, and water quality of this reach can be found in Section 3.1 and Section 2.0,).

The relative quantity and spatial distribution of each mesohabitat type in the study area was field delineated as a precursor to study site and transect

[7] A study team comprised of agency and SCE&G biologists from the TWC was formed to make technical decisions regarding input parameters and to review study output. Specifically, the team designated: 1) boundaries of the study area, 2) locations of specific representative or critical study sites, 3) locations of study site transects, 4) Habitat Suitability Index (HSI) criteria, and 5) calibration flows and range of flows to be assessed. Some study team members participated in field and analytical activities as feasible.

selection. The study team defined each mesohabitat a type of interest, and assigned specific attributes to each type. The upstream and downstream boundary of each mesohabitat within the study area was delineated and geo-referenced in the field, and the information transferred to a GIS format.

The study team reviewed the mesohabitat mapping data, defined study reaches, and located study sites and transects within each study reach during a series of site visits in May 2007. Standard PHABSIM data collection and flow modeling procedures (Bovee, 1982, Bovee *et al.* 1998) were used to evaluate habitat suitability. Modeling was based on hydraulic data developed from cross-sectional depth, velocity, and substrate field measurements following Milhouse, *et al.* (1989), using PHABSIM for Windows (V 1.2). Hydraulic measurements were also obtained at Millrace Rapids (a limiting river channel site) to evaluate zone-of-passage hydraulics for striped bass migration.

The study area was divided into four reaches. Reach breaks were established where observable changes in stream geomorphology (*e.g.* slope, width, dominant substrate and mesohabitat habitat types etc) or hydrology (*i.e*. tributary inflow) occurred (Figure 3-1). For example, reach I was comprised of riffle/shoal/glide complexes and runs, whereas reach 2 was dominated by uniform run mesohabitat. It was observed that discharges through reaches 3 and 4 were consistently 100 cfs higher than those for the corresponding conditions at sites in reaches 1 and 2, due to tributary inflow entering the river in reach 2. Reach 3 comprises Oh Brother Rapids and Ocean Boulevard, an area of unique and extensive split channels and riffle/shoal complexes; reach 4 includes a deep run and wide glide habitat unique to the lower river.

A total of 10 study sites were distributed among the reaches, and a total of 21 PHABSIM transects were located among the study sites. In addition, depth and wetted area changes at two deep riverine pool transects and a limiting zone of passage site were empirically delineated at each calibration flow but not modeled (Table 3-4).

The TWC recommended species of both ecological and management interest for modeling. Based on TWC consultation, habitat-discharge relationships were initially developed for 32 species/lifestages.

Species of management interest (smallmouth bass, rainbow trout, brown trout) included spawning, fry, juvenile and adult lifestages. Trout are presently managed as a put-grow-and-take fishery; juvenile trout criteria were thus modeled to distinguish habitat use of recently stocked fish from adult-sized fish; habitat suitability for spawning and fry life stages of trout was modeled at the request of Trout Unlimited. Zone-of-Passage criteria were used to estimate discharges needed to facilitate striped bass upmigration past Millrace Rapids. Juvenile American shad, YOY shortnose sturgeon and adult striped bass habitat suitability were modeled at select study sites.

Non-game species and lifestages were combined into habitat use guilds to account for ecologically important aquatic resources and quantify habitat suitability of specific habitat types. Representative criteria within each guild were then selected as surrogates for collective similar habitat use requirements. Specific guilds were associated with applicable mesohabitats following Leonard and Orth (1988), using each study site's inherent hydraulic characteristics that most closely corresponded to guild depth and velocity definitions (Table 3-5).

During a subsequent workshop, supplemental modeling was performed to accommodate a study team recommendation that the shallow-slow guild be modeled at all study sites to account for habitat use in stream margins and transition zones after Leonard and Orth (1988), and habitat suitability for striped bass be modeled in runs using Crance (1985) HSI criteria.

Habitat suitability for each evaluation species and lifestage was quantitatively rated using HSI criteria, in which parameters of depth, velocity, and substrate are independently assigned suitability rating values (Bovee et al., 1998). The modeled flows ranged from approximately 400 up to 20,000 cfs, based on a three-calibration flow model. Calibration flows were approximately 500, 1,200, and 10,000 cfs, and provided by releases from the Project. Data were collected during June and July, 2007; modeling was performed during September through October, 2007.

A standard PHABSIM modeling approach rated habitat suitability for each applicable species and lifestage at flow increments across the range of interest using Weighted Usable Area (WUA) as the index. Data were reported in the draft report in tabular and graphic format for each independent study site. Table 3-6 through Table 3-15 reports raw WUA model output for individual study sites and species/lifestages. Habitat suitability was generally greatest for most species and lifestages at flows between 500 and 1,300 cfs, with some variability among study sites.

A draft report was prepared for study team review and comment, documenting the methods and results (Appendix E-2). The study team received the draft study on November 19, 2007 and met to review the results during a workshop December 11-13, 2007. At the workshop, the study team collectively discussed the draft report, and used the model interactively to conduct supplemental runs. The TWC then met to further analyze the data on January 23-24, 2008 (meeting notes included in Volume II).

The TWC used the model data to address four specific habitat management objectives identified by the agencies:

1. *Establish flows that provide at least 80% maximum potential WUA for evaluation species.*

The TWC concluded that some consolidation and data reduction of the model results of individual species, lifestages, guilds and study sites was justifiable. For example, the TWC observed that many individual species within certain guilds had redundant WUA curves and that these could be combined at the study site level into a single blended guild curve. The deep-slow guild was eliminated as it was generally not responsive to flow changes. The TWC also identified key and secondary criteria among the stand-alone management species that would drive flow recommendations. This process reduced the WUA curves from 32 to nine key species (Table 3-16).

The TWC developed a riverwide model by combining weighted WUA results from each study site. Raw WUA was converted to a percentage of the maximum WUA occurring for each species/lifestage at each flow increment. The TWC developed a flow recommendation using these data, and iteratively reviewed the resulting flow recommendations' effect on individual species and study sites. The TWC also developed a monthly time series to target specific months/season for which a given set of habitat use criteria were applicable (Table 3-17).

A Microsoft Access® database was used to calculate flow and WUA relative percentage for each month for flow scenarios of interest to the TWC to test the success of various flow scenarios at attaining habitat protection thresholds. After exploring a number of scenarios, the TWC agreed on the following proposed flow regime:

TIME PERIOD	FLOW (CFS)	PRIMARY BIOLOGICAL FUNCTION
Jan. 1 – Mar. 31	700	Achieves 80-100% of overall maximum WUA
April 1 – 14	1,000	Enhances spawning and adult trout habitat
April 15 – May 14	1,300	Striped bass upstream passage at Millrace
May 15 – May 31	1,000	Enhances adult trout habitat
June 1 – Dec. 31	700	Achieves 80-100% of overall maximum WUA

These flows provide seasonally varying flows that mimic the pattern of a natural hydrograph, and close to 100% of maximum WUA for most target species/lifestages, which exceeds the minimum target threshold of 80% maximum WUA.

2. Ensure that summer flows in the LSR support striped bass.

Two issues of importance to striped bass were identified - spring zone of passage flows that would ensure striped bass could ascend Millrace Rapids to seek refuge in cooler upstream water, and also sufficient habitat suitability in deep riverine pools and runs. The TWC noted that the zone-of-passage results in this study (1,200 – 1,300 cfs) were similar to the previous study (Isely et al., 1995). Striped bass likely move into the LSR during a short period in the spring (mid April to mid May); therefore the passage flow should target this period.

The TWC discussed a recent SCDNR striped bass telemetry study that shows:

- Peak movement into the LSR was April 21 and 22nd during 2006-07,
- Fish move out of the LSR during a short time period (September).

Striped bass habitat suitability in pools and runs was evaluated by the TWC using HSI criteria (Crance 1985). PHABSIM modeling performed at the workshop showed that riffle, glide and shoal habitat in the Saluda river is unsuitably shallow, and that runs infinitely increase in suitability across the flow range of interest as they gradually deepen toward the 6 ft optimum. The deep riverine pools provide suitable depths for striped bass across the entire flow range of interest and do not change significantly in wetted area. The TWC concluded that the flow recommendation would be supportive of striped bass habitat by promoting habitat connectivity during the spring volitional migration period and by providing deep pool refuge during the summer months.

3. Provide flows that maintain and enhance the LSR trout fishery.

The TWC determined that the flow recommendation would generally provide 80% or more of optimal habitat suitability for both juvenile and adult trout. The discharge would also consistently provide sufficient cool water to meet the thermal metabolic requirements of rainbow and brown trout species. Increases in shallow-fast guild habitat suitability should also indirectly benefit the trout fishery by enhancing the forage and drift production of these organisms for trout consumption. The TWC believes that flows of 700 and 1,000 cfs would also not exceed wadeable access conditions for angling at most if not all historic wading locations used by trout anglers.

4. Maintain option of implementing flows for shortnose sturgeon, if they are found to inhabit the LSR during the life of the license.

The TWC acknowledged that shortnose sturgeon historically occurred in the project area, but currently do not. Thus sturgeon habitat suitability may become a management goal in the future depending on the success of other basin-wide restoration initiatives. As new information emerges, the TWC may be able to target flows to accommodate sturgeon. The TWC discussed that the historic seasonal hydrograph combined with the PHABSIM study results can provide a perspective from which to set realistic flow expectations for that species when the time comes.

The TWC also considered flow recommendations that meet habitat protection goals that may need to be implemented during unusually dry or wet years.

Low Inflow Protocol

The purpose of the LIP is to manage water needs during periods of low inflow. An effective LIP should provide a flow regime that would vary seasonally, address lake and downstream needs, and be operationally feasible during drought conditions. The Instream Flow TWC has considered potential impacts of reduced flow during low flow years on water temperature, and acknowledged that it may be necessary to pulse the project discharge periodically to maintain an ambient water temperatures below 20^{o} C. The TWC noted that the model data showed that a flow of 400 cfs during low inflow years would still meet the criterion of providing at least 80% of maximum WUA for most species/guilds.

The April 15-May 15 striped bass passage flow would be reduced under increasingly stringent drought stages. It was noted that during more severe droughts, some passage could be provided through pulses. The TWC agreed that study data would be examined to estimate the magnitude, timing, and duration needed for pulses to be effective.

Further work is currently being conducted within the TWC to develop a LIP for the Saluda Project. Once finalized, the LIP will be submitted to the FERC in conjunction with the Comprehensive Settlement Agreement for inclusion into the new license.

High Flow Protocol

This protocol would be implemented in “wet” years when there was an opportunity to enhance habitat and vary stream flows to be more consistent with a natural hydrograph so that releases during high flows years could help offset lower flow years. It was noted that the upper flow limit for wadeability was generally agreed among fishermen to be around 1,000 cfs. After additional discussion, the group reached consensus on the following proposed high flow protocol:

- If reservoir is at pool elevation of 356.5 feet on March 1, begin releasing the 1000 cfs on March 1 rather than April 1.

Further work is currently being conducted within the TWC to finalize a High Inflow Protocol (HIP) for the Saluda Project. Once fully developed, the HIP will be submitted to the FERC in conjunction with the Comprehensive Settlement Agreement for inclusion into the new license.

In comments issued in response to issuance of the DLA (letter dated March 14, 2007), SCDNR noted that the flows recommended by the Instream Flow and Aquatic Habitat TWC appear consistent with the State Water Plan and with SCDNR's management objectives for the LSR.

On May 1 and 2, 2008, the TWC conducted a site visit to the Lower Saluda River to view the proposed 700 cfs and 1,000 cfs releases. The purpose was to empirically confirm that the habitat conditions predicted by the PHABSIM model at these proposed flows met TWC expectations.

The TWC explored the Corley Island, Ocean Boulevard and Oh Brother Rapids study sites extensively, and compared model output of depth, velocity and wetted width on specific transects to the conditions observed in the field. These sites were selected as they were complex to model, and because of the relatively high importance of the Oh Brother/Ocean Boulevard reach to the trout fishery. The TWC also evaluated habitat by rating the prevailing hydraulics to the HSI criteria used in the study.

The TWC empirically concluded that:

- the PHABSIM model very accurately predicted the hydraulics and habitat conditions in the river at both flows;

- both 700 and 1,000 cfs flows will meet the habitat protection objectives set forth by the TWC; and
- the most difficult wading location (downstream segment of Oh Brother Rapids) can be waded by skilled anglers at 1,000 cfs.

3.10.7 Saluda Crayfish White Paper

During initial meetings of the Rare, Threatened and Endangered Species TWC (See march 8, 2006, RT&E Species TWC Meeting Notes; Volume II), USFWS staff expressed interest in the status of the Saluda crayfish (since re-named the Newberry Burrowing Crayfish) in the Project vicinity. The Saluda crayfish is a terrestrial burrowing crayfish of the genus *Distocambarus* that is endemic to South Carolina. As a result of the request, Dr. Arnie Eversole, Professor Emeritus at Clemson University and a regional crayfish expert, was contracted to prepare a brief summarizing the status, ecology, and known occurrences of this species (Eversole, 2006).

Dr. Eversole's (2006) assessment describes habitat for Saluda crayfish as isolated, poorly drained areas where the ground is saturated during the rainy season (November – March), often in association with a perched water table. Sites are generally isolated from floodplains and streams, although some have been found in low moist areas near the headwaters of streams (colluvial valleys). Soils found in association with Saluda crayfish burrows include Chewacla, Worsham, Toccoa-Cartecay, Enon, and Sedgefield.

According to Dr. Eversole's assessment, the known range of the Saluda crayfish encompasses portions of the Tyger, Enoree, Lower Broad and Saluda River Basins. All known occurrences of the species are from 14 sites in Newberry County, with the closest confirmed Saluda crayfish site (George's Loop) located approximately 1.2 miles from the Saluda Project boundary in a wooded site at the headwaters of a small tributary to Beaverdam Creek.

Additional detail regarding the status and distribution of the Saluda crayfish in the Saluda Project vicinity is provided in the Saluda Crayfish Final White Paper (Eversole, 2006), which is included as Appendix E-2. An analysis of the potential for this species to occur in the Saluda Project Area is included in the Rare, Threatened and Endangered Species Assessment (Final Assessment included in Appendix E-2).

3.10.8 2005 Lower Saluda River Crayfish Assessment

In response to a request by the USFWS and in preparation for the relicensing of the Project, SCE&G contracted with Kleinschmidt Associates to perform a crayfish assessment in the LSR in the fall of 2005. The first of these assessments was conducted on October 11, 2005, and assessments continued on a weekly basis through November 15, 2005. During the sampling period a total of 41 crayfish were collected from the LSR. Of those individuals, there were 19 males and 22 females field identified. All of the specimens captured were of two genus', Procambarus and Cambarus; it is believed that only two species were found within those genus', *Cambarus (Depressicambarus) latimanus* and *Procambarus (Scapulicambarus) troglodytes*. A memo issued to the Fish and Wildlife RCG regarding the findings of this survey can be viewed in Appendix E-2.

3.11 USFWS Comments on Impacts on Endangered Species

In response to issuance of the ICD, the USFWS requested that SCE&G assess the potential for rare, threatened and endangered (RT&E) species to occur in the Project Area, as well as any potential impacts of Project operations on these species. An RT&E Technical Working Committee (RT&E TWC) was subsequently formed, which included representatives of the USFWS, other state and federal resource agencies, and several NGO's. Under direction of the RT&E TWC, SCE&G subsequently developed an R&TE Species Assessment (Appendix E-2) to provide the requested information. SCE&G consulted with USFWS throughout development of the RT&E Species Assessment, as part of the RT&E Species TWC. Following review of the Draft RT&E Report, USFWS expressed satisfaction that the report addressed the federal species under their jurisdiction (email correspondence from Amanda Hill, USFWS to Shane Boring, Kleinschmidt Associates, dated September 25, 2007).

3.12 Existing Measures to be Continued and New Measures Proposed by the Applicant

Macroinvertebrate Surveys

Freshwater macroinvertebrates are important indicators of ecological health in aquatic systems. Continuation of macroinvertebrate sampling will allow SCE&G to closely monitor the status of the LSR aquatic community and detect any changes resulting from implementation of instream flow enhancements. SCE&G is in the process of developing a macroinvertebrate sampling program in cooperation with the Fish and Wildlife TWC. Upon completion, this management program will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project.

Freshwater Mussel Research and Restoration

As previously noted, surveys conducted in support of relicensing found no native freshwater mussels in the LSR downstream of the Project (See section 3.10.5 for additional detail). As such, SCE&G proposes to implement a freshwater mussel restoration program after issuance of a new FERC license. The proposed program is currently being developed in consultation within the TWC and will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the proposed program after issuance of a new FERC license for the Project. While still in the development stages, the initial phases of the restoration program will likely focus on translocation of tagged, native species from adjacent basins to suitable habitat in the LSR to determine survivorship and reproductive potential. The restoration program will likely employ an adaptive management framework to allow for adjustment based on findings of the initial experimental phases. All aspects of the program will be closely coordinated with SCDNR's mussel restoration and research efforts in the Broad and Congaree rivers.

Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement

As discussed in Section 3.3, in order to investigate ongoing recovery efforts of diadromous fish in the Santee-Congaree basin, SCE&G is a participant of the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement, which is a collaborative approach among utilities with licensed hydroelectric projects (SCE&G and Duke Energy Carolinas, LLC) and federal and state resource agencies (SCDNR, USFWS and NCWRC) that will address diadromous fish protection, restoration and enhancement in the Santee River Basin through implementation of a 10-year action plan. It has been addressed through the Accord that reservoir elevation limitations, required flow releases, low inflow protocols or high inflow protocols to be developed in a relicensing agreement for the Saluda Hydro Project among the USFWS, SCDNR and SCE&G along with reservation by the USFWS of any fishway prescriptions for this project will be filed with the FERC for the term of the new Saluda Hydro Project license. It is an understanding that any diadromous fish study needs will be addressed through the Accord. The Accord shall terminate for SCE&G at the end of the term of the new FERC license for the Saluda Hydro Project (expected to be issued by the FERC in 2010).

Sturgeon Management Program

Shortnose sturgeon have been documented as far upstream as the Gervais St Bridge on the Congaree River, just downstream of the confluence of the LSR and Broad River (See section 3.10.1.4 for additional detail). While surveys conducted in support of the current relicensing failed to capture sturgeon in the LSR (Appendix E-2), the NMFS indicated in comment on the DLA that, because access is not physically blocked, the LSR must be considered as potential habitat for sturgeon. Accordingly, SCE&G is currently engaged in consultation with NMFS for the cooperative development of a long-term management strategy for shortnose and Atlantic sturgeon. Upon completion, this management program will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project. Information on shortnose sturgeon will be provided to the public as part of an RT&E species awareness program.

Minimum Flows

SCE&G proposes to implement minimum flows as part of the new license to support aquatic habitat in the LSR downstream of the Project. During normal inflow years (i.e., non-drought), SCE&G proposes to releases a minimum flow of 700 cfs from January 1 through March 31 and from June 1 through December 31, 1300 cfs from April 15 through May 14, and 1000 cfs from April 1 through April 14 and May 15 through May 31 (Table included in section 3.10.6). The 700 cfs is aimed at optimizing habitat for target key species and lifestages identified by the Instream Flow/Aquatic Habitat TWC (TABLE 3-1); PHABSIM modeling conducted in support of the IFIM Study suggests that, during a normal water year, a 700 cfs minimum flow would provide near 100% of maximum Weighted Usable Area (WUA) for most target species (Section 3.10.6). The proposed 1300 cfs spring flow is aimed at providing sufficient depth and wetted width to allow striped bass to migrate upstream through the Millrace Rapids. Millrace Rapids is located adjacent to Riverbanks Zoo, near the downstream extent of the LSR, and is thought to be the limiting zone-of-passage for inmigrating striped bass (Isley et al., 1995). Recent telemetry studies by the SCDNR have identified the LSR as a significant thermal refuge area for Santee Basin striped bass during the summer months (See section 3.10.6). A previous IFIM study on the LSR (Isley et al., 1995) suggested that approximately 1300 cfs is needed for effective passage through the reach at Millrace Rapids. The 1000 cfs flow is intended to provide a gradual transition in and out of the spring fish passage flow.

SCE&G also proposes to implement a High Inflow Protocol during higher inflow years. Specifically, during years when the reservoir has reached its summer target elevation on or before March 1, SCE&G will initiate releases of the 1000 cfs spring flow on March 1 rather than April 1. Early initiation of spring flows is intended to provide additional flow for spring spawning fish and to provide additional wetted width and depth at key habitat areas that PHABSIM modeling has indicated could benefit from additional flow (i.e., Oh Brother and Ocean Boulevard rapids areas).

Finally, SCE&G proposes to implement a LIP during drought years. The proposed LIP is based on the low inflow recommendations developed by the Instream Flow/Aquatic Habitat TWC and would utilize a staged approach based on lake level, the US Drought Monitor Designation and the USGS 28 Day Average Flow of the three gauged rivers that provide inflow to Lake Murray. Under the proposed protocol, flow would be curtailed in phases linked to the severity of the drought event (included in section 3.10.6). Under the most severe condition of LIP Stage IV (US Drought Monitor Designations of D3 - Extreme and D4 - Exceptional), flows would be reduced to 400 cfs during all months. It should be noted that, while 400 cfs is a significant reduction, PHABSIM modeling conducted in support of the IFIM Study suggests that the flow would still provide approximately 80% of maximum WUA for most target species and lifestages (Section 3.10.6), a level deemed acceptable in consultation with the resources agencies and other TWC participants (See January 23-28, 2008 Instream Flow Workshop Meeting Notes). These minimum flows, LIP and HIP programs will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license and will be implemented after issuance of a new FERC license.

RT&E Educational Programs

SCE&G proposes to implement a Rare, Threatened and Endangered Species Program to inform and educate the public regarding RT&E species that utilize Lake Murray and the LSR. Specifically, the program will provide details on the life history, conservation status, and habitat needs of species known to occur in the project area, such as bald eagle, rocky shoals spider lily and the federally endangered wood stork. For species that are rarely seen on the Project, such as the wood stork, and species that occur in the Project vicinity, but have not been detected in the immediate Project area, such as the federally endangered shortnose sturgeon, the program will include a mechanism to allow the public to report sightings of these species. Because of the popularity of both the LSR and Lake Murray for recreation, implementation of the RT&E Species Awareness Program should serve as an educational tool highlighting the importance of the Project as habitat for these species, as well as a means for providing additional monitoring of their occurrences.

Table 3-1: Preliminary Proposed Minimum Flow Releases for the Lower Saluda River During Normal Water Years

TIME PERIOD	MINIMUM FLOW (CFS)
January 1 – March 31	700
April 1 – April 14	1000
April 15 – May 14	1300
May 15 – May 31	1000
June 1 – December 31	700

Trout Adaptive Management Program

SCE&G proposes to implement an Adaptive Management Strategy for the LSR trout fishery, which is currently managed as a put, grow, and take fishery. During initial stage consultation, Trout Unlimited requested an analysis of the potential for the LSR to support a self-reproducing trout population (See report in Appendix E-2). While findings of the analysis suggested that current biotic and abiotic conditions in the LSR likely would not support a self-reproducing trout strategy, SCE&G agreed to develop an Adaptive Management Program to periodically re-evaluate habitat conditions in the LSR. This strategy is founded on the assumption that continued DO enhancements and implementation of minimum flows will likely result in improved macrohabitat conditions for trout in future years, possibly making the LSR more suitable for a self-reproducing management strategy. While still in the development phase, the proposed program will likely involve consultation with pertinent agencies, NGO's, and regional experts on a 5 to 10 year interval to review pertinent macrohabitat data (e.g., DO, temperature, flow conditions). The Adaptive Management Program will be filed with the FERC upon completion, which will be in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license and will be implemented after issuance of a new FERC license.

3.13 Anticipated Effects

Continued coldwater releases associated with Project operations will result in the LSR continuing to function primarily as a coolwater system, supporting both the put, grow and take trout fishery and components of the native warmwater fauna. Implementation of the proposed 700 cfs minimum flow would likely result in improvements in the thermal regime for trout and increased habitat availability, as increased flow will result in less pooling and associated warming of water during periods of non-generation.

Stratification of the Lake Murray during the summer months will likely continue to result in periodic hypolymnetic releases to the LSR that are low in DO. However, recent installation of aeration equipment on Project turbines (hub baffles and turbine venting) and development of operating scenarios that optimize the aeration efficiency of the turbines ("look up" tables) have drastically reduced the magnitude, frequency and duration of such episodes. In the near term, SCE&G's proposal to continue turbine aeration and to continue to further refine operating scenarios that optimize the turbine aeration is expected to result in continued improvements in DO, which will undoubtedly enhance habitat for warmwater and coolwater species present in the LSR. In the long term, SCE&G is proposing to install new aerating runners on all of the units. This new technology should provide higher DO levels in the LSR as historically noticed.

Lake Murray will continue to experience thermal and chemical stratification during the summer months, resulting in periods of low hypolymnetic DO. These low DO events have been shown to result in reduced availability of deep, coolwater refuge habitat for striped bass in Lake Murray, particular during high inflow years, and have resulted in periodic striped bass fish kills (section 2.6 for additional information). While these "temperature/DO crunch" periods for striped bass will undoubtedly occur again in the future, implementation of SCE&G's proposal to operate unit 5 in a preferential "first on, last off" scenario will likely aid in minimizing the potential for impact during certain years. Water quality modeling conducted in support of relicensing suggested that operating Unit 5 in "first on, last off" mode, rather than the current "last-on, first off" mode, could potentially help preserve colder bottom water under some scenarios, resulting in increased available refuge habitat for striped bass (i.e., temperature <27°C and DO >2.5 mg/L) during some years. Additional detail regarding water quality impacts, the Unit 5 proposal, and water quality modeling conducted as part of relicensing are provided in Sections 2.2.1.3.4, 2.2.2.1.4, and 2.2.2.2.

Implementation of minimum flows in the LSR is expected to result in significant enhancement of aquatic habitats. Compared to the current 180 cfs minimum, implementation of the proposed 700 cfs minimum flow would significantly improved wetted width, as well as improve macrohabitat parameters such as depth and velocity for target riverine species. PHABSIM modeling conducted in support of the IFIM Study suggests that, during a normal water year, the proposed 700 cfs minimum flow would provide near 100% of maximum Weighted Usable Area (WUA) for most target species (Section 3.10.6). The proposed 1300 cfs spring flow would ensure passage of striped bass above Millrace Rapids, significantly enhancing the ability of the LSR to serve as a thermal refuge for striped bass during the summer months. Implementation of a Low Inflow Protocol is expected to significantly improve conditions for aquatic species and habitat by ensuring that sufficient water is provided to the LSR during periods of drought. PHABSIM modeling suggest that implementation of the 400 cfs during low inflow conditions would still provide approximately 80% of maximum WUA for most target species and lifestages, a level deemed acceptable in consultation with the resources agencies and other TWC participants (See January 23-28, 2008 Instream Flow Workshop Meeting Notes).

3.14 Comprehensive Plans

South Carolina Water Resources Commission. 1985. Instream flow study - Phase I: Identification and Priority Listing of Streams in South Carolina for which Minimum Flow Levels Need to be Established. Report Number 149. Columbia, South Carolina. June, 1985.

AND

South Carolina Water Resources Commission. 1988. Instream flow study - Phase II: determination of minimum flow standards to protect instream uses in priority stream segments. Report No. 163. Columbia, South Carolina. May 1988.

The above-referenced documents provided an important historical perspective and data synthesis during the current relicensing process regarding Instream flow needs in the LSR. Phase I identified the Saluda River as a priority river for which minimum flows needed to be established. The river, including the LSR segment, was studied further during Phase II and minimum flows necessary to support general instream uses were determined (i.e., navigation, water quality, fishery resources, run-of-river hydroelectric power production, threatened and endangered species, and unique ecological characteristics). The flows recommended by Phase II were initially considered by the Instream Flow/Aquatic Habitat TWC prior to scoping and execution of the Instream Flow Incremental Methodology (IFIM) (Appendix E-2). The minimum flow recommendations resulting from the IFIM study are consistent with the goals of both Phase 1 and Phase 2, but are more site-specific and detailed, and are supportive of the river uses designated therein.

National Marine Fisheries Service. 1999. Fishery Management Report No. 35 of the Atlantic States Marine Fisheries Commission: Shad and river herring [includes alewife (Alosa pseudoharengus), blueback herring (Alosa aestivalis), Alabama shad (Alosa alabamae), American shad (Alosa sapidissima), and Hickory shad (Alosa mediocris)] - Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. April 1999. 77 pages

The above referenced document has the stated goal to 'protect, enhance, and restore east coast migratory spawning stocks of American shad, hickory shad, and river herrings'. The NMFS management plan identifies several objectives critical to accomplishing this goal; among those relevant to the Project are promoting improvements in degraded or historic habitat; installing passage facilities at dams; improving water quality; ensuring adequate flows for migration, spawning, and nursery usage; and ensuring impingement and entrainment mortalities do not impact fish stocks.

SCE&G has reviewed the NMFS Management Plan and suggests that the Saluda Project is consistent with the plan's goals and objectives. Further, SCE&G has consulted with NMFS throughout relicensing regarding these species. In 2005, SCE&G initiated a Diadromous Fish Study to investigate the abundance, distribution and spawning of American shad, hickory shad, and blueback herring, as well as American eel, on the LSR and Upper Congaree River. Finally, the Instream Flow Study assessed habitat suitability for these species under alternative flow scenarios in the Project Area.

National Marine Fisheries Service. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000. 6 pages.

SCE&G has reviewed the NMFS Technical Addendum and submits that the Saluda Project is consistent with the plan's goals and objectives. It consists of corrections to Amendment 1 of the Interstate Fishery Management Plan, which requires a number of fishery-independent and fishery-dependent monitoring programs for shad and river herring, as well as stocking and hatchery operations. As discussed above, SCE&G has consulted with agencies on and completed Diadromous Fish Studies to investigate the abundance, distribution and spawning of American shad, hickory shad, and blueback herring on the LSR and Upper Congaree River. Further, SCE&G's participation in the Santee Basin Diadromous Fish Accord is consistent with the goals and objectives of this plan to enhance and restore fish stocks within Project waterways.

United States Fish and Wildlife Service, National Marine Fisheries Service, and South Carolina. Department of Natural Resources. 2001. Santee-Cooper Basin diadromous fish passage restoration plan. Charleston, South Carolina. August 28, 2001. 50 pages.

Over the past 10 years, the SCDNR, USFWS, and NMFS have worked together to develop the "Santee Cooper Basin Diadromous Fish Passage Restoration Plan", which was submitted to the FERC as a Comprehensive Plan under Section 10(a)(2)(a) of the Federal Power Act (USFWS et al. 2001). The USFWS, NMFS, and SCDNR, as well as the above referenced plan were consulted throughout development and execution of the diadromous fish studies conducted in support of relicensing. The plan identified the Saluda River as less than optimal for diadromous fish restoration efforts for a variety of reasons including: the large number of dams in the basin (approximately 13); limited number of river miles available to upstream migrating fish prior to reaching the Saluda Hydro Dam (approximately 10); and the cost and potential biological limitation (i.e., pressure-related impacts to outmigrating fish) of establishing fish passage at the Saluda Hydro Dam. In addition, cold hypolimnetic water released from the Saluda Hydro Dam may cause migrating fish to select the warmer water of the Broad River and not enter the Saluda (USFWS et al. 2001). Over the past several years the Applicant has worked with these agencies and is a participant in the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement.

2003 Review of the Atlantic States Marine Fisheries Commission's Fishery Management Plan for Atlantic Striped Bass.

SCE&G has concluded that this plan is not relevant to the relicensing of the Saluda Hydroelectric Project. The above referenced document is applicable to migratory stocks of Atlantic striped bass from Maine through North Carolina. The Saluda Project is in South Carolina, and striped bass stocks in the vicinity are comprised of stock augmented populations that are dam-locked.

National Marine Fisheries Service. 1998. Recovery Plan for the Shortnose Sturgeon (Acipenser brevirostrum). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages.

The above-referenced Recovery Plan for Shortnose Sturgeon is relevant to the Project and has been considered during the current relicensing effort. Although shortnose sturgeon have not been documented within the Saluda Project in recent history, the Project is thought to be within the species' historic range. As part of relicensing, SCE&G conducted a Shortnose Sturgeon Study to assess the status of the species downstream of the Project in the LSR and upper Congaree River (Appendix E-2). While no sturgeon were captured during the study, consultation with NMFS indicated that the LSR must be considered as potential habitat for the species since access to the LSR is not physically blocked by a dam or other structure. As such, SCE&G is engaged in ongoing consultation with the NMFS, which has recommended continued monitoring of the species. SCE&G is currently developing a management plan for this species which will be filed with the FERC upon completion. Potential Project impacts to shortnose sturgeon were also considered as part of the RT&E Assessment.

The NMFS (2008) has cited the LSR and upper Congaree River as being important to the recovery goals for shortnose sturgeon due to the presence of potential spawning habitat. SCE&G has found that the sturgeon study and associated NMFS consultation contribute to the knowledge base regarding the status of shortnose sturgeon in the LSR, and thus are consistent with the recovery goals outlined in the Recovery Plan.

National Marine Fisheries Service. 2000. Fishery Management Report No. 36 of the Atlantic States Marine Fisheries Commission: Interstate Fishery Management Plan for American eel (Anguilla rostrata). Prepared by the American Eel Plan Development Team. April 2000. 78 pages.

The above-referenced document is relevant to the Project and has been considered during the current relicensing effort. One of the goals of the above referenced documents is to "protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic States." SCE&G has had regular consultation with the NMFS regarding this species and has completed three years of American Eel Surveys to investigate presence/absence and relative abundance of adult and juvenile American eels in the LSR. Although no eels were captured during the eel survey, incidental capture of eels has occurred during other fish sampling efforts and in anecdotal reports from fishermen. The efforts made by SCE&G are aimed at ensuring the Project is consistent with the goals and objectives of the Fishery Management Plan for American eel.

United States Fish and Wildlife Service. 1994. Elements of consensus on American shad management in the stretch of Savannah River between Strom Thurmond (Clarks Hill) Dam and Augusta. Department of the Interior, Charleston, South Carolina. October 1994.

SCE&G would suggest that this plan is not relevant to the Saluda Hydroelectric Project. The Project is not located in the Savannah River Basin, nor does it receive or contribute waters to the Savannah Basin.

National Marine Fisheries Service. 1998. Fishery Management Report No. 31 of the Atlantic States Marine Fisheries Commission. Amendment 1 to the Interstate 73 Fishery Management Plan for Atlantic sturgeon (Acipenser oxyrhynchus oxyrhynchus). July 1998.

The above-referenced management report for Atlantic sturgeon has some limited relevance to the Project, and as such, was considered during the current relicensing effort. It consists of an amendment intended to address shorting-comings in the Fishery Management Plan (FMP) for Atlantic sturgeon, among which is a failure to outline conservation measures for protecting remaining populations and individual spawning areas. The focus of the plan is on locations where spawning habitat and stocks currently exist or where restoration of historical spawning sites is feasible.

NMFS noted during consultation that a small number of Atlantic sturgeon had recently been documented in the Santee-Cooper Lakes, and as such, requested that the species be included in the RT&E Assessment (Appendix E-2). The above referenced report was utilized as an information resource regarding life history and status of the species during development of the RT&E Assessment. However, since the report is focused on existing stocks, which current information suggests likely do not occur within the areas of influence of the Project, any goals or objectives are likely of little relevance to the Project.

United States Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

SCE&G has reviewed the above-referenced document and has ensured that the Project is consistent with the USFWS's recreational fisheries policy. An integral facet of the relicensing process involved extensive consultation between SCE&G and the USFWS through recreation and aquatic resource TWC meetings. SCE&G owns and operates numerous recreational sites on Lake Murray, associated islands, and lands downstream on the LSR to support recreational fishing. They further manage their lands to protect the ecology of the fishery, which is consistent with the USFWS's policy on promoting recreational fishing.

3.15 Aquatic Resources Tables

Table 3-2: Freshwater Mussel Species Documented as Occurring in the Saluda Project Vicinity (Source: Alderman, 2006)

SPECIES DOCUMENTED IN STUDY AREA				
COMMON NAME	**SPECIES**	**G RANK[1]**	**FEDERAL STATUS[2]**	**AREA OF OCCURANCE[3]**
Roanoke Slabshell	Elliptio roanokensis	G2,G3	SOC	BR, CO
yellow lampmussel	Lampsilis cariosa	G3,G4	SOC	BR, CO
Carolina slabshell	Elliptio congaraea	G4	SOC	CO
Carolina Lance	Elliptio angustata	G4	SOC	LM, LMT, BR, CO
Common Elliptio	Elliptio complanata	G5		LM, LMT, BR, CO, S*
Variable Spike	Elliptio icterina	G4		LMT, CO
Atlantic Spike	Elliptio producta	G4		LM, LMT
Savannah Lilliput	Toxolasma pullus	G3	SOC	LM, LMT
Eastern floater	Pyganodon cataracta	G5		LM, LMT
paper pondshell	Utterbackia imbecillis	G5		LM, LMT
Rayed Pink Fatmucket	Lampsilis splendida	G3	SOC	LM, CO
Eastern Creekshell	Villosa delumbis	G4		LM, LMT, BR, CO, S*
Creeper	Strophitus undulatus	G5		S*, CO
Florida pondhorn	Uniomerus carolinianus	G4		LM, LMT
northern lance	Elliptio fisheriana	G4		LM

[1] G1 - Critically Imperiled; G2 - Imperiled; G3 - Vulnerable; G4 - Apparently Secure; G5 - Secure

[2] SOC = Federal Species of Concern

[3] BR = Broad; CO = Congaree; S = Saluda; LM = Lake Murray; LMT = Lake Murray Tributaries

* In Broad River washout area of Saluda/Broad confluence

Table 3-3: Fish Species Typical of Lake Murray and the Lower Saluda River

COMMON NAME	SCIENTIFIC NAME	LAKE MURRAY	LOWER SALUDA RIVER
Amiidae			
bowfin	Amia calva	X	X
Anguillidae			
American eel	Anguilla rostrata		X
Aphredoderidae			
pirate perch	Aphredoderus sayanus		X
Atherinidae			
brook silverside	Labidesthes sicculus	X	
Catastomidae			
Northern hog sucker	Hypentelium nigricans		X
creek chubsucker	Erimyzon oblongus		X
spotted sucker	Minytrema melanops	X	X
striped jumprock	Moxostoma rupiscartes		X
silver redhorse	Moxostoma anisurum		X
smallfin redhorse	Moxostoma robustum		X
shorthead redhorse	Moxostoma macrolepidotum	X	X
v-lip redhorse	Moxostoma pappillosum		X
river carpsucker	Carpiodes carpio	X	
Centrarchidae			
black crappie	Pomoxis nigromaculatus	X	X
white crappie	Pomoxis annularis	X	X
bluegill	Lepomis macrochirus	X	X
dollar sunfish	Lepomis marginatus	X	
pumpkinseed	Lepomis gibbosus	X	X
green sunfish	Lepomis cyanellus	X	
Lepomis hybrid	Lepomis sp.	X	
redbreast sunfish	Lepomis auritus	X	X
redear sunfish	Lepomis microlophus	X	X
warmouth	Lepomis gulosus	X	X
largemouth bass	Micropterus salmoides	X	X
smallmouth bass	Micropterus dolomeiu		X
Cluepeidae			
gizzard shad	Dorosoma cepedianum	X	X
threadfin shad	Dorosoma petenense	X	X
blueback herring	Alosa aestivalis	X	X
Cyprinidae			
dusky shiner	Notropis cummingsae		X
spottail shiner	Notropis hudsonius	X	X
rosyface chub	Notropis rubescens		X
sandbar shiner	Notropis scepticus		X
swallowtail shiner	Notropis procne	X	X
yellowfin shiner	Notropis lutipinnis		X
coastal shiner	Notropis petersoni	X	
highfin shiner	Notropis altipinnis		X
ironcolor shiner	Notropis chalybaeus		X
Eastern silvery minnow	Hybognathus regius	X	X
whitefin shiner	Cyprinella nivea		X

COMMON NAME	SCIENTIFIC NAME	LAKE MURRAY	LOWER SALUDA RIVER
thicklip chub	Cyprinella labrosa		X
golden shiner	Notemigonus crysoleucas	X	X
bluehead chub	Nocomis leptocephalus		X
carp	Cyprinus carpio	X	X
Esocidae			
chain pickerel	Esox niger	X	X
Cyprinodontidae			
lined topminnow	Fundulus lineolatus		X
Ictaluridae			
snail bullhead	Ameiurus brunneus	X	X
flat bullhead	Ameiurus platycephalus	X	X
brown bullhead	Ameiurus nebulosus	X	X
yellow bullhead	Ameiurus natalis	X	X
white catfish	Ameiurus catus	X	X
channel catfish	Ictalurus punctatus	X	X
Lepisosteidae			
longnose gar	Lepisosteus osseus	X	X
Moronidae			
white bass	Morone chrysops	X	X
striped bass	Morone saxatilis	X	X
white perch	Morone americana	X	X
Percidae			
carolina darter	Etheostoma collis		X
piedmont darter	Percina crassa		X
tessellated darter	Etheostoma olmstedi	X	X
yellow perch	Perca flavescens	X	X
swamp darter	Etheostoma fusiforme	X	
Poeciliidae			
eastern mosquitofish	Gambusia holbrooki	X	X
Salmonidae			
brown trout	Salmo trutta		X
rainbow trout	Oncorhynchus mykiss		X

Table 3-4: Lower Saluda River Instream Flow Study – Summary of Transects, Listed in Order from Upstream to Downstream

TRANSECT ID	STUDY SITE	REACH	MESOHABITAT
Deep Pool 2	below USGS gage	1	Pool
21	Toenail Riffle	1	glide-run
20	Toenail Riffle	1	riffle/run
19	Toenail Riffle	1	riffle/run
18	point bar	1	Run
17	Sandy Beach	1	Glide
16	Sandy Beach	1	Shoal
15	Sandy Beach	1	Riffle

TRANSECT ID	STUDY SITE	REACH	MESOHABITAT
14	Corley island side channel	2	Glide
13	Corley island side channel	2	Glide
12	Reach 2 Run	2	Run
11	Corley island main channel	2	Glide
10	Corley island main channel	2	Riffle
9	Ocean Boulevard	3	glide/shoal
8	Ocean Boulevard	3	Run
7	Ocean Boulevard	3	Shoal
6	Oh Brother	3	Riffle
5	Oh Brother	3	Riffle
4	Oh Brother	3	Riffle
Zone Of Passage	Millrace Rapids	4	Shoal
3	Millrace Rapids	4	Shoal (ABANDONED)
2	Riverbanks Zoo	4	Run
Deep Pool 1	Riverbanks Zoo	4	Pool
1	Shandon	4	Glide

Table 3-5: Habitat Guilds Associated with Specific Study Sites and Mesohabitats

REACH	STUDY SITE	GUILD	MESOHABITAT
1	Toenail Riffle (T 19-21)	Shallow-fast	Riffle, with a run thalweg
1	Point Bar Run (T 18)	Deep-slow	Run
1	Sandy Beach (T 15-17)	Shallow-fast	Glide/riffle/shoal complex
2	Corley Island side channel (T 13-14)	Shallow-slow	Glide
2	Corley Island main channel (T 10-11)	Shallow-fast	Riffle/glide complex
2	Reach 2 Run (T 12)	Deep-fast	Run
3	Ocean Boulevard (T 7-9)	Shallow-fast	Riffle /shoal complex
3	Oh Brother Rapids (T 4 -6)	Shallow-fast	Riffle/shoal complex
4	Reach 4 Run (T 2)	Deep-fast	Run
4	Shandon Glide (T 1)	Shallow-slow	Glide

Table 3-6: Weighted Usable Area – Discharge Relationship, Reach 1, Riffle-Run-Glide Complex (Study Site Toenail Riffle)

DISCHARGE (cfs)	BNT Juvenile	BNT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	Robust RH spawning	Shallow-Fast spawning	Saluda Darter Adult	macroinvertebrates
300	13,621	1,706	12,743	39,356	10,556	91,214	9,573	1,764	6,598	83,143	16,341	39,252
400	27,161	3,800	23,554	71,117	18,388	99,052	38,967	3,103	1,811	112,118	19,306	78,713
446	33,576	5,184	27,917	84,710	20,098	100,336	57,325	5,651	1,384	120,532	18,728	87,198
500	42,097	7,272	32,836	100,109	21,535	102,689	75,402	11,262	1,467	124,587	17,887	92,388
600	57,402	11,922	41,176	127,468	22,254	103,496	97,336	24,386	1,538	123,172	16,192	98,753
700	71,340	17,604	48,686	147,071	22,269	106,552	108,110	42,865	721	117,792	13,858	100,372
800	83,642	24,188	55,124	157,068	22,247	102,601	117,318	63,504	810	105,969	11,660	103,973
900	92,955	31,147	60,187	160,274	22,226	95,851	122,727	83,965	893	93,022	10,457	99,898
1,000	99,309	38,296	63,658	161,731	22,134	90,534	126,917	101,020	1,013	82,408	9,438	94,266
1,200	103,115	52,521	66,314	163,789	21,581	80,097	125,997	127,263	1,139	65,888	7,692	82,760
1,400	102,064	64,072	65,887	164,735	20,824	68,952	117,068	143,598	1,285	49,562	6,235	71,410
1,605	99,250	72,279	65,630	159,869	20,163	58,408	106,498	152,447	1,620	37,573	4,810	60,470
1,800	95,840	77,183	65,506	155,050	19,504	49,295	93,339	156,763	1,728	28,617	3,489	49,667
2,000	91,297	82,055	64,214	147,636	18,790	41,201	77,421	156,344	1,799	23,066	2,640	38,060
3,000	65,909	86,119	56,464	124,137	15,492	12,237	33,475	142,138	1,915	7,551	124	7,171
4,000	47,405	80,148	51,510	100,638	14,267	3,107	21,895	119,297	883	1,925	6	335
5,000	41,690	61,367	46,876	79,785	14,322	138	22,677	108,108	131	2,000	8	170
6,000	37,708	25,575	43,596	76,477	13,768	51	26,147	91,050	-	2,999	9	110
7,000	39,945	22,620	40,948	76,191	13,030	22	25,849	82,897	-	3,253	0	37
8,000	40,474	17,633	38,190	75,723	12,360	9	22,343	82,770	-	3,187	-	-
10,000	43,180	27,290	34,362	70,549	11,635	-	18,167	82,046	-	2,484	-	-
14,000	33,526	37,557	27,774	59,562	10,546	-	11,957	75,065	-	2,855	-	-
16,000	25,275	37,523	25,388	59,179	10,294	-	9,631	69,784	-	1,324	-	-
20,000	12,379	26,716	20,988	59,016	9,848	-	8,105	65,537	-	299	-	-

Table 3-7: Weighted Usable Area – Discharge Relationship, Reach 1 Run (Study Site Point Bar Run)

DISCHARGE (cfs)	BNT juvenile	BNT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	Redhorse Juvenile	RBSF Spawning	RBSF Adult	Redhorse Adult	Am shad YOY	SNS Incubation
300	103,583	57,631	43,894	206,699	96,051	190,450	47,724	66,245	91,754	168,152	263,578	133,802	75,335	5,772
400	110,026	71,331	45,147	216,011	125,628	174,909	53,552	83,404	92,744	155,050	293,770	147,355	100,700	10,894
500	111,414	82,772	43,593	221,400	153,276	161,115	58,273	92,567	90,978	125,254	310,960	152,827	128,493	15,145
540	111,149	86,989	42,617	223,417	163,773	155,801	59,291	94,656	90,593	114,615	314,421	155,739	138,944	16,765
600	110,659	92,557	41,198	226,331	173,596	147,669	59,995	97,383	89,538	100,539	317,441	159,769	153,739	19,171
700	108,206	99,492	39,009	230,743	177,418	135,036	60,430	100,974	85,496	80,297	315,993	165,295	172,053	21,611
800	105,711	105,048	36,885	232,539	179,263	124,773	60,236	103,861	82,430	63,811	311,732	168,752	188,384	23,638
900	103,631	109,515	34,773	233,698	181,058	110,721	59,378	106,332	81,766	56,575	308,125	170,764	204,130	25,866
1,000	100,498	112,810	32,732	234,392	182,808	95,556	57,159	108,661	79,023	51,611	303,444	171,336	215,999	28,272
1,200	87,473	114,581	28,408	235,658	186,271	70,040	51,856	111,877	70,165	50,338	289,903	170,798	222,239	34,486
1,400	75,071	106,443	24,655	236,751	190,129	55,305	46,341	113,218	63,681	43,824	277,894	169,690	224,580	42,028
1,605	63,266	97,645	21,007	237,703	189,400	45,708	42,310	114,064	59,662	37,093	264,520	168,050	226,981	50,290
1,800	53,768	93,319	18,096	238,512	186,311	38,563	40,077	113,797	55,649	33,037	257,202	166,313	229,191	59,120
2,000	47,719	88,699	16,059	234,861	183,047	32,728	38,275	111,983	51,873	30,809	255,620	164,469	230,757	69,943
3,000	27,693	64,365	9,933	142,164	138,996	14,261	32,406	98,946	33,927	22,500	257,884	149,092	232,438	117,454
4,000	15,610	42,614	7,617	56,248	93,503	8,740	26,148	85,958	19,956	16,062	255,121	130,713	221,438	129,505
5,000	9,676	25,680	6,610	50,094	55,579	5,275	21,644	73,735	13,609	12,518	254,571	112,232	180,206	121,690
6,000	8,150	21,314	5,589	48,466	30,981	3,643	18,587	58,288	11,210	10,406	250,464	94,226	116,516	108,858
8,000	6,620	17,227	4,847	35,346	20,846	3,001	15,859	35,678	9,335	6,688	237,500	61,346	45,990	73,008
10,000	5,837	14,526	4,569	30,029	15,860	2,693	13,769	32,598	6,717	4,386	224,760	43,344	32,087	37,062
14,000	5,495	11,441	4,304	28,421	7,648	2,669	10,368	30,458	9,564	5,780	200,883	37,868	19,697	19,525
16,000	5,434	10,488	4,285	28,975	6,568	2,740	9,725	27,175	11,656	5,636	190,938	36,354	14,531	17,886
20,000	5,102	8,082	4,310	26,824	4,893	2,493	9,352	26,464	11,626	5,249	173,437	33,369	7,053	13,611

Table 3-8: Weighted Usable Area – Discharge Relationship, Reach 1 Glide-Shoal-Riffle (Study Site Sandy Beach)

DISCHARGE (cfs)	BNT juvenile	BNT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	RBRH Spawning	Shallow-fast Spawning	Saluda DRTR adult	macroinvertebrates	SNS Incubation
300	30,257	10,686	13,725	68,475	42,089	56,634	39,483	20,983	28,173	60,523	5,938	31,897	234
400	36,219	15,198	15,558	76,074	46,514	52,898	45,333	33,631	34,919	53,515	2,400	31,193	497
446	37,723	17,176	16,006	78,127	47,781	49,916	46,991	38,898	38,088	51,406	3,847	29,861	732
500	38,773	19,363	16,228	80,367	48,504	45,848	47,972	44,741	38,351	47,562	3,465	29,050	1,030
540	39,209	20,830	16,212	81,579	48,531	43,623	48,558	48,626	38,351	44,447	3,223	28,282	1,260
600	38,434	22,853	14,713	95,729	48,763	42,047	51,997	56,052	38,923	40,615	2,865	26,485	1,619
700	37,943	25,615	14,832	82,074	47,465	35,250	47,933	60,172	36,449	35,267	2,531	23,292	2,288
800	36,267	27,488	13,657	80,441	46,143	32,080	46,068	64,645	33,613	30,884	2,265	20,083	3,034
900	34,460	28,730	12,418	78,194	44,401	28,954	43,359	67,701	28,242	27,293	1,997	17,229	4,199
1,000	32,654	29,542	11,218	74,784	42,952	26,454	40,242	69,738	25,124	24,137	1,670	14,826	5,524
1,200	29,637	30,164	9,137	64,916	42,592	22,165	33,154	72,070	12,689	20,180	1,114	10,804	8,687
1,400	27,363	29,684	7,527	54,017	41,007	15,794	27,238	71,932	9,700	18,853	781	7,340	12,678
1,800	24,053	26,035	5,900	45,455	35,294	26,260	17,664	68,496	11,389	15,466	569	4,807	24,142
2,000	23,775	24,005	6,180	46,314	34,543	42,122	15,936	66,238	7,912	15,585	451	4,108	30,559
4,000	34,025	21,257	6,159	47,231	47,965	25,879	17,848	54,458	23,520	10,301	66	5,055	56,950
6,000	27,798	28,687	3,307	41,512	44,912	9,692	13,500	42,135	16,593	6,635	14	7,754	50,139
8,000	20,087	26,898	2,389	42,205	40,467	4,821	8,028	36,259	-	4,593	-	6,433	48,576
10,000	21,498	23,360	1,704	26,668	33,094	1,976	11,926	33,850	3,870	6,684	-	4,733	49,194
14,000	20,935	17,295	859	7,194	21,291	335	12,804	32,772	-	5,008	-	996	47,342
18,000	18,968	16,968	729	4,761	11,848	-	8,335	27,963	-	4,689	-	777	41,489
20,000	17,838	16,808	699	2,987	7,720	-	8,908	27,241	-	4,593	-	639	38,255

Table 3-9: Weighted Usable Area – Discharge Relationship, Reach 2 Run (Study Site Representative Run)

DISCHARGE (cfs)	BRNT juvenile	BRNT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	Deep-Fast spawning	Redhorse fry	Redhorse juvenile	Redhorse adult	Am. Shad spawning	SNS incubation
300	89,999	83,430	99,475	164,376	14,761	81,673	40,440	75,233	5,024	9,847	40,021	104,013	36,049	31,532
400	91,374	85,555	107,511	178,365	22,744	76,336	48,841	86,375	2,610	9,196	40,333	112,997	50,084	55,888
500	89,164	87,238	109,804	187,978	29,509	72,505	57,371	94,859	874	8,486	42,810	118,737	65,217	73,956
583	88,145	91,518	110,908	193,323	34,305	69,914	59,381	101,438	284	7,667	43,264	121,941	77,319	82,999
600	87,773	92,431	111,017	194,087	35,031	69,436	59,505	102,579	192	7,376	43,344	122,455	79,672	84,639
700	84,798	96,187	110,597	198,545	37,843	66,085	59,741	108,154	-	6,419	43,856	125,044	92,721	92,489
800	81,270	90,520	109,586	201,468	39,735	58,092	60,004	112,993	-	6,025	49,227	127,510	104,082	98,785
900	74,503	78,926	107,640	204,023	41,436	50,732	57,698	116,336	-	5,019	56,881	129,482	110,943	104,717
1,000	67,424	67,335	104,532	206,251	42,708	44,324	54,778	118,709	-	4,064	69,292	130,568	116,118	110,724
1,211	53,925	51,974	97,961	207,707	45,497	33,294	49,431	121,774	-	2,836	93,913	130,770	121,274	124,530
1,400	46,013	50,985	91,587	208,068	47,833	25,439	42,716	122,956	-	2,052	102,914	130,269	122,934	133,625
1,600	40,027	51,231	85,197	208,429	49,152	19,860	34,724	122,506	-	1,748	103,925	129,330	123,454	141,683
1,800	35,152	51,195	79,493	208,599	50,090	14,938	28,100	121,083	-	1,528	97,822	127,653	123,903	147,160
2,000	30,480	49,980	74,549	205,527	50,873	11,185	24,205	119,407	-	1,310	92,659	125,863	123,370	153,222
3,000	15,058	21,950	58,247	168,164	50,384	2,450	15,099	107,279	-	1,161	79,520	114,370	113,274	168,155
4,000	9,285	9,219	50,518	134,347	43,522	-	11,657	94,865	-	1,444	68,713	103,770	92,117	166,516
6,000	5,614	1,937	42,112	69,665	29,249	-	8,217	71,371	-	1,753	47,567	84,035	50,298	144,651
8,000	4,852	1,885	39,106	60,222	18,102	-	6,448	56,100	-	1,464	33,542	68,780	29,785	113,647
10,000	5,344	2,436	36,939	58,329	11,990	-	5,550	44,360	-	2,697	24,615	56,543	15,709	87,891
12,000	7,197	2,723	35,980	46,643	9,005	-	6,094	34,931	-	3,351	18,897	47,537	8,235	67,877
14,000	9,297	3,726	35,496	38,372	7,393	-	7,162	31,314	-	3,956	15,742	40,377	4,464	51,255
18,000	14,865	6,588	35,308	30,231	4,411	-	8,186	30,516	-	3,674	12,831	33,625	644	29,040
20,000	17,931	6,813	35,302	30,245	3,017	-	7,400	30,803	-	3,035	12,441	32,685	476	22,379

Table 3-10: Weighted Usable Area – Discharge Relationship, Reach 2 Glide-Riffle (Study Site Corley Island Main Channel)

DISCHARGE (cfs)	RBT juv.	RBT adult	BNT juvenile	BNT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	RBRH spawning	Shallow-Fast spawning	Saluda Darter adult	macroinvert.	SNS spawning
258	1,972	14,205	4,143	445	10,605	50,883	5,155	1,865	2,333	36,472	3,488	3,695	-
344	3,867	31,593	8,115	1,090	37,912	49,676	10,896	10,013	9,889	83,696	4,219	12,609	-
384	4,768	40,055	9,971	1,480	51,451	53,670	15,737	13,836	37,444	91,277	4,726	15,003	-
430	5,914	49,464	13,288	2,362	64,671	64,820	22,692	18,832	37,444	97,608	5,042	16,742	-
516	7,429	67,025	20,555	5,349	73,147	66,133	33,931	28,709	34,312	106,971	5,176	23,623	-
602	8,643	82,604	27,154	8,491	78,451	64,891	44,399	41,856	31,222	106,405	5,022	25,524	-
774	11,303	103,668	38,921	16,360	82,570	68,386	51,947	66,618	34,444	81,558	3,778	24,611	361
860	12,745	108,857	43,553	20,019	82,408	68,012	49,255	79,652	34,444	68,914	3,046	24,308	631
1,032	15,022	112,774	49,050	28,029	80,708	61,426	49,505	98,151	34,563	49,207	1,996	25,492	1,188
1,204	16,332	109,457	52,161	34,840	78,270	54,176	49,808	110,175	33,778	38,376	1,418	25,140	2,501
1,380	16,918	101,971	52,012	40,232	75,824	47,612	46,469	115,488	33,778	31,480	1,234	22,438	4,953
1,548	17,392	94,414	51,253	44,219	73,479	41,780	42,975	118,206	26,089	25,743	941	19,849	7,942
1,720	17,958	85,289	50,313	46,803	71,023	35,837	39,192	119,437	25,522	20,224	628	17,286	11,792
2,580	15,968	56,935	38,677	47,214	58,406	14,477	23,002	111,564	978	6,605	42	14,655	42,898
3,440	14,595	50,236	29,322	41,649	47,237	5,521	13,939	103,756	311	1,414	4	5,298	78,750
4,300	13,527	42,746	22,631	32,782	38,801	2,041	12,473	93,604	311	609	-	336	96,506
6,020	10,886	28,853	15,004	12,561	25,197	907	9,294	77,675	-	250	-	31	103,180
6,880	9,593	27,833	12,760	10,795	21,319	411	7,757	69,080	-	306	-	13	98,005
8,600	7,742	27,318	11,361	8,534	17,830	74	5,310	50,058	-	290	-	13	84,223
10,320	6,437	27,171	11,172	9,166	15,487	45	5,441	40,649	-	258	-	13	72,409
15,480	4,011	22,861	7,493	9,343	11,355	-	3,260	33,601	-	156	-	6	48,541
17,200	3,405	20,484	6,590	6,258	10,725	-	3,199	30,729	-	148	-	-	43,009

Table 3-11: Weighted Usable Area – Discharge Relationship, Reach 2 Glide (Study Site Corley Island Side Channel)

DISCHARGE (cfs)	Shallow slow	RBSF spawning	RBT juvenile	RBT adult	BNT juvenile	BNT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	SNS spawning
42	2,951	16,826	9,180	33,713	22,971	14,348	56	24,446	6,584	13,151	-
56	2,212	14,345	9,335	35,384	22,614	17,844	1,853	22,446	5,953	14,528	14
70	2,305	12,599	9,432	37,577	22,154	20,479	6,683	19,265	5,371	15,508	282
84	1,988	12,127	9,524	39,863	21,491	21,408	11,657	16,202	5,235	16,382	897
98	1,688	10,870	9,624	42,069	20,398	21,735	15,971	14,491	5,409	17,275	1,961
112	1,698	10,105	9,730	44,297	19,247	21,100	19,094	13,113	5,670	18,272	3,377
126	2,540	9,338	9,812	46,547	18,181	21,185	21,818	11,719	5,816	19,351	5,026
140	3,311	8,811	9,859	48,458	17,241	20,900	24,398	11,097	5,905	20,419	6,718
196	4,849	9,208	9,759	52,443	14,563	18,985	33,208	9,902	6,122	24,041	12,843
225	3,700	9,897	9,598	53,370	13,389	16,538	36,548	9,597	6,129	25,360	15,529
280	2,243	9,626	9,183	54,523	11,427	11,047	40,580	8,721	5,859	26,804	19,835
420	2,220	8,913	8,026	53,793	8,377	6,821	42,569	5,484	4,031	27,795	27,880
560	4,013	5,861	6,890	51,540	6,407	7,197	43,032	2,684	2,918	27,876	34,293
700	1,425	3,552	5,842	49,732	5,383	7,268	42,906	1,241	3,330	27,775	40,383
840	3,346	1,928	5,023	49,096	4,600	5,571	42,507	398	3,439	27,750	44,311
980	4,765	812	4,393	48,981	4,144	3,051	41,277	82	3,772	27,634	46,241
1,260	1,542	-	3,456	45,029	4,467	1,787	37,139	-	4,261	27,223	47,363
1,400	533	-	3,109	40,475	4,713	1,992	34,818	-	4,101	26,763	47,487
1,960	311	-	2,320	24,686	6,445	3,723	25,270	-	3,515	24,358	45,936
2,520	2,129	-	1,920	21,105	7,051	4,609	17,223	-	2,131	21,893	42,243
2,800	2,633	-	1,755	19,177	6,726	4,550	14,359	-	2,126	20,254	40,035

Table 3-12: Weighted Usable Area – Discharge Relationship, Reach 3 Shoal Run (Study Site Ocean Boulevard)

DISCHARGE (cfs)	SMB spawning	SMB fry	SMB juvenile	SMB adult	BNT juvenile	BNT adult	RBT juvenile	RBT adult	RBRH Spawning	Shallow-fast spawning	Darter	Macroinvertebrates	SNS Incubation
140	186	67,471	47,800	62,653	33,285	11,875	56,948	15,600	-	5,451	938	14,400	11
187	879	73,506	53,339	73,324	39,228	15,152	65,780	23,110	-	7,407	969	27,200	28
234	2,040	73,614	65,537	81,185	44,520	18,328	71,805	28,688	-	11,436	1,767	30,666	62
273	2,593	72,442	74,856	87,186	49,213	21,074	75,628	32,542	-	14,266	2,616	31,399	147
281	2,621	72,070	76,399	88,453	50,119	21,609	76,294	33,308	-	14,978	2,802	31,476	161
322	2,801	70,035	82,103	95,280	54,271	24,106	79,078	37,067	-	18,429	4,210	31,353	287
328	2,828	69,618	82,649	96,268	54,813	24,447	79,415	37,531	-	18,816	4,468	31,336	304
374	2,975	66,713	83,991	103,821	58,048	27,112	81,257	40,334	-	20,607	5,782	30,862	443
421	3,066	63,046	83,903	111,589	59,931	29,622	81,903	43,511	-	21,129	6,765	29,508	593
468	3,157	59,938	83,751	118,617	60,526	32,071	82,128	46,410	-	22,411	7,178	28,104	800
562	3,415	58,090	80,819	132,978	61,958	36,357	82,379	49,774	-	24,594	8,404	27,119	1,287
655	3,706	55,930	78,204	145,177	62,709	39,298	81,578	49,824	-	27,759	9,738	26,985	1,932
749	3,976	51,659	76,622	154,261	62,180	41,703	80,050	48,904	-	30,775	11,185	26,619	2,627
796	4,094	49,579	75,787	157,410	61,298	42,828	79,005	48,959	-	32,352	11,666	27,196	2,946
842	4,196	47,745	74,577	160,107	60,267	43,789	77,864	49,073	-	34,202	12,153	27,641	3,291
936	4,223	45,573	72,808	164,643	58,277	45,548	75,527	49,125	-	36,283	13,231	28,391	4,007
1,404	4,554	42,632	71,632	177,553	51,314	49,982	64,748	46,247	-	46,275	13,697	26,120	6,583
1,872	4,572	30,493	66,837	189,642	46,750	48,194	56,261	49,408	-	42,471	8,796	26,551	9,556
2,340	4,313	30,363	59,643	199,369	43,348	44,668	49,903	47,892	2,732	35,084	5,914	23,630	12,969
2,808	4,380	21,569	55,188	204,741	39,559	40,185	44,233	46,784	2,732	29,285	4,354	23,724	16,040
3,276	4,361	16,250	52,613	207,775	34,685	36,633	38,964	45,500	-	24,347	3,078	18,191	20,181
3,744	4,247	12,756	44,162	207,120	30,438	34,448	34,228	42,614	740	17,470	2,082	13,569	24,545
4,212	4,138	9,961	36,454	204,338	27,016	32,105	30,370	37,269	740	11,670	1,391	9,972	29,260
4,674	4,041	7,894	30,359	197,951	23,701	30,029	27,039	32,405	740	8,622	799	7,133	34,348
5,616	4,194	5,102	22,172	181,759	18,297	23,160	22,472	23,891	351	4,927	414	3,500	45,715
6,552	4,527	3,476	16,829	167,240	14,859	17,191	19,159	17,186	351	2,574	15	1,344	55,277
7,488	4,693	2,415	13,356	151,138	13,119	13,695	16,945	12,919	1,130	1,495	0	232	61,525
8,424	4,829	1,603	11,666	137,714	12,406	11,051	15,163	9,835	779	974	-	30	66,251
9,360	5,107	959	10,526	125,846	12,202	9,373	13,761	8,913	779	662	-	18	69,004

Table 3-13: Weighted Usable Area – Discharge Relationship, Reach 3 Riffle (Study Site Oh Brother Rapids)

DISCHARGE (CFS)	WETTED AREA	Jv BRT	Ad BRT	Jv RBT	adult RBT	Sp SMB	fry SMB	juv SMB	adult SMB	RBRH Sp	Shallow-Fast sp	S DRTR Adult	macroinvertebrates	SNS Spawning
160	186,316	19,529	2,795	15,271	47,062	31,916	78,688	33,288	6,439	13,905	94,785	12,132	38,969	-
213	216,462	25,284	4,372	17,168	63,408	44,607	99,971	45,717	9,465	29,126	111,342	11,184	43,354	-
266	225,065	31,010	6,121	18,759	78,808	57,330	105,790	54,916	13,862	29,126	126,011	9,921	46,139	-
310	235,139	35,604	7,762	19,825	90,237	62,872	106,484	58,818	18,148	34,834	131,093	8,999	48,479	-
319	237,910	36,519	8,111	20,058	92,802	63,671	106,740	59,474	19,062	39,908	132,139	8,907	48,697	-
366	243,592	41,494	10,112	21,370	105,053	67,082	103,953	63,112	24,312	39,782	133,371	8,622	49,027	-
372	244,368	42,140	10,395	21,531	106,325	67,561	103,697	63,484	25,036	44,542	133,319	8,584	48,929	-
426	251,102	47,635	12,925	22,922	116,806	69,873	102,311	66,020	31,673	36,151	129,436	8,698	47,533	-
479	258,654	47,389	13,359	23,750	103,891	70,722	102,934	67,718	38,116	35,029	105,889	11,104	41,630	-
532	263,132	50,545	15,285	24,308	108,538	69,529	105,037	68,064	44,700	29,321	98,133	10,602	39,620	-
638	264,910	54,903	19,032	24,607	114,812	69,060	99,660	64,412	57,480	24,881	83,803	9,388	37,452	3
745	265,512	57,900	22,873	24,254	120,614	72,023	90,308	61,601	67,494	22,832	69,239	8,512	34,607	6
851	266,155	59,402	26,731	23,852	120,811	74,051	83,016	59,806	74,546	22,832	57,694	7,089	31,523	18
908	266,491	59,657	28,660	23,570	118,930	73,049	79,347	59,213	77,286	25,568	53,535	6,423	30,000	23
958	266,773	59,864	30,202	23,328	117,589	72,048	76,164	58,135	79,675	37,419	50,708	5,923	28,749	29
1,064	267,299	59,667	33,151	22,655	113,938	70,048	69,495	55,076	83,862	26,003	45,529	4,947	26,303	111
1,596	268,498	50,339	42,434	18,160	97,871	61,395	41,013	38,590	87,921	26,003	24,963	1,938	14,496	2,301
2,128	269,254	40,482	45,441	15,059	84,107	54,109	24,576	24,179	80,410	26,173	15,546	1,164	6,367	8,453
2,660	269,899	32,888	44,437	12,954	75,293	47,652	13,481	15,721	71,815	10,508	9,672	786	2,330	20,784
3,192	270,466	26,267	41,263	11,641	70,428	42,490	6,147	11,643	63,625	10,302	5,474	491	594	36,611
3,724	270,975	20,769	35,560	10,472	61,795	38,671	1,830	9,798	58,104	1,321	2,823	344	108	48,468
4,788	271,834	13,350	24,938	8,844	50,271	33,859	555	7,913	48,224	1,597	657	102	28	61,687
6,384	273,136	6,918	7,239	6,994	44,665	27,484	414	5,918	38,662	1,954	510	15	44	66,442
7,448	273,891	4,347	3,157	6,393	41,204	23,329	347	4,605	34,270	2,165	704	35	64	64,265
8,512	274,580	2,953	2,656	5,856	38,828	19,766	268	3,481	30,638	-	838	75	69	59,874
10,640	275,408	1,291	2,473	5,048	35,118	16,473	87	2,400	24,647	-	1,033	169	39	51,713

Table 3-14: Weighted Usable Area – Discharge Relationship, Reach 4 Run (Study Site Riverbanks Zoo)

DISCHARGE (CFS)	BRNT juvenile	BRNT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	Redhorse Adult	Deep fast Spawning	Redhorse Fry	Redhorse Juvenile	American shad	SNS Incubation
300	57,732	44,808	33,724	153,964	74,748	203,671	29,391	44,234	116,354	29,515	23,874	79,404	69,377	15,363
400	64,479	48,446	36,729	177,149	90,627	205,494	34,785	51,324	132,764	36,158	24,285	85,897	84,248	21,168
500	70,680	50,502	38,874	196,477	105,650	215,768	35,952	57,969	145,172	40,209	22,426	88,993	96,871	25,633
600	77,206	51,434	40,597	209,938	114,703	220,690	36,455	63,539	154,189	44,697	21,251	90,848	109,098	28,940
688	83,286	52,429	41,873	217,281	119,613	221,477	36,827	68,003	159,554	47,976	20,757	91,935	118,475	31,579
700	84,125	52,672	42,035	218,014	120,258	221,477	36,881	68,539	160,154	48,366	20,725	92,098	119,680	31,933
800	90,841	54,185	43,247	218,470	121,782	220,994	38,158	72,513	164,838	50,657	20,775	92,443	128,187	34,693
900	96,254	55,712	43,674	218,647	121,199	214,224	41,319	75,018	169,885	51,449	21,066	92,747	135,189	37,554
1,000	100,067	57,191	43,931	219,953	119,007	210,673	42,442	77,790	174,461	51,106	20,013	92,832	141,400	40,234
1,200	105,791	58,774	44,206	225,854	113,835	207,620	43,794	81,313	182,136	51,909	19,293	90,468	148,838	44,536
1,400	108,030	61,480	44,751	233,372	108,225	201,944	42,023	84,351	187,280	51,270	17,104	88,079	147,158	47,623
1,600	109,651	64,307	45,392	238,506	103,062	196,151	40,266	86,560	190,258	50,071	15,784	84,914	142,710	49,808
1,800	112,432	67,175	46,276	239,927	99,652	192,037	38,689	86,252	191,924	49,233	14,977	82,380	137,722	51,212
2,000	110,448	70,047	46,884	236,408	95,604	187,420	37,540	86,791	192,453	49,018	14,678	80,367	132,325	52,378
4,000	95,584	91,063	51,216	228,705	57,220	153,276	32,787	85,579	198,815	21,393	13,472	69,198	111,174	54,600
6,000	87,536	104,795	55,484	249,638	52,207	137,099	32,764	87,632	201,250	1,591	13,825	67,813	87,931	62,523
8,000	82,405	107,925	58,454	269,996	68,511	134,896	32,174	93,304	207,803	566	12,237	67,766	80,500	80,990
10,000	80,943	105,135	60,990	281,819	86,474	130,056	32,566	100,402	212,417	325	11,161	67,605	88,583	95,169
12,000	76,214	74,702	61,755	286,795	99,083	129,350	34,184	104,475	216,168	-	11,121	68,732	102,736	102,754
14,000	70,239	66,209	61,111	291,255	108,225	125,113	37,086	107,620	220,266	211	11,872	70,556	116,886	107,241
16,000	66,748	66,440	60,867	298,097	113,448	128,873	37,270	110,325	223,682	621	10,335	71,321	128,472	111,116
18,000	63,761	64,479	60,871	305,241	114,559	128,422	37,484	112,366	228,094	1,190	9,423	71,299	135,810	113,643
20,000	60,370	52,781	60,737	308,423	116,001	127,198	34,922	113,811	230,158	1,618	9,617	72,773	142,960	114,377

Table 3-15: Weighted Usable Area – Discharge Relationship, Reach 4 Glide (Study Site Shandon)

DISCHARGE (cfs)	BRT juvenile	BRT adult	RBT juvenile	RBT adult	SMB spawning	SMB fry	SMB juvenile	SMB adult	Shallow-slow Guild fry	RBSF Spawning	SNS Incubation
300	208,449	70,223	211,519	265,799	24,819	308,186	196,279	100,895	161,733	17,778	2,256
400	232,912	86,496	226,338	297,250	28,448	297,216	228,417	125,026	137,135	21,664	3,678
500	248,275	100,469	234,336	316,299	30,437	287,842	250,195	147,525	103,156	24,247	5,043
600	259,664	111,973	239,995	330,146	31,461	275,710	265,386	168,795	74,405	24,784	6,288
688	268,276	120,629	244,280	340,082	32,064	264,859	271,488	186,327	54,028	25,086	7,338
700	268,935	121,788	244,732	341,378	32,159	263,352	271,963	188,497	51,869	25,116	7,490
800	275,604	130,662	246,502	350,085	32,670	252,522	276,386	203,766	35,982	25,351	8,667
900	277,139	138,339	247,131	353,770	32,897	243,931	275,160	219,420	31,771	25,155	9,822
1,000	278,124	145,061	247,643	351,889	32,905	235,743	273,013	235,067	28,168	24,544	11,113
1,200	280,157	156,136	249,385	341,954	32,504	220,237	267,510	263,865	22,569	23,407	14,073
1,316	280,596	161,204	250,081	337,215	32,218	211,656	263,967	279,295	20,512	22,818	16,005
1,400	280,189	163,958	249,769	333,198	31,919	205,881	261,092	287,643	19,621	22,401	17,561
1,600	279,899	169,057	248,606	324,471	31,123	192,966	255,450	306,078	17,207	20,642	21,094
1,800	277,502	173,551	246,795	314,330	30,280	181,991	252,342	322,367	10,034	18,365	24,323
2,000	273,125	176,337	243,651	304,277	29,534	173,552	249,224	335,858	2,518	16,370	27,950
3,000	246,721	189,183	212,160	267,456	25,642	126,394	235,110	353,253	1,150	8,677	47,639
4,000	227,386	199,830	183,266	251,622	22,083	90,772	202,651	349,938	1,421	3,230	60,820
5,000	204,423	201,735	159,650	241,045	19,781	63,257	169,746	338,278	1,652	1,417	69,991
6,000	181,611	200,057	139,361	229,392	17,923	44,505	137,764	327,138	5,923	572	78,804
8,000	139,769	190,785	107,182	220,012	15,760	28,254	91,675	298,779	13,105	164	89,674
9,000	122,318	182,098	95,412	216,970	14,954	21,906	76,378	278,910	12,435	5,289	95,643
10,000	106,901	169,655	85,111	212,143	14,208	16,552	66,064	269,989	10,056	9,644	101,153
12,000	83,242	141,753	69,100	195,480	12,523	10,803	54,734	253,532	5,306	12,031	113,076
16,000	53,842	103,509	49,140	135,100	9,543	8,503	41,578	217,585	2,877	13,346	133,410
20,000	36,861	68,866	37,451	102,045	7,031	8,127	33,263	192,809	1,607	14,922	136,323

Table 3-16: Key (K) and Secondary (S) Habitat Suitability Species and Lifestages Resulting from TWC Review Process

SPECIES/GUILD	LIFESTAGE/CURVE	PRIORITY
Brown Trout	Adult	K
	Juvenile	K
	Fry	S
	Spawning	S
Rainbow Trout	Adult	K
	Juvenile	K
	Fry	S
	Spawn	S
Smallmouth Bass	Adult	K
	Juvenile	K
	Fry	S
	Spawning	S
Shortnose Sturgeon	Spawning	S
	YOY	S
Striped Bass	Adult	K_1
Deep-slow Guild	Blended	S
Deep-fast	Blended	K
Shallow-slow	Blended	K
Shallow-fast	Blended	K

Table 3-17: Time Series of Habitat Use for Key Species and Lifestages Identified During January 2008 TWC Workshop

KEY SPECIES/MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Adult trout												
Juvenile trout												
Brown trout spawn/fry												
Rainbow trout spawn/fry												
Striped bass passage												
Striped bass thermal refuge												
Smallmouth bass spawning												
Smallmouth bass juveniles												
Shallow-slow guild												
Shallow-fast guild												
Deep-fast guild												

3.16 Aquatic Resources Figures

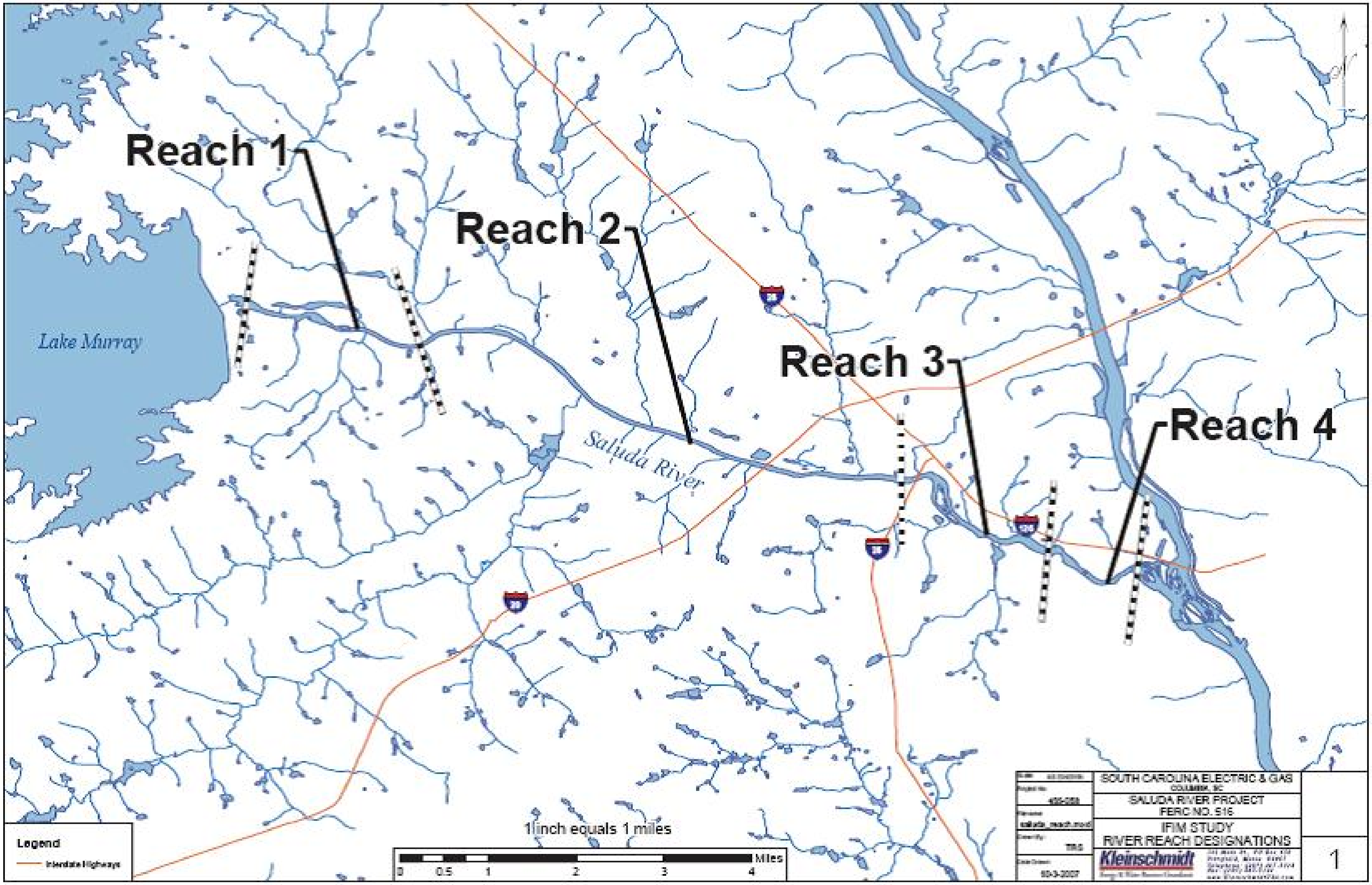

Figure 3-1: Lower Saluda River Instream Flow Study Area and Reach Boundaries

4.0 WILDLIFE RESOURCES

4.1 Existing Wildlife Resources

4.1.1 Wildlife Habitats

Although the Lake Murray[8] shoreline continues to undergo development, the project area contains extensive habitats that support diverse and abundant wildlife populations. Shoreline habitats are typical of the Piedmont area of South Carolina and include pine plantations, bottomland and upland hardwood forests, mixed pine/hardwood forests open fields, and sandhills. The majority of wildlife habitats in shoreline areas are found in the 75 ft. setback, riparian buffer zones, Environmentally Sensitive Areas (ESAs), Forest and Game Management areas and undeveloped areas of the project. Details regarding the vegetative resources (*i.e.*, wildlife habitats) are presented in Section 5.0.

Forested and other terrestrial areas surrounding the project harbor typical woodland species such as wild turkey, white-tailed deer, raccoon, gray squirrel, opossum, and gray fox. Terrestrial areas also support a variety of resident and migratory birdlife including songbirds, woodpeckers, raptors, and upland game birds. Typical species include red-tailed and red-should hawks, bobwhite quail, mourning dove, American robin, eastern bluebird, pileated woodpecker, and meadowlark. The project area also supports an abundance of terrestrial reptiles and amphibians such as eastern box turtle, green anole, broad-headed skink, gray rat snake, southern toad, green tree frog, and marbled salamander.

The abundant open- and shallow-water habitats within the project area support a variety of aquatic and semi-aquatic wildlife such as beaver, river otter, muskrat, and possibly mink. Shallow, often vegetated areas in creekmouths, backwaters, and along reservoir shorelines are used for foraging and cover by migratory and resident waterfowl such as wood ducks, Canada geese, American coots, and

[8] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

black ducks, as well as wading birds such as great blue herons, great egrets, and green herons. In addition to providing important breeding habitat for most amphibian species, these shallow waters also provide year-round habitat for aquatic reptile and amphibian species such as eastern newt, bullfrog, spring peepers, brown and red-bellied water snakes, and mud and musk turtles. Open water areas are often utilized by such species as bald eagle, kingfisher, osprey, and various gulls for foraging. Typical wildlife species for the project area are listed in Table 4-4 through Table 4-6.

Lunch Island, also known as Bomb Island, on Lake Murray is one of the largest pre-migratory roosting sites for purple martins in the United States (Russell and Gathreaux, 1999). The purple martin is a neotropical migrant, meaning that it migrates annually from its normal range in South America, the West Indies and portions of Central America, northward to breeding grounds across North America (Brown, 1997). This species is unique in that it nests in large colonies and is almost entirely dependant upon man-made structures for nesting (Russell and Gathreaux, 1999). Following the fledging period, purple martins often congregate in large nocturnal roosts of 100,000 or more birds prior to returning southward (Brown, 1997). Beginning in late June and extending through August or early September these congregations engage in two mass movements daily as they exit the roost in the morning to feed and return in the evening (Russell and Gathreaux, 1999). It has been estimated that at least 700,000 birds utilize the Lunch Island roost (Russell and Gauthreaux, 1999), prompting SCDNR, and the Columbia Chapter of the National Audubon Society to request that the eastern end of the island be designated as North America's first purple martin sanctuary. In April of 1995, SCE&G signed a Memorandum of Agreement with SCDNR and the Columbia Chapter of the National Audubon Society regarding the management of Lunch Island for the benefit of the purple martin population.

Osprey Nesting Platform Program

In 1996, the Lake Murray Association initiated a program to construct and install osprey nesting platforms around the Lake Murray shoreline (LMA, 2007). These platforms, which were originally constructed of wood but have been replaced with all-metal structures, provide valuable habitat for this species. From 1996 through 2007, a total of 20 platforms have been erected (13 wooden platforms, 7 metal).

The Lake Murray Association also has 3 all-metal platforms available for replacements and future installations. SCE&G has assisted the Lake Murray Association in this endeavor by providing a current total (as of 2007) of 6 all-metal platforms. Each year the Lake Murray Association has met its goal of installing at least 2 platforms (pers. communication with Ken Fox, LMA). General observations of osprey in the area indicate that Lake Murray supports a significant number of individuals. Although the exact number of osprey inhabiting the Project area is not currently known, during the last couple years (2006-2007) many have been observed sitting on old nest sites and diving for fish.

According to a spring 2007 nesting survey conducted by the LMA, at least 47 active nests, built upon varying structures, were used by breeding osprey within the lake area (Table 4-1). Of this number, more than half of the platforms erected by LMA were used by breeding birds, constituting almost 20 percent of the total nests identified. An average of two adult birds and two fledging offspring were documented per nest. Limitations of the survey, cited by LMA, include the extensive shoreline mileage that made it impossible to document all breeding activity around the lake. Regardless, this effort, which includes plotting nest locations on a map, provides valuable baseline data for future monitoring (LMA, 2007).

Table 4-1: Results of Spring 2007 Osprey Nesting Survey of Lake Murray Shoreline Conducted by LMA

STRUCTURE	NESTS	ADULTS	FLEDGLINGS
Platforms	9	18	20
Power pole	14	28	28
Tree	24	46	43
Total	**47**	**92**	**91**

Source: (LMA, 2007)

4.2 Rare, Threatened, and Endangered Species

As part of relicensing, SCE&G formed a Rare, Threatened and Endangered Species Technical Working Committee (RT&E TWC) to address Project-related issues related to rare, threatened and endangered species. The RT&E TWC is comprised of representatives from state and federal resource agencies (i.e., SCDNR, NMFS and USFWS), representatives from several NGO's, and other stakeholders.

In response to USFWS's identification of potential RT&E species in the counties that contain the Project (Letter dated August 1, 2005) (Table 4-3), the TWC performed an assessment of the likelihood that RT&E species or their habitats occur within the Project area (Kleinschmidt, 2008). Many of the species listed by the USFWS occupy coastal plain habitats and as such, are not supported by environments present within the Project boundaries. Of the species identified by USFWS, only the wood stork and bald eagle are known to occur within the Saluda Project Boundary. They are described in greater detail below.

Bald Eagle

The bald eagle was listed as federally-endangered on March 11, 1967, partially due to significant population declines attributed to DDT exposure. Subsequent to the banning of DDT, populations began to increase and the eagle's status was lowered from endangered to threatened on July 12, 1995 (USFWS, 1995a). Today, the species has recovered to the degree that it was recently removed from the Federal Endangered Species List, effective July 2007 (72 FR 37345 37372) (USFWS, 2007). In South Carolina, the number of estimated nesting pairs has increased from 13 in 1977 to 181 in 2003 (Wilde et al., 2003). The bald eagle continues to receive protection under the South Carolina Nongame and Endangered Species Conservation Act as a state endangered species, as well as through the Eagle Protection Act (16 U.S.C. §§ 668-668d).

Bald eagles may be found throughout North America, typically around water bodies where they feed primarily on fish and scavenge carrion. Studies suggest reservoirs, especially those associated with hydroelectric facilities, are particularly attractive to foraging bald eagles (Brown 1996). Eagles nest in large trees near water and typically use the same nest for several years, making repairs to it annually (Degraaf and Rudis, 1986). In South Carolina, the distribution of eagle nesting has shifted, from historically being located primarily along the coast, to encompass more inland areas; this expansion has been attributed to the construction of approximately 491,000 acres of large reservoirs in the state since the early 1900's (Wilde et al., 2003).

Bald eagles have likely used Lake Murray for foraging and nesting since its construction in 1930. Eagles utilizing the lake for foraging are thought to be a mix of native nesting adults and juveniles from South Carolina and adult and juveniles from outside the state (Wilde et al., 2003). Eagles forage on Lake Murray year round, with peak usage likely occurring during the winter months. Nesting of bald eagles on Lake Murray was first documented in 1996, and since that time, the nesting population has increased to six pairs (Wilde et al., 1996). Productivity (young produced) has also increased substantially around the lake from two chicks in 1996 to 10 chicks in the 2002/2003 nesting season (Wilde et al., 2003). According to reports by the Lower Saluda Scenic River Advisory Council, bald eagles are also seen along the LSR corridor and have been seen nesting in an area near the confluence of the lower Saluda and the Broad Rivers (LSSRAC, 2005).

Lake Murray was one of four South Carolina reservoirs affected by an outbreak of Avian Vacuolar Myelinopathy (AVM), which was first documented at DeGray Lake, Arkansas in the winter of 1994-1995 (Jeffers, 2000). AVM has been confirmed in birds from 11 reservoirs in five southern states (SC, NC, GA, AR, TX) and has resulted in the death of at least 93 bald eagles, thousands of American coots, and smaller numbers of waterfowl and other species (Wilde et al., 2003; Birrenkott et al., 2004). AVM is thought to be linked to an unknown neurotoxin that causes lesions in the white matter of the brain and the spinal cord. Affected animals demonstrate difficulty flying, swimming and walking (Jeffers, 2000). Evidence suggests that bald eagles contract AVM by preying on afflicted coots and other waterfowl that are unable to evade predators (Wilde et al., 2003).

Researchers suspect that the neurotoxin thought to cause AVM may be the product of a cyanobacteria (blue-green algae) often found growing in association with aquatic vegetation (i.e., *Hydrilla*) (Wilde et al., 2003). Sampling conducted at AVM-affected reservoirs by SDCNR and the University of South Carolina (USC) during 2001 and 2002 found that one particular species of blue-green algae, which is known to produce toxic compounds, had the greatest incidence of colonization at the location with the highest eagle mortality from AVM (Strom Thurmond Lake on the South Carolina/Georgia border). In addition, a recently-published feeding study involving mallards found a cause-effect relationship between ingestion of *Hydrilla* from these sites and AVM infection (Birrenkott et al., 2004).

As part of the Saluda Dam Remediation Project, from 2002 to 2005 SCE&G funded monthly surveys on Lake Murray to monitor for the presence of AVM-affected birds, as well as periodic collections of American coots to screen for the disease. To date, there have been no known occurrences of AVM in the Lake Murray bald eagle population; however, a low percentage of the coots collected during the winters of 1999 (2 out of 17 collected), 2000 (5 out of 27 collected), and 2003 (1 out of 30 collected) did test positive for the disease, as well as one Canada goose collected during December 2000 (Wilde et al., 2003). Despite the presence of some affected prey species, SCDNR and USC scientists have concluded that, to date, the presence of AVM at Lake Murray does not appear to have resulted in extensive losses of breeding adult bald eagle as both the number and productivity of eagles nesting on Lake Murray have increased from 1996 level (Wilde et al., 2003). It should be noted that the presence of AVM in the lone coot from the 2003 collection was determined only through clinical testing, with no birds displaying obvious neurological impairment, suggesting that AVM was not severe at Lake Murray during the 2002/2003 season (Wilde et al., 2003).

Wood Stork

The wood stork was federally-listed as endangered on February 28, 1984 (USFWS, 1996). The only stork native to North America, wood storks occurred historically throughout the coastal plain of the southeastern U.S. and Texas. The current U.S. breeding population has declined from an estimated 20,000 pairs in the 1930's to between 5,500 to 9,500 in recent years, with declines attributed primarily to loss of suitable foraging and nesting habitat. Currently, nesting of the species in the U.S. is thought to be limited to the coastal plain of South Carolina, Georgia, and Florida (USFWS, 1996).

Wood storks are highly colonial and typically nest in large rookeries and feed in flocks (USFWS, 1996). Typical foraging habitats include narrow tidal creeks, flooded tidal pools, and freshwater marshes and wetlands. Like most other wading birds, storks feed primarily on small fish. However, because wood storks feed by tactilocation (using the sense of touch), depressions where fish become concentrated during periods of falling water levels are particularly attractive sites (USFWS, 1996). Storks typically use tall cypresses or other trees near water for colonial nest sites. Nests are usually located in the upper branches of large trees and several nests are typically located in each tree. Trees used for nesting and roosting typically provide easy access from the air and an abundance of lateral limbs (USFWS, 1996).

While wood storks are primarily birds of freshwater and brackish wetlands along the coastal plain, wood stork activity has been reported by local residents at several locations within the Lake Murray area since approximately 1999 (Personal Communication, E. Eudaly, USFWS, August 2004). In 2004, SCE&G, in coordination with the USFWS and SCDNR, developed a long-term study plan to document wood stork usage within the Saluda Project Boundary and in the Project vicinity (SCE&G and Kleinschmidt, 2004a). A summary of this survey effort and preliminary results of two of the five years worth of surveys is provided in Section 4.4.2.

4.3 Agency and Public Recommendations Concerning Wildlife Resources

4.3.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) was also filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below, are the remarks and study requests regarding wildlife resources that were provided by stakeholders in comment letters following the issuance of the ICD.

In a letter dated August 1, 2005, the USFWS requested information regarding migratory bird species to evaluate migratory bird use at Lake Murray and the Saluda River, as well as riparian ecosystems. More specifically, the USFWS suggested conducting surveys of migratory birds and their habitats to provide baseline information on populations.

Migratory bird surveys were performed at the Project with agency consultation. More discussion on this subject is included under Second Stage consultation and in section 4.3.2.

In addition to the migratory bird surveys, the USFWS in conjunction with CCL/American Rivers, SCDNR, LSSRAC, and NMFS requested studies to assess the condition of rare, threatened, and endangered (RT&E) species (wood stork and bald eagle) in the Project area, as well as how Project operations may potentially affect these species. They were also interested in gathering information as to how Project operations could be used to protect, restore, or enhance the populations of these listed species. These entities noted that Management Plans should be developed for RT&E species existing in the Project area or under the influence of the Project, including the wood stork and bald eagle. DNR also notes that management plans should be developed for RT&E species affected by the Project in their DLA comments (dated March 14, 2008).

In a first stage consultation comment letter (dated August 1, 2005), the USFWS also requested that aerial surveys for potential roosting, nesting, and foraging sites for the federally endangered wood stork should continue.

Consultation on RT&E species was undertaken by the RT&E resources group including the USFWS and other agencies, and is also discussed under Second Stage Consultation. Between February 2005 and November 2006, monthly aerial surveys were conducted to collect additional information on wood stork usage at the Project. Upon meeting with agencies on February 9, 2007 (meeting notes included in Volume II), SCDNR and USFWS agreed that the monthly surveys for wood stork could cease due to the apparently sporadic and infrequent use of the Project Area by this species. It was also noted that only foraging behavior has been documented during their presence in the Project Area; no nesting behavior has been observed. The group noted that other surveys performed in the Project Area (migratory bird surveys and bald eagle surveys) would serve to document any wood stork presence. The development of a management program is discussed under Second Stage Consultation.

4.3.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of wildlife resources during these meetings is described below.

On March 8, 2006, during the Terrestrial TWC meeting, the USFWS provided clarification of their objectives for requesting a migratory bird survey of the Project. In addition to requesting a comprehensive list of all bird species using the Project area, the USFWS requested for continuation of the wood stork surveys and identification of all bald eagle sites.

Bald Eagle nesting sites have currently been documented by SCE&G and continue to be updated on a regular basis. Due to the sensitive nature of this information, it is not included in this License Application.

During the March 8, 2006 Terrestrial TWC meeting, it was noted that the USFWS and the SCDNR both requested information regarding waterfowl usage of Lake Murray. It was noted that since the mid 1970's, Lake Murray waterfowl has declined considerably, which may or may not be correlated with a decreasing aquatic vegetation trend. While previous boat-based surveys on the main lake pool during winter months of 2003-2006 provide information on species distribution, the agencies noted that it has limited value in assessing seasonal and/or annual trends. At the May 3, 2006 Terrestrial Resource TWC meeting, the SCDNR requested for a study plan to be developed which includes conducting five to six waterfowl surveys during winter months on Lake Murray.

On July 26, 2006, the TWC was presented with a Waterfowl Survey Study Plan to address the SCDNR requests. In order to build the waterfowl historical database and provide information on habitat use, it was agreed that the standard aerial surveys would be conducted during winter months for a period of three years, with an interim report being issued after the second year of surveying has been completed. A series of surveys were conducted during the 2006 to 2007 season and the 2007 to 2008 season. The 2006 to 2007 and the 2007 to 2008 survey reports can be viewed in Appendix E-3. The third year survey will be conducted during the 2008 to 2009 season. Any additional information obtained *during the last year of the survey will be provided to the FERC after the License Application has been filed.*

At the July 26, 2006 Terrestrial TWC meeting, a comprehensive list of bird species using the Project developed from existing literature sources, including the Columbia Audubon observations from Dreher Island State Park, data compiled by Riverbanks Zoo, the University of South Carolina's observations from Saluda Shoals Park and other areas of the LSR was presented. After distribution and review of the list by the TWC, it was noted that the brown pelican should be added to the list as a species known to use the Project area. With this, it was agreed upon by all RCG members, including the USFWS, that this list would satisfy the migratory bird survey request.

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to wildlife resources are provided below.

In response to the issuance of the DLA, DNR commented (letter dated March 14, 2008) that migrating and winter waterfowl are benefited by maintaining a full pool in the winter months. They note that they agree with Recreation TWC's proposal for a reservoir guide curve. However, they point out that an exception to this may occur during low inflow years. DNR also notes that it may be necessary to identify and implement PM&E measures in order to account for the historic loss of waterfowl habitat on the reservoir for both habitat and recreational aspects.

As part of the Saluda Relicensing Process and as required by FERC Order dated June 23, 2004 (South Carolina Electric & Gas Company, 107 FERC ¶ 62,273 (2004), ordering paragraph 'I') and subsequent Order dated October 28, 2004 (South Carolina Electric & Gas Company, 109 FERC ¶ 61,083 (2004)) discussions between DNR and SCE&G on potential mitigation for the historic loss of waterfowl habitat on Lake Murray are currently ongoing. These discussions include developing a waterfowl impoundment area on non-SCE&G owned lands outside the Project. Should SCE&G successfully negotiate with the current landowners, this would successfully mitigate for loss of waterfowl habitat. Any land obtained for the development of the waterfowl impoundment will be *incorporated into the Project PBL and will become a part of Project 516. License exhibits will be amended to reflect the inclusion of this property. Currently discussions are continuing on this issue and more detailed information will be filed in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.*

As described above, DNR also requested that management plans be developed for RT&E species that are influenced by the project. Species identified include the bald eagle and the wood stork. DNR also points out that a "management strategy and protection mechanism" be developed for the purple martin island roosting site.

In consultation with state and federal agencies, SCE&G proposes to develop and implement management programs for both the bald eagle *and the wood stork. Preliminary details regarding these management programs are included in section 4.6 of this document. SCE&G would like to continue its efforts of working within the TWC to finalize the plans in concert with the overall Comprehensive Settlement Agreement. With regards to the purple martin roosting site on Lunch Island, SCE&G will continue to work with SCDNR and the Columbia Chapter of the National Audubon Society to accommodate their request that the eastern end of the island be designated as North America's first purple martin sanctuary. Moreover, SCE&G will continue to prohibit public access to the island during the summer months, when the birds are roosting.*

4.4 Results of Recommended Studies

4.4.1 Lake Murray Wintering Waterfowl Survey

In recent years, during their mid-winter waterfowl surveys, SCDNR has noted a declining trend in waterfowl use of Lake Murray (Buddy Baker, SCDNR, Pers. Comm.; See meeting notes). In response to a request for information, SCE&G developed and has initiated an ongoing study on the abundance and distribution of wintering waterfowl using the reservoir. The study consists of aerial surveys conducted during the winter months over a three year period from 2006 to 2009.

Preliminary results of the first season of aerial surveys (2006-2007) documented seven waterfowl species and over 4,000 individuals in the Project vicinity (Table 4-2) (Kennamer, 2007). Lesser Scaup were the most numerous species observed, with groups of 500 to 1,535 documented during individual sightings. All seven species documented during the surveys were fairly common. Concentrations of >100 birds were documented at four locations including 1) an area just west of the SC Hwy 391 bridge over the Saluda River fork, 2) the Hollow Creek region of the lake, 3) the Lowman Creek area near the Lighthouse Marina, and 4) around islands in the vicinity of the Saluda Dam.

Several conditions were identified during the surveys that may help explain the potential decrease in waterfowl use of the lake reported by SCDNR. Considerable recreational boating was noted, which can create disturbances that deter bird use. Also, waterfowl use of the lake may be influenced by the decrease in aquatic vegetation resulting from SCE&G's aquatic plant control activities. Waterfowl, particularly winter visitors, forage on invasive species of aquatic plants, which have been reduced through multi-year partial reservoir drawdowns and other vegetation controls methods.

Table 4-2: Species List Compiled from Waterfowl Aerial Surveys of Lake Murray in 2006-2007

GUILD	COMMON NAME	SCIENTIFIC NAME
Swans		
	Mute Swan	Cygnus olor
Geese		
	Canada Goose	Branta canadensis
Dabbling Ducks		
	Mallard	Anas platyrhynchos
Diving Ducks		
	Ring-Necked Duck	Aythya collaris
	Lesser Scaup	Aythya affinis
	Bufflehead	Bucephala albeola
Rails		
	American Coot	Fulica americana

Source: (Kennamer, 2007)

4.4.2 Wood Stork Surveys

Sighting of the federally endangered wood stork from the Lake Murray vicinity were reported by local residents to the USWFS and other agencies periodically from approximately the late 1990's through 2004 (Terrestrial Resources TWC Notes, March 8, 2006). As part of an order approving and modifying the latest update to the Lake Murray SMP in 2004, [South Carolina Electric & Gas Company, 107 FERC ¶ 62,273 (June 23, 2004 FERC ordering paragraph 'H') and subsequent Order dated October 28, 2004 (South Carolina Electric & Gas Company, 109 FERC ¶ 61,083 (2004))] the FERC subsequently required SCE&G, in consultation with SCDNR and the USFWS, to designate two areas near Bush River as wood stork "conservation areas". The order further required that all other wood stork roosting and foraging habitat identified within the Project boundary remain protected and undeveloped until new evidence is submitted to indicate that protection of these areas is not warranted.

Following issuance of the order, SCE&G initiated consultation with the USFWS and SCDNR, and in late-summer 2004, two aerial reconnaissance surveys of Lake Murray were coordinated through the SCNDR. These surveys documented approximately 60 storks feeding at various locations in the middle Saluda River and the upper portion of Lake Murray, within the Saluda Project Boundary. Additionally, two wading bird nesting sites were observed along the floodplain of the middle Saluda River above the reservoir; although unoccupied at the time of the surveys, nests observed at these sites were characteristic of wading birds, including wood storks (Wood Stork Aerial Reconnaissance Survey Report (2004), Appendix E-3). In response to these wood stork sightings and the FERC order, SCE&G coordinated with the SCDNR and USFWS in developing and initiating a multi-year study aimed at documenting wood stork use of the Saluda Hydro Project Boundary and vicinity (Wood Stork Study Plan (2004), Appendix E-3). The study included monthly aerial surveys conducted within suitable habitat in the Saluda Project vicinity during the nesting and post-breeding season of each year (February through November).

After two years of aerial surveys, completed in 2005 and 2006, a total of 20 survey events had been performed. No wood storks were observed during the 2005 surveys. During 2006, a small number of wood storks were observed soaring above the Saluda River upstream of Lake Murray and feeding in nearby wetlands during the late summer months (a single stork during August and an additional 12-16 in September); although none of these observations were from within the Project boundaries. Similarly, no wood stork nesting activity was observed during any surveys. In fact, the two wading bird nesting area identified during the reconnaissance surveys were occupied by great blue herons during both 2005 and 2006 surveys (SCE&G, 2005)(SCE&G, 2007).

The lack of nesting observed during the study was not surprising and consistent with the known life-history of wood storks as a coastal nesting species rather than one that inhabits inland reservoirs (USFWS 1996). Timing of wood stork observations during 2006 (August and September) suggested that these were likely post-dispersal migrants from coastal nesting sites. During the late-summer/early-fall period, when chicks have fledged and adults are no longer tied to the nest site by chick rearing, adult and juvenile wood stork dispersing from nesting colonies often undertake extensive migrations to exploit ephemeral food resources prior to returning to coastal areas for the winter months. In South Carolina and Georgia, young-of-year storks typically fledge during July and August, but return to the nest for an additional 3 to 4 weeks to be fed before finally dispersing from the colony site in August and September (USFWS, 1996). Storks dispersing post-breeding from southern US colonies (Florida, Georgia, and South Carolina) have been documented as far north as North Carolina and as far west as Mississippi and Alabama (USFWS, 1996).

The study also concluded that the notable presence of wood storks in 2004, when 60 foraging individuals were observed in a shallow embayment in the Saluda River Arm of Lake Murray, can likely be attributable to temporary conditions created during construction of the Saluda Backup Dam when lake elevations dropped to levels near elevation 343.5'. During the lake drawdown, shallow areas lacking dense aquatic vegetation were created in many coves and embayments, conditions known to be attractive to foraging wood storks (Coulter and Bryan 1993). In addition, these locations were likely the site of concentrated fish numbers, providing superior foraging opportunities. Thus, their occurrence during 2004 was likely an atypical occurrence (SCE&G, 2005) (SCE&G, 2007).

Originally, the survey was scheduled to span a 5-year period, however, due to the limited nature of stork activities observed in the Project vicinity, the USFWS and SCDNR agreed with SCE&G's proposal to discontinue further wood stork surveys on Lake Murray (meeting notes from February 9, 2007 included in Appendix E-3. Further, the agencies determined that continued protection of the areas identified in the FERC order as wood stork “conservation areas” was no longer warranted (Kleinschmidt, 2008). SCE&G filed a letter with the FERC dated March 27, 2007 describing these findings and consultation with the agencies. The FERC concurred with and approved the completion of this study by letter dated April 10, 2008.

4.4.3 Resident and Migratory Bird Literature Review

First round consultation comments to the ICD by USFWS requested surveys to evaluate the effects of the project on resident and migratory bird use. In particular, information was requested on population estimates and habitat utilization of Lake Murray, the Saluda River, and the associated riparian ecosystems (USFWS, 2005). Upon further inquiry by SCE&G regarding study objectives, USFWS agreed that a comprehensive listing of birds using the Project vicinity would satisfy their request for information. In response, SCE&G conducted an extensive literature review utilizing the abundant data sources in the area, which included local avian experts and enthusiasts that maintain active bird count databases for the region. Resources consulted include the University of South Carolina, the local chapter of the Audubon Society (Columbia Audubon), and the Riverbanks Zoo. The USFWS, along with the Terrestrial Resource TWC, agreed that this research effort satisfied the request for more information (TWC Meeting Notes dated May 3, 2006 and July 26, 2006).

Results of the literature review tallied a total of 193 different species belonging to 48 families occurring in the Lake Murray and LSR area. Of these numbers, the most commonly represented family was Paridae, consisting largely of warbler species, which are small songbirds. The second most represented family was Anatidae, which are mostly duck species. Of the total number of species documented, about 65% are known to occur both at Lake Murray and the LSR. The remaining species were evenly split between these two locations (19% documented only at Lake Murray, 17% documented only on LSR). The species list compiled for the Saluda Project vicinity is provided in Table 4-7.

4.5 USFWS Comments on Impacts on Endangered Species

SCE&G consulted with the USFWS, as part of the RT&E TWC, throughout the planning and preparation of the RT&E report. Following their review of the Draft RT&E Report, USFWS expressed satisfaction that the report addressed the federal species under their jurisdiction (email correspondence from Amanda Hill, USFWS to Shane Boring, Kleinschmidt Associates, dated September 25, 2007).

4.6 Existing Measures to be Continued and New Measures Proposed by the Applicant

4.6.1 Bald Eagle Management Program

SCE&G will formalize their Bald Eagle Management Program in consultation with agency representatives, which outlines procedures and guidelines for shoreline activity in adherence of the National Bald Eagle Management Guidelines (USFWS, 2007). Following de-listing of the species from the Endangered Species Act in 2007, the USFWS published the National Bald Eagle Management Guidelines to ensure the continued protection of bald eagles under the Bald and Golden Eagle Protection Act (USFWS, 2007). Restrictions on activities occurring near bald eagles nests vary according to the type of disturbance; however, it is generally prohibited to create a potential "disturbance" within 660 ft of an active nest during the nesting season (September through May) and 330 ft during the non-nesting season.

SCE&G's Bald Eagle Management Program, will identify specific activities and sets a minimum allowable distance to existing bald eagles nests that they can be performed. The information is presented in the Program in the form of an easily-referenced matrix. In order to adhere to the National Bald Eagle Management Guidelines, the Bald Eagle Management Program includes the following activities:

- In reviewing requests for shoreline activities, SCE&G Lake Management staff will consider the disturbance matrices (from SCE&G's Bald Eagle

Management Program) for consistency with the National Bald Eagle Management Guidelines (USFWS, 2007);

- SCANA Corporate Environmental, SCE&G Lake Management, and/or their consultants will continue to coordinate with SCDNR endangered species biologists on an annual basis to acquire the most up-to-date data information regarding the location and status of active eagle nests in the Project vicinity; and
- SCE&G Lake Management and/or SCANA Corporate Environmental will consult with SCNDR and/or USFWS Ecological Services staff in the event that a yet undocumented nest is discovered in an area of proposed shoreline disturbance, or if there is difficulty in determining the disturbance category of a proposed activity.

Moreover, information on bald eagles will be provided to the public in the form of an RT&E species awareness program. Upon completion, this management program will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project.

4.6.2 Wood Stork Management Program

In 2008, as a result of a February 2, 2008 conference call between USFWS, SCDNR, and SCE&G, SCE&G will develop a Wood Stork Management Program designed to continue tracking wood stork activity in the Project Area. The program includes taking particular care in identifying and documenting wood stork presence during annual wintering waterfowl and bald eagle surveys. Further, the program establishes a public information component to bring awareness of the species, its habitat needs, and life history to users of Lake Murray, as well as to collect information on public sightings. Information on wood storks will be provided to the public in the form of an RT&E species awareness program, which encourages individuals to call SCE&G to report potential wood stork sightings. Upon completion, this management program will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project.

4.7 Anticipated Effects and Proposed Measures

Waterfowl

During agency consultation regarding updates to the current SMP, SCDNR noted a potential decrease in waterfowl use of Lake Murray, which may be a partial result of management of the Lake, and thus, would be Project-related. SCDNR has proposed several possible explanations for the apparently decrease in waterfowl activity. Birds may be deterred by the recreational boating activity on the lake, which creates considerable disturbances particularly during times of day and seasons when recreation is high. Also, sale and development of land around the lake may have also contributed to a reduction in waterfowl habitat as well as to higher disturbance to birds. Finally, lower waterfowl activity, particularly by overwintering species that rely heavily on invasive aquatic plant species, may be attributable to the decrease in aquatic vegetation resulting from SCE&G's aquatic plant control activities. A waterfowl study conducted during the winters of 2006/2007 and 2007/2008 in support of the current relicensing similarly concluded that recreational boating and other human disturbance, as well recent reductions in aquatic plants, likely limit the role of Lake Murray to a temporary stopover area for migratory species, rather than a long-term overwintering area (Kennamer, 2007; 2008).

SCE&G is working with SCDNR and USFWS to develop a proposal for the designation of a new waterfowl management and hunting area to mitigate for areas that have been lost to land sales and development, per requirements of the June 23, 2004 FERC Order (South Carolina Electric & Gas Company, 107 FERC ¶ 62,273 (2004), ordering paragraph 'I') approving the current SMP. In their progress report to FERC on the matter, dated December 31, 2007, SCE&G proposed a plan that was developed in cooperation with SCDNR and USFWS and involves creating a hydraulically-manipulated impoundment with constructed berms and installed intake structures and pumps. The goal is to be able to manipulate the water level of the proposed impoundment on a seasonal basis so they can plant vegetation and flood to optimize foraging conditions and maintenance of waterfowl habitat. Such a development would increase the quality of waterfowl habitat in the Project Area, and is expected to lead to increased waterfowl activity as well as recreation opportunities. This particular program is still in the developmental stages and requires procurement of property at the candidate site. SCE&G continues to work out the details of this preliminary proposal and will provide detailed information in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. Should acquisition of these non-project lands not occur due to factors beyond the control of the SCE&G, SCE&G will continue to consult with SCDNR and USFWS to determine the best way to comply with the June 23, 2004 FERC Order to designate waterfowl hunting areas. Any mitigation measure will be submitted to FERC for consideration.

Migratory Birds

It was suggested by USFWS during consultation that migratory birds, including songbirds, waterfowl and other groups, may be impacted by project-related losses of floodplain habitat and alteration of riparian habitat. As explained previously, SCE&G conducted a review of all available literature and databases regarding resident and migratory bird use at and near the Project (see Section 4.4.3). The resulting species list documented a substantial number of species occurring in the area. The terrestrial TWC indication that it is unlikely migratory birds, as a group, are experiencing significant adverse affects of Project operation (although individual species may experience some adverse affects due to habitat fragmentation – see Section 4.7).

Habitat Fragmentation and Development

Development of the riparian and forested lands around Lake Murray for residential and commercial purposes increases fragmentation of the landscape, which can negatively affect wildlife species (USDA, 2002). Because over 50 percent of the shoreline is privately developed, access to the lake for foraging, consumption, or breeding is likely limited for some species. Also, forest fragmentation leads to smaller patches of habitat in which animals are left to satisfy their life requirements (i.e., forage, find mates, etc.). Smaller patches experience changes in microclimate and resource availability that can limit suitability for some species, especially those with highly specific habitat needs (i.e., birds that inhabit cool, shaded, forest interiors). Animals such as turtles and mammals that venture between patches are at increased risk of predation, vehicle collision, and human interactions. Area-dependent species, such as larger mammals and migrating birds, may decline or be extirpated locally due to fragmentation of the landscape that leads to reproductive failure or increased mortality (USDA, 2002).

As explained in section 8.0, SCE&G abides by an SMP that is designed to help balance shoreline development, recreational use, and environmental protection. Concurrent with updates to the SMP, rebalancing of land use categories in the Project boundary was conducted during 2007 and 2008 as part of relicensing. Rebalancing involved a systematic evaluation and scoring of lands in terms of their most beneficial uses, identified as economic or natural resource. Although current fragmentation cannot be undone, the rebalancing will allow SCE&G to protect remaining, selected lands that provide natural resource, recreation, and scenic values. Through rebalancing, SCE&G has identified areas containing significant natural resources and set them aside under the 'Natural Areas' land use category. Natural Areas, which include ESAs, are not available for sale, and docks, excavations, and shoreline activity are prohibited. Further, ESAs have a 50-foot natural buffer zone designated around them where vegetation clearing is prohibited (as well as within the ESA).

In addition to protections to habitat afforded through classification as 'Natural Areas' or ESAs, wildlife will benefit from changes in the SMP and permitting program that reduce further land fragmentation and shoreline development. Specifically, the following changes to the SMP have been proposed for lands classified as 'future development' and 'easement' property:

- Establishment of a 75-foot wide non-disturbance buffer zone, which allows only a single 10-foot wide meandering path per dock and limited brushing.
- Provides incentives to encourage landowners who own within 75 feet of the 360' contour to deed SCE&G the required property to create up to a 75-foot wide non-disturbance buffer zone.
- Encourages less development density by requiring larger lots with more shoreline footage to qualify for docks.
- Reduces the number of future potential docks and increases the distance between docks.
- Incentives for landowners that own down to the water to create "Greenspaces" along the shoreline, which are undeveloped lands that have been set aside and maintained as naturally vegetated areas.

RT&E Species

Wood stork usage of the Saluda Project area appears sporadic and extremely limited in nature. Although congregations of the species were found in the Project during construction of the Saluda Backup Dam in 2004, this was apparently a temporary result of available foraging opportunities associated with the reservoir drawdown (i.e., increased frequency of shallow embayments and pools with trapped fish). The species is unlikely to be affected by normal operation of the Project due to its rarity in the Project Area. However, SCE&G will continue to monitor potential occurrences and activity of wood storks during SCE&G's waterfowl surveys, and they will consult with resource agencies if new information regarding habitat use is obtained.

Bald eagles are common inhabitants of Lake Murray and the LSR, and according to regular monitoring of the species, they appear to be well-habituated and tolerant of human activity. A vulnerable time for bald eagles, however, is during reproduction when they may be particularly sensitive to disturbance. SCE&G's continued adherence to the National Bald Eagle Management Guidelines (USFWS 2007), which will include the formalization of the Bald Eagle Management Program for the Saluda Project in consultation with resource agencies, will ensure continued bald eagle productivity and nesting success around Lake Murray. Consequently, continued Project operations and use of the reservoir and river for recreation, in conjunction with the management program for this species, are not expected to result in any negative effects to bald eagles.

4.8 Comprehensive Plans

United States Fish and Wildlife Service. Canadian Wildlife Service. 1998 (update). North American Waterfowl Management Plan. Department of the Interior. Environment Canada. May 1986.

This plan identifies waterfowl population goals and outlines a program to attain these goals. The 1998 Update emphasizes the need for habitat maintenance in the eastern U.S. with focus on protecting breeding and migration habitat for 43 species of ducks, geese, and swans. As discussed in section 4.7, consultation on the subject of waterfowl habitat with resource agencies has indicated a potential decrease in waterfowl use of Lake Murray, which may be a partial result of management of the Lake, and thus, would be Project-related. However, current discussions and mitigation requests may result in habitat establishment through a Comprehensive Settlement Agreement. Furthermore, SCE&G will continue to consult with SCDNR and USFWS to determine the best way to comply with the above referenced June 2004 FERC Order to designate waterfowl hunting areas.

4.9 Wildlife Resources Tables

Table 4-3: Federally Listed Species, Candidate Species, and Selected Federal Species of Concern Occurring or Potentially Occurring in the Four County Region Surrounding the Saluda Hydroelectric Project (FERC No. 516) (Source: Kleinschmidt, 2007)

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]	COUNTIES
Birds			
Bald eagle	*Haliaeetus leucocephalus*	P	Lexington, Newberry, Richland, Saluda
Red-cockaded woodpecker	*Picoides borealis*	E	Lexington, Richland, Saluda
Wood stork	*Mycteria americana*	E	Newberry
Fish			
Robust Redhorse Sucker	*Moxostoma robustum*	SC	Lexington (possible)
Saluda darter	*Etheostoma saludae*	SC	Lexington, Richland, Saluda, Newberry
Shortnose sturgeon	*Acipenser brevirostrum*	E	Lexington (possible), Richland
Invertebrates			
Carolina heelsplitter	*Lasmigona decorata*	E	Lexington (possible), Newberry (possible), Richland (possible), Saluda (possible)
Saluda crayfish	*Distocambarus youngineri*	SC	Newberry
Plants			
Canby's dropwort	*Oxypolis canbyi*	E	Richland
Georgia aster	*Aster georgianus*	C	Richland
Little amphianthus	*Amphianthus pusillus*	T	Saluda
Piedmont bishop-weed	*Ptilimnium nodosum*	E	Saluda
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	Richland
Schweinitz’s sunflower	*Helianthus schweinitzii*	E	Lexington
Rocky Shoal’s spider-lily	*Hymenocallis coronaria*	SC	Lexington, Richland
Smooth coneflower	*Echinacea laevigata*	E	Lexington (possible), Richland

1 Federal Status – E (listed as Endangered under Endangered Species Act); T (listed as Threatened under Endangered Species Act); C (Candidate for Federal listing); SC (Federal Species of Concern); P (Federally protected).
2 Bald eagle was removed from the list of federally threatened and endangered species on June 28, 2007; however, the species remains federally protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Table 4-4: Mammals Commonly Found In and Around Lake Murray

COMMON NAME	SCIENTIFIC NAME
Terrestrial Mammals	
white-tailed deer	*Odocoileus virginianus*
Raccoon	*Procyon lotor*
gray squirrel	*Sciurus carolinensis*
virginia opossum	*Didelphis virginiana*
Fox	*Family Canidae*
Coyote	*Canis latrans*
Skunk	*Family Mustelidae*
Bobcat	*Felis rufus*
Voles	*Family Cricetidae*
Shrews	*Family Soricidae*
Aquatic Mammals	
Beaver	*Castor canadensis*
river otter	*Lutra canadensis*
Muskrat	*Ondatra zibethicus*
Mink	*Mustela vison*

Table 4-5: Reptiles (Terrestrial and Aquatic) and Amphibians Commonly Found In and Around Lake Murray

COMMON NAME	SCIENTIFIC NAME
Terrestrial And Aquatic Reptiles	
Eastern box turtle	*Terrapene carolina*
painted turtle	*Chrysemys sp.*
mud turtle	*Kinosternon sp.*
musk turtle	*Sternotherus sp.*
snapping turtle	*Chelydra serpentina*
green anole	*Anolis carolinus*
Northern fence lizard	*Sceloporus undulates hyacinthinus*
broadhead skink	*Eumeces laticeps*
Copperhead	*Agkistrodon contortrix*
gray rat snake	*Elaphe obsolete spiloides*
black racer	*Coluber constrictor*
timber rattlesnake	*Crotalus horridus horridus*
cottonmouth	*Agkistrodon piscivorus*
brown water snake	*Nerodia taxispilota*
redbelly water snake	*Nerodia erythrogaster erythrogaster*
Amphibians	
Southern toad	*Bufo terrestris*
Bullfrog	*Rana catesbeiana*
green frog	*Rana clamitans*
green treefrog	*Hyla cinerea*
leopard frog	*Rana sp.*
marbled salamander	*Ambystoma opacum*
red salamander	*Pseudotrition ruber*

Table 4-6: Bird Species Commonly Found at Lake Murray

COMMON NAME	SCIENTIFIC NAME OR FAMILY
Waterfowl	
wood duck	*Aix sponsa*
Canada goose	*Branta canadensis*
American coot	*Fulica Americana*
Mallard	*Anas platyrhrnchos*
American black duck	*Anas rubripes*
ring-necked duck	*Aythya collaris*
American anhinga	*Anhinga anhinga*
double-crested cormorant	*Phalacrocorax auritus*
herons and egrets	*Family Ardeidae*
Raptors	
bald eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
great horned owl	*Bubo virginianus*
red-tailed hawk	*Buteo jamaicensis*
red-shouldered hawk	*Buteo lineatus*
Upland Game Birds	
wild turkey	*Meleagris gallopavo*
northern bobwhite	*Colinus virginianus*
mourning dove	*Zenaida macroura*
Songbirds	
Warblers	*Family Parulidae*
Thrushes	*Family Turdidae*
American robin	*Turdus migratorius*
Vireos	*Family Vireonidae*
Finches	*Family Fringillidae*
Miscellaneous Birds	
Woodpeckers	*Family Picidae*
Vultures	*Family Cathartidae*
Gulls	*Family Laridae*
yellow-bellied sapsuckers	*Sphyrapicus varius*

Table 4-7: Results of Literature Review Documenting Bird Species in the Saluda Hydroelectric Project Vicinity

FAMILY	COMMON NAME	SCIENTIFIC NAME	DOCUMENTED OCCURRENCE[A]
Accipitridae	Northern harrier	*Circus cyaneus*	LM
Anatidae	American wigeon	*Anas americana*	LM
Anatidae	black duck	*Anas rubripes*	LM
Anatidae	Bufflehead	*Bucephala albeola*	LM
Anatidae	common goldeneye	*Bucephala clangula*	LM
Anatidae	common merganser	*Mergus merganser*	LM
Anatidae	Gadwall	*Anas strepera*	LM
Anatidae	lesser scaup	*Aythya affinis*	LM
Anatidae	northern shoveler	*Anas cylpeata*	LM
Anatidae	Pintail	*Anas acuta*	LM
Anatidae	Redhead	*Aythya americana*	LM
Anatidae	ring-neck duck	*Aytha americana*	LM
Anatidae	ruddy duck	*Oxyura jamaicensis*	LM
Anatidae	surf scoter	*Melanitta perspicillata*	LM
Ardeidae	little blue heron	*Florida caerula*	LM
Caridae	Bonaparte's gull	*Larus philadelphia*	LM
Ciconiidae	wood stork	*Mycteria americana*	LM
Emberizidae	white-crowned sparrow	*Zonotrichia leucophrys*	LM
Fringillidae	pine siskin	*Spinus pinus*	LM
Fringillidae	purple finch	*Carpodacus purpureus*	LM
Gaviidae	common loon	*Gavia immer*	LM
Laridae	caspian tern	*Hydroprogne caspia*	LM
Laridae	Forster's tern	*Sterna forsteri*	LM
Motacillidae	American pipit	*Anthus rubescens*	LM
Parulidae	Louisiana warbler	*Seiurus motacilla*	LM
Pelecanidae	brown pelican	*Pelecanus occidentalis*	LM
Pelecanidae	American white pelican	*Pelecanus erythrorhynchos*	LM
Phasianidae	wild turkey	*Meleagris gallopavo*	LM
Podicipedidae	horned grebe	*Podiceps auritus*	LM
Scolopacidae	common snipe	*Capella gallinago*	LM
Scolopacidae	greater yellow legs	*Tringa melanoleuca*	LM
Scolopacidae	least sandpiper	*Calidris minutilla*	LM
Scolopacidae	lesser yellowlegs	*Tringa flavipes*	LM
Scolopacidae	pectoral sandpiper	*Calidris melanotos*	LM
Scolopacidae	western sandpiper	*Calidris mauri*	LM
Scolopacidae	Wilson's snipe	*Gallinago delicata*	LM
Accipitridae	bald eagle	*Haliaeetus leuccocephalus*	LM, LSR
Accipitridae	broad-winged hawk	*Bueto platypterus*	LM, LSR
Accipitridae	Cooper's hawk	*Accipter cooperii*	LM, LSR
Accipitridae	Osprey	*Pandion haliaetus*	LM, LSR

FAMILY	COMMON NAME	SCIENTIFIC NAME	DOCUMENTED OCCURRENCE[A]
Accipitridae	red-shouldered hawk	*Bueto lineatus*	LM, LSR
Accipitridae	red-tailed hawk	*Buteo jamaicensis*	LM, LSR
Accipitridae	sharp-shinned hawk	*Accipter striatus*	LM, LSR
Alcedinidae	belted kingfisher	*Megacerle alcyon*	LM, LSR
Anatidae	blue-winged teal	*Anas discors*	LM, LSR
Anatidae	Canada goose	*Branta canadensis*	LM, LSR
Anatidae	common goldeneye	*Bucephala clangula*	LM, LSR
Anatidae	green-winged teal	*Anas crecca*	LM, LSR
Anatidae	hooded merganser	*Lophodytes cucullatus*	LM, LSR
Anatidae	Mallard	*Anas platyrhynchos*	LM, LSR
Anatidae	red-breasted merganser	*Mergus serrator*	LM, LSR
Anatidae	wood duck	*Aix sponsa*	LM, LSR
Apodidae	chimney swift	*Chetura pelagica*	LM, LSR
Ardeidae	great blue heron	*Ardea herodias*	LM, LSR
Ardeidae	great egret	*Casmerodius albus*	LM, LSR
Ardeidae	green heron	*Butorides virescens*	LM, LSR
Bombycillidae	cedar waxwing	*Bombycilla cedrorum*	LM, LSR
Cardinalidae	blue grosbeak	*Passerina caerulea*	LM, LSR
Cardinalidae	indigo bunting	*Passerina cyanea*	LM, LSR
Cardinalidae	Northern cardinal	*Cardinalis cardinalis*	LM, LSR
Cardinalidae	rose-breasted sparrow	*Pheucticus ludovicianus*	LM, LSR
Cathartidae	black vulture	*Coragyps atratus*	LM, LSR
Cathartidae	turkey vulture	*Cathartes aura*	LM, LSR
Certhiidae	brown creeper	*Certhia familiaris*	LM, LSR
Charadriidae	killdeer	*Charadruis vociferus*	LM, LSR
Columbidae	mourning dove	*Zenaida macroura*	LM, LSR
Columbidae	rock dove	*Columba liva*	LM, LSR
Corvidae	American crow	*Corvus brachyrhynchos*	LM, LSR
Corvidae	blue jay	*Cyanocitta cristata*	LM, LSR
Corvidae	fish crow	*Corvus ossifragus*	LM, LSR
Cuculidae	yellow-billed cuckoo	*Cocoyzus americanus*	LM, LSR
Emberizidae	chipping sparrow	*Spizella passerina*	LM, LSR
Emberizidae	dark-eyed junco	*Junco hyemalis*	LM, LSR
Emberizidae	eastern towhee	*Pipilo erythrophthalmus*	LM, LSR
Emberizidae	field sparrow	*Spizella pusilla*	LM, LSR
Emberizidae	fox sparrow	*Passerella iliaca*	LM, LSR
Emberizidae	Savannah sparrow	*Passerculus sandwichensis*	LM, LSR
Emberizidae	song sparrow	*Melsopiza melodi*	LM, LSR
Emberizidae	swamp sparrow	*Melospiza georgiana*	LM, LSR
Emberizidae	white-throated sparrow	*Zonotrichia albicollis*	LM, LSR
Falconidae	American kestrel	*Falco sparverius*	LM, LSR
Falconidae	Merlin	*Falco columbarius*	LM, LSR
Fringillidae	American goldfinch	*Spinus tristis*	LM, LSR
Fringillidae	house finch	*Carpodacus mexicanus*	LM, LSR
Hirundinidae	barn swallow	*Hirundo rustica*	LM, LSR

FAMILY	COMMON NAME	SCIENTIFIC NAME	DOCUMENTED OCCURRENCE[A]
Hirundinidae	cliff swallow	*Petrochelidon pyrrhonota*	LM, LSR
Hirundinidae	Northern rough-winged swallow	*Stelgidopteryx serripennis*	LM, LSR
Hirundinidae	purple martin	*Progne subis*	LM, LSR
Icteridae	brown-headed cowbird	*Molothrus ater*	LM, LSR
Icteridae	common grackle	*Quiscalus quiscula*	LM, LSR
Icteridae	orchard oriole	*Icterus spurius*	LM, LSR
Icteridae	red-winged blackbird	*Agelaius phoeniceus*	LM, LSR
Laridae	herring gull	*Larus argentatus*	LM, LSR
Laridae	ring-billed gull	*Larus delawarensis*	LM, LSR
Mimidae	brown thrasher	*Toxostoma rufum*	LM, LSR
Mimidae	gray catbird	*Dumetella carolinesis*	LM, LSR
Mimidae	Northern mockingbird	*Mimus polyglottos*	LM, LSR
Paridae	Carolina chickadee	*Parus carolinesis*	LM, LSR
Paridae	tufted titmouse	*Parus bicolor*	LM, LSR
Parulidae	American redstart	*Setophaga ruticilla*	LM, LSR
Parulidae	black and white warbler	*Mniotilta varia*	LM, LSR
Parulidae	blackburnian warbler	*Dendroica fusca*	LM, LSR
Parulidae	blackpoll warbler	*Dendroica striata*	LM, LSR
Parulidae	black-throated blue warbler	*Dendroica caerulescens*	LM, LSR
Parulidae	black-throated green warbler	*Dendroica virens*	LM, LSR
Parulidae	blue-winged warbler	*Vermivora pinus*	LM, LSR
Parulidae	Canada warbler	*Wilsonia canadensis*	LM, LSR
Parulidae	Cape May warbler	*Dendroica tigrina*	LM, LSR
Parulidae	chestnut-sided warbler	*Dendroica pensylvanica*	LM, LSR
Parulidae	common yellowthroat	*Geothlypis trichas*	LM, LSR
Parulidae	golden-winged warbler	*Vermivora chrysoptera*	LM, LSR
Parulidae	hooded warbler	*Wilsonia citrina*	LM, LSR
Parulidae	magnolia warbler	*Dendroica magnolia*	LM, LSR
Parulidae	nothern parula	*Parula americana*	LM, LSR
Parulidae	ovenbird	*Seiurus aurocapillus*	LM, LSR
Parulidae	pine warbler	*Dendroica pinus*	LM, LSR
Parulidae	prairier warbler	*Dendroica discolor*	LM, LSR
Parulidae	prothonotary warbler	*Protonotaria citrea*	LM, LSR
Parulidae	Swainson's warbler	*Limnothlypis swainsonii*	LM, LSR
Parulidae	Tennessee Warbler	*Vermivora peregrina*	LM, LSR
Parulidae	worm-eating warbler	*Helmitheros vermivorus*	LM, LSR
Parulidae	yellow warbler	*Dendroica petechia*	LM, LSR
Parulidae	yellow-brested chat	*Icteria virens*	LM, LSR
Parulidae	yellow-rumped warbler	*Dendroica coronata*	LM, LSR
Parulidae	yellow-throated warbler	*Dendroica dominica*	LM, LSR
Passeridae	house sparrow	*Passer domesticus*	LM, LSR
Phalacrocoracidae	double-crested cormorant	*Phalacrocorax auritus*	LM, LSR
Picidae	downy woodpecker	*Dendrocopos pubescens*	LM, LSR
Picidae	hairy woodpecker	*Dendrocopos villosus*	LM, LSR

FAMILY	COMMON NAME	SCIENTIFIC NAME	DOCUMENTED OCCURRENCE[A]
Picidae	northern flicker	*Colaptes auratus*	LM, LSR
Picidae	pileated woodpecker	*Dryocopus pileatus*	LM, LSR
Picidae	red-bellied woodpecker	*Centurus carolinus*	LM, LSR
Picidae	red-headed woodpecker	*Melanerpea erythrocephalus*	LM, LSR
Picidae	yellow-bellied sapsucker	*Sphyrapicus varius*	LM, LSR
Podicipedidae	pied-billed grebe	*Podilymbus podiceps*	LM, LSR
Rallidae	American coot	*Fulica americana*	LM, LSR
Regulidae	golden-crowned kinglet	*Regulus satrapa*	LM, LSR
Regulidae	ruby-crowned kinglet	*Regulus calendula*	LM, LSR
Sittidae	brown-headed nuthatch	*Sitta pusilla*	LM, LSR
Sittidae	red-breasted nuthatch	*Sitta canadensis*	LM, LSR
Sittidae	white-breasted nuthatch	*Sitta carolinensis*	LM, LSR
Strigidae	Eastern screech owl	*Megascops asio*	LM, LSR
Strigidae	great horned owl	*Bubo virginianus*	LM, LSR
Sturnidae	european starling	*Sturnus vulgaris*	LM, LSR
Sylviidae	blue-gray gnatcatcher	*Polioptila caerula*	LM, LSR
Thraupidae	scarlet tanager	*Piranga olivacea*	LM, LSR
Thraupidae	summer tanager	*piranga rubra*	LM, LSR
Trochilidae	ruby-throated hummingbird	*Archilochus colubris*	LM, LSR
Troglodytidae	carolina wren	*Thryothorus ludovicianus*	LM, LSR
Troglodytidae	winter wren	*Troglodytes troglodytes*	LM, LSR
Turdidae	American robin	*Turdus migratorius*	LM, LSR
Turdidae	eastern bluebird	*Sialia sialis*	LM, LSR
Turdidae	hermit thrush	*Catharus guttatus*	LM, LSR
Turdidae	wood thrush	*Hylocichla mustelina*	LM, LSR
Tyrannidae	Eastern kingbird	*Tyrannus tyranus*	LM, LSR
Tyrannidae	Eastern phoebe	*Sayornis phoebe*	LM, LSR
Tyrannidae	Eastern wood pewee	*Contopus virens*	LM, LSR
Tyrannidae	great creasted flycatcher	*Myiarchus crinitus*	LM, LSR
Vireonidae	blue-headed vireo	*Vireo solitarius*	LM, LSR
Vireonidae	red-eyed vireo	*Vireo olivaceus*	LM, LSR
Vireonidae	white-eyed vireo	*Vireo griseus*	LM, LSR
Accipitridae	Mississippi kite	*Ictinia missippiensis*	LSR
Anhingidae	anhinga	*Anhinga anhinga*	LSR
Caprimulgidae	chuck-will's-widow	*Caprimulgus carolinensis*	LSR
Cardinalidae	painted bunting	*Passerina ciris*	LSR
Cardinalidae	rose-breasted grosbeak	*Pheucticus ludovicianus*	LSR
Emberizidae	vesper sparrow	*Pooecetes gramineus*	LSR
Hirundinidae	tree swallow	*Tachycineta bicolor*	LSR
Icteridae	Baltimore oriole	*Icterus galbula*	LSR
Icteridae	eastern meadowlark	*Sturnella magna*	LSR
Laniidae	loggerhead shrike	*Lanius ludovicianus*	LSR
Parulidae	bay-breasted warbler	*Dendroica castanea*	LSR
Parulidae	cerulean warbler	*Dendroica cerulea*	LSR
Parulidae	Kentucky warbler	*Oporornis formosus*	LSR

FAMILY	COMMON NAME	SCIENTIFIC NAME	DOCUMENTED OCCURRENCE[A]
Parulidae	Louisiana waterthrush	*Seiurus motacilla*	LSR
Parulidae	Nashville warbler	*Vermivora ruficapilla*	LSR
Parulidae	Northern waterthrush	*Seiurus noveboracensis*	LSR
Parulidae	orange-crowned warbler	*Vermivora celata*	LSR
Parulidae	palm warbler	*Dendroica palmarum*	LSR
Scolopacidae	solitary sandpiper	*Tringa solitaria*	LSR
Scolopacidae	spotted sandpiper	*Actitis macularius*	LSR
Strigidae	barred owl	*Strix varia*	LSR
Trochilidae	rufous hummingbird	*Selasphorus rufus*	LSR
Troglodytidae	house wren	*Troglodytes aedon*	LSR
Turdidae	gray-cheeked thrush	*Catharus minimus*	LSR
Turdidae	Swainson's thrush	*Catharus ustulatus*	LSR
Turdidae	veery	*Catharus fuscescens*	LSR
Tyrannidae	acadian flycatcher	*Empidonax virescens*	LSR
Tyrannidae	least flycatcher	*Empidonax minimus*	LSR
Tyrannidae	olive-sided flycatcher	*Contopus cooperi*	LSR
Tyrannidae	yellow-bellied flycatcher	*Empidonax flaviventris*	LSR
Vireonidae	Philadelphia vireo	*Vireo philadelphicus*	LSR
Vireonidae	yellow-throated vireo	*Vireo flavifrons*	LSR

a : LM = Lake Murray; LSR = Lower Saluda River

Sources:

Giovannone, J., Riverbanks Zoo Bird Observation Data: 2005

Giovannone, J., Riverbanks Zoo Bird Observation Data: 2006

Carter, R., Giovannone, J., Griggs, J. 2006 Saluda Shoals Park Bird Observation Data.

Carter, R., Giovannone, J., Griggs, J. 2006 Lake Murray Bird Observation Data.

Pitts, I. Dreher Island State Park Bird Checklist: 2006 Update.

Pitts, I. Dreher Island State Park Bird Observation Data: 2006 Update.

Columbia Audubon. 2006 Christmas bird Count: Lower Saluda River Observation Area (provided by J. Giovannone).

5.0 BOTANICAL RESOURCES

5.1 Existing Botanical Resources

5.1.1 Upland Habitat

The botanical and forestry resources of the Project area consist mainly of the dominant woody pioneer or climax species of the southern Piedmont hardwood forests. Forested areas of the Project function mostly in support of forestry, wildlife or game management, and recreational or aesthetic values. Various combinations of tree and shrub species cover 4,513.5 acres of Project lands over a shoreline distance of 92.9 miles (Mead and Hunt, 2002). One of the most common trees is loblolly pine (see Table 5-3 for scientific names), coming in early after disturbance of most well-drained sites and dominating for up to 40 years afterwards.

SCE&G manages forest resources on a total of 10,532 acres of its land (within a quarter mile of Lake Murray) according to the South Carolina Forestry Commission's Best Management Practices. In addition, they employ management measures such as selective harvesting of pines and hardwoods, and maintenance of a 100-foot wide shoreline buffer, to protect water quality, wildlife, fishery, and aesthetic values. SCE&G also does not allow logging in certain areas including cliffs, steep slopes, or atypical groups of trees. On private riparian lands sold by SCE&G since 1984, a 75-foot vegetated buffer zone above the 358.5[9]-foot contour is maintained in accordance with current FERC license conditions. In this zone, limited brushing or clearing of specific vegetation is allowed. Consultation and a permit from SCE&G is required to remove any tree or shrub 3 inches or greater in diameter or to trim/limb any tree greater than ten feet tall. Enforcement of buffer zone compliance is by written agreement, with penalties imposed by SCE&G through denial or revocation of dock permits for violators (SCE&G, 1994).

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[9] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

5.1.1.1 Lake Murray

The upland habitat located above the 358.5-foot contour interval along the Lake Murray shoreline is characterized by vegetation typical of southern Piedmont hardwood forests. It is dominated by a combination of woody tree and shrub species, including both pioneer and climax species. As mentioned previously, the most common tree species is loblolly pine, which is a quick and dominating colonizer to disturbed, well-drained sites. This tree is also the species of choice for the regional forestry industry, growing rapidly and generating clear, straight wood for a number of uses (Mead and Hunt, 2000).

In areas not managed for pine, succession to deciduous tree species has occurred (Mead and Hunt 2002). Common species of deciduous forests include red maple, sweet gum, several oak species (i.e., white, red, southern red, black, chinkapin), and several hickory species (i.e., shagbark, mockernut, and pignut). Common mesic sub-canopy species found in these forested areas include flowering dogwood, American holly, black cherry, hop hornbeam, redbud, wax myrtle and wild azalea. These forested areas cover about 4,513 acres of project lands and are located along about 93 miles of the Lake Murray shoreline. They function mostly in support of forestry, wildlife or game management, and recreation or aesthetic values (Mead and Hunt, 2000 and 2002).

5.1.1.2 Lower Saluda River

Habitat diversity found in the LSR is more homogeneous than the highly diversified habitats of Lake Murray. In the areas below the Dam, botanical resources consist of mesic (moderately moist) hardwood forests, pine plantations of various ages, and wetlands. The mixed hardwood forest cover type dominates much of the available habitat along the LSR, especially near the rivers edge (pers observation, A. Stuart, Kleinschmidt, 2003; Mead and Hunt, 2002). Canopy species in this forest type include white oak, southern red oak, shagbark hickory, post oak, winged elm, as well as loblolly pine stands. Some of these stands are in the 100-acre floodplain and are considered jurisdictional wetlands (Mead and Hunt 2002). The various pine plantations occurring downstream of the Dam range from young rows of planted loblolly pines to older, thinned (merchantable) and un-thinned (natural) pine forests. On the north bank of the Saluda River, bottomland hardwood forest has been delineated, which is a wetland vegetation community and is described in more detail in the wetlands section below.

The forest edge habitat of the LSR, which is located in the transitional area between open and forested cover types, comprises approximately ten percent of the total habitat along the LSR. This cover type is the interface between the forested and field habitats and provides a great deal of vegetative diversity and height class complexity (Colinvaux, 1993).

Open field habitat makes up approximately fifteen percent of the available habitat along the LSR. Open field habitat is limited to those areas that are periodically mowed and maintained and are typically dominated by assorted grasses. These cover areas are confined to a narrow strips in agricultural areas along the river corridor as well as in transmission rights-of-way (pers observation, A. Stuart, Kleinschmidt, 2003).

5.1.1.3 Islands

The 62 SCE&G owned islands within the Project boundary support a variety of plant communities depending on elevation and land-use history. The riverine islands primarily support bottomland hardwood forests. The herbaceous layer on the islands consists of a mixture of forbs and graminoid plants and may be patchy depending on the canopy cover.

Loblolly pine-mixed hardwood islands are found on the middle and lower portions of the lake. Most of these islands have been subjected to periodic burning and have a dense canopy composed of loblolly and shortleaf pine, water oak, and sweetgum, which does not allow for a significant herbaceous understory to develop.

Other islands are more open and disturbed. They support scattered trees and shrubs and, in the most open areas, a dense herbaceous layer consisting of assorted grasses and forbs. The disturbed vegetation community is dominated by successional species. Successional describes a species or community that is ephemeral in that it will be replaced by species that will form the climax community. An abandoned farm field, for example, contains successional species. These species will be replaced by a more stable, long-term community unless regular disturbance such as annual mowing keeps it in an early-successional state. Continued natural and anthropogenic disturbances in the form of wind and wave action, prescribed burning, past agricultural use and present recreational use serve to maintain the open aspect of these islands (Mead and Hunt, 2002). The herbaceous layer on the open and disturbed islands is dominated by grasses and composites in the autumn, many of which are typical species of old field succession. Old field succession typically occurs when agricultural or farm fields are abandoned and the herbal communities give way to pines, the organic layer of the soil deepens, and the water retaining capacity of the soil increases (Colinvaux, 1993).

The most ecologically distinct island is Lunch Island (also known as Bomb Island), located approximately 4.5 miles upstream of the Dam, which has a dense stand of switch cane and abundant pokeberry. As mentioned in more detail in the Wildlife section, this island is home to one of the largest purple martins roosts in the world. Like a number of other small islands in the lake, Lunch Island is covered by an open habitat of scattered trees and shrubs over a dense herbaceous layer of grasses and composite forbs (SCE&G, 1994).

The islands provide important wildlife habitat for a number of species and are a major recreational and aesthetic asset for the lake. The islands total approximately 617.7 acres, with a combined shoreline length of 36.9 miles (Mead and Hunt, 2002).

5.1.2 Description of Wetlands, Floodplains, Impacts and Mitigative Measures

5.1.2.1 Wetlands

According to the National Wetland Inventory (NWI) database, wetland habitats are abundant around the Lake Murray perimeter. The NWI, which is maintained by the USFWS, is a mapping system that provides information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. NWI maps for the Saluda Project Area document numerous wetlands along the coves and peninsulas of the highly convoluted lake shoreline (*NWI maps – Appendix E-4*).

The wetland habitats represented within the Project area have been classified according to Cowardin et al. (1979), and represent several subsystem/classes. They include *Palustrine* forested, emergent and scrub-shrub wetlands (PFO, PEM, PSS); and *Lacustrine* littoral wetlands (L2) (Cowardin et al., 1979). Each of the NWI wetland types and their general distribution in the Project area are described further below.

Palustrine forested (PFO1) is the most abundant wetland community in the Project area, occupying approximately 1,618 acres below the 358.5-foot contour around the lake (NWI map; Mead and Hunt, 2002a). PFO1 wetlands are characterized by woody vegetation 6 meters tall or taller, and consist primarily of broad-leaved deciduous species (Cowardin et al., 1979). Some forested wetlands around Lake Murray have also been referred to as bottomland hardwoods during various assessments. Typical species include various oaks (i.e., cherrybark, chestnut, willow, water, shumard, and laurel) and sweet gum. The sub-canopy includes red maple, American hornbeam and American elm; and the herbaceous layer includes various grasses and sedges. In some areas around the lake this wetland type experiences seasonal flooding, however, water regime for most areas is semi-permanently flooded. Hydrologic inputs are flooding, stream flow and runoff (Mead and Hunt, 2002a).

Palustrine scrub-shrub (PSS) wetlands occupy the lake fringe, along shallow coves and tributary banks. There are approximately 140 acres of this type of wetland below the 358.5-foot contour around Lake Murray (Mead and Hunt, 2002). PSS wetlands can be found in coves, with the most extensive areas occurring along the Saluda River arm of Lake Murray just upstream of the Little River confluence (Mead and Hunt, 2002). The vegetation community is dominated by woody vegetation less than 6 meters tall, which can include young trees as well as true shrubs. It consists mostly of broad-leaved deciduous species such as buttonbush, black willow, and occasional persimmon and water willow (Cowardin et al. 1979; NWI maps; Mead and Hunt, 2002).

Palustrine emergent wetlands (PEM) are located throughout the lower elevations of the shoreline, within coves. The plant communities include erect, rooted, herbaceous hydrophytes (water-loving) species that are present most of the growing season in most years (Cowardin et al, 1979). This vegetation is present particularly along the larger flat regions of the Saluda River and Little Saluda River arms of Lake Murray. Approximately 363 acres of emergent wetland exist below the 358.5-foot contour around the lake, with nearly ninety percent of them occurring in the headwater region of the lake along the Saluda River (Mead and Hunt, 2002).

Lacustrine littoral wetlands, mostly with unconsolidated bottoms (L2UB), occur in the upper arms of the lake but are most prevalent near the central body of the lake. Generally, this wetland type extends from the shoreward boundary of the lake to a depth of 2 meters. It is dominated by non-persistent emergent plant species, which fall below the waters surface at the end of the growing season so that little sign of emergent vegetation is present during parts of the year. Vegetative cover is largely lacking (less than 30%) as are large stable surfaces for plant and animal attachment (Cowardin et al., 1979).

Only some of the wetlands within the Project have been formally delineated per Army Corps of Engineers (ACOE) specifications. In addition to the described wetland information derived from NWI maps, limited information on wetlands located downstream of the Project Dam was obtained in support of the back up dam remediation project. In March 2000, SCE&G staff conducted wetland delineation immediately downstream of the Project Dam, during which a total of 31 different locations and approximately 55 acres of jurisdictional wetlands were identified (Mead and Hunt, 2002). The different wetland types documented include abandoned borrow pits/quarries that had developed ponded and *palustrine* habitats; a narrow riverine forested wetland; seasonally flooded scrub-shrub habitat; seasonally flooded bottomland hardwoods; and emergent wetlands (Mead and Hunt, 2002).

Currently, wetlands in the Project area are unlikely to be eligible for State protection, unless new legislation is passed. However, whether or not they receive Federal protection depends on if they represent ‘isolated features’, which are wetlands without a connection to navigable waters. For the most part, wetlands around the perimeter of Lake Murray that have a surface water connection to the lake (which is navigable water) will likely be eligible for protection under the Federal Clean Water Act. However, the greater the geographical distance between the wetland and lake, or the more ephemeral the nature of the wetland - the more ambiguous is its jurisdictional status.

Wetlands protection afforded by the State of South Carolina exists only as the Coastal Tidelands and Wetlands Act (S.C. Code Ann. § 48-39-10 – 48-39-360 (2005)), which protects “critical areas” as defined as coastal waters, tidelands, beaches, or beach/dune systems. The State does not protect inland wetlands, many of which, however, are protected by Federal Clean Water Act. One exception to this occurs in the case of isolated wetlands, which can be argued to be exempt from Federal protection based on recent Supreme Court rulings. On January 9, 2007, however, new legislation termed The Isolated Wetlands Protection Act was introduced in the SC Senate. If passed, it would require development of isolated wetlands above a certain size be authorized through a permit from the SCDHEC before beginning construction. The bill is still pending in the SC State Legislature.

5.1.2.2 Floodplains

The Saluda Project is not operated as a flood control reservoir. However, in times when tropical storms and hurricanes are predicted to affect inflow to the reservoir, operations of Saluda Hydro are increased to maintain the operating level of Lake Murray (See Exhibit B).

The lower Saluda basin is narrow and the LSR is steeply banked and channelized. After extended operation at high flows, water will top the river bank in many areas. Although this event occurs occasionally, it does not appear sufficient to support a floodplain ecosystem with associated functions. Areas considered floodplain, are few and limited to a few scattered locations where the river bends. According to FEMA data, the lands bordering the LSR are in a zone considered 10-year floodplain, which indicates that the annual chance of flooding along the banks is 10% (*see Appendix E-4 – FEMA profile graphs*). However, this is likely a significant overestimation under current operations, and it may in fact be based on pre-project conditions. Flows associated with the 10-year frequency event are 32,000 cfs; however, due to SCE&G's use of flow forecasting models and the storage capacity of the reservoir, downstream flows are moderated and rarely exceed the maximum plant hydraulic capacity (approximately 20,000 cfs). No downstream flows have exceeded plant capacity (via spillway gate operation) since 1969, with the installation of Unit 5 (which has a rated hydraulic capacity of 6000 cfs).

5.1.3 Environmentally Sensitive Areas (ESAs)

Various areas within the Project area have been designated as Environmentally Sensitive Areas (ESA) because they offer ecologically significant resources, including botanical. The ESA designation is a resource tool in consideration of management alternatives and establishment of management objectives (SCE&G, 1994). Originally, ESAs were documented and described in detail by SCE&G in response to an order of the FERC issued in South Carolina Electric & Gas Company, 56 FERC ¶ 62,194 (1991). Since then, the ESAs have been resurveyed and their classifications have been revised (SCE&G, 2006). Because the original inventory provided extensive information on botanical resources of the ESAs, it is used in the descriptions below. A summary of the recent survey and classification system is provided in Section 5.3.2.

In the 1994 inventory undertaken by SCE&G, ESAs below the 358.5' contour were classified into 11 habitat types (SCE&G, 1994). They included ten vegetated classes, and two un-vegetated classes (e.g., shallow shoals and rocky shores having littoral buffer or fishery values). Two of the vegetated classes, islands and bottomland hardwood forests, were described in the preceding section. The remaining vegetated classes are described below. Common vegetation species found in each of the habitat types are listed in Table 5-3.

5.1.4 Islands

Described above in Section 5.1.1.3 – *Islands*.

5.1.5 Bottomland Hardwood

Described as PFO1 above in Section 5.1.2 – *Wetlands*.

5.1.6 Mature Hardwood

These areas occur on the forested slopes, primarily on the upper lake, and were described briefly above as upland forested habitat. This habitat has a highly diverse canopy layer, which includes a wide variety of oaks, as well as beech, sweet gum and hickory tree species. The subcanopy layer is also diverse and composed of many shrub species including American holly, flowering dogwood, mountain laurel, fetter bush, wild azalea. Because of the dense upper layers, herbaceous species are scarce (SCE&G, 1994).

5.1.7 Shallow Coves

This ESA type consist of jurisdictional wetlands that include flats and gentle slopes above elevation 350.5' which is about 6 feet below the annual mean high-water mark (SCE&G, 1994). They occur immediately below buttonbush and willow flats (described below). Depending on water level, they provide shallow water or exposed shoreline habitat and are usually inundated from late winter through spring. They support distinctly-zoned assemblages of forbs, grasses, sedges, and rushes. These areas provide habitat for several wildlife species and are significant to the recreational fishery, representing most of the suitable spawning and nesting habitat for the resident centrarchids (*i.e.* bass and sunfish).

5.1.8 Buttonbush and Willow Flats

The areas are jurisdictional wetlands that usually occur at or just below the 358.5' contour and are common along the upper margins of shallow coves and other shoreline areas (SCE&G, 1994). They support buttonbush on the lake side, with black willow located behind the buttonbushes. The stability provided by the root systems of the plants growing in this habitat reduces the effects of erosion caused by wave action. Because of this stability, spawning centrarchids use these areas extensively. The structural complexity of these areas also provides a safe haven for larval and juvenile fishes.

5.1.9 Monotypic Stands of Water Tupelo

This forested wetland type is consistently inundated, and located within low wet flats of the upper lake (SCE&G, 1994). The shrub layer in this forest type is lacking and swamp beggar-tick grows on the trunks of the trees at or just above the high water mark. These areas are relatively limited, and are unique because they represent most northern occurrence of water tupelo known to exist in the Saluda River basin.

5.1.10 Exposed Bar

These areas of Lake Murray occur in the upper lake and are typically associated with the riverine islands (SCE&G, 1994). They are remnants of the old river system and consist primarily of sand and heavier materials deposited during flood events along the river banks before the Saluda River was impounded. These areas are inundated during most of the year and are usually exposed only during the winter months, which classify them as wetlands under the NWI mapping system. Graminoid plants typically tend to dominate the plant community structure of the exposed bars. The more protected downstream bar areas offer favorable spawning locations for nest-building bass, crappie, and sunfishes.

5.1.11 Wet Flats

This ESA type exists in the upper lake between the bottomland hardwoods and shallow coves and have two distinct forest cover types depending on elevation (low wet flats *vs.* higher flats) (SCE&G, 1994). Both types are jurisdictional wetlands. The wet flats provide important wildlife habitat for the lake ecosystem and, when submerged, are prime feeding areas for migratory waterfowl. During high-water periods, they are also an important source of course particulate organic matter for the lake, which forms an important supplement to fine and dissolved sources of nutrients supplied by tributary creeks and rivers.

5.1.12 Purple Martin Roost

This ESA is designated as such because it serves as a significant island roosting location for this bird species. It is described in more detail in Section 4.0 – *Wildlife*. It contains vegetation similar to other open islands in addition to a dense stand of switch cane and abundant pokeberry (SCE&G, 1994).

5.1.13 Invasive Aquatic Plants

5.1.13.1 Lake Murray

Aquatic plant surveys have been conducted by boat and by plane on Lake Murray on a periodic basis since the early 1990's. There are several invasive aquatic plant species that are under observation on Lake Murray. These include hydrilla (*Hydrilla verticillata)*, Eurasian water milfoil (*Myriophyllum spicatum*), and several species of pondweed (*Potamogeton pusillus, P. crispus, and P. illinoensis, P. diversifolius*), to name a few (Aulbach-Smith, 1998a). Hydrilla populations have declined in Lake Murray due to the introduction of triploid Chinese grass carp into the Lake in 2003 (SCDNR, 2005). The diet of grass carp is almost exclusively aquatic plants and they can help tremendously in the reduction of invasive plant species (Aulbach, 2001b). As of the 2007 survey, the hydrilla appears to be well controlled on Lake Murray with no direct evidence of this species being observed. However, there is still concern noted that there may be tubers and/or hardened root crowns surviving in the lake sediments that may regerminate. Eurasian milfoil, although once a cause for concern on Lake Murray, was not mentioned as a problem species in the 2007 report. Several species of pondweed are present; however, colonies have been reduced due to consumption by grass carp. Small patches of Illinois pondweed (*P. illinoensis*) were noted during the 2007 survey (Aulbach, 2007).

The 2007 survey also notes the establishment of rattlebush (*Sesbania punicea*) as a common species along the Lake Murray shoreline. Until two years ago, this exotic species was not known to exist at the Project. Furthermore, this also reflects a change in the overall composition of emergent aquatic vegetation along the shoreline.

Water primrose (*Ludwigia hexapetala*) continues to be observed along the Lake Murray shoreline in 2007. It is noted, however, that many homeowners control the plant through raking and herbicide applications and that it may also be consumed by the deer population (Aulbach, 2007).

5.1.13.2 Lower Saluda River

The majority of aquatic vascular plants on the LSR are introduced species. Seasonal changes and water fluctuations in the LSR tend to cause a reduction in the numbers of aquatic plants present in the river channel. However, Brazilian elodea is one *exotic species* that is continuing to expand, and is also becoming more common in the rocky shoals. There is concern that Brazilian elodea may crowd out riverweed, a native plant that usually resides in the rocky shoals. Parrot's feather (*Myriophyllum aquaticum*) grows sporadically amongst Brazilian elodia (Aulbach, 2002). Aquatic plants, such as Asian dayflower (*Murdannia keisak*) and water primrose (*Ludwigia uruguayensis*), are present in the shallow backwaters downstream from the confluence with the emergency spillway (see Appendix E-4 *Aquatic Macrophytes of the LSR*) (Aulbach, 2001a).

5.1.14 Rare, Threatened, and Endangered Species

In comments issued in response to the ICD, the USFWS provided a list of all known rare, threatened and endangered (RT&E) species occurring in the four-county region surrounding the Project (See letter dated August 1, 2005). In addition to threatened and endangered species, this list also included species that are candidates for federal listing and federal species of concern. Among the list of identified RT&E species were several plant species that were identified as potentially-occurring in the Project area. They are listed in Table 5-1.

Table 5-1: Results of Assessment of Rare, Threatened, and Endangered Plant Species Within the Saluda Hydroelectric Project Area

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS*	COUNTY	TYPICAL HABITAT	STATUS IN PROJECT AREA
Canby's dropwort *Oxypolis canbyi)*	E	Richland	coastal plains	No known populations; Habitat lacking.
Georgia aster (*Aster georgianus*)	C	Richland	well illuminated, dry oak-pine flatwoods and uplands, disturbed	No known populations; Potential to occur
Little amphianthus (*Amphianthus pusillus*)	T	Saluda	eroded depressions/quarry pools on flat-to-doming granitic outcrops	No known populations; Habitat lacking.
Piedmont bishop-weed *(Ptilimnium nodosum)*	E	Saluda	Rocky/gravel shoals, margins of clear, swift-flowing streams; and edges of intermittent pineland ponds in the coastal plain	No known populations Unlikely to occur based on surveys
Rough-leaved loosestrife (*Lysimachia asperulaefolia*)	E	Richland	Pine pocosin and Carolina bay	No known populations Habitat lacking.
Schweinitz's sunflower (*Helianthus schweinitzii*)	E	Lexington	Well illuminated situations with shallow, poor, clayey and/or rocky soils (roadsides, pastures, etc.)	No known populations Habitat lacking.

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS*	COUNTY	TYPICAL HABITAT	STATUS IN PROJECT AREA
Shoal's spider-lily (*Hymenocallis coronaria*)	SC	Lexington, Richland	Rocky shoals and bedrock outcrops	No viable populations known Unlikely to occur based on surveys
Smooth coneflower (*Echinacea laevigata*)	E	Lexington (possible), Richland	Xeric hardpan forests, diabase glades or dolomite woodlands	No known populations Unlikely to occur based on surveys

Source (SCE&G, 2007)
* Federal Status – E (listed as Endangered under Endangered Species Act); T (listed as Threatened under Endangered Species Act); C (Candidate for Federal listing); SC (Federal Species of Concern); P (Federally protected).

In 2007, in response to the USFWS's request for a literature-based assessment, SCE&G produced a report on RT&E species' requirements and the availability of their habitats in the Project area (Kleinschmidt, 2008). According to this assessment, SCDNR has determined that most plants identified by USFWS are unlikely to occur in the Project boundaries because their required habitat is either limited or lacking altogether in the Project area, and/or field surveys for their presence were negative (see Table 5-1). This conclusion, that the Project area lacks suitable habitat for federally listed species, was supported by an assessment of the Saluda Dam remediation project areas (ARM Environmental, 2001). More information on surveys for RSSL is provided in Section 5.3.1, below. The RT&E assessment is also provided in Appendix *E-2.*

5.2 Agency and Public Recommendations Concerning Botanical Resources

5.2.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) was also filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below, are the remarks and study requests regarding botanical resources that were provided by stakeholders in comment letters following the issuance of the ICD.

During initial consultation, in a joint letter from the CCL and American Rivers (dated August 10th, 2005), it was requested that a Floodplain Flow Evaluation be performed to "assess stream flows needed for incremental levels of floodplain inundation for the Congaree River including the Congaree National Park". It was noted that a central part of this study included an inventory of floodplain vegetation that would provide a good representation of the existing flora along the "affected river reaches". It is also noted that the evaluation should identify the flow regimens and releases from Saluda Hydro that will "fully support" the hydrologic needs of the downstream floodplain, their flora, and fauna. Similarly, the LSSRAC requested in their letter dated August 12, 2005 that a Floodplain Vegetation Assessment be performed. It is described that the floodplain communities be assessed on the reaches of the lower Saluda and Congaree rivers, and the floodplain area of the Congaree National Park.

The extent of Project impact on the downstream areas of the Congaree National Park is still being discussed by the TWC and through the ESWM process at this time.

The LSSRAC also noted in their August 12, 2005 letter that " the ICD indicates that there is little information on the habitats, botanical species, and environmentally sensitive areas (ESA) of the LSR corridor; therefore, we think that additional inventory, assessment, and conservation planning for these resources is needed on the river". This suggestion was also made by the SCDNR in their letter dated August 11, 2005.

SCE&G currently maintains a 100 ft natural buffer along the river channel on land that they own in order to protect water quality and the scenic values of the river.

Both the SCDNR and the Newberry County Government expressed concern for invasive aquatic species in their ICD comment letters. In a letter dated August 15, 2005, Newberry County requested that more information be provided to lake users on weed control methods. The SCDNR noted in their letter (August 11, 2005) that "information such as species composition, location, and acreage of aquatic plants in the project is needed to develop an aquatic plant management plan".

This is detailed further below, under second stage consultation.

Concern for Rare, Threatened or Endangered plant species is expressed in the comment letters of several agencies/organizations. Information on the locations of rare and federally threatened and endangered species occurring within the Project area is requested in the SCDNR (August 11, 2005), USFWS (August 1, 2005), and LSSRAC (August 12, 2005) comment letters. This includes plant as well as wildlife species.

Particular plant species of concern were further explored during the relicensing meetings of second stage consultation, primarily the Rocky Shoals Spider Lily (RSSL). This is detailed further below.

5.2.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of botanical resources during these meetings is described below.

As referenced in the comment letters of SCDNR (August 11, 2005), USFWS (August 1, 2005), and LSSRAC (August 12, 2005) the issue of RT&E plant species focused primarily on one species, the Rocky Shoals Spider Lily (RSSL).

During the March 8, 2006 Fish and Wildlife TWC meeting (meeting notes in Volume II) the Coastal Conservation League/American Rivers asked that a RSSL survey be performed to document the populations and examine potential impacts from Project operations. To accommodate this request, a float trip was organized for May 31, 2006 and attended by agency, Kleinschmidt, and SCE&G personnel. Survey results were written up in memo form and can be viewed in Appendix E-4. Results are discussed in Section 5.3.1. Furthermore, as discussed in section 5.5.1, a RSSL enhancement program is being developed as a part of the relicensing process.

On February 9, 2006, the USFWS, SCDNR and Newberry County requested during a Resource Group Meeting that an Aquatic Plant Management Plan be developed.

It was agreed that the program would be handled under the Aquatic Plant Management Council and that a Memorandum of Understanding (MOU) would be developed between SCDNR and SCE&G (See Meeting Notes from February 9, 2006 in Volume II).

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to botanical resources are provided below.

In their comment letter dated March 14, 2008, DNR requests that management plans for RT&E botanical species be developed in consultation with agencies. One species that they specifically point out should have a management plan is the RSSL. The CCL and American Rivers in a joint letter dated March 14, 2008, also request that monitoring for RSSL on the LSR occur periodically.

As briefly eluded to above, a RSSL enhancement program is currently being developed for the Saluda Project in consultation with state and federal agencies. The enhancement program will likely be similar in nature to the plan established for the Columbia Hydroelectric Project (FERC Project No. 1895). Further discussion is included under section 5.5.1.

In reference to the proposed development of an Aquatic Plant Management Plan along with the Aquatic Plant Management Council, Lake Watch, in letter dated March 14, 2008, notes that this plan should be reviewed yearly. Lake Watch also notes that the impacts of this plan to project operations, recreational users, and fish and wildlife should be considered.

5.3 Results of Recommended Studies

5.3.1 Rocky Shoals Spider Lily Survey

On May 31, 2006, members of the Rare, Threatened, and Endangered Species TWC conducted a survey of the LSR for presence of the RSSL (RSSL Memo, Appendix E-4). The survey was conducted by canoe, and foot where necessary, along the entire reach from the Project dam to the Senate Street Landing on the Congaree River. To aid in identification, the survey was conducted during the RSSL blooming season, which typically is from mid-May through mid-June. Two suspected RSSL plants were found in the Ocean Boulevard Rapids area of the LSR, but could not be positively identified due to lack of blooms. Conversely, the group also observed several hundred blooming RSSL at the known site at the confluence of the Broad and Saluda rivers. This information suggested that the suspected plants were either not RSSL or did not represent a viable population.

5.3.2 Mapping of Environmentally Sensitive Areas

Environmentally Sensitive Areas were first inventoried during a shoreline survey by SCE&G in 1994. This information was intended to provide SCE&G with information useful for assessing the Lake's resources and preparing recommendation to ensure protection of the environmental qualities of the Lake (SCE&G, 1999). SCE&G reviewed the inventory and decided that emphasis should be placed on the 'shallow cove' and button bush and willow flats' classifications because they were most important in providing habitat for a number of wildlife species and are of primary importance to the recreational fishery. They represent the majority of suitable spawning and nesting habitat for most resident fish and wildlife (SCE&G, 1999).

On May 9, 2006, in response to an order of the FERC dated June 23, 2004 (South Carolina Electric & Gas Company, 107 FERC ¶ 62,273 (2004)) requiring that the licensee update the list of ESAs at the Saluda Project (ordering paragraph 'D'), SCE&G submitted an updated set of maps documenting ESAs. The maps reflected the ESAs identified during surveys of Lake Murray that were conducted by SCE&G and SCDNR representatives (USFWS was invited but could not attend on this occasion, however they have attended past ESA mapping exercises) between May and September of 2005. Mileage for the surveyed ESAs is provided in Table 5-2.

Table 5-2: Statistics for ESAs in Saluda Hydroelectric Project Boundary

ESA	FREQUENCY	LENGTH (FEET)	LENGTH (MILES)
Bottomland Hardwood	9	6,801.6	1.29
Button Bush - Continuous	417	152,195.5	28.82
Button Bush - Intermittent	137	24,244.9	4.59
Shallow Cove	50	32,889.1	6.23
Wet Flat	1	55.1	0.01
Total	614	216,186.2	40.9

Source (SCE&G GIS, May 4, 2007)

During the current relicensing process, the Lake and Land Management TWC further refined the ESA classifications and developed descriptions for each aimed at facilitating identification of areas requiring ESA designation. They consist of the following classifications:

- Continuous Vegetated Shoreline - Continuous vegetated linear shoreline at least 66 feet in length with vegetation greater than 5 feet wide measured perpendicular to the shoreline. This class can have gaps that are at least 8 to 20 feet in length with little or no vegetation below the normal high water mark (358.5-ft contour). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline;
- Intermittent Vegetated Shoreline - Linear shoreline coverage of vegetation at least 66 feet in length where 16 to 40 percent of the total linear footage is gap; (*to be revisited by SCE&G and Resource Groups)*
- Shallow Coves with Stream Confluence - Includes areas where streams enter the lake and form coves where lake water is predominately above the 353.5 foot contour line. The upgradient portion of shallow coves is typically vegetated with buttonbush and willow. Where this overlap occurs, shoreline will be given a vegetative shoreline classification; and
- Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in

length (see Section 5.1.2 & 5.1.11 for definitions of Bottomland Hardwood and Wet Flats).

5.4 USFWS Comments on Impacts on Endangered Species

As explained previously, USFWS was a key member of the RT&E TWC and thus was consulted throughout the planning and preparation of the RT&E Assessment (Appendix E-2). USFWS has expressed satisfaction that the report addresses the federal species under their jurisdiction (email correspondence from Amanda Hill, USFWS to Shane Boring, Kleinschmidt Associates, dated September 25, 2007).

5.5 Existing Measures to be Continued and New Measures Proposed by the Applicant

5.5.1 RSSL Monitoring

As previously noted, an extensive RSSL population occurs at the confluence of the Broad and Congaree Rivers. Although not located within the Project Area, agency staff suggested during consultation that the portion of the population on the Saluda side of the confluence could potentially be "under Project influence" and thus requested that a management program be prepared for the population. These plants are already being monitored under an enhancement plan that was developed in the late 1990s as part of SCE&G's relicensing of the Columbia Hydroelectric Project (FERC Project No. 1895) (Kleinschmidt Associates, 1998) (RSSL memo, 2006, Appendix E-4). The Columbia RSSL Enhancement Plan was implemented in 2006 and involves various components including harvesting seeds and greenhouse propagation, planting of additional seedlings, education/public outreach, and monitoring of existing plant colonies. While SCE&G no longer owns the Columbia Project, SCE&G still supports and assists the City of Columbia in implementing the Columbia RSSL Enhancement Project. SCE&G is currently developing a similar Enhancement Program for the Saluda Project, which will mirror the enhancement and monitoring efforts at the Columbia Project. The RSSL will also be included in the public awareness program associated with the RT&E species found in the Project Area. Once finalized through the TWC, the RSSL enhancement program will be submitted to FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the cooperative program after issuance of a new FERC license for the Project.

5.5.2 Invasive Species MOU

The Aquatic Plant Management Council consists of resource agency specialists and was formed to help control the spread of invasive species within waterways of SC. As part of this relicensing, SCE&G is consulting with the Aquatic Plant Management Council on the development of an MOU to formalize their cooperation within this organization. Upon completion, any MOU that is developed will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the MOU after issuance of a new FERC license for the Project.

5.6 Anticipated Effects

Vegetation Disturbance

Impacts to botanical resources are anticipated to occur through land disturbances and vegetation clearing required during expansion of recreation sites and creation of meandering pathways through buffer zones. In addition, maintenance of utility line right-of-ways and roadsides in the Project Area require herbicide application and mowing, which affects community structure by selecting for early successional species and eliminating or reducing woody species, light-intolerant species, and species intolerant of disturbance.

Unapproved disturbances to vegetation below the 360' contour or within buffer zones, aside from pathway creation, require re-vegetation according to SCE&G's permitting program, as provided in the SMP. Responsible landowners are required to submit and implement a re-vegetation plan that complies with guidelines set forth by SCE&G. Furthermore, the plan must be approved by SCE&G Lake and Land Management Department prior to implementation. The guidelines call for planting native vegetation at disturbed locations, with species composition and densities determined based on site-specific factors including topographic slope and upland or riparian zone. Use of these plans will minimize negative impacts of unauthorized vegetation disturbance in the buffer zone.

Botanical resources in Lake Murray may also potentially be impacted by SCE&G's invasive species program. Although grass carp introduction has proved effective in reducing the amount and coverage of invasive aquatic vegetation in Lake Murray, particularly of Hydrilla, there has potentially been an associated reduction in beneficial and native vegetation due to excessive carp grazing.

Floodplain

Current project operations moderate flows downstream, thus reducing the magnitude and frequency of out-of-bank flooding. As described previously, FEMA data shows lands bordering the LSR comprise a 10-year floodplain. This is likely an overestimation, perhaps based on pre-project conditions. Flows associated with the 10-year frequency are exceedingly rare as SCE&G has operated the Saluda Project for decades as to not exceed maximum plant hydraulic capacity, which is approximately 20,000 cfs. The most obvious ecological consequence of minimizing the magnitude and duration of floods (compared to inflows) is transition of the vegetation community within the LSR corridor from flood-tolerant species to species more tolerant of dry conditions. Additional potential consequences of such hydrological changes include changes in soil chemistry and composition, wildlife habitats, and overall loss of floodplain values and functions.

Although it is unlikely that the LSR corridor has 10-year flood storage capacity, information on the presence or lack of floodplains resulting from less frequent flooding within the LSR corridor (e.g., 50-year or 100-year events) is lacking. Also, identified as a concern during consultation, is the potential affect of Project operations on the Congaree National Park (CNP), the largest remnant old-growth floodplain forest remaining in North America. While the CNP is clearly out of the Project boundary, SCE&G is currently entertaining proposals on operational changes that may have beneficial impacts to the CNP. SCE&G will continue to participate in the NPS ESWM process to determine if changes in operation of Saluda Hydro may provide additional habitat opportunities without contravening the designated uses of the Project. Preliminary proposals are expected from the NPS by September 2008. Any recommendations in changes to operation of the Project will be submitted to the FERC for consideration and/or implementation in the new license.

RT&E Species

Of the RT&E botanical species identified as occurring in the four county region surrounding the Project, only the Georgia aster and RSSL were identified by the RT&E Assessment as occurring or potentially occurring in the Project Area or in the vicinity of the Project, and thus have potential to be impacted by Project operations. The remaining RT&E species identified during the assessment either are not present in the Project Area or lack required habitat. Georgia aster, although not actually documented, may potentially occur in the disturbed habitats of the transmission line rights-of-way and the frequently-mowed road shoulders (B. Pittman, SCDNR, Pers. Comm.). Negative impacts to such plants may arise through herbicide application during maintenance. In contrast to herbicide use, however, routine mowing of these areas likely constitutes a benefit to this species as it helps eliminate competition by woody competitors (USFWS, 2001).

As explained previously, thriving colonies of RSSL are known to occur downstream of the Project in the confluence of the Broad and Saluda rivers. According to the 2007 annual report on RSSL enhancement at the Columbia Project, plant abundance on the Broad River may have declined since the initial RSSL survey in 1998 (Kleinschmidt, 2008). Although the magnitude of decline can not be determined due to differing survey techniques used between visits, implementation of minimum flows at the Columbia Project has likely contributed. Also, it is possible the decrease is temporary and that numbers may increase as the distribution of plants adjusts to the new flow regime. The Broad River contributes the majority of flow to the Congaree River at its confluence with the LSR, and is expected to impact the RSSL occurring at the confluence proportionately. Under certain flow conditions (i.e., high project releases from Saluda and extremely low flows in the Broad), release from Saluda Hydro have the potential to temporarily inundate those RSSL plants located on the LSR side of the confluence area. However, these event are typically short in duration (less than 1 day), and to date, there has been no evidence indicating that Project operations have had a negative affect on this portion of the RSSL population.

Proposed changes to Saluda Project operations may involve the provision of flows to enhance recreation opportunities and flows to enhance fisheries and other aquatic habitat. SCE&G also conducted a study to determine flow levels that best benefit anglers, paddlers and swimmers, and to determine flows needed to support boat passage (canoe, kayak, and small motor boat), as well as an IFIM study to determine habitat needs for target aquatic species (see IFIM discussions included in section 3.10.6). The resulting flows may affect RSSL colonies at the confluence by increasing recreational activity that can also lead to increased trampling and other types of disturbances (i.e., picking flowers). Also, modified annual minimum flows may alter the current habitat for the plants by deepening the water in some areas where they exist; however, these modifications will likely be subtle and within the species ability to acclimate. Conversely, the ecological flows will likely benefit the species by ensuring that a minimum flow is maintained and may open up some areas to colonization by this species that were formerly too shallow or dry.

5.7 Comprehensive Plans

As required in section 4.38(f)(6) of the Commission's regulations, the applicant has reviewed and found there to be no relevant state or federal comprehensive plans identified on the Commission's list with respect to Botanical Resources.

5.8 Botanical Resources Tables

Table 5-3: Listing of Botanical Species Found Within the Saluda Project Area

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
American beech	*Fagus grandifolia.*	X							X				X
American elm	*Ulmus americana*	X				X		X			X		
American holly	*Ilex opaca*					X		X	X				
American hornbeam	*Carpinus caroliniana*					X							
Arrowwood	*Viburnum dentatum*												X
Asian dayflower*	*Murdannia keisak*												X
Asters	*Aster sp.*							X					
Barnyard grass	*Echinochloa crusgalli*		X	X			X	X					
Beggar-tick	*Bidens frondosa*		X	X	X								
Bermuda grass	*Cynodon dactylon*							X					
Black cherry	*Prunus serotina*	X						X					
Black highbush blueberry	*Vaccinium atrococcum*							X					
Black oak	*Q. velutina*	X						X					

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Black walnut	*Juglans nigra*												X
Black willow	*Salix nigra*				X			X					
Blackberries	*Rubus sp.*							X					
Blueberry	*Vaccinium sp.*								X				
Blue-flowered eryngium	*Eryngium prostratum*			X	X								
Blunt spikerush	*Eleocharis obtusa*			X									
Bosc's bluet	*Hedyotis boscii*		X	X	X								
Box elder	*Acer negundo*	X											X
Brazilian elodea*	*Egeria densa*	X											X
Brittle waternymph*	*Najas minor*	X											
Butterweed	*Senecio glabellus*										X		
Buttonbush	*Cephalanthus occidentalis*				X			X			X		
Camphor weed	*Heterotheca subaxillaris*							X					
Catbriars	*Smilax bona-nox*							X					
Catbriars	*S. rotundifolia*							X					
Catbriars	*S. glauca*							X					

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Cedar	*Juniperus silicicola*												X
Cherry	*Prunus sp.*												X
Cherrybark oak	*Quercus falcata var. pagodaefolia*					X							
Cherrybark oak	*Quercus pagoda*							X					
Chickweed	*Stellaria media*												X
chinkapin oak	*Q. muhlenbergii*	X							X				
Christmas fern	*Polystichum acrostichoides*								X				
Clearweed	*Pilea pumila*												X
Cockle-bur	*Xanthium strumarium*		X	X	X								
Kentucky Bluegrass	*Poa pratensis*												X
Bentgrass	*Gramineae sp.*												X
Fescue	*Festuca sp.*												X
Cottonwood	*Populus deltoides*							X					X
Crab-apple	*Malus Angustifolia*							X					
Creeping burhead	*Echinodorus cordifolius*				X								
Creeping fimbry	*Fimbristylis autumnalis*		X										
Creeping primrose	*Ludwigia palustris*		X	X			X				X		

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Creeping rush	*Juncus repens*		X	X									
Daisy	*Erigeron sp.*												X
Dandelion	*Taraxacum offinciniale*												X
Deciduous holly	*Ilex decidua*					X		X			X		
Ditch stonecrop	*Penthorum sedoides*										X		
Dogwood	*Cornus sp.*												X
Dog fennel	*Eupatorium capillifolium*							X					
Dwarf bulrush	*Hemicarpha micrantha*		X				X						
Dwarf crabgrass	*Digitaria serotina*		X	X									
Eastern false-willow	*Baccharis halimifolia*							X					
Ebony spleenwort	*Asplenium platyneuron*								X				
Eclipta	*Eclipta alba*		X	X	X								
Elder	*Sambucus canadensis*												X
Elm	*Ulmus sp.*												X
English ivy	*Hedera helix*							X					
Eryngium	*Eryngium prostratum*		X										
Eurasian Water Milfoil*	*Myriophyllum spicatum*	X											

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Fall panic	*Panicum dichotomiflorum*		X	X									
False pimpernel	*Linderina dubia*									X			
Fetterwood	*Leucothoe fontanesiana*								X				
Fireweed	*Erechtites hieracifolia*				X						X		
Flatedge spp.	*Cyperus polystachyos*						X						
Flatedge spp.	*C. strigosus*						X	X					
Flatedge spp.	*C. erythrorhizos*			X			X	X					
Flatedge spp.	*C. flavescens*						X						
Flatsedges	*C. iria*			X									
Flatsedges	*C. compressus*			X									
Flatsedges	*C. haspan*			X									
Flatsedge	*Cyoerus sp.*		X								X		
Fleabane	*Erigeron annuus*												X
Flowering dogwood	*Cornus florida*	X							X				
Goldenrod	*Solidago odora*							X					
Green ash	*Fraxinus pennsylvanica*	X						X			X		
Harbor sweet gum	*Liquidambar sp.*										X		

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Honeysuckle	*Gaylussacia sp.*							X					X
Hop hornbeam	*Ostraya virginiana*	X							X				
Horse-nettle	*Solanum carolinense*												X
Japanese honeysuckle	*Lonicera japonica*							X					X
Hydrilla*	*Hydrilla verticillata*	X											
Johnson grass	*Sorghum halepense*							X					
Juniper-leaf	*Polypremum procumbens*		X	X	X								
Laurel oak	*Quercus laurifolia*					X							
Least spikerush	*E. acicularis*			X	X								
Lespedeza	*Lespedeza intermedia*							X					
Loblolly pine	*Pinus taeda*	X						X	X		X		X
Maple	*Acer sp.*												X
Mistletoe	*Phoradendron serotinum*							X					
Mockernut hickory	*C. tomentosa*	X											
Mountain laurel	*Kalmia latifolia*								X				

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Muscadine grape	*Vitis rotundifolia*							X					
Mustards	*Brassia sp.*												X
Oak various spp.	*quercus sp.*												X
Overcup oak	*Quercus lyrata*				X			X			X		
Panic grasses	*Panicum dichotomiflorum*				X								
Panic grasses	*P. rigidulum*				X								
Panic grasses	*P. scoparium*				X								
Panic grasses	*Dichanthelium sp.*							X					
Panic grasses	*Panicum sp.*										X		
Parasitic mistletoe	*Phoradendron serotinum*										X		
Parrot's feather*	*Myriophyllum aquaticum*												X
Passion flower	*Passiflora incarnata*							X					
Pepper	*Ampelopsis arborea*							X					
Persimmon	*Diospyros virginiana*				X			X					
Pignut hickory	*C. glabra*	X											

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Plume grass	*Erianthus sp.*							X					
Poison ivy	*Toxicodendron radicans*												X
Pokeberry	*Phytolacca americana*							X					
Pokeweed	*Phytolacca americana*												X
Pondweed *sp.* *	*Potamogeton crispus*	X											
Pondweed *sp.* *	*Potamogeton illinoensis*	X											
Pondweed *sp.* *	*Potamogeton pusillus*	X											
Post oak	*Quercus stellata*							X					
Purple-top tridens	*Tridens favus*							X					
Rabbit tobacco	*Gnaphalium obtusifolium*							X					
Rattle bush	*Sesbania punicea*							X					
Red cedar	*Juniperus virginiana*							X	X				
Red maple	*Acer rubrum*	X				X		X	X		X		
Red oak	*Q. rubra*	X							X				X
Redbud	*Cercis canadensis*	X											
Red-top panic grass	*Panicum rigidulum*		X	X			X	X					
River birch	*Betula nigra*	X						X					

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
River seedbox	*Ludwigia leptocarpa*							X					
Rushes	*Juncus sp.*						X						
Sassafrass	*Sassafras albidum*												X
Sedges	*Carex sp.*					X							
Shagbark hickory	*Carya ovata*	X							X				
Shortleaf pine	*P. echinata*	X						X					X
Shortleaf pine	*Pinus taeda*							X					
Shumard oak	*Quercus shumardii*					X							
Slender fimbry	*Fimbristylis autumnalis*			X			X	X					
Slender St. John's-wort	*Hypericum mutilum*							X					
Smart weeds	*Polygonum sp.*										X		
Smartweed	*Polygonum pennsylvanicum*		X	X	X								
Smooth sumac	*Rhus glabra*							X					
Sourwood	*Oxydendron arboreum*	X							X				
Southern red oak	*Quercus falcata*	X						X	X				
Spikerush	*Eleocharis sp.*		X	X									
Spikerush	*E. baldwinii*				X								

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Spiny amaranth	*Amaranthus Spinosus*												X
Spotted wintergreen	*Chimaphila maculata*								X				
St. Andrew's-cross	*Ascyrum hypericoides*					X							
Stalkless yellowcress	*Rorippa sessiliflora*			X									
Sugarberry	*Celtis laevigata*							X			X		
Sunflower	*Helianthus annuus*												X
Swamp beggar-tick	*Bidens discoidea*									X			
Swamp chestnut oak	*Quercus michauxii*					X			X				
Swamp dogwood	*Cornus foemina*					X							
Sweet gum	*Liquidambar styraciflua*	X			X	X		X	X		X		
Switch cane	*Arundinaria gigantea*					X		X	X		X		
Sycamore	*Platanus occidentalis*				X			X			X		X
Teal lovegrass	*Eragrostis hypnoides*			X			X	X			X		
Throughworts	*Eupatorium sp.*							X					
Toothcup	*Rotala ramosior*		X	X	X		X	X					

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Tridens	*Tridens flavus*							X					
Triple-awn grass	*Aristida sp.*							X					
Trumpet creeper	*Campsis radicans*										X		
Trumpet vine	*Campsis radicans*							X					
Tulip poplar	*Liriodendron tulipifera*	X									X		
Vetch	*Vicia sp*							X					X
Violets	*Viola sp.*												X
Virginia creeper	*Parthenocissus quinquefolia*												X
Walnut	*Juglans sp.*												X
Water hickory	*Carya aquatica*	X						X			X		
Water oak	*Quercus nigra*	X				X		X					
Water primrose*	*Ludwigia hexapetala*				X								X
Water tupelo	*Nyssa aquatica*									X	X		
Water willow	*Justicia americana*				X								
Wax myrtle	*Myrica cerifera*	X											X
White oak	*Quercus alba*	X							X				X
Wild azalea	*Rhododendron canescens*	X							X				
Wild ginger	*Hexastylis arifolia*								X				
Wild oat	*Avena sativa*												X

SPECIES COMMON NAME	SPECIES LATIN NAME	LAKE MURRAY	SHALLOW COVES	SHALLOW SHOALS	BUTTONBUSH AND WILLOW FLATS	BOTTOMLAND HARDWOOD	EXPOSED BARS	ISLANDS	MATURED HARDWOOD FORESTS	WATER TUPELO STANDS	WET FLATS	ROCKY SHORES	LOWER SALUDA RIVER
Willow	*Salix sp.*												X
Willow oak	*Quercus phellos*	X				X		X			X		
Winged sumac	*Rhus copallina*							X					
Wood sage	*Teucrium scorodonia*												X

*Indicates an invasive aquatic plant species

6.0 HISTORICAL AND CULTURAL RESOURCES

6.1 Prehistory of the Region

The Paleoindian period can be tentatively dated from about 11,000–8000 BC. At the beginning of this period, most of South Carolina was cool and dry, with boreal tundra and spruce-pine forests covering most of the state. By the end of this period, the climate ameliorated, rainfall was more frequent, and the state was covered with deciduous forests that contained beech, elm, hickory, oak, and birch. It was also during this time that the large megafauna, including mammoth, mastodon, giant sloth, and bison became extinct. It is still not clear whether humans or the climate played a more prevalent role in the extinction of these large animals, although it is likely that both contributed to their extinction.

Most of our knowledge about the Paleoindian period in the Southeast is based on surface collections and inference rather than controlled subsurface excavations. The limited information we do have, however, suggests that the earliest Native Americans had a mixed subsistence strategy based on the hunting (or scavenging) of the megafauna and smaller game combined with the foraging of wild plant foods. Groups are thought to have consisted of small, highly transient bands made up of several nuclear and/or extended families. Settlements appears to be concentrated along major rivers near the Fall Line and in the Coastal Plain, although it is almost certain that many additional sites along the coast have been inundated by the rise of sea level that has occurred since that time.

Environmental change at the end of the Pleistocene led to changes in human settlement patterns, subsistence strategies, and technology. As the climate warmed and the megafauna became extinct, population size increased and there was a concomitant decrease in territory size and settlement range. Much of the Southeast during the early part of this period consisted of a mixed oak-hickory forest. Later, during the Hypsithermal interval between 6000 and 2000 BC, southern pine communities became more prevalent in the interriverine uplands, and extensive riverine swamps were formed.

The Archaic period has typically been divided into three subperiods, Early Archaic (8000–6000 BC), Middle Archaic (6000–3000 BC), and Late Archaic (3000–1000 BC) based on changes in projectile point morphology, settlement patterns, and subsistence practices. Each of these subperiods appears to have been lengthy and successful in adapting technology to prevailing climatic and environmental conditions of the time.

The Woodland period sees a number of important developments in the region, including a gradual increase in population and sedentism; the widespread adoption of ceramic vessel technology; the introduction of the bow and arrow technology; the intensification of horticultural activities; the establishment of long distance trading networks; and the use of conical burial mounds for interring the dead. Like the preceding Archaic Period, the Woodland is traditionally divided into three subperiods: Early Woodland (1000–500 BC), Middle Woodland (500 BC–AD 500), and Late Woodland (AD 500–1000).

The Mississippian Period, dating from AD 1000–1540, saw dramatic changes across most the Southeastern United States. Mississippian societies were complex sociopolitical entities that were based at mound centers, usually located in the floodplains along major river systems. The flat-topped platform mounds served as both the literal and symbolic manifestation of a complex sociopolitical and religious system that linked chiefdoms across a broad network stretching from the Southeastern Atlantic Coast, to the Spiro Mounds in Oklahoma in the west, to as far north as Aztalan in Wisconsin. Mound centers were surrounded by outlying villages that usually were built along major rivers to take advantage of the rich floodplain soils. Smaller hamlets and farmsteads dotted the landscape around villages and provided food, tribute, and services to the chief in return for protection and inclusion in the sociopolitical system. While Mississippian subsistence was focused to a large extent on intensive maize agriculture, the hunting and gathering of aquatic and terrestrial resources supplemented Mississippian diets.

6.2 History of the Region

Permanent European settlement in South Carolina began in 1670, when English adventurers from the island of Barbados settled on the west bank of the Ashley River near what is now Charleston; they relocated to the present site of Charleston in 1680. Settlers began moving inland relatively quickly, forming a trading post along the Congaree River as early as 1700. This trading post was located south of what is now Columbia, which was the furthest upriver point where boat traffic was possible. Speculators began purchasing farm land along the Congaree River south of Columbia, creating plantations dedicated to cash crops that could be sent to Charleston. The pace of settlement increased in the 1740s and 1750s.

In the wake of the Revolutionary War, the most important development in the midlands region was the creation of the new state capitol at Columbia, located on a plain above the Congaree River just below the confluence of the Broad and Saluda Rivers. Improvements in transportation became increasingly important in the early nineteenth century, in the attempt to allow goods from further north and west in the state to pass around the shoals of the Broad and Saluda River to get to the Congaree River, whence they could easily be shipped either to Charleston or Georgetown. This interest resulted in the Columbia Canal, which started at a diversion dam across the Broad River and followed the southern bank of the Broad and Congaree Rivers, and the Saluda Canal, which bypassed shoals in the Saluda River and directed boats to the entrance of the Columbia Canal. The various falls in the Broad and Saluda Rivers above Columbia also provided sources of power for new manufacturing enterprises, most notably the Saluda Factory along the southern bank of the Saluda River, approximately two miles from its confluence with the Broad River; begun in 1834, the plant was destroyed during the Civil War.

In the late nineteenth and early twentieth centuries, despite some promising manufacturing developments, including the Columbia Mills (the first textile plant in the country to be powered by hydroelectric power, using waters from the original Columbia Canal), the areas to the west of Columbia remained primarily agricultural. There were, however, a number of small, localized settlements with small houses, churches, and cemeteries. In the 1920s the Lexington Water Power Company (LWPC) began to develop plans for the creation of a dam and hydroelectric facility at Dreher's Shoals on the Saluda River. Agents for the LWPC began acquiring the large tracts of land necessary to develop the massive lake and surrounding lands, totaling approximately 100,000 acres. In the process, the LWPC removed or relocated three churches, six schools, and 193 graveyards.

Development of the hydroelectric facility began in 1927 with land-clearing operations and the beginning work on the dam. Once completed, the dam was 1.5 miles long and was the largest earthen dam that had yet been built. By 1929, construction on the dam was complete enough so that the lake could be partially filled. Storms in the autumn of that year flooded the dam and damaged the unfinished powerhouse; by 1930, the repairs had been completed and the project began generating electricity and the lake was named Lake Murray in honor of William Murray, who first conceived of the plan for the hydroelectric development. The lake was filled to the 358.5 foot elevation by 1933.

6.3 Tribal, Agency and Public Consultation Concerning Cultural Resources

As part of the relicensing process, SCE&G established a Cultural Resource Conservation Group (CRCG) that included members of the general public and the following organizations: the Catawba Indian Nation (CIN) Tribal Historic Preservation Officer; Irmo Chapin Recreation Commission; Lake Murray Historical Society; Lake Murray Homeowners Association; Lake Murray Regional Tourism Board; Lake Murray Watch; South Carolina Department of Natural Resources; South Carolina Department of Parks, Recreation and Tourism; South Carolina Institute of Archaeology and Anthropology (SCIAA); and the State Historic Preservation Office (SHPO). As of September 2007, four meetings of the CRCG had taken place. The public also has had the opportunity to provide comments during any of the regularly scheduled quarterly public meetings held since September 2005 or through submitting comments on the Saluda Hydro Relicensing website.

6.3.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) was also filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below, are the remarks and study requests regarding cultural resources that were provided by stakeholders in comment letters following the issuance of the ICD.

On May 24, 2005, the SHPO provided confirmation of the receipt of the ICD and noted that their only comment was that discussion of the Cultural Resource Surveys be included in the License Application.

6.3.2 Second Stage Consultation

The Catawba Indian Nation was an active member in the Cultural Resource RCG meetings and provided comments to the Cultural Resource Surveys therein. Written correspondence acknowledging the receipt of the final Data Recovery Plan on June 16, 2008, the Stage II Cultural Resource Survey on May 18, 2007, the draft HPMP on December 12, 2007, the data recovery plan on December 11, 2007 was provided.

The Bureau of Indian Affairs also provided confirmation of the receipt of the DLA by letter dated December 19, 2007. Therein they state that the Eastern Band of the Cherokee Indians needs to be included in consultation as well as the Catawba Indian Nation through the Tribal Historic Preservation Office.

The Eastern Band of the Cherokee Indians has been invited to participate since the distribution of the ICD and has been transmitted all draft and final copies of the cultural resource surveys documents. At this point, they have not provided any comments on these documents. SCE&G will continue, however, to provide the Eastern Band of the Cherokee with pertinent information.

6.4 Results of Recommended Studies

SCE&G has conducted numerous cultural resources surveys within the Project boundary in recent years, in association with the proposed relicensing of the Project. These studies have included Trinkley and Southerland (2001), Hendrix and Bailey (2003), Lansdell and Bailey (2003), Norris et al. (2005), and Green et al. (2007). Together, these studies constitute partial compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. The most recent of these, Norris et al. (2005) and Green et al. (2007), represent the most comprehensive survey of cultural resources within the Area of Potential Effect (APE).

The results of these surveys were submitted for review to the South Carolina State Historic Preservation Office (SHPO) and the Tribal Historic Preservation Officer (THPO) for the Catawba Indian Nation. Green et al. (2007) contained the final recommendations for NRHP eligibility, of all known cultural resources within the APE. This report also included recommendations regarding the potential for the known historic properties within the APE to be affected by Project operations. Discussions of the results of these surveys follows.

6.5 Resources Inventoried and National Register Eligibility

From April 27, 2005, through January 24, 2007, Stage I (reconnaissance) and Stage II (intensive) cultural resource investigations were conducted at Lake Murray and portions of the Lower Saluda River in Lexington, Newberry, Richland and Saluda counties, South Carolina (Norris et al. 2005; Green et al. 2007). As a result of these studies, 156 archaeological sites, 42 isolated finds, and eight aboveground historic resources were investigated. Of these resources, the Tree House Site (38LX531), the Meetze Family Cemetery (38LX526), the Amick Family Cemetery (38NE666), and Epting's Campground (Structure 63-0521) were determined eligible for inclusion in the National Register of Historic Places (NRHP). In addition, seventeen other archaeological sites were determined to be potentially eligible for the NRHP. The Saluda Dam and Power House Complex (Historic Resource 243-0127) was previously determined eligible for the NRHP (Trinkley 2001; Butler and Jordan 1997), and archaeological sites 38RD134 and 38SA1 were previously determined potentially eligible for the NRHP (Lansdell and Bailey 2003).

The Saluda Dam Complex (Historic Resource 243-0127) is a multi-component architectural resource that includes the Saluda Dam, the Saluda Hydroelectric Facility, and other resources associated with these structures. The various components of Historic Resource 243-0127 have construction dates that range from 1927 to 1958, with some of the structures undergoing more recent alterations. The Saluda Dam Complex is considered eligible for inclusion in the NRHP under Criterion A for its association with industrial history; Criterion B for its association with significant people; and Criterion C for its architecture and engineering design (Trinkley 2001:107). Treatments for the Saluda Dam Complex are contained in Appendix D of the Historic Properties Management Plan (HPMP) (Green and Jones 2008).

Seven potentially eligible archaeological sites, as well as the National Register eligible Meetze Family Cemetery (38LX526), Amick Family Cemetery (38NE666), and the Epting Campground, are not currently being affected by Project operations. As such, no additional work is necessary for these resources at this time. However, SCE&G has agreed to monitor these sites periodically to check for erosion or other project related impacts. Should the condition of these sites substantially change, or should there be an undertaking that would adversely affect these sites, then additional investigations may be necessary at that time.

The remaining 136 archaeological sites, seven surveyed structures, and 42 isolated finds were determined ineligible for the NRHP and no additional work is necessary in these areas (Green et al. 2007). Table 6-1 presents all of the historic properties identified within the APE.

6.6 Areas of Tribal Concern

The archaeological record indicates that the Saluda River region has been inhabited by Native Americans for at least 13,000 years, as shown in the number of prehistoric archaeological sites within the region. There was a very clear and strong presence of Native Americans in the central South Carolina region in the early eighteenth century when European explorers first entered the region and it continued well into the period of European settlement. This presents a well-justified traditional connection to the region that includes the project area on the part of Native Americans.

Under Section 106 of the National Historic Preservation Act, the Commission is obligated to seek out any federally-recognized Indian tribe that can demonstrate a traditional cultural or religious connection to land under its jurisdiction and to involve them in the relicensing process. The Applicant invited seventeen Tribes to participate in the identification and evaluation of historic properties at the Saluda Project. Two Tribes accepted the invitation to participate: the Catawba Indian Nation (CIN) and the Eastern Band of Cherokee Indians (EBCI) (Tribes). The Applicant continued to seek consultation with the Tribes in the development of a Historic Properties Management Plan (HPMP) (Green and Jones 2008). The Commission will seek consultation with the Tribes in the development of a Programmatic Agreement (PA) for the Saluda Project.

6.7 Existing Measures to be Continued, New Measures Proposed by the Applicant and Anticipated Effects

6.7.1 Management of Project Lands and Related Effects of Shoreline Development and Use on Historic Properties

The continued management and operations of the Project may affect historic properties as a result of Project-induced shoreline and riverbank erosion, the construction of any Project-related recreational facilities, and on-going development along the shoreline of Saluda Lake. However, the incorporation of historic properties into the planning and permitting process could have a beneficial effect on historic properties that lie along the shoreline through discovery and protection of significant sites.

Proposed Action

SCE&G proposes to manage historic properties under two different management documents: a Shoreline Management Plan (SMP) and an HPMP. The SMP guides the type and degree of development that may take place within the project boundary. It outlines how SCE&G will consider cultural resource issues when issuing permits for the construction of docks, seawalls, and other water-control structures. The HPMP is designed to be used in coordination with the SMP.

SCE&G proposes to develop management procedures, including the use of permits through the SMP, for historic properties. According to the SMP, property owners who request permits for construction would be notified if their property contains an area that has been designated as having a high probability to contain intact archaeological deposits that has not been previously investigated as part of the Stage I or Stage II surveys, or if it contains a previously recorded site that was determined to be a significant historic site. In the event that an archaeological deposit is found during development activities, the property owner is required by the SMP to notify the SCE&G who will in turn contact the SHPO. This SMP will be filed with the FERC once full TWC and public review has been completed.

In June 2008, SCE&G filed with the Commission an HPMP. This HPMP has been incorporated into the Application, and will complement a Programmatic Agreement (PA) which the Commission will develop. Under the new license, SCE&G proposes to manage historic properties through the HPMP and the PA. Together, these documents will guide the Applicant in the management both of the historic properties that have been identified within the Project APE and of any currently-unknown historic properties that may be discovered during the term of the License. By reference, the HPMP will then provide the necessary management of historic properties under the Applicant's other management plans including the SMP.

The HPMP includes principles and procedures to address:

a) Completion, if necessary, of identification, evaluation and mitigation of historic properties within the Project APE;

b) A plan for monitoring and if needed protection of historic properties within the Project APE that may be affected by shoreline erosion, other Project-related ground-disturbing activities, and vandalism;

c) Mitigation of unavoidable adverse effects to historic properties;

d) Treatment and disposition of any human remains that may be discovered, taking into account any state and federal laws and regulations;

e) Discovery of previously unidentified historic properties during Project operations;

f) A plan for public interpretation of the historic and archeological values of the Project;

g) Curation of all archaeological materials and appropriate field and research notes, maps, drawings and photographic records collected as part of this Agreement (with the exception of human skeletal remains and associated funerary objects) in accordance with the requirements of 36 CFR Part 79, Curation of Federally owned and Administered Archeological Collections.

Collectively, the proposed measures for the general management of historic properties would have a beneficial effect upon historic properties along the shoreline of Lake Murray and the LSR.

6.7.2 Effects of Continued Project Operations on Archaeological Resources

Effects on historic properties within the APE might result from Project-related activities such as reservoir operations and Project-related ground-disturbing activities. Effects also might result from other forces such as wind and water erosion, recreational activities, and vandalism. The type and level of effects on historic properties can vary widely, depending upon the setting, size, and visibility of the resource, as well as whether there is public knowledge about the location of the resource.

Proposed Action

Erosion, regardless of its cause, constitutes one of the most significant threats to historic properties associated with hydroelectric projects. With the development of an HPMP, SCE&G will have the tools available to identify, protect, and, as appropriate, mitigate for any newly discovered archaeological sites or protect and mitigate for additional disturbance of known archaeological sites.

According to Green et al. (2007), potentially eligible archaeological sites 38NE636, 38NE638, 38NE639, 38SA110, 38SA128, 38SA129, 38SA148, 38SA150, 38SA174, and 38SA224 are all experiencing some level of erosion, mostly below the 358.5[10] ft maximum pool elevation (Table 1-1). Although they are each being impacted to some extent, the SHPO and other consulting parties have agreed that no additional work is necessary at these sites at this time. In lieu of additional work at these sites, SCE&G is currently conducting data recovery investigations at the Tree House Site (38LX531), and will perform periodic monitoring at each of these sites to look for additional erosion or other

[10] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

project-related impacts. Should the condition of these sites substantially change, or should there be an undertaking that would adversely affect these sites (e.g., construction), then additional investigations may be necessary at that time.

6.8 Comprehensive Plans

As required in section 4.38(f)(6) of the Commission's regulations, the applicant has reviewed and found there to be no relevant state or federal comprehensive plans identified on the Commission's list with respect to Cultural Resources.

6.9 Cultural Resources Tables

Table 6-1: List of Historic Properties and Management Recommendations for the Saluda Hydroelectric Project

SITE NO.	DESCRIPTION	NRHP RECOMMENDATION	PROJECT EFFECTS	MANAGEMENT RECOMMENDATIONS
38LX526	Meetze Family Cemetery, Early–mid 19th century	Eligible	None	Monitoring
38LX531	Paleoindian–Mississippian habitation site	Eligible	Moderate erosion of riverbank	Data recovery/preservation in place
38LX537	Mid-19th/20th century house site	Potentially Eligible	None	Monitoring
38LX539	Mid-19th/20th century house site	Potentially Eligible	None	Monitoring
38LX540	Mid-19th/20th century house site	Potentially Eligible	None	Monitoring
38LX554	19th/20th century house site	Potentially Eligible	None	Monitoring
38LX555	19th/20th century house site	Potentially Eligible	None	Monitoring
38NE636	Pre-contact lithic scatter	Potentially Eligible	Minor erosion along shoreline	Monitoring
38NE638	Middle Archaic, Late Archaic, and Late Woodland/ Mississippian lithic scatter	Potentially Eligible	Moderate erosion along shoreline	Monitoring
38NE639	Bouknight Ferry Causeway, 18th century	Potentially Eligible	Minor erosion along causeway	Monitoring
38NE666	Amick Family Cemetery, mid to late 19th century	Eligible	None	Monitoring

SITE NO.	DESCRIPTION	NRHP RECOMMENDATION	PROJECT EFFECTS	MANAGEMENT RECOMMENDATIONS
38RD134	Early Archaic–Woodland lithic scatter	Potentially Eligible	None (previously stabilized)	Monitoring
38SA1	Early Archaic–Early Woodland artifact scatter	Potentially Eligible	None (previously stabilized)	Monitoring
38SA110	Early Archaic lithic scatter	Potentially Eligible	Minor erosion along shoreline	Monitoring
38SA128	Woodland or Mississippian artifact scatter	Potentially Eligible	Minor erosion along shoreline	Monitoring
38SA129	Pre-contact lithic scatter	Potentially Eligible	Minor erosion along shoreline	Monitoring
38SA148	Woodland or Mississippian artifact scatter	Potentially Eligible	Shoreline inundated at 356.5 ft pool elevation	Monitoring
38SA150	Middle Woodland artifact scatter	Potentially Eligible	Approx. 90% of the site is inundated at the 356.5 ft pool elevation	Monitoring during major drawdowns below the 350 ft Plant Datum, but no more than once every five years.
38SA159	Historic cemetery	Potentially Eligible	None	Monitoring
38SA169	Pre-contact lithic scatter	Potentially Eligible	None	Monitoring

SITE NO.	DESCRIPTION	NRHP RECOMMENDATION	PROJECT EFFECTS	MANAGEMENT RECOMMENDATIONS
38SA174	Mid-19th/20th century house site; Woodland or Mississippian artifact scatter	Potentially Eligible	Considerable erosion along shoreline	Monitoring
38SA224	Woodland or Mississippian habitation site	Potentially Eligible	Approx. 90% of the site is inundated at the 356.5 ft pool elevation	Monitoring during major drawdowns below the 350 ft Plant Datum, but no more than once every five years
243-0127	Saluda Dam and Power House Complex	Eligible	None	Follow protocols in the HPMP
63-0521	Epting's Campground, 1937	Eligible	None	Monitoring

7.0 RECREATIONAL RESOURCES

Lake Murray[11], the LSR, and the four surrounding counties (Richland, Lexington, Saluda, and Newberry) make up one complete tourism region defined as the Capital City/Lake Murray Country region by the South Carolina Department of Parks, Recreation and Tourism (SCPRT). This region of the state is home to many state, local, and municipal parks, which provide a wide range of water and land-based recreation opportunities including hiking, biking, swimming, boating, and angling. This area of the state sees 2.8 million visitors annually, almost half a million of which come to the area exclusively for recreation activities (SCBCB, 2005a).

The Saluda Hydro Project, which includes Lake Murray and a portion of the LSR, which flows from Saluda Dam to the confluence of the Broad River, provides both passive and active outdoor recreation opportunities, including scenic viewing, picnicking, boating, bird watching, fishing, golfing, hunting, and camping. Other water sports that are available include wake boarding, knee boarding, waterskiing, hydrofoiling, parasailing, and swimming.

Lake Murray supports an active recreational fishery and is an important boating resource. The lake is host to numerous national and local fishing tournaments annually, and is stocked with striped bass each spring by the SCDNR. Surplus bluegill and largemouth bass reared at the SCDNR hatcheries are occasionally stocked as well. Between 2003 and 2006, an average of 27 permits were granted for fishing tournaments on Lake Murray (SCE&G, 2007). The lake supports substantial boating activity, which includes both power boats, canoes and kayaks, and sail boats. Lake Murray is the site of 6-8 sailing regattas annually (Mead and Hunt, 2002) and an average of approximately 30 regatta permits were granted annually for Lake Murray between 2003 and 2006 (SCE&G, 2007). In addition, the lake is used as a focal point for holiday and tourist events such as the annual Lake Murray Poker Run and the Independence Day celebrations.

The LSR extends 11 miles from the outflow of the Saluda Dam to its confluence with the Broad River to form the Congaree River near downtown Columbia. Similar to the Lake, the LSR also supports an active recreational fishery. The cold waters of the river support a trout and striped

[11] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

bass fishery and offer a range of paddling experiences from flat water to whitewater with class II to V rapids.

7.1 Regional Resources

The region surrounding the Saluda Hydro Project includes portions of the Sumter National Forest, Dreher Island State Park; Sesquicentennial State Park, Harbison State Forest, and Congaree National Park. Of these parks and forest, only Dreher Island State Park is within the Project boundary. Numerous trails, game management sites, and state heritage preserves are also located in close proximity to the Project. In addition, several local, county, and municipal parks are located within close proximity to the Project or provide access to project waters.

Sumter National Forest consists of approximately 360,000 acres, partially located in Newberry (58,974 acres) and Saluda Counties (4,480 acres), as well as other parts of South Carolina. (SCPRT, 2002; SCDC, 2008). Portions of the forest are designated wildlife management areas where hunting is permitted. The forest also provides campgrounds, hunting camps, picnic areas, boating sites, rifle ranges, swimming areas, and 360 miles of trails. Dreher Island State Park is one of two state parks within the Lake Murray Country region. It is 348 acres in size and is located on Lake Murray in the community of Prosperity. The park provides campsites, cabins, trails, picnic areas, playgrounds, a marina, and boat access to Lake Murray (Kleinschmidt, 2007a). Sesquicentennial State Park, located in the City of Columbia, is 1,419 acres in size and offers campsites, trails, and fishing and picnicking opportunities (SCPRT, 2007). Harbison State Forest, also in the City of Columbia, is a 2,176 acre tract that provides hiking, mountain biking, picnicking, an environmental center and event center, and canoe launching on the Broad River, above the confluence with the LSR (SCFC, 2007). At 26,000 acres, Congaree National Park, approximately 25 miles downstream of the confluence, is reported to be the largest remaining tract of old-growth bottomland hardwood forest remaining in the U.S. It is a congressionally designated wilderness area that provides 18 miles of hiking trails, a 2.3 mile boardwalk, and a canoe trail (NPS, 2007a).

Other popular trails nearby include the 0.5 mile trail in Lexington County at the Riverbanks Zoo and Botanical Gardens; a 2.5 mile riverfront trail at Riverfront Park in Columbia (connected by the Three Rivers Greenway described below); the 11.5 mile Sesquicentennial Trail in Richland County; the 7.5 mile Lynches Woods trail in Newberry County; and the 2.3 mile Boardwalk Loop in Richland County at the Congaree National Park (SCPRT, 2002).

Several state heritage preserves, offering unique cultural or natural resource features, that are open to the public are also located within proximity of the Project (SCPRT, 2002). Congaree Creek Heritage Preserve, located in Lexington County, is open year-round to the public, covers 627 acres, and offers the 6-mile Guignard Brickworks Loop Trail and canoe trails on the Congaree Creek and the Congaree River (SCDNR, 2007a). Also in Lexington County are Shealy's Pond Heritage Preserve, a 62 acre site, and Peachtree Rock Heritage Preserve, a 460 acre site (SCDNR, 2007b and SCDNR, 2007c). Both preserves are open year-round for hiking and sightseeing. A third site, Nipper Creek, is open by appointment only. Nipper Creek is in Richland County and 90 acres in size (SCDNR, 2007d).

There are several local, county and municipal parks in the area surrounding Lake Murray and the LSR. These parks include, but are not limited to: Crooked Creek Park in Chapin; Guignard Park in Cayce; Virginia Hylton Park in Lexington; and St. Andrews Park and Seven Oaks Park in Columbia (ICRC, 2007a; RCRC, 2007). These parks provide a wide variety of recreation opportunities such as picnic facilities, playgrounds, sports fields, and trails.

One regional park provides access to the LSR. Saluda Shoals Park, managed by the Irmo Chapin Recreation Commission, covers 300 acres on the river's north shore, approximately 2 miles downstream of Saluda Dam. The park provides multiple facilities such as picnic areas and pavilions, hiking trails, playgrounds, a splash park, a visitor's center and an environmental center, a boat ramp (for motorized and carry-in access), a separate canoe and kayak launch area, fishing piers, a dog park, multiple trails, concessions, and canoe/kayak rentals. The site is open year round, from 7:00 am to sunset, and also provides coded gate entry to the park 24-hours a day for angling access. The park is staffed and charges a fee for entrance, though annual passes are also available (ICRC, 2007b).

Riverbanks Zoo, located in Columbia, while not providing direct formal access to the LSR, is located on its shores and provides a pedestrian bridge, which traverses the river, connecting the Zoo to the Riverbanks Botanical Gardens. The Zoo also has an adjacent picnic area on the shores of the LSR that provides informal hand-carry and shoreline access to the river (Riverbanks Zoo and Botanical Gardens, 2007).

There are no federally designated wilderness areas or wild and scenic rivers in the vicinity of the Project; however, a portion of the LSR below the Saluda Dam is designated by the South Carolina General Assembly (SC Code of Laws Title 49, Chapter 29 South Carolina Scenic Rivers Act) as a State Scenic River (SC Legislature, 1989). Approximately 10 miles of the river hold this special designation, which begins approximately 1 mile downstream of the Dam and extends to the confluence with the Broad River. It is managed by the SCDNR in compliance with the South Carolina Scenic Rivers Act. SCE&G made the donation of scenic easements over properties it owns along the LSR and below, which allowed the State Scenic River designation, and was approved by the Commission in the late 1980's.

Segments of both the LSR and the Congaree River are also listed on the Nationwide Rivers Inventory (NRI) by the National Park Service. The NRI is a listing of more than 3,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. The LSR from the dam to river mile 3 is so designated because it "affords scenic wilderness experience in urban areas; diversified flora and fauna" (NPS, 2007b).

Downstream of the Project, a section of the Congaree River has been designated as a water trail. The Congaree River Blue Trial extends approximately 50 miles from the Gervais Street Landing (West Columbia Landing), just downstream of the confluence of the Saluda River and the Broad, to the Bates Bridge Landing in Wateree, SC, just above the confluence of the Congaree and Wateree Rivers. The trail travels through or past the Congaree Creek Heritage Preserve, the Congaree Bluffs Heritage Preserve and Congaree National Park (American Rivers, 2008).

7.2 Project Resources

Within the project boundary, there are approximately 130 public, commercial, and private recreation sites[12] supporting such facilities as boat launches, marinas, boat slips, wet and dry storage, campgrounds, picnic areas, beaches, fishing areas and piers, trails, playgrounds, and other facilities. Twenty-three sites within the project boundary are informal sites that are primarily used for bank fishing. There are a total of 20 SCE&G-owned public access sites, including two sites on the LSR located outside the project boundary which are leased to the Riverbanks Zoo and Botanical Gardens that function primarily as lake or river access, providing opportunity for boat launches, shoreline angling, picnicking, and swimming. Collectively, these sites include one designated swimming area, 15 boat launches, six fishing piers, and one campground. Restroom facilities are provided at 9 of the 20 sites, and picnic tables are provided at 12 sites.

7.2.1 Lake Murray

7.2.1.1 Public Access Sites

SCE&G owns 15 formal public access sites on Lake Murray and has set aside 62 undeveloped, SCE&G-owned islands in Lake Murray to be available for public recreation. Of the 15 formal recreation sites, SCE&G operates 13 of them, and leases the remaining two sites, Dreher Island State Park and Larry L. Koon Boat Landing, to others as public recreation areas. Table 7-1 provides a listing of the formal public access areas and a summary of the facilities and opportunities available at each. Additional inventory detail on public access sites can be found in the Saluda Hydro Project Recreation Assessment Study Report (Kleinschmidt 2007a) in Appendix E-6. Figure 7-1 presents the location of the sites, which are dispersed around the Lake. With the exception of Dreher Island State Park, all sites are operated for day-use.

[12] For purposes of this Application, public recreation sites refer to sites that are open to the public without discrimination, and which are operated by federal, state, and local agencies and/or SCE&G. A commercial site refers to a site operated by a business for profit. A private site refers to a site open only to specific individuals via membership or residency requirements.

A description of each formal public recreation site at Lake Murray (Kleinschmidt, 2007a) follows, as well as a general assessment of the site's ability to comply with accessibility standards set forth in the Americans with Disabilities Act (ADA) (1990), site conditions reported in the 2006 Recreation Assessment public access site user survey (Kleinschmidt, 2007a) found in Appendix E-6, and recommendations for improvements and additional facilities needed for the accommodation of existing and potential future use levels (Kleinschmidt, 2007a).

Table 7-1: Lake Murray Public Recreation Site Summary

SITE	SIZE (IN ACRES)	BOAT LAUNCH	FISHING DOCKS/ PIERS	PICNIC TABLES	CAMP SITES	RESTROOMS	DESIGNATED SWIMMING AREA
Dam Site	6.8	×	×	×		×	
Parksite	17.9			×		×	×
Larry L. Koon Boat Landing	1.8	×		×		×	
Shull Island	0.36	×					
Murray Shores	1.6	×		×		×	
River Bend	11.6	×	×	×		×	
Higgins Bridge	1.1	×					
Kempson Bridge	2.93	×	×				
Lake Murray Estates Park	7.5	×	×	×			
Macedonia Church	4.8			×			
Sunset	2.3	×	×	×		×	
Rocky Point	1.7	×		×			
Bundrick Island	88						
Dreher Island State Park	348.0	×		×	×	×	
Hilton	4.4	×	×	×		×	

Dam Site (Photo 7-1) is a seasonally-staffed day use area, providing lake access for boating and fishing, and picnicking. The site is located on the northern end of Saluda Dam; and is accessible from Route 6. It is a large seasonal site providing parking for vehicles with and without trailers, picnic tables, grills, shoreline access, a fishing pier, restrooms, and a walking path to Parksite. This site provides ADA compliant parking, however, facilities such as restrooms, fishing piers, and courtesy docks within the park do not meet ADA standards. The majority of individuals interviewed at this site during the 2006 Recreation Assessment (Kleinschmidt, 2007a) indicated this site was in very good to excellent condition. Among the recommended improvements were additional lighting and boat docks and improved restroom facilities and maintenance, such as trash pickup.

Parksite (Photo 7-2) is located on the southern end of Saluda Dam, also off Route 6. This is a seasonally-staffed, day use site, designed primarily for swimming, picnicking, and sightseeing. Newly renovated in July 2006, Parksite offers picnic tables and shelters, grills and firepits, a concession stand, scenic overlook, a designated swimming area, ADA compliant restrooms and paths, and parking, including spaces compliant with the ADA. The majority respondents interviewed at this site rated the condition to be very good to excellent. Among the recommendations made for this site were improvements to aesthetics and maintenance of the swimming area. However, portions of the site were still under construction throughout much of the 2006 recreation season and the beach area was closed until later in the season, due to ongoing construction, low water, and other safety issues. This site is open seasonally and has a trail which provides pedestrian access to the Dam site.

Larry L. Koon Boat Landing (Photo 7-3) is located on the southern shore of Lake Murray, on Shull Island. The site is accessible from Shull Island Road, is open year round and is unstaffed; there are no entrance fees for this site. This site is a day use site primarily used for boat access and picnicking and features picnic tables, grills, and a firepit/ring. There is parking for both vehicles and vehicles with trailers, including ADA compliant spaces, and the boat launch is compliant with ADA standards. Of those interviewed at Larry Koon, half rated the site as excellent and 28 percent rated the site as very good. Recommendations for this site included an expanded parking area, additional and/or improved restrooms, and maintenance activities such as trash removal.

Shull Island (Photo 7-4) is located on the southern shore of Lake Murray, on Shull Island and adjacent to Larry L. Koon Boat Landing, generally serving as overflow when parking at Larry Koon is full. Shull Island is leased to the Lexington County Recreation Commission, but is owned and operated by SCE&G. The site features a gravel parking area and a concrete ramp. Parking also occurs below the high water line when lake levels are low. Due to its informal nature, this site is not ADA compliant. A majority of survey respondents stated that the site was in either very good or excellent condition and recommended restrooms, expanded parking, and improvements to the boat launch. Because this site is not staffed or gated, it is open year round.

Bundrick Island (Photo 7-5) is an undeveloped recreation area covering approximately 88 acres that is used primarily by boaters year round. Vehicular access is gated and there is no parking associated with this site. Entrance is permitted by foot or bicycle from Brady Porth Road. This site is located on a peninsula and is used for picnicking, informal camping, and swimming. SCE&G leases 4.15 acres of Bundrick Island to SCDNR and the Lexington County Sheriff's Department in a joint lease. SCE&G permits use of the site by organized groups such as the Boy Scouts and will unlock the gate to allow for vehicular access for these purposes under prior arrangement. Half of respondents at this site reported that Bundrick Island is in very good to excellent condition. Trash cans, restrooms, and maintenance activities were cited most often as being needed.

Murray Shores (Photo7-6) is located on the southern shore of the lake and is an unstaffed, year-round, day use boat launch facility that also has picnic tables, grills and a firepit/ring, portable restrooms, and provides shoreline access for fishing. This site does not have designated ADA compliant parking nor are its facilities compatible with ADA standards. The majority of respondents stated that the site is in good to excellent condition. Although this site provides portable restroom facilities, restrooms were recommended for this site, as was lighting.

River Bend is a year-round, unstaffed, day use site located on the lake's southern shore (Photo 7-7) on River Bend Point, and is accessible via River Bend Point Road. The site is used primarily for boat access to the lake and provides parking, picnic tables, a grill, restrooms, a boat launch, and a fishing pier. There are no parking spaces identified as ADA compliant and no facilities at this site meet ADA standards for accessibility. Over half of respondents indicated they considered River Bend to be in good to excellent condition. Improved or additional lighting and restrooms were recommended most often.

Higgins Bridge (Photo 7-8) is located on the far western shore of Lake Murray on the upper Saluda River, at the headwaters of the lake. It is a day use site with gravel parking and a paved boat ramp. Due to its informal nature, none of the facilities at this site are compliant with the ADA. The site is not gated or staffed and is, therefore, open year round. Almost half of the individuals providing a condition rating for this site considered it to be in good condition, while 38 percent considered the site to be in very good to excellent condition. Restrooms, picnic tables, and trash cans were indicated as the most needed improvements. This site was also identified as needing improvements to the existing boat launch for access at times of low water.

Kempson Bridge (Photo 7-9) is also located on the headwaters of Lake Murray on the upper Saluda River. Newly renovated in 2006, Kempson Bridge features parking for vehicles with trailers, a fishing pier, and boat ramp. The site is open year round, is unstaffed, and is a day use site providing boat access and shoreline fishing. Though some parking spaces are identified as ADA, the boat ramp and fishing pier do not meet ADA standards for accessibility. All of the individuals at this site rate it in good to excellent condition; though approximately 60 percent indicated need for additional and improved facilities such as trash cans and restrooms.

Lake Murray Estates Park (Photo 7-10) is located on the southern shore of Lake Murray, at the end of Ruby River Road, in a residential subdivision. It is an unstaffed, year-round day use site featuring a boat ramp, parking for vehicles with trailers, a fishing pier, and picnic tables. None of the facilities at this site are compliant with the ADA. Over 90 percent of respondents interviewed here stated Lake Murray Estates Park to be in good to excellent condition. However, the majority of individuals stating a need for additional facilities (95 percent) indicated a need for restrooms.

Macedonia Church (Photo 7-11) is located adjacent to the Macedonia Lutheran Church, on the northern shore of the lake. This site is unstaffed and open year round. There are some facilities associated with the church, such as an outdoor chapel, as well as picnic tables. This site is a used primarily for shoreline fishing. Seventy-five percent of respondents stated that the site was excellent and respondents indicated a need for restrooms and maintenance activities. There is no ADA compliant parking or facilities at this site.

Sunset (Photo 7-12) is an unstaffed, day use site located on the northern shore of the lake, off Sunset Road, and is open year round. This site features a picnic table, firepits/rings, portable toilets, a fishing pier, boat ramp, and shoreline access. None of the facilities at this site are compliant with the ADA. All of the individuals rating this site stated that Sunset was in good to excellent condition. Among the recommendations for additional facilities or improvements were trash cans, restrooms, and a designated swimming area.

Rocky Point (Photo 7-13) is located on the northern shore of the lake, accessible from Rocky Ramp Road. This site is unstaffed, ungated, and open year round. Parking occurs roadside and the site offers a boat ramp and a covered picnic table. This site receives very little use; only two individuals were interviewed here during the 2006 Recreation

Assessment (Kleinschmidt, 2007a). Both stated the site is in good condition.

Dreher Island State Park is operated by the SCPRT and encompasses all of Dreher Island (Photo 7-14) on the northern shore of the lake. This is a staffed, year-round park providing opportunities for day use and overnight activities. The park supports a wide array of recreation facilities such as tent and RV campsites and a designated primitive camping area, villas, shoreline access, beaches, three boat ramps (including a tournament ramp), playgrounds, picnic shelters and tables, fire rings, hiking and biking trails, a tackle shop, a marina, and a visitor's center. The site has many facilities, which are compliant with the ADA including parking, camp sites, restrooms and shower facilities, and boat launch, among others. Ninety-one percent of the individuals who provided a condition rating for this site stated that Dreher Island State Park is in very good to excellent condition. Additional restrooms and swimming areas and maintenance activities were the most recommended improvements.

Hilton (Photo 7-15) is located on the northern shore of Lake Murray, off of Cove Launch Road. The site is an unstaffed, year round, day use site with a 2-lane boat launch, a fishing pier, picnic tables, and restrooms. Although there is an ADA designated parking, there are no ADA compliant facilities at this site. The majority of respondents stated the site is in excellent condition. Trash cans and improvements to the existing boat launch were the most recommended measures for this site.

In addition to the public access sites owned and/or managed by SCE&G, SCE&G allows access to 62 islands in Lake Murray for recreational day use purposes such as picnicking and swimming. Collectively, the islands that SCE&G has set aside for recreational use encompass 100 acres of land and are accessible by boat only. Among them is Lunch Island, also known as Doolittle Island or Bomb Island. The island was designated in 1996 as a purple martin sanctuary. During the summer months, when the birds are roosting, public access to the island is prohibited (PMCA, 2008). However, the thousands of birds can be observed by visitors from the water who travel to the island via private vessel or chartered tour boat.

SCE&G also leases 54.6 acres of land to the Indian Waters Council, Boy Scouts of America, Inc. The property is called Camp Barstow and has campsites, athletic and activity fields, staff quarters, an adult lodge, an adult training field, a training shelter, a swimming area, a boat dock, an ecology shelter, and a dining hall. Other facilities include rifle and archery ranges, a volleyball court, a climbing/rappelling tower, a handicraft shelter, and a barrier-free campsite. SCE&G also leases portions of future development lands to other various entities such as U.S. Coast Guard Auxiliary, the Lions Club, Lexington County Law Enforcement Agency, SC Department of Natural Resources, and the Prosperity Fire Department.

7.2.1.2 Commercial Sites

Commercial sites in the Project boundary include marinas, campgrounds, restaurants, and hotels and resorts. Commercial operations sites offer significant public access and support services, such as marina services, restaurants, etc. Lake tours are also offered on a double decked, 65 foot tour boat, the Southern Patriot.

In general, marinas are dispersed along the lake and provide access to all portions of the lake. They typically provide boat ramps and launching facilities, fuel services, groceries and food, boat sales, rentals and/or repair, bait and tackle, and boat storage. There are currently 31 public marinas operating on Lake Murray (Table 7-2). Most of these sites are commercially operated, with the notable exception of the marina at Dreher Island State Park. Because these are commercial ventures, they are subject to changing hands frequently.

Table 7-2: Marinas on Lake Murray

MARINA NAME	MULTI SLIPS	RAMP	DOCK	BAIT AND/OR TACKLE	DRY STORAGE	FUEL	RESTAURANT	FOOD	LODGING	PUMP-OUT FACILITIES	CAMPING
Acapulco, USA	9	×	×						×		
Adams Campground	6	×	×				×				×
Agnew Lake Services	22	×	×							×	
Barn	9	×	×	×		×		×			×
Dreher Island State Park	54	×	×	×		×		×	×		×
Blacks Bridge Marina	3	×	×	×				×			
Bucks	2	×	×				×	×			
Captain’s Choice Marina	7	×	×								
Crayne’s Landing	2	×	×	×				×			
Dano’s	2	×	×				×				
Eptings Landing	1	×	×	×							×
Holiday Shores Point	2	×	×								
Holland’s Landing	64	×	×	×		×	×	×	×		×
Jacob J. Meetze	1	×	×								×
Jakes Landing	152	×	×	×	×	×		×	×	×	
Johnny Shealy		×	×								×
Lake Murray Marina	205	×	×			×	×			×	
Lighthouse Marina	140	×	×		×	×	×	×		×	
Little River Marina	2	×	×	×		×		×			
Little River Landing	2	×		×				×			
Marshall’s Marina	20	×	×								
Putnams Landing	46	×	×	×		×		×	×		
Riverwinds Landing	11	×	×	×				×	×		
Roys Landing	1	×	×								
Saluda River Resort		×		×				×	×		×
Siesta Cove	20	×	×	×				×	×		×
Southshore Marina	105	×	×	×	×	×		×		×	
Spinners Marina	**41**	×	×	×				×	×		

7.2.1.3 Private Sites

Fifty-eight sites around the lake are operated privately and are available to limited membership. Many of the private marinas and landings exist in conjunction with subdivisions located around the lake, private clubs, or condo associations. These sites are important in that they provide access for specific types of opportunities (*e.g.,* sailing clubs), and to a large number of people at various locations around the lake. SCE&G’s

parent company, SCANA, owns and operates an 18 acre site on Pine Island, which is open to SCANA employees and their guests. The island supports a conference center, swimming pool and beach, picnic area with shelters, marina, and tennis courts.

In addition, approximately 9,000 private docks associated with residences or waterfront lots provide access to the lake for shoreline property owners.

7.2.2 Saluda River

7.2.2.1 Public Access Sites

There are several formal and informal public access sites on the LSR, providing a range of water and land based recreation opportunities (Kleinschmidt, 2007a). Boating access for motorized water-craft is limited to the two most upstream access sites, Saluda Shoals Park and Metts Landing, while carry-in access is available at these sites plus Gardendale and Mill Race A (upstream of Riverbanks Zoo and outside of the project boundary) and Mill Race B (downstream of Riverbanks Zoo and outside of the project boundary). Shoreline access for angling and swimming, sunbathing, sightseeing, and/or picnicking is available at all public access sites on the LSR. Table 7-3 provides a listing of the available public recreation sites on the LSR and the amenities available at each. Additional inventory detail can be found in the Saluda Hydro Project Recreation Assessment Study Report (Kleinschmidt 2007a) in Appendix E-6. Figure 7-2 shows the locations of these sites on the river.

Table 7-3: Lower Saluda River Public Recreation Site Summary

SITE	SIZE (IN ACRES)	BOAT LAUNCH	FISHING DOCKS/ PIERS	PICNIC TABLES	CAMP SITES	RESTROOMS	DESIGNATED SWIMMING AREA
Mill Race A	0.4						
Mill Race B	0.5						
Gardendale	4.7	×					
Saluda Shoals Park	240.0	×	×	×		×	×
James R. Metts Landing	1.0	×					

As discussed above, Saluda Shoals Park, the largest site on the river, is managed by the Irmo Chapin Recreation Commission. It is a large, staffed, year-round park providing multiple facilities in various sites around the park, which support picnicking, hiking, boating, fishing and swimming, among other activities. This site has multiple picnic areas and pavilions, playgrounds, a splash park, a visitor's center and an environmental education center, a boat ramp, dog park, multiple trails including over 1.5 miles of paved trails and several miles of unpaved trails, concessions, and canoe/kayak rentals. Many of the facilities at Saluda Shoals Park are ADA compliant, including picnic facilities, restrooms, parking, and trails. The Irmo Chapin Recreation Commission offers educational and recreation programs through the Park, such as guided paddling trips on the LSR. Over three-quarters of respondents interviewed stated that this site is in excellent condition. A wide variety of recommendations were made for Saluda Shoals Park, however. Among them were a designated swimming area, additional picnic tables, and improved trails.

James R. Metts Landing, also known as Hope Ferry Landing, is located across the river from Saluda Shoals Park on the southern shore of the LSR. The site provides both motorized and non-motorized access to the river. The site is unstaffed, open year round, is managed for day use only, and does not provide ADA compliant facilities though there are ADA designated parking spaces. Nearly 50 percent of the individuals rating the condition of Metts Landing stated the site is in very good condition; 34 percent reported that the site is in excellent condition. Among the recommendations for this site were restrooms and improved parking.

Gardendale is located on the north shore of the LSR, approximately 6 miles downstream of the dam. The site provides a gravel parking area, carry-in river access, and a multi-purpose trail about one mile long. None of the facilities are compliant with the ADA. The site is unstaffed and open year-round though the condition of the access road may preclude some vehicular access during certain times of the year. Seventy-two percent of the respondents surveyed at this site stated that it is in good to very good condition. Fifty percent respondents who suggested additional facilities are needed cited a need for restroom facilities. An improved boat launch and maintenance activities were also suggested for this site.

Mill Race A and B are not formal recreation sites and are located outside of the project boundary. These sites are located on the north shore of the LSR, approximately 9 miles downstream of the dam. Mill Race A is upstream of the Riverbanks Zoo and Mill Race B is downstream of the Zoo. The City of Columbia manages the Zoo and leases the property. The sites border the popular Mill Race rapid, where boaters access Class II to Class V whitewater, depending on flow (Photo 7-16 & 7-17). Mill Race A, at the bottom of Mill Race rapid, has paved parking associated with the Zoo. Mill Race B, which is located just above the confluence with the Broad River and is just above Shandon rapids, is adjacent to a gravel parking area that also provides overflow parking for the Zoo. Use of both of these areas are primarily by individuals gaining access to the rocky outcroppings of the rapids for sun bathing, picnicking, kayaking, fishing, and other leisure activities. There are no formal facilities to support this use and the Applicant does not consider these areas Project recreation sites.

Forty-three percent of the individuals who rated Mill Race A reported the site to be in good condition. Of the individuals indicating a need for additional facilities, 30 percent suggested restroom facilities and 42 percent suggested trashcans. For users of Mill Race B, 40 percent of the respondents stated that the site is in good condition; while 41 percent indicated it was in very good to excellent condition. Restrooms and trash cans were cited as the most needed improvements.

7.2.2.2 Commercial Sites

There are no commercial ventures that provide access to the LSR, however, there are several operators that provide services for recreation activities on the river. Adventure Carolina provides several paddling options on the LSR including a whitewater kayaking class and canoe, kayak, and tube rentals. Calm Water Kayak Tours offers 4-hour guided kayak trips and lessons along the LSR. Palmetto Outdoor offers tube and kayak rentals and whitewater rafting on the LSR. Kayak and canoe rentals are also offered at Saluda Shoals Park. Organized trips are also offered on the LSR through non-profit organizations and clubs such as Canoeing for Kids and Palmetto Paddlers.

7.2.2.3 Private Sites

There are a few private access sites, which serve specialty groups and private interests. Trout Unlimited has access to a residential neighborhood, River's Edge Estates, on the south shore of the river by the I-26 bridge. This site has a small parking area, angling access trail, and fishing platform for use by neighborhood residents and TU members. Access to the site is by parking permit only (personal communication, Mike Waddell, Trout Unlimited, May 16, 2007). Canoeing for Kids also has a private access site, primarily for leading canoeing, kayaking and rafting trips on the LSR. The site is located on the south shore of the river in proximity to the I-20 bridge (Canoeing for Kids, 2007). Cornerstone Presbyterian Church, located off of Bush River Road, owns waterfront property adjacent to Rawls Creek and allows river access from its property to members of the congregation (SCDAP, 2000). In addition, there are several neighborhoods, residences, and cottages, generally on the south shore of the river, through which property owners can gain access to the river.

7.3 Designated Waters and Project Lands

As discussed in Section 7.1, there are no federally designated wilderness areas nor wild and scenic rivers in the vicinity of the Project; however, a portion of the LSR below the Saluda Dam is designated by the South Carolina General Assembly (SC Code of Laws Title 49, Chapter 29 South Carolina Scenic Rivers Act) as a State Scenic River (SC Legislature, 1989). Segments of both the LSR and the Congaree River are also listed on the Nationwide Rivers Inventory (NRI) by the National Park Service. View Section 7.1 for further detail regarding these classifications.

7.4 Existing and Potential Recreation Use

Lake Murray and the LSR are a destination for nearby residents and tourists alike. The Lake offers boating, fishing, and other water-based activities, as well as golf, hiking, dining and shopping at shore and near-shore parks, marinas, restaurants, and businesses. There are many special events such as fishing tournaments, sailing regattas, the Lake Murray Poker Run, the Lake Murray Dam Run, and the lake-wide Independence Day celebration that draw locals and tourists to the lake community. The LSR offers a wilderness experience in an urban setting, providing opportunities for angling, flatwater and whitewater boating, tubing, swimming and sunbathing. Paddling events such as the “Millrace Massacre” and the “Iceman Challenge”, Canoeing for Kids, and Olympic kayak training are also held on the LSR.

SCPRT reports that approximately 90 percent of participation in outdoor recreation occurs in an area close to a resident’s home for day to day activities (SCPRT, 2002). Activities that require special environments, such as boating and fishing, generally occur within a region of slightly greater proportions around a resident’s home, but still nearby to their residence. At the Saluda Project, a majority of the recreation activity occurring at the Project is attributed to residents of nearby local communities; either shoreline property owners or individuals residing in Columbia, Irmo, Lexington, Gilbert, Newberry, Prosperity and Chapin, and other communities surrounding the lake and the LSR. A smaller portion of recreational use at the Project is attributed to a more regional population from the outskirts of Richland, Lexington, Saluda, and Newberry Counties (Kleinschmidt, 2007a).

7.4.1 Existing Recreation Use

The Saluda Project supported approximately 695,000 recreation days within the project boundary during the 2006 peak recreation season, defined as April 1st and September 30th in the 2003 FERC Form 80 Report on Recreational Resources (Table 7-4). Lake Murray experienced approximately 463,000 recreation days at public recreation sites during this time period (67 percent of total use), while the LSR experienced a total of approximately 232,000 recreation days resulting from visits made to SCE&G access sites and the Mill Race sites during the peak recreation season (33 percent of total use). Weekday use accounts for 17 percent of total use; 37 percent of total use occurs on weekends;

and 46 percent of total use occurs on holidays. June and July account for the majority (41 percent) of total use during this time period (Kleinschmidt, 2007a and Kleinschmidt, 2007b). Total use reported in the 2003 FERC Form 80 was 1,250,000 recreation days annually; while the 1997 FERC Form 80 reported 1,200,000 recreation days annually at the Project (SCE&G, 2003 and SCE&G, 1997).

The most used Lake Murray sites during the 2006 recreation season were Dreher Island State Park (116,680 recreation days or 25 percent of total use),[13] Bundrick Island (94,580 recreation days or 20 percent of total use), Dam Site (54,460 recreation days or 12 percent of total use), and Larry Koon (54,080 recreation days or 12 percent of total use). The sites with the least amount of use, equal to or less than 1 percent of total use, were Rocky Point (330 recreation days), Higgins Bridge (3,090 recreation days), and Kempson Bridge (5,620 recreation days) (Kleinschmidt, 2007a and Kleinschmidt, 2007b).

Because all of the recreation sites surveyed during the 2006 Recreation Assessment (Kleinschmidt, 2007a) provide access to Lake Murray, it is not surprising that the majority of activities that individuals participate in at these sites are water-based recreation activities (80 percent). Fishing, either from a boat or the bank, is by far the most participated in activity by users of Lake Murray sites (53 percent of total use). After fishing, motor boating (14 percent of total use), swimming (8 percent of total use), and picnicking (5 percent of total use) are popular activities. These sites also support limited land-based activities such as walking/hiking, sightseeing and picnicking (Kleinschmidt, 2007a).

[13] Dreher Island accounted for an estimated 78,750 patrons during the 2006 study period (personal communication, Ashley Berry, Manager, Dreher Island State Park, October 5, 2006). Approximately 77 percent of the total use at the park is attributed to day use and 23 percent is attributed to overnight visitation (camping and villa rentals). The park is a popular location for hosting fishing tournaments on the lake; during fiscal year 2005-2006, 63 fishing tournaments were hosted at the park.

Table 7-4: Estimate of Recreation Days for Lake Murray and Lower Saluda River Sites by Month and Day Type, April 1 through September 30, 2006

	LAKE MURRAY SITES	LOWER SALUDA RIVER SITES	MILL RACE SITES[A]	TOTAL
April				
Weekdays	42,840	17,400	5,570	65,810
Weekends	35,240	6,390	2,880	44,510
Holidays	0	0	0	0
Total	78,080	23,790	8,450	110,320
May				
Weekdays	31,100	16,180	3,190	50,470
Weekends	37,400	5,720	4,600	47,720
Holidays	20,220	4,440	1,570	26,230
Total	88,720	26,340	9,360	124,420
June				
Weekdays	52,800	23,850	13,390	90,040
Weekends	43,440	8,760	6,910	59,110
Holidays	0	0	0	0
Total	96,240	32,610	20,300	149,150
July				
Weekdays	34,300	22,780	4,200	61,280
Weekends	29,860	11,390	5,530	46,780
Holidays	20,950	6,500	1,690	29,140
Total	85,110	40,670	11,420	137,200
August				
Weekdays	26,170	8,180	3,360	37,710
Weekends	30,270	13,350	2,790	46,410
Holidays	0	0	0	0
Total	56,440	21,530	6,150	84,120
September				
Weekdays	20,310	16,310	1,790	38,410
Weekends	24,430	5,770	2,580	32,780
Holidays	13,210	4,480	880	18,570
Total	57,950	26,560	5,250	89,760
Total				
Weekdays	**207,520**	**104,700**	**31,500**	**343,720**
Weekends	**200,640**	**51,380**	**25,290**	**277,310**
Holidays	**54,380**	**15,420**	**4,140**	**73,940**
TOTAL	**462,540**	**171,500**	**60,930**	**694,970**

[a] Outside the project boundary.

The LSR supported an estimated 232,430 recreation days during the 2006 recreation season total, 171,500 recreation days within the project boundary and roughly 60,900 recreation days outside the project boundary at the Mill Race sites. The most used sites were Saluda Shoals Park (135,050 recreation days or 58 percent of total use on the LSR), Mill Race B (37,950 recreation days or 16 percent of total use), Metts Landing (24,520 recreation days or 11 percent of total use) and Mill Race A (22,980 recreation days or 10 percent of total use). The site with the least amount of use was Gardendale (11,930 recreation days or 5 percent of total use) (Kleinschmidt, 2007a and Kleinschmidt, 2007b).

Activities participated in by users of the LSR sites were varied. A higher percentage of individuals recreating at LSR sites participate in land-based activities as compared with Lake Murray recreation sites. Activities participated in at individual sites are dependent upon the support facilities provided and both shoreline and boat access are provided on the LSR. About half of the activities that individuals participate in at these sites are water-based recreation activities (51 percent). As with the Lake Murray sites, fishing, either wading or from a boat, pier, or the bank, is the most participated in activity at LSR sites (21 percent of total use). Canoeing and kayaking, both flatwater and whitewater, comprise 20 percent of total use, making paddling the second most popular activity. Sightseeing/wildlife viewing is the third most popular activity on the LSR (13 percent of total use), followed by hiking/walking (12 percent of total use) (Kleinschmidt, 2007a).

7.4.2 Future Recreation Use

Because of the association of locality with recreation participation, population growth is typically a good indicator of future recreational use. Cordell et al. (2004) reports that "(p)opulation has been, is, and will be the major driver of outdoor recreation participation growth in this country." In fact, between 1960 and 2000, the population of southern states grew more rapidly than any other region in the United States (Cordell and Tarrant, 2002). The population of the counties around the lake (Richland, Newberry, Saluda, and Lexington) increased by 4.1 percent between 2000 and 2005 and is projected to increase by another 24.0 percent by the year 2030 (SCBCB, 2005b). For counties surrounding the LSR – Richland and Lexington – population is expected to increase by 31.3 percent from 2005 to 2030, with Lexington County having the fastest population growth of the area, at 41.6 percent from 2005 to 2030 (SCBCB, 2005b). If participation in recreation increases at a similar rate, one can expect to see significant increased demand for recreation opportunities in the future, including at those sites that are estimated to be reaching capacity and, in a few cases, exceeding capacity under current use levels.

Population in the four counties surrounding the Project is expected to increase by an average of approximately 4.4 percent for each of the five year periods over the next 25 years for a total increase of 24.0 percent from 2005 to 2030 (SCBCB, 2005b). Estimated recreation use stemming from public access sites on Lake Murray and the LSR could total almost 860,000 recreation days during the recreation season (April 1st through September 30th) in the year 2030 -- an increase of approximately 165,000 recreation days (24 percent) over 2006 levels (Table 7-5). Use of Lake Murray public access sites could increase by roughly 110,000 recreation days by the year 2030 and use of LSR access sites could increase by approximately 55,000 recreation days in the same time period. Applying current outdoor recreation trends and existing public recreation facilities, fishing may likely continue to be the dominant activity at the Project in the year 2030 (Kleinschmidt, 2007a and Kleinschmidt, 2007b).

Table 7-5: Estimated Future Recreation Days for the Saluda Project (April 1 through September 30)

		ESTIMATED FUTURE PARTICIPATION				
	USE ESTIMATES (2006)	2010	2015	2020	2025	2030
Population Growth Rates		4.87%	4.62%	4.37%	4.19%	3.68%
Lake Murray Sites	462,540	485,070	507,480	529,650	551,840	572,150
Lower Saluda River Sites	171,500	179,850	188,160	196,380	204,610	212,140
Mill Race Sites	60,930	63,900	66,850	69,770	72,690	75,370
TOTAL	**694,970**	**728,820**	**762,490**	**795,810**	**829,150**	**859,660**

7.5 Adequacy of Existing Recreation Sites to Accommodate Existing and Potential Future Recreational Use

The capacity and typical use density of public recreation sites around the lake and on the LSR were estimated during the 2006 recreation season from Memorial Day through September 30 (Table 7-6). Public recreation sites at the project are generally well used with several sites reportedly being used at their design capacity, particularly on weekends and holidays[14] (Kleinschmidt, 2007a). The capacity at which public access sites are currently used was estimated for all sites with the exception of Bundrick Island, which does not have a parking area, and which is used mainly by boaters.

Results suggest that Dam Site, Parksite, Rocky Point and Dreher Island State Park on Lake Murray are consistently used within their design capacities, regardless of day type (weekend, weekday or holiday), and could accommodate additional use. Three sites, Riverbend, Higgins Bridge, and Kempson Bridge, are currently used at rates approaching capacity, though this trend was only observed on holidays for Riverbend and Kempson Bridge.

The remaining seven sites were observed to be used at rates that regularly meet or exceed their design capacities on some or all day types. Larry Koon and Shull Island are used beyond their capacities, regardless of day type. Lake Murray Estates Park is utilized at rates that exceed its capacity on weekends. Use exceeds capacity on weekends and holidays at Sunset and Hilton. Capacity is exceeded on holidays at Murray Shores but this site is consistently used within its design capacity on weekdays and weekends. Use at Macedonia Church is considered to exceed design capacity on weekdays and weekends.

Table 7-6: Recreation Site Capacity (Percent Use Capacity for May 27 through September 30, 2006)

PUBLIC ACCESS SITES	MAXIMUM AVERAGE HOURLY VEHICLE COUNT	TOTAL NUMBER OF PARKING SPACES	PERCENT CAPACITY
DAM			
Weekdays	21	181	12%
Weekends	70	181	39%
Holidays	68	181	38%
TOTAL	**53**	**181**	**29%**
PARKSITE			
Weekdays	2	343	1%
Weekends	11	343	3%
Holidays	13	343	4%

[14] For the purposes of this License Application, sites were considered to be utilized within their design capacities if parking areas were less than 75 percent full on weekends. Use is considered to be approaching capacity if parking areas were between 75 and 99 percent full on weekends. Use is considered to be exceeding capacity if parking areas were greater than 99 percent full on weekends.

PUBLIC ACCESS SITES	MAXIMUM AVERAGE HOURLY VEHICLE COUNT	TOTAL NUMBER OF PARKING SPACES	PERCENT CAPACITY
TOTAL	**9**	**343**	**2%**
LARRY KOON			
Weekdays	100	49	205%
Weekends	75	49	153%
Holidays	80	49	163%
TOTAL	**85**	**49**	**174%**
SHULL ISLAND			
Weekdays	27	8	331%
Weekends	32	8	397%
Holidays	31	8	381%
TOTAL	**30**	**8**	**370%**
MURRAY SHORES			
Weekdays	15	50	29%
Weekends	34	50	68%
Holidays	63	50	126%
TOTAL	**37**	**50**	**74%**
RIVERBEND			
Weekdays	17	84	20%
Weekends	44	84	52%
Holidays	72	84	86%
TOTAL	**44**	**84**	**53%**
HIGGINS BRIDGE			
Weekdays	3	8	33%
Weekends	6	8	75%
Holidays	5	8	67%
TOTAL	**5**	**8**	**58%**
KEMPSON BRIDGE			
Weekdays	5	16	31%
Weekends	5	16	31%
Holidays	15	16	94%
TOTAL	**8**	**16**	**52%**
LAKE MURRAY ESTATES PARK			
Weekdays	11	22	51%
Weekends	37	22	167%
Holidays	18	22	80%
TOTAL	**22**	**22**	**99%**
MACEDONIA CHURCH			
Weekdays	23	12	194%
Weekends	14	12	119%
Holidays	8	12	67%
TOTAL	**15**	**12**	**127%**
SUNSET			
Weekdays	4	28	14%
Weekends	31	28	110%
Holidays	56	28	200%
TOTAL	**30**	**28**	**108%**
ROCKY POINT			
Weekdays	2	3	67%

PUBLIC ACCESS SITES	MAXIMUM AVERAGE HOURLY VEHICLE COUNT	TOTAL NUMBER OF PARKING SPACES	PERCENT CAPACITY
Weekends	1	3	17%
Holidays	1	3	33%
TOTAL	**1**	**3**	**39%**
DREHER ISLAND STATE PARK			
Weekdays	56	619	9%
Weekends	150	619	24%
Holidays	152	619	25%
TOTAL	**119**	**619**	**19%**
HILTON			
Weekdays	20	37	54%
Weekends	39	37	106%
Holidays	37	37	100%
TOTAL	**32**	**37**	**87%**
SALUDA SHOALS PARK			
Weekdays	139	463	30%
Weekends	138	463	30%
Holidays	131	463	28%
TOTAL	**136**	**463**	**29%**
METT'S LANDING			
Weekdays	19	25	75%
Weekends	27	25	109%
Holidays	21	25	84%
TOTAL	**22**	**25**	**89%**
GARDENDALE			
Weekdays	10	40	24%
Weekends	43	40	108%
Holidays	13	40	33%
TOTAL	**22**	**40**	**55%**
MILLRACE A			
Weekdays	34	45	76%
Weekends	62	45	138%
Holidays	30	45	66%
TOTAL	**42**	**45**	**93%**
MILLRACE B			
Weekdays	32	64	50%
Weekends	79	64	124%
Holidays	44	64	68%
TOTAL	**52**	**64**	**81%**

In addition to the capacity at which recreation sites along Lake Murray are being used, a boating density study was undertaken in 2007 (Kleinschmidt, 2007c) to identify the area available for recreational boating on Lake Murray by lake segment (Figure 7-3), assess boat densities occurring under normal (weekend) and peak (holiday) use conditions, and determine whether recreational boat use of Lake Murray is currently above, below, or at a desirable, or optimal, level.

Results of the boating density study (Kleinschmidt, 2007c) show that Lake Murray is currently utilized well below its recreational boating capacity (Table 7-7). Weekend percent capacity only exceeds 20 percent in Segment 2. Six segments (1, 6, 7, 8, 10, and 12) had weekend percent capacities between 10 percent and 20 percent, with the remaining five segments (3, 4, 5, 9, and 11) being below 10 percent capacity on weekends. Percent capacity averaged about 12 percent on weekends across the entire reservoir. Holiday use, which is the peak use time for the reservoir, was higher in most segments, leading to higher percent capacities on holidays. Four segments (1, 2, 10, and 12) had percent capacities over 20 percent, with Segment 1 having the highest percent capacity (26 percent). Six segments (3, 5, 6, 7, 8, and 11) had percent capacities between 10 percent and 20 percent. The remaining two segments (4 and 9) were still below 10 percent capacity on holidays. Percent capacity averaged about 16 percent on holidays across the entire reservoir.

Table 7-7: Estimated Recreational Boating Carrying Capacity and Average Use Densities

		WEEKEND		HOLIDAY	
SEGMENT	OPTIMUM RECREATIONAL BOATING CAPACITY[a]	AVERAGE PEAK USE[b]	PERCENT CAPACITY[c]	AVERAGE PEAK USE[d]	PERCENT CAPACITY[e]
1	916	112	12%	242	26%
2	635	138	22%	156	25%
3	1,379	121	9%	153	11%
4	742	42	6%	53	7%
5	579	43	7%	74	13%
6	267	49	18%	50	19%
7	371	56	15%	53	14%
8	368	39	11%	58	16%
9	379	26	7%	18	5%
10	491	75	15%	111	23%
11	298	19	6%	42	14%
12	150	25	17%	36	24%

[a] ((usable acreage/use factor) * boating activity distribution) summed for all activities per lake segment
[b] derived from aerial count estimates adjusted by population growth estimates
[c] (average peak weekend use/optimum recreational boating capacity) * 100
[d] derived from aerial count estimates adjusted by population growth estimates
[e] (average peak holiday use/optimum recreational boating capacity)* 100

If future use maintains the same pace as anticipated population growth, additional public access will be required to accommodate this increase in demand (roughly an additional 75,000 recreation days (or visits by people) by the year 2030), and managers will be required to determine whether existing sites may be expanded or if additional sites will be required to accommodate that use. SCE&G is proposing a Recreation Plan for the Project which outlines recreation site improvements, with particular focus on alleviating congestion at sites experiencing high use levels, and providing future access, which is targeted for those areas of the lake that both serve a greater number of recreationists around the lake and provide access to areas of the lake experiencing less density on average.

There are several recreation sites that may not adequately accommodate existing or projected future use as currently designed and constructed. As Larry Koon and Shull Island are used beyond their capacities, regardless of day type, they will need modifications or improvements to accommodate use in the future as well as existing use levels. Lake Murray Estates Park, Macedonia Church, Sunset, Hilton, Metts Landing, and Gardendale are likewise currently utilized above their respective capacities on weekends and will need modifications or improvements to accommodate existing and future use levels. Although use levels at the Millrace sites are high on weekends, these sites are informal and outside of the project boundary. Sites that would be expected to approach capacity in the future and, therefore, require modification or improvement would be Murray Shores and Higgins Landing. SCE&G has proposed improvements to existing sites, including Larry Koon, Murray Shores, and Gardendale, to be implemented as part of the Project Recreation Plan. Both the Plan and improvements are discussed below in Section 7.9.

SCE&G is also proposing the addition of four new public access sites on Lake Murray and two new public access sites on the LSR. In addition, SCE&G has set aside several parcels as future recreation lands for development into recreation access sites, as future use levels and needs dictate. Among these, Shull Island covers over 20 acres and is adjacent to the existing Larry Koon and Shull Island sites. SCE&G has also reserved approximately 28 acres in proximity of the Hilton access site. And several parcels (Big Creek and Little Saluda Point) would provide additional access to the riverine sections of the lake (Segments 11 and 12). These provisions for future recreation opportunities are discussed in greater detail in Section 7.9.

7.6 Recreation Management

Recreation activities within the Saluda Hydro project boundary are managed by a combination of state agencies, local governments, and SCE&G. Generally, within each recreation site, the site operator is responsible for management. However, boating, fishing, and hunting regulations and enforcement in South Carolina are the responsibility of the SCDNR.

SCDNR requires that all boat operators under the age of 16 complete a boating course approved by the Department to operate any watercraft with a 15 hp motor or greater unless accompanied by an adult 18 years old or older. SCDNR also regulates watercraft use within 50 feet of docks, piers, moored vessels, or people in the water; wake jumping; registration and titling; required boater equipment; hours of operation; and enforcement.

With respect to fishing, SCDNR regulates fishing methods and devices; creel limits; selling and importing species; licensing; and enforcement. SCDNR also regulates hunting, including waterfowl hunting that may occur within the Project area. However, waterfowl hunting is limited by state law within proximity of a residence or marina on the lake. In Lexington and Richland Counties, waterfowl hunting is prohibited within 350 yards of a dwelling or marina. In Newberry and Saluda Counties, waterfowl hunting is prohibited within 250 yards of such structures. SCDNR regulates hunting methods and bag limits; licensing and enforcement; and sets allowable seasons for each species.

SCE&G currently maintains a number of safety measures at the Project. With respect to recreational use of the Project and safety concerns, the FERC conducts annual inspections of the Project and requires independent safety inspections. SCE&G performs regular Project inspections and provides a siren warning system for downstream flow releases, warning and information signs posted at public access sites on the lake and river and along the river shoreline, river staff gages and river level markings on bridge abutments, an electronic notification system for project operations, and website posting of current conditions and planned operations, educational materials and website links to safety information.

As discussed in Exhibit H, SCE&G maintains a warning system on the LSR to warn river users of sudden changes in water level. Sirens and strobe lights are located at the USGS gauge platform below the Saluda powerhouse, between the USGS gauge platform and Metts Landing, at Metts Landing, upstream of Riverbanks Zoo and two locations downstream of the Zoo (Shandon Rapids and confluence with the Broad River). There are also stand alone strobe lights at the spillway discharge and Saluda Shoals Park. Sirens and strobe lights are active 24 hours per day. The LSSRAC and American Whitewater, with assistance from SCE&G, established a series of color-coded river markers, positioned along the LSR, to provide information associated with rising water levels. SCE&G also manages an electronic call system via email and telephone that alerts registered individuals about sudden changes in water levels on the LSR. Anyone may register for this service. Registration is available through the Company website. SCE&G's website provides information on current water level conditions (with a date and time stamp) and planned operations. SCE&G's website also provides links to such information as a Hazardous Waters Safety Bulletin, SCDNR Boating Safety, SCDNR Stream Data, American Whitewater Safety Code, and the USGS gage below Lake Murray Dam. Buoys, signs, and fences are placed throughout the Project as part of the Public Safety Plan on file with the FERC.

As stated above and discussed in Section 7.9 below, SCE&G is proposing to implement a Recreation Plan that would outline SCE&G's role in providing existing and future recreation opportunities. In addition, SCE&G is proposing to install several new siren/strobe combinations, stand-alone strobes and warning signs along the LSR. The proposed new warning system equipment is currently being developed in consultation with the TWC and will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement.

7.7 Recreation Needs Identified in Management Plans

7.7.1 South Carolina State Comprehensive Outdoor Recreation Plan (2002)

The 2002 State Comprehensive Outdoor Recreation Plan (SCORP) is South Carolina's official comprehensive outdoor recreation plan. This five-year plan serves as a guide to federal, state, and local governmental agencies and the private sector involved in recreation and natural resources planning and development. The six main goals of the SCORP are to do the following: continue a planning process for the administration of outdoor recreation opportunities, provide a comprehensive system of public and private recreation lands and sites, provide opportunities for enjoyment of historic and natural heritage opportunities, provide opportunities for outdoor recreation and improved quality of life to all segments of the population, encourage cooperative efforts to meet recreation needs, and encourage sustainable development.

While there are no recommendations specific to the Saluda Project itself, although the plan does encourage the conservation of open spaces along the lakes and rivers related with hydro projects. Also, the SCORP does identify 11 state-wide management priorities for recreation development. Detailed recommendations within each of the 11 major issue categories are outlined in the SCORP. Among those are:

- Hydropower Projects - The SCDNR, SCPRT, and others will continue to encourage utility companies to conserve open space on lakes and rivers associated with hydropower projects;
- Scenic Rivers - The SCDNR will continue to work with landowners and communities in designating significant rivers as state scenic rivers and work toward conservation of these resources;
- Multiple Use Urban Trail Resources - The Cities of Columbia, West Columbia and Cayce will continue development of the Three Rivers Greenway. The Irmo-Chapin Recreation Commission and partners will extend trails from Saluda Shoals Park along the LSR;
- Canoe Trails - The Lower Saluda Scenic River Advisory Council will seek to establish additional canoe/kayak access on the Lower Saluda above Riverbanks Zoo;
- Implementing Existing Plans - Lower Saluda Corridor Plan - The Lower Saluda Scenic Advisory Committee, SCDNR, SCPRT, and others will continue to work together to implement the corridor plan. The coalition is working with SCE&G to improve safety and protect the scenic qualities of the river. The Irmo-Chapin Recreation Commission will continue to develop the Saluda Shoals Regional Park. SCE&G, Trout Unlimited, SCDNR, and DHEC will work toward improvements in the water quality of

the river. Establishment of a public greenway has been recommended through a planning charrette update of the plan; and

- Public/Private Partnerships – Public agencies will seek additional corporate partnerships for new and expanded recreation and educational facilities. SCE&G, SCPRT, and SCDNR will consider a partnership for public open space and natural resources protection on Lake Murray.

7.7.2 The Lower Saluda River Corridor Plan (1990) and Update (2000)

The Lower Saluda River Corridor Plan (1990) is comprised of two main components: a) recommendations for the LSR and b) a visual Master Plan for the corridor, which identifies several parks or points of access in the corridor. The recommendations for the corridor made in the original plan included but were not limited to: patrolling, staffing and law enforcement access; ADA accessibility; linear trails; develop various additional access sites along the LSR; improve maintenance activities; develop and improve a river warning system; and develop public education materials.

The Lower Saluda River Corridor Plan was updated in 2000. The Plan revisits the recommendations and proposals made in the original plan. A key issue raised in the Update was the need to work closely with SCE&G to maintain higher minimum flows; provide water quality to support the fishery habitat year round; and increase the safety of water releases. In addition, the transfer of management responsibilities for the recreational facilities on the north side of the Saluda River from SCE&G to the greenways management group was recommended. According to the Plan, SCE&G would be expected to provide some form of financial remuneration to the group for the management of these facilities including maintenance, utilities, and coordination with law enforcement.

Featured prominently in the Update is the Three Rivers Greenway, which includes the Saluda Riverwalk and is identified as providing a 12-mile linear park system along the Broad, Congaree and Saluda Rivers. The Update of the concept plan also includes proposed additional or continued improvements including, but not limited to, implementation of the Three Rivers Greenway Trail, including the development of a new take-out at Stacy's Ledge and access to

Sandy Beach; construction of an improved portage trail at Mill Race Rapids, and improvements to Metts Landing. The plan also recommends additional access at I-20, I-26 and Twelvemile Creek.

7.7.3 The Three Rivers Greenway Plan

The River Alliance[15] is spearheading the Three Rivers Greenway Project, a 12-mile linear park that would include sections of shoreline along the Saluda, Broad, and Congaree Rivers, as discussed above. A portion of the Three Rivers Greenway, the Saluda Riverwalk, would encompass lands along the LSR from the I-26 bridge to the confluence with the Broad River. Among the access and improvements for the LSR proposed as part of the Saluda Riverwalk are a pedestrian bridge connecting Richland and Lexington Counties, a continuous trail along the northern shore of the river, and a park at the site of Mill Race rapids that would include trash receptacles, picnic tables, bathrooms and a ranger and rescue station. This portion of the Three Rivers Greenway is still under development.

7.7.4 Expanding the Experience: Trails for South Carolina. The South Carolina State Trails Plan (2002)

The State Trails Plan was developed to promote coordination between state agencies, advocates, and the public with respect to trail acquisition and development, assist resource managers in the decision making processes that affect trails development such as grant funds, and to promote the state as a leader in trails development, tourism and recreation. The goals of the Plan include: developing an interconnected network of trails across the state and encourage connectivity of existing trails; promoting sustainable trails development that minimize effects to the surrounding environment while maintaining longevity; developing trails to provide access to tourism destinations and points of interest; encouraging multiple use of trails in the state; promoting

[15] According to their website "[t]he River Alliance is a non-profit public sector/private sector partnership, incorporated in 1995 as a South Carolina Non-Profit Public Benefit Corporation". Their mission is to provide access for residents to the rivers that are in their community. They have made specific contributions to the Three Rivers Greenway Project. More information can be found at http://www.riveralliance.org/.

public use and access; and encouraging trails for fun, economic development, and health benefits.

Existing and proposed trails for the state are identified by county. In Richland County, the LSR is identified as a canoe trail. Proposed trails in Richland County include the Three Rivers Greenway. Proposed trails for Lexington County include an extension of the Saluda Shoals Greenway, a Saluda Shoals Horse trail, and an 8 mile trail connecting Saluda Shoals Park to the Riverbanks Zoo. There are no trails proposed for Newberry and Saluda Counties within proximity of the Project.

7.8 Agency and Public Recommendations Concerning Recreational Resources

7.8.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) was also filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below, are the remarks and study requests regarding Recreation that were provided by stakeholders in comment letters following the issuance of the ICD.

The SCDNR, by letter dated August 11, 2005, requested a Recreational Uses and Needs Study be preformed on Lake Murray. The agency stated that it requested the study in order to evaluate present recreation in the Project area, as well as future recreational uses. This study request also involves the evaluation of the best locations for future access points and what type of access is necessary. This request was also made in a joint ICD comment letter submitted by CCL and American Rivers (letter dated August 10, 2005), City of Columbia Parks and Recreation (letter dated August 11, 2005), the LMA (letter dated August 12, 2005), the SCWF (letter dated August 15, 2005), the LSSRAC (letter dated August 12, 2005), South Carolina Parks Recreation and Tourism

(SCPRT)(letter dated August 12, 2005), TU (letter dated August 15, 2005), and Lake Watch (letter dated August 15, 2005). SCDNR further recommended the location and property for a large, multi-lane boating event site should be explored and a description of public recreation sites that includes information capacity and handicapped accessibility be provided. SCPRT requested a "build out" scenario be used to identify the volume of use based on future development proposed in the shoreline management plan.

Through agency consultation and in working with the Recreation RCG and TWC, a Recreation Assessment Study Report was developed for the Project Area. Additional details regarding this study can be viewed above, and a full report is attached in Appendix E-6.

In their letter dated August 12, 2005, SCPRT requested a Boat Carrying Capacity Study be performed on Lake Murray. They recommended this study provide information on how the "build out" will affect boating carrying capacity, water quality, and fish and wildlife habitat. As a part of the process, SCPRT recommended that this study include an inventory of current and future residential docks, public and private marinas, dry storage, and other boat access opportunities. Similarly, Lake Murray Homeowners Coalition (letter dated August 15, 2005) requested that a "Total Build-out Study" be performed to assess areas that are not conducive to development.

A Boat Density Study was preformed on Lake Murray through consultation with stakeholders and resources groups. Details regarding this particular study are included above. The study report can also be viewed in Appendix E-6.

CCL and American Rivers, in a joint letter filed August 10, 2005, requested that a Recreation Flow Study be performed on the LSR. It is recommended that this study be performed to evaluate the effects Project operations have on instream flow and the recreation that occurs on the Saluda and at the confluence area. CCL/American Rivers requested flow levels that best benefit anglers, paddlers and swimmers be evaluated, as well as safety during recreational activity. City of Columbia Parks and Recreation (letter dated August 11, 2005), SCDNR (letter dated August 11, 2005) and the LSSRAC (dated August 12, 2005) requested in their ICD comment letters this study be performed, however LSSRAC additionally requested the optimal recreation experiences for anglers and boaters of different experience levels be evaluated. SCPRT made a similar request for this study in their comment letter dated August 12, 2005. In reference to the identification of recreational opportunities on Lake Murray, SCPRT also requested in their above stated comment letter that paddling opportunities in its tributary and tributary arms be investigated. The Lake Murray Association requested (comment letter dated August 12, 2005) downstream flows *not* be released for recreational activities during the drought or late summer.

Through consultation with the Recreation TWC, a Recreational Flow Assessment was performed on the LSR in early summer of 2007. Results of this assessment have been used to aid in flow discussions with any recommendations for recreational flows to be contained in the Project Recreation Plan.

Similarly, American Whitewater (letter dated August 12, 2005) and the City of Columbia Parks and Recreation (letter dated August 11, 2005) requested that a Ramping Study be performed on the LSR. It is requested that this study include the study of staged releases at Saluda Hydro to potentially be implemented during high use recreational periods. This was also mentioned in the comment letter of the LSSRAC (letter dated August 12, 2005) and TU (letter dated August 15, 2005).

The issue of ramping is currently being discussed by the Safety and Recreation RCG's. SCE&G has evaluated the option regarding ramping (during periods not identified for specific recreational flows) and feels that it eliminates reserve capabilities and conflicts with Project purposes. Because of the reserve function served by Saluda Hydro, SCE&G must be able to go to full generation within no more than fifteen minutes from the notification of a reserve call. Thus the recreating public must not be conditioned in any way to expect only a gradual rise in river levels when the warning system activates. To accede to the request for ramping would in our view be reckless and result in dangerously naive expectations of gradual, predictable rates of river level rise. It is important that river users understand that all water levels can be unsafe and that conditions in the lower Saluda River are unpredictable and subject to rapid and dramatic change at any time. Sirens and warning systems are designed to alert users of changing conditions. Recreationists should be advised clearly and consistently *to leave the river immediately upon notification. That is the circumstance to which they must be conditioned. Ramping would increase the risk to personal safety by creating the dangerous illusion for recreationists that it is safe in every alert situation to be as "gradual" in their response to the warnings as they believe the "ramped" increase in flow and water depth will be. The tendency of many recreationists likely would be to try to prolong the immediate recreational experience based on a false expectation of predictably gradual water level increases, rather than to leave the river immediately in response to consistent and accurate warnings that river levels may rise unpredictably rapidly and dramatically. In addition to these human factors, ramping may hamper the proper activation of the sirens and strobe lights controlled by pressure transducers. These safety related warning devices activate with a prescribed rate of rise in the river. Slow rises will not activate them. Ramping therefore, could have a direct and negative effect upon safety by rendering warning systems ineffective. In lieu of ramping, SCE&G has already developed a call down system and provides information on current and planned operations on the Company website and is in the process of evaluating the need for additional warning equipment.*

American Whitewater, in their letter dated August 12, 2005, noted they believed the spillway should be studied for its value as a recreational resource. It was recommended these methods include "at a minimum an on-water single flow whitewater boating feasibility study, possibly followed by a controlled whitewater flow study", (August 12, 2005, ICD Comment letter).

It is SCE&G's position that allowing the spillway to be used in this manner is not a reasonable or safe option at this Project. SCE&G believes that the individual risk would be too great and that the spillway should be operated only under emergency and testing purposes.

Also requested by American Whitewater in the ICD comment letter dated August 12, 2005, is the upgrade and repair of all existing access points. SCPRT similarly noted that they would like to see the continuation of existing access points along the LSR (ICD comment letter dated August 12, 2005).

SCPRT, in their letter dated August 12, 2005, requested acreage be added to the small recreation access sites in the Project area. SCPRT recommended that this should be accomplished in order to provide for future recreational needs and additional shore based recreation.

A recommendation was made by SCPRT in their ICD comment letter (dated August 12, 2005) that the islands in Lake Murray and the LSR be protected and a plan should be developed to accomplish this. SCPRT justified this in their statement that "population growth and increasing boat use may severely affect these recreational resources over the term of the license".

A specific interest SCPRT expressed in their ICD comments (letter dated August 12, 2005) is for the permanent protection of Dreher Island State Recreation Area. They additionally requested protection be given to a new state park property with significant associated shoreline in the Lexington or Saluda area of the Project.

SCPRT noted in their ICD comments (letter dated August 12, 2005) that they would like SCE&G to continue to participate in the implementation of the Lower Saluda River Corridor Plan and Update. This includes such specific aspects as recreational access at Sandy Beach, I-20, and I -26, as well as a take out above Mill Race Rapids and the development of the Saluda River greenway and Three Rivers Greenway. A take-out above Mill Race Rapids is also requested by American Whitewater in their August 12, 2005 ICD comment letter.

Regarding the requests listed above, the Recreational RCG was involved in discussions regarding future access points, as well as other facilities around the Project area. A Recreational Plan is currently being developed in consultation with the TWC and will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

In their ICD comment letter (dated August 12, 2005), American Whitewater requested scheduled flow releases be studied and provided for activities such as whitewater boating, special events, and rescue training.

SCE&G has been working with entities to provide flows for particular events for the past several years. These events currently include releases for Columbia Fire Department Swiftwater Rescue Training, as well as special recreational events such as Canoeing for Kids and Kayaking Championships. SCE&G has worked with these groups in order to develop a recreational flow release schedule for the new license term. This schedule includes flows for wade fishing, boating and safety training throughout the year. During the recreational flow periods, it has been agreed in the TWC that Saluda will be taken out of reserve operations for safety concerns.

It is also recommended by SCPRT (ICD comment letter dated August 12, 2005) that an evaluation of the waterfowl hunting areas around Lake Murray be performed. In their ICD comment letter they noted concern that the remaining areas for waterfowl hunting are dwindling. SCDNR also recommended that consideration be given to a designated waterfowl hunting area (letter dated August 11, 2005).

SCE&G is currently working with SCDNR to locate a suitable habitat area for waterfowl in the Project vicinity and more detailed information will be filed in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

In their ICD comment letter, (dated August 12, 2005) SCPRT requested that an "[i]nteractive process to periodically review recreation needs and adjust resources associated with the [P]roject" be developed.

There are current discussions among the Recreation and Safety RCG's to continue Safety meetings on a periodic basis beyond relicensing. Recreation at the project will continue to be evaluated through the filing of the FERC Form 80 recreation report once the license is issued.

ICD comment letters suggested that the implementation of additional water level rise safety warning systems is necessary. The letters also mention the need for an investigation of possible new alternatives for warning systems, such as an online and phone communication system. The entities that requested this item included the CCL and American Rivers (letter dated August 10, 2005), Lake

Watch (letter dated August 15, 2005), LSSRAC (letter dated August 12, 2005), SCDNR (letter dated August 12, 2005), SCPRT (letter dated (letter dated August 12, 2005), League of Women Voters (letter dated August 14, 2005), SCWF (letter dated August 15, 2005), American Whitewater (letter dated August 12, 2005), and TU (letter dated August 15, 2005). Those groups who noted the particular request to study options on a Public Information System regarding river flows included: CCL and American Rivers, Lake Watch, City of Columbia Parks and Recreation (letter dated August 11, 2005), Newberry County Gov. (letter dated August 15, 2005), and the River Runner Outdoor Center (letter dated August 16, 2005).

SCE&G has been working with stakeholders to address the issues mentioned above. Since 2005, SCE&G has introduced a public information website on Saluda Hydro planned releases for Lake level management, as well as testing an emergency call-down notification system. The website provides as up-to-date as possible planned release (excluding emergency reserve calls) information from Saluda Hydro and can be viewed at http://www.sceg.com/en/my-community/lower-Saluda-river. The call down system is designed to alert those who have requested to be involved in the program when a release from Saluda Hydro has been initiated, planned or otherwise. It does so by activation of a phone message as well as an email message. This call-down system was activated on April 14, 2008. Also, SCE&G is currently evaluating additional siren and strobe locations along the 10 mile stretch of the LSR with the Safety TWC.

Lake Watch (letter dated August 15, 2005) requested that a dispute resolution study be performed during the relicensing process. Lake Watch explained in their ICD comment letter that this study be performed to determine how to best improve communication with the public in resolving disputes or complaints. Lake Watch also makes this request in their DLA comments (letter dated March 14, 2008). In reference to this request, SCPRT notes in their DLA comments (letter dated March 14, 2008) that they would recommend that periodic reviews take place to review recreational needs and adjust recreational resources.

SCE&G has discussed several forums for keeping discussion open after the relicensing. There have been proposals for yearly safety meetings as well as lake management meetings after the relicensing is complete. Furthermore, to discuss recreational release schedules for the following year, SCE&G has planned yearly stakeholder meetings at the end of the recreation season. On a different note, SCE&G uses a variety of communications tools to provide the public with timely information concerning lake and river issues. The company's web site has various sections that address lake issues and whom to contact with questions. Also on the site is a link to the company's speaker's bureau in which the general public can request speakers on a variety of topics, including lake and river management. In 2007, the company added a section to the site on the Lower Saluda River. This site includes a listing of planned generation, the current conditions at Saluda Hydro (i.e. what level it is generating) and links to various resources on river and boating safety. A weekly email report on Saluda operations and the lake is sent to a large list of external stakeholders to provide information to disseminate to interested parties. The Public Affairs group also provides timely news items to local media through press release.

7.8.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of Recreation during these meetings is described below. Many items that were requested in the ICD comment letters were also requested during the RCG meetings. This is noted in the responses under 7.6.1, Initial Stage Consultation. Only additional studies, not discussed above, are included in this section.

The Recreation and Safety RCGs collectively developed and edited Work Plans that illustrate the issues that have been identified through consecutive meetings. The items discussed in the Work Plan are continuing to be discussed by the resources groups at this time. The Work Plans can be viewed in Appendix E-6 and contain many of the issues identified in ICD comment letters.

Items that were identified by the RCG as issues that were not identified during the Initial Stage Consultation are described below. The RCG noted that recreational activities need to be protected and enhanced for future use in the

Project Area. This includes security at recreation facilities and sufficient egress points on the LSR.

The RCG also identified that the conservation of land for future recreation as an important issue. Therefore, in addition to the issues listed under the initial consultation, the RCG identifies that providing wildlife areas is an important recreational value. The Work Plan notes that a possible resolution to this is the conservation of large tracts of land within the PBL into easements. Additionally, the group indicates that they would like reconsideration of Two Bird Cove and Hurricane Hole Cove (presently designated as special recreation areas) classifications. The RCG also endorses the use of adaptive management for future recreation planning.

The Recreation RCG identifies in the Work Plan that LSR flows are a recreation concern. It is identified in the Work Plan that safe recreational opportunities should be available through scheduled flow releases. It is requested in the Work Plan that consideration be given to a take out area for small trailered boats at in the Gardendale area above 126. It is also noted that the impacts that Lake levels have on recreation is an issue to be reviewed. The Work Plan identifies a possible resolution to this issue may be the identification of a reliable lake level that will provide year-round recreational access to lake users.

In the Safety RCG, Lake Watch representatives sought a review of the shoal marker program on Lake Murray. They noted that low lake levels could possibly negate the usefulness of the buoys.

The group discussed this item originally on February 14, 2006 (meeting notes included in Volume II) and an additional meeting was held on July 31, 2007 to discuss this item specifically. The Safety RCG thus developed a protocol for reporting unmarked shoals in Lake Murray to DNR personal. This reporting sheet is available on SCE&G's Lake Management website and includes information such as GPS coordinates of unmarked shoal, lake elevation at time of detection, and nearest landmark.

The resource group also expressed concern about amphibious aircraft on the lake, as well as other non-traditional vehicles, and the possible safety issues that could result. They also discussed the dangers that power lines pose to sailboat navigation.

The resource group discussed these issues on October 24th, 2006 (meeting notes located in Volume II). Resource group members deemed that problems posed by power lines should be described/confirmed by the sail boating community. Resource group member Steve Bell of Lake Watch volunteered to contact Winward Point Yacht club in order to see if this was an issue of concern. The group noted that issues regarding amphibious aircraft, as well as other non-traditional vehicles (submarines, etc.) could be addressed in the ongoing Safety meetings that occur after relicensing if they became a problem in the future.

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to recreational resources are provided below.

By letter dated March 13, 2008, AW lists their interests as related to the Saluda Project. They note that their interests are focused around 4 items which can be described as the provision of ample whitewater boating opportunities downstream of the Project, public river access that is free and meets the current and future recreation demands, online accessible flow information, and ramping and safety initiatives.

It is noted in the comment letter provided by SCPRT (dated March 14, 2008), that SCPRT would request that hydro unit start-ups are phased in slowly and that the warning systems are activated early to allow for sufficient time for users to egress the river. SCDNR also makes this suggestion in their DLA comment letter (March 14, 2008). SCDNR notes that additional warning devices on the LSR are necessary and that the hydro unit start-up is phased so that the rate of water rise is not in excess of 0.02 ft/minute.

SCE&G has been working with the Safety RCG on the implementation of a warning system along the entire stretch of the LSR. This system is designed so that river users are provided with ample time to egress the river. Furthermore, in reference to the request for phased startup of the units, this option is not feasible as the Project operates as a reserve facility. Therefore, the plant must provide power in the event of a reserve call within 15 minutes. Phased startup would far surpass the 15 minute reserve requirement, and conflict with the Project's primary purpose as a reserve facility. Ramping could adversely affect the operation of the warning system that was installed to provide recreators with advance warning of rising water. To accede to the request for ramping would in our view be reckless and result in dangerously naive expectations of gradual, predictable rates of river level rise. It is important that river users understand that all water levels can be unsafe and that conditions in the lower Saluda River are unpredictable and subject to rapid and dramatic change at any time. Sirens and warning systems are designed to alert users of changing conditions. Recreationists should be advised clearly and consistently to leave the river immediately upon notification. That is the circumstance to which they must be conditioned. Ramping would increase the risk to personal safety by creating the dangerous illusion for recreationists that it is safe in every alert situation to be as "gradual" in their response to the warnings as they believe the "ramped" increase in flow and water depth will be. The tendency of many recreationists likely would be to try to prolong the immediate recreational experience based on a false expectation of predictably gradual water level increases, rather than to leave the river immediately in response to consistent and accurate warnings that river levels may rise unpredictably rapidly and dramatically.

SCPRT explained in their March 14, 2008 DLA comment letter that they believe all the recreation sites that were proposed by SCE&G at the March 3, 2008 meeting are necessary recreational improvements for the Project. Furthermore, they note that continued discussions should address any additional facilities that are needed, along with a timing schedule for development, and the establishment of a periodic review process.

Additionally, SCPRT requests in their comment letter (dated March 14, 2008) that information be provided on the number of boat access lanes, number of parking spaces, number of fishing piers, number of picnic tables/shelters, and number of campsites in the License Application.

The above referenced information is available in the Recreation Studies provided in Appendix E-6.

SCDNR, in their March 14, 2008 DLA comment letter, makes several recommendations that are pertinent to the Recreation plan, including a list of proposed recreational enhancements. They note that recreation sites that are not compliant with ADA standards should be prioritized for improvement where applicable. SCDNR also notes that facilities providing bank fishing and pier based angling opportunities should be prioritized due to their high recreational uses. SCDNR also recommends that shoreline access along the LSR be enhanced by providing additional ingress and egress sites. It is further pointed out by SCDNR that a schedule should be developed for the implementation of the enhancements proposed in the Recreation Plan. They additionally note that a time frame be developed for when meetings will be held with stakeholders to discuss recreational needs in the future and when the next recreational uses and needs study will be held.

Also, in their DLA comment letter, referenced above, SCDNR notes that they are supportive of the TWC proposal on the recreational flow schedule and encourages SCE&G to implement this schedule as soon as possible.

As a part of the Recreation TWC's issue resolution agreements for recreational flows, there has been agreement reached on a preliminary set of recreation flows and a certain total yearly amount of flow (quantified in acre-feet) to be provided. This agreement will be filed with the FERC in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

In reference to the LSR Corridor plan, SCDNR suggests in their DLA comment letter (March 14, 2008) that SCE&G support the development of proposed greenway trails along the LSR. SCDNR also encourages the designation of the riverine section in the upper reaches of Lake Murray as a “featured paddling area”. SCDNR notes that this could be supported by the future installation of boating access facilities that are specifically designed for canoes and kayaks. SCDNR adds that in order to aid in the suitability of the area for paddling, restrictions should be placed on docks through this area on SCE&G property.

These comments have been taken into account in the Recreation Plan and in discussions with the Lake and Land Management TWC. SCE&G has proposed in their June 10, 2008 rebalancing proposal to classify 14 tracts totaling 275.14 acres along the LSR plus the 45.04 acres already in the Scenic River Easement as recreation. Also included in this proposal is a recreation area on the upper end of the reservoir to serve as a paddling area.

7.9 Existing Measures to be Continued and New Measures Proposed by the Applicant

SCE&G will continue to provide recreational access to project waters through existing public access sites on Lake Murray and the LSR. SCE&G will continue to operate the 16 formal public access sites on Lake Murray and the LSR and continue leasing Dreher Island State Park to the SCPRT, Larry Koon Boat Landing and James Metts landing on the LSR to the Lexington County Recreation Commission, and Saluda Shoals Park to the Irmo-Chapin Recreation Commission. SCE&G will also continue to allow access to its 62 undeveloped islands in Lake Murray for public recreation.

The Saluda draft Recreation Plan is being developed by the Recreational TWC and is scheduled to be finalized in the winter of 2008. The primary goal of the Recreation Plan is to address future recreation use and capacity concerns at the Project by identifying and providing for future public access to project lands and waters in order to accommodate population growth, commercial businesses, tourism, development and changing recreation use patterns. The Recreation Plan outlines the following improvements for existing recreation sites at the Project:

- Evaluate the feasibility of increased parking and improve barrier free access at Larry Koon Boat Landing;
- Provide picnic facilities at Shull Island, Higgins Bridge, Kempson Bridge, Metts Landing, and provide ADA compliant restroom facilities at Kempson Bridge;
- Improve signage, parking, lighting and barrier free access and facilities at Murray Shores;
- Increase the size of and improve ADA compliance at River Bend;
- Increase the size of, expand and pave parking area, add restroom facilities, and improve barrier free access at Sunset;
- Add restrooms, lighting, a fishing pier and improve ADA compliance at Hilton;
- Increase or expand the courtesy docks and improve barrier free facilities at the Dam Site;
- Improve and expand parking and add ADA compliant restroom facilities at Lake Murray Estates Park; and
- Pave the access road and parking lot, add restroom and picnic tables, increase capacity, and improve the hand-carry access at Gardendale.

While improvements at these sites would be provided by SCE&G, some of these facilities would continue to be managed and maintained by the SCDNR or Lexington County Recreation Commission, where such management currently exists. In addition, SCE&G is exploring the option of leasing Gardendale to the Irmo-Chapin Recreation Commission.

In addition to improvements at existing recreation sites, SCE&G is proposing the development of the following additional public access sites at Lake Murray and the LSR:

- Cloud's Creek - Cloud's Creek is located on the south side of the reservoir at the Spann Road bridge, near the intersection of Spann Road and US Hwy 378. At this site, SCE&G proposes to install a gravel parking lot and carry-in access. This site would provide direct access to the Cloud's Creek arm of Segment 12 of the lake.
- Little Saluda Point - Little Saluda Point is located on the south side of the reservoir at the Hwy. 391 bridge, near the intersection of Highway 391 and US Highway 378, adjacent to an existing commercial site, Little River Marina. The existing gravel parking lot, which contains an estimated 10 spaces for vehicles, will be utilized for parking (with permission of Little River Marina). In addition,

SCE&G proposes to set aside adjacent acreage for potential future expansion and install fishing piers and a walking path. This site would also provide direct access to Segment 12 of Lake Murray.

- Old Corley Bridge Road Canoe Access - Old Corley Bridge Road Canoe Access is located on the west side of Rocky Creek approximately four miles off of US Highway 378 on Corley Bridge Road. SCE&G would improve and develop this site for public use by constructing a gravel parking lot and carry in access and installing signage. This site would provide direct access to Segment 12 of Lake Murray.
- Shealy Tract - Shealy Tract is located on the south side of the reservoir at the end of Frank Shealy Rd. At this site, SCE&G proposes to install a fishing pier and gravel parking lot. This site is located across the lake from Dreher Island State Park and would provide access to Segments 7, 8 and 9.
- Twelve-mile Creek – Although Twelve-mile Creek is currently not designated as a future recreation site, SCE&G proposes to explore leasing this site to the Lexington County Recreation and Aging Commission for future development.
- Candy Lane - Candy Lane is located upstream of the Mill Race rapids off of Greystone Boulevard and would provide an opportunity for portaging of the Mill Race rapids. SCE&G proposes to explore leasing the site to the City of Columbia and installing parking and carry in access.

SCE&G is also proposing to set aside project lands for future recreation development. The lands that are favorable for such future development have been determined to be topographically suitable for such development, free of sensitive resources such as rare, threatened, or endangered species, fish spawning beds, wetlands, etc.; and would not be expected to exacerbate current on-water use patterns.

- Shull Island – This site covers over 20 acres and is located adjacent to Larry Koon Boat Landing and the Shull Island site.
- Simpson's Ferry – Simpson's Ferry is across the lake from River Bend and would provide access to the lake from the northern shore between Sunset and Kempson's Bridge.
- Long Pine – Long Pine covers over 30 acres and would provide access to the lake from the northern shore between Rocky Point and Dreher Island State Park.
- Hilton – This site is approximately 28 acres and is located on Mallard Drive, across the cove from the existing Hilton site.

- Water Treatment Plant - This site is located on the east side of the reservoir off of Hwy. 6. This site provides access to Segment 2.
- Stone Mountain – Stone Mountain is an approximately 27 acre site located on the northern shore of the lake on Stinking Creek. This site is located on Segment 6, between the existing Hilton site and Rocky Point.
- Big Creek – This site covers over 20 acres and would also provide access to the lake from the northern shore between Sunset and Kempson's Bridge on Segment 11. The site is located off of Hwy. 391 near Blacks Bridge.
- Shealy Road Access Area – This site is located on the south side of the reservoir in Hollow Creek between Shull Island and Murray Shores and provides access to Segment 7. Road access is via Frank Shealy Road, off of Hwy. 378.
- Rocky Creek – This site is located on the south side of the reservoir between Shull Island and Murray Shores, surrounding Rocky Creek, and provides access to Segment 10.
- Little River/Harmon's Bridge – This site is located up the Little Saluda River, where Hollywood Rd. crosses the reservoir, and provides access to Segment 12.
- Crayne's Bridge Public Park – This site is located on Camping Creek between Dreher Island and Rocky Point, where Wheeland Rd. crosses the reservoir, and provides access to Segment 8.

Under the assumption that participation in recreation activities at the Project grows at the rate of population, recreation participation is projected to grow by approximately 24 percent by the year 2030. Adopting these improvement measures would provide enhanced recreational opportunities to meet the needs of existing recreators and help to accommodate the additional demand for amenities and resources associated with increased use in the future at relatively minimal additional cost.

The Recreation Plan would provide a mechanism for monitoring public access needs for the entire project over time, in conjunction with required FERC Form 80 filings and consider trends in use, types of use (e.g., camping, swimming, sightseeing, boating, fishing, etc.), population growth, and development. Results would be used to identify and plan for future access needs. The Recreation Plan will ensure adaptive management of recreation resources in the future for the duration of the license term.

The Recreation Plan would also compliment SCE&G's consultation and cooperative efforts with the various regional projects such as the Three Rivers Greenway and the Lower Saluda River Corridor Plan. The Recreation Plan would also compliment the efforts of and be implemented in conjunction with the Project SMP. SCE&G proposes to implement recreation site improvements, the proposed development of additional public access sites, and proposed lands to be set aside for future recreational development identified in the Recreation Plan after issuance of a new FERC license for the Project.

SCE&G is also working with the Recreation RCG to establish recreational flow releases on the LSR to support on water activities, such as wade angling and whitewater boating. Target flow releases of between 700 cfs and 1,000 cfs are scheduled to be provided on a total of 32 days over the course of between 5 and 9 hours per day annually in support of wade angling activities. These flows are sufficiently low enough to also provide opportunities for swimming, tubing and rock hopping. Flow releases for whitewater activities, including kayaking events, and rafting, are scheduled for 19 days from 3 to 9 hours per day annually. These releases will range from just over 2,000 cfs to 10,000 cfs for Canoeing for Kids events. Additional flow releases between 8,000 cfs and 15,000 cfs to be scheduled on 11 days are being evaluated for swift water rescue training. SCE&G proposes to implement the recreational flow releases after issuance of a new FERC license for the Project.

Currently, SCE&G is working with the Safety RCG to determine the appropriate locations to install additional warning sirens and strobes along the lower Saluda River. Among the locations currently proposed for additional warning systems are:

- Sandy Beach, upstream of Metts Landing
- Corley Island
- Gardendale
- I-20 Bridge
- River's Edge/Oh Brother Rapids
- Ocean Boulevard
- Stacey's Ledge

Warning siren installation will be included in the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to begin siren installation after issuance of a new FERC license for the Project.

7.10 Measures or Facilities Recommended by Agencies

Comments on the Project ICD, Draft License Application, and relicensing resource group meetings, including the development of the current Recreation Plan, identified issues and recommendations associated with existing and potential future recreational use of project lands and waters (also discussed in detail in Section 7.8.1). Among the recommendations made by agencies and stakeholders through the consultation process are the following:

- creation of public access sites and greenway trail concepts as proposed in the Three Rivers Greenway which include a continuous trail along the northern shore of the river (Saluda Riverwalk), and a park at the site of Mill Race rapids;
- development of public access sites and greenway trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include implementation of the Three Rivers Greenway, improvements to Saluda Shoals Park, improvements to Metts Landing including additional parking and facilities, improvements to Gardendale including parking and restrooms, a new fishing pier below I-20, a carry-in boat launch just below I-26, a new access site(s) and portage trail at Stacy's Ledge, and an improved portage trail around Mill Race rapids on the south shore of the river;
- several improvements to existing recreation sites including, but not limited to, expansion and/or improvement of the parking area at all Lake Murray and LSR recreation sites; ADA accessible fishing pier at Larry Koon, Murray Shores, Dam Site, Saluda Shoals Park, Dreher Island State Park; ADA compliant courtesy dock at Shull Island and Lake Murray Estates; expand trails at Saluda Shoals Park; add restroom facilities at Metts Landing; install boat slips and a sailboat mooring area at Dreher Island State Park; and develop Bundrick Island into a formal recreation site with parking, trails, and picnic facilities.
- creation of a state park on the south side of the reservoir;
- creation of a multi-lane boating facility that can accommodate large tournaments;
- development of a boat ramp for small trailered boats at Gardendale or further downstream, above I-26;

- development of a take out above Mill Race Rapids;
- acquire lands adjacent to existing recreation sites to the extent possible to allow for future expansion;
- provide designated waterfowl hunting areas on Lake Murray;
- reconsider special recreation designation areas classification (e.g., Two Bird Cove and Hurricane Hole);
- designate the riverine area in the upper end of the reservoir as a canoe/kayak area with restrictions to docks; and
- scheduled flow releases to support on-water recreation activities such as wade angling and whitewater canoeing/kayaking.

Many of the provisions listed above are identified for inclusion in the Project Recreation Plan and tasked for implementation by SCE&G. Among these are the development of a take out above the Mill Race Rapids, the acquisition of lands for the potential future expansion of existing access sites, and scheduled flow releases for on-water recreation activities on the LSR. SCE&G will continue to coordinate with stakeholders on recreation improvements and provisions for future use accommodations through the Recreation Plan protocol.

7.11 Anticipated Effects

7.11.1 Effects to Access and Opportunities

Recreation sites on Lake Murray are well distributed and provide a variety of settings, levels of development, and opportunities. All provide some kind of water access, and collectively, recreation sites provide a variety of experiences, with some being urban and others rural. Results of the recreation site assessment, supported by survey results, suggest that sites are generally in good condition overall, and several have recently been renovated. However, while many sites accommodate ADA compliant parking, few sites are developed to provide a high level of barrier free access. Several of the sites are regularly staffed. Sites that are not staffed are frequented regularly by managing personnel and/or law enforcement to check on site and safety conditions.

Site users are predominantly local residents who do not have shoreline access via private residences. They tend to use recreation sites that provide the recreation experience and/or facilities they seek, but which are also located close to their homes. Because of this, population growth in the surrounding counties is expected to be an influential factor in increased use of project recreation sites. Subsequently, use of public access sites will increase over time as the local population continues to grow and demand for outdoor recreation opportunities increases. Recreation in the Project area may level off or even decrease if public access opportunities do not increase with demand. Recreationists may shift use to other areas in response to crowding and limited opportunities.

SCE&G is in the process of finalizing a project-specific Recreation Plan. The Recreation Plan will identify and provide for improvements to existing public access sites and future public access to project lands and waters in order to accommodate population growth, commercial businesses, tourism, development and changing recreation patterns of use. The Recreation Plan will also provide a method for monitoring public access needs over time and in coordination with required FERC Form 80 filings, consider trends in use, multiple types of use (e.g., camping, swimming, sightseeing, boating, fishing, etc.) population growth, development, etc. Results of monitoring will be used to identify and plan for future access needs under the Recreation Plan update protocol.
The Plan would provide a means to manage future access on the lake and the river and to direct future development to appropriate areas and at appropriate levels. The Recreation Plan would benefit both recreationists and resources by permitting development in areas of lower boat density that can accommodate the additional public and/or private access, and prohibiting further development in locations where boat density is heavy and safety issues are a concern.

It is expected that improvements to existing access and the provision of additional sites and opportunities at Lake Murray and along the LSR outlined in the Plan will contribute to the Project's ability to support recreational use of the lake and river. It is not clear, however, if these improvements will redistribute existing use to other sites, contribute to increased use of the area, or both.

Improvements to existing access sites would be expected to increase the capacity of these sites to accommodate existing use levels and potentially provide additional capacity to accommodate use level increases in the future. Such improvements may make particular sites more attractive for recreationists than others, thereby increasing patronage overall or shifting use from those sites which are not slated for improvements. The provision of additional access sites is expected to both alleviate recreational pressure on existing recreation sites as well as better disperse use around different arms of the lake. For example, Segment 12 was identified as being the third busiest on weekends and second busiest on holidays. However, this section of the lake is currently only served by the Lake Murray Estates access site. Both the Clouds Creek and Little Saluda Point future sites would provide additional hand-carry access to this arm of the lake. The addition of the Shealy Tract site would be expected to reduce pressure at surrounding sites such as Murray Shores and the lake's busiest site, Larry Koon Boat Landing.

It is anticipated that SCE&G's existing undeveloped properties, identified and reserved as future public access to the lake and riverfront, will address recreation needs in the immediate and distant future by providing access to areas where it is otherwise limited by private and commercial ownership, thereby potentially increasing public recreational access site use overall, alleviating crowding at existing high use recreation sites, and dispersing use across the lake.

Irrespective of changes to patterns and levels of use at the Project resulting from SCE&G's proposals, given that existing use capacities are typically exceeded on peak weekends at about half of the Lake Murray sites and at the majority of LSR sites, improvements to existing access sites, the addition of new access sites, and the reservation of Project lands for future access sites will enhance the recreation experience for all patrons.

7.11.2 Effects of Project Operations

Saluda Hydro Project is operated primarily as a reserve generation facility with one unit on line at minimum gate to provide downstream flow in the Saluda River. The remaining project units can be started and brought to full load within 15 minutes when demand dictates. In addition to reserve generation, the Project is operated to manage the reservoir elevation on a seasonal basis. Two aspects of project operation have the potential to affect recreation opportunities and access on Lake Murray and the LSR: lake level fluctuations and flow releases. Lake level changes have the potential to reduce the overall surface area of the lake available to specific activities though boat launches at the Project have been extended to accommodate launching at elevation 348.5’ at all public park sites except Rocky Point and normal lake level fluctuations are not expected to restrict access for motorized boating. Flow releases provide opportunities for various on-water activities depending on flow and have the potential to create hazardous conditions depending on the rate of change in water levels for downstream recreationists.

During the existing license period, SCE&G has managed the reservoir using monthly target elevations subject to revision based on climatic conditions, reservoir levels, dam maintenance requirements, or operational considerations. The reservoir is normally maintained between El. 348.5’ in the winter and El. 356.5’ in the summer with occasional drawdowns to El. 343.5’ for project maintenance or aquatic vegetation control. The reservoir is typically drawn down on an annual basis beginning in August from El. 356.5’ to between El. 352.5’ and El. 348.5’ in December. Spring fill generally begins in January or February increasing the reservoir level to El. 356.5’ by May. Summer elevations of between 352.5’ and 356.5’ are generally maintained from May through August, the peak summer recreation season.

The two most popular water-based recreation activities on Lake Murray are boating and fishing (Kleinschmidt, 2007a). The peak boating season extends from Memorial Day to Labor Day, when the existing guide curve targets an elevation range of between 352.5’ and 356.5’. Angling, both from shore and from a boat, occurs year round. April and May, when lake elevation is targeted for between 354.5’ and 356.5’, coincides with the period when bass and crappie are most active (see section 3.0, Aquatic Resources). With the exception of extreme drought conditions, boating and angling access is available at all times of the year under the project rule curve as boat launches have been expanded to accommodate access down to El 343.5’.

Approximately half of all use on the LSR is attributed to water-based activities (Kleinschmidt, 2007d). Across all day types and sites, the most popular on-water activities are whitewater canoeing/kayaking (13 percent of total use), boat fishing (11 percent of total use), and bank angling (9 percent of total use). Swimming and rock-hopping also occur on the LSR, generally at the Mill Race sites which are outside of the Project boundary (Kleinschmidt, 2007a).

Whitewater canoeing/kayaking, primarily downstream of the Gardendale access site, is generally available at the widest range of flows. Opportunities for whitewater boating at different flows can be accommodated by various river features and “play spots” that are created at various flows along the lower half of the river to the confluence with the Broad River. Although the range of acceptable flows varies by experience level, generally whitewater boating opportunities are available and favorable at flows of between 2,300 cfs up to 18,000 cfs. Flatwater canoeing/kayaking, like whitewater boating, is generally available at all water levels ranging from 500 cfs and up, from Metts Landing/Saluda Shoals Park to Gardendale. This upper section of the river is predominantly flatwater even at higher flows. Power boating, including fishing from a boat, is generally best at flows between 1,000 cfs and 4,000 cfs. Activities requiring lower flows include wade angling, swimming and rock hopping. Because these activities involve full or partial body contact with the water, they are best suited at flows that provide minimized current, shallower depths, exposed rocks and shoals, and the presence of eddies, generally between 500 and 1,100 cfs (Kleinschmidt, 2007d).

To some degree, any number or all of the most popular on-water activities are available at flows of 4,000 cfs and less. Boating activities are generally available at flows of between 1,000 cfs and 4,000 cfs, whereas, non-boating on-water activities, such as swimming and wade angling, are best suited for flows of 1,000 cfs or less. Daily average flows of less than 1,000 cfs are generally available 38 percent of the time year-round; hourly average flows of less than 1,000 cfs are generally available 60 percent of the time year-round. Whereas flows of less than 4,000 cfs, daily average, are generally available 83 percent of the time year-round and flows of less than 4,000 cfs hourly average are generally available 27 percent of the time year-round. Higher flows, for whitewater activities such as canoeing/kayaking and rafting, of 12,000 cfs or greater are generally only available approximately 2 percent of the time year-round on a daily average and hourly average basis. However, daily average flows represent a range of flows provided on a daily basis, hourly average flows on an hourly basis, and peak flows of 12,000 cfs and higher for specific durations are provided much more often than 2 percent of the time year-round (Kleinschmidt, 2007d).

With respect to the provision of scheduled flow releases for recreation on the LSR, such releases will support and make available opportunities to participate in the most popular water-based activities such as whitewater canoeing/kayaking, fishing (from a boat, from shore or wade angling), swimming, tubing and rock-hopping (sun-bathing and picnicking on the rocky outcroppings of the LSR at low water). Although any number or all of the most popular on-water activities are available approximately 83 percent of the time year-round, on average, under normal operating conditions, scheduled releases will provide a level of assurance that these activities are available during certain times throughout the year and enable recreationists to better plan and anticipate participation in their preferred activities.

During flow releases at Saluda Dam, upstream sections of the LSR, primarily in the vicinity of Metts Landing and Corley Island, experience the greatest increase in river stage during the shortest time durations at all flow levels. According to flow modeling (Kleinschmidt, 2007d), during the first 15 minutes of a flow release of 18,000 cfs, the overall net increase in river stage over baseline conditions is over 4 feet 3 inches. This produces a rate of change, how quickly the water rises at a given point, of approximately 3.4 inches per minute. A release of 10,000 cfs would produce a net increase in river stage of 3.65 feet at Metts Landing and 2.16 feet at Corley Island during the first 15 minutes after the initial water level increase (wave arrival). This would result in a rate of change of 2.9 inches per minute and 1.7 inches per minute, respectively (Kleinschmidt, 2007d).

This rate of change is generally attenuated as flows decrease and as the river release progresses downstream. At sites downstream of Corley Island, the rate of change experienced during the first 15 minutes of wave arrival for flows of 5,000 cfs is generally less than 0.24 inches per minute. Oh Brother Rapids and Ocean Boulevard, popular sites for wade angling activities, would generally experience a net increase in stage over baseline conditions of 1.86 feet and 0.85

feet over the first 15 minutes of water arrival, respectively, during the 18,000 cfs release. This results in a rate of change of 1.44 inches per minute at Oh Brother Rapids and 0.72 inches per minute at Ocean Boulevard. The Mill Race sites experience stage increases and rates of change that are much more tempered than upstream sites, even at higher flows. Specifically, Botanical Gardens and Shandon Rapids experienced an increase of 2.03 feet and 1.92 feet, respectively, at flows of 18,000 cfs during the first 15 minutes of wave arrival (Kleinschmidt, 2007d)

To address concerns regarding the rate of rise and overall increased water levels during project generation, SCE&G is working with the Safety RCG to identify additional locations for sirens and strobe warning devices. Given the location of the existing sirens and the calibration of the volume to reach upstream and downstream of the existing locations, only 7 percent of the 11 miles of the lower Saluda River are currently covered by the existing warning system. However, the locations, operational settings, and decibel levels of the existing warning systems are designed to provide for public safety at high use areas of the river while attempting to minimize the effect of loudness, frequency and duration to residences and businesses located within proximity of the lower Saluda River (S&ME, 2004). SCE&G will continue to work with stakeholders to improve the adequacy of the project flows warning system which will provide an additional measure of safety for users of the LSR.

7.12 Comprehensive Plans

South Carolina Department of Parks, Recreation, & Tourism. 2002. South Carolina's Statewide Comprehensive Outdoor Recreation Plan (SCORP). Columbia, South Carolina. 2002.

As discussed in section 7.7.1, the 2002 State Comprehensive Outdoor Recreation Plan (SCORP) is South Carolina's official comprehensive outdoor recreation plan. Section 7.7.1 also discusses those issues identified in the plan that are applicable to the Project and how they are addressed.

South Carolina Department of Parks, Recreation, & Tourism. 2002. The South Carolina State Trails Plan. Columbia, South Carolina. 2002.

As discussed in section 7.7.4, the State Trails Plan was developed to promote coordination between state agencies, advocates, and the public with respect to trail acquisition and development, assist resource managers in the decision making processes that affect trails development such as grant funds, and to promote the state as a leader in trails development, tourism and recreation. SCE&G will continue to coordinate with SCPRT where feasible. Furthermore, SCE&G has proposed to place 14 tracts totaling 275.14 acres, plus the 45.04 acres already in the Scenic River Easement, into the recreation classification along the LSR. These tracts will be open to the public.

South Carolina Department of Natural Resources. 2000. Lower Saluda Scenic River Corridor Plan Update. Columbia, South Carolina. December 2000.

As discussed in section 7.7.2, the Lower Saluda River Corridor Plan (LSRCP) is the result of a cooperative effort among community leaders, interested individuals, and landowners of which SCE&G is one. Its objective is to conserve and enhance the 10-mile segment of the Lower Saluda River, beginning one mile below Lake Murray Dam to its confluence with the Broad River. At its conception in 1990, the LSRCP was oriented to advance goals toward water quality improvement, land conservation, improved river access, and river safety. The 2000 update to the LSRCP identified recreation as the primary issue of concern, given the significant increase in activity on the river, although water quality and safety continue to be concerns. In 1991, the LSRCP led to designation of the LSR as a State Scenic River for the outstanding natural resources it provides within the highly urbanized environment of Columbia, South Carolina. Among the natural resources so prized are the cold water fishery, recreational boating opportunities, and rare threatened and endangered species habitat.

Water from the Lake Murray tailrace directly contributes to the LSR and thus, has a direct effect on the valued resources of the river corridor. Stream flow is regulated by releases from the Saluda Hydroelectric facility. SCE&G has been an active participant on the Lower Saluda Scenic River Advisory Council since its creation in 1989, and they have worked closely with other members of the advisory council to accomplish LSRCP goals regarding increasing minimum flows, improving water quality for fishery habitat, increasing safety of water releases, improving management of river access sites on

SCE&G lands, and connecting recreation sites through greenways to lessen impacts to surrounding lands. Many of these issues have been addressed through the collaborative effort of relicensing the Project. And in fact, most of the members, or member's organizations, of the Lower Saluda Scenic River Advisory Council also held positions on the various TWCs assembled for Saluda Project relicensing.

7.13 Recreational Resources Photographs

Photo 7-1: Damsite

Photo 7-2: Parksite

Photo 7-3: Larry Koon

Photo 7-4: Shull Island

Photo 7-5: Bundrick Island

Photo 7-6: Murray Shores

Photo 7-7: River Bend

Photo 7-8: Higgins Bridge

Photo 7-9: Kempson Bridge

Photo 7-10: Lake Murray Estates Park

Photo 7-11: Macedonia Church

Photo 7-12: Sunset

Photo 7-13: Rocky Point

Photo 7-14: Dreher Island State Park

Photo 7-15: Hilton

Photo 7-16: Mill Race A

Photo 7-17: Mill Race B

7.14 Recreation Figures

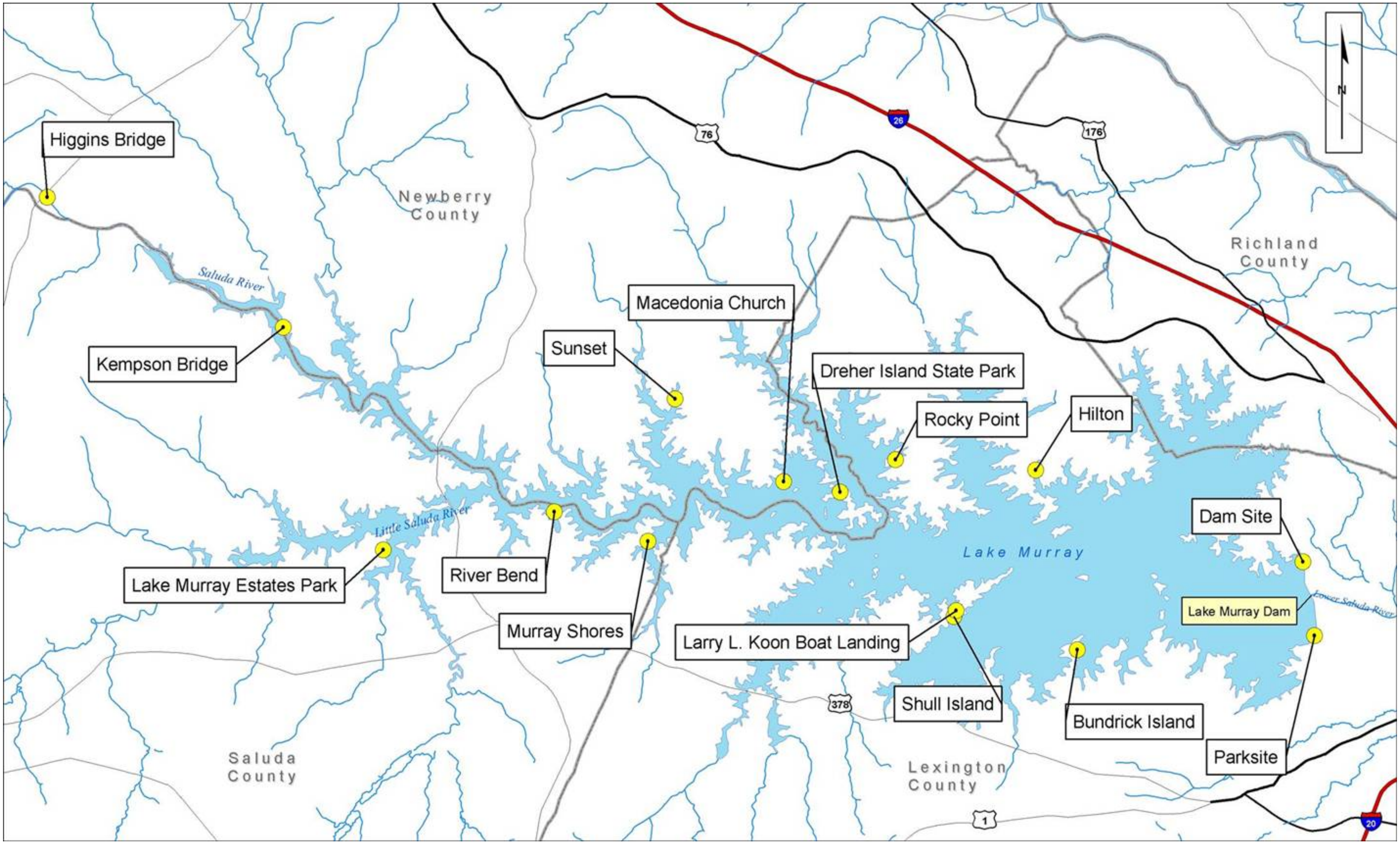

Figure 7-1: Lake Murray Recreation Sites

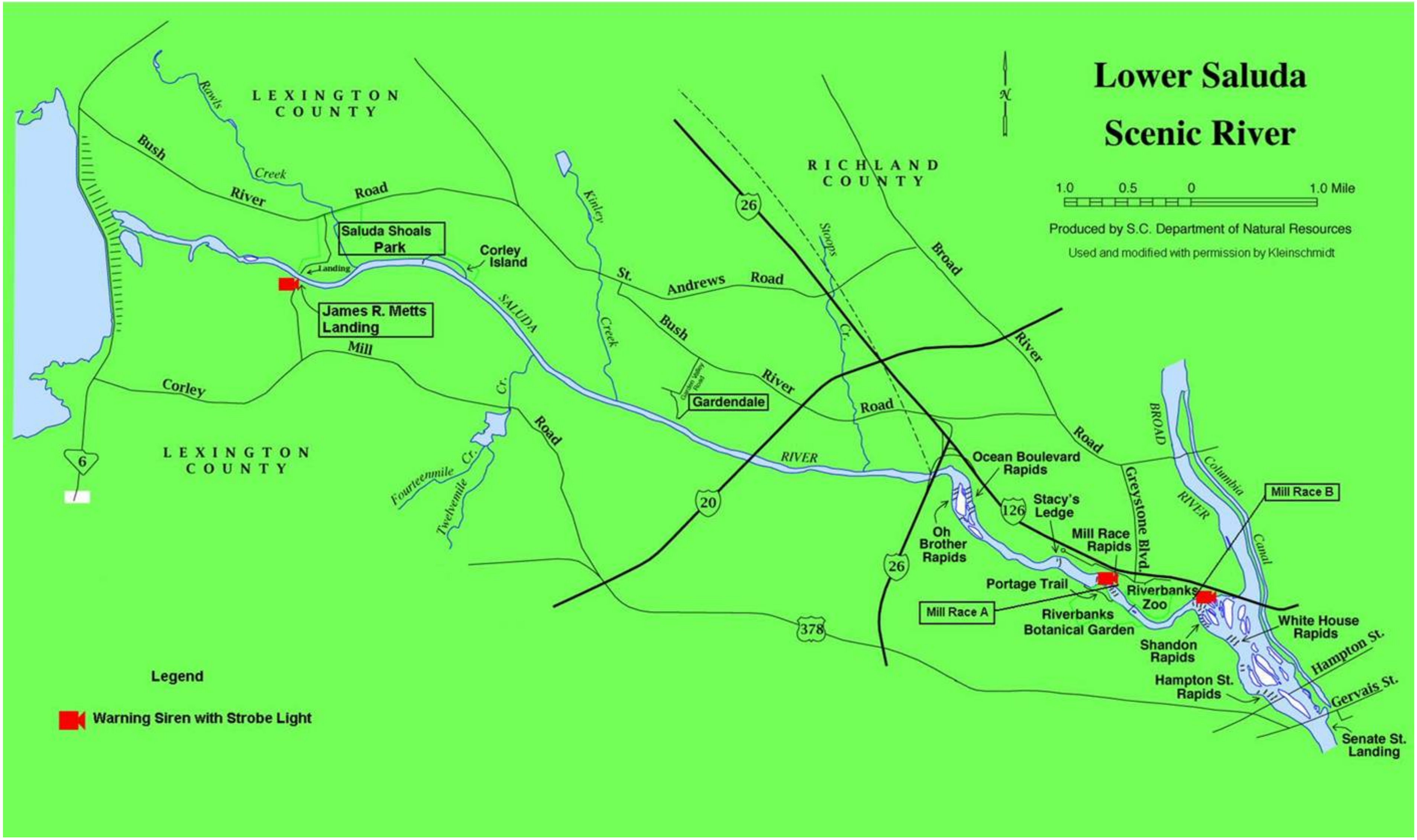

Figure 7-2: Lower Saluda River Recreation Sites

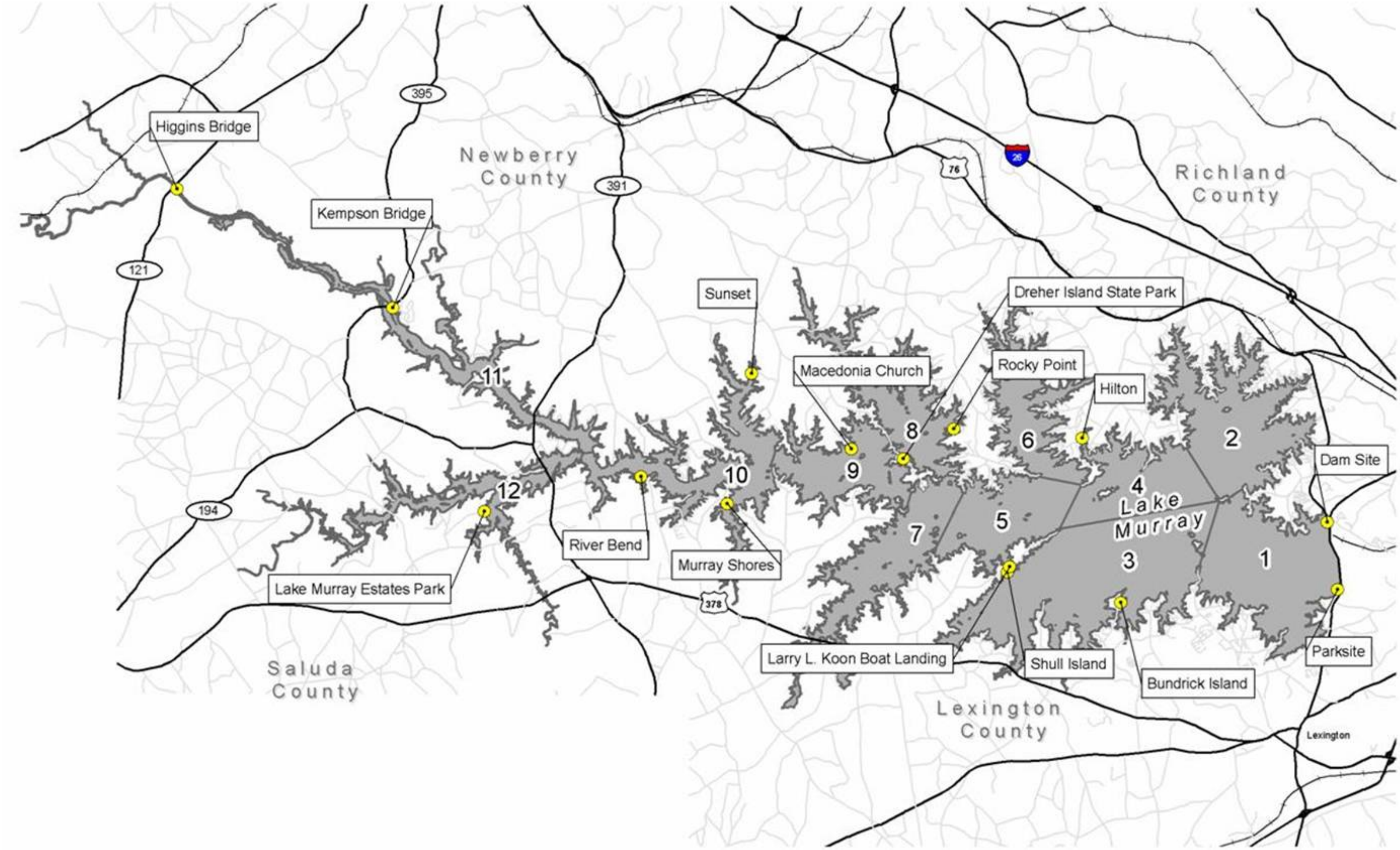

Figure 7-3: Segments of Lake Murray Used for the Boating Density Analysis

8.0 LAND MANAGEMENT AND AESTHETICS

The Saluda Project[16] is located in the Santee River Basin in the Piedmont region of South Carolina, near the City of Columbia. The Santee River Basin is comprised of the Santee, Congaree, Catawba-Wateree, Broad and Saluda Rivers.

8.1 Existing Development, Land Use, and Aesthetics

8.1.1 Development and Land Use

8.1.1.1 Region

The Project lies within Richland, Lexington, Newberry and Saluda Counties in South Carolina, with Lexington County having more Project property than any other of the counties (*Project Location Map, Exhibit A-1)*. At 756 square miles in size, Richland County is the largest of the four counties, followed by Lexington County (699 square miles), Newberry County (631 square miles) and Saluda County (452 square miles) (South Carolina Association of Counties, 2004). Richland and Lexington Counties are among the most densely populated counties in the sate, ranking 2nd and 5th respectively out of 46 counties total (Ibid).

Richland County supports the University of South Carolina and Fort Jackson, the largest army-training military facility in the U.S. The county is viewed as being in the head of South Carolina's transportation hub (Richland County, 2003). It is served by three interstate highway systems, eight additional major U.S. highways, five passenger airlines, and bus and passenger rail services (South Carolina Association of counties, 2004). The City of Columbia is the county seat, and also the state capital.

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[16] Unless otherwise noted, all elevation references in Exhibit E are given in North American Vertical Datum 1988 (NAVD 88); conversion to traditional plant datum (PD, used in numerous supporting studies for this License Application Exhibit and often erroneously referred to as msl) requires the addition of 1.50 feet.

The City of West Columbia is located in Lexington County, where a majority of Project lands and Lake Murray lie. Lexington County is served by several major transportation routes connected to the capital city (South Carolina Association of Counties, 2004). The City of Lexington is the county seat.

Saluda and Newberry Counties are home to the southwestern and northwestern reaches of Lake Murray, respectively. Large tracts of the Sumter National Forest are located in both counties but are not part of the Project. The Long Canoe Ranger District occupies the most western reaches of Saluda County and the Enoree Ranger District occupies the northern portion of Newberry County. Transportation infrastructure in the counties is substantial, though as between Saluda and Newberry counties, only Newberry County has a major highway system running through it. The communities of Saluda and Newberry serve as the county seats for these two counties.

Richland, Lexington and Newberry Counties all have zoning and/or land use plans in place to guide development in unincorporated areas. Incorporated communities in these counties generally maintain separate zoning requirements. There is no zoning or land use plan in place for Saluda County, though incorporated areas within the county do have zoning.

8.1.1.2 Project Area

Land use in the vicinity of the Project is influenced by topography, soil characteristics, and allowable uses of land and water resources. Social and economic factors such as employment, population and development also influence land use patterns.

Land use within the Project boundary is subject to various state, federal, and local regulations in addition to SCE&G's Shoreline Management Program, which includes the company's Shoreline Management Plan (SMP). The Program identifies the major land uses around the lake and the location of environmentally sensitive areas, and is designed to balance competing demands for and uses of limited shoreline resources. Specifically, the Program provides strategies regarding the management and permitting of shoreline activities and facilities within the Project boundary, and is based on management practices established by SCE&G over the years.

SCE&G developed its shoreline permitting program in 1975, and added land use component to the program, the SMP, in 1980. The Shoreline Management Plan (SMP) has been updated every five years in consultation with relevant federal, state and local agencies. The most recent plan was submitted to FERC on February 1, 2000 and was approved by FERC with modifications on June 23, 2004 (107 FERC ¶ 62,273) and further clarified and modified on October 28, 2004 (109 FERC ¶ 61,083).

As part of the relicensing process, SCE&G agreed to review lands within the project boundary and potentially revise their classifications. This process is referred to as “rebalancing.” Item 40 and ordering paragraph F of the order of June 23, 2004 approving and modifying the updated SMP directed SCE&G to establish procedures and criteria for future land re-classifications (rebalancing) to be included in the relicensing proceedings. (South Carolina Electric & Gas Company, 107 FERC ¶ 62,273). Through rebalancing, land use classifications were consolidated to simplify the SMP and clarify its intent, while adhering to the historical management prescriptions agreed to and developed with agencies and stakeholders. The outcome of rebalancing includes a revised SMP that consolidates previous documents and provides comprehensive guidance for the management of project lands on the Lake Murray shoreline.

In the Draft SMP, currently out for public review and finalized by the Lake and Land Management TWC, there are four distinct land management classifications: Multi-Purpose, Public Recreation, Natural Areas, and Project Operations. These land management classifications and their associated management prescriptions are provided below. Final land management classifications and prescriptions will be discussed in more depth in the Final SMP (SCE&G, 2008).

Multi Purpose

Within this classification are four sub-classifications as follows:

- Easement Properties includes lands that SCE&G has never owned, or sold but holds and retains easements on within the PBL. These lands may support a variety of uses including privately-run commercial ventures and residential developments.
- Commercial sub-classification includes lands that SCE&G owns but that have been leased for commercial uses.
- 75-foot Setback sub-classification refers to the 75-foot-wide setback lands (formerly referred to as buffer zone) between the 358.5-foot contour (high water mark) and the adjoining back property line. These areas were first required per the 1984 FERC license order, and they are protected under the SCE&G permitting program as vegetated areas.
- Future Development lands are SCE&G-owned and located between the 358.5-foot and the PBL. They are generally undeveloped but are sellable and available for development with certain restrictions encompassed in SCE&G's permitting program and regulated by FERC.

Public Recreation

Project lands under this classification are recreational resources for the public and include areas managed expressly for recreation as well as those with recreation as a secondary usage. They include SCE&G-owned properties, such as islands. Public lands devoted to public recreation include developed parklands and, properties set aside for future recreational development as well as some forest lands leased by SCE&G to SCDNR as part of the statewide Wildlife Management Area (WMA) Program. It also includes State Parks and publicly available islands owned by SCE&G. SCE&G manages the areas individually based on the specific, designated recreational activities including swimming, picnicking, boat launching, etc.

Natural Areas

Natural areas consist of lands that warrant special protection because they provide important habitat for various wildlife species, have large wetlands; cultural and/or historical significance, or include Environmentally Sensitive Area (ESA). Natural Areas are not available for sale and docks, excavations, and other potentially damaging shoreline activity is not permitted in these areas. Additional measures have been implemented to protect Natural Areas.

Project Operations

Properties classified as Project Operation contain project works critical to the operation of the Saluda Project. Public access to these lands is restricted for reasons of safety and security.

A supporting component of the SMP, which provides specific guidance and specifications for development and activities along the shoreline, is SCE&G's Shoreline Permitting Program. The Permitting Program allows SCE&G to monitor construction, water withdrawals, maintenance and placement of docks, boat lifts, boat ramps, excavation, seawalls, rip rap, vegetation clearing and other shoreline developments/activities (SCE&G, 2007). SCE&G will provide a detailed permitting handbook that contains the permitting processes and specifications for various shoreline developments as part of the comprehensive settlement agreement. Permitting fees are assessed for most structures to help defray some of the costs of the program management. The permitting program and associated fees are available on SCE&G's Project website.

8.1.2 Aesthetics

FERC's Final Environmental Assessment for the Saluda Dam Seismic Remediation provided an excellent summary of the aesthetic characteristics of the Saluda Project (FERC, 2002). Except where noted, the information reported in this section is taken directly from that document.

The Saluda Project is located in an area of low, rolling hills between 300 and 1000 feet above sea level and has a local relief of approximately 100 feet. The lake is characterized by multitudes of irregularly shaped peninsulas and numerous inlets and islands, most of which are heavily forested.

At about 48,000 acres, Lake Murray is the fifth largest lake in South Carolina, following Lakes Marion, Thurmond, Hartwell and Moultrie (SCPRT, 2002 in FERC, 2002). It is located in close proximity to South Carolina's capital city and it supports a significant recreation industry. Since its development, the lake has become a natural draw for residents and tourists alike. The early 1970s saw a marked increase in development pressure on the lake, and today much of the lake is developed, primarily for residential use (FERC, 2003). Parkland, protected lands, and 75-foot setback areas around the lake provide a natural buffer between Project waters and homes constructed after the buffer policy was implemented in 1981 (16 FERC ¶ 62,479) (Although the original buffer requirement as approved by the Commission was fifty (50) feet, few if any properties had only a 50 foot buffer imposed). Shoreline development consists primarily of residences, docks, gazebos and boat lifts, and in some places, particularly prior to the implementation of the first SMP, clearing has resulted in some areas having a maintained and manicured appearance.

The eastern half of the lake comprises the main body of the reservoir and has an expansive viewshed over miles of open water and a few large inlets. The majority of the shoreline in this area is tree covered and interspersed with extensive shoreline development, ranging from individual private docks and large houses to marinas, landings, and park sites. A few large forested islands are located in the main body of the reservoir. The light to moderate tree covered shoreline and the lake's forested islands dominate most distant views across the open water and soften the contrasting shoreline development. The Project's Dam and five large intake towers are clearly visible from the main body of the reservoir. With the extended viewshed of the main body of the reservoir and the tree-covered shoreline, these manmade structures do not detract significantly from the overall visual character of the reservoir.

The western half of the lake is more riverine in nature than the main body of the reservoir and branches out into narrow arms that extend up into many drainage ways and creeks that enter the reservoir. Viewsheds in this area are varied and shortened by the encroaching shoreline and the increased number of small coves, creek beds, and drainage ways. Overall, the shoreline contains less intensive development and more trees and vegetation than the main body of the reservoir. Much of the development in this area includes individual private boat docks and small houses. Typically, the upper ends of the coves in this area are narrow, undeveloped, and heavily vegetated.

The downstream area affected by the Project includes the north and south side of the river downstream of the existing Dam. The north side of the river is disturbed by existing development, primarily the Project powerhouse, McMeekin Station and various appurtenant facilities. The south side of the river is disturbed by an ash landfill and wastewater pond associated with McMeekin Station, a Training Center and borrow area used during the Saluda Dam Remediation Project. The area downstream of the Dam is primarily not visible from Highway 6, a state highway with north and southbound lanes, as it crosses over the original Dam due to the construction of the new Back-up Dam. Views of the open water, the Project's intake structures and distant shoreline of the reservoir as well as the City skyline on clear days are prominent from the highway and create a generally pleasing viewshed. Motorists have somewhat fleeting views of the areas upstream of the Dam as they drive on Highway 6. Given the relatively limited, fleeting views of the downstream area and its partially developed nature, the aesthetic quality of the downstream area is considered to be moderate.

During normal water levels, portions of the lake bottom along the periphery of the reservoir shoreline and islands and bars are exposed. At elevation 348.5, the reservoir has a surface area of about 40,000 acres and about 8,000 acres of lake bottom is exposed. The lake bottom appears as a dark band of substrate around the periphery of the reservoir and around islands and bars. Exposed aquatic vegetation, tree stumps and woody debris are present throughout much of the dewatered area. In general, the shoreline around the main body of the reservoir, including the back ends of small coves, is gently slopes. The shoreline along upper reaches of the lake, including the longer, narrower coves and inlets tend to have more steep slopes (SCE&G Tommy Boozer, personal communication).

The LSR is classified as a State Scenic River and is detailed in the Lower Saluda River Corridor Plan (lower Saluda RiverTF, 1990). This plan was developed by a committee assembled to address the preservation and enhancement of the LSR's natural, cultural and recreational features. This committee was originally developed in 1988 and outlined a set of formal goals, as listed below:

- Enhance existing and potential recreational, natural, and cultural values.
- Examine potential impacts of anticipated growth.
- Develop management alternatives to guide future corridor planning.
- Study use patterns and make recommendations regarding safety issues.

The Lower Saluda River Corridor Plan is primarily broken into two parts. Part A consists of over 70 recommendations developed by the committee and are regarding items such as access and facilities, historic and archaeological sites, law enforcement, litter, resource protection, tourism, and user safety. The second section of the plan, Part B, is the detailed visual plan for the river that contains conceptual plans for future park sites, as well as future ingress/egress points. In summary, this plan focuses on maintaining the integrity and natural environment of the Saluda River corridor, while balancing the continued development of the area (lower Saluda RiverTF, 1990). An update to this plan was developed in 2000, and is to be used in conjunction with the original document. Although many of the recommendations included in the plan are outside of the purview of the FERC relicensing, any access or facilities incorporated as a result of the relicensing will be consistent with the Lower Saluda River Corridor Plan, and its update.

8.2 Agency and Public Recommendations Concerning Land Use

8.2.1 Initial Stage Consultation

On April 29, 2005, the Initial Consultation Document (ICD) for the Saluda Hydro Project was sent in electronic format to the consulting agencies and stakeholders for review. The Notice of Intent (NOI) was also filed simultaneously with the issuance of the ICD. The ICD is attached in Volume II. Study requests and comments on the ICD were due by August 1, 2005, and can be viewed in Volume II.

Summarized below, are the remarks and study requests regarding Land Use and Aesthetics that were provided by stakeholders in comment letters following the issuance of the ICD.

In their August 11, 2005 ICD comment letter provided during initial consultation, the SCDNR requested that a rebalancing of the developmental and non-developmental status of project lands occur (See Volume II for comment letter). The USFWS also called for an evaluation of land use at the Project in their August 1, 2005 ICD comment letter (Volume II).

This activity is also requested in the August 12, 2005 ICD comment letter provided by the LSSRAC (See Volume II). In the above stated comment letter provided by the LSSRAC it is noted that they "recommend that an inventory of land ownership around the Project boundary be conducted to determine the feasibility of aggregating desirable parcels for parks, open spaces, other recreation, habitat preservation, and viewshed protection".

There is also concern shown by Lake Watch for the future development lands in their August 15, 2005 letter noting that "Project land classifications are heavily weighted towards development, with most of the protected areas located in the upper most tributaries" (Volume II).

The South Carolina Wildlife Federation (SCWF) stated in their ICD comment letter (letter dated August 15, 2005) that they are also concerned with the wildlife habitats around the Project area. They recommended that "areas with high natural resource values should be set aside and protected for the conservation of wildlife and their natural habitat".

In an ICD comment letter, dated August 12, 2005, the SCPRT recommended that the current Project lands be reviewed in consultation with resource agencies and stakeholders. It also expressed concern that the current allocation of Project lands raises concern that there is not enough land allocated for future recreational needs.

The CCL/American Rivers, in a joint letter dated August 10, 2005, also requested that the land classifications be reviewed at the Project. It is noted in the above mentioned letter that this is to "ensure that an adequate balance of shoreline uses is achieved in the future".

Project lands have been a topic of discussion for the Lake and Land Management RCG and TWC. They have to date completed a Project lands rebalancing exercise in February and April of 2007. Moreover, the group has been involved in evaluating several proposals made by SCE&G and individual stakeholders (discussed further in Section 8.1.1.2).

Several agencies and non-governmental organizations (NGOs) called for an update of the SMP in their comment letters responding to the ICD. The USFWS in their ICD comment letter dated August 1, 2005, requested that the SMP be updated and revised in consultation with the state and federal resource agencies.

The request to review and update the SMP was also made by Lake Watch in their August 15, 2005 ICD comment letter. They noted that "there are many problems with the existing shoreline plan that need to be addressed in the relicensing process". Lake Watch also outlined the particular sections of the SMP that they believe need to be addressed. These sections include docks, commercial and private marinas, erosion and sedimentary control, excavation, permitting application process, public education, and buffer zone restoration.

The Lake and Land Management TWC has systematically reviewed the individual sections of the SMP and has made subsequent recommendations concerning the various subjects included therein. A new SMP has been developed in consultation with TWC members. Meeting notes regarding the TWC's update of the SMP can be viewed in Volume II. The revised SMP and Permitting Handbook will be filed with the FERC following public review.

In their letters responding to the ICD the Lake Murray Homeowners Coalition (LMHOC) (letter dated August 15, 2005) and Lake Watch (letter dated August 15, 2005) requested that a shoreline development impacts study be performed. LMHOC explained further in their ICD comment letter that development impacts should be studied as they related to fish and wildlife habitat, recreation, water quality and safety.

As discussed previously, the Lake and Land Management TWC has to date completed a Project lands rebalancing exercise in February and April of 2007. Meetings to discuss the results of the rebalancing exercises began in November of 2007 and have continued through 2008. During this process resource agencies and stakeholder representatives assessed various characteristics of the shoreline in order to make recommendations on land uses and classifications. Shoreline development and its impacts are directly taken into account during the rebalancing, as well as environmental and recreational resources.

Subsequent to their review of the ICD, several entities noted that they would like to see the buffer zones and environmentally sensitive areas identified and mapped. The Lake Murray Association (letter dated August 12, 2005) and the Newberry County Government (letter dated August 15, 2005) both recommended this in their comment letters responding to the ICD. The SCWF (letter dated August 15, 2005) also recommended that these areas be identified and mapped. However, the SCWF further requested that a form of monitoring, protection and re-establishment after misuse be discussed.

SCE&G has updated their shoreline maps to include all ESA's and buffer zones. This information is contained in a GIS database and has been submitted to the SCDNR and USFWS. Further, these maps have been included in the new SMP developed in the relicensing process. Further monitoring of shoreline buffer zones and ESA's is done on a periodic basis by SCE&G shoreline management, which includes photo and video documentation of ESA's within the PBL.

In their August 15, 2005 comment letter, Newberry County Government recommended that the Base Flood Elevations be identified on a lake map. They explained that "this action will reduce the risk of property owners building in the flood zones associated with the Project boundary".

This is not a relicensing nor project related issue since county zoning ordinances dictate building requirements. Therefore, this is not being addressed during the relicensing.

Upon review of the ICD, the LSSRAC recommended in their August 12, 2005 comment letter that an inventory of the ESA's on the LSR be performed. Specifically, they state that "[c]onsiderable effort and attention has been directed to Lake Murray shoreline management and the classification of environmentally sensitive areas on the lake. However, the ICD indicates that there is very little information on the natural/sensitive areas of ecologically significant resources along the lower Saluda River; therefore, we think that additional inventory, assessment, and conservation planning for these resources is needed".

SCE&G currently maintains a 100 ft buffer along the river channel on land that they own in order to protect water quality and the scenic values of the river. SCE&G proposes to place additional lands along the lower Saluda River into a recreation category and will file the details with the in conjunction with the Comprehensive Settlement Agreement for consideration and inclusion in the new license.

Lake Watch requested, in their subsequent comments to the ICD issuance, that a study be considered to evaluate the existing aesthetic resources (letter dated August 15, 2005) on Lake Murray. Lake Watch noted that this study should be related to development, as they estimate that 95% of the Lake shoreline will be developed based on current land use designations.

During Project land rebalancing exercises, aesthetics were considered during the scoring process. Lands were judged according to the degree which the shoreline was naturally vegetated. This would include land cover such as pine, hardwood, bottomland hardwood forests, and natural rocky points. Meeting notes can be viewed in Volume II (dated December 20, 2006).

8.2.2 Second Stage Consultation

As detailed above, a series of RCG meetings were held as a part of second stage consultation. Consultation in the area of Land Use and Aesthetics during these meetings is described below. Many items that were requested in the ICD comment letters were also requested during the resource group meetings. This is noted in the responses under Section 8.2.1, Initial Stage Consultation. Only additional studies, not discussed above, are included in this section.

In the February 9, 2006 Lake and Land Management RCG meeting, it was discussed that the SCDNR had requested that intermittent and perennial streams be mapped and their associated 75' buffer zone.

SCE&G has since mapped all of the environmentally sensitive areas, intermittent and perennial streams and buffers into a GIS database and will be made available in the SMP.

Lake Watch requested in the February 9, 2006 Lake and Land Management RCG meeting that a technical committee be formed to identify and review all of the Federal and State regulations that have a nexus to the management of the Project and associated lands. It was also recommended that this group meet with FERC staff in order to clarify FERC regulations and requirements.

On April 20, 2006, SCE&G hosted a Quarterly Public Meeting to address this subject. The FERC Representative for the Saluda Project, Allan Creamer, was available for a relicensing question and answer session (meeting notes are contained in Volume II).

Similarly, Lake Watch also requested in the February 9, 2006 Lake and Land RCG meeting that Tennessee Valley Authority (TVA) and ACOE studies on shoreline development be reviewed.

During the relicensing meetings, the group reviewed TVA and ACOE guidelines when they felt it necessary to aid in the development of various shoreline management goals. On May 8, 2006 the TWC reviewed TVA and Corps *guidelines for bank stabilization while discussing what guidelines on Lake Murray should entail (meeting notes are contained in Volume II).*

In their comments for the February 9, 2006 Lake and Land Management RCG meeting, the SCDNR requested that management restrictions be developed and placed in the SMP that limit encroachments around ESAs.

On March 28, 2006 the Lake and Land Management Technical Working Committee (TWC) (a sub-committee of the RCG) discussed the implementation of a buffer zone around continuous ESAs. Through these discussions, and further discussions on the SMP and Permitting Handbook, it has been determined that ESAs should have a 50-foot natural buffer zone designated around them.

At the November 1, 2005 Lake and Land RCG meeting, Lake Watch requested that a Communications/Procedural TWC be developed. Lake Watch noted that its purpose would be to study how those parties involved in the relicensing process could better work together and communicate to work towards various goals and objectives.

The RCG discussed this issue and it was concluded that if increased communication between groups was needed then joint group meetings would be held (See November 1, 2005 meeting notes in Volume II). SCE&G also developed Operating Procedures on September 5, 2005 that were reviewed and commented on by the stakeholders and subsequently finalized in December of 2005 (Volume II).

Subsequent to the submittal of the Draft License Application (DLA) in December of 2007, further comments and study requests were provided by several entities in response to the issuance. Comments in reference to land use and aesthetic resources are provided below.

In response to the proposal for future development lands presented by SCE&G to the TWC on January 22, 2008 (meeting notes included in Volume II), DNR noted several further recommendations for future development lands in their March 14, 2008 DLA comment letter. They recommend that: the buffer width be increased from 75 to 100 ft, the width of shoreline needed to acquire a dock be increased from 150 to 200 ft, the identification of "strategic" properties along the lake to be protected from development, the identification of a large tract of land adjacent to the Project for water-based public recreation, the development and management of a migrating and wintering waterfowl area, to address the management of SCE&G owned lands along the LSR, and to place all currently classified Forest Management lands into Conservation Easement.

In their DLA comment letter, the USFWS also makes recommendations regarding the SMP. They note the following should be incorporated into the SMP: "1) no docks allowed within the Forest and Game Management Areas, 2) 100 ft vegetated, undisturbed buffer on fringeland sales, 3) increase width of shoreline needed to acquire a dock from 150 ft to 200 ft and, 4) fund and develop management areas for migrating and wintering waterfowl, as ordered by FERC."

The USFWS (DLA comment letter dated June 3, 2008) provided several comments in response to rebalancing. They note that they are greatly concerned with this issue and support the proposal made by the stakeholder focus group on April 8, 2008.

Since the stakeholder focus group proposal on November 8, 2007, SCE&G has made several counter proposals on rebalancing and the management of future development lands to the TWC, culminating in the proposal that was given on June 10, 2008. SCE&G has included in this proposal many of the stakeholder recommendations made thus far in the process and the proposal is being considered as the rebalancing component of a comprehensive settlement agreement.

There were several comment letters on the DLA sent in by individuals. One letter, submitted by James L. Leslie of Lake Murray Docks, notes that he recommends that the commercial boat dock permitting process should not be restricted from public disclosure at any point during the process. He continues to note that all files should be made public. He also suggests how he believes this process should take place.

The Applicant complies fully with the Commission's policies set forth in the standard license articles dealing with land use and shoreline management.

There were also several emails submitted by stakeholders (email dated February 12, 2008, included in Volume II) that note their desire for higher mean lake levels. Two other emails submitted by individual stakeholders (both emails dated January 18, 2008) note the stakeholders' belief that SCE&G should not be listed as the owner of Lake Murray and the public should instead be listed as the owner. In these comment letters the stakeholders also note that there should be no more sales of Project lands and the value of the Project lands should be purveyed to the public.

All of these issues have been thoroughly evaluated in the RCG's and TWC's. The resolution of these issues is addressed in part in the Application and will be addressed further as part of the Comprehensive Settlement Agreement.

8.3 Applicant Proposed Mitigation

As mentioned previously, in conjunction with its relicensing activities SCE&G assembled a diverse group of stakeholders in the Lake and Land Management TWC to revise and make more comprehensive the Shoreline Management Plan (SMP), as well as perform "land use rebalancing" (as ordered in the June 23, 2004, (107 FERC ¶62,273) Order). Rebalancing discussions ensued in the TWC on October 31, 2006, with more formalized discussions occurring on November 21, 2006 (see meeting notes in Volume II). At that time, the TWC decided to undertake a two-fold approach to rebalancing by reviewing both the economic and natural resource values of the individual parcels of current SCE&G future development lands. Subsequently, members of the TWC were placed on two separate committees, economics and natural resources, to consider and score the values of the future development lands without prejudice. Each parcel of the 299 future development properties was assigned an economic "value" as well as a natural resource "value" by the two separate committees on February 26 & 27, 2007(natural resources) and April 3 & 4, 2007 (economics). These "values" or "scores" were considered in future land classification and rebalancing discussions.

As explained previously, the process of land use rebalancing also included consolidating and renaming the original ten land use classifications down to four: Public Recreation, Natural Areas, Project Operations, and Multi-Purpose. The Multi-purpose classification is further composed of four sub-classifications: easement, commercial, 75-ft buffer zone, and future development.

Subsequent to the land scoring exercise preformed by the TWC subcommittees in early 2007, there were several proposals made by both SCE&G and individual stakeholder groups on the rebalancing of future development lands. This culminated in the proposal presented by SCE&G on June 10, 2008, into which SCE&G incorporated many of the recommendations made by resource agencies and stakeholders (presentations available in Volume II). SCE&G's June 10, 2008 presentation proposes to protect from development 9,189 acres of land and 185 miles of currently undeveloped shoreline - lands identified as providing natural resource, recreation, and scenic values (Table 8-1). The majority of the protected acreage came from reclassifying previously designated Future Development lands to forest management, which is now included under the Public Recreation Classification. In addition, SCE&G proposes to lease 24 large forested tracts, a total of 2,754 non-project acres, to SCDNR. Table 8-2 shows the rebalancing, in acreages and shoreline miles, of Project lands as proposed by SCE&G. Approximately 860 acreages and 40 shoreline miles were removed from the Future Development classification (now a sub-classification under the Multi-Purpose Classification) and placed in more protective classifications. The Natural Areas classification received almost half of this acreage, increasing in size from 42 to 506 acres.

Moreover, during rebalancing the TWC emphasized preservation of large, contiguous blocks of lands to minimize land use fragmentation. Such lands included shoreline acreage on the LSR and forested lands in the upper region of Lake Murray. In the June 10, 2008 proposal, SCE&G noted that in addition to the 45.04 acres already in the Scenic River easement on the LSR, they were proposing to classify 14 tracts totaling 275.14 acres as recreation. Thus increasing the Project lands preserved along the LSR to 320.18 acres. Further, and as described above, in order to enhance both the natural and recreation values of the Project, SCE&G has proposed to lease 24 non-project timber tracts totaling 2754 acres to SCDNR for the life of the new license. These tracts are located in the upper portion of Lake Murray, with all but one tract being contiguous with the PBL. If the rebalancing proposal is accepted by the TWC as part of the

Comprehensive Settlement Agreement, then there is the potential for SCDNR to include these lands as part of the State WMA (wildlife management area) program. The rebalancing proposal will be included with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. SCE&G proposes to implement the rebalancing proposal after issuance of a new FERC license for the Project.

Table 8-1: Summary of Project and Non-Project Shoreline Mileages and Acreages Placed in New Classifications Following Re-Balancing Source (SCE&G 6/10/08 Presentation)

	New Classification[a]							
	Natural Areas		**Forest Management** (*under* Public Recreation Classification)		**Other Public Recreation**		**Leased to SCDNR**	
	mi.	**acres**	**miles**	**acres**	**miles**	**acres**	**miles**	**acres**
Previously Future Development	23	506	110	3,776	47	953	-	-
Non-Project Lands	-	-	-	-	-	658	-	2,754
Lower Saluda River	-	-	-	-	6	541	-	-
Sub-Totals	23	506	110	3,776	53	2,152	-	2,754
Grand Total Lands Protected from Development:	**185 miles**		**9189 acres**					

[a] Values are approximate, rounded to whole number. Mileage values are for shoreline mileage.

Table 8-2: Project Lands Previously Classified as Future Development Lands Reclassified to Other Classifications During Re-Balancing Source (SCE&G 6/10/08 Presentation)

Classification	**Acreage**[a]		**Shoreline Mileage**[a]	
	Before	**After**	**Before**	**After**
Natural Areas	42	506	2	23
Forest Management (*under* Public Recreation Classification)	3570	3776	100	110
Other Public Recreation	764	953	38	47
Future Development (now *under* Multi-Purpose Classification)	1818	958	91	51

[a] Values are approximate, rounded to whole number. Mileage values are for shoreline mileage.

Concurrent with land use rebalancing, SCE&G with the TWC made revisions to the SMP and Permitting Program. SCE&G also developed a detailed permitting handbook to accompany the SMP and educate potential project applicants on the permitting process and specifications for various shoreline developments and activities. Revisions include changes to SCE&G's management policy, permitting requirements, and development specifications. It also elaborates on formerly unaddressed matters.

Considerable additional protections to the environmental and scenic values of the Project will result from rebalancing, SMP revisions and changes to the Permitting Program. A summary of the proposed changes are provided below and a comprehensive table outlining the changes to the Permitting Program is provided in Table 8-3.

- Increases Lot Size.
- Requires multi-slip docks in lieu of individual docks, where appropriate.
- Establishes the entire 75-ft buffer zone as non-disturbance, which excludes brushing of any sort.
- Establishes a full 75-ft buffer zone around the lake by encouraging (as condition for dock permit) landowners owning down to the 360' ft to deed the required footage to SCE&G.
- Establishes 'Natural Areas' where development is prohibited.
- Restricts development within the Project boundary Line by only allowing sale of future development lands to the associated back property owner, and including in each deed non-development and vegetation management restrictions.
- Protects additional Forest Management & Recreation Lands.
- Dock Policy for Forest Management Lands.
- State Park on the Lexington Side of Lake Murray.
- Protect property on Lower Saluda River.
- Update and improve existing Park Sites.

8.4 Applicant's Policy Regarding Shoreline Development

Through SCE&G's SMP and Permitting Program (both newly revised and currently under public review), SCE&G aims to balance land use in the Project Area to maintain the environmental, aesthetic, and recreational character of the lands within the Project boundary. This has involved designating various lands as 'non-disturbance' areas, which restricts development activities and is intended to maintain these lands in a vegetated condition.

Shoreline vegetation is an important component to a healthy lake environment, and SCE&G's is committed to maintaining and enhancing the vegetated buffer around the lake. Forested, riparian buffers along reservoir shorelines provide a variety of environmental functions and ecological values. These include trapping and/or filtering sediment runoff; reducing bank erosion; removing phosphorous and other nutrients; and sequestering contaminants such as pesticides. A vegetated shoreline contributes leaves and other nutrients to the lake, as well as woody debris that provides fish and amphibian habitat. Overhanging shrubs and trees in the riparian zone helps to moderate near-shore water temperature for aquatic species, as well as provides habitat for terrestrial species, including nesting birds. Finally, vegetated buffers provide societal values. To some individuals, a "natural" shoreline appearance is generally more aesthetically pleasing than a highly manipulated one, and the increased wildlife activity that accompanies higher vegetation complexity contributes to a more enjoyable recreational experience.

During rebalancing, SCE&G identified a 'Natural areas' land use classification, which includes lands warranting special protection because they provide important habitat for wildlife; have cultural and/or historical significance; or are environmentally sensitive areas. Natural Areas are maintained as vegetated lands and are not available for sale, nor are docks, excavations, or shoreline activity permitted in these areas. Several of these areas exist below the high water mark (358.5 ft contour interval) and in the 75-ft buffer zone, particularly in the case of ESAs.

As described previously, after issuance in 1984 of the presently effective license, SCE&G began requiring that private property owners who bought land within the Project boundary maintain a 75-foot-wide vegetated setback located between the lake's high water mark (358.5-foot contour interval) and back property development. Owners of adjoining lands are allowed to travel by foot to the lake through the setback, and use setback lands for passive activities such as bird and wildlife viewing, picnicking, and hiking. However, they are not allowed to encroach with improvements or erect any water-oriented structures (docks, ramps, etc.), change the contour of the land, or post the property, without written consent from SCE&G.

With the recent changes to the SMP and Permitting Program the 75-ft set back lands are now designated as 'non disturbance' areas and now prohibit *any* vegetation clearing by back property owners who purchased their lands after approval of the 2007 SMP. Property owners who purchased their property *prior* to 2007, but after 1984, may still conduct limited brushing on lands that adjoin their property, including set back lands, not including lands below the 358.5-foot contour (previously referred to as the 360-foot contour), to remove exotic and invasive vegetation.

SCE&G has developed specific principles and guidelines for vegetation management aimed at encouraging native, riparian vegetation along the Lake Murray shoreline. Vegetation management of setback lands and lands below the 358.5-ft contour interval is described in SCE&G's *Buffer Zone and Riparian Zone Management Plan*, which was revised in 2007 and is included in the SMP (SCE&G, 2007). It describes management goals and strategies for addressing disturbed shoreline areas that require re-vegetation. Such disturbance may arise from natural or human causes such as flood-induced erosion or non-approved land use. The plan outlines coverage criteria for grasses, forbs, and shrubs; as well as duff or mulch layer thickness; spacing for replacement trees, when necessary; and recommended species for planting.

8.5 Comprehensive Plans

South Carolina Department of Natural Resources. 2000. Lower Saluda Scenic River Corridor Plan update. Columbia, South Carolina. December 2000.

The Lower Saluda River Corridor Plan (LSRCP) is the result of a cooperative effort among community leaders, interested individuals, and landowners of which SCE&G is one. Its objective is to conserve and enhance the 10-mile segment of the Lower Saluda River, beginning one mile below Lake Murray Dam to its confluence with the Broad River. At its conception in 1990, the LSRCP was oriented to advance goals toward water quality improvement, land conservation, improved river access, and river safety.

The 2000 update to the LSRCP identified recreation as the primary issue of concern, given the significant increase in activity on the river, although water quality and safety continue to be concerns. In 1991, the LSRCP led to designation of the LSR as a State Scenic River for the outstanding natural resources it provides within the highly urbanized environment of Columbia, South Carolina. Among the natural resources so prized are the cold water fishery, recreational boating opportunities, and rare threatened and endangered species habitat.

Water from the Lake Murray tailrace directly contributes to the LSR and thus, has a direct effect on the valued resources of the river corridor. Stream flow is regulated by releases from the Saluda Hydroelectric facility. SCE&G has been an active participant on the Lower Saluda Scenic River Advisory Council since its creation in 1989, and they have worked closely with other members of the advisory council to accomplish the goals of the LSRCP regarding increasing minimum flows, improving water quality for fishery habitat, increasing safety of water releases, improving management of river access sites on SCE&G lands, and connecting recreation sites through greenways to lessen impacts to surrounding lands. Many of these issues have been addressed through the collaborative effort of relicensing the Project. And in fact, most of the members, or member's organizations, of the Lower Saluda Scenic River Advisory Council also held positions on the various TWCs assembled for Saluda Project relicensing.

Forest Service. 2004. Sumter National Forest revised land and resource management plan. Department of Agriculture, Columbia, South Carolina. January 2004.

Respectfully, the Applicant believes that this plan is not relevant to the relicensing of the Saluda Hydroelectric Project. The Sumter National Forest is composed of three separate ranger districts (RD). The Enoree RD is north of the Project and east of Interstate 26, the Long Cane District is west of the Project along the state border and east of the Savannah River, and the Andrew Pickens RD is on the northwest edge of the state. The Project lies entirely outside of the boundaries and downstream of all three RDs. Further, the Project does not influence any resources within the National Forest.

8.6 Land Management and Aesthetics Tables

Table 8-3: Proposed Permitting Requirements as Compared to the Requirements Set Forth Under the Previous SMP

Topic	Specification / Requirement	
	New	**Old**
Easement Properties		
Community Access - Boat Ramp and Courtesy Docks		
Maximum ramp width	*12 ft*; public and semi public ramps may be granted a variance	*15 ft*; public and semi public ramps may be granted a variance
Common access area ramp	Minimum of three (3) participating shoreline property owners required	Not specified
Minimum distance to adjoining property	100 ft	Not specified
Minimum number of units	50	Not specified
Minimum shoreline footage	100 ft; plus additional 1.5 ft for every residential unit more than 50	Not specified
Common access in coves	Docks and ramps allowed only if cove greater than 200 ft wide from 360-360 contour	Not specified
County zoning requirements for docks	SCE&G requires letter from County zoning Administration stating site meets existing regulations	Not specified
Existing slope and water depth	Must accommodate ramp and dock at min. lake level elevation of 352 ft	Not specified
Size of common access docks	750 sq ft; 75 ft long For more than 10 units, may be eligible for a slip dock	Not specified
Parking	Must be above 75-ft buffer zone;	Not specified

Topic			Specification / Requirement	
			New	Old
			Clearance between any structures on opposing banks minimum 75 ft	Not specified
Easement Properties				
	Private Multi-slips			
		Continuous shoreline frontage	1000 ft	Not specified
		Number of slips	With min. 50 ft. Greenspace[1]: Two slips per 100 feet of shoreline . Without Greenspace : Up to 1.5 slips[2] per 100 feet of shoreline With ESA but no Greenspace: One slip for each 100 feet of shoreline. With 50 ft Greenspace AND ESA: 1.5 slips[3] per 100 ft of ESA shoreline with a minimum 50 ft Greenspace on the entire shoreline.	Not specified
		Minimum distance from adjoining property line	150 ft (and meet minimum county zoning requirements; which ever provides for greater distance).	Not specified
		Encroachment into Coves	Minimum of 500 ft from 360' contour elevation required across coves Docks may not extend more than 1/3 the distance across a cove or channel.	Not specified
	Commercial Marinas			
		Minimum shoreline frontage	300	
		Distance from other facilities	Facility with 20 or less watercraft - not closer than ¼-mile radius from existing private multi-slip facility or commercial marina. Facility with 21-125 watercraft: not closer than ½-mile radius to an existing multi-use facility	Not specified

Topic	Specification / Requirement	
	New	**Old**
	Facility with 126 or more watercraft: not closer than 1-mile radius to an existing multi-use facility	
Easement Properties		
Distance from other facilities	Facility located within ¼ -mile radius of existing facility but separated by a peninsula may be located on the opposite side of the peninsula if there is a minimum linear shoreline distance along the 360' contour one (1) mile between the existing and property	
Distance from adjacent property[4]	Facilities with 20 watercraft or less: a minimum of 150 feet from common property line (or meet minimum county zoning, which ever provides for greater distance) Facilities with 21-125 watercraft: a minimum of 250 feet from common property line (or meet minimum county zoning, which ever provides for greater distance) Facilities with 126 or more watercraft: a minimum of 400 feet from common property line (or meet minimum county zoning, which ever provides for greater distance)	Not specified
Distance from ESA	100 feet minimum	
Encroachment in coves	Facilities with 20 or fewer watercraft: minimum of 350 ft extending from the 360' to the 360' contour across the cove or waterway Facilities with 21-125 watercraft: minimum of 500 ft extending from the 360' to the 360' contour across the cove or waterway Facilities with more than 126 watercraft: minimum of 750 ft extending from the 360' to the 360' contour across the cove or waterway	

Topic		Specification / Requirement	
		New	Old
		No facility may encroach or extend more than one-third the distance across any cove area or waterway	
	Maximum number of slips	200	Not specified
	Coverage of slips	Not permitted	Not specified
	Landowner incentive to establish buffer zone	Owners with less than 75 ft in depth to the 360' contour would be required to deed SCE&G so much of their property to create uniform 75-ft buffer zone After condition met, SCE&G will permit a dock along the shoreling if property qualifies for al other dock permitting requirements.	Not specified
Future Development Properties			
Purchase of property		Only back property owners may purchase adjacent SCE&G future development land (located between PBL and back property). No buildings or structures allowed on purchased property and only limited burshing allowed between PBL and 75-ft buffer. Penalty fee system and loss of dock privileges implemented to enforce restrictions	Not specified
Buffer zone			
	Access path	Single path allowed to access dock. Must measure 10-ft wide with meandering design Only trees 8-inch dbh (diameter at breast height) or smaller removed within path.	Not specified Removal of trees 3-inch dbh at 4 ft height permitted
	Limited brushing	Buffer zones est. ***after*** 2007: Non-disturbance. No brushing except to create meandering access path	Buffer zones est. ***prior*** to 2004 FERC Order: Limited brushing in adjacent properties by the back property owner per permit granted by SCE&G.

Topic		Specification / Requirement	
		New	Old
			Buffer zones est. ***after*** June 2004 FERC Order: No disturbance of vegetation within 25 ft of 360' contour. Limited brushing for vegetation less than 3' dbh in remaining 50 ft of buffer.
	ESA Setback	Non-disturbance except for meandering access trail	Per 2004 FERC Order: 75-ft buffer zone includes 50 ft non-disturbance setback area adjacent to ESA, and limited brushing in remaining 25 ft of zone.
	360' Contour setback	Non-disturbance with access path	Per 2004 FERC Order: 75-ft buffer zone includes 25 ft non-disturbance setback area adjacent to 360' contour interval. Limited brushing in remaining 50 ft of zone.
Docks	Individual dock requirements	Lot must be at least 200 ft measured along the PBL Lots exceeding 400 ft measured along the PBL may be required to participate in multi-slip dock, if all permitting requirements are met.	Lot must be at least 100 ft measured along the 75-ft buffer zone
	Common dock requirements	Requires 2 lot owners maximum Each lot must be at least 150 ft measured along the PBL At least 200 ft between common docks and or common dock and existing individual.	For 2 to 5 lot owners Each lot must have a minimum width of 50 ft measured along the 75-ft buffer zone At least 100 feet between common docks and or common dock and existing indiv. Dock.
Future Development Properties			
	Community boat ramp and courtesy dock	Lot must be minimum of 300 ft measured along the PBL with minimum 150 ft setback to nearest existing property line Parking and turn around space must be above the 75-ft buffer zone.	Lot must be minimum of 100 ft along buffer zone with minimum 100 ft setback to nearest existing property line Not specified
	Multi-slip dock	Minimum of 400 ft measured at the PBL required; 1.5 slips per 200 ft	Setbacks and distance requirements same as easement property

Topic		Specification / Requirement	
		New	Old
		Minimum of 500 ft from 360' contour elevation required across coves	
All Properties			
General Specifications for Docks			
	Subdividing lots	Not specified	If lot subdivided, dock permit will be canceled. New permit issued only if shoreline width requirement met.
	Overall dock size	May not exceed 750 sq ft	May not exceed 450 sq ft
	Location	Decking of fixed walkway must be above the 360' contour	Dock horizontally located between 360' and 362' contour.
	Covered docks	Not permissible unless covered portion located within *16 ft* of 360' contour No permanent screening or enclosures permitted	Not permissible unless covered portion located within *15 ft* of 360 contour Not specified
	Encroachment across cove or waterway	No dock, marina, multislip, or platform shall extend more than one-third the distance across cove/waterway	Not specified
	Water toys	*Temporary placement only.* May not extend more than one-third distance across cove/waterway for more than 24 consecutive hours.	Not specified
	Stories allowed	Single story docks only	Not specified
	Docks in ESAs	Continuous ESAs - No docks allowed Intermittent ESAs - Docks allowed at limited locations	Not specified
Mooring		Permanent mooring prohibited; temporary moorings only with permit approval from ACOE	Prohibited
Effluent			

Topic		Specification / Requirement	
		New	Old
	Commercial marina sewer pump-out	Facilities with *more than ten watercraft* or which accommodate watercraft with marine sanitation facilities required to maintain sewer pump-out disposal system	Marinas must have facilities to remove effluent waste from boats pursuant to SCDHEC regulations. *No watercraft minimum stated*.
All Properties			
	Multi-slip	If accommodating watercraft with marine sanitation, facility is required to install, operate, and maintain sewer pump-out disposal systems.	Not specified
Erosion control (shoreline stabilization)			
	Retaining walls & seawalls	Only allowed where average eroded bank height is greater than 3 feet and wall is constructed at 360' contour elevation. (Earth fills below 360' contour prohibited).	Permitted on 360' contour but not below
	Bio-engineering		
		Two feet or less or erosional scarp: approved bioengineering techniques required	Not specified
		Two feet or more or erosional scarp: approved bioengineering and/or vegetated riprap techniques preferred.	Not specified
	Riprap	Depth: one layer when installed in vegetated areas below 360' contour.	Not specified
		Material: SCDOT Class B, or larger, quarry-run stone, natural stone, or other material approved by SCE&G. Tires, scrap metal, crushed block, construction/demolition debris, or other types of material prohibited.	Materials require prior approval from SCE&G. No concrete blocks or building materials may be used below 360' contour.
		Placement: confined to area between 6 feet below the high water mark (360' elevation) and high water mark (360' elevation) except where the entire placement is on/above severely eroded banks	Permitted on and below 360' contour.
	Sand	No sand placed below the 360' contour	Not specified

Topic	Specification / Requirement	
	New	Old
Silt	Silt fencing must be properly installed on the 360' contour or setback, where applicable, before any land disturbance activities take place.	Not specified
Agency consultation	SCDNR & USFWS consultation required for stabilization projects that exceed 500 linear feet of shoreline. SCDHEC may require individual permit for large shoreline projects	Consultation not required
Land owner permission	Applicant for stabilization project must be owner of tract of land immediately adjoining the 360' contour or SCE&G-owned buffer zone or have written permission of easement property owner on water rights tract.	Not specified
All Properties		
Timeframe of projects	Stabilization activities performed in the dry, July - February. In emergency situations, for repairs necessary to ensure integrity of existing structures, work may be performed outside July-February timeperiod upon approval.	Not specified
Natural Areas/ESA	Stabilization activities may not be undertaken within 50 feet of ESA No dock permits or sale of future development land adjoining natural areas but ESA /PBL footage could be included in the participation of a multi-slip, common, or individual docks Areas where Intermittent ESA's have been identified may accommodate limited docks, with approval from SCDNR and USFWS	Not specified
Vegetation restoration	No vegetation clearing below 360' contour may occur without approval from SCE&G. Unavoidable impacts to existing vegetation within the immediate work footprint requires replacement with native vegetation.	Not specified

Topic		Specification / Requirement	
		New	Old
Excavation			
	Maximum slope	4 to 1. Must begin below the 354' elevation unless otherwise approved by SCE&G in consultation with SCDNR	4 to 1 without rip-rap; 2 to 1 with rip-rap installed.
All Properties			
Summary of Prohibitions			
		No fixed structures except docks	No encroachments other than docks.
		No seawalls/ retaining walls	No seawalls/ retaining walls
		No sand/earthfill	Not specified
		No fences	Not specified
		No swimming pools	Not specified
		No ATVs other water craft or automobiles except as launch and retrieval device	Not specified
		No fixed structures.	No improvements
		No fixed or land-based structures (storage buildings, shelters, patios, gazebos, brick barbeques, fences, swimming pools, satellite dish, signs, dog pens or invisible fencing, boat storage) without written consent from the Lake Management Department.	No improvements
		No septic tanks and/or drain fields.	Not specified
		No planting of ornamental lawn grasses.	Not specified
		No storage or stockpiling of construction material.	Not specified
		No vegetation removal of any type except in a permitted 10-foot wide access path to the shoreline.	No unauthorized clearing of the trees or underbrush.
		No fires or overnight camping .	Not specified
		No roofs or covers over any dock unless the dock is within *16 ft* of the 360' contour.	No roofs or covers over any dock unless the dock is within *15 ft* of the 360' contour.
		No boathouses or enclosures	Not specified
		No excavation/dredging above the 354' contour or in shallow water habitat and ESA's without DNR approval.	No excavation altering 360' contour
		No drive-on docks	Not specified
		Permanent screening or enclosures will not be allowed on fixed seating areas of docks.	Not specified

Topic	Specification / Requirement	
	New	Old
	No upland water gardens will be permitted to drain into the lake.	Not specified
	No permament moorings; temporary mooring upon ACOE approval	Prohibited

1 Under certain conditions, private land owners may voluntarily establish ‘Greenspaces’ along the shoreline, which are undeveloped lands that have been set aside by and maintained as vegetated areas. Greenspaces are used to help determine eligibility for multi-slip development.

2 Fractions of slips for properties *without* a Greenspace will be rounded down to an even number of slips (i.e., between 14 ½ and 15 ½ slips will be rounded down to 14 slips).

3 Fractions of slips for properties *with* Greenspace will be rounded up (i.e., between 14 ½ and 15 ½ slips will be rounded up to 16 slips).

4 Measured from each outside edge of the dock walkway to the nearest common property line between the proposed development property and the adjacent property owner

5 6-foot requirement is measured vertically for steep slopes and horizontally for more gradual slopes where the vertical requirement would prove impractical

9.0 REFERENCES

9.1 Introduction

Bureau of Water. 1998. Watershed Water Quality Assessment – Saluda River Basin, Technical Report No. 005-98.

Federal Energy Regulatory Commission (FERC). July 22, 2002. Final Environmental Assessment; Saluda Dam Seismic Remediation.

Mead and Hunt. 2000. Environmental Assessment. Saluda Hydroelectric Project; FERC Project No. 516-SC.

Mead and Hunt. 2002a. Environmental Assessment. Saluda Dam remediation Prepared for SCE&G.

Paul C. Rizzo Associates, Inc. March 2005. Foundation Design Basis and Geologic Mapping Rockfill Berm and RCC Berm Saluda Dam Remediation Project.

South Carolina Department of Natural Resources Homepage (SCDNR). 2002. South Carolina Drought News Release. <http://www.dnr.state.sc.us/climate/sco/drought /release90602.html>. 8 Oct. 2004.

Stone and Webster Engineering Corporation. 1995. Sixth Periodic Safety Inspection Report. Saluda Hydroelectric Project; FERC Project No. 516-SC.

United States Department of Agriculture- Soil Conservation Service (USDA). 1960. Soil Survey of Newberry County, SC.

United States Department of Agriculture- Soil Conservation Service (USDA). 1962. Soil Survey of Saluda County, SC.

United States Department of Agriculture- Soil Conservation Service (USDA). 1976. Soil Survey of Lexington County, SC.

United States Department of Agriculture- Soil Conservation Service (USDA). 1978. Soil Survey of Richland County, SC.

9.2 Water Use and Quality

Environmental Research Center, Inc. (ERC). 1976. Environmental Inventory of Lake Murray, South Carolina. Prepared for South Carolina Electric & Gas Co., January 1976.

Golterman, H. L. 1975. Physiological limnology. Elsevier Sci. Publ. Co., Amsterdam, Oxford, and New York. xiii + 489 p.

Hayes, W.E. 1994. Lake Murray Fishery Management Plan. South Carolina Wildlife Marine Resources Department. Freshwater Fisheries District.

Kleinschmidt Associates. 2008. Smith Mountain Hydroelectric Project: Environmental Assessment. Prepared for Appalachian Power Company.

Kleinschmidt Associates, Loginetics, Inc., Paladin Water Quality Consulting, and Reservoir Environmental Management, Inc. 2003. Lower Saluda River DO Technical Study Report. Prepared for South Carolina Electric and Gas Company.

Raleigh, R. F., L. D., Zuckerman, and P. C. Nelson. 1986. *Habitat Suitability Index Models and Instream Flow Suitability Curves: Brown Trout, Revised.* U.S. Fish and Wildlife Services Biol. Rep. 82(10.124). 65 pp. [First printed as: FWS/OBS-82/10.71, September 1984-J.

Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. *Habitat Suitability Information: Rainbow Trout.* U.S. Fish and Wildlife Services FWS/OBS-82/10.60. 64 pp.

Reservoir Environmental Management, Inc. (REMI). 2005. Saluda Project (FERC No. 516) - Lake Murray Water Quality Report. Prepared for South Carolina Electric & Gas Co., 36 pp.

Ruane, R.J. 2008a. Whitepaper Regarding Increasing the Winter Minimum Pool Level for Normal Operations of Lake Murray. Prepared by Reservoir Environmental Management, Inc. for SCE&G.

Ruane, R.J. 2008b. Final Lake Murray CE QUAL 2E Lake Wide Water Quality Model. Prepared by Reservoir Environmental Management, Inc. for SCE&G.

Ruane, RJ. 2004. Draft Lake Murray CE QUAL 2E Lake Wide Water Quality Model. Prepared by Reservoir Environmental Management, Inc. for SCE&G.

South Carolina Department of Health and Environmental Control (SCDHEC). 2007. South Carolina Fish Consumption Advisories. Bureau of Water, 32pp.

South Carolina Department of Health and Environmental Control (SCDHEC). 2006. Water Quality Classifications and Standards. Regulation 61-69, June 23, 2006.

South Carolina Department of Health and Environmental Control (SCDHEC). 2004. Water Classification & Standards (R.61-68) and Classified Waters (R.61-69). Bureau of Water, June 25, 2004.

United States Environmental Protection Agency. 1986. Ambient Water Quality Criteria for Dissolved Oxygen (freshwater). EPA 440/5-86-003. Wash. D.C. 46 pp.

9.3 Aquatic Resources

Alderman, John M. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray and Selected Tributaries. Prepared for Kleinschmidt Associates.

Barbour, M.T.; J. Gerritsen; G.E. Griffith; R. Frydenborg; E. McCarron; J.S. White; and M.L. Bastian. 1996. A framework for biological criteria for Florida streams using benthic macroinvertebrates. J. N. Am. Benthol. Soc. 15:185-211.

Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004/ viii + 131 pp.

Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Office of Biol. Serv., USFWS, U.S. Dept. Of Interior, Wash., DC. FWS/OBS-82-26. 248 pp.

Carnagey, D. 2007. Final Report: 2007 Macroinvertebrate Assessment of the Lower Saluda River, Downstream of the Saluda Hydroelectric Project (Lake Murray) Operated by South Carolina Electric & Gas, Lexington County, South Carolina. Carnagey Biological Services, LLC.

Carnagey, D. February 2006. Final Report: Macroinvertebrate Assessment of the Lower Saluda River, Downstream of the Saluda Hydroelectric Project (Lake Murray) Operated by South Carolina Electric & Gas, Lexington County, South Carolina. Carnagey Biological Services, LLC.

Collins, M. R., D. Cooke, B. Post, J. Crane, J. Bulak, T. I. J. Smith, T. W. Greig, J. M. Quattro.2003. Shortnose Sturgeon in the Santee-Cooper Reservoir System, South Carolina. Transactions of the American Fisheries Society 132:1244-1250.

Crane, J. S. 1987. Lower Saluda River fishery study, preliminary report. South Carolina Wildlife and Marine Resources Department, Columbia, SC.

Death, R.G. 1995. Spatial patterns in benthic invertebrate community structure: products of habitat stability or are they habitat specific. Freshwater Biology 33: 455-467.

Death, R.G. and M.J. Winterbourn. 1995. Diversity patterns in stream benthic invertebrate communities: the influence of habitat stability. Ecology 76(5): 1446-1460.

Duke Energy. 2005. Catawba – Wateree Hydro Project, FERC No. 2232, Diadromous Fish Sampling in the Wateree River – 2004 & 2005.

Environmental Research Center, Inc. (ERC). 1976. Environmental Inventory of Lake Murray, South Carolina. Prepared for South Carolina Electric & Gas Co., January 1976.

Eversole, Dr. Arnold G., and Shane M. Welch. 2006. Distocambarus youngineri: White Paper. Prepared for Kleinschmidt Associates.

Hayes W.E., G. M. Penny and K J Roosen. 2002. Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-63—5-5.

Hayes W.E., J G. M. Penny and K. J. Roosen. 2001. Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-63 5-4.

Hayes W.E. G. M. Penny and Roosen. 2000. Fisheries investigations in lakes and streams – District III. SCDNR Ann. Prog. Rpt. F-63-5-3: 93 pp.

Hayes, W.E. 1994. Lake Murray Fishery Management Plan. South Carolina Wildlife Marine Resources Department. Freshwater Fisheries District.

Hayes W.E. and G. M. Penny. 1993. Fisheries investigations in lakes and streams – District III. SCDNR Ann. Prog. Rpt. F-18-19: 125 pp.

Hayes W.E. and G. M. Penny. 1992 Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-18-19: 136 pp.

Hayes W.E. and G. M. Penny. 1991 Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-18-17: 130 pp.

Hayes W.E. and G. M. Penny. 1990 Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-18-16: 122 pp.

Hayes W.E. 1986. Fisheries investigations in lakes and streams – District III. SCWMRD Ann. Prog. Rpt. F-18-12: 46 pp.

Isely, J.J. October 2006. *Final Report: Saluda River and Upper Congaree River Diadromous Fish Sampling; Diadromous Fish Studies 2006.* South Carolina Cooperative Fish and Wildlife Research Unit, USGS Biological Resources. Division, Clemson, SC: 1pp.

Isely, J.J. 2005. *Final Report: Saluda River and Upper Congaree River Diadromous Fish Sampling; Diadromous Fish Studies 2005.* South Carolina Cooperative Fish and Wildlife Research Unit, USGS Biological Resources. Division, Clemson, SC: 1pp

Isley, J. J., Jobsis, G., and S. Gilbert. 1995. *Instream Flow Requirements for the Fishes of the Lower Saluda River* (Conducted as part of relicensing studies for the Saluda Project - FERC No. 516).

Kleinschmidt Associates. 2008. Saluda Hydroelectric Project: Final Rare, Threatened and Endangered Species Assessment. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2007a. Final Report: Evaluation of usage of the Lower Saluda River by Inmigrating Juvenile American Eels; Diadromous Fish Studies 2007. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2007b. Study Plan: American Shad Telemetry Study for the Lower Saluda, Congaree and Broad Rivers; Diadromous Fish Studies 2006. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2007c. Final Report: An Estimate of the Annual Number of Fish Entrained and Subsequent Turbine Mortality at the Saluda Hydro Project Lake Murray, South Carolina. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2007d. Final Report: Status of the Shortnose Sturgeon in the Lower Saluda and Upper Congaree Rivers; Diadromous Fish Studies 2007. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2007e. Final Report: Columbia Fish Ladder Evaluation Report. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2006a. *Study Plan: Macroinvertebrate Assessment of the Lower Saluda River.* Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2006b. Study Plan: Evaluation of Usage of the Lower Saluda River by Inmigrating Juvenile American Eel (Anguilla rostrata). Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2006c. *Final Report: American Eel (Anguilla rostrata) Survey; Diadromous Fish Studies 2006.* Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2006d. *Study Plan: Saluda Hydro Fish Entrainment Desktop Study Plan.* Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2005a. *Study Plan: 2005 Diadromous Fish Studies.* Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 2005b. *Final Report: American Eel (Anguilla rostrata) Survey; Diadromous Fish Studies 2005*. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates, Loginetics, Inc., Paladin Water Quality Consulting, and Reservoir Environmental Management, Inc. 2003. *Lower Saluda River DO*

Technical Study Report. Prepared for South Carolina Electric and Gas Company.

Mead and Hunt. 2002a. Environmental Assessment. Saluda Dam remediation Prepared for SCE&G.

Milhouse, R.T., M.A. Updike, and D.M. Schneider. 1989. Physical habitat simulation system reference manual - Version II. U.S. Dept. Of Interior, Fish and Wildl. Serv. Wash., DC. Biol. Rept. 89(16).

Newcomb, T.J. and J.S. Fuller. 2001. *Anadromous and Catadromous Fish Survey of Santee/Cooper Basin in North Carolina and South Carolina.* Department of Fisheries and wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA. Final Report, Prepared for Duke Power, June 25, 2001. 25pp.

Price, J. 2005. South Carolina Comprehensive Wildlife Conservation Strategy Species Accounts: Carolina Heelsplitter. Available online at www.dnr.sc.gov/cwcs. Accessed September 20, 2007.

Shealy Environmental Services, Inc. (Shealy). 2001. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, SC. Report prepared for South Carolina Electric & Gas Company.

Shealy Environmental Services, Inc. 2001. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, SC. Report prepared for South Carolina Electric & Gas Company.

Shealy Environmental Services, Inc. 2003. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, SC. Report prepared for South Carolina Electric & Gas Company.

Shealy Environmental Services, Inc. 2004. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, SC. Report prepared for South Carolina Electric & Gas Company.

Shealy Environmental Services, Inc. 2005. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, SC. Report prepared for South Carolina Electric & Gas Company.

South Carolina Department of Health and Environmental Control (SCDHEC). 2004. Water Classification & Standards (R.61-68) and Classified Waters (R.61-69). Bureau of Water, June 25, 2004.

South Carolina Department of Natural Resources. 2007. Freshwater Fishing Rules and Regulations. Available online at http://www.dnr.sc.gov/regs/pdf/freshfishing.pdf.

United States Fish and Wildlife Service, National Marine Fisheries Service, and South Carolina Department of Natural Resources. 2001. *Santee-Cooper Basin Diadromous Fish Passage Restoration Plan.*

Valentin, S.; J.G. Wasson; and M. Philippe. 1995. Effects of hydropower peaking on epilithon and invertebrate community trophic structure. Regulated Rivers: Research and Management 10: 105-119.

Ward, J.V. and J.A. Stanford. 1995. Ecological connectivity in alluvial river ecosystems and its disruption by flow regulation. Regulated Rivers: Research and Management 11: 105-119.

Welch, S.M. 2000. *A Report on the Historical Inland Migrations of several Diadromous Fishes in South Carolina Rivers.* Department of Aquaculture, Fisheries and Wildlife, Clemson University, SC. Report prepared for Mr. Douglas W. Cook, South Carolina Department of Natural Resources. December 4, 2000. 19pp.

9.4 Wildlife Resources

Birrenkott, A.H., S.B. Wilde, J.J. Haines, J.R. Fischer, T.M. Murphy, C.P. Hope, P.G. Parnell, and W.H. Bowerman. 2004. Establishing a food-chain relationship between aquatic plants and avian vacuolar myelinopathy in mallards (Anas platyrhynchos). Journal of Wildlife Diseases 40(3)485-492.

Brown, C.R. 1997. Purple martin (Progne subis). In the Birds of North America, no. P287 (A.Poole and F. Gill, Editors). The Academy of Natural Sciences, Philadelphia,
Pennsylvania; The American Ornithologists' Union, Washington, DC.

Brown, 1996. Brown, R.D. 1996. Attraction of bald eagles to habitats just below dams in Piedmont North and South Carolina. Pp. 299-306 In: Raptors in Human Landscapes. Bird, D.M., D.E. Varland, J.J. Negro (eds). Academic Press. San Diego, CA

Coulter, M.C. and A.L. Bryan, Jr. 1993. Foraging ecology of Wood Storks (Mycteria Americana) in east-central Georgia. I. Characteristics of Foraging Sites. Colonial Waterbirds 16:59-59-70.

DeGraaf, R.M. and D.D. Rudis. 1986. New England Wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. Broomall, PA: USDA/USFS. 491p

Federal Energy Regulatory Commission (FERC). 2004. Order Approving Land Use and Shoreline Management Plan with Modifications and Amending Exhibit R. Order No. 20040623-3015. Dated June 23, 2004.

Jeffers, R.D. 2000. The mystery of the dying eagles. Endangered Species Bulletin 25(5):4-5.

Kennamer, R.A. 2007. A Final Report of Activities under Contract Agreement between The University of Georgia Research Foundation, Inc., Savannah River Ecology Laboratory and Kleinschmidt Associates. Prepared and edited by R. A. Kennamer, *The Savannah River Ecology Laboratory*, *Aiken, SC.*

Kleinschmidt Associates. 2008. Saluda Hydroelectric Project: Final Rare, Threatened and Endangered Species Assessment. Prepared for South Carolina Electric & Gas. Columbia, SC.

Lake Murray Association (LMA). 2007. Lake Murray Association Newsletters. Spring 2006, Winter 2007 and Spring 2007 editions. Available on-line at http://www.lakemurrayassociation.com/LL_Newsletter_Link.htm. Accessed August 5, 2007.

Russell, K.R. and S.A. Gauthreaux, Jr. 1999. Spatial and temporal dynamics of a purple martin pre-migratory roost. Wilson Bulletin 111:354-362.

SCE&G & Kleinschmidt. 2004a. Wood Stork Monitoring Plan. Saluda Hydro Project (FERC No. 516). Available on-line at http://www.saludahydrorelicense.com/StudyReports.htm. Accessed July 2007.

South Carolina Electric and Gas Company (SCE&G). 2005. Lake Murray Wood Stork Surveys; 2005 Summary Report. Prepared by Kleinschmidt Associates, December 2005. Available on-line at http://www.saludahydrorelicense.com/StudyReports.htm. Accessed July 9, 2007.

South Carolina Electric and Gas Company (SCE&G). 2007. Lake Murray Wood Stork Surveys; 2006 Summary Report. Prepared by Kleinschmidt Associates, March 2007. Available on-line at http://www.saludahydrorelicense.com/StudyReports.htm. Accessed July 9, 2007.

United States Department of Agriculture (USDA) 2002. The Southern Forest Resource Assessment Summary Report. Terra-1: Terrestrial Ecosytems. Multifagency effort led by USDA Forest Service. Available on-line at http://www.srs.fs.fed.us/sustain/report/summry/summary.htm. Accessed May 30, 2008.

United States Fish & Wildlife Service (USFWS). 2005. Letter to James M. Landreth, VP, SCE&G from Timothy Hall, Field Supervisor, USFWS. Re: First Stage Consultation Comments and Request for Studies, Saluda Hydroelectric Project, FERC No. 516, Richland, Lexington, Newberry, Saluda Counties, South Carolina. Dated August 1, 2005.

United States Fish & Wildlife Service (USFWS). 2007. Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife. Federal Registry Citation page 72 FR 37345 37372. Date 7/09/2007. Available on line at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2007_register&docid=fr09jy07-6. Accessed August 2007.

United States Fish and Wildlife Service (USFWS). 1995a. Endangered and Threatened Wildlife and Plants; Final Rule to Reclassify the Bald Eagle From Endangered to Threatened in All of the Lower 48 States. 50 CFR Part 17. Federal Register Vol. 60, No. 133, July 12, 1995. Citation page 60 FR 35999 36010. Department of the Interior.

United States Fish and Wildlife Service (USFWS). 1996. Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta, Georgia. 41 pp.

Wilde, S.B., T.M. Murphy, and C. Hope. 2003. Lake Murray Monitoring Project: 2002-2003. Report prepared by South Carolina Department of Natural Resources and University of South Carolina, Baruch Institute. 34 pp.

9.5 Botanical Resources

Access Washington Homepage. 2004. General Information about Hydrilla. http://www.ecy.wa.gov/programs/wq/plants/weeds/hydrilla.html. December 20, 2004. Ann. Prog. Rpt. F-63-1-8: 82 pp.

ARM Environmental. 2001. Assessment of Threatened and Endangered Species for the proposed Lake Murray Dam Remediation project, June 2000.

Aulbach, Cynthia. 2007. Baseline Survey of Aquatic Plants, Lake Murray, SC 2007. Prepared for South Carolina Electric & Gas Company. Unpubl. Rpt.

Aulbach, Cynthia. 2006. Hydrilla Survey, Lake Murray, SC 2006. Prepared for South Carolina Electric & Gas Company. Unpubl. Rpt.

Aulbach, Cynthia. 2005. Water Primrose Survey, Lake Murray, SC 2005. Prepared for South Carolina Electric & Gas Company. Unpubl. Rpt.

Aulbach, Cynthia. 2002. Aquatic macrophytes of the Lower Saluda River, SC. SCE&G Unpubl. Rpt.

Aulbach, Cynthia. 2001a. 2001 Aquatic Macrophytes of the Lower Saluda River, SC. SCE&G Unpubl. Rpt.

Aulbach, Cynthia. 2001b. Summary of Hydrilla and Pondweed Survey, Lake Murray, SC. SCE&G Unpubl. Rpt.

Aulbach-Smith, Cynthia. 1998a. Distribution of Aquatic Plants in Lake Murray, SC, 1989-1997. SCE&G Unpubl. Rpt.

Aulbach-Smith, Cynthia. 1998b. 1997 Survey of Hydrilla in Lake Murray and Drawdown Results. SCE&G Unpubl. Rpt.

Colinvaux, P. 1993. Ecology 2. John Wiley and Sons, New York, NY. 688pp.

Cowardin, L.M., V. Carter V., F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31.Washington, D.C.

Federal Energy Regulatory Commission (FERC). 1991. Order Amending Land Use and Shoreline Management Plan. Issued September 17, 1991. South Carolina Electric and Gas Company. Project No. 516-080. Docket No. P-516-080. FERC 62,194.

Kleinschmidt Associates. 2008. Saluda Hydroelectric Project: Final Rare, Threatened and Endangered Species Assessment. Prepared for South Carolina Electric & Gas. Columbia, SC.

Kleinschmidt Associates. 1998. *Columbia Hydroelectric Project: Rocky Shoals Spider Lily Plant Survey.* Columbia Hydroelectric Project (FERC# 1895).

Mead and Hunt. 2002. Environmental Assessment. Saluda Dam remediation Prepared for SCE&G.

Saluda Hydro Rare, Threatened, and Endangered Species Technical Working Committee (RT&E TWC). 2006. Memo to Saluda Hydro Project Relicensing Stakeholders. Dated July 20, 2006. RE: May 2006 Lower Saluda River Rocky Shoals Spider Lily Survey Observations.

South Carolina Electric & Gas (SCE&G). 2006. Updated List of Environmentally Sensitive Areas. Draft Lake Murray drawings with accompanying cover letter to

Richard Christie, SCDNR, from Michael Summer, General Manager, SCE&G. Dated February 22, 2006. Filed by FERC May 10, 2006.

South Carolina Electric and Gas (SCE&G). 1999. Lake Murray, FERC Project 516 Land Use and Shoreline Management Plan. Lake Murray Five Year Review.

South Carolina Electric and Gas Company (SCE&G). 1994. Shoreline Inventory Saluda Hydroelectric Project FERC 516 Lake Murray. Columbia, SC.

United States Fish and Wildlife Service. 2001. Candidate listing and priority assignment form: Georgia aster (Aster georgianus). Asheville, NC. 7 pp.

9.6 Historical and Cultural Resources

Green, William and Heather Jones. 2008. Historic Properties Management Plan, Saluda Hydroelectric Project, Lexington, Richland, Newberry and Saluda Counties, South Carolina. S&ME, Inc., Columbia, South Carolina. Prepared for South Carolina Electric & Gas Company, Columbia, South Carolina.

Green, William, Heather Jones, Kenneth Styer, and Michael Nelson. 2007. Stage II Cultural Resource Reconnaissance Survey of the Saluda Hydroelectric Project Area. Lexington, Newberry, Richland, and Saluda Counties, South Carolina. S&ME, Inc., Columbia, South Carolina. Prepared for South Carolina Electric & Gas Company, Columbia, South Carolina.

Hendrix, M. Patrick and Ralph Bailey. 2003. Intensive Architectural Survey of the SC Route 6 Improvements Project, Lexington and Richland Counties, South Carolina. Brockington and Associates, Inc.

Lansdell, Brent and Ralph Bailey. 2002. Assessment of Known and Potential Archaeological sites in the Saluda Dam Remediation Project at Lake Murray, Lexington, Newberry, Richland and Saluda Counties, South Carolina. Brockington and Associates, Inc., Atlanta, Georgia and Charleston, South Carolina. Submitted to South Carolina Electric and Gas, Columbia, South Carolina.

Norris, Sean, Ted Karpynec, Jeffrey Holland, and William Green. 2005. Stage I Cultural Resource Reconnaissance Survey of the Saluda Hydroelectric Project Area. Lexington, Newberry, Richland, and Saluda Counties, South Carolina. TRC, Columbia, South Carolina. Prepared for South Carolina Electric & Gas Company, Columbia, South Carolina.

Trinkley, Michael and Nicole Southerland. 2001. Cultural Resources Survey of the SCE&G Saluda Dam Complex, Lexington County, South Carolina. Chicora Foundation, Inc., Columbia, SC.

9.7 Recreational Resources

American Rivers. 2008. Congaree River Blue Trail. [Online] URL: http://www.americanrivers.org/site/DocServer/Final_Congaree_Blue_Trail_Brochure.pdf?docID=6201. Accessed May 21, 2008.

Bureau of Outdoor Recreation (BOR). 1977. Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity. Department of Interior, Washington, DC.

Canoeing for Kids. 2007. Canoeing for Kids Headquarters. [Online] URL: http://www.canoeingforkids.org/directions.htm. Accessed June 27, 2006.

Cordell, H. Ken, et al. 2004. Outdoor Recreation for 21st Century America: A Report to the Nation: The National Survey on Recreation and the Environment. State College, PA: Venture Publishing Inc.

H.K. Cordell and M.A. Tarrant, 2002. Changing Demographics, Values, and Attitudes. Journal of Forestry. 100:7 pp28-33.

Irmo Chapin Recreation Commission (ICRC). 2007a. Parks of the Irmo Chapin Recreation Commission. http://www.icrc.net/Parks.aspx. Accessed August 25, 2007.

Irmo Chapin Recreation Commission (ICRC). 2007b. Saluda Shoals Park. http://www.icrc.net/saludashoals/default.aspx. Accessed August 25, 2007.

Kleinschmidt Associates (Kleinschmidt). 2005. Saluda Hydro Initial Consultation Document. Prepared for South Carolina Electric and Gas. April, 2005. [Online] URL: http://www.saludahydrorelicense.com/documents/FinalSaludaICD_2005-4FERCupdatedwithappendixWQtables.pdf. Accessed June 26. 2007.

Kleinschmidt Associates (Kleinschmidt). 2007a. Recreation Assessment Study Report. Prepared for South Carolina Electric and Gas. April, 2007. [Online] URL: http://www.saludahydrorelicense.com/documents/RAMainBody.pdf. Accessed June 26, 2007.

Kleinschmidt Associates (Kleinschmidt). 2007b. Spring Addendum to the Recreation Assessment Study Report. Prepared for South Carolina Electric and Gas. August, 2007.

Kleinschmidt Associates (Kleinschmidt). 2007c. Boating Density Study Report. Prepared for South Carolina Electric and Gas. *Unpublished Draft*, 2007.

Kleinschmidt Associates (Kleinschmidt). 2007d. Downstream Recreation Flow Study Report. Prepared for South Carolina Electric and Gas. *Final*, 2007.

Mead and Hunt. 2002. Recreational Element: Initial Consultation Package. Mead & Hunt, Madison, WI. 21pp.

National Park Service (NPS). 2007b. Nationwide Rivers Inventory – South Carolina. [Online] URL: www.nps.gov/rtca/nri/states/sc.html. Accessed August 26, 2007.

National Park Service (NPS). 2007a. Congaree National Park. [Online] URL: http://www.nps.gov/cosw/. Accessed August 25, 2007.

Newberry County. 2008. Outdoor Recreation in Newberry County. [Online] URL: http://www.newberrycounty.org/recreation.html. Accessed May 21, 2008.

Purple Martin Conservation Association (PMCA). 2008. Project Martin Roost: Lake Murray, South Carolina. [Online] URL: http://purplemartin.org/roost/roostdetail.php?roost=300. Accessed May 21, 2008.

Richland County Recreation Commission (RCRC). 2007. Richland County Parks. [Online] URL: http://www.richlandcountyrecreation.com/masterlist.asp. Accessed August 25, 2007.

Riverbanks Zoo and Garden. 2007. Riverbanks Zoo and Garden. [Online] URL: http://www.riverbanks.org/. Accessed August 25, 2007.

S&ME. 2004. Acoustical Testing Report for the Saluda River Warning System. Prepared for SCE&G. June 24, 2004. [Online] URL: http://www.saludahydrorelicense.com/documents/AcousticalTestingReport.pdf. Accessed August 27, 2007.

South Carolina Budget and Control Board, Office of Research and Statistics (SCBCB). 2005a. South Carolina Statistical Abstract 2005: Domestic Destination Visitation to South Carolina Non-Coastal Areas by Region (2004). [Online] URL: http://www.ors2.state.sc.us/abstract/chapter15/recreation2b.asp. Accessed August 30, 2007.

South Carolina Budget and Control Board, Office of Research and Statistics (SCBCB). 2005b. South Carolina Statistical Abstract 2005: South Carolina Population Projections 2005 – 2030. [Online] URL: http://www.ors2.state.sc.us/population/proj2030.asp. Accessed July 25, 2006.

South Carolina Department of Commerce (SCDC), Division of Research. 2008. Development a Rural Definition: Analysis of South Carolina Counties. Discussion Paper DP-2008-001. January 2008. [Online] URL:

http://www.sccommerce.com/docdirectory/Rural%20Definition%20-%20Developing%20a%20Rural%20Definition%20for%20South%20Carolina,%20Analysis%20of%20South%20Carolina%20Counties%202008.pdf. Accessed May 21, 2008.

South Carolina Department of Natural Resources (SCDNR). 2007a. Congaree Creek Heritage Preserve. [Online] URL: http://www.dnr.sc.gov/managed/heritage/congcreek/description.html. Accessed August 25, 2007.

South Carolina Department of Natural Resources (SCDNR). 2007b. Shealy's Pond Heritage Preserve. [Online] URL: http://www.dnr.sc.gov/managed/heritage/shealyspnd/description.html. Accessed August 25, 2007.

South Carolina Department of Natural Resources (SCDNR). 2007c. Peachtree Rock Heritage Preserve. [Online] URL: http://www.dnr.sc.gov/managed/heritage/peachtree/description.html. Accessed August 25, 2007.

South Carolina Department of Natural Resources (SCDNR). 2007d. Nipper's Creek Heritage Preserve. [Online] URL: http://www.dnr.sc.gov/managed/heritage/nippercrk/description.html. Accessed August 25, 2007.

South Carolina Department of Parks, Recreation and Tourism (SCPRT). 2007. Sesquicentennial State Park. [Online] URL: http://www.southcarolinaparks.com/park-finder/state-park/469.aspx. Accessed August 25, 2007.

South Carolina Department of Parks, Recreation and Tourism (SCPRT) and the Palmetto Conservation Foundation. 2002. Expanding the Experience: Trails for South Carolina. The South Carolina State Trails Plan.

South Carolina Department of Parks, Recreation and Tourism. Recreation, Planning and Engineering Office (SCPRT). 2002. South Carolina Statewide Comprehensive Outdoor Recreation Plan. [Online] URL: http://www.scprt.com/facts-figures/outdoorrecreationplan.aspx. Accessed June 26, 2007.

South Carolina Design Arts Partnership (SCDAP). 2000. Lower Saluda Scenic River Corridor Plan Update. Clemson, South Carolina. Prepared for the Lower Saluda Scenic River Advisory Council and the South Carolina Department of Natural Resources.

South Carolina Electric & Gas (SCE&G). 1997. Licensed Hydropower Development Recreation Report, Form 80, for the Saluda Hydro Project (FERC No. 516). Accession No.: 970508-0090. Filed April 22, 1997.

South Carolina Electric & Gas (SCE&G). 2003. Licensed Hydropower Development Recreation Report, Form 80, for the Saluda Hydro Project (FERC No. 516). Accession No.: 20030430-0246. Filed March 24, 2003.

South Carolina Electric & Gas (SCE&G). 2007. Marine Event Permit Information: 2003 – 2006.

South Carolina Forestry Commission. 2007. Harbison State Forest. [Online] URL: http://www.state.sc.us/forest/refharb.htm. Accessed August 25, 2007.

South Carolina Legislature. 1989. South Carolina Code of Laws : Title 49 - Waters, Water Resources and Drainage; Chapter 29 – South Carolina Scenic Rivers Act. [Online] URL: http://www.scstatehouse.net/code/t49c029.htm. Accessed March 22, 2007.

South Carolina State Forest (SCFC). 2007. Harbison State Forest. [Online] URL: http://www.state.sc.us/forest/refharb.htm. Accessed August 30, 2007.

South Carolina Water Resources Commission, South Carolina Department of Parks, Recreation and Tourism and the Lower Saluda River Task Force. 1990. The Lower Saluda River Corridor Plan.

The River Alliance. 2007. Three Rivers Greenway. [Online] URL: http://www.riveralliance.org/3rg.htm. Accessed June 26, 2007.

Warren, Roger, and Phillip Rea. 1989. Management of Aquatic Recreation Resources. North Carolina State University, Publishing Horizons, Inc., Columbus, OH.

9.8 Land Management and Aesthetics

Federal Energy Regulatory Commission (FERC). July 22, 2002. Final Environmental Assessment; Saluda Dam Seismic Remediation.

Federal Energy Regulatory Commission (FERC). October 30, 2003. Final Environmental Assessment, Sale of Land for Future Private Development; Saluda Hydroelectric Project

Lower Saluda River Task Force (lower Saluda RiverTF). 1990. The Lower Saluda River Corridor Plan. A collaboration of the South Carolina Water Resources Commission and the South Carolina Department of Parks, Recreation and Tourism. Available on line at http://www.dnr.sc.gov/water/envaff/river/scenic/lowersaluda.html. Accessed August, 2007.

Richland County. 2003. Future Horizons for Richland County: Trends, Issues, and Policy Implications. 43pp.

South Carolina Association of Counties. 2004. County Profiles: Land Area and Population Density. http://www.sccounties.org. August 19, 2004.

South Carolina Department of Parks, Recreation & Tourism (SCPRT). 2002 South Carolina State Comprehensive Outdoor Recreation Plan. Recreation, Planning & Engineering Office. 1205 Pendleton Street, Columbia, SC. 157pp.

South Carolina Electric & Gas Company (SCE&G). 2007. Draft Lake Murray Shoreline Management Plan. Saluda Hydroelectric Project (FERC No. 516). Prepared by Kleinschmidt Associates. September 2007.