ATTACHMENT 1c

OUR SUBMITTAL TO THE CONSULTING AGENCIES AND TRIBES -

Appendices 16 through 30

Appendix 16

Designate New Waterfowl Hunting Areas – Update – August 28, 2008

SCE&G
A SCANA COMPANY

August 28, 2008

Kimberly D. Bose
Federal Energy Regulatory Commission
ATTN: OEP/Division of Hydropower Administration and Compliance
888 First Street, N. E.
Washington, D. C. 20426

Subject: South Carolina Electric & Gas Company
Saluda Hydroelectric Project, FERC Project No. 516
Shoreline Management Plan – June 23, 2004 FERC Order
Paragraph (F) – Future Development Land Re-classification and
Paragraph (I) Waterfowl Hunting Area

Dear Secretary Bose:

South Carolina Electric & Gas Company (SCE&G), Licensee for Saluda Hydroelectric Project, FERC Project No. 516, hereby files an original and eight copies of a request for an extension of time until June 30, 2009 to comply with Paragraph F and the waterfowl hunting area section of Paragraph I of the ORDER APPROVING LAND USE AND SHORELINE MANAGEMENT PLAN WITH MODIFICATIONS AND AMENDING EXHIBIT R issued by the Federal Energy Regulatory Commission (FERC) on June 23, 2004 and ORDER CLARIFYING AND MODIFYING ORDER AND DENYING REHEARING issued on October 28, 2004. The original FERC Orders requested that the land re-classification procedure and criteria (paragraph F) be addressed in the next Land Use and Shoreline Management Plan update that will be conducted as part of the current project relicensing process and resolution of this issue should be filed as part of the new license application which will be submitted to the FERC prior to or on August 31, 2008. By letter dated May 31, 2005 the Licensee requested an extension of time until August 31, 2008 to comply with Paragraph I of the original Order (waterfowl hunting areas). The FERC issued ORDER GRANTING EXTENSION OF TIME TO FILE SUPPLIMENTS TO LAND USE AND SHORELINE MANAGEMENT PLAN dated December 15, 2005, concluding that the Licensee did not provide enough justification for the requested time extension for Paragraph I, and required compliance of this paragraph by December 31, 2006. The Licensee filed an interim report on June 1, 2006 describing the progress it is making to meet the new deadline and FERC acknowledged our progress by letter dated July 27, 2006. By letter dated December 29, 2006 the Licensee filed a report describing the progress we are making to meet this requirement and requested an extension of time until August 31, 2008 to comply with this section of Paragraph I of the original Order (waterfowl hunting area). The FERC issued ORDER

GRANTING EXTENSION OF TIME TO FILE DOCUMENTATION OF WATERFOWL HUNTING AREA DESIGNATION dated March 6, 2007 approving this extension of time request and ordered that a report be filed with the Commission on or before December 31, 2007 describing the progress the Licensee is making to meet the extended deadline. By letter dated December 10, 2007 the Licensee filed a progress report of designating a new waterfowl hunting area for the Saluda Hydroelectric Project and FERC acknowledged our progress report by letter dated January 29, 2008. Paragraphs F and I are repeated below followed by a description of our request for an extension of time for these paragraphs.

"**(F)** The licensee, after consultation with the U. S. Fish and Wildlife Service, the South Carolina Department of Natural Resources and Department of Parks, Recreation and Tourism, shall establish a procedure and criteria for future land re-classifications. The land re-classification procedure and criteria shall be incorporated into the next. Land Use and Shoreline Management Plan update to be conducted with the next project relicensing."

Compliance: Land rebalancing of the shoreline is an integral part of the shoreline management plan and associated with the new license application settlement agreement. The new license application was filed by letter dated August 27, 2008; however the settlement agreement has not been completely resolved by the new license application filing date and will continue for several months as we attempt to reach agreements on all of the issues associated the new license application.

As part of its relicensing activities SCE&G assembled a diverse group of stakeholders in the Lake and Land Management Technical Working Committee (TWC) to revise and make more comprehensive the Shoreline Management Plan (SMP), as well as perform "land use rebalancing". Rebalancing discussions ensued in the TWC on October 31, 2006, with more formalized discussions occurring on November 21, 2006. 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.

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. 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. 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. 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. As the Commission can tell there was a large amount of effort that went into developing a land rebalancing program acceptable to all stakeholders, however, SCE&G still has a few items that need to be resolved before this activity is finalized. The rebalancing proposal will be included with the Comprehensive Settlement Agreement for consideration and inclusion in the new license. Our plan according to our post-filing schedule is to file the Comprehensive Settlement Agreement by June 2009.

"**(I)** The licensee's proposed changes to its recreation facilities are approved and made a part of the project's Exhibit R-Recreation Plan. The proposed recreation changes shall include designation of Two Bird Cove and Hurricane Hole Cove as special recreation areas and a full description of the two additional recreation sites proposed by SCE&G as future recreation areas. The licensee shall also consult with the U.S Fish and Wildlife Service and South Carolina Department of Natural Resources and designate new waterfowl hunting areas for those lost to land sales and development, and indicate these areas in the Recreation Plan. The licensee's proposed changes shall be implemented within 1 year of issuance of this order. The licensee shall file, for Commission approval, as-built drawings of the implemented recreation facilities within

60 days of completing construction. These changes shall be indicated in the next Land Use and Shoreline Management Plan update."

Compliance: The new license application was filed by letter dated August 27, 2008; however the settlement agreement, which will include details associated with designation of a waterfowl hunting area, has not been completely resolved by the new license application filing date and will continue for several months as we attempt to reach agreements on all of the issues associated the new license application.

As noted in our previous filings and annual status reports, the plan that is being developed in consultation with SCDNR and USFWS 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 vegetation can be planted and flooded 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. On March 13, 2008, June 18, 2008, July 10, 2008, and again on August 5, 2008 SCE&G met with the property owners to discuss a contract for the option to purchase the land that appears to be suitable for this activity. At this filing, there are still several items that need to be negotiated with the property owners in order to provide the appropriate waterfowl hunting habitat land that SCDNR believes they need. SCE&G is also working with SCDNR to assure the appropriate funding can be secured and still needs to negotiate details for the design, construction, and annual maintenance of the waterfowl hunting area. SCE&G continues to work out the details of this 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. The plan according to our post-filing schedule is to file the Comprehensive Settlement Agreement by June 2009. Attached is a letter from SCDNR dated August 26, 2008 which expresses their concurrence with this request for a time extension in order to address the issues stated above.

The above descriptions are submitted to the Commission as documentation to respectfully request an extension of time until June 30, 2009 for Paragraph F (land re-balancing) and the waterfowl hunting area designation section of Paragraph I associated with the ORDER APPROVING LAND USE AND SHORELINE MANAGEMENT PLAN WITH MODIFICATIONS AND AMENDING EXHIBIT R issued by the Commission on June 23, 2004. Granting this extension of time will allow the Licensee the ability to resolve these issues through the settlement agreement associated with the new license application which was, we believe, the original intent for requesting completion of these activities as part of the new license application filing.

If you have any questions about this filing, please call Mr. William Argentieri at (803) 217-9162 or Mr. Tommy Boozer at (803) 217-9007.

Very truly yours,

Michael Summer

Michael C. Summer, General Manager
Fossil/Hydro Technical Services

WRA/wa

Enclosure

c: M. C. Summer/W. R. Argentieri/SHFile
A. I. Spell/M. C. Clonts/J. R. Stockman
T. C. Boozer
R. R. Mahan
Corporate Records
B. J. McManus - Jones Day
R. W. Christie – SCDNR
V. Vejdani - SCDNR
A. K. Hill – USFWS
D. M. Murray – FERC Washington (MC PJ 12.2)

South Carolina Department of

Natural Resources

Robert D. Perry
Certified Wildlife Biologist
Director, Office of Environmental Programs
1000 Assembly Street Room 310A
PO Box 167
Columbia, SC 29202
803-734-3766
803-734-3767
perryb@dnr.sc.gov

John E. Frampton
Director
Don Winslow
Chief-of-Staff

August 26, 2008

Mr. William R. Argentieri
South Carolina Electric & Gas Company
111 Research Drive
Columbia, SC 29203

Dear Mr. Argentieri,

Reference is made to numerous discussions and meetings including several site visits between Department of Natural Resources (DNR) staff and representatives of South Carolina Electric and Gas Company (SCE&G) to discuss opportunities to develop waterfowl habitat off the Saluda River. These meetings and discussions have been a product of the effort to pursue mitigation for lost waterfowl habitat and waterfowl hunting opportunity on and around Lake Murray as a result of decades of development.

This correspondence is submitted to indicate support of ongoing SCE&G efforts to secure the identified tract targeted to satisfy the mitigation need. DNR is aware SCE&G has met frequently with the landowner and continues to seek an option to purchase the tract. DNR acknowledges the negotiations have been time consuming, technical and difficult. Additionally SCE&G has consulted frequently with DNR regarding recommendations and needs for consideration in the prospective purchase of land. DNR recommends you notify the Federal Energy Regulatory Commission with a request for a time extension to complete the purchase and supply a development plan. DNR fully supports the need for additional time to complete work on this issue.

DNR continues to be pleased with the cooperative and enthusiastic response demonstrated by SCE&G staff in pursuit of the stated mitigation need, and DNR looks forward to working with you and your staff in the coming weeks to finalize a project meeting resource requirements and providing replacement public use opportunities. Please do not hesitate to contact me if you have any questions regarding this transmittal.

Very truly yours,

Bob Perry

Bob Perry

c: Dick Christie
Vivianne Vejdani

Document Content(s)

Appendix 17

Final Report and Recommendations of the Saluda/Congaree Ecologically Sustainable Water Management Process

Final Report and Recommendations of the Saluda/Congaree Ecologically Sustainable Water Management Process

October 2008

A cooperative effort led by the National Park Service, American Rivers, The Nature Conservancy, the U.S. Fish and Wildlife Service, and Carolina Coastal Conservation League. This project has been jointly funded by the National Park Service's Challenge Cost Share Program and American Rivers.

INTRODUCTION

South Carolina Electric and Gas (SCE&G), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), American Rivers (AR), The Nature Conservancy (TNC), and others have been working together to facilitate a science-based, stakeholder-inclusive process for balancing human and ecosystem needs for water in the Saluda and Congaree rivers. Modeled after the Ecologically Sustainable Water Management (ESWM) approach pioneered by TNC's Freshwater Initiative (Richter et al. 2006), the goal of this partnership is to improve knowledge, collaboration, and communication within the context of FERC relicensing concerning the allocation of water in Lake Murray, the lower Saluda River, and the Congaree River. What follows is a description of the ESWM methodology, a proposed flow recommendation, and an adaptive management framework to ensure ongoing collaboration toward the enhancement and sustainability of the Saluda, Broad and Congaree rivers.

ESWM is a multi-step process that incorporates scientific information, professional judgment, and diverse stakeholder interests to develop one or more flow recommendations that meet the needs of as many stakeholder interests as possible. As defined by Richter et al. (2006), ESWM is intended to be an "adaptive, inter-disciplinary, science-based process for developing flow recommendations." It requires an in depth investigation of the ecological and societal needs of the river and its hydrology. This is accomplished by convening a series of facilitated workshops that merge scientific tools and information, expert judgment from scientists, and stakeholder interests to enhance the dialogue about water allocation.

In most assessments of hydroelectric project operations, decision makers are faced with balancing competing demands and uses for finite water resources. In this regard, the relicensing of Saluda Dam presents a fairly typical water allocation puzzle; providing lake levels suitable for recreation and aesthetics, providing recreational and biological flows below the dam in the lower Saluda River, while maintaining optimal flexibility for producing hydropower to meet societal demands and regulatory obligations. What sets the Saluda Dam relicensing project apart from other relicensing projects is its relationship to Congaree National Park – an internationally significant floodplain ecosystem approximately 30 miles downstream from the Saluda Dam. Potential impacts to Congaree National Park as a result of altered hydrology associated with operations of the Saluda Dam have presented the need for stakeholders and decision-makers to balance societal needs with protection and enhancement of these natural, cultural and recreational public resources as part of the Saluda Dam relicensing process.

Originally designated in 1976 as Congaree Swamp National Monument (PL 94-545), Congress authorized the NPS to preserve and protect the largest remnant tract of old growth bottomland hardwood forest in the United States. In 2003, Congress upgraded the park to full national park status making it South Carolina's first and only national park. Located along the northeastern bank of the Congaree River and including a portion of the lower Wateree River, today Congaree National Park (CNP) protects a floodplain ecosystem consisting of nearly 26,000 acres. The long-term health of this unique floodplain ecosystem is directly linked to the flow regime of the Saluda, Broad, Congaree, and Wateree rivers.

Further compounding the complexity of the Saluda Dam Relicensing is the influence of the Broad River, a relatively unregulated and prominent contributor to flows in the Congaree. The Congaree River begins approximately 17 miles upstream of CNP at the confluence of the Saluda and Broad Rivers. On average, the Broad contributes approximately 2/3 of the flows within the Congaree; however, this relationship is complicated by a variety of factors leading to an apportionment that varies seasonally and annually from this average (Plewa and Graf 2005). A key challenge in understanding and improving the dynamic nature of flows in the Congaree is to agree on a means of managing Saluda Dam in light of unregulated flow contributions of the Broad in order to achieve needed flexibility in generation, stability in lake levels, and beneficial ecological and recreational flows in the lower Saluda.

Since 1930, flows in the Congaree River have been, in part, regulated by the operation of the Saluda Dam. Water releases from the Saluda Dam are typically inconsistent with the natural hydrograph and result in altered flow conditions both within and adjacent to CNP. These altered flow conditions and their associated effects on the complex ecological communities within the CNP floodplain remain a primary concern of the NPS and other stakeholders. While the ecological implications of this altered hydrologic regime on CNP resources have only recently become the focus of extensive study, several targeted scientific studies funded by the NPS have examined this relationship in order to provide useful information during the Saluda Dam relicensing process.

The United States Geological Survey (USGS) recently completed a flood frequency analysis on the peak flows within the Broad, Saluda and Congaree rivers for various periods of the historic record including pre- and post-impoundment of Lake Murray (Conrads et al. 2007). The analysis of daily gage heights on the Congaree River indicate that the operation of the Saluda Dam has decreased high gage heights that occur in the first six months of the year (December – May) and has increased the low gage heights that occur in the last half of the year (June – November). The operation of Saluda Dam has also increased the 1-, 3-, 7-, 30-, and 90-day minimum gage heights by up to 23.9% and decreased the 1-, 3-, 7-, 30-, and 90-day maximum gage heights by up to 7.2%. Overall, the operation of the Saluda Dam has affected monthly average gage heights by up to 18%.

These data support previous evidence and observations that the CNP floodplain may be undergoing a shift in community structure. Preliminary field evidence indicates that recruitment of bald cypress (*Taxodium distichum*), the co-dominant canopy species within the park, may be profoundly inhibited as a result of artificially prolonged flooding during the growing season (B. Sharitz, pers. comm.). In other words, by increasing water heights during low flow conditions, bald cypress seedlings experience prolonged inundation at a life stage that is highly intolerant to submersion. These changes in water level are further reflected in the surficial ground-water, which may have an effect on the root zone within the CNP floodplain and the associated vegetative community structure within the park. Together, these environmental changes occurring within the Congaree floodplain represent an ongoing suite of effects with a direct nexus to the operation of Saluda Dam.

Because of the influence of Saluda Dam operations in affecting flood frequency, timing, duration at CNP, the opportunity to enhance operations in a manner that benefits CNP while achieving other water allocation goals, plus the potential for increasing stakeholder awareness of the resource sensitivity at CNP, we chose to develop and implement an ESWM-based process in conjunction with the ongoing FERC relicensing of Saluda Dam.

METHODOLOGY

In 2006, after consulting with various partners, the NPS, FWS, AR, and others (henceforth, ESWM Leadership Committee or ESWM LC) approached SCE&G with the prospect of conducting an ESWM process for the Congaree and Saluda rivers. Since that time, and broadly following the approach laid out by TNC (Figure 1), the Saluda ESWM process has successfully completed a number of essential tasks associated with developing a science-based, stakeholder-inclusive consensus regarding future operations of Saluda Dam. Due to logistical and funding constraints associated with agency budget cycles and the existence of an ongoing FERC relicensing (ESWM was not developed with FERC relicensing in mind), we deviated somewhat from the original six-step process, chiefly by initiating the process with a literature review prior to the initial orientation meeting. In addition, we began developing a spatially-explicit floodplain inundation model prior to our first stakeholder workshop. This change in order likely had no effect on the desired outcomes of the ESWM process. All products developed prior to the initial stakeholder workshop were viewed as "draft" and participants were encouraged to provide constructive comments throughout the process.

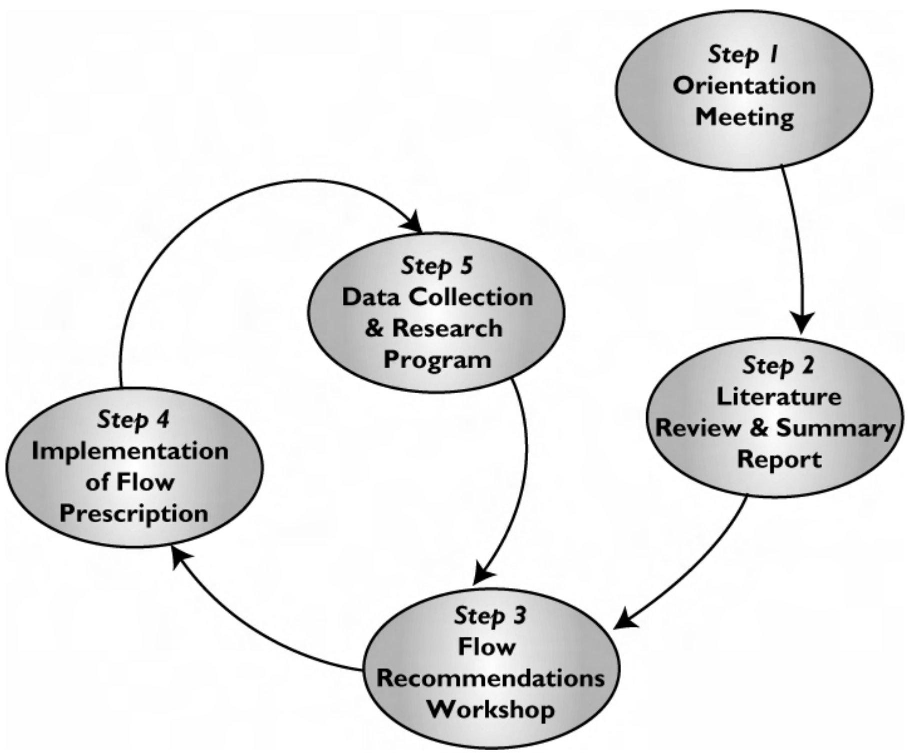


Figure 1. ESWM flow diagram from Richter et al. 2006. Steps 3–5 are repeated indefinitely to enable refinement of the flow recommendations over time.

Step 1: Basin-wide Literature Review and Floodplain Inundation Model
This step entailed the development of the basin-wide literature review and summary report that pulled together available relevant information concerning water allocation in the Saluda, Broad and Congaree rivers. Much of this information was contained in SCE&G's Initial Consultation Document (Kleinschmidt 2005). In addition, NPS contracted with the University of South Carolina to conduct an objective basin-wide literature review and develop an accompanying summary report (Graf and Stroup 2006 – see Appendix A). A floodplain inundation model was also developed as a GIS-based decision support system for modeling the effects of various river flows on floodplain inundation depths at Congaree National Park (Graf and Meitzen 2006 – see Appendix B). The flood inundation model used U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) software, a Geographic Information System (GIS), and HEC-Geo RAS GIS extension tools. Primary data sources included United States Geological Survey (USGS) stream flow data and high-resolution LiDAR data.

Step 2: Orientation Workshop
All stakeholders were invited to present their interests relating to water allocation associated with Saluda Dam, and to propose ESWM as a process for sharing information and developing a set of recommendations related to project operations. Nearly 50 participants attended the one-day orientation workshop which took place on June 26, 2007 at the University of South Carolina (USC). Participants acquired an in-depth understanding of the range of issues relating to the ESWM process, hydropower operations, river and floodplain ecology, and other stakeholder interests. There was a broad consensus that ESWM was an appropriate method for developing flow recommendations, and most participants agreed to attend future workshops in accordance with the ESWM framework. Several participants subsequently provided comments and input relating to the literature review and model development.

The group agreed on a vision for the Saluda, Broad and Congaree rivers:

"We envision an integrated river system, including Lake Murray, the Congaree National Park, the floodplain and riparian areas, that is managed with the inherent flexibility to take advantage of natural flow variation, provide ample electric power generation capacity, release flows that restore, improve and sustain ecological values, enhance aesthetic and economic values along the banks and shorelines, provide adequate clean water for withdrawals and assimilation, allow a variety of recreational opportunities such as swimming, boating, fishing, wildlife viewing and hiking, so that all these resource values will be enhanced and able to be continually improved as knowledge is gained and technologies are developed during our and future generations."

Step 3: Development of Indicator Species and Refinement of Model
Following the Orientation Workshop, with the assistance of USC, work was undertaken to refine the floodplain inundation model and develop a database of life history attributes for a suite of

flow sensitive indicator species (Appendix C). Flow sensitive indicator species were selected based on three main criteria:

(1) The species exists in the Congaree River corridor
(2) The species is affected by flow/floodplain inundation and/or temperature patterns
(3) Scientific information and/or reliable expert information exists for the species and the ecological relationship(s) of interest.

Step 4: Technical Workshop

The Technical Workshop took place on January 28-29, 2008 at USC. Based on consensus and additional information gained during steps 1, 2 and 3, a somewhat smaller group consisting of subject matter experts from various fields was assembled for this 2-day workshop to begin evaluating species life history information in the context of existing and potential future project operations. After an introduction to the status of existing information, workshop participants were divided into three facilitated groups based on expertise and interest. Group 1 focused on in-channel species; group 2 focused on aquatic species that inhabit or rely upon the floodplain; and group 3 focused on terrestrial species that inhabit or rely upon the floodplain. The groups were tasked to use existing information and expert judgment to identify important hydrological characteristics and/or develop flow recommendations for receptor species within their area of the river corridor.

The meeting outcomes included identification of key environmental constraints of particular indicator species with respect to Congaree flows. Examples of species information identified include the sensitivity of striped bass spawning behavior to slight changes in water temperature, and the sensitivity of bald cypress seedlings to floodplain inundation, the importance of inter- and intra-annual variability for overall community structure, and the relationship between river flows and habitat connectivity within the floodplain.

Following the initial Technical Workshop, the ESWM LC met to consolidate the information gained and the data gaps identified at the January meeting. The result of this meeting was the development of a conceptual diagram depicting critical flow and temperature thresholds for a variety of indicator species (Figure 2).

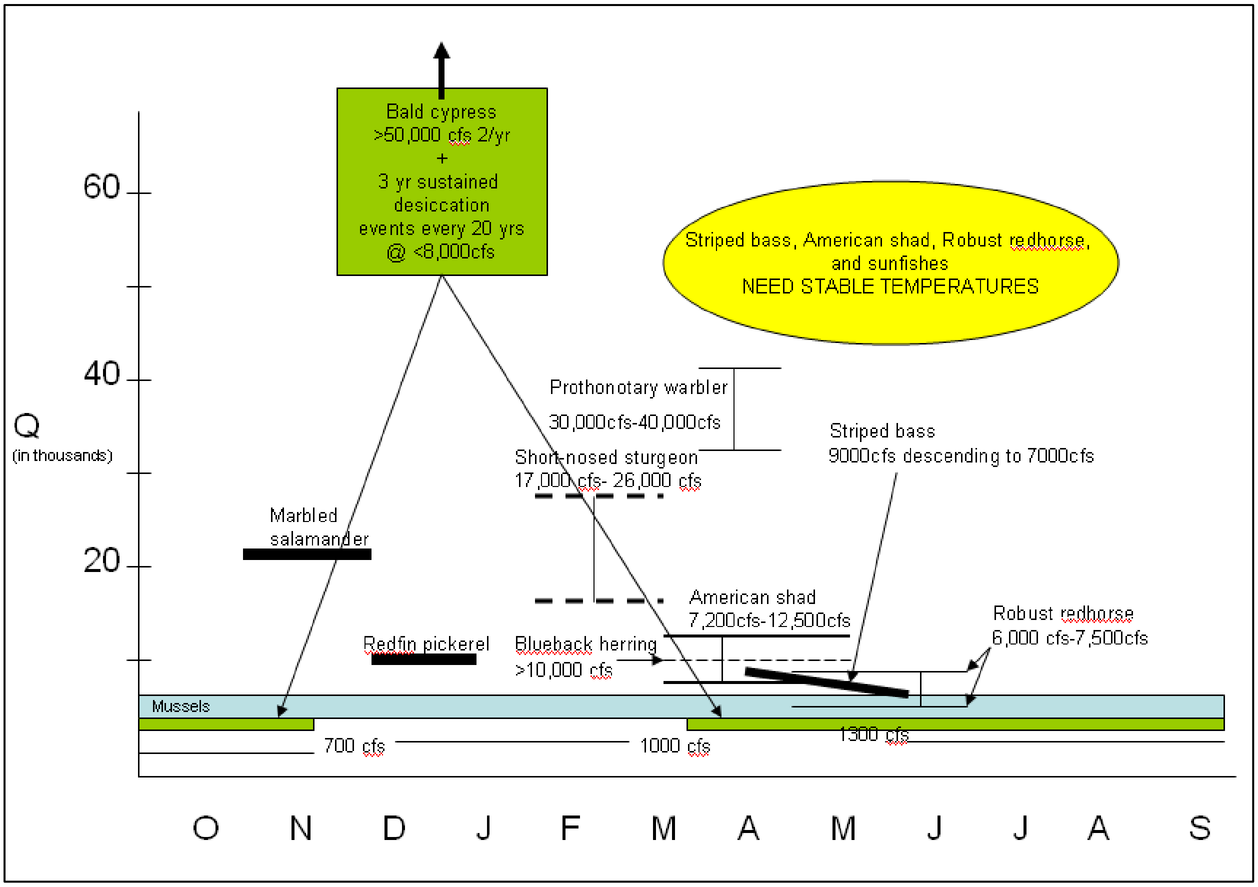


Figure 2. Conceptual diagram depicting flow and temperature thresholds for a variety of indicator species in the Congaree River basin.

Step 5: Flow Recommendation Workshops

The initial Flow Recommendation Workshop reconvened all stakeholders for a 1-day meeting at Saluda Shoals State Park on April 21, 2008. The focus of this meeting was to update stakeholders on progress made during the Technical Workshop with respect to key indicator species, and to begin a dialogue related to a Naturalized Flow Scenario (described below). While there was general consensus that a Naturalized Flow Scenario holds promise for sustaining and enhancing ecological resources, it was clear that further refinement of the scenario, analysis of its implications to lake levels, recreational flows, and reserve generating capacity is needed. Additional workshops will likely be needed as the group strives to agree on a flow scenario that meets the needs of all stakeholders. Integrating the ESWM Process with FERC relicensing is a key component of this step that will ultimately result in the development of a settlement agreement and, to the extent necessary and feasible, specific license articles.

Step 6: Monitoring, Research, and Feedback

Monitoring and additional research are key elements of the ESWM approach and in general will take place after a new license is issued. Despite the best research, expert judgment, and collaborative negotiations, ecological uncertainties will continue to exist with respect to ecological flows and the indicator species they target. In order to be effective, adaptive management must offer a balance between the flexibility that is necessary to achieve optimal ecological function within the river ecosystem and the certainty required by SCE&G and other stakeholders in ensuring ample water resources for human needs. An adaptive management framework is described the subsequent section.

GOALS RESULTING FROM THE ESWM PROCESS

The ESWM Process successfully produced a number of desirable and specific flow goals that meet or enhance the downstream needs of the Congaree River as it relates to the set of receptor species. These include operations to:

- Enhance high, medium and low levels of floodplain inundation and connectivity between the Congaree River and the creeks, guts, sloughs, and oxbows that provide habitat for many species;

- Stabilize water temperature in the Congaree River during spawning periods for striped bass and robust redhorse;

- Enhance Congaree River flows for spawning shortnose sturgeon, American shad, blueback herring, striped bass, sunfish and robust redhorse;

- Enhance breeding success for Prothonotary warbler and Marbled salamander;

- Enhance different levels of flooding in some years and refrain from inducing flooding in dry periods in some years to produce the variability needed for the bald cypress;

- Provide flows with inter- and intra-annual variability to mimic the inherent natural environmental variability that benefits different species in different years that sustains diverse biological assemblages.

We recognize that developing operational rules to meet all of these downstream flow needs, combined with goals associated with reservoir levels and recreational flows, would be extremely complex. Furthermore, trying to assure that Saluda operations coincide with specific flow events on the Broad River in real time would be difficult if not impossible. Therefore, to simplify, we suggest the following operation scenario to meet many of the downstream ecological needs while simultaneously creating a balance with other water allocation desires. We call this the ***naturalized flow scenario***.

FLOW RECOMMENDATIONS

The following describes our recommendations in the context of the naturalized flow scenario:

(1) Naturalized Flow Period: Provide 30 days of naturalized flows annually where SCE&G will operate Saluda Dam to release downstream flows continuously with limited variability based on average inflow into Lake Murray from the previous day. This period would generally be from

April 1 to April 30, but could start as early as March 21 and end as late as May 10 depending on climatic conditions and management goals.

Two of every 5 years provide an additional two-week flow naturalization period alternating between an early period (March 1 to March 15) and a late period (May 15 and May 31). The rationale is to produce naturalized flow conditions with intra- and inter-annual variability targeting spring spawning events for aquatic indicator species identified during the ESWM Process. The primary purpose of these periods is to increase flow variability for the full suite of ecological functions. Priorities for the early period are shortnose sturgeon and American shad spawning, and increased early season floodplain inundation. For the later period, priorities are temperature and flow stabilization for robust redhorse, sunfish and other late season spawners.

(2) Limitations to Naturalized Flows: The naturalized flow scenario would be in effect for Congaree River flows up to 30,000 cfs. The rationale for this upper limit is that higher discharge events (i.e., flood events in which the river banks CNP are over topped resulting in near complete flooding of the park's floodplain) are dominated by Broad River flows making Saluda flows of less importance during these events. This assumption corresponds to the conclusions of Conrads et al. (2007) and the ESWM floodplain inundation model (Graf and Meitzen 2006).

(3) Limitation on Temperature Fluctuations: During the naturalized flow period defined in Section 1, Saluda Dam would be operated so that temperatures in the Congaree River, in the vicinity of I-77, do not vary more than 1 degree Celsius from ambient temperatures (as represented by the Broad River). Temperature fluctuations greater than this can result in the failure of spawning events.

We recognize that an adaptive management process will be needed to understand the limits on Saluda Dam operations to meet this objective. A real time temperature gage would also need to be established and maintained in the I-77 vicinity.

We recognize that SCE&G values the use of Saluda Dam for reserve operations and agree that one reserve operation call resulting in greater than +\- 1 degree C change could be permitted during each 30-day naturalized flow period.

(4) Compatibility with Saluda River Flows: Releases from Saluda Dam during the naturalized flow period would never be less than the minimum flows recommended by the Saluda instream flow study (700 cfs March, 1000 cfs April 1-14, and 1,300 cfs April 15-May 15) unless under low inflow protocol (LIP) operations. (LIP operations are not yet agreed to but SCE&G has proposed reducing downstream flows in a step wise manner to as low as 400 cfs depending on the severity of the drought and lake levels.) Additionally, adjustments to operations during the flow naturalization period needed to support recreation flows for the Saluda River, as currently planned, is fully supported.

(5) Low Inflow Periods: Operate Saluda Dam during low inflow periods to maintain low flows in the Saluda River during the growing season – April 1 through October 15 – in order to perpetuate the positive effects of low flow periods for the Congaree ecosystem (e.g., bald cypress recruitment). We find the general concepts of the Low Inflow Protocol, as currently being discussed in the Instream Flow Technical Working Committee, to be consistent with our recommendations.

(6) **Lake Levels:** Limit Lake Murray drawdown to 354 ft and refill the reservoir to full pool (358 ft) by March 1 during normal operating conditions (non-LIP periods). More extreme drawdowns and later full pool targets would lessen the likelihood of meeting downstream flow targets and naturalized flow period goals.

(7) **Scheduling Naturalized Flow Periods:** The exact timing of the naturalized flow periods will be agreed to by an Adaptive Management Team (AMT) consisting of SCE&G, state and federal agencies and other relicensing stakeholders with relevant experience and interests. The AMT would meet twice annually, once in October to evaluate the effects of the previous year's naturalized flow period, and once in February to set the dates for the upcoming year. This would allow for real-time adaptation of flowing timing related to biological and climatic factors. In addition, the AMT may elect to meet as necessary to adjust to extreme, unforeseen weather events.

Adaptive Management Framework

The complexity and inherent uncertainty associated with our knowledge of nature means that any effort to actively "manage" natural systems is unlikely to result in outcomes that accomplish our preconceived notions of an optimized natural ecosystem. Further complicating this endeavor is the fact that most natural systems are already highly altered by the competing demands of society. This is indeed the case when it comes to decisions about the allocation of water within the Saluda, Broad, and Congaree rivers. The Naturalized Flow Scenario proposed within this document represents an initial attempt to optimize nature in the face of competing uses for water resources. Creating a balance between and among competing uses can best be accomplished through an iterative approach.

Adaptive management is an iterative approach to deal with complexity and uncertainty pertaining to the management of natural resources and other complex systems. To be successful, open dialogue, collaboration, long-term stakeholder engagement, monitoring, and maximum flexibility in decision-making are essential elements. The realities associated with the hydropower industry and FERC regulations require that constraints be placed on adaptive management such that legal and regulatory obligations of the power company and other stakeholders (e.g., the National Park Service) can be achieved. To accomplish this, an adaptive management framework needs to be developed that includes provisions identifying (1) metrics, (2) a monitoring plan, and (3) decision thresholds. In addition, adaptive management also requires a funding source and the establishment of a management body or council.

1. **Metrics.** Metrics are those parameters within the natural system (or developed system) that require measurement and serve as indicators of the effectiveness of management actions. Examples for the Saluda/Congaree system might include abundance of various age classes of striped bass within the Congaree River, recruitment of bald cypress saplings at CNP, etc.

2. **Monitoring Plan.** A monitoring plan identifies the timing, frequency, sampling methods, etc associated with various metrics. Continuing the example from above, a monitoring plan for the Saluda/Congaree system would identify precisely how and when striped bass populations and bald cypress stands would be measured.

3. **Decision Thresholds.** Decision thresholds are those pre-identified, generally quantitative, values for a particular metric that elicit a switch to a pre-identified alternative operational or monitoring approach. Examples for the Saluda/Congaree include a low level of reproductive success for striped bass over a three year period.

In order to be successful, all of these elements should be developed, implemented, and if necessary changed by an adaptive management council consisting of experts and interested stakeholders that meets on a regular and recurrent basis (e.g., twice annually). Adaptive management also requires ample funding to coordinate the council and implement the monitoring plan. Within the context of ESWM and the Saluda Relicensing Project, an adaptive management approach can be established via an Agreement In Principle, the details of which can be determined at later date after ample consideration and discussion among stakeholders.

SUMMARY

Thus far, the ESWM framework has proven to be an effective means of developing broad-based consensus relying on scientific analysis, expert judgment, and good-faith negotiations. ESWM has succeeded in focusing attention on the ecological needs of the Congaree River and Congaree National Park as they relate to the operations of Saluda Dam while generally diffusing much of the bureaucracy and adversarial nature that can accompany the FERC relicensing process. Through this process we have developed a set of flow recommendations for improving ecological processes and functions within the Congaree River while striving for balance among the various other uses associated with Saluda Dam operations. Specifically, our recommendations seek this balance by proposing a naturalized flow scenario allowing for continuous downstream flows for a set period each spring that approximate natural inflows. In addition, our recommendations are explicitly designed to stress the importance of intra- and inter-annual variability in order to meet broad-based ecological needs of the Congaree River ecosystem. We specifically propose the establishment of an Adaptive Management Team to continually monitor, evaluate, and recommend periodic adjustments to flow management procedures. The true test of whether the Saluda/Congaree ESWM Process will be effective in achieving its goals will require continued dialogue between and among all stakeholders as we move from the analysis of ecological indicators toward a testable set of consensus-based operational protocols.

LITERATURE CITED

Conrads, P.A., T.D. Feaster, and E.A. Roehl, Jr. 2007. Separating anthropogenic influences on hydrology using data mining techniques: A case study of the Congaree National Park, South

Carolina. Water Environment Federation Technical Exhibition Conference 2007, San Diego, California, October 2007

Graf, W.L. and K.M. Meitzen. 2006. Congaree Floodplain Decision Support Project: Assessing the extent of river regulation effects on resources with and around Congaree National Park – Part II: Floodplain Inundation Modeling Using HEC-RAS and GIS. A Report to NPS. 23 pp.

Graf, W.L. and L.J. Stroup. 2006. Congaree Floodplain Decision Support Project: Assessing the extent of river regulation effects on resources with and around Congaree National Park – Part 1: Literature Review. A Report for the National Park Service. June 2006. 47 pp.

Kleinschmidt. 2005. Initial Consultation Document. Saluda Hydroelectric Project Relicensing – FERC No. 516. April 2005. Prepared for South Carolina Electric & Gas. 364 pp.

Plewa T.T. and W.L. Graf. 2005. Hydrologic variation of the Congaree River near Congaree National Park, South Carolina. A report for the National Park Service. 25 pp.

Public Law 94-545. 1976. As enacted, the bill (H.R. 11891), approved October 18, 1976, is Public Law 94-545 (90 Stat. 2517) of the 94th Congress.

Ritcher, B.D., A.T. Warner, J.L. Meyer, and K. Lutz. 2006. A collaborative and adaptive process for developing environmental flow recommendations. *River Res. Applic*. 22:297-318.

APPENDIX A:

Literature Review for Saluda, Broad and Congaree Rivers

CONGAREE FLOODPLAIN DECISION SUPPORT PROJECT: ASSESSING THE EXTENT OF RIVER REGULATION EFFECTS ON RESOURCES WITHIN AND AROUND CONGAREE NATIONAL PARK PART 1: LITERATURE REVIEW

Congaree River, South Carolina (W.L. Graf, 2005)

A Report for the National Park Service
Piedmont – South Atlantic Cooperative Ecosystems Studies Unit
Contract No. H5000030930, Order No. J5240050013
Requisition Reference No. R5240050013

by

William L. Graf and Laura J. Stroup
Department of Geography
University of South Carolina
Columbia, South Carolina 29208

June 10, 2006

ABSTRACT

The content of this report, a literature review relevant to the resources of the Saluda, Broad and Congaree Rivers, was compiled from September 2005 to May 2006. This project was undertaken to better inform the National Park Service at Congaree National Park about natural and cultural features of the area for the Federal FERC relicensing of Saluda Dam. This report contains citations and accompanying annotations of sources related to the physical, chemical, biological, and socio-economic aspects of the three river basins. Congaree National Park Library resources compose the first section of this report. Materials cited include newspaper articles, reports, published papers, internet links, and books. The second section contains newspaper articles, reports, published papers, internet links, and books obtainable online, and resources from the University of South Carolina Libraries, SC DHEC, SC DNR, and USC Geography Department resources. The lack of literature on the Broad River is evident, and is an important finding, as Congaree National Park receives 2/3s of it water from the Broad River Basin. Additionally, more information and reports are likely to be created through the Federal relicensing process, and it is hoped this report will form the basis of future literature compilation regarding the three rivers and their relationship with Congaree National Park.

TABLE OF CONTENTS

INTRODUCTION

This report satisfies Object 1 of the Congaree Floodplain Decision Support Project: the compilation of an extensive and comprehensive annotated literature review which identifies the physical, biological, chemical and socio-economic characteristics of rivers influencing Congaree National Park. The comprehensive information enclosed includes the Broad, Saluda, and Congaree Rivers.

This project consists of the following sections: 1) citations and annotations regarding newspaper articles, reports, published papers, internet links, and books compiled and obtainable from the Congaree National Park Library; and 2) resources compiled from newspaper articles, reports, published papers, internet links, and books obtainable online, and resources from the University of South Carolina Libraries, SC DHEC, SC DNR, internet and USC Geography Department resources.

Congaree National Park Library Resources
Relevant to The Congaree Floodplain Decision Support Project
Compiled Dec. 7, 2005-January 23, 2005

General/Compilations

National Park Service, U.S. Department of the Interior. 1996. Water Resources Management Plan, Congaree Swamp National Monument. May 1996.

This plan provides information regarding impacts to water resources in the Monument and addresses the most pressing water resources issues. The report recommends improving the understanding of fluvial processes and hydrodynamics of the Congaree floodplain, assessing the degree of surface and groundwater contamination, detecting the effects of changing discharge on aquatic resources, participating in corridor planning, tracking land use within the watershed, and ensuring the safety and enjoyment of visitors while augmenting public awareness through education.

SC DHEC. 1998. Initial Unified Watershed Assessment Saluda Basin. Received November 1, 1999.

The Saluda River Basin was named a FY 1999-2000 SC watershed restoration priority. This report outlines the unified watershed assessment to sustain water quality and aquatic resources developed by representatives of SC DHEC and NRCS.

State of South Carolina, Water Resources Commission. n.d. South Carolina Drought. General Informational Brochure.

The Water Resources Commission has prepared a basic informational brochure relating to the climatic factors, drought management areas, and mitigation and conservation activities surrounding drought in the state of South Carolina.

State of South Carolina, Water Resources Commission, Amy Rudell. 1984. Congaree River: A Preliminary Management Survey. South Carolina State Scenic Rivers Program, SCWRC Admin. Report No. 143. September 1984.

As a cooperative effort between the National Park Service and the SCWRC in the summer of 1982, field investigations were conducted to document the environmental, historical, and geologic significance of the Congaree River to support a 1976 declaration that 37 miles of the river were eligible for protection under the State Scenic Rivers Program. This report contains general information regarding socio-economic, ecological, administrative, cultural, and hydrologic features of the area.

The Strom Thurmond Institute at Clemson University. 1985. The Situation and Outlook for Water Resource Use in South Carolina 1985-2000. South Carolina Water Resources Commission, First Year Executive Summary. November 1985.

This report was compiled in order to better anticipate water needs in the state, regarding water resources, approaching the next century. The report specifically focuses upon industrial water demand, the financial condition of water supply systems, rate structures, and several policy-related questions.

The U.S. Dept. of the Interior, USGS. 2001. Water Resources Data South Carolina Water Year 2001. Water Data Report SC-01-1, pp.113-336.

This report provides water-year information for 2001 regarding gage water quantity and/or quality characteristics. The Santee River watershed information is within the page numbers listed in the cite. A good general source for gage and water quality data for the Santee Basin for a recent water year.

FERC Relicensing

American Rivers. n.d. The Rivers and Streams of South Carolina. Meeting Handout(?)

This document outlines the importance of South Carolina's rivers in terms of the global diversity of freshwater aquatic life as well as mounting threats to their future survival. American River contends that the designation of South Carolina waterways as Wild and Scenic Rivers, as well as altering hydropower dam operations to balance environmental and economic interests, are two critical factors in their approach.

Day, J. 2003. Letter to M.R. Salas, Secretary of FERC, regarding SCE&G Project No. 516. June 19, 2003.

This letter is in regards to a letter filed with FERC on April 9, 2003 by the U.S. FWS citing concern over whether SCE&G was compliant with their FERC license during the time of drawdown of Lake Murray during construction activities on the Saluda Dam. The SCE&G believes they were in compliance, and attaches data in Appendix A of this letter from their lawyers to prove their case.

FERC, Office of Hydropower Licensing. 2002. Scoping Document 1: Saluda Dam Seismic Remediation Project South Carolina, FERC Project No. 516. May 2002.

FERC enlisted the input of the NPS regarding the appropriate level of environmental analysis needed for the Saluda Dam Remediation Project. The Scoping Document provides background information on the project to enlist agency expertise regarding environmental impacts of the dam retrofitting.

FERC. 2002. Draft Environmental Assessment: Saluda Dam Seismic Remediation, FERC Project No. 516. June 28, 2002.

The Environmental Assessment is intended to identify and quantify the effects of the construction of the backup Saluda Dam, and associated drawdown, will have on the environment, economy of the region, and local landowners. FERC asserts the construction of the backup dam must be completed without delay due to earthquake risk and that temporary adverse impacts of the project should not translate to long-term changes.

FERC. 2003. Order Extending Term of License, SCE&G. Project No. 516-374. November 18, 2003.

This order gives SCE&G permission to extend the license termination date for the Saluda Project No. 516 in order to give the company time to conduct studies after lake Murray has been filled and the environment is returned to baseline conditions. The termination date of the license was extended three years from August 31, 2007 to August 31, 2010, with August 31, 2008 the deadline for filing the relicensing application.

Fretwell, S. 2002. Dams up for license renewal: Public gets rare chance to improve conditions as part of relicensing process. *The State*. A1, A5. November 25, 2002.

This article highlights the issues, interests, and processes involved in the FERC relicensing of South Carolina's 21 eligible dams. Since FERC licenses are applicable for 30-50 years, the several-years-long relicensing process offers an opportunity for stakeholders to assert their views regarding the future operation and management of South Carolina's hydroelectric dams. The piece includes a map of the relevant dams up for relicensing.

Hydropower Reform Coalition. n.d. Ten Reasons Why Dams Damage Rivers. Meeting Handout(?)

The top ten reasons dams have negative effects on the environment are outlined, followed by short explanations.

The Hydropower Reform Coalition. n.d. FERC's Alternate Relicensing Process made Simple. PowerPoint Presentation from Workshop(?)

This printout of a PowerPoint presentation addresses comparisons of the traditional versus alternative relicensing process as well as the background needed to make informed decisions regarding the process.

Long, J.M. 2003. The Links among Hydropower, Flooding, and Aquatic Communities in Congaree Swamp National Monument, South Carolina. Division of Science and Natural Resource Management, Southeast Region, Natural Resource Challenge Newsletter. No. 3 (May 2003).

This short piece examines the effects of Saluda Dam operation on Congaree Swamp National Monument. The author notes the opportunities occurring to examine the linkages between river flow and aquatic communities in the Park due to the 2003 dam retrofitting and the 2007 expiration of the Saluda Dam FERC operating license.

National Park Service, 2005? Congaree National Park, South Carolina: New Hydro License could Enhance Congaree National Park Floodplan Ecosystem. Accessed: http://www.nps.gov/ncrc/programs/hydro/examples/sc.pdf

This online report provides background information about both the Park and the Saluda Dam-related FERC process. The report then explains the Hydropower Assistance Program, support provided through the NPS, available to the Park to help negotiate operating standards of the Dam consistent with Park conservation. To date, the Program has assisted the Park in obtaining $50,000 to research impacts of Dam operation on the Park and to help develop flow prescriptions which are science- and stakeholder-based.

Lake Murray and the Saluda Dam

Congaree National Monument. 1994. Lake Murray Dam Failure Emergency Response Plan. September 1994.

This packet of papers, in the administrative flies of the Park Library, recounts the plan to provide early warning and evacuation for employees and visitors to the Park in case of Saluda Dam failure. Funding requests for warning devices, and a map denoting their location, is included in the papers.

Flach, T. 2002. Deal to Alter Saluda's Flow: Water quality standards set for river during Lake Murray drawdown. *The State*. Metro Section, B1, B5. August 8, 2002.

Environmental groups, SCE&G representatives, and state officials agreed upon water quality standards during the drawdown of Lake Murray for the dam construction, starting September 15, 2002. River levels will fluctuate less and the river will operate closer to run-of-river conditions during the two-year planned drawdown. Congaree officials are uncertain the plan will be beneficial as it allows SCE&G to fall short of water quality of standards sometimes without a penalty and water flows affecting habitat will be altered.

Flach, T. 2003. Construction Begins on the New Lake Murray Dam: Past quakes spur new lake dam. *The State*. Metro Section, B1, B5. February 16, 2003.

Flach examines the seismic environment of Lake Murray and the Saluda Dam compared to a smaller but similar dam in California which failed due to an earthquake. FERC officials have mandated SCE&G construct a backup dam for the current Saluda Dam in order to protect downstream residents in the unlikely, but deadly, event of an earthquake. The article features a cross-section and schematic of the dam.

Flach, T. 2003. SCE&G may act to protect fish: Utility considers putting more oxygen in Saluda River. *The State*. Metro Section, B1. July 31, 2003.

SCE&G representatives may investigate a plan to inject more oxygen into the water through the installation of upgraded turbines in the Saluda Dam. State DHEC officials are uncertain as to how well this plan will protect fish by preventing fish kills, but SCE&G will have to comply with new state water quality standards when passed.

Flach, T. 2003. Environmentalists challenge Lake Murray Dam: Its way of handling hydropower called threat to Saluda River water, fish. The State. Metro Section, B1, B6. September 7, 2003.

Two environmental groups, American Rivers and the South Carolina Coastal Conservation League have filed a complaint with FERC. The groups, as well as an alliance of Midlands environmentalists, want more restrictions placed upon SCE&G's Saluda Dam operation to lessen the threat of decreased water quality to fish and wildlife downstream. Specifically DO and sediment are of concern. Lake Murray homeowners have watched the conflict with interest as they believe changes in operating procedures could also give them the benefit of better lake level conditions.

Flach, T. 2003. Backup dam slowed by rain, relics. The State. Metro Section, B1, B5. September 17, 2003.

A slowdown in construction due to weather and the discovery of items dating to the dam's construction has drawn criticism from Lake Murray residents. Crews are speeding up construction, but FERC officials will not allow lake levels to increase, due to the amount of pressure on the dam, until the new retrofit is attached to the existing dam and is no longer at risk of failure.

Flach, T. 2004. The New Lake Murray Dam: Project's first year full of surprises and 'scares.' *The State*. Metro Section, B1, B8. February 22, 2004.

Flach recounts the construction and structural problems encountered while retrofitting the Saluda Dam. The newspaper article includes a good summary of events occurring since construction began February 25, 2003 as well as useful schematics, pictures, and maps to better understand the project.

Holleman, J. 2002. 'The only whitewater we've got': Lake Murray drawdown stirs expectations for Saluda River recreation. *The State*. Get Out! And Stay Out! Section, E17. September 6, 2002.

The typical operation of the Lake Murray Dam causes the Saluda River below it to be suitable for calm-water canoeing. However, canoe and kayak trip guides as well as whitewater rafters had hoped the need to draw down the Lake Murray for the retrofitting would lead high releases initiating more exciting whitewater. However, the drawdown has proven unpredictable and not as exciting to whitewater interests as initially anticipated.

Robertson, P. 2004. Rising Hope. *South Carolina Wildlife*. May-June 2004, pp. 4-11.

Robertson relates that the drawdown of Lake Murray, though inconvenient for lakeside homeowners, dangerous for boaters, and bad for the local economy, has a positive impact in relation to fish and wildlife. Many fisherman and ecologists cited the drawdown as having a positive impact upon sport fisheries.

SCANA Corporation. 2001. SCANA in the Community - Lake Murray Backup Dam Project, About the Project and Frequently Asked Questions.

These two printouts from the internet provide pertinent background information regarding the construction of the backup dam provided by SCANA.

South Carolina Electric and Gas Company, Columbia, SC. 1997. Initial Stage Consultation Document. Columbia Hydroelectric Project FERC Project No. 1895. March 1997.

This document presents background information regarding the site and the project, and proposed future operation. The FERC relicensing process consists of three phases of which this document is the first. It was forwarded to interested agencies for review and comment to begin the relicensing process according to FERC regulations. SCE&G anticipated working closely with all interested agencies throughout each stage of the relicensing process. The most recent license expired June 30, 2000. A map of the project is enclosed.

Congaree River/Floodplain, National Park/Monument

Assessment of Flood Prediction Capabilities Workshop. 1999. Assessment of Flood Prediction Capabilities, Congaree Swamp National Monument. Workshop findings and papers. January 19, 1999.

These materials outline the outline of the meeting as well as the phases of the Flood Prediction Support System for Congaree Swamp National Monument. An abstract of a Master's Thesis from Clemson University highlights the floodplain modeling methodology.

Federal Emergency Management Agency (FEMA). 2000. Appeal Resolution for Congaree River in Richland and Lexington Counties, South Carolina. September 26, 2000.

Due to the great amount of feedback regarding the revised flood study of the Congaree River, FEMA performed additional analyses and developed a new HEC-2 hydraulic model of the Congaree River to resolve appeals. Specifically, the appeals of Dr. John Grego, University if South Carolina, Dr. Paul Sandifer, SC DNR, and Ms. Deborah A. Hottel, McNair Law Firm, were listed as the appellants under Part 67 of the NFIP regulations. These three parties provided detailed technical analyses of the Congaree Floodplain, including alternative BFEs, floodway delineations, period of flood record used, and roughness coefficients of the HEC-2 model used by FERC.

Hayes, J.C, D.E. Linvill, H. Merdun, I. Strassman, and B. Morse. 2000. A Flood Prediction Decision Support System for Congaree Swamp National Monument, Final Project Report for the United States Department of Interior, National Park Service. January 31, 2000. (Disk in Library File).

The study utilized two routing models to examine the flood stage of the Congaree River based upon the USGS gage at Columbia. Further work examined flood levels at various interior points of the Monument based upon a statistical analysis of crest gage data.

Hurley, N.M. 1992. Inundation Characteristics of the Congaree Swamp National Monument, Near Gadsden, South Carolina. Project Proposal SC94e. U.S. Geological Survey, Water Resources Division, Columbia, SC. July 1992. (Disk in Library File).

This project's objectives were to predict the recurrence, severity, and duration of flooding inundation of the Monument and to assist the NPS in developing an early warning system for evacuation of visitors prior to flooding.

Maluk, T.L**.** and T. A. Abrahamsen. 1999. Results of water-quality sampling and ecological characterization of streams of Congaree Swamp, South Carolina, 1995-1998 prepared as part of the National Water-Quality Assessment Program. Columbia, S.C. : U.S. Dept. of the Interior, U.S. Geological Survey ; Denver, Colo. : Branch of Information Services [distributor], 1999. Available at the Congaree N.P. Library.

This report constitutes the NAWQA Program ecological assessment of streams and the Congaree River within Congaree Swamp between 1995-1998. Water quality samples were collected at one site for the Congaree River and on Myers Creek. Samples were selected at two sites on Cedar Creek and Toms Creek. Samples were analyzed for pesticides, ions, nutrients, and suspended sediments.

Morse, B.C., J.C. Hayes, D.E. Linvill. 1999. Simulation of Flows in the Congaree River. Interim Report Submitted to the National Park Service. Department of Agricultural and Biological Engineering, Clemson University. March 1999.

The goal of this project was to investigate the USGS Diffusion Analogy Model (DAFLOW) as a method for routing flows from the USGS gage at Columbia to the

USGS gage on the Congaree River west of Wise Lake near Gadsden. The accuracy and timing of flood peaks was of interest so that Park rangers can warn visitors of flooding events. Another goal of this project was to evaluate the sensitivity of the model to various input parameters.

Merdum, H., J.C. Hayes, and D.E. Linvill. 1996. Statistical Analysis of River Flows into Congaree Swamp National Monument. Department of Agricultural and Biological Engineering, Clemson University. October 1996.

The objectives for developing a floodplain decision support system for Congaree are to first study and document flood events and obtain swamp hydropatterns through utilizing streamflow data from upstream gages and to second determine lag times between upstream rivers and the Congaree River, and to third predict the recurrence, severity, and duration of flooding at the Congaree Swamp.

Patrick Center for Environmental Research, The Academy of Natural Sciences of Philadelphia. 1998. Aquatic Field Studies in the Congaree River near Columbia, South Carolina, 1997. Report No. 98-4F, Submitted to Carolina Eastman Division, Eastman Chemical Company. April 30, 1998.

No impacts of the expansion of the Eastman Chemical Company were found during two prior Academy of Natural Sciences biological studies of the Congaree River in 1974 and then in 1979. This biological study is meant to supplement and update the earlier surveys to assess the overall health of the river, determine if effluent from the Company is affecting the River, and to determine whether significant changes to the biota have occurred since the last 1979 study. This report found that the Company is not impacting the biota in the Congaree River, but that the main stressors affecting the study area are upstream and include nutrient enrichment, a high sediment load, and markedly-fluctuating river levels. The researchers did not note a deterioration of biological communities in the study area compared to 1979 levels.

Plewa, T.M. and W.L. Graf. 2005. Hydrologic Variation of the Congaree River near Congaree National Park, South Carolina. A Report for the National Park Service. Department of Geography, University of South Carolina. January 29, 2005.

This report explores the relationships between the flows of the Broad, Saluda, and Congaree Rivers near Congaree National Park and upstream dams by investigating stream gage data. The relative flow of the rivers in terms of volume contribution to the Congaree, and dam operation affecting streamflow, is discussed.

Strassmann, I. 1997. Modeling of Surface Flows into Congaree Swamp. Clemson University Diploma Paper, Department of Agricultural and Biological Engineering. February 1997.

This report is part of the larger Flood Prediction System Project for the Congaree Swamp National Monument. This particular study focuses upon the modeling of surface water flows, specifically how Cedar Creek reacts to flooding events. A second focus of this study is to understand flood waves travel from a stream gage upstream of the Monument, to the Park, and determine the cause of the variation in these lag times.

Fish Communities and Aquatic Species

Bulak, J.S., N.M. Hurley, Jr., and J.S. Crane. 1993. Production, Mortality, and Transport of Striped Bass Eggs in Congaree and Wateree Rivers, South Carolina. *American Fisheries Society Symposium* 14: 29-37.

From 1988 to 1990, the annual amount and mortality of striped bass eggs were investigated in the Congaree and Wateree Rivers. A striped bass egg transport model was developed in order to determine the link between biological events and physical processes.

Crawford, C.R., J.C. Davis, C.B. Hall, J. McCarthy, E. Robey, and E. Winn. 1990. Congaree Swamp: Larval Fish Study. Marine Science Program, University of South Carolina. December 6, 1990.

The purpose of this study was to assess the degree of utilization of the Congaree's floodplain by larval fish species. The unique hydrologic and intermittent, but frequent, flooding regime of the Park may be used by fish particularly adapted to this type of flooding event. Traps set throughout the floodplain were used to survey species diversity and abundance. Seasonal issues and fish trap difficulties impeded the conclusions of this study.

May, T., W. Brumbaugh, M. Walther, and B. Poulton. U.S. Department of the Interior, USGS and L. Rose, SC DHEC. 2005. Concentrations of Total Mercury in Sediment, Invertebrates, and Fish from the Congaree National Park, SC. Final Report CERC-8335-FY05-32-11. July 18, 2005.

In the summer of 2003, SCDNR employees collected sediment, fish, and invertebrate samples from Congaree National Park to test for Hg, specifically MeHg, in the park. GPS coordinates were collected for each of 29 collection sites. Sediment Hg concentrations were found to be low to moderate. The highest mean Hg concentration among invertebrates was found in Aeschidae dragonly larvae. Considerable Hg contamination was found in fish—10% of all fish sampled exceeded the USEPA guidelines for human consumption, especially for larger fish. This warrants additional investigation. The study authors recommend monitoring of Hg in sport fish of catchable size every three years. Map is included of sampling sites.

Pescador, M.L., B.A. Richard, and A.K. Rasmussen of Florida A&M University. 2004. An Aquatic Invertebrate Survey for the Congaree Swamp National Park, Richland County, South Carolina. March 2004.

The objectives of this study were to determine the health of the riparian ecosystems within Congaree National Park environment through sampling benthic macroinvertebrates. Specific tasks included investigating species richness, assembling permanent collections of insects for public viewing, and creating a spatial database to provide an overview of the diversity and a general water quality assessment for lake and streams in the Park.

Rose, L, for the South Carolina Department of Natural Resources and National Park Service. 2001. Annual Report: Species Diversity and Condition of the Fish Community of Congaree Swamp National Monument. CA No. H5240-00-0290. October 29, 2001.

A comprehensive survey of the fish community was conducted for Congaree National Monument to determine the relative health of the community. At each sampling location, physical and chemical samples were collected including, pH, DO, conductivity, temperature, and observations regarding fluvial geomorphology.

Smoak, L.A. and E. Gilinsky. 1982. Benthic Macroinvertebrate Communities of a Floodplain Creek in the Congaree Swamp Monument. Department of Biology, Virginia Commonwealth University. Contract No. CX5000-0-0946. February 1982.

This report addresses the importance of floodplain streams as a source of water for the Monument. The biological component of floodplain streams centers on the macroinvertebrate community. These organisms can be used as indicators of both short-term and long-term environmental disturbance in the Monument, specifically as it realtes to water quality.

South Carolina Department of Natural Resources, Jim Bulak. 1997. Job Progress Report: Fishery Survey of the Congaree Swamp National Monument. July 1, 1996 - June 30, 1997.

The purpose of this survey is to compare fish populations in a fished and an unfished oxbox lake and survey the fish community at Cedar Creek. Information on this survey can be used to determine the effects of fishing on the fish community and additionally provide an initial description of this community.

South Carolina Department of Natural Resources, L. Rose and J. Bulak. 2005. Species Diversity and Condition of the Fish Community During a Drought in Congaree National Park. Final Report. October 2005.

From 1999 to 2002, SCDNR, under agreement from the Park Service, conducted 59 fish surveys at 33 sites within the Park to establish baseline data to characterize the condition of the fish community. The two main objectives of the study were to inventory fish species and define the relative condition of the fish community within the Park. Drought conditions were experienced during the sampling period and enabled sampling in areas that would have normally been inaccessible and further provided insight regarding habitat naturally degraded by the drought.

Taylor, J.M. 1994. Invertebrate Survey of Congaree Swamp National Monument: Study plan for the Survey of the Aquatic Macroinvertebrate Communities of the Congaree River, Cedar Creek and Tom's Creek within the Congaree Swamp National Monument, Richland County, South Carolina. September 9, 1994.

The aquatic environment of Congaree can be used as a means to assessing impacts of human alteration of the environment in and around the Monument. Macroinvertebrates are an integral part of the tropic structure in the Monument and are excellent indicators of water quality. The study will provide baseline information on the macroinvertebrate communities in the Park, will provide continuous information regarding water quality, and will provide a complete list of taxa found at present in the Park.

Water Quality and Water Resources

Birch, J.B. n.d. Water Quality of the Congaree National Monument. Institute of Ecology, University of Georgia.

This report describes the physical characteristics of the Congaree river and floodplain which influence water quality. Suspended sediments, chemical concentrations, and ions are discussed. The report is divided into three sections: the first concerning water quality on Cedar Creek at low flow, the second, floodwater quality for the back floodplain, and the third the front floodplain.

Coyle, J., P. Anderson, and M. Nelson. 1997. Preliminary Report of Findings of the Contaminant Assessment Process for the Congaree Swamp National Monument. December 1997.

The Biological Resources Division of the USGS developed a systematic process for determining whether environmental contaminants threaten habitats and biota of DOI managed-lands. The contaminant assessment process (CAP) allows the Monument to assess potential threat from contaminants. The database is a compilation of GIS overlays and other EPA, SCDHEC, etc., databases that allow Monument threats to be analyzed spatially.

Foote, L. 199-?. Chapter Two: Sediment Dynamics of the Congaree River through Congaree Swamp National Monument, 1996-1998.

This report is one component of the larger study "Rizzo, W. and A.L. Foote. 1996. Processes and Profiles on Major Waterways in Congaree Swamp National Monument and Big Thicket National Preserve. National Wetlands Research Center, National Perk Service Research Report." Cited below. The study authors designed a series of field experiments to give preliminary indications of how bottomland forests like Congaree trap sediments and characterize the sediment transporting ability of normal versus flood flows.

Knowles, D.B., M.M. Brinson, R.A. Clark, and M.D. Flora. 1996. Water Resources Management Plan Congaree Swamp National Monument. May 1996.

This report consists of a compilation of water quality information in the Monument tracing two types of past studies: intensive short-term studies of chemicals and nutrients in surface water, and long-term analysis of surface water samples for physical and chemical characteristics. SCDHEC stores data from water quality sampling within the Monument in the EPA-STORET database. Maps and sample data from the database are included in the report.

National Park Service, Water Resources Division. 1996. Themes for Water-related Research and Resource Assessments.

This report presents and overview of the aquatic-research needs of national parks. Nine themes are outlined: protocols to assess impacts on wetlands, of backcountry recreation, boat and marina impacts, riparian resource/water quality relations, assess visitor impacts, assess land use changes, assess recreational fishing impacts, and generally assess baseline characteristics of water resources.

Rickard, M. 1991. A Water Quality Study at the Congaree Swamp National Monument of Myers Creek, Reeves Creek, and Toms Creek. National Park Service Cape Lookout National Seashore, Morehead City, NC. November 1991.

The purpose of this study was to develop a water quality monitoring program for Myers Creek, Reeves Creek, and Toms Creek. Basic water quality parameters were collected including dissolved metals. The data was analyzed in order to determine if upstream industrial development had affected water quality in the Monument.

Rizzo, W. and A.L. Foote. 1996. Processes and Profiles on Major Waterways in Congaree Swamp National Monument and Big Thicket National Preserve. National Wetlands Research Center, National Perk Service Research Report.

This report highlights major constituents of water quality for numerous points throughout the Park. Attached are annual profiles of water quality parameters for the various water quality sampling sites.

SC DHEC. 1995. Watershed Water Quality Management Strategy, Saluda-Edisto Basin. Technical Report No. 003-95.

DHEC, pursuant to EPA regulations, published basin planning reports for the four major basins in South Carolina. Area wide plans must then be established to provide a source of general information specific to water quality management in that basin. The report includes information relevant to pollutant TMDLs, BMPs, and NPDES permit issuances for the relevant basin.

SC DHEC. 1999. Congaree River Basin Description. Water Quality Assessment.

This report describes basin characteristics, water quality parameters for each station, and a list of supplemental literature. Maps and data tables regarding water quality trends and status by station are enclosed.

U.S. Department of the Interior, USGS. 2000? Surface Water Quality and Trophic Status of the Aquatic Ecosystems of Congaree Swamp National Monument (DRAFT). National Wetlands Research Center Final Report. December 20, 2000.

The USGS undertook this study in order to establish baseline water quality parameters essential to maintaining the natural ecosystem communities in the Park. A series of experiments were designed to understand how forested bottomlands trap sediments and to characterize the sediment-transporting ability of the river during normal and high flow regimes. Numerous ecological and hydrological baseline characteristics were discovered during the study.

Water Resources Division and Service-wide Inventory and Monitoring Program, National Park Service, Department of the Interior, Volumes 1 and 2. 1998. Baseline Water Quality Data Inventory and Analysis, Congaree Swamp National Monument. Technical Report NPS/NRWRD/NRTR-98/148. May 1998. (Disks in Library Files).

These documents present the results of a surface-water quality data retrieval and compilation from six of EPA's national databases: STORET, RF3, IFD, DRINKS, GAGES, and DAMS. The effort represents a compiled view of descriptive water quality information for Congaree National Monument.

Wetlands and Vegetation

Aerial Information Systems. 1998. Photo Interpretation Report USGS-NPS Vegetation and Inventory and Mapping Program Congaree Swamp National Monument. Aerial Information Systems Project Report. October 12, 1998.

This report provides a background to the park, information regarding flooding in Congaree Swamp, and divides the park into five vegetation mapping zones. The report contains a useful timeline-outline of the applicable vegetation mapping activities at Congaree Swamp.

Allen, B.P., E.F. Pauley, R.R. Sharitz of the Savannah River Ecology Laboratory. 1994. Vegetation Sampling and Effects of Hydrology on Forest Recruitment and Long-term Community Structure in the Congaree Swamp National Monument. Final Report, Cooperative Agreement No. CA-5000-9-8020. March 1, 1994.

In the Congaree National Monument, flood tolerance and shade tolerance act as filters to influence species composition and community structure of an area. The construction of the Saluda Dam may be influencing species distribution on the Congaree floodplain.

Specifically, sugarberry and water oak species migrated to wetter sites following the construction of the dam. The migration and increasing frequency of ironwood and sugarberry may be indicative of changes in flood frequencies that have led to species compositional changes in Congaree National Park.

Brinson, M.M. and R.D. Rheinhardt. 1998. Wetland Functions and Relations to Societal Values. In *Southern Forested Wetlands: Ecology and Management*. M.G. Messina and W.H. Conner (Eds.). New York: Lewis Publishers.

This book chapter overviews the past approaches to assessing the functions and values of wetlands, discusses the necessity of classification when assessing functions, and then concludes by addressing how a functional assessment can be used in a decision-making process to determine both market and non-market economic values.

Dawson, R.H. 1992. Vegetation Classification System for Congaree Swamp National Monument South Carolina. National Park Service Southeast Regional Office, Atlanta, Georgia. May 27, 1992.

Floodplain hardwood forests, like that of Congaree, are often vegetatively classified in various ways. The development of a vegetation and land-use cover classification system is essential for the processing of remotely sensed data like aerial photography and satellite imagery. Vegetation communities were delineated from NAPP 1:40,000, 1.5 m, resolution aerial photography.

Eargle, M.F. and J.M. Dean. 1989. A Functional Comparison of Two Bottomland Hardwood Sites in South Carolina using WET. Submitted for Publication to the Proceedings for the Association of State Wetland Managers. September 1989.

This report questions whether WET software is an adequate tool for extrapolating wetland function in wetland ecosystems in South Carolina in a diverse gradient of physical and biologic settings. A study area in Congaree NP was compared with a plot in Francis Biedler Forest.

Frost, C.C. and S. Wilds. 2001. Presettlement Vegetation and Natural Fire Regimes of the Congaree Swamp Uplands.

The goal of this project was to provide a new map of the original vegetation of the Congaree Swamp uplands in order to better inform management decisions. Utilizing maps, created by GIS through this project, can better enable foresters in the Park to establish management plans that conserve natural communities.

Gaddy, L.L., Kohlsaat, T.S., E.A. Laurent, and K.B. Stansell. 1975. A Vegetation Analysis of Preserve Alternatives Involving the Biedler Tract of the Congaree Swamp. Division of Natural Area Acquisition and Resources Planning, South Carolina Wildlife and Marine Resources Department. December 1975.

This report recounts the importance of the Biedler Tract as the last major remnant of bottomland hardwood ecosystem. Specifically, the authors note the unusual concentration of champion, record-breaking tree species, for South Carolina and nationally.

Gaddy, L.L. and G.A. Smathers. 1980. The Vegetation of the Congaree Swamp National Monument. Veroff: Geobot. Inst. ETH, Stiftung Rubel, Zurich 69. Heft, 171-182.

This article discusses and describes the physical and vegetation characteristics of the Congaree River floodplain. Further, current and future vegetation and ecological mapping efforts and studies are described.

Keefe, T.L. S.C. Dial, and W.T. Eatson. 1962. The Florisitcs of Cypress-Gum Stands in the Congaree Swamp. University of South Carolina.

This piece discusses the 13,000 acre tract once owned by Santee Cypress Company. The article recounts the physical attributes of the tract as well as a study of 24 10m x 10m quadrants of cypress-gum stands as well as stands of other species on higher ground that have not been cut over for at least several decades.

Lacy, R.B., T.P. Curley, B.C. Jones, and J.R. Wisdom. 1995. Wetland Resource Characterization of the Congaree Swamp National Monument, South Carolina: Database Preparation based on Remotely Sensed Data for Use in Geographic Information Systems. Final Project report prepared by South Carolina Department of Natural Resources, Land Resources and Conservation Districts Division for the National Park Service.

A comprehensive characterization of wetlands within the Monument is needed to provide a bottomland forest inventory to establish baseline conditions and to compare and combine data sources to assist in making vegetation community determinations. A remote sensing-based GIS database was produced from disparate information sources to be useful for ecological questions and management issues within the Monument. This baseline wetland inventory is useful to monitor and manage the Park's resources.

Patterson, G.G., G.K. Speiran and B.H. Whetstone. 1985. Hydrology and its effects on Distribution of Vegetation in Congaree Swamp National Monument, South Carolina. USGS, prepared in cooperation with the National Park Service. Water-Resources Investigations Report 85-4256.

This report describes the interaction of flooding vegetation and the physical characteristics of CSNM. The distribution of vegetation types within the Monument is influenced by the duration of saturated soils during the growing season, which is in turn influenced by inundation by the Congaree River. The frequency of large floods have decreased slightly since the completion of the Saluda Dam in 1929. The report contains many useful maps, figures, and charts to describe the hydrologic characteristics of the Monument.

Rheinhardt, R.D. M.M. Brinson, and F.M. Farley. 1997. Applying Wetland Reference Data to Functional Assessment, Mitigation, and Restoration. *Wetlands* 7(2): 195-215.

Rheinhardt, *et al*. outline the hydrogeomorphic (HGM) assessment procedure used to rapidly collect quantitative field data on wetland reference sites in order to assess ecological functions in wetlands. The authors also demonstrate how a HGM assessment can be utilized to determine a minimum area over which restoration should be applied in order to carry out a no-net-loss objective.

Rikard, M. 1989. Hydrologic and Vegetative Relationships of the Congaree Swamp National Monument. 1989. Cooperative Park Study Unit Clemson University. Technical Report Series, National Park Service. April 5, 1989.

This report aims to gain a better understanding of the relationships between vegetation and hydrologic conditions in order to better inform park management. Additionally, past changes in the hydrology of the Congaree River and how they affected the vegetation in the Monument, and how areas of unlogged land compare to recently logged land, are examined. Upstream changes in both water quality and quantity should be examined as to how they effect Monument vegetation.

Sharitz, R.R., R.L. Schneider, K.W. Dyer, and N.C. Martin. 1986. Wetland Forest Regeneration and Hydrologic Regime. In *Annual Report of Ecological Research at the Savannah River Ecology Laboratory*. W.D. McCort and R.B. Wolf (Eds.). Supported under Contract DE-AC09-76SR00-819 between the University of Georgia and the U.S. Department of Energy. July 31, 1986.

This report examines the effect of hydrologic regime on the regeneration of Savannah River floodplain forest. Southeastern floodplain forests, most notably Cypress-tupelo forests, are distributed along topographic and hydrologic gradients. Factors that impede reproduction include low seed production, viability, and dispersal, lack of suitable substrate for seed germination, and hydrologic conditions which impede seedling survival.

Smathers, G.A. 1980. Congaree Swamp National Monument Vegetation Type Map. U.S. Department of the Interior, National Park Service, NPS-SER Research/Resources Management Report No. 36. 11 pp.

The author describes a limited study of the vegetation types in Congaree National Monument needed for initial establishment, management, and preservation of the Park. Twenty-seven vegetation types were found. Quantitative data suggests the classification of these types into eleven plant community types. A useful map is enclosed in this report.

Story, M.H., J.R. Irons, A.L. Davis, and E.C. Brown de Colstoun. 199-?. Augmenting the NPS Vegetation Mapping Program using LANDSAT 7 Data. Type 1 application Proposal submitted in response to NASA Research Announcement NRA-00-OES-08, Carbon Cycle Science and Related Opportunities in Biology and Biogeochemistry of Ecosystems and Applications.

This report describes a Park Service-wide effort to map vegetation in the 250 units of the National Park System. The primary source-mapping material is from aerial photography. At the current rate, it will take 50 years for the Vegetation Mapping Program (VMP) to complete all the parks. The authors propose to utilize LANDSAT 7 Enhanced Thematic Mapper Plus (ETM+) data combined with digital elevation models (DEMs) to produce accurate maps to a scale of 1:48,000 that will contain less detail than the 1:24,000 VMP program maps.

Thompson, A.J. 1998. An Ecological Inventory and Classification of an Old-Growth Floodplain Forest in the Southeastern United States Coastal Plain. M.S. Thesis University of Georgia.

The author found that Congaree Swamp's floodplain system is characterized by greater structural and functional complexity than younger forests. The ecologically-complex system is strongly influenced by the fluvial processes of the Congaree River as well as natural disturbances such as wind storms. These characteristics directly impact species composition and the structures of plant communities. The two objectives of the study were to determine what vegetation associations exist and determine how this flooplain forested system fits within the accepted definition of old-growth forests.

Maps/Topography/ Remotely Sensed Data

Congaree Swamp National Monument. 1998. Map Files of Congaree Swamp National Monument. Excel Map Inventory File. July 17, 1998.

File contains information regarding maps applicable to the Monument, their respective dates, scale, author, material, location, etc.

Gaddy and Smathers. 1980. Vegetation Types.

A color map showing vegetation classification types within the Monument.

Karapatakis, D.J. 2001. Creation of a Digital One-Foot Contour Map of the Congaree Swamp National Monument. Report for the Congaree Swamp National Monument by the Savannah River Ecology Laboratory GIS and Remote Sensing Lab, October 8, 2001.

Using ESRI's ARC Info Software, the SREL created a one-foot contour map for Congaree Swamp National Monument. The map is based upon the 2-ft contour map from the USGS, interpolated to 1-ft using the ARC Info software, as well as LIDAR data acquired from Richland County, SC.

National Park Service, Congaree Swamp National Monument, Richland County, South Carolina. n.d. Stratification of Vegetation Types Using Park Drainages to Demark General Transtion Zones.

Black and white map of general vegetation zones (1-6).

National Park Service, Congaree Swamp National Monument. n.d. Flood Prediction Study—Crest Gauge Locations.

Black and white map of gage locations for flood prediction study. Gages 1, 2, 3, and 5 were continuously recording.

National Park Service, Congaree Swamp National Monument. n.d. Congaree Swamp National Monument Surface Hydrology.

Black and white map showing general area of frequent inundation?

Wiggins-Brown, H., T. Phillipi, D. Karapatakis. 2000. Review and Verification of the Congaree Swamp National Monument Topographic Database. Report for the Congaree Swamp National Monument by the Savannah River Ecology Laboratory GIS and Remote Sensing Lab, March 1, 2000.

The Savannah River Ecology Laboratory GIS and remote sensing lab reviewed the existing National Monument database including hard copy 2 ft contour maps and digital 4 ft contour data produced by SCDNR. More than 2 dozen sites were surveyed through the Monument using highly accurate GPS systems. The USGS data was found to be off by 1.4 feet and the SCDNR data was found to be geometrically inaccurate. The report recommends the collection of LIDAR-type data to collect the more accurate information.

Weblinks/Other Resources

USGS gages for Congaree National Park:

02169500 Congaree River at Columbia, SC

02169625 Congaree River at Congaree NP Near Gadsden, SC

02169672 Cedar Creek at Congaree NP Near Gadsden, SC

These gages have information regarding stream stage (ft), temperature (˚C), and discharge (cfs) every 15 minutes from 2/23/04 weekly to the present from the USGS National Water Information System (NWIS). See Theresa Yednock for this information.

Other Resources: The Saluda and Congaree Rivers

General/Compilations

Handel, S.N., W.T. Batson, D.J. Colquhoun, W.D. Dawson, P.J. DeCoursey, and R.L. Janiskee. 1979. *Research Bibliography of the Congaree Swamp National Monument Area*. Prepared under contract for the United States Department of the Interior National Park Service Southeast Regional Office, Atlanta, Georgia. Columbia, SC. May 1979, 383 pp.

This compilation is both a summary of biologic, ecologic, geologic and climatologic studies concerned with the Park's environs completed prior to 1979, as well as a guide for the NPS to determine what future studies were needed. The group was concerned with the future growth of Richland County and increased visitorship to the Monument adversely affecting Congaree Swamp. A multidisciplinary group of USC researchers compiled the study from the local resources of the Thomas Cooper Library, Richland County Public Library, computer searches, private collections, and the expertise of USC faculty members.

Hupp, C.R. 2000. Hydrology, geomorphology, and vegetation of coastal plain rivers in the south-eastern USA. *Hydrological Processes*. 14: 2991-3010.

This article compiles the current hydrological, geomorphological, and vegetational knowledge of southeastern coastal plain rivers. The author examines the physical distributions of these systems as well as their physical characteristics. The article contains a large number of diagrams, pictures, and charts illustrating the above characteristics. The author concludes by arguing that a large degree of multidisciplinary research is still needed to fully understand these complex, low gradient systems.

The Santee Basin

Abrahamsen, T.A. 2001. Ecological Data Collected in the Santee River Basin and Coastal Drainage, North and South Carolina, 1996-1998. U.S. Geological Survey Open File Report, 01-352.

As part of the NAWQA program, the ecological characteristics of 23 reaches of 16 streams in the Santee River Basin and some coastal drainages were evaluated using qualitative and quantitative techniques. The Broad, Saluda and Congaree, as well as the Catawba and Wateree Rivers, are included in this NAWQA study unit. Ecological factors examined include algal and benthic communities and habitat characteristics such as channel width and depth, bank and bed composition, and riparian vegetation characteristics. The goal of the project is to relate physical and chemical water quality characteristics to health of aquatic communities and human land use activities. This is a map, table, and hence data-rich report, comparing the ecological characteristics of the streams surveyed in this NAWQA unit.

Hughs, B., Abrahamsen, T., Maluk, T., Reuber, E., and L.J. Wilhelm. 2000. Water Quality in the Santee River Basin and Coastal Drainages, North and South Carolina, 1995-98. U.S. Dept. of the Interior, U.S. Geological Survey, Circular 1206. Accessed April 6, 2006: http://pubs.usgs.gov/circ/circ1206/pdf/circ1206.pdf

This report summarizes the major water quality findings for the Santee River Basin as part of the federal National Water-Quality Assessment (NAWQA) Program. In this effort, the quality of water resources for drinking water use as well as the status of ecological communities are assessed. The study found that surface water in the basin generally meets federal standards, however heavy agricultural and urban land uses have impacted water quality through elevated concentrations of pesticides, bacteria, and nutrients. Specific information is reported on particular heavy metals, pesticides, and nutrients in surface as well as groundwater. There is a good map of land use in the basin on page 3 of the report.

Hurley, N.M. 1991. Transport simulation of striped bass eggs in the Congaree, Wateree, and Santee rivers, South Carolina / by Noel M. Hurley, Jr. ; prepared in cooperation with the South Carolina Wildlife and Marine Resources Division [i.e. Department] Columbia, S.C.: U.S. Geological Survey. Available at Government Documents, University of SC, Thomas Cooper Library.

This USGS report recounts a 1988 study of the transport of striped bass eggs in the Congaree and other area rivers. The bass is an important game fish to dammed lakes in the Santee Basin, bringing many sport fishing dollars to the state each year. Egg survival depends upon four factors: spawning location, water temperature, streamflow and flow velocity. Results of model runs were used to predict the distance to the hatching point and distance to spawning point from sample sites. The model is site specific, but provides an easy method for estimating travel of the eggs. The report contains much information regarding the study area and flow characteristics of the Congaree River.

U.S. Geological Survey. 1995. The Santee River Basin, factors affecting a major resource. U.S.G.S Fact Sheet Number FS185-95. Available at the University of South Carolina Thomas Cooper Library and Congaree NP Library.

This short factsheet outlines the physical characteristics of the basin including Size, flow characteristics, climate, and land use. Major threats to the Basin are overviewed and the importance of the Basin to human water supply and electricity generation is noted. The piece also includes helpful Basin maps.

The Saluda River

Derrick, F. R. 1955. The distribution of the fishes of the Saluda River drainage basin, South Carolina. M.S. Thesis Department of Biology University of South Carolina. Available at the South Caroliniana Library.

The purpose of this survey was to provide insight into the distribution of fishes in the Saluda Basin, determine whether there are any undescribed species in the basin, add to the University of South Carolina fish collection, and serve as a baseline study for future research related to faunal changes in the basin. The effort was part of a statewide survey of flora and fauna. Like the Anderson study of the Congaree Basin listed below, this study is a descriptive cataloging of the fish species found in the basin at the time with maps of locations found and actual black and white photos of the relevant fish.

Koman, Tara M. 2003. The hydrologic effects of dams on the Saluda River, South Carolina. Department of Geography M.S. thesis available at the University of South Carolina Thomas Cooper Library and Congaree N.P. Library.

The author utilizes statistical methods and a software program, Indicators of Hydrologic Alteration (IHA), to determine the degree of hydrologic alteration cased by dams on the Saluda River. Specifically, concurrent changes, caused by dam installation, in the river's geomorphology and the riparian ecosystem, are explored.

Lower Saluda Scenic River Project. http://www.dnr.state.sc.us/water/envaff/river/low_saluda_scenic.htm

In 1991, a ten-mile stretch of the Lower Saluda River below Lake Murray Dam was named a State Scenic River Corridor. This webpage overviews the opportunities available for recreation, conservation measures, and groups involved in the conservation of this stretch of the Saluda including a plan for a continuous greenway trail along the north side of the River.
See additionally:
South Carolina Water Resources Commission, SC Department of Parks, Recreation, and Tourism, Lower Saluda River Task Force, 1990. "The Lower Saluda River Corridor Plan." July, 1990. 463 pp. Accessed November 8, 2005: http://www.dnr.state.sc.us/water/envaff/river/LowerSaludaPlanComplete.pdf Also available at the University of South Carolina South Caroliniana Library.

Middle Saluda Scenic River. Accessed December 4, 2005: http://www.dnr.state.sc.us/water/envaff/river/mid_sal_map.htm

This site is not as comprehensive as the website for the Lower Saluda Scenic River Project, but the website explains the Corridor's administration by SCDNR. The Middle Saluda River became the first river protected under the Scenic Rivers Program in South Carolina in 1978. Located in northern Greenville County and completely within Jones Gap State Park, about five miles of the Middle Saluda and its major tributary, Coldspring Branch, are protected by a 600-foot wide scenic corridor established through an agreement with the South Carolina Department of Parks, Recreation and Tourism.

USEPA, 2002. Endangered and threatened Wildlife and Plants; Reopening of public comment period and notice of availability of draft economic analysis for proposed critical habitat determination for the Carolina Heelsplitter. March 6, 2002. Accessed April 20, 2006: http://www.epa.gov/fedrgstr/EPA-IMPACT/2002/March/Day-06/i5275.htm

The Saluda River Basin may contain habitat historically utilized by the Carolina Heelsplitter, a medium-sized freshwater mussel with a green-brown to dark brown shell. Recent collection records of the species indicate that it has been eliminated from all but a few regions of its historic range in the Carolinas. The four small remaining populations include: one each in the Pee Dee and Catawba River systems and two in the Savannah River system. There have been no successful collections of the heelsplitter in the Saluda River despite repeated attempts in recent years. Decline of the species is presumed due to changes in water and habitat quality including These factors include pollutants in wastewater discharges (sewage treatment plants and industrial discharges); habitat loss and alteration associated with impoundments and other stream alteration activities; and increased stormwater run-off and the run-off of silt, fertilizers, pesticides, and other non-point pollutant sources. Proposed critical habitat of the species, implemented under the ESA, includes tributary portions the Saluda River watershed, among others.

SCDHEC Watershed Strategy Coordinator. 2004. Watershed Water Quality Assessment: the Saluda River. October, 2004: 196 pp. Accessed April 5, 2006: http://www.scdhec.gov/water/pubs/saluda.pdf

SCDHEC watershed water quality assessment reports provide information to both internal and external parties to enable broader participation in the water quality management process. Water quality data from the Saluda River Basin was collected from 1997 to 2001 and assessed during this third five-year watershed management cycle. This updated atlas provides summary information on a watershed basis, as well as geographical presentations, of all permitted watershed activities. A waterbody index and facility indices allow the reader to locate information on specific waters and facilities of interest.

The Reedy River

Beasley, B.R. M. Criss, L. Quattro and R. Scharf. 2001. "The Reedy River Report: Managing a Watershed." Department of Natural Resources. Land, Water and Conservation Division. Water Resource Publication Report: Number 22.

The purpose of this report was to conduct a comprehensive investigation of the Reedy River's resources. The Friends of the Reedy River initiated the interest in this study which was overseen by SCDNR. SCDNR was interested in studying the human and natural resources of the watershed through a citizen-based planning effort that comprehensively examined the watershed's resources so the community may make more informed management decisions. The Reedy River Task Force was established to examine critical issues in the watershed and create a long-term management plan. The report includes information on the basin's physical geography including maps and images, historical information, biological, cultural, and recreational resources, and growth management opportunities. Appendices include useful tables and information regarding flow data, flood information, and relevant laws and the Reedy River Watershed Committee Proposal.

Frank, Barbara J. 1973. The effects of urbanization on the stream flow of the Reedy River, Greenville, South Carolina. Ph.D. Thesis available at University of South Carolina South Caroliniana Library.

This thesis utilizes the 1941-1971 gage record, aerial photo coverage, and present geomorphic character to document the changes in channel geomorphology due to urbanization through time. The objective of the study is to note the changes in the various hydraulic components of the Reedy River through time and if they manifest in stream characteristics. The author noted that channel manipulation and increased erosion from the urban area have been especially influential.

McKoy, Henry B. 1969. *The Story of the Reedy River*. Greenville, SC: Keys Printing Co, 74 pp. Available at the South Caroliniana Library.

This book provides some general information regarding the physical geography of the Reedy River through maps and physical descriptions, however it is mostly about the river's historical importance to South Carolina, namely, the founding of Greenville. Historical pictures, postcards, and maps are included. Information on floods and the U.S. Army Corps. of Engineers Plan's for the River are also recounted.

The Congaree River/National Park

Anderson, W.D. 1954. The distribution of the fishes of the Congaree river drainage area, South Carolina. M.S. Thesis Department of Biology, available at the University of South Carolina South Caroliniana Library.

This thesis provides a physical description of the basin, maps of where fish samples were collected, descriptions of fish collected, and actual black and white pictures of fish samples collected. The study is a very descriptive cataloging of the fish species found in the Congaree River basin at that time, including fifteen families, thirty-two genera, and forty-three species. The endeavor provides one part of what was envisioned as a cataloging of the general fauna of the state, starting with the Santee Basin.

Lee, J.K. and C. S. Bennett. 1981. A finite Model Study of the Impact of the proposed I-326 crossing on the flood stages of the Congaree River near Columbia, South Carolina. Prepared in cooperation with the South Carolina Department of Highways and Public Transportation. Columbia, S.C.: U.S. Dept. of the Interior, Geological Survey ; Denver, Colo.: Open-File Services Section. No. 81-1194. Available at the Congaree National Park Library.

A two-dimensional model finite-element surface water model developed by Norton and King was used to assess the hydraulic impact of the proposed Interstate 326 crossing on the Congaree River floodplain. An extensive dike system, the proposed highway crossing, and high roughness combine to cause significant lateral velocities and variations in stage during flooding events.

Plewa, T.M. and W.L. Graf, 2005. Hydrologic Variation of the Congaree River near Congaree National Park, South Carolina: A Report for the National Park Service. January 29, 2005.

This project examined a number of questions regarding how the flows of the Broad and Saluda Rivers affect the stage levels in Congaree National Park (CNP) and its creeks, most notably Cedar Creek. Streamflow data from USGS gages indicate that the Broad River contributes 2/3s of the Congaree River's water, while the Saluda River contributes 1/3. The Broad River therefore has a greater influence on conditions in CNP, with large flow volumes frequently obscuring the daily and hourly variations of the Saluda River. Waves of water from the operation of Parr Shoals Dam, upstream on the Broad River, reach the Park in about a day while pulses of water reach the Park from the Saluda Dam in about 15 hours. Operations of the Saluda dam can cause fluctuations of the gage in CNP of .25 to .5 ft. When stage levels at CNP reach about 8 feet, water in the Congaree River begin to influence Cedar Creek, the flow backing up into tributary flows.

United States. Congress. Senate. Committee on Energy and Natural Resources. Subcommittee on Public Lands, National Parks, and Forests. Mississippi River National Heritage Corridor Act, Congaree Swamp National Monument Expansion and Wilderness Act, and Charles Pinckney Historic Site : hearing before the Subcommittee on Public Lands, National Parks, and Forests of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, second session, on S. 1643 ... S. 2018 ... S. 2058 ... June 23, 1988. Washington: U.S. G.P.O. Available in Government Documents, USC Thomas Cooper Library.

The purpose of 2108, the focus of this government report in the Congressional Record, is to expand the boundaries of then the Congaree National Monument, to designate certain land contained within wilderness, and to increase the amount of money appropriated to Park development. The report notes the importance of the near-virgin southern hardwood floodplain forest of Congaree and as such Congress appropriates an additional $3 million for Park development.

Cooney, T.W. 1990. Concentrations of metals in bed material in the area of Congaree Swamp National Monument and in water in Cedar Creek, Richland County, South Carolina, prepared in cooperation with the National Park Service. Columbia, S.C.: U.S. Geological Survey ; Denver, Colo. Accessed April 25, 2006: http://library.usgs.gov/index.html

This report describes a study carried out by USGS and the National Park Service investigating the concentrations of selected metals in the surface waters of the Park including the bed of a major tributary to the Congaree River, Cedar Creek. Thirty-seven samples were taken at 28 sites in the study area between June 1985 and June 1986. Barium, iron, magnesium, and manganese occurred at various levels throughout the sample sites because they are naturally occurring in the basin. Concentrations of cadmium in Cedar Creek, a toxic metal, equaled or exceeded US EPA drinking water standards. Manganese also equaled or exceeded US EPA drinking water standards in

Cedar Creek in some samples. All other metals were below these US EPA concern levels. Metal concentrations were generally higher in Cedar Creek compared with Tom's Creek. There is some evidence that the floodplain acts as a sink for certain trace metals.

Hamel, P. B. 1989. Breeding bird populations on the Congaree Swamp National Monument, South Carolina. P. 617-628. In: R. R. Sharitz and J. W. Gibbons, eds. Freshwater wetlands and wildlife. DOE Symp. Series No. 61. US DOE Office of Sci. and Tech. Infor., Oak Ridge, TN.

The author notes that there is little data available regarding bird species in undisturbed bottomland hardwood forests. This study was designed to document the birds of Congaree Swamp, describe the breeding communities of species there, and compare species in undisturbed versus clearcut portions of the Swamp. Bird communities differed in old growth areas in quantity rather than by type. More species achieved the highest densities in the old growth areas, especially cavity nesting species. Bird species in the clearcut areas were more typical of open areas throughout the region and some species found in these areas were previously unrecorded in the Park.

Levey, R.A. 1977. Characterisitcs of coarse-grained point bars, Upper Congaree River, South Carolina. M.S. Thesis Department of Geology. Available at the University of South Carolina Thomas Cooper Library.

This Masters thesis describes the coarse-grained point-bar system of the upper Congaree River in Columbia, SC. The study objectives were to 1) develop a depositional model of a Coastal-Piedmont boundary river system, 2) relate the geomorphic structure of point bars and bed forms to their internal stratification, and 3) compare the results of this study to the known point bar sequence model. The author found that the facies type, morphologic features, and bedforms in the river depended upon local channel geometry, velocity distribution, sediment size and availability, and discharge pattern.

Maliszewski, Laura M. 2005. Assessment of contaminant sources and pathways affecting the Congaree National Park, South Carolina. M.S. Thesis Department of Civil and Environment Engineering available at the University of South Carolina Thomas Cooper Library.

The author asserts that hydrology is single most important factor influencing Congaree National Park due to the delivery of water, sediments, and nutrients that sustain the Park's unique ecosystem. This study compiled all previous studies and technical reports to identify deficiencies in water quality information, such as lack of groundwater quality and pesticide data as well as general water quality issues. The author compiled this information into a database. Suggestions were also made for further research in heavy metals entering the Park through surface water and sediment, the degree of fecal contamination entering the Park through Tom's Creek, and creating a water quality monitoring program at the Park.

Michie, J.L. 1980. An archeological survey of Congaree Swamp: cultural resources inventory assessment of a bottomland environment in central South Carolina. Columbia, S.C.: Institute of Archeology and Anthropology, University of South Carolina. Available at the South Caroliniana Library.

Before this study, the Congaree River Valley in Richland, Lexington and Calhoun Counties had never been subject to a large-scale archeological exploration and survey. The report contains background information regarding the founding of the Monument, hydrological, biological, historical, economic, and information on past human settlement in the area. The report contains numerous maps, profiles, and pictures of the study area. One major prehistoric site was found as well as several sights of more recent historical significance.

Rose, Leonard J. 2004. Species diversity and condition of the fish community during a drought in Congaree National Park. M.A. Thesis School of the Environment available at the University of South Carolina, Thomas Cooper Library.

This Masters thesis utilizes statistical clustering and ordination techniques to better understand how three distinctive fish communities within the Park related to habitat conditions during a drought. Dry conditions enabled sampling in areas that would otherwise not have been possible. The researcher was able to observe the fish community during a natural degradation of fish habitat brought on by drought in order to inventory the fish species within Congaree NP and define the relative condition of the fish community within the Park. This information was used to develop a model that predicts fish communities given habitat conditions.

Schuck-Kolben, R.E. 1992. Simulation of the effects of proposed construction of 12th Street extension and of flood-plain reforestation on flood elevations, Congaree River near Columbia, SC. Columbia, S.C.: U.S. Geological Survey. Available in Government Documents, USC Thomas Cooper Library.

The USGS and SC Department of Transportation sponsored this report to determine the effects of extending the Congaree-I-326 bridge as well as partial reforestation of the floodplain on subsequent flood elevations of the Congaree River. A model was used to simulate surface flows on a horizontal plane. Roughness associated with tree growth on the floodplain, and elevations to account for the embankment created for the bridge extension, were the only variables modified in the model runs. Water surface elevations and discharges were compared in different areas of the floodplain to evaluate the effects of floodplain conditions on the level of the 100-year flood. The authors found that the bridge extension had minimal impact on the flood discharge, while the increased roughness caused by mature pine trees had more of an impact. They also found that the construction of dams on the Saluda and Broad Rivers have impacted flood magnitude, especially the Saluda Dam due to its size and proximity to the study area. Lake Murray and the Saluda Dam provide limited flood protection for this stretch of the Congaree.

Wachob, A. 2002. “Impact of Removing the Granby Dam on Water Levels in the Congaree River.” Department of Natural Resources Land, Water and Conservation Division. Water Resource Publication Report Number 27. Accessed April 3, 2006: http://www.dnr.sc.gov/water/hydro/HydroPubs/Abs_dnr_R27.htm.

This report examines the impact of removing Granby Dam on water levels in the Congaree River. The author utilized a combination of surveyed water-surface and riverbed elevation data, flow rate data for the Congaree River, and computer model simulations to compare current water depths, flow velocities, and flow distributions to these features if the dam would be removed. The author found that without the dam, the lock system would be filled with sediment, water depth in the channel would decrease, and the level of water in the lock would decrease for all discharge levels.

Congaree National Park/Monument and Vegetation

Crewz, D.W. 1976. A floristic analysis of the Congaree River floodplain, South Carolina: succession and regeneration. M.S. Thesis Department of Biology available at the University of South Carolina Thomas Cooper Library and at the Congaree National Park Library.

This thesis study characterizes the effects of varied logging practices on the regeneration of mature bottomland forest and associated successional trends. The study includes an analysis of some harvested areas as well as relatively undisturbed forest in order to establish baseline conditions for future studies and argue for the protection of Congaree Swamp’s forest.

Jones, R. H. and R. R. Sharitz. 1998. Survival and growth of woody plant seedlings in the understorey of floodplain forests in South Carolina. *Journal of Ecology* 86:574-587.

Regression models were used to determine the likelihood of woody seedling survival in South Carolina floodplain forest due to species, location on the floodplain, time and seedling size and growth. Weak positive and negative relationships were noted regarding peak river discharge during the winter and during the summer, respectively. The authors contend that simulation models could be produced that include prediction of seedling age, species, intensity of winter floods, and degree of summer droughts.

Megonigal, J. P., W. H. Conner, S. Kroeger and R. R. Sharitz. 1997. Aboveground production in southeastern floodplain forests: A test of the subsidy-stress hypothesis. *Ecology* 78:370-384.

The authors concluded that the subsidy-stress hypothesis does not adequately explain net primary production in Southeastern floodplain forests. It was hypothesized that frequent flooding induced greater productivity compared to upland forests, however, this was not the case. Extensive flooding exacted a great degree of stress on floodplain forest productivity, and stress was exacerbated by impoundment or levee development.

FERC Relicensing

FERC Office of Hydropower Licensing, 2002. "Scoping Document 1, Saluda Dam Seismic Remediation Project South Carolina FERC Project No. 516. May 2002, 35 pp. Accessed April 20, 2006: http://www.ferc.gov/industries/hydropower/safety/saluda/saluda_sd1.pdf

As part of its oversight capacity, FERC implements a dam safety program, through its Division of Dam Safety and Inspections (D2SI), to ensure that Commission-licensed projects comply with Federal dam safety standards and are designed constructed, and operated safely. The D2SI Regional Engineer has the authority to, among other things, require a licensee to take an action to repair or modify project works for the purpose of achieving or protecting the safety, stability, and integrity of project works. It has been determined that the Saluda Dam near Columbia, SC would fail if subjected to a repeat of the Charleston Earthquake that occurred in 1886. The magnitude of the Charleston earthquake is estimated by seismologists, including the United States Geological Survey, to be about 7.3. The Saluda Dam must be strengthened to withstand earthquakes in the interest of public safety for the thousands of people living downstream. (copied, paraphrase).This document's purpose is to outline the scoping process involved in the retrofitting of the dam including NEPA requirements: such as inviting stakeholders to be involved in the process and determining alternatives.

South Carolina Electric & Gas Company. 2005. *Initial Consultation Document, Saluda Hydroelectric Relicensing, FERC No. 516.* prepared by Kleinschmidt Energy and Water Resource Consultants, Columbia, SC. April 2005, 286 pp. Accessed April 20, 2006: http://www.saludahydrorelicense.com/milestones.htm

This document is supplied by SCE&G, on their FERC Saluda Dam relicensing website. The Initial Consultation Document (ICD) provides information related to all project resources to interested state and federal resource agencies, nongovernmental organizations (NGOs), and the general public for review and comment. This comment period officially begins the Stage 1 Consultation efforts required under the FERC licensing process. This ICD for Saluda Hydro provides information relative to the site, the Project Works (structures, equipment, and facilities), and current and future operations. There are three distinct phases in the enhanced traditional licensing process, of which preparation of the ICD is the first. SCE&G anticipates working closely and cooperatively with all interested parties through each stage of the process in order to address and resolve collaboratively resource issues.

Bennett, Samantha. n.d. Developing a Water Quality model for FERC Re-licensing Stakeholder Presentations. Walden Associates, Inc. Wayne, PA Accessed November 8, 2005: http://www.walden-assoc.com/p0889/p0889.htm

While presenting water quality data for stakeholder meetings is often challenging, Section 603 of the Energy Act requires dam owners to hold stakeholder meetings on lake water quality issues during the FERC re-licensing process. Traditionally, maps, tables, and graphs have been distributed at stakeholder meetings to present water quality data.

This is often perceived as misleading and confusing. This paper presents the methodology for presenting complex water quality issues to a non-technical audience. The process used for data collection, data projection, modeling parameter selection, and modeling techniques to generate a water quality model in Lake Murray, South Carolina is reviewed.

Natural Heritage Institute. 2005. Santee River Basin Model (SRM). Accessed November 8, 2005: http://www.n-h-i.org/srm.html

SRM was developed to assist the South Carolina chapter of The Natural Conservancy, the Coastal Conservation League, American Rivers, and the Catawba-Wateree Relicensing Coalition in relicensing negotiations for Duke Power's (Duke) Catawba-Wateree Project (P-2232), South Carolina Energy and Gas's (SCE&G) Saluda Project (P-516), and the State of South Carolina's Santee-Cooper Project (P-199). The model is available to all stakeholders, and the site includes a downloadable users' manual as well as necessary additional files needed to run the model.

Lake Murray and the Saluda Dam

Environmental Research Center, Inc., 1975, "Environmental Inventory of Lake Murray, South Carolina—Volumes I and II," prepared for SCE&G, January 1976. Available in the USC School of Law Library.

Volume 1 of this two-volume series contains general information regarding the history, past and present socio-economic characteristics of the surrounding area, general specifications of the Lake and powerplant and the findings of the environmental inventory of the Lake, conducted by the EPA, from 1974-1975. The volume includes numerous fold-out maps including general area, bathymetric, weather and maps of the study sites supplemented with graphs of the accompanying data. The study found water quality was worse for samples at the sites in the upper section of Lake Murray than the lower lake, where variables remained stable. This was attributed to the upper Lake's proximity to tributaries with a large degree of urban and agricultural land use and the lower Lake being impounded for a longer time which allowed for associated biological and chemical stabilizing processes. Volume Two contains appendices of water quality data and notes regarding field sampling procedures, lab procedures, as well as a large number of data tables.

Bayne, C. 1999. Lake Murray: Legend and Leisure. Third Edition, Revised. Bayne Publishing Co. Sunset, S.C.

This largely pictorial work showcases the history and current state of Lake Murray. It is composed of one and two-page stories and anecdotes about current or historical aspects of the Lake. Maps of the area, historical pictures, and schematics of the Saluda River Hydro-electric Development are included.

Rohde, Kelly L. 2003. Immediate Impact of the Lake Murray Construction [2003 Dec.]. Seminar Paper written for History 816. Available at the University of South Carolina South Caroliniana Library, 17 pp.

This seminar paper describes the history of the Lake Murray Dam Project on the Saluda River. The paper first gives historical background of the region that became Lake Murray and the surrounding towns of Columbia, Lexington, Chapin, etc. In 1912, the site was passed over in favor of the Parr Shoals Hydro Project on the Broad River for a hydroelectric project. Then, Lexington Power Company received Federal Power Commission permission to begin construction on Saluda Dam February 27, 1927. The paper recounts much of the controversy surrounding the buyout of local landowners to obtain the 100,000 acres of land needed for the Saluda Dam Project as well as the economic boon to the area as a result of the construction of the dam and the creation of Lake Murray.

Lake Greenwood

Lake Greenwood Facts – Buzzard's Roost Hydro Project (circa 1940). 2005. http://www.co.greenwood.sc.us/_fileUploads/forms/112_Lake%20Greenwood%20Facts.pdf December 15, 2005. Accessed April 2, 2006.

This is a short report on the FERC relicensing of Buzzard's Roost Hydro Project by Duke Power on behalf of Greenwood County, the owner of the hydroelectric dam. The report contains the history and specifications of the project and describes its use to supply electricity to Greenwood. Greenwood County claims that as a result of the licensing process, additional public use facilities will be constructed. The County is concerned with the amount of development and growth of the Lake area due to people moving to the region to take advantage of lake amenities and how this will affect the quality of the Lake.

Saluda River Water Quality

Miller, A. SCDHEC Bureau of Water. 2004. Total Maximum Daily Load Development for Fecal Coliform Bacteria Lower Saluda River and Tributaries Stations: Lower Saluda S-149, Twelve Mile Creek S-294, Kinley Creek S-260. September 1, 2004: 33 pp.(HUC 03050109-210) Accessed April 24, 2006: http://www.scdhec.gov/water/html/tmdlsc.html

This website contains links to the lower Saluda TMDL report as well as for other rivers in the state. The TMDL process establishes the allowable loadings of pollutants. This TMDL is targeted at three stations in the Lower Saluda watershed: S-149 is located in the Lower Saluda main stem approximately 3 river miles downstream from the Lake Murray dam, S-294 is located on Twelve Mile Creek which is tributary to the Lower Saluda River, and Kinley Creek, which is monitored at station S-260. These three sites exceeded §303(b) regulations regarding fecal coliform. From 1994-1998, fecal coliform water quality standards were exceeded in 17% of samples at the downstream Lake Murray site, 21% of samples at the Twelve Mile Creek site, and 90% of samples at the Kinley Creek site. Management of this pollutant will involve limiting runoff from urban and agricultural lands, reducing inflow from possible failing septic systems, and decreasing uncontrolled access of livestock to streams.

SC DHEC, 1995, “Watershed Water Quality Management Strategy—Saluda-Edisto Basin,” Technical Report No. 003-95, prepared by South Carolina Department of Health and Environmental Control.

SC DHEC began watershed planning activities in 1972 as a result of a U.S. EPA grant. Subsequently, these plans have been updated on a 5-year basis. The watershed approach is useful in improving communication between relevant agencies and the public, allows for focus upon Congressional and Legislative mandates, and also to allow DHEC to act in a proactive manner in terms of watershed planning. The report contains useful information, including maps and summaries, of issues concerning water quality broken down by sub-basins of the Saluda-Edisto Basin. Tables included at the end of the report highlight water quality concerns in the constituent basins.

SC DHEC, 1998, “Watershed Water Quality Assessment—Saluda River Basin,” Technical Report No. 005-98, prepared by South Carolina Department of Health and Environmental Control, Bureau of Water, December, 1998.

SC DHEC began watershed planning activities in 1972 as a result of a U.S. EPA grant. Subsequently, these plans have been updated on a 5-year basis. The watershed approach is useful in improving communication between relevant agencies and the public, allows for focus upon Congressional and Legislative mandates, and also to allow DHEC to act in a proactive manner in terms of watershed planning. The report contains useful information, including maps and summaries, of issues concerning water quality broken down by sub-basins of the Saluda River.

SC DHEC, 2004, “Watershed Water Quality Assessment: Saluda Basin Technical Report No. 004-04, 3rd edition, prepared by the South Carolina Department of Health and Environmental Control, October 2004. Accessed February 20, 2006: http://www.scdhec.gov/eqc/water/pubs/saluda.pdf

SC DHEC began watershed planning activities in 1972 as a result of a U.S. EPA grant. Subsequently, these plans have been updated on a 5-year basis. The watershed approach is useful in improving communication between relevant agencies and the public, allows for focus upon Congressional and Legislative mandates, and also to allow DHEC to act in a proactive manner in terms of watershed planning. The report contains useful information, including maps and summaries, of issues concerning water quality broken down by sub-basins of the Saluda River.

SCDHEC Bureau of Water. 2004. Upper Saluda River Basin…Fecal Coliform Bacteria, EPA Finalized TMDL. September 29, 2004. 77 pp. Accessed April 20, 2006: http://www.epa.gov/waters/tmdldocs/Final%20Upper%20Saluda%20FC%20TMDL.pdf.

Levels of fecal coliform in the Upper Saluda are a serious concern. SC DHEC has named thirteen water quality stations on the Upper Saluda in violation of South Carolina §303(b) standards due to fecal coliform levels. There are 19 point sources for this pollutant in the watershed. A load-duration curve methodology was utilized to determine allowable total maximum daily load (TMDL) for the relevant stations. Some point sources will have to reduce their load to meet the water quality standard for this in this area of the Upper Saluda.

General Basin Water Management

American Rivers. n.d. River Restoration Case Study: Hydropower Dam Reform, Santee and Cooper Rivers: The Santee-Cooper Hydroelectric Project South Carolina. Accessed, November 16, 2005: http://www.americanrivers.org/site/DocServer/santee_cooper_case_study_04.pdf?docID=569

This is a short paper regarding a parallel FERC relicensing effort in the state. American Rivers, an environmental NGO concerned with river integrity, seeks to motivate the public to become involved in the FERC relicensing process of the Santee-Cooper Project, noting the critical window of influence regarding 40-50 year timeframe of a FERC license. The report contains background of the issue as well as conveys the group's discontent with public input and procedure in this FERC process.

Badr, A.W., A. Wachob, and J.A. Gellici, 2004. "South Carolina Water Plan, Second Edition." South Carolina Department of Natural Resources, Land, Water, and Conservation Division. January 2004. 132 pp. Accessed, January 14, 2006: http://www.dnr.state.sc.us/water/admin/pubs/pdfs/SCWaterPlan2.pdf

This document overviews the State of South Carolina's water management strategy. There is a good map on page 61 of DHEC's watershed water quality monitoring network and the Saulda River's annual watershed water quality management sites.

Trimble, Stanley and Weinrich, F. 1987. Reforestation and the Reduction of Water Yield on the Southern Piedmont Since Circa 1940. *Water Resources Research*: 23(3), 425-437.

This paper provides a general overview of the reforestation of the Southeastern piedmont from historical faming uses and the consequent effects on stream discharge. The authors found that the reversion from row crops to forest and pasture land covers decreased annual stream discharge from 4 to 21%. A portion of the study area was represented by the western part of the Saluda River Basin. The authors additionally note that small increases in forested land cover (10-28%) significantly reduced water yields causing a mixed bag of effects—decreased erosion concomitant with decreased runoff for water supply purposes.

Tufford, D.L. and H.N. McKellar. 1999. Spatial and temporal hydrodynamic and water quality modeling analysis of a large reservoir on the South Carolina (USA) coastal plain. *Ecological Modelling*. 114: 137-173.

Though mostly about the model to estimate water quality for Lake Marion, the article contains a detailed physical description of the Saluda River Basin to Lake Marion, and a map depicting the basin. The authors used phytoplankton kinetic rates in a hydrodynamic model to determine water quality in reference to DO, ammonia, and nutrients, as well as other indicators. The built WASP5 model was not able to effectively model all environmental conditions of Lake Marion, however portions of the model are useful for research and experimental purposes.

U.S. Army Corps. of Engineers. Charleston District. 1974. Special flood hazard information report : Congaree River, Broad River & Saluda River, Richland & Lexington Counties, South Carolina. Prepared for the Central Midlands Regional Planning Council by the U.S. Army Engineer District, Charleston Corps of Engineers, Charleston, S.C. Available in Government Documents, University of South Carolina Thomas Cooper Library.

The portions of Richland and Lexington County covered by the report are subject to flooding of the Broad, Saluda, and Congaree Rivers. The report included descriptions of past floods and identifies areas subject to future floods. Maps, aerial photos, and river profiles are provided. This report was prepared at the request of the Central Midlands Regional Planning Council and the SC Department of Water Resources. The report additionally provides gage information, basin background information, basin infrastructure descriptions, and flood damage reduction measures.

Historical Maps

Calhoun, Patrick B. 1770. Map of Cherokee Lands, 1770 Dec. 8 and 1993 Nov. 3. Available at the University of South Carolina South Carolinana Library.

Lexington Water Power Company. 1927. “Map showing location of Saluda River hydro-electric development near Columbia, SC.” Lexington Water Power Co., Murray & Flood Engineers. Available at the University of South Carolina South Caroliniana Library.

Maps

FISHUNT and E. H. Fetner. 197-?. A sportsman’s map of “Santee”: Lake Marion & Lake Moultrie. Columbia, S.C.

This map includes commercial & public landings, best fishing areas, a map of Cooper River, a map of upper Lake Marion, and a sketch map of the Congaree River.

U.S. National Park Service. 1995. Congaree Swamp National Monument, South Carolina. Washington, D.C. Available at the University of South Carolina Thomas Cooper Library.

U.S. National Park Service. 1988. Congaree Swamp National Monument, South Carolina: official map and guide. [Washington, D.C.] : National Park Service, U.S. Dept. of the Interior.

U.S. Geological Survey (U.S.G.S). Relevant topographic quad maps for the Saluda/Congaree Basins:

U.S.G.S. Congaree N.P. relevant 1:24,000 7.5 minute quads
Southwest Columbia
Fort Jackson South
Congaree
Eastover
Saylors Lake
Gadsden
Wateree
Staley Crossroads
Saint Mathews
Fort Motte

U.S.G.S. Saluda River relevant 1:24,000 7.5 minute quads
Eastatoe Gap
Table Rock
Cleveland
Dacusville
Paris Mountain
Greenville
Pelzer
Bolton East
Fork Shoals
Ware Shoals West
Ware Shoals East
Cokesbury
Waterloo
Ninety Six
Dyson
Chappells
Silverstreet
Prosperity
Denny
Delmar
Lake Murray West
Lake Murray East
Irmo
Columbia North
Southwest Columbia

U.S.G.S. Reedy River relevant 1:24,000 7.5 minute quads
Mauldin
Simpsonville
Fork Shoals
Hickory Tavern
Ware Shoals East
Cokesbury
Waterloo

Imagery
Richland County GIS 1-foot resolution aerial imagery (Congaree GIS Dataset stored at the park). Accessed November 4, 2005: http://www.richlandmaps.com/ .

USDA Aerial Photos available at the University of South Carolina Thomas Cooper Library.

Relevant Web Links
Lake Murray Association Website
Accessed December 2, 2005: http://www.lakemurrayassociation.com/whats_news.htm.

The Lake Murray Association (LMA) website provides updated information of the group's activities. According to their website, the organization, "provides representation for all lake users from the four counties around the lake on issues that pertain to the development, management and use of Lake Murray. The Association works to foster cooperation among the various users and organizations with an interest in the lake (i.e., stakeholders) to insure a clean, safe, and user friendly lake." Specifically, they are interested in relicensing issues, lake levels, safety, weed control, pollution monitoring, and shoreline management.

Saluda-Reedy Watershed Consortium.
Accessed December 2, 2006: http://www.saludareedy.org/.

Excellent site for general information regarding the Upper Saluda Watershed, from its headwaters until its confluence with the Reedy River in Lake Greenwood. The Consortium was formed to address the concerns of development and land use change in the region in order to preserve water quality and abundance. The Consortium has a two-year strategic plan for 2005-2006 which outlines protection of the watershed and sustainable future plans.

Friends of Congaree Swamp Website. Accessed March 15, 2006: http://www.friendsofcongaree.org/.

The Friends are a non-profit organization which advocates the park as a significant local, regional, state, and national resource and strives for associated conservation, enhancement, and educational outreach opportunities. Website information includes past events held in the Park, membership information, and an archive of Organization Newsletters.

River Alliance Website. Accessed November 8, 2005:
http://www.riveralliance.org/

The River Alliance's mission is connecting people to Columbia's rivers, making them accessible while at the same time protecting their resources, and bringing the rivers back into the daily lives of area residents and visitors. The Alliance is responsible for and maintains the Three Rivers Greenway and the Riverwalk as well as organizing accompanying community educational programming and outreach.

Saluda Hydro Project Relicense Website. Accessed April 20, 2006:
http://www.saludahydrorelicense.com/.

This site provides up-to-date information on the progress of the multi-year FERC relicensing process including stakeholder and federal and state government input as well as soliciting online public comment. Numerous additional resources are continually added to this updated site including biological studies relevant to the Relicensing process.

SCDNR, 2005. Lake and Stream Data. Accessed November 9, 2005:
http://www.dnr.state.sc.us/water/hydro/gages.htm

Obtain information from this SC DNR site regarding real-time Lake Levels of Lake Murray as well as Stream Gages in the Saluda River Basin in real-time and compared to historical averages.

SCDNR, 2005. SCDNR GIS Clearinghouse County Selection map to download USGS. Topographic maps. Accessed October 7, 2005:
http://www.dnr.sc.gov/pls/gisdata/download_data.select_county_map.

From this site, one can download relevant topographic maps by county for GIS or viewing applications.

SCDHEC, 2005. Saluda River Basin. Accessed October 26, 2005:
http://www.scdhec.net/water/shed/saluda_main.html

Water quality information and general geographical information on both the Saluda and Congaree Basins.

Natural Resources Conservation Service. 2005. Accessed October 26, 2005:
http://www.sc.nrcs.usda.gov/programs/SaludaRiverWater.html

This site contains information regarding land use in the Saluda Basin, a map of the watershed, and information about encompassing counties.

Stream Gages in the Saluda and Congaree Basins are as follows:
02162290 SOUTH SALUDA RIVER NEAR CLEVELAND, SC
02162500 SALUDA RIVER NEAR GREENVILLE,S.C.
02163001 SALUDA RIVER NEAR WILLIAMSTON, SC
021630967 GROVE CREEK NEAR PIEDMONT, SC
02163500 SALUDA RIVER NEAR WARE SHOALS, SC
02164000 REEDY RIVER NEAR GREENVILLE, SC
02164110 REEDY RIVER ABOVE FORK SHOALS, S. C.
021650905 REEDY RIVER NEAR WATERLOO, SC
02165200 SOUTH RABON CREEK NEAR GRAY COURT,S.C.
02166500 LAKE GREENWOOD NEAR CHAPPELLS, SC
02166501 LAKE GREENWOOD TAILRACE NR CHAPPELLS, SC
02167000 SALUDA RIVER AT CHAPPELLS, SC
02167450 LITTLE RIVER NR SILVERSTREET, SC
02167563 BUSH RIVER AT NEWBERRY, SC
02167582 BUSH RIVER NR PROSPERITY, S C
02168500 LAKE MURRAY NEAR COLUMBIA, SC
02168501 LAKE MURRAY TAILRACE NEAR COLUMBIA, SC
02168504 SALUDA RIVER BELOW LK MURRAY DAM NR COLUMBIA,
02169000 SALUDA RIVER NEAR COLUMBIA, SC
02169500 CONGAREE RIVER AT COLUMBIA, SC
02169570 GILLS CREEK AT COLUMBIA, SC
02169625 CONGAREE RIVER AT CONGAREE NP NEAR GADSDEN, SC
02169672 CEDAR CREEK AT CONGAREE NP NEAR GADSDEN, SC
02169740 CONGAREE RIVER AT SOUTHERN RR NR FT MOTTE, SC

Broad River Resources

General Basin Water Management

Broad Scenic River Advisory Council. 2003. Broad Scenic River Management Plan. Report 32. Duke Power, A Division of Duke Energy, SC DNR, and SC DHEC, August 15, 2003.

In 1991, a 15.3 mile segment of the Broad River on the border of York and Cherokee Counties was designated a state scenic river. An advisory council was formed with members representing bordering landowners, river users, and community interests. The role of the Council is to advise SC DNR in protecting and managing this scenic river corridor. The plan's goals are to protect and enhance the natural, cultural, and scenic resources of the river for present as well as future generations. The first two sections of the plan provide an introduction to the Broad Scenic River Project. The remaining sections highlight the management plan by providing information regarding the resources, concerns, and uses of the Broad River Corridor. Recommendations and opportunities for the community outreach and education compose the final section of the plan.

Furman University. n.d. The River Basins Research Initiative at Furman University. http://ees.furman.edu/research/rbri/rbri.html. Accessed February 22, 2006.

The goal of this NASA, EPA, SC DHEC, and NSF-Research Experience for Undergraduates (REU)-sponsored research program is to determine the degree of human impact due to urbanization on the Lower Broad River Basin in both rural and urban areas. The effort is multi-disciplinary and includes the use of GIS and remote sensing, water quality and biological sampling, and geomorphic analysis. Research is completed in the summer by undergraduates under the guidance of Furman faculty and is available on the website.

Leigh, D.S. 1998. A >12,000-Year Record of Natural Levee Sedimentation Along the Broad River near Columbia, South Carolina. *Southeastern Geographer*. 38(2): 95-111.

This article described sedimentary analysis of an 8.1 m natural levee, north of Columbia, SC, along the Broad River. Seven meters depth of levee sediments span 12,000 years of deposition during late Pleistocene and Holocene time. The research indicates that incision of the river channel had concluded by end of the Pleistocene and aggradation of sediment on the floodplain characterizes the majority of the Holocene. The author asserts that paleoindian archeological sites could therefore be buried under several meters of deposits for Southern piedmont rivers. Paleosedimentation rates are about an order of magnitude lower then historical sedimentation rates, consistent with the findings in other river systems. This would indicate that sedimentation is increasing with increasing anthropogenic influence.

SC DNR. 2004. The Broad Scenic River Website. http://sercc.com/water/envaff/river/broad_scenic.htm Accessed February 22, 2006.

This site describes the Scenic Rivers Stewardship program and the Broad River Advisory Council's efforts to work with basin landowners to voluntarily protect river resources. The designated scenic river stretch is 15 miles from the 99 Islands dam to the confluence with the Pacolet River in South Carolina. The Advisory Council encourages landowners to consider memorandums of agreement, conservation easements, and land donation. The Advisory Council also recommends areas of special significance to be protected within the watershed for outstanding natural features, historic sites, etc.

Smith, K. 1993. Broad Scenic River Management Plan, South Carolina Water Resources Commission, Report No. 176, Columbia, South Carolina.

On May 17, 1989, Broad River Landowners Coalition requested the South Carolina Water Resources Commission investigate if a portion of the Broad river, extending from 99-Islands to its confluence with the Pacolet River, was eligible for induction as a state scenic river. A further reach was added, to the confluence with George Branch in Chester County, on May 25, 1990. Landowner opposition led this additional segment to be excluded from the scenic river designation. The goal of this management plan, created by the Saluda River Advisory Council, is to manage and enhance the aesthetics and recreational values of the Broad River Scenic Corridor through a local, community-based plan that is consistent with the state scenic rivers program. There are useful maps of the scenic river reach included in the report. Contact Mary Crockett at SC DNR for this report: crockettm@dnr.sc.gov

Broad River Water Quality

SC DHEC, Bureau of Water. 1998. Watershed Water Quality Management Strategy: Broad Basin, Bureau of Water Technical Report No. 001-98, Columbia, South Carolina.

SC DHEC began watershed planning activities in 1972 as a result of a U.S. EPA grant. Subsequently, these plans have been updated on a 5-year basis. The watershed approach is useful in improving communication between relevant agencies and the public, allows for focus upon Congressional and Legislative mandates, and also to allow DHEC to act in a proactive manner in terms of watershed planning. The report contains useful information, including maps and summaries, of issues concerning water quality broken down by sub-basins of the Broad River. Special concerns were noted for the lower Broad River in terms of water quality, specifically heavy metals. pH and DDT levels were so much a concern that aquatic life was not supported in some of the sites surveyed. Contact Mary Crockett at SC DNR for the report: crockettm@dnr.sc.gov or Richelle Tolton at SC DHEC Bureau of Water: TOLTONRD@dhec.sc.gov

SC DHEC, Bureau of Water. 2001. Watershed Water Quality Assessment Technical Report, Broad River Basin. 001-01. http://www.scdhec.net/eqc/water/shed/broaddoc.html Accessed Feb. 22, 2006.

This report describes and effort by DHEC to collect and compile water quality information for the Broad River watershed. Physical geographies of the Basin and components sub basins are included. Appendix C contains useful water quality summary tables and maps of the basin.

Fish Communities and Aquatic Species

Duke Engineering Services, 1999. Broad River Fish and Habitat Study, Conducted by Duke Power Laboratory Services.

The Ninety-nine Islands Hydroelectric Station powerhouse was built from 1905-1910, while the concrete dam was constructed in 1917. Both structures are eligible for inclusion in the National Register of Historic Places. The hydroelectric station is a modified peaking plant located on the main branch of the Broad River in Cherokee County, near Blackburg, SC. The Ninety-Nine Islands Dam impounds a 175 ha (433 ac) reservoir with free-flowing tailwater. The drainage basin totals 4020 km^2 (1550 mi^2). The heavy transport of silt by the channel has substantially reduced the area and volume of the reservoir since it was completed in 1910. The report contains information necessary for FERC relicensing , including information regarding water quality, fish, wildlife and botanical resources, existing and proposed measures for dam operation, hydrologic characteristics, archeological and historical resources, and recreation facilities as well as opportunities. Contact Mary Crockett at SC DNR for the report: crockettm@dnr.sc.gov

Foley, J.R. 1972. A Qualitative and Quantitative Study of the Annual Species Succession of the Phytoplankton in the Broad River near Parr, South Carolina. Masters of Science thesis for the Department of Biology, University of South Carolina. Available at the South Caroliniana Library.

The purpose of this thesis endeavor was to document basic qualitative and quantitative data regarding succession of phytoplankton species in conjunction with Broad River physical and water quality factors. The author was interested in comparing phytoplankton conditions before and after the construction of the nuclear and hydroelectric generation facilities on Frees Creek and Parr Shoals. Foley found that fluctuations in river statge, turbulence, turbidity and nutrient concentrations interrupted the progress of the phytoplankton community in reaching maturity.

SC DNR. 2005. Broad River Basin Aquatic Inventory. Accessed February 22, 2006: http://www.dnr.sc.gov/fish/fwfi/broadriver.html.

DNR purports that baseline data is needed for fish species in the Broad River Basin which have received relatively little attention. In response to federal dam relicencing activity in the basin, DNR has been conducting spot surveys of aquatic species. A more comprehensive survey of the River will characterize the composition and health of the biotic community. General physical basin parameters will also be collected. Mary Crockett at SC DNR related that the complete report of the Broad River's fish communities should be completed by the end of Summer 2006. Contact Mary Crockett at SC DNR for further information: crockettm@dnr.sc.gov

SC DNR. 2002? An inventory of the aquatic resources of the Broad River, with emphasis on fishes. Accessed April 5, 2006: www.dnr.sc.gov/fish/fwfi/broadriverresearch.pdf

The Broad River Mitigation Trust fund was established to oversee the protection and mitigation of threats to the fish community in the Broad River Basin. A representative from SC DNR, USFWS, Duke Power Company, and one from SCE&G serve as trustees overseeing Trust expenditures. The objective of this report is to obtain monies in order carry out the following tasks. The final goals of this study are to inventory the aquatic resources of the Broad River with emphasis on fish species, examine the major fish habitat types in the basin as determine the degree they are influenced by dams, compare the results of this study to existing studies in order to make correlations between the fish community and environmental variables, and use the data collected to protect and enhance the aquatic resources of the Broad River Basin.

Vegetation and Indigenous Species

Aulbach-Smith, C.A. 1999. Land Cover and Vegetation of the Broad River Scenic Corridor South Carolina, submitted to Duke Engineering and Services, Botanical Services of South Carolina.

Using 1989 and 1994 NAPP false color-infrared photos, soil survey maps, aerial surveys, and ground-truthing, the land cover of Broad River Scenic Corridor was determined. Mapping of the inundation zone additionally utilized USGS 7.5 minute quads. The report describes, in detail, the 11 land cover types determined, 6 of which are forest types, but also includes freshwater, agricultural fields, scrub, wildlife management areas, and "other." The report contains no map of the classifications in the corridor, which would have been extremely helpful in understanding their extent and distribution. However, it does describe the characteristics of a minimally impacted reach of the Broad River. Contact Mary Crockett at SC DNR for the report: crockettm@dnr.sc.gov

Gaddy, L.L. 1999. Inventory of Rare, Threatened, and Endangered Species and Significant Natural Areas of the Upper Broad River Corridor from Ninety-Nine Islands Lake to Lockhart, South Carolina, submitted to Duke Engineering and Services.

This report chronicles the species of concern in the Broad River Scenic Corridor. The lower reaches of the major tributaries, King's Creek, Thickety Creek, Bullock Creek, and the lower Pacolet River were also surveyed as part of this inventory. The purpose of the study was to inventory major habitats in the study area for the presence of rare and endangered species of plants and animals and also for significant natural areas. Field work was conducted Fall 1998 to June of 1999. Six state-listed species were found in the corridor and associated tributaries: rough sedge, shoals spider lily, single-flowered broomrape, sweet cicely, Canada moonseed, and drooping sedge. Additionally, several species not common to the area, but noteworthy, include the Carolina laurel, the Diana butterfly, and the piedmont heartleaf.

Historical Resources

Broad River Basin Historical Society. 1991-2002. The Broad River Notebook. Hickory Grove, SC. Available at the University of South Carolina, Caroliniana Library.

This serial publication recounts the importance of the Broad River to the history of northern South Carolina, namely western York County. The publication includes genealogical information and historical accounts of the region which often include the Broad River. Historical hydroclimatological information can be obtained from many of the accounts, such as in the December 2001 issue, which recounts bridge-building and flooding on the Broad River.

Broad River (and major tributaries) U.S.G.S relevant 1:24,000 7.5 minute quads

Fingerville East
Valley Falls
Chesnee

Cowpens
Boiling Springs South
Gaffney
Spartanburg
Pacolet
Pacolet Mills
Wilkinsville
Kelton
Moore
Glen Springs
Cross Anchor
Union West
Union East
Reidville
Woodruff
Enoree
Ora
Philson Crossroads
Sedalia
Whitmire North
Blacksburg North
Blacksburg South
Kings Creek
Hickory Grove
Lockhart
Leeds
Carlisle
Blair
Pomaria
Jenkinsville
Chapin
Richtex
Irmo
Columbia North

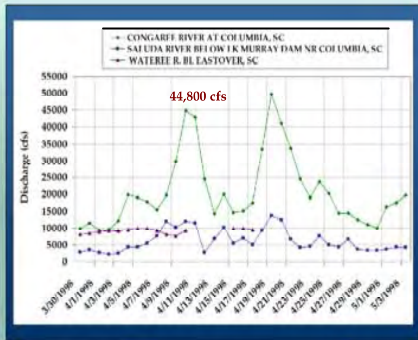
U.S.G.S. Gaging Stations for the Broad River Basin
02157490 BEAVERDAM CREEK ABOVE GREER, SC
02153680 BROAD R NR HICKORY GROVE S C
02161000 BROAD RIVER AT ALSTON, SC
02161500 BROAD RIVER AT RICHTEX, S. C.
02153551 BROAD RIVER BELOW CHEROKEE FALLS, SC
02153200 BROAD RIVER NEAR BLACKSBURG, SC
02156500 BROAD RIVER NEAR CARLISLE, S. C.
02153500 BROAD RIVER NEAR GAFFNEY, SC
021603257 BRUSHY CREEK NEAR PELHAM, SC
02155600 BUCK CREEK NEAR FINGERVILLE, SC

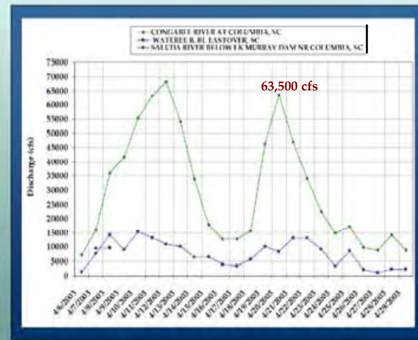
02153800 BULLOCK CREEK NR SHARON, SC
02167557 BUSH RIVER AT JOANNA, SC
02162010 CEDAR CREEK NEAR BLYTHEWOOD, SC
02153780 CLARKS FORK CREEK NR SMYRNA, SC
02160381 DURBIN CREEK ABOVE FOUNTAIN INN, SC
02159600 DUTCHMAN CREEK NEAR PAULINE, S.C.
02160326 ENOREE RIVER AT PELHAM, SC
02160200 ENOREE RIVER AT TAYLORS, SC
02160700 ENOREE RIVER AT WHITMIRE, SC
02160500 ENOREE RIVER NEAR ENOREE S.C.
02160390 ENOREE RIVER NEAR WOODRUFF, SC
02159800 FAIRFOREST CREEK AT SPARTANBURG, S. C.
02160000 FAIRFOREST CREEK NEAR UNION, S.C.
02160775 HELLERS CREEK NR POMARIA, SC
021607224 INDIAN CREEK ABOVE NEWBERRY, SC
02156301 LAWSON FORK CREEK @ TREATMENT PLANT @ SPARTANBURG
02156050 LAWSONS FORK CREEK AT DEWEY PLANT NR INMAN, SC
02156300 LAWSONS FORK CREEK AT SPARTANBURG SC
021584051 MAPLE CREEK NEAR DUNCAN, SC
02157500 MIDDLE TYGER RIVER AT LYMAN, S.C.
02157470 MIDDLE TYGER RIVER NEAR GRAMLING, SC
02157510 MIDDLE TYGER RIVER NEAR LYMAN, SC
02156450 NEALS CREEK NR CARLISLE, SC
02154500 NORTH PACOLET RIVER AT FINGERVILLE, S. C.
02157000 NORTH TYGER RIVER NEAR FAIRMONT, S. C.
02158000 NORTH TYGER RIVER NEAR MOORE, S. C.
021556525 PACOLET RIVER BELOW LAKE BLALOCK NEAR COWPENS, SC
02156000 PACOLET RIVER NEAR CLIFTON, S. C.
02155500 PACOLET RIVER NEAR FINGERVILLE, SC
02150495 SECOND BROAD RIVER NR LOGAN, NC
02162093 SMITH BRANCH AT NORTH MAIN ST AT COLUMBIA, SC
02154790 SOUTH PACOLET RIVER NR CAMPOBELLO, SC
02158408 SOUTH TYGER RIVER BELOW DUNCAN, SC
02158410 SOUTH TYGER RIVER BELOW LYMAN, SC
02158500 SOUTH TYGER RIVER NEAR REIDVILLE, S. C.
02159000 SOUTH TYGER RIVER NEAR WOODRUFF, S. C.
021563931 TURKEY CREEK NEAR LOWRYS, SC
02160105 TYGER RIVER NEAR DELTA, SC
02159500 TYGER RIVER NEAR WOODRUFF, S. C.
02161700 WEST FORK LITTLE RIVER NR SALEM CROSSROADS, S.C.

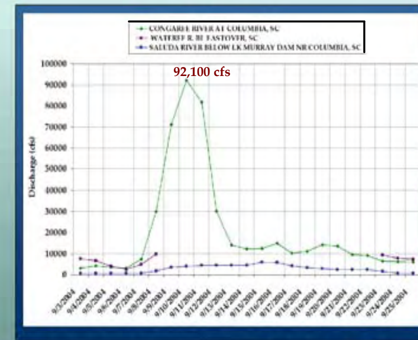
APPENDIX B:

Floodplain Inundation Modeling using HEC-RAS & GIS – EXAMPLES

HEC-RAS GIS Flood Inundation Depth Models and Flood Hydrographs

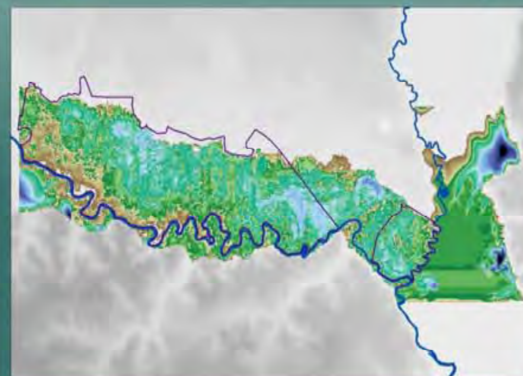


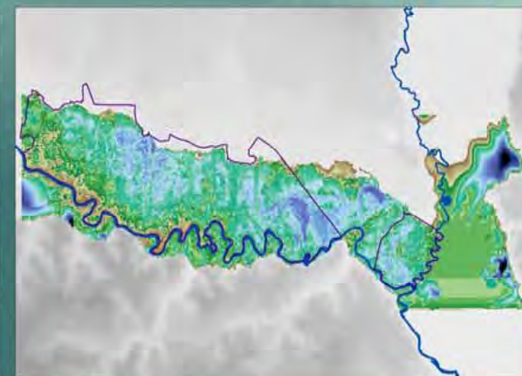


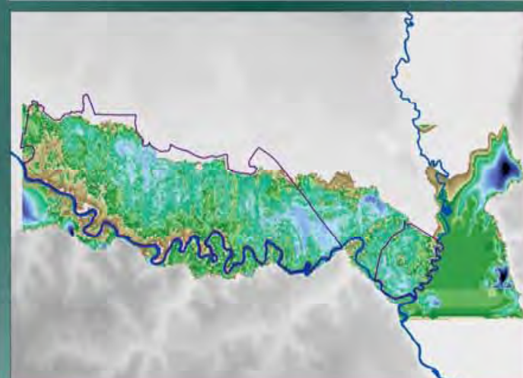


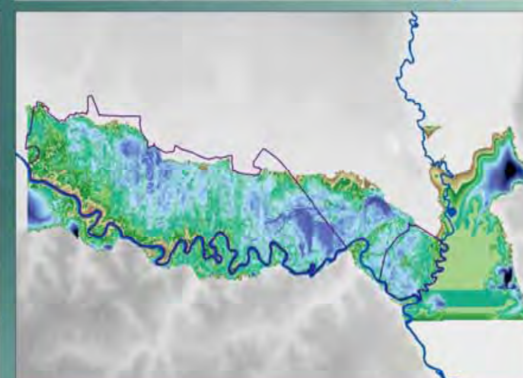
Flood Inundation Depths (feet)

- 0 - 0.67
- 0.68 - 1.43
- 1.44 - 2.18
- 2.19 - 2.85
- 2.86 - 3.52
- 3.53 - 4.28
- 4.29 - 4.95
- 4.96 - 5.62
- 5.63 - 6.29
- 6.3 - 7.05
- 7.06 - 7.8
- 7.81 - 8.47
- 8.48 - 9.15
- 9.16 - 9.82
- 9.83 - 10.49
- 10.5 - 11.16
- 11.17 - 11.91
- 11.92 - 12.59
- 12.6 - 13.26
- 13.27 - 13.93
- 13.94 - 14.68
- 14.69 - 15.44
- 15.45 - 16.11
- 16.12 - 16.78
- 16.79 - 17.45
- 17.46 - 18.29



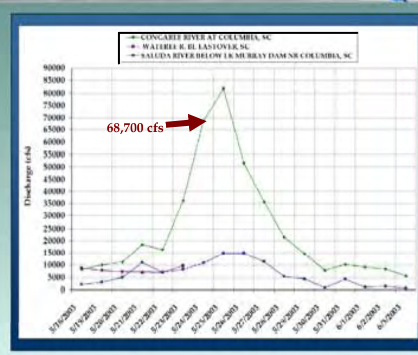


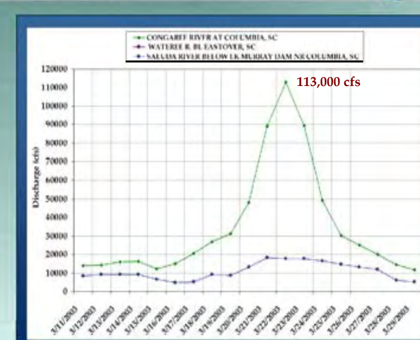




Flood Inundation Depths (feet)

- 0 - 0.67
- 0.68 - 1.43
- 1.44 - 2.18
- 2.19 - 2.85
- 2.86 - 3.52
- 3.53 - 4.28
- 4.29 - 4.95
- 4.96 - 5.62
- 5.63 - 6.29
- 6.3 - 7.05
- 7.06 - 7.8
- 7.81 - 8.47
- 8.48 - 9.15
- 9.16 - 9.82
- 9.83 - 10.49
- 10.5 - 11.16
- 11.17 - 11.91
- 11.92 - 12.59
- 12.6 - 13.26
- 13.27 - 13.93
- 13.94 - 14.68
- 14.69 - 15.44
- 15.45 - 16.11
- 16.12 - 16.78
- 16.79 - 17.45
- 17.46 - 18.29





APPENDIX C:

Indicator Species and Associated Life History Attributes w/citations

ESWM Species List, Updated January 15, 2008

Group	Common Name	*Genus*	*Species*	Available Literature	Documented Response to Flow	Ecologically Significant	Threatened or Endangered	Category
Bird	Wood Duck	*Aix*	*sponsa*	many	yes (floodplain)	common/economic		Keep
Bird	Woodstork	*Mycteria*	*americana*	many	yes	foraging in floodplain, 100s in Wateree	State Species Concern, Federally Endangered	Keep
Bird	Prothonotary Warbler	*Protonotaria*	*citrea*	many	yes (floodplain)			Keep
Fish	Shortnose Sturgeon	*Acipenser*	*brevirostrum*	med.	yes/connectivity		Federally/State Endangered	Keep
Fish	American Shad	*Alosa*	*sapidissima*	many	connectivity of rivers			Keep
Fish	Redfin Pickerel	*Esox*	*americanus*	many	yes (floodplain)	floodplain spawner (fall)		Keep
Fish	Redbreast Sunfish	*Lepomis*	*auritus*	med.	yes	floodplain spawner		Keep
Fish	Striped Bass	*Morone*	*saxatilis*	many	yes	economic sig.		Keep
Fish	Robust redhorse	*Moxostoma*	*robustum*	med.	yes/connectivity			Keep
Fish	Blueback herring	*Alosa*	*aestivalis*	med.	yes/connectivity	floodplain spawner		Keep
Invertebrate	Roanoke Slabshell	*Elliptio*	*roanokensis*	med.	yes			Keep
Invertebrate	Yellow Lampmussel	*Lampsilis*	*cariosa*	med.	yes			Keep
Mammal	Otter	*Lontra/Lutra*	*canadensis*	many	some indication			Keep
Mammal	Wild Boar	*Sus*	*scrofa*	med.	negative relationship	direct management implications		Keep
Plant	Water Tupelo	*Nyssa*	*aquatica*	many	yes (floodplain)			Keep
Plant	Bald Cypress	*Taxodium*	*distichum*	many	yes (floodplain)			Keep

American Shad	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)			--Spawning occurs March-May in temperatures ranging from 12.5 to 25ºC, with a peak at 21-23ºC. [2,3] --Spawning occurs over flats or shallow water.[3]									
Growth (for juvenile stages)			--Larvae are generally found in the eddy and backwater areas of rivers. [1] --Feeding success is often low among first-feeding larvae. Abundant preferred food is an important consideration for survial.[1] --Larvae remain in tidal freshwater nursery until late fall, when they migrate out to sea or downstream to the mouth of the river to overwinter. [3]									
Maintenance (foraging, prey avoidance, competition with other sp.)			--Adult American shad feed little in freshwater while on a spawning run as prey zooplankton is much smaller than marine prey and is therefore unavailable.[3] --Larvae and juveniles prefer crustacean zooplankton and immature insects, but also feed on copepods, shrimp, worms, and some fishes.[1,3,5] --One of the largest threats with American shad is its inability to migrate due to fragmentation of river spawning habitat by hydroelectric dams.[4]									

1. Crecco, V.A. and Blake, M.M. Blake. 1983. Feeding Ecology of Coexisting Larvae of American Shad and Blueback Herring in the Connecticut River. *Transactions of the American Fisheries Society*.

2. DNR, South Carolina. 1983. “American Shad Eggs by Temperature” data. See Jim Bulak for more information.

3. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.

4. Patty, S.S., N. Roth, and D. Mountain. 1999. Maryland, the Power Plant Research Program, and Chesapeake Bay Watershed. *The Science of the Total Environment* 240: 171-188. [For context: Dams are a large impediment to spawning runs].

5. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.

Jim Bulak: Only anecdotal information is available for SC populations of American shad.
Feeding and timing of growth information.—juvenile summer size from SCDNR monitoring collections. Rate of growth is dependent upon food supply. During current drought, growth rate is slower, all things being average. Any rains would increase nutrient availability.

Bald cypress	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction **Reproduction** (flowering, seed dispersal, germination)					--Floods May-Jul. have a negative affect on recruitment because they impede seed germination.[2]					--Floods occurring Oct.-Feb. are important to seed dispersal.[2]		
Growth (seedling/sapling stages)			Seedlings sensitive to flooding in low lying areas and drought in higher elevations (Almquist 2002).									
Maintenance (mature tree growing season, photosynthesis, root development and maintenance)	Mature trees tolerant of a winter floods during dormancy (Almquist 2002)											Mature trees tolerant of a winter floods during dormancy (Almquist 2002

1. McLeod, K.W. 2000. Species selection trials and silvicultural techniques for the restoration of bottomland hardwood forests. *Ecological Engineering* 15:S35-S46.

2. Meyer, J., et al. 2003. Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam. June 2003. pp. 150.

Patterson, G.G., G.K. Speiran and B.H. Whetstone. 1985. Hydrology and its effects on Distribution of Vegetation in Congaree Swamp National Monument, South Carolina. USGS, prepared in cooperation with the National Park Service. Water-Resources Investigations Report 85-4256. [I gave this one to you in digital format, it is in the hydrology folder].

Visser, J.M. and C.E. Sasser. 1995. Changes in tree species composition, structure and growth in a bald-cypress-water tupelo swamp forest, 1980-1990. *Forest Ecology and Management* 72: 119-129.

From Park Library, See LS summary of Minchin and Sharitz below:
Another possibility, although I doubt that this supports our argument for ecological flows due to the climatologic and insect effects ecosystem effect uncertainties:

Minchin, P.R. and R.R. Sharitz, 2007. Age Structure and Potential Long-term Dynamics of the Floodplain Forests of Congaree National Park. A report for the Park, Final Report submitted August 31, 2007.

The object of this research was to determine if alterations in the hydrograph of the Congaree River have known effects on the on the floodplain forests of Congaree. The study authors analyzed the size distribution of species and tested for evidence of long-term changes in forest composition due to changes in hydrologic regime. The authors also examined woody species recruitment during the 2004 season to compare with previous season's recruitment data. The study revealed that the community is trending toward a drier condition community, suggesting a long-term change in forest composition. Specifically, since 1930 (era of Saluda Dam establishment), the age cohorts of trees on study sites appeared to be increasingly indicative of species "typical of less frequently and less deeply flooded conditions." The majority of plots in sloughs with a significant trend (toward drier conditions) were on relatively higher elevation sites (located more than 3 km from the river channel) [this would indicate sites in the sloughs that used to get flooded by high floods no longer do], whereas most of the BLHW plots with significant trajectories were on lower elevation sites [used to having more water for a longer time than they now do?] within 2 km of the main channel. "Some BLHW plots may be undergoing a succession toward less flood-tolerant species that is primarily driven by sedimentation, rather than changes in the hydrologic regime."

The authors found that the modified run-of-river period for the retro-fit drawdown of Saluda Dam during the sample time [which was not true run-of-river in any case], encouraged no detectable pattern affecting woody seedling recruitment. They caution that at least ten years of observation would be needed to separate out effects of change in river flow patterns from variation in other environmental factors that would affect woody regeneration.

The frequency of large floods have decreased: 2 year floods now occur every 4.5 years and 5-year floods now occur every 25 years. Both high and low discharges have also been reduced, the typical winter flooding period has been extended into the early growing season, and the vertical movement of shallow groundwater has been reduced during low flows. The biota of floodplains is adapted to the timing and intensity of floods, conditions it uniquely adapted to. In the Savannah River, floods during the dormant season are important to seed dispersal by canopy-dominant species. Alternately, floods of several weeks duration in the growing season, due to Strom Thurmond Dam, are detrimental to woody seedlings and have been shown to limit recruitment of Bald cypress (*Taxodium distichum*) and Water tupelo (*Nyssa aquatica*) seedlings.

<table>
<tr><th>Blueback Herring</th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Reproduction (spawning or nesting)</td><td></td><td colspan="6">--Spawn over vegetation in backwater tributary systems, including BLHFs and will use flooded areas to lay eggs—prefer shallow, flooded areas.[2,4,5]
--Optimal spawning temperature is between 21-25˚C. [2]
--Fluctuations in flow affect habitat use: moderate to high flows increase use of spawning and nursery areas and hence recruitment.[4]
--Eggs are initially demersal and adhesive in still water and may become pelagic after hardening and release from the substrate. [2]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Growth (for juvenile stages)</td><td></td><td></td><td colspan="8">--Larvae are generally found in the eddy and backwater areas of rivers. [1]
--Feeding success is often low among first-feeding larvae. Abundant preferred food is an important consideration for survial.[1]
--Smaller juveniles remain in the rivers where they hatched until fall.[2]
--Flood-induced expansions of flooded forest habitat would be beneficial if flooded ample time to allow eggs to hatch, larvae to grow, and then to be slowly incorporated into the river.[4]</td><td></td><td></td></tr>
<tr><td>Maintenance (foraging, prey avoidance, competition with other sp.)</td><td></td><td colspan="4">--Adults feed primarily on zooplankton and some fishes, but do not eat extensively while on spawning run.[2,3]
--Young feed especially on rotifers, and then on copepods, insects, shrimp, and worms. [1,2,3]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1. Crecco, V.A. and Blake, M.M. Blake. 1983. Feeding Ecology of Coexisting Larvae of American Shad and Blueback Herring in the Connecticut River. *Transactions of the American Fisheries Society*.

2. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.

3. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.

4. Walsh, H.J. 2005. Early life history of blueback herring and alewife in the lower Roanoke River, North Carolina. *Transactions of the American Fisheries Society* 134(4): 910 -926.

Jim Bulak information: competition with American Shad. There are 4 species of plankton grazers in the system— anadromous American shad, blueback herring, and resident gizzard shad and threadfin shad. In the last 20 years, the relative percentage of blueback herring has declined. New fish lifts favor American Shad over Blueback herring—style of fishlift? Stocks of herring are down along the Atlantic coast. This may be cyclic, indicating other things may be going on. Herring have lost ground to American shad in the last decade. Herring in Saluda River/Congaree River would use Congaree floodplain habitat. However, only a small percentage of herring would reach that high up in the system.

Feral hog	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)	--Births of piglets occur all year, but are less frequent August-November, with two peaks noted: December-January, and April-May.[2] -- Successful breeding is dependent upon food supply, however, the high reproductive level of this species allows for rapid recovery even after the end of a food shortage.[2]											
Growth (for juvenile stages)												
Maintenance (foraging, prey avoidance, competition with other sp.)	--Non-native feral hogs place the resources of Congaree National Park at risk: wetland communities, native vegetation, streams, aquatic habitats, rare or endangered species, historic structures, and trails can be damaged by hog rooting and other destructive behaviors.[3] --Lack of inundation of the floodplain, such as during drought conditions, may result in hogs concentrating their activity on the floodplain and remaining there for long periods or year-round due to water availability, lower temperatures, greater food availability, etc.[3] --Wild pigs are opportunistic foragers, although they have a decided preference for plant material most of the year, they can prey on mussel sp.[1,4] --The most depredated hardwood seedlings on the Savannah River Site by feral hog include cherrybark oak and swamp chestnut oak.[1]											

1. Mayer, J.J., E.A. Nelson, and L.D. Wike. 2000. Selective depredation of planted hardwood seedlings by wild pigs in a wetland restoration area. *Ecological Engineering* 15:S79-S85.

2. Tate, J. 1984. Techniques for Controlling Wild Hogs in Great Smokey Mountains National Park: Proceedings of a Workshop, November 29-30, 1983. National Park Service-Southeast Region, Research-Management Report SER-72. p.4

3. USGS, NPS, and Clemson University. 2005. Final Report: Feral Hog impact monitoring, management plan development, and initial management for Congaree National Park. NPS Agreement No. F 5240 00 0265, USGS No: 1434-HO-00RM-0062. May, 2005. 33 pp.

4. Williams, J.D. and A.J. Benson. 2004. Freshwater Mussels (Family Unionidae) of the Congaree Swamp National Park. Final Report to the Congaree Swamp National Park. U.S. Geological Survey, Gainesville, FL, December 30, 2004.

Prothonotary Warbler	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Reproduction (spawning or nesting)		--Nesting highly specific to cavities over water. [1,5] --Nesting success dependent upon high water levels to reduce predation and hence improve reproductive success.[2, 4] --Comparatively larger clutches and more fledglings in swamp habitat than levee. [3]										
Growth (for juvenile stages)			Warblers in swamp habitat perceive and attack more prey per unit time. This could lead to more, healthy offspring. [3]			? Also a growth month?						
Maintenance (foraging, prey avoidance, competition with other sp.)		--Depend upon critical food resources associated with the presence of water. [2, 4] --To maintain the diversity of BLHF bird communities, an intact system is important, including all elevational and hence moisture varying zones. P.W. particularly like wetter habitats.[5]										

1. Bunn, A.G., D. L. Urban, and T.H. Keitt. 2000. Landscape connectivity: A conservation application of graph theory. *Journal of Environmental Management* 59: 265-278.
2. Hoover, J.P. 2006. Water Depth Influences Nest Predation for a Wetland-dependent bird in fragmented bottomland forests. *Biological Conservation* 127:37-45.
3. Lyons, J.E. 2005. Habitat-specific Foraging of Prothonotary Warblers: Deducing Habitat Quality. *The Condor* 107:41-49.
4. Petit, L.J. and Petit, D.R. 1996. Factors governing habitat selection by prothonotary warblers: field tests of the Fretwell-Lucas models. *Ecological Monographs* 66: 367-387.
5. Wakely, J.S. and T.H. Roberts. 1996. Bird Distributions and Forest Zonation in a Bottomland Hardwood Wetland. *Wetlands* 16(3):296-308.

Koman, T. M. 2003. The hydrologic effects of dams on the Saluda River, South Carolina. Masters Thesis in the Department of Geography, USC. [This paper used to establish pre-dam peak flood period]

Redbreast sunfish	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)			--Spawn April - June.[3] --Sunfish are at disadvantage for reproduction during peak flooding on floodplain.[4] --Nests are found in shallow areas on sand and gravel substrates.[1] --Impoundments may prevent redbreast sunfish from reaching suitable spawning areas,[1] and may delay spawning due to cold-water releases.[5]									
Growth (for juvenile stages)							Juvenile sunfishes utilize the floodplain.[1]					
Maintenance (foraging, prey avoidance, competition with other sp.)		--Numbers of sunfish decrease with peak flooding.[4] --Dusky Shiners prey on eggs of redbreast sunfish and trick them into raising their young. Whether an obligate or facultative nesting relationship for the shiner, is not known. [2] --Food items include aquatic insects, small clams, crustaceans (crayfish), and small fishes.[3,5]								Form wintering schools in deeper waters and disband in spring for nest sites.[1]		

1. Brim, J. 1991. Coastal Plain Fishes: Floodplain Utilization and the Effects of Impoundments. Master of Science in the Department of Biological Sciences, University of South Carolina.
2. Fletcher, D.E. 1993. Nest Association of Dusky Shiners (Notropis cummingsae) and Redbreast Sunfish (Lepomis auritus), a Potentially Parasitic Relationship. *Copeia* (1):159-167.
3. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.
4. Rose, L. and J. Bulak. 2005. Flood Mediated Change of the Fish Community in Congaree National Park Streams. South Carolina Department of Natural Resources Freshwater Fisheries, 18 Pp.
5. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.

Jim Bulak information: Redbreast sunfish may like more constant conditions, counter to understanding that most fish like peak flooding conditions—drought tolerant. Life history species—spawn from May- June, so less likely during the natural hydrologic cycle to experience a flood event during their spawning period.

<table>
<tr><th>Redfin Pickerel</th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Reproduction (spawning or nesting)</td><td colspan="5">--Species take advantage of peak flooding for reproduction on floodplain.[1,5,6]
--Evidence that redfin pickerel can spawn over a long time period, from fall to early spring.[1,2,5]
--Temperature and rainfall prior to spawning date are the dominant factors in spurring reproduction.[1] Floodplain inundation may be the dominant factor.[2]
--Eggs in three developmental stages indicate that redfin pickerel can take advantage of unpredicatable hydrologic events to spawn.[2]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Growth (for juvenile stages)</td><td></td><td colspan="5">Larval fish utilize floodplain.[1,2,3]</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Maintenance (foraging, prey avoidance, competition with other sp.)</td><td></td><td colspan="5">--A voracious predator, larvae and smaller juveniles eat zooplankton and insects. Adults eat predominantly fishes, but may eat crayfish and other invertebrates. [5]
--Numbers of Redfin Pickerel increase with peak flooding.[2,5,6]
--Upstream in streams fragmented by impoundments, redfin pickerel were replaced by largemouth bass and white bass is terms of piscivore abundance and composition.[4]</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1. Ballek, M.S. 1994. Reproduction and Early Life History of the Redfin Pickerel, (Esox americanus americanus). Master of Science in the Department of Biological Sciences, University of South Carolina.
2. Brim, J. 1991. Coastal Plain Fishes: Floodplain Utilization and the Effects of Impoundments. Master of Science in the Department of Biological Sciences, University of South Carolina.
3. Crawford, C.R., J.C. Davis, C.B. Hall, J. McCarthy, E. Robey, and E. Winn. 1990. Congaree Swamp: Larval Fish Study. Marine Science Program, University of South Carolina. December 6, 1990.
4. Guenther, C.B. and A. Spacie. 2006. Changes in Fish Assemblage Structure Upstream of Impoundments within the Upper Wabash River Basin, Indiana. *Transactions of the American Fisheries Society* 135:570-583.
5. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.
6. Rose, L. and J. Bulak. 2005. Flood Mediated Change of the Fish Community in Congaree National Park Streams. South Carolina Department of Natural Resources Freshwater Fisheries, 18 Pp.

Jim Bulak information: Pickerel take advantage of beneficial environmental conditions – like a weed.

River Otter	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)		--Breeding of river otters occurs early spring in temperate regions.[2,5] --Timing of reproduction can alter due to environmental factors.[2]										
Growth (for juvenile stages)			--Young are helpless at birth—are born blind, lightly furred, toothless, and are dependent on the mother for 6-8 weeks.[4,5] --Natal dens are located in upland areas adjacent to river corridors, protected from rapid changes in water levels. Dens are horizontally or vertically distant from the nearest water body.[4]									
Maintenance (foraging, prey avoidance, competition with other sp.)		--Protecting instream flow, seasonal flow regimes, riparian vegetation, and the physical structure of banks and floodplains are key conservation considerations.[1,4,5,6] --Areas of shallow water and wetlands provide shallow water habitats for otter prey including slow-swimming fish, amphibians, reptiles, and invertebrates.[1,5,6] --Otters participate in cooperative foraging, especially clumped around fishing pools and other habitat structures.[3]										

1. Boyle, S. 2006. North American River Otter (*Lontra canadensis*): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project. September 2, 2006. 56 pp.
2. Crait, J.R., G.M. Blundell, J.K. Herreman, and M. Ben-David. 2006. Notes and Discussion: Late Season Breeding of River Otters in Yellowstone National Park. *American Midland Naturalist* 156:189-192.
3. Gorman, T.A., J.D. Erb, B.R. McMillan, and D.J. Daniels. 2006. Space use and sociality of river otters (*Lontra canadensis*) in Minnesota. *Journal of Mammalogy* 87(4): 740-747.
4. Gorman, T.A., J.D. Erb, B.R. McMillan, D.J. Martin and J.A. Homyack. 2006. Site Characteristics of River Otter (*Lontra Canadensis*) Natal Dens in Minnesota. *American Midland Naturalist* 156:109-117.
5. Melquist, W.E. and A.E. Dronkert. 1999. Section IV: Species Biology, Management, and Conservation, Chapter 7 River Otter. In, *Wild Furbearer Management and Conservation in North America*: 626-641.
6. New Mexico Department of Game and Fish, Conservation Services Division. 2006. Feasibility Study: Potential for Restoration of River Otters in New Mexico. Review Draft; July 24, 2006. 59 pp.

Roanoke slabshell	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Reproduction (spawning or nesting)				--Blueback herring, gizzard shad, and white perch serve as hostfish.[4] --Gravid individuals found in the Broad and Congaree Rivers 5/15/-7/3/07.[4] --Gravid individuals are found in North Carolina in early spring.[1] --Ensuring flow of water in sand and gravel areas May-August may facilitate reproduction.[3] --Tailwater discharges from dams create low water temperatures that impede reproduction.[3] [Timeframe in summer months?].								
Growth (for juvenile stages)				--Hydropower peaking may prevent the settlement of juvenile mussels as well as cause reduced growth.[3] [Timeframe in summer months?]. --Increased juvenile recruitment is significantly correlated to the re-watering of channel margin habitats. [2]								
Maintenance (foraging, prey avoidance, competition with other sp.)			--Considered habitat generalists.[2] --Usually found associated with the deeper channels near shore in relatively fast flowing water. The substrate consists of coarse to medium sized sand and small gravel.[1] --Invasive bivalves, such as the Asian clam (*Corbicula fluminea*), may outcompete native mussels. [5] --*Sus scrofa* has a habitat degrading negative relationship with freshwater mussels and additionally uses them as a food source.[5]									

1. Bogan, A.E. and J.M. Alderman. 2004. Workbook and Key to the Freshwater Bivalves of South Carolina. 72 pp.
2. Krueger, E. and R. Heise. 200? Freshwater mussels of the Great Pee Dee River (Rev. 3): Habitat Preferences of Known Occurring Species; and Relationships to Flow, Emersion and Dissolved Oxygen.
3. Meyer, J., et al. 2003. Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam. June 2003. pp. 47.
4. Price, J. (DNR) and C. Eads (NC State U.). 2007. Personal communication. Email dated December 6, 2007.
5. Williams, J.D. and A.J. Benson. 2004. Freshwater Mussels (Family Unionidae) of the Congaree Swamp National Park. Final Report to the Congaree Swamp National. Park. U.S. Geological Survey, Gainesville, FL, December 30, 2004. [No Roanoke Slabshell were found during the sampling conducted for this study. The absence of migratory host-fish, blocked in their migration by downstream dams, may be a factor. The recent installation of fish ladders on downstream dams may restore some of the host fish and hence mussels to the Park region].

Robust Redhorse	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Reproduction (spawning or nesting)			--Utilize shallow water gravel bars in the main channel during spring for spawning[1] in temperatures 21-23°C.[2] --Spawn from March to May, when they gather in large groups over shallow gravel riffles.[5]									
Growth (for juvenile stages)			--Laboratory studies demonstrated fine sediment particles that settle in gravel can entrap eggs and larvae and suffocate them.[4] --Predation on young by introduced flathead and blue catfish also poses a threat.[3,4] --May be tolerant of lentic habitat in juvenile stage.[4]									
Maintenance (foraging, prey avoidance, competition with other sp.)		--During flooding, robust redhorse accessed the floodplain and occupied flooded forest habitat.[3] --Foraging on the floodplain occurs prior to spawning.[3]			--Primary threats to the species are habitat loss due to impoundment, siltation, and other types of alteration.[4] --Food is primarily bivalve molluscs, which are crushed with their teeth.[4]	--Inhabit larger, deeper, and faster bodies of water, near outside river bends, and are therefore difficult to catch. Often found in association with fallen trees, and other woody debris.[3,4,5]						

1. Coughlan, D.J., B.K. Baker, D.H. Barwick, A.B. Garner, and W.R. Doby. 2007. Catostomid Fishes of the Wateree River, South Carolina. *Southeastern Naturalist* 6(2): 305-320.
2. Georgia Power. 1999-2000. Robust Redhorse Conservation Strategy. [see Jim Bulak for information].
3. Grabowski, T.B. 2006. Seasonal and diel movements and habitat use of robust redhorses in the lower Savannah River, Georgia and South Carolina. *Transactions of the American Fisheries Society* 135 (5):1145 -1155.
4. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site. Athens, GA: University of Georgia Press.
5. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.

Jim Bulak: Robust redhorse have been stocked in the Broad River as of the last year to two years and have the potential to move into the adjoining Saluda-Congaree system.
Coughlan is a good contact. Lead biologist, Duke Power Huntersville, NC. DJCoughlan@duke-energy.com

Shortnose Sturgeon	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)		--Begin migration when temperatures are above 9˚C.[2] --Spawning takes place at temperatures between 10-15˚C.[2] --Spawning sites consists of coarse, hard substrate of gravel or cobble with fast flow.[3,5,6] --Eggs are demersal, and adhesive after fertilization, attaching to hard substrate and then drifting after 2 hours.[3] --Flow volume and water temperature in the fall preceding spawning were correlated with year-class strength.[7]										
Growth (for juvenile stages)		--Larvae and juveniles are poor swimmers. They stay near the bottom for two weeks, then migrate downstream.[3]										
Maintenance (foraging, prey avoidance, competition with other sp.)					--Non-spawning populations were associated with areas where rivers turn and velocity slows: creating levees and sandy shoals.[5] --These sandy or muddy bottom areas provide good foraging for adult food preference of mollusca, particularly Corbicula sp.[1,3,5] Other food preferences include worms, crustaceans, insect larvae, small clams, small fishes,[6] and isopods.[4] --Sturgeon seek deeper water during temperature extremes, especially the summer in SC. This is for temperature preference and may also allow them to conserve energy in slow moving water.[1,5]							

1. Collins, M.R., D. Cooke, B. Post, J. Crane, J. Bulak, T.I.J. Smith, T.W. Greig, and J.M. Quattro. 2003. Shortnose Sturgeon in the Santee-Cooper Reservoir System, South Carolina. *Transactions of the American Fisheries Society* 132:1244-1250.

2. Finney, S. T .; Isely, J. J .; Cooke, D. W. 2006. Upstream Migration of Two Pre-Spawning Shortnose Sturgeon Passed Upstream of Pinopolis Dam, Cooper River, South Carolina. *Southeastern Naturalist* 5 (2):369-375.

3. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.

4. Norwood, C., M.R. Collins, and W.C. Post. In Press. Comparison of Diets of Co-occurring Atlantic Shortnose Sturgeons in Two South Carolina Rivers. South Carolina Department of Natural Resources, 9 pp.

5. Palmer, A.G. 2001. Seasonal, Diel, and Tidal Movements of Shortnose Sturgeon (*Acipenser brevirostrum*) in the Cooper River, South Carolina. Masters Thesis in Marine Biology at the University of Charleston, South Carolina. 57 pp.

6. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.

7. Woodland, R.J. and D.H. Secor. 2007. Year-class Strength and Recovery of Endangered Shortnose Sturgeon in the Hudson River, New York. *Transactions of the American Fisheries Society* 136:72-81.

Jim Bulak: Shortnose sturgeon have been documented spawning at the I-77 bridge vicinity.—timing-- April sometime?

Mark Collins—DNR Sturgeon expert and Bill Post. Extensive work on the sturgeon in SC rivers.

Striped Bass	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)		--Spawns in early spring after migrating up coastal or tributary rivers.[5] --Eggs are slightly heavier than water, so are suspended in the water column and bounce along bottom, drifting downstream. Therefore, good distance is needed for eggs to develop and hatch before reaching still water.[3,5] --Favorable condition of the floodplain frees up nutrients, leading to greater egg potential survival. This is water management dependent.[1]										
Growth (for juvenile stages)					--Juveniles depend upon open reservoir waters for nurseries.[2,5] --Larvae depend upon high concentrations of small zooplankton during the first few days after hatching.[4] --The upper portion of Lake Marion had higher zooplankton densities than the riverine habitat, meaning it is better nursery habitat.[2] --Management of upstream dams may increase recruitment in upper Lake Marion by optimizing temperature and flow.[2]							
Maintenance (foraging, prey avoidance, competition with other sp.)				--Voracious feeders on other fish—menhedan, herrings, shad sp., and eel.[5]								

1. Bulak, J.S. 1994. Factors Affecting Recruitment of Striped Bass, *Monrone saxatilis*, in the Santee-Cooper system, South Carolina. Ph.D. Dissertation at the University of South Carolina in the Department of Biology.

2. Bulak, J.S., J.S. Crane, D.H. Secor, and J.M. Dean. 1997. Recruitment Dynamics of Striped Bass in the Santee Cooper System, South Carolina. *Transactions of the American Fisheries Society* 126:133-143.

3. Bulak, J.S., N.M. Hurley, Jr., and J.S. Crane. 1993. Production, Mortality, and Transport of Striped Bass Eggs in Congaree and Wateree Rivers, South Carolina. *American Fisheries Society Symposium* 14: 29-37.

4. Marcy, B.C., D.E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. Athens, GA: University of Georgia Press.

5. Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. Chapel Hill, N.C.: The University of North Carolina Press.

Water Tupelo (*Nyssa aquatica*)	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Reproduction (flowering, seed dispersal, germination)					--Floods May-Jul. have a negative affect on recruitment because they impede seed germination.[2]					--Floods occurring Oct.-Feb. are important to seed dispersal.[2]		
Growth (seedling/sapling stages)												
Maintenance (mature tree growing season, photosynthesis, root development and maintenance)												

1. McLeod, K.W. 2000. Species selection trials and silvicultural techniques for the restoration of bottomland hardwood forests. *Ecological Engineering* 15:S35-S46.

2. Meyer, J., et al. 2003. Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam. June 2003. pp. 150.

Patterson, G.G., G.K. Speiran and B.H. Whetstone. 1985. Hydrology and its effects on Distribution of Vegetation in Congaree Swamp National Monument, South Carolina. USGS, prepared in cooperation with the National Park Service. Water-Resources Investigations Report 85-4256. [I gave this one to you in digital format, it is in the hydrology folder].

Visser, J.M. and C.E. Sasser. 1995. Changes in tree species composition, structure and growth in a bald-cypress-water tupelo swamp forest, 1980-1990. *Forest Ecology and Management* 72: 119-129.

Minchin, P.R. and R.R. Sharitz, 2007. Age Structure and Potential Long-term Dynamics of the Floodplain Forests of Congaree National Park. A report for the Park, Final Report submitted August 31, 2007.

The object of this research was to determine if alterations in the hydrograph of the Congaree River have known effects on the on the floodplain forests of Congaree. The study authors analyzed the size distribution of species and tested for evidence of long-term changes in forest composition due to changes in hydrologic regime. The authors also examined woody species recruitment during the 2004 season to compare with previous season's recruitment data. The study revealed that the community is trending toward a drier condition community, suggesting a long-term change in forest composition. Specifically, since 1930 (era of Saluda Dam establishment), the age cohorts of trees on study sites appeared to be increasingly indicative of species "typical of less frequently and less deeply flooded conditions." The majority of plots in sloughs with a significant trend (toward drier conditions) were on relatively higher elevation sites (located more than 3 km from the river channel) [this would indicate sites in the sloughs that used to get flooded by high floods no longer do], whereas most of the BLHW plots with significant trajectories were on lower elevation sites [used to having more water for a longer time than they now do] within 2 km of the main channel. "Some BLHW plots may be undergoing a succession toward less flood-tolerant species that is primarily driven by sedimentation, rather than changes in the hydrologic regime." The authors found that the modified run-of-river period for the retro-fit drawdown of Saluda Dam during the sample time [which was not true run-of-river in any case], encouraged no detectable pattern affecting woody seedling recruitment. They caution that at least ten years of observation would be needed to separate out effects of change in river flow patterns from variation in other environmental factors that would affect woody regeneration.

The frequency of large floods have decreased: 2 year floods now occur every 4.5 years and 5-year floods now occur every 25 years. Both high and low discharges have also been reduced, the typical winter flooding period has been extended into the early growing season, and the vertical movement of shallow groundwater has been reduced during low flows. The biota of floodplains is adapted to the timing and intensity of floods, conditions it uniquely adapted to. In the Savannah River, floods during the dormant season are important to seed dispersal by canopy-dominant species. Alternately, floods of several weeks duration in the growing season, due to Strom Thurmond Dam, are detrimental to woody seedlings and have been shown to limit recruitment of Bald cypress (*Taxodium distichum*) and Water tupelo (*Nyssa aquatica*) seedlings.

<table>
<tr><th>Wood Duck</th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Reproduction (spawning or nesting)</td><td colspan="6">--Timing and success of reproduction/nesting depends on timing of flooding for nest establishment and to reduce predation. [1,3]
--Laying females depend upon feeding on invertebrates in shallow water for egg formation. [3]</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Growth (for juvenile stages)</td><td></td><td colspan="6">Fledging of offspring.[1]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Maintenance (foraging, prey avoidance, competition with other sp.)</td><td></td><td colspan="4">Peak flooding aides in reduced floodplain nest predation. [2, 3]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1. Hepp, G.R., R.A. Kennamer, and W.F. Harvey. 1989. Recruitment and Natal Philopatry of Wood Ducks. *Ecology* 70:897-903.

2. Nielsen, C.L.R. and R.J. Gates. 2007. Reduced Nest Predation of Cavity-Nesting Wood Ducks During Flooding in a Bottomland Hardwood Forest. *The Condor* 109:210-215.

3. Ryan, D.C., R.J. Kawula, and R.J. Gates. 1998. Breeding Biology of Wood Ducks using Natural Cavities in Southern Illinois. *Journal of Wildlife Management* 62(1):112-123.

Koman, T. M. 2003. The hydrologic effects of dams on the Saluda River, South Carolina. Masters Thesis in the Department of Geography, USC. [This paper used to establish pre-dam peak flood period]

<table>
<tr><th>Wood stork</th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Reproduction (spawning or nesting)</td><td></td><td></td><td colspan="6">--Nesting begins between mid-March to late April in northern populations.[1]
--Nesting timing can be correlated with appropriate water level and/or evaporation rate. [3,5]
--Production of eggs is partially dependent on the female’s ability to collect and store nutrients which is dependent upon water levels.[5]
--Nestlings eat food brought back by their parents. Clutch size ranges from 2-5 eggs. Incubation is 30 days. There is fierce competition for food among the nestlings, with the smallest usually unable to survive in times of food shortage.[5]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Growth (for juvenile stages)</td><td></td><td></td><td></td><td></td><td colspan="5">--Nestlings fledge in about 60 days after hatching.[5]
--A successful fledgling leaves the nest but remains near the colony for an additional 25 days.[5]</td><td></td><td></td><td></td></tr>
<tr><td>Maintenance (foraging, prey avoidance, competition with other sp.)</td><td></td><td colspan="11">--Adult wood storks do not feed in water deeper than their legs are long, about 50 cm. Most of their food is obtained at a depth between 15 and 50 cm.[5]
--Wood storks feed less successfully in deep water than shallow due to a “searcher” method of stirring and groping for foraging and feeding. [2,3,4,5] They depend heavily on receding water level to concentrate prey.[1,2]
--Consumed fish prey (particularly Gabusia affinis) are small, averaging only 4.6 cm.[2,5]
--Wading birds forage more successfully in groups than singly, and prefer to feed in sites with large flocks containing snowy egret. [3,5]
--High water levels are a barrier around nests against predation.[5]
--More non-breeding wood storks are found in the Everglades WCAs in dry years as this is better habitat than natural areas which are dried out during drought.[1]</td></tr>
</table>

1. Bancroft, G. T., W. Hoffman, and R.J. Sawicki. 1992. The Importance of Water Conservation Areas in the Everglades to the Endangered Wood Stork (*Mycteria americana*). *Conservation Biology* 6(3):392-398.
2. Depkin, F.C., L.K. Estep, A. L. Bryan, C.S. Eldridge, and I.L. Brisbin. 2005. Comparison of Wood Stork Foraging Success and Behavior in Selected Tidal and Non-tidal Habitats. *Wilson Bulletin* 117(4):386-389.
3. Gawlik, D.E. and G.E. Crozier. 2007. A Test of Cues Affecting Habitat Selection by Wading Birds. *Auk* 124(3):1075-1082.
4. Kelly, J.F. D.E. Gawlik, and D.K. Kieckbusch. 2003. An Updated Account of Wading Bird Foraging Behavior. *Wilson Bulletin* 115(1):105-107.
5. Wolff, W.F. 1994. An Individual-oriented Model of a Wading Bird Nesting Colony. *Ecological Modelling* 72: 75-114.

Yellow Lampmussel	J	F	M	A	M	J	J	A	S	O	N	D
Reproduction (spawning or nesting)			--Smallmouth bass, largemouth bass, striped bass and black crappie all resulted in large numbers of glochidia to juvenile mussels (other species, marginal).[4] --Observed gravid in the Congaree River 5/16-5/30/07.[4] --Observed gravid in N. Carolina throughout the year, although peak is in the cooler months.[1] --Tailwater discharges from dams create low water temperatures that impede reproduction[3] [Timeframe in summer months?].				Also a critical month?					
Growth (for juvenile stages)				--Hydropower peaking may prevent the settlement of juvenile mussels as well as reduce growth[3] [Timeframe in summer months?]. -- Increased juvenile recruitment is significantly correlated to the re-watering of channel margin habitats. [2]								
Maintenance (foraging, prey avoidance, competition with other sp.)			--Habitat preference is for sand to gravel glides and pools, and moderate current.[2,5] --*Sus scrofa* has a habitat degrading negative relationship with freshwater mussels and additionally uses them as a food source.[5] -- Invasive bivalves, such as the Asian clam (*Corbicula fluminea*), may outcompete native mussels. [5] --Mussels in this subfamily may have more difficulty tolerating short dry spells than others.[2]									

1. Bogan, A.E. and J.M. Alderman. 2004. Workbook and Key to the Freshwater Bivalves of South Carolina. 72 pp.
2. Krueger, E. and R. Heise. 200? Freshwater mussels of the Great Pee Dee River (Rev. 3): Habitat Preferences of Known Occurring Species; and Relationships to Flow, Emersion and Dissolved Oxygen.
3. Meyer, J., et al. 2003. Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam. June 2003. pp. 47. [No hostfish has yet been identified for the Yellow Lampmussel. [Anadromous host-fish suspected: reproduction could be limited of host is unable to reach mussel habitat and is extirpated such as from dam fragmentation of system].
4. Price, J. (DNR) and C. Eads (NC State U.). 2007. Personal communication. Email dated December 6, 2007.
5. Williams, J.D. and A.J. Benson. 2004. Freshwater Mussels (Family Unionidae) of the Congaree Swamp National Park. Final Report to the Congaree Swamp National. Park. U.S. Geological Survey, Gainesville, FL, December 30, 2004. [No Roanoke Slabshell were found during the sampling conducted for this study. The absence of migratory host-fish, blocked in their migration by downstream dams, may be a factor. The recent installation of fish ladders on downstream dams may restore some of the host fish and hence mussels to the Park region].

Appendix 18

SCE&G Response to October 2008 ESWM Proposal

SCE&G Response to October 2008 ESWM Proposal

Although the Ecological Sustainable Water Management (ESWM) program was not part of the Saluda Hydro Relicensing process, SCE&G did participate in a good faith effort to work with the organizations and governmental agencies participating in this program to develop a meaningful flow release scheme that would provide additional benefits, over and above those negotiated within the relicensing process, for river reaches beyond the lower Saluda River. Prior to receiving the ESWM Leadership Committee (LC) proposal, SCE&G received a proposal from SC Department of Natural Resources (SCDNR) requesting additional flows to enhance the striped bass population in the Congaree River. These flow releases would also enhance other species identified through the ESWM process. After reviewing the proposals from the ESWM LC and SCDNR, SCE&G would like to work on both of these proposals as one effort in order to provide a set of flow releases that could be achieved by Saluda Hydro operations. The following is the SCE&G response to the October 2008 proposal from the ESWM LC for additional flow releases from Saluda Hydro.

(1) Naturalized Flow Period: Provide 30 days of naturalized flows annually where SCE&G will operate Saluda Dam to release downstream flows continuously with limited variability based on average inflow into Lake Murray from the previous day. This period would generally be from April 1 to April 30, but could start as early as March 21 and end as late as May 10 depending on climatic conditions and management goals.

Two of every 5 years provide an additional two-week flow naturalization period alternating between an early period (March 1 to March 15) and a late period (May 15 and May 31). The rationale is to produce naturalized flow conditions with intra- and inter-annual variability targeting spring spawning events for aquatic indicator species identified during the ESWM Process. The primary purpose of these periods is to increase flow variability for the full suite of ecological functions. Priorities for the early period are shortnose sturgeon and American shad spawning, and increased early season floodplain inundation. For the later period, priorities are temperature and flow stabilization for robust redhorse, sunfish and other late season spawners.

SCE&G Response: In accordance with a request from the State General Assembly (House Bill H-4548) and the Governor of South Carolina, SCDNR has developed a proposal that addresses additional flow releases to enhance the Santee Cooper striped bass populations in the Congaree River and other species addressed in the ESWM process. These flow releases are being requested between April 1st and May 10th. Any additional flow releases associated with the ESWM process should be consistent with the flows requested by SCDNR so our system dispatch only has to provide one set of parameters. We appreciate your understanding of the complexity of trying to ask our system dispatchers to manage too many parameters at this one plant. Two other issues will need to be addressed once any additional flow release is proposed. These two issues have to do with the potential negative impact on recreational flows and fish habitat availability in the lower Saluda River that we are trying to enhance with our new minimum flow scheme.

It should be noted that the reservoir guide curve for Lake Murray, developed during relicensing, has a reservoir level target of el. 358.0 ft. Plant Datum (PD) beginning March 1 of each year and continuing until September 1. One implication of this is that once the reservoir has reached el. 358.0 ft. PD, most or all inflow will need to be discharged on a daily basis to keep the reservoir from exceeding its target level. This change in project operation from previous practice will provide increases in downstream flow in those years when there is sufficient inflow to allow the reservoir to reach the 358.0 ft. PD target elevation.

(2) Limitations to Naturalized Flows: The naturalized flow scenario would be in effect for Congaree River flows up to 30,000 cfs. The rationale for this upper limit is that higher discharge events (i.e., flood events in which the river banks CNP are over topped resulting in near complete flooding of the park's floodplain) are dominated by Broad River flows making Saluda flows of less importance during these events. This assumption corresponds to the conclusions of Conrads et al. (2007) and the ESWM floodplain inundation model (Graf and Meitzen 2006).

SCE&G Response: We would like to discuss this scenario in more detail and request that you provide clarification of what you are requesting for flows up to 30,000 CFS. Our understanding at this time is that the ESWM LC is in agreement with the new proposed guide curve. Since the new proposed guide curve reduces the annual drawdowns from eight feet to four feet, SCE&G has a greater concern with being able to manage the lake level safely during times of high inflow especially during the spring and fall seasons. Usually, if there are high flows in the Broad River, such as the 30,000 CFS recommended by your LC, it is more likely that there will be higher flows in the Saluda River basin. Therefore, SCE&G has a greater need to manage the releases for dam safety and not be as concerned with meeting a specified flow release over a specified period of time. It is imperative that dam safety comes first when managing water during a high inflow event to the point of even pre-planned flow releases as necessary to maintain the lake level in a safe manner. SCE&G needs to maintain operating flexibility of Saluda Hydro, especially during high inflow periods. Requesting designated flow releases when flows on the Broad River are up to 30,000 CFS will severely constrain our ability to manage the lake safely. And as you have already noted, flow releases from Saluda Hydro have less importance during times of high flows on the Broad River. Since this ESWM process is outside of the relicensing scope and addressing issues that are completely outside of the project boundary, SCE&G is less inclined to alter its operation for flows in excess of 8,000 CFS on the Broad River. At this time, the striped bass flow proposal by SCDNR appears to be more manageable.

(3) Limitation on Temperature Fluctuations: a) During the naturalized flow period defined in Section 1, Saluda Dam would be operated so that temperatures in the Congaree River, in the vicinity of I-77, do not vary more than 1 degree Celsius from ambient temperatures (as represented by the Broad River). Temperature fluctuations greater than this can result in the failure of spawning events.

b) We recognize that an adaptive management process will be needed to understand the limits on Saluda Dam operations to meet this objective. A real time temperature gage would also need to be established and maintained in the I-77 vicinity.

c) We recognize that SCE&G values the use of Saluda Dam for reserve operations and agree that one reserve operation call resulting in greater than +\- 1 degree C change could be permitted during each 30-day naturalized flow period.

SCE&G Response: a) SCE&G will not agree to any temperature limitations on flow releases during the year. During the spring time of the year diurnal temperature fluctuations greater than one degree Celsius have been observed to occur naturally on the lower Saluda River. The expectation of maintaining water temperatures is too constraining as the releases are subject to too many variables outside of SCE&G's control, such as ambient temperature, tributaries flows and temperature, and Broad River flows and temperature. Besides, the proposed constant flow release being requested by SCDNR should provide the more stable thermal environment that you are trying to achieve. Another issue is that during the spring time of the year there is a greater likelihood of a high inflow which would present the need to generate even outside of the reserve status. It is not in the best interest of the safety of the project to place this type of limitation on the flow releases during this time of the year. Besides, the new minimum flow scheme will help to provide more stable temperatures because the difference from minimum flow to higher flows will be less of a change.

b) Since temperature fluctuations are impracticable to be measured that far from the powerhouse, a new USGS gauge will not be required.

c) SCE&G appreciates your understanding of the importance of having Saluda Hydro available for reserve status as part of our total operating scenario. Since Saluda Hydro is such an important component of our planning and generating system, we cannot remove it from reserve status for an entire month. We have already agreed to remove Saluda from reserve status for 51 partial days associated with recreational flows and an additional 11 partial days for swift water rescue training throughout the year. You have noted below, that you support these recreational flows. Therefore, the only days that SCE&G will agree to remove Saluda Hydro from reserve status are those already identified as part of recreation and swift water rescue training.

(4) Compatibility with Saluda River Flows: Releases from Saluda Dam during the naturalized flow period would never be less than the minimum flows recommended by the Saluda instream flow study (700 cfs March, 1000 cfs April 1-14, and 1,300 cfs April 15-May 14) unless under low inflow protocol (LIP) operations. (LIP operations are not yet agreed to but SCE&G has proposed reducing downstream flows in a step wise manner to as low as 400 cfs depending on the severity of the drought and lake levels.)

Additionally, adjustments to operations during the flow naturalization period needed to support recreation flows for the Saluda River, as currently planned, is fully supported.

SCE&G Response: SCE&G will agree to the minimum flows and recreational flows as described in the final settlement agreement. Based on the proposed SCDNR striped bass flows, the originally agreed upon minimum flows were recently changed by the Instream Flow TWC and we are in the process of re-evaluating this new proposal. Members of your LC were in attendance at the Instream Flow TWC meeting and were supportive of changing the previously agreed to minimum flows.

(5) Low Inflow Periods: Operate Saluda Dam during low inflow periods to maintain low flows in the Saluda River during the growing season – April 1 through October 15 – in order to perpetuate the positive effects of low flow periods for the Congaree ecosystem (e.g., bald cypress recruitment). We find the general concepts of the Low Inflow Protocol, as currently being discussed in the Instream Flow Technical Working Committee, to be consistent with our recommendations.

SCE&G Response: As part of the Saluda Hydro Relicensing process we have organized a Low Inflow Protocol (LIP) focus group that is developing a LIP that will be presented to the other TWC and RCG members. Members of your LC are part of this focus group and as such we hope that you will be agreeable to the conditions presented by this group.

(6) Lake Levels: Limit Lake Murray drawdown to 354 ft and refill the reservoir to full pool (358 ft) by March 1 during normal operating conditions (non-LIP periods). More extreme drawdowns and later full pool targets would lessen the likelihood of meeting downstream flow targets and naturalized flow period goals.

SCE&G Response: At this time the proposed Saluda Hydro operating guide curve has an operating range of four feet, from a normal maximum operating lake level of 358' Plant Datum (PD) between March 1 and August 31, and a lower operating limit of 354' PD during normal inflow years. During periods of low inflow these elevations might not be met. As noted in your proposal and in accordance with our proposed guide curve, during the months of April and May the target normal operating lake level is proposed to be 358' PD.

(7) Scheduling Naturalized Flow Periods: The exact timing of the naturalized flow periods will be agreed to by an Adaptive Management Team (AMT) consisting of SCE&G, state and federal agencies and other relicensing stakeholders with relevant experience and interests. The AMT would meet twice annually, once in October to evaluate the effects of the previous year's naturalized flow period, and once in February to set the dates for the upcoming year. This would allow for real-time adaptation of flowing timing related to biological and climatic factors. In addition, the AMT may elect to meet as necessary to adjust to extreme, unforeseen weather events.

SCE&G Response: SCE&G agrees that it would be essential to determine if the flows provided during the spring are enhancing the striped bass population and other species identified in your study. Therefore, we agree that participation in meetings to evaluate the effectiveness of the program is beneficial.

Adaptive Management Framework:

1. Metrics. Metrics are those parameters within the natural system (or developed system) that require measurement and serve as indicators of the effectiveness of management actions. Examples for the Saluda/Congaree system might include abundance of various age classes of striped bass within the Congaree River, recruitment of bald cypress saplings at CNP, etc.

SCE&G Response: Since the latest SCDNR proposal is to incorporate these additional flows into the minimum flow regime and these flows are requested for improvements to an area outside of the Project boundary, SCE&G would expect representatives of the ESWM LC or other resource agencies to take the lead in developing the existing parameters and required measurements prior to implementation of a new flow scheme. We would be willing to participate in these meetings and assist with developing your study plans.

2. Monitoring Plan. A monitoring plan identifies the timing, frequency, sampling methods, etc associated with various metrics. Continuing the example from above, a monitoring plan for the Saluda/Congaree system would identify precisely how and when striped bass populations and bald cypress stands would be measured.

SCE&G Response: Since the latest SCDNR proposal is to incorporate these additional flows into the minimum flow scenario and these flows are requested for improvements to an area outside of the Project boundary, SCE&G would expect representatives of the ESWM LC or other resource agencies to take the lead in developing any study plans and provide the necessary resources for monitoring the effectiveness of the program. SCE&G would be interested in working with your LC representatives to develop the monitoring plans. Any monitoring plan should include evaluation of species in the lower Saluda River to determine if these flows are negatively impacting any of their habitats. If the monitoring plan results suggest that flow releases from Saluda Hydro are not the limiting factor for meeting the indicators set by the monitoring plan, then SCE&G would not be required to continue to release any additional flows, above the minimum flows, to enhance the species in the Congaree River.

3. Decision Thresholds. Decision thresholds are those pre-identified, generally quantitative, values for a particular metric that elicit a switch to a pre-identified alternative operational or monitoring approach. Examples for the Saluda/Congaree include a low level of reproductive success for striped bass over a three year period.

SCE&G Response: Any decision to change the agreed upon flow release scheme will need to be within the demonstrated operating parameters of the hydroelectric project and agreed to by SCE&G prior to implementation. Further, any decision to change operations must be consistent with conditions set forth in the new FERC license.

4. Funding source and the establishment of a management body or council.

SCE&G Response: Based on whatever flows are eventually agreed to, SCE&G would provide the engineering and system dispatch resources necessary to operate the Project, manage the requested flows, and meet the parameters of the proposed flows. SCE&G would participate in the management body or council as long as there is interest from representatives of the ESWM LC. SCE&G reserves the right to discontinue any additional flow release program if representatives of the ESWM LC do not perform the recommended studies and monitoring, or participate in the annual meetings during the years that flows are provided.

Appendix 19

Proposed Striped Bass Adaptive Management Program
DRAFT

Proposed Striped Bass Adaptive Management Program
DRAFT

At the request of the General Assembly, the SCDNR recently convened a group of stakeholders to provide recommendations to enhance the declining Santee-Cooper striped bass population. This declining population is largely dependent on spawning habitat in the Congaree River. Since the lower Saluda River contributes flows to the Congaree, SCDNR biologists developed recommendations which may provide more consistent flows during the spring spawning in April and May On August 25, 2008, SCDNR requested that SCE&G consider this recommendation to provide additional flows for the enhancement of striped basin the Congaree River.

- Instream flows are needed in the spring to provide adequate spawning habitat and nursery areas for a variety of fish species. One of these is striped bass, which is an important sport fish in the Santee River basin. Others include the American shad and the Robust redhorse, and the DNR has partnered with SCE&G and other resource agencies and utilities to restore these species. For these purposes, flows above the 1,300 cfs base flow previously discussed are needed in some years from April 1 through May 10.

- Instream flows should be released continuously (not on an average daily basis) to moderate the temperature change effects of releases from Lake Murray dam.

- When average daily flows in the Broad River for the previous day are less than 2,900, an instream flow of 1,300 cfs should be provided for the lower Saluda if hydrological conditions allow, or else the LIP should be implemented.

- When average daily flows in the Broad River for the previous day are ≥ 7,700 cfs, there is no need to further augment the base flow of lower Saluda River as the sum of the Broad River flow (≥ 7,700 cfs) and lower Saluda base flow (1,300 cfs) would be ≥ 9,000.

- When the target level for Lake Murray has been reached by April 1, and average daily flows in the Broad River are ≥ 2,900 and < 7,700 cfs for the previous day, continually release from Lake Murray dam <u>the lesser</u> of 1) 45% of the previous day's flow of the Broad River measured at the Alston gage (which would mean the Saluda was supplying 31% of the flow in the Congaree River), OR 2) the flow required above the 1,300 cfs base flow to attain a flow in the Congaree of 9,000 cfs.

Appendix 20

INSTREAM FLOW TECHNICAL WORKING COMMITTEE
Meeting Notes
December 10, 2008

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
INSTREAM FLOW TECHNICAL WORKING COMMITTEE

SCE&G Lake Murray Training Center
December 10, 2008

Final JSH 1-5-09

ATTENDEES:

Bill Argentieri, SCE&G
Ray Ammarell, SCE&G
Amanda Hill, USFWS
Jim Bulak, SCDNR
Scott Harder, SCDNR
Milton Quattlebaum, SCANA Serv.
Hal Beard, SCDNR
Ron Ahle, SCDNR
Matt Rice, American Rivers
Chad Altman, SCDHEC
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Jeni Hand, Kleinschmidt Associates
Dick Christie, SCDNR
Vivian Vejdani, SCDNR
Bill Marshall, SCDNR
Mike Waddell, Trout Unlimited
Tanjenique Paulin, SCDNR
Brandon Kulik, Kleinschmidt Associates*
Will Dillman, SCDHEC

*Conference Call

*DATE: Dec*ember 10, 2008

ACTION ITEMS

- Present agency request on new minimum flows for the LSR to SCE&G managers
  Bill Argentieri

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting and noted that the purpose of the meeting would be to review South Carolina Department of Natural Resources (SCDNR) proposal to SCE&G for enhanced flows provided by the lower Saluda River (LSR) for striped bass (STB) spawning/recruitment in the Congaree River. Alan noted that today's meeting will be dedicated to discussing: SCDNR's proposal, which will be explained in detail by Jim Bulak through a PowerPoint presentation; the memo Brandon Kulik sent out, which explains the impact on the various guilds and species in the LSR for SCDNR's proposed flows; updates to the low inflow protocol (LIP), which will be explained in detail by Ray Ammarell through a PowerPoint presentation.

Jim Bulak's Presentation on Lake Murray Dam Flows and Striped Bass Spawning in the Congaree. The PowerPoint presentation may be viewed at the following link:
http://www.saludahydrorelicense.com/documents/JBulakLakeMurrayDamflowsandstripedbassspawning12-10-2008.pdf

Jim noted that his presentation includes information from various scientific papers on striped bass. Jim briefly explained the following proposal from the SCDNR regarding flow regime for the LSR:

- *Instream flows are needed in the spring to provide adequate spawning habitat and nursery areas for a variety of fish species. One of these is striped bass, which is an important sport fish in the Santee River basin. Others include the American shad and the Robust redhorse, and the DNR has partnered with SCE&G and other resource agencies and utilities to restore these species. For these purposes, flows above the 1,300 cfs base flow previously discussed are needed in some years from April 1 through May 10.*

- *Instream flows should be released continuously (not on an average daily basis) to moderate the temperature change effects of releases from Lake Murray dam.*

- *When average daily flows in the Broad River for the previous day are less than 2,900, an instream flow of 1,300 cfs should be provided for the lower Saluda if hydrological conditions allow, or else the LIP should be implemented.*

- *When average daily flows in the Broad River for the previous day are ≥ 7,700 cfs, there is no need to further augment the base flow of lower Saluda River as the sum of the Broad River flow (≥ 7,700 cfs) and lower Saluda base flow (1,300 cfs) would be ≥ 9,000.*

- *When the target level for Lake Murray has been reached by April 1, and average daily flows in the Broad River are ≥ 2,900 and < 7,700 cfs for the previous day, continually release from Lake Murray dam the lesser of 1) 45% of the previous day's flow of the Broad River measured at the Alston gage (which would mean the Saluda was supplying 31% of the flow in the Congaree River), OR 2) the flow required above the 1,300 cfs base flow to attain a flow in the Congaree of 9,000 cfs.*

Jim briefly explained the importance of striped bass in the Santee Basin. He noted that STB in the Santee Basin was the first population in the world to be land locked, which is when we learned that STB could solely survive in freshwater systems. He noted that because of the decline in STB populations in the Santee Basin, SCDNR has recently mandated no harvest of STB for four months and has reduced the bag limit. Jim thought that some of the main reasons for decline in STB populations in the basin are mostly due to overfishing and the drought that the basin has experienced in the past ten years.

Jim displayed graphs that illustrated the abundance of STB and movement through the Santee Basin over the years. Jim noted that STB are able to spawn successfully in the Congaree River because the eggs are allowed to float downstream for long periods of time without impedance and are able to hatch during this process. Jim noted that the SCDNR conducted a study on STB reproduction that looked at when spawning occurred and how long it last. The results of the study showed that about 80% of STB spawning occurs in the Congaree River and the other 20% occurs in the Wateree River. He explained that most of the spawning in the Congaree River occurs in the vicinity of the sandbar located below the I-77 Bridge down to the CNP. He also explained that peak spawning occurs between April and mid-May time period. Most of the spawning occurs in the evening, with very little at night and early morning. STB usually spawn with two to three days of rising temperature. He specifically noted that spawning occurs around 20˚C and will cease if temperatures decrease. Jim noted that back in the 1980's when SCE&G operated the Saluda Hydro Project as a peaking facility, striped bass would typically spawn on the weekends, which is when SCE&G was not operating the Project as much. Jim displayed a graph that illustrated average temperature of the Broad, Saluda and Congaree rivers. He noted that from the graph the conclusion can be made that with above average flows in the basin, reproductive success of STB is good, but when we have below average flows in the basin, STB populations tend to decline.

Jim noted that the period of concern is between April 1st through May 10th and noted that the base minimum flow assumes 1,300 cfs. He noted that no flow augmentation is needed when the Broad River is >7,700 cfs. Jim noted that if flows are below this then on a continuous basis each day release in the LSR should be 45% of the previous days flows within the Broad River, or the release needed to reach 9,000 cfs in the Congaree River, whichever is lower. He added that no augmentation is needed when flows in the Broad River are < 2,700 cfs.

Brandon Kulik's Memo-Potential Effect of Flow Augmentation Recommended on Lower Saluda River Aquatic Habitat Suitability (Attachment A).

Alan asked Brandon Kulik to briefly summarize the memo he prepared and sent out to the group to describe the effects that the requested flows may have on the species that were chosen for the Saluda IFIM. Brandon noted that the purpose of the memo was to compare the effect on LSR habitat suitability of the proposed releases to support Congaree striped bass spring spawning, based on the IFIM model output developed by the TWC. Brandon noted that during review of IFIM data, the TWC developed a flow recommendation that provided at least 80% of optimal habitat for as many habitat use targets as possible. The resulting flow recommendation provided for a tiered flow regime of 700, 1,000 and 1,300 cfs.

Brandon explained that the deep fast guild reaches optimum suitability at a plateau between 1,000 and 1,500 cfs and exceeds the 80% of optimal threshold from 700 cfs up through the 2,800 cfs target, as this group is tolerant of higher velocities found at high discharges. The shallow fast guild reaches optimal suitability at about 700 cfs, and declines thereafter due to increased depths at higher flows. Flows exceeding 1,300 cfs provide habitat lower than the 80% target threshold; flows greater than 1,700 cfs reduce suitability to less than 60% of optimal. The shallow slow guild exhibits optimal habitat at 300 cfs and declines as flow increases, as both depth and velocity characteristics exceed the suitability range with the exception of newly wetted stream margins. Flows greater than 2,100 cfs reduce suitability to less than 60% of optimal.

Brandon noted that the LSR trout fishery is supported by a put-grow-and take strategy that relies on juvenile-sized fish that are stocked during mid-winter, and grow to catchable size, with some holdover fish contributing to the fishery. Therefore juvenile habitat suitability is an important factor to promote growth and recruitment to the fishery. Brandon explained that adult rainbow trout optimal habitat suitability exists between 1,300-1,700 cfs, and remains at or above the 80% threshold throughout the flow range of interest; however, juvenile rainbow trout habitat suitability is optimized at 700 cfs and fails to exceed the 80% threshold at flows above 1,500 cfs. Adult brown trout habitat reaches optimal suitability at 700 cfs and falls below 80% optimal at about 1,300 cfs;

however, juvenile brown trout habitat suitability fails to exceed the 80% threshold at flows above 1,000 cfs.

Brandon noted that the LSR smallmouth bass population relies on natural reproduction, with the spawning lifestage occurring during the time of the proposed flow augmentation. Brandon explained that smallmouth bass spawning optimal habitat suitability exists between 1,500-1,900 cfs, and remains at or above the 80% threshold throughout the flow range of interest.
Under SCDNR's recommendations of scenarios (1) and (2) the 1,300 cfs flow would commence earlier in April than originally recommended. However, under scenario (3), flow during April and early May would at times be potentially substantially higher than that recommended by the TWC. Brandon noted that this does not appear to impair habitat suitability goals for the deep fast guild, adult rainbow trout, and smallmouth bass spawning. However shallow-fast and shallow-slow guilds, and juvenile rainbow and brown trout habitat target thresholds would not be met during these periods. Brandon explained the exact degree of impact would vary annually and be dictated by the magnitude and duration of the augmentation required to compensate for the prevailing Broad River flow.

Brandon pointed out that although not strictly a habitat variable, the Oh Brother/Ocean Boulevard reach is a critical focal point for angling. Brandon explained that the TWC received feedback from anglers that flows greater than 1,000 cfs through this area preclude safe wading and significantly limit the angling suitability in this area. Brandon noted that a proposal to increase flow during April and May should consider impact to this fishery.

Jim noted that a flow of 1,300 cfs in itself would be a great benefit above existing conditions. He explained that the TWC has only considered the LSR species in the IFIM. He pointed out that the group should look further downstream to see how other species are effected. He noted that anadromous fish do not use the LSR for spawning. He noted that the Congaree River is another module that needs to be considered in deliberation. He finally noted that SCDNR's request never exceeds the average flow of the LSR for that time of year.

Ray Ammarell's Presentation on Low Inflow Protocol (LIP) for the Saluda Hydro Project. The PowerPoint presentation may be viewed at the following link:
http://www.saludahydrorelicense.com/documents/RAmmarellSTBFlowSummary12-10-2008.pdf

To give the TWC an update, Ray Ammarell has prepared a PowerPoint presentation on the LIP that was developed by the focus group.

Low Inflow Protocol for the Saluda Hydro Project

Ray began the presentation by discussing the effects that SCDNR's proposal may have on the guide curve that was developed for the Saluda Hydro Project. He explained that the proposed guide curve targets having reservoir at el. 358' PD by March 1. Ray briefly explained some of the main points of the guide curve for the Saluda Hydro Project.

- After reservoir reaches target el., must pass all inflow to maintain reservoir at target.
- Current ("old") rule curve targets el. 358' PD by May 1, so during April the reservoir was still being filled, which means SCE&G had to store inflow;

- Proposed minimum flows during April and May are much higher than previous practice – 1,000 & 1,300 CFS vs. ~500 CFS or less;
- Proposed mode of operation presumably will provide higher average flow in the LSR during April and May than historically in most years (this was desirable to SCDNR & other stakeholders);
- Also presumably will increase percentage of LSR flow in the Congaree in most years during April and May compared with historic flows; and
- Should meet some portion of SCDNR striped bass flow goal.

Ray noted that in order to evaluate SCDNR's STB flow proposal he had to:

- Look at percentage of LSR flow in the Congaree historically vs. with proposed license conditions (guide curve, minimum flows), as an average flow over the period April 1 –May 10 each year.
- Look at percent of the SCDNR goal met historically and with the proposed license conditions as an average flow over the period April 1 –May 10 each year.
- Used an Excel based reservoir operation model and net inflow computed from reservoir level and outflow data from USGS.
- Model simulated operation using proposed minimum flow and guide curve, and computed average LSR flow during April 1 –May 10 for 1981 –2008 net inflow. (Case 0)
- Also simulated operation using SCDNR striped bass flows for two cases:
  - Case 1 –STB flows eliminated when reservoir fell more that 0.1' below target; and
  - Case 2 –STB flows eliminated when Low Inflow Protocol triggered by 1' reservoir drop (STB flows in effect become new minimum flows during April 1 –May 10.)
- Average flows include minimum flow, recreation flow, and additional releases to stay at target elevation.

Ray displayed a graph that illustrated LSR flow as a percent of Broad River flow. The graph included historical flows; Case 1 which tracks the same as with the new guide curve (STB curve without 1 ' reservoir drop); and Case 2 which showed how STB flows are controlled by the LIP. In summary Ray noted the following:

- Over all the years modeled, the average LSR flow April 1 –May 10 increased from 27% of the Broad River @ Alston historically, to 39% with proposed license conditions alone (Case 0). Implementing the striped bass flows subject to the 1' reservoir drop LIP (Case 2) increased the average LSR flow to 43% of the Broad River @ Alston.
- The minimum LSR flow April 1 –May 10 (in 1995) increased from 8% of the Broad River @ Alston historically, to 25% with proposed license conditions alone (Case 0). Implementing the striped bass flows subject to the 1' reservoir drop LIP (Case 2) increased the average LSR flow to 34% of the Broad River @ Alston.
- Over all the years modeled, the average LSR flow April 1 –May 10 as a percentage of the SCDNR striped bass flow goal increased from 125% historically to 169% with proposed license conditions alone.
- The minimum LSR flow April 1 –May 10 as a percentage of the SCDNR striped bass flow goal (in 1988) increased from 22% to 67% with proposed license conditions alone.

Jim pointed out that SCDNR may only request these STB flows for 50% of the years, meaning that they may not need these flows every year. Jim added that one thing that is not taken into account is the temperature effects from the LSR flows. He explained that if there is a continuous percentage of flows in the Broad River, then there will be less effect on temperature. Jim noted that the issue is SCE&G is not leaving a lot of storage room in Lake Murray, so flows will likely be increased when during rain events, which will have greater temperature fluctuations in the Congaree River. Ray noted these releases will be more representative of a natural flow, which is what was requested from stakeholders during this relicensing process. Alan asked Shane Boring about John Grego's analysis on the mixing of the water temperatures from the LSR and Broad. Shane noted that Jon's analysis show that the water temperatures are stable around the I-77 Bridge and Kodak Eastman.

Alan asked the group what the Instream Flow TWC thought of SCDNR's flow regime proposal. Amanda Hill noted that although the group did not consider this issue during the development of flows for the LSR, the USFWS thinks that flows for the STB in the Congaree River are important and should be considered. She also noted that the group should also take into consideration the impacts on survival of adult trout in the LSR. Matt Rice noted that American Rivers also supports flows for the STB spawning in the Congaree River. He noted that the timing works well with the Ecological Sustainable Water Management objectives for the Congaree River. He added that American Rivers was also concerned about temperature effects, specifically, with large slugs of water from the LSR after a rain event. Bill noted that SCE&G management is not willing to change the guide curves because of safety issues. Matt noted that SCE&G should allow for some flexibility to release over a longer period of time rather than one big slug of water. Bill also explained to the group that that type of flow release is not economical for SCE&G.

Alan noted that the purpose of this TWC was to establish a minimum flow for the Saluda Hydro Project, does this proposal change the minimum flows that the group originally agreed to. Hal noted that spawning periods of striped bass vary from year to year, so maybe the group should develop some type of adaptive management plan to compensate for this issue. Alan asked the group if the group wants to discuss adjustment of the minimum flow or would everyone prefer using an adaptive management approach. Dick noted that he thought the group should keep their options open because there may be some effects on lake level and recreation for the LSR. Bill indicated that the STB flows maybe supplemental/additional to instream flows if the flows are available. Dick noted that the group has three options available:

1. Supplemental flows
2. New minimum flows
3. Give and take option. Implement early April/May time frame and reduce flows during the other time periods.

The stakeholders and agencies caucused to discuss the approach they would like to take to provide flows for spawning STB in the Congaree River. The stakeholders and agencies developed a new minimum flow proposal as outlined below for SCE&G to review.

- From January 1st to March 31st implement a minimum flow of 700 cfs with an LIP of 500 cfs;
- From April 1st to May 10th implement a minimum flow of 1,000 cfs with additional striped bass flows of 40% of the Broad River flows with an LIP of 1,000 cfs;

- May 11th to May 31st implement a minimum flow of 1,000 cfs with no STB flows and an LIP of 1,000 cfs; and
- From June to December implement a minimum flow of 700 cfs with an LIP of 500 cfs.

Bill asked the group what kind of triggers they would like to see for the LIP. Dick suggested a 2ft drop in the reservoir with a 14 day averaging period. Bill noted that he would need to evaluate how this will impact the reservoir and discuss this proposal with SCE&G management, then get back to the group.

Attachment A:
Potential Effect of Flow Augmentation Recommended on Lower Saluda River Aquatic Habitat Suitability

Potential effect of flow augmentation recommendation on Lower Saluda River aquatic habitat suitability

During the relicensing of the Saluda Hydroelectric Project, an IFIM study that analyzed habitat suitability for a suite of guilds and key management species in the Lower Saluda River (LSR) was used by the TWC to recommend flows to maintain a balanced aquatic ecosystem and support recreational LSR fisheries, including rainbow and brown trout. The study was documented in Kleinschmidt (2008).

The Santee-Cooper striped bass population is reported to depend on spawning habitat in the Congaree River. Flows in the subject area of the Congaree are partially influenced by discharge via the LSR from the Saluda Hydroelectric Project as well as by the Broad River to which the Saluda is a tributary. South Carolina DNR (SCDNR) recently recommended more suitable flows for Congaree spawning habitat during the spring period as a means to reverse striped bass population declines, and benefit other species. This recommendation may at times require flow augmentation from the LSR, thus SCDNR has requested a review of the effect of this recommendation on other potentially competing aquatic habitat objectives.

The purpose of this memo is to compare the effect on LSR habitat suitability of the proposed releases to support Congaree striped bass spring spawning, based on the IFIM model output developed by the TWC.

Summary of Proposed LSR Augmentation Flow Recommendation:

For Congaree spring fish spawning, LSR flows above the 1,300 cfs base flow are needed in some years from **<u>April 1 through May 10</u>**.

1. When average daily flow in the Broad River for the previous day is greater than 7,700 cfs: an LSR instream flow of 1,300 cfs should be provided
2. When average daily flow in the Broad River for the previous day is less than 2,900 cfs, an LSR instream flow of 1,300 cfs should be provided if hydrological conditions allow, or else the LIP should be implemented.
3. When average daily flow in the Broad River is *between* 2,900 and 7,700 cfs for the previous day, and the Lake Murray target level has been reached, an augmented flow ranging between 1,800 and 2,800 cfs would be continuously released from Lake Murray dam, depending on circumstances[1].

Analysis

During review of IFIM data, the TWC developed a flow recommendation that provided at least 80% of optimal habitat for as many habitat use targets as possible. The resulting flow recommendation provided for a tiered flow regime of 700, 1,000 and 1,300 cfs.
The TWC determined that the following species and lifestages would drive habitat-based flow recommendations during April and May (see *Instream Flow/Aquatic Habitat TWC IFIM workshop*

[1] <u>the lesser</u> of 1) 45% of the previous day's flow of the Broad River measured at the Alston gage (which would mean the Saluda was supplying 31% of the flow in the Congaree River), OR 2) the flow required above the 1,300 cfs base flow to attain a flow in the Congaree of 9,000 cfs.

notes, January 23-25 2008):

Rainbow trout adult
Rainbow trout juvenile
Brown trout adult
Brown trout juvenile
Smallmouth bass spawning
Shallow fast guild
Shallow slow guild
Deep fast guild
Striped bass (zone of passage at Millrace)

Table 1 and Figures 1-8 compare the percentage of optimal habitat provided to each target species/guild at the TWC-recommended flow to that which would occur at times under the proposed Congaree augmentation flow, and is based on PHABSIM model data from the entire LSR study area.

The deep fast guild reaches optimum suitability at a plateau between 1,000 and 1,500 cfs and exceeds the 80% of optimal threshold from 700 cfs up through the 2,800 cfs target, as this group is tolerant of higher velocities found at high discharges. The shallow fast guild reaches optimal suitability at about 700 cfs, and declines thereafter due to increased depths at higher flows. Flows exceeding 1,300 cfs provide habitat lower than the 80% target threshold; flows greater than 1,700 cfs reduce suitability to less than 60% of optimal. The shallow slow guild exhibits optimal habitat at 300 cfs and declines as flow increases, as both depth and velocity characteristics exceed the suitability range with the exception of newly wetted stream margins. Flows greater than 2,100 cfs reduce suitability to less than 60% of optimal.

The LSR trout fishery is supported by a put-grow-and take strategy that relies on juvenile-sized fish that are stocked during mid-winter, and grow to catchable size, with some holdover fish contributing to the fishery (H Beard, SCDNR, personal communication, December 2007). Therefore juvenile habitat suitability is an important factor to promote growth and recruitment to the fishery. Adult rainbow trout optimal habitat suitability exists between 1,300-1,700 cfs, and remains at or above the 80% threshold throughout the flow range of interest; however, juvenile rainbow trout habitat suitability is optimized at 700 cfs and fails to exceed the 80% threshold at flows above 1,500 cfs. Adult brown trout habitat reaches optimal suitability at 700 cfs and falls below 80% optimal at about 1,300 cfs; however, juvenile brown trout habitat suitability fails to exceed the 80% threshold at flows above 1,000 cfs.

The LSR smallmouth bass population relies on natural reproduction, with the spawning lifestage occurring during the time of the proposed flow augmentation. Smallmouth bass spawning optimal habitat suitability exists between 1,500-1,900 cfs, and remains at or above the 80% threshold throughout the flow range of interest.
Under scenarios (1) and (2) the 1,300 cfs flow would commence earlier in April than originally recommended. However, under scenario (3), flow during April and early May would at times be potentially substantially higher than that recommended by the TWC. This does not appear to impair habitat suitability goals for the deep fast guild, adult rainbow trout, and smallmouth bass spawning. However shallow-fast and shallow-slow guilds, and juvenile rainbow and brown trout habitat target thresholds would not be met during these periods. The exact degree of impact would vary annually

and be dictated by the magnitude and duration of the augmentation required to compensate for the prevailing Broad River flow[2].

Although not strictly a habitat variable, the Oh Brother/Ocean Boulevard reach is a critical focal point for angling. The TWC received feedback from anglers that flows greater than 1,000 cfs through this area preclude safe wading and significantly limit the angling suitability in this area (M Waddell, TU, personal communication, May 2008). A proposal to increase flow during April and May should consider impact to this fishery.

Table 1. Comparison of habitat optimization for key guilds and species in the Lower Saluda River at flows ranging from 300 to 2,800 cfs.

Flow (cfs)	Deep Fast	Shallow Slow	Shallow Fast	Rainbow trout Adult	Rainbow trout Juvenile	Brown trout Adult	Brown trout Juvenile	Smallmouth bass Spawning
300		*100*						
400	*75*	*86*	*79*	81	97	83	97	57
700	86	63	99	94	100	100	100	88
1000	95	61	80	99	95	85	90	93
1300	100	72	66	100	87	77	76	98
1400	100	71	64	100	85	76	72	99
1500	100	69	62	100	82	76	69	100
1600	99	67	61	100	79	76	66	100
1700	98	64	60	100	77	76	63	100
1800	97	62	58	99	74	76	61	100
1900	96	60	56	98	72	75	58	100
2000	95	60	52	97	70	75	56	99
2100	95	59	50	95	68	72	54	99
2200	94	59	49	93	67	69	52	97
2300	93	58	48	91	65	67	50	96
2400	92	58	47	89	64	64	48	95
2500	91	57	45	86	62	62	46	94
2600	90	57	44	84	61	60	44	92
2600	90	57	44	82	60	58	43	91
2800	88	57	42	80	58	56	41	90

[2] This risk could be further investigated and estimated by reviewing historic April and May flow duration data from the Alston gage.

Figure 1. Weighted Usable Area Lower Saluda River Deep Fast Guild

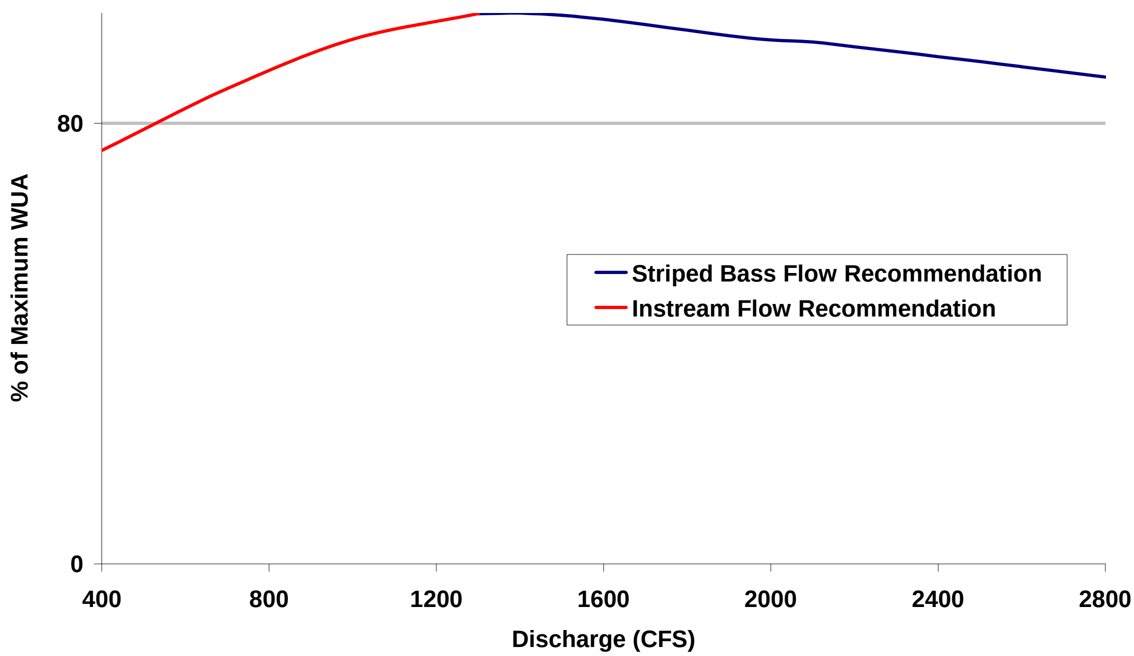


Figure 2. Weighted Usable Area Lower Saluda River Shallow Slow Guild

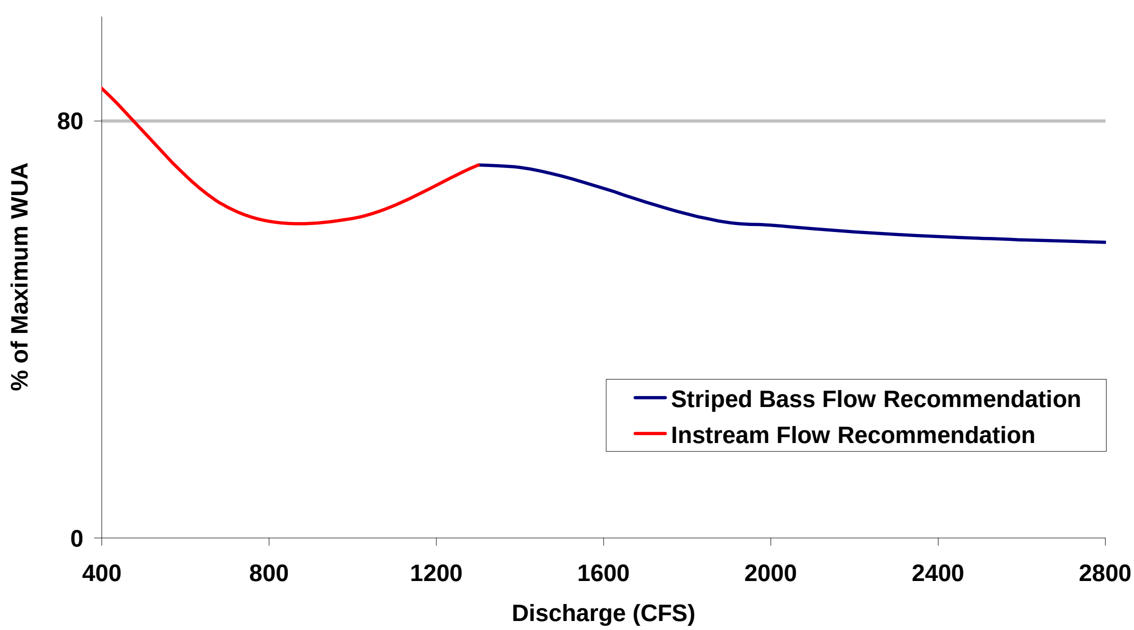


Figure 3. Weighted Usable Area for Lower Saluda River Shallow Fast Guild

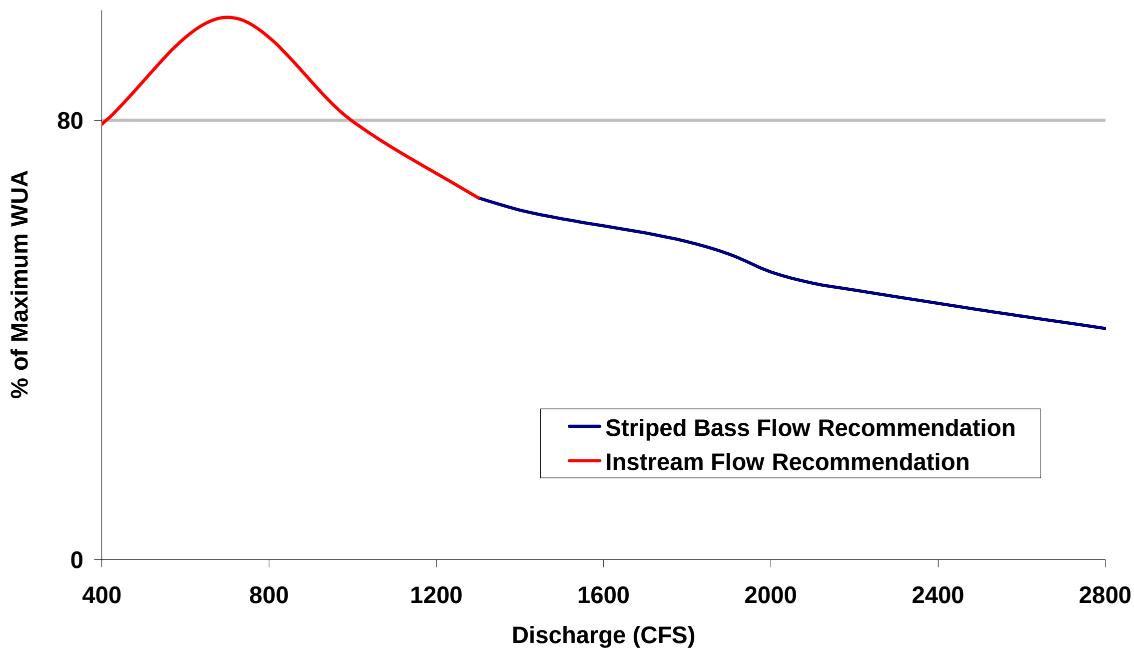


Figure 4. Weighted Usable Area for Lower Saluda River Rainbow Trout Adult

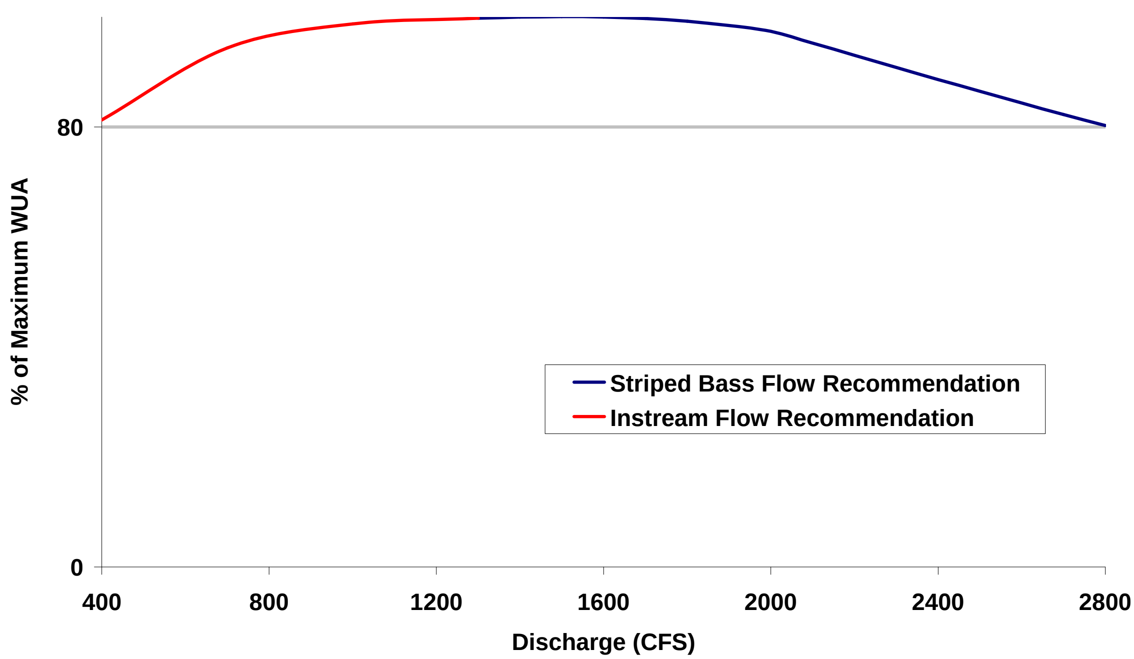


Figure 5. Weighted Usable Area for Lower Saluda River Rainbow Trout Juvenile

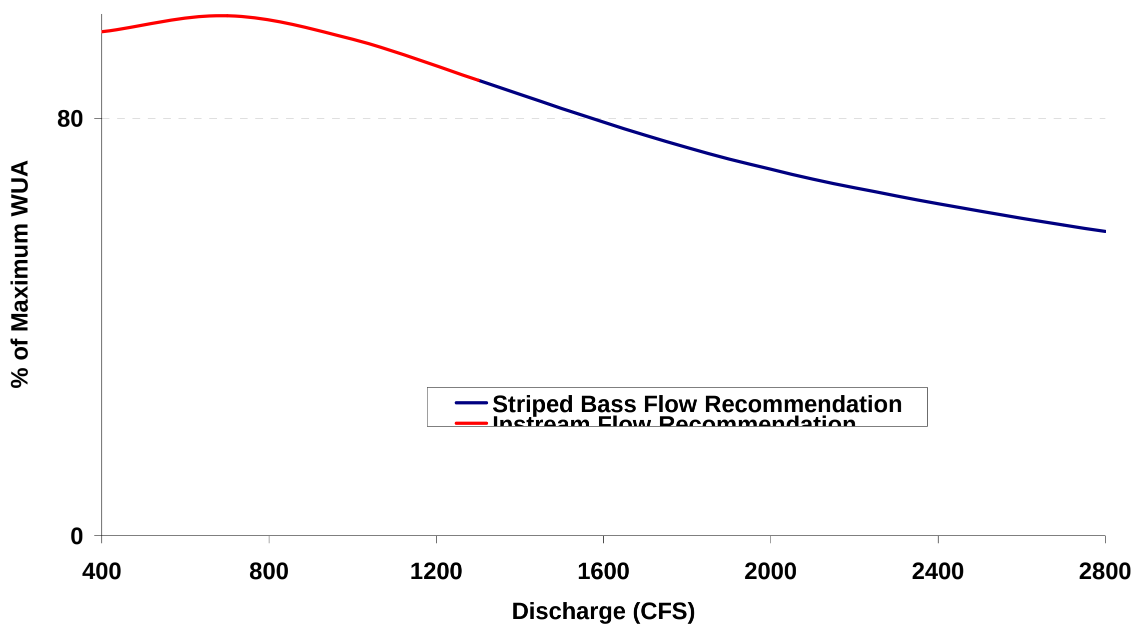


Figure 6. Weighted Usable Area for Lower Saluda River Brown Adult

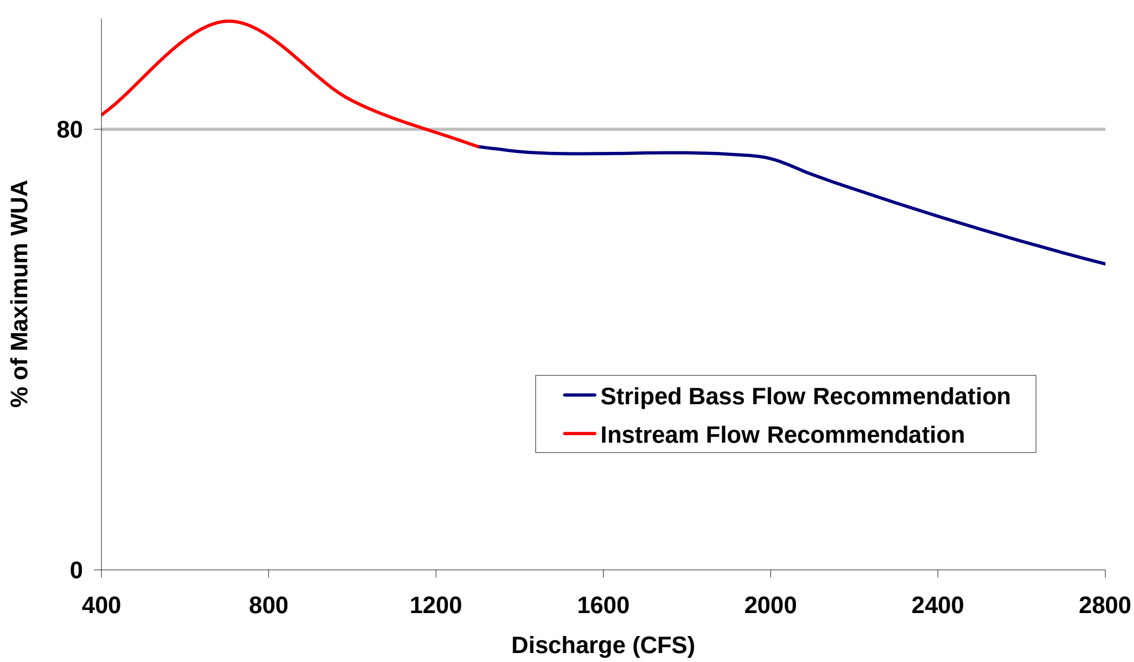


Figure 7. Weighted Usable Area for Lower Saluda River Brown trout Juvenile

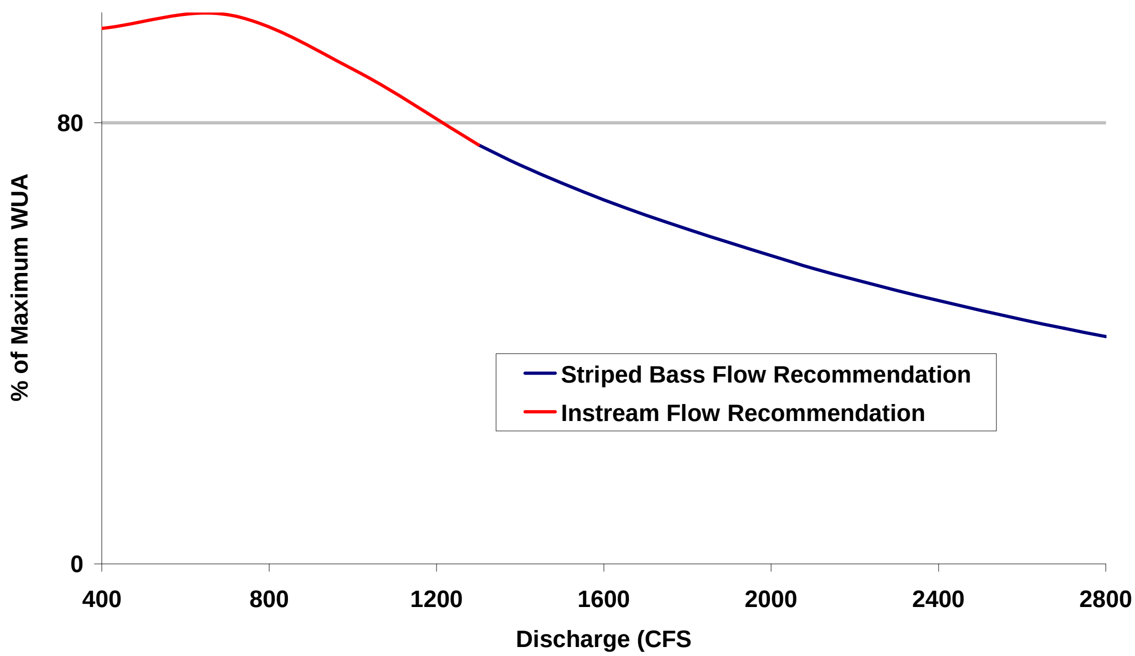
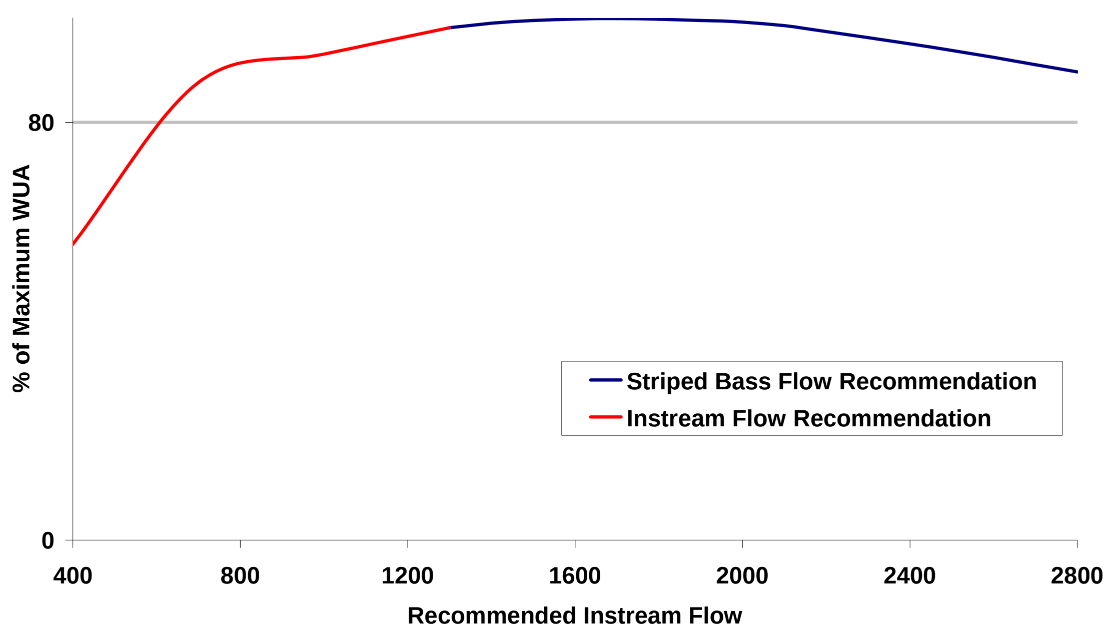


Figure 8. Weighted Usable Area Lower Saluda River
Smallmouth Bass Spawning



Upstream Passage Hydraulic Analysis

Kleinschmidt (2008) estimated that DHEC depth and wide zone of upstream passage criteria at Millrace Rapids were satisfied at approximately 1,300 cfs. Although flows incrementally higher than 1,300 will exceed these criteria, water velocity will increase at higher flows, and may impact fish passage effectiveness. At 1,300 cfs fish would experience velocities ranging from 5.4 to 5.7 ft/sec (1.6-1.75 m/sec). Flows of 1,800 – 2,800 cfs produce velocities ranging between approximately 6 to 7 ft/sec (Table 2).

Table 2. Mean column velocity (ft/sec) at three transects in Millrace Rapids.

TRANSECT	500 CFS	800 CFS	1,300 CFS	1,600 CFS	1,.800 CFS	2,000 CFS	2,200 CFS	2,400 CFS	2,600 CFS	2,800 CFS
T-3	4.3	4.8	5.4	5.7	5.8	6.1	6.3	6.5	6.7	6.8
T-2	4.4	5.0	5.7	5.9	6.0	6.2	6.4	6.6	6.8	6.9
T-1	4.3	4.6	5.4	5.8	6.0	6.2	6.4	6.6	6.8	7.0

Striped bass ascending the LSR during April would experience ambient water temperature of approximately 16^{o}C. According to Haro *et al.* (2004), at that temperature an 18-inch long (FL) (approximately 500 mm) striped bass would have approximately a 66% chance of successful upstream passage at 1,300 cfs (Table 3). At velocities between 6 and 7 ft/sec (1.8-2.1 m/sec) the probability of successful upstream passage declines to approximately 61%.

Table 3: Percentage of adult striped bass ascending a hydraulic slope similar to Millrace Rapids (***source: Haro et al., 2004***)

STRIPED BASS	**VALUE**
Temp (°C)	16
FL (mm)	500

PROPORTION ASCENDING

Water Velocity (m/sec)	**Distance (m)** 5	10	15	20	25	30
0.5	99%	98%	97%	95%	93%	91%
1	99%	97%	94%	91%	88%	84%
1.5	98%	94%	89%	84%	78%	72%
2	96%	89%	81%	71%	**61%**	49%
2.5	92%	80%	65%	48%	30%	14%
3	86%	64%	37%	13%	1%	0%
3.5	75%	36%	4%	0%	0%	0%
4	55%	3%	0%	0%	0%	0%
4.5	21%	0%	0%	0%	0%	0%

Using Haro *et al.* (2004) criteria for white sucker as a surrogate fluvial freshwater fish, a 16-inch long (FL) (approximately 400 mm) fish would have an approximately 32% chance of successful upstream passage at 1,300 cfs (Table 4). At 1,800-2,800 cfs, with velocities between 6 and 7 ft/sec (1.8-2.1 m/sec) the probability of successful upstream passage declines to approximately 21%.

Table 4: Percentage of adult white sucker ascending a hydraulic slope similar to Millrace Rapids (*source: Haro et al., 2004*)

WHITE SUCKER	VALUE
Temp (°C)	16
FL (mm)	400

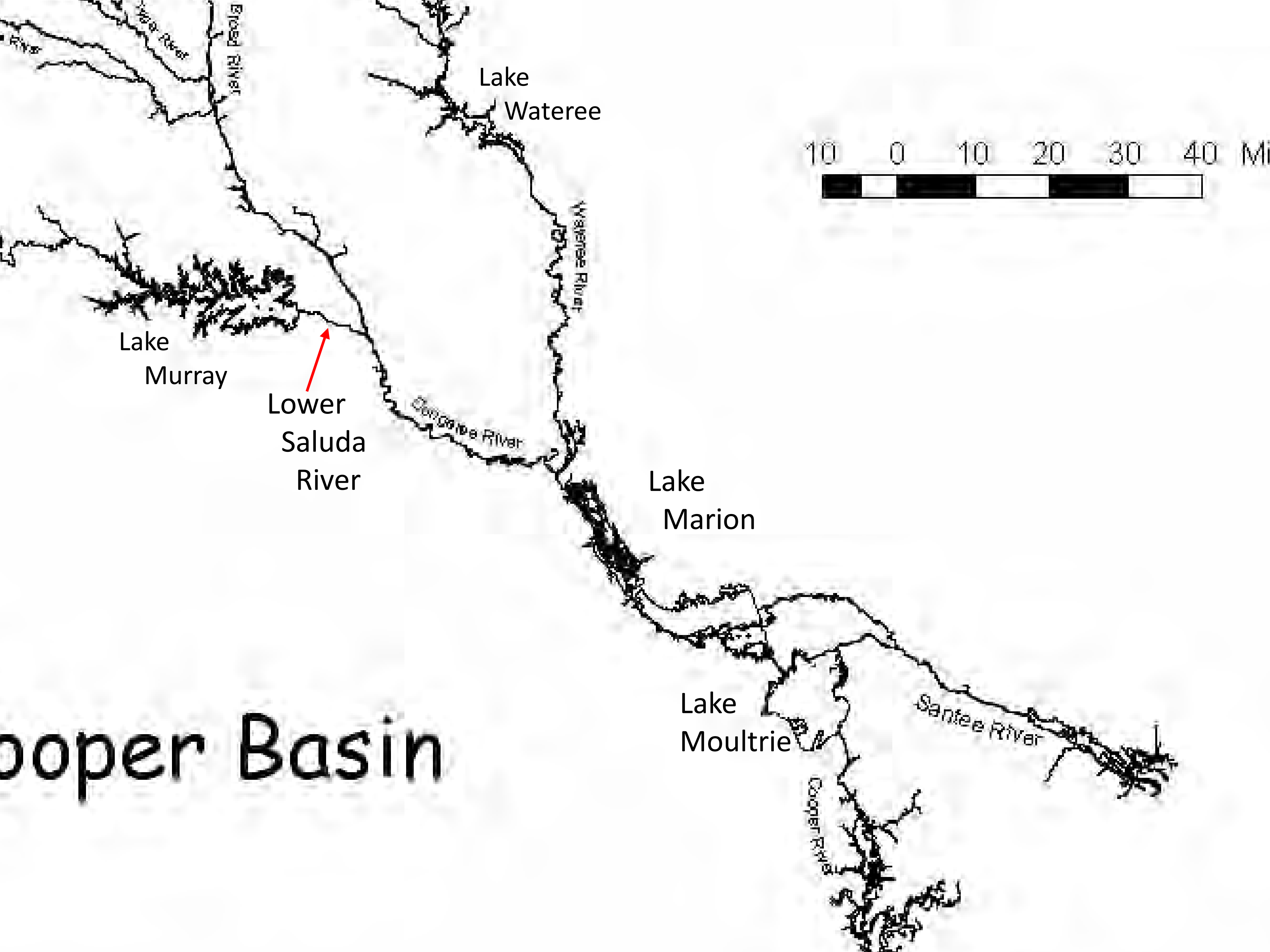
PROPORTION ASCENDING

Water Velocity (m/sec)	Distance (m) 5	10	15	20	25	30
0.5	99%	95%	90%	85%	78%	72%
1	97%	91%	83%	74%	64%	54%
1.5	95%	84%	71%	56%	43%	32%
2	91%	72%	52%	34%	**21%**	12%
2.5	83%	55%	30%	14%	5%	2%
3	71%	33%	10%	2%	0%	0%
3.5	53%	12%	1%	0%	0%	0%
4	31%	2%	0%	0%	0%	0%
4.5	11%	0%	0%	0%	0%	0%

Lake Murray Dam flows and striped bass spawning in Congaree River

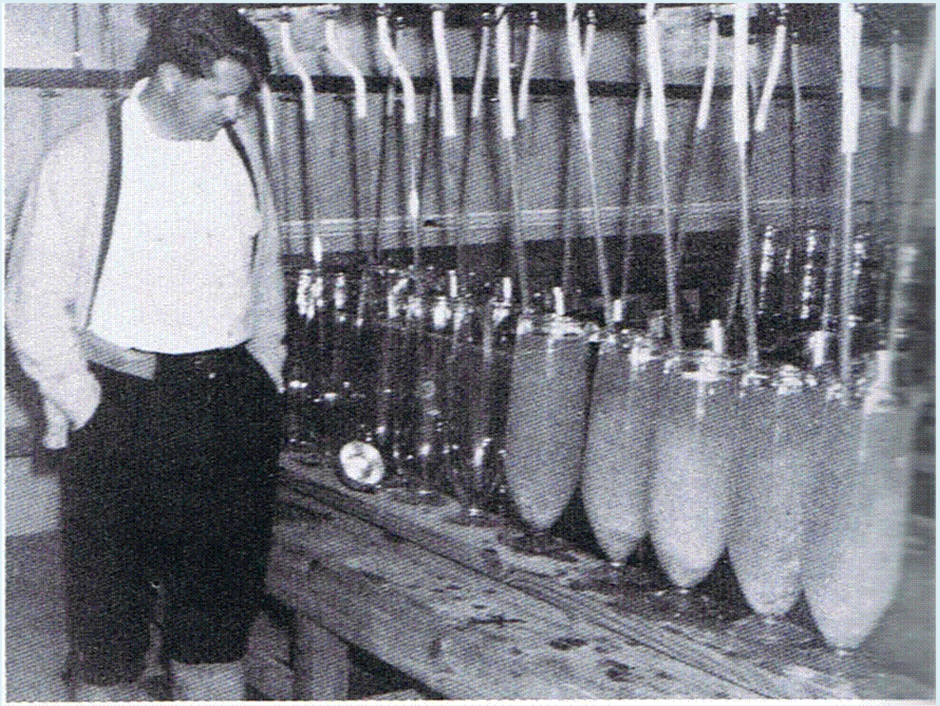
Objective

- Consider Congaree River striped bass flow needs in Lake Murray dam license
  - Importance
  - Biological needs
  - Affect of Flow and Temperature
    - i.e. it is ‘under the influence’ of the dam
  - DNR recommendation
  - Questions/Discussion

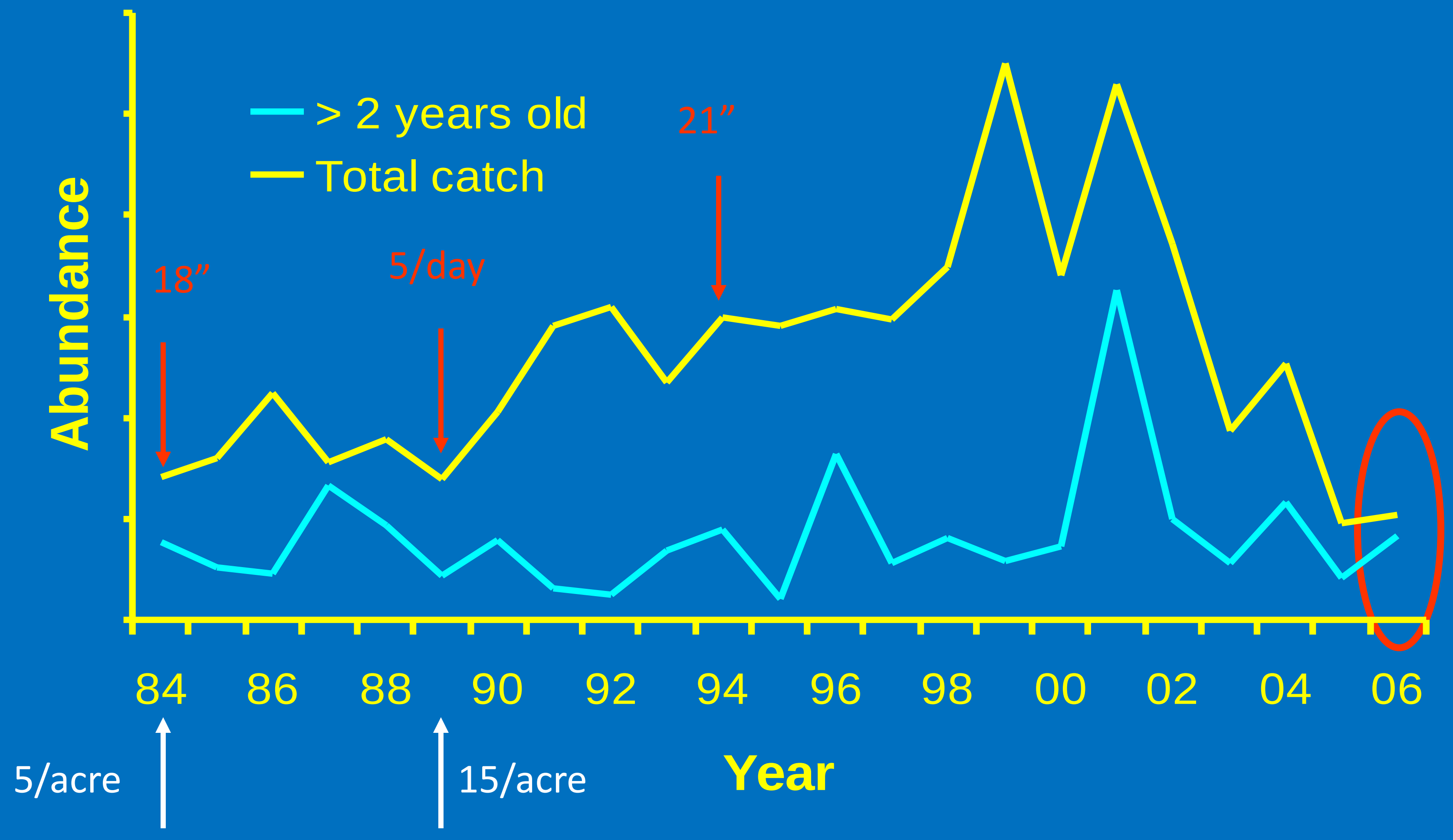

Lake
Wateree
10 0 10 20 30 40 Mi
Broad River
Wateree River
Lake
Murray
Lower
Saluda
River
Congaree River
Lake
Marion
Lake
Moultrie
Santee River
Cooper River
ooper Basin

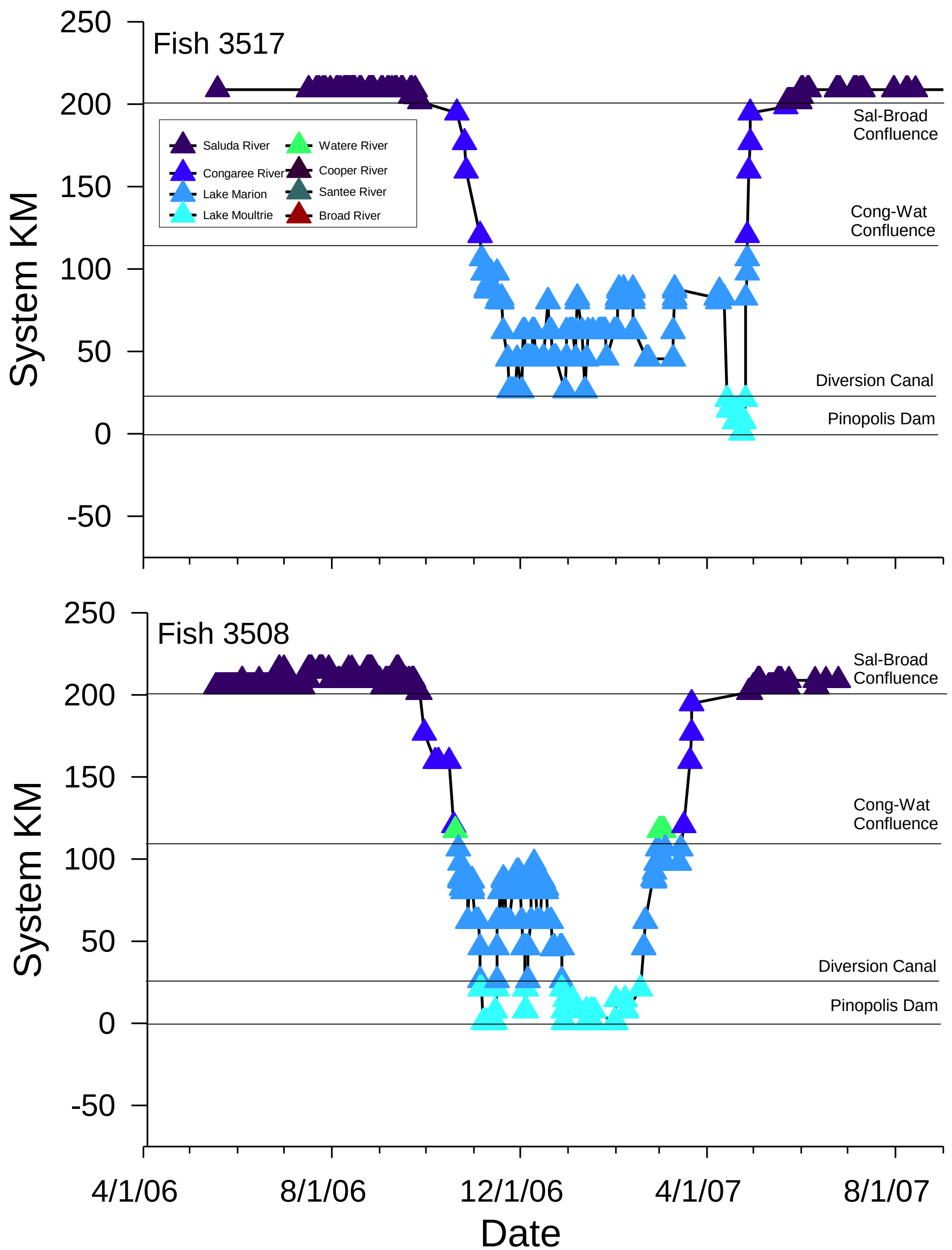
Importance of Striped Bass

- State Fish of SC
- Initial inland population
- Aquaculture developed
- Economic, recreational - $260 million
- Representative migratory species
- Well-studied
- Santee-Cooper population collapse

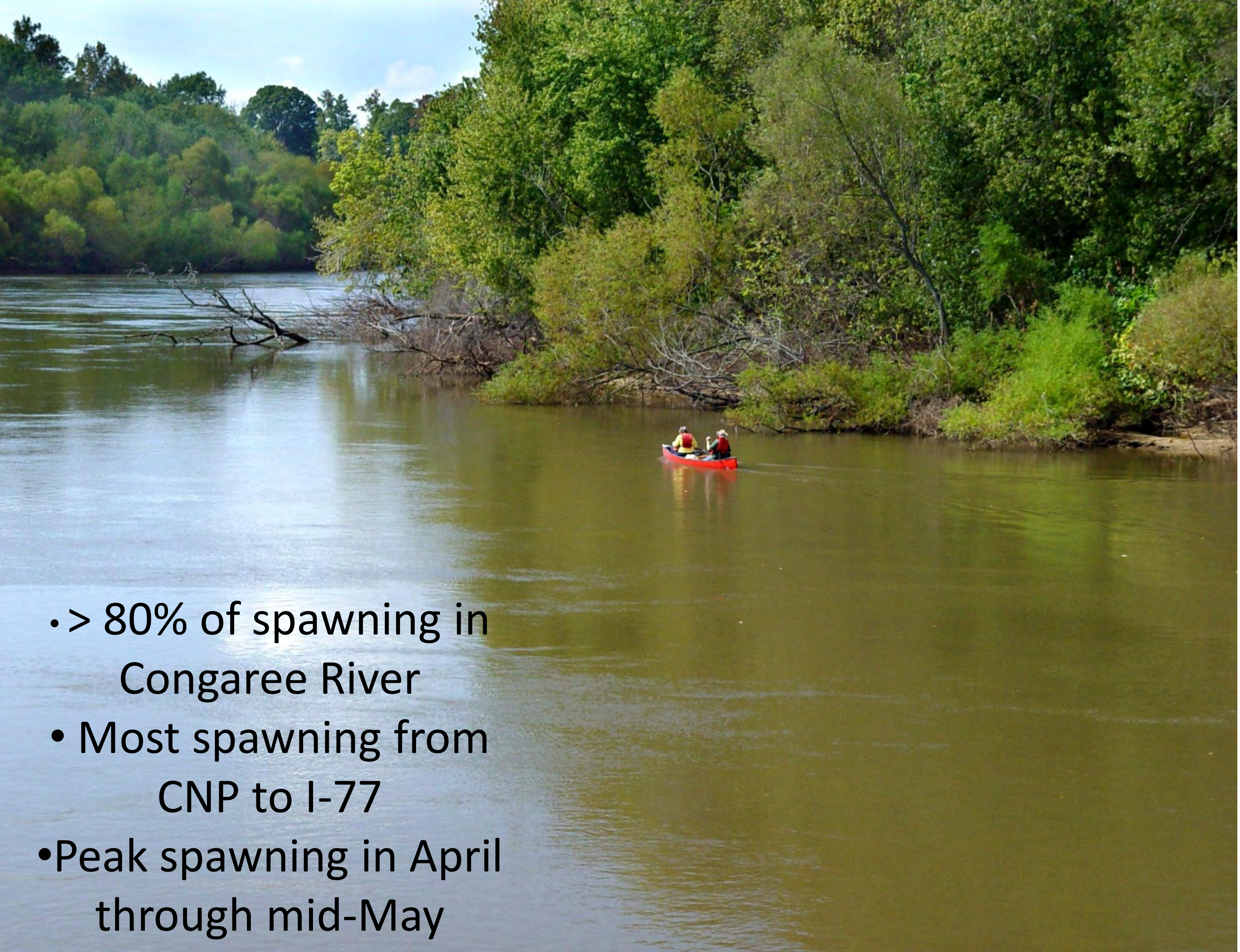


Striped Bass Abundance

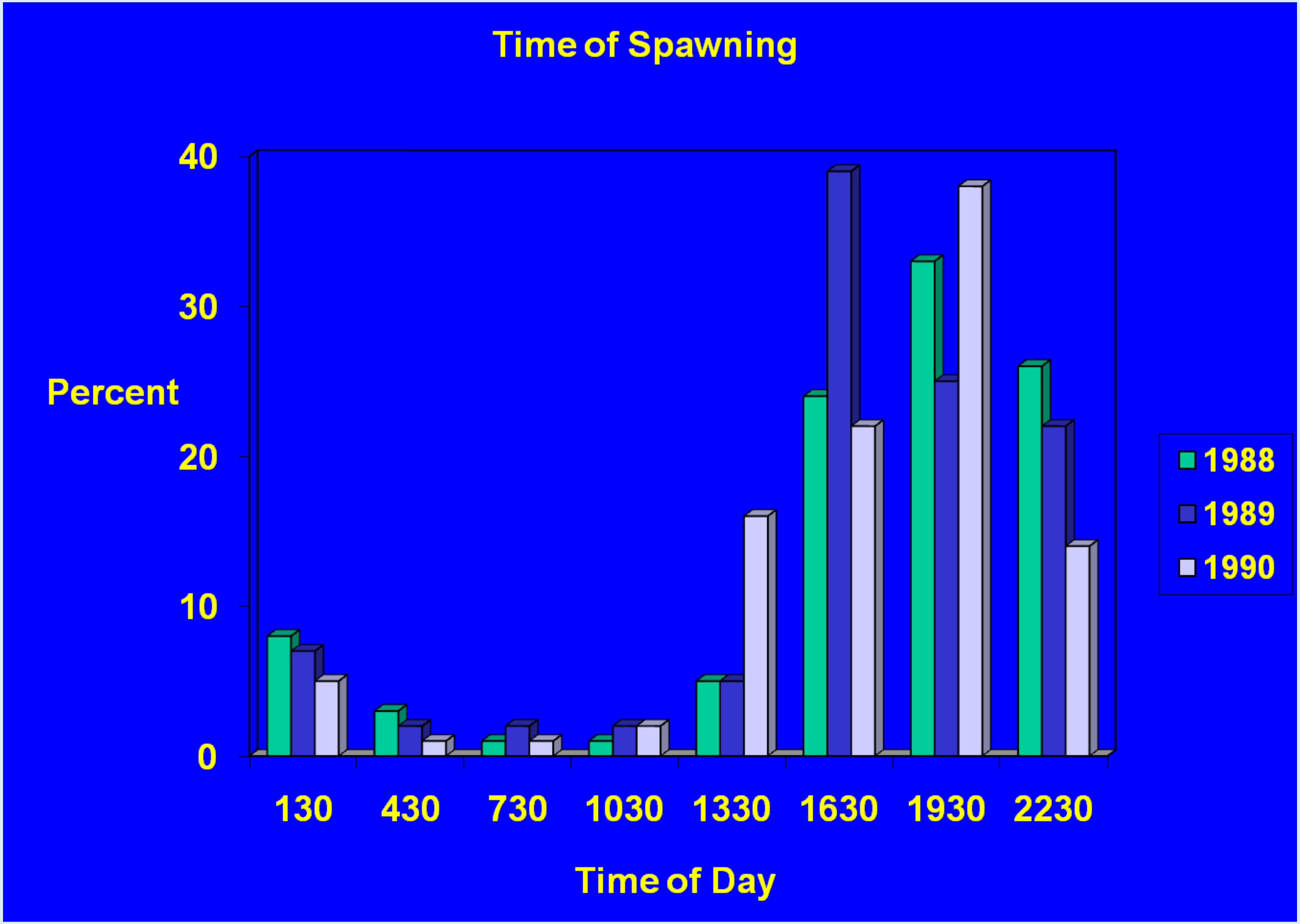


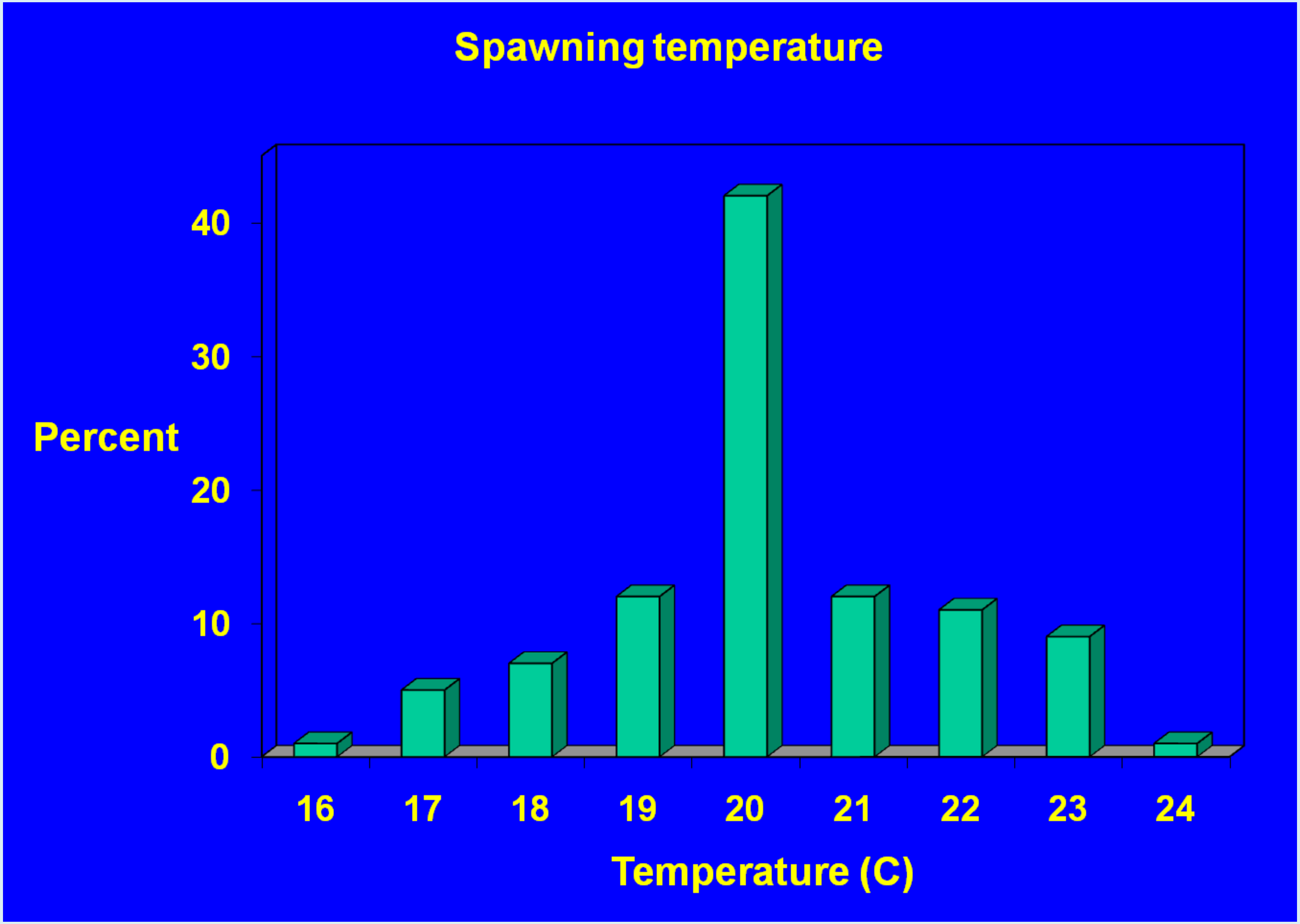


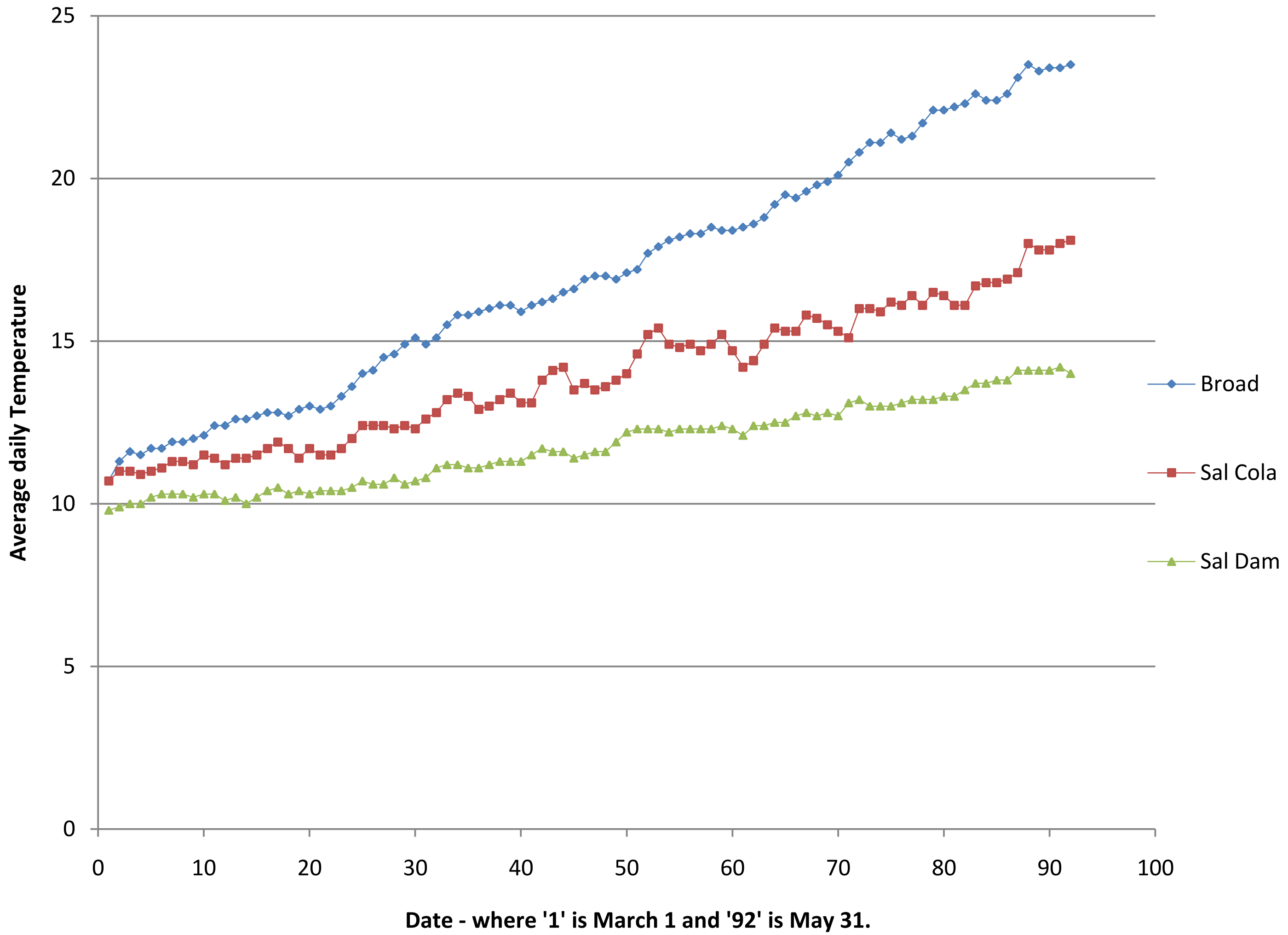
Fish 3517
Fish 3508
System KM
250
200
150
100
50
0
-50
Saluda River
Congaree River
Lake Marion
Lake Moultrie
Watere River
Cooper River
Santee River
Broad River
Sal-Broad Confluence
Cong-Wat Confluence
Diversion Canal
Pinopolis Dam
4/1/06
8/1/06
12/1/06
4/1/07
8/1/07
Date



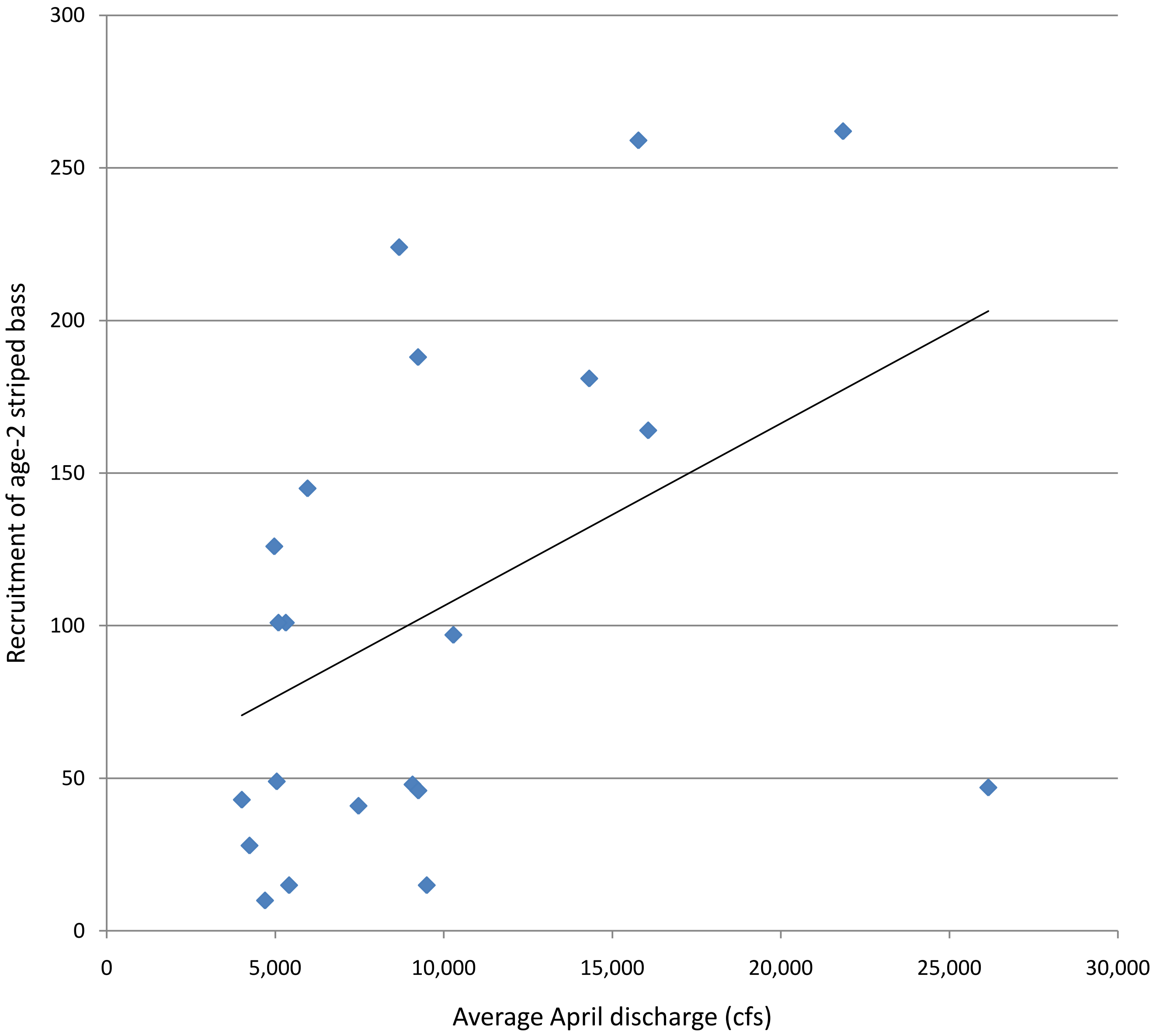
- > 80% of spawning in Congaree River
- Most spawning from CNP to I-77
- Peak spawning in April through mid-May


Time of Spawning
Percent
40
30
20
10
0
130
430
730
1030
1330
1630
1930
2230
Time of Day
1988
1989
1990


Spawning temperature
Percent
40
30
20
10
0
16
17
18
19
20
21
22
23
24
Temperature (C)



25
20
15
10
5
0
Average daily Temperature
0
10
20
30
40
50
60
70
80
90
100
Date - where '1' is March 1 and '92' is May 31.
Broad
Sal Cola
Sal Dam



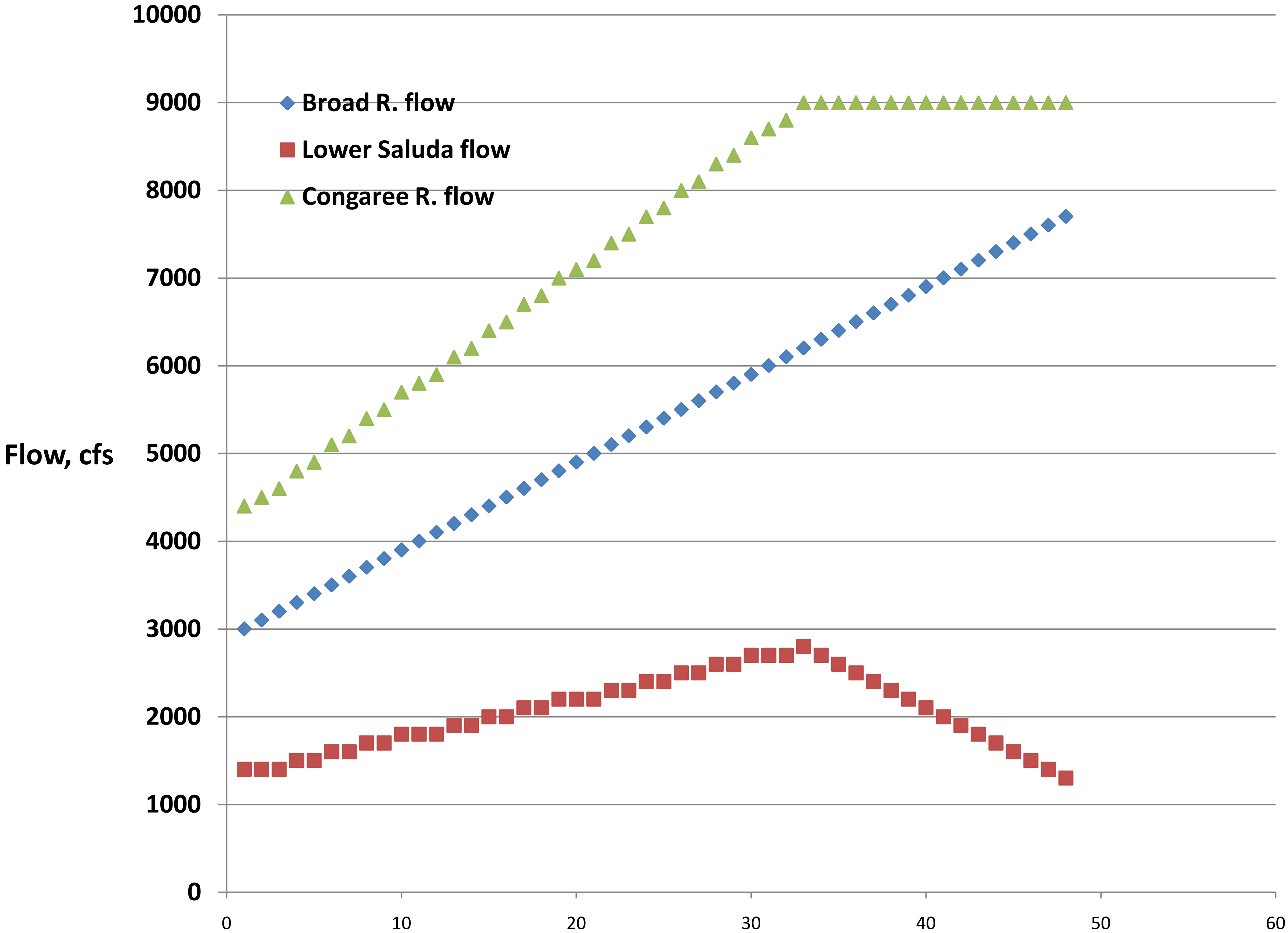
300
250
200
150
100
50
0
Recruitment of age-2 striped bass
0
5,000
10,000
15,000
20,000
25,000
30,000
Average April discharge (cfs)

Average LSR contribution

- LSR @ Cola, 1926-2007
  - Mean annual flow = 2,749 cfs
- Congaree R. @ Cola, 1956-2007
  - Mean annual flow = 8,872 cfs
- By subtraction, mean flow in Broad = 6,123 cfs
- LSR supplies, on average, 31% of Congaree River flow
- LSR mean flow is 45% of Broad's mean flow

DNR recommendation

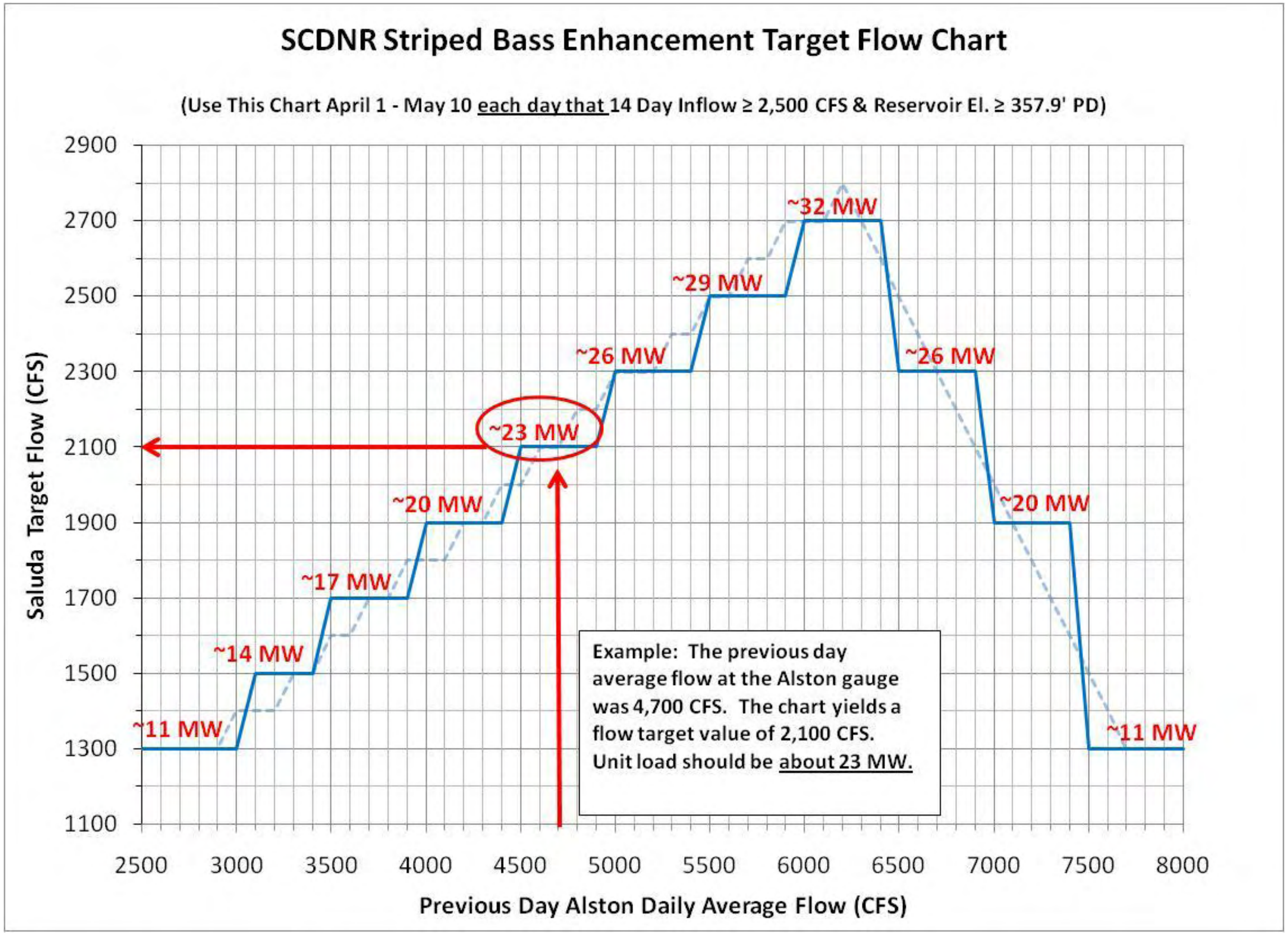
- Period of concern is April 1 through May 10
- Assume base minimum flow is 1,300 cfs
- No flow augmentation when Broad > 7,700
- On a continuous basis each ‘day’, release into LSR
  - 45% of previous days flow within Broad, OR
  - the release needed to reach 9,000 cfs in Congaree (whichever is lower)
- No augmentation needed when Broad < 2,700



Broad R. flow
Lower Saluda flow
Congaree R. flow
Flow, cfs
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60

SCDNR Striped Bass Flow Request:

1. Increase percentage of Lower Saluda River flow in Congaree River April 1 – May 10:
   - SCDNR goal is 45% of Broad River (Alston) flow or balance of 9,000 CFS from LSR



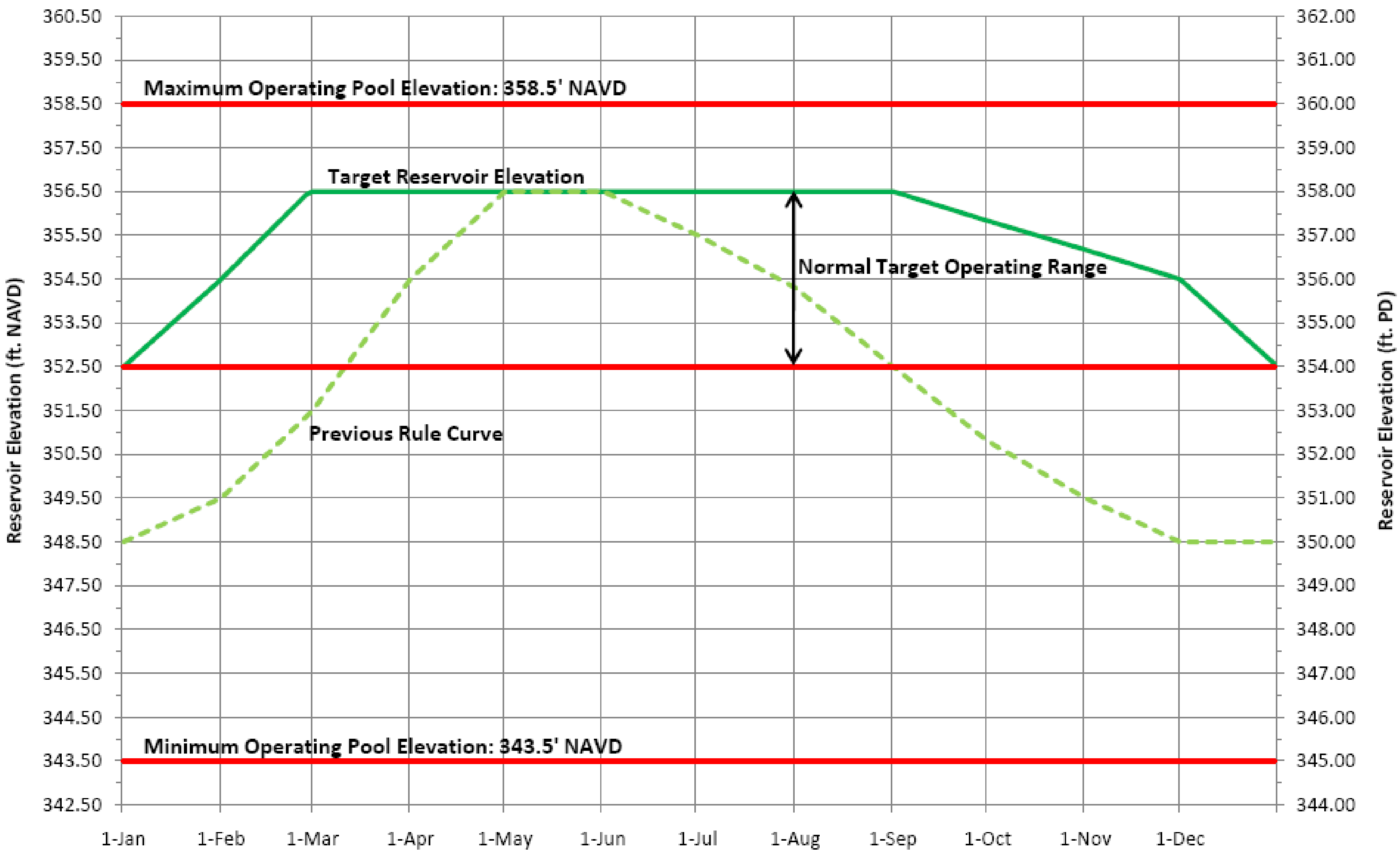
Effect of Proposed License Conditions

- Proposed guide curve targets having reservoir at el. 358’ PD by March 1.
- After reservoir reaches target el., must pass all inflow to maintain reservoir at target.
- Current (“old”) rule curve targets el. 358’ PD by May 1, so during April reservoir was still being filled → had to store inflow.
- Proposed minimum flows during April and May are much higher than previous practice – 1,000 & 1,300 CFS vs. ~500 CFS or less.
- Proposed mode of operation presumably will provide higher average flow in the LSR during April and May than historically in most years (this was desirable to SCDNR & other stakeholders.)
- Also presumably will increase percentage of LSR flow in the Congaree in most years during April and May compared with historic flows.
- Should meet some portion of SCDNR striped bass flow goal.

EXHIBIT B-17

Saluda Hydroelectric Project No. 516

Reservoir Guide Curve



How to Evaluate?

- Look at percentage of LSR flow in the Congaree historically vs. with proposed license conditions (guide curve, minimum flows), as an average flow over the period April 1 – May 10 each year.

- Look at percent of the SCDNR goal met historically and with the proposed license conditions as an average flow over the period April 1 – May 10 each year.

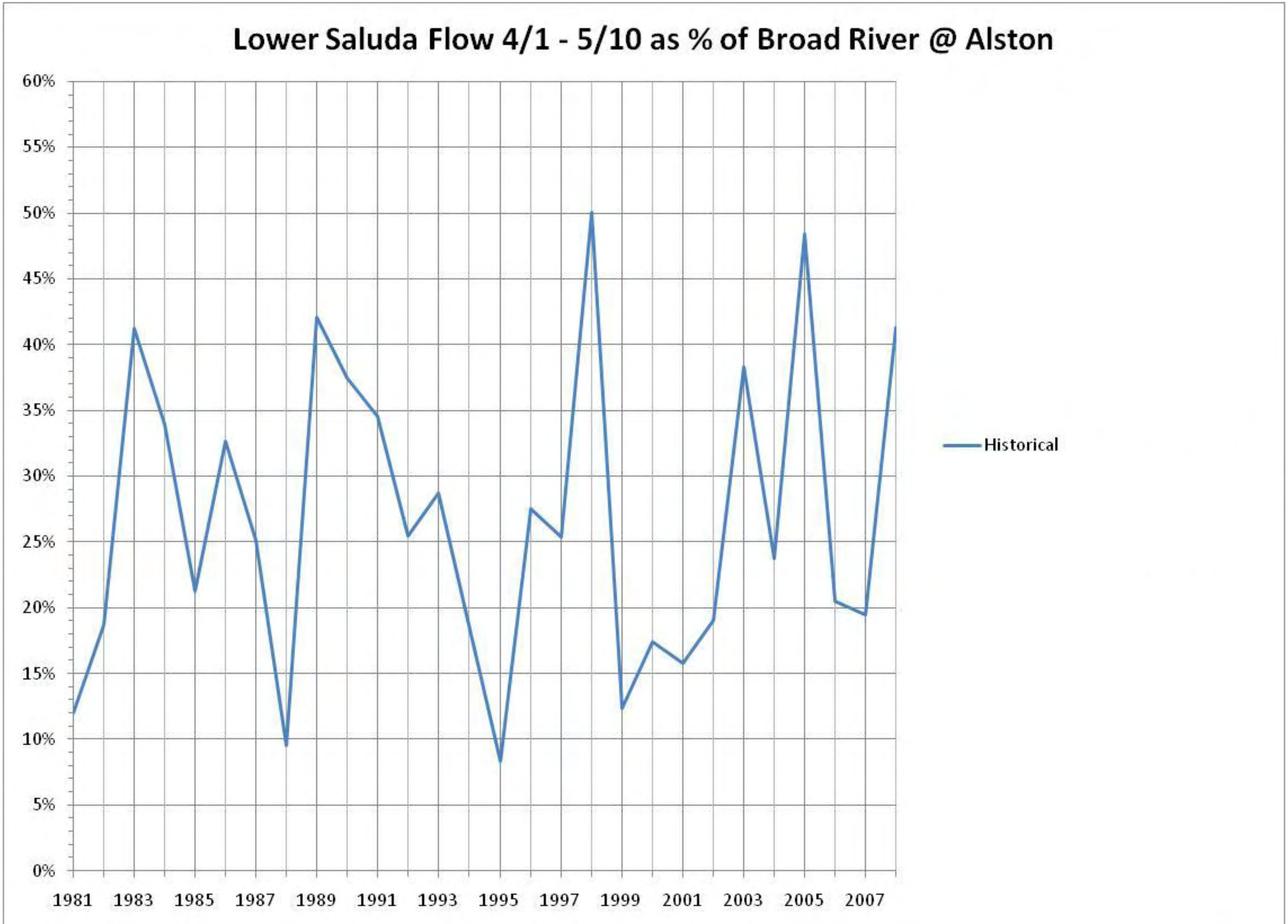
- Used an Excel based reservoir operation model and net inflow computed from reservoir level and outflow data from USGS.

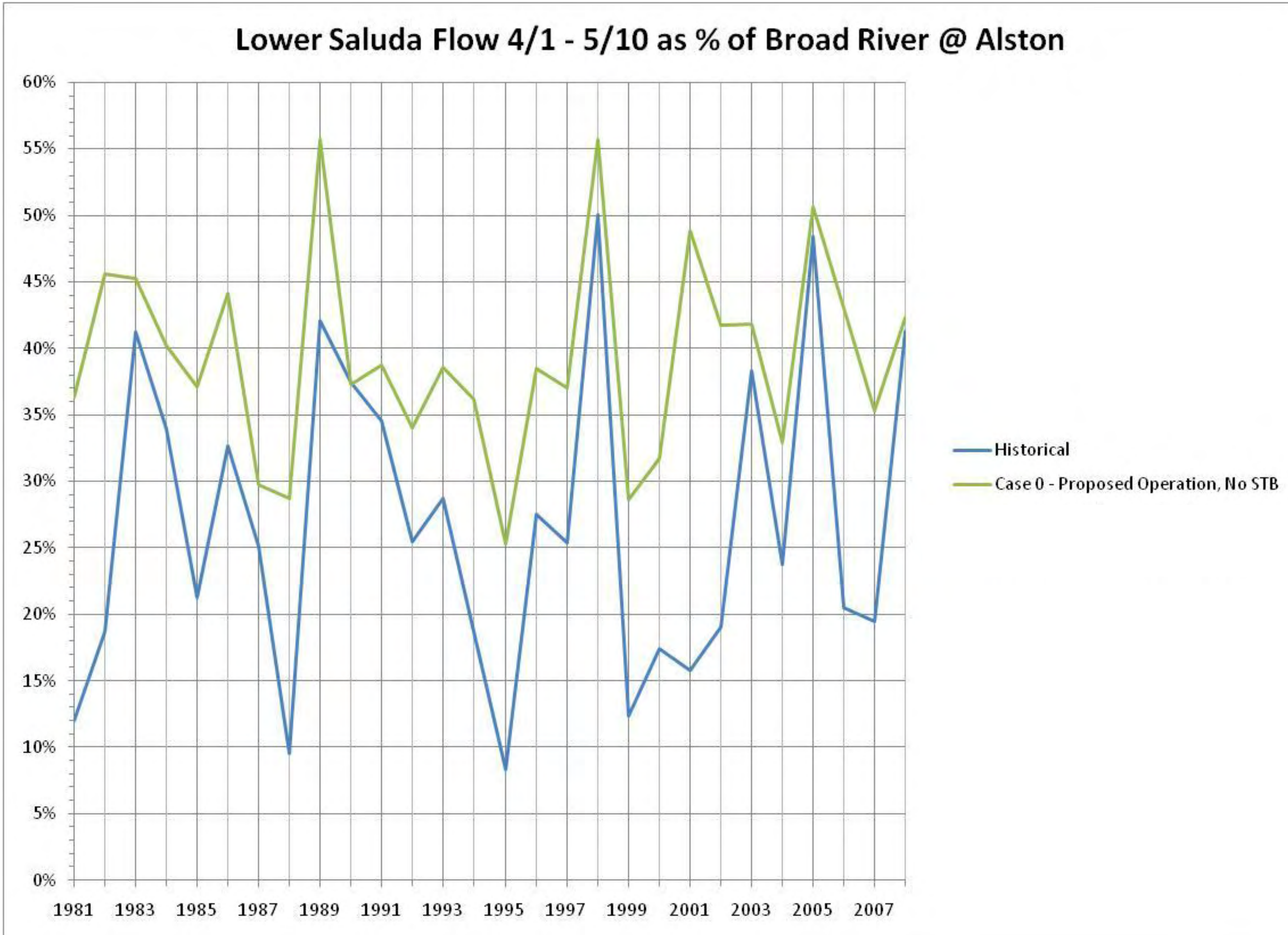
- Model simulated operation using proposed minimum flow and guide curve, and computed average LSR flow during April 1 – May 10 for 1981 – 2008 net inflow. (Case 0)

- Also simulated operation using SCDNR striped bass flows for two cases:
  - Case 1 – STB flows eliminated when reservoir fell more that 0.1’ below target
  - Case 2 – STB flows eliminated when Low Inflow Protocol triggered by 1’ reservoir drop (STB flows in effect become new minimum flows during April 1 – May 10.)

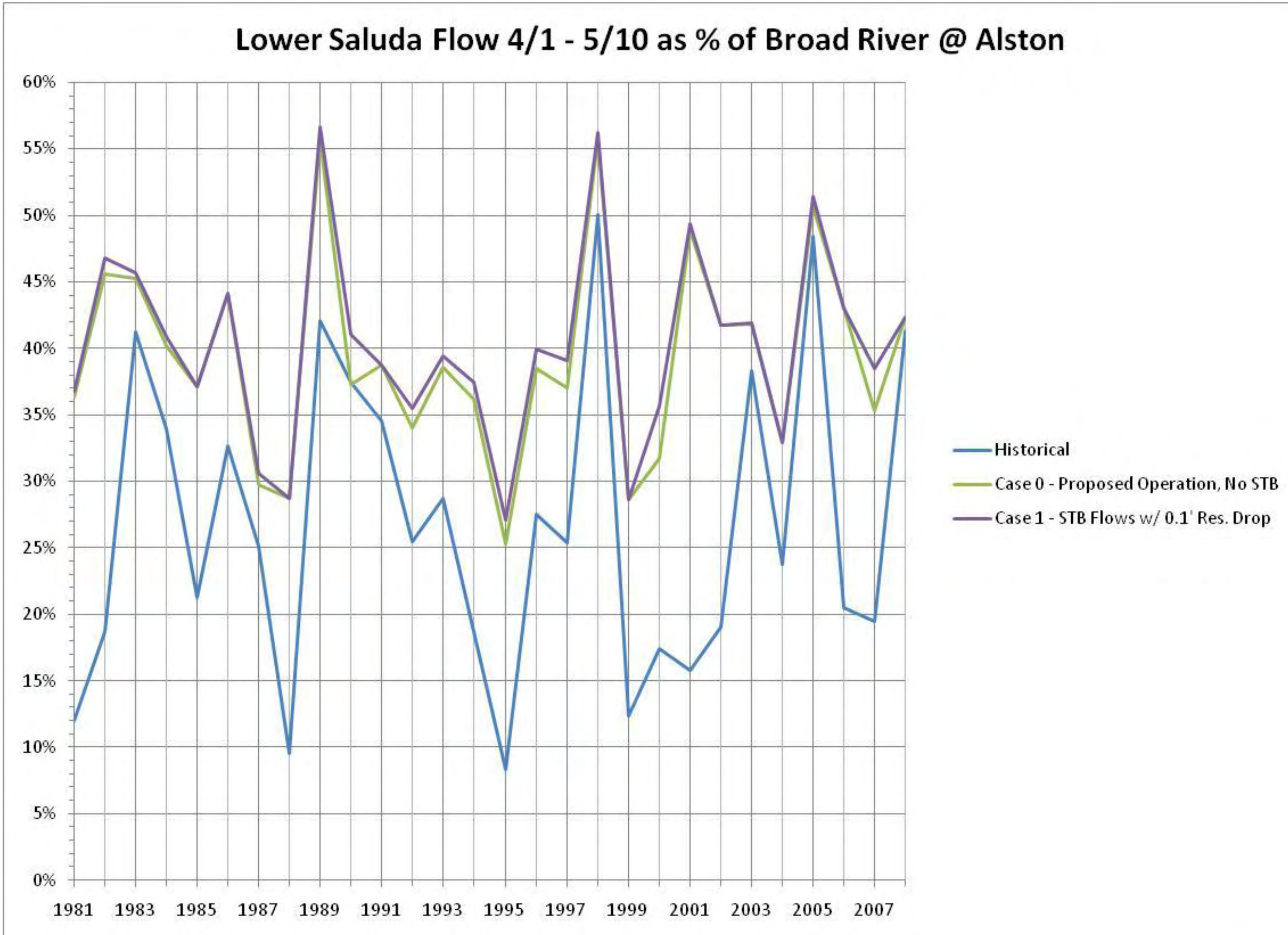
- Again, computed average LSR flow during April 1 – May 10 for 1981 - 2008.

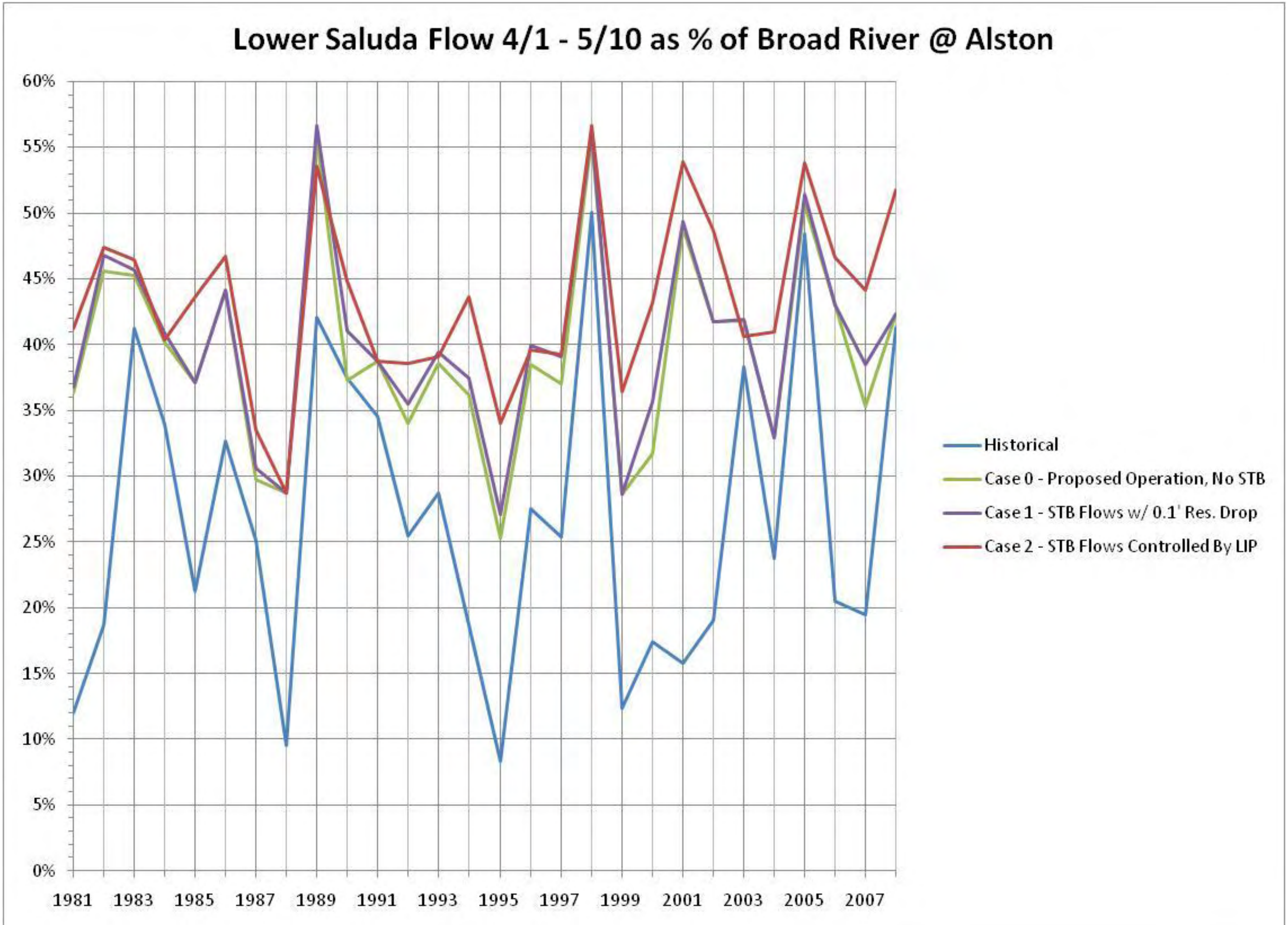
- Average flows include minimum flow, recreation flow, and additional releases to stay at target elevation.

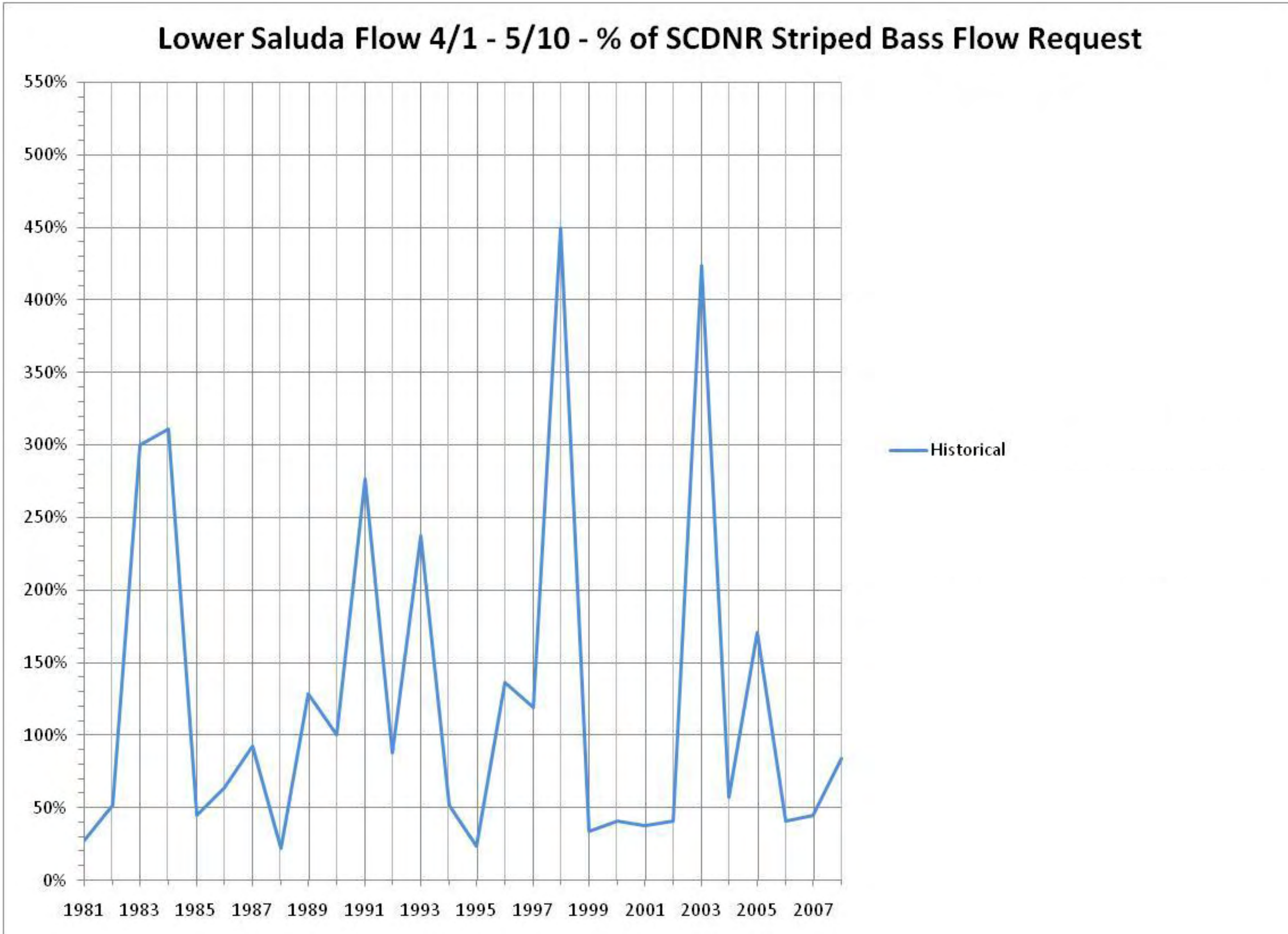

Lower Saluda Flow 4/1 - 5/10 as % of Broad River @ Alston
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical

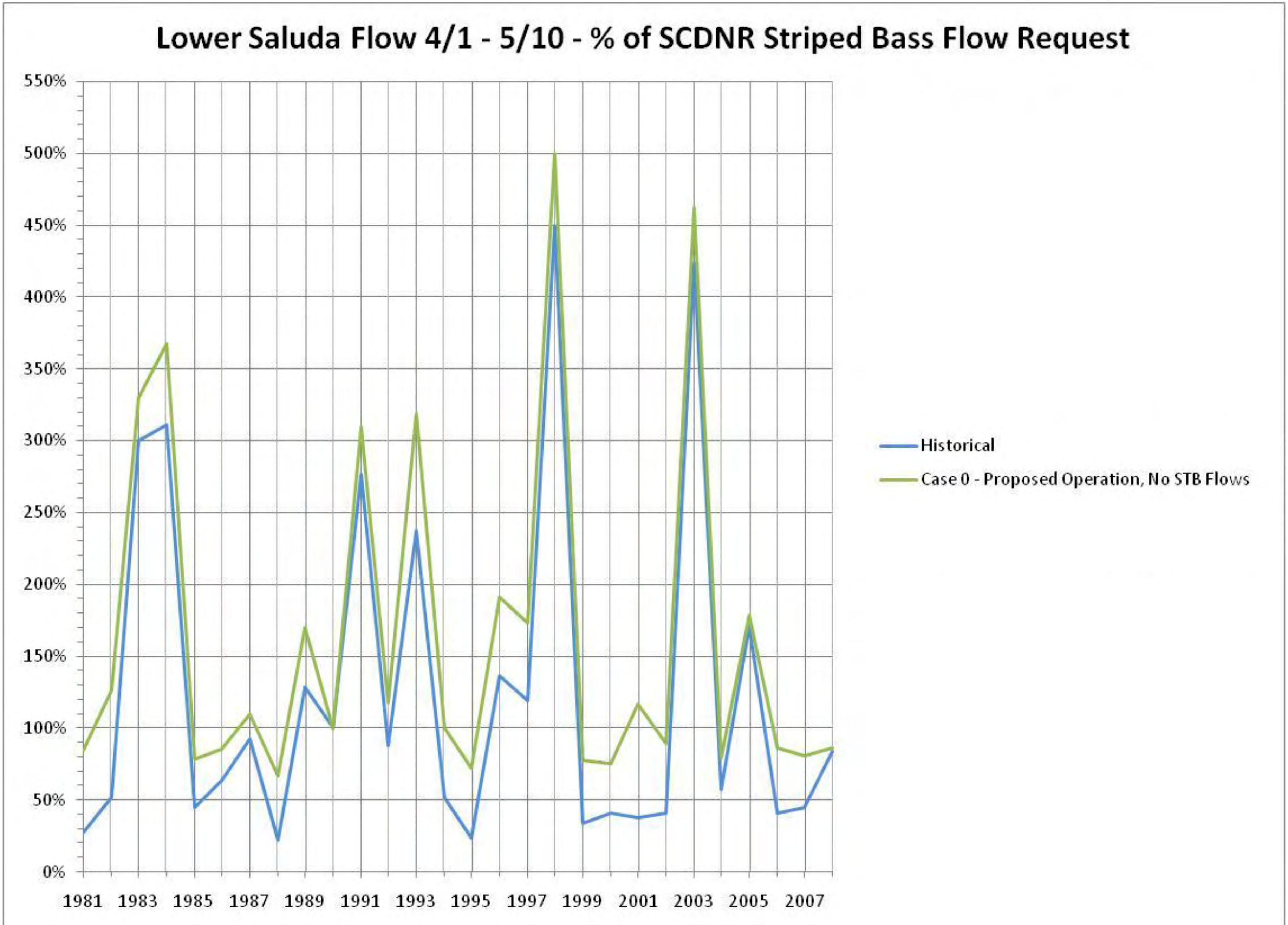


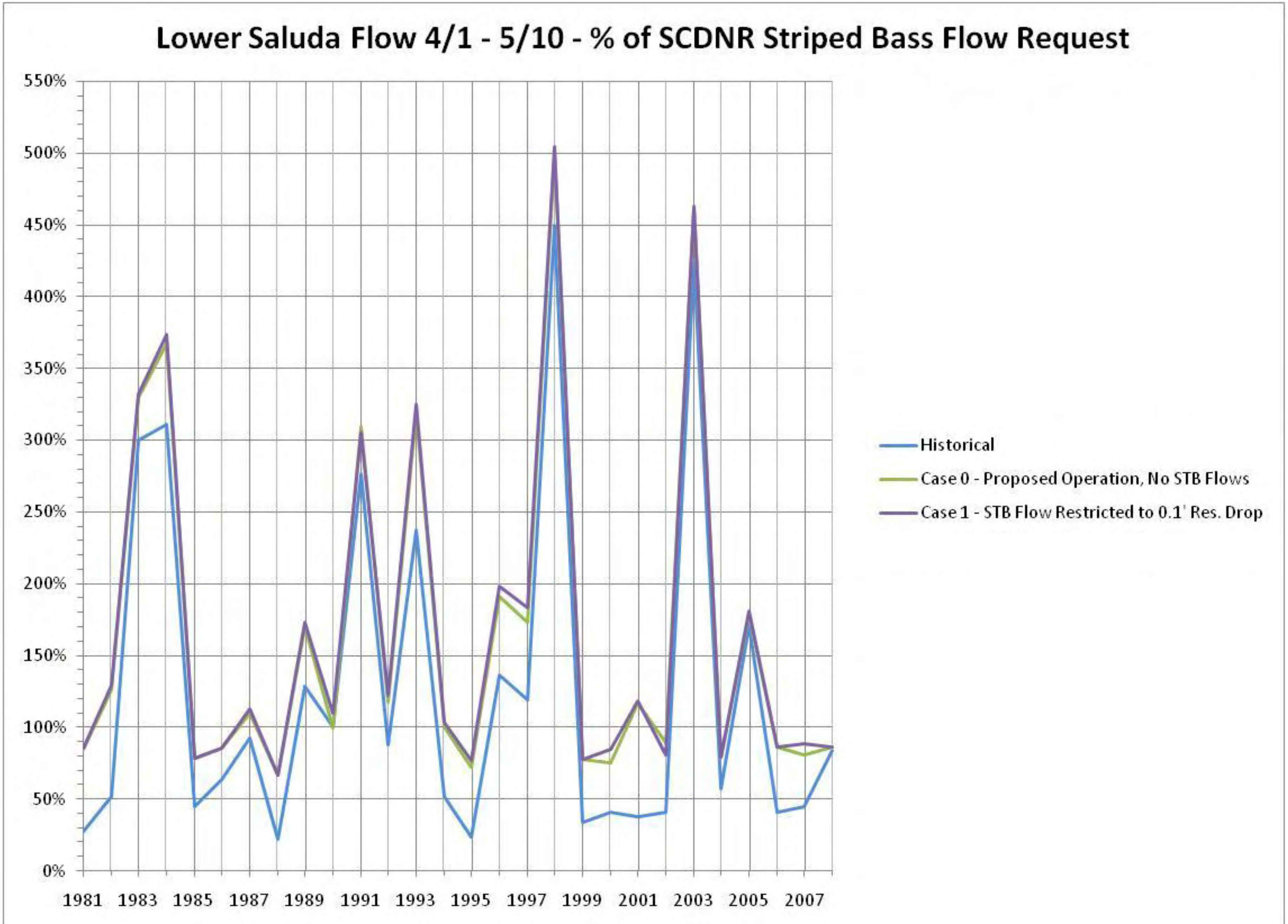
Lower Saluda Flow 4/1 - 5/10 as % of Broad River @ Alston
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB


Lower Saluda Flow 4/1 - 5/10 as % of Broad River @ Alston
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB
Case 1 - STB Flows w/ 0.1' Res. Drop

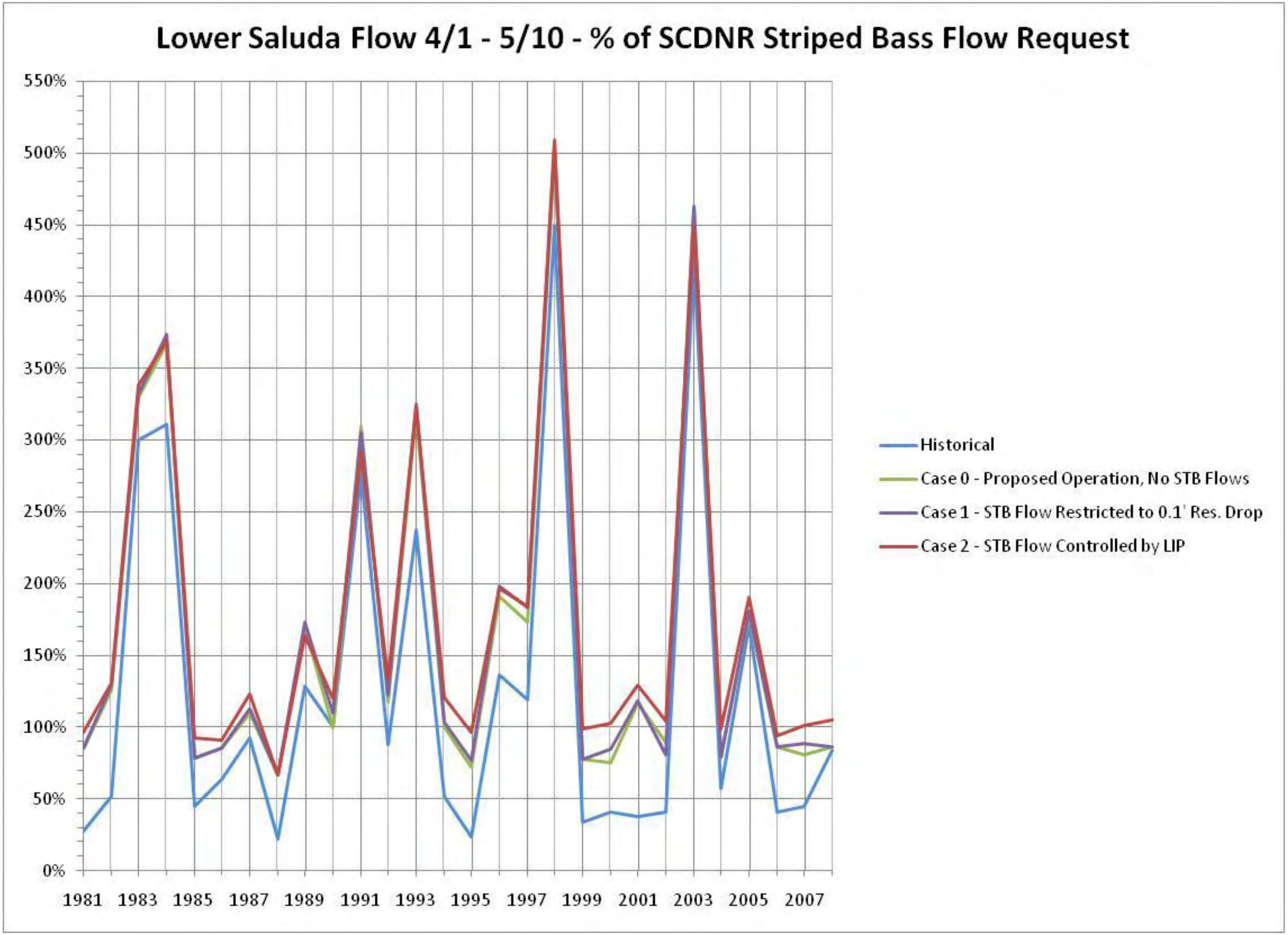

Lower Saluda Flow 4/1 - 5/10 as % of Broad River @ Alston
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB
Case 1 - STB Flows w/ 0.1' Res. Drop
Case 2 - STB Flows Controlled By LIP


Lower Saluda Flow 4/1 - 5/10 - % of SCDNR Striped Bass Flow Request
550%
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical


Lower Saluda Flow 4/1 - 5/10 - % of SCDNR Striped Bass Flow Request
550%
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB Flows



Lower Saluda Flow 4/1 - 5/10 - % of SCDNR Striped Bass Flow Request
550%
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB Flows
Case 1 - STB Flow Restricted to 0.1' Res. Drop



Lower Saluda Flow 4/1 - 5/10 - % of SCDNR Striped Bass Flow Request
550%
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Historical
Case 0 - Proposed Operation, No STB Flows
Case 1 - STB Flow Restricted to 0.1' Res. Drop
Case 2 - STB Flow Controlled by LIP

Summary

- Over all the years modeled, the average LSR flow April 1 – May 10 increased from 27% of the Broad River @ Alston historically, to 39% with proposed license conditions alone (Case 0). Implementing the striped bass flows subject to the 1' reservoir drop LIP (Case 2) increased the average LSR flow to 43% of the Broad River @ Alston.

- The minimum LSR flow April 1 – May 10 (in 1995) increased from 8% of the Broad River @ Alston historically, to 25% with proposed license conditions alone (Case 0). Implementing the striped bass flows subject to the 1' reservoir drop LIP (Case 2) increased the average LSR flow to 34% of the Broad River @ Alston.

- Over all the years modeled, the average LSR flow April 1 – May 10 as a percentage of the SCDNR striped bass flow goal increased from 125% historically to 169% with proposed license conditions alone.

- The minimum LSR flow April 1 – May 10 as a percentage of the SCDNR striped bass flow goal (in 1988) increased from 22% to 67% with proposed license conditions alone.

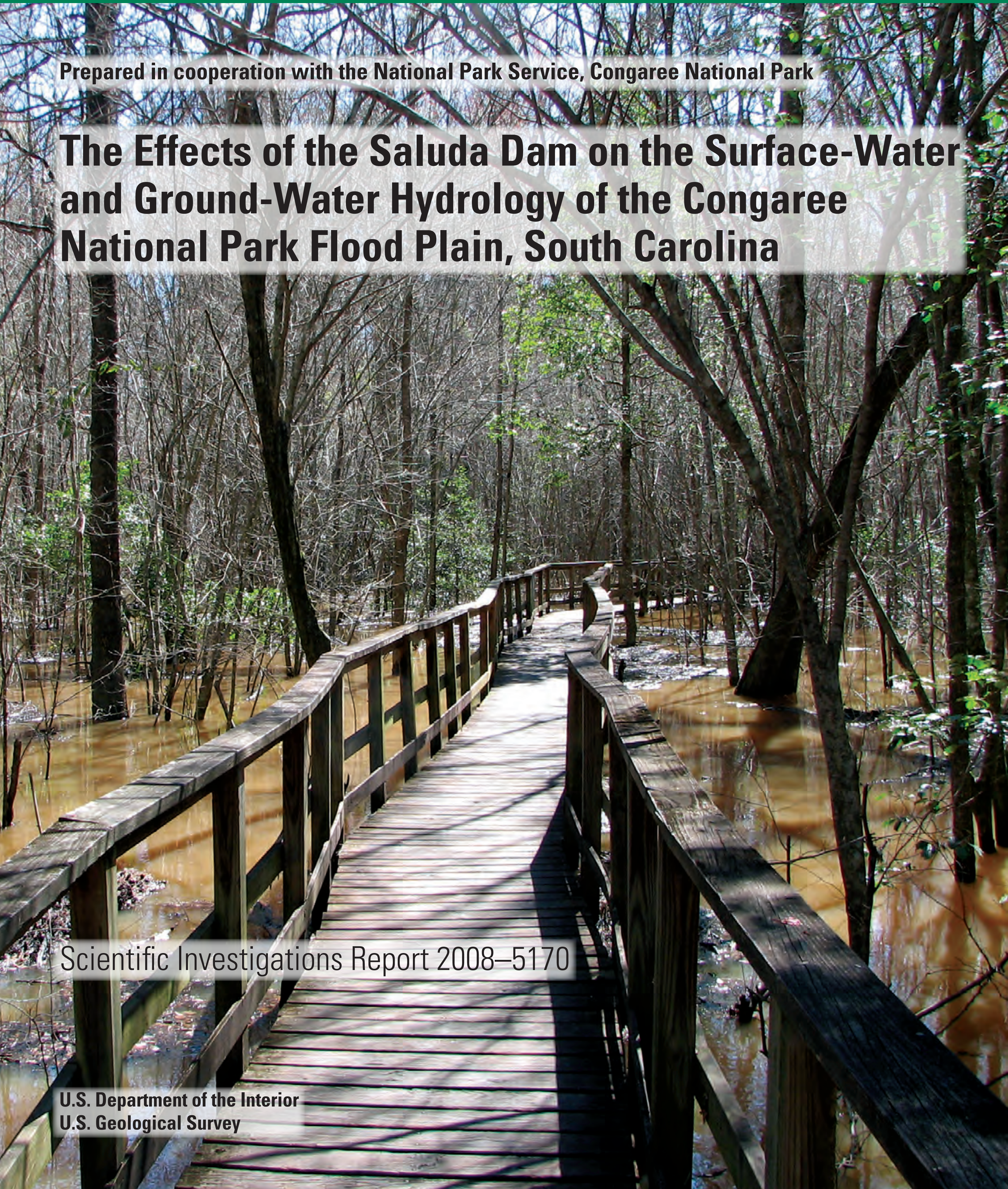
Appendix 21

The Effects of the Saluda Dam on the Surface-Water and Ground-Water Hydrology of the Congaree National Park Flood Plain, South Carolina

USGS
science for a changing world

Prepared in cooperation with the National Park Service, Congaree National Park

The Effects of the Saluda Dam on the Surface-Water and Ground-Water Hydrology of the Congaree National Park Flood Plain, South Carolina



Scientific Investigations Report 2008–5170

U.S. Department of the Interior
U.S. Geological Survey

Cover. **Front:** Boardwalk in the Congaree National Park. **Back:** Boggy gut in the Congaree National Park *(photographs taken by Theresa Thom, National Park Service)*.

The Effects of the Saluda Dam on the Surface-Water and Ground-Water Hydrology of the Congaree National Park Flood Plain, South Carolina

By Paul A. Conrads, Toby D. Feaster, and Larry G. Harrelson

Prepared in cooperation with the National Park Service, Congaree National Park

Scientific Investigations Report 2008–5170

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2008

For product and ordering information:
World Wide Web: http://www.usgs.gov/pubprod
Telephone: 1-888-ASK-USGS

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment:
World Wide Web: http://www.usgs.gov
Telephone: 1-888-ASK-USGS

Suggested citation:
Conrads, P.A., Feaster, T.D., and Harrelson, L.G., 2008, The effects of the Saluda Dam on the surface-water and ground-water hydrology of the Congaree National Park flood plain, South Carolina: U.S. Geological Survey Scientific Investigations Report 2008–5170, 58 p. (online at *http://pubs.water.usgs.gov/sir2008-5170*)

Contents

Figures

Tables

Conversion Factors, Definitions, and Acronyms and Abbreviations

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = 0.56 \times (°F - 32)$$

Vertical coordinate information is referenced either to the North American Vertical Datum of 1988 (NAVD 88) or National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced either to the North American Datum of 1983 (NAD 83) or North American Datum of 1927 (NAD 27).

Unless otherwise stated, elevation, as used in this report, refers to distance above the North American Vertical Datum of 1988 (NAVD 88).

Acronyms and abbreviations used in this report

ANN	artificial neural network
BEP	back error propagation
CNP	Congaree National Park
DCP	data-collection platform
DMSK	Data Miner Software Kit
FEMA	Federal Emergency Management Agency
GA	Georgia
GOES	Geostationary Operational Environmental Satellites
ME	mean error
MLP	multi-layer perceptron
MOVE	Maintenance of Variance Extension
MSE	mean square error
MWA	moving window average
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NPS	National Park Service
NWIS	National Water Information System
OLS	ordinary least squares
PME	percent model error
RMSE	root mean square error
R	Pearson coefficient
R^2	coefficient of determination
SC	South Carolina
SCE&G	South Carolina Electric & Gas
SSE	sum of squared error
USGS	U.S. Geological Survey

The Effects of the Saluda Dam on the Surface-Water and Ground-Water Hydrology of the Congaree National Park Flood Plain, South Carolina

By Paul A. Conrads, Toby D. Feaster, and Larry G. Harrelson

Abstract

The Congaree National Park was established "… to preserve and protect for the education, inspiration, and enjoyment of present and future generations an outstanding example of a near-virgin, southern hardwood forest situated in the Congaree River flood plain in Richland County, South Carolina" (Public Law 94–545). The resource managers at Congaree National Park are concerned about the timing, frequency, magnitude, and duration of flood-plain inundation of the Congaree River. The dynamics of the Congaree River directly affect ground-water levels in the flood plain, and the delivery of sediments and nutrients is constrained by the duration, extent, and frequency of flooding from the Congaree River. The Congaree River is the southern boundary of the Congaree National Park and is formed by the convergence of the Saluda and Broad Rivers 24 river miles upstream from the park. The streamflow of the Saluda River has been regulated since 1929 by the operation of the Saluda Dam at Lake Murray. The U.S. Geological Survey, in cooperation with the National Park Service, Congaree National Park, studied the interaction between surface water in the Congaree River and ground water in the flood plain to determine the effect Saluda Dam operations have on water levels in the Congaree National Park flood plain.

Analysis of peak flows showed the reduction in peak flows after the construction of Lake Murray was more a result of climate variability and the absence of large floods after 1930 than the operation of the Lake Murray dam. Dam operations reduced the recurrence interval of the 2-year to 100-year peak flows by 6.1 to 17.6 percent, respectively. Analysis of the daily gage height of the Congaree River showed that the dam has had the effect of lowering high gage heights (95th percentile) in the first half of the year (December to May) and raising low gage heights (5th percentile) in the second half of the year (June to November). The dam has also had the effect of increasing the 1-, 3-, 7-, 30-, and 90-day minimum gage heights by as much as 23.9 percent and decreasing the 1-, 3-, 7-, 30-, and 90-day maximum gage heights by as much as 7.2 percent. Analysis of the ground-water elevations in the Congaree National Park flood plain shows similar results as the gage-height analysis—the dam has had the effect of lowering high ground-water elevations and increasing low ground-water elevations. Overall, the operation of the dam has had a greater effect on the gage heights within the river banks than gage heights in the flood plain. This result may have a greater effect on the subsurface water levels of the surficial flood-plain aquifer than the frequency and magnitude of inundation of the flood plain.

Introduction

The Congaree National Monument, established in 1976, became South Carolina's first National Park in 2003 (National Park Service, 2006). The Congaree National Park (CNP) is a 22,200-acre palustrine wetland along the northern bank of the Congaree River composed of a forested flood plain made up of virgin bottomland hardwoods (fig. 1). Historically, bottomland hardwood forests existed on forested flood plains throughout the southeastern United States (Patterson and others, 1985). Over time, human activities disturbed many of these bottomland hardwood forests; however, the CNP flood plain remains essentially intact and is one of the last undisturbed stands of bottomland hardwoods remaining in the southeastern United States. The old growth forest preserved at the CNP includes some of the tallest trees and one of the highest forest canopies in the southeastern United States and is recognized as an International Biosphere Reserve, National Natural Landmark, wilderness area, and "globally important bird area" (Patterson and others, 1985).

The Congaree River is formed by the convergence of the Saluda and Broad Rivers at Columbia, South Carolina, approximately 24 river miles upstream from the CNP (fig. 2). The Congaree River defines the southern boundary of the CNP (figs. 1 and 2). As with most river systems, periods of inundation in response to episodic and seasonal surface-water fluctuations affect the flood plain of the Congaree River. The regulation of the Saluda and Broad Rivers pre-dates the establishment of the CNP. As with the majority of large river basins

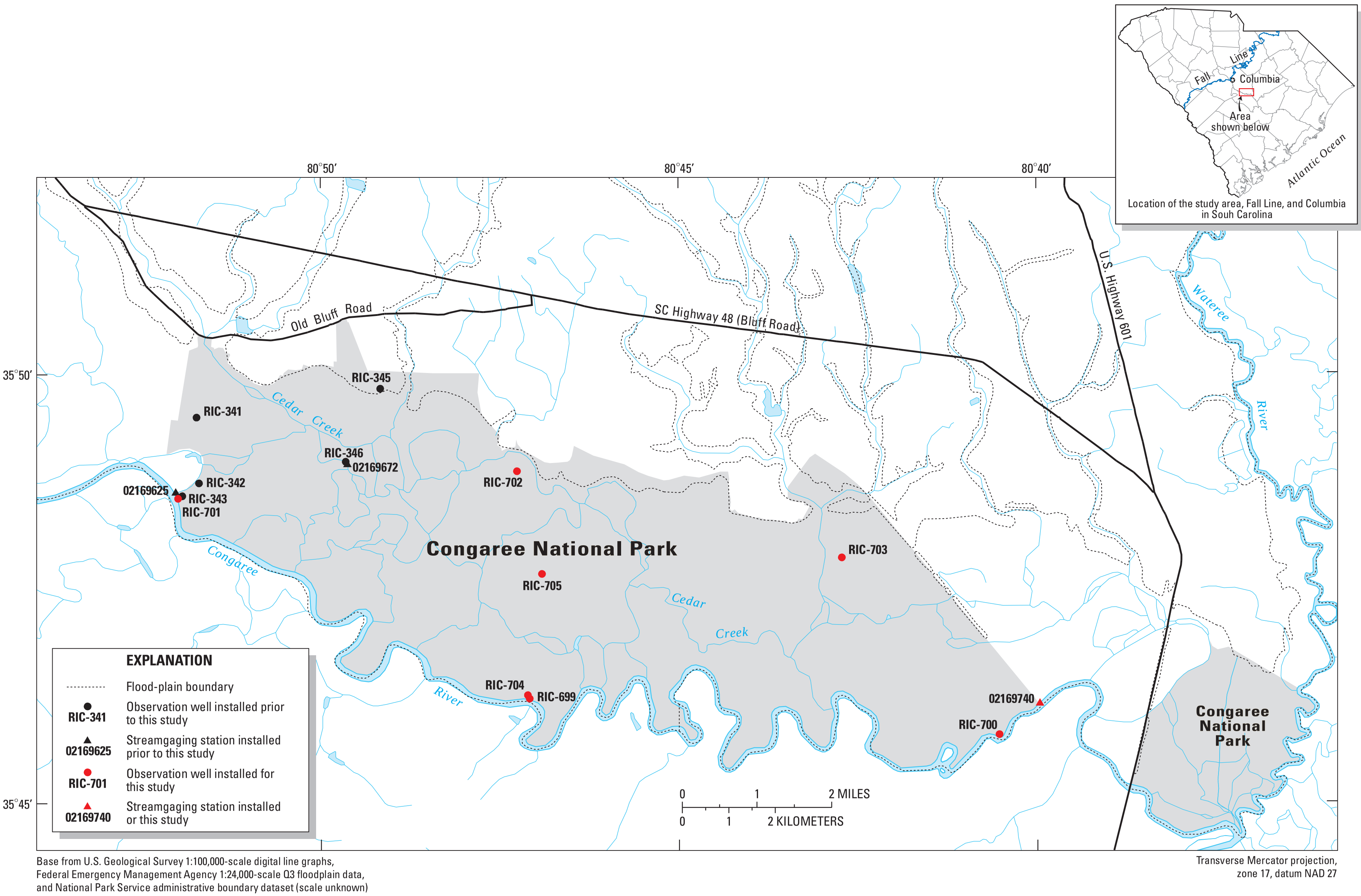


Figure 1. Locations of U.S. Geological Survey observation wells and streamgaging stations in the Congaree National Park, South Carolina.

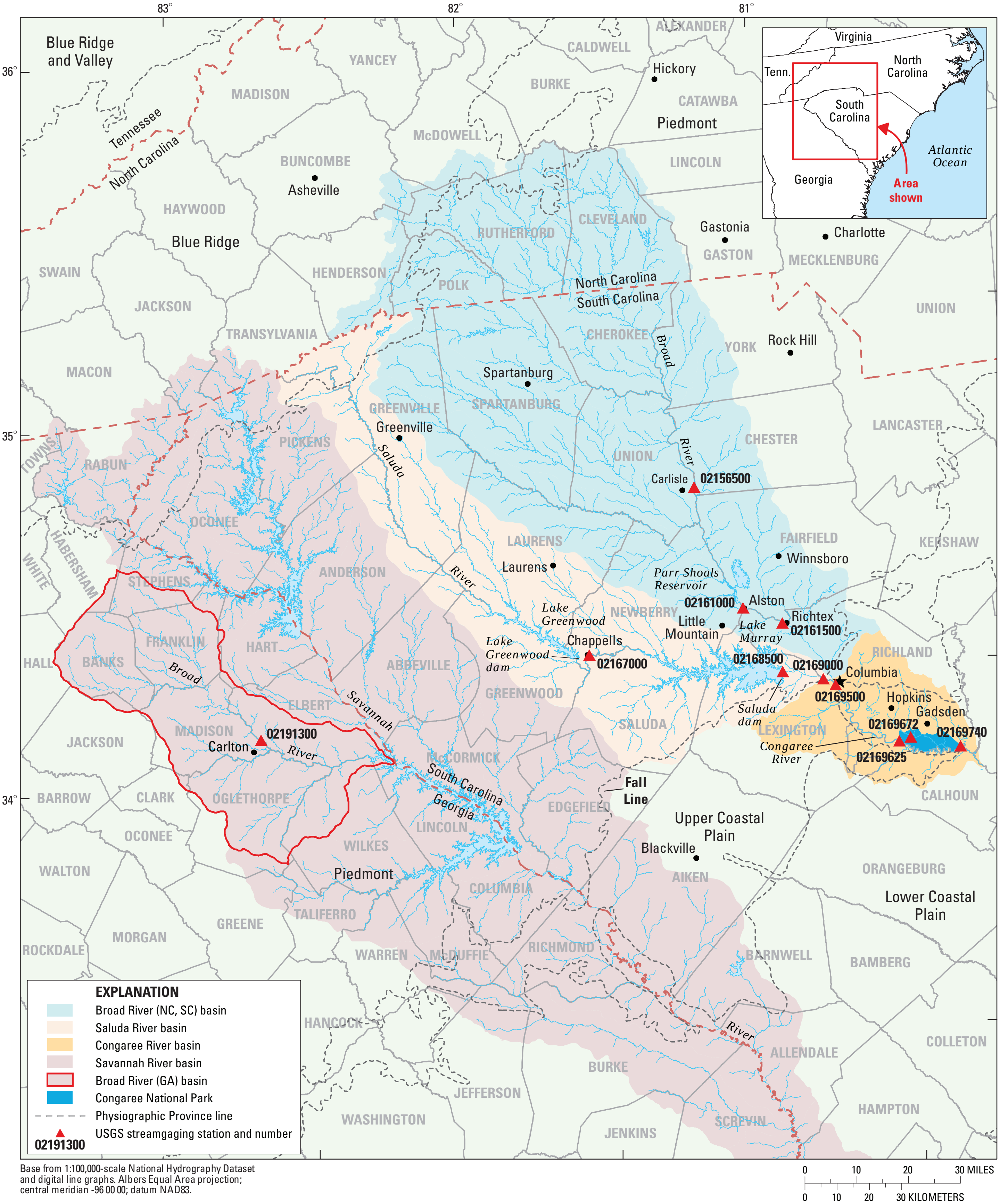


Figure 2. Locations of the Saluda, Congaree, Savannah, and Broad River basins, and U.S. Geological Survey streamgaging stations (table 1) in Georgia and South Carolina used in the study.

in South Carolina, major reservoirs and low-head dams have altered streamflows in the Saluda and Broad River basins since the late 1800s (South Carolina Water Resources Commission, 1983). On the Saluda River, low-head dams built in conjunction with textile plants were some of the first major structures to alter the natural streamflow under low-flow conditions. The first major regulation affecting high streamflows occurred with the completion of the Saluda Dam forming Lake Murray in 1929, which was built for electric power generation. Low-head dams on the Broad River also have regulated low streamflows since the late 1800s and early 1900s.

The CNP was established "…to preserve and protect for the education, inspiration, and enjoyment of present and future generations an outstanding example of a near-virgin, southern hardwood forest situated in the Congaree River flood plain in Richland County, South Carolina" (Public Law 94–545). The resource managers at CNP are concerned about the timing, frequency, magnitude, and duration of flood-plain inundation of the Congaree River. The dynamics of the Congaree River directly affect the ground water in the flood plain, and the delivery of sediments and nutrients is constrained by the duration, extent, and frequency of flooding from the Congaree River. Flooding in the CNP flood plain replenishes sediment and nutrients, thereby maintaining the viability of the ecosystem. The flora and fauna that inhabit the CNP flood plain are dependent on the amount, type, and distribution of these sediments and nutrients (Patterson and others, 1985).

In 2004, the U.S. Geological Survey (USGS), in cooperation with the National Park Service (NPS), began an investigation to evaluate the effects that regulated streamflow from the Saluda River has on the Congaree River and the ground-water resources of the CNP flood plain. The impetus for this current USGS-NPS investigation was the result of altered streamflow patterns (referred to as "modified run-of-river") from the Saluda Dam Hydroelectric Station due to construction of a back-up dam located downstream from the original dam. Under true run-of-river operations with an unaltered streamflow pattern, the daily mean streamflow in and out of Lake Murray would be equal. Due to constraints of operating a hydroelectric facility, a modified run-of-river operation specified that inflows must be released within a specified time, such as 24 hours.

In the fall of 2002, South Carolina Electric and Gas (SCE&G) began to lower the water level in Lake Murray to 15 feet (ft) below full pool to reduce hydraulic pressure on the dam during the construction of the back-up dam. From December 2002 to June 2004, the Saluda Dam was operated under modified run-of-river conditions to maintain the lower water level in the dam. Figure 3 highlights four streamflow periods on the Saluda River below Lake Murray: (1) before construction of the Saluda Dam, (2) after construction of the Saluda Dam, (3) modified run-of-river, and (4) post run-of-river. From a graphical perspective, the modified run-of-river period does not seem to be drastically different from other historical periods of similar duration. That is, one could take

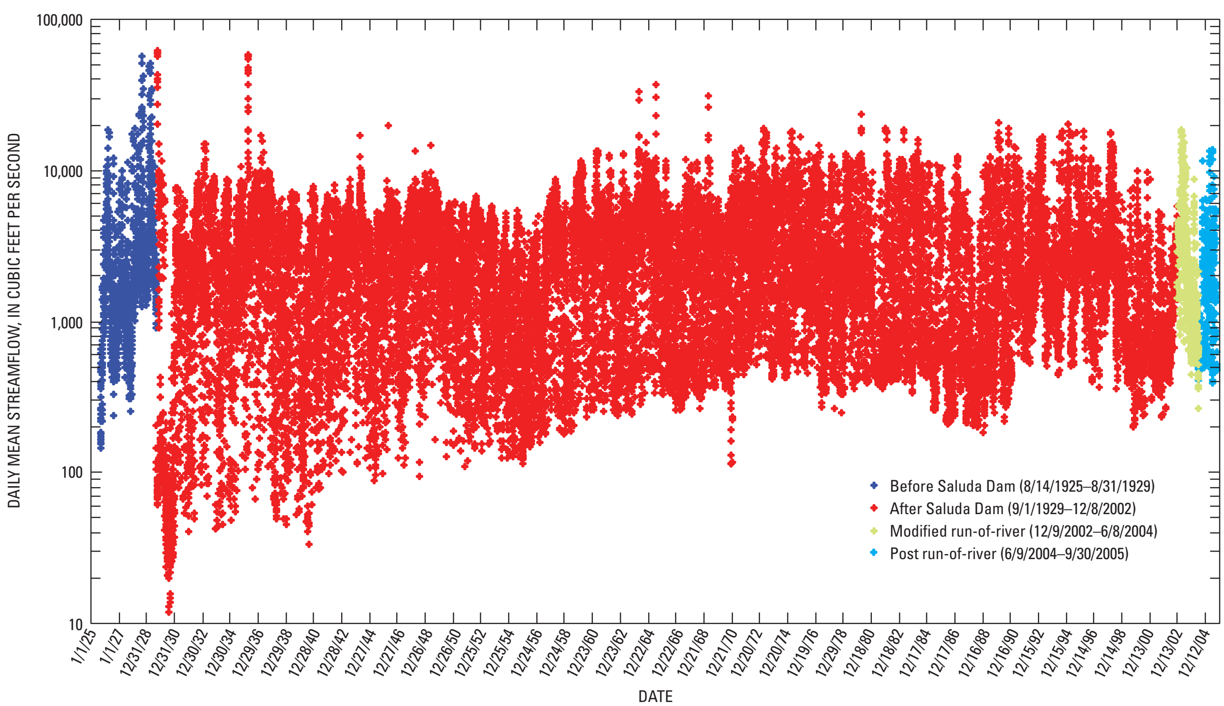


Figure 3. Daily mean streamflow at Saluda River Columbia from August 1925 to September 2005.

the data as a whole from the modified run-of-river period and overlay it on several other historical periods. The 18-month period of modified run-of-river operation only provided a small "snap shot" of unregulated conditions on the Saluda and Congaree Rivers. To further address the issue of the effects of regulation, the USGS compiled and analyzed historic hydrologic data back to the 1800s to evaluate the effect of the altered streamflow patterns on the hydrology of the surface water in the Congaree River and ground water of the CNP flood plain. Water-resource managers can use this information to make informed decisions on the potential effects of future streamflow in the Congaree River.

Purpose and Scope

The purpose of this report is to present the results of the investigation that was conducted to assess the effect that the Saluda Dam has on the annual peak flows and daily gage heights of the Congaree River and ground-water elevations in the flood plain of CNP. The scope of the study area is the Congaree River from the confluence of the Broad and Saluda Rivers to the CNP and the surficial aquifer of the CNP flood plain. The investigation did not include the interactions between surface water and the deeper confined aquifers in the CNP flood plain.

An important part of the USGS mission is to provide scientific information for the effective water-resources management of the Nation. To assess the quantity and quality of the Nation's surface water, the USGS collects hydrologic and water-quality data from rivers, lakes, and estuaries by using standardized methods, and maintains the data from these stations in a national database. Often this database is underutilized and not well interpreted for addressing contemporary hydrologic issues. The techniques presented in this report demonstrate how to extract valuable information from the USGS database to assist local, State, and Federal agencies to address contemporary water-resource management issues. The statistical analysis of annual peak flows on the Broad, Saluda, and Congaree Rivers and the development of regression models demonstrate how to use historical databases to evaluate the effects of regulation and climate variability on the magnitude of peak flows. The application of data-mining techniques, including Artificial Neural Network (ANN) models, to the Congaree River and ground water in the CNP flood plain demonstrates how to develop empirical models of complex hydrologic systems to integrate disparate databases and how to use the models to address contemporary issues of concern.

Previous Investigations

Whetstone (1982) published a report that presented the peak-flow magnitudes and frequencies of major rivers in South Carolina. The report included a comparison of the magnitude and frequency of peak flows for the Congaree River for the period prior to and after the construction of the Saluda Dam in 1929. Guimaraes and Bohman (1992) and Feaster and Tasker (2002) have subsequently updated the magnitude and frequency of peak flows at South Carolina streamflow stations. Peak flows are defined as the highest instantaneous flow for an independent event at a streamflow gage in a given water year[1].

Patterson and others (1985) published a report specifically describing the hydrology and its effects on distribution of vegetation in the CNP in South Carolina. In a regional hydrogeologic study, Aucott and others (1987) describe the general geohydrologic framework of the Coastal Plain sediments in the CNP area. Aucott (1996) summarizes the hydrology of the southeastern Coastal Plain aquifer system in South Carolina (including the area encompassing the CNP), parts of Georgia, and North Carolina. The report describes the predevelopment and contemporary (as of 1982) ground-water flow systems in addition to the geohydrologic framework, general water-quality characteristics, and the results of ground-water flow simulations.

Koman (2003) investigated the hydrologic effect of dams on the Saluda River. The general objectives of the investigation were to assess if substantial changes in the hydrologic regimes had occurred over time. These changes were assessed primarily on the basis of hydroecological indices from data at numerous USGS streamflow-gaging stations in the Saluda River basin. In addition, an assessment of changes of the Congaree River at Columbia streamflow data was made.

Graf and Stroup (2006) compiled a literature review that summarizes the available technical resources on the physical, chemical, biological, and socioeconomic aspects of the three river basins affecting the CNP. The literature cited includes newspaper articles, reports by State and Federal agencies and universities, books, Internet links, and published papers.

Minchin and Sharitz (2007) analyzed the size distribution of trees in the CNP flood plain and tested for evidence of long-term changes in the forest composition due to changes in the natural hydrology of the flood plain with the operation of the Saluda Dam. Results from the study indicate trends toward less flood-tolerant tree species in the flood plain. They could not, however, definitively attribute the trends as evidence of effects of the operation of the Saluda Dam. They present an alternative hypothesis that long-term climate change, as seen in apparent decreases in annual rainfall, may be driving shifts in the flood-plain forest composition.

Approach

Given the numerous and intrinsic processes that influence regulated streamflow, such as daily, seasonal, interannual rainfall patterns, and power-generation demands, it was concluded that it would be difficult to quantify the effects of the Saluda

---

[1] Water year in U.S. Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which the period ends and includes 9 of the 12 months. Thus, the year ending September 30, 1980, is called the "1980 water year."

Dam on the hydrology of the CNP by using only the 18-month modified run-of-river period during the construction of the back-up dam. Comparing the short periods of streamflows in the Saluda River under modified run-of-river conditions with long-term streamflows under peaking conditions would at best provide a circumstantial depiction of how regulation on the Saluda River may be affecting streamflows in the Congaree River and, subsequently, flooding in the CNP.

The approach of analyzing the 18-month modified-run-of-the-river period was replaced with an analysis of historical streamflow records collected prior to the construction of the Saluda Dam at streamgaging stations on the Congaree, Broad, and Saluda Rivers (fig. 2). Using the historical data dating back to the 1800s, empirical models were developed to generate long-term surface- and ground-water records that represent unregulated conditions on the Saluda and Congaree Rivers. Because the intrinsic nature of the system is captured and accounted for in these historical data, the mathematical relations in the empirical models reflect hydrologic conditions in the Congaree River comparable to those that occurred prior to the construction of the Saluda Dam. Consequently, the simulated long-term records provide a means to assess the effect that regulation on the Saluda River has had on the annual peak flows and daily gage heights in the Congaree River and ground-water elevation in the CNP flood plain since the construction of the Saluda Dam.

Three approaches were used to analyze the effect of the Saluda Dam using the historical databases. The first approach analyzed historical annual peak flows for the Broad and Saluda River basins in South Carolina to quantify the effect of the Saluda Dam on reducing peak flows on the Congaree River. For comparison purposes, peak flows from the Broad River in Georgia (fig. 2), which is an unregulated stream with a similar period of record as the Congaree River and Broad River (South Carolina), also were analyzed. Oddly enough, the Georgia station is located on a stream also named the Broad River (Broad River Carlton, table 1) but is not part of the same basin as the Broad River in South Carolina (fig. 2). Using the long-term peak-flow data from the Broad River in Georgia, similar analyses were performed to test the hypothesis that the reduction in peak flows on the Congaree River might not be wholly a result of regulation but could be related to climate variability as a result of fewer large flood events over the last century.

The second approach used streamflow data from the Saluda River prior to the construction of Saluda Dam to develop an empirical model of historical streamflow for the Saluda River as it would have been prior to the impoundment of Lake Murray. The model was used to simulate daily streamflow for the Saluda River for a 75-year period as if the dam were not in place. These simulated data represent unregulated streamflow conditions (without dam). Differences in the simulated unregulated hydrograph and regulated hydrograph (with dam) were compared to quantify differences in the timing, frequency, and magnitude of gage heights at the CNP.

The third approach analyzed the surface-water/ground-water interactions of the CNP flood plain. To evaluate the dynamics of the ground-water system in the CNP, four of the ground-water monitoring wells established by Patterson and others (1985) were reactivated. The ground-water network was expanded by adding seven monitoring wells. Empirical models of ground-water elevations at selected monitoring wells were developed that simulated ground-water elevations as a function of gage heights of the Congaree River. To quantify the effect of the regulation by the Saluda Dam on the ground-water resources of the CNP, the 75-year with-dam and without-dam hydrographs were used as inputs to the ground-water models, and the differences in the ground-water response were determined.

Description of Study Area

The Congaree River begins at the confluence of the Broad and Saluda Rivers at Columbia, SC (fig. 2). The Broad River originates in the mountains of western North Carolina and flows southeast through the foothills of the Blue Ridge Mountains and the Piedmont of South Carolina. The Broad River basin encompasses approximately 5,310 square miles (mi^2) of which 1,510 mi^2 are located in North Carolina and 3,800 mi^2 are in South Carolina (South Carolina Water Resources Commission, 1983; North Carolina Department of Environmental and Natural Resources, 2001). The Saluda River originates in the Blue Ridge Mountains but predominantly drains from the Piedmont of South Carolina and joins the Broad River near the Fall Line to form the Congaree River (fig. 2). The Saluda River basin encompasses approximately 2,500 mi^2.

The first major regulation of the Saluda River occurred with the construction of the Saluda Dam in the 1920s located 10 miles (mi) upstream from the confluence with the Broad River. Logging for the project began in the spring of 1927 and on August 31, 1929, the intake tower gates were closed and the water began to fill Lake Murray (Bayne, 1992). The flood of record on the Saluda River that occurred from September 26 to October 2, 1929, delayed the filling of the reservoir. After this major storm, Lake Murray gradually was filled to a water-surface elevation of 350 ft (National Geodetic Vertical Datum of 1929, NGVD 29) by 1931. Over the next 2 years, the lake water level was raised to 360 ft, which is still considered full pool (South Carolina Electric & Gas, 2008).

In 1958, the McMeekin Station, a coal-fired powerplant, went into operation next to the Saluda Dam Hydroelectric Plant (SCANA, 2006). After the McMeekin Station became operational, the Saluda Hydroelectric Plant transitioned from a base-load powerplant to a peak-load powerplant that generates electricity to quickly meet power demands for short durations of time.

The CNP flood plain is located adjacent to the Congaree River approximately 24 river miles downstream from Columbia near the town of Hopkins in Richland County, SC

Table 1. U.S. Geological Survey surface-water data for streamgaging stations located in South Carolina and Georgia used in the study.

[USGS; U.S. Geological Survey; NAD 83, North American Datum of 1983; SC, South Carolina; RR, railroad; GA, Georgia]

USGS station number and name (fig. 2)	Name used in this report	Latitude (degrees, minutes, seconds, datum NAD 83)	Longitude (degrees, minutes, seconds, datum NAD 83)	Drainage area, in square miles	Period of record
02156500 Broad River near Carlisle, SC	Broad River Carlisle	34° 35' 46"	81° 25' 20"	2,790	October 1938 to current year
02161000 Broad River at Alston, SC	Broad River Alston	34° 14' 35"	81° 19' 11"	4,790	October 1896 to December 1907, October 1980 to current year
02161500 Broad River at Richtex, SC	Broad River Richtex	34° 11' 05"	81° 11' 48"	4,850	October 1926 to July 1928, October 1929 to September 1983
02167000 Saluda River at Chappells, SC	Saluda River Chappells	34° 10' 40"	81° 51' 40"	1,360	October 1926 to current year
02168500 Lake Murray near Columbia, SC	Lake Murray	34° 03' 07"	81° 13' 15"	2,420	August 1929 to current year
02169000 Saluda River near Columbia, SC	Saluda River Columbia	34° 00' 50"	81° 05' 17"	2,520	August 1925 to current year
02169500 Congaree River at Columbia, SC	Congaree River Columbia	33° 59' 35"	81° 03' 00"	7,850	October 1939 to current year
02169625 Congaree River at Congaree National Park near Gadsden, SC	Congaree River CNP	33° 48' 38"	80° 52' 02"	8,290	October 1986 to September 1987, October 1994 to current year
02169672 Cedar Creek at Congaree National Park near Gadsden, SC	Cedar Creek	33° 48' 58"	80° 49' 39"	71	November 1980 to November 1983, June 1985 to September 1986, April 1987 to September 1987, December 1993 to current year
02169740 Congaree River at Southern RR near Fort Motte, SC	Congaree River Fort Motte	33° 46' 12"	80° 39' 58"	Undetermined	December 2003 to September 2005
02191300 Broad River above Carlton, GA	Broad River Carlton	34° 04' 24"	83° 00' 12"	760	July 1897 to current year; only annual peaks between January 1913 and September 1997

(fig. 2). The CNP is approximately 3 mi wide and 12 mi long and encompasses an area of approximately 22,200 acres. The land-surface elevations in the CNP flood plain range from approximately 120 ft above North American Vertical Datum of 1988 (NAVD 88) near the western boundary to approximately 82 ft above NAVD 88 along the eastern boundary, which equates to a southeasterly topographic slope of 3.1 feet per mile (ft/mi). A series of low scarps and terraces located approximately 1,200 ft north of the CNP flood plain is known as the Congaree Sand Hills. The terraces that form the Congaree Sand Hills are known as the Coharie, Hazelhurst, Okefenokee, Sunderland, and Wicomico terraces, and the elevations range from 125 to 270 ft (Colquhoun, 1965; Patterson and others, 1985; not shown in fig. 2).

Underlying the CNP is a complex mix of igneous and metamorphic crystalline basement rocks and unconsolidated sedimentary formations. Overlying the crystalline basement rocks is approximately 500 ft of interbedded sands and clays of late Cretaceous and younger ages (Patterson and others, 1985). The geologic formations presented in this report are discussed beginning with the deepest formation and concluding with the uppermost formation.

The igneous and metamorphic crystalline basement rocks of Paleozoic age beneath the CNP are similar to those found near land surface in the adjacent Piedmont Physiographic Province of South Carolina. Unconsolidated sediments of late Cretaceous to Holocene age cover the older rocks in the eastern parts of South Carolina, and alluvial deposits of Quaternary age typically occupy valleys (Overstreet and Bell, 1965).

In the study area, the Middendorf Formation of late Cretaceous age overlies igneous and metamorphic rocks of the

Paleozoic age. The Middendorf Formation generally consists of fine to coarse-grained sand that is light gray in color. The sediment is micaceous, glauconitic, and may be calcareous in some intervals. The formation also may contain clay that is green, purple, and maroon in color. Greenish-gray micaceous silty sandstone is found in some fraction(s) of the formation (Aucott and others, 1987).

The Black Creek Formation of late Cretaceous age overlies the Middendorf Formation. The Black Creek Formation consists of gray to white, micaceous, phosphatic, quartzose, calcareous, glauconitic sand. Interbedded in the sand are thinly laminated dark gray to black clay layers containing nodules of pyrite and marcasite along with fragments of lignite (Aucott and others, 1987).

The Black Mingo, Congaree, McBean, and Barnwell Formations of Tertiary age overlie the Black Creek Formation. The Black Mingo Formation consists of gray sandy shale, black sandy limestone, and may be carbonaceous and fossiliferous in places. This formation may be present under the CNP flood plain. The Congaree Formation consists of yellowish-brown to green, fine- to coarse-grained sand and sandstone. Also present may be dark green to gray quartzose glauconitic clay. The McBean Formation consists of green to yellow fine-grained glauconitic sand with gray-green glauconitic marl. The Barnwell Formation consists of massive brown to red fine- to coarse-grained sand (Aucott and others, 1987). The Congaree, McBean, and Barnwell Formations pinch out just south of the CNP and are not present in the study area beneath the CNP (Aucott and others, 1987).

Alluvial and terrace deposit(s) of Pleistocene and Holocene age are present in the CNP flood plain. These alluvial deposit(s) overlie the Black Mingo Formation and consist of a fining-upward sequence of gravel, sand, silt, and clay. In the CNP flood plain, the sediment accretes in thin layers during inundation of the flood plain. The amount of sediment accumulation varies within the flood plain; however, sediment accumulation is greatest near the banks of the Congaree River. Sediment deposited near the river is coarser than sediment deposited further inland from the river. Due to the meandering of the Congaree River over geologic time, the lithology in the flood plain varies greatly from place to place over relatively short distances (Patterson and others, 1985; Shelley, 2007a–e). Ground water may be both confined and unconfined in the shallow aquifer beneath the CNP flood plain (Patterson and others, 1985).

Recent information by Shelley (2007a) on the geology, geomorphology, and tectonics of the Congaree River Valley in central South Carolina illustrates the complexity of these individual terraces. Shelley (2007b–f) mapped 14 terraces and collectively named them the Congaree River Valley terrace complex and correlated the new interpretation with the terraces defined in Colquhoun (1965; Shelley, 2007a). A full discussion of the terraces is beyond the scope of this report; however, for more information, the reader is encouraged to review Shelley (2007a) and associated publications (Shelley, 2007b–f).

The hydrogeologic framework of the study area is discussed in descending order in this report and is restricted to the shallow flood plain, Black Creek, and Middendorf aquifers and associated confining units. The shallow flood-plain aquifer includes all sediment from land surface down to the contact between the shallow flood-plain aquifer and the Black Creek confining unit (fig. 4). Within the CNP, sediment that makes up the shallow flood-plain aquifer is the lowermost geologic terrace mapped by Shelley (2007b–f). The shallow flood-plain aquifer is an intricate assortment of intraflood-plain terraces, alluvial fans, rimswamps, dune fields, and meanderbelts of post-late Pleistocene age composed mainly of sand, clay, and peat deposited in the Congaree River flood plain (Shelley, 2007f). These deposits vary in composition, thickness, hydraulic conductivity, and permeability, throughout the CNP. The thickness varies across the CNP flood plain due to differing erosional and depositional patterns beneath and throughout the flood plain. The Floridan-Tertiary sand confining unit, Floridan aquifer system, and Tertiary sand aquifer are absent in the study area. Aucott and others (1987) report the Tertiary sand aquifer pinching out near the lower portion of the CNP flood plain (fig. 4).

The Black Creek aquifer of late Cretaceous age and associated confining unit may underlie the CNP flood plain (fig. 4). The updip limit of the Black Creek aquifer is in the upper Coastal Plain Physiographic Province and generally parallels the Fall Line. The shallow flood-plain aquifer and the Black Creek confining unit may share a common contact (fig. 4); however, the movement of ground water between the two aquifers may be limited due to clay deposits within the shallow flood-plain aquifer and Black Creek confining unit.

The updip limit of the Middendorf aquifer is generally at the Fall Line. The Middendorf aquifer of late Cretaceous age and the associated confining unit underlie the entire Black Creek aquifer and CNP flood plain (fig. 4). In the upper Coastal Plain near the outcrop areas and in the subsurface, the Middendorf aquifer is light gray, white, and buff sand commonly interbedded with lenses of white, pink, or purple clay (Aucott and others, 1987).

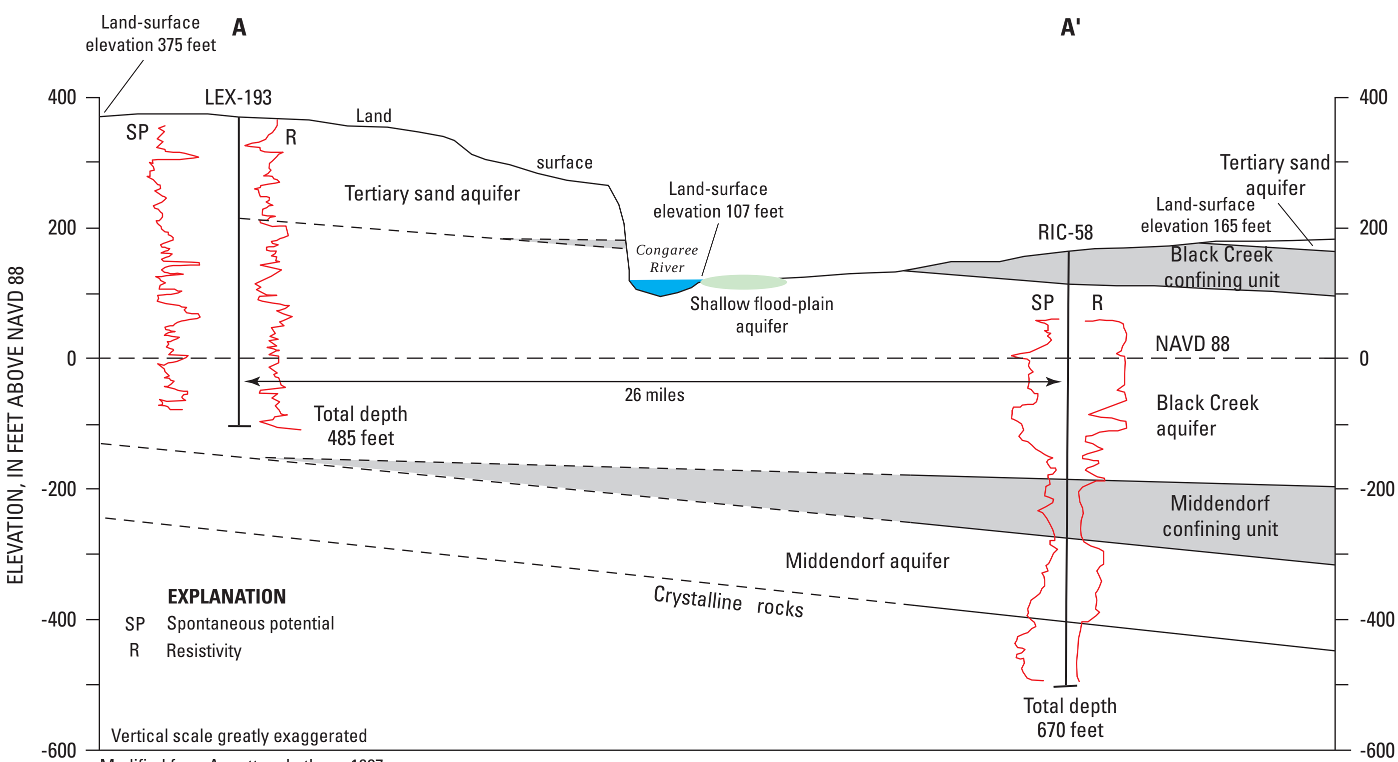
Data-Collection Networks

The USGS maintains various streamgaging station networks in the Broad, Saluda, and Congaree River basins and ground-water elevation networks in the CNP. In addition to using the available historical data, four discontinued observation wells were reactivated and seven observation wells and one streamgage were installed for this study.

A network of 11 streamgaging stations provided current and historical data and was used for the analysis of streamflow and elevation (table 1; fig. 2). Seven of the gages were located upstream from the CNP flood plain in the Broad and Saluda River basins, and three gages were located in or near the CNP flood plain. One streamgaging station was located in the

Series	South Carolina geologic units	South Carolina aquifers or confining units
Holocene	Alluvium and terrace deposits	Surficial aquifer
Pleistocene		
Miocene	Hawthorn Formation	Floridan-Tertiary sand confining unit
Oligocene (missing)		
Eocene	Santee Limestone	Floridan aquifer system
	Barnwell Formation	Tertiary sand aquifer
	McBean Formation	
	Congaree Formation	
Paleocene	Black Mingo Formation (undifferentiated)	
		Black Creek confining unit
Upper/Late Cretaceous	Black Creek Formation	Black Creek aquifer
	Middendorf Formation	Middendorf confining unit
		Middendorf aquifer
Paleozoic	Crystalline rocks	

Location of hydrogeologic section A to A', Congaree National Park, and the physiographic province line in South Carolina.



Modified from Aucott and others, 1987

Figure 4. Generalized strike-oriented cross section illustrating the correlation of the hydrogeologic section from well LEX-193 to well RIC-58 through the Congaree National Park, South Carolina.

Broad River basin in Georgia, which is not associated with the Broad River basin in South Carolina. The available data from the streamgaging stations vary from less than 2 years for the newly installed gage at Congaree River Fort Motte to more than 100 years at the Broad River Carlton (table 1). Six of the stations used in the study have greater than 60 years of record. A description of the maintenance of the streamgaging stations, processing the data, determination of streamflow, and archiving the data can be found in Rantz and others (1982) and Cooney (2001). Daily discharge values for the stations are available from the USGS National Water Information System (NWIS) Website (U.S. Geological Survey, 2008).

To create a long-term dataset for the Broad River (SC), the streamflow records for the Broad River Alston and the Broad River Richtex were combined. The drainage area for Broad River Richtex is slightly more than 1 percent larger than the drainage area for Broad River Alston (fig. 2). The two stations have concurrent water-year peaks for 1981–83. The mean percent difference for those peaks is 5.7 percent. Under excellent measuring conditions, which rarely occur in the field, a streamflow measurement is considered to have an uncertainty of approximately 5 percent; therefore, because the mean percent difference between the two stations was within that level of uncertainty, it was concluded that combining the peak flows from the two stations without any adjustment was reasonable. Hereafter, the combined peak-flow records for the Broad River Alston and Broad River Richtex streamgaging stations will be referred to as the peak-flow data for Broad River Richtex. The combined record for the two stations includes water years 1897 to 1907 and 1926 to 2005.

The ground-water network used for the study consisted of 11 observation wells instrumented with continuous (30-minute interval) water-level recorders (table 2; fig. 1). The USGS and the South Carolina Department of Natural Resources share a common well-numbering system, which is used in this report as the USGS identifier. Wells are sequentially numbered in each county using an alphanumeric well designation. The alphabetic prefix refers to the county and the number refers to the chronological order in which the wells were inventoried in that county. For example, the first well inventoried in Richland County, South Carolina, is designated RIC-1.

Four discontinued wells from the 1980s network were reactivated and seven new wells were installed for this study to define ground-water elevation fluctuation throughout the CNP flood plain (table 2; fig. 1). Prior to reactivation, the four discontinued wells (RIC-341, RIC-342, RIC-345, and RIC-346) were inspected and developed with compressed air to remove sediment from the screens and well bore. Other wells from the 1980s network were determined not to be suitable for reactivation. Because the CNP is a designated wilderness area, the new wells were installed close to the existing roads or trails to limit the effect of well construction in the flood plain and to minimize their visibility. Three of these wells were located close to the Congaree River and were accessible by boat.

Table 2. U.S. Geological Survey well data for observation wells located in the Congaree National Park flood plain used in the study.

[USGS; U.S. Geological Survey; NAD 83, North American Datum of 1983; NAVD 88, North American Vertical Datum of 1988]

USGS well identifier (see fig. 1)	USGS station number	Latitude (degrees, minutes, seconds, datum NAD 83)	Longitude (degrees, minutes, seconds, datum NAD 83)	Elevation of land-surface (datum NAVD 88)	Well depth (feet below land surface)	Top of screened zone (feet below land surface)	Bottom of screened zone (feet below land surface)	Period of record used for the study
RIC-341	334930080514400	33° 49' 31"	80° 51' 43"	101.98	18.3	8.0	13.0	11/07/2003–07/28/2005
RIC-342	334844080514200	33° 48' 45"	80° 51' 41"	105.09	28.0	23.0	28.0	11/08/2003–09/28/2005
RIC-345	334950080491000	33° 49' 31"	80° 49' 09"	115.24	22.2	18.0	22.2	11/06/2003–09/02/2006
RIC-346	334859080493900	33° 48' 60"	80° 49' 38"	99.25	23.5	13.5	23.5	10/29/2003–10/04/2006
RIC-699	334613080470400	33° 46' 14"	80° 47' 05"	99.11	14.5	9.5	14.5	11/26/2003–9/30/2005
RIC-700	334548080403100	33° 45' 48"	80° 40' 31"	86.37	13.0	8.0	13.0	11/26/2003–5/30/2005
RIC-701	334833080515800	33° 48' 34"	80° 51' 59"	107.65	14.8	9.8	14.8	10/29/2003–10/15/2006
RIC-702	334852080471400	33° 48' 53"	80° 47' 15"	95.95	13.0	8.0	13.0	10/24/2003–07/20/2005
RIC-703	334751080424200	33° 47' 52"	80° 42' 43"	88.65	12.0	2.0	12.0	12/10/2003–7/25/2005
RIC-704	334616080470600	33° 46' 16"	80° 47' 06"	99.63	14.0	9.0	14.0	11/26/2003–8/25/2005
RIC-705	334741080465400	33° 47' 41”	80° 46' 54"	93.84	14.5	9.5	14.5	7/07/2003–7/02/2007

The new observation wells were installed by hand augering boreholes into the alluvial flood-plain sediment. The borehole refusal depth with a hand auger was approximately 15 ft due to the lithology of the sediments encountered. The typical construction of an observation well is shown in figure 5. The observation wells vary in depth from 12 to 28 ft (table 2). Each well was instrumented with a pressure transducer and data logger. Three of the wells were instrumented with data-collection platforms (DCP) that transmitted water-level data in near real time (4-hour delay) by way of the Geostationary Operational Environmental Satellites (GOES) to a USGS receiving station for display on the NWIS Web page. Well information, including coordinate location, screening intervals, and period of record, are listed in table 2. Lithologic descriptions of fluvial sediment encountered during the installation of the existing and new wells are presented in Appendix 1.

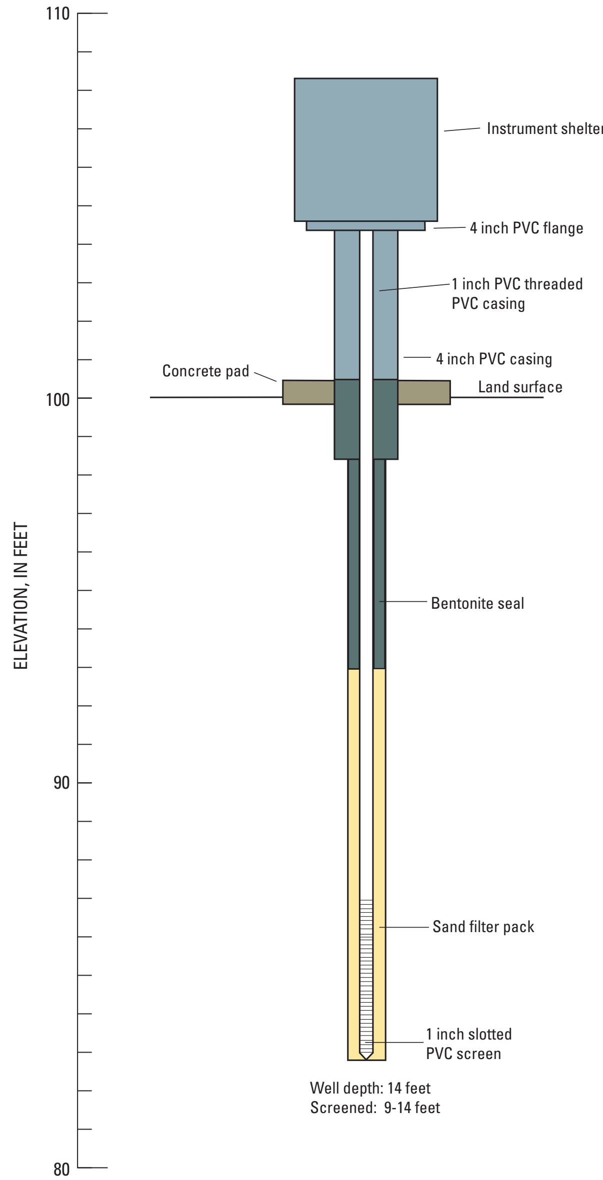


Figure 5. Typical well construction for U.S. Geological Survey observation wells installed in the Congaree National Park, South Carolina.

Characterization of Surface Water and Ground Water

Large river basins, like the Congaree River basin, are complex systems where surface-water and ground-water resources are constantly responding to changing hydrologic, meteorologic, and anthropogenic conditions from small to large subwatersheds within the basin. The headwaters of the 8,290-mi^2-basin of the Congaree River CNP begin in the Saluda and Broad River basins in the Blue Ridge Mountains of western North Carolina. The Saluda River flows through the Piedmont Province, including the I–85 corridor and the metropolitan areas of Greenville and Spartanburg, SC. The Broad River also flows through the Piedmont Province and joins the Saluda River at Columbia, SC, just before flowing into the Coastal Plain near the CNP. The following sections characterize the streamflow of the lower Saluda and lower Broad Rivers and the Congaree River, the gage heights of the Congaree River, and ground-water elevations in the Congaree River flood plain at the CNP.

Surface Water

As mentioned previously, the Congaree River is formed by the confluence of the Saluda and Broad Rivers near the Fall Line at Columbia, SC (fig. 2). The Broad River basin comprises about two-thirds of the drainage area of the Congaree River. At high streamflows, the Broad River essentially is unregulated because of the limited storage capacity of the various dams throughout the basin. On the other hand, the Saluda Dam significantly regulates downstream streamflow in the Saluda River. The Lake Greenwood Dam upstream from Lake Murray (fig. 2) also regulates streamflow in the Saluda River but to a lesser degree than the Saluda Dam.

Although surface-water regulation in the Broad River basin has been extensive, most of the regulation has been for the production of hydroelectric power rather than flood control and, therefore, generally has little effect on streamflow except during low- to medium-flow conditions. The storage capacity for most of the reservoirs on the Broad River, when compared to highest daily mean streamflow, is such that large floods are not significantly altered. A quick assessment of this assumption can be made from the storage capacity of the Parr Shoals Reservoir (fig. 2), which is the largest reservoir on the Broad River in South Carolina. For example, the difference between the normal storage and maximum storage in Parr Shoals Reservoir (fig. 2) is 12,000 acre-feet, (5.23 x 10^8 cubic feet (ft^3); U.S. Army Corps of Engineers, 2006). At the Broad River Carlisle gage, which is located upstream from Parr Shoals Reservoir, the highest daily mean streamflow for water year 2005 was 31,200 cubic feet per second (ft^3/s) (Cooney and others, 2005). Thus, assuming that streamflow rate and no outflow (for simplicity and ease of comparison with the storage capacity of other reservoirs), the reservoir would rise from normal storage to maximum storage in slightly less than 5 hours. Once the reservoir reaches maximum storage, the streamflow would be the same as if there were no reservoir. The highest daily mean peak flow for Broad River Carlisle from 1939 to 2005 is 114,000 ft^3/s. At that streamflow rate and assuming no outflow, the Parr Shoals Reservoir would rise from normal storage to maximum storage in just over an hour and a half.

In the upper part of the Saluda River basin above Lake Greenwood, several small water-supply reservoirs affect streamflow. Controlled releases from Lake Murray and Lake Greenwood have altered natural streamflow patterns of the lower part of the Saluda River since 1930 and 1940, respectively (South Carolina Water Resources Commission, 1983). The storage capacity for Lake Murray and Lake Greenwood is 2,114,000 and 270,000 acre-feet, respectively. The difference between the normal storage and the maximum storage for Lake Murray is 100,000 acre-feet (4.3 x 10^9 ft^3; U.S. Army Corps of Engineers, 2006). The highest daily mean streamflow measured at Saluda River Chappells for water year 2005 was 8,520 ft^3/s. Thus, assuming that streamflow rate and no outflow, it would take 142 hours (5.9 days) for Lake Murray to rise from normal to maximum storage. Using the highest daily mean streamflow for 1941–2005 (14,800 ft^3/s), it would take 82 hours (3.4 days) to rise from normal to maximum storage.

The USGS has monitored streamflow on the Saluda River near Columbia at a site located 8.8 mi downstream from the Saluda Dam since August 1925 (fig. 3; table 1). Figure 3 shows four streamflow periods on the Saluda River: (1) before the construction of Saluda Dam, (2) after construction of the Saluda Dam, (3) modified run-of-river, and (4) post modified run-of-river. The lower and upper daily mean streamflows for the period prior to the construction of the Saluda Dam appear to be higher than streamflows for the period after the completion of the Saluda Dam. In addition, the minimum daily mean streamflows tended to increase until some time in the mid to late 1960s when streamflow began to reach a more stable pattern of variation. As previously mentioned, this is probably associated with the McMeekin Station coming online in 1958.

Duration hydrographs for Congaree River Columbia based on 67 years of data are shown in figure 6. Daily duration graphs characterize the state of streamflow with respect to time. The plotted percentiles are best explained by an example.

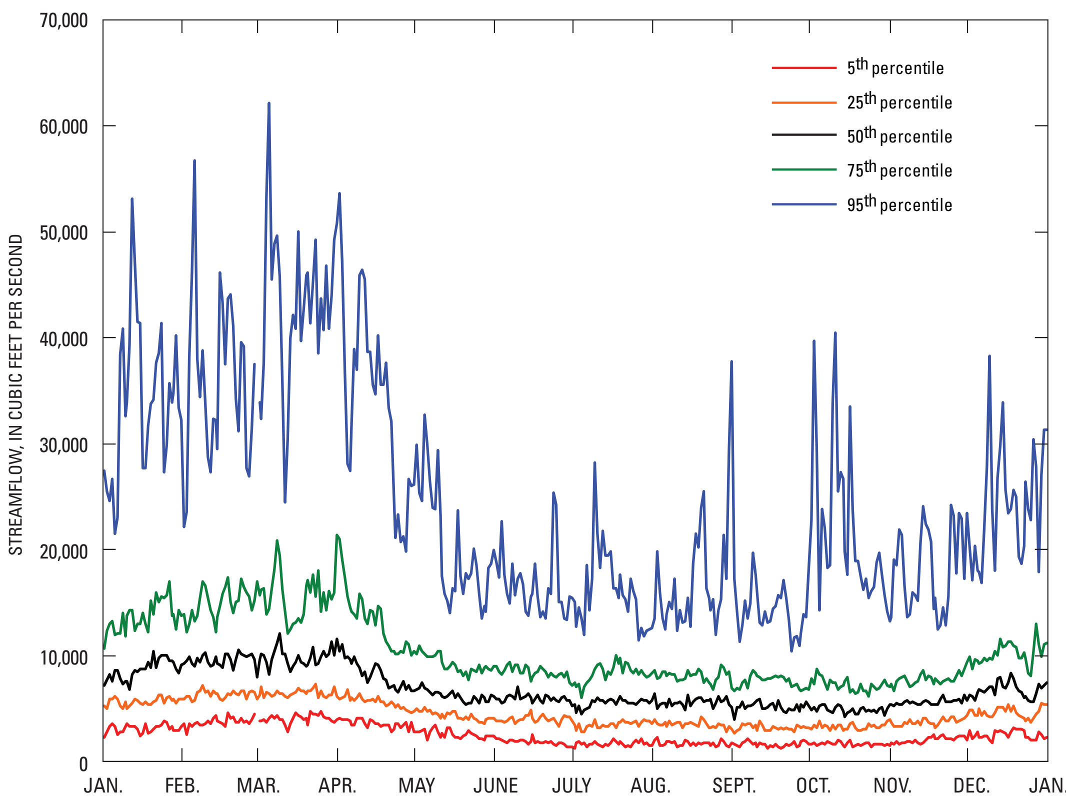


Figure 6. Duration hydrographs for Congaree River Columbia. Percentiles are based on streamflow data for 1940 to 2006.

Based on 67 years of daily mean streamflow data at Congaree River Columbia, the 75th-percentile daily mean streamflow for March 8 is 21,000 ft^3/s. This means that 75 percent of all daily mean streamflows that occurred on March 8 of each of the 67 years of data were equal to or less than 21,000 ft^3/s. Streamflows between the 0 and 10th percentiles occur during very dry hydrologic conditions, and streamflows between the 90th and 100th percentiles occur during very wet hydrologic conditions. Streamflows between the 25th and 75th percentiles occur during normal hydrologic conditions. Daily mean streamflow at Congaree River Columbia ranges from a minimum of less than 1,500 ft^3/s during periods of low streamflow to greater than 60,000 ft^3/s or more during periods of high streamflows (fig. 6). Seasonally, the highest streamflows typically occur in late winter and early spring (January through April), and the lowest streamflows occur in late summer and early fall (July through November).

The Congaree River flows 24 river miles from the Congaree River Columbia streamgage to the Congaree River CNP streamgage. Through this reach, the river transitions from the high gradient streams of the Saluda and Broad Rivers in the Piedmont to a low gradient river of the Coastal Plain Physiographic Province. With the decrease in gradient, there is a decrease in stream velocity that results in deposition of sands, silts, and clays, especially during floods when the sediment load is large (Patterson and others, 1985). At the CNP, the flood plain of the Congaree River is wide and portions of the bank are incised with many guts and sloughs hydraulically connecting the flood plain and river through a large range of river elevations.

The surface-water elevations for three stations in or near the CNP flood plain—Congaree River CNP, Cedar Creek, and Congaree River Fort Motte—are shown in figure 7 along with Congaree River Columbia. The hydrograph for Congaree River CNP generally shows broadened and attenuated pulses compared to the Congaree River Columbia hydrograph. Surface-water elevations at Congaree CNP change sharply and rapidly compared to those measured at the Congaree River Fort Motte gage. The sharp response may be due to the elevation of the riverbank at this location. Water begins to enter the creeks of the flood plain at an elevation of approximately 102 ft. The well-defined banks at the Congaree River CNP

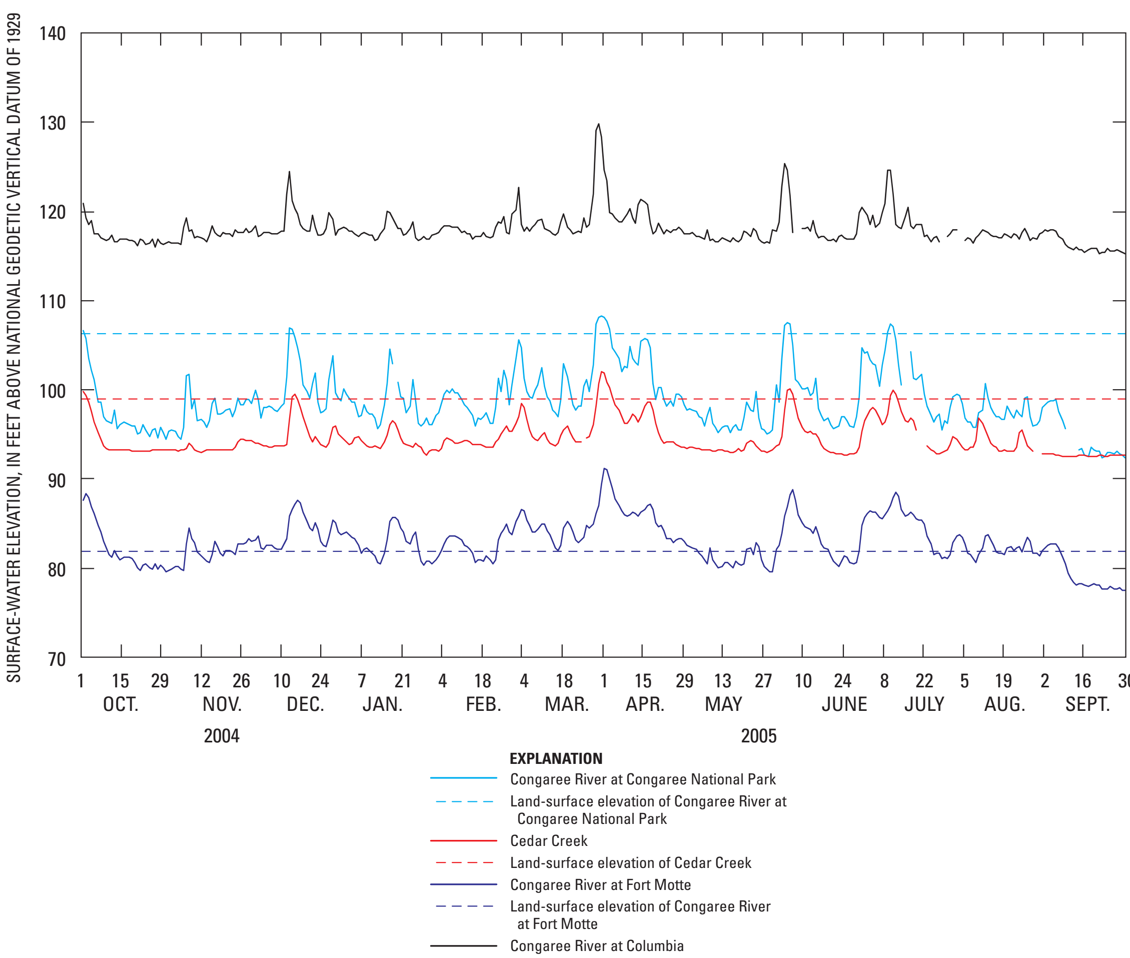


Figure 7. Surface-water and land-surface elevations at Congaree River Columbia, Congaree River Congaree National Park, Cedar Creek, and Congaree River Fort Motte for the 2005 water year.

gage may limit the dispersion of streamflow into the flood plain, producing the highly variable hydrograph. Flooding at Congaree River CNP begins with bankfull conditions when the surface water reaches an elevation of approximately 106.4 ft (NGVD 29; Patterson and others, 1985).

Although the drainage area at the Cedar Creek gage is small compared to Congaree River CNP (71.0 and 8,290 mi^2, respectively), the hydrographs show similar responses due to hydrologic connections in the flood plain. The Cedar Creek gage is located approximately 2.3 mi northeast from the Congaree River CNP gage. A distinct attenuation in the surface-water hydrograph is evident and likely is due to the smaller drainage area, limited runoff from the watershed, local precipitation, and flood-plain characteristics. Most of the Cedar Creek basin is under direct influence of the surface-water elevations in the Congaree River as a result of surface-water and ground-water interactions between the Congaree River and the CNP flood plain.

The shape of the hydrograph for Congaree River Fort Motte also is attenuated when compared to the hydrographs for Congaree River CNP and Congaree River Columbia due to the storage capacity of the flood plain and to the configuration of the riverbank at this location. In this area, the riverbanks of the Congaree River are lower in elevation relative to the river than the riverbanks near Congaree River CNP. This lower elevation allows main-channel streamflows to move into the flood plain and disperse, thereby attenuating the shape of the hydrograph at the downstream gage.

Ground Water

Ground-water and surface-water systems are more closely interrelated in swamps, such as the CNP, than in most other environments. In a flood-plain aquifer that is hydraulically connected to an adjacent river, the elevation of the surface water in the river tends to dominate the lateral and vertical movement of the adjacent ground-water system. Downward infiltration from precipitation tends to have less of an effect on the water level in flood-plain aquifers compared to adjacent river stages (Munster and others, 1996). The flow system in the CNP flood plain can be classified as a local flow system that is characterized by shallow and short flow paths (from recharge to discharge areas) and interaction with local rivers or surface-water bodies (Winter and others, 1998).

The depth of the ground water in the CNP flood plain is shallow and may be confined or unconfined depending on the underlying type(s) of sediment (Patterson and others, 1985). The permeability, hydraulic conductivity, hydraulic head, and saturated thickness of the heterogeneous sediments vary across the flood plain. Ground water flows from the higher elevations outside the flood plain toward streams and creeks that flow to the flood plain. Ground-water discharge from the flood plain is to the Congaree River, to evapotranspiration, and to the tributaries where the low-permeability surface sediments are breached (Patterson and others, 1985).

The ground- and surface-water interactions between the flood-plain aquifer and adjacent river are classified in terms of a losing river, gaining river, or both gaining in some reaches and losing in other reaches (Winter and others, 1998). A losing river reach exists where the surface water in a river seeps into the adjacent ground-water system through the riverbed or temporary bank storage as the elevation of the ground water becomes lower than the surface-water elevation in the adjacent river (fig. 8*A*). A gaining river reach occurs when ground water seeps into an adjacent river through the riverbed or bank as the elevation of the ground water adjacent to the river becomes greater than the surface-water elevation in the river (fig. 8*B*). Depending on the frequency, magnitude, and duration of the fluctuating surface-water elevations in the Congaree River, the surface-water and adjacent ground-water systems are continuously in a dynamic state of adjustment between bank storage and overbank flooding (fig. 9). Precipitation, evaporation, and evapotranspiration affect the ground-water levels to some degree in the CNP flood plain, but these fluxes are unknown and are not as influential as changes in the surface-water elevations in the Congaree River.

To gain a better understanding of the surface- and ground-water dynamics and spatial variability, a time-series clustering algorithm was applied to the time series of surface- and ground-water elevations to subdivide the data into groups of gages having similar behaviors (Risley and others, 2003;

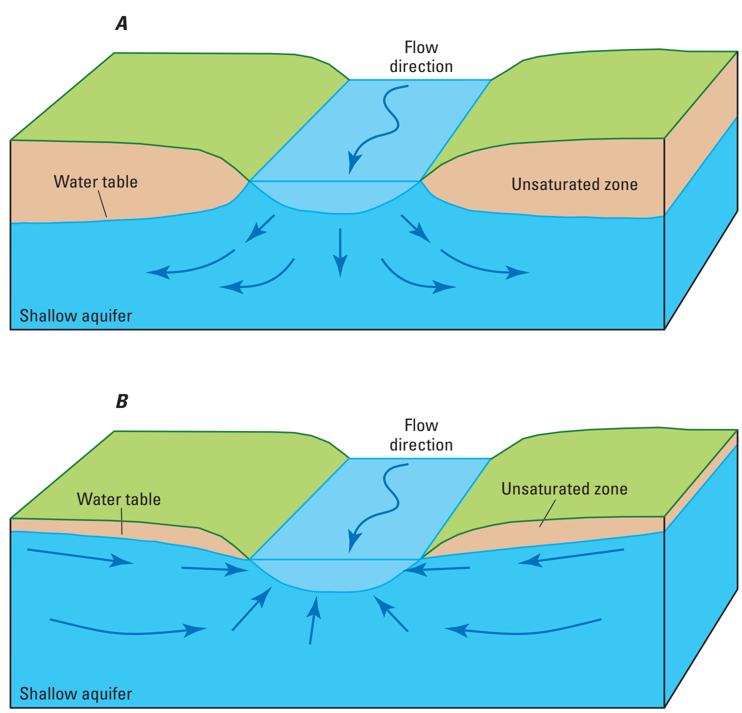


Figure 8. *A,* Losing stream, water level in stream higher than water level in adjacent aquifer; *B,* Gaining stream, water level in aquifer higher than water level in adjacent stream (modified from Winter and others, 1998).

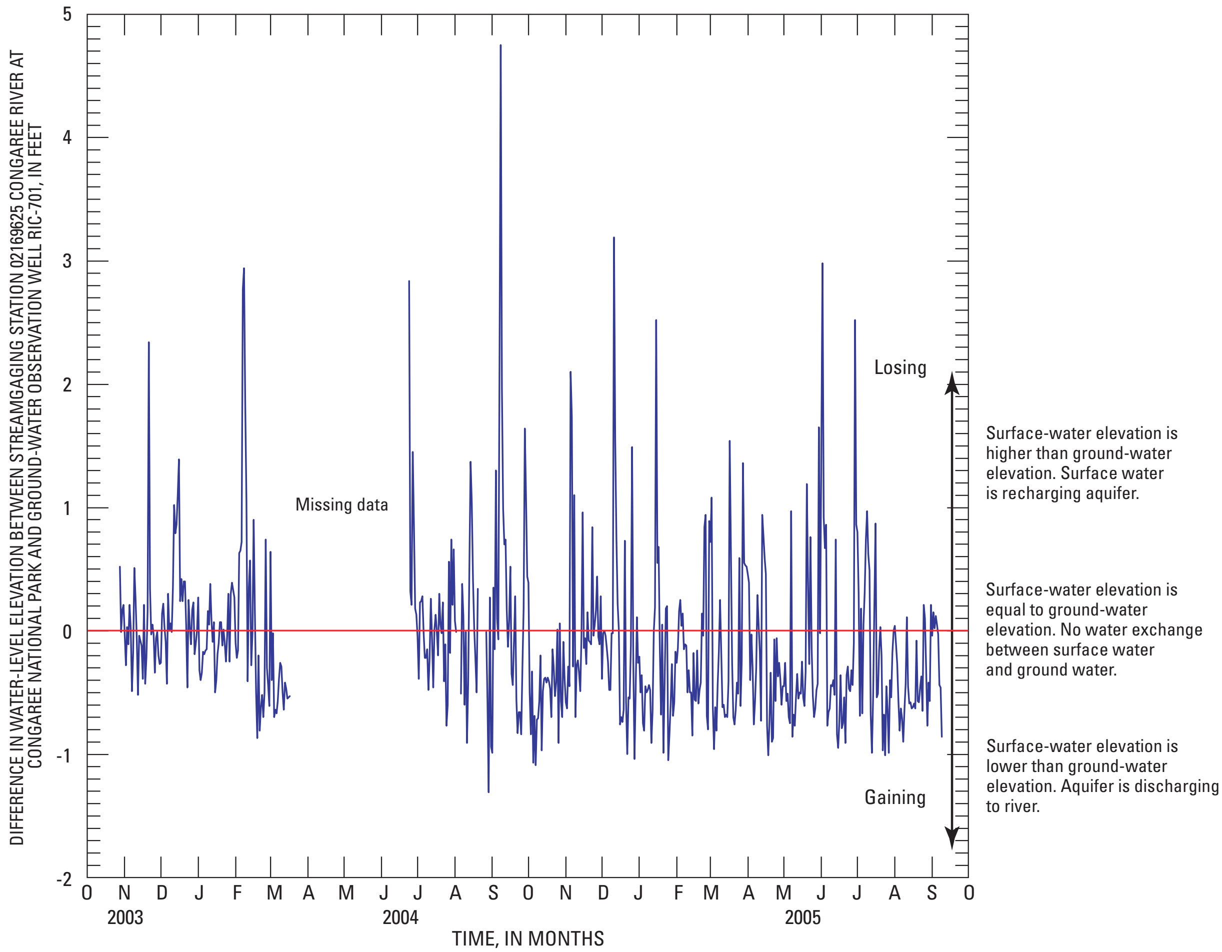


Figure 9. Hydraulic interaction between flood-plain ground water and surface water in the Congaree River for the period October 28, 2003, to September 10, 2005, in the Congaree National Park, South Caroina. Positive differences indicate period when the river water is either stored in the river bank or is recharging the aquifer system, and negative differences indicate periods when the aquifer is discharging to the river.

Roehl and others, 2006; Stewart and others, 2006). By using a statistical technique, such a time-series clustering, sites of similar behavior can be objectively grouped together rather than subjectively grouping the sites with a preconceived conceptual model of the system.

The ground-water hydrographs were cross-correlated to produce matrices of Pearson coefficients (table 3) and coefficients of determination (R^2). The Pearson coefficient (R) is a measure of the correlation between two variables, and the R^2 is a measure of the proportion of the variation between two variables. Each row and column of the correlation matrix in table 3 represents a different gaging station and its behavioral similarity to each of the other gaging stations. The k-means clustering analysis, using the Data Miner Software Kit (DMSK) package, (Weiss and Indurkhya, 1998) was used to optimize the stations that should be in a group based on the cumulative distances between each vector (the R^2 between two stations) and the mean of that vector's group. Two stations can have a high correlation and be assigned to different groups on the basis of the mean of the group to which they are assigned. The number of groups (k) was determined by the sensitivity of the root mean square error to k.

Cluster analysis of the dynamic variability of the daily time series indicated three groups of wells with similar dynamic behavior (fig. 10). Compared to Congaree River CNP, the hydrographs of the Group 1 wells (RIC-346, RIC-699, RIC-700, and RIC-701) are the most similar to the streamgage hydrographs. The correlations for the Group 1 wells with the streamgages range from 0.81 to 0.99. For this report, Pearson coefficients from 0.0 to 0.3 are considered weak, from 0.3 to 0.7 are considered moderate, and from 0.7 to 1.0 are considered strong. The Group 2 wells are RIC-342, RIC-703, and RIC-705, and their correlation to the streamgages range from 0.82 to 0.91. The Group 3 wells include RIC-341, RIC-702, and RIC-704, and correlations are the least similar to the streamgages. The correlation coefficients for the Group 3 wells with streamgages range from 0.66 to 0.82 (table 3).

Table 3. Pearson correlation coefficient matrix of surface- and ground-water elevations for selected U.S. Geological Survey data-collection sites at the Congaree National Park, South Carolina.

	Congaree River CNP (Station 02169625)	Cedar Creek (Station 02169672)	Congaree River Fort Motte (Station 02169740)	RIC-341	RIC-342	RIC-345	RIC-346	RIC-699	RIC-700	RIC-701	RIC-702	RIC-703	RIC-704	RIC-705
02169625	1.00													
02169672	0.91	1.00												
02169740	0.93	0.91	1.00											
RIC-341[c]	0.69	0.72	0.74	1.00										
RIC-342[b]	0.82	0.84	0.88	0.92	1.00									
RIC-345	0.15	0.24	0.18	0.19	0.28	1.00								
RIC-346[a]	0.81	0.92	0.86	0.80	0.86	0.41	1.00							
RIC-699[a]	0.97	0.91	0.98	0.75	0.89	0.17	0.83	1.00						
RIC-700[a]	0.92	0.91	0.99	0.79	0.92	0.16	0.86	0.97	1.00					
RIC-701[a]	0.88	0.80	0.89	0.70	0.82	0.06	0.75	0.91	0.88	1.00				
RIC-702[c]	0.66	0.68	0.72	0.97	0.91	0.17	0.75	0.73	0.77	0.62	1.00			
RIC-703[b]	0.83	0.90	0.91	0.88	0.93	0.15	0.91	0.88	0.93	0.81	0.87	1.00		
RIC-704[c]	0.75	0.76	0.82	0.93	0.98	0.24	0.79	0.84	0.87	0.77	0.93	0.90	1.00	
RIC-705[b]	0.83	0.88	0.89	0.91	0.95	0.15	0.89	0.88	0.91	0.82	0.90	0.97	0.92	1.00

[a] Group 1 observation wells. [b] Group 2 observation wells. [c] Group 3 observation wells.

One well was not included in the group assignments from the time-series cluster analysis. Observation well RIC-345 is located on a bluff just north of the flood plain and outside of the CNP flood plain. Though ground-water elevations for this well are influenced somewhat by the change in surface-water elevation in the Congaree River, the predominant influence on ground-water elevations may have more to do with local precipitation and evapotranspiration. Well RIC-345 has a much weaker correlation with the Congaree River gages (0.15 and 0.18) and the Cedar Creek gage (0.24) than the other wells (table 3).

A representative ground-water hydrograph for one well from each group of wells (RIC-699, RIC-703, RIC-341, respectively) is shown in figure 11*A* along with the hydrograph for Congaree River CNP. The Group 1 well (RIC-699) response is highly similar to the riverine response. The change in the surface-water elevation is reflected at RIC-699 nearly instantaneously and illustrates the dynamic relation that exists between surface water in the Congaree River and ground water along the interface connecting the two water bodies. The Pearson coefficient (R) between the Group 1 well (RIC-699) and Congaree River CNP is 0.97. The response of the Group 2 well (RIC-703) is attenuated as compared to the Group 1 well but shows a similar overall response. The R between RIC-703 and Congaree River CNP is 0.83. The Group 3 well (RIC-341) shows very little similarity to the daily variability of the river but does show general similarity in seasonal responses. The R between RIC-341 and Congaree River CNP is 0.69.

It is interesting to note the seemingly anomalous group assignments, such as the Group 3 gage, RIC-704, that is proximal to the Group 1 gage, RIC-699, near the Congaree River (fig. 10). The ground-water elevations at RIC-704, either due to the flood-plain aquifer characteristics, proximity to the surface-water features, screen depth and length, or some other hydrogeologic factor, are similar to the ground-water elevations of the Group 3 gages, which are much farther from the river. The ground-water elevations for these gages and the Group 3 well RIC-702 are shown in figure 11*B*, and it is apparent that the Group 3 ground-water elevations are more similar to each other than to the Group 1 well levels. The dissimilarities between RIC-699 and RIC-704 and the similarities between RIC-704 and RIC-702 illustrate the complexities of the flood-plain aquifer hydrogeologic properties.

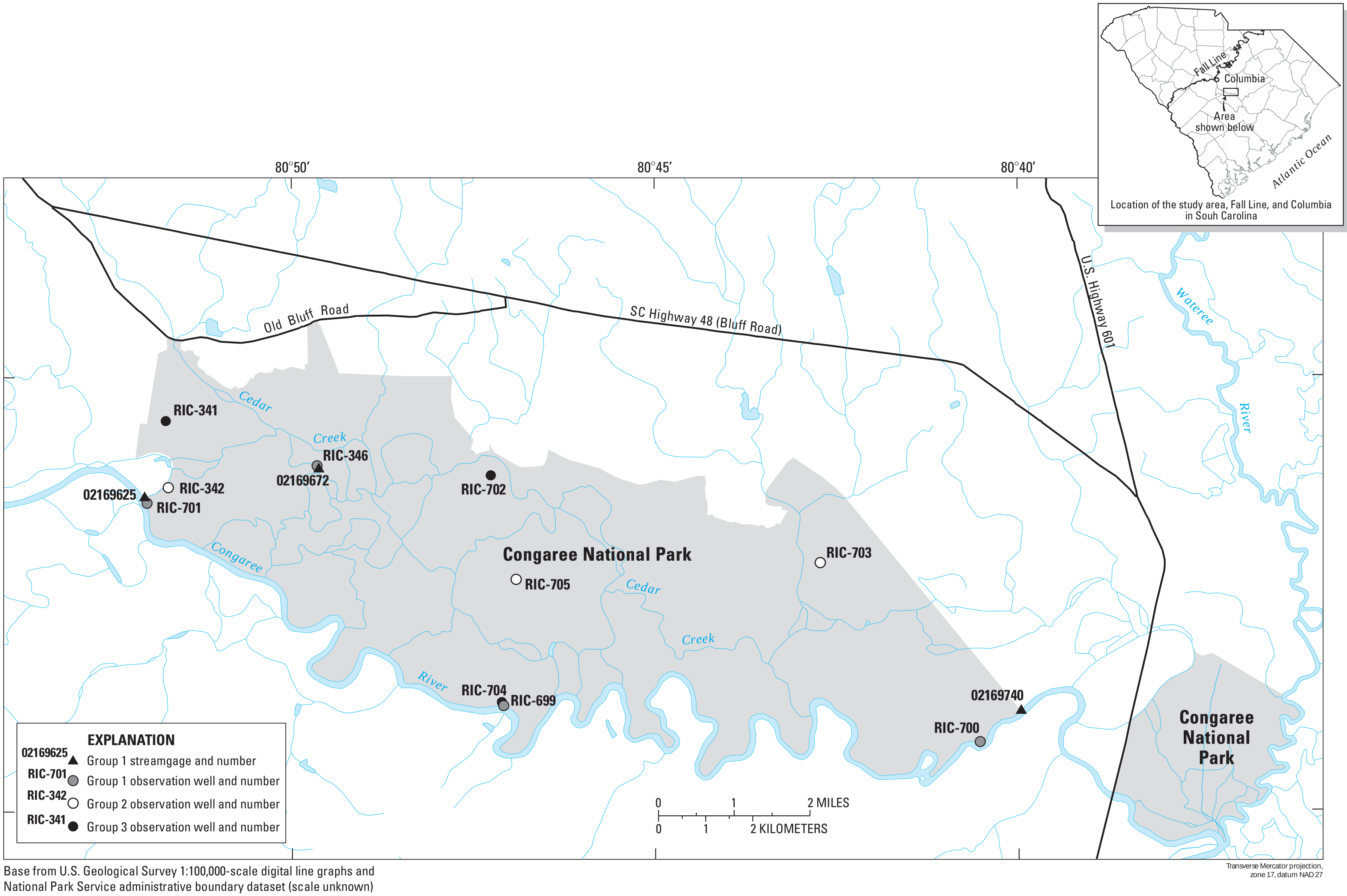


Figure 10. Spatial distribution of Group 1, Group 2, and Group 3 streamgages and observation wells.

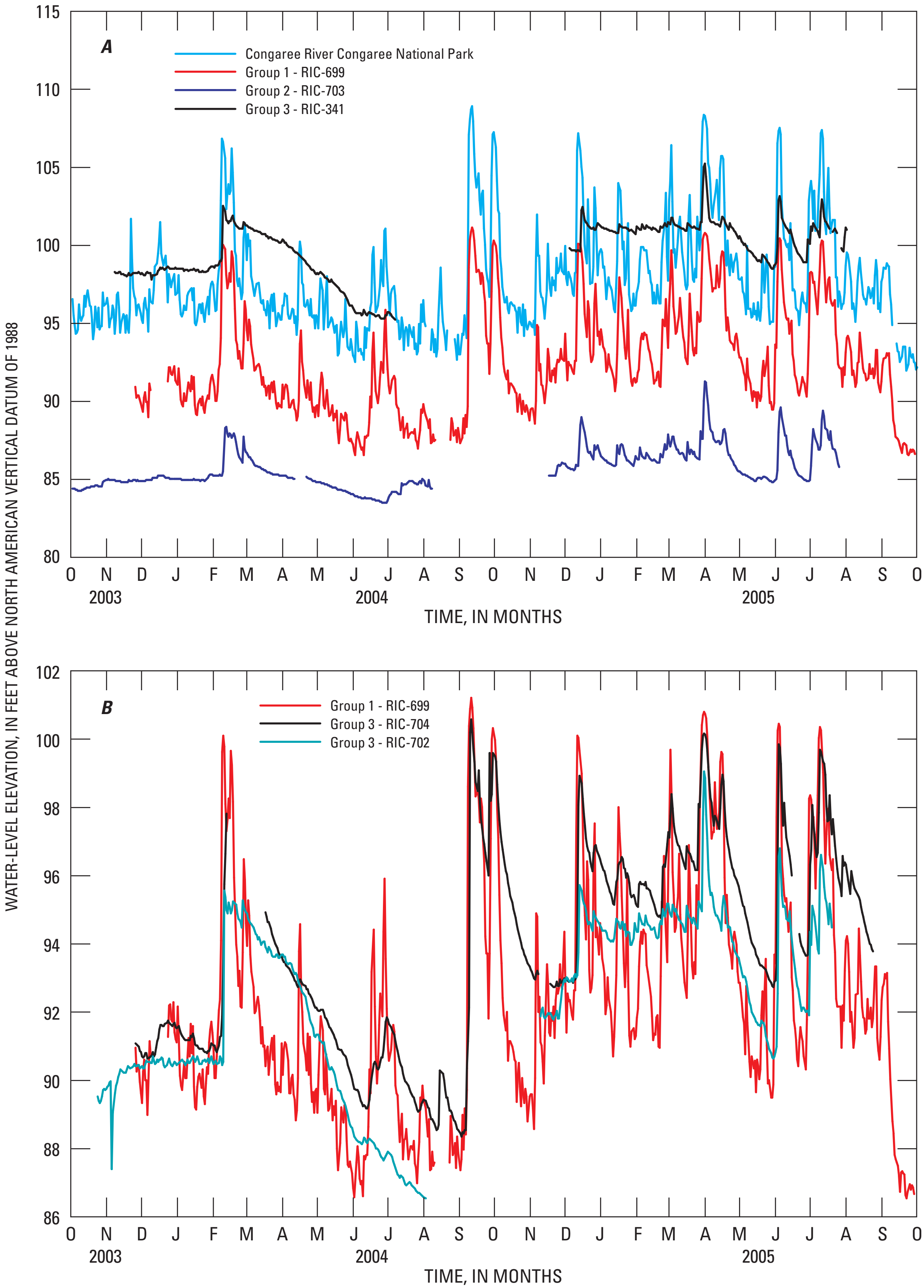


Figure 11. *A,* Surface- and ground-water elevations at Congaree River Congaree National Park, RIC-699 (Group 1 well), RIC-703 (Group 2 well), and RIC-341 (Group 3 well); *B,* Ground-water elevations at RIC-699 (Group 1 well), and RIC-702 and RIC-704 (Group 3 wells).

Water-Table Elevation Distribution

Surface- and ground-water elevations in and near the CNP flood plain varied throughout the data-collection period. Synoptic surface- and ground-water elevations for selected data-collection locations are shown in figure 12 for two dates when the lowest (September 10, 2005) and the highest (September 11, 2004) surface-water elevations were recorded at the Congaree River CNP gage during the study. Due to the limited number of data points in the CNP flood plain (10 sites in 22,200 acres) and the complexities of the ground-water flow paths through the CNP, ground-water contour maps were not generated for high- and low-water conditions. The missing data noted in figure 12 represent periods when data collection was interrupted because of equipment failure. Observation well RIC-345 is outside of the flood plain, and the ground-water elevations presented on the map correspond to the dates of the lowest and highest water levels of the Congaree River and not for the period of record of this particular observation well.

The lowest surface-water elevation of 89.98 ft was recorded at Congaree River CNP on September 10, 2005, at 4:30 p.m. when the Congaree River and the CNP flood plain were experiencing a relatively dry period. During this period of low surface-water elevation, the thickness of the unsaturated zone beneath the CNP flood plain was the greatest observed during the study. The thickness of the unsaturated zone beneath an observation well is determined by subtracting the measured ground-water elevation from the land-surface elevation. Of the three wells recording water levels in the flood plain during this period, the thickness of the unsaturated zone was 7.61 ft, 6.23 ft, and 10.14 ft at observation wells RIC-342, RIC-346, and RIC-699, respectively. North of the flood plain, at observation well RIC-345, the thickness of the unsaturated zone was 13.16 ft.

The highest surface-water elevation of 108.15 ft was recorded at Congaree River CNP on September 11, 2004, at 8:30 p.m. when the Congaree River and the CNP flood plain were experiencing a relatively wet period. During this period of high surface-water elevations, the unsaturated zone beneath the CNP flood plain was at its thinnest or absent, and the water elevations at some sites were above land surface, indicating flooding in the CNP. Of the five observation wells recording during this period, floodwater depths of 0.92 ft, 1.40 ft, 5.54 ft, and 2.06 ft were recorded at RIC-704, RIC- 342, RIC-700, and RIC-699, respectively. The unsaturated zone at RIC-345, outside of the flood plain, was 13.16 ft, illustrating that no flooding was occurring at this site during this time.

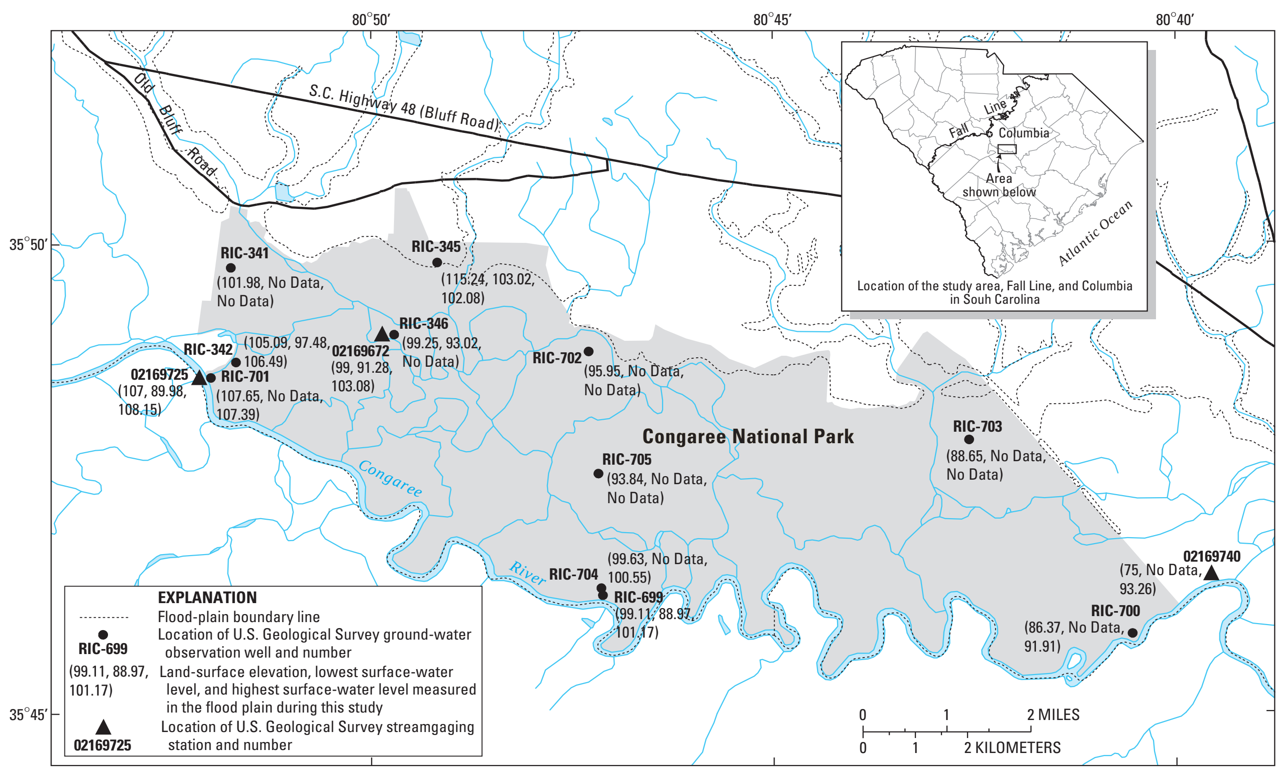


Figure 12. Location, land-surface, and surface- and ground-water elevations for U.S. Geological Survey streamgages and observation wells in the Congaree National Park flood plain near Hopkins, South Carolina. Water levels represent the lowest (September 10, 2005) and the highest (September 11, 2004) surface-water elevations recorded at streamgage 02169625 in the Congaree River during this study. Note that observation well RIC-345 is outside of the flood plain, and the ground-water elevations presented on the map correspond to the dates of the lowest and highest water levels of the Congaree River and not for the period of record of the well.

Analysis of Surface-Water and Ground-Water Dynamics

The analysis of surface- and ground-water dynamics was quantified to describe the interaction between surface water in the Congaree River and ground water in the CNP flood plain. Historical peak-flow data were evaluated using linear regression to quantify how regulation of the Saluda Dam has affected peak flows on the Congaree River. The effects of the Saluda Dam on the daily water level of the Congaree River and CNP flood-plain aquifer were evaluated using long-term synthetic surface- and ground-water datasets simulated using artificial neural network (ANN) models.

Analysis of Surface-Water Peak Flows and Potential Effect of Climatic Variability

A previous investigation compared the magnitude and frequency of floods at the Congaree River Columbia for two different periods (Whetstone, 1982): (1) 1892–1929, representing the period before the construction of Lake Murray (pre-regulation), and (2) 1930–1978, representing the period after construction of Lake Murray (post-regulation) (fig. 13). Patterson and others (1985) presented information (fig. 13) implying that the operation of the Saluda Dam had significantly affected the magnitude and frequency of floods at Congaree River Columbia. As an example, the report stated that the 2-year recurrence-interval flow for the pre-regulation period was equivalent to a 4.5-year recurrence-interval flow for the post-regulation period. The report also stated that a 5-year recurrence-interval flow for the pre-regulation period equated to a 25-year recurrence-interval flow for the post-regulation period. Following that same line of reasoning and examining figure 13, it would appear that the 10-year recurrence-interval flow for the pre-regulation period would equate to something beyond the 100-year recurrence-interval flow for the post-regulation period. Although not explicitly stated by Patterson and others (1985), the implication was that construction of the Saluda Dam had significantly altered flooding in the Congaree River and subsequently in the CNP. However, current statistical analysis of the available data along with comparisons of other long-term USGS streamgaging stations indicate otherwise.

The USGS has collected streamflow data in the conterminous United States since the late 1800s. In South Carolina, Congaree River Columbia, has one of the longest records of water-year maximum peak flows in the State. The USGS has collected streamflow data at the current site since 1939. The National Weather Service collected daily streamflow data at the current site and at a site 1,000 ft upstream from Congaree River Columbia from 1891 to 1939 (Cooney and others, 2005). From the perspective of climatic variability, 114 years of record may provide only a narrow view of the long-term behavior of such systems.

Climatic variability can be assessed from lake and ocean sediments, mass balance of glaciers, and from paleohydrologic data (Jarrett, 1991). Such research has shown that in the past 10,000 years, there have been numerous periods where the climate has varied from present conditions with annual mean temperatures varying by about plus or minus 4 degrees Fahrenheit (°F) and annual mean precipitation varying by as much as plus or minus 20 percent from modern values. An investigation on the Colorado River (Jarrett, 1991) included paleohydrologic techniques using standardized tree-ring chronologies to reconstruct annual average streamflows for a 450-year period before 1960. The data showed that a 35-year period (8 percent of the total record) from 1896 to 1930 contained the longest series of high-flow years during the

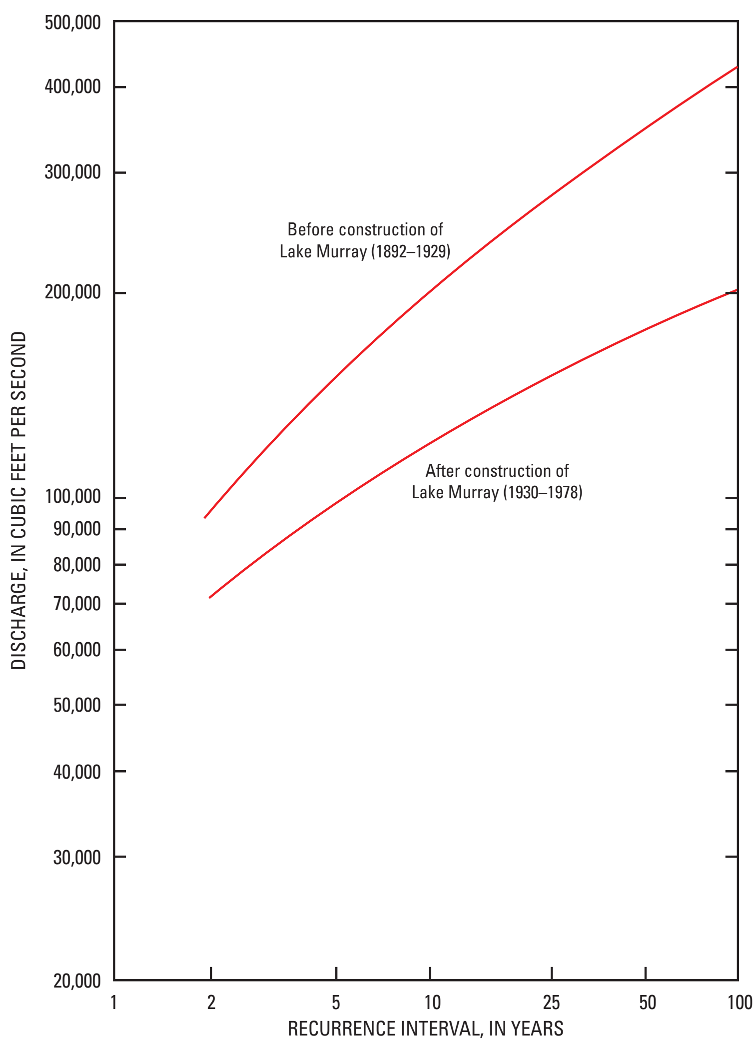


Figure 13. Flood frequency for the Congaree River Columbia streamgaging station (station 02169500; from Patterson and others, 1985).

entire 450-year period. This example highlights how a water-resources assessment made from a relatively short period of record that is, by chance, collected during an unusually wet or dry period could significantly skew the more long-term reality of what might be expected to occur.

From long-term streamgaging information and historical documents, the latter part of the 1800s and early part of the 1900s was a period in which many significant floods occurred in and around South Carolina. The peak-flow record at Congaree River Columbia shows that the five largest floods (in order of decreasing magnitude) occurred in 1908, 1928, 1929, 1916, and 1912 (fig. 14). The peak-flow record from historical documents also includes the gage height for a major flood in 1852. The 1908 flood has been noted as being the most extensive flood in South Carolina with all major rivers in the State rising from 9 to 22 ft above flood stage (Paulson and others, 1991). The peak-flow record at the Savannah River at Augusta, GA, streamgaging station includes continuous peak-flow data since 1876. Prior to that, local residents marked the crest of large floods, which local newspapers also reported (Hess and Stamey, 1993). The USGS peak-flow record for Savannah River at Augusta further validates this was a particularly wet period in the late 1800s and early 1900s with the largest four floods occurring in October 1929, September 1929, 1908, and 1888. The October 1929 flood is the largest recorded since 1796.

Most long-term streamgages in and around South Carolina are located on streams that are now regulated. This is the case with both the Congaree River and Savannah River gages mentioned in the previous paragraph. For comparison purposes, the USGS streamflow database was reviewed to find unregulated streamflow gages in and around South Carolina that also had long-term records similar to that at Congaree River Columbia. Such records would help determine how the wet period of the late 1800s and early 1900s relates to the subsequent record at a long-term, unregulated site. Along with the stations in the lower part of the Broad River in South Carolina, an unregulated gage with long-term record in the

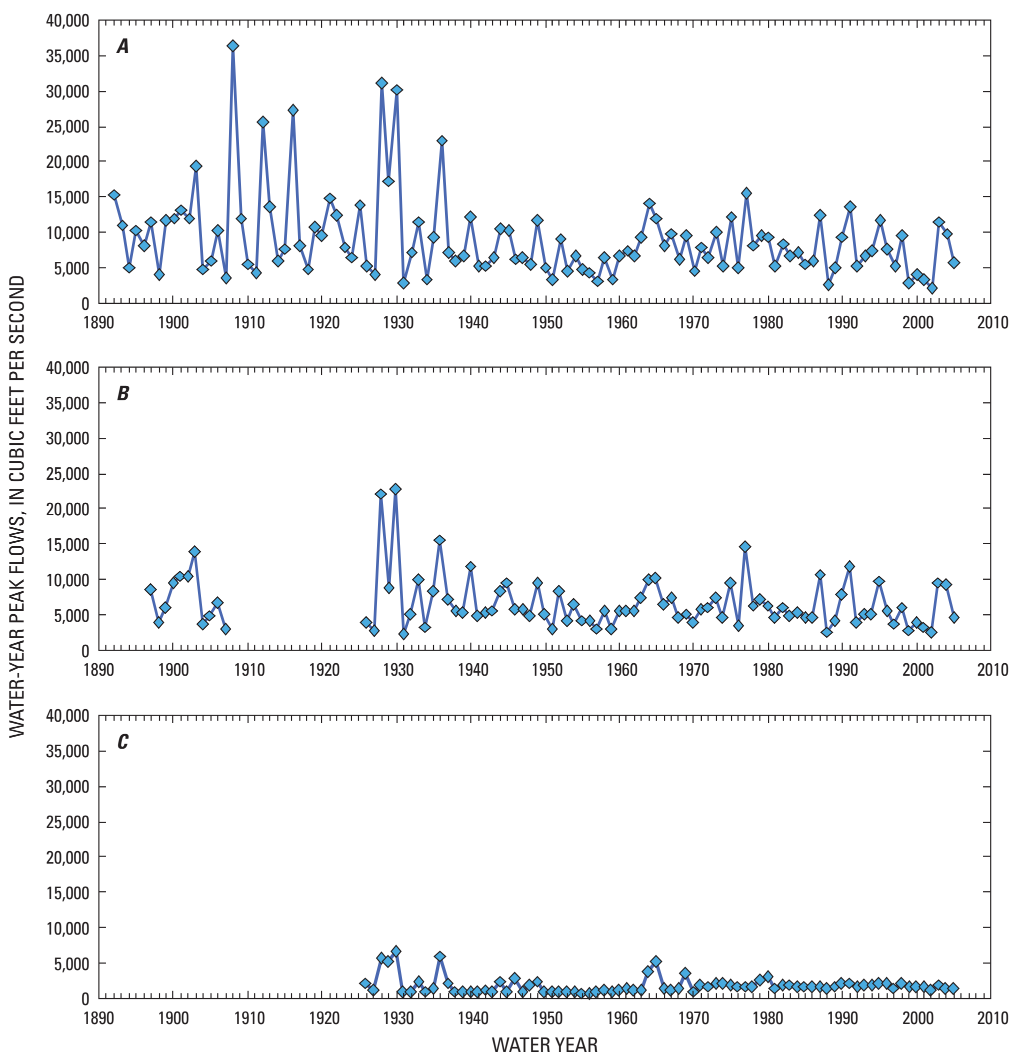


Figure 14. Maximum water-year peak flows for the period of record at the *(A)* Congaree River Columbia, *(B)* Broad River Richtex, and *(C)* Saluda River Columbia streamgaging stations.

Piedmont of Georgia also was determined to be useful for making such an assessment. Both of the Broad River basins are located primarily in the Piedmont Physiographic Province. The USGS has been collecting streamflow data at Broad River Carlton since 1913 (fig. 15). The National Weather Service provided peak-flow records from 1897 to 1913.

An analysis of the peak-flow data at Broad River Richtex and Broad River Carlton was made using historical streamflow data and similar periods of record as those collected on the Congaree River both prior to and after construction of the Saluda Dam. As previously mentioned, peak flows are defined as the highest instantaneous flow for an independent event at a streamflow gage in a given water year. For the historical review and analysis of streamflow in the Saluda, Broad (Georgia and South Carolina), and Congaree River basins, data from the following USGS streamgaging stations were used: Saluda River Columbia, Broad River Alston, Broad River Richtex, Congaree River Columbia, and Broad River Carlton (fig. 2; table 1). Analyses indicate that the difference in the recurrence-interval flows at Congaree River Columbia computed using streamflow data collected before and after the construction of the Saluda Dam (fig. 13) may have more to do with varying climatic conditions than regulation of the Saluda River.

A comparison of the water-year maximum peak flows for Congaree River Columbia, Saluda River Columbia, and Broad River Alston shows that the Congaree River peak flows are highly correlated to the Broad River Richtex peak flows (fig. 14). As previously stated, the peak flows at Saluda River Columbia measured after water year 1930 reflect regulated conditions on the Saluda River (South Carolina Water Resources Commission, 1983). As can be seen in figure 14, the three largest peaks at Congaree River Columbia occurred in water years 1908, 1928, and 1930, respectively. The next three largest floods occurred in water years 1916, 1912, and 1936, respectively. Given that regulation tends to reduce the large peaks on a river, one might conclude that the completion of the Saluda Dam in 1930 is the main reason why only one major flood (1936) has occurred at Congaree River Columbia since that time. Unfortunately, the Broad River streamgaging station in South Carolina (Broad River Alston and Broad River Richtex) was inactive from water years 1908 to 1925. Nonetheless, it is reasonable to assume based on the strong graphical correlation between Congaree River Columbia and Broad River Richtex that there were also major floods on the Broad River in 1908, 1912, and 1916. As previously mentioned, the 1908 flood was noted as the most extensive flood of record in South Carolina (Paulson and others, 1991).

Broad River Carlton is on an unregulated stream in the Savannah River basin, has a drainage basin of 760 mi^2, and is completely located in the Piedmont Province of Georgia (fig. 2). The streamgaging station is located in Madison County, GA, which is approximately due west of Columbia, SC. Noted as being the largest flood at that site since 1888, the largest flood of record occurred on August 25, 1908. The next two largest floods occurred in water years 1902 and 1912,

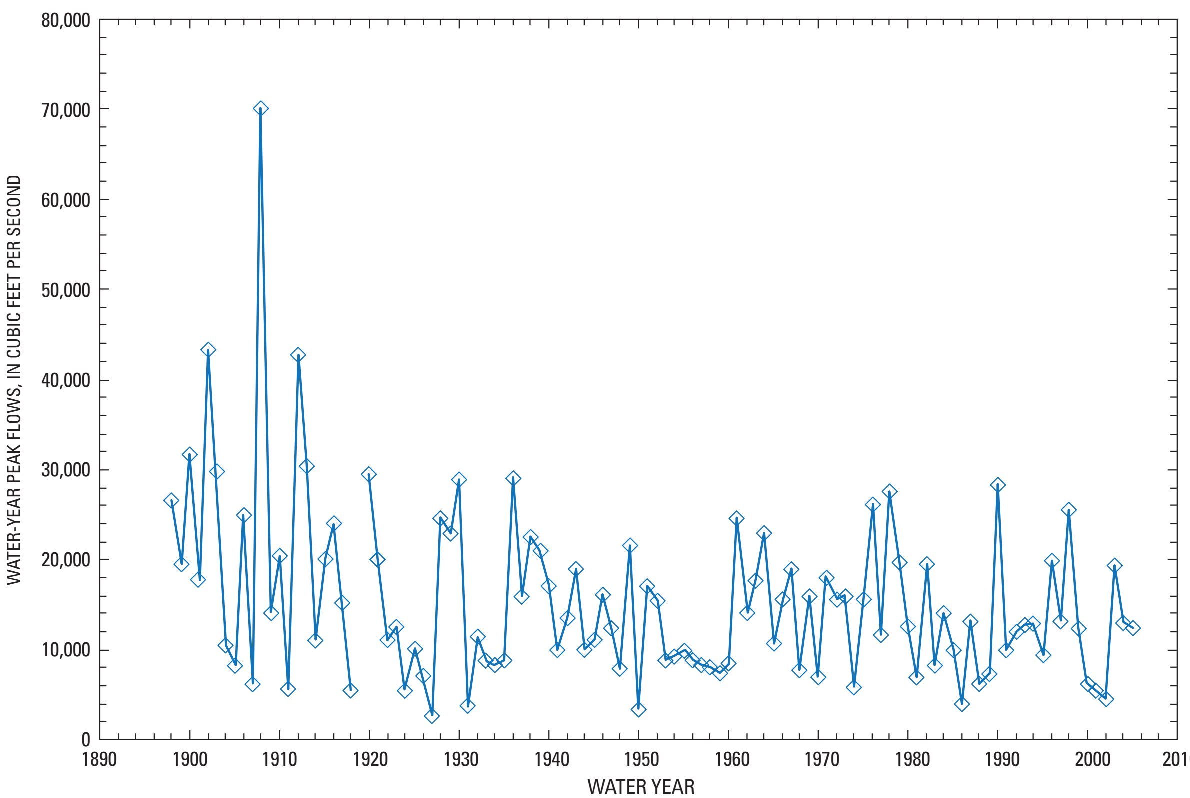


Figure 15. Maximum water-year peak flow for the period of record (1897–2005) at the Broad River Carlton streamgaging station.

respectively. At Congaree River Columbia and Broad River Carlton, there are 107 years in which both streamgages were operated concurrently. Of those 107 years, there were 47 years in which the peaks occurred within plus or minus 8 days of each other. Another 16 peaks occurred within 1 month of each other indicating similar climatic characteristics between the two basins and giving additional validity for comparing the two stations.

For comparison purposes, a Pearson Type III distribution with log transformation of the peak flows (log-Pearson Type III) was used to compute flood-frequency statistics for Congaree River Columbia, Broad River Richtex, and Broad River Carlton (Hydrology Subcommittee of the Interagency Advisory Committee on Water Data, 1982). Two periods were analyzed for each station: (1) beginning of record to 1930 and (2) 1931 to 2005. The breakpoint of 1930 was chosen to perform a similar analysis as was done by Whetstone (1982) on peak-flow data collected before and after the construction of the Saluda Dam. Results from the analyses are shown in figure 16. It should be noted that typically the recurrence-interval scale is plotted using a probability scale but is being shown here using a logarithmic scale.

The percentage differences in the 100-year recurrence interval flows for the two periods for Congaree River Columbia, Broad River Richtex, and Broad River Carlton were 151, 133, and 112 percent, respectively (fig. 16; table 4). With respect to estimating the magnitude and frequency of floods at a streamgaging station, these graphs and the percentage differences highlight the importance of record length and the influence of large floods when doing a log-Pearson Type III analysis. The comparisons also support the conclusion that the significant differences between the pre-and post-regulation recurrence-interval flows as noted in Whetstone's (1982) report are more related to climatic variability than to regulation of the Saluda River.

Regression Analysis Using Historical Peak-Flow Data

To quantify how regulation on the Saluda River has affected peak flows on the Congaree River, regression techniques were used to develop pre- and post-regulation relations between the peak flows at Congaree River Columbia and Broad River Richtex. Because of the uncertainty that construction of the Saluda Dam may have had on the water year 1929 and 1930 peaks, those data from the Broad and Congaree Rivers were excluded from the analysis. For the period from 1897 to 1928, which defines the relation between the peak flows on the Congaree and Broad Rivers as they were prior to regulation on the Saluda River, there were 14 years for which peak flows were measured concurrently at both the Congaree River Columbia and Broad River Richtex. After review of the peak-flow data, the water year 1899 peaks were excluded from the regression because of uncertainty in the Broad River value. A record-extension regression method called Maintenance of Variance Extension (MOVE) was used to extend the peak-flow record from the short unregulated period (1897–1928) at Congaree River Columbia based on the longer unregulated period (1897–2005) at Broad River Richtex (Hirsch, 1982). Hirsch (1982) compared four record-extension methods and found that the MOVE.2 regression technique was the most effective in terms of producing a time series with properties (such as variance and extreme order statistics) most like those of the records they are intended to represent. The MOVE.2

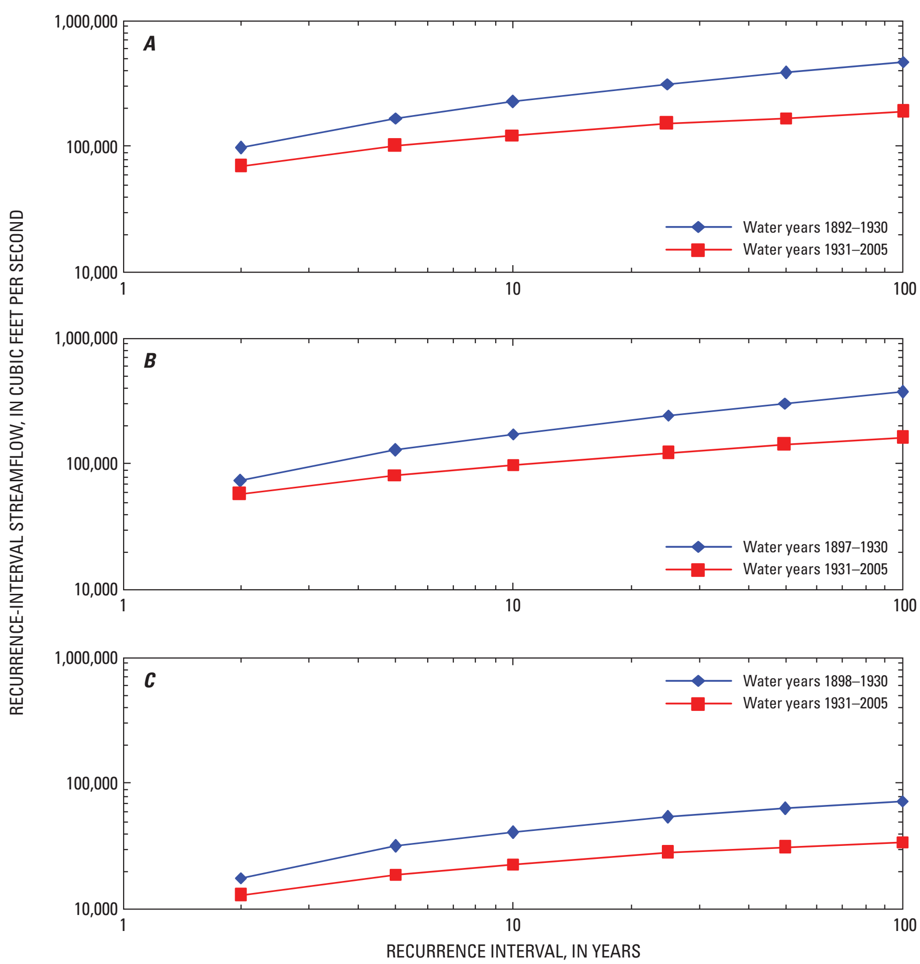


Figure 16. Recurrence-interval streamflows for two periods at the *(A)* Congaree River Columbia, *(B)* Broad River Richtex, and *(C)* Broad River Carlton streamgaging stations.

Table 4. Recurrence-interval flows computed for two periods at the Congaree River Columbia, Broad River Richtex, and Broad River Carlton streamgaging stations.

[ft^3/s, cubic feet per second]

Recurrence interval, in years	Congaree River Columbia			Broad River Richtex (South Carolina)			Broad River Carlton (Georgia)		
	Recurrence-interval flow (ft^3/s) (1892–1930)	Recurrence-interval flow (ft^3/s) (1931–2005)	Percent difference	Recurrence-interval flow (ft^3/s) (1897–1930)	Recurrence-interval flow (ft^3/s) (1931–2005)	Percent difference	Recurrence-interval flow (ft^3/s) (1898–1930)	Recurrence-interval flow (ft^3/s) (1931–2005)	Percent difference
2	97,400	68,400	42.4	70,500	58,100	27.4	17,000	12,300	38.2
10	224,000	122,000	83.6	170,000	100,000	75.0	39,600	22,000	80.0
50	386,000	167,000	131	305,000	142,000	115	61,000	29,800	105
100	470,000	187,000	151	379,000	161,000	133	70,100	33,000	112

regression method was used to estimate peak flows for water years 1931–2005 at Congaree River Columbia based on the relation between stations Broad River Richtex and Congaree River Columbia as it existed prior to regulation (1897–1928). The correlation coefficient between the measured unregulated peaks at the two stations is 0.98, indicating a very strong relation between the peak flows for the unregulated period (fig. 17).

Peak flows for water years 1931–2005 were estimated at Congaree River Columbia using the regression relation shown in figure 17 and the measured peak flows at the Broad River Richtex streamgaging station. The estimated peaks, therefore, represent conditions as they would have existed at Congaree River Columbia for unregulated conditions on the Saluda River. The frequency distribution for the "unregulated" condition at Congaree River Columbia was determined from a log-Pearson Type III analysis using the estimated peaks for the Congaree River streamgage and was compared with results from a similar analysis using the measured peaks (fig. 18).

As shown in figure 18, the magnitude and frequency of floods have been affected by regulation of the Saluda River but not to the extent implied in Patterson and others (1985; figs. 13 and 18; table 4). For the 2-year to 100-year recurrence-interval flows, the percentage differences between the measured peak flows (regulated) and the estimated peak flows (unregulated) at Congaree River Columbia for water years 1931–2005

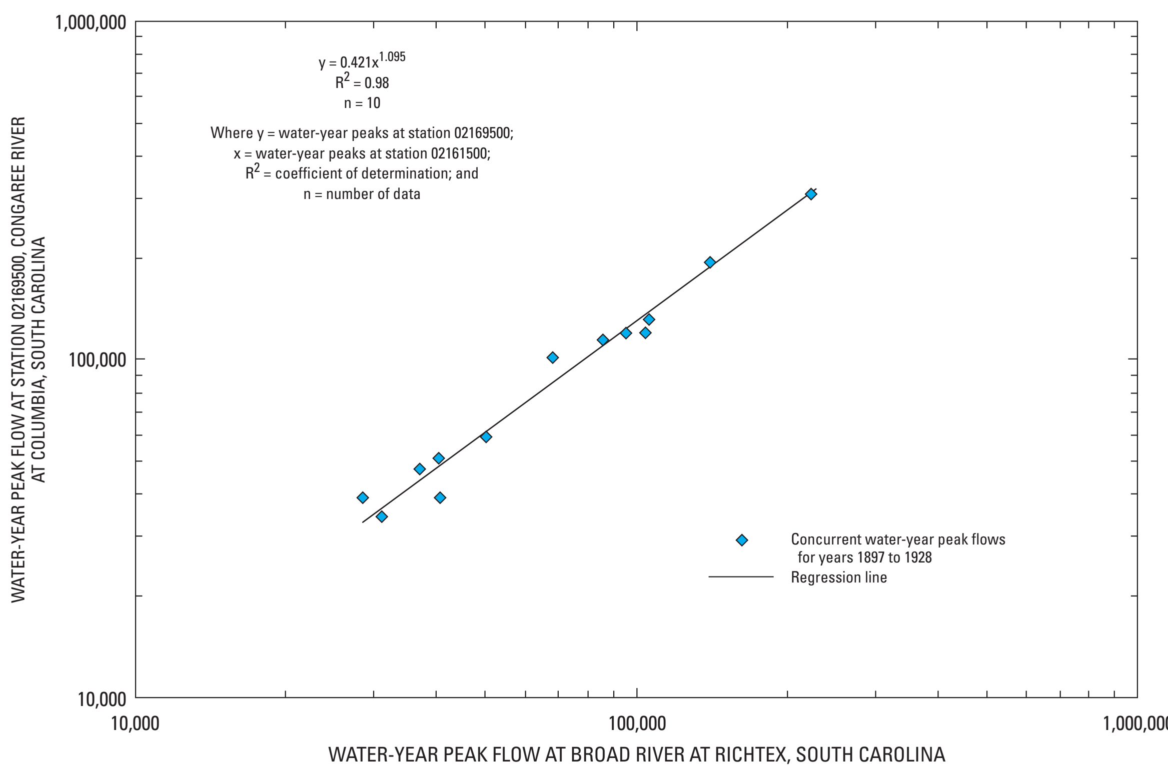


Figure 17. Regression relation between concurrent peak flows for water years 1897–1928 at the Congaree River Columbia and Broad River Richtex streamgaging stations.

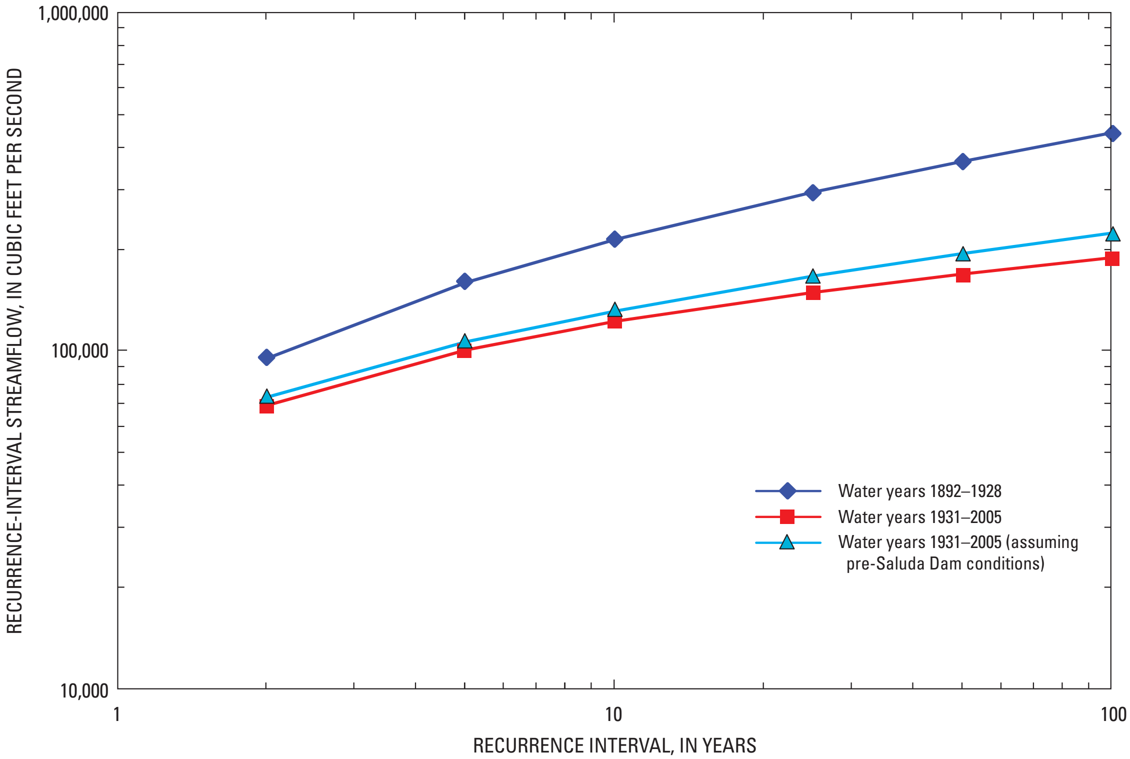


Figure 18. Recurrence-interval streamflows at the Congaree River Columbia streamgaging station computed using measured peak-flow data for water years 1892–1930 (unregulated) and 1931–2005, and using simulated peak-flow data for water years 1931–2005 assuming pre-Saluda Dam conditions (simulated unregulated).

ranged from 6.1 to 17.6 percent (table 5), respectively. These percentage differences are comparable to the standard error of prediction for the regression equation used to estimate the unregulated peak flows at Congaree River Columbia for the period from 1931 to 2005. Thus, the analysis indicates that the Saluda Dam has caused about an 18- percent decrease in the magnitude of the 100-year recurrence-interval flood estimate at Congaree River Columbia. Consequently, the more significant decrease in the 100-year recurrence-interval flood estimate based on peak-flow data from before the construction of the Saluda Dam as compared to the flood estimate after the construction of the Saluda Dam appears to be related to climate variability. These conclusions are supported by comparisons discussed in the previous section (fig. 16; table 4) from flood estimates using similar periods at Broad River Richtex and Broad River Carlton. Those comparisons show

Table 5. Recurrence-interval flows at Congaree River Columbia for measured and estimated peak flows.

[ft^3/s, cubic feet per second]

Recurrence interval, in years	Recurrence-interval flows from measured, unregulated peak-flow data for water years 1892–1928 (ft^3/s)	Recurrence-interval flows from measured, regulated peak-flow data for water years 1931–2005 (ft^3/s)	Recurrence-interval flows from estimated, unregulated peak-flow data from water years 1931–2005 (ft^3/s)	Percent difference in recurrence-interval flows from the measured, regulated peak-flow data and estimated, unregulated peak-flow data
2	94,600	68,400	72,600	6.1
5	159,000	100,000	106,000	6.0
10	212,000	122,000	131,000	7.4
25	291,000	148,000	165,000	11.5
50	360,000	167,000	192,000	15.0
100	436,000	187,000	220,000	17.6

that similar differences can be attributed to the major floods that occurred in the early 1900s, the magnitudes of which have not been experienced in these basins in the last seven to eight decades.

As part of an investigation by Koman (2003) of the hydrologic effect of dams on the Saluda River, the issue of regional climate variability was addressed. Koman (2003) analyzed monthly rainfall data from two precipitation gages in the study area—Little Mountain and Laurens, South Carolina (fig. 2). The analysis was based on precipitation data from 1926 to 2001. A precipitation anomaly value was computed for each month and then analyzed by year. The results showed that no significant change in the precipitation volumes had occurred since 1926. The results may have been different had precipitation data for several decades prior to 1926 been included.

A detailed analysis of climate variability was beyond the scope of this investigation. However, a cursory review was made of precipitation data from the U.S. Historical Climatology Network for several gages in or around the study area. The gages reviewed were Little Mountain, Winnsboro, and Blackville, South Carolina (fig. 2). The period of record available for each gage was 1893–2005, 1887–2005, and 1892–2005, respectively. A graphical review of the maximum monthly precipitation by year was made. For all three gages, it appears that the period before 1930 showed overall higher maximum monthly precipitation values than the period after 1930 (fig. 19). In addition, a simple linear regression through the data shows a distinct downward trend for the Winnsboro and Blackville stations and a slight downward trend at the Little Mountain station. If the Little Mountain data are analyzed for the period from 1893 to 1930, however, there is a distinct upward trend (fig. 20).

In August 2001, the Federal Emergency Management Agency (FEMA) issued letters of final determination for the Congaree River flood hazard study (Federal Emergency Management Agency, 2001). For that study, the 100-year recurrence-interval flood estimate was determined using data through 1998. Statistical techniques were used to estimate "regulated" peak flows for the unregulated period on the

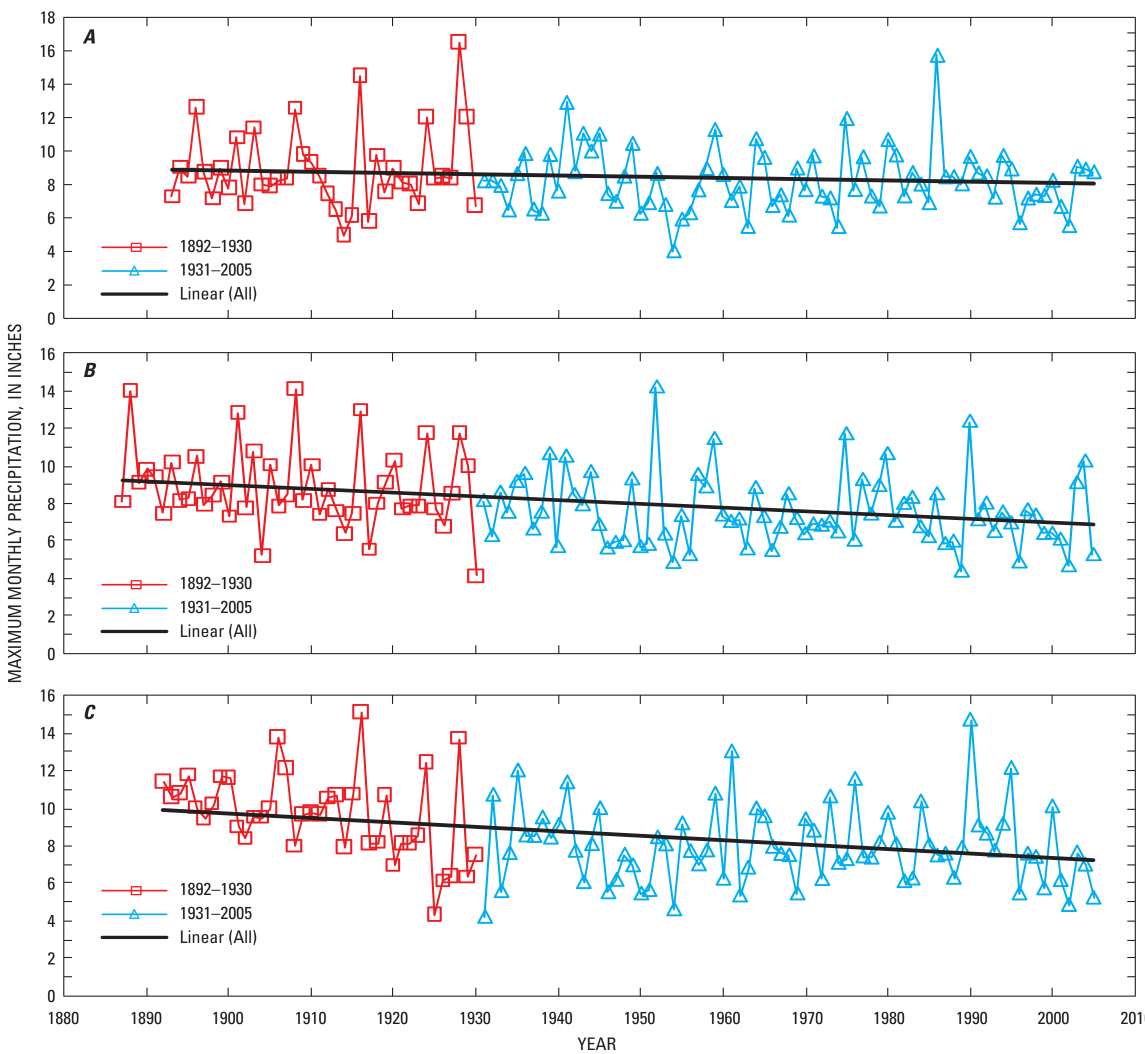


Figure 19. Maximum monthly precipitation by year at *(A)* Little Mountain, *(B)* Winnsboro, and *(C)* Blackville, South Carolina.

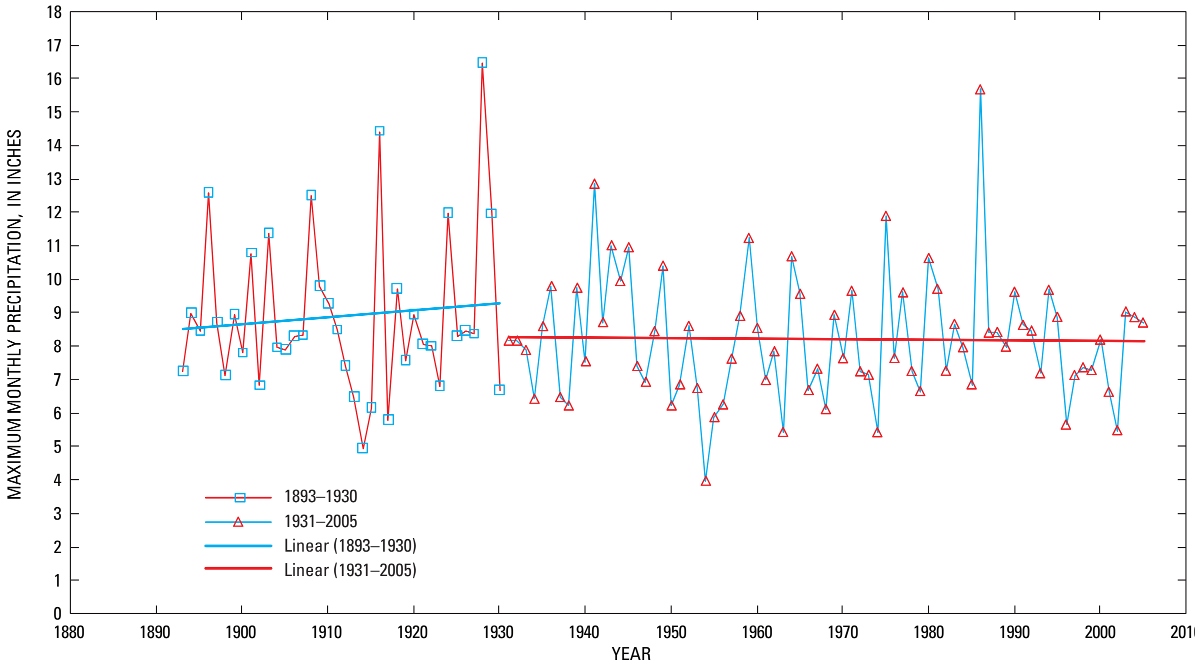


Figure 20. Maximum monthly precipitation at Little Mountain, South Carolina.

Congaree River. Those estimated regulated peaks were combined with the measured regulated peaks to form a regulated period of record for 1892–1998. The 100-year flood estimate using those data was determined to be 292,000 ft^3/s. For comparison purposes, the unregulated data from 1892 to1929 were combined with the unregulated regression estimates of peak flows for the period from 1931 to 2005, and a log-Pearson Type III analysis was done to estimate the 100-year recurrence-interval flood for "unregulated" conditions. That 100-year flood estimate was 315,000 ft^3/s, a 7.9-percent increase from the regulated 100-year flood estimate documented in the FEMA study. These differences are well within the 95-percent confidence limits of the estimates and also are within the uncertainty of the statistical analyses used in the estimations of the regulated and unregulated peak flows. Once again, this indicates that regulation of the Saluda River has not significantly altered the magnitude of the largest floods on the Congaree River.

Analysis of Surface-Water Daily Gage Heights

To evaluate the effect of the controlled releases on the Congaree River stage in the vicinity of the CNP, data-mining techniques, including ANN models, were applied to the long-term hydrologic database. Artificial neural network based models have been successfully developed for complex estuarine systems along the Georgia and South Carolina coast (Roehl and others, 2000; Conrads and others, 2002, 2003, 2006). The type of ANN model used for this analysis was the multilayered perceptron described by Jensen (1994), which is a multivariate, nonlinear regression method based on machine learning. A brief description of ANN models can be found in Appendix 2.

The simulation of 75 years of "with-dam" and "without-dam" conditions were developed using a series of two cascading models in which the output from one model is used as input to a subsequent model (fig. 21). The first model, the without-dam model (fig. 21; table 6), simulated

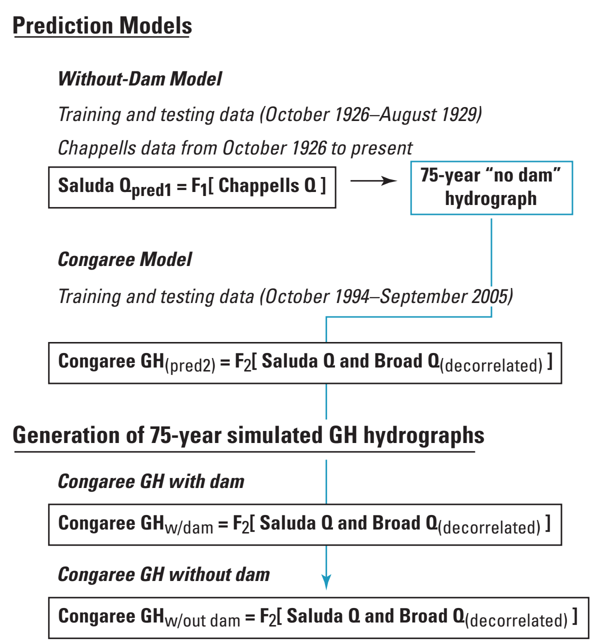


Figure 21. The without-dam streamflow model and Congaree gage-height (GH) model and the generation of the 75-year simulated hydrographs.

Table 6. Summary statistics for the surface-water models used in the study.

[HLN, hidden layer neurons; n, number of input vectors; R^2, coefficient of determination; ME, mean error; RMSE, root mean square error; PME, percent model error; ft^3/s, cubic feet per second; %, percent; ft, feet]

Model name	Output variables	Number of HLN (Appendix 2)	Range of output variable: Minimum	Range of output variable: Maximum	n	R^2	ME	RMSE	PME
Training									
WithoutDam	Flow at station 02169000	1	2,320 ft^3/s	57,100 ft^3/s	26	0.89	–158.9 ft^3/s	5,459 ft^3/s	10.0%
CongareeGH	Gage height at station 02169625	3	0.55 ft	20.84 ft	1,456	0.95	-0.23 ft	0.90 ft	4.4%
Testing									
WithoutDam	Flow at station 02169000	1	255 ft^3/s	57,100 ft^3/s	1,063	0.88	–133.5 ft^3/s	2,137 ft^3/s	3.8%
CongareeGH	Gage height at station 02169625	3	0.56 ft	21.18 ft	4,502	0.95	-0.3 ft	0.86 ft	4.2%

the Saluda River streamflows at the Saluda streamgages using the without-dam dataset from October 1926 to August 1929. Two variables were used as input to the ANN model. The first variable was the 2-day moving window average (MWA) of streamflow at Saluda River Columbia. A MWA is the average of (n) values in a data sequence. The second variable was the 3-day time difference (derivative) in streamflow at Saluda River Columbia. Time derivative variables capture the trajectory, or momentum, of the system as it moves into and out of changing hydrologic conditions. The dataset was bifurcated into training and testing datasets using a zone-average filter. The filter separates the datasets into a user-specified number of zones or boxes that determines the input vectors with the highest information content and reserves those vectors for the training dataset. Using the zone-average filter, all the data are used in the test dataset and a small selected sample of the data is used for the training dataset. For the without-dam model, 26 vectors were used to train the model, and 1,063 vectors were used to test the model.

The measured and simulated values from the model are shown in figure 22. The R^2, the mean error (ME), root mean square error (RMSE), and percent model error (PME) were computed for the training and testing datasets and are listed in table 6. Model accuracy usually is reported in terms of R^2 and is a good measure of the ability of a model to capture the overall trend of the data. The ME and RMSE statistics provide a measure of the simulation accuracy of the ANN models. The ME is a measure of the bias of model simulations—whether the model over or under simulates the measured data. The ME is presented as the adjustment to the simulated values to equal the measured values. Therefore, a negative ME indicates an over simulation by the ANN model and a positive ME indicates an under simulation by the model. Mean errors near zero may be misleading because negative and positive discrepancies in the simulations can cancel each other. RMSE addresses the limitations of ME by computing the magnitude rather than the direction (sign) of the discrepancies. The units of the ME and RMSE statistic are the same as the simulated variable of the model. The PME was computed by dividing the RMSE by the range of the measured data. The model statistics for the without-dam model evaluated with the testing dataset show that the model explains 88 percent of the variability of the streamflow (R^2 = 0.88) and the model over simulates the measured values by an average of 133.5 ft^3/s. The magnitude of the model error over the range of the measured data, as seen in the RMSE, is 2,137 ft^3/s for a PME of 3.8 percent (table 6).

Model performance also can be evaluated by plotting the cumulative frequencies of the measured and simulated values. The ability of the without-dam model to capture frequency distribution of the measured data is shown in figure 23. The largest discrepancy in the model is the frequencies of streamflows of 3,000 ft^3/s. The data for the period indicate that these streamflows occur 71 percent of the time, and the model simulates these streamflows 64 percent of the time (fig. 23).

The second model, the Congaree gage height model (fig. 21), simulates the gage height for the Congaree CNP using streamflow inputs from the Saluda and Broad River streamgages (figs. 2, 21). The streamflow data at the two gages have similar response to regional meteorological conditions. To develop a representative empirical model, it is necessary to determine the optimal time delays of input variables, or explanatory variables, on a response variable. For the Saluda and Broad River streamflow inputs, it was determined that a 1-day delay (or lag) and a 3-day moving window average was the optimum signal transformation for the highest correlation for both streamflow inputs to the Congaree River gage height. These transformations were applied to the Saluda River and Broad River streamflow data, and the resulting time series were summed for input to the model.

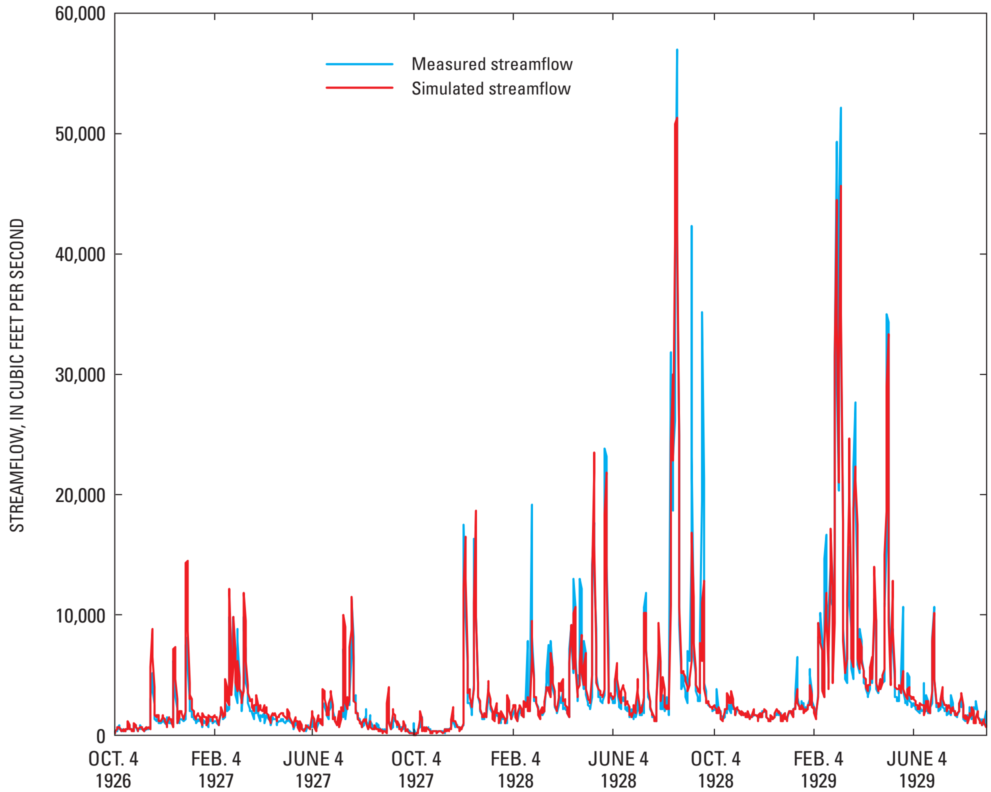


Figure 22. Measured and simmulated streamflow at Saluda River Columbia for October 1926 to August 1929.

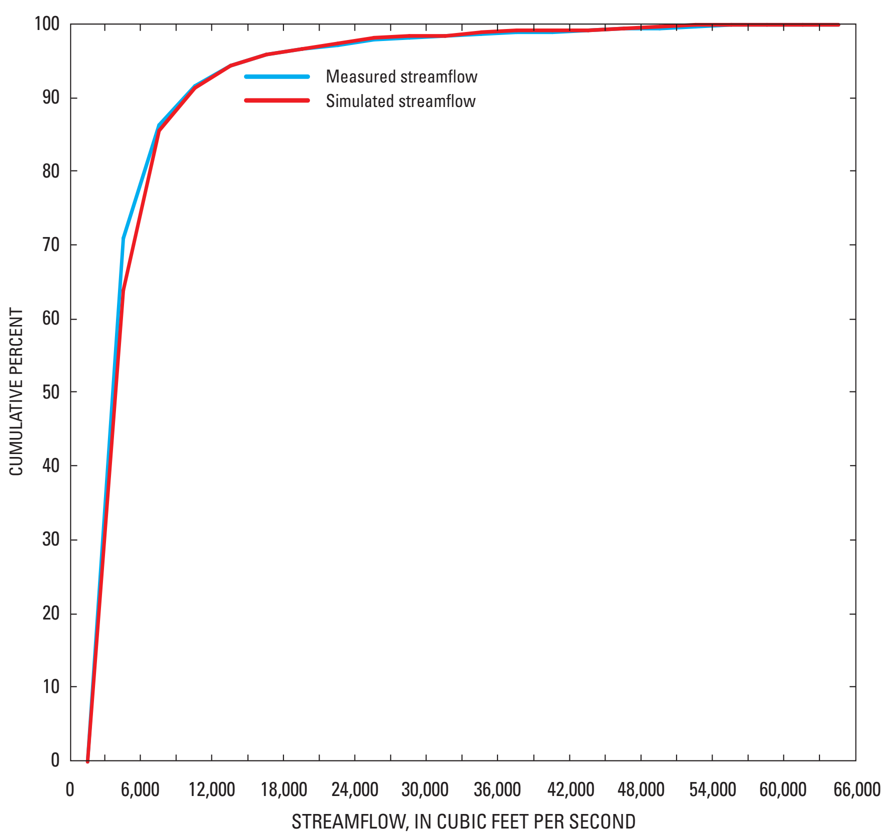


Figure 23. Measured and simulated cumulative frequency of streamflow at Saluda River Columbia for October 1926 to August 1929.

The dataset for the Congaree gage height model was randomly bifurcated into training and testing datasets. Approximately 25 percent of the data (1,456 vectors) was used to train the ANN model, and 75 percent of the data (4,502 vectors) was used to test the model. The Congaree gage height model captures the overall trend of measured data, as indicated in figure 24, but is unable to simulate the extremes of the range of gage heights, especially the low gage heights. The frequency distributions of the measured and simulated data show that the model predictions generally follow the same distribution of gage heights as the measured data but with a small over prediction (fig. 25). The inability of the model to simulate the extreme low gage heights can be seen in the frequency distribution curves where the simulated curve diverges from the measured curve around a gage height of 2.0 ft. Overall, the Congaree gage height model has a percent model error of 4.2 percent (table 6).

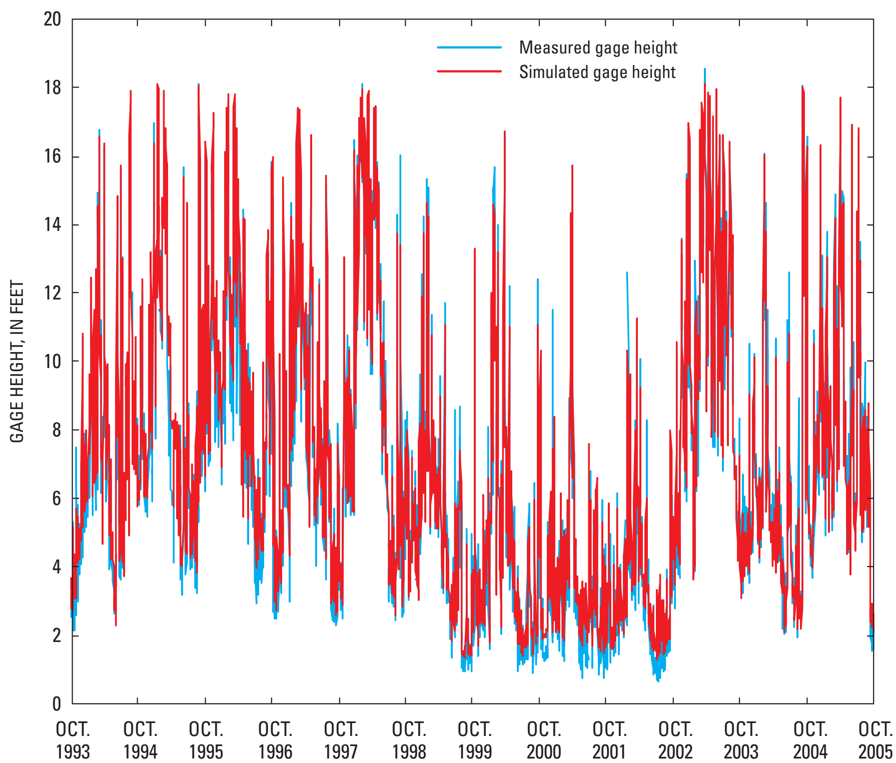


Figure 24. Measured and simulated gage height at Congaree River Congaree National Park for October 1993 to October 2005.

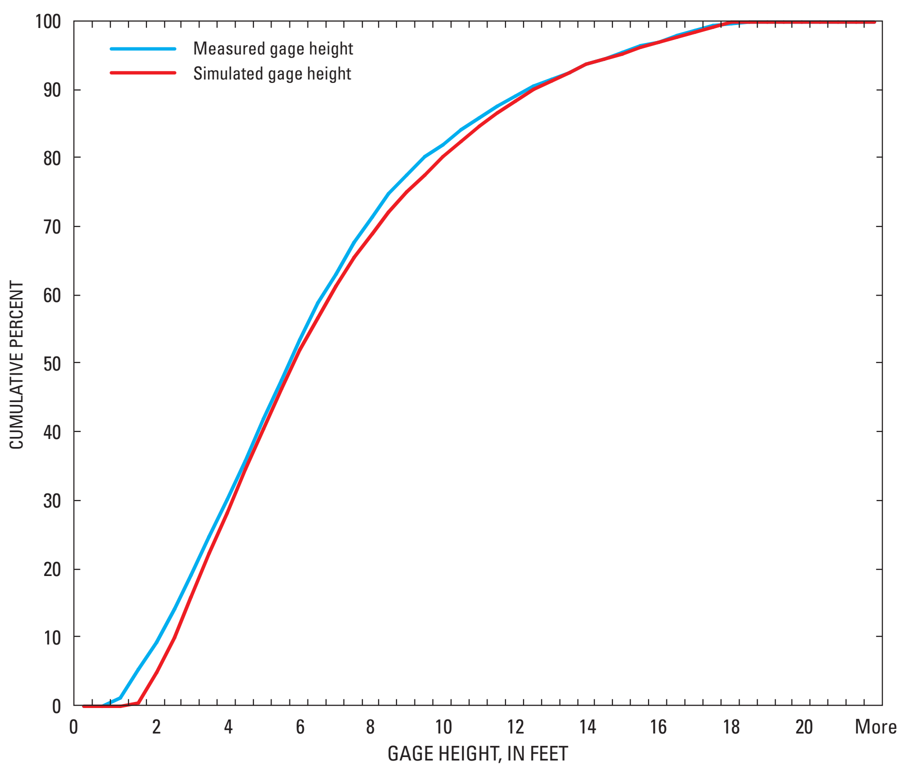


Figure 25. Measured and simulated cumulative frequency of gage height at Congaree River Congaree National Park for October 1983 to September 1989 and May 1993 to September 2005.

Long-Term Daily Gage-Height Model Results and Analysis

The models were used to evaluate the effect of the operation of the Saluda Dam on the surface-water gage heights at the CNP. Two 75-year gage-height hydrographs were generated using the measured Saluda River streamflow data (Saluda River Chappells) and a simulated hydrograph of the Saluda River streamflow data using the without-dam model scenario (fig. 21). The simulated hydrographs were compared for changes in the timing and duration of gage heights at the CNP. Regulated streamflows from hydroelectric plant operations typically modulate both the peak flows and sustained flows to meet electric power demand. The timing and peak flows of the simulated without-dam hydrograph for the Saluda River show similar behavior to the unregulated streamflows of the Broad River as indicated in a short period of the 75-year hydrograph shown in figure 26. It should be noted that the simulated without-dam hydrograph is not completely unregulated because of the regulated streamflows from the operation of the Lake Greenwood Dam.

The frequency distribution curves of the two 75-year hydrographs show the general, or overall, effect of the dam. In general, the dam has increased low to medium daily gage heights and decreased medium to high daily gage heights. Without the dam, the occurrence of low to medium daily gage heights increased and the occurrence of medium to high daily gage heights decreased (fig. 27). The two frequency curves cross at a gage height of 8.5 ft. Below this gage height, the without-dam curve shows higher percent of occurrences than the with-dam frequency curve. For example, gage heights of 5 ft occurred more frequently without the dam approximately 28.3 percent of the time or less, whereas with the dam, gage heights of 5 ft occurred approximately 23.6 percent of the time. Alternatively, 25 percent of the time or less, gage heights without the dam were approximately 5.0 ft as compared to approximately 5.5 ft with the dam. Above a gage height of 8.5 ft, the with-dam frequency curve shows a higher occurrence of gage heights. For example, 85 percent of the time or less, gages heights without the dam were approximately 13.0 ft as compared to approximately 12.3 ft with the dam.

Duration hydrographs showing the distribution of daily percentile gage heights were generated to evaluate and summarize the effect of the dam on a temporal scale (fig. 28). The gage-height duration hydrograph 5th, 50th, and 95th percentile for the with-dam and without-dam simulated data are shown in figure 28. For the 5th and 50th percentile duration hydrographs (low and medium gage heights), the dam has the effect of decreasing gage heights in the first half of the year and increasing gage heights in the second half of the year. For the 50th percentile, the decrease in gage heights can be as great as 2.17 ft (April 4) or increase gage height as much as 2.45 ft (August 31). For the 95th percentile duration hydrographs (high gage heights), the effect of the dam generally lowers the gage height throughout the year.

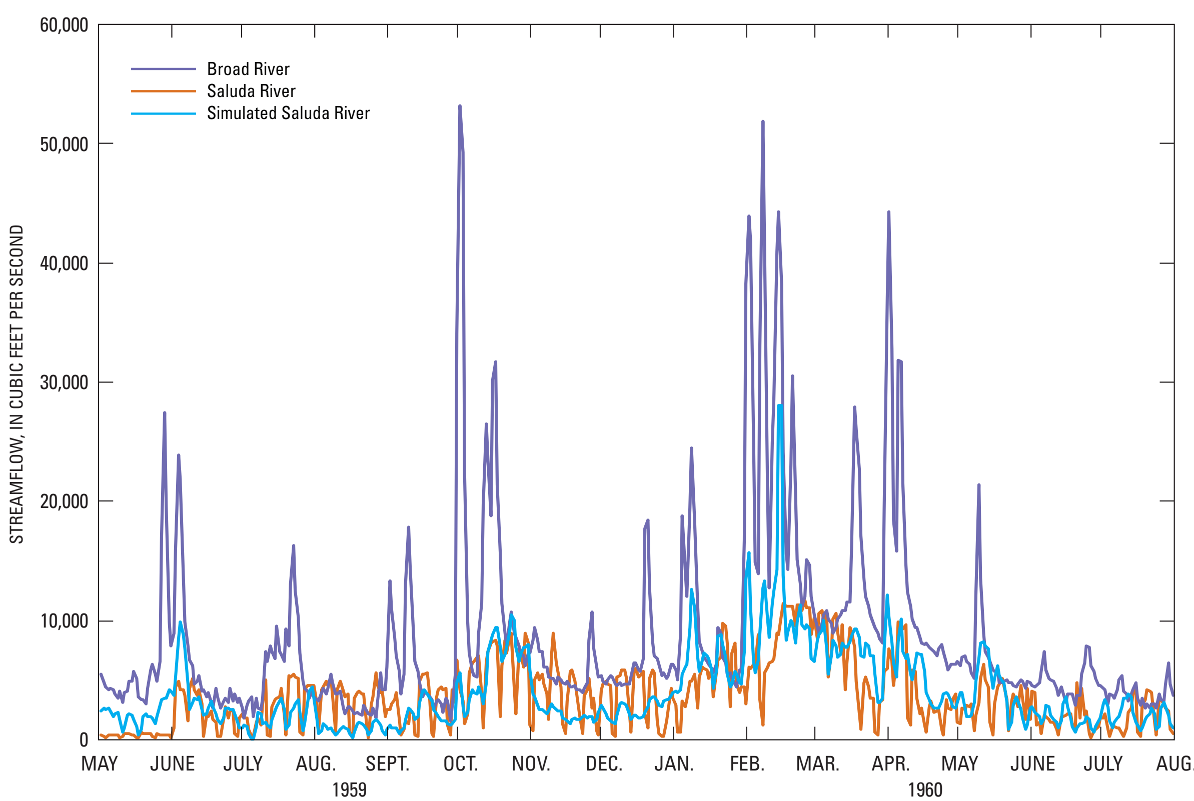


Figure 26. Measured streamflow at the Broad and Saluda Rivers and simulated streamflow for the Saluda River without the dam for May 1, 1959, to July 31, 1960.

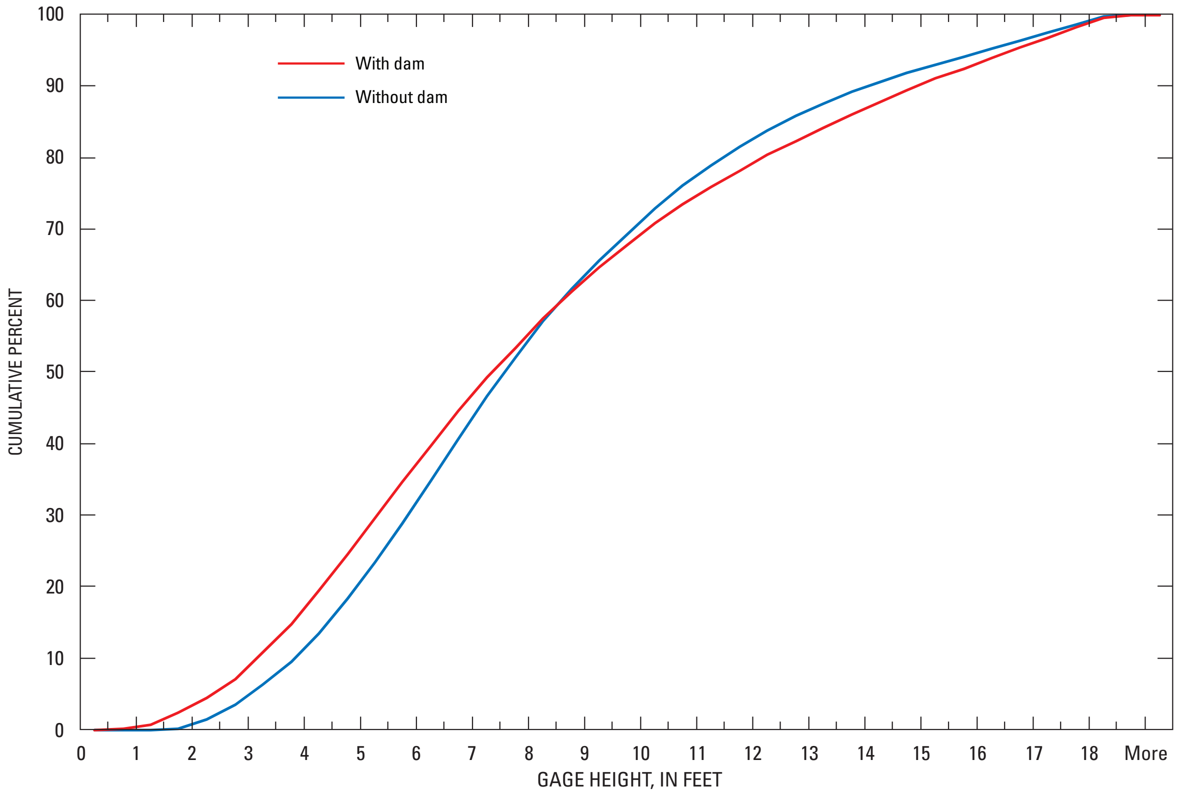


Figure 27. Frequency distribution curves for daily simulated gage heights at Congaree River Congaree National Park for October 1, 1929, to September 30, 2005.

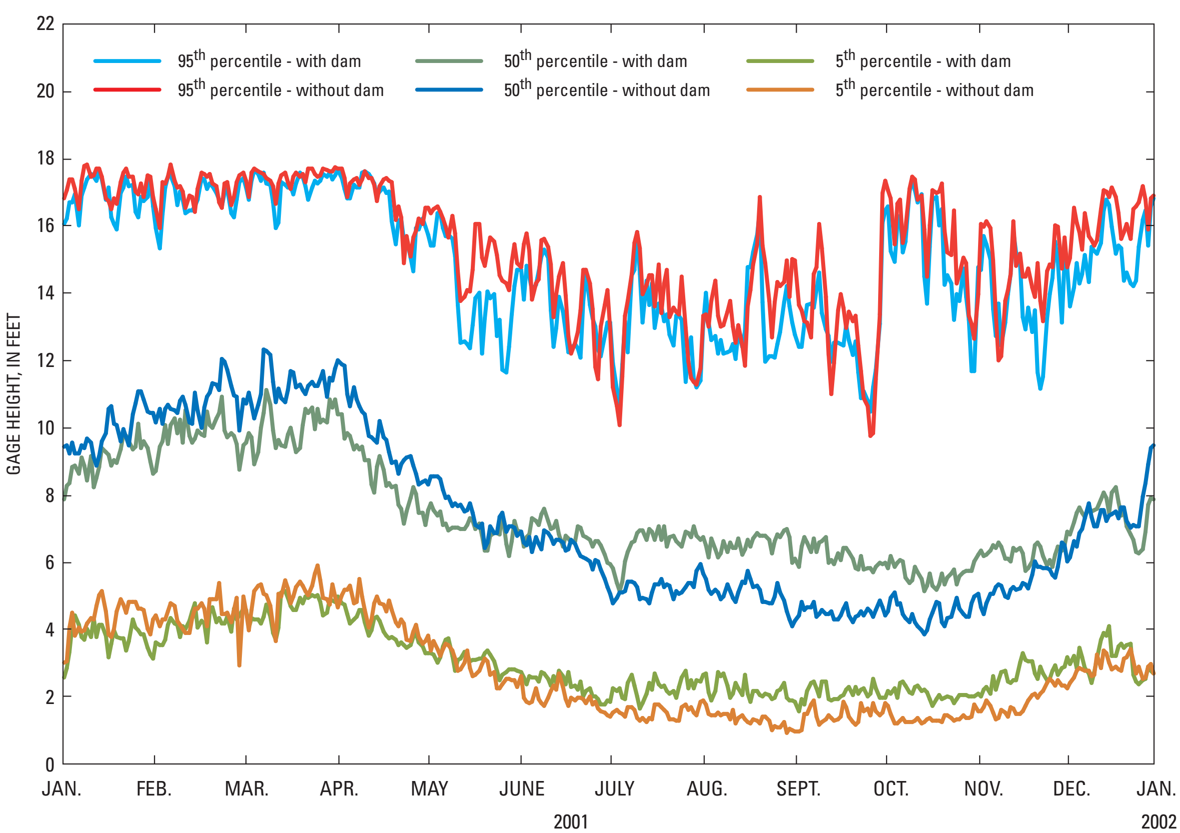


Figure 28. Daily duration hydrographs showing the 95th, 50th, and 5th percentiles for simulated gage heights with and without the dam at Congaree River Congaree National Park.

Hydroecological Indices

Differences in gage-height characteristics also can be analyzed by determining hydroecological indices of the with-dam and without-dam hydrographs. The ecological importance of streamflow characteristics and the ecological integrity of natural streamflow conditions has been researched by Richter and others (1996) and Poff and others (1997). Typically, hydroecological indices characterizing the magnitude, frequency, duration, timing, and rate of change of streamflows of pre-impoundment and post-impoundment streamflow records are computed and compared. Rather than compute the indices on the limited pre- and post-impoundment streamflow hydrographs, the simulated 75-year hydrographs were used to compute hydroecological indices using the National Hydroecological Integrity Assessment Software (Henriksen and others, 2006). Of the 171 indices computed by the software, 56 were selected to quantify the change in the magnitude, frequency, duration, and timing of the two simulated gage-height hydrographs.

The monthly minimums, means, and maximum gage heights were determined for the 75-year hydrographs, and the percentage change from the without-dam to the with-dam condition was computed to evaluate differences in temporal magnitude (table 7). Similar to the percentile plots shown in figure 28, the monthly mean values indicate that the dam decreased mean gage heights between December and May by as much as 10 percent, whereas the monthly mean gage heights with the dam increased by as much as 18.5 percent between the months of June and November. Two indices were generated that characterize the frequency of the magnitude of low- and high-flow events. The average number of events below the 25th percentile and the average number of events above the 75th percentile per year increased 26.5 and 22.6 percent, respectively, from the without-dam condition.

Table 7. Average monthly change from a without-dam condition for minimum, mean, and maximum gage heights for the 75-year simulation period.

Month	Minimum change from without-dam condition (percent)	Mean change from without-dam condition (percent)	Maximum change from without-dam condition (percent)
January	–12.7	–7.4	–3.8
February	–11.1	–7.2	–3.6
March	–11.1	–9.2	–3.1
April	–14.3	–10.0	–6.0
May	–6.2	–7.2	–7.9
June	4.4	3.8	–1.1
July	15.6	12.6	5.1
August	22.2	15.8	5.5
September	23.1	18.5	6.7
October	19.7	13.6	6.3
November	10.9	8.3	3.1
December	–0.8	–1.5	–4.3

The dam also had the effect of increasing the duration of minimum n-day gage heights and decreasing the duration of the maximum n-day gage heights (table 8). Minimum 1-, 3-, 7-, 30-, and 90-day gage heights increased from 13.9 to 23.9 percent, whereas maximum 1-, 3-, 7-, 30-, and 90-day gage heights decreased from 1.5 to 7.2 percent.

Table 8. Average change in minimum and maximum 1-, 3-, 7-, 30-, and 90-day gage height duration from a without-dam condition for the 75-year simulation period.

Duration	Minimum change from without-dam condition (percent)	Maximum change from without-dam condition (percent)
1-day	22.6	–1.5
3-day	23.1	–1.9
7-day	23.9	–3.8
30-day	21.7	–6.6
90-day	13.9	–7.2

Four indices characterize the timing of the minimum and maximum gage heights and the variability of minimum and maximum gage heights (table 9). The variability in the timing is determined from the coefficient of variation between the Julian date and value (minimum or maximum). The day of the minimum and maximum gage height changes by less than 6 days from the without-dam condition. The largest change, 12 days, occurred with the timing of the minimum variability.

Table 9. Average change in the timing of the annual minimum and maximum gage heights and minimum and maximum variability from a without-dam condition for the 75-year simulation period.

Gage heights	Julian date: With dam	Julian date: Without dam	Julian date: Absolute change, in days
Minimum	260.8	257.5	3.3
Minimum variability	49.6	37.3	12.3
Maximum	45.0	50.2	5.2
Maximum variability	62.1	65.5	3.4

Overall, the dam has had more of an effect of raising low water levels in the Congaree River than on decreasing high water levels. The operation of the dam has had more of an effect on raising water levels within the channel of the Congaree River than in decreasing the inundation of the flood plain. The raising of water levels within the channel will affect the gradient controlling the ground-water/surface-water interactions between the river channel and the flood-plain aquifer.

Analysis of Ground-Water Dynamics

Two aspects of the dynamic interaction of the Congaree River and the ground water of the CNP flood plain were investigated—the inundation of the flood plain during high-water events on the Congaree River and the effects of the regulated streamflow from the Saluda Dam on ground-water elevations of the CNP flood plain. The timing of the rising of the surface-water and ground-water elevations was examined to discern whether flooding occurred from surface water over-flowing the flood plain or from fully saturated ground water rising above the land surface. The effects of the Saluda Dam on the ground-water dynamics were analyzed using a similar approach to the daily surface-water gage height analysis using the 75-year with-dam and without-dam simulation and ANN models of selected observation wells.

Flooding

The water-level data shown in figure 12 are a snapshot in time and do not indicate the dynamics of the pathway of material during the initial inundation of floodwaters and the potential for mobilization of materials either from the river or from the flood-plain deposits. The timing of the rise of river-water levels and ground-water elevations is important for understanding the transport of constituents in the flood plain. If ground-water elevations rise prior to the riverine water, constituents in the porewater of the flood-plain deposits can be mobilized and transported to the river. If the river levels rise prior to the ground water, the river water can transport sediments and nutrients to the flood plain and potentially can recharge the local flood-plain aquifer system. During extreme low-water conditions, the aquifer system discharges to the river and during extreme high-water conditions, the flooded surface water saturates the aquifer system.

To analyze the flooding dynamics of the flood plain, water-level data for two sets of streamgages and nearby observation wells were plotted to evaluate the timing of the rising floodwaters of September 2004. One set of gages was the Congaree River CNP and the proximal wells RIC-701 and RIC-342 (figs. 1, 29*A*). The second set of gages was Cedar Creek and the nearby well RIC-346 (figs. 1, 29*B*). The wells near the Congaree River CNP all lagged the rising river stages, indicating for this area of the CNP flood plain during flooding conditions there is a net movement of river materials into the flood plain (fig. 29*A*). The lag in the rise of ground water at RIC-701 was greater than 10 hours, and the lag in the rise at RIC-342 was greater than 2 days. The hydrographs in figure 29 also show the differences in the ground-water response of the Group 1 and Group 2 wells. The receding limb of the flood hydrograph for the Group 1 well closest to the river, RIC-701, shows a similar response and approximately equal rates of recession. The rate of recession of the more interior Group 2 well, RIC-342, shows a much lower recession rate on the receding limb, indicating an extended delay in the release of ground water into the river. The hydrographs for the Cedar Creek gage and RIC-346 show that ground water typically lags the rise of the surface- water system by greater than 2 days and does not reach the magnitude of the water level of Cedar Creek (fig. 29*B*).

Development of Ground-Water Artificial Neural Network Models

To evaluate the effects of the Saluda Dam releases on the ground-water dynamics in the CNP, ANN models were developed for selected wells in each of the three classes of wells (fig. 10) from the cluster analysis described previously. The ground-water elevation response to the river water levels is attenuated as the water travels through the various flow paths in the flood plain (figs. 11, 30). To capture the dynamic response of the ground-water elevations and develop accurate models, various signals, or variables, were computed from the gage-height record, including moving window averages (MWA), lagged variables, and time derivatives and used for candidate input variables to the models. Often there is a time delay between an input variable and a response variable. Lagged variables capture these time delays by shifting the signal back in time by a specified time increment. Time-derivative variables, such as the 7-day change in gage height, or the 5-day change in 3-day MWA, captures the trajectory of the system as it moves into and out of changing hydrologic conditions. The input variables to the models are listed in table 10.

The models for the Group 1 wells (RIC-699, RIC-700, and RIC-701) responded relatively rapidly to the changing river stages. The models used two inputs, the 2- or 3-day MWA of gage height at Congaree CNP and the time derivative of the 7-day change in gage heights (table 10). The same statistics used to evaluate the surface-water ANN models were used to evaluate the ground-water ANN models (table 11). For the Group 1 models, less than 15 percent of the data was used to train the models. The remainder of the data was used to test, or evaluate, the models. The R^2 for the testing datasets was greater than 0.96, and the percent model error ranged from 3.3 to 3.6 percent (table 11). Plots of the measured and simulated daily ground-water elevations show that the models are able to capture the overall trend of the data and the dynamic variability (fig. 30). The RIC-700 model over simulates the low ground-water elevations during the summer and fall of 2004. The over simulation also can be seen in the frequency distribution plot and the small difference between the measured and simulated curves (fig. 30).

The ground-water response in the Group 2 wells (RIC-342 and RIC-703) is attenuated as compared to the Group 1 wells and this is reflected in the inputs to the ANN models. For these models, the MWA of gage height ranged from 5 to 10 days (table 10). In addition, two or three time derivatives of gage height were used to capture temporal changes in the trajectory of hydrologic conditions. For these

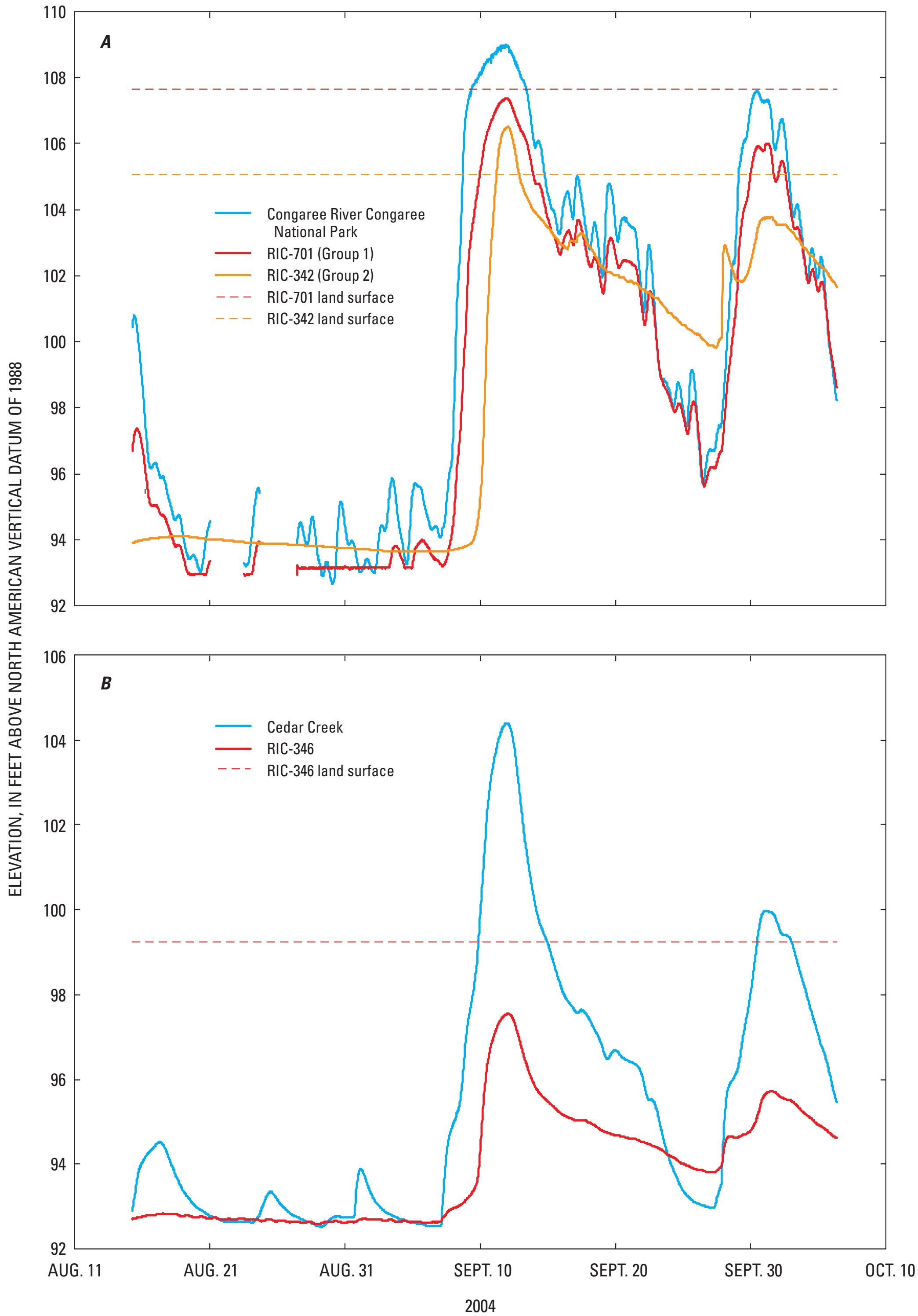


Figure 29. Water-level elevations for *(A)* Congaree River Congaree National Park and observation wells RIC-701 and RIC-342, and *(B)* Cedar Creek and observation well RIC-346 in the Congaree National Park flood plain for August 15 to October 6, 2004.

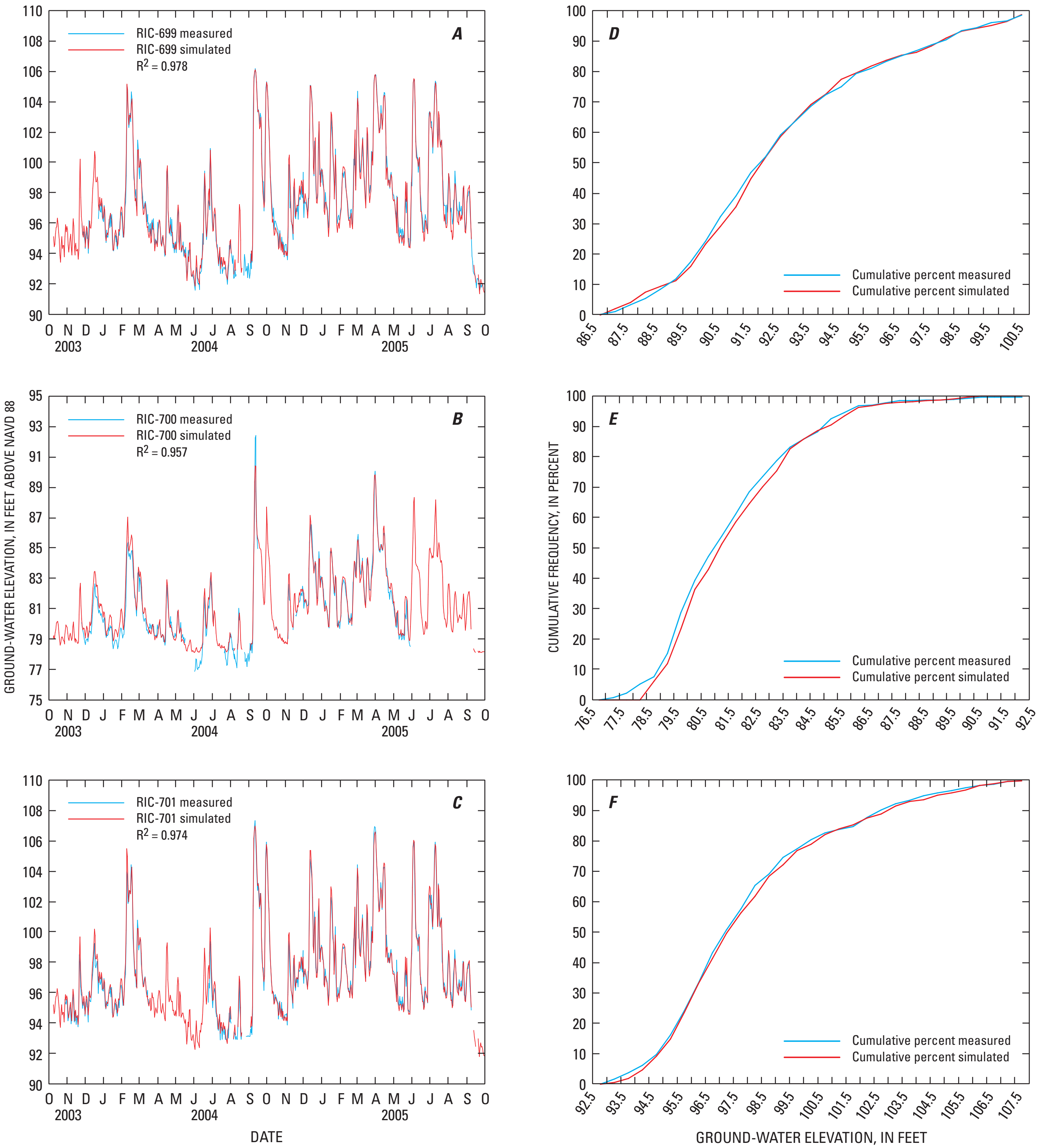


Figure 30. Measured and simulated ground-water elevations for Group 1 observtion wells *(A)* RIC-699, *(B)* RIC-700, and *(C)* RIC-701, and measured and simulated cumulative frequency distributions for observation wells *(D)* RIC-699, *(E)* RIC-700, and *(F)* RIC-701.

Table 10. Variables used in the ground-water artificial neural network models.

[MWA, moving window average]

Model	Inputs	Description
Group 1 models		
gw_699	GHA2	2-day MWA of gage height
	GHDI7	7-day change in gage height
gw_700	GHA3	3-day MWA of gage height
	GHDI7	7-day change in gage height
gw_701	GHA2	2-day MWA of gage height
	GHDI7	7-day change in gage height
Group 2 models		
gw_342	GHA10	10-day MWA of gage height
	GHA3DI5	5-day change in 3-day MWA of gage height
	GHA5DI10	10-day change in 5-day MWA of gage height
	GHA20DI15	15-day change in 20-day MWA of gage height
gw_703	GHA5	5-day MWA of gage height
	GHA20DI10	10-day change in 20-day MWA of gage height
	GHA20DI45	10-day change in 45-day MWA of gage height
	GHA3DI5	5-day change in 3-day MWA of gage height
	GHA5DI10	10-day change in 5-day MWA of gage height
Group 3 models		
gw_341	MONTH	numerical value for month of the year
	GHA38(001)	38-day MWA of gage height lagged 1-day
	GHA3DI5	5-day change in 3-day MWA of gage height
	GHA10DI5	15-day change in 10-day MWA of gage height
gw_702	MONTH	numerical value for month of the year
	GHA35	35-day MWA of gage height
	GHA3DI5	5-day change in 3-day MWA of gage height
	GHA10DI5	15-day change in 10-day MWA of gage height
	GHA3	3-day MWA of gage height
gw_704	GHA14	14-day MWA of gage height
	GHA3DI5	5-day change in 3-day MWA of gage height
	GHA20DI15	15-day change in 20-day MWA of gage height

Table 11. Summary statistics for the ground-water models used in the study.

[USGS, U.S. Geological Survey; HLN, hidden layer neurons; Min, minimum; Max, maximum; n, number of vectors; R^2, coefficient of determination; ME, mean error; SSE, sum of squares error; MSE, mean square error; RMSE, root mean square error; PME, percent model error; %, percent]

USGS well identifier	Model name	Number of HLN (fig. 19)	Range of output variable		n	R^2	Statistics				
			Min, water level	Max, water level			ME, water level	SSE, water level	MSE, water level	RMSE, water level	PME
Group 1 wells training											
RIC-699	gw_699	3	87.04	100.78	70	0.994	0.027	6.77	0.097	0.32	2.3%
RIC-700	gw_700	4	77.48	90.64	75	0.981	–0.166	12.65	0.169	0.42	3.2%
RIC-701	gw_701	3	93.09	106.97	72	0.990	–0.098	9.43	0.131	0.37	2.6%
Group 2 wells training											
RIC-342	gw_342	2	93.68	105.00	325	0.904	–0.052	195.77	0.602	0.78	6.9%
RIC-703	gw_703	3	83.51	91.27	252	0.880	0.026	51.36	0.204	0.45	5.8%
Group 3 wells training											
RIC-341	gw_341	3	95.27	104.45	256	0.868	0.040	114.21	0.446	0.67	7.3%
RIC-702	gw_702	2	86.58	98.86	282	0.828	–0.350	331.51	1.176	1.09	8.9%
RIC-704	gw_704	2	88.38	100.22	287	0.879	–0.077	285.93	0.996	1.00	8.5%
Group 1 wells testing											
RIC-699	gw_699	3	87.04	100.78	631	0.98	0.024	151.05	0.239	0.49	3.6%
RIC-700	gw_700	4	76.87	92.42	445	0.96	–0.237	118.75	0.267	0.52	3.3%
RIC-701	gw_701	3	92.94	107.38	569	0.97	–0.104	136.19	0.239	0.49	3.4%
Group 2 wells testing											
RIC-342	gw_342	2	93.71	106.53	328	0.89	–0.053	236.97	0.722	0.85	6.7%
RIC-703	gw_703	3	83.51	91.30	254	0.81	–0.038	83.68	0.329	0.58	7.4%
Group 3 wells testing											
RIC-341	gw_341	3	95.35	105.26	223	0.85	–0.00003	119.70	0.537	0.74	7.4%
RIC-702	gw_702	2	86.57	99.05	256	0.80	–0.398	332.20	1.298	1.14	9.2%
RIC-704	gw_704	2	88.46	100.60	282	0.85	–0.067	360.26	1.278	1.13	9.3%

models, approximately half the data was used to train the models and half to test, or evaluate, the models. The R^2 for the testing dataset for these models was greater than 0.81, and the PME was less than 7.4 percent (table 11). Plots of the measured and simulated daily ground-water elevations show that the models are able to capture the overall trend of the data, but models are not able to capture the dynamic variability as well as the Group 1 models (fig. 31). The cumulative frequency distribution plots show that the RIC-342 (fig. 31*C*) models simulated the overall occurrence of ground-water elevations more accurately than the RIC-703 model (fig. 31*D*).

The Group 3 wells, RIC-341, RIC-702, and RIC-704, used a MWA of gage heights that ranged from 14 and 38 days (table 10). In addition, two time derivatives of gage heights were used to capture temporal changes in the trajectory of hydrologic conditions. For two of the models (gw_341 and gw_702) an additional input variable for month of the year was used to capture some of the seasonal variability. These models had an average sensitivity to the "month" variable of approximately 5 percent. For these models, approximately half the data was used to train the models and half to test, or evaluate, the models. The R^2 for the testing datasets for these models was greater than 0.80, and the PME ranged from 7.4 to 9.3 percent (table 11). Plots of the measured and simulated daily ground-water elevations show that the models are able to capture the overall trend of the data (fig. 32), but the Group 3 models are not able to capture the dynamic variability as well as the Group 1 and Group 2 models (figs. 30, 31). The cumulative frequency distribution plots show that the models capture the overall shape of the frequency distribution of the measured data but generally under simulate the ground-water elevation occurrences for a portion of the range of ground-water elevations (fig. 32).

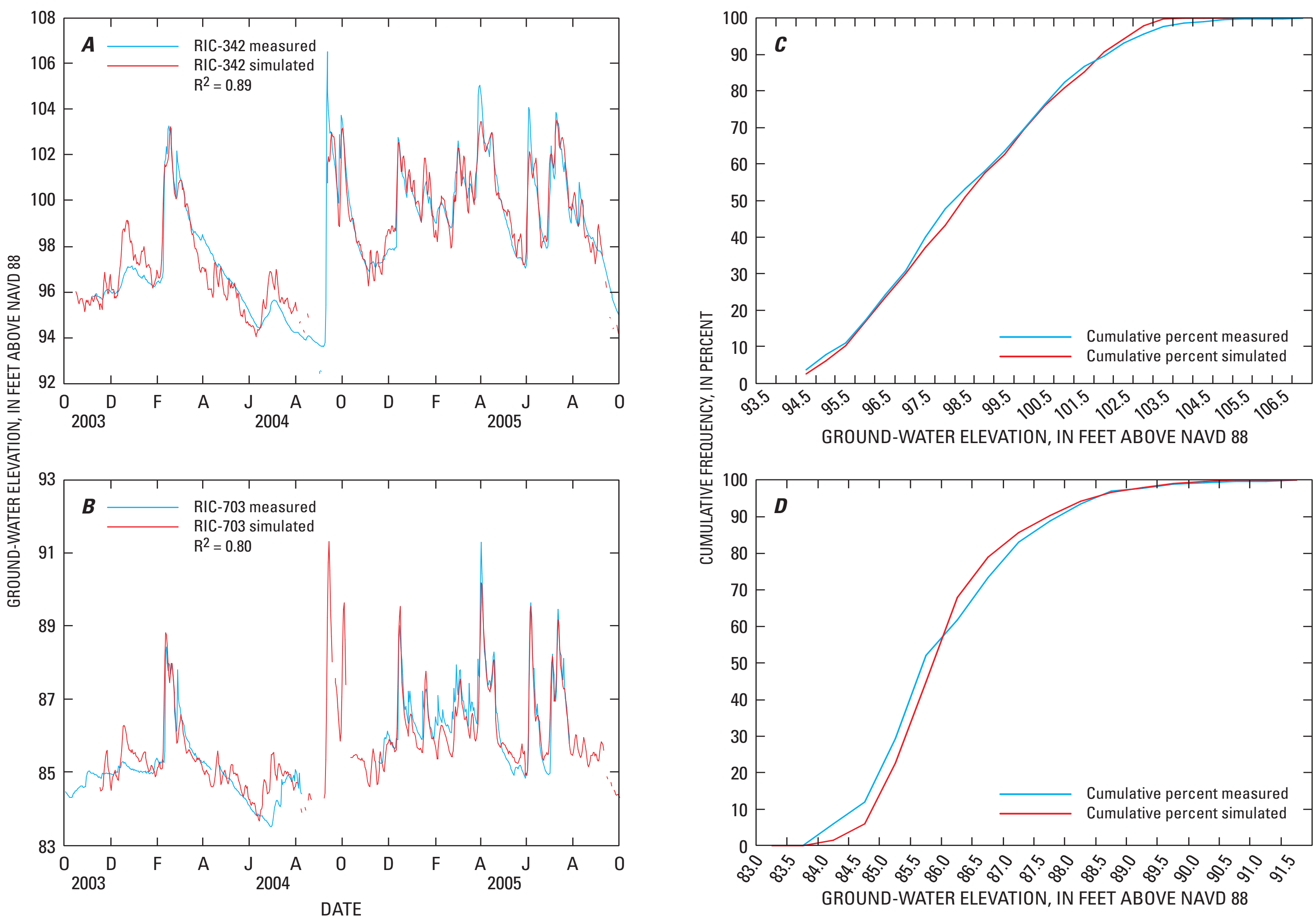


Figure 31. Measured and simulated ground-water elevations for Group 2 observation wells *(A)* RIC-342 and *(B)* RIC-703, and measured and simulated cumulative frequency distributions for observation wells *(C)* RIC-342 and *(D)* RIC-703.

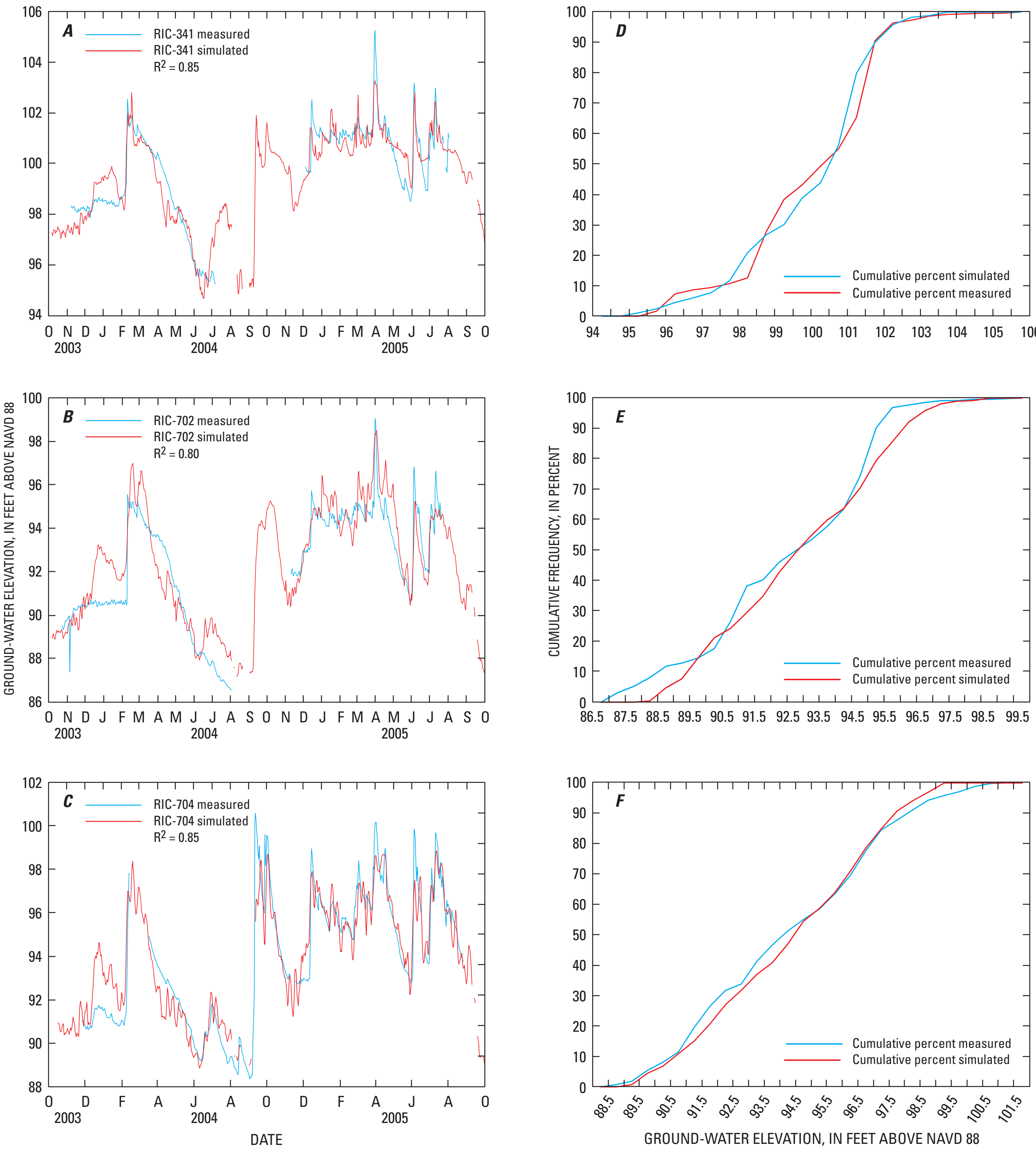


Figure 32. Measured and simulated ground-water elevations for Group 3 observation wells *(A)* RIC-341, *(B)* RIC-702, and *(C)* RIC-704, and measured and simulated cumulative frequency distributions for observation wells *(D)* RIC-341, *(E)* RIC-702, and *(F)* RIC-704.

Long-Term Daily Ground-Water Level Elevation Results and Analysis

A similar approach for evaluating the effect of the operation of the Saluda Dam on the daily surface-water gage heights at the CNP was used to evaluate the effect on ground-water levels. Two 75-year hydrographs were generated for the modeled Group 1, 2, and 3 wells using the with-dam and without-dam hydrographs generated for the Congaree CNP gage. The simulated hydrographs were then evaluated using cumulative frequency distribution plots and duration hydrographs of the 5th, 50th, and 95th percentiles to quantify the effect the operation of Saluda Dam has had on ground-water elevations in CNP (figs. 33–35).

The cumulative frequency distribution curves for Group 1, 2, and 3 observation wells illustrate that a general divergence between the with-dam and without-dam simulations occurs in the low to mid ground-water elevations between the 0 percent and 50 percent range (figs. 33–35). This result indicates that the operations of Saluda Dam have generally increased the magnitude of the lower ground-water elevations for a given frequency. Similar to the cumulative frequency distribution graph for Congaree CNP (fig. 27), three of the cumulative frequency distribution curves—RIC-699, RIC-703, and RIC-341—show a decrease in the frequency of high ground-water elevation. At these observation wells, ground-water elevations begin to diverge at the 70 percent, 40 percent, and 60 percent range, respectively, indicating that the operations of the dam have decreased the frequencies of these higher ground-water elevations. Overall, the operations of the dam have had a greater effect on raising low ground-water elevations than decreasing high ground-water elevations.

To evaluate the effect of the Saluda Dam on the daily and seasonal ground-water elevations, duration hydrographs were generated for the 5th, 50th, and 95th percentiles (figs. 33–35). As one would expect, the overall effect of the Saluda Dam on the ground-water elevations is similar, to the effect on the gage heights in the river. As with the surface-water analysis, the effect of the dam can be seen in the majority of the 50th percentile duration hydrographs. In general, these graphs show that with-dam ground-water elevations have decreased from the without-dam ground-water elevations during the first half of the year and have increased from the without-dam ground-water elevations during the second half of the year. Some of the duration hydrographs show that the dam has had no effect for certain periods of the year. For example, the 5th percentile duration hydrograph for RIC-700 (fig. 33*B*) shows little difference between the with-dam and without-dam low water-levels from June to November. For RIC-341 (fig. 35*A*), the 50th percentile duration hydrographs show little effect of the dam from January to May although the 5th percentile duration hydrograph indicates the dam has caused a decrease in low ground-water elevations from February to June and a rise in ground-water elevations from July to January.

The percentile duration hydrographs also are presented as box and whisker plots in figure 36 and summarized in table 12. For the majority of wells, the median values for the 95th percentile are higher without the dam than with the dam. Conversely, all the median values for the 5th percentiles are lower without the dam than with the dam. The maximum 5th, 50th, and 95th percentiles for the ground-water elevations for all the observation wells are equal to or lower for with-dam ground-water elevations than for without-dam elevations, indicating surface-water regulation by the Saluda Dam has lowered the high ground-water elevations in the CNP flood plain even for the 5th percentile values. The range of differences in the maximums ranged from no change (RIC-341—difference in 50th percentile) to 1.75 ft (RIC-341—difference in the 5th percentile; table 12). However, minimum 5th, 50th, and 95th percentiles for ground-water elevations for all observation wells are equal to or higher for with-dam ground-water elevations than for without-dam elevations, indicating that the lower ground-water elevations may have increased due to the regulation of the Saluda Dam. The differences in the minimums ranged from no change (RIC-700—difference in 5th percentile) to 1.90 ft (RIC-702—difference in the 50th percentile). For the majority of the wells, the changes in the minimum ground-water elevations were larger than the changes in the maximum ground-water elevations.

The range of ground-water elevations represents the difference in ground-water elevations between the lowest and highest simulated ground-water elevation for a specified percentile at a given observation well. For all observation wells, the simulated range is lower for the with-dam ground-water elevations. The maximum range in ground-water elevations for the 5th, 50th, and 95th were –2.23 ft (RIC-341), –2.61 ft (RIC-702), and –1.3 ft (RIC-342), respectively (table 12).

Overall, the operation of the dam has had more of an effect of raising low and median ground-water elevations than on lowering high ground-water elevations. In addition to the surficial ground-water elevations being higher, the interannual range in surficial ground-water elevations has decreased. A shift in the seasonal surficial ground-water elevations (lower in the first half of the year and higher in the second half of the year) and a decrease in the range of ground-water elevations may have an effect on the root zone of the swamp and an ecological effect on the vegetative community structure.

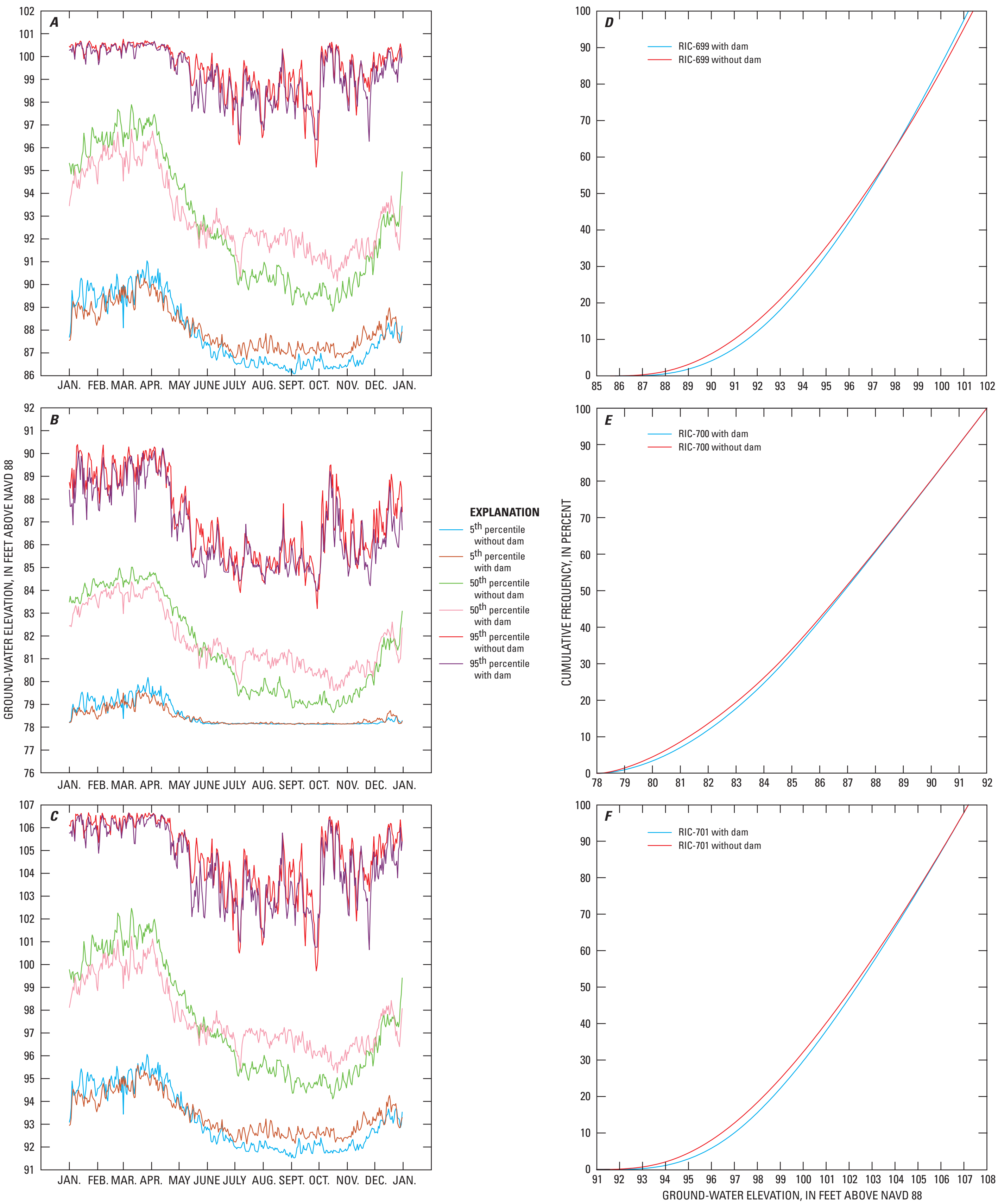


Figure 33. Duration hydrographs and cumulative frequency distribution for simulated 75-year daily mean ground-water elevation calculated for Group 1 observation wells RIC-699 *(A* and *D)*, RIC-700 *(B* and *E)*, and RIC-701 *(C* and *F)* for the with-dam and without-dam river gage heights at Congaree River Congaree National Park.

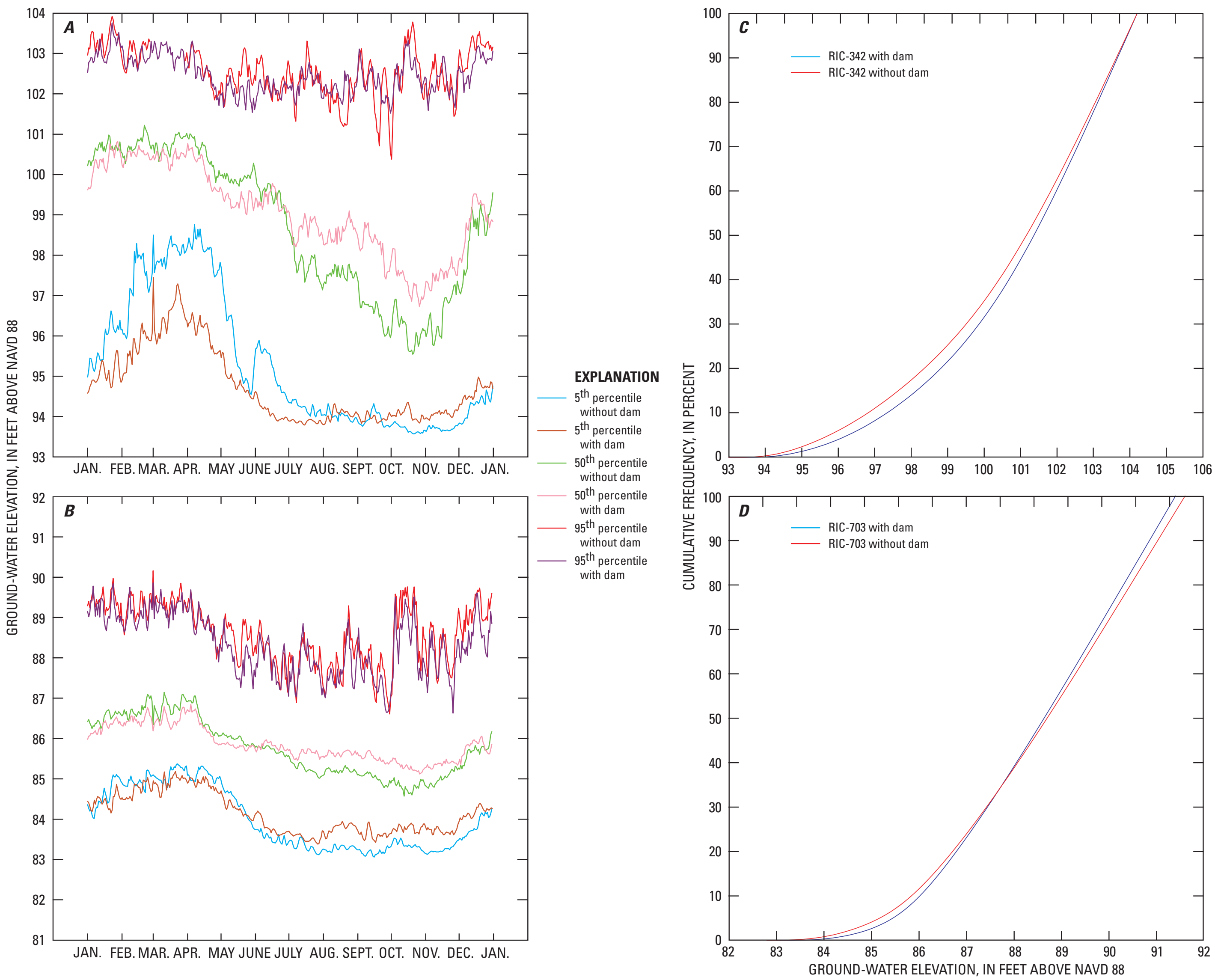


Figure 34. Duration hydrographs and cumulative frequency distribution for simulated 75-year daily mean ground-water elevation calculated for Group 2 observation wells RIC-342 *(A* and *C)* and RIC-703 *(B* and *D)* for the with-dam and without-dam river gage heights at Congaree River Congaree National Park.

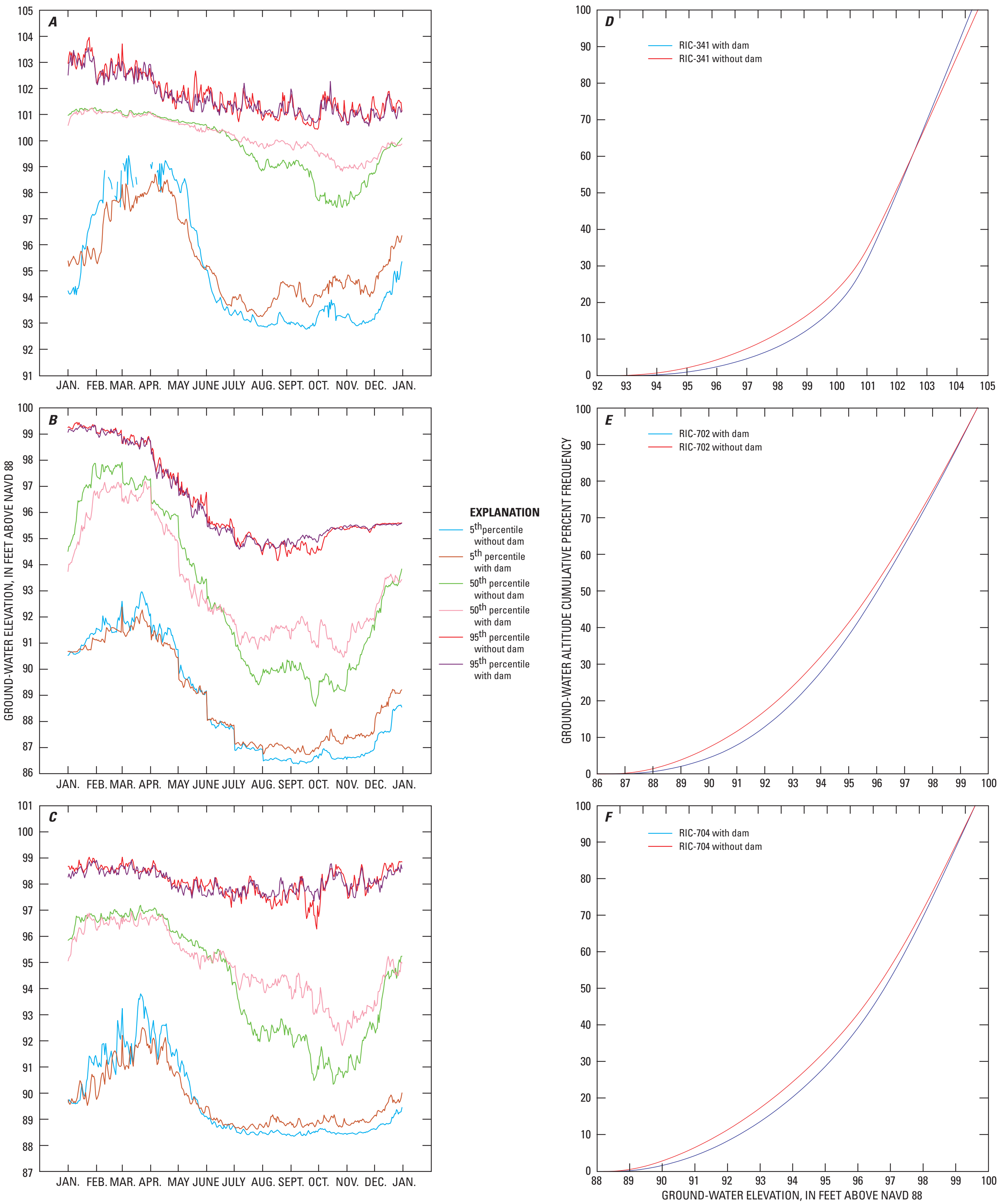


Figure 35. Duration hydrographs and cumulative frequency distribution for simulated 75-year daily mean ground-water elevation calculated for Group 3 observation wells RIC-341 *(A* and *D)*, RIC-702 *(B* and *E)*, and RIC-704 *(C* and *F)* for the with-dam and without-dam river gage heights at Congaree River Congaree National Park.

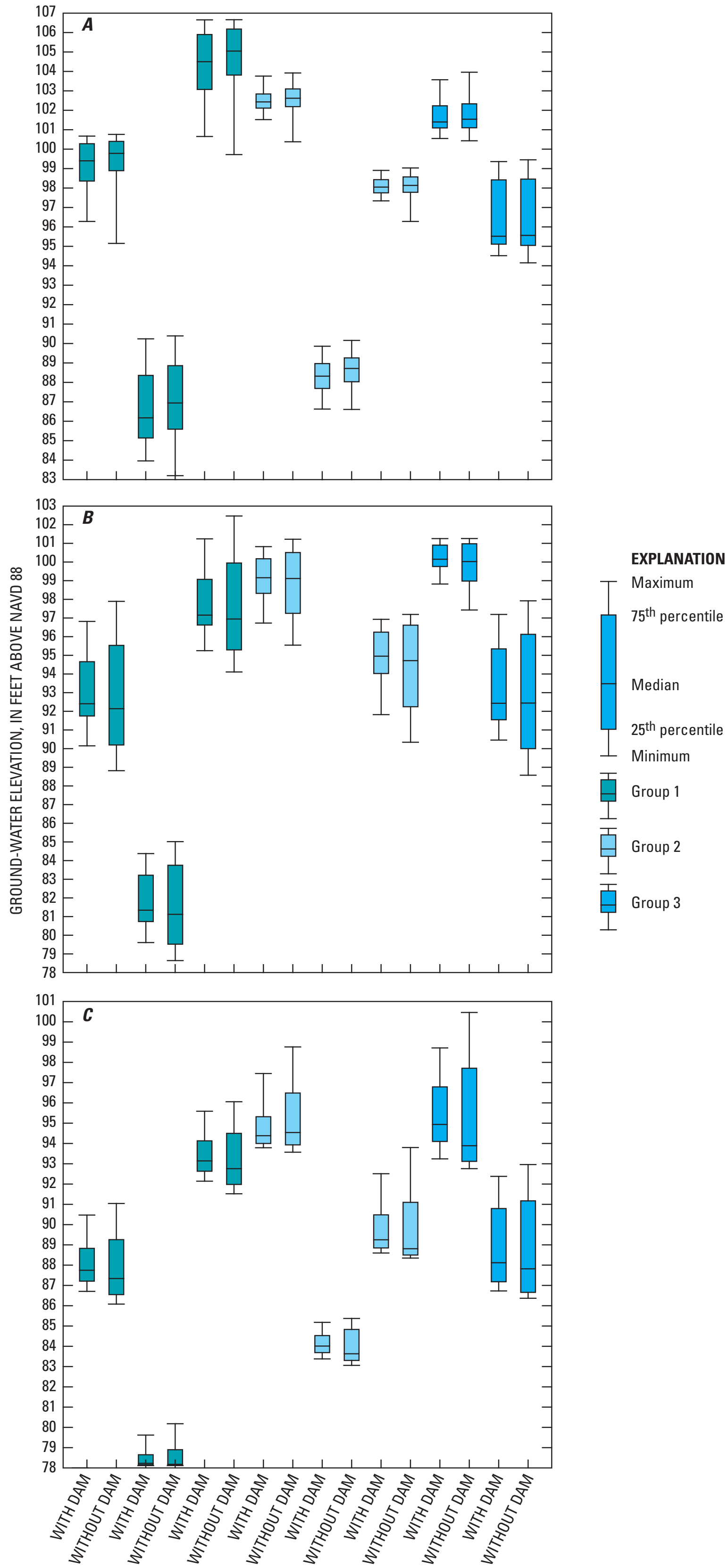


Figure 36. Box and whisker plots showing the *(A)* 95th, *(B)* 50th, and *(C)* 5th percentiles for simulated ground-water elevations with and without the dam.

Table 12. General statistics calculated for 5th, 50th, and 95th percentile water-level elevations for Group 1, 2, and 3 observation wells in the Congaree National Park using the 75-year daily ground-water elevations for the with-dam and without-dam gage heights in the Congaree River Congaree National Park.

[USGS, U.S. Geological Survey; NAVD 88, North American Vertical Datum of 1988]

USGS well identifier	Statistic	5th percentile for with-dam ground-water elevation (NAVD 88), in feet	5th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 5th percentiles statistics, in feet	50th percentile for with-dam ground-water elevation (NAVD 88), in feet	50th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 50th percentiles statistics, in feet	95th percentile for with-dam ground-water elevation (NAVD 88), in feet	95th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 95th percentiles statistics, in feet
Group 1 observation wells										
RIC-699	Maximum	90.47	91.04	–0.57	96.82	97.89	–1.07	100.67	100.76	–0.09
	Minimum	86.71	86.08	0.63	90.15	88.82	1.33	96.28	95.15	1.13
	Median	87.75	87.34	0.41	92.41	92.14	0.27	99.4	99.78	–0.38
	Range	3.76	4.96	–1.2	6.67	9.08	–2.41	4.39	5.61	–1.22
RIC-700	Maximum	79.62	80.18	–0.56	84.38	85.02	–0.64	90.24	90.39	–0.15
	Minimum	78.12	78.12	0	79.61	78.64	0.97	83.96	83.2	0.76
	Median	78.23	78.18	0.05	81.34	81.12	0.22	86.18	86.94	–0.76
	Range	1.5	2.06	–0.56	4.76	6.38	–1.62	6.28	7.19	–0.91
RIC-701	Maximum	95.59	96.52	–0.93	101.24	102.46	–1.22	106.65	106.66	–0.01
	Minimum	92.14	91.52	0.62	95.25	94.11	1.14	100.65	99.72	0.93
	Median	93.14	92.76	0.38	97.15	96.94	0.21	104.5	105.05	–0.55
	Range	3.45	4.54	–1.09	5.99	8.36	–2.37	6	6.94	–0.94
Group 2 observation wells										
RIC-342	Maximum	97.45	98.76	–1.31	100.82	101.22	–0.4	103.76	103.92	–0.16
	Minimum	93.79	93.57	0.22	96.73	95.54	1.19	101.52	100.38	1.14
	Median	94.38	94.54	–0.16	99.16	99.12	0.04	102.43	102.62	–0.19
	Range	3.66	5.19	–1.53	4.1	5.68	–1.58	2.24	3.54	–1.3
RIC-703	Maximum	85.18	85.37	–0.19	86.84	87.14	–0.3	89.86	90.16	–0.3
	Minimum	83.38	83.06	0.32	85.12	84.57	0.55	86.63	86.61	0.02
	Median	84.01	83.63	0.38	85.77	85.73	0.04	88.32	88.72	–0.4
	Range	1.8	2.31	–0.51	1.72	2.58	–0.86	3.23	3.55	–0.32

Table 12. General statistics calculated for 5th, 50th, and 95th percentile water-level elevations for Group 1, 2, and 3 observation wells in the Congaree National Park using the 75-year daily ground-water elevations for the with-dam and without-dam gage heights in the Congaree River Congaree National Park.—Continued

[USGS, U.S. Geological Survey; NAVD 88, North American Vertical Datum of 1988]

USGS well identifier	Statistic	5th percentile for with-dam ground-water elevation (NAVD 88), in feet	5th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 5th percentiles statistics, in feet	50th percentile for with-dam ground-water elevation (NAVD 88), in feet	50th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 50th percentiles statistics, in feet	95th percentile for with-dam ground-water elevation (NAVD 88), in feet	95th percentile for without-dam ground-water elevation (NAVD 88), in feet	Differences in 95th percentiles statistics, in feet
Group 3 observation wells										
RIC-341	Maximum	98.71	100.46	–1.75	101.26	101.26	0	103.57	103.96	–0.39
	Minimum	93.24	92.76	0.48	98.82	97.43	1.39	100.55	100.43	0.12
	Median	94.94	93.89	1.05	100.15	100.02	0.13	101.4	101.54	–0.14
	Range	5.47	7.7	–2.23	2.44	3.83	–1.39	3.02	3.53	–0.51
RIC-702	Maximum	92.38	92.96	–0.58	97.19	97.92	–0.73	99.36	99.45	–0.09
	Minimum	86.37	86.37	0	90.46	88.56	1.9	94.52	94.15	0.37
	Median	88.12	87.82	0.3	92.43	92.44	–0.01	95.52	95.56	–0.04
	Range	5.62	6.59	–0.97	6.73	9.34	–2.61	4.84	5.3	–0.46
RIC-704	Maximum	92.51	93.8	–1.29	96.93	97.19	–0.26	98.91	99.03	–0.12
	Minimum	88.6	88.35	0.25	91.82	90.34	1.48	97.34	96.28	1.06
	Median	89.25	88.81	0.44	94.95	94.72	0.23	98.05	98.14	–0.09
	Range	3.91	5.45	–1.54	5.11	6.85	–1.74	1.57	2.75	–1.18

Summary

The Congaree National Monument was established in 1976 and became South Carolina's first National Park in 2003. The U.S. Geological Survey, in cooperation with the National Park Service, Congaree National Park, studied the interaction between surface water in the Congaree River and ground water in the flood plain to determine the effect Saluda Dam operations have on water levels in the Congaree National Park.

Understanding the hydrologic and ecological effects of reservoir flow releases on downstream ecosystems is critical to balancing the social and economic benefits of hydroelectric power generation with the integrity of Congaree National Park. A common perception of the effect of the Saluda Dam on the Congaree National Park was that the dam had significantly reduced the frequency and magnitude of peak flows (and gage heights), thus jeopardizing the ecological benefits of periodic inundation of the Congaree National Park flood plain. Although not explicitly expressed in a previous study on the hydrology of the Congaree Swamp National Monument, the two flood-frequency curves for pre- and post-impoundment floods implied a large decrease in the frequency and magnitude in flood flows, affecting the understanding of many hydrologists and ecologists on the effect of the Saluda Dam.

Analysis of peak flows in this study showed the reduction in peak flows after the construction of Lake Murray and Saluda Dam was more a result of climate variability and the absence of large floods after 1930 than the operation of the dam. The analysis for this study showed that dam operations reduced the recurrence interval of the 2-year to 100-year peak flows by 6.1 to 17.6 percent, respectively. Analysis of the daily gage height of the Congaree River showed that the dam has had the effect of lowering low to medium (5th and 50th percentile) gage heights in the first half of the year (December to May) and raising low to medium gage heights in the second half of the year (June to November). The dam also has had the effect of increasing the 1-, 3-, 7-, 30-, and 90-day minimum gage heights by as much as 23.9 percent and decreasing the 1-, 3-, 7-, 30-, and 90-day maximum gage heights by as much as 7.2 percent. Analysis of the ground-water elevations in the Congaree National Park flood plain shows similar results as the gage-height analysis—the dam has had the effect of lowering high ground-water elevations and increasing low ground-water elevations.

Overall, the operation of the dam has had more of an effect on the water-surface elevations within the river banks than water-surface elevations in the flood plain. This result may have a larger effect on the subsurface water levels of the surficial flood-plain aquifer than the frequency and magnitude of inundation of the flood plain. A shift in the seasonal surficial ground-water levels (lower in the first half of the year and higher in the second half of the year) may have an effect on the root zone of the swamp and an ecological effect on the vegetative community structure.

Acknowledgments

The authors would like to thank Tracy Swartout, Martha Bogle, Bill Huslander, Theresa Thom, Theresa Yednock, John Torrence, David Shelley, and Laura Maliszewski of the National Park Service for providing logistical support, assistance, information, data, and access to the land and wells at the Congaree National Park. The authors also extend their appreciation to Bill Argentieri and Ray Ammarell, South Carolina Electric & Gas, for providing helpful information on the operation of Saluda Dam and to Edwin A Roehl, Jr., Advanced Data Mining, for collaboration on developing the preliminary artificial neural network model of the Congaree River.

Selected References

Alden, A.S., and Munster, C.L., 1997, Assessment of river-floodplain interactions: Environmental and Engineering Geoscience, v. 3, no. 4, p. 537–648.

American Geological Institute, 1976, Dictionary of geologic terms (rev. ed.): Garden City, NY, Anchor Press/Double Day, 472 p.

Aucott, W.R., 1996, Hydrology of the southeastern coastal plain aquifer system in South Carolina and parts of Georgia and North Carolina: U.S. Geological Survey Professional Paper 1410E, 83 p.

Aucott, W.R., Davis, M.E., and Speiran, G.K., 1987, Geohydrologic framework of the Coastal Plain aquifers of South Carolina: U.S. Geological Survey Water-Resources Investigations Report 85–4371, 7 sheets.

Bates, P.D., Stewart, M.D., Desitter, A., Anderson, M.G., Renaud, J.P., and Smith, J.A., 2000, Numerical simulation of floodplain hydrology: Water Resources Research, v. 36, p. 2517–2530.

Bayne, Coy, 1992, Lake Murray—Legend and leisure (2d ed., revised): South Carolina, Wise Printing Company, 60 p.

Bedinger, M.S., 1981, Hydrology of bottomland hardwood forest of the Mississippi Embayment, *in* Clark, J.R., and Benforado, J., eds., Wetlands of bottomland hardwood forests: New York, Elsevier, 401 p.

Bouwer, Herman, 1989, The Bouwer and Rice slug test—An update: Journal of Ground Water, v. 27, no. 3, p. 304–309.

Burt, T.P., Bates, P.D., Stewart, M.D., Claxton, A.J., Anderson, M.G., and Price, D.A., 2001, Water table fluctuations within the floodplain of the River Severn, England: Journal of Hydrology, v. 262, p. 1–20.

Colquhoun, D.J., 1965, Terrace sediment complexes in central South Carolina—6th Annual Field Conference, guidebook: Atlantic Coastal Plain Geological Association, 62 p.

Conrads, P.A., and Roehl, E.A., Jr., 2005, Integration of data mining techniques with mechanistic models to determine the impacts of non-point source loading on dissolved oxygen in tidal waters: Proceedings of the South Carolina Environmental Conference, March 2005, Myrtle Beach, SC, 8 p.

Conrads, P.A., and Roehl, E.A., Jr., 2007, Analysis of salinity intrusion in the Waccamaw River and Atlantic Intracoastal Waterway near Myrtle Beach, South Carolina, 1995–2002: U.S. Geological Survey Scientific Investigations Report 2007–5110, 41 p.

Conrads, P.A., Roehl, E.A., Jr., and Cook, J.B., 2002, Estimation of tidal marsh loading effects in a complex estuary: American Water Resources Association Annual Conference, May 2002, New Orleans.

Conrads, P.A., Roehl, E.A., Jr., Daamen, R.C., and Kitchens, W.M., 2006, Simulation of water levels and salinity in the rivers and tidal marshes in the vicinity of the Savannah National Wildlife Refuge, Coastal South Carolina and Georgia: U.S. Geological Survey Scientific Investigations Report 2006–5187, 134 p.

Conrads, P.A., Roehl, E.A., Jr., and Martello, W.P., 2003, Development of an empirical model of a complex, tidally affected river using artificial neural networks: Water Environmental Federation TMDL Specialty Conference, November 2003, Chicago, Illinois.

Cooney, T.W., 2001, Surface water quality-assurance plan for the South Carolina District of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 01–121, 48 p.

Cooney, T.W., Drewes, P.A., Ellisor, S.W., Lanier, T.H., and Melendez, F., 2005,Water resources data, South Carolina, water year 2005: U.S. Geological Survey Water-Data Report SC–05–1, 621 p.

Devine, T.W., and Roehl, E.A., Jr., 2003, Virtual sensors—Cost effective monitoring: Proceeding from the Air and Waste Management Association Annual Conference, June 2003, Girdwood, Alaska, 10 p.

Dowla, F.U., and Rogers, L.L., 1995, Solving problems in environmental engineering and geosciences with artificial neural networks: Cambridge, MA, The Massachusetts Institute of Technology, 239 p.

Edision, J.P., Lacy, C.M., Nance, Luke, Hansen, W.F., Lowery, M.A., and Hurley, N.M., Jr., 2005, Development of a 10- and 12-digit hydrologic unit code numbering system for South Carolina, 2005: U.S. Department of Agriculture, National Resources Conservation Service, 38 p. + 1 pl.

Feaster, T.D., and Tasker, G.D., 2002, Techniques for estimating the magnitude and frequency of floods in rural basins of South Carolina, 1999: U.S. Geological Survey Water-Resources Investigations Report 02–4140, 40 p.

Federal Emergency Management Agency, 2001, Flood insurance study, Richland County, South Carolina, and incorporated areas: Washington, DC, Federal Emergency Management Agency, August 20, 2001.

Fetter, C.W., Jr., 2001, Applied hydrogeology, (4th ed.): Oshkosh, University of Wisconsin, 598 p.

Geological Society of America, 1991, Rock color chart with genuine Munsell color chips: Boulder, CO, Geological Society of America.

Graf, W.L., and Stroup, L.J., 2006, Congaree floodplain decision support project—Assessing the extent of river regulation effects on resources within and around Congaree National Park—Part 1: Literature review, A report for the National Park Service Piedmont—South Atlantic Cooperative Ecosystems Studies Unit, Department of Geography, University of South Carolina, Columbia, SC, 47 p.

Guimaraes, W.B., and Bohman, L.R., 1992, Techniques for estimating magnitude and frequency of floods in South Carolina, 1988: U.S. Geological Survey Water-Resources Investigations Report 91–4157, 173 p.

Heath, R.C., 1982, Basic ground-water hydrology: U.S. Geological Survey Water-Supply Paper 2220, 84 p.

Henriksen, J.A., Heasley, J., Kennen, J.G., and Niewsand, S., 2006, Users' manual for the Hydroecological Integrity Assessment Process Software (including the New Jersey Assessment Tools): U.S. Geological Survey, Biological Resources Discipline, Open-File Report 2006–1093, 71 p.

Hess, G.W., and Stamey, T.C., 1993, Annual peak discharges and stages for gaging stations in Georgia through September 1990: U.S. Geological Survey Open-File Report 92–113, 277 p.

Hinton, G.E., 1992, How neural networks learn from experience: Scientific American, September 1992, p. 145–151.

Hirsch, R.M., 1982, A comparison of four streamflow record extension techniques: Water Resources Research, v. 18, no. 4, p. 1081–1088.

Hydrology Subcommittee of the Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood frequency: Reston, VA, Office of Water Data Collection, U.S. Geological Survey Bulletin 17B, 183 p.

Jarrett, R.D., 1991, Paleohydrology and its value in analyzing floods and droughts, *in* National Water Summary 1988–89, Hydrologic Events and Floods and Droughts: U.S. Geological Survey Water-Supply Paper 2375, p. 105–116.

Jensen, B.A., 1994, Expert systems-neural networks, Instrument engineer's handbook, (3d ed.): Radnor PA, Chilton.

Koman, T.M., 2003, The hydrologic effects of dams on the Saluda River, South Carolina: Columbia, SC, University of South Carolina, Department of Geography, Masters Thesis, 266 p.

Kuehn, Wolfgang, and Mueller, Uwe, 2000, River bank filtration—An overview: Journal of the American Water Works Association, v. 92, no. 12, p. 60–69.

McBride, M.S., and Pfannkuch, H.O., 1975, The distribution of seepage within lakebeds: Journal of Research of the U.S. Geological Survey, v. 3, no. 5, p. 505–512.

Meinzer, O.E., 1923, Outline of groundwater hydrology, with definitions: U.S. Geological Survey Water-Supply Paper 494, 494 p.

Minchin, P.R., and Sharitz, R.R., 2007, Age structure and potential long-term dynamics of the floodplain forests of Congaree National Park: National Park Service Research Final Report, 37 p.

Munster, C.L., Mathewson, C.C., and Wrobleski, C.L., 1996, The Texas A&M University Brazos River hydrologic field site: Winter College Station, TX, Environmental and Engineering Geosciences, v. II, no. 4, p. 517–530.

National Park Service, 2006, Congaree National Park, South Carolina, Website at *http://www.nps.gov/cong/historyculture/index.htm* (accessed on December 6, 2006).

Newcome, R.C., and Brown, S.G., 1961, Evaluation of bank storage along the Columbia River between Richland and China Bar, Washington: U.S. Geological Survey Water-Supply Paper 1539–I, 13 p.

North Carolina Department of Environmental and Natural Resources, 2001, Basin wide assessment report, Broad River basin: Division of Water Quality, Web page at *http://h2o.enr.state.nc.us/esb/Basinwide/BRD2001.pdf* (accessed November 2006).

Ott, Lyman, 1988, An introduction to statistical methods and data analysis (3d ed.): Boston, MA, PWS–KENT, 835 p.

Overstreet, W.C., and Bell, Henry, III, 1965, Geologic map of the crystalline rocks of South Carolina: U.S. Geological Survey Miscellaneous Geologic Investigations Map I–413, scale 1:250,000.

Patterson, G.G., Speiran, G.K., and Whetstone, B.H., 1985, Hydrology and its effects on distribution of vegetation in Congaree National Monument, South Carolina: U.S. Geological Survey Water-Resources Investigations Report 85–4256, 31 p.

Paulson, R.W., Chase, E.B., Roberts, R.S., and Moody, D.W., 1991, National Water Summary 1988–89: U.S. Geological Survey Water-Supply Paper 2375, 591 p.

Poff, N.L., Allen, J.D., Bain, M.B., Karr, J.R., Presetegaard, K.L., Richter, B.D., Sparks, R.E., and Stromberg, J.C., 1997, The natural flow regime: Bioscience, v. 47, p. 769–784.

Rantz, S.E., and others, 1982, Measurements and computation of streamflow, v. 1 and 2: U.S. Geological Survey Water-Supply Paper 2175, 631 p.

Richter, B.D., Baumgartner, J.V., Powell, J., and Braun, D.P., 1996, A method for assessing hydrologic alteration within ecosystems: Conservation Biology, v. 10, p. 1163–1174.

Risley, J.C., Roehl, E.A., Jr., and Conrads, P.A., 2003, Estimating water temperatures in small streams in Western Oregon using neural network models: U.S. Geological Survey Water-Resources Investigations Report 02–4218, 60 p.

Roehl, E.A., Jr., Conrads, P.A., and Cook, J.B., 2003, (Discussion of) Using complex permittivity and artificial neural networks for contaminant prediction: Journal of Environmental Engineering, v. 129, p. 1069–1071.

Roehl, E.A., Jr., Conrads, P.A., and Roehl, T.A.S., 2000, Real time control of the salt front in a complex tidally affected river basin, Proceedings of the Artificial Neural Networks In Engineering Conference: New York, ASME Press, Smart Engineering System Design, v. 10, p. 947–954.

Roehl, E.A., Jr., Risley, J.C., Stewart J., and Mitro, M., 2006, Numerically optimized empirical modeling of highly dynamic, spatially expansive, and behaviorally heterogeneous hydrologic system—Part 1: Proceedings of the Environmental Modeling and Software Society Conference, July 2006, Burlington, VT, 6 p.

Rosenblatt, F., 1958, The perceptron—A probabilistic model for information storage and organization in the brain: Psychological Review, v. 65, p. 386–408.

Rumelhart, D.E., Hinton, G.E., and Williams, R.J., 1986, Learning internal representations by error propagation, parallel distributed processing—Explorations in the microstructure of cognition, v. 1: Cambridge, MA, The MIT Press, p. 318–362.

SCANA, 2006, Lake Murray Dam: SCANA Corporation Energetic Minds Web page at *http://www.energeticminds.com/students/lakemurray/default.aspx* (accessed on May 29, 2008).

Shelley, D.C., 2007a, Geology and geomorphology of the Congaree River Valley and vicinity, central South Carolina: Columbia, SC, University of South Carolina, Department of Geological Sciences, Ph.D. dissertation, 369 p.

Shelley, D.C., 2007b, Geologic map of the Congaree 7.5-minute quadrangle, Richland, County, South Carolina: South Carolina Department of Natural Resources Geological Survey, Geologic Quadrangle Map (GQM) 31, scale 1:24,000.

Shelley, D.C., 2007c, Geologic map of the Eastover 7.5-minute quadrangle, Richland and Sumter Counties, South Carolina: South Carolina Department of Natural Resources Geological Survey, Geologic Quadrangle Map (GQM) 30, scale 1:24,000.

Shelley, D.C., 2007d, Geologic map of the Gadsden 7.5-minute quadrangle, Calhoun and Richland Counties, South Carolina: South Carolina Department of Natural Resources Geological Survey, Geologic Quadrangle Map (GQM) 37, scale 1:24,000.

Shelley, D.C., 2007e, Geologic map of the Saylor’s Lake 7.5-minute quadrangle, Calhoun, Lexington, and Richland Counties, South Carolina: South Carolina Department of Natural Resources Geological Survey, Geologic Quadrangle Map (GQM) 38, scale 1:24,000.

Shelley, D.C., 2007f, Geologic map of the Wateree 7.5-minute quadrangle, Lexington, Richland, and Sumter Counties, South Carolina: South Carolina Department of Natural Resources Geological Survey, Geologic Quadrangle Map (GQM) 36, scale 1:24,000.

Socolow, R.S., Frimpter, M.H., Turtora, M., and Bell, R.W., 1994, A technique for estimation ground-water levels at sites in Rhode Island from observation-well data: U.S. Geological Survey Water-Resources Investigations Report 94–4138, 43 p.

Sophocleous, Marios, 2002, Interactions between groundwater and surface water—The state of the science: Hydrogeology Journal v. 10, no. 1, Springer-Verlag, p. 52–67.

South Carolina Department of Natural Resources, South Carolina State Climatology Office, South Carolina storms of the century Web page at *http://www.dnr.sc.gov/climate/sco/stormsofcentury.html* (accessed December 2006).

South Carolina Electric & Gas, 2008, Lake Murray: South Carolina Electric & Gas Web page at *http://www.sceg.com/en/my-community/lake-murray/* (accessed on May 29, 2008).

South Carolina Water Resources Commission, 1983, South Carolina State water assessment: SCWRC Report No. 140, 367 p.

Stewart J., Mitro, M., Roehl, E.A., Jr., and Risley, J.C., 2006, Numerically optimized empirical modeling of highly dynamic, spatially expansive, and behaviorally heterogeneous hydrologic system—Part 2, *in* Gourbesville, Philippe, Cunge, Jean, Guinot ,Vincent, and Liong, Shie-Yui, eds., Proceedings for the Hydroinformatics 2006,7th International Conference on Hydroinformatics, September 4–8, Nice, France, v. 4, p. 2765–2772.

Thomas, M.C., Southwell, M., and McGinness, H.M., 2004, Floodplain-river ecosystems—Fragmentation and water resources development: Journal of Geomorphology, v. 71, p. 126–138.

To'th J., 1963, A theoretical analysis of groundwater flow in small drainage basins: Journal of Geophysics Research, v. 68, p. 4785–4812.

U.S. Army Corps of Engineers, 2006, National inventory of dams Web page at *http://crunch.tec.army.mil/nid/webpages/nid.cfm* (accessed November 2006).

U.S. Geological Survey, 1996, National water summary on wetland resources: U.S. Geological Survey Water-Supply Paper 2425, 431 p.

U.S. Geological Survey, 2008, National water information real-time water data for South Carolina Web page at *http://waterdata.usgs.gov/sc/nwis/rt* (accessed May 29, 2008).

Weiss, S.M., and Indurkhya, Nitin, 1998, Predictive data mining-a practical guide: San Francisco, Morgan Kaufmann Publishers, Inc., 228 p.

Wharton, C.H., Kitchens, W.M., Pendleton, E.C., and Sipe, T.W., 1982, The ecology of bottomland hardwood swamps of the southeast—A community profile: U.S. Fish and Wildlife Service Biological Services Program Publication FWS/OBS–81/37, 133 p.

Whetstone, B.H., 1982, Techniques for estimating magnitude and frequency of floods in South Carolina: U.S. Geological Survey Water-Resources Investigations Report 82–1, 78 p.

Winter, T.C., Harvey, J.W., Franke, O.L., and Alley, W.M., 1998, Ground water and surface water a single resource: U.S. Geological Survey Circular 1139, 79 p.

Woessner, W.W., 1998, Changing views of ground-water stream interaction, *in* Van Brahana, E.J., Eckstein,Y., Ongley, L., Schneider, W.R., and Moore, J.E., eds., Proceedings of the Joint Meeting of the XXVIII Congress of the International Association of Hydrogeologists and the Annual Meeting of the American Institute of Hydrology, St. Paul, MN: American Institute of Hydrology, September 27–October 2, 1998.

Woessner, W.W., 2000, Stream and fluvial plain ground-water interactions—Rescaling hydrogeologic thought: Ground Water, v. 38, no. 3, p. 423–429.

Appendix 1. Generalized lithologic descriptions of sediment samples examined during the installation of observation wells RIC-341, RIC-345, RIC-346, RIC-699, RIC-700, RIC-701, RIC-702, RIC-703, RIC-704, and RIC-705 in the Congaree National Park, South Carolina.

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)]

USGS observation well identifier (fig. 1)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Sample interval depth (feet below land surface)	Generalized lithologic description	Lithologic color (Geological Society of America, 1991)
RIC-341	33° 49' 31"	80° 51' 43"	0–5	Silty, clayey fine grain sand; 50 percent fine quartz sand, 25 percent silt, 25 percent clay	Brown
			5–8	Plastic clay; 10 percent fine grain quartz sand, 10 percent silt, 80 percent clay	Mottled gray and yellow-orange
			8–10	Clayey fine grain sand; 50 percent, fine grain quartz sand, 50 percent clay	Gray to off-white
			10–22	Clayey medium grain sand; 40 percent medium grain quartz sand, 30 percent fine grain quartz sand, 30 percent clay	Gray to off-white
			22–24	Course grain sand; 40 percent coarse grain quartz sand, 40 percent medium grain quartz sand, 20 percent fine grain quartz sand	Light tan
RIC-345	33° 49' 31"	80° 49' 09"	0–3	Medium sand; 60 percent medium grain quartz sand, 20 percent fine grain quartz sand, 10 percent silt, 10 percent clay	Light tan
			3–8	Clayey sand; 40 percent medium grain quartz sand, 10 percent fine grain quartz sand, 10 percent silt, 40 percent clay; slightly micaceous	Light tan to off-white
			8–12	Slightly clayey sand; 30 percent medium grain quartz sand, 40 percent fine grain quartz sand, 10 percent silt, 20 percent clay	Light tan
			12–17	Slightly clayey medium sand; 60 percent medium grain quartz sand, 30 percent fine grain quartz sand, 10 percent clay	Light gray
			17–49	Sand; 50 percent medium grain quartz sand, 30 percent fine grain quartz sand, 20 percent clay; gravel at 24, 27, 37 to 39, 42 to 44, and 46 to 49 feet	Light gray to cream white
RIC-346	33° 49' 00"	80° 49' 38"	0–11	Silty clay; 5 percent fine grain quartz sand, 40 percent silt, 55 percent clay	Brown
			11–22	Moderately plastic silty clay; 10 percent fine grain quartz sand, 40 percent silt, 50 percent clay	Mottled light gray to orange

Appendix 1. Generalized lithologic descriptions of sediment samples examined during the installation of observation wells RIC-341, RIC-345, RIC-346, RIC-699, RIC-700, RIC-701, RIC-702, RIC-703, RIC-704, and RIC-705 in the Congaree National Park, South Carolina.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)]

USGS observation well identifier (fig. 1)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Sample interval depth (feet below land surface)	Generalized lithologic description	Lithologic color (Geological Society of America, 1991)
			22–24	Clayey sand; 60 percent medium grain quartz sand, 10 percent fine grain quartz sand, 30 percent clay	Light grayish-brown
			24–28	Clayey sand; 20 percent medium grain quartz sand, 60 percent fine grain quartz sand, 20 percent clay	Light grayish-brown
			28–34	Clayey sand; 5 percent coarse grain quartz sand, 10 percent medium grain quartz sand, 60 percent fine grain quartz sand, 25 percent clay; some gravel at 28 to 29 feet	Light grayish-brown
			34–42	Slightly clayey sand; 25 percent coarse grain quartz sand, 25 percent medium grain quartz sand, 30 percent fine grain quartz sand, 10 percent silt, 10 percent clay	Light brown
			42–50	Slightly clayey sand; 40 percent coarse grain quartz sand, 30 percent medium grain quartz sand, 20 percent fine grain quartz sand, 10 percent clay	Light brown
			50–55	Gravel; 70 percent gravel, 10 percent coarse grain sand, and 20 percent medium grain sand	Light brown to gray
			55–64	Clay; 10 percent silt, 90 percent clay	Dark gray
RIC-699	33° 46' 14"	80° 47' 05"	0–3	Swamp muck; 40 percent sand, 50-55 percent clay, less than 10 percent mica	Dark yellowish brown 10 YR 4/2
			3–6	Clayey sand; 10 percent sand, 80 percent clay, 10 percent mica	Moderate brown 5 YR 3/4
			6–6.5	Sand with minor clay; 85 percent sand, 10 percent clay, 5 percent mica	Olive gray 5 YR 4/1
			6.5–7	Sandy clay; 40 percent sand, 55 percent clay, 5 percent mica	Dark greenish gray 5 GY 4/1
			7–9	Sandy clay with clayey sand lens 4 to 8 inches thick; 20-75 percent sand, 20-75 percent clay, 5 percent mica	Olive gray 5 YR 4/1

Appendix 1. Generalized lithologic descriptions of sediment samples examined during the installation of observation wells RIC-341, RIC-345, RIC-346, RIC-699, RIC-700, RIC-701, RIC-702, RIC-703, RIC-704, and RIC-705 in the Congaree National Park, South Carolina.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)]

USGS observation well identifier (fig. 1)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Sample interval depth (feet below land surface)	Generalized lithologic description	Lithologic color (Geological Society of America, 1991)
			9–10	Sand with some clay; 80 percent sand, 15 percent clay, 5 percent mica	Dark greenish gray 5 GY 4/1
			10–15	Sand with some clay; 90 percent sand, 5 percent clay, less than 5 percent mica	Dark greenish gray 5 GY 4/1
RIC-700	33° 45' 48"	80° 40' 31"	0–3	Swamp muck; 10 percent sand, 85 percent clay, 5 percent mica	Moderate brown 5 YR 4/4
			3–5.5	Swamp muck; 10 percent sand, 80 percent clay, 10 percent mica, with some dark organics present	Moderate brown 5 YR 4/4
			5.5–6.5	Clayey sand; 80 percent sand, 10 percent clay, 10 percent mica	Moderate yellowish brown 10 YR 5/4
			6.5–7	Sandy clay; 30 percent sand, 60 percent clay, 10 percent mica	Moderate yellowish brown 10 YR 5/4
			7–10	Interbedded sandy clay/clayey sand; material varies between 20 percent to 70 percent sand and/or clay	Moderate yellowish brown 10 YR 5/4
			10–13	Clayey sand; 80 percent sand, 10 percent clay, 10 percent mica	Moderate yellowish brown 10 YR 5/4
RIC-701	33° 48' 34"	80° 51' 59"	0–5	Swamp muck; 20 percent sand, 70 percent clay, 10 percent mica	Moderate brown 5 YR 4/4
			5–6	Sandy clay; 20 percent sand, 70 percent clay, 10 percent mica	Dark yellowish brown 10 YR 4/2
			6–8	Sandy clay; 20 percent sand, 70 percent clay, 10 percent mica	Moderate yellowish brown 10 YR 5/4

Appendix 1. Generalized lithologic descriptions of sediment samples examined during the installation of observation wells RIC-341, RIC-345, RIC-346, RIC-699, RIC-700, RIC-701, RIC-702, RIC-703, RIC-704, and RIC-705 in the Congaree National Park, South Carolina.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)]

USGS observation well identifier (fig. 1)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Sample interval depth (feet below land surface)	Generalized lithologic description	Lithologic color (Geological Society of America, 1991)
			8–9	Clayey sand; 60 percent sand, 30 percent clay, 10 percent mica	Grayish brown 5 YR 3/2
			9–11	Sandy clay; 20 percent sand, 70 percent clay, 10 percent mica	Moderate brown 5 YR 4/4
			11–14	Clayey sand; 60 percent sand, 30 percent clay, 10 percent mica	Pale brown 5 YR 5/4
			14–15.5	Clayey course sand; 75 percent sand, 20 percent clay, 5 percent mica	Pale brown 5 YR 5/4
RIC-702	33° 48' 53"	80° 47' 15"	0–6	Swamp muck; 20 percent sand, 70 percent clay, less than 10 percent mica	Pale brown 5 YR 5/4 to greenish gray 5 G 6/1
			6–9	Sandy clay; 40 percent coarse sand, 60 percent clay, no mica present	Mottled, gray, red, and brown
			9–11	Sandy clay; 20 percent coarse sand, 80 percent clay	Mottled, light olive gray 5 Y 6/1 to Light brown gray 5 YR 6/1
			11–12	Gravely clay; 40 percent gravel, 60 percent clay, no mica present	Mottled, light olive gray 5 Y 6/1 to Light brown gray 5 YR 6/1
			12–13	Gravely clay; 10 percent gravel, 90 percent clay, no mica present	Mottled, light olive gray 5 Y 6/1 to Light brown gray 5 YR 6/1
RIC-703	33° 47' 52"	80° 42' 43"	0–2.5	Swamp muck; 20 percent sand, 80 percent clay	Moderate brown 5 YR 4/4
			2.5–4	Clayey sand; 80 percent sand, 20 percent clay	Light olive gray 5 Y 6/1
			4–5.5	Coarse sand; 90 percent sand, 10 percent clay	Greenish gray 5 GY 6/1
			5.5–6	Sandy clay; 30 percent sand, 70 percent clay	Light brown 5 YR 5/6 to greenish gray 5 GY 6/1
			6–6.5	Coarse sand; 60 percent sand, 40 percent clay	Greenish gray 5 GY 6/1

Appendix 1. Generalized lithologic descriptions of sediment samples examined during the installation of observation wells RIC-341, RIC-345, RIC-346, RIC-699, RIC-700, RIC-701, RIC-702, RIC-703, RIC-704, and RIC-705 in the Congaree National Park, South Carolina.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)]

USGS observation well identifier (fig. 1)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Sample interval depth (feet below land surface)	Generalized lithologic description	Lithologic color (Geological Society of America, 1991)
			6.5–7.5	Sandy clay; 10 percent clay, 90 percent sand	Greenish gray 5 GY 6/1
			7.5–11.5	Sandy clay; 20 percent sand, 80 percent clay	Medium bluish gray 5 B 5/1
			11.5–12	Sandy clay; less than 5 percent sand, 95 percent clay	Medium bluish gray 5 B 5/1
RIC-704	33° 46' 16"	80° 47' 06"	0–3.5	Swamp muck; 15 percent sand, 80 percent clay, 5 percent mica	Light brown 5 YR 6/4
			3.5–5.5	Clayey sand with some very coarse grain sand or fine grain gravel	Light brown 5 YR 6/4 to Pale yellowish brown 10 YR 6/2
			5.5–8	Plastic sandy clay	Pale yellowish brown 10 YR 6/2
			8–12	Clay, slightly sandy;	Pale yellowish brown 10 YR 6/2
			12–14	No recovery	--
RIC-705	33° 47' 41"	80° 46' 54"	0–6	Swamp muck; 10 percent sand, 90 percent clayey silt, organics present	Moderate brown 5 YR 4/4 to Pale yellowish brown 10 YR 6/2
			6–10	Clayey very fine grain sand; 80 to 90 percent sand, 10 to 20 percent clay	Medium gray to medium dark gray
			10–14.5	Clayey sand, 80 percent sand, 20 percent clay, fine to coarse sand with courser material at bottom of hole, some mica present	Medium gray to medium dark gray

Appendix 2: Description of Artificial Neural Network Models

Models generally fall into one of two categories: deterministic (or mechanistic) or empirical. Deterministic models are created from first-principles equations, whereas empirical modeling adapts generalized mathematical functions to fit a line or surface through data from two or more variables. The most common empirical approach is ordinary least squares (OLS), which relates variables using straight lines (single variable), planes (two variables), or hyper-planes (more than two variables), whether the actual relations are linear or not. Calibrating either type of model attempts to synthesize an optimal line or surface through the observed data. Calibrating models is difficult when data have substantial measurement error or are incomplete, or when the variables for which data are available provide only a partial explanation of the causes of variability. The principal advantages that empirical models have over deterministic models are that they can be developed much faster and are more accurate when the modeled systems are well characterized by data. Empirical models, however, are prone to problems when poorly applied. Overfitting and multicollinearity caused by correlated input variables can lead to invalid mappings between input and output variables (Roehl and others, 2003).

An ANN model is an empirical flexible mathematical structure capable of describing complex nonlinear relations between input and output datasets. The structure of ANN models is loosely based on the biological nervous system (Hinton, 1992). Although numerous types of ANNs exist, the most commonly used type of ANN is the multilayer perceptron (MLP) (Rosenblatt, 1958). As shown in figure A2-1, MLP ANNs are constructed from layers of interconnected processing elements called neurons, each executing a simple "transfer function." All input layer neurons are connected to each hidden layer neuron and each hidden layer neuron is connected to each output neuron. There can be multiple hidden layers, but a single layer is sufficient for most problems.

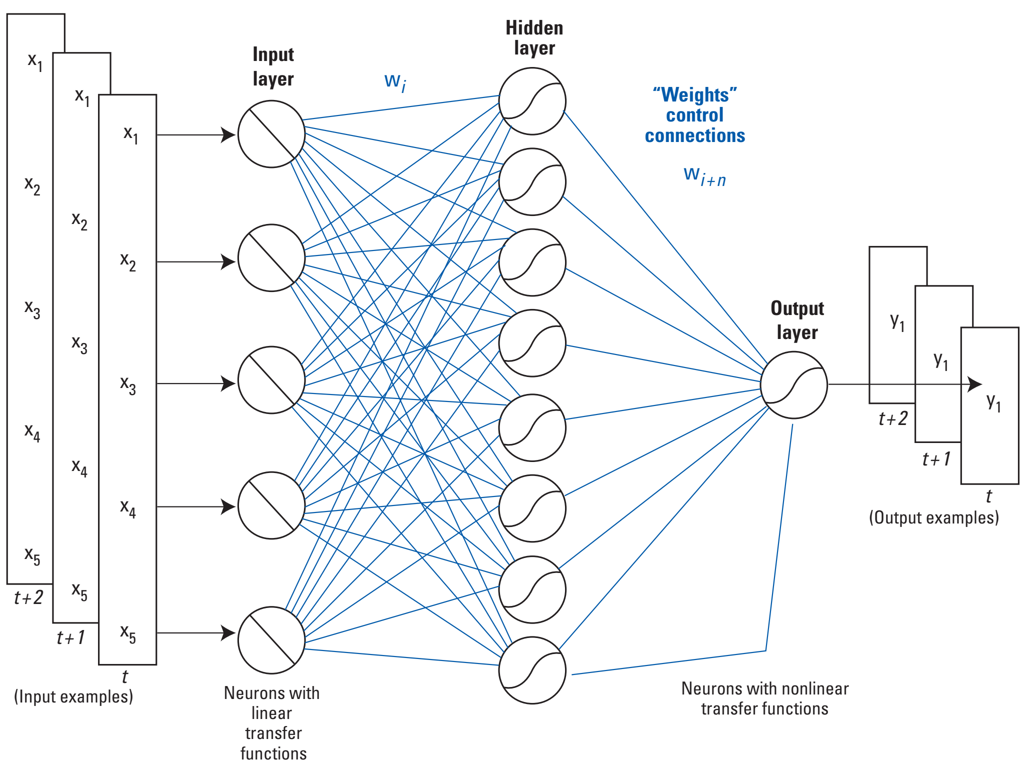


Figure A2-1. Schematic diagram showing multilayer perceptron artificial neural network architecture (Conrads and Roehl, 2007).

Typically, linear transfer functions are used to simply scale input values from the input layer to the hidden layer and generally fall within the range that corresponds to the mostly linear part of the s-shaped sigmoid transfer functions used from the hidden layer to the output layer (fig. A2-1). Each connection has a “weight” w_i associated with it, which scales the output received by a neuron from a neuron in an antecedent layer. The output of a neuron is a simple combination of the values it receives through its input connections and their weights, and the neuron’s transfer function.

An ANN is “trained” by iteratively adjusting its weights to minimize the error by which it maps inputs to outputs for a dataset composed of input/output vector pairs. Simulation accuracy during and after training can be measured by a number of metrics, including R^2 and root mean square error (RMSE). An algorithm that is commonly used to train MLP ANN models is the back error propagation (BEP) training algorithm (Rumelhart and others, 1986). Jensen (1994) describes the details of the MLP ANN, the type of ANN used in this study. Multilayer perceptron ANNs can synthesize functions to fit high-dimension, nonlinear multivariate data. Devine and Roehl (2003) and Conrads and Roehl (2005) describe their use of MLP ANN in multiple applications to model and control combined manmade and natural systems including disinfection byproduct formation, industrial air emissions monitoring, and surface-water systems affected by point and nonpoint-source pollution.

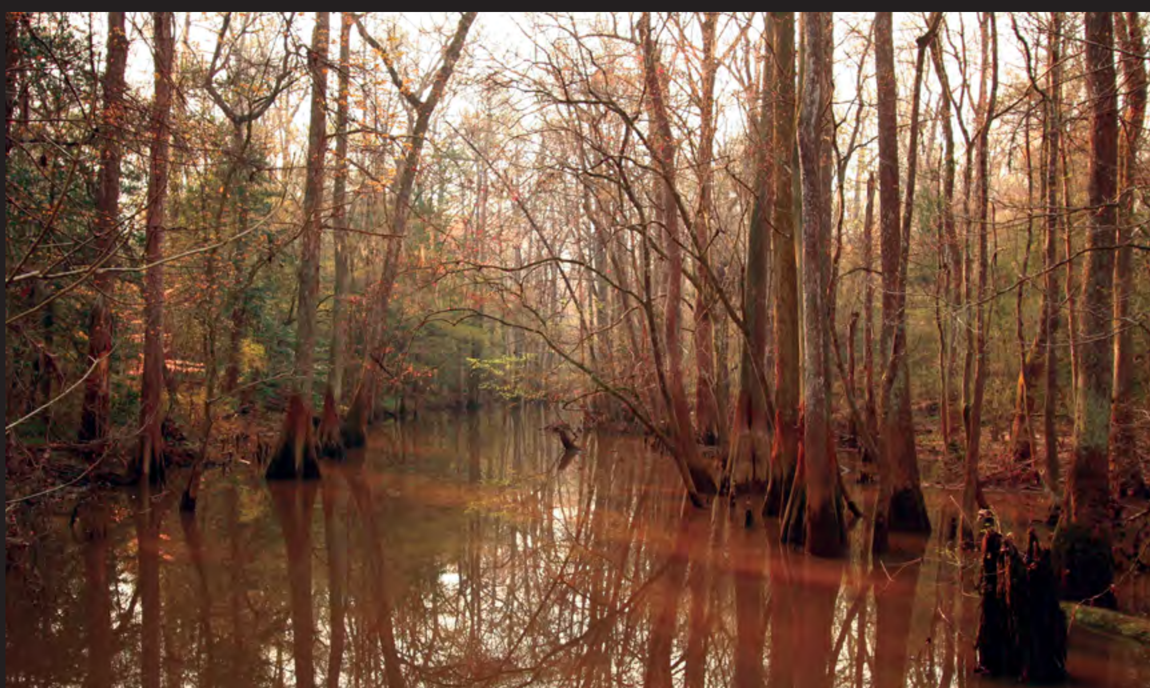
Experimentation with a number of ANN architectural and training parameters is a normal part of the modeling process. For the modeling of the Saluda and Congaree Rivers, a number of candidate ANNs were trained and evaluated for their statistical accuracy and their representation of process physics. Interactions between combinations of variables also were considered. Finally, a satisfactory model can be exported for end-user deployment. In general, a high-quality simulation model can be obtained when:

- The data ranges are well distributed throughout the range of hydrologic conditions of interest,
- The input variables selected by the modeler share “mutual information” about the output variables,
- The form “prescribed” or “synthesized” for the model used to “map” (correlate) input variables to output variables is a good one. Techniques such as OLS and physics-based finite-difference models prescribe the functional form of the model’s fit of the calibration data. Machine-learning techniques like ANNs synthesize a best fit to the data.

Prepared by:
USGS Enterprise Publishing Network
Raleigh Publishing Service Center
3916 Sunset Ridge Road
Raleigh, NC 27607

For additional information regarding this publication, contact:
Director
USGS South Carolina Water Science Center
720 Gracern Road, Suite 129
Columbia, SC 29210
phone: 803-750-6100
email: dc_sc@usgs.gov

Or visit the South Carolina Water Science Center Website at:
http://sc.water.usgs.gov



Conrads and others—**Effects of the Saluda Dam on the Hydrology of the Congaree National Park Flood Plain, South Carolina**—Scientific Investigations Report 2008–5170

Appendix 22

RECREATION PLAN FOR THE SALUDA HYRDOELECTRIC PROJECT
FINAL TWC DRAFT
DECEMBER 2008

SOUTH CAROLINA
ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

RECREATION PLAN FOR THE SALUDA HYRDOELECTRIC PROJECT (FERC NO. 516)

FINAL TWC DRAFT

DECEMBER 2008

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA
ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RECREATION PLAN FOR THE SALUDA HYDROELECTRIC PROJECT (FERC NO. 516)

FINAL TWC DRAFT

DECEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RECREATION PLAN FOR THE SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

DRAFT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1.0 PROJECT DESCRIPTION

The Saluda Hydroelectric Project (FERC No. 516), which includes Lake Murray and portions of the lower Saluda River, is an existing hydroelectric facility owned and operated by South Carolina Electric & Gas Company (SCE&G). The Project is located in Richland, Lexington, Saluda, and Newberry Counties, SC. The Project impounds the 48,000 acre Lake Murray, a popular recreation area for boating and fishing, having numerous public access sites and supporting several popular recreational sport fisheries. The lower Saluda River (LSR), below the Saluda Dam, supports an active recreational fishery and offers a range of paddling experiences from flat water to whitewater with class II to V rapids.

1.1 Regional Setting

Lake Murray, the lower Saluda River, 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.

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

1.2 Lake Murray

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 South Carolina Department of Natural Resources (SCDNR). Surplus bluegill and largemouth bass reared at the SCDNR hatcheries are occasionally stocked as well. 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 regattas annually (Mead and Hunt, 2002). 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. There are 14 public access sites on Lake Murray owned by SCE&G. All but two, Dreher Island State Recreation Area and Larry L. Koon Boat Landing, are managed by SCE&G.

1.3 Lower Saluda River

The lower Saluda River 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. Approximately 8 miles of the LSR is within the project boundary line (PBL). Similar to the Lake, the LSR also supports an active recreational fishery. The cold waters of the river support a trout and striped bass fishery and offer a range of paddling experiences from flat water to whitewater with class II to V rapids. Approximately 10 miles of the river, from approximately one mile downstream of the Dam to the confluence with the Broad River, 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 (NPS) as possessing “outstandingly remarkable” natural or cultural values. The LSR from the dam to RM 3 is so designated because it “affords scenic wilderness experience in urban areas; diversified flora and fauna” (NPS, 2007). There are three formal public access sites owned by SCE&G on the LSR and two, Saluda Shoals Park and James R. Metts Landing, are managed by the Irmo-Chapin Recreation Commission (ICRC) and the Lexington County Recreation and Aging Commission (LCRAC), respectively.

2.0 DATA COLLECTION METHODS

As part of the Saluda Hydro Project relicensing process, several studies were undertaken during 2006 and 2007. These studies provide information and support conclusions and recommendations made in this Recreation Plan. A variety of data collection methodologies were employed during the performance of these studies. They included the following: vehicle counts, on-site interviews, literature searches, GIS and spatial analysis, carrying capacity analysis, level logger deployment, and HEC-RAS modeling, among other methods. The following are descriptions of the methodologies employed for each effort.

2.1 2006 Saluda Hydro Project Recreation Assessment

The purpose of the 2006 Saluda Hydro Project Recreation Assessment was to evaluate existing and future recreational use, opportunities, and needs for the Saluda Project (Kleinschmidt, 2007a). Specifically, the goals of this study were to characterize existing recreational use of SCE&G's recreation sites on Lake Murray and the LSR and examine future recreational needs relating to public recreation sites. Primary data collection included site inventories and assessments, counts of vehicles at recreation sites, user surveys, and a waterfowl focus group. Secondary data collection included information from the SCPRT, aerial photographs of boating use on the lake, and available relevant literature. Analyses included current recreation use estimates derived from both vehicle counts and people per vehicle information provided in the user surveys, future recreation use estimates calculated using population growth rates as a proxy for future recreation participation rates, and recreation site capacities using parking as the determinate. Recreation needs to accommodate existing and future use were based on site inventories, conditions, capacity assessments, use estimates and projections, user preferences and opinions, and consultation with relicensing stakeholders.

2.2 2007 Saluda Hydro Project Spring Use Addendum

In comments received on the draft 2006 Saluda Hydro Project Recreation Assessment described above, the SCPRT, SCDNR, and the Saluda River Chapter of Trout Unlimited (SRCTU) requested information concerning recreational use during winter/spring (January – May), particularly concerning specific user groups whom they expected to utilize LSR sites outside of the sampling frame of the 2006 Saluda Hydro Project Recreation Assessment. Therefore, the goals of the 2007 Saluda Hydro Project Spring Use Addendum were to collect additional information concerning spring use on Lake Murray and the LSR and to identify needs of selected recreational user groups for facilities on the LSR to support spring use (Kleinschmidt, 2007b). Primary data collection entailed facilitated meetings and personal interviews of recreationists who use recreation sites on the LSR. Secondary data collection included the 2006 Saluda Hydro Project Recreation Assessment, the Lower Saluda Corridor Plan and Update, and other relevant literature. As with the Recreation Assessment, analysis included calculating current recreation use estimates by applying the percent of total annual use attributable to the months of January and May at Dreher Island State Recreation Area and Saluda Shoals Park to Lake Murray and LSR recreation site use estimates for Memorial Day through September 30, respectively. Future recreation use estimates were calculated using population growth rates as a proxy for future recreation participation rates. Perceptions of site conditions and needs on the LSR were obtained from a variety of sources including a literature review, trout angler focus group discussions, and on-site interviews.

2.3 2007 Saluda Hydro Project Boating Density Assessment

The goals of the 2007 Saluda Hydro Project Boating Density Assessment were to identify the area available for recreational boating on Lake Murray by lake segment, to assess boat densities occurring under normal (weekend) and peak (holiday) use conditions, and to examine whether recreational boating use of Lake Murray is currently above, below, or at a desirable, or optimal, level

(Kleinschmidt, 2007c). The methodology employed for this effort was derived from standard accepted practices published in the Bureau of Outdoor Recreation (1977) *Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity* and *Management of Aquatic Recreation Resources* by Warren and Rea (1989). The data used for this study included an examination of existing aerial photographs (The Louis Berger Group, 2002) of recreational boating at the Project and information collected from the survey research portion of the 2006 Saluda Hydro Project Recreation Assessment. Combined, the information provided the inputs necessary to assess recreational boating densities on Lake Murray.

2.4 2007 Saluda Hydro Project Downstream Recreation Flow Assessment

The 2007 Saluda Hydro Project Downstream Recreation Flow Assessment examined downstream flows for the LSR for various types of recreation at different river reaches under different flow conditions (Kleinschmidt, 2008). The goals of the study included characterizing currently available recreation opportunities on the LSR, understanding the “rate of change” of the instream conditions of the LSR at various flows along various river reaches, and identifying potential public safety issues associated with LSR flows. This study undertook a three-phase approach. Phase I involved a literature review and desktop analysis of the recreation opportunities, patterns of use, physical characteristics, and hydrology of the LSR. Phase II involved a focus group, structured surveys and on-site reconnaissance of an expert panel of experienced recreationists to assess existing opportunities and the feasibility and potential quality of particular flow ranges for on-water activities. Phase III involved the deployment of water level data loggers at various predetermined intervals along the LSR. A HEC-RAS model was developed utilizing the level logger data for the purposes of determining maximum stages and rates of change (in feet) for scheduled flow events under simulated operating scenarios.

3.0 SITE DESCRIPTIONS, USE ESTIMATES, BOAT DENSITIES, AND RECREATIONAL FLOW RECOMMENDATIONS

The following is a summary of the results of the studies related to recreation performed in support of this plan. Detailed results can be found in respective reports (Kleinschmidt, 2007a; 2007b, 2007c; 2008).

3.1 Recreation Site Descriptions

As of 2007, within the project boundary, there are approximately 130 public, commercial, and private recreation sites[1] 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. There are 17 "Existing Recreation Sites" owned by SCE&G that function primarily as lake or river access, providing boat launches, shoreline angling, picnicking, and swimming areas. SCE&G has also set aside 10 additional sites that are designated as "Existing Future Recreation Sites." One of these "Existing Future Recreation Sites," Bundrick Island, is currently used by boaters as an informal site; there is no road access to the site. The other nine "Existing Future Recreation Sites" are available to the public, but no facilities or amenities are provided on these sites. Collectively, the "Existing Recreation Sites" provide two designated swimming areas, 19 boat launches or carry-in launches, 19 courtesy or fishing piers, and one campground. Restroom facilities are provided at nine of the 20 sites, and picnic tables are provided at 12 sites (Table 3-1). In addition to these sites, there are two overnight anchoring areas required by FERC Order 107 FERC ¶ 62,273 to be designated as Special Recreation Areas: Two Bird Cove and Hurricane Hole Cove. Locations of "Existing Recreation Sites, " "Existing Future Recreation Sites," private sites, and commercial sites on Lake Murray and the LSR can be found in Appendix A. The following sections concentrate on the 17 "Existing

[1] For purposes of this Recreation Plan, public recreation sites refer to sites that are open to the public without discrimination, and which are operated by federal, state, and local agencies 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.

Recreation Sites," as well as Bundrick Island and two informal access sites on the LSR that are owned by SCE&G but outside the PBL (Mill Race)[2].

[2] Although the Mill Race sites are located outside the PBL, they were included in the recreation studies performed during the Saluda Hydro Relicensing Process in order to determine Project effects on recreational use of these sites.

Table 3-1. Existing Recreation Sites and Existing Future Recreation Sites at the Saluda Hydro Project (2007)

Name	Site Number	Type of Facility	Acres	# of Picnic Tables	# of Grills	# of Firepits/Rings	# of Boat Pump Outs	# of Trails	# of Shelters	# of Designated Swimming Areas	# of Stores	# of RV Dumping Stations	# of Potable Water	# of Boat Fuel Pumps	# of Trash Cans	# of Docks	# of Playgrounds	# of Showers	# of Concessions	# of Wet Slips	# of Parking Spaces	# of ADA Spaces	# of Flush Toilets	# of ADA Toilets	# of Portable Toilets	# of RV Sites	# of Cabin Sites	# of Tent Sites	# of Primitive Sites	# of Hard Surfaced Boat Launches	# of Gravel Boat Launches	# of Unimproved Boat Launches	# of Carry-in Launches	Total # of Boat Launch Lanes	# of Courtesy/Fishing Docks	# of ADA Compliant Courtesy/Fishing Docks
Park Site - Lexington Side	1-01	Picnic Area	17.9	80	45	2	0	Multiple	27	1	0	0	2	0	12	0	0	0	1		343	4	4	4	0	0	0	0	0	0	0	0	0		0	0
Larry L. Koon Boat Landing	1-02	Launch Ramp	1.8	4	2	1	0		1	0	0	0	0	0	1	1	0	0	0		49	2	2	0	0	0	0	0	0	1	0	0	0	2	1	1
Shull Island	1-02A	Future	22.4																																	
Shull Island	1-02B	Launch Ramp	0.4	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		8	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Murray Shores	1-03	Launch Ramp	1.6	7	3	1	0		1	0	0	0	0	0	1	1	0	0	0		50	0	0	0	2	0	0	0	0	1	0	0	0	2	1	0
River Bend	1-04	Launch Ramp	11.6	5	1	6	0		1	0	0	0	0	0	2	2	0	0	0		84	0	2	2	0	0	0	0	0	1	0	0	0	2	2	0
Sunset	1-05	Launch Ramp	2.3	1	0	2	0		0	0	0	0	0	0	2	2	0	0	0		28	0	0	0	2	0	0	0	0	1	0	0	0	1	2	0
Simpson's Ferry	1-05A	Future	11.6																																	
Rocky Point	1-06	Launch Ramp	1.7	1	0	0	0		1	0	0	0	0	0	0	0	0	0	0		3	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0
Long Pine	1-06A	Future	31.4																																	
Hilton	1-07	Launch Ramp	4.4	5	2	0	0		2	0	0	0	0	0	3	2	0	0	0		37	2	2	0	0	0	0	0	0	1	0	0	0	2	2	0
Hilton	1-07A	Future	27.9																																	
Dam Site - Irmo Side	1-08	Picnic Area/Launch Ramp	6.8	23	13	3	0	Multiple	7	0	0	0	0	0	7	3	0	0	1		181	3	2	2	0	0	0	0	0	1	0	0	0	3	3	1
Saluda Shoals Park	1-09	Picnic Area/Launch Ramp	240.0	50	6	0	0	Multiple	4	1	0	0	0	0	17	0	2	0	1		463	18	6	6	0	0	0	0	0	1	0	0	0	1	1	1
James R. Metts Landing	1-10	Launch Ramp	1.0	0	0	0	0		0	0	0	0	0	0	3	0	0	0	0		25	2	0	0	0	0	0	0	0	1	0	0	1	2	0	0
Dreher Island State Recreation Area	1-11	Campground/Launch Ramp	348.0	219	133	0	0	Multiple	14	0	1	0	2	1	13	4	3	1	0	30	619	14	22	4	0	97	5	15	5	3	0	0	0	6	4	4
Macedonia Church	1-12	Picnic Area	4.8	4	0	0	0		1	0	0	0	0	0	0	0	0	0	0		12	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Higgins Bridge	1-13	Launch Ramp	1.1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		8	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Kempson Bridge	1-14	Launch Ramp	2.9	0	0	0	0		0	0	0	0	0	0	0	2	0	0	0		16	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0
Gardendale	1-15	Launch Ramp	4.7	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0		40	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0
Water Treatment Plant	1-16	Future	4.3																																	
Stone Mountain	1-17	Future	26.5																																	
Cloud's Creek	1-18	Future	3.0																																	
Big Creek	1-19	Future	22.3																																	
Little Saluda Point	1-20	Future	15.4																																	
Bundrick Island	1-21	Future/Informal Site	87.9	0	0	0	0		0	0	0	0	0	0	2	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Lake Murray Estates Park	1-22	Launch Ramp	7.7	2	2	0	0		0	0	0	0	0	0	1	2	0	0	0		22	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0
Two Bird Cove	1-23	Special Recreation Area																																		
Hurricane Hole Cove	1-24	Special Recreation Area																																		

3.1.1 Lake Murray

SCE&G owns 14 "Existing Recreation Sites" on Lake Murray and has set aside 64 SCE&G-owned islands in Lake Murray as undeveloped, natural areas that are available for public recreation. Of the 14 "Existing Recreation Sites," SCE&G operates 12 of them, and leases the remaining two sites, Dreher Island State Recreation Area and Larry L. Koon Boat Landing, to others for use as public recreation areas. With the exception of Dreher Island State Recreation Area and River Bend, all sites are operated for day-use only.

3.1.2 Lower Saluda River

There are several formal and informal public access sites on the LSR, providing a range of water- and land-based recreation opportunities. Boating access for motorized water-craft is limited to the two most upstream access sites, Saluda Shoals Park and James R. 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.

3.2 Existing and Future Recreation Use Estimates

Estimated and future recreation use estimates are compiled from two sources: the Recreation Assessment Study Report (Kleinschmidt, 2007a) and the Spring Use Addendum Study Report (Kleinschmidt, 2007b).

3.2.1 Existing Recreation Use

The Saluda Hydro Project supported approximately 634,000 recreation days at "Existing Recreation Sites" (plus Bundrick Island but excluding Two Bird Cove and Hurricane Hole Cove) within the project boundary during the 2006 peak recreation season, defined as April 1st through September 30th in the 2003 FERC Form 80 Report on Recreational Resources (Table 3-3). Lake Murray experienced approximately 463,000 recreation days during this time period (73 percent of total use), while the LSR (excluding Mill Race) experienced a total of approximately 172,000 recreation days during the peak recreation season (27 percent of total use). Weekday use accounted for 49 percent of total use; 40 percent of total use occurred on weekends; and 11 percent of total use occurs on holidays. June and July account for the majority (40 percent) of total use during this time period. 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, 1997; SCE&G, 2003).

The most used “Existing Recreation Sites” on Lake Murray (including Bundrick Island) were Dreher Island State Recreation Area (116,670 recreation days or 25 percent of total use), and Bundrick Island (94,570 recreation days or 20 percent of total use), Dam Site - Irmo Side (54,460 recreation days or 12 percent of total use), and Larry L. Koon Boat Landing (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).

Because all of the “Existing Recreation Sites” provide access to Lake Murray, it is not surprising that the majority of activities that individuals participated in at these sites were water-based recreation activities (80 percent). Fishing, from either a boat or the bank, was 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) were popular activities. These sites also supported limited land-based activities such as walking/hiking, sightseeing, and picnicking.

Table 3-3. Estimate of Recreation Days for Saluda Hydro Project Existing Recreation Sites (plus Bundrick Island) 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	42,830	17,400	5,570	65,800
Weekends	35,230	6,390	2,880	44,500
Holidays	0	0	0	0
Total	78,060	23,790	8,450	110,300
May				
Weekdays	31,100	16,180	3,190	50,470
Weekends	37,410	5,720	4,600	47,730
Holidays	20,220	4,430	1,570	26,220
Total	88,730	26,330	9,360	124,420
June				
Weekdays	52,800	23850	13390	90,040
Weekends	43,440	8760	6910	59,110
Holidays	0	0	0	0
Total	96,240	32,610	20,300	149,150
July				
Weekdays	34,300	22780	4200	61,280
Weekends	29,860	11390	5530	46,780
Holidays	20,950	6500	1690	29,140
Total	85,110	40,670	11,420	137,200
August				
Weekdays	26,170	8180	3360	37,710
Weekends	30,270	13350	2790	46,410
Holidays	0	0	0	0
Total	56,440	21,530	6,150	84,120
September				
Weekdays	20,310	16310	1790	38,410
Weekends	24,430	5770	2580	32,780
Holidays	13,210	4480	880	18,570
Total	57,950	26,560	5,250	89,760
Total				
Weekdays	207,510	104,700	31,500	343,710
Weekends	200,640	51,380	25,290	277,310
Holidays	54,380	15,410	4,140	73,930
TOTAL	462,530	171,490	60,930	694,950

[a] Outside the project boundary.

The LSR supported an estimated 232,420 recreation days total, 171,490 recreation days within the project boundary and roughly 60,930 recreation days outside the project boundary at the Mill Race sites, from April 1st through September 30th, 2006. 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), James R. 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).

Activities participated in by users of the LSR sites were varied. About half of the activities that individuals participated in at these sites were water-based recreation activities (51 percent). As with the Lake Murray sites, fishing, either wading or from a boat, pier, or the bank, was the most participated in activity at LSR sites (21 percent of total use). Canoeing and kayaking, both flatwater and whitewater, comprised 20 percent of total use, making paddling the second most popular activity. Sightseeing/wildlife viewing was the third most popular activity on the LSR (13 percent of total use), followed by hiking/walking (12 percent of total use).

3.2.2 Future Recreation Use

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 Hydro Project, a majority of the recreation activity occurring from "Existing Recreation Sites" was 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 was attributed to a more regional population from the outskirts of Richland, Lexington, Saluda, and Newberry Counties.

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, 2005). 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, 2005). 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 were estimated to be reaching capacity and, in a few cases, exceeding capacity under current use levels.

Estimated recreation use stemming from “Existing Recreation Sites” (including Bundrick Island) at the Saluda Hydro Project could total almost 784,270 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 3-4). Use of Lake Murray public access sites could increase by roughly 110,000 recreation days by the year 2030; use of LSR access sites (including Mill Race) could increase by approximately 55,000 recreation days in the same time period. Since this estimate of future recreation days was based on population projections, which will likely change over time, a process has been developed to adjust this plan periodically over the life of the license (see Section 6.2). Applying current outdoor recreation trends and existing public recreation facilities, fishing will likely continue to be the dominant activity at the Project in the year 2030.

Table 3-4. Estimated Future Recreation Days from Existing Recreation Sites (including Bundrick Island) at the Saluda Hydro Project

		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	462,530	485,060	507,460	529,640	551,830	572,140
Lower Saluda River Sites	171,490	179,840	188,150	196,370	204,600	212,130
Mill Race Sites	60,930	63,900	66,850	69,770	72,690	75,370
TOTAL	694,950	728,790	762,460	795,780	829,130	859,640

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

During the 2006 recreation season, the capacities of "Existing Recreation Sites" around the lake and on the LSR were estimated. "Existing Recreation Sites" at the project were generally well used with several sites reportedly being used at their design capacity, particularly on weekends and holidays[3]. The current capacity at which public access sites are used was estimated for all sites with the exception of Bundrick Island, which does not have a parking area, and is used mainly by boaters.

Results suggested that Dam Site - Irmo Side, Park Site - Lexington Side, Rocky Point and Dreher Island State Recreation Area 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, River Bend, Higgins Bridge, and Kempson Bridge, are currently used at rates approaching capacity, though this trend was only observed on holidays for River Bend and Kempson Bridge.

[3] For the purposes of this Plan, 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.

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 L. Koon Boat Landing 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, and 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.

3.3 Boat Densities on Lake Murray

In addition to the capacity at which “Existing Recreation Sites” along Lake Murray are being used, the boating density study identified the area available for recreational boating on Lake Murray by lake segment (Appendix A), assessed boat densities occurring under normal (weekend) and peak (holiday) use conditions, and determined whether recreational boat use of Lake Murray was currently above, below, or at a desirable, or optimal, level.

Results of the boating density study (Kleinschmidt, 2007c) showed that Lake Murray is currently utilized well below its recreational boating capacity. 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.

3.4 Recreational Flow Recommendations on the Lower Saluda River

As stated previously, about half of the total use at “Existing Recreation Sites” on the LSR is water-based activities. Based on the results of Kleinschmidt (2008), the range of acceptable flows for water-based activities varies by experience level. Generally, whitewater boating opportunities are available at all water levels ranging from 500 cfs and up and are favorable at flows of between 2,300 cfs (rated “good” to “excellent” during the on-site reconnaissance) 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. 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. According to Kleinschmidt (2008), wade angling, swimming, and rock-hopping are best enjoyed at flows between 500 and 1,100 cfs.

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. 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. 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 and hourly average flows on an hourly basis. Therefore, peak flows of 12,000 cfs and higher for specific durations are provided much more often than 2 percent of the time year-round.

4.0 CONSULTATION PROCESS AND METHODOLOGY

Beginning in November 2005, SCE&G has undertaken an extensive consultation process associated with the Saluda Hydro Project Relicensing. After issuance of the Initial Consultation Document (ICD), SCE&G formed the Recreation Resource Conservation Group (RCG) to discuss and resolve recreation-related issues submitted in response to the ICD. The first meeting of the Recreation RCG was held on November 18, 2005. At subsequent meetings, smaller Technical Working Committees (TWC) were formed to deal with specific issues raised during the initial RCG meeting. In the Recreation RCG, three TWCs were formed to deal with recreation-related issues: Recreation Management, Downstream Flows, and Lake Levels. In total, the Recreation RCG and its associated TWCs met over 20 times from 2005 to 2008. Membership lists and meeting minutes are available in Appendix B.

After the formation of the TWCs, the Recreation RCG continued to develop a Work Plan, which included a Mission Statement, Identified Issues, RCG Responsibilities, Tasks and Products, Schedule, and Possible Mitigation Measures to be Considered. The Recreation RCG also developed a Recreation Vision Statement for the Saluda Project and agreed on a Standard Process to aid in the development of this Plan. The Standard Process is further described in Section 4.1 and Section 4.2. The final Work Plan, Vision Statement, and Standard Process can be found in the Recreation RCG Working Documents in Appendix C.

The Recreation Management TWC was tasked with dealing with issues associated with future recreational needs at the Saluda Hydro Project, including facility upgrades and policy. This TWC was used to complete three studies: the Recreation Assessment Study Report (Kleinschmidt, 2007a), the Spring Use Addendum Study Report (Kleinschmidt, 2007b), and the Boating Density Report (Kleinschmidt, 2007c). The results of these studies were described in previous sections and provide the necessary background information for recreation planning at the Saluda Hydro Project.

The Downstream Flows TWC was tasked with developing a schedule of recreational releases for the LSR. This TWC completed one study: the Downstream Recreation Flow Assessment Report (Kleinschmidt, 2008). The results of this study applicable to recreational flows were described in a previous section. Upon completion of this report, the Downstream

Flows TWC met several times to agree on a recreational flow schedule for the Saluda Hydro Project.

The Lake Levels TWC was tasked with determining an appropriate lake level for recreational activities and examining the effects of various lake levels on recreation. Using results from a previous study (The Lake Murray Association, 2006) and utilizing the Standard Process Questions, the Lake Levels TWC agreed on two lake level scenarios submitted to the Operations RCG.

4.1 Standard Process

In order to remain focused on those issues relevant to the Recreation RCG, the group agreed to use a Standard Process to guide decision making during the consultation process.

4.2 Standard Process Steps and Questions

The four steps of the Standard Process are intended to ensure that all facility improvements and needs identified through the consultation process are consistent with desired future conditions. The first step was to determine desired future condition. This was accomplished through identifying the issues, finalizing the Vision Statement, and completing the first set of questions on the Standard Process Form. The second step was to establish baseline conditions. This was accomplished through the various studies performed during the consultation process. The third step was to determine what actions are needed and when they should occur. This step was accomplished through consultation with the Recreation RCG and was based on results of the various studies performed. Finally, the final step was the consultation associated with various proposals for recreation facility improvements at the Saluda Hydro Project.

4.3 Recreation Solution Principles

Early in the consultation process, the Recreation RCG agreed that it needed a set of "guidelines" to assist with recreation planning to ensure any facility improvements would take into consideration the various issues at the Saluda Hydro Project. The result was a set of Solution Principles. These Solution Principles can be found in the Recreation RCG Working Documents in Appendix C.

5.0 RECREATION SITE RECOMMENED IMPROVEMENTS AND DEVELOPMENT

Perceptions of those interviewed at public recreation sites suggest that sites are generally not crowded and in good condition overall. It is desirable to maintain those perceptions and the diversity of the recreation experiences provided while accommodating additional use. However, while many sites accommodate American with Disabilities Act (ADA) compliant parking, few sites are developed to provide a high level of barrier free access. Most sites are not staffed but are frequented regularly by managing personnel and/or law enforcement to check on site and safety conditions. Nonetheless, improved maintenance was recommended for the majority of recreation sites. Specific improvement to “Existing Recreation Sites” and development of “Proposed Recreation Sites” are described in Section 5.1 and 5.2. “Existing Recreation Sites” that do not need improvement, whether because they are not well used or are in satisfactory condition, are described in Section 5.3.

5.1 Proposed Improvements at Existing Recreation Sites

Lake Murray Sites

Larry L. Koon Boat Landing (1-02; 1.8 acres)

Larry L. Koon Boat Landing is a large formally developed boat launch. The site is considered in very good condition by visitors. It ranks 4th in patronage among Lake Murray public access sites, accommodating 12 percent of all use estimated for the peak season. The site is partially ADA compliant. This site is most commonly used for boat fishing. This is a very popular boat launch, and is well used, frequently to capacity. Of all public access sites on the lake, patrons rated this site as being most crowded. SCE&G owns the site but it is leased to the LCRAC. The LCRAC will continue to be responsible for operation and maintenance (O&M) of the site. At this site, in order to relieve the capacity issues, enhance barrier free access, and eliminate an issue related to the entrance/exit, SCE&G will:

- Evaluate alternatives to increase parking capacity (such as overflow parking at Shull Island [1-02A]);

- Identify substitute sites through education (web site, maps, etc.);
- Pave an ADA compliant path from the parking lot to the restroom facilities; and
- Widen the existing driveway to eliminate the “trailer drop” into the drainage ditch.

Shull Island (1-02B; 0.4 acres)

Shull Island is located adjacent to Larry L. Koon Boat Landing. It is relatively undeveloped site with a gravel lot and launch. This site generally serves as overflow for Larry L. Koon Boat Landing. The site is considered by users to be in very good condition. It ranks 6th in patronage among all public access sites at the Lake, accommodating approximately 5 percent of all use. This site is not ADA compliant. Boat fishing and swimming are the primary uses of this site. This site is a popular boat launch, frequently used to its capacity. This site should be managed in concert with Larry L. Koon Boat Landing, to accommodate additional parking. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, SCE&G will:

- Add two ADA compliant picnic tables.

Murray Shores (1-03; 1.6 acres)

Murray Shores is predominantly a boat launch site. Boat fishing is the most popular activity at this location. It is well developed, and also supports SCE&G’s Shoreline Stabilization Demonstration Project. Murray Shores is considered by its users to be a little above average in its condition. It ranks 7th in use among all public access sites, accommodating approximately 5 percent of all estimated use at public access sites at Lake Murray. This site is not ADA compliant. The site accommodates current levels of use and can absorb additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to make the site easier to find, enhance barrier free access, improve safety, and relieve potential future capacity issues, SCE&G will:

- Install additional directional signs to the site (working with Lexington and/or Saluda counties);

- Refurbish the existing courtesy dock for ADA compliance;
- Stripe the existing parking lot;
- Install additional lighting; and
- Construct ADA compliant restroom facilities, depending on availability of a sewer connection. If a sewer connection is not available at the scheduled time of construction, SCE&G will install an ADA compliant vault type restroom facility.

River Bend (1-04; 11.6 acres)

River Bend is a formal day use access site, with facilities to support shoreline fishing, picnicking, and boat launching. It is considered by patrons to be slightly above average in condition. It ranks 5th in usage among the public access sites on the lake, accommodating approximately 7 percent of all estimated use. This site is partially compliant with the ADA. This site is estimated to be used below design capacity (except for holidays) and can absorb additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to improve barrier free access, relieve potential future capacity issues, and expand the site for potential future use, SCE&G will:

- Refurbish the existing fishing pier for ADA compliance;
- Refurbish the existing courtesy dock for ADA compliance;
- Pave an ADA compliant path to both the fishing pier and courtesy dock;
- Pave and stripe the existing overflow parking area; and
- Add 5.9 acres for future use (Site 4B).

Sunset (1-05; 2.3 acres)

Sunset is a day use site used primarily for picnicking, shoreline fishing, and some swimming. The site is considered by users to be in very good condition. It ranks 8th in usage among the lake sites, accounting for approximately 4 percent of total estimated use. This site does not provide barrier free access. Estimated use is at the site's design capacity. SCE&G owns the site and will continue to be responsible for O&M of the site.

At this site, in order to provide barrier free access, relieve potential future capacity issues, and expand the site for potential future use, SCE&G will:

- Refurbish the existing fishing pier for ADA compliance;
- Refurbish the existing courtesy dock for ADA compliance;
- Pave and stripe existing parking area;
- Construct ADA compliant restroom facilities, depending on availability of a sewer connection. If a sewer connection is not available at the scheduled time of construction, SCE&G will install an ADA compliant vault type restroom facility;
- Install stabilization material on the sides of the existing boat ramp to eliminate drop-off conditions;
- Construct an additional ADA compliant paved parking lot; and
- Add 29.9 acres for future use.

Hilton (1-07; 4.4 acres)

Hilton is a formal day use site with a boat launch, picnic facilities, and a fishing pier. The site is considered to be in near excellent condition by its users, and ranks 9th in usage among all lake sites. It accommodates approximately 3 percent of all estimated use at the lake stemming from public access sites. Boat fishing is reported as the primary activity at this site. This site does not offer barrier free access. Estimated use is at the site's design capacity. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to improve barrier free access and improve safety, SCE&G will:

- Refurbish the existing courtesy dock for ADA compliance;
- Construct ADA compliant restroom facilities, depending on availability of a sewer connection. If a sewer connection is not available at the scheduled time of construction, SCE&G will install an ADA compliant vault type restroom facility;
- Pave an ADA compliant path to the existing courtesy dock;
- Install additional lighting; and

- Construct and ADA compliant fishing pier, including paving a path from the parking lot to the fishing pier.

Dam Site - Irmo Side (1-08; 6.8 acres)

Dam Site - Irmo Side is a well-developed day use recreation area that functions primarily as a boat launch. It is located on the north side of the Saluda Dam. The site is considered well maintained by users. It ranks third in patronage among all public access sites at the Lake, accommodating 12 percent of all estimated use during the peak season. Primary uses of this site are fishing from shore, pier/dock, or boat. It is partially compliant with the ADA. This site is estimated to be used below design capacity and can absorb additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to improve barrier free access and relieve potential future capacity issues, SCE&G will:

- Construct an ADA compliant courtesy dock;
- Refurbish the existing fishing pier for ADA compliance; and
- Pave an ADA compliant path to the existing restroom facilities.

Higgins Bridge (1-13; 1.1 acres)

Higgins Bridge is a rural site with a small, single lane boat launch. It provides access to the upper Saluda River. This site is considered by users to be in average condition. There are no support facilities at this location. The site ranks 14th in usage among all 15 public access sites on the lake, accounting for approximately 1 percent of estimated use. This site does not offer barrier free access. Estimated use at this site is approaching design capacity but the site can absorb some additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, SCE&G will:

- Add two ADA compliant picnic tables.

Kempson Bridge (1-14; 2.9 acres)

Kempson Bridge is a newly redeveloped site used primarily for boat launching and shoreline fishing. It is considered to be in near excellent condition. It is ranked 13th in usage with about 1 percent of all estimated use for the lake. This site is partially compliant with the ADA. The site is estimated to be used below design capacity (except for holidays) and can adsorb additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to improve available amenities, SCE&G will:

- Install an ADA compliant vault type restroom facility, including an ADA compliant paved path to the facility; and
- Add two ADA compliant picnic tables.

Lake Murray Estates Park (1-22; 7.7 acres)

Lake Murray Estates Park is a formal day use site, with facilities supporting shoreline fishing, boat launching, and picnicking. The site is located in a residential neighborhood, near a gated community. This site is difficult to find without detailed directions. Users of this site consider it to be in very good condition. It is ranked 10th in usage among all 15 public access sites, accommodating approximately 3 percent of all estimated use. This site does not provide barrier free access. This site is estimated to be approaching design capacity but can adsorb some additional use. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, in order to make the site easier to find, improve available amenities, and relieve potential future capacity issues, SCE&G will:

- Install additional directional signs to the site (working with Saluda County);
- Construct ADA compliant restroom facilities, depending on availability of a sewer connection. If a sewer connection is not available at the scheduled time of construction, SCE&G will install an ADA compliant vault type restroom facility;
- Pave and stripe existing parking area; and
- Pave an ADA compliant path from the parking lot to the existing fishing pier.

Lower Saluda River Sites

James R. Metts Landing (1-10; 1.0 acres)

James R. Metts Landing is predominantly a boat launch site located across the river from Saluda Shoals Park. This site was ranked by its patrons as being in very good condition, the largest percentage of whom use the site for fishing. It ranks 3rd in usage among all the LSR sites, accommodating approximately 11 percent of estimated use. This site is used at capacity. SCE&G owns the site but it is operated by the LCRAC. The LCRAC will continue to be responsible for O&M of the site. At this site, SCE&G will:

- Add two ADA compliant picnic tables; and
- Construct a bank fishing area.

Gardendale (1-15; 4.7 acres)

Gardendale is a relatively informal access site, with walk-in access and a carry-in launch. Canoeing/kayaking was the most popular activity at this site. Park patrons rated the condition of this site as good to very good. Gardendale is the least used of all the LSR sites, ranking 5th, and accounting for approximately 5 percent of all use. This site does not provide barrier free access. The site is estimated to be used at capacity on weekends. SCE&G owns the site and will continue to be responsible for O&M of the site. At this site, SCE&G will:

- Explore a lease for the property to the ICRC.

5.2 Proposed Future Recreation Sites

In addition to the above proposed improvements at "Existing Recreation Sites", stakeolders recommended that SCE&G set aside additional project lands for future recreation development. As part of the rebalancing of shoreline classifications conducted in the Lake and Land Management TWC, which included input from the Recreation Management TWC, SCE&G agreed to designate approximately 200 acres and 10 shoreline miles as Recreation (project lands) as well as to include 900 acres of land from outside the project (proposed project lands) in the Recreation classification. These lands have been determined to be topographically suitable for recreational use, free of sensitive resources such as rare, threatened, or endangered (RTE) species, fish spawning beds, wetlands, etc.; and would not be expected to exacerbate current on-water use patterns. These lands include the "Existing Future Recreation Sites" shown in Table 3-1 as well as some additional lands to accommodate future recreational use of the Project. The location of these proposed lands is shown in Appendix D. SCE&G currently owns these properties but may lease the property during the new license term. If the property is leased during the new license term, SCE&G will inform FERC as to the change in status of the property. These "Proposed Future Recreation Sites" (pending FERC approval of this plan) are:

Existing Future Recreation Sites	**Proposed Future Recreation Sites**
Shull Island (1-02A; 22.4 acres)	Old Corley Bridge Road (1-25; 2.0 acres)
Simpson's Ferry (1-05A; 11.6 acres)	Shealy Point Tract (1-26; 40.1 acres)
Long Pine (1-06A; 31.4 existing acres, additional 20 acres proposed)	Shealy Road Access Area (1-27; 27.6 acres)
Hilton (1-07A; 27.9 acres)	Rocky Creek (1-28; 648.0 acres)
Water Treatment Plant (1-16; 4.3 acres)	Little River/Harmon's Bridge (1-29; 2.8 acres)
Stone Mountain (1-17; 26.5 acres)	Crayne's Bridge Public Park (1-30; 47.9 acres)
Cloud's Creek (1-18; 3.0 acres)	Twelve-mile Creek (1-31; 52.0 acres)
Big Creek (1-19; 22.3 existing acres, additional 15 acres proposed)	Candi Lane (1-32; 3.1 acres)
Little Saluda Point (1-20; 15.4 existing acres, additional 14.2 acres proposed)	Lower Saluda River (1-33; 320.2 acres)
Bundrick Island (1-21; 87.9 acres)	

5.3 Proposed Development of Future Recreation Sites

Several locations have been identified through review of existing recreation management plans, consultation with the Recreation Management TWC, and results of relicensing recreation studies conducted for the Project. As a result, the following sites will be developed within the first ten years of license issuance to accommodate increased future recreational use of project waters.

Lake Murray Sites

Cloud's Creek (1-18; 3.0 acres)

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. SCE&G owns the site and will be responsible for O&M of the site once completed. At this site, in order to provide a take-out/put-in on the Cloud's Creek Canoe Trail, SCE&G will:

- Construct a gravel parking lot for approximately 8 to 10 vehicles; and
- Construct a carry-in launch.

Little Saluda Point (1-20; 29.6 acres)

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). SCE&G owns the site and will be responsible for O&M of the site once completed. At this site, in order to improve bank fishing access on Lake Murray, SCE&G will:

- Construct two ADA compliant fishing piers;
- Install shoreline stabilization materials as necessary; and
- Pave an ADA compliant path from the parking lot to the fishing piers.

Old Corley Bridge Road (1-25; 2.0 acres)

Old Corley Bridge Road is located on the west side of Rocky Creek approximately four miles off of US Highway 378 on Corley Bridge Road. SCE&G owns the site and will be responsible for O&M of the site once completed. At this site, in order to provide a take-out/put-in on the Cloud's Creek Canoe Trail, SCE&G will:

- Construct a gravel parking lot for approximately 8 to 10 vehicles;
- Construct a carry-in launch; and
- Install directional signs to the site (working with Saluda County).

Lower Saluda River Sites

Twelve-mile Creek (1-31; 52.0 acres)

Twelve-mile Creek is located approximately 3.5 miles below the Saluda Dam and about 2 miles from the boat launches at Saluda Shoals Park and James R. Metts Landing. The site can be accessed via Corley Mill Road from US Highway 378. At this site, SCE&G will:

- Explore a lease for the property to the LCRAC.

Candi Lane (1-32; 3.1 acres)

Candi Lane is located approximately 8.5 miles below the Saluda Dam and about 3.5 miles below the Gardendale site. This site is primarily intended to be a take-out above the Mill Race rapids, approximately 0.5 miles downstream. The site can be accessed via Greystone Blvd from Interstate 126. At this site, SCE&G will:

- Explore a lease for the property to the City of Columbia.

5.4 Existing Recreation Sites Not Needing Improvements at This Time

During the course of development of this Recreation Plan, several sites were identified that may need improvements but which are unfeasible for a given reason. SCE&G will continue to monitor site conditions over time to check on user perceptions of the condition ratings at these sites. This will be done informally by staff. If conditions warrant improvements at these sites, they will be detailed in future addenda (see Section 6.2).

Lake Murray Sites

Park Site - Lexington Side (1-01; 17.9 acres)

Park Site - Lexington Side is a newly renovated day use site, positioned on the south side of the Saluda Dam. Park Site - Lexington Side is the only site that was rated as being in poor condition by patrons, and then only on weekdays. Patronage was also lower than expected at this site. However, it is likely that these results were due to low water levels, beach closure early in the season at a site that is first and foremost a swimming beach, and heavy road construction on Route 6 in 2006. Internal records of revenue collected at this site show that 2006 use at this site was just two percent of historical use (prior to construction beginning on the back-up Saluda Berm). It ranks 12th in patronage among all public access sites at the Lake, accommodating one percent of all estimated use during the peak season. Primary use of this site is picnicking (although swimming may increase in use as road and site construction are now concluded). This site provides very good compliance with the ADA. This site is estimated to be used below design capacity and can absorb additional use.

No improvements are schedule for Park Site - Lexington Side during the first ten years of the new license. Park Site - Lexington Side was recently renovated (completed in 2007); therefore, Recreation RCG members felt that no improvements were needed. Site conditions will continue to be monitored informally by SCE&G staff. SCE&G will continue to be responsible for O&M at this site.

Rocky Point (1-06; 1.7 acres)

Rocky Point is a relatively rural day use site. It is small compared to other locations with a boat launch. Rocky Point receives very limited usage, ranking 15th (last) in usage among all the lake sites. It accommodates less than one percent of all estimated use for the public access areas on the lake. This site does not provide barrier free access. This site is estimated to be used below design capacity and can adsorb additional use.

Since Rocky Point receives such little use, Recreation RCG members decided that no improvements were needed at this time. Site conditions will continue to be monitored informally by SCE&G staff. SCE&G will continue to be responsible for O&M at this site.

Dreher Island State Recreation Area (1-11; 348.0 acres)

Dreher Island State Recreation Area is the largest park on the lake in terms of physical area. The Park is formally developed, managed by the state, and provides numerous facilities for day use (boat launches, picnic areas, etc.) and overnight use (campground, villa rentals). The site is considered by its users to be in very good condition. Dreher Island ranks 1st in usage among all lake sites. It accommodates approximately 25 percent of all estimated use at the lake. This site is in compliance with the ADA. This site is estimated to be used below design capacity for day use activities and can adsorb additional use.

Athough Dreher Island State Recreation Area accommodates the most use of all sites on Lake Murray, the site was designed to receive this much use and appears to be used below its capacity. SCE&G will continue to informally consult with park staff to determine if future improvements are necessary. SCPRT will continue to be responsible for O&M at this site.

Macedonia Church (1-12; 4.8 acres)

Macedonia Church is a shoreline area used primarily for bank fishing. The site is located adjacent to the church for which it is named. It is considered by users to be in very good condition. It ranks 11th in usage among all of the lake access sites, accommodating 1 percent of estimated use. This site does not provide barrier free access. Estimated use is at the site's design capacity; however, patrons frequently use the church parking area for overflow parking.

Since this site receives little use overall, and is considered to be in satisfactory condition, no improvements to this site have been scheduled at this time. SCE&G will continue to informally monitor site conditions. SCE&G will continue to be responsible for O&M at this site.

Bundrick Island (1-21; 87.9 acres)

Bundrick Island is an undeveloped area on a small peninsula that juts into the Lake. It provides a fairly remote, undeveloped wooded setting with natural sand beaches on the shoreline. Vehicular access is prohibited. The site serves primarily as a day use area for boaters. The site is very popular, ranking 2nd in patronage among all public access sites, accommodating approximately 20 percent of all estimated use. This site is not ADA compliant. In addition to boating activities, this site supports camping, picnicking and bicycling.

Although Bundrick Island could potentially be a large park on the southern side of the reservoir near the town of Lexington, Recreation RCG members felt that the site should continue to be managed in its current state for as long as possible. The site serves a unique population and is obviously well like by patrons. SCE&G will continue to informally monitor this site to see if perceptions change.

Two Bird Cove and Hurricane Hole Cove (1-23 and 1-24)

Two Bird Cove and Hurricane Hole Cove will continue to be designated as special recreation areas to accommodate overnight anchorage. SCE&G will informally monitor use of these areas. There is no O&M associated with these sites.

Lower Saluda River Sites

Saluda Shoals Park (1-09; 240.0 acres)

Saluda Shoals is a large community park on the LSR. It provides two miles of trail along the river, access for wade and bank fishing, boat launch, picnic shelters, and a water spray park. It is the only site with a dog park and bridle trails. Saluda Shoals was rated by respondents as being in nearly excellent condition. The site ranks 1st in usage, accounting for 58 percent of all use estimated for the LSR public access sites. Much of this site accommodates barrier free access. The site is well used and enjoyed by patrons. It is used below capacity.

Although Saluda Shoals Park is the most used site on the LSR, it is currently used within designed capacity. The ICRC monitors site conditions and is in frequent contact with SCE&G regarding site needs. SCE&G will continue to be an active member in this partnership. The ICRC will continue to be responsible for O&M at this site.

Mill Race (MILLA & MILLB; 0.9 acres)

Mill Race A and B are informal shoreline areas on the LSR, outside the project boundary. They are located at Riverbanks Zoo. Mill Race A is particularly popular with whitewater boaters as it provides access to a short section of whitewater rapids on the LSR. Mill Race B also provides access to the rapids and may be used as a take-out area. Both sites are used for sunbathing, picnicking, and other leisure activities along the shoreline and on rocky outcroppings in the river. There are no formal facilities at these sites beyond parking associated with the zoo. Mill Race A and B are ranked 4th and 2nd, respectively, in usage among all the public access river sites. Collectively, these sites accommodated approximately 26 percent of the total estimated use at public access sites on the LSR. These sites do not provide barrier free access.

SCE&G is not proposing any improvements to these sites as they are located outside the project boundary. The Saluda River Walk, a portion of the Three Rivers Greenway pathway, is being planned by the River Alliance and City of Columbia and will provide significant access in this area. If completed, this phase of the project will provide access to these two sites. While SCE&G is supportive of the River Alliance's plans, it cannot guarantee the Three River's Greenway Project will be constructed. However, SCE&G will continue to work with the River Alliance, City of Columbia, and other groups, with a view toward the ultimate construction of the Three Rivers Greenway pathway.

6.0 SCHEDULE AND FUTURE CONSULTATION

Improvements at the Existing Recreation Sites and Proposed Future Recreation Sites will occur according to a schedule as outlined below. In order to accommodate the adaptive nature of recreation planning, the schedule is presented in five-year increments. Additional consultation will be required upon approval of this plan to accommodate additional improvements and/or development of the Proposed Future Recreation Sites beyond the ten year schedule presented here. This future consultation is outlined in Section 6.2.

6.1 Implementation Schedule

Many of the improvements at Existing Recreation Sites are scheduled to be completed within the first five years of license issuance (Table 6-1). Collectively, these improvements should alleviate some congestion at Existing Recreation Sites, improve ADA compliance at the majority of Existing Recreation Sites, provide for more shore-based fishing access, and provide for more shore-based activities.

Table 6-1: Schedule of Improvements at Existing Recreation Sites and Development of Proposed Future Recreation Sites, Years One through Ten of the New License in Five Year Increments

Site Name (Number)	Years 1 – 5	Years 6 – 10
Larry L. Koon Boat Landing (1-02)	Evaluate alternatives to increase parking capacity; Identify substitutes through education; Pave an ADA compliant path from the parking lot to the restroom facilities; Widen the existing driveway	
Shull Island (1-02B)	Add two ADA compliant picnic tables	
Murray Shores (1-03)	Install additional directional signs to the site; Refurbish the existing courtesy dock for ADA compliance; Stripe the existing parking lot; Install additional lighting; Construct ADA compliant restroom facilities	
River Bend (1-04)	Refurbish the existing fishing pier for ADA compliance; Refurbish the existing courtesy dock for ADA compliance; Pave an ADA compliant path to both the fishing pier and courtesy dock; Add 5.9 acres	Pave and stripe the existing overflow parking area
Sunset (1-05)	Refurbish the existing fishing pier for ADA compliance; Refurbish the existing courtesy dock for ADA compliance; Pave and stripe the existing parking area; Construct ADA compliant restroom facilities; Install stabilization material on the sides of the existing boat ramp; Add 29.9 acres	Construct an additional parking lot
Hilton (1-07)	Refurbish the existing courtesy dock for ADA compliance; Construct ADA compliant restroom facilities; Pave an ADA compliant pat to the existing courtesy dock; Install additional lighting	Construct an ADA compliant fishing pier, including paving a path from the parking lot to the fishing pier
Dam Site - Irmo Side (1-08)	Construct an ADA compliant courtesy dock; Refurbish the existing fishing pier for ADA compliance; Pave an ADA compliant path to the existing restroom facilities	
James R. Metts Landing (1-10)	Add two ADA compliant picnic tables	Construct a bank fishing area
Higgins Bridge (1-13)	Add two ADA compliant picnic tables	
Kempson Bridge (1-14)	Add two ADA compliant picnic tables; Install an ADA compliant vault type restroom facility, including an ADA compliant paved path to the facility	
Gardendale (1-15)	Explore a lease for the property to the ICRC	
Cloud's Creek (1-18)	Construct a gravel parking lot; Construct a carry-in launch	
Little Saluda Point (1-20)		Construct two ADA compliant fishing piers; Install shoreline stabilization materials as necessary; Pave an ADA compliant path from the parking lot to the fishing piers

Site Name (Number)	Years 1 – 5	Years 6 – 10
Lake Murray Estates Park (1-22)	Install additional directional signs to the site; Construct ADA compliant restroom facilities; Pave and stripe existing parking area; Pave an ADA compliant path from the parking lot to the existing fishing pier	
Old Corley Bridge Road (1-25)	Construct a gravel parking lot; Construct a carry-in launch; Install directional signs to the site	
Twelve-mile Creek (1-31)	Explore a lease for the property to the LCRAC	
Candi Lane (1-32)	Explore a lease for the property to the City of Columbia	

6.2 Future Consultation Process

A process has been developed to review and develop future addenda to this Plan beyond the initial ten years after license issuance and over the licensing term. Recreation use levels, site capacities, and needs will be reviewed every 10 years using the most recent FERC Form 80 Recreation Report. The Recreation RCG members will review the results of this periodic assessment, in light of the proposed improvements that have been implemented to date, and make appropriate recommendations for the following ten year period to account for changing needs. Such recommendations could include identification of new sites on lands set aside for future recreation development and the continued improvement to existing recreation sites. During Year 9 of the current ten year period (i.e., 9 years after license issuance, 19 years after license issuance, etc.), SCE&G will host a public meeting with interested stakeholders at which time they will review the most recent use and capacity assessment, make recommendations for the following ten years, and receive comments from stakeholders on what improvements need to be considered. Within 30 days of this meeting, SCE&G will provide a draft copy of the ten year plan to meeting participants and ask for written comments. A 30-day comment period will be observed. Upon receipt of these written comments, SCE&G will file a Recreation Plan Addenda with FERC. The final addendum will include any comments or edits provided by the stakeholders, as appropriate, as well as a consultation record and table of responses to stakeholder comments.

7.0 OTHER ISSUES ADDRESSED WITHIN THE RECREATION RCG CONSULTATION PROCESS

Over the course of the consultation process, several issues were identified in the Recreation RCG that did not directly apply to this plan. The Recreation RCG agreed that "Issue Recommendations" would be drafted and finalized as part of the consultation process. These recommendations were then sent to other RCGs in the Saluda Hydro Relicensing Process for their consideration. For example, minimum lake levels were identified as an issue that have an effect on recreational use of the lake from private docks. A recommendation was sent from the Recreation RCG to the Operations RCG requesting that new minimum lake levels be considered as part of the operations of the Saluda Hydro Project. One exception is the recreational flow releases drafted by the Downstream Flows TWC. These releases are meant to be managed through the Recreation RCG. Further descriptions of the issues and associated recommendations are provided below. Complete issue recommendations can be found in Appendix E.

7.1 Minimum Lake Levels for Lake Murray

The Saluda Project License sets a minimum reservoir elevation of 345 ft. Plant Datum (PD) and a maximum reservoir elevation of 360 ft. PD. In the past, SCE&G normally has operated the reservoir in the range of 350 ft. PD to 358 ft. PD. Occasionally, the reservoir has been drawn down to near 345 ft. PD for vegetation control and project maintenance work. Referencing a guide curve, SCE&G sets target reservoir elevations for each month of the year to account for historic, expected seasonal inflow variations. Target elevations may vary from year to year, depending on inflow projected and/or available, planned and emergency maintenance activities, unit availability, etc.

The lake typically reaches 358 ft. PD at the beginning of June. Beginning in September, water is released, via generation, to achieve 350 ft. PD by December 31. Rising lake levels begin again around January 1 with the objective to continue to allow the rise so as to reach approximately 358 ft. PD by June 1.

The Lake Murray Association (LMA), Lake Murray Homeowners Coalition (LMHOC), and Lake Murray Watch (LMW) have expressed concerns that elevations less than 354 ft. PD at Lake Murray impede recreational use of the reservoir. According to a 2005 survey of Lake Murray users conducted by LMA, over half (51%) of lake users who responded, responded that 354 ft. PD was the minimum lake level needed for “year around safe lake use” at their “normal site or dock”; 98% of respondents indicated 356 ft. PD.

The Recreation RCG has recommended that two operating scenarios be modeled within the Operations RCG. Both scenarios entail a target elevation (358 ft PD) being reached by April 1 of each year and held until the first Monday of September (to coincide with Labor Day). The difference in the two scenarios is the minimum lake level.

7.2 Protection of Natural/Undeveloped Lands for Public Recreation

SCE&G manages its lands around Lake Murray according to a Shoreline Management Plan (SMP), which is designed to comply with the terms of the Project License, regulations, and orders of the FERC. Its aim is to provide a balance between shoreline development, recreational use, and environmental protection.

SCE&G has identified eight distinct land management classifications for the land within the PBL. The classifications consist of Easement, Forest and Game Management, Public Recreation, Commercial Recreation, Future Development, Conservation Areas, 75-Foot Setback, and Project Operations. Although SCE&G aims to manage their lands according to this classification system, the public has the right to access SCE&G-owned lands regardless of classification, with the exception of lands reserved and used for Project Operations.

The Lower Saluda Scenic River Advisory Council (LSSRAC), SCPRT, LMW, and Coastal Conservation League/American Rivers (CCL/AR) have expressed concerns regarding the conservation of lands to enhance recreational use around Lake Murray and in the LSR corridor, protect the scenic integrity of the Project, protect wildlife habitat, and provide informal recreational opportunities.

The Recreation Management TWC drafted a recommendation for the Lake and Land Management TWC (L&LMTWC) that outlined appropriate activities on each classification of Project land. During the drafting of this recommendation, a focus group of stakeholders met outside of the consultation process and drafted recommendations for submission to the L&LMTWC. The Recreation Management TWC agreed to forward these recommendations from the focus group although not all recommendations had the full endorsement of the entire Recreation Management TWC. Both recommendations are included in Appendix E, along with the memorandum sent to the L&LMTWC.

7.3 Warning System for Rising Water on the Lower Saluda River

The Lower Saluda Scenic River Advisory Council, American Whitewater, Trout Unlimited, and American Rivers have expressed concern over the safety of river users due to the unscheduled flows from the Project, as well as the rates that the river level changes due to the higher flows (> 10,000 cfs). SCE&G currently has a warning system in place that covers the area from the Riverbanks Zoo to the confluence with the Broad River, as well as the area from the Saluda Hydro powerhouse to James R. Metts Landing/Saluda Shoals Park. In 2008, SCE&G installed additional sirens and strobe lights between the Saluda Hydro powerhouse and Saluda Shoals Park. Sirens and strobe lights are located at the U.S. Geological Survey (USGS) gauge platform below the Saluda Hydro powerhouse, between the USGS gauge platform and James R. Metts Landing, at James R. Metts Landing, upstream of Riverbanks Zoo, and two locations downstream of the Zoo (Shandon Rapids and confluence with the Broad River). Along with stand alone strobe lights at the spillway discharge and Saluda Shoals Park, the sirens located at the USGS gauge platform, between the USGS platform and James R. Metts Landing, and at James R. Metts Landing are activated automatically by the plant Distributed Control System (DCS) equipment when Saluda Hydro starts to generate 5 MW or 800 cfs. The sirens sound for three minutes once activated. Subsequent siren activation is made automatically after a six minute delay from the initial activation. All strobe lights activate and remain on for 16 minutes concurrently with the initial siren activation. These sirens can be activated manually from a push button inside the Saluda powerhouse. At the Zoo location, the siren activates with a 1 inch rate of rise (ROR). The sirens sound for three minutes once activated. There is a hold-off period of 60 minutes at the Zoo location sirens and an override if the water level rises three inches during that 60-minute hold-off period; the sirens will activate again and then reset for the next 60-minute hold-off period. A strobe light activates and remains on for 16 minutes concurrently with the siren activation. Sirens are active 24 hours per day, and were tested in 2004 to calibrate the volume to cover an area 1500 feet upstream and downstream of the Zoo siren, and

500 feet upstream and downstream of the Metts Landing siren. Since 2004 two additional sirens and strobe lights were installed downstream of the Zoo. The Zoo location float switch activates these new sirens on a three-minute delay. Prominent warning signs posted near the strobe lights and sirens warn people that the activation of the sirens and/or the light signals potentially dangerous conditions caused by a rising water level. These two new sirens were tested for volume level and coverage area as part of their installation.

SCE&G also manages an electronic ring-down call system (operational on April 14, 2008) that is activated by the SCE&G System Dispatchers upon initiation of significant generation at Saluda. Upon activation, a message is sent to registered individuals via e-mail and telephone, alerting them to the initiation of generation. Registration for this ring-down service can be made at SCE&G's website (http://www.sceg.com/en/my-community/lower-saluda-river/). This system was developed in response to Safety RCG member requests for notification of initiation of Saluda Hydro generation Information about current and planned operations is also provided on a website maintained by SCE&G.

The Recreation RCG has developed numerous recommendations to improve river user safety on the LSR. These include continued consultation with river stakeholders to improve the current warning system and the installation of additional warning devices on the LSR.

7.4 Recreational Flow Releases on the Lower Saluda River

SCE&G currently operates the Saluda Hydro Project in order to provide reserve capacity for the company's utility obligations, a mode of operation that the company proposes to continue under the new license. Project generators are typically offline, i.e., not operating, but can be started and synchronized to the electrical grid and can increase output immediately in response to a generator or transmission outage on SCE&G's system or in response to a call for reserve power from neighboring utilities, with which the company has reserve agreements and obligations. As a result, flows from Saluda Hydro to the LSR are generally unscheduled.

Although currently there is no minimum flow requirement for the Project, SCE&G has an informal agreement with the South Carolina Department of Health and Environmental Control (SCDHEC) to provide a minimum of 180 cfs at the Project to maintain downstream water quality of the LSR. SCE&G typically releases a minimum flow of approximately 500 cfs to enhance water quality during the low dissolved oxygen (DO) season (July – November). The average annual flow from the Saluda Dam to the LSR is 2,595 cfs with a minimum average daily flow of 285 cfs.

The LSSRAC, SCPRT, SCDNR, AW, SRCTU, and CCL/AR have requested instream flows for the LSR to support recreational uses such as small boat navigation, swimming, wade and boat fishing, and other downstream uses.

AW, CCL/AR, and the City of Columbia Parks and Recreation Department have also requested scheduled recreational releases for whitewater boating, wade fishing, and special events.

The recommendation for recreational releases will be administered through compliance with this Recreation Plan. The recommendation includes the flexibility to change the recreational flow schedule yearly and provides for those times when inflow to the reservoir has triggered the Low Inflow Protocol.

In addition to the recreational releases outlined in Appendix E, SCE&G has agreed to provide the City of Columbia Fire Department (CFD) with flow releases to allow them to train for swift water rescue on the lower Saluda River. These flows will be as follows.

During a “normal” flow year, SCE&G will provide 6 days (8 hours per day) of flows ranging from 12,000 cfs to 15,000 cfs in March. SCE&G will coordinate with the CFD at least 30 days prior to implementation of the flows as to the exact dates the flows will be available. The Saluda Hydro Project will remain available for reserve operations during these times.

During a “normal” flow year, SCE&G will provide 5 days (8 hours per day) of flows ranging from 8,000 cfs to 10,000 cfs in the September to December months.

SCE&G will coordinate with the CFD at least 30 days prior to implementation of the flows as to the exact dates the flows will be available. The Saluda Hydro Project will remain available for reserve operations during these times.

Reduced flows will be made available to the CFD based on the Low Inflow Protocol (LIP). The flows will range from 12,000 cfs to 15,000 cfs in March, but will be reduced to 3 days (10 hours per day). The September to December flows will range from 8,000 cfs to 10,000 cfs but will be reduced to 3 days (10 hours per day). SCE&G will coordinate with the CFD at least 30 days prior to implementation of the flows as to the exact dates the flows will be available. The Saluda Hydro Project will remain available for reserve operations during these times. The triggers for implementing these reduced flows and the elimination of the swift water rescue training flows during low inflow periods will be determined once the LIP is finalized. This issue has not been resolved at this time.

As with the recreation flow releases, flows will be measured at the USGS gage below the Saluda Dam (02168504). Actual flows may vary ± 10%.

7.5 Placement and Maintenance of Shoal Markers

Lake Murray is a large reservoir and, like many other reservoirs, has hazards that present a danger to boaters and other recreationists. The LMW and the LMA have raised the issue of the responsibility for marking these hazards to make Lake Murray safer for the boating public. SCE&G has historically depended on the SCDNR to bear responsibility for the marking of hazards. Stakeholders contend that the SCDNR system is not as effective as it could be because of the yearly fluctuations in water level, unmarked hazards, and missing/damaged shoal markers.

The Recreation RCG is recommending SCE&G continue to cooperate with the SCDNR in the marking of hazards in Lake Murray. This includes support for public communication regarding locations of unmarked hazards and a system whereby the SCDNR can be made aware of these areas.

7.6 Protection of the Trout Fishery in the Lower Saluda River

The LSR is successfully managed (and classified by the SCDHEC) as a put, grow, and take trout fishery by the SCDNR. Currently, annual stockings of brown and rainbow trout species are necessary to support the trout fishery in the LSR.

Trout stockings vary in number depending primarily on availability of fish from the SCDNR Walhalla Fish Hatchery. Stocking records suggest that typically the SCDNR stocks approximately 30,000 to 34,000 trout annually in the LSR, with approximately 60% being rainbow trout. The length of the fish at the time of stocking is typically 6-8" for brown trout and 9-10" for rainbow trout.

Trout are typically stocked from November – March throughout the LSR after the dissolved oxygen (DO) levels in the releases of water from Lake Murray have improved to safer levels for fish. The initial stocking event is typically done by the use of helicopter to facilitate distribution of both species along the LSR. Subsequent stockings are conducted by truck with stocking limited to three locations along the LSR. Intense fishing pressure, predation, potential late-summer and fall low DO concentrations, and thermal regimes affect both carryover and incidental reproductive success of adult trout in the LSR. However, while continued stocking efforts by the SCDNR will be required to support the trout fishery, changes in project operations (i.e., minimum flows) should facilitate increased carryover of stocked trout. Increased adult carryover could provide increased opportunities for natural reproduction of trout, further enhancing the LSR trout fishery.

The Recreation RCG is recommended a number of measures to support the trout fishery in the LSR. These include providing sufficient access points, maintaining state water quality standards, and continuing relationships with appropriate agencies to support the health and survival of the trout in the LSR.

8.0 AS BUILT AND CONCEPT DESIGN DRAWINGS

SCE&G is providing as built drawings and/or concept design drawings of all recreation sites referenced in this plan in Appendix F. These drawings are provided to show detail regarding site amenities (i.e., location of boat ramps, docks, etc.) and the relation of the site to the existing project boundary. Pending FERC approval of this plan, these drawings will be updated as sites are modified and/or the project boundary is approved. For those sites where no updates are scheduled and no property is being added (i.e., the project boundary is not being changed), the drawings reflect best available information regarding site amenities. SCE&G will update these drawings as necessary during the 10 year review process incorporated in Section 6.2.

9.0 REFERENCES

Bureau of Outdoor Recreation (BOR). 1977. Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity. Department of Interior, Washington, DC.

Cordell, H. K., and M.A. Tarrant. 2002. Changing Demographics, Values, and Attitudes. Journal of Forestry 100(7): 28-33.

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.

Kleinschmidt Associates (Kleinschmidt). 2007a. Recreation Assessment Study Report. South Carolina Electric & Gas Company, Columbia, SC.

Kleinschmidt Associates (Kleinschmidt). 2007b. Spring Use Addendum Study Report. South Carolina Electric & Gas Company, Columbia, SC.

Kleinschmidt Associates (Kleinschmidt). 2007c. Boating Density Report. South Carolina Electric & Gas Company, Columbia, SC.

Kleinschmidt Associates (Kleinschmidt). 2008. Downstream Recreation Flow Assessment Report. South Carolina Electric & Gas, Columbia, SC.

The Lake Murray Association, Inc. 2006. Report on September 2005 Lake Murray User Survey. The Lake Murray Association, Inc., Ballentine, SC.

The Louis Berger Group, Inc. 2002. Investigation of Boating Use on Lake Murray: Final Report. South Carolina Electric & Gas Company, Columbia, SC.

Mead and Hunt. 2002. Recreational Element: Initial Consultation Package. Mead & Hunt, Madison, WI.

National Park Service (NPS). 2007. Nationwide Rivers Inventory – South Carolina. [Online] URL: www.nps.gov/rtca/nri/states/sc.html. Accessed August 26, 2007.

South Carolina Budget and Control Board, Office of Research and Statistics (SCBCB). 2005. 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 Parks, Recreation and Tourism (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 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 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.

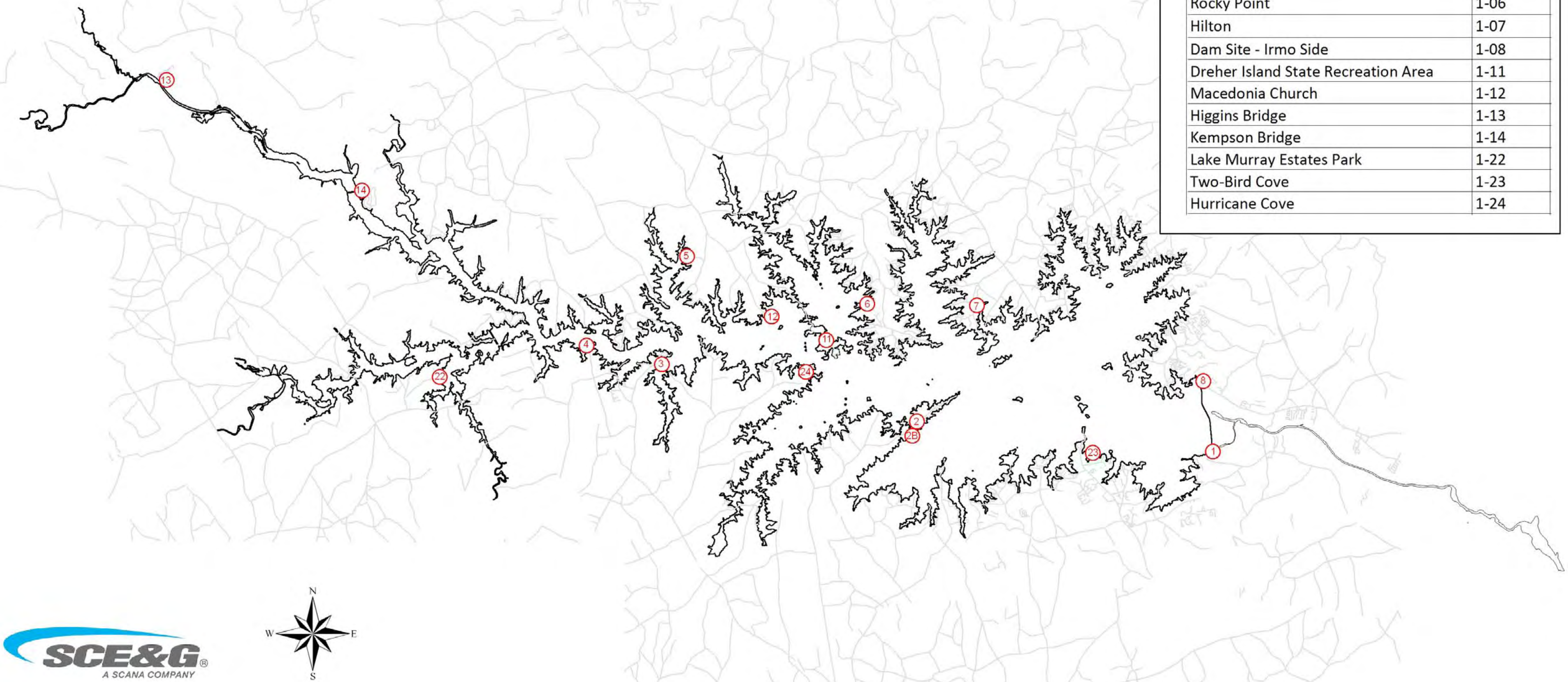
Warren, Roger, and Phillip Rea. 1989. Management of Aquatic Recreation Resources. North Carolina State University, Publishing Horizons, Inc., Columbus, OH.

APPENDIX A

MAPS OF EXISTING RECREATION SITES, EXISTING FUTURE RECREATION SITES, AND SEGMENTS OF LAKE MURRAY USED FOR THE BOATING DENSITY ANALYSIS

Figure A-1
Lake Murray Existing Recreation Sites

Existing Park Sites	Number
Park Site - Lexington Side	1-01
Larry L. Koon Boat Landing	1-02
Shull Island	1-02B
Murray Shores	1-03
River Bend	1-04
Sunset	1-05
Rocky Point	1-06
Hilton	1-07
Dam Site - Irmo Side	1-08
Dreher Island State Recreation Area	1-11
Macedonia Church	1-12
Higgins Bridge	1-13
Kempson Bridge	1-14
Lake Murray Estates Park	1-22
Two-Bird Cove	1-23
Hurricane Cove	1-24



SCE&G
A SCANA COMPANY

1 inch equals 3 miles

Figure A-2
Lower Saluda
Existing Recreation Sites

Lower Saluda Park Sites	Number
Saluda Shoals Park	1-09
James R. Metts Landing	1-10
Gardendale	1-15

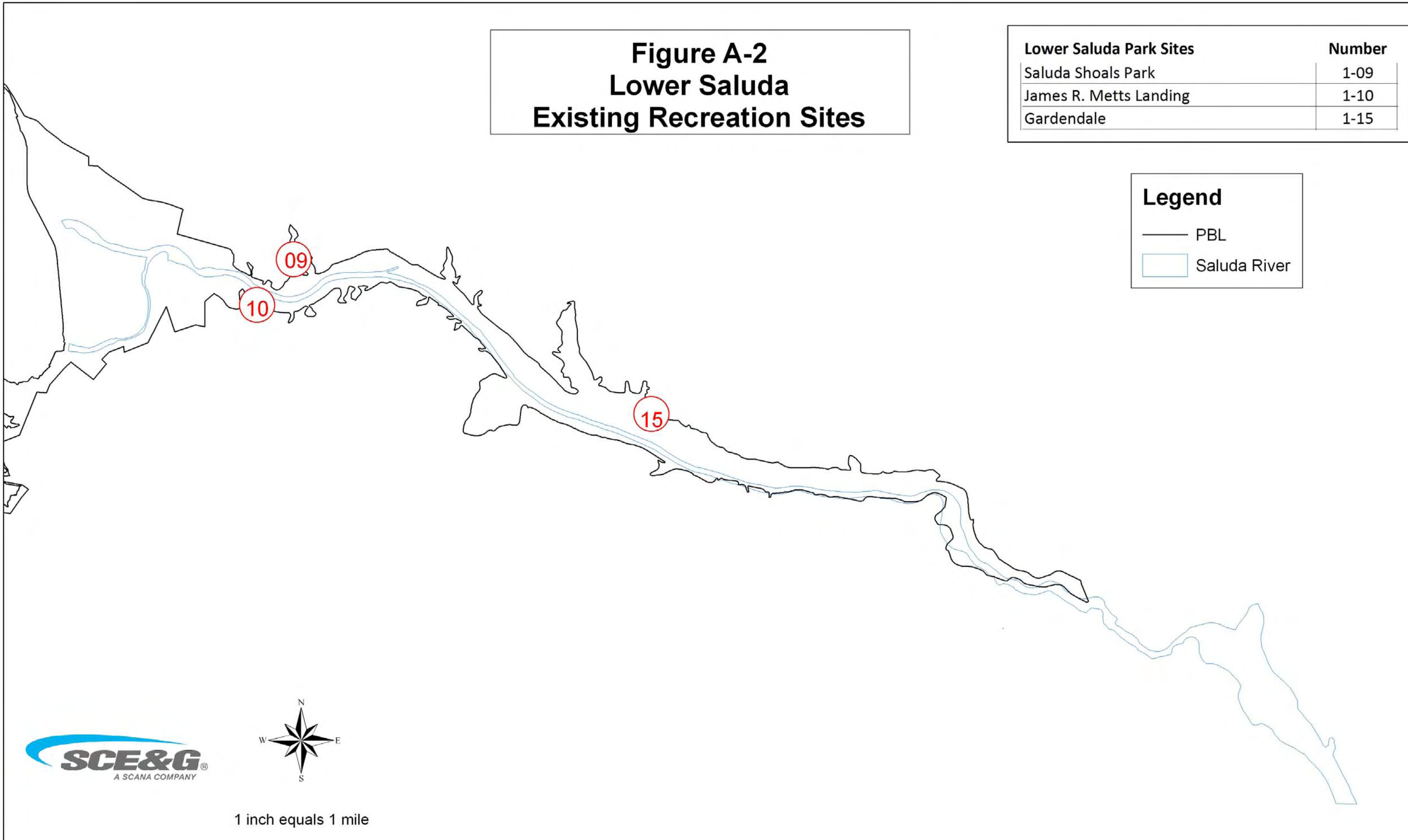
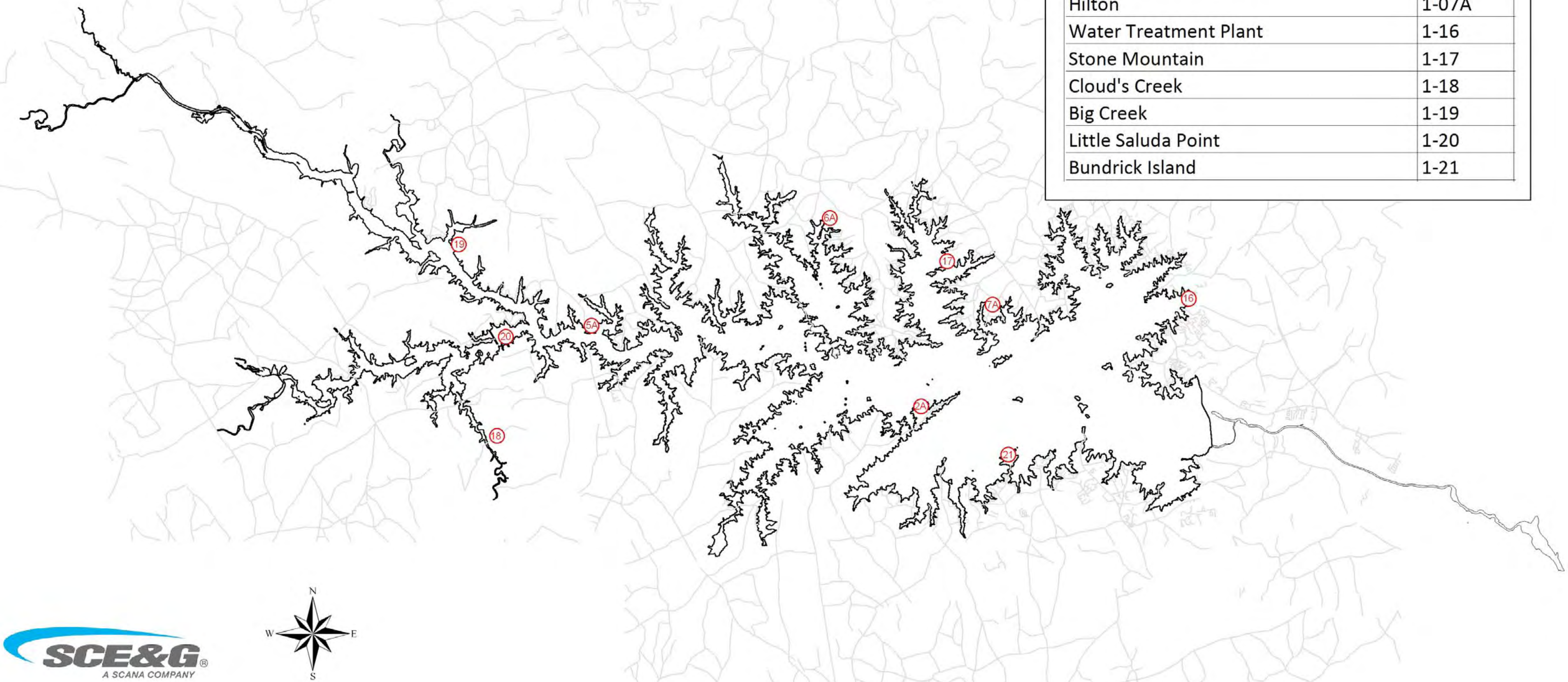


Figure A-3
Lake Murray Existing Future Recreation Sites

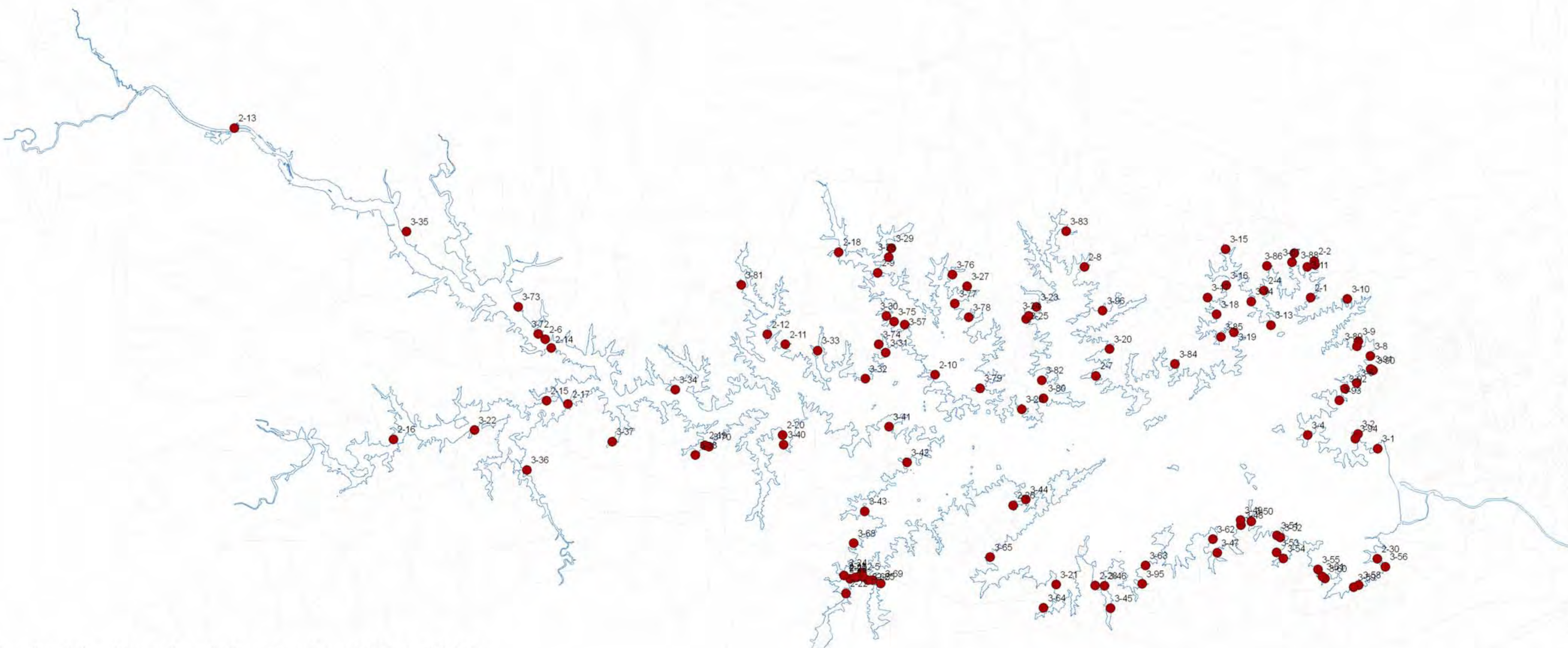
Existing Future Park Sites	Number
Shull Island	1-02A
Simpson's Ferry	1-05A
Long Pine	1-06A
Hilton	1-07A
Water Treatment Plant	1-16
Stone Mountain	1-17
Cloud's Creek	1-18
Big Creek	1-19
Little Saluda Point	1-20
Bundrick Island	1-21



SCE&G A SCANA COMPANY

1 inch equals 3 miles

Figure A-4
Commercial and Private Recreation Sites



Lake Murray Public Access Recreation		
NAME	CODE	Description
Lake Murray Marina	2-1	Restaurant
Billy Dreher Island State Park	2-10	
P-L Landing	2-11	Ramp; Dock; Food; Motel
Holland Landing	2-12	Food; Camping; Bait & Tackle
Saluda River Resort	2-13	Ramp; Tackle; Food; Camping
Blacks Bridge Marina	2-14	Ramp; Dock; Food; Bait & Tackle
Barn	2-15	Food; Bait & Tackle; Camping
Little River Landing	2-16	Ramp; Bait & Tackle; Food
Little River Marina	2-17	Ramp; Dock; Bait & Tackle; Food
Crayne's Landing	2-18	Bait & Tackle;Food;Ramp;Dock;Fishing Dock
Spinner's Marina	2-19	Ramp; Dock; Bait & Tackle; Food; Multi-Slip;Cottage Rental
Agnew Lake Services	2-2	
Acapulco	2-20	Ramp; Dock
The Last Resort	2-21	Boat Ramp;Multi-Slips
Roys Landing	2-22	Ramp; Dock
Adams Towne	2-23	Ramp; Dock; Camping
Holiday Shores Point	2-24	Ramp; Dock
Southshore Marina	2-25	Bait & Tackle; Food
Siesta Cove	2-26	Camping; Food; Bait & Tackle
Captain's Choice Marine	2-27	Boat Sales;Repairs
Hendrick Landing	2-28	Ramp; Dock
Weed's	2-29	Boat Sales
Jakes Landing	2-30	Food
Lighthouse Marina	2-4	Restaurant;Ramp
Charlie's Fisherman's Wharf	2-5	Restaurant;Multi-Slip
Riverwinds Landing	2-6	Cottage Rental;Ramp;Multi-Slip;Bait & Tackle
Putnams Landing	2-7	Bait-Tackle; Food
Eptings Landing	2-8	Camping
Bucks	2-9	Ramp; Dock
Lake Murray Private Access Recreation		
Columbia Sailing Club	3-1	Private Club
Ballentine Cove	3-10	Subdivision
North Lake Development	3-11	Subdivision
Shadowood Subdivision	3-12	Subdivision
Coast Guard Auxiliary	3-13	
Woodmen of the World	3-14	Private Club
Cedar Cove Subdivision	3-15	Private Club
Forty Love Point Subdivision	3-16	Private Club
Indian Fork	3-17	Private Club
Lake Murray Boating/Sporting Club	3-18	Private Club
Lake Murray Sailing Club	3-19	Private Club
Yacht Cove	3-2	Condo
Hilton Place	3-20	Subdivision
Turner's Pointe	3-21	Multi-Slip;Ramp;Subdivision
Camp Barstow (Boy Scouts of America)	3-22	Camping;Swimming;Docks
Plantation Hills	3-23	Subdivision
Shady Acres	3-24	Subdivision
Night Harbor	3-25	Subdivision
Timberlake	3-26	Subdivision
Stephenson Lakes	3-27	Subdivision
Lake Wood	3-28	Subdivision
Smallwood	3-29	Subdivision
Newberry Lions Club	3-30	Private Club
Newberry Exchange Club	3-31	Private Club
Edgewater Shores	3-32	Subdivision
The Club at Plantation Point	3-33	Multi-Slip;Ramp;Subdivision
Newberry Firemans Association	3-34	
Lake View Subdivision	3-35	Subdivision
Clouds Creek Estates	3-36	Subdivision
Crystal Springs Creek	3-37	Subdivision
Nautical Shores Subdivision	3-38	Subdivision
Pine Island Club	3-4	Private Club
J.B. Martin Employee Club	3-40	Private Club
Columbia Farms Employee Club	3-41	Private Club
Lexington County Law Enforcement	3-42	Private Club
Harbor Watch	3-43	Subdivision
Leesville Fire Department	3-44	Private Club
Moss Rock Subdivision	3-45	Subdivision
Hallmark Shores	3-46	Subdivision
The Landings	3-47	Subdivision
Mallard Shores	3-48	Condo
Spences Point	3-49	Condo
Lands End	3-50	Condo
Harborside	3-51	Condo
Windward Pointe	3-52	Subdivision
Harbor Place	3-53	Subdivision
Mallard Cove	3-54	Condo
Secret Cove	3-55	Subdivision
Boardwalk Villa	3-56	Condo
Friendly Boating Club	3-57	Private Club
Hegman Place	3-58	Common;Subdivision
Pilgrim Point	3-59	Common;Subdivision
Clearwater Cove	3-6	
Whitewater Bay	3-60	Common;Subdivision
Kingston Harbour	3-61	Common;Subdivision
Spence Plantation	3-62	Common;Subdivision
Cherokee Shores	3-63	Multi-Slip;Ramp;Subdivision
Hammock Bay	3-64	Common;Subdivision
Pintail Point	3-65	Multi-Slip;Ramp;Subdivision
Adams Towne	3-66	Ramp;Docks;Camping
	3-67	
Lake Village	3-68	Common;Subdivision
Marina Cove	3-69	Common;Subdivision
Sandhill Landing	3-70	Common;Subdivision
The Barn	3-71	Food; Bait & Tackle; Camping;Ramp
El Paraiso	3-72	Common;Subdivision
Harborview	3-73	Common;Subdivision
Autumn Cay	3-74	Common;Subdivision
Beaufort Shores	3-75	Common;Subdivision
The Oaks	3-76	Common;Subdivision
The Reserve at Lake Murray	3-77	Common;Subdivision
Paradise Cove	3-78	Multi-Slip;Ramp;Subdivision
Crystal Pines	3-79	Common;Subdivision
The Village	3-8	Subdivision
Magnolia Key	3-80	Common;Subdivision
Churchhill Landing	3-81	Common;Subdivision
The Peninsula	3-82	Common;Subdivision
Bush River Plantation	3-83	Common;Subdivision
Palmetto Shores	3-84	Common;Subdivision
The Estates at Hilton	3-85	Common;Subdivision
Lakeport	3-86	Common;Subdivision
Lakeside	3-87	Multi-Slip;Ramp;Subdivision
Johnny Shealy	3-88	Ramp
Bell Mont	3-89	Common;Subdivision
Tatters Wharf	3-9	Subdivision
Wexford	3-90	Common;Subdivision
The Palms at Rocky Point	3-91	Common;Subdivision
Sellwood Shores	3-92	Common;Subdivision
Regatta	3-93	Common;Subdivision
Lake Murray Docks, Inc	3-94	Private Club;Multi-Slip
Beechcreek Place	3-95	Common;Subdivision
Manor of Wingfield	3-96	Common;Subdivision

Saluda Hydroelectric Project No. 516
South Carolina Electric & Gas Company

SCE&G®
A SCANA COMPANY

N
W E
S

1 inch equals 1 mile

Figure A-5
Segments of Lake Murray Used for Boating Density Analysis

Existing Park Sites	Number
Park Site - Lexington Side	1-01
Larry L. Koon Boat Landing	1-02
Shull Island	1-02B
Murray Shores	1-03
River Bend	1-04
Sunset	1-05
Rocky Point	1-06
Hilton	1-07
Dam Site - Irmo Side	1-08
Dreher Island State Recreation Area	1-11
Macedonia Church	1-12
Higgins Bridge	1-13
Kempson Bridge	1-14
Lake Murray Estates Park	1-22

1 inch equals 3 miles

APPENDIX B

MEETING NOTES

Recreation Resource Conservation Group Members

Name	E-mail Address
Alan Axson	cfdwaxson@columbiasc.net
Alan Stuart	alan.stuart@kleinschmidtusa.com
Alison Guth	alison.guth@kleinschmidtusa.com
Amanda Hill	amanda_hill@fws.gov
Bill Argentieri	bargentieri@scana.com
Bill Brebner	yaccove@bellsouth.net
Bill Marshall	marshallb@dnr.sc.gov
Charlene Coleman	cheetahtrk@yahoo.com
Charlie Rentz	flyhotair@greenwood.net
Dave Anderson	dave.anderson@kleinschmidtusa.com
David Hancock	dhancock@scana.com
Dick Christie	dchristie@comporium.net
George Duke	kayakduke@bellsouth.net
Gerrit Jobsis	gjobsis@americanrivers.org
Guy Jones	guyjones@sc.rr.com
Irvin Pitts	ipitts@scprt.com
Jeff Duncan	jeff_duncan@nps.gov
Jennifer O'Rourke	jenno@scwf.org
Jennifer Summerlin	jennifer.hand@kleinschmidtusa.com
Jim Cumberland	jimc@scccl.org
Jim Devereaux	jdevereaux@scana.com
JoAnn Butler	jbutler@scana.com
Joy Downs	elymay2@aol.com
Karen Kustafik	kakustafik@columbiasc.net
Keith Ganz-Sarto	keith_ganz_sarto@hotmail.com
Kelly Maloney	kelly.maloney@kleinschmidtusa.com
Larry Turner	turnerle@dhec.sc.gov
Lee Barber	lbarber@sc.rr.com
Malcolm Leaphart	malcolml@mailbox.sc.edu
Mark Davis	mdavis@scprt.com
Mark Leao	mark_leao@fws.gov
Marty Phillips	marty.phillips@kleinschmidtusa.com
Matthew Rice	mrice@americanrivers.org
Mike Waddell	mwaddell@esri.sc.edu
Miriam Atria	miriam@lakemurraycountry.com
Norman Ferris	norm@sc.rr.com
Randy Mahan	rmahan@scana.com
Regis Parsons	rparsons12@alltel.net
Richard Mikell	adventurec@mindspring.com
Stan Jones	sjones@imichotels.net
Steve Bell	lakewatchman@yahoo.com
Suzanne Rhodes	suzrhodes@juno.com

Name	E-mail Address
Tim Vinson	vinsont@dnr.sc.gov
Tommy Boozer	tboozer@scana.com
Tony Bebber	tbebber@scprt.com
Van Hoffman	vhoffman@scana.com
Vivianne Vejdani	vejdaniv@dnr.sc.gov

Downstream Flows Technical Working Committee Members

Name	E-mail Address
Alan Stuart	alan.stuart@kleinschmidtusa.com
Bill Argentieri	bargentieri@scana.com
Bill Marshall	marshallb@dnr.sc.gov
Charlene Coleman	cheetahtrk@yahoo.com
Dave Anderson	dave.anderson@kleinschmidtusa.com
Guy Jones	guyjones@sc.rr.com
J. Hamilton Hagood	jhamilton@scana.com
Jennifer Summerlin	jennifer.hand@kleinschmidtusa.com
Jim Cumberland	jimc@scccl.org
Karen Kustafik	kakustafik@columbiasc.net
Malcolm Leaphart	malcolml@mailbox.sc.edu
Matthew Rice	mrice@americanrivers.org
Mike Waddell	mwaddell@esri.sc.edu
Randy Mahan	rmahan@scana.com
Tony Bebber	tbebber@scprt.com
Vivianne Vejdani	vejdaniv@dnr.sc.gov

Lake Levels Technical Working Committee Members

Name	E-mail Address
Alan Stuart	alan.stuart@kleinschmidtusa.com
Bertina Floyd	bertfloyd@sc.rr.com
Bill Argentieri	bargentieri@scana.com
Dave Anderson	dave.anderson@kleinschmidtusa.com
Dick Christie	dchristie@comporium.net
Joy Downs	elymay2@aol.com
Lee Barber	lbarber@sc.rr.com
Steve Bell	lakewatchman@yahoo.com
Tim Vinson	vinsont@dnr.sc.gov

Recreation Management Technical Working Committee Members

Alan Stuart	alan.stuart@kleinschmidtusa.com
Alison Guth	alison.guth@kleinschmidtusa.com
Bill Argentieri	bargentieri@scana.com
Bill Marshall	marshallb@dnr.sc.gov
Dave Anderson	dave.anderson@kleinschmidtusa.com
David Hancock	dhancock@scana.com
Dick Christie	dchristie@comporium.net
George Duke	kayakduke@bellsouth.net
Jennifer Summerlin	jennifer.hand@kleinschmidtusa.com
Jim Cumberland	jimc@scccl.org
Joy Downs	elymay2@aol.com
Lee Barber	lbarber@sc.rr.com
Malcolm Leaphart	malcolml@mailbox.sc.edu
Mark Davis	mdavis@scprt.com
Randy Mahan	rmahan@scana.com
Steve Bell	lakewatchman@yahoo.com
Tim Vinson	vinsont@dnr.sc.gov
Tommy Boozer	tboozer@scana.com
Tony Bebber	tbebber@scprt.com
Van Hoffman	vhoffman@scana.com
Vivianne Vejdani	vejdaniv@dnr.sc.gov

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE GROUP

SCE&G Training Center
November 18, 2005

final acg 1-25-06

ATTENDEES:

Alison Guth, Kleinschmidt Associates	Dave Anderson, Kleinschmidt Associates
Randy Mahan, SCANA Services, Inc.	Tommy Boozer, SCE&G
David Hancock, SCE&G	George Duke, LMHC
Van Hoffman, SCANA Services, Inc.	Jim Devereaux, SCE&G
Tim Vinson, SCDNR	Bill Marshall, SCDNR
Steve Bell, Lake Watch	Alan Axson, Columbia Fire
Gerrit Jobsis, American Rivers, CCL	Michael Waddell, Trout Unlimited
Dick Christie, SCDNR	Irvin Pitts, SCPRT
Tony Bebber, SCPRT	Joy Downs, LMA

HOMEWORK ITEMS:

- Each entity will list the issues and goals they feel are valuable and important – forward to Dave Anderson
- Review the ICD and list of study requests
- Read about the SCORP through the online website

AGENDA ITEMS FOR NEXT MEETING:

- Tommy Boozer will give an update on recreation around Lake Murray and associated issues
- Tony Bebber will give a brief explanation on the SCORP
- The group will begin discussion on the issues and goals that were submitted to Dave Anderson

DATE OF NEXT MEETING: **January 11, 2006 at 9:00 a.m.**
Located at the Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting and gave a short recap of the previous resource conservation groups. He encouraged those who have not yet seen the Operations Presentation given by Lee Xanthakos to come to the January 12th quarterly public meeting. Alan noted that the RCG meetings were generally scheduled in the beginning of the month due to agency conflicts with other Relicensings, whose meetings are generally focused at the end of the month.

The group began discussion on the merging of the Recreation and Safety Resource groups. Randy Mahan noted that some concerns arose when joining these groups due to the fact that the Recreation group will potentially be discussing quite a few land use issues that may not directly tie in to safety. When posed a question about what he believed the groups would cover, Tommy Boozer answered that the recreation group would most likely be dealing with land issues and what entities were in charge with handling certain issues around the lake. Joy Downs noted that LMA would like to see the safety group meeting even after Relicensing to discuss safety related issues. The group concluded that it may be best to keep the groups separate and break up the Lake and River issues on the agenda into morning and afternoon sessions. If a combined meeting was necessary then it could be arranged for. Alan noted that it may be important for the Recreation RCG members to read the Safety meeting notes.

The group briefly discussed the need for more law enforcement personnel to attend. Dick Christie pointed out that the group should keep in mind that the Technical Working Committees (TWC) will include members of the DNR law enforcement who might not have time to attend RCG meetings.

Alan noted they had received the second set of comments on the Operating Procedures, and a revised set of the operating procedures will be sent out in the following weeks. Bill Marshall mentioned that the LSSRAC had a comment on the Operating procedures that was in reference to the time of the day during which the meetings were held. He noted that there were individuals who would like to be involved, but could not do so due to work conflicts. One individual then asked if it would be out of the question for agency personnel to come after hours. Dick Christie replied that although it was not completely out of the question, the group needed to remember that the agencies are juggling quite a few things and there is a need to keep the agency personnel involved in this process because their input is very important.

One suggestion that was made during the meeting was for group members to have the opportunity to add items to the meeting minutes after the meeting was over. The group decided that if you have any additional comments you can add it to a section at the end of the meeting minutes that was specified as “Additional Comments”.

The group began to discuss the draft mission statement and add to it. A question arose as to what the SCORP was. Tony Bebber noted that it was revised every five years and is a document used to allocated funds. He noted that it contained quite a bit of information that could help identify goals for the recreation group. Tony was asked to give a brief presentation on the SCORP at the next meeting.

One individual asked whether they could submit comments on issues that would then be posted on the website. Alan responded that comments on the milestone documents and such would be posted on the website, however, comments on particular issues need to expressed within the RCG, that it was in fact part of the purpose of the RCGs.

After a short lunch break, Alan passed out a list of study requests relating to recreation that were compiled from all of the requests that were received. A homework item included a review of the study requests in order to ensure that everyone’s requests were properly covered and expressed. Alan also pointed out that if anyone feels a presentation is needed to educate the group on a particular issue then to please make that request. Tommy Boozer was asked to give an update on recreation, listing problems and issues. He noted that one of the things that they were doing was working with a landscape architect to look at the area on the Lexington side of the dam where the construction will be. He also added that they will have a recreation map that shows all the existing recreation sites and also lists future recreational sites and impromptu areas.

In closing, the group discussed some of the homework items for next time. Randy Mahan pointed out that it may be a good idea to go online and read about the SCORP. The group also decided that it would be good for each entity to prioritize their interests and have them ready for discussion by the next meeting. Dave Anderson noted that he would send out an email to group members regarding this following the meeting.

The group decided that the next Recreation meeting would occur on January 11, 2006 at 9:00 at the Training Center.

Meeting Adjourned

Attached below is the agenda for this meeting:

Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

November 18, 2005
9:30 AM
Lake Murray Training Center

- **9:35 to 9:45** Introduction
  - SCE&G and KA Staff
  - Resource Agency Representatives
  - NGO Representatives
  - Individuals
- **9:45 to 10:15** Purpose of Resource Groups and Discussion on Combining Recreation and Safety RCGs
- **10:15 to 10:45** Discuss Recreation RCG Procedures
- **10:45 to 11:45** Develop Recreation RCG Mission Statement
- **11:45 to 12:45** Lunch
- **12:45 to 1:30** Develop List of Homework Assignments
- **1:30 to 2:00** Develop an Agenda for Next Meeting and Set Next Meeting Date

Adjourn

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE GROUP

LAKE MURRAY TRAINING CENTER
January 11, 2006

final dka 02-22-06

ATTENDEES:

Name	Organization	Name	Organization
Bill Argentieri	SCE&G	Norm Ferris	TU
Alison Guth	Kleinschmidt Associates	Bill Marshall	SCDNR/LSSRAC
Randy Mahan	SCANA	Patrick Moore	CCL/American Rivers
Charles Rentz	Resident	David Hancock	SCE&G
Steve Bell	Lake Watch	Dave Anderson	Kleinschmidt Associates
Karen Kustafik	Columbia Parks and Recreation	Lee Barber	LMA
George Duke	LMHOC	Guy Jones	River Runner Outdoor Center
Tim Vinson	SCDNR	Alan Stuart	Kleinschmidt Associates
Tony Bebber	SCPRT	Tommy Boozer	SCE&G
Jim Devereaux	SCE&G		

HOMEWORK ITEMS:

- Dave Anderson – send updated list of sites and amenities to group

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING:

February 15, 2006 at 9:30 a.m.
Located at the Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Tommy B. began the meeting by giving an update on recreational access around the reservoir. He showed maps of SCE&G owned access, public marinas, and private marinas, and noted that there is recreational access around the entire lake. Tommy also noted that Billy Dreher State Park and Saluda Shoals Park are two large recreation areas on the Chapin side and Lower Saluda River, respectively. Tommy also pointed out the tract of land leased to the Lexington County Sheriffs Department. Tommy noted that they had some property set aside on the upstream part of the river such as Kempsons Bridge and Higgins Bridge for future recreation areas. He further noted that all of the boat ramps at public access areas on the lake were extended when the lake was down for the dam remediation project so that boats can launch from 345'. He also pointed out that SCE&G has 10 sites set aside for future development and are looking at additional sites. Tommy also explained that all of the islands on the lake are owned by SCE&G and are open to the public for recreation. Steve B. noted that all of the project lands that SCE&G owns below the 360' is open to the public. The group discussed that if it was private property you could not walk on it, even if it is below the 360'. The group discussed that SCE&G is only required by FERC to purchase land that is necessary to the operation of the project and that it was an unusual project since it has so much property. It was mentioned that the high water mark is the project boundary on Lake Norman in Charlotte, NC. It was discussed that the FERC has the option of requiring a licensee to buy a piece of property for operation of the project.

Tommy B. continued that the five year review resulted in a commitment to some improvements, including building a fishing platform at Sunset Point, paving at Hilton Park, and enlarging the parking lot at River Bend. Tommy also talked about Park Site 1 on the Lexington side of the dam and noted when the highway was redesigned for the dam remediation, it took the main entrance to the site. A new entrance is being designed at the intersection near Corley Mill Road that will have a stoplight. He further noted that the new bridge would change some of the aesthetics at the park site. He also noted that many utilities have a drop box for user fees, but SCE&G has no plans of doing this so that they can continue to use the user fees for traffic control. The other issue SCE&G looked at in relation to the dam remediation and the new highway was the site on the Irmo side of the dam, which may have some issues when the new highway is complete. Tommy mentioned that all of their parks have some sort of parking lot with a boat ramp and courtesy dock and at some sites they have rest rooms or Port-a-johns. He noted that any future park sites will have to be buffered away from neighborhoods. Another issue Tommy talked about is public marinas and wet storage around the lake and the possibility of these facilities closing.

George D. asked about a couple of marinas that went out of business when the water went down, which led to a discussion of the service these marinas provide. It is hard for them to compete with private marinas since most of them do not provide gas and food, so many public marinas are going private to remain in business. However, Tommy noted that losing these public marinas affects public access so SCE&G is working on getting a clause in new permits that says that a public marina will have to remain a public marina unless they get a new permit. Tommy noted that Lake Murray Tourism has a brochure with all the information about public and private marinas, but he doesn't think this information is on the web. The group noted that maybe this was something they can look into. Lee B. mentioned that the conversion of marinas from public to private was one thing that interests his group, especially the loss of space for larger boats. Steve B. mentioned that small access points encourage development around the lake. Tommy B. and David H. agreed and noted they try to get new neighborhoods to put in community access points.

Tommy continued his presentation and moved to the LSR and noted three recreation areas on the river (Saluda Shoals, Metz Landing, and Gardendale) and that they are looking for property for another take out above the rapids.

Bill M. presented an update on the Lower Saluda River Corridor Plan and provided a brief history of the plan. The plan was written in the late 1980s and published in 1990 when the river received scenic river status (about a 10 mile stretch of the river). The 1990 plan identifies eight potential and existing park/access sites along the river. Currently, five park/access sites are established: Saluda Shoals Park, Hope Ferry (Metts) Landing, Gardendale Landing, Riverbanks Zoo, and Riverbanks Garden. Bill M. noted that many of the current facilities on the river (Saluda Shoals, Riverbanks Zoo) were originally leased by SCE&G. Bill M. talked about the plan update in 2000 and the vision for a greenway trail going down the entire river linking existing parks and access sites on the north bank and linking with the Three Rivers Greenway. Bill M. told the group what he knows about the Three Rivers Greenway. There were some concerns about Rocky-shoal spider lilies below the Greenway and Bill A. noted that SCE&G is working with the Zoo and SC Native Plants Society for spider lily enhancement associated with the Columbia project.

Bill M. also showed the planned path for the Saluda River corridor that would link up the park sites at the top of the dam with the proposed river side trail, which starts at Saluda Shoals Park. Bill M. doubted this trail would be completed given that the trail would have to be routed along Bush River Road to avoid security concerns around the dam. Steve B. asked about SCE&G owned property along the river and Tommy B. said it is very fragmented now. There was some discussion about how to control development along the river and the impact that the proposed Corridor Plan may have on visitation. Bill M. noted it will increase but he has no information to discern how much, other than what anecdotal evidence suggests on existing sections of the Three Rivers Greenway.

Bill M. talked about a particular section between the I-20 and I-26 bridges that will be difficult to complete because of existing land uses.

Tony B. presented information about the last Statewide Comprehensive Outdoor Recreation Plan (SCORP) done for South Carolina in 2002. The SCORP is in the process of being updated and may be of use during the Relicensing process. SCPRT has conducted a phone survey for the new SCORP. Tony B. noted the SCORP is the official plan used by state agencies for recreation planning and is listed as a FERC-approved comprehensive plan. The SCORP considers outdoor recreation related to citizen participation and analyzes demand for recreational opportunities. It also identifies funding opportunities and is used as a tool to distribute monies in the state. Tony B. talked a little bit about the process of writing the plan and that the final plan is approved the National Park Service. Tony B. then gave a brief overview of results from the latest SCORP, highlights of which are: state is in a region of unprecedented growth; steady population growth and trend toward an older population and high minority population; tourism accounts for $9 billion of gross state product; and nature based and cultural tourism are expected to grow. After presenting some basic results about participation trends in various activities, Tony identified the following issues that were raised in the SCORP process: protecting significant lands for public recreation; manage and expand trail resources; maintain/improve existing parks and recreation facilities; increase funding for variety of park facilities; acquire public open space; provide more multi-use athletic complexes; create partnerships; implement existing plans; increase ongoing education about recreational opportunities and avoid user conflicts; and increase public beach access.

Tommy B. asked about visitation to Billy Dreher State Park and if it operates profitably. Tony B. thinks it is getting close to breaking even and that use is increasing. George D. pointed out that we need to concentrate on facilities close to the population base.

The group then discussed the mission statement and decided to finalize the statement and post it to the website. Afterwards, the group started listing recreation issues associated with Lake Murray and the Lower Saluda River. Among the group, the issues were public access, conservation of lands, instream flows, dependable water levels on the lake, safety as it relates to flows, river access/egress, canoe portages; provide for sufficient nature based recreational activities, permanent protection for Dreher Island, protection of property for a state park on the south side of the reservoir, implementation of the Lower Saluda Scenic River Corridor Plan, and water quality as it relates to primary contact activities. Bill A. also mentioned having a ten year review cycle for recreation activities. Bill A. asked for clarification of nature based activities and wondered if this meant SCE&G sponsoring fishing tournaments. Tony B. replied that fishing, hunting, hiking, canoeing, and bird watching are typical activities and that tournaments are not usually considered nature-based tourism. He envisions SCE&G providing the places for tournaments, not necessarily sponsorship.

The group had a discussion about adaptive management and how any sort of recreation plan would be based on this principle. Steve B. noted that we don't need to put anything off that we can do now. Dave said that adaptive management is a way of correcting things that change with time. The group also briefly discussed the American Whitewater request for using the spillway as a recreational resource; Bill A. said that SCE&G has a severe liability issue with this request.

The group further discussed lake levels and it was suggested that a survey be done to see what is acceptable to lake users. Randy M. mentioned that there is difference between what is convenient and what they can use.

The group then began to identify information that they might need to address some of the issues raised. Tim Vinson noted completing a Boating Needs Assessment. George D. mentioned looking at industry figures of boating participation. The group also talked about a carrying capacity study like was done on the Duke Power projects. Dave mentioned completing an inventory of existing sites and amenities available at each one. Tommy B. agreed to update the table provided in the ICD and see if the group thinks any other information will be necessary.

The discussion then switched to the river and the need for Mike Dawson to update the group on the Three Rivers Greenway. The group is interested in hearing about access, facilities plan, projected timeframe, safety issues, parking and ADA compliance, and an instream flow analysis at the confluence. Jim D. agreed to talk to Mike about giving the group a presentation.

Below is a table of issues as recorded by Dave A.

LSR	Both	Lake
public access/portage	scenic integrity	aquatic weeds – covered under lake and land management
conservation of land	future growth	access
safety as it has to do with security at the recreational facilities, and safety related to flows	adaptive management	facilities/adequacy
facilities/adequacy	water quality - covered under water quality group	new state park in Lexington County
communication	fishing	expansion of facilities
recreation Flows/instream flows	non-boating access	conservation of land – management prescriptions identified in land use group and specifics for recreation will be developed in this group, will make recommendations
		paddling access
		large multi-lane facility
		lake level reliability – will be carried over between this group and the other group

The agenda for this meeting is attached below.

Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

January 11, 2005
9:00 AM
Lake Murray Training Center

- **9:00 to 10:45** Update on Recreation around Lake Murray and Associated Issues – Tommy Boozer, SCE&G
- **10:45 to 11:00** Break
- **11:00 to 11:30** Discussion on the SCORP – Tony Bebber, SCPRT
- **11:30 to 12:00** Lunch
- **12:00 to 12:15** Group Discussion of Mission Statement for Finalization Purposes
- **12:15 to 3:00** Group Discussion of Recreation Interests

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE GROUP

LAKE MURRAY TRAINING CENTER
February 15, 2006

final dka 03-17-06

ATTENDEES:

Name	Organization	Name	Organization
Bill Argentieri	SCE&G	David Hancock	SCE&G
Alison Guth	Kleinschmidt Associates	George Duke	LMHC
Alan Stuart	Kleinschmidt Associates	Norm Nicholson	LCSD
Randy Mahan	SCANA	Lee Barber	LMA
Tom Eppink	SCANA	Dave Anderson	Kleinschmidt Associates
Steve Bell	Lake Watch	Van Hoffman	SCE&G
Guy Jones	River Runner	Bill Marshall	SCDNR/LSSRAC
Tony Bebber	SCPRT		

HOMEWORK ITEMS:

- Alan Stuart/Tom Eppink – ADA Design Standards
- All – Review Standard Process Form
- All – draft a vision statement for Lake Murray/LSR

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **April 17, 2006 at 9:30 a.m.**
Located at the Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

The meeting began with a group review of the updated facility inventory provided by David H. Tommy B. and David H. had updated the inventory from last meeting and included some additional variables such as number of shelters, number of grills, etc. There was a discussion regarding additional variables that should be collected so that the group can understand what is currently available around the lake and river. Tony B. mentioned that number of parking spaces would be useful to know so we can begin to talk about facility capacity. He noted he could get this information for Dreher Island. David H. commented counting parking spaces at some sites would be problematic because of gravel parking areas and/or un-striped parking lots. Dave A. asked if it would be acceptable to come up with an estimate based on the size of the parking area. Dave A. also mentioned we could identify paved and non-paved parking areas.

There was some discussion on the inventory of existing docks at access sites. Lee B. mentioned that knowing dock capacity would be useful, citing Hilton as an example where the dock is not big enough. David H. replied the dock at Hilton is supposed to be a courtesy dock for launching/trailering boats. There is also a fishing dock at Hilton. The group agreed that knowing the function of the dock would be helpful, i.e., identifying courtesy docks, multi-slip docks, fishing docks.

Dave noted the inventory at present has no indication of ADA compliant facilities at any of the sites. There was some discussion on whether we should record ADA compliant facilities (the entire facility is compliant) versus ADA compliant amenities (parking spaces, restrooms, trails). Alan S. and Tom E. agreed to research ADA design standards so we can be consistent across all recreational sites. Dave wondered if there are any design standards for ramp length, as this is a fluctuating reservoir. David H. replied SCE&G makes the ramps at their sites as long as functionally possible to accommodate for this.

Guy J. wondered if we could record the quality of the facility, specifically citing Gardendale as a facility that needs improvement. David H. noted this area was strictly supposed to be for launching canoes; Guy replied a different put-in (i.e., steps) would be better for canoe access. Dave A. remarked we need to focus on the big picture at the moment and individual sites will be discussed later.

Dave A. questioned the group as to the necessity of collecting all of the information for private marinas as well. Randy M. stated that SCE&G does not really have much of an impact as to what amenities are available at these private facilities. Tony B. noted it would be nice to know the number of slips and boat launches, but not much beyond that. George D. asked for clarification for the meaning of "private," noting there are public private facilities and then private facilities that you have to belong to an organization before using the facility. The group discussed this distinction and concluded it will be nice to know if the facility is open to the public, and make the distinction between those facilities and those that are not available unless you are a member of an organization. One classification scheme put facilities into either public, commercial, or private.

The group also discussed adding a variable on the number of restrooms and identifying the restrooms as either seasonal (port a johns) or year round. There was also some discussion on how this information will be stored once collected. Steve B. wondered if we could include a facility's potential for expansion as a variable. Randy M. replied that we do not want to give the public any expectations of what might happen around the lake. Steve B. agreed but wanted to make sure the group understands what the potential build out will be around the lake.

Bill M. asked for clarification regarding ownership of recreational sites. David H. replied that SCE&G pays for most of the public sites around the lakes and does all of the maintenance on those sites. The group then discussed the need for identifying public campgrounds. The group decided to add "Primitive Camping" as a variable to the facility inventory. The list of variables the group would like to see added to the inventory are: courtesy dock, fishing dock, parking, overflow parking, multi-slip docks, private, commercial, restrooms (seasonal/permanent), ADA compliance, primitive camping, formal camping, on-site security.

Dave A. introduced the "standard process" that is being proposed for use by this group as a way of staying focused on recreation issues around the lake/river. Dave went over the standard process diagram (attached) and briefly discussed the solution principles that will guide decision making for this group. Dave agreed to send out the principles for comment by the next meeting. The solution principles are:

1. Consideration of new recreational facilities should be based on demonstrated need and the potential impact on existing facilities.

2. Priority should be given to demonstrated need within the FERC project boundary.

3. Priority should be given to recreational proposals where multiple stakeholders offer significant participation.

4. Recreational facilities should appeal to a broad public.

5. Reasonable access for the disabled should be provided.

6. Recreational needs should be prioritized for the project.

7. The improvement or expansion of existing recreational facilities should be considered first.

8. Additional recreational studies (if needed) should be only of sufficient scope and duration to provide necessary information to develop issue solutions.

9. Consensus based solutions are preferred over studies, unless solutions cannot be developed with existing information.

Preferred consideration will be given to ideas that:

- do not promote facilities that would adversely impact existing commercial operations;
- identify actual recreational needs that are not filled by existing facilities;
- receive broad public support;
- expand existing recreational facilities prior to developing green field sites;
- require doing recreational studies only if consensus cannot be reached with existing information (It is preferred to put financial resources into recreational facilities and opportunities that benefit the overall Project, rather than fund unnecessary/subjective studies).

These principles will be discussed at the next meeting after the group has had a chance to review them.

The group then discussed a few specifics of the solution principles. George D. wondered if we could shift some of the cost of the access sites to those people that use them. Randy M. pointed out that it would nice to identify potential partners through the process. There was also a brief discussion concerning demographic projections and how they relate to future recreational use. Lee B. noted we might be able to find projected boat sales data from the boating industry. Alan S. questioned Bill M. and Guy J. to see if they are comfortable with the process since they have focused interests on the Lower Saluda River. Both men agreed they are comfortable with the process.

Dave A. then introduced the standard process form that will guide the group throughout relicensing (the blank form is attached). Dave directed the group to approach the questions from a general sense to gauge whether the questions are sufficient for this project. Someone mentioned it would be nice to change “tailrace” to “Lower Saluda River” and “impoundment” and “reservoir” to “Lake Murray.”

The group then began to discuss Step One questions. Rather than summarize the suggested responses to these questions, these meeting notes (and any future notes talking about answering the process questions) will simply state the group discussed the answers to the questions. The actual result of this discussion will be tracked using the Microsoft Word Tracking Tool on the Standard Process Form. For example, someone mentioned water level stability, which can be found as a response to Question One. Any disagreements about a particular answer will be summarized in the meeting notes.

The group agreed to review Question Three and get their vision statement to Dave by the next meeting. Dave will compile these visions and the group will discuss and finalize a vision statement for recreational opportunities at the Project.

As a result of discussing Question Five, the group discussed the need for more commercial marinas around the lake. Steve B. felt that there are areas on the lake that could use a commercial marina. Lee B. disagreed. There was some discussion on whether new marinas are needed or if the current ones need to be upgraded. David H. explained the current moratorium on multi-slip marinas and why it is in place. The group agreed that any future access sites should not impact existing commercial operations. Lee B. suggested asking Archie Trawick, owner of Jake’s Landing, to come and speak to the group. Norm N. said that a marina management company had taken over Lake Murray Marina and wondered if it would be beneficial for them to come speak to the group.

After lunch, the group began to form Technical Working Committees. Dave A. listed three TWCs that he envisioned forming based on the issues submitted in response to the Initial Consultation Document. These are Recreation Management, Downstream Flows, and Lake Levels. The Recreation Management TWC will deal with future facilities, existing and future sites, policy, etc. The Downstream Flows TWC will talk about scheduled recreational releases. The Lake Levels TWC will help determine an appropriate lake level for recreational activities and will examine the effects of various lake levels on recreation. Membership in the TWCs is as follows:

Recreation Management	Downstream Flows	Lake Levels
Tommy Boozer	Charlene Coleman	Lee Barber
David Hancock	Malcolm Leaphart	Steve Bell
Tony Bebber	Patrick Moore	Bill Argentieri
SCDNR Rep	Guy Jones	DNR Rep
Steve Bell	Tom Eppink	Alan Stuart (facilitator)
Van Hoffman	Bill Marshall	
George Duke	Karen Kustafik	
Lee Barber (observer)	Dave Anderson (facilitator)	
Dave Anderson (facilitator)		

Bill M. asked about bringing up a new issue. He wanted to know about equipment requirements for the Lower Saluda River. He brought up that at other rivers he is familiar with, there are requirements for certain equipment before a recreational user is allowed on the river (i.e., helmets, PFDs). Alan S. noted that any regulations would be a legislative issue, but education could help the situation. Dave A. asked Bill M. if he would like to add this issue to the Parking Lot for the Safety RCG. Bill agreed.

Dave reminded the members of the TWCs that the recreation season is rapidly approaching and that he would like to see the first meeting of the Recreation Management TWC occur as quickly as possible. He also reminded the group that he would like to complete Step One of the Standard Process at the next RCG meeting. The group agreed on the next meeting date and then broke up into respective TWCs to schedule meetings.

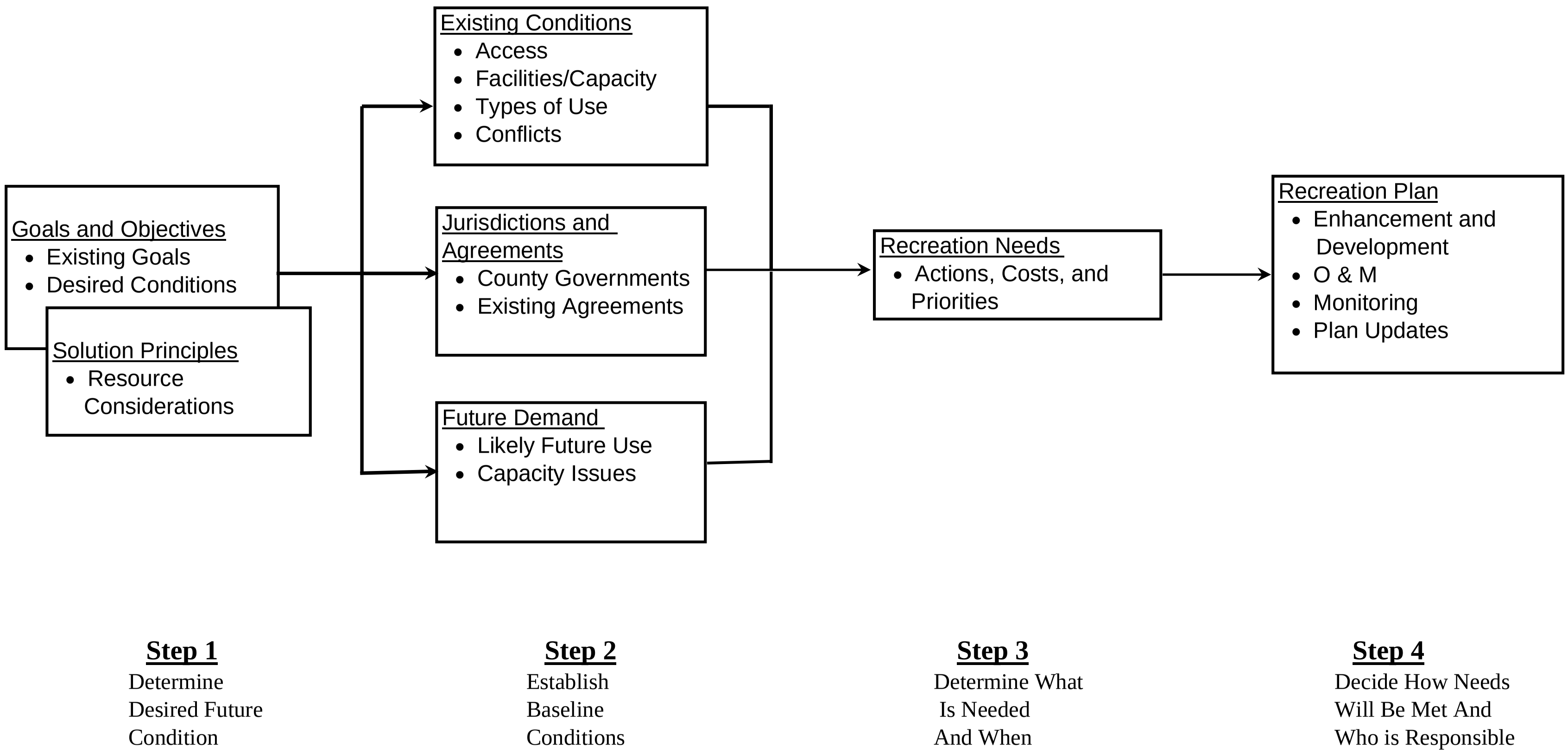
Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

February 15, 2006
9:30 AM
Lake Murray Training Center

- **9:00 to 10:00** Discussion of Facility Inventory
- **10:00 to 12:00** Discussion of Standard Questions
- **12:00 to 12:30** Lunch
- **12:30 to 3:00** Identification of Technical Working Committees

Recreation Plan Development Standard Process



KLEINSCHMIDT ASSOCIATES

Recreation Issues Standard Process

The following is a list of standard questions designed to help characterize existing recreation resources and aid in development of an appropriate recreation plan for the Saluda Project. Questions pertaining to recreation management are categorized according to a four-step recreation planning process developed for the project. Questions pertaining to reservoir levels and downstream flows are listed following the facility management material.

STEP 1 – DETERMINE DESIRED FUTURE CONDITION

1. Identify impoundment and/or downstream tailrace qualities important to keep and any qualities that need changes.

2. Are there unique characteristics of the reservoir and/or tailrace relative to other reservoirs/tailraces in the area?

3. What is the overall vision for the reservoir and/or tailrace, in terms of recreation experiences and opportunities?

4. Are there sensitive biological or cultural resources associated with the Project that need to be considered? Where are these resources located and are there seasonal sensitivities (e.g., nesting or spawning times, etc.)?

5. Identify specific goals and objectives for managing recreation at the reservoir and/or in the tailrace.

STEP 2 – ESTABLISH BASELINE CONDITIONS

6. What is the nature of existing recreational access to the reservoir?
   a. How many public accessible, developed recreation sites are there?
   b. Where are they located/how are they distributed around reservoir?
   c. Of these publicly accessible access sites how many are owned and operated by public versus private entities and how are they supervised?
   d. How many sites, open to the public, provide boat access to the reservoir?
   e. How many provide shoreline fishing?
   f. Identify the most heavily used facilities.
   g. Are there informal, undeveloped use areas? Where are they?

7. What types of existing developed facilities are there?
   a. Enumerate boat ramps, restrooms, docks, and other facilities.
   b. What is the existing capacity at each site?
   c. What is the general condition of each site and its facilities?
   d. Ideas for improving existing facilities.

8. Describe notable recreation activities on the reservoir.
    a. List recreation activities currently occurring and identify most prominent activities.
    b. Where are these uses occurring, and are they concentrated in certain areas?
    c. Identify existing impediments to these activities, if any.

9. Are there known management issues associated with use?
    a. Are there areas of congestion, and if so where?
    b. Are there known conflicts between users, and if so where and when?
    c. Are there other known management issues, such as littering, trespassing, etc.?

10. What is the expected future demand for recreation activities at the reservoir?
    a. Will existing facility capacity likely be exceeded, and if so where and when?
    b. Would accommodating this demand be consistent with the long-term vision for the reservoir?
    c. Will demand introduce new or additional congestion, conflicts, or other management issues?

11. Identify current local benefits from recreation and any local detriments.

STEP 3 – DETERMINE WHAT IS NEEDED AND WHEN

12. Ideas for better or different access, consistent with Step 2 above.

13. Potential facility enhancements or upgrades, consistent with Step 2 above.

14. Potential new facilities, or other management actions, consistent with Step 2 above.

15. What are the priorities regarding identified needs both in terms of resources and time? How do priorities compare across the entire Project?

STEP 4 – DECIDE HOW NEEDS WILL BE MET AND WHO IS RESPONSIBLE

QUESTIONS REGARDING RESERVOIR LEVELS

16. How is the reservoir currently operated and what are the typical reservoir levels during key recreation seasons?

17. Are there changes to reservoir level operations that you would like to see addressed to improve the overall value of the reservoir, and how specifically would such changes benefit recreation?

18. Are there seasonal and/or daily variations in reservoir level that can occur without adversely affecting the overall value of the project (including impoundment objectives such as recreation, fish and wildlife, flood control, generation, navigation, etc.)?

19. What are the reservoir levels at which recreation problems tend to occur (may be different for different locations or problems)?

20. When (i.e., what time of year) and how frequently do problems occur related to reservoir levels?

21. Why are the current operating water levels important to the operation of the project and the overall system?

22. Are there state or federal operating requirements that stipulate specific operating goals?

QUESTIONS REGARDING DOWNSTREAM FLOWS

23. Are there riverine recreation opportunities below the dam? If yes, move to additional questions, if not, stop.

24. Do we know how different flow levels affect recreation opportunities and specific recreation activities?

25. Can opportunities be enhanced by modifying releases, and in what way?

26. How would modified releases affect upstream lake levels?

27. How would suggested modified downstream flows affect project operations at the project and at upstream and downstream projects?

28. Are there additional concerns with regard to state and federal requirements or existing ecological issues that limit suggested changes to downstream flows?

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE GROUP

LAKE MURRAY TRAINING CENTER
April 17, 2006

final dka 05-15-06

ATTENDEES:

Name	Organization	Name	Organization
Bill Argentieri	SCE&G	Alan Stuart	Kleinschmidt Associates
Dave Anderson	Kleinschmidt Associates	Jennifer Summerlin	Kleinschmidt Associates
Randy Mahan	SCANA Services	Tom Eppink	SCANA Services
David Hancock	SCE&G	Tony Bebber	SCPRT
George Duke	LMHOC	Joy Downs	LMA
Karen Kustafik	Columbia Parks and Recreation	Malcolm Leaphart	Trout Unlimited
Tommy Boozer	SCE&G	Tim Vinson	SCDNR
Bill Marshall	SCDNR & LSSRAC	Patrick Moore	CCL/AR
Steve Bell	Lake Watch		

HOMEWORK ITEMS:

- Dave Anderson – Check Recreation Interests and Issues for issues needed on Recreation RCG Work Plan
- Dave Anderson – E-mail vision statement to Recreation RCG
- Dave Anderson – Combine Recreation RCG Work Plan and Recreation Issue Standard Process into one document and email to all RCG members
- Dave Anderson – Draft issue sheets for issue tracking
- Everyone – Finalize Standard process form
- Everyone – Review stakeholder list on the web
- Dave Anderson – Schedule next Recreation RCG meeting

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **July 21, 2006 at 9:30 a.m.**
Located at the Lake Murray Training Center

Kleinschmidt
Energy & Water Resource Consultants

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson opened the meeting by briefly reviewing the Recreation Issues Standard Process, which is designed to help characterize existing recreation resources and aid in development of an appropriate recreation plan for the Saluda Project. Dave A. noted that the questions pertaining to recreation management are categorized according to a four-step recreation planning process developed for the project. He added that the list will be distributed to all members in Microsoft Word in order to track changes as the document is completed.

Dave A. noted that in order to keep everyone focused on the overall purpose of the Recreation RCG, he formulated a draft recreation vision statement (attached) and asked the group to provide comments and/or changes. The group modified the vision statement and Dave A. noted that he would send out these track changes by email to all group members.

Dave A. reviewed the Recreation RCG Work Plan (attached) and noted that he came up with a list of Identified Issues from comments to the ICD and previous meeting minutes. He briefly talked about each issue and group members suggested and agreed to the necessary changes. George Duke noted that he was unclear as to why there were two documents and suggested combining them into one document to avoid confusion. The group agreed and Dave noted that he would combine the documents and send them out to everyone.

After a short break, the group began to examine RCG Tasks and Responsibilities listed on the Work Plan. Dave asked the group to provide comments. Joy Downs had a couple of specific suggestions on the need to address minimum winter levels and lake level fluctuations. Steve Bell suggested that the Recreation RCG should make recommendations to the Lake and Land Management RCG to ensure adequate lands are retained to meet recreational needs. Through brief discussion, the group agreed to all changes.

Dave then focused attention on the Work Scope and Product section of the Work Plan. He went through each task and noted the tasks that have been completed and tasks that are in the process of being completed. Through brief discussion, changes were made by group members. Steve B. wanted to know about the timeframe for discussing the amount of land that SCE&G sets aside for the future. Dave replied that once we have completed Step One and Step Two, the results and the expertise represented in the RCG will determine the amount of land that will be set aside for the future. The group then discussed the schedule for future issues that will be addressed.

After lunch, Dave discussed up-dates from the Technical Working Committees (TWC). He noted that the Downstream Flow TWC had a meeting at the SCDNR office and agreed to start identifying users of the lower Saluda River (attached). He added that the TWC plans to use this list to eventually determine an optimum flow and schedule for various river users. They are currently examining the River Alliance study along with other studies through a working bibliography.

Dave then updated the group on issues that are being addressed in the Recreation Management TWC. The group has discussed Lake Murray and lower Saluda River questionnaires to be implemented in concurrence of site counts at SCE&G owned sites at the Project. Dave mentioned that the Recreation Management TWC will also examine aerial photographs of Lake Murray to look for possible information on boat densities. George Duke noted that the 2001 photos may not be valid due to the significant changes over the years, and suggested we need to take new photos on a couple of dates to compare current use with use reported in 2001. There was further discussion about assessing ADA compliance on SCE&G sites as part of the recreation site inventory. Alan Stuart presented information on ADA compliance to educate the group. The presentation included the amount of complexity that is involved with this process, such as types of ramps, gangways, railings, edge protection, restrooms, and parking lot types. David Hancock noted that if any new facilities are built, they must be ADA compliant.

Dave reminded the group that one of their tasks is to finalize the Standard Process Form and to review the stakeholder list on the Saluda relicensing website. There was some discussion about the TWC sending items to the RCG for approval. Dave noted all issues will be finalized by the RCGs, which may then task a TWC to deal with the issue. The TWC will decide what information is needed to deal with the issue and whether or not existing information is sufficient. After the TWC determines if the existing information is sufficient, or conducts a study to collect needed information, they will then send their recommendation to the RCG for approval. Dave noted that agenda items for the next meeting will be updates from the TWC. The group agreed to schedule the next meeting around the July Quarterly Public Meeting.

Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

April 17, 2006
9:30 AM
Lake Murray Training Center

- **9:30 to 10:30** Review of Standard Process and Development of Vision Statement
- **10:30 to 11:30** Review Recreation RCG Work Plan
- **11:30 to 12:30** Lunch
- **12:30 to 1:00** Update from Downstream Flows TWC
- **1:00 to 1:45** Update from Recreation Management TWC (to include presentation on ADA design standards)
- **1:45 to 2:00** Discussion of Questions for FERC Representative
- **2:00 to 2:15** Develop an Agenda for Next Meeting and Set Next Meeting Date

Adjourn

Recreation Vision Statement for the Saluda Project

The long-term vision for the Saluda Project is to recognize, protect, and enhance the fishery, water quality, and recreational opportunities on the reservoir and the Lower Saluda River, while recognizing the need to protect habitat supporting threatened, endangered, and sensitive species of the reservoir and tailwater, and ensure adequate facilities and public access are provided. Given the size of the reservoir it is felt that it can continue to support a diversity of recreation opportunities.

Improvements to be considered at the Saluda Project include:

Providing appropriate operations and maintenance of public recreation facilities.

Optimizing the capacity of existing public recreation facilities to accommodate existing and future demand.

Improving access and safety in the publicly accessible waters below the dam and minimizing impacts of project operations on downstream recreation, recognizing the need to meet power generation, and downstream flow responsibilities at Saluda.

Managing lake level drawdowns so as to minimize the occurrence of surface elevations lower than 354’ in the late summer and early fall.

Ensuring public access areas for the non-boating public remain available along the shoreline.

Development of new facilities if a proven need arises.

Recreation Resource Conservation Group Work Plan
Saluda River Project

Facilitator:

Dave Anderson	Kleinschmidt Associates	dave.anderson@kleinschmidtusa.com	205-981-4547

Members:

Name	Organization	E-mail	Work Phone
Alan Axson	Columbia Fire Department	cfdwaxson@columbiasc.net	
Alan Stuart	KA	alan.stuart@kleinschmidtusa.com	
Alison Guth	KA	alison.guth@kleinschmidtusa.com	
Amanda Hill	USFWS	amanda_hill@fws.gov	
Bill Argentieri	SCE&G	bargentieri@scana.com	
Bill Marshall	Lower Saluda Scenic River Advisory Council, DNR	marshallb@dnr.sc.gov	
Charlene Coleman	American Whitewater	cheetahtrk@yahoo.com	
Charles (Charlie) Rentz		flyhotair@greenwood.net	
David Hancock	SCE&G	dhancock@scana.com	
Dick Christie	SCDNR	dchristie@infoave.net	
George Duke	LMHC	kayakduke@bellsouth.net	
Gerrit Jobsis	Coastal Conservation League & American Rivers	gerritj@scccl.org; gjobsis@americanrivers.org	
Guy Jones	River Runner Outdoor Center	guyjones@sc.rr.com	
Irvin Pitts	SCPRT	ipitts@scprt.com	
James A. Smith	LMA	bkawasi@sc.rr.com	
Jeff Duncan	National Park Service	jeff_duncan@nps.gov	
Jennifer O'Rourke	South Carolina Wildlife Federation	jenno@scwf.org	
Jennifer Summerlin	Kleinschmidt Associates	jennifer.summerlin@kleinschmidtusa.com	
Jim Devereaux	SCE&G	jdevereaux@scana.com	
JoAnn Butler	resident	jbutler@scana.com	
Joy Downs	Lake Murray Assn.	elymay2@aol.com	
Karen Kustafik	City of Columbia Parks and Recreation	kakustafik@columbiasc.net	
Keith Ganz-Sarto		keith_ganz_sarto@hotmail.com	
Kelly Maloney	Kleinschmidt Associates	kelly.maloney@kleinschmidtusa.com	
Larry Michalec	Lake Murray Homeowners Coalition	lmichalec@aol.com	
Larry Turner	SCDHEC	turnerle@dhec.sc.gov	
Leroy M. Barber Jr.	LMA	lbarber@sc.rr.com	
Malcolm Leaphart	Trout Unlimited	malcolml@mailbox.sc.edu	
Mark Leao	USFWS	mark_leao@fws.gov	
Marty Phillips	Kleinschmidt Associates	marty.phillips@kleinschmidtusa.com	
Michael Waddell	TU - Saluda River Chapter	mwaddell@esri.sc.edu	
Miriam S. Atria	Capitol City Lake Murray Country	miriam@lakemurraycountry.com	
Norman Ferris	Trout Unlimited	norm@sc.rr.com	
Patricia Wendling	LMA	wwending@sc.rr.com	
Patrick Moore	SCCCL AR	patrickm@scccl.org	
Ralph Crafton	LMA	crafton@usit.net	
Randy Mahan	SCANA	rmahan@scana.com	
Richard Mikell	Adventure Carolina	adventurec@mindspring.com	
Stanley Yalicki	LMA	joyyalicki@aol.com	
Steve Bell	Lake Murray Watch	bellsteve9339@bellsouth.net	
Suzanne Rhodes	SC Wildlife Federation	suzrhodes@juno.com	
Tim Vinson	SCDNR	vinsont@dnr.sc.gov	
Tom Brooks	Newberry Co.	tbrooks@newberrycounty.net	
Tommy Boozer	SCE&G	tboozer@scana.com	
Tony Bebber	SCPRT	tbebber@scprt.com	
Van Hoffman	SCANA Land Mgt.	vhoffman@scana.com	

Recreation Resource Conservation Group Work Plan
Saluda River Project

Mission Statement

The mission of the Recreation RCG is to ensure adequate and environmentally-balanced public recreational access and opportunities related to the Saluda Hydroelectric Project for the term of the new license. The objective is to assess the recreational needs associated with the lower Saluda River and Lake Murray and to develop a comprehensive recreation plan to address the recreation needs of the public for the term of the new license. This will be accomplished by collecting and developing necessary information, understanding interests and issues and developing consensus-based recommendations.

Identified Issues

- the need for better public access
    - access site above the Mill Race rapids
    - creation of a state park on the south side of the reservoir
    - creation of a multi-lane boating facility that can accommodate large tournaments
    - non-boating access
    - paddling access
    - expansion of existing facilities to accommodate future growth
    - security at recreation facilities
- protect the scenic integrity of the Project
- using the concept of adaptive management in future recreation planning
- creation of a communication system that would encompass information on lake levels and river flows
- protection of the cold water fishery on the Lower Saluda River
- creation of scheduled recreation flows for the Lower Saluda River
- identification of a reliable lake level that will provide year round access for a majority of lake users

RCG Tasks and Responsibilities

- Utilizing and modifying the Standard Process for evaluating and addressing recreation management and access issues specific to the Saluda Project, including developing a vision statement for the Project.
- Identifying specific areas where lake level fluctuations may be adversely affecting recreation at the lake, including the nature and timing of the effect (e.g., access to sections of water, access to facilities and aesthetics).
- Working with the Operations Resource Conservation Group to identify “reasonable” (based on hydrologic, structural, and other limitations identified) changes and alternatives for modifying project operations, including operations that would benefit recreation.
- Identifying any studies, if applicable, that need to be performed for identifying and/or evaluating changes to Project operations.
- Presenting a range of reasonable alternatives or recommendations to the Saluda Hydro Relicensing Group (SHRG) regarding modifications to facilities or current Project operations and provide recommendations for recreation access, facilities, and use.

Recreation Resource Conservation Group Work Plan
Saluda River Project

Work Scope and Product

- **Task 1 –** Utilize the stepwise process diagram and solution principles to guide the planning process for addressing recreation management issues at the Saluda Project.
- **Task 2 –** Develop a Vision Statement for the Saluda Project.
- **Task 3 –** Review the operational constraints and current operations of the Saluda Project (see Initial Consultation Document).
- **Task 4 –** Answer the list of questions on the Standard Process Form in order to characterize the existing and potential future condition of access and lake level fluctuations – from a recreation setting perspective.
- **Task 5 –** Review stakeholder requests (e.g., agency letters) for particular studies and/or enhancement measures to ensure that these are incorporated into study planning, if applicable
- **Task 6 –** Develop and recommend operation scenarios to the Operations RCG for analysis. These scenarios should reflect initial thinking on potential solutions and be designed to narrow the focus of Task 10 below. Analysis by the Operations RCG will focus on an assessment of potential recreational impacts associated with any suggested changes to operations.
- **Task 7 –** Discuss results of the Operations RCG analyses.
- **Task 8 –** Develop study designs/methods/plans and review agreed upon studies, literature reviews, etc.
- **Task 9 –** Check the solution principles to ensure proposed study plans are consistent.
- **Task 10 –** Provide recommendations for Project operations and recreation access, facilities, and use to be considered in conjunction with all ecological and recreational issues.
- **Task 11 –** Develop a consensus based Recreation Plan for the Saluda Project that addresses all of the issues and tasks identified above.

Schedule

Late 2005/Early 2006—Finalize Mission Statement, Standard Process Form, Solution Principles, and Work Plan
Mid-2006—Complete identification of studies, literature reviews, etc. that need to be completed to address issues and tasks identified in the Work Plan
Late 2006—Begin compilation of existing information, review preliminary study results, and draft an outline of the Recreation Plan
2007—Complete any studies identified in Task 8 and review results; draft recommendations to SHRG, complete draft Recreation Plan
2008—Finalize Recreation Plan and provide comments on Draft License Application

IDENTIFIED USERS OF THE LOWER SALUDA RIVER

- swimmers
  - children & teenagers on the river banks
  - people at access areas
  - rock people
  - educational groups and clubs
- tubers
- fishermen
  - bank
    - trout
    - food—people that actually fish to feed their families
    - bass and other
    - father and son type outings to learn to fish
    - scouts and other clubs, groups
  - boat
    - trout
    - trophy bass
    - recreational
    - food
    - business (oriental group that fishes near bridges)
  - wade
    - trout
    - children w/ parents
- charity groups
  - canoe, raft, sit on tops, etc
- social groups
- clubs
- educational groups
  - schools and university
  - scouts
  - club field trips
  - outdoor clubs
- hikers
- mountain bikers
- kayakers and canoeists—(skilled)
- recreational boaters (rental and less skilled)
- 4x4 clubs
- zoo visitors
- rescue training
- kayak and canoe classes
- us team boaters practicing (olympic and world team level)
- bird watchers
- nature lovers

WORKING BIBLIOGRAPHY OF STUDIES ON THE LOWER SALUDA RIVER

de Kozlowski, Steven J. 1988. Instream Flow Study, Phase II: Determination of Minimum Flow Standards to Protect Instream Uses in Priority Stream Segments; A Report to the SC General Assembly. SC Water Resources Commission.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE GROUP

LAKE MURRAY TRAINING CENTER
July 21, 2006

final dka 08-14-06

ATTENDEES:

Name	Organization	Name	Organization
Alison Guth	Kleinschmidt Associates	Tim Vinson	SCDNR
Dave Anderson	Kleinschmidt Associates	John Frick	landowner
Bill Argentieri	SCE&G	Steve Bell	Lake Watch
Alan Stuart	Kleinschmidt Associates	Regis Parsons	landowner
Tom Eppink	SCANA Services	Tony Bebber	SCPRT
Tommy Boozer	SCE&G	Joy Downs	LMA
David Hancock	SCE&G	Richard Mikell	Adventure Carolina
George Duke	LMHC		

HOMEWORK ITEMS:

- Tony Bebber – check on combining data for the Recreation Participation & Preference Study for four counties around Lake Murray
- Dave Anderson – email web link on Recreation Participation & Preference Study to group
- Entire Group – review and prioritize issues

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **October 25, 2006 at 9:30 a.m.**
Located at the Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson welcomed the group and noted that the purpose of the meeting would be to finalize the Work Plan, Vision Statement, Solution Principles, and begin discussion on the Recreation Plan (attached, dated July 14, 2006). After passing out the working documents, Dave noted that they would begin an interactive session of reviewing each section and make changes as needed. The group began this exercise by separating possible solutions from the Identified Issues in the Work Plan. During this discussion, Tim Vinson noted that he would like to see additional boating access sites on the Lexington side of Lake Murray. David Hancock replied and noted this issue would be covered with the possible creation of a state park on the south side of the reservoir. Tim agreed that this would sufficiently address his issue. The group continued through the document and modified items to ensure that they correctly covered all the issues.

The group briefly discussed whether to cover the issue of Two Bird Cove in the Work Plan. Regis Parsons, a landowner in the cove, was concerned about the recent classification of the cove to a special recreation area. The group decided that since this issue overlapped between the Recreation and Lake and Land Management RCGs, they would mention the item in the Recreation Work Plan, but deal with it primarily in the Lake and Land Management RCG.

As the group progressed through the Work Plan, Dave noted that he had included all of the comments and issues in the draft and, because of this, several items were repeated in the document. The group agreed to remove a few items that were already noted in the document.

After complete review of the Work Plan, the group moved on to discuss the Vision Statement. Dave noted that the Vision Statement can be explained as the over-arching image of the Project in fifty years that guides the group through the tasks set out in the Work Plan.

During discussions on the Vision Statement, John Frick noted that he believed there needed to be an item included that encouraged low density development around the lake, as well as ensuring back property owners access to the lake. The group noted that this was not an issue that pertained to the Recreation Vision Statement and the issue was placed in the Parking Lot for the Lake and Land Management RCG. There were no additional comments on the Vision Statement and the group moved to Solution Principles and made a few changes. All changes made during the meeting are attached (document dated July 21, 2006).

After a short break, the group began to discuss the Recreation Plan "straw man" (attached). Dave noted that the Recreation Plan is the primary deliverable from the Recreation RCG. Dave reviewed each item in the document. During discussions, it was noted that the new Recreation Participation & Preference Study is available; however, the report does not group the data into the four counties surrounding the Project. Tony Bebber will check on combining data for the Recreation Participation & Preference Study for the four counties as a homework item.

There was brief discussion regarding the prioritization of recreation sites that were at capacity and looking into expanding existing sites. Dave explained there will be an implementation schedule because, budget-wise, not all improvements could be done at one time. It was also noted that SCE&G and the agencies will meet on a regular basis to discuss the schedule and any priority adjustments. Alan suggested that the meetings be scheduled after the implementation schedule was developed. The group agreed. The group voiced no objections to the direction that the Recreation Plan was headed.

Dave gave a brief update as to the status of the TWCs. He noted the Recreation Assessment Study was started this past spring. He explained that the interviewers have been hired and in place since Memorial Day. Dave also noted that the inventory of existing SCE&G recreation sites has been completed and the database will be ready by the end of the year. Dave also pointed out that as of June 30, they have completed 173 of the 600 sample days and have completed approximately 660 questionnaires. Dave also noted that the TWC recently had discussions regarding the Boat Density Study Plan and the group is going to move forward with this study. He added that both studies will be using the new Recreation Participation & Preference Study funded by SCPRT and noted he would send the web link to the group.

Finally, Dave explained that there was a study plan currently under internal review that will be submitted to the Downstream Flows TWC for approval. Dave asked the group if there were questions on any of the studies mentioned. George Duke noted that he was a little concerned with the use of a 1977 study as a baseline for the Boat Density Study. Dave replied the 1977 procedures are generally used throughout FERC relicensings when performing a boat density study. He noted that they use the values for water skiing when applying values to jet skis because jet skis were not around in 1977. Dave also added that they have an idea of the number of jet skis from the interviews at the recreation sites. George also expressed concern that since 2006 was a drought year, accurate boat counts would not be attained. Dave noted that they would be using 2001 photography to obtain the counts.

Dave concluded the meeting and reviewed the homework assignments. He noted that before the next meeting the group should review and prioritize those issues that do not need the results of the studies currently taking place. The next Recreation RCG meeting was set for October 25th, 2006.

Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

July 21, 2006
9:30 AM
Lake Murray Training Center

- **9:30 to 10:30** Finalize Recreation RCG Work Plan (Dave Anderson)
- **10:30 to 10:45** BREAK
- **11:00 to 12:00** Finalize Recreation Vision Statement (Dave Anderson)
- **12:00 to 1:00** LUNCH
- **1:00 to 1:30** Finalize Solution Principles (Dave Anderson)
- **1:30 to 2:00** Discussion of Recreation Plan Straw Man (Dave Anderson)
- **2:00 to 2:10** BREAK
- **2:10 to 2:30** Update on TWCs (Dave Anderson)
- **2:30 to 2:45** Develop an Agenda for Next Meeting and Set Next Meeting Date

Adjourn

Recreation Resource Conservation Group

Working Documents

July 14, 2006

Recreation Resource Conservation Group Work Plan

DRAFT

Facilitator:		
Dave Anderson	Kleinschmidt Associates	dave.anderson@kleinschmidtusa.com
Members:		
Name	Organization	E-mail
Alan Axson	Columbia Fire Department	cfdwaxson@columbiasc.net
Alan Stuart	KA	alan.stuart@kleinschmidtusa.com
Alison Guth	KA	alison.guth@kleinschmidtusa.com
Amanda Hill	USFWS	amanda_hill@fws.gov
Bill Argentieri	SCE&G	bargentieri@scana.com
Bill Marshall	Lower Saluda Scenic River Advisory Council, DNR	marshallb@dnr.sc.gov
Charlene Coleman	American Whitewater	cheetahtrk@yahoo.com
Charles (Charlie) Rentz		flyhotair@greenwood.net
David Hancock	SCE&G	dhancock@scana.com
Dick Christie	SCDNR	dchristie@infoave.net
George Duke	LMHC	kayakduke@bellsouth.net
Gerrit Jobsis	Coastal Conservation League & American Rivers	gerritj@scccl.org; gjobsis@americanrivers.org
Guy Jones	River Runner Outdoor Center	guyjones@sc.rr.com
Irvin Pitts	SCPRT	ipitts@scprt.com
James A. Smith	LMA	bkawasi@sc.rr.com
Jeff Duncan	National Park Service	jeff_duncan@nps.gov
Jennifer O'Rourke	South Carolina Wildlife Federation	jenno@scwf.org
Jennifer Summerlin	Kleinschmidt Associates	jennifer.summerlin@kleinschmidtusa.com
Jim Devereaux	SCE&G	jdevereaux@scana.com
JoAnn Butler	resident	jbutler@scana.com
Joy Downs	Lake Murray Assn.	elymay2@aol.com
Karen Kustafik	City of Columbia Parks and Recreation	kakustafik@columbiasc.net
Keith Ganz-Sarto		keith_ganz_sarto@hotmail.com
Kelly Maloney	Kleinschmidt Associates	kelly.maloney@kleinschmidtusa.com
Larry Michalec	Lake Murray Homeowners Coalition	lmichalec@aol.com
Larry Turner	SCDHEC	turnerle@dhec.sc.gov
Leroy M. Barber Jr.	LMA	lbarber@sc.rr.com
Malcolm Leaphart	Trout Unlimited	malcolml@mailbox.sc.edu
Mark Leao	USFWS	mark_leao@fws.gov
Marty Phillips	Kleinschmidt Associates	marty.phillips@kleinschmidtusa.com
Michael Waddell	TU - Saluda River Chapter	mwaddell@esri.sc.edu
Miriam S. Atria	Capitol City Lake Murray Country	miriam@lakemurraycountry.com
Norman Ferris	Trout Unlimited	norm@sc.rr.com
Patricia Wendling	LMA	wwending@sc.rr.com
Patrick Moore	SCCCL AR	patrickm@scccl.org
Ralph Crafton	LMA	crafton@usit.net
Randy Mahan	SCANA	rmahan@scana.com
Richard Mikell	Adventure Carolina	adventurec@mindspring.com
Stanley Yalicki	LMA	joyyalicki@aol.com
Steve Bell	Lake Murray Watch	bellsteve9339@bellsouth.net
Suzanne Rhodes	SC Wildlife Federation	suzrhodes@juno.com
Tim Vinson	SCDNR	vinsont@dnr.sc.gov
Tom Brooks	Newberry Co.	tbrooks@newberrycounty.net
Tommy Boozer	SCE&G	tboozer@scana.com
Tony Bebber	SCPRT	tbebber@scprt.com
Van Hoffman	SCANA Land Mgt.	vhoffman@scana.com

Mission Statement

The mission of the Recreation RCG is to ensure adequate and environmentally-balanced public recreational access and opportunities related to the Saluda Hydroelectric Project for the term of the new license. The objective is to assess the recreational needs associated with the lower Saluda River and Lake Murray and to develop a comprehensive recreation plan to address the recreation needs of the public for the term of the new license. This will be accomplished by collecting and developing necessary information, understanding interests and issues and developing consensus-based recommendations.

Identified Issues

- ensure that recreational facilities and opportunities are protected and enhanced for current and future users, on and near the lake and river
  - support creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on north bank of river connecting Saluda Shoals Park to Gardendale Landing and to Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek
  - access site above the Mill Race rapids (encompassed within LSR Corridor Plan item, above)
  - creation of a state park on the south side of the reservoir
  - creation of a multi-lane boating facility that can accommodate large tournaments
  - boating access
  - non-boating access
  - paddling access
  - expansion of existing SCE&G and public commercial facilities to accommodate future growth
  - security at recreation facilities
  - sufficient egress points on lower Saluda River
  - fishing opportunities for non-boaters
  - A riverfront greenway trail is wanted by the community as expoused by the River Alliance. Assistance by SCE&G will in making this trail a reality will also help by opening up many areas of the river now only reached by boat, or by trespassing. The River Alliance has proposed a trail to extend up the north shore of the Saluda from the Riverbanks Zoo to I26. Continuation of the trail to Saluda Shoals, connecting the Gardendale site and an additional access area between I20 and I26 is also envisioned by the LSRAC and Saluda Shoals. Also, there is no legal access except by boat to the stretch of river upstream of the rapids above Saluda Shoals which should be remedied with a riverfront trail connection if possible, or through seperate access. The trail should parallel the river and not disturb the scenic integrity of the riverbank, but should allow for sufficient viewscapes and even water access by foot, especially to the popular, shallower riffle areas.

Deleted: the need for better public access

   - consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Hopes Ferry. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.
   - public access with parking and trails on the Lexington (south) side such as the public park at the confluence of 12 Mile Creek and the Saluda River proposed in the Corridor Plan by SC PRT and the SC DNR (Lower Saluda River Advisory Council).
   - safe recreational opportunities should be available on the Saluda below the lake through daily flow release schedules, and with release rates deemed to be not life threatening through a controlled study using river experts and stakeholders.
- conservation of lands to protect the scenic integrity of the Project and to provide wildlife habitat areas
- using the concept of adaptive management in future recreation planning
- creation of a communication system that would encompass information to better inform the public of existing and projected conditions regarding lake levels and river flows as related to anticipated hydro operations and maintenance
- protection of the cold water fishery on the lower Saluda River
- identification of flows needed for the lower Saluda River to support a variety of recreational uses
- creation of scheduled recreation flows for the lower Saluda River
- identification of a reliable lake level that will provide year round access for a majority of lake users
- consideration of The Lower Saluda River Corridor Plan and the Lower Saluda Scenic River Corridor Plan Update and their related public access sites and greenway-trail concepts
- identification and conservation of undeveloped shoreline and adjacent land for recreational use
- management of river flows to improve safety for river users (coordinate with Safety RCG)
- minimum flows to provide for recreational navigation and to protect and enhance aquatic life in river (coordinate with Fish and Wildlife RCG)

Deleted: on

Deleted: Lower

Deleted: Lower

RCG Tasks and Responsibilities

- Utilizing and modifying the Standard Process for evaluating and addressing recreation management and access issues specific to the Saluda Project, including developing a vision statement for the Project.
- Identifying specific areas where lake and river levels, river flows, and/or lake and river level fluctuations may be adversely affecting recreation including the nature and timing of the effect (e.g., access to sections of water, access to facilities, and aesthetics).
- Identifying specific areas where river flow changes may be adversely affecting recreation along the river, including the nature and timing of the effect (e.g., access to and safe use of sections of river).
- Working with the Operations Resource Conservation Group to identify "reasonable" (based on hydrologic, structural, and other limitations identified) changes in Project operations that would benefit recreation.

Deleted: level

Deleted: at the lake,

Deleted: and alternatives for modifying project operations, including

- Working with the Safety RCG and the Fish and Wildlife RCG to coordinate actions on issues of mutual interests such as river flows, lake levels, and the siting and management recreational facilities.
- Identifying any studies, if applicable, that need to be performed for identifying and/or evaluating (1) changes to Project operations, (2) enhancements to existing facilities, and (3) creation of new facilities to provide for public recreational access and opportunities.
- Make recommendations to the Lake and Land Management RCG to ensure adequate project lands are retained to meet recreational needs.
- Presenting a range of reasonable alternatives or recommendations to the Saluda Hydro Relicensing Group (SHRG) regarding modifications to facilities or current Project operations, needs for additional future access and facilities, and provide recommendations for recreation access, facilities, and use.

Work Scope and Product

- **Task 1** – Utilize the stepwise process diagram and solution principles to guide the planning process for addressing recreation management issues at the Saluda Project.
- **Task 2 –** Develop a Vision Statement for the Saluda Project.
- **Task 3** – Review the operational constraints and current operations of the Saluda Project (see Initial Consultation Document).
- **Task 4** – Answer the list of questions on the Standard Process Form in order to characterize the existing and potential future condition of access and lake levels and river flows – from a recreation setting perspective.
- **Task 5** – Review stakeholder requests for particular studies and/or enhancement measures to ensure that these are incorporated into study planning, if applicable
- **Task 6** – Develop and recommend operation scenarios to the Operations RCG for analysis. These scenarios should reflect initial thinking on potential solutions and be designed to narrow the focus of Task 10 below. Analysis by the Operations RCG will focus on an assessment of potential recreational impacts associated with any suggested changes to operations.
- **Task 7** – Discuss results of the Operations RCG analyses.
- **Task 8 –** Develop study designs/methods/plans and review agreed upon studies, literature reviews, etc.
- **Task 9** – Check the solution principles to ensure proposed study plans are consistent.
- **Task 10** – Provide recommendations for Project operations and recreation access, facilities, and use to be considered in conjunction with all ecological (including water quality), recreational, and safety issues.
- **Task 11** – Develop a consensus based Recreation Plan for the Saluda Project that addresses all of the issues and tasks identified above.

Deleted: (e.g., agency letters)

Deleted: and

<u>Schedule</u>

Late 2005/Early 2006—Finalize Mission Statement, Standard Process Form, Solution Principles, and Work Plan
Mid-2006—Complete identification of studies, literature reviews, etc. that need to be completed to address issues and tasks identified in the Work Plan
Late 2006—Begin compilation of existing information, review preliminary study results, and draft an outline of the Recreation Plan
2007—Complete any studies identified in Task 8 and review results; draft recommendations to SHRG, complete draft Recreation Plan
2008—Finalize Recreation Plan and provide comments on Draft License Application

Recreation Vision Statement for the Saluda Project

DRAFT

The long-term vision for the Saluda Project is to recognize, protect, and enhance the fishery, water quality, aesthetic values, cultural resources, and public recreational opportunities on the reservoir and the Lower Saluda River, while recognizing the need to protect habitat supporting threatened, endangered, and sensitive species of Lake Murray and the lower Saluda River, and ensure adequate facilities and public access are provided. Given the size of the reservoir/hydro-project area, it is felt that it can continue to support a diversity of recreation opportunities. Recognizing that needs and demands will change, recreational uses will be monitored and managed to balance access/uses with the protection of natural resources and environmental quality; and planning for new facilities and management schemes will remain adaptive to changes.

Deleted: the reservoir

Deleted: tailwater

Deleted: .

Deleted: reservoir

Recreational opportunities for Lake Murray and the lower Saluda River over the next 30 to 50 years of the pending new FERC license for SCE&G should incorporate the following attributes:

- Recreational sites access areas on the lake and the river should be adequate to allow for the continued rapid population growth in the midlands over the term of the new license based on surveys of the public and input from the stakeholders and public.

- Sites should be spaced around the lake and along the river corridor to provide legal public access to the different geographic sections of both.

- Uncrowded conditions should be available most of the time at the sites, with natural viewscapes and provisions for most of the current and anticipated popular recreational activities incorporated into the overall provisions.

- Patrols and/or assistance for emergencies should be provided, though not necessarily manned, such as adequate phone boxes.

- Safe recreational opportunities should be available for boaters on the lake with adequate lake levels for the navigational markers, and on the river with release levels that are not life-threatening to the average person.

- The recommendations of the Lower Saluda Scenic River Advisory Council should be implemented to reflect the broad community-based consensus for river access, with consideration of additional river access to areas where trespassing is now the only way to enter an area.

Improvements to be considered at the Saluda Project include:

- Evaluation of SCE&G-owned Project lands for possible reclassification for recreation activities.

- Providing appropriate operations and maintenance of public recreation facilities.

- Optimizing the capacity of existing public recreation facilities to accommodate existing and future demand.

- Improving access and safety in the public waters below the dam and minimizing impacts of project operations on downstream recreation, recognizing the need to meet power generation, and downstream flow responsibilities at Saluda.

Deleted: ly

Deleted: accessible

- Managing lake level drawdowns so as to optimize safety and recreational opportunities.

Deleted: minimize the occurrence of surface elevations lower than 354' in the late summer and early fall

- Managing river flows so as to optimize safety and recreational opportunities.

- Ensuring public access areas for the non-boating public remain available along the lake and river shorelines.

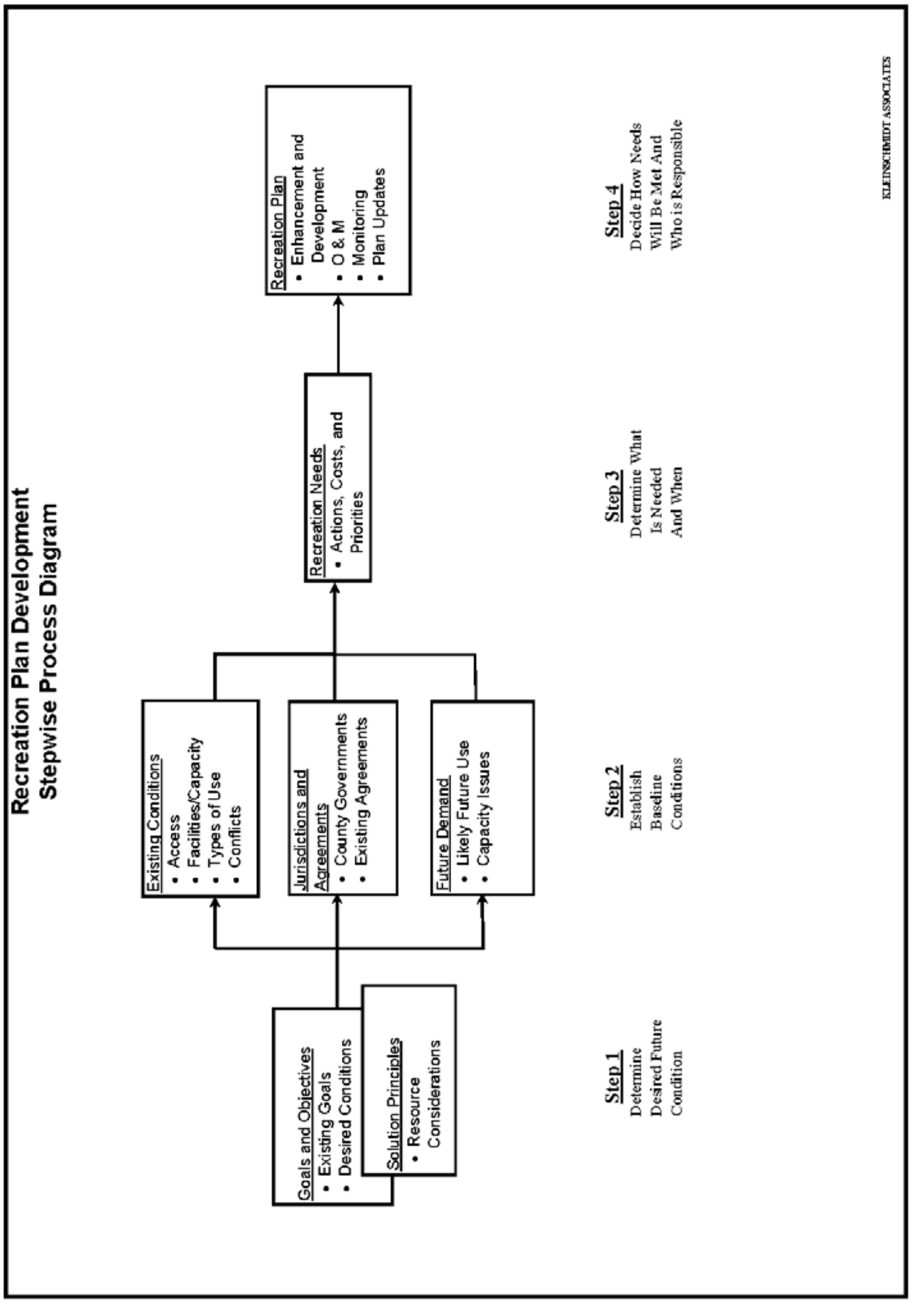
- Development of new facilities in accordance with the comprehensive plan as the need arises.

Deleted: if a proven

Recreation Plan Development

DRAFT

Stepwise Process Diagram



Solution Principles

Consideration of new recreational facilities should be based on demonstrated need and the potential impact on existing facilities.

1. Priority should be given to demonstrated need within the FERC project boundary.

2. Priority should be given to recreational proposals where multiple stakeholders offer significant participation.

3. Recreational facilities should appeal to a broad public.

4. Reasonable access for the disabled should be provided.

5. Recreational needs should be prioritized for the project.

6. The improvement or expansion of existing recreational facilities should be considered first.

7. Additional recreational studies (if needed) should be only of sufficient scope and duration to provide necessary information to develop issue solutions.

8. Consensus based solutions are preferred over studies, unless solutions cannot be developed with existing information.

9. A schedule of proposed improvements should be considered so that all costs are not in the first few years of the new license.

10. A process should be developed to adjust proposed improvements over the 30+ year time frame approximately every 7 to 10 years to account for changing needs. This should include the ability to trade a new needed facility for a proposed (but not built) facility of approximately the same cost.

11. Sufficient "future recreational" land should be set aside now to handle the recreational needs of 30+ years.

Preferred consideration will be given to ideas that:

- do not promote facilities that would adversely impact existing commercial operations;

- identify actual recreational needs that are not filled by existing facilities;

- receive broad public support;

- expand existing recreational facilities prior to developing green field sites;

- require doing recreational studies only if consensus cannot be reached with existing information (It is preferred to put financial resources into recreational facilities and opportunities that benefit the overall Project, rather than fund unnecessary/subjective studies).

Standard Process Form

The following is a list of standard questions designed to help characterize existing recreation resources and aid in development of an appropriate recreation plan for the Saluda Project. Questions pertaining to recreation management are categorized according to the four-step recreation plan stepwise process diagram developed for the project. Questions pertaining to reservoir levels and downstream flows are listed following the facility management material.

STEP 1 – DETERMINE DESIRED FUTURE CONDITION

1. Identify Lake Murray and/or Lower Saluda River (LSR) qualities important to keep and any qualities that need changes.

Change:
Relative water level stability
Predictability – desire flows in river to be more predictable; desire advanced notice of flows to be available to public
Accessibility and amenities (boardwalk accessible from land and water)
Water quality – desire to resolve DO problems in the tailrace and in the reservoir
Minimum flow – desire minimum flow standards that will protect aquatic health in river
Management of flow increases – desire slower rates for increasing flows in river to increase margin of safety for downstream river users

Keep:
Water quality
Natural shoreline and riverbanks
Undeveloped lands remain undeveloped
Aesthetics
Fishing opportunities
Hunting opportunities
Wildlife watching
Living on lake/river
Solitude
Keep islands natural
Safety/security
Public-private balance
Shoreline Management Program
Contingency reserve capacity

2. Are there unique characteristics of Lake Murray and/or the LSR relative to other reservoirs/tailraces in the area?

Location – near and within metropolitan area
Size
Uninterrupted by bridges
Amount of land owned by SCE&G

Extensive shoreline
Usable/accessible shoreline
Purple Martin habitat
Whitewater paddling in river
Cold water fisheries in river

3. What is the overall vision for Lake Murray and/or the LSR, in terms of recreation experiences and opportunities?

Insert Final Vision Statement

4. Are there sensitive biological or cultural resources associated with the Project that need to be considered? Where are these resources located and are there seasonal sensitivities (e.g., nesting or spawning times, etc.)?

ESA
Lands that support wildlife habitat
See Cultural RCG
Rocky shoals spider lily; Saluda River
Spawning, migrating fishes; lower Saluda and Congaree River
Trout; lower Saluda

5. Identify specific goals and objectives for managing recreation at Lake Murray and/or in the LSR.

Lake levels
River levels and flows
Minimum flows to support aquatic community health and recreational uses in the river
Recreational flows
Management of flow changes from the hydro to improve safety for downstream river users
Scheduled recreational releases
Knowledge of current and anticipated generation releases made accessible to the public
Park on Lexington side of lake
Park/preserve on Lexington side of river at Twelve-mile Creek as describe in LSR Corridor Plan
Provide takeout point above Zoo at Millrace Rapids
LSR greenway trail described in LSSR Corridor Plan Update (involves River Alliance/City of Columbia and ICRC/Saluda Shoals Park)
Assure long term stability of Billy Dreher Island, Flotilla Island, and Saluda Shoals Park
Large tournament facility
Reasonable avoid negatively impacting commercial facilities
Conservation of existing project lands for wildlife and scenic values
Estimate current and future recreational use of reservoir and river
Year-round access for recreation sites

Deleted: s

STEP 2 – ESTABLISH BASELINE CONDITIONS

6. What is the nature of existing recreational access to Lake Murray and the LSR?
    a. How many public accessible, developed recreation sites are there?
    b. Where are they located/how are they distributed around the Project?
    c. Of these publicly accessible access sites how many are owned and operated by public versus private entities and how are they supervised?
    d. How many sites, open to the public, provide boat access to the reservoir and the LSR?
    e. How many provide shoreline fishing?
    f. Identify the most heavily used facilities.
    g. Are there informal, undeveloped use areas? Where are they?

7. What types of existing developed facilities are there?
    a. Enumerate boat ramps, restrooms, docks, and other facilities.
    b. What is the existing capacity at each site?
    c. What is the general condition of each site and its facilities?
    d. Ideas for improving existing facilities.

8. Describe notable recreation activities on Lake Murray and/or the LSR.
    a. List recreation activities currently occurring and identify most prominent activities.

Greatest activity is independent family recreation, including many forms of boating, waterskiing, swimming/sunbathing, fishing, picnicking, and camping.
Solitary wade fishing in river.
Bank fishing at public sites and impromptu sites in the lake and river.
Small and large bass tournaments.
Motor boating
Sailing
Fishing from boats
Fishing from banks
Wade fishing
Swimming and sunning
Picnicking
Canoeing and kayaking (flatwater and whitewater)
Floating with tubes and rafts

    b. Where are these uses occurring, and are they concentrated in certain areas?

Lower Saluda River supports all above activities except sailing
Whitewater boating concentrated on Saluda River below I-26 Bridge
Swimming and sunning on Lower Saluda concentrated at Riverbanks Zoo area; and will expand upriver when greenway trail opens in 2007
Wade fishing concentrated at shoal areas of lower River: at least four areas along river

    c. Identify existing impediments to these activities, if any.

Dramatic river fluctuations are impediments to recreational activities along the lower Saluda River.

9. Are there known management issues associated with use?
    a. Are there areas of congestion, and if so where?
    b. Are there known conflicts between users, and if so where and when?

Fishing tournaments are disruptive to other boaters and residents. There needs to be an established, enforced protocol for organizes fishing tournaments.
Jet skis and large motorboats are disruptive to anglers, other boaters, and residents.

    c. Are there other known management issues, such as littering, trespassing, etc.?

Enforcement of established rules are limited by funding, staffing, and political boundaries.

Deleted: excellent but

    d. Are there known issues regarding recreational safety?

Wade fishing, canoeing/kayaking, and other water contact and bank use is often dangerous due to river fluctuations in water levels on the Lower Saluda River.

10. What is the expected future demand for recreation activities at Lake Murray?
    a. Will existing facility capacity likely be exceeded, and if so where and when?
    b. Would accommodating this demand be consistent with the long-term vision for the reservoir?
    c. Will demand introduce new or additional congestion, conflicts, or other management issues?

11. Identify current local benefits from recreation and any local detriments.

STEP 3 – DETERMINE WHAT IS NEEDED AND WHEN

12. Ideas for better or different access, consistent with Step 2 above.

13. Potential facility enhancements or upgrades, consistent with Step 2 above.

14. Potential new facilities, or other management actions, consistent with Step 2 above.

15. What are the priorities regarding identified needs both in terms of resources and time? How do priorities compare across the entire Project?

STEP 4 – DECIDE HOW NEEDS WILL BE MET AND WHO IS RESPONSIBLE

QUESTIONS REGARDING RESERVOIR LEVELS

16. How is the Project currently operated and what are the typical reservoir levels during key recreation seasons?

- SCE&G operates Saluda Hydroelectric Project as a multi-purpose project. The seasonal changes in elevations provide hydroelectric generation, maintenance of downstream water quality, a unique tailrace fishery, and municipal/industrial water supply.
- SCE&G has a verbal agreement with SCDHEC for a minimum flow of 180 cfs.
- During the low DO season which generally runs from late June to early December, SCE&G will try to maintain a minimum flow of 400 – 500 cfs to help maintain a higher level of DO in the Lower Saluda River.
- From April through the end of August the lake is operated near the normal operating high water level of el. 358 ft Plant Datum (PD). Maximum full pool is el. 360.
- Drawdown begins near the end of August or early September and ends in late December near the winter pool level of 350 - 352 ft PD. This allows additional storage capacity in anticipation of the late winter and early spring rainy season.
- At the beginning of January the lake is allowed to refill during the rainy season so it will be at the normal operating high water level of 358 ft. PD by April.
- The plant normally schedules power operations for contingency reserve to meet our obligation to the Virginia/Carolinas Reserve Sharing Group (VACAR), a member of the Southeastern Electric Reliability Council (SERC), which is governed by the North American Electric Reliability Council (NERC). During the fall and in anticipation of heavy rains from a tropical storm or hurricane the plant will generate as necessary to manage the lake level, system reserve, and emergency generation requirements.
- Power generation may be increased to allow SCE&G to meet their obligations of contingency reserve as part of our VACAR agreement with neighboring utilities.

17. Are there changes to Project operations that you would like to see addressed to improve the overall value of the reservoir, and how specifically would such changes benefit recreation?

- What minimum lake elevation will provide recreational benefits during each season of the year?
- Current reservoir level operations balance the multi-purpose use of the reservoir. Maintaining the existing reservoir level fluctuations would allow for continued water level management through daily and weekly power generation operations however recreation would see no additional benefits. Conversely, limiting the seasonal fluctuation may have recreational benefits but other project purposes would be compromised (power generation, water level management, water quality maintenance, and aquatic weed control).

18. Are there seasonal and/or daily variations in reservoir level that can occur without adversely affecting the overall value of the project (including impoundment objectives such as recreation, fish and wildlife, flood control, generation, navigation, etc.)?

- There are not large daily fluctuations at the Saluda Hydroelectric Project.

19. What are the reservoir levels at which recreation problems tend to occur (may be different for different locations or problems)?

- There appears to be a potential impact to recreational resources when the lake level is lower.
- SCE&G already extended boat ramps at several of their public access parks to accommodate a water level down to el. 345 ft PD.

20. When (i.e., what time of year) and how frequently do problems occur related to reservoir levels?

- In general, the operation of Saluda Hydroelectric Project has been consistent throughout the years except for 1990, 1996, 2002 – 2004, and 2006. During those years the lake level was lowered to around el. 345 – 348 ft PD for the following project maintenance requirements:
  1990 – Intake towers maintenance
  1996 – Hydrilla control as requested by SCDNR
  2002 – 2004 – FERC Order for safety during dam remediation project
  2006 – Upstream riprap repair
- It will be necessary to lower the lake level to around el. 345 ft PD in the future for maintenance of project structures and installing new recreational access.

21. Why are the current operating water levels important to the operation of the project and the overall system?

- The Saluda Hydroelectric Project is a multi-purpose reservoir. The current operating water levels are critical for the project to meet its required purposes. The changes in water level have many beneficial impacts both upstream and downstream of the dam :
- The project is used to meet our contingency reserve capacity obligation as part of the VACAR agreement. This is for a loss on our own system or by one of our neighboring Reserve Sharing Group utilities.
- Electricity (inexpensive, clean, renewable)
- Electric system ancillary services (transmission line maintenance & overload protection, security resource for VCS Nuclear Statino)
- Navigation support
- Trout fishery
- Downstream water quality and aquatic habitat
- Municipal and industrial water supply

22. Are there state or federal operating requirements that stipulate specific operating goals?

- SCE&G and SCDHEC have an agreement to discharge a minimum flow or 180 cfs from the project.
- Article 12 of the FERC license requires that reservoir levels and discharge from storage be controlled by reasonable rules and regulations of the Commission for the protection of life, health, and property and for other beneficial public uses including recreational purposes.
- Exhibit H of the latest FERC license application identifies the lower lake level to be Elev. 350 during normal flow years and Elev. 345 during low flow years.

- Our McMeekin Generating Station NPDES permit requires a minimum of 2,500 cfs discharge from Saluda prior to discharging the fossil plant circulating water return directly into the Lower Saluda River.

QUESTIONS REGARDING DOWNSTREAM FLOWS

23. Are there riverine recreation opportunities below the dam? If yes, move to additional questions, if not, stop.

Yes, trout fishing (wading, bank, boat), striper fishing (wading, bank, boat), canoeing/kayaking, tubing, sunbathing/swimming/rock hopping, picnicking, walking/hiking, bicycling, wildlife watching.

24. Do we know how different flow levels affect recreation opportunities and specific recreation activities?

25. Can opportunities be enhanced by modifying releases, and in what way?

26. How would modified releases affect upstream lake levels?

27. How would suggested modified downstream flows affect project operations at the project and at upstream and downstream projects?

28. Are there additional concerns with regard to state and federal requirements or existing ecological issues that limit suggested changes to downstream flows?

29. How binding is the VACAR agreement and when does it expire? (I notice that it is not listed in the state/federal operating requirements in Question 22).

Recreation Resource Conservation Group

Working Documents

July 21, 2006

Deleted: July 14, 2006

Recreation Resource Conservation Group Work Plan

DRAFT

Facilitator:

Dave Anderson	Kleinschmidt Associates	dave.anderson@kleinschmidtusa.com

Members:

Name	Organization	E-mail
Alan Axson	Columbia Fire Department	cfdwaxson@columbiasc.net
Alan Stuart	KA	alan.stuart@kleinschmidtusa.com
Alison Guth	KA	alison.guth@kleinschmidtusa.com
Amanda Hill	USFWS	amanda_hill@fws.gov
Bill Argentieri	SCE&G	bargentieri@scana.com
Bill Marshall	Lower Saluda Scenic River Advisory Council, DNR	marshallb@dnr.sc.gov
Charlene Coleman	American Whitewater	cheetahtrk@yahoo.com
Charles (Charlie) Rentz		flyhotair@greenwood.net
David Hancock	SCE&G	dhancock@scana.com
Dick Christie	SCDNR	dchristie@infoave.net
George Duke	LMHC	kayakduke@bellsouth.net
Gerrit Jobsis	Coastal Conservation League & American Rivers	gerritj@scccl.org; gjobsis@americanrivers.org
Guy Jones	River Runner Outdoor Center	guyjones@sc.rr.com
Irvin Pitts	SCPRT	ipitts@scprt.com
James A. Smith	LMA	bkawasi@sc.rr.com
Jeff Duncan	National Park Service	jeff_duncan@nps.gov
Jennifer O'Rourke	South Carolina Wildlife Federation	jenno@scwf.org
Jennifer Summerlin	Kleinschmidt Associates	jennifer.summerlin@kleinschmidtusa.com
Jim Devereaux	SCE&G	jdevereaux@scana.com
JoAnn Butler	resident	jbutler@scana.com
Joy Downs	Lake Murray Assn.	elymay2@aol.com
Karen Kustafik	City of Columbia Parks and Recreation	kakustafik@columbiasc.net
Keith Ganz-Sarto		keith_ganz_sarto@hotmail.com
Kelly Maloney	Kleinschmidt Associates	kelly.maloney@kleinschmidtusa.com
Larry Michalec	Lake Murray Homeowners Coalition	lmichalec@aol.com
Larry Turner	SCDHEC	turnerle@dhec.sc.gov
Leroy M. Barber Jr.	LMA	lbarber@sc.rr.com
Malcolm Leaphart	Trout Unlimited	malcolml@mailbox.sc.edu
Mark Leao	USFWS	mark_leao@fws.gov
Marty Phillips	Kleinschmidt Associates	marty.phillips@kleinschmidtusa.com
Michael Waddell	TU - Saluda River Chapter	mwaddell@esri.sc.edu
Miriam S. Atria	Capitol City Lake Murray Country	miriam@lakemurraycountry.com
Norman Ferris	Trout Unlimited	norm@sc.rr.com
Patricia Wendling	LMA	wwending@sc.rr.com
Patrick Moore	SCCCL AR	patrickm@scccl.org
Ralph Crafton	LMA	crafton@usit.net
Randy Mahan	SCANA	rmahan@scana.com
Richard Mikell	Adventure Carolina	adventurec@mindspring.com
Stanley Yalicki	LMA	joyyalicki@aol.com
Steve Bell	Lake Murray Watch	bellsteve9339@bellsouth.net
Suzanne Rhodes	SC Wildlife Federation	suzrhodes@juno.com
Tim Vinson	SCDNR	vinsont@dnr.sc.gov
Tom Brooks	Newberry Co.	tbrooks@newberrycounty.net
Tommy Boozer	SCE&G	tboozer@scana.com
Tony Bebber	SCPRT	tbebber@scprt.com
Van Hoffman	SCANA Land Mgt.	vhoffman@scana.com

Recreation Resource Conservation Group Work Plan

DRAFT

Mission Statement

The mission of the Recreation RCG is to ensure adequate and environmentally-balanced public recreational access and opportunities related to the Saluda Hydroelectric Project for the term of the new license. The objective is to assess the recreational needs associated with the lower Saluda River and Lake Murray and to develop a comprehensive recreation plan to address the recreation needs of the public for the term of the new license. This will be accomplished by collecting and developing necessary information, understanding interests and issues and developing consensus-based recommendations.

Identified Issues

- ensure that recreational facilities and opportunities are protected and enhanced for current and future users, on and near the lake and river
    - boating access, including future access on Lexington side of lake
    - non-boating access
    - paddling access
    - security at recreation facilities
    - sufficient egress points on lower Saluda River
    - fishing opportunities for non-boaters
- conservation of lands
    - protect the scenic integrity of the Project,
    - provide wildlife habitat areas, and
    - provide formal and informal (impromptu areas) recreational opportunities
        - consideration of Two Bird Cove and Hurricane Hole Cove (special recreation designation areas) classification
- using the concept of adaptive management in future recreation planning
- River flows
    - safe recreational opportunities should be available on the Saluda below the lake through daily flow release schedules, and with release rates deemed to be not life threatening through a controlled study using river experts and stakeholders.
    - lack of scheduled recreation flows for the lower Saluda River
    - management of river flows to improve safety for river users (coordinate with Safety RCG)
    - minimum flows to provide for recreational navigation and to protect and enhance aquatic life in river (coordinate with Fish and Wildlife RCG)
- lack of a communication system that would encompass information to better inform the public of existing and projected conditions regarding lake levels and river flows as related to anticipated hydro operations and maintenance
- protection of the cold water fishery on the lower Saluda River
- impacts of lake level on recreational use of the lake
- consideration of The Lower Saluda River Corridor Plan and the Lower Saluda Scenic River Corridor Plan Update and their related public access sites and greenway-trail concepts

Possible Resolution

Deleted: the need for better public access

Deleted: <#>support creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on north bank of river connecting Saluda Shoals Park to Gardendale Landing and to Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek¶
<#>access site above the Mill Race rapids (encompassed within LSR Corridor Plan item, above)¶
<#>creation of a state park on the south side of the reservoir¶
<#>creation of a multi-lane boating facility that can accommodate large tournaments¶

Inserted: <#>support creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on north bank of river connecting Saluda Shoals Park to Gardendale ... [1]

Inserted: <#> (encompassed wi ... [2]

Deleted: <#>expansion of existi ... [3]

Inserted: <#>SCE&G and publ ... [4]

Deleted: <#>A riverfront green ... [5]

Inserted: <#>A riverfront green ... [6]

Inserted: <#>consideration of a ... [7]

Inserted: <#>¶

Formatted: Bullets and Numbering

Deleted: to

Deleted: and to

Inserted: and to provide wildlif ... [8]

Formatted: Bullets and Numbering

Formatted: Underline

Deleted: creation

Deleted: on

Deleted: Lower

Deleted: identification of flows ... [9]

Inserted: identification of flow ... [10]

Deleted: <#>Lower

Deleted: <#>lower Saluda Riv ... [11]

Inserted: <#>lower

Deleted: <#>identification and ... [12]

Inserted: <#>identification an ... [13]

Inserted: <#>management of ... [14]

Inserted: <#>¶

- support creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on north bank of river connecting Saluda Shoals Park to Gardendale Landing and to Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek
- access site above the Mill Race rapids (encompassed within LSR Corridor Plan item, above)
- creation of a state park on the south side of the reservoir
- creation of a multi-lane boating facility that can accommodate large tournaments
- A riverfront greenway trail is wanted by the community as expoused by the River Alliance. Assistance by SCE&G will in making this trail a reality will also help by opening up many areas of the river now only reached by boat, or by trespassing. The River Alliance has proposed a trail to extend up the north shore of the Saluda from the Riverbanks Zoo to I26. Continuation of the trail to Saluda Shoals, connecting the Gardendale site and an additional access area between I20 and I26 is also envisioned by the LSRAC and Saluda Shoals. Also, there is no legal access except by boat to the stretch of river upstream of the rapids above Saluda Shoals which should be remedied with a riverfront trail connection if possible, or through separate access. The trail should parallel the river and not disturb the scenic integrity of the riverbank, but should allow for sufficient viewscapes and even water access by foot, especially to the popular, shallower riffle areas.
- consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Hopes Ferry. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.
- public access with parking and trails on the Lexington (south) side such as the public park at the confluence of 12 Mile Creek and the Saluda River proposed in the Corridor Plan by SC PRT and the SC DNR (Lower Saluda River Advisory Council).
- identification of flows needed for the lower Saluda River to support a variety of recreational uses
- identification of a reliable lake level that will provide year round access for a majority of lake users
- Consideration of conservation easements on large tracts of land within the PBL

Formatted: Bullets and Numbering

RCG Tasks and Responsibilities

- Utilizing and modifying the Standard Process for evaluating and addressing recreation management and access issues specific to the Saluda Project, including developing a vision statement for the Project.
- Identifying specific areas where lake and river levels, river flows, and/or lake and river level fluctuations may be adversely affecting recreation including the nature and timing of the effect (e.g., access to sections of water, access to facilities, and aesthetics).

Deleted: level

Deleted: at the lake,

- Identifying specific areas where river flow changes may be adversely affecting recreation along the river, including the nature and timing of the effect (e.g., access to and safe use of sections of river).
- Working with the Operations Resource Conservation Group to identify "reasonable" (based on hydrologic, structural, and other limitations identified) changes in Project operations that would benefit recreation.
- Working with appropriate RCGs to coordinate actions on issues of mutual interests such as river flows, lake levels, conservation of lands, and the siting and management of recreational facilities.
- Identifying any studies, if applicable, that need to be performed for identifying and/or evaluating (1) changes to Project operations, (2) enhancements to existing facilities, and (3) creation of new facilities to provide for public recreational access and opportunities.
- Presenting a range of reasonable alternatives or recommendations to the Saluda Hydro Relicensing Group (SHRG) regarding modifications to facilities or current Project operations, and provide recommendations for future recreation access and facilities.

Deleted: and alternatives for modifying project operations, including

Deleted: the Safety

Deleted: and the Fish and Wildlife RCG

Deleted: <#>Make recommendations to the Lake and Land Management RCG to ensure adequate project lands are retained to meet recreational needs.¶

Inserted: <#>Make recommendations to the Lake and Land Management RCG to ensure adequate project lands are retained to meet recreational needs.¶

Deleted: needs for additional future access and facilities,

Deleted: ,

Deleted: , and use

Work Scope and Product

- **Task 1** – Utilize the stepwise process diagram and solution principles to guide the planning process for addressing recreation management issues at the Saluda Project.
- **Task 2** – Develop a Vision Statement for the Saluda Project.
- **Task 3** – Review the operational constraints and current operations of the Saluda Project (see Initial Consultation Document).
- **Task 4** – Answer the list of questions on the Standard Process Form in order to characterize the existing and potential future condition of access and lake levels and river flows – from a recreation setting perspective.
- **Task 5** – Review stakeholder requests for particular studies and/or enhancement measures to ensure that these are incorporated into study planning, if applicable
- **Task 6** – Develop and recommend operation scenarios to the Operations RCG for analysis. These scenarios should reflect initial thinking on potential solutions and be designed to narrow the focus of Task 10 below. Analysis by the Operations RCG will focus on an assessment of potential recreational impacts associated with any suggested changes to operations.
- **Task 7** – Discuss results of the Operations RCG analyses.
- **Task 8** – Develop study designs/methods/plans and review agreed upon studies, literature reviews, etc.
- **Task 9** – Check the solution principles to ensure proposed study plans are consistent.
- **Task 10** – Provide recommendations for Project operations and recreation access and facilities to be considered in conjunction with all ecological (including water quality), recreational, and safety issues.
- **Task 11** – Develop a consensus based Recreation Plan for the Saluda Project that addresses all of the issues and tasks identified above.

Deleted: (e.g., agency letters)

Deleted: ,

Deleted: ,

Deleted: and use

Deleted: and

<u>Schedule</u>

Late 2005/Early 2006—Finalize Mission Statement, Standard Process Form, Solution Principles, and Work Plan
Mid-2006—Complete identification of studies, literature reviews, etc. that need to be completed to address issues and tasks identified in the Work Plan
Late 2006—Begin compilation of existing information, review preliminary study results, and draft an outline of the Recreation Plan
2007—Complete any studies identified in Task 8 and review results; draft recommendations to SHRG, complete draft Recreation Plan
2008—Finalize Recreation Plan and provide comments on Draft License Application

Recreation Vision Statement for the Saluda Project

DRAFT

The long-term vision for the Saluda Project is to recognize, protect, and enhance the fishery, water quality, aesthetic values, cultural resources, and public recreational opportunities on the reservoir and the Lower Saluda River, while recognizing the need to protect habitat supporting threatened, endangered, and sensitive species of Lake Murray and the lower Saluda River, and ensure adequate facilities and public access are provided. Given the size of the reservoir/hydro-project area, it is felt that it can continue to support a diversity of recreation opportunities. Recognizing that needs and demands will change, recreational uses will be monitored and managed to balance access/uses with the protection of natural resources and environmental quality; and planning for new facilities and management schemes will remain adaptive to changes.

Recreational opportunities for Lake Murray and the lower Saluda River over the next 30 to 50 years of the pending new FERC license for SCE&G should incorporate the following attributes:

- Recreational sites access areas on the lake and the river should be adequate to allow for the continued rapid population growth in the midlands over the term of the new license based on surveys of the public and input from the stakeholders and public.

- Sites should be spaced around the lake and along the river corridor to provide legal public access to the different geographic sections of both.

- Uncrowded conditions should be available most of the time at the sites, with natural viewscapes and provisions for most of the current and anticipated popular recreational activities incorporated into the overall provisions.

- Patrols and/or assistance for emergencies should be provided, though not necessarily manned, such as adequate phone boxes.

- Safe recreational opportunities should be available for boaters on the lake with adequate lake levels for the navigational markers, and on the river with release levels that are not life-threatening to the average person.

- The recommendations of the Lower Saluda Scenic River Advisory Council should be implemented to reflect the broad community-based consensus for river access, with consideration of additional river access to areas where trespassing is now the only way to enter an area.

Improvements to be considered at the Saluda Project include:

- Evaluation of SCE&G-owned Project lands for possible reclassification for recreation activities.

- Providing appropriate operations and maintenance of public recreation facilities.

- Optimizing the capacity of existing public recreation facilities to accommodate existing and future demand.

Deleted: the reservoir

Deleted: tailwater

Deleted: .

Deleted: reservoir

Formatted: Indent: Left: 0", Bulleted + Level: 1 + Aligned at: 0.25" + Tab after: 0.5" + Indent at: 0.5", Tabs: 0.25", List tab + Not at 0.5"

Deleted: ¶

Recreation Vision Statement for the Saluda Project

DRAFT

- Improving access and safety in the public waters below the dam and minimizing impacts of project operations on downstream recreation, recognizing the need to meet power generation, and downstream flow responsibilities at Saluda.

- Managing lake level drawdowns so as to optimize safety and recreational opportunities.

- Managing river flows so as to optimize safety and recreational opportunities.

- Ensuring public access areas for the non-boating public remain available along the lake and river shorelines.

- Development of new facilities in accordance with the comprehensive plan as the need arises.
- Evaluation of other properties and potential partnerships as needed to meet the mission statement

Deleted: ly

Deleted: accessible

Deleted: minimize the occurrence of surface elevations lower than 354' in the late summer and early fall

Formatted: Bullets and Numbering

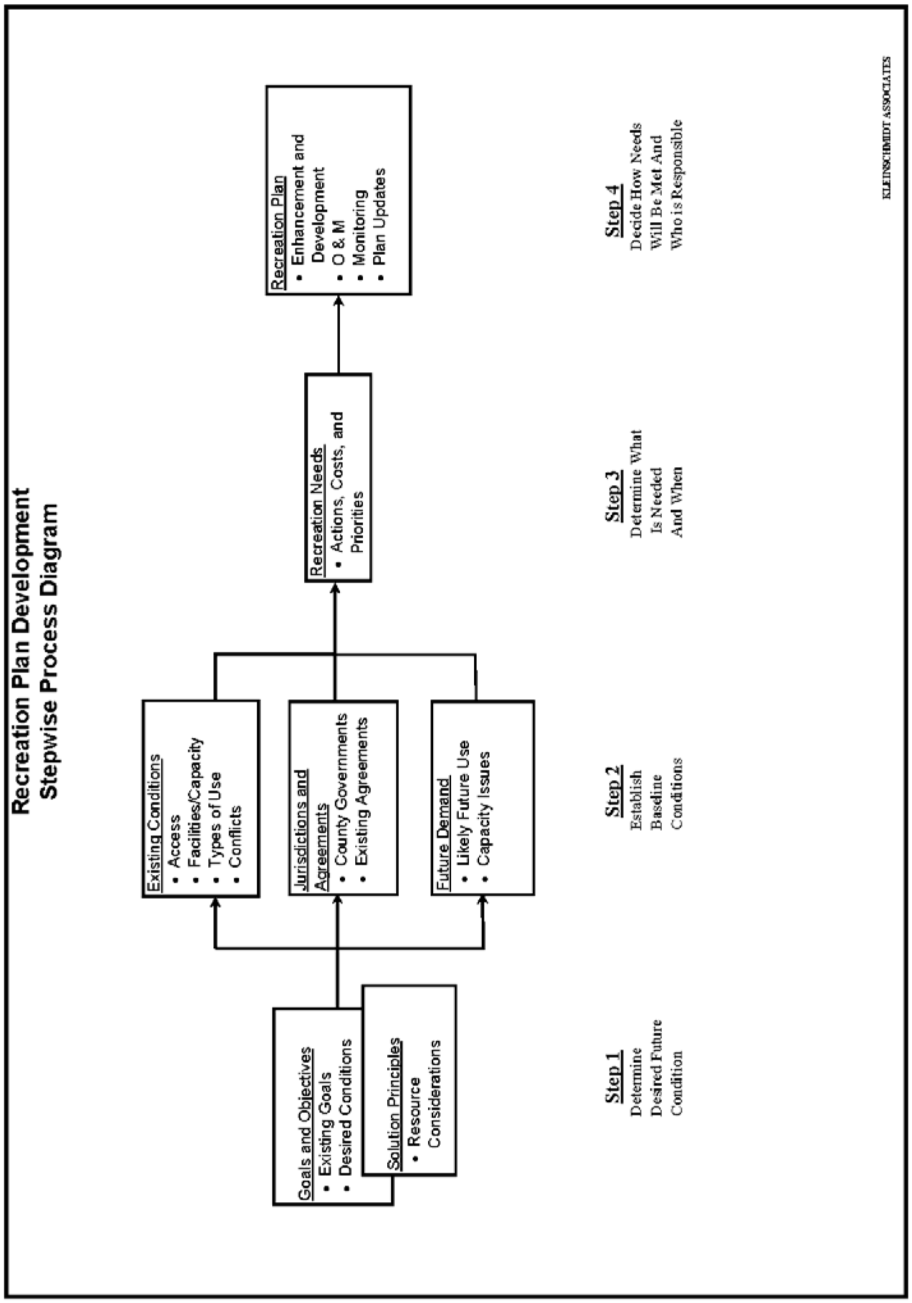
Deleted: if a proven

Deleted: ¶

Recreation Plan Development

DRAFT

Stepwise Process Diagram



Deleted: 10

Solution Principles

Consideration of new recreational facilities should be based on demonstrated need and the potential impact on existing facilities.

1. Priority should be given to demonstrated need within the FERC project boundary.

2. Priority should be given to recreational proposals where multiple stakeholders offer significant participation.

3. Recreational facilities should appeal to a broad public.

4. Reasonable access for the disabled should be provided.

5. Recreational needs should be prioritized for the project including a schedule of proposed improvements so that all costs are not in the first few years of the new license.

6. The improvement or expansion of existing recreational facilities should be considered first.

7. Additional recreational studies (if needed) should be only of sufficient scope and duration to provide necessary information to develop issue solutions.

8. Consensus based solutions are preferred over studies, unless solutions cannot be developed with existing information.

9.

10. A process should be developed to adjust proposed improvements over the 30+ year time frame approximately every 7 to 10 years to account for changing needs. This should include the ability to trade a new needed facility for a proposed (but not built) facility of approximately the same cost.

11. Sufficient "future recreational" land should be set aside now to handle the recreational needs of 30+ years.

Deleted: A schedule of proposed improvements should be considered so that all costs are not in the first few years of the new license

Preferred consideration will be given to ideas that:

- do not promote facilities that would adversely impact existing commercial operations;
- identify actual recreational needs that are not filled by existing facilities;
- receive broad public support;
- expand existing recreational facilities prior to developing green field sites;

Deleted: 10

- require doing recreational studies only if consensus cannot be reached with existing information (It is preferred to put financial resources into recreational facilities and opportunities that benefit the overall Project, rather than fund unnecessary/subjective studies).

Deleted: 10

Standard Process Form

The following is a list of standard questions designed to help characterize existing recreation resources and aid in development of an appropriate recreation plan for the Saluda Project. Questions pertaining to recreation management are categorized according to the four-step recreation plan stepwise process diagram developed for the project. Questions pertaining to reservoir levels and downstream flows are listed following the facility management material.

STEP 1 – DETERMINE DESIRED FUTURE CONDITION

1. Identify Lake Murray and/or Lower Saluda River (LSR) qualities important to keep and any qualities that need changes.

Change:
Relative water level stability
Predictability – desire flows in river to be more predictable; desire advanced notice of flows to be available to public
Accessibility and amenities (boardwalk accessible from land and water)
Water quality – desire to resolve DO problems in the tailrace and in the reservoir
Minimum flow – desire minimum flow standards that will protect aquatic health in river
Management of flow increases – desire slower rates for increasing flows in river to increase margin of safety for downstream river users

Keep:
Water quality
Natural shoreline and riverbanks
Undeveloped lands remain undeveloped
Aesthetics
Fishing opportunities
Hunting opportunities
Wildlife watching
Living on lake/river
Solitude
Keep islands natural
Safety/security
Public-private balance
Shoreline Management Program
Contingency reserve capacity

2. Are there unique characteristics of Lake Murray and/or the LSR relative to other reservoirs/tailraces in the area?

Location – near and within metropolitan area
Size
Uninterrupted by bridges
Amount of land owned by SCE&G

Deleted: 10

Extensive shoreline
Usable/accessible shoreline
Purple Martin habitat
Whitewater paddling in river
Cold water fisheries in river

3. What is the overall vision for Lake Murray and/or the LSR, in terms of recreation experiences and opportunities?

Insert Final Vision Statement

4. Are there sensitive biological or cultural resources associated with the Project that need to be considered? Where are these resources located and are there seasonal sensitivities (e.g., nesting or spawning times, etc.)?

ESA
Lands that support wildlife habitat
See Cultural RCG
Rocky shoals spider lily; Saluda River
Spawning, migrating fishes; lower Saluda and Congaree River
Trout; lower Saluda

5. Identify specific goals and objectives for managing recreation at Lake Murray and/or in the LSR.

Lake levels
River levels and flows
Minimum flows to support aquatic community health and recreational uses in the river
Recreational flows
Management of flow changes from the hydro to improve safety for downstream river users
Scheduled recreational releases
Knowledge of current and anticipated generation releases made accessible to the public
Park on Lexington side of lake
Park/preserve on Lexington side of river at Twelve-mile Creek as describe in LSR Corridor Plan
Provide takeout point above Zoo at Millrace Rapids
LSR greenway trail described in LSSR Corridor Plan Update (involves River Alliance/City of Columbia and ICRC/Saluda Shoals Park)
Assure long term stability of Billy Dreher Island, Flotilla Island, and Saluda Shoals Park
Large tournament facility
Reasonable avoid negatively impacting commercial facilities
Conservation of existing project lands for wildlife and scenic values
Estimate current and future recreational use of reservoir and river
Year-round access for recreation sites

STEP 2 – ESTABLISH BASELINE CONDITIONS

Deleted: s

Deleted: 10

6. What is the nature of existing recreational access to Lake Murray and the LSR?
    a. How many public accessible, developed recreation sites are there?
    b. Where are they located/how are they distributed around the Project?
    c. Of these publicly accessible access sites how many are owned and operated by public versus private entities and how are they supervised?
    d. How many sites, open to the public, provide boat access to the reservoir and the LSR?
    e. How many provide shoreline fishing?
    f. Identify the most heavily used facilities.
    g. Are there informal, undeveloped use areas? Where are they?

7. What types of existing developed facilities are there?
    a. Enumerate boat ramps, restrooms, docks, and other facilities.
    b. What is the existing capacity at each site?
    c. What is the general condition of each site and its facilities?
    d. Ideas for improving existing facilities.

8. Describe notable recreation activities on Lake Murray and/or the LSR.
    a. List recreation activities currently occurring and identify most prominent activities.

Greatest activity is independent family recreation, including many forms of boating, waterskiing, swimming/sunbathing, fishing, picnicking, and camping.
Solitary wade fishing in river.
Bank fishing at public sites and impromptu sites in the lake and river.
Small and large bass tournaments.
Motor boating
Sailing
Fishing from boats
Fishing from banks
Wade fishing
Swimming and sunning
Picnicking
Canoeing and kayaking (flatwater and whitewater)
Floating with tubes and rafts

b. Where are these uses occurring, and are they concentrated in certain areas?

Lower Saluda River supports all above activities except sailing
Whitewater boating concentrated on Saluda River below I-26 Bridge
Swimming and sunning on Lower Saluda concentrated at Riverbanks Zoo area; and will expand upriver when greenway trail opens in 2007
Wade fishing concentrated at shoal areas of lower River: at least four areas along river

c. Identify existing impediments to these activities, if any.

Deleted: 10

Dramatic river fluctuations are impediments to recreational activities along the lower Saluda River.

9. Are there known management issues associated with use?
   a. Are there areas of congestion, and if so where?
   b. Are there known conflicts between users, and if so where and when?

Fishing tournaments are disruptive to other boaters and residents. There needs to be an established, enforced protocol for organizes fishing tournaments.
Jet skis and large motorboats are disruptive to anglers, other boaters, and residents.

   c. Are there other known management issues, such as littering, trespassing, etc.?

Enforcement of established rules are limited by funding, staffing, and political boundaries.

Deleted: excellent but

   d. Are there known issues regarding recreational safety?

Wade fishing, canoeing/kayaking, and other water contact and bank use is often dangerous due to river fluctuations in water levels on the Lower Saluda River.

10. What is the expected future demand for recreation activities at Lake Murray?
    a. Will existing facility capacity likely be exceeded, and if so where and when?
    b. Would accommodating this demand be consistent with the long-term vision for the reservoir?
    c. Will demand introduce new or additional congestion, conflicts, or other management issues?

11. Identify current local benefits from recreation and any local detriments.

STEP 3 – DETERMINE WHAT IS NEEDED AND WHEN

12. Ideas for better or different access, consistent with Step 2 above.

13. Potential facility enhancements or upgrades, consistent with Step 2 above.

14. Potential new facilities, or other management actions, consistent with Step 2 above.

15. What are the priorities regarding identified needs both in terms of resources and time? How do priorities compare across the entire Project?

STEP 4 – DECIDE HOW NEEDS WILL BE MET AND WHO IS RESPONSIBLE

QUESTIONS REGARDING RESERVOIR LEVELS

Deleted: 10

16. How is the Project currently operated and what are the typical reservoir levels during key recreation seasons?

- SCE&G operates Saluda Hydroelectric Project as a multi-purpose project. The seasonal changes in elevations provide hydroelectric generation, maintenance of downstream water quality, a unique tailrace fishery, and municipal/industrial water supply.
- SCE&G has a verbal agreement with SCDHEC for a minimum flow of 180 cfs.
- During the low DO season which generally runs from late June to early December, SCE&G will try to maintain a minimum flow of 400 – 500 cfs to help maintain a higher level of DO in the Lower Saluda River.
- From April through the end of August the lake is operated near the normal operating high water level of el. 358 ft Plant Datum (PD). Maximum full pool is el. 360.
- Drawdown begins near the end of August or early September and ends in late December near the winter pool level of 350 - 352 ft PD. This allows additional storage capacity in anticipation of the late winter and early spring rainy season.
- At the beginning of January the lake is allowed to refill during the rainy season so it will be at the normal operating high water level of 358 ft. PD by April.
- The plant normally schedules power operations for contingency reserve to meet our obligation to the Virginia/Carolinas Reserve Sharing Group (VACAR), a member of the Southeastern Electric Reliability Council (SERC), which is governed by the North American Electric Reliability Council (NERC). During the fall and in anticipation of heavy rains from a tropical storm or hurricane the plant will generate as necessary to manage the lake level, system reserve, and emergency generation requirements.
- Power generation may be increased to allow SCE&G to meet their obligations of contingency reserve as part of our VACAR agreement with neighboring utilities.

17. Are there changes to Project operations that you would like to see addressed to improve the overall value of the reservoir, and how specifically would such changes benefit recreation?

- What minimum lake elevation will provide recreational benefits during each season of the year?
- Current reservoir level operations balance the multi-purpose use of the reservoir. Maintaining the existing reservoir level fluctuations would allow for continued water level management through daily and weekly power generation operations however recreation would see no additional benefits. Conversely, limiting the seasonal fluctuation may have recreational benefits but other project purposes would be compromised (power generation, water level management, water quality maintenance, and aquatic weed control).

18. Are there seasonal and/or daily variations in reservoir level that can occur without adversely affecting the overall value of the project (including impoundment objectives such as recreation, fish and wildlife, flood control, generation, navigation, etc.)?

- There are not large daily fluctuations at the Saluda Hydroelectric Project.

19. What are the reservoir levels at which recreation problems tend to occur (may be different for different locations or problems)?

Deleted: 10

- There appears to be a potential impact to recreational resources when the lake level is lower.
- SCE&G already extended boat ramps at several of their public access parks to accommodate a water level down to el. 345 ft PD.

20. When (i.e., what time of year) and how frequently do problems occur related to reservoir levels?

- In general, the operation of Saluda Hydroelectric Project has been consistent throughout the years except for 1990, 1996, 2002 – 2004, and 2006. During those years the lake level was lowered to around el. 345 – 348 ft PD for the following project maintenance requirements:
  1990 – Intake towers maintenance
  1996 – Hydrilla control as requested by SCDNR
  2002 – 2004 – FERC Order for safety during dam remediation project
  2006 – Upstream riprap repair
- It will be necessary to lower the lake level to around el. 345 ft PD in the future for maintenance of project structures and installing new recreational access.

21. Why are the current operating water levels important to the operation of the project and the overall system?

- The Saluda Hydroelectric Project is a multi-purpose reservoir. The current operating water levels are critical for the project to meet its required purposes. The changes in water level have many beneficial impacts both upstream and downstream of the dam :
- The project is used to meet our contingency reserve capacity obligation as part of the VACAR agreement. This is for a loss on our own system or by one of our neighboring Reserve Sharing Group utilities.
- Electricity (inexpensive, clean, renewable)
- Electric system ancillary services (transmission line maintenance & overload protection, security resource for VCS Nuclear Statino)
- Navigation support
- Trout fishery
- Downstream water quality and aquatic habitat
- Municipal and industrial water supply

22. Are there state or federal operating requirements that stipulate specific operating goals?

- SCE&G and SCDHEC have an agreement to discharge a minimum flow or 180 cfs from the project.
- Article 12 of the FERC license requires that reservoir levels and discharge from storage be controlled by reasonable rules and regulations of the Commission for the protection of life, health, and property and for other beneficial public uses including recreational purposes.
- Exhibit H of the latest FERC license application identifies the lower lake level to be Elev. 350 during normal flow years and Elev. 345 during low flow years.

Deleted: 10

- Our McMeekin Generating Station NPDES permit requires a minimum of 2,500 cfs discharge from Saluda prior to discharging the fossil plant circulating water return directly into the Lower Saluda River.

QUESTIONS REGARDING DOWNSTREAM FLOWS

23. Are there riverine recreation opportunities below the dam? If yes, move to additional questions, if not, stop.

Yes, trout fishing (wading, bank, boat), striper fishing (wading, bank, boat), canoeing/kayaking, tubing, sunbathing/swimming/rock hopping, picnicking, walking/hiking, bicycling, wildlife watching.

24. Do we know how different flow levels affect recreation opportunities and specific recreation activities?

25. Can opportunities be enhanced by modifying releases, and in what way?

26. How would modified releases affect upstream lake levels?

27. How would suggested modified downstream flows affect project operations at the project and at upstream and downstream projects?

28. Are there additional concerns with regard to state and federal requirements or existing ecological issues that limit suggested changes to downstream flows?

29. How binding is the VACAR agreement and when does it expire? (I notice that it is not listed in the state/federal operating requirements in Question 22).

Deleted: 10

Page 2: [1] Inserted Bill Marshall 5/30/2006 10:39 AM

support creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on north bank of river connecting Saluda Shoals Park to Gardendale Landing and to Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek

Page 2: [2] Inserted Bill Marshall 5/30/2006 10:39 AM

(encompassed within LSR Corridor Plan item, above)

Page 2: [3] Deleted SCANA 7/21/2006 10:00 AM

expansion of existing SCE&G and public commercial facilities to accommodate future growth

Page 2: [4] Inserted Dave Anderson 5/17/2006 3:37 PM

SCE&G and public commercial

Page 2: [5] Deleted SCANA 7/21/2006 10:01 AM

A riverfront greenway trail is wanted by the community as expoused by the River Alliance. Assistance by SCE&G will in making this trail a reality will also help by opening up many areas of the river now only reached by boat, or by trespassing. The River Alliance has proposed a trail to extend up the north shore of the Saluda from the Riverbanks Zoo to I26. Continuation of the trail to Saluda Shoals, connecting the Gardendale site and an additional access area between I20 and I26 is also envisioned by the LSRAC and Saluda Shoals. Also, there is no legal access except by boat to the stretch of river upstream of the rapids above Saluda Shoals which should be remedied with a riverfront trail connection if possible, or through seperate access. The trail should parallel the river and not disturb the scenic integrity of the riverbank, but should allow for sufficient viewscapes and even water access by foot, especially to the popular, shallower riffle areas.

consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Hopes Ferry. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.

public access with parking and trails on the Lexington (south) side such as the public park at the confluence of 12 Mile Creek and the Saluda River proposed in the Corridor Plan by SC PRT and the SC DNR (Lower Saluda River Advisory Council).

safe recreational opportunities should be available on the Saluda below the lake through daily flow release schedules, and with release rates deemed to be not life threatening through a controlled study using river experts and stakeholders.

Page 2: [6] Inserted Malcolm Leaphart 5/30/2006 10:58 AM

A riverfront greenway trail is wanted by the community as expoused by the River Alliance. Assistance by SCE&G will in making this trail a reality will also help by opening up many areas of the river now only reached by boat, or by trespassing. The River Alliance has proposed a trail to extend up the north shore of the Saluda from the Riverbanks Zoo to I26. Continuation of the trail to Saluda Shoals, connecting the Gardendale site and an additional access area between I20 and I26 is also envisioned by the LSRAC and Saluda Shoals. Also, there is no legal access except by boat to the stretch of river upstream of the rapids above Saluda Shoals which should be remedied with a riverfront trail connection if possible, or through seperate access. The trail should parallel the river and not disturb the scenic integrity of the riverbank, but should allow for sufficient viewscapes and even water access by foot, especially to the popular, shallower riffle areas.

Page 2: [7] Inserted	Malcolm Leaphart	5/30/2006 10:59 AM

consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Hopes Ferry. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.
public access with parking and trails on the Lexington (south) side such as the public park at the confluence of 12 Mile Creek and the Saluda River proposed in the Corridor Plan by SC PRT and the SC DNR (Lower Saluda River Advisory Council).
safe recreational opportunities should be available on the Saluda below the lake through daily flow release schedules, and with release rates deemed to be not life threatening through a controlled study using river experts and stakeholders.

Page 2: [8] Inserted	Bill Marshall	5/30/2006 10:40 AM

and to provide wildlife habitat areas

Page 2: [9] Deleted	SCANA	7/21/2006 10:17 AM

identification of flows needed for the lower Saluda River to support a variety of recreational uses
creation of scheduled recreation flows for the

Page 2: [10] Inserted	Dave Anderson	5/18/2006 9:57 AM

identification of flows needed for the lower Saluda River to support a variety of recreational uses

Page 2: [11] Deleted	SCANA	7/21/2006 10:10 AM

lower Saluda River
identification of a reliable lake level that will provide year round access for a majority of lake users

Page 2: [12] Deleted	SCANA	7/21/2006 10:32 AM

identification and conservation of undeveloped shoreline and adjacent land for recreational use
management of river flows to improve safety for river users (coordinate with Safety RCG)
minimum flows to provide for recreational navigation and to protect and enhance aquatic life in river (coordinate with Fish and Wildlife RCG)

Page 2: [13] Inserted	Dave Anderson	5/18/2006 9:55 AM

identification and conservation of undeveloped shoreline and adjacent land for recreational use

Page 2: [14] Inserted	Bill Marshall	5/30/2006 10:45 AM

management of river flows to improve safety for river users (coordinate with Safety RCG)
minimum flows to provide for recreational navigation and to protect and enhance aquatic life in river (coordinate with Fish and Wildlife RCG)

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

RECREATION PLAN

DRAFT

JULY 2006

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA
ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RECREATION PLAN

DRAFT

JULY 2006

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RECREATION PLAN

DRAFT

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION

These sections will be basic descriptions of existing and/or planned future recreation opportunities.

1.1 Regional Setting

This section will briefly describe recreation opportunities in the Lake Murray region. In order to be consistent with the Statewide Comprehensive Outdoor Recreation Plan (SCORP), the region is defined as the "Capital City & Lake Murray Country" tourism region and includes the counties of Richland, Lexington, Saluda, and Newberry.

1.2 Lake Murray

This section will briefly describe Project facilities, Lake Murray, and recreation opportunities available on the lake.

1.3 Lower Saluda River

This section will briefly describe recreation opportunities available on the lower Saluda River. We must also describe what is actually in the project boundary.

2.0 DATA COLLECTION METHODS AND STORAGE

This section will basically be the methodology from the Recreation Assessment Study and the Boat Density Study.

3.0 SITE DESCRIPTIONS, USE ESTIMATES, AND BOAT DENSITY ANALYSIS

This section will incorporate results from the Recreation Assessment Study and the Boat Density Study.

4.0 FACILITY DEVELOPMENT CONSULTATION PROCESS AND METHODOLOGY

This section will describe the consultation process with the Recreation RCG. We will incorporate the following subheadings to help describe the process.

4.1 Standard Process

This section will describe the Standard Process that we are using in the Recreation RCG.

4.2 Standard Process Steps and Questions

Basically, this will be a list of the four steps and the final questions from the Standard Process form.

4.3 Recreation Solution Principles

This will be a reiteration of the final Solution Principles we are following.

5.0 FACILITY DEVELOPMENT PRIORITIZATION AND SCHEDULING

The following questions briefly describe the process we will use for determining facility development and prioritization.

"Does the *existing* supply of recreation sites/facilities meet the *current* demand for them?" The answer to this question defines our baseline – it tells us what exists *now* and how it is *currently* used.

1. Identify supply of recreation sites. In this instance, supply of recreation sites around Lake Murray will be determined using the results of the recreation site inventory. That will tell us (a) what's available for public access sites and (b) approximately how many people these sites can accommodate at any period in time (site capacity).
2. Estimate whether we are meeting *current* demand for these recreation sites. We need to estimate at what level these sites are being used now. This is determined from our vehicle counts, which are occurring concurrently with the site surveys. This information will be supplemented with results from the user surveys, which will tell us whether the patrons of recreation sites feel the existing facilities are adequate to meet their needs, and the staging locations of special events (regattas, fishing tournaments, etc.).

5.1 Prioritization Consultation

"Will the current supply of recreation sites/facilities meet expected future demand?"

1. Determine what *future* participation in recreation might look like. We need to estimate how many more people will be demanding recreational access to the Project. This information will come from estimates of population projections (population trends are an indicator of potential growth in recreation demand); trends in participation in outdoor recreation from national studies, the SCORP, River Corridor studies, and other relevant literature.
2. Decide whether the *existing* sites might accommodate our expected *future* use, or whether those sites might need to be *expanded* or new sites *created*. The capacity at which these sites are being used currently will be compared with the estimates of future use to gain an idea of how much additional use in the future a site could or could not handle.

5.2 Implementation Schedule

"If site expansion or new access is determined to be required, where and when should that occur?"

1. Identify the recreation sites where expansion might be necessary. Identify the activities that need to be accommodated. Determine whether (a) the site can accommodate an expansion and (b) whether an expansion is desirable at that site. Data required here will come from the site evaluation, professional engineers, and resource

managers/professionals. For boat launches, also examine maps from the boating density study, survey results, and accident locations to identify whether or not waters in front of the launch can handle additional boat traffic.

2. If it is determined that new sites should be created, the location of any potential site should be determined by examining the following items, at a minimum:
   a. Location of existing project lands that are available
   b. Topographic suitability of available project lands to meet the need
   c. Location of other sensitive resources (T&E species, spawning beds, wetlands, etc.).
   d. Current on-water use patterns that might become more concentrated by the development of a new site.
3. Develop a prioritization schedule that will identify the approximate time frame for these improvements to occur.

5.3 Annual Consultation

We will include an annual consultation with the SCDNR and SCPRT that will review improvements made during the prior year and review the schedule for the upcoming year. If the schedule of improvements needs adjusting, it can occur at this meeting.

5.4 Recreation Plan Addenda

We will include an annual report describing improvements made during the previous year and plans for the coming year; basically meeting notes from the annual consultation.

6.0 RECREATION CONCEPT PLAN EVALUATION

This section will describe the detailed improvements that we agree will take place.

6.1 Suitable Sites for Development

This section will describe the sites and the improvements to those sites.

6.2 Unsuitable Sites for Development

During the course of consultation, we may find that a site may need improvements that are unfeasible for a given reason. We will record why these sites are unsuitable in order to provide a record for future use.

7.0 OTHER ISSUES ADDRESSED WITHIN THE RECREATION RCG CONSULTATION PROCESS

If we have any other recommendations related to recreation, we will describe them in this section.

8.0 REFERENCES

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE CONSERVATION GROUP

LAKE MURRAY TRAINING CENTER
October 25, 2006

final dka 11-27-06

ATTENDEES:

Name	Organization	Name	Organization
Alan Stuart	Kleinschmidt Associates	Dave Anderson	Kleinschmidt Associates
Jeni Summerlin	Kleinschmidt Associates	Steve Bell	Lake Watch
Jenn O'Rourke	SCWF	Marty Phillips	Kleinschmidt Associates
Tony Bebber	SCPRT	Richard Mikill	Adventure Carolina
Bill Brebner	YCOA	Joy Downs	LMA
Randy Mahan	SCANA Services	Bill Marshall	SCDNR, LSSRAC
Tim Vinson	SCDNR	Tom Eppink	SCANA Services
Tommy Boozer	SCE&G	David Hancock	SCE&G

HOMEWORK ITEMS:

- Dave Anderson—revise the Recreation RCG Issues Matrix and send out to RCG members
- Dave Anderson—develop a Communication System Plan
- Dave Anderson—send out the Standard Process Form with track changes to RCG members
- TWC—review draft responses to Work Plan items relating to reservoir levels in preparation for the next meeting

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **February 7, 2006 (tentative) at 9:30 a.m.**
Located at the Lake Murray Training Center

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RESOURCE CONSERVATION GROUP

LAKE MURRAY TRAINING CENTER
October 25, 2006

final dka 11-27-06

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson of Kleinschmidt Associates welcomed everyone and opened the meeting with a review of study updates for the Recreation RCG. He indicated that approximately 2,000 surveys were completed this summer for the Saluda Recreation Assessment. Dave A. noted that the Boat Density Study Plan was finalized and sent out to RCG members. He mentioned that SCE&G's 2001 aerial photographs will be used to estimate boat densities on Lake Murray. Dave also noted that the Downstream Flow Assessment Study Plan has been finalized. He then handed the floor over to Marty Phillips of Kleinschmidt Associates to present information on boat density/carrying capacity studies performed at other FERC projects.

Presentation on Boat Density/Carrying Capacity Studies at FERC Projects

Marty noted that the purpose of the presentation was to give committee members an overview of boat densities and carrying capacities. Marty noted that there was a difference between estimating boat densities and carrying capacities. Boat densities are the number of boats per unit area, which may include type of boat/activity, and may address shoreline configuration and availability of open water. Carrying capacity is defined as the type and level of visitor use that could be accommodated while sustaining the desired resource and social objectives. Boat densities illustrate how and where the lake is used, and may provide input to shoreline management decisions. Boat density is a building block used in the estimation of carrying capacity. She identified a variety of inputs that might be used for density and carrying capacity studies. The inputs chosen for any individual study should be selected to address the individual needs of a project's scope and with a clear understanding of how results will be used. There are multiple methods that can be used for estimating density or carrying capacity; each is generally tailored to the project at hand.

Marty explained that, similar to the entire relicensing process, it is important to balance the needs of the people who use the lake, when considering boat density information and carrying capacity studies. There is a significant amount of overlap between carrying capacity studies and shoreline management plans. Each may independently consider a multitude of resource areas, such as boat density, public access, fisheries, water quality, shoreline erosion, etc. Marty suggested that it is appropriate to consolidate research and management efforts – and avoid duplication of information gathering and analysis – by incorporating boat density information into a shoreline management plan, thereby balancing resource needs comprehensively.

Marty pointed out that, typically a licensee may be responsible for the provision of public access within the project boundary to a water body. Typically, state agencies are responsible for managing activity on the water at FERC licensed projects.

She provided a few examples of other projects that have conducted carrying capacity studies. She pointed out that most boat counts are based on a predetermined sampling schedule. She explained that mapping boat densities helps managers view areas of high use, where they may wish to discourage additional access, and areas of low use, where additional access might be appropriate. This can be important input for a shoreline management plan. She specifically noted that different user groups may use the resource differently. She noted that sometimes just boat counts are used and sometimes the counts are combined with on-the-ground survey research. In general, most studies show that different user groups will have different perceptions of crowding on weekdays, weekends, and holidays. Also that different user groups tend to have different characteristics and different needs, all of which need to be recognized by resource managers. Finally, Marty noted that because public preferences and resource conditions may evolve over time, management strategies should be flexible in order to accommodate changing conditions and resource needs.

The presentation can be viewed at the following link:

http://www.saludahydrorelicense.com/documents/CarryingCapacityPresentation.ppt

HEC-ResSim Model Discussion

Dave noted that the HEC-ResSim Model would be discussed at the Quarterly Public Meeting on October 26th located at Saluda Shoals Park.

Dave also verified with the group that we would be requesting the Operations TWC to analyze keeping the lake levels at 354' msl, 355' msl, and 356'msl.

Standard Process Questions – Questions 1 to 5 and 16 to 22

The group worked to finalize Standard Process Questions 1 through 5 and 16 through 22 of the Work Plan. The group was reminded that the purpose of this exercise is to track the progress of the Recreation TWC/RCG. It was noted that the third sentence of the first answer should be changed to "Maintain a balance between public/private recreational access." Joy Downs noted that "Maintaining and/or improving the water quality of Lake Murray" should be added to the end of the first paragraph. It was noted that the third sentence in the second paragraph should be changed to "The quality of amenities and access should be improved for recreational users: and an "s" needed to be added to the word "standard" in the fifth sentence in the second paragraph. The last sentence in the fist question should read: "The Project should also continue to provide reasonably affordable, reliable energy to SCE&G's service area."

Dave A. then read the second question and asked if anything needed to be changed. It was noted that the word "managed" should be added in the second sentence after the word "access." It was noted that the third sentence should read, "This may be to the amount of project lands." It was also noted that "striped bass fishery" should be added to the second paragraph of Question Two.

Dave A. read Question Three and no comments were made. He then read Question Four and asked for comments. It was noted that "bald eagles, wood storks, and purple martins" should be added to the end of the second paragraph. Dave A. noted that he would send the standard process form out to committee members with the track changes included.

Bill Argentieri drafted responses to the Work Plan questions on reservoir levels. These were provided to and reviewed with the TWC. It was agreed to modify the eighth bullet to read as follows: "Power generation is increased to allow SCE&G to meet their obligations of contingency reserve as part of our VACAR agreement with neighboring utilities." TWC members will review the document more thoroughly in preparation for discussion at the next meeting.

Lower Saluda River Corridor Plan

Dave introduced Bill Marshall and noted that he serves on the Lower Saluda Scenic River Advisory Council with the South Carolina Department of Natural Resources (SCDNR). Bill M. opened his presentation by explaining the South Carolina Scenic Rivers Act. He noted that the act has enabled the SCDNR to create a cooperative, non-regulatory program, which involves landowners, river users, community interests, and the SCDNR working for conservation on eight State Scenic Rivers, which are designated through state legislation. He explained that for each scenic river a local advisory council is created to put together a scenic river management plan, which sets river conservation and management objectives for the advisory council.

Bill M. explained that the Lower Saluda Scenic River begins at the old railroad pilings below the Lake Murray Dam and ends at the confluence of the Lower Saluda River (LSR) and Broad River. Presenting a series of photographs, he pointed out popular locations along the LSR, including Mill Race Rapids, the confluence with the Broad, Ocean Boulevard, and Oh Brother Rapids.

Bill M. explained that the Lower Saluda Scenic River Advisory Council consists of 16 members. He noted that the objectives of the Advisory Council are to protect/conserve natural, cultural, and scenic qualities of the river corridor and improve water quality, public access, and river-user safety. These general objectives are expanded upon in the 1990 Lower Saluda River Corridor Plan and the 2000 Corridor Plan Update; which serve as management plans for the Scenic River. He explained that the 1990 Corridor Plan process lead to the LSR being designated a State Scenic River in 1991.

Bill explained why and how a Task Force of local community leaders and interests created the 1990 Lower Saluda River Corridor Plan. The Task Force and its committees addressed issues such as access and facilities, historic and archeological sites, law enforcement, resource protection, river-user safety, tourism, and litter. Bill presented conceptual plans and park opportunities from the

1990 Corridor Plan. Saluda Shoals Park and Riverbanks Botanical Garden are the only concepts that were realized from the 1990 plan. A Twelvemile Creek Park concept was proposed in the 1990 plan; and this site may still present an opportunity for a future public park or preserve.

Bill M. then reviewed the 2000 LSR Corridor Plan Update. He explained that this plan was produced from a community-based planning process convened by the Advisory Council and focused on recreational access issues; and a primary feature of this plan is the proposal of a LSR Greenway Trail along the north bank of the Saluda to connect Lake Murray, Saluda Shoals Park, Gardendale Landing, and Riverbanks Zoo. The first section consisted of designing a trail that starts at the Lake Murray Dam, which will then run through Saluda Shoals Park. The next section extends from Saluda Shoals Park down to Gardendale Landing. The third section consists of extending the trail from Gardendale down to the I-26-bridge to connect with the Three River's Greenway. He mentioned that this third section would be challenging as it requires getting through the asphalt plant and sewer lagoon, which are located in between Gardendale and the I-26 bridge. He then explained that the Three River's Greenway will run from the I-26 bridge to the Broad River. In closing, Bill noted the Advisory Council's desired outcomes for the hydro relicensing process and these included finding ways to support the LSR Greenway Trail through the relicensing process.

The PowerPoint presentation may be viewed at the following link:

http://www.saludahydrorelicense.com/documents/SaludaRiverCorridorPlans.ppt

Communication System Needs

The TWC was provided a list of communication-related systems that were discussed in the October 24th Safety RCG meeting.

Communication System Needs

<u>Information Needed</u>

Recreation Sites
Lake Levels (Rule Curve)
Generation Schedule
- Lake Level Management/Normal Operations
- Reserve Calls
- Special Releases
- Special Drawdowns
  - Maintenance
- Minimum Flow

Identification of Shoals at Different Lake Levels
Education About
What to do in an Emergency
How To Get Information

How To Get Information

Word of mouth*
Signage
Internet*
Newspaper*
Tourism Department
University South Carolina 101
High Schools
Local Outfitters*
Call Down System*
Marinas/Parks
Brochures
Billboards
Real Estate Agents
Conservation Group
Low Frequency AM Radio**
Electronic Info Boards**
Newsletter**
Emails**

* Determined to be those sources of information that can be updated more frequently
** Added by Recreation RCG

The group expanded on a number of items. SCE&G indicated they are examining providing information on “Lake Level Management/Normal Operations” on a two day rotating window, i.e., they will provide scheduled releases for two days in advance. The group indicated it would be nice to know the dates, times and range of expected flows for the “Reserve Calls,” “Special Releases,” and “Special Drawdowns.”

There was a brief discussion about warnings the difference between a communication system and warning system. It was suggested that some of these listings could be updated daily. David Hancock noted and the group agreed that it would be beneficial to explain why SCE&G is increasing flows in the LSR. Dave A. agreed to draft a Communication Systems Plan for future review.

Develop an Agenda for Next Meeting and Set Next Meeting Date

Dave A. will update the Issues Matrix and submit it to the TWC for comment. Joy D. noted that the effects of docks on water quality in Lake Murray should be addressed in the Issues Matrix.

The next meeting date is tentatively scheduled for February 7, 2007.

Saluda Hydro Relicensing
Recreation Resource Conservation Group

Meeting Agenda

October 25, 2006
9:30 AM
Lake Murray Training Center

- **9:30 to 10:00** Study Updates/Study Plan Questions (Dave Anderson)
- **10:00 to 10:30** Presentation on Boat Density/Carrying Capacity Studies at FERC Projects (Marty Phillips)
- **10:30 to 10:45** BREAK
- **10:45 to 11:00** HEC-ResSim Model Discussion (Dave Anderson)
- **11:00 to 12:00** Standard Process Questions – Questions 1 to 5 and 16 to 22 (Dave Anderson)
- **12:00 to 1:00** LUNCH
- **1:00 to 1:30** Lower Saluda River Corridor Plan (Bill Marshall)
- **1:30 to 1:45** BREAK
- **1:45 to 2:30** Communication System Needs (Dave Anderson)
- **2:30 to 2:45** Develop an Agenda for Next Meeting and Set Next Meeting Date

Adjourn

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
LAKE AND LAND MANAGEMENT and RECREATION RCGs MEETING

SCE&G Lake Murray Training Center
February 7, 2007

Final acg 3-7-07

ATTENDEES:

Alison Guth, Kleinschmidt Associates	Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates	Tony Bebber, SCPRT
Lee Barber, LMA	Joy Downs, LMA
Stan Jones, CALM	John Altenberg, Sea Tow, CALM
Tammy Wright, CALM	Archie Trawick Jr., CALM, Jakes Landing
Bill Brebner, Yacht Cove Owners	George Duke, LMHOC
John Frick, landowner	Bill Shipley, CALM
Joe Agnew, CALM	Charlie Higgins, CALM, Holland's Marina
Jon Dukes, Lake Murray Boat Club, CALM	Edie Beaver, CALM, Lake Murray Vacation
Angie Walston, CALM, Lake Murray Vac.	Randy Walston, Acapulco, Lake Murray Vacation.
Donnie LeJohn, Spinners Marina	Suzanne Rhodes, SC Wildlife Fed.
Steve Bell, Lake Murray Watch	George King, landowner
Dave Anderson, Kleinschmidt Associates	Tommy Boozer, SCE&G
David Hancock, SCE&G	Kim Westbury, Saluda County
Teresa Powers, Newberry County	Jenn O'Rourke, SC Wildlife Federation
Carl Sundias, CALM, South Shore Marina	Bill Mathias – LMPS

HOMEWORK:

- Dave Anderson– To issue recreation assessment to Recreation Management TWC
- Dave Anderson- Provide examples of recreation plans from other projects to the RCG.

DATE OF NEXT MEETING: **TBA**
Review of Recreation Assessment in Quarterly Public Meeting on April 19th at 10:00 am and 7:00 pm

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Presentation by the Commerce Association of Lake Murray:

Dave Anderson of Kleinschmidt Associates opened the meeting and the group began with introductions. Dave noted that the first item on the agenda included a presentation from the Commerce Association of Lake Murray (CALM) (link to presentation at http://www.saludahydrorelicense.com/documents/SCEGpresentation4_000.ppt). Carl Sundias of South Shore Marina, and a member of CALM, began the presentation. He proceeded to describe the membership of the organization and noted that it not only consisted of marina operators, but other local businesses affected by the lake. Carl explained that the group had collectively developed a mission statement and he proceeded to review the mission statement with the group. After Carl had reviewed the mission of the CALM, Stan Jones of Lighthouse Marina reviewed some of the goals of the group. Stan explained that they were working with the Grow Boating Initiative which would provide boating infrastructure grants. He also reviewed how marinas help to improve the economy and meet the needs of the community. In conclusion, the CALM made a formal request of the Recreation RCG that the moratorium on multi slip dock permits be amended to allow permit applications at existing commercial marinas.

After the presentation, the floor was opened for questions. Dave asked about the Grow Boating Initiative and if it was related to the national "Take Me Fishing" campaign. Carl and Stan indicated that they do not believe that the two are related and they explained that much of the funding for this initiative comes from portions of boat sales. Lee Barber asked how the work of the CALM aligned with the work of other agencies. Stan explained that they were willing to work with other groups to provide boats or facilities for smart boating courses and such.

The group had a brief discussion on boating safety and David Hancock of SCE&G asked if any of the marina operators have licensed captains that offer basic training on boat operation. A few of the marina operators indicated that they were licensed captains or knew of licensed captains that could assist their patrons. Many of the marina operators noted that they helped individuals who appeared to be having trouble or were inexperienced. Tommy Boozer noted that this may be an important item to note in the Safety RCG.

Tommy asked Stan for a little background on the requirements by DHEC in order to receive the clean marina certification. Stan noted that DHEC has just begun to fully develop the criteria; however, he anticipates that Lighthouse Marina will receive its certification this month. He explained that once a marina is certified, DHEC will do testing to make sure that water quality is maintained. Stan further noted that the Commerce Association has also received grants for new pump out facilities, many of which will be pump out boats.

Dave noted that a concern of the Recreation RCG was regarding recreational access to the reservoir and asked the Commerce Association for their opinion regarding current public access to the lake. Carl noted that the marinas have a difficult time competing with the free ramps, which has, in turn, started to put some of the smaller marinas out of business. Carl noted that they do feel the public needs more access, however once more free public access is put in place, the commercial marinas struggle to compete. Dave noted that the RCG's and TWC's do consider the impacts to commercial operators in their discussions. Tommy pointed out that FERC requires SCE&G to fulfill certain needs regarding recreational access, to which SCE&G must comply in order to protect their license. However, Tommy further noted that any access SCE&G provides is basic and does not include the amenities that the marinas provide, such as fuel or food.

The group briefly discussed the CALM's request for an amendment to the moratorium on multi-slip dock permits. Carl noted that the existing commercial marinas would like to perform upgrades and safety improvements that would require the lifting of the moratorium for existing facilities. Tommy noted that this was something that they would consider.

Lake and Land Management Group Update:
The group reconvened after a short break and Alan provided the group with an update on Lake and Land Management. Alan explained that the TWC had been meeting quite frequently and building on the existing Shoreline Management Plan section by section. Alan noted that the draft SMP would progress from the TWC to the RCG to SCE&G management for approval. From that point, Alan explained, the SMP would go out for public comment. Alan asked the CALM to submit any comments that they had so far on the SMP documents as soon as they could. The CALM noted that they could have any comments on the draft documents submitted to the Alison Guth by the end of March. Alan noted that the TWC has thus far attempted to introduce the needs of the commercial marinas; however, it will be very helpful if the commercial marinas can provide the group with specific needs.

Alan continued to explain what the Lake and Land Management group has been discussing. Dave noted that one item that overlapped both Recreation and Lake and Land groups was the issue of the designation of Two-Bird Cove and Hurricane Hole Cove as special recreation areas. This issue, however, was specifically being dealt with under the Lake and Land group.

Adaptive Management in FERC Licenses:

After lunch, Dave provided the group with a presentation on Adaptive Management in the context of FERC licenses. The presentation can be viewed at http://www.saludahydrorelicense.com/documents/2007-02-07AdaptiveManagement.ppt . Dave noted that adaptive management is a relatively new principle in ecological fields, and the first example of adaptive management being used in a FERC license occurred around 10 years ago. As Dave proceeded through the presentation, he pointed out where the Recreation RCG stood within the adaptive management procedures (in the Planning Stage).

Update on Recreation RCG and TWC's:

There was group discussion on Recreation Plans, and Dave noted that he would send out an example of a recreation plan to the group. In regards to the drafting of a Recreation Plan for Lake Murray, Dave suggested that the Recreation Management TWC take the lead on this. The group agreed that that was acceptable. Dave explained that the Recreation Plan for Lake Murray would need to be drafted by the end of 2007 and finalized by early 2008. Dave explained that the results of the recreation assessment study would be needed for the drafting of the recreation plan. The results of the recreation assessment study would be presented at the April 19th Quarterly Public Meeting. Dave also mentioned that the Recreation RCG would convene in April to view the results of the boating density study and the recreation assessment. He explained that the Recreation Management TWC should anticipate bi-weekly conference calls/meetings during the next several months. Dave noted that the Downstream Flows TWC would probably meet sometime in the fall and the Lake Levels TWC would convene in the next couple weeks.

The group concluded discussions noting that the Lake and Land and Recreation group would be working close together during the land rebalancing process. The group adjourned.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

SCDNR HEADQUARTERS
March 01, 2006

final dka 03-22-06

ATTENDEES:

Name	Organization	Name	Organization
Tom Eppink	SCANA	Charlene Coleman	AW
Bill Marshall	SCDNR and LSSRAC	Malcolm Leaphart	TU
Patrick Moore	AR/SCCCL	Dave Anderson	Kleinschmidt Associates
Guy Jones	River Runner	Jennifer Summerlin	Kleinschmidt Associates
Karen Kustafik	Columbia Parks and Recreation		

HOMEWORK ITEMS:

- Charlene Coleman – send list of river users to group
- All – Review list of river users and begin to fill in “who, what, when, where, why”
- All – compile a working bibliography of existing studies related to the LSR
- Dave – scan and email creel surveys done on the LSR

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave A. began the meeting by going over the tasks associated with the committee. Dave outlined the function of the group to include proposing recreational flows for the lower Saluda River and the effects of project operations on recreational use of the LSR. Tom E. questioned the group about what recreational issues exist on the LSR. Someone identified the coldwater trout fishery and the striper fishery. Dave asked if there were any conflicts between users on the LSR, noting that, in general, there are conflicts between boat and wading anglers. Malcolm replied that there are some problems with boats going to fast through “runs” the wading anglers are fishing, but it is not a major issue on the LSR.

Malcolm L. questioned the group as to what “recreational flows” means. Dave replied that he thinks it means flows conducive to certain activities, or optimal flows. Malcolm replied that their main concerns with the LSR are that project releases are not announced in advance and that recreating is often unsafe because of the extreme flow level changes; and, that TU advocates for the best flows to be set based on scientific studies for the fish, not for the fishermen or other rereationists. Tom E. believed the flow issues will be dealt with in the Safety RCG and in the Fish & Wildlife RCG.

Dave reviewed the plan for the TWC for the coming months. Dave thought the group should begin by reviewing existing information on the number of users on the river. Dave reminded the group that the number of users needs to be established so we can project use for the new license term. Dave wondered if we would be able to use information from the SCORP to estimate use.

Dave questioned the group as to whether it is necessary to separate users in any sort of recreational analysis. The group agreed that if another group were to conduct a use estimate for the Project, then it would be necessary to differentiate different types of uses on the LSR.

Tom questioned the group as to what would be each groups “preferred” flow for the LSR, not taking other Project uses into account (i.e., what would each group like to see if their respective uses were the only consideration). Malcolm replied that he would like to see more of a ‘run of the river’ flow regime with flows out of the lake based on flows into the lake with scheduled releases that averaged those flows over a 24 hour period for less fluctuation. Tom replied there will ultimately be a flow regime. Dave also noted the FERC will be using the current license as a baseline and they will not go back to pre-Project conditions in an environmental analysis.

Tom continued the exercise of identifying who uses the LSR, pointing out that he envisioned identifying who, what, where, and whens of recreational use on the LSR. Tom noted that once all of this information is identified, we can begin to diagram use and provide some flow recommendations to the operations group.

Charlene discussed her classification of river users. She identified several different types of river users, as well as different sub-categories of users. The group agreed that Charlene's classifications are a good place to start and asked Charlene to type out her list and send it to the group (attached). Tom asked Charlene if there was any information about the number of users to go along with her list. Charlene replied we would have to do an informal account because different types of users are present at different times of the year. Malcolm added we need to add bikers to the list. Charlene noted that some bikers use the spillway at the dam because it's "extreme" to go over the rocks.

Bill M. noted that the largest number of river users is at the Zoo, either lounging on the rocks or enjoying the water. Tom noted that this is the next step in the process—to identify users and their locations. Charlene noted we could include drug dealers and people who are "trolling" for dates. Patrick noted that even though we joke about "rock people", there are optimal flows for those users as well.

Malcolm asked about scheduled flows. Dave pointed out the comments from the SCDNR concerning an instream flow study. The comments that SCDNR submitted in response to the ICD indicate that in lieu of an instream flow study, SCE&G can implement an instantaneous flow of at least 470 cfs to support one-way downstream navigation, and flows of 590 cfs (July – November), 1170 cfs (Jan-April), and 880 cfs (May, June and December) to provide seasonal aquatic habitat. Dave talked about the possibility that another group might conduct an IFIM based on existing data, and the Operation RCG is doing an operations model that we will have to consider when making recreational flow recommendations.

Malcolm questioned the flows the DNR is requesting and where the numbers are from. Bill M. replied that he thinks these numbers came from a study conducted by the DNR. Charlene wondered where these flows would be measured, in the tailrace or at the Zoo, etc. Tom wants to confirm the DNR standards for navigational flows. Bill M. believes the 470 cfs is the minimum flow based on an earlier study; the study does not address navigation through Millrace because jon boats do not navigate through these rapids.

Tom questioned if everyone in the group has an idea for their optimal flows. Tom clarified that, looking at the big picture, the committee will identify different flows for different users. We need to identify the impact of these various flows on different uses, and then base our optimum flow on the fewest negative impacts for the greatest number of users. Guy J. questioned the group as to how

SCE&G will regulate flows to suit the public. Tom E. replied the new license will allow SCE&G to operate under a certain regime. The group will look at all alternatives and decide on the best outcomes. Tom thinks the final plan will fall somewhere in the middle.

Dave reminded the group that their task is to identify recreational flows and make a recommendation to other groups based on these flows. Dave reminded everyone to review the standard process form before the next RCG meeting. Dave also reminded the group that recreation is only one part of downstream flows; there are ecological considerations that will have to be made before any flow regime is approved.

The meeting adjourned with everyone agreeing to attempt to fill out the river user outline via e-mail before meeting again. The next meeting time will be determined after this process occurs.

IDENTIFIED USERS OF THE LOWER SALUDA RIVER

- swimmers
  - children & teenagers on the river banks
  - people at access areas
  - rock people
  - educational groups and clubs
- tubers
- fishermen
  - bank
    - trout
    - food—people that actually fish to feed their families
    - bass and other
    - father and son type outings to learn to fish
    - scouts and other clubs, groups
  - boat
    - trout
    - trophy bass
    - recreational
    - food
    - business (oriental group that fishes near bridges)
  - wade
    - trout
    - children w/ parents
- charity groups
  - canoe, raft, sit on tops, etc
- social groups
- clubs
- educational groups
  - schools and university
  - scouts
  - club field trips
  - outdoor clubs
- hikers
- mountain bikers
- kayakers and canoeists—(skilled)
- recreational boaters (rental and less skilled)
- 4x4 clubs
- zoo visitors
- rescue training
- kayak and canoe classes
- us team boaters practicing (olympic and world team level)
- bird watchers
- nature lovers

WORKING BIBLIOGRAPHY OF STUDIES ON THE LOWER SALUDA RIVER

de Kozlowski, Steven J. 1988. Instream Flow Study, Phase II: Determination of Minimum Flow Standards to Protect Instream Uses in Priority Stream Segments; A Report to the SC General Assembly. SC Water Resources Commission.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

LAKE MURRAY TRAINING CENTER
April 18, 2006

final dka 05-15-06

ATTENDEES:

Name	Organization	Name	Organization
Dave Anderson	Kleinschmidt Associates	Jeni Summerlin	Kleinschmidt Associates
Karen Kustafik	City of Cola. Parks & Rec.	Charlene Coleman	American Whitewater
Patrick Moore	CCL/AR	Tom Eppink	SCANA Services
Bill Marshall	SCDNR & LSSRAC	Mike Waddell	Trout Unlimited

HOMEWORK ITEMS:

- Dave Anderson – contact Kelly Maloney about drafting a flow study on the lower Saluda River

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

The Downstream Flows Technical Working Committee (TWC) met shortly after the Safety Resource Conservation Group (RCG) meeting to briefly discuss issues concerning flows/users on the lower Saluda River. In the preceding Safety RCG meeting, the Downstream Flows TWC was given the additional responsibility to address not only recreational flow needs but also to address safety issues related to downstream flows.

The group began to look at the user list to examine flows that are suitable for each individual activity. Dave A. pointed out that the DNR recommends a minimum flow of 470 cfs for one-way downstream navigation, and flows of 590 cfs (July – November), 1170 cfs (Jan-April), and 880 cfs (May, June and December) for seasonal aquatic habitat. Dave A. reminded the group that ultimately a schedule of flows and how they are implemented needs to be developed.

As previously stated in the Safety RCG meeting, Patrick M. would like to see a flow study to understand the rate of change of the lower Saluda River at various flows and river reaches. He also suggested coming up with a study that analyzes different flows for various user groups and skill levels that will provide reasonably safer conditions. He noted that an example of safer conditions would be when users feel compelled to get off the river based on the rate of change in the river.

Dave A. mentioned that we may be able to correlate the flow study with the river survey. He suggested adding questions to the lower Saluda River Questionnaire being developed by the Recreation Management TWC, such as “did you feel comfortable on the river today.” He noted that the interviewers would write down the time and date of the interview that could then be correlated to the USGS gage information for that day and time. He added that once the river survey is complete, the results will be presented to the group to determine if a flow study is needed.

There was some further discussion as to how to incorporate a flow study with the river survey. Patrick suggested adding in questions pertaining to skill level and comfort level on the river, the amount of river flow adequate for the user’s activity, and how often they use the river. Ultimately, the group decided to forego adding additional questions to the questionnaire. Bill M. suggested that the TWC needed to consider a study to understand the rate of change in the river under differing hydro release rates to see how rising waters levels can affect the safety of river users. He also suggested that the study could focus on characterizing rivers conditions and associated potential hazards at different flows and under changing/increasing flow conditions.

The group decided to explore the possibility of designing a study with the goals of: 1) understanding the “rate of change” of the river at various flows at various river reaches; and 2) an analysis of different flows for various user groups and skill levels that provide the safest conditions.

Dave A. noted that he would turn over these issues to Kelly Maloney, an individual with whitewater experience from Kleinschmidt. He added that Kelly will get in touch with everyone about drafting a flow study plan to address these goals.

Saluda Hydro Relicensing
Downstream Flows Technical Working Committee

Meeting Agenda

April 18, 2006
2:30 pm
Lake Murray Training Center

There was no set agenda for this meeting as it was intended to discuss updates on the Working Document and a request for a flow study on the lower Saluda River.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

SCDNR HEADQUARTERS
September 20, 2006

final dka 10-20-06

ATTENDEES:

Name	Organization	Name	Organization
Tom Eppink	SCANA	Malcolm Leaphart	TU
Bill Marshall	SCDNR and LSSRAC	Dave Anderson	Kleinschmidt Associates
Patrick Moore	AR/SCCCL	Jennifer Summerlin	Kleinschmidt Associates
Mary Crockett	SCDNR	Alan Stuart	Kleinschmidt Associates
Kelly Maloney (by phone)	Kleinschmidt Associates		

ACTION ITEMS:

- Dave Anderson – contact Hal Beard about creel surveys
- Dave Anderson – send out study plan to committee members and finalize

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **TBA**

Kleinschmidt
Energy & Water Resource Consultants

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave welcomed the Downstream Flow TWC (DFTWC) members and noted the purpose of the meeting was to discuss and finalize the Downstream Recreation Flow Assessment Study Plan (attached). Dave noted that he would like to go through each section so all committee members have the opportunity to comment on the study plan.

Dave briefly summarized the introduction of the study plan and no comments were made. Dave further explained the purpose of the study is to assess recreational flows for the lower Saluda River (LSR) for different types of recreation at different river reaches under different flow conditions. Malcolm asked how a rate of changed will be determined. Dave noted that rate of change will be estimated from the tailrace to the confluence using level loggers. He explained that level loggers will measure down to a tenth of a foot. He added that all flows will be investigated to examine how the river rises differently. Dave noted that the locations of level loggers coincide with the HEC Res-Sim model and cross sections were chosen according to river habitats (riffle, run, pool).

The group continued to review the study plan and Dave briefly discussed the goals of the study plan. There were no comments provided on Goals One and Two. Dave read Goal Three and it was noted that “public” should be inserted before the word “ingress” for Objective Three of Goal Three. Dave then briefly reviewed the locations the level loggers will be placed in the lower Saluda River. He noted that rate of change will be estimated between each location. There was some discussion about where the level loggers will be placed in the LSR and the group agreed that a second level logger should be added to Oh Brother Rapids and Ocean Boulevard locations.

Dave then began to discuss the three phases of methodology. He noted that the first phase will include hydrologic data, creel surveys, and the IFIM study. Dave then explained that Phase Two will include a downstream flows focus group and a land based reconnaissance. There was some discussion about the benefits of doing a water-based reconnaissance. The group also felt flow ranges should be provided in order to assess actual flows rather than collect opinions on flows. At the end of the reconnaissance, members will fill out a questionnaire about the flows for that day. There was a brief discussion about what flow ranges should be evaluated. Kelly Maloney noted that Phase One will help identify the specifics of the flows. The group decided that flow ranges will be determined by the DFTWC based on the results from Phase One. There was further discussion about the use of video documentation to capture a rate of change of event. The group decided to include this option in the study plan as part of the Phase Two work.

Dave briefly reviewed Phase Three and asked the group to provide comments. It was noted that "minimum of 180 days" should be deleted and replaced with "deployed long enough to capture the full range of flow releases necessary to complete the study." The group also agreed that the first two bullets should be removed from Phase Three (overall and daily average flow). It was suggested the comment matrix should be added to the appendix of the study plan. Dave noted that questionnaires will be drafted once Phase One is complete. Dave mentioned that he would send out the study plan to committee members so everyone can review changes made.

Comments from Bill Marshall: Folks, more food for thought...I was thinking this morning about some ideas which have been expressed about understanding rate-of-change and even experiencing rate-of-change.

I'm not sure what we concluded yesterday about the use of video, but I'm thinking now that we may want to consider trying to capture video or time-lapsed photography of certain rates of change in order to better document the (call it what you will) surge/bubble/wave/wall-of-water experience in the river. Since we are relying upon expert assessments of river conditions, visual information when combined with the water level logger data could be more effective than logger data alone in documenting and evaluating what happens in the river. Perhaps a video component could be accomplished quickly if we were able to schedule one rapid high-flow release event and have cameras deployed at selected points.

This idea could be an option for later consideration under Phase 2 (expert recon) of the study. What do you all think?

Comments from Malcolm Leaphart: The draft, including the comments and replies, has evolved to an accurate document of the scope and intentions for the Downstream Flow study as discussed at the past meetings. The disposition of the major issue of future recreational needs is still of key concern. Would you please clarify in the Recreational Flows Plan, exactly what the 'Saluda Recreation Assessment' is, who will be doing it, and when? This is the phrase from the answer you provided to several questions about future recreational needs in the table of comments and responses:

"Future use will be addressed in the Saluda Recreation Assessment"

The concern is that future recreation needs are a major issue because of the inadequate current sites, especially on the lower Saluda, but also on Lake Murray where marinas are closing or have been converted to private use. Most of the stakeholders would have preferred this issue be a starting point for committee efforts, rather than it still not being addressed to date. So, we would appreciate you stating the intentions for an assessment at some future time with some level of certainty and with as much level of detail as you can at this time as to how it will be dealt it ultimately in the relicensing. It is certainly much too important an issue to fail to cover or to loose track of...

Reply from Dave Anderson: The Recreation Assessment is currently being conducted. The study plan is on the web site:

http://www.saludahydrorelicense.com/documents/001-SaludaRecreationAssessmentStudyPlanFINAL.pdf

Reply from Malcolm Leaphart: My request was not for the study details, but to clearly state that the issue of future recreation needs are highlighted as the important issue it is in the draft. So, let me re-state my request and be more specific... The following paragraph from the Downstream Flows does not include any reference to future recreation needs (except the term 'opportunities' which is too vague to infer future needs from). Please add a reference to this paragraph that states that future recreation needs is one of the goals of the Assessment as documented.
Thanks.

"The 2006 Saluda Project Recreation Assessment is currently being conducted under the Recreation RCG. This study utilizes vehicle counts and on-site interviews of individuals at Project recreation sites to ascertain opportunities, patterns, and levels of use along the lower Saluda River. These data will be reviewed and analyzed to determine what recreation activities are currently supported by access sites along the lower Saluda River, what recreation activities are being participated in by individuals at these sites, how much use the lower Saluda River receives, and any specific comments made by respondents pertaining to safety, river flows, and barriers to access."

Reply from Kelly Maloney: I would agree that future recreation use levels and needs on the lower Saluda River should be addressed in the relicensing process and the Saluda Recreation Assessment (the study plan of which was distributed by Dave) should address all of the concerns that you have raised. Because we are not considering future uses or needs in the Downstream Recreation Flow Assessment Study Plan, however, I do not believe that the flow study is the most appropriate forum to discuss the goals and objectives of Saluda Recreation Assessment. I'm not clear on the reason why we would want to specifically highlight a goal of another study for an issue that is not a part of the study plan at hand.

Future uses are not included as part of the goals of the flow study plan because we are attempting to determine the appropriateness of certain flow levels for certain activities. Irrespective of how use levels increase or change in the future, the flows most appropriate for certain activities would not change. Though use distributions may shift and other access locations utilized in the future, the capacity and condition of existing access sites, as well as the potential for additional sites and improvements which would support recreational use of the lower Saluda River, are wholly addressed in the Recreation Assessment.

As you pointed out, there are two places in the flow study plan that reference the Saluda Recreation Assessment: Section 2.1 and Appendix C. Section 2.1 discusses the aspects of the Saluda Recreation Assessment that will be utilized as part of the Phase I investigation for the flow study. Because the flow study is not considering future uses, I believe it would confuse the issue to discuss details of the Recreation Assessment that are not being used or considered here in the flow study.

Likewise, I do not believe that Appendix C is the forum to outline the goals and objectives of the Saluda Recreation Assessment. If an issue was raised that we believed to be out of the scope of the flow study but addressed by the Saluda Recreation Assessment, we referenced that document in Appendix C. If you feel it would be helpful to include a hyperlink to the Saluda Recreation Assessment Study Plan (such as the one forwarded by Dave) in Appendix C, we can certainly do that.

Reply from Malcolm Leaphart: The reason to expand the statement as I suggested is because it is incomplete in listing all of the goals of the Recreation Assesment that is being summarized by the statement. However, I have no major objection in leaving it as it is since the Recreation Assesment includes the goal of identifying future recreational needs, and the point has been made in our exchanges of the importance of that. Please include our exchanges, including this one, as an addendum to the last meeting summary for the Recreation Flow Assessment TWC.

It is evidently important to further clarify why I made this simple request: There is a concern that the critical issues identified at the beginning of the relicensing process, including in ICD comments from stakeholders, are not the focus and organizational point for the process. Tracking of issues is very difficult as a result, as is keeping up with all the inter-relations between the many issues being dealt with in seperate groups. Also, a promised issues spreadsheet for tracking has not been communicated to date and will soon become a moot point. So, any opportunity to emphasize key issues is looked for, such as for the future recreation needs issue which is a very sensitive one. It was originally not even included in the first drafts of the Recreation Assesment, and only added after stakeholder requests. To many of the stakeholders, identifying future recreation needs is a much more important issue and goal worthy of a seperate TWC when compared to identifying possible site upgrades which could be done outside of the relicensing process as a maintenance item - much like the recent upgrade to the Hilton boat landing. Will continue to try to participate positively as SCE&G manages the relicensing process, and appreciate the opportunity to express concerns and to try to keep the focus on critical issues.

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

DOWNSTREAM RECREATION FLOW ASSESSMENT STUDY PLAN

DRAFT

SEPTEMBER, 2006

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

DOWNSTREAM RECREATION FLOW ASSESSMENT STUDY PLAN

DRAFT

SEPTEMBER, 2006

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

DOWNSTREAM RECREATION FLOW ASSESSMENT STUDY PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

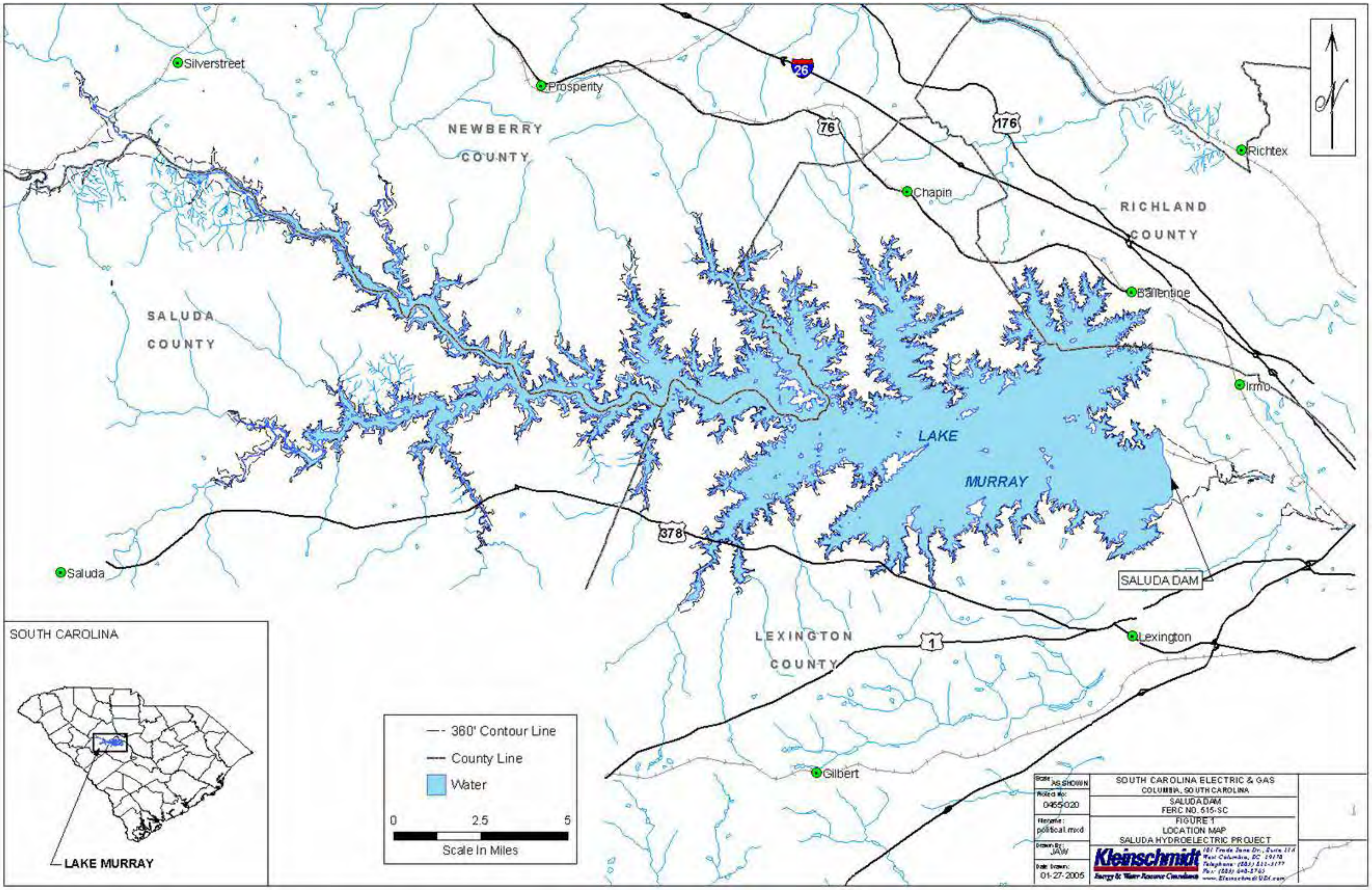
DOWNSTREAM RECREATION FLOW ASSESSMENT STUDY PLAN

1.0 INTRODUCTION

The Saluda Hydroelectric Project (Project), is a Federal Energy Regulatory Commission (FERC) licensed project (FERC No. 516), owned and operated by South Carolina Electric & Gas Company (SCE&G), pursuant to the license issued by the FERC in 1984. The Project is located on the Saluda River within Richland, Lexington, Saluda, and Newberry Counties, South Carolina, and situated within proximity of the towns of Irmo, Chapin, and Lexington and within the metropolitan area of the City of Columbia, South Carolina, which is approximately 10 miles east of the Project (Figure 1). The Saluda Project includes Lake Murray, the Saluda Dam and Spillway, the Saluda Berm, Saluda Powerhouse, intake towers, and associated penstocks.

SCE&G is in the process of relicensing the Saluda Project as the current operating license expires on August 31, 2010. This relicensing process involves cooperation and collaboration with a variety of stakeholders, including state and federal resource agencies, state and local government, non-governmental organizations (NGO), and interested individuals, in order to identify and address any operational, economic, and environmental issues associated with a new operating license for the Project. The Downstream Flows Technical Working Committee (TWC) is comprised of interested stakeholders (Appendix A) who are collaborating with SCE&G to identify and make recommendations related to public safety and recreational opportunities associated with downstream project flows to the lower Saluda River. The Downstream Flows TWC has requested that a study be designed and implemented that would assess flows, identify preferred flows for recreational activities, and determine safety issues associated with river flows that may need to be addressed through the work of the Safety Resource Conservation Group (RCG).

Figure 1: Project Location



1.1 Study Area

SCE&G currently operates the Saluda Project in order to provide reserve capacity for the company's utility obligations, a mode of operation that the company proposes to continue under the new license. Project generators are typically offline, *i.e.*, not operating, but can be started and synchronized to the electrical grid and can increase output immediately in response to a generator or transmission outage on SCE&G's system or in response to a call for reserve power from neighboring utilities, with which the company has reserve agreements and obligations. As a result, flows from the Saluda Project are generally unscheduled. Although there is no minimum flow requirement for the Project, SCE&G has an informal agreement with the South Carolina Department of Health and Environmental Control (SCDHEC) to provide a minimum of 180 cfs at the Project to enhance downstream water quality[1]. The average annual flow from the Saluda Dam to the lower Saluda River is 2,595 acre feet with a minimum average daily flow of 285 cfs. For the purposes of this study, the geographic scope will be from the base of the dam to the confluence with the Broad River (Figure 2).

1.2 Purpose and Content of the Study

The Downstream Flows TWC has requested an assessment of recreational flows for the lower Saluda River for different types of recreation at different river reaches under different flow conditions. The assessment is designed to provide information pertinent to optimum and preferred flows for particular recreation activities and any public safety issues associated with recreational use of the river. This study encompasses the following goals and objectives:

Goal 1: *Characterize currently available recreation opportunities on the lower Saluda River. This will be accomplished by meeting the following objectives:*

i. Utilize the information collected during the Saluda Project Recreation Assessment to identify sites providing recreational access to the lower Saluda River and the recreation activities supported by these sites.

[1] At certain times of the fall season, SCE&G can not utilize a full range of operations due to dissolved oxygen concerns.

ii. Utilize the information collected during the Saluda Project Recreation Assessment to identify the patterns of use on the lower Saluda River by type, location, and volume.

iii. Estimate preferred flows associated with reasonable and safe recreational use of the lower Saluda River for specified activities to serve as input constraints to the HEC Res-Sim model being developed by the Operations RCG.

Goal 2: *Understand the "rate of change" of the lower Saluda River at various flows at various river reaches. This will be accomplished by meeting the following objectives:*

i. Identify and characterize water level changes at predetermined intervals, encompassing the various river channel types (pools, runs, shoals) along the lower Saluda River from the dam to the confluence with the Broad River, capturing the full range of project operation flow scenarios.

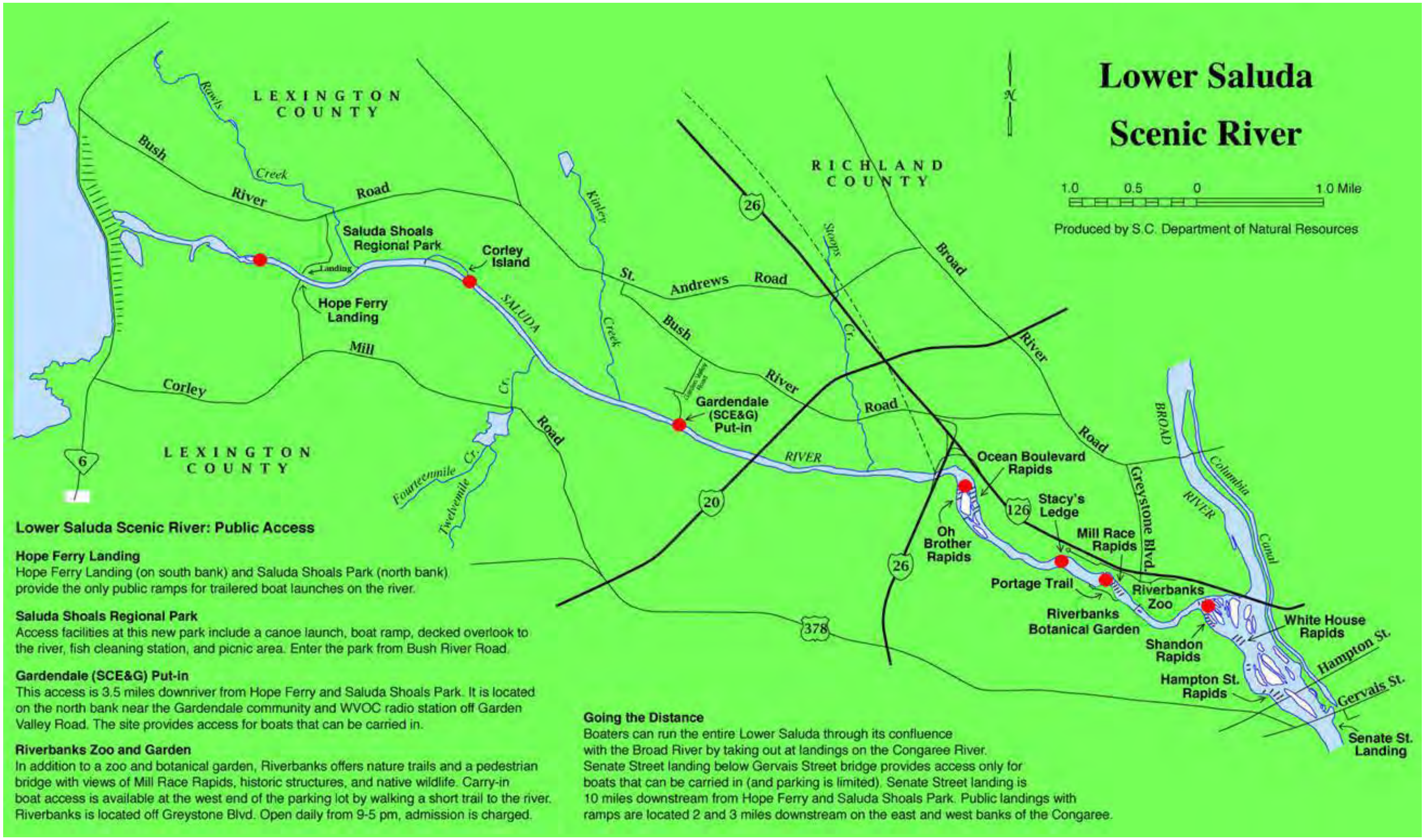
Goal 3: *Identify potential public safety issues associated with lower Saluda River flows. This will be accomplished by meeting the following objectives:*

i. Identify potential safety issues and barriers on the lower Saluda River.

ii. Identify potential locations for additional flow release warning systems such as sirens, strobes, and signage on the lower Saluda River.

iii. Identify locations for ingress and egress on the lower Saluda River as related to the safety of river users.

Figure 2: Study Area for Downstream Flow Assessment and Approximate Locations for Level Loggers (Source: South Carolina Department of Natural Resources, as modified by Kleinschmidt)



2.0 METHODOLOGY

Information gathered for this study will be used to examine the suitability of the lower Saluda River for several types of recreation activities as a function of variations in flow levels. This study will take a three-phase approach to meet the goals of the study through the objectives identified above. Phase I will involve a desktop analysis of the recreation opportunities, patterns of use, physical characteristics, and hydrology of the lower Saluda River. Phase II will involve structured surveys and on-site reconnaissance of an expert panel of experienced boaters, recreationists, NGO's, and agency staff familiar with the river to assess the feasibility and potential quality of particular flow ranges for on-water activities. Phase III will involve the deployment of water level data loggers at various predetermined intervals along the lower Saluda River from the dam to the confluence with the Broad River.

2.1 Phase 1 – Literature Review and Desktop Analysis

This task involves compilation and review of existing information about river channel characteristics, hydrology, current and planned recreational opportunities, and flow data for the lower Saluda River.

Literature searches will be conducted via the web, libraries, and SCE&G and agency collections. Consultation may include local paddling clubs, the Irmo Chapin Recreation Commission (ICRC), American Rivers (AR), American Whitewater (AW), Saluda Chapter of Trout Unlimited/Federation of Fly Fishers, the River Alliance, and others to determine if there are current or recent river recreational studies or data pertinent to this effort. South Carolina whitewater, fishing, and outdoor recreation tourism guidebooks will be reviewed in an effort to identify potential boating, angling, and other recreational opportunities on the lower Saluda River. Other relevant documents may include the Three Rivers Greenway plan, South Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP), and the Lower Saluda Scenic River Corridor Plan and Update.

Relevant summary hydrology data, from SCE&G, United States Geological Survey (USGS), South Carolina Department of Natural Resources (SCDNR), and other state agencies will be collected. In addition, any existing studies on instream flow and creel surveys will also be reviewed. Historic records of minimum, maximum, and average flow rates will be reviewed and seasonal variations will be noted. These data will be examined to determine the number of days the lower Saluda River may be available for each identified primary recreation activity.

The 2006 Saluda Project Recreation Assessment is currently being conducted under the Recreation RCG. This study utilizes vehicle counts and on-site interviews of individuals at Project recreation sites to ascertain opportunities, patterns, and levels of use along the lower Saluda River. These data will be reviewed and analyzed to determine what recreation activities are currently supported by access sites along the lower Saluda River, what recreation activities are being participated in by individuals at these sites, how much use the lower Saluda River receives, and any specific comments made by respondents pertaining to safety, river flows, and barriers to access.

2.2 Phase 2 – Focus Group and Land-Based Reconnaissance

An expert panel will be compiled to collect and disseminate information regarding recreation opportunities and potential flow effects on recreation on the lower Saluda River. The expert panel will consist of the experienced recreational users and resource experts that make up the Downstream Flows TWC and others as needed. A survey (Appendix B) and focus group discussion panel will be conducted to document characteristics of the lower Saluda River with respect to the nature and seasonal distribution of on-water activities; the locations and flows for wading, swimming holes, velocity refuges, rapids and eddies; existing and potential ingress and egress locations; potential locations for additional safety lights/sirens; and any potential safety hazards.

The expert panel will also conduct an on-site reconnaissance. The purpose will be to augment existing information on flows, opportunities, and safety concerns. This will involve a facilitated expert panel site visit led by a principal researcher. The expert panel will observe and assess the lower Saluda at predetermined geographic intervals. Ideally, the land-based reconnaissance will be scheduled when flows are provided in the river reach within an estimated recreational flow range. The expert panel will complete a land-based reconnaissance survey (Appendix C) similar to the focus group survey, which will solicit additional information on locations and flows for select recreation activities and potential safety hazards.

River flows identified by the expert panel during these efforts will serve as input constraints for the HEC Res-Sim model. The purpose of this model is to determine effects of downstream flows on various resources, based on flow constraints provided by the focus group. The model will determine a series of operational regimes which target the diverse interests of the various resource groups and identify a balance between these interests and project operations with respect to lake levels, generation needs, and project outflows.

2.3 Phase 3 – Field Data Collection

To accurately assess the effect of Project generation on water levels in the lower Saluda River, water level data loggers will be deployed at predetermined intervals correlated with the HEC Res-Sim cross-sections along the River from the Saluda Dam to the confluence of the Broad River (Figure 2). Water level loggers will record the barometric pressure, water depth, and temperature once per minute and will be deployed for a total minimum of 180 days. These data will be correlated with hydrologic data (such as from USGS gaging stations) to determine (for the study time period):

- the overall average flow (in cfs);
- daily average flow (in cfs);
- overall average river depth (in feet) for each water level data logger location;
- daily average river depth (in feet) for each water level data logger location;
- average maximum river depth (in feet) for each water level data logger location;
- average time to maximum river depth for each water level data logger location;
- average time to recession for each water level data logger location;
- average rate of change in water level for each water level data logger location;
- maximum river depth (in feet) for each water level data logger location by flow;
- minimum time to maximum river depth for each water level data logger location by flow;
- maximum time to recession for each water level data logger location by flow ; and

- minimum, average, and maximum rate of change in water level for each water level data logger location by flow level.

The information gathered through field reconnaissance, literature review, flow and hydrologic data analysis, and the expert panel will provide a basis by which to identify preferred flows for the lower Saluda River that target particular recreation activities at appropriate locations. These flows will be provided as input constraints to the HEC Res-Sim model to determine the feasibility, suitability, and availability of such flows. Recommendations for special recreational flow releases may be developed from the HEC Res-Sim model analysis of recreational flow inputs.

Likewise, any existing and potential safety issues associated with typical and preferred flows will be identified and recommendations for safety measures to be considered by the Safety RCG will be provided. In particular, the location of the level loggers will assist in determining which sections of the river may be in need of additional safety and protection measures such as additional warning lights/sirens, formal ingress/egress sites, and determine which areas of the river may be suitable as velocity refuges.

3.0 DELIVERABLES

The Draft and Final Report will be prepared for this effort. The Draft Report will be reviewed internally by the Downstream Flows TWC and Recreation RCG. Comments and edits from the Downstream Flows TWC will be incorporated into a Final Report for Saluda Hydro Relicensing Group. The report will include an executive summary, an introduction, objectives, methods, and results. It will also include recommendations for optimal recreation flows and flow schedules for use as HEC Res-Sim model inputs. The report will also outline safety concerns, including rate of change, and potential measures to enhance public safety.

4.0 SCHEDULE

The proposed schedule for completion of the Recreation Flow Assessment Study is as follows:

TASK	DATE
Literature Review and Desktop Analysis	Winter 2006
Focus Group and Expert Panel Land-Based Reconnaissance	Spring 2007
Field Data Collection	Fall 2006 – Summer 2007
Submit Draft Report	Fall 2007
Client and TWC Review	Fall 2007
Submit Final Report	Winter 2007

5.0 REFERENCES

American Whitewater. 2006. Whitewater Flow Studies. [Online} URL: http://www.americanwhitewater.org/content/Wiki/stewardship:whitewater_flow_studies. Accessed June 16, 2006.

Lienemann, Anne, Peter Jonas, and Jim Vogel. 2004. Whitewater and River Boating Report for the Oroville Hydroelectric Project (FERC No. 2100). Prepared for the California Department of Water Resources. January 2004.

Rood, Stewart B., and Wilco Tymensen. 2001. Recreational Flows for paddling along rivers in southern Alberta. Prepared for Alberta Environment, Lethbridge, AB. October 2001.

South Carolina Department of Parks, Recreation and Tourism, Recreation, Planning and Engineering Office. 2002. South Carolina Statewide Comprehensive Outdoor Recreation Plan.

South Carolina Design Arts Partnership. 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 Water Resources Commission, South Carolina Department of Parks, Recreation and Tourism, and Lower Saluda River Task Force. 1990. The Lower Saluda River Corridor Plan. Report #170. Columbia, South Carolina.

Whitaker, Doug, Bo Shelby, and John Gangemi. 2005. Flows and Recreation: A Guide to Studies for River Professionals. October 2005.

Whitaker, Doug, and Bo Shelby. 2000. Boating Feasibility Study for the Lake Chelan Hydroelectric Project (FERC No. 637). Prepared for Public Utility District No. 1 of Chelan County, Wenatchee, Washington. October 2000.

APPENDIX A

DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

Name	Contact Information	Affiliation
Bill Marshall	marshallb@dnr.sc.gov	Lower Saluda Scenic River Advisory Council, DNR
Charlene Coleman	cheetahtrk@yahoo.com	American Whitewater
Dave Anderson	dave.anderson@kleinschmidtusa.com	Kleinschmidt Associates
Guy Jones	guyjones@sc.rr.com	River Runner Outdoor Center
Jennifer Summerlin	jennifer.summerlin@kleinschmidtusa.com	Kleinschmidt Associates
Karen Kustafik	kakustafik@columbiasc.net	City of Columbia Parks and Recreation
Malcolm Leaphart	malcolml@mailbox.sc.edu	Trout Unlimited
Patrick Moore	patrickm@scccl.org	SCCCL AR
Tom Eppink	teppink@scana.com	SCANA Services, Inc.

APPENDIX B

LOWER SALUDA RIVER FOCUS GROUP SURVEY

APPENDIX C

LOWER SALUDA RIVER LAND-BASED RECONNAISSANCE SURVEY

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Patrick Moore	1) The study should address all types of recreation, from the perspective of different skill levels at the full range of operation flows.	The study will cover on-water activities and solicit input on the range of flows appropriate for specific on-water activities. Information on appropriateness of flows for varying skill levels will be captured during focus group discussions and the land-based reconnaissance.
Patrick Moore	2) The study should look at different types of river, i.e. pool, riffle, shoal etc. in its rate of change analysis	These will be captured by the locations of the level loggers, the on-site reconnaissance (some locations of the river better than others for certain activities), etc.
Patrick Moore	The study should address all types of recreation at the full range of operation flows.	The study will address the range of flows experienced during the deployment of the level loggers. The expert panel will be providing information based on their experience with flows in the full range of operation, as appropriate.
Patrick Moore	3) The study should look at different types of river in its rate of change analysis	Expected to be addressed by level logger locations.
Patrick Moore	The study should look at prospective use and associated issues.	This will be addressed by the Saluda Recreation Assessment and is not a component of this study.
Patrick Moore	(the predetermined intervals should be representative of and not just be limited to “rec flow ranges”, this is the only way to capture the impact of actual project operations on the existing and beneficial uses)	The predetermined intervals in this context are spatial intervals, not temporal intervals. The range of flows that are experienced during the deployment of the level loggers are the full range of flows that will be assessed.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Tony Bebber	i. Identify and characterize potential/anticipated recreation areas on the lower Saluda River. 1. Identify activities that may be supported by these areas. 2. Identify anticipated patterns of use of these areas by type and volume. 3. Estimate preferred flows associated with reasonable and safe recreational use. 4. Understand the "rate of change" at various flows at these areas.	With exception of the rate of change and preferred flows, these will be addressed by the Saluda Recreation Assessment.
Patrick Moore	i.e. if it goes to 20,000 unannounced, you need access points much more frequently than if there is an operational ramping, otherwise, you could be forcing people to handle conditions they are not comfortable with or trespass.	This will be taken into consideration in the assessment of ingress, egress, and safety warning devices.
Tony Bebber	Red dots are insufficient areas to consider. These appear to be major kayaking areas. You must consider other recreational activities – wade fishing, bank fishing, swimming, tubing, rock use, sunbathing, picnicking, walking, bicycling, etc.	Red dots correlate with the HEC Res-Sim model cross sections that will be used for assessment of recreational flows and provide a range of hydrological conditions (pools, riffle, shoals). Red dots also correlate with or are within proximity of recreation access sites. Recreational activities are likely concentrated in areas in proximity of these access sites (for example, rock use, sunbathing, etc. occurs frequently at Mill Race, which is also considered a kayaking area).

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Tony Bebber	What about anglers and other users?	Opinions on appropriate flows for anglers will be solicited during focus group discussions and the land-based reconnaissance. However, flows for anglers, for the most part, will likely be determined by the most suitable and appropriate flows for fish habitat. TU advocates for the best flows to be set based on scientific studies for the fish, not for the fishermen or other recreationists. Fish habitat suitability would generally be the limiting factor for optimal flows for any kind of angling (from a canoe, bank angling, wading, etc.). SCDNR has already identified optimum flows for fish habitat on the lower Saluda River. The flow assessment will target on-water activities only. The focus group discussion and land-based reconnaissance will provide information on appropriate flows for other uses. For example, it would seem to me that the optimum flows for rock people are any flows where the rocks are exposed and easily accessible. Likewise, for picnickers, sunbathers, mountain bikers etc. who utilize exposed rocks in the river bed for recreational activities. For swimming, any flow, including no flow, could be appropriate. Individuals have opportunities to swim in eddies at different flows, for example.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Tony Bebber	What about inexperienced users?	Issues associated with recreational use by inexperienced individuals are expected to be addressed by "optimal" flow recommendations and identification of safety issues provided by the expert panel. Inexperienced users will not be included in the focus group discussions or land-based reconnaissance as these efforts require experience and familiarity to adequately assess flow needs for various activities.
Bill Marshall	The following use of terms needs clarification… sounds like the writer is wanting to understand how rapids and river conditions change with flows???	The focus group discussion and land-based reconnaissance should provide information on what rapids, eddies, etc. are produced under what flows which will contribute to the analysis of preferred flow inputs for the HEC Res-Sim model.
Tony Bebber	How will you anticipate future use associated with Three Rivers Greenway, ICRC greenway extension, park at 12 mile Creek, etc. Also, be aware that much of the recreational activity occurs from private property, such as the Rivers Edge subdivision (near Oh Brother Rapids) and Cornerstone Church.	Future use will be addressed in the Saluda Recreation Assessment.
Patrick Moore	Since operations are required to protect everyone and not just experts, we should get a range of experiences as needed. Liability waivers are an option. The panel should observe the rate of change, if not experience it.	The field reconnaissance will be targeted to observe varying flow conditions on the river. This may or may not encompass a "rate of change" event.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Patrick Moore	All operational ranges should be evaluated. This study should evaluate real world operations on recreation, not just limit itself to predetermined "recreational flow ranges". All recreators currently have to recreate in the full 180-18,000cfs range and the study should reflect that.	The focus group discussion and land-based reconnaissance is expected to provide information on the optimum flows, between 180 and 18,000 cfs, for various recreation activities. The level loggers will provide rate of change information.
Patrick Moore	Part of the study must include assessment of the quality of the recreational experience by people actually boating, tubing, swimming, fishing (wading and from boats and banks), not just stream-side observations	An assessment of crowdedness, condition of recreation facilities, what recreation activities people are participating in, why they chose the site that they did, recommendations for additional facilities and improvements, and an assessment of on-water safety issues will be provided by the Saluda Recreation Assessment.
Bill Marshall	Will water depth (stage as it is termed below) be measured in tenths of feet?? The units need to be detailed, down to 0.25-foot increments or better seems desirable…????)…	Level loggers will measure to 0.10 foot.
Bill Marshall	This time frame (180 days) certainly seems adequate to capture the a normal range of hydro flows under the various power-production demands; however, the last six-months have been abnormal and to my knowledge there have been very few rapid, high-flow release event for hydropower production. We need to capture data for the normal, expected hydro release scenarios or this study will be of little use to us.)	The TWC will determine the schedule for level logger deployment.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Tony Bebber	Group needs to decide which 6 month period is best.	The TWC will determine the schedule for level logger deployment.
Bill Marshall	the event specific information I am describing above is needed to meet what I think is the main objective behind Goal 2 of this study … Goal 2: Understand the "rate of change" of the lower Saluda River at various flows at various river reaches. We are trying to better understand an identified safety issue and that issue is connected to specific types of events. The above list of "average" statistics is not very useful to the question in my mind. We need water level change data for distinct hydro operation events (or types of events) that present the potential threat to public safety.	This comment is addressed in the revised study plan. Minimums and maximum rates of change, etc. for different flow releases were added to the bullet list.
Tony Bebber	Be aware that AVERAGE FLOW is not the issue. High flows and sudden rises are of great concern to anglers, sunbathers, tubers, inexperienced paddlers, and others. Low flows are of concern to paddlers.	Included bullets accordingly – see above.
Patrick Moore	The location of ingress egress is intimately related to being on the river when the water begins to rise and figuring out how long different users have to get off before they are out of their league.	This will be taken into consideration in the assessment of ingress, egress and safety warning devices.
Patrick Moore	Rephrase - The study must provide an assurance that specific conditions/flows/rates of change will be observed and a flow schedule will be developed to create these conditions.	Recommendations developed for this study will provide input into the HEC Res-Sim model. This study can not assure that specific flow recommendations will be implemented, but must be balanced with other uses.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Patrick Moore	I do not understand the idea that specific conditions/flows/rates of change cannot be intentionally created for us to experience for liability purposes. We are being asked to sign off on these same unannounced releases for the next 30-50 years? It is common for applicants to release water for studies and activities like canoeing for kids and rescue training	Rather than depend on water availability, this study provides the opportunity for all flow ranges be considered. It is felt that the expert panel can provide recommendations/observations based on their experiences on the river. These recommendations/observations will be considered equal to the results of a full blown recreational flow study.
Tony Bebber	The study plan seems to be skewed toward recreational boating (primarily paddling) and generally ignores wade fishing, bank fishing, swimming/sunbathing/rock use, tubing, and other uses along the river.	The flow assessment will target on-water activities only. The focus group discussion and land-based reconnaissance will provide information on appropriate flows for other uses.
Tony Bebber	The study plan does not address potential recreation use associated with anticipated new recreation venues (Three Rivers Greenway, Lower Saluda Greenway/Saluda Shoals extension, potential new park at 12 mile creek, etc.) or residential recreational use (Rivers Edge Subdivision and others).	Future use will be addressed in the Saluda Recreation Assessment.
Tony Bebber	I assume the red dots on the map are the locations for testing. These all appear to be paddling areas and have little to do with other activities. You must consider other recreational activities - wade fishing, bank fishing, swimming, tubing, rock use, sunbathing, picnicking, walking, bicycling, etc. Shouldn't the shoreline along Saluda Shoals Park be a prime spot to be considered?	Red dots correlate with the HEC Res-Sim model cross sections that will be used for assessment of recreational flows and provide a range of hydrological conditions (pools, riffle, shoals). Red dots also correlate with or are within proximity of recreation access sites. Recreational activities are likely concentrated in areas in proximity of these access sites (for example, rock use, sunbathing, etc. occurs frequently at Mill Race, which is also considered a kayaking area).

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Tony Bebber	You must also be aware that all current and future users are not "experts" or familiar with the dangers presented by the hydro project river.	These issues are expected to be addressed by “optimal” flow recommendations and identification of safety issues provided by the expert panel.
Bill Marshall	The main concern expressed in my comments is related to the purpose behind Goal 2 ... to understand the “rate of change” of the lower Saluda River at various flows at various river reaches. To better understand the safety issues associated with rapidly rising water, we need to characterize water level change for specific types of hydro events. As the plan currently reads, it appears to miss the specificity needed to really understand this public safety issue. Therefore, I have supplied suggestions for more specific language.	This comment is addressed in the revised study plan. Minimums and maximum rates of change, etc. for different flow releases were added to the bullet list.
Malcolm Leaphart	I endorse and 'second' all of the comments from Tony Bebber listed below and in his redline comments in his response to you of August 18 on the proposed 'Downstream Recreation Flow Assessment Study'. In fact, the draft study as noted could be more appropriately titled a 'Downstream Paddlers Flow Assessment Study'. The inclusions that Tony noted are critical to ensure that other recreation uses are not left out.	The flow assessment will target on-water activities only. The focus group discussion and land-based reconnaissance will provide information on appropriate flows for other uses.
Malcolm Leaphart	Also, the realization of the tremendous increase in usage because of the new river parks and greenways is extremely significant. As the tv ad goes, “This is not your father’s Buick”	Future use will be addressed in the Saluda Recreation Assessment.

Response to Comments Submitted to Draft Downstream Recreation Flow Assessment Study Plan		
Author	**Comment**	**Response**
Patrick Moore	River flows and rates of change identified by the focus group during these efforts will serve as input constraints for the HEC Res-Sim model.	The HEC Res-Sim model will not to model the rates of change. These will be analyzed separate from the model.
Patrick Moore	The purpose of this model is to determine effects of downstream flows on various resources, based on flow constraints provided by the focus group, which will be derived from an analysis of the full range of flows and intended to protect designated and existing uses in a safe manner.	The expert panel will be providing information on the optimum flows based on their experience of the full range of flows but the full range of flows will not likely be provided for observation.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Downstream Flows Technical Working Committee
SCE&G's Lake Murray Training Center
February 25, 2008

Final JMS 3-21-08

ATTENDEES:

Bill Argentieri, SCE&G	Dave Anderson, Kleinschmidt Associates
Alan Stuart, Kleinschmidt Associates	Tony Bebber, SCPRT
Dick Christie, SCDNR	Harry Tinsley, Cola Fire
Jeni Hand, Kleinschmidt Associates	Travis Carricato, Cola Fire
Mike Weddell, TU	Malcolm Leaphart, TU
Matt Rice, American Rivers	Gerrit Jobsis, American Rivers
Charlene Coleman, American Whitewater	Steve Bell, Lake Watch
Karen Kustafik, City of Cola, Parks	Jim Cumberland, CCL
Vivianne Vejdani, SCDNR	Bill Marshall, LSSRAC

ACTION ITEMS

- Provide Bill Argentieri with a time frame and flows needed for the Columbia Fire Department rescue squad training on the LSR.

Harry Tinsley and Travis Carricato

NEXT MEETING

Downstream Flows TWC
TBA

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson of Kleinschmidt Associates opened the meeting at approximately 10:00 AM and welcomed all committee members. Dave noted that American Whitewater and American Rivers will be presenting their proposals for recreational flow recommendations for the lower Saluda River (LSR). Dave noted that once the group has made the recreational flow recommendations, then the group will discuss the next steps to be taken.

Presentation of American Whitewater Proposal, Charlene Coleman (Attachment A).

Charlene Coleman noted that American Whitewater submitted flow recommendations for the Saluda Hydro Project before the draft application was submitted to FERC. Charlene explained each of the requested flow events month by month. Specifically she noted that in January they have been hosting the Iceman Race for the past seven years during the first non-holiday weekend. In March, for the past five years they have been hosting the Whitewater Festival, which is a good showcase event. She explained that the flows they are requesting are just a general idea, not in black and white. In the month of May, they requested a flow of 10,000 cfs on Mother's Day weekend for the Canoeing for Kids event. She requested that a Rescue Rodeo be scheduled during the third weekend in June. Charlene noted that currently, there is no rescue rodeo in the southeast for rescue teams. She explained that people would find it interesting to watch and it would also give the Columbia Fire Department an opportunity to demonstrate what kind of funding is needed for the department and ideally it would bring all different squads together.

There was extensive discussion about the flows needed by the Columbia Fire Department for swift water rescue training. Harry Tinsley noted that for technical skill development, they would need a flow of 12,000 cfs, which would allow for a better rescue and explained that different flows provide different risks. Harry explained that they would request to have these flows during early spring before it gets hot and people start recreating on the rocks. He explained that since they have approximately 60 techs to train every year, they would like to have flows between 12,000 and 15,000 cfs for approximately 6 hours per day for five days. They would prefer to have the training start in the early morning around 6:00 am until 2:00 pm. They have to conduct the training for a whole week because they will have six shifts. He further explained that they would need to conduct the training twice a year. Gerrit Jobsis noted that may be it would be possible to conduct one of their rescue trainings during the month of December, when SCE&G draws down the reservoir for the winter.

Charlene continued describing American Whitewater flow requests and noted that for the last weekend in July they would like to have a Whitewater Rodeo. She explained that they use to have this event every year, but took it out. One of the big events that is a big showcase for the City of Columbia is the US Team Jr. Wildwater Racing Practice, which occurs in the month of August. For the month of September, Charlene noted that she put the Columbia Fire Department rescue training in for this month as a starting point for the rescue squad. Finally for the month of October, Charlene noted that they would like to schedule a second canoeing for kids on the third Saturday of the month.

Presentation of American Rivers Proposal, Matt Rice (Attachment B).

Matt Rice noted that members of the Downstream Flows Technical Working Committee recommend the listed schedule of planned releases aimed to improving safe wade fishing and whitewater boating to be incorporated into SCE&G's new operating license for the Lake Murray Dam. Matt explained that American Whitewater flows are included in the schedule and are not competing. Matt noted that TWC members recommend 37 days and the corresponding flow releases be dedicated to whitewater recreation on the LRS. He noted that this recommendation is for one weekend a month in the months of December through May and two weekends a month June through November. Matt explained that the two boating flow ranges identified on the schedule attempt to address the recreational needs of all skill levels of whitewater users as well as other activities on the LSR. The low boating flow range (1,800 cfs-2,400 cfs) aims to enhance whitewater recreation for novice to intermediate boaters. The high boating flow range (3,800 cfs - 4,500 cfs) aims to enhance whitewater recreation for intermediate to expert boaters. Matt noted that these flows would be protected against a reserve call. It was also noted that establishing a 2-3 day weekend of flows, rather than just a day, would assist in attracting out-of-town visitors to paddle of fish and stimulate weekend tourism activity.

Matt noted that the wade fishing recreational flow recommendation aims to provide safe scheduled, wadeable flows on 42 weekend days in a one year period. He explained that they would like the wading flows to be protected from reserve calls. He noted that these flow proposals are from the Saluda instream flow recommendations. Wade fishing flows are optimum at 700 cfs and needed at "no more than" 1000 cfs. The recommendation is for two weekends a month dedicated to wade fishing from December through August and one weekend a month September through November. These flows would also be useful for swimming/rock use at Mill Race and other current and future access points during the season for other activities.

Dave asked the group if there was any discussion needed on flooding on the Congaree National Park (CNP). Gerrit noted that he is currently developing flows needed for the LSR to inundate the CNP. He explained that inundation occurs with a flow of 18,000 to 30,000 cfs from the Congaree River and noted that he is examining how much the LSR is contributing to the flooding. Gerrit noted that if SCE&G could provide the Columbia fire department rescue squad with their flows during the time the CNP needs to be flooded in the spring, would be beneficial.

In regards to the flow recommendations from the group, Dave Anderson noted that since the Saluda Hydro Project is used for reserve capacity, SCE&G is willing to provide one weekend a month for recreational flows. Dave explained to the group that when SCE&G provides these recreational flows, Saluda will not be available for a reserve call. Dave also noted that these recreational flows can not be guaranteed as safe because no flows are guaranteed as safe. Gerrit noted that the boating/fishing organizations should have a caucus to discuss their requests, since SCE&G is providing recreational flows for one weekend a month.

After a brief caucus, the organizations returned with a revised draft recommendations for the recreational flow releases on the LSR. The revised recommendations are as follows:

Boating

- 39 days dedicated to whitewater boating.
- 32 days will not be protected from reserve operations (operations OK). These days are highlighted in blue on the chart.
- 7 days including the Wildwater training weekend (2 days), the rescue rodeo weekend (2 days), Memorial Day (1 day), Labor Day (1 day), and July 4 (1 day) will be protected from reserve operations (No operations). These days are highlighted in red.
- Flows for Labor Day, Memorial Day, and July 4: 700cfs-1500cfs

Wade Fishing/Swimming

- 38 days dedicated to wade fishing including MLK Day and Presidents Day
- 38 days protected from reserve operations (No operations)
- Target release window 7:00am-9:00pm (May-October); 7:00am-Noon or Noon-5:00pm, possibly alternating (November-April)
- Make up days: If weather events such as tropical storms make operations necessary on wade fishing days, missed days will be made up in a three month period.

Adaptive management

- Meet annually to schedule recreation days.
- Meet every 3 years to comprehensively review recreation schedule looking at recreation trends, trout reproduction and holdover etc.

Rescheduling

- If a scheduled flow release is cancelled or interrupted due to operational requirements such as dam safety or lake level management cause from climatic conditions, then request to have the flow event rescheduled with in a quarter or three months time frame.

Reserve calls

- During planned operation events, SCE&G should incorporate a rate of change (flow) in the event of a reserve call.

Warning System

- Request that an advanced warning (strobe lights and sirens) system be placed at the Saluda Spillway, Metts Landing and Corley Island.
- Request that a 10-15 minute warning be given in advance to allow people enough time to get off the river.

Fire Department Rescue Training
Not a part of the recreation recommendation

There was a brief discussion about providing the rescue squad the flows needed to train their team. Bill Argentieri noted that SCE&G could come up with an agreement outside of the license to provide flows for training. Bill noted that once the Columbia Fire Department submitted time frames and flows needed then he would discuss this with upper management.

The meeting adjourned at approximately 3:30 pm and Dave noted that he would contact everyone regarding the next meeting date.

ATTACHMENT A

American Whitewater Proposal for Recreational Flow Releases on the Lower Saluda River

Issue Recommendation
Recreational Flow Releases on the Lower Saluda River

DRAFT February 5, 2008

Issue:

SCE&G currently operates the Saluda Hydro Project in order to provide reserve capacity for the company's utility obligations, a mode of operation that the company proposes to continue under the new license. Project generators are typically offline, i.e., not operating, but can be started and synchronized to the electrical grid and can increase output immediately in response to a generator or transmission outage on SCE&G's system or in response to a call for reserve power from neighboring utilities, with which the company has reserve agreements and obligations. As a result, flows from Saluda Hydro to the lower Saluda River (LSR) are generally unscheduled.

Although there is no minimum flow requirement for the Project, SCE&G has an informal agreement with the South Carolina Department of Health and Environmental Control (SCDHEC) to provide a minimum of 180 cfs at the Project to maintain downstream water quality of the LSR. SCE&G typically releases a minimum flow of approximately 500 cfs to enhance water quality during the low dissolved oxygen (DO) season (July – November). The average annual flow from the Saluda Dam to the LSR is 2,595 cfs with a minimum average daily flow of 285 cfs.

The Lower Saluda Scenic River Advisory Council, South Carolina Department of Parks, Recreation and Tourism, South Carolina Department of Natural Resources, American Whitewater, Saluda River Chapter of Trout Unlimited, and Coastal Conservation League/American Rivers have requested instream flows for the LSR to support recreational uses such as small boat navigation, swimming, wade and boat fishing, and other downstream uses.

American Whitewater, the Coastal Conservation League/American Rivers, and the City of Columbia Parks and Recreation Department have also requested scheduled recreational releases for whitewater boating, wade fishing, and special events.

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.

Daily average flows of less than 4,000 cfs are generally available 83 percent of the time year-round. Hourly average flows of less than 4,000 cfs 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.

Recommendation:

Based on the results of the Downstream Recreation Flow Assessment, the Recreation RCG recommends:

1. SCE&G meets the attached schedule for recreational flow releases in the LSR; and
2. SCE&G hosts an annual meeting the third week of October of each year to review the previous year's flows, set the specific dates for the following year's flows (with the understanding that the volume of water and number of days will remain consistent from year to year, even if the schedule varies), and discuss any outstanding issues with appropriate stakeholders.

Schedule of Recreational Flow Releases in the Lower Saluda River

Flows will be measured at the USGS gage below the Saluda Dam (02168504). Actual flows may vary ± 10%.

January

First non-holiday weekend (Saturday and Sunday) (**Iceman Race**)
- 1,000 cfs or 4,000 cfs from 10:00AM to 4:00PM

February

No scheduled flows

March

St. Patrick's Day Weekend (Saturday and Sunday) (**Whitewater Festival**)
- 500 cfs from 8:00AM to 11:00AM
- 2,000 cfs from 11:30AM to 1:00PM
- 3,300 cfs from 1:30PM to 3:30PM
- 14,000 cfs from 4:00PM to 6:00PM

April

No scheduled flows

May

Saturday before Mother's Day (**Canoeing for Kids**)
- 10,000 cfs from 7:30AM to 4:30PM

June

Third weekend (Saturday and Sunday) (**Rescue Rodeo**)
- 1,000 cfs from 7:00AM to 11:00AM
- 3,000 cfs from 12:00PM to 4:00PM

July

Last weekend (Saturday and Sunday) (**Whitewater Rodeo**)
- 3,300 cfs from 8:00AM to 4:00PM

August

First weekend (Saturday and Sunday) (**US Team Jr. Wildwater Racing Practice**)

- 7,000 cfs from 8:00AM to 4:00PM

September

First consecutive Friday/Saturday/Sunday (**Rescue Training**)

- Friday – 800 cfs from 1:00PM to 5:00PM
- Saturday – 1,500 cfs from 7:00AM to 11:00AM; 3.500 cfs from 1:00PM to 5:00PM
- Sunday – 7,000 cfs from 7:00AM to 12:00PM

October

Third Saturday (**Canoeing for Kids**)

- 1,400 cfs from 7:30AM to 4:30PM

November

No scheduled flows

December

No scheduled flows

ATTACHMENT B

American Rivers Proposal of Draft Recommendations for Recreational Flow Releases on the Lower Saluda River

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

The Lower Saluda Scenic River Advisory Council, City of Columbia Parks and Recreation Department, South Carolina Department of Natural Resources, American Whitewater, the Saluda River Chapter of Trout Unlimited, the Coastal Conservation League, and American Rivers support in-stream flows that enhance safe recreational uses on the Lower Saluda River. Members of the Technical Working Committee recommend the following schedule of planned releases aimed at improving safe wade fishing and whitewater boating be incorporated into SCE&G's new operating license for the Lake Murray Dam. The schedule of planned recreational releases is followed by a justification of the recommended releases.

Target release ranges unless otherwise noted:
Boating low: 1,800cfs-2400cfs
Boating high: 3,800cfs-4500cfs

Wade fishing: 700cfs (not to exceed 1000cfs during fishing hours)

Target release window unless otherwise noted:
Boating: 12:00PM-6:00PM at Millrace (May-October)
10:00AM-4:00PM at Millrace (November-April)
Wade fishing: 7:00AM-7:00PM (May-October)
7:00AM-12:00PM (November-April)

January
Boating: First non-holiday weekend for the Iceman Race (2 days)
Flows: 1,000cfs or 4,000cfs

Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

February
Boating: One weekend (2 days). Schedule and flow release posted on SCE&G website
Flows: Either low boating recreation flow range (1,800-2400cfs) or high flow range (3,800-4,500cfs)

Wade fishing: Two weekends (4 days). Schedule posted on SCE&G website
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

March
Boating: St. Patrick's Day Weekend for the Whitewater Festival (2 days)
Flows: 8:00AM-11:00AM – 700cfs
11:00AM-1:00PM – 1,800-2,500cfs
1:30PM-3:30PM – 3,800-4,500cfs
3:30PM-6:00PM – 14,000cfs

Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

April

Boating: One weekend (2 days)
Flows: Low flow (1,800-2,400cfs) or high flow boating release (3,800-4,500cfs)

Wade fishing: Two weekends (4 days)
Flows: April 1-15: 1000cfs (higher flows for striped bass passage)
April 15-30: 1300cfs

May

Boating: Weekend before Mothers Day for Canoeing for Kids (2 days)
Flows: 7:30AM-4:30PM: 10,000cfs

Wade fishing: Two weekends (4 days)
Flows: May 1-15: 1300cfs (higher flows for striped bass passage)
May 15-31: 1000cfs

June

Boating: Two weekends including the third weekend for the Rescue Rodeo event (4 days)
Flows: First weekend – low or high boating release
Third weekend – 7:00AM-11:00AM: 1000cfs
12:00PM-4:00PM: 3,000cfs
Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

July

Boating: Two weekends including the last weekend for the Whitewater rodeo (4 days)
Flows: High boating flow 3,800cfs-4,500cfs

Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

August

Boating: Two weekends including the first weekend for U.S. Team Wildwater Racing practice (4 days)
Flows: 8:00AM-4:00PM: 7,000-10,000cfs

Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

September

Boating: Two weekends including the first consecutive Friday/Saturday/Sunday for rescue training (5 days)

Flows: Friday-700cfs
Saturday-7:00AM-11:00AM: low boating flows (1,800-2,400cfs)
1:00PM-5:00PM: high boating flows (3,800-4,500cfs)
Sunday- 7:00AM-12:00PM: 7,000cfs

Wade fishing: One weekend (2 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

October

Boating: Two weekends including the third weekend for Canoeing for Kids (4 days)
Flows: Third weekend-low boating flows (1,800-2,400cfs) additional weekend-low or high boating flows (4 days)

Wade fishing: One weekend (2 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

November

Boating: Two weekends (4 days)
Flows: Either high (3,800-4,500cfs) or low boating flows (1,800-2,400cfs)

Wade fishing: One weekend (2 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

December

Boating: One weekend (2 days)
Flows: Either high (3,800-4,500cfs) or low boating flows (1,800-2,400cfs)

Wade fishing: Two weekends (4 days)
Flows: 700cfs (not to exceed 1000cfs during fishing hours)

Holiday Recreational Flows

January 1 – Wade fishing 7:00AM-5:00PM flows: 700cfs (not to exceed 1000cfs during fishing hours)
January 21 – Wade fishing 7:00AM-5:00PM
Presidents Day – Wade fishing 7:00AM-5:00PM
Memorial Day – Wade fishing 10:00AM-7:00PM
July 4 – Boating 10:00AM-6:00PM (not to exceed high or low boating flow ranges unless scheduled in advance)
Columbus Day – Boating 10:00AM-6:00PM
Friday after Thanksgiving – Wade fishing 7:00AM-5:00PM
Christmas day – Wade fishing 12:00PM-5:00PM

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

The Lower Saluda River is a unique and valuable resource for the people of Richland and Lexington Counties. With adequate river flows, the river is regionally known as a productive trout fishery as well as an exciting whitewater destination. These recreational uses of the river compete. According to the Recreational Flow Assessment conducted by Kleinschmidt and experienced local wade fishermen and whitewater boaters, flows between 500cfs and 1000cfs were ideal for wade fishing and swimming where flows between 1000cfs-4000cfs were adequate for boaters. The proposal above is an effort to enhance safe wade fishing/swimming and whitewater boating on the LSR by providing scheduled safe releases for each activity (no reserve peaking operations during scheduled recreational release) while accounting for the overall biological health of the river and other competing uses including Lake Murray management.

Whitewater Boating

Members of TWC recommend 37 days and the corresponding flow releases be dedicated to whitewater recreation on the Lower Saluda River. The recommendation calls for one weekend a month in the months of December through May and two weekends a month June through November. The logic behind this schedule is as follows:

December through May (one weekend a month) – This time period is popular for wade fishing because of DNR's stocking schedule and cooler water temperatures. Recreational releases should favor wade fishing during these months.

June through August (two weekends a month) – This time period is popular for boating.

September through November (two weekends a month) – This time period coincides with the reservoir draw down, theoretically providing an opportunity to schedule draw down releases to enhance white water recreation.

The group believes the boating flow days should occur on consecutive weekend days to encourage out of town boaters to spend at least one night in the Columbia area to bring valuable tourist dollars to the region.

The two boating flow ranges identified on the schedule attempt to address the recreational needs of all skill levels of whitewater users as well as other activities on the LSR. The low boating flow range recommendation aims to enhance whitewater recreation for novice to intermediate boaters. The high boating flow range aims to enhance whitewater recreation for intermediate to expert boaters. The group recommends equal release days of both the low boating flow and the high boating flow throughout the year depending on water availability.

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

Target Recreational Releases

<u>Low Boating flow range 1,800cfs-2,400cfs</u>
The final flow assessment identified a flow of 2,272cfs as good to excellent for whitewater boaters, flatwater boaters, swimmers and tubers. This flow, which falls within the low boating flow range, was better suited for novice to intermediate whitewater boaters. This flow range was also identified as a desirable flow by boaters outside of the recreational flow assessment.

<u>High Boating Flow Range 3,800cfs-4,500cfs</u>
The final flow assessment identified a flow of 3,938cfs as good to excellent for intermediate to expert whitewater boaters as well as flatwater boaters. This flow falls within the high boating flow recommendation and is aimed at enhancing intermediate to expert whitewater recreation.

<u>High Event Flows 7,000cfs +</u>
The group recommends high releases of 7,000cfs and above five days a year. These flows will benefit specific events; U.S. team Jr. Wildwater Racing Practice, Rescue Training, Whitewater Festival, and Canoeing for Kids. These high flows would also allow local outfitters to run whitewater raft trips. High flows are only recommended if they do not severely degrade trout habitat, inhibit potential trout spawning, or substantially lower Lake Murray in low water years.

It is critical SCE&G post scheduled boating flows in advance and cease reserve peaking operations at Lake Murray Dam during the target recreational release window on all days dedicated to whitewater recreation in order to ensure the safety of all LSR users.

Wade Fishing

The Lower Saluda River is a unique fishery in South Carolina. It is a popular destination for trout fishermen throughout the state. It supports a healthy put, grow, and take rainbow and brown trout fishery. There is anecdotal evidence that increasing numbers of trout are holding over every year. With adequate minimum flows, improved dissolved oxygen, and proper management, there is potential trout will spawn in the future. A “wild” trout fishery will bring greater numbers of anglers to the Columbia area further increasing tourist revenues associated with the LSR.

The wade fishing recreational flow recommendation aims to guarantee safe, scheduled, wadeable flows on 42 weekend days in a one-year period. The recommendation calls for two weekends a month dedicated to wade fishing from December through August and one weekend a month September through November. The logic behind the schedule is as follows:

December through May (two weekends a month) - This time period is the most popular and productive for wade fishing. It coincides with DNR’s stocking schedule and water temperatures are cooler.

June through August (two weekends a month) - This time period is popular for fishing, swimming, and rock hopping.

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

September through November (one weekend a month) - This time period is less productive for wade fishing because it is pre-stocking. The reservoir is also drawn down during this time theoretically presenting an opportunity to release recreational boating flows.

Wading flows should be released on consecutive weekend days to encourage visits from out of town anglers. Flows during wade fishing days should not exceed 1,000cfs at any time during the target release window (7:00am-7:00pm in the summer months and 7:00am-Noon in winter months) to guarantee angler safety. Currently, anglers wade at their own risk due to Lake Murray Dam operations**. It is critical SCE&G halt reserve peaking operations during the target release window on days dedicated wade fishing to ensure wade fishing safety.**

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES: LOWER SALUDA RIVER					
MONTH	**ACTIVITY AND FLOW**	**BOATING DAYS**	**BOATING HOURS**	**WADE FISH DAYS**	**WADE FISH HOURS**
January	Boating: first non-holiday weekend for Iceman Race (2 days) Flows: 1,000cfs or 4,000cfs Wade fishing**:** two weekends (4 days) Flows: 700cfs	2	12	4	20
February	Boating: one weekend (2 days) Flows: Either low boating recreation flow range (1,800-2,400cfs) or high flow range (3,800-4,500cfs) Wade fishing: two weekends (4 days) Schedule posted on SCE&G website. Flows: 700cfs	2	12	4	20
March	Boating: St. Patrick's Day Weekend for the Whitewater Festival (2 days) Flows: 8:00am-11:00am – 700cfs 11:00am-1:00pm – 1,800-2,500cfs 1:30pm-3:30pm – 3,800-4,500cfs 3:30pm-6:00pm – 14,000cfs Wade fishing: two weekends (4 days) Flows: 700cfs	2	20	4	20
April	Boating: one weekend (2 days) Flows: low flow (1,800-2,400cfs) or high flow release (3,800-4,500cfs) Wade fishing: two weekends (4 days) Flows: April 1-15: 1,000cfs April 15-30: 1,300cfs (higher flows for striped bass passage)	2	12	4	20
May	Boating: weekend before Mothers Day for Canoeing for Kids (2 days) Flows: 7:30am-4:30pm – 10,000cfs Wade fishing: two weekends (4 days) Flows: May 1-15: 1300cfs May 15-31: 1,000cfs (higher flows for striped bass passage)	2	12	4	48
June	Boating: two weekends including third weekend for Rescue Rodeo (4 days) Flows: Rescue Rodeo weekend - 7:00am-11:00am – 1,000cfs 12:00pm-4:00pm – 3,000cfs Other weekend – either low flow (1,800-2,400cfs) or high flow (3,800-4,500cfs); Wade fishing: two weekends (4 days) Flows: 700cfs	4	30	4	48

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LOWER SALUDA RIVER

Proposed by members of the Downstream Flows Technical Working Committee

---

DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES: LOWER SALUDA RIVER					
MONTH	**ACTIVITY AND FLOW**	**BOATING DAYS**	**BOATING HOURS**	**WADE FISH DAYS**	**WADE FISH HOURS**
July	Boating: two weekends including the last weekend for the Whitewater Rodeo (4 days) Flows: high boating flow 3,800cfs-4,500cfs (high on both weekends?) Wade fishing: two weekends (4 days) Flows: 700cfs	4	24	4	48
August	Boating: two weekends including the first weekend for U.S. Team Wildwater Racing practice (4 days) Flows: 8:00am-4:00pm - 7,000-10,000cfs; Other weekend – either low flow (1,800-2,400cfs) or high flow (3,800-4,500cfs) Wade fishing: two weekends (4 days) Flows: 700cfs	4	28	4	48
September	Boating: two weekends including the first consecutive Friday-Saturday-Sunday for rescue training (5 days). Flows: Rescue training – Friday - 700cfs (7am-5pm??), Saturday - 7:00am-11:00am: low boating flows (1,800-2,400cfs); 1:00pm-5:00pm: high boating flows (3,800-4,500cfs), Sunday - 7:00am-12:00pm: 7,000cfs; Other weekend – either low flow (1,800-2,400cfs) or high flow (3,800-4,500cfs) Wade fishing: one weekend (2 days) Flows: 700cfs	5	37	2	24
October	Boating: two weekends including third weekend for Canoeing for Kids (4 days) Flows: CFK on third weekend - low boating flows (1,800-2,400cfs); Other weekend – either low flow (1,800-2,400cfs) or high flow (3,800-4,500cfs) Wade fishing: one weekend (2 days) Flows: 700cfs	4	24	2	24
November	Boating: two weekends (4 days) Flows: either high (3,800-4,500cfs) or low boating flows (1,800-2,400cfs) Wade fishing: one weekend (2 days) Flows: 700cfs	4	24	2	10
December	Boating: one weekend (2 days) Flows: either high (3,800-4,500cfs) or low boating flows (1,800-2,400cfs) Wade fishing: two weekends (4 days) Flows: 700cfs	2	12	4	20
Totals		**37**	**247**	**42**	**350**

REVISED DRAFT RECOMMENDATIONS FOR RECREATIONAL FLOW RELEASES ON THE LSR

Boating

- 39 days dedicated to whitewater boating.
- 32 days will not be protected from reserve operations (operations OK). These days are highlighted in blue on the chart.
- 7 days including the Wildwater training weekend (2 days), the rescue rodeo weekend (2 days), Memorial Day (1 day), Labor Day (1 day), and July 4 (1 day) will be protected from reserve operations (No operations). These days are highlighted in red.
- Flows for Labor Day, Memorial Day, and July 4: 700cfs-1500cfs.

Wade Fishing/Swimming

- 38 days dedicated to wade fishing including MLK Day and Presidents Day.
- 38 days protected from reserve operations (No operations).
- Target release window 7:00am-9:00pm (May-October); 7:00am-Noon or Noon-5:00pm, possibly alternating (November-April).
- Make up days: If weather events such as tropical storms make operations necessary on wade fishing days, missed days will be made up in a three month period.

Adaptive management

- Meet annually to schedule recreation days.
- Meet every 3 years to comprehensively review recreation schedule looking at recreation trends, trout reproduction and holdover etc.

Rescheduling

- If a scheduled flow release is cancelled or interrupted due to operational requirements such as dam safety or lake level management cause from climatic conditions, then request to have the flow event rescheduled with in a quarter or three months time frame.

Reserve calls

- During planned operation events, SCE&G should incorporate a rate of change (flow) in the event of a reserve call.

Warning System

- Request that an advanced warning (strobe lights and sirens) system be placed at the Saluda Spillway, Metts Landing and Corley Island.
- Request that a 10-15 minute warning be given in advance to allow people enough time to get off the river.

Fire Department Rescue Training

- Not a part of the recreation recommendation.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

SCE&G Training Center
April 23, 2008

Final ACG 8-11-08

ATTENDEES:

Alan Stuart, Kleinschmidt Associates
Alan Axson, Cola. Fire Dept.
Bill Marshall, SCDNR
Jim Cumberland, CCL
Vivianne Vejdani
Bill Argentieri, SCE&G
Karen Kustafic, Cola. Parks
Matt Rice, American Rivers
Tony Bebber, SCPRT

DATE: April 23, 2008

ACTION ITEMS

- Send the updated recreational flow spreadsheet out to committee members
Dave Anderson
- Develop a low inflow protocol for the Saluda Hydro Project
Kleinschmidt
- Determine flows to be eliminated for each stage of drought for the Lower Saluda River
Downstream Flows TWC members

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson opened the meeting and noted that the purpose of the meeting would be to review SCE&G's counter proposal to the stakeholders request for recreational flows for the lower Saluda River (LSR). Bill A. suggested that instead of having predetermined flows each year, maybe it would be better to set aside a predetermined acre/feet in the Lake for the recreational flows and determine flow allocation at the October Downstream Flows Recreation meeting. Bill A. noted that this may work out better if a future event such as an Olympic event comes about and there are no days available for the event, because all recreational flows have been predetermined.

Bill A. discussed SCE&G's responses to the Downstream Flows Recreation TWC stakeholders request for recreational flows. Bill noted that SCE&G has set aside a total of 62 days without Saluda's capacity counted towards their reserve obligation. He further explained that 11 of those days were set aside for swift water rescue, which leaves 51 days for recreational flows. The 51 days are partial days because it is more difficult to take Saluda out for a full day or multiple days. He explained that SCE&G is currently developing a low inflow protocol for the lower Saluda River and

Kleinschmidt
Energy & Water Resource Consultants

once it has been finalized, SCE&G will follow through with the TWC's critical times. Bill A. noted in regards to the high or low boating flows, that SCE&G would prefer the 10:00 am to 4:00 pm because there is more likely to be a reserve need in the evening. Bill A. also explained that if scheduled recreation days were lost due to inclement weather, then they will not be able to reschedule make-up days.

In response to SCE&G's responses, Matt Rice noted that 51 days for recreational flows was a fair request, but had some concerns with the specific language. Particularly, he noted they were not comfortable with loosing recreation days for "any other reason" as stated in SCE&G's response. He explained that they would like to develop acceptable language for this. Matt noted that the group would support up to 5 lost recreational days, but anything over 5 Matt noted should be made up.

In regards to ramping, Matt noted that they were not as concerned about ramping on recreational flows and reserve calls, as they were concerned about ramping for non-reserve operations such as lake level management. He noted that the lights and sirens should be calibrated for small rises and be activated by operations of the hydro with an appropriate lag time for each location. Matt suggested developing enforceable language for the last paragraph on ramping.

Matt requested that the times for wade fishing/swimming hours from May through October be changed to 8:00 am through 6:00 pm. Matt explained that this is when the river will be most heavily used by rock users and tubers etc.. Bill A. noted that earlier times were chosen because fisherman will most likely be on the river during these times. Matt explained he spoke with Mike Waddell and Malcolm Leaphart and they noted that most of the good fishing is in the winter months from November through April. Jim Cumberland requested that the wade fishing/swimming hours in May through October be changed to 8:00 am to 5:00 pm. Bill A. noted that they originally offered the time 6:00 am to 3:00 pm because SCE&G did not want to get too far into the evening hours where there is the possibility of a reserve call. The group noted that that would be acceptable and they also would be fine with boating flows from 10:00 am to 4:00 pm.

The group briefly reviewed the spreadsheet that contained the recreational flows for each month. Changes that were made by the group were highlighted in the spreadsheet. The group then went through the exercise of using allotted acre/feet to accommodate future events. The group agreed that there was a lot more flexibility with having water stored for reserve in Lake Murray for future recreation flows. Jim Cumberland asked if there was any room to add to the 45,000 acre/feet. Bill A. explained that if the water is there then we will try to accommodate the flows needed. Bill Marshall asked if there would be flexibility with the times that the flows are provided. Bill A. noted that it is certainly possible and explained that it would be helpful if committee members had an idea of the times that they want to change and to let SCE&G know before the meetings planned in October so SCE&G can talk with the dispatchers. Dave noted that he would send the excel file with the corrected recreational flows back out to committee members and noted he would develop the wording for the recreation plan.

Alan asked Bill A. if SCE&G was still willing to concede to 51 recreational flow days during a drought when there is a higher strain on the system. Bill A. noted that once a low inflow protocol is created, certain recreational flows and days will be eliminated during specific drought stages. Bill A. noted that the group should determine how they would like the flows to be eliminated at different stages of drought. The group adjourned.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Downstream Flows Technical Working Committee
SCE&G's Lake Murray training Center
June 11, 2008

ATTENDEES:

Alan Stuart, Kleinschmidt Associates
Matt Rice, American Rivers
Tony Bebber, SCPRT
Randy Mahan, SCANA Services
Bill Argentieri, SCE&G
Dave Anderson, Kleinschmidt Associates
Carl Bussells, Kleinschmidt Associates
Ray Ammarell, SCE&G

ACTION ITEMS: Determine Recreational Flow Reductions for each of the four Low Inflow Protocol stages.

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson of Kleinschmidt Associates opened the meeting around 1:30, and proposed that recreational flows would be reduced by 25% overall with each drought stage, and by Stage IV, all recreational flows would be reduced to the minimum flow of 400 CFS. In other words, the proposed scheme was 100% for normal inflow, 75% for Stage I drought, 50% for Stage II, and so on.

Dave suggested that some non-event boating days should be reduced to 1-day events instead of 2-day for a Stage I drought. Matt, Tony, and Alan concluded that the main priorities for recreational flows should be Canoeing for Kids, Junior Olympics (USTWWR Prac.), Rescue Rodeo, and the Iceman Competition. These events were not reduced for Stage I. Dave and Bill explained that release times for higher flows will depend on where the event occurs because of the time the water takes to reach the event. After editing the spreadsheet tool used for examining different reduction scenarios, the group agreed that a reduction of 20% was agreeable for Stage I.

For Stage II, Bill proposed that recreational flows for a stage 2 event could be at 60% instead of 50%. Randy concurred and stated that a drop from Stage II to Stage III can be greater because a Stage III drought is less likely. In this case, the Low Inflow Protocol (LIP) recreational flow reduction scheme is 100% at normal, 80% at Stage I, 60% at Stage II, 25% at Stage III and 0% at Stage IV. For Stage II, all non-event boating days were removed, the White Water Festival was reduced to 1 day, and the Iceman Race was reduced to 1000 CFS. Bill noted that the spreadsheet will to be used as a guideline during the annual recreational flows meeting. Matt added that flows should be adjusted depending on event turnout, cancellation, etc. He said that the Rescue Rodeo is a good signature for the Southeast and instigates tourism, and it should be a 2-day event.

Alan called Charlene Coleman for a word on the priority of events. She explained that she would prefer the order of priorities for a Stage III drought be Canoeing for Kids in May, then Junior Olympics, Rescue Rodeo, and Canoeing for Kids in October.

All agreed that all recreational events (except for wade fishing levels) will be cancelled during a Stage IV drought. The group agreed that the 32 “minimum” flow days in a Stage IV drought will still be “non-reserve” days.

In response to a request to provide flow release information on the Lower Saluda River website as soon as SCE&G is aware of a release, Bill noted that flow release information is already provided with as much advance notice as possible. Alan suggested that it would be helpful for the future recreational flow schedule to be available as a PDF. Tony added the recreational flow information could be combined into one page with attachments, informational boxes, or links, so users would only have to check one place.

The group discussed release patterns, and Bill noted that SCE&G has already tried to spread out flows for lake level management releases, such as releasing 4,000 CFS for 5 hours rather than 10,000 CFS for 2 hours. Matt added that this would be much safer and less harmful to wildlife.

Bill noted that ‘ramping’ was not favorable mainly because it could affect the siren system operation and people could be confused by trying to figure if a flow release is going to be ramped or not be ramped depending on the reason for a release. Tony noted that most river accidents and drowning are alcohol related. Everyone agreed that there must be a compromise between the two, so release patterns could be less extreme.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION RCG
Lake Levels TWC

SCE&G Lake Murray Training Center
February 1 , 2007

Final acg 3-29-07

ATTENDEES:

Alison Guth, Kleinschmidt Associates
Joy Downs, LMA
Bertina Floyd, Lake Murray Homeowners Coalition
Bill Argentieri, SCE&G
Steve Bell, Lake Murray Watch

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alison Guth opened the meeting and noted that the discussion would be regarding the Reservoir Levels section of the Recreation Standard Process Form. She asked what additional information was needed to answer the questions specified in the document. The group noted that they would like to go through the questions and update the items when necessary. Bill Argentieri fielded questions on the responses that he provided in the document and the group collectively made additions and wording changes. Steve Bell indicated that he believed more information was needed on how SCE&G makes operation decisions based on the flow forecasting models. He noted that he would not like to see the lake drop in September unless there was an approaching hurricane. Bill replied that in the fall they usually aim for an elevation based on the flow model and generate in a systematic manner to reach the desired elevation. He continued to explain that in the spring the dispatchers prefer the lake level to be around 3 0' to 3 2' in order to prepare for the spring rain events.

In addition to discussion on the Standard Process Form, the group had brief discussion on the operations model. It was noted that this group would make lake level recommendations back to the Recreation RCG, which would then make lake level recommendations to the Operations group for input into the HEC ResSim model. The group noted that there would be other factors that would help determine what the lake level would be best, such as the results from the IFIM studies. Joy noted that according to the Lake Murray Association user surveys, an elevation of 3 4' would meet the recreation needs of most of the individuals surveyed.

The group concluded the additions and changes to Standard Process Form and adjourned. The group would meet again when necessary.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TECHNICAL WORKING COMMITTEE

LAKE MURRAY TRAINING CENTER
March 3, 2006

final dka 03-22-06

ATTENDEES:

Name	Organization	Name	Organization
David Hancock	SCE&G	George Duke	LMHC
Dave Anderson	Kleinschmidt Associates	Tim Vinson	SCDNR
Tommy Boozer	SCE&G	Tony Bebber	SCPRT
Steve Bell	Lake Murray Watch	Jennifer Summerlin	Kleinschmidt Associates

HOMEWORK ITEMS:

- Tommy B. – send out acreage of current management prescriptions
- All – research dock restrictions and any boating capacity studies the USACE used on Lake Lanier
- Dave – scan and email existing boating use study
- Tim – send Dave questions used by DNR during previous surveys
- Dave – draft inventory form and inventory database

PARKING LOT ITEMS:

- Discussion of shoreline classifications

DATE OF NEXT MEETING: **March 17, 2006 at 10:00 a.m.**
Conference Call

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave A. opened the meeting by briefly going over the objectives of the TWC and what the committee needs to accomplish by the start of the recreation season. The first thing that the committee went over is the facility inventory that has been discussed in the Recreation RCG meetings. Dave reminded the group that they need to have the complete list of amenities by the end of the day in order to complete the facility inventory.

There was some discussion as to how the information would be maintained after it was collected. Dave explained the benefits of storing the information in a database, which would allow SCE&G to easily update the information, and will allow the data to be used in a variety of ways (GIS, brochure, website, etc.). Tommy reminded the group that SCE&G goes through the updating process when it is time to submit their Form 80s and also during the 5-year review of the lake management plan. Tommy noted that the 5-year review was originally a recreational review and has evolved to encompass the entire lake and land management program. The group also discussed how this information would be available on a website.

Dave reminded the group that a website is peripheral to collecting the information; we need to focus since the recreation season is approaching. There was a group discussion of additional variables that need to be collected for purposes of a complete facility inventory. One of the main points from this discussion focuses on ADA compliance. The group agreed that we must contact the Department of Vocational Rehabilitation and have them evaluate all of SCE&G's park sites as part of the facility inventory. The group agreed to a final set of variables (to be shown on the inventory form—attached) that must be collected as part of the inventory. Dave will send out a draft form with the information to be collected prior to next meeting and will also begin to design the database that will store the information.

Steve B. indicated that shorelines in the forest management and future development classification and buffer zones are open to the public for passive recreational uses and should be included in the inventory of areas available for public use. Tommy Boozer indicated that he did not want to include these in the inventory of areas "designated" as recreational sites. Steve B. noted that the islands, which have no amenities, are included, so why not the forest management lands, future development, and buffers. David H. and Tommy expressed their concern about advertising buffer zones as designated recreational sites due to the potential for conflict it may create. Steve B indicated that members of the Recreational Resource Group should be aware that these shorelines, while not designated as recreational sites, are available for public use, noting that the FERC recently

Kleinschmidt
Energy & Water Resource Consultants

ruled that public access paths to the buffers should be provided as needed. Steve B. suggested that, for the purpose of inventory, forest management, future development, and buffers should be listed as a separate category (i.e., non designated areas, impromptu, passive) and included as part of the recreational resource inventory. The group agreed to further discuss this issue at a later time.

The group briefly returned to the discussion of facility inventory. Dave wanted to make sure that the list of amenities the group has agreed to will satisfy the comments from the SCPRT on the Initial Consultation Document. Tony B. indicated they would, but he would like to see numbers with those variables where a count makes sense (parking spaces, tables, etc.). Dave also wanted to make sure the group agreed that this information would only be collected for SCE&G public areas and not for private or commercial areas. The group agreed, but wanted to make sure the information we already have on private/commercial facilities is not lost.

There was some discussion as to whether the islands need to be taken off the SCE&G facilities list. Tommy wants them to stay on the list because they are an important part of recreational use on the lake. The group agreed to leave the islands on the list and indicate they can be used for primitive camping. Dave questioned the numbers assigned to some private facilities and not others. David H. replied they have not updated the numbers and need to do so as part of this exercise.

After lunch, the group concentrated on existing use data and the need to collect additional data for purposes of relicensing. Dave summarized the study request for recreation and went over the studies that need to be in place by the start of recreation season. Dave asked the group if a carrying capacity study was necessary given SCE&G cannot regulate the numbers of boats on the lake. Dave preferred the term boat density study and reminded the group that SCE&G has conducted this type of study in 2001. There was some discussion as to how the boat counts provide useful information and possible uses of this information in analyses of crowding on the lake. The group agreed to look at the existing boating count study and make a determination if this type of study needs to be conducted again. Dave will scan the report and send to the group so they can make a determination by Friday, March 10.

The group then discussed some of the studies done in support of the Catawba-Wateree relicensing for Duke Power. Tony pointed out the user surveys they conducted at existing sites as well as the surveys done of the surrounding region to determine the need for more access sites. Tommy B. questioned if this information was useful for locating new recreation sites. Tony replied that not only did the surveys do that, but also provided information as to satisfaction with existing facilities. Tommy reminded the group that the main determination they will use in deciding locations of new sites is whether SCE&G owns the property—it is highly unlikely that SCE&G will purchase additional properties for future sites.

Dave questioned the group if it would be possible to use counts conducted during the remediation project to estimate use at recreation facilities. The group agreed this information might prove useful, but is probably not an accurate reflection of use. The group discussed doing a use estimate of SCE&G facilities as well as conducting a survey of users at these sites. Tim mentioned the DNR has some questions they use for these types of surveys and he will send the questions to Dave. Dave will also look at the Catawba-Wateree study and see if there are any applicable questions the group can use. Dave will draft a questionnaire for the group's consideration at the next meeting.

Dave reminded the group that we must reach a decision on the boat density study as soon as possible so the group can finalize plans for the recreation season. Tony pointed out the season starts on April 1 and he would like to see the survey conducted over an entire year. The group examined the calendar for the coming weeks and agreed to have conference call on March 17 to talk about a user questionnaire. Dave reminded the group that the LSR needs to be included in any studies. After reviewing the homework items, the meeting adjourned.

Additional Comments Received

Charlene Coleman: Well as a comment. I'd have to say Steve Bell raises a valid point, that I also questioned. I too believe there should be an acknowledgement of public ownership of such areas. The ostrich never saw anything with his head stuck in the sand. I see this inventory as a great asset in pursuing restoration of damaged buffers by "undetermined", sudden plant death by shore fronting landowners. Some of the islands I know are private and should be documented as such. I feel certain they do not pay taxes on this land. A public trail around the lake would be an awesome project too. Also, I'm pretty tired of people clearing all the way to the river too.

Patrick Moore: The Coastal Conservation League and American Rivers support including project lands open to public recreation in the recreation inventory. These lands have existing recreational uses that will probably only increase in the future. To get the full picture of current and future recreational use on Lake Murray it would be useful to know who uses these lands now, who is likely to use them in the future, which ones have public access from roads/other public lands etc. We can figure out a way to include these project lands open to public recreation and avoid advertising them as public recreation areas. I am under the impression that part of our job is to make a reccomendation to the L&LM RCG about the current and future shoreline classifications based on our recreation studies.

Site Visit/Inventory Forms

Inspected by: ___________ Date: ____________

Site Name/Code: _________________

Address: ____

City: _____________________ State: _____ Zip Code: ___________

Facility Type:

_____ Campground/Campsites _____ Picnic Area _____ Day Use

_____ Overlook Site _____ Informal Site

Access:

_____ Paved access ______ # of lanes

_____ Unpaved access ______ # of lanes

Operations:

_____ Manned _____ Seasonal

_____ Unmanned _____ Year Round

_____ Fee ($)

Site Facilities:

#	Type	#	Type	
_____	Picnic Tables	_____	Potable Water	
_____	Grills	_____	Dumping Station	
_____	Firepit/ring	_____	Boat Ramp	(_____# of lanes)
_____	Sanitation	_____	Docks	
_____	Trails (specify use______________)	_____	Playground	
_____	Shelter	_____	Showers	
_____	Designated Swim Area	_____	Food	
_____	Store	_____	Marina	
_____	Fuel			

Parking Lots:

__#_____Type_____________

_____ ADA spaces

_____ Regular spaces

_____ Vehicle & trailer spaces

_____ Spaces delineated?

_____ Curbs?

Sanitation Facilities:

Type:	# Unisex	# Women	# Men
Flush	______	________	________
Portable	______	________	________

Campground/Campsite:

	RV sites	Cabin sites	Tent sites	Wilderness sites
# of sites	______	______	______	______
On site parking	______	______	______	______
Water front	______	______	______	______
ADA compliant	______	______	______	______

Boat Launch Facilities:

_____ Hard surface

_____ Gravel

_____ Unimproved

_____ Carry In

Courtesy/Fishing Docks:

Courtesy/Fishing	Dimensions	ADA Compliant
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MMANAGEMENT TECHNICAL WORKING COMMITTEE

CONFERENCE CALL
March 17, 2006

final dka 04-05-06

ATTENDEES:

Name	Organization	Name	Organization
Malcolm Leaphart	Trout Unlimited	Tim Vinson	SCDNR
Tommy Boozer	SCE&G	Steve Bell	Lake Murray Watch
Van Hoffman	SCE&G	Tony Bebber	SCPRT
David Hancock	SCE&G	Dave Anderson	Kleinschmidt Associates

HOMEWORK ITEMS:

- Tommy B. – locate photographs from boating use study
- Dave A. – finish and distribute site inventory form
- All – review draft site user questionnaire and provide feedback to Dave A.
- Tommy B. – review lease agreements for Dreher Island and Saluda Shoals
- Tim V. – provide group with number and location of regatta permits

PARKING LOT ITEMS:

- Discussion of project lands open to the public

DATE OF NEXT MEETING: **March 24, 2006 at 9:30 a.m.**
Conference Call

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

After working out a few bugs with the conference call system, the meeting began with a discussion of the draft inventory form to be used to collect information from SCE&G public sites (attached). There was some discussion on whether Dreher Island and/or Saluda Shoals would be included in the inventory, mainly centering on if SCE&G would be able to fund any improvement projects at these sites. Tommy B. said they would have to review the lease agreements for these two facilities and see what kind of arrangement is currently in place.

There was some discussion on the ADA assessment for the park sites. David H. has not had a chance to contact the Department of Vocational Rehab, but will do so. Someone questioned if all the sites would have to be brought into compliance as a result of the assessment. Dave A. replied that no, they would not have to be, but upgrading existing facilities may be part of a mitigation package for the license application.

The group then proceeded to go through each section of the inventory form. Tommy and David H. agreed that there are no “Campsite” facility types on Lake Murray and the group agreed to drop this type. We will add “Launch Ramp” and “Primitive Camp” to this section. There were some questions on the “Access” section; the group agreed that changing this to “Road Access” would make the intention of this section more clear. The group agreed to change the heading from “Site Facilities” to “Site Amenities” to avoid confusion. There were some suggested changes to this section, including dropping “Sanitation”, “Boat Ramp”, and “Showers”. These amenities are covered in other sections of the form. The group agreed to add “Trash Cans”, “Pump Out”, and “Trail Mileage” to this section. The group agreed to add “estimated” to the “Parking Lots” section to account for unimproved parking lots. “Showers” will be added to the “Sanitation Facilities” section, along with “ADA Compliance”. Under “Campground/Campsites”, the word “wilderness” will be changed to “primitive”. Finally, “# of lanes” will be added to “Boat Launch Facilities”. There was some discussion about inventorying the signs going into and at the sites; Dave A. said that this was a section he had deleted from the form, but would add it back. After this review of the inventory form, Dave A. agreed to modify the form and redistribute to the TWC for approval.

The discussion turned to the report “Investigation of Boating Use on Lake Murray” and some of the comments received from its email distribution. There was some discussion of whether the revised lake section map (attached) that Dave distributed correctly identified the sections used in the report. Tommy B. said the sections appeared correct. Someone asked about the time of day the photographs were taken. Tommy B. didn’t remember exactly, but will investigate this. Tommy does have the photo set from some of the dates and will distribute these for the TWC to examine. Tommy will also locate the rest of the photos for use by the committee. Steve B. indicated he was fine with using these photos in lieu of conducting another boating density studies. Pending an examination of the actual photos, the group agreed that additional boat counts were not necessary.

The discussion then turned to the draft "Public Access Site Questionnaire" distributed by Dave A. prior to the meeting (attached). Dave explained that the questionnaire as written was meant to be filled out on-site by site users. There was some discussion about the pros and cons of using this method versus doing an interview type questionnaire. The group agreed that they would like to use the interview type questionnaire. Dave A. explained that this type of survey would mean that the group would have to delete about five questions from the questionnaire and that the wording of the questions would have to be modified to be more conducive to a spoken interview. Tony mentioned that perhaps we could offer some type of "give-away" for completing the interview. The group also decided the sampling period should be from sun-up to sun-down in order to include all users of the sites. There was some discussion of the individual questions; these remarks will be captured in actual changes to the questionnaire.

Since the meeting was running long, the group agreed to table the discussion on project lands open to the public. Homework assignments were reviewed and the meeting adjourned.

Saluda Hydro Relicensing
Recreation Management Technical Working Committee

Meeting Agenda

March 17, 2006
10:00 AM
Conference Call

- **10:00 to 10:10** Review Inventory Form and Approve Final Version
- **10:10 to 10:20** Discussion of "Investigation of Boating Use on Lake Murray"
- **10:20 to 10:35** Discussion of Public Site User Questionnaire
- **10:35 to 10:45** Discussion of Project Lands Open to the Public
- **10:45 to 11:00** Moving Forward

Additional Comments Received

Tim Vinson: Tommy asked me at our last meeting together if the ski and boating courses have to be permitted by DNR. I think it was understood that DNR does not have any regulation on these, but I found out today the DHEC does require persons to get Navigable Waters Permits for the installation of such devices.

Also, I have found out the number of regatta permits for Lake Murray in the year 2004. Not sure if anything is published on the year 2005, still checking into that and the locations of these events.

Malcolm Leaphart: Maybe we did not cover the following questions last week since we 'tabled' the discussion of "Project Lands Open to the Public"; but, would like to discuss these during the TWC conference call tomorrow. My suggested agenda topic is: 'Public access plans for the lower Saluda River Corridor '.

Also, I am assuming that more studies are not needed to show that more access needs to be provided on the river, right?? Additional studies should not be needed either for a river trail along the entire corridor as that was documented in the SC DNR Charrette which included landowners and broad public interest groups, including individual citizens (reference with Bill Marshall who led that effort and can supply plan copies). Thanks.

Q. What additional public access is planned for the new license plan along the lower Saluda River?

Q. Will consideration be given to expanding the Gardendale throw-in landing to a ramp suitable for small trailered boats? Or, if that is not a suitable site for a trailer launch because of hydraulics, where can a ramp suitable for small trailered boat launchings be located so that most of the river above I20 is accessible upstream? An upstream trip from there, especially by motor boat, is much safer for the public in that it allows for a downstream return to the landing in case of problems with motors, handling very high or very low flows, etc. Making the safer upstream trip from the Hopes Ferry landings only gives access to the short stretch to the dam - and that stretch is often not navigable at low flows at the sandy island a short distance upstream.

Q. What plans are being considered to make a riverfront trail from Saluda Shoals to the Riverbanks Zoo a reality? That is, will SCE&G help by developing trails or 'cluster parks', including parking, on their river corridor property, including along the stretch just below I-20 above the asphalt plant.

Q. Was a right of way for a public trail provided for in the property sale to a private party for the land sold between the Zoo and I-26 (the old Columbia Police Club property)? If not, what is the mitigation for not keeping that land and providing public access to that critical stetch just above the Mill Race Rapids and Zoo where public access and recreation demands are the highest?

Q. Will SCE&G support the River Center' and help to develop it as envisioned by the River Alliance?

Q. Will any access be provided, through a small ramp and/or cluster park in the stretch between theh old trestles where the scenic river corridor begins and the sandy island upstream from Saluda Shoals Park? That is prime fishing water due to the location near the dam. While security concerns may not allow public facilities at the dam, facilities near the beginning of the scenic river corridor should be feasable and an acceptable substitute site.

Site Visit/Inventory Forms

Inspected by: ___________ Date: ____________

Site Name/Code: _________________

Address: ____

City: _____________________ State: _____ Zip Code: ___________

Facility Type:

_____ Campground/Campsites _____ Picnic Area _____ Day Use

_____ Overlook Site _____ Informal Site

Access:

_____ Paved access ______ # of lanes

_____ Unpaved access ______ # of lanes

Operations:

_____ Manned _____ Seasonal

_____ Unmanned _____ Year Round

_____ Fee ($)

Site Facilities:

#	Type	#	Type
_____	Picnic Tables	_____	Potable Water
_____	Grills	_____	Dumping Station
_____	Firepit/ring	_____	Boat Ramp (_____# of lanes)
_____	Sanitation	_____	Docks
_____	Trails (specify use______________)	_____	Playground
_____	Shelter	_____	Showers
_____	Designated Swim Area	_____	Food
_____	Store	_____	Marina
_____	Fuel		

Parking Lots:

__#_____Type_____________

_____ ADA spaces

_____ Regular spaces

_____ Vehicle & trailer spaces

_____ Spaces delineated?

_____ Curbs?

Sanitation Facilities:

Type:	# Unisex	# Women	# Men
Flush	______	________	________
Portable	______	________	________

Campground/Campsite:

	RV sites	Cabin sites	Tent sites	Wilderness sites
# of sites	______	______	______	______
On site parking	______	______	______	______
Water front	______	______	______	______
ADA compliant	______	______	______	______

Boat Launch Facilities:

_____ Hard surface

_____ Gravel

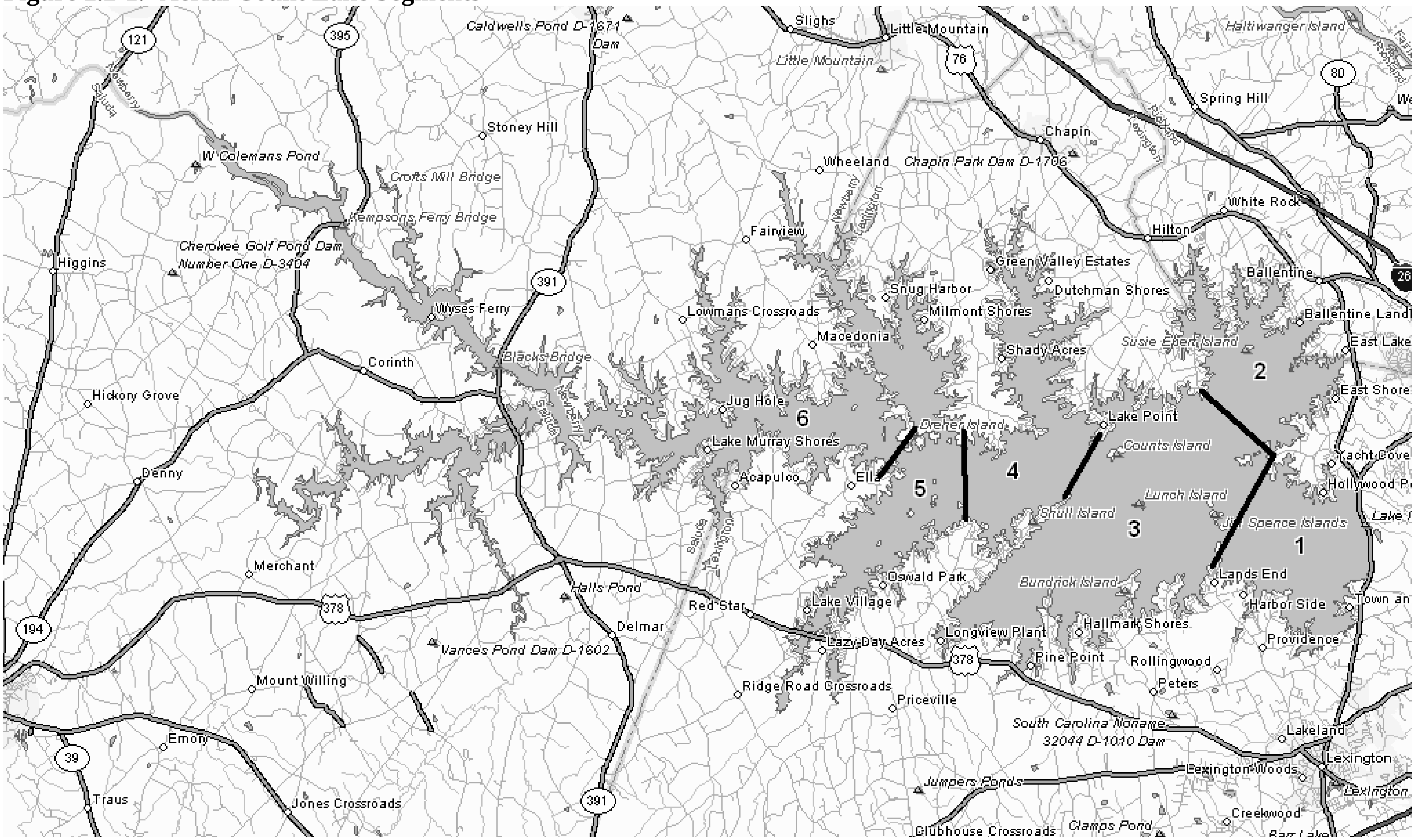
_____ Unimproved

_____ Carry In

Courtesy/Fishing Docks:

Courtesy/Fishing	Dimensions	ADA Compliant
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____

Figure 2.2-1. Aerial Count Lake Segments



Clerk:________	Location:____________________	Site: ________________	Date: ________	Time: ________ am/pm

Lake Murray and Lower Saluda River Recreation Study
Public Access Site Questionnaire

IN QUESTIONS 1 THROUGH 8, WE'D LIKE TO LEARN ABOUT YOUR TRIP TODAY:

1. What recreational activities did you participate in today at ***Lake Murray/Lower Saluda River***? *(Please check only one main activity in the first column and all other secondary activities in the second column.)*

Check only one main activity	**Check all other activities**	**Types of Activities**
		FISHING:
☐	☐	boat fishing
☐	☐	bank/pier/dock fishing
☐	☐	stream fishing
☐	☐	tailrace/river fishing
		BOATING:
☐	☐	motor boating
☐	☐	pontoon
☐	☐	water skiing/tubing/other tow
☐	☐	jet skiing
☐	☐	sailing
☐	☐	lake canoeing/kayaking
☐	☐	river canoeing/kayaking
		OTHER:
☐	☐	bicycling
☐	☐	tent or vehicle camping
☐	☐	hiking/backpacking
☐	☐	sightseeing
☐	☐	hunting
☐	☐	nature study/wildlife viewing
☐	☐	lake swimming
☐	☐	picnicking
☐	☐	other:________________________

2. Including yourself, how many people are in your party today? *(Please fill in blank.)*

   ______ people in party

3. Today, how many hours did you visit ***Lake Murray/Lower Saluda River*** for recreational purposes? *(Please fill in blank.)*

   ______ hours

4. In total, how many days will you be visiting ***Lake Murray/Lower Saluda River*** on this trip? *(Please fill in blank.)*

   ______ days

5a. How would you rate the crowdedness ***on the water on Lake Murray/Lower Saluda River*** today? *(Please circle one number.)*

Light		Moderate		Heavy
1	2	3	4	5

5b. How would you rate the crowdedness ***at the particular recreation site you are at*** today? *(Please circle one number.)*

Light		Moderate		Heavy
1	2	3	4	5

6a. How would you rate the overall condition ***at the particular recreation site you are at*** today? *(Please circle one number.)*

Poor — Excellent

1 2 3 4 5

6b. Please rate the condition of the facilities ***at the particular recreation site you are at*** today. *(Please circle all that apply. If a facility is not available at this site, please indicate whether or not it is needed.)*

	Poor				**Excellent**	**Is Facility Needed at this Site?**	
restrooms	1	2	3	4	5	Yes	No
swimming area	1	2	3	4	5	Yes	No
fishing pier/dock	1	2	3	4	5	Yes	No
picnic tables/shelter	1	2	3	4	5	Yes	No
trash cans	1	2	3	4	5	Yes	No
boat launch	1	2	3	4	5	Yes	No
boat dock	1	2	3	4	5	Yes	No
camping area	1	2	3	4	5	Yes	No
signs	1	2	3	4	5	Yes	No
lighting	1	2	3	4	5	Yes	No
fish cleaning station	1	2	3	4	5	Yes	No
access road	1	2	3	4	5	Yes	No
parking lot	1	2	3	4	5	Yes	No

6c. Please indicate which additional facilities are needed ***at the particular recreation site you are at*** today. *(Please check all that apply.)*

- ☐ better access road
- ☐ paving/grading of parking area or access road
- ☐ increased security/patrolling
- ☐ better lake/river access
- ☐ better maintenance (emptying trash cans, cleaning restrooms, etc.)
- ☐ ADA compliant facilities
- ☐ other – *(please describe ____)*

7a. Have you had any negative experiences while participating in recreational activities at ***Lake Murray/Lower Saluda River*** on this trip? *(Please check one box.)*

- ☐ Yes
- ☐ No ➔ *(If no, skip to Question 8.)*

7b. If yes, please indicate the types of issues experienced at ***Lake Murray/Lower Saluda River*** on this trip. *(Please check all that apply.)*

- ☐ too much litter/trash
- ☐ too crowded
- ☐ water levels too high
- ☐ poor weather
- ☐ reckless boaters
- ☐ boating hazards
- ☐ water levels too low
- ☐ water temperature
- ☐ boats too noisy
- ☐ people too noisy
- ☐ poor site conditions
- ☐ difficult access
- ☐ other - *(please describe ____)*

8. In preparing for and making this trip to ***Lake Murray/Lower Saluda River***, about how much money did you spend on each of the following items before you got home? *(If you live in this area and/or didn't spend anything for certain items, write $0. If you paid for other members of your party, please include these costs in your costs. Please fill in the blank, providing your best estimate rounded to the nearest dollar.)*

$______ Food & Drink
$______ Hotel/Motel/Lodging
$______ Boating Rentals, Bait and Tackle and Other Recreational Supplies
$______ Gasoline (auto and boat)
$______ Guide Fees or User Fees (parking/entrance/admission)
$______ Other (________________________________)
$______ TOTAL

IN QUESTIONS 9 THROUGH 14B, WE'D LIKE TO LEARN ABOUT YOUR TRIPS TO LAKE MURRAY/LOWER SALUDA RIVER IN GENERAL:

9. During what ***one*** season do you spend the most time participating in recreational activities at ***Lake Murray/Lower Saluda River***? *(Please check only one.)*

   ☐ Winter (Dec.-Feb.)
   ☐ Spring (March-May)
   ☐ Summer (June-Aug.)
   ☐ Fall (Sept.-Nov.)
   ☐ Except for this trip, I haven't participated in recreation activities at Lake Murray/Lower Saluda River. ➔ *(Skip to Question 15)*

10. In an average year, approximately how many days do you spend at ***Lake Murray/Lower Saluda River*** for recreational purposes? (*Please fill in the blank for each month; if you do not visit Lake Murray/Lower Saluda River in a specific month, write 0.*)

Number of Trips	**Number of Trips**	**Number of Trips**
_____ January	_____ May	____ September
_____ February	_____ June	____ October
_____ March	_____ July	____ November
_____ April	_____ August	____ December

11a. During the past 5 years, has the number of visits you have made to ***Lake Murray/Lower Saluda River*** increased, decreased, or stayed about the same? *(Please check one box.)*

   ☐ increased
   ☐ decreased
   ☐ stayed about the same ➔ *(Skip to Question 12a.)*
   ☐ I live here year round ➔*(Skip to Question 12a.)*

11b. If the number of trips has increased or decreased, what is the major reason for this change? *(Please fill in blank.)*

   ____

12a. Do you ever go boating (including boat fishing) on ***Lake Murray/Lower Saluda River***? *(Please check one box.)*

   ☐ Yes
   ☐ No ➔ *(If no, skip to Question 13.)*

12b. When you are boating and/or boat fishing on ***Lake Murray/Lower Saluda River***, what is the average amount of time you spend on the water during an average day, not including time spent launching or trailering your boat? *(Please fill in blanks, as appropriate.)*

   Boating: _____ average hours/day Boat Fishing: _____ average hours/day

12c. When you are boating and/or boat fishing on ***Lake Murray/Lower Saluda River***, what is the average number of people in your party, including yourself? *(Please fill in blanks, as appropriate.)*

   Boating: _____ average group size Boat Fishing: _____ average group size

12d. What is the name of the launch site or access area that you typically use for boating and/or boat fishing on ***Lake Murray/Lower Saluda River***? *(If you use your own pier/dock as the typical access site, please write* 'own dock' *under name of launch site.)*

   Boating launch site/access area:____

   Boat Fishing launch site/access area:____________________________________

13a. Overall, are the number and types of existing recreational facilities and activities at ***Lake Murray/Lower Saluda River*** adequate to meet your needs? *(Please check one box.)*

   ☐ Yes ➔ *(If yes, skip to Question 14a.)*
   ☐ No

13b. If no, please write in the name of the ***Lake Murray/Lower Saluda River recreation sites*** where additional facilities are needed and check the types of facilities needed at each site. *(Please check all that apply.)*

(1) Name of Site:	(2) Name of Site:	(3) Name of Site:
☐ restrooms	☐ restrooms	☐ restrooms
☐ swimming area	☐ swimming area	☐ swimming area
☐ fishing pier/dock	☐ fishing pier/dock	☐ fishing pier/dock
☐ picnic shelter	☐ picnic shelter	☐ picnic shelter
☐ boat launch	☐ boat launch	☐ boat launch
☐ boat dock	☐ boat dock	☐ boat dock
☐ better lake/river access	☐ better lake/river access	☐ better lake/river access
☐ paving/grading	☐ paving/grading	☐ paving/grading
☐ trash cans	☐ trash cans	☐ trash cans
☐ lighting	☐ lighting	☐ lighting
☐ camping area	☐ camping area	☐ camping area
☐ signs	☐ signs	☐ signs
☐ other – *(please describe* ____________________ ____________________*)*	☐ other – *(please describe* ____________________ ____________________*)*	☐ other – *(please describe* ____________________ ____________________*)*

14a. Have you had any negative experiences while participating in recreational activities at ***Lake Murray/Lower Saluda River***? *(Please check one box.)*

☐ Yes
☐ No ➔ *(If no, skip to Question 15.)*

14b. If yes, please indicate the types of issues experienced while participating in recreational activities at ***Lake Murray/Lower Saluda River***. *(Please check all that apply.)*

☐ too much litter/trash
☐ too crowded
☐ water levels too high
☐ poor weather
☐ reckless boaters
☐ boating hazards
☐ water levels too low
☐ water temperature
☐ boats too noisy
☐ people too noisy
☐ poor site conditions
☐ difficult access
☐ other - *(please describe* ____*)*

IN QUESTIONS 15 THROUGH 19, WE'D LIKE TO LEARN A LITTLE BIT ABOUT YOU:

15. Do you have a seasonal or permanent home in either Richland, Lexington, Saluda, and Newberry Counties, South Carolina? *(Please check one box.)*

☐ Yes
☐ No

16. What is your zip code? If you are a seasonal resident, please provide the zip code of your seasonal home? (*Please fill in the blank.)*

_____ zip code

17. Are you . . .? *(Please check one.)*

☐ male
☐ female

18. In what year were you born? *(Please fill in blank.)* _________

19. Do you have any additional comments? *(Please be as specific as possible.)*________________________

____

____

____

Thank you for your help with this important study! We appreciate your time today.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MMANAGEMENT TECHNICAL WORKING COMMITTEE

CONFERENCE CALL
March 24, 2006

final dka 03-28-06

ATTENDEES:

Name	Organization	Name	Organization
Malcolm Leaphart	Trout Unlimited	Tim Vinson	SCDNR
Tommy Boozer	SCE&G	Steve Bell	Lake Murray Watch
Van Hoffman	SCE&G	Tony Bebber	SCPRT
David Hancock	SCE&G	Dave Anderson	Kleinschmidt Associates
Lee Barber	LMA	Marty Phillips	Kleinschmidt Associates
Kelly Maloney	Kleinschmidt Associates	George Duke	LMHC
Patrick Moore	AR/CCL		

HOMEWORK ITEMS:

- Tommy B. – review lease agreements for Dreher Island and Saluda Shoals
- Tim V. – provide group with number and location of regatta permits and regatta form
- Dave A. – email Malcolm recreation site spreadsheets
- Dave A. – locate and distribute recreation site maps and future recreation properties
- Dave A. – distribute revised lake questionnaire and river questionnaire
- Dave A. – distribute draft study plan

PARKING LOT ITEMS:

- Discussion of project lands open to the public

DATE OF NEXT MEETING: **April 7, 2006 at 9:30 a.m.**
Conference Call

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave A. opened the meeting by conducting a "roll call" to see who was on the conference call. After establishing who was on the call, Dave introduced Marty and Kelly, who are helping write the study plan for estimating use at SCE&G owned recreation sites. After the introductions, Dave pointed the group to the draft inventory form (attached) he sent for final review. There were very few comments on the form and Dave will finalize the form for inclusion in the study plan. George D. asked if the inventory will include commercial sites. Someone replied that the group had agreed to not include the commercial sites in the inventory, but we will retain the information we have already collected on these commercial sites.

Malcolm commented that we need to list out the objectives of the TWC and asked about the purpose of the surveys being proposed. The group agreed this would be a useful exercise. Steve B. agreed that we need to review the issues that are supposed to be dealt with in the TWC and make sure we have not forgotten anything. The group discussed when this could take place and agreed it is something they could do before or after the next RCG meeting on April 17.

Malcolm asked about the sites where we are conducting the inventory. Tommy explained that they had passed out a spreadsheet with SCE&G Public Sites, Public Landings and Marinas, and Private Marinas listed on them. Malcolm had not received a copy of that and requested a copy. Dave will send him the spreadsheet. Malcolm also asked about designated future sites and how he could find out where these are located. Someone pointed out that Tommy B. had brought these to a previous meeting. Malcolm requested a copy of these maps; Dave agreed to locate better copies and distribute them.

Dave A. introduced the second version of the user questionnaire, pointing out that the questionnaire has been changed to be more conducive to an interview type format. Dave told the group that he had received comments on the previous version from SCPRT and SCE&G. The current questionnaire (attached) takes into account these comments, but also is much shorter to accommodate user interviews. Dave also noted that there will be two versions of the questionnaire—for the lake and river. The version the group discussed is for the lake; a version for the river will be distributed next week. The group then proceeded to go over the questionnaire.

There were no comments on the first two questions—these are necessary for estimating use. The group talked about why Question Three had gone from listing all activities (along with primary activity) to just listing the primary activity. Someone commented that not asking about all activities was for time consideration and did not provide useful information for management of the recreation sites. The group then discussed the benefits of knowing all activities participated in, including recognizing there are "secondary" activities that take place. The group agreed to reword the question to included responses for additional activities. The group also agreed to take out "stream fishing" from the list since the questionnaire is dealing with lake users.

There was some discussion on Question 5A. Tommy and David H. want to keep the question in, but the group decided that asking about mileage on the water would lead to bad information. The group decided to explore using a handout for respondents to point to there boating destination. Someone also mentioned it would be nice to know motivations for going to specific places on the lake (i.e., less crowded). The group agreed to consider this, but Dave is not willing to add additional questions in consideration of the interview length. Once a final version of the questionnaire is available, the group can decide if knowing these motivations is more important than any of the questions on the questionnaire. There was also some discussion on asking about how far people traveled to get to a particular recreation site. Someone mentioned that we are asking for ZIP codes and could estimate distance with that information. Someone also mentioned that we could add "Location" to Question 6B to gauge whether there were any problem with the location of the sites. There was also some discussion on Question 5B; someone mentioned that responses to that are very subjective. Kelly M. acknowledged that it is subjective, but this question is necessary for dealing with issues of boat densities.

There was considerable discussion on Question 6B. Tommy and David H. had suggested this question be removed. They felt that one bad experience with a dirty restroom (when several people before that had experienced a clean restroom) could skew the results. The group agreed that this is useful information to have when considering site expansion or new facilities. The group decided to look at this question again, perhaps rewording it to an open-ended format (e.g., What additional amenities are needed at this site? What is your favorite part about this site? What is your least favorite part?). There was also some discussion on turning Question 7B into an open-ended question.

There were a few comments on Questions 8-12. Someone suggested asking for ZIP codes for both the permanent home and the seasonal home; the group agreed this would be better than the current version. We also need to look at changing this question to say "waterfront" or something like that. Someone also suggested adding "about this recreation facility" to the end of Question 11. There was some discussion about recording race of the respondent. Dave commented that he could not trust an interviewer to accurately record race without asking the question. The group talked about adding questions on race, which we will explore. Someone commented that we may need bilingual signs at the facilities; other comments talked about having bilingual interviewers because of the large Hispanic population. There was also some discussion about providing incentives for completing the survey; Marty agreed to look at how much something like this would cost—specifically cold water bottles. Marty commented that incentives work in other types of surveys but she was not aware of any research using incentives for interviews.

The group then discussed the schedule for the study. Dave told the group that considering everything we have to accomplish before the survey starts (inventory, pre-test, training) that is impossible to start on April 1. He proposed that we conduct the interviews and counts from Memorial Day to Labor Day to capture peak recreation use. Someone commented that the recreation season is defined as April 1 to late September. Someone mentioned that peak fishing times are in March, April, and the fall months and that waterfowl hunting takes place in the winter. The group was concerned that we will miss these activities if we just survey the summer months. When revising the study plan, Kleinschmidt will consider how we could address some of the off season activities.

Dave told everyone that they will be getting a revised draft lake questionnaire, a draft river questionnaire, and a draft study plan the following week. The group set April 7, 2006 at 9:30 am for their next meeting.

Saluda Hydro Relicensing
Recreation Management Technical Working Committee

Meeting Agenda

March 24, 2006
9:30 AM
Conference Call

- **9:30 to 10:00** Review and Finalize SCE&G Public Site Inventory Form
- **10:00 to 10:30** Review Public Access Site Questionnaire
- **10:30 to 11:00** Discussion of Recreation Site Assessment Schedule
- **11:00 to 11:15** Schedule Next Meeting and Moving Forward

Additional Comments Received

Patrick Moore: I listened in on my first rec management TWC this morning and was surprised to hear we are not dealing with Mill Race.

Doesn't SCE&G own the access areas? While it may be outside the project boundary and thus outside our inventory and rec user study, project impacts are present and at their most dangerous to users at Mill Race. This more than a safety issue, it is a rec issue and we should be able to report to the rec RCG on user demographics. How do ya'll plan to address this within recreation RCG? This is ongoing recreation on SCE&G land that is impacted by the project. It seems like we need to address it considering it is where such a large portion of the rec on the LSR takes place.

Karen Kustafik: I am curious about how locations will be selected for the survey, because many of those activities are location dependent.

I assume both official and unofficial access sites will be surveyed? Tony--is this your effort? I had to depart yesterday's meeting and meant to catch up with you when we resumed after break. Was there further discussion about the survey, and possible integration of safety concerns?

It may be informative to note whether the participant had alcoholic beverages with them. Randy mentioned the possibility of pushing for legislative change re PFDs, and data collected on the percentage of river users using PFDs may be useful to make that case.

SCE&G Public Site Inventory Form

Inspected by: ___________ Date: ____________

Site Name: _________________ Site Code: __________

Site Address: ____

City: _____________________ State: _____ Zip Code: ___________

Facility Type:

_____ Primitive Camp _____ Picnic Area _____ Day Use

_____ Overlook Site _____ Informal Site _____ Launch Ramp

Road Access:

_____ Paved access......................................______ # of lanes

_____ Unpaved access..................................______ # of lanes

Operations:

_____ Manned _____ Seasonal (From_____To_____)

_____ Unmanned _____ Year Round

_____ Fee ($) ....(Site_____; Parking;_____)

Site Amenities:

#	Type	#	Type
_____	Picnic Tables	_____	Potable Water
_____	Grills	_____	Boat Fuel
_____	Firepit/ring	_____	Trash Cans
_____	Boat Pump Out	_____	Docks
_____	Trails (specify use_____________: Miles_____)	_____	Playground
_____	Shelter	_____	Showers
_____	Designated Swim Area	_____	Concession
_____	Store	_____	Marina (# of slips_____)
_____	Dumping Station		

Parking Lots:

Type	Estimated # Paved	Estimated # Gravel	
ADA Spaces	_____	_____	_____ Spaces delineated?
Regular Spaces	_____	_____	_____ Curbs?
Vehicle & trailer spaces	_____	_____	

Sanitation Facilities:

	Flush	(ADA?)	Portable	(ADA?)	Showers	(ADA?)
Unisex	_____	(_____)	_____	(_____)	_____	(_____)
Women	_____	(_____)	_____	(_____)	_____	(_____)
Men	_____	(_____)	_____	(_____)	_____	(_____)

Campground/Campsite:

	RV sites	Cabins	Tent sites	Primitive sites
# of sites	______	______	______	______
On site parking	______	______	______	______
Water front	______	______	______	______
ADA compliant	______	______	______	______

Boat Launch Facilities:

_____ Hard surface _____ Unimproved _____ # of Lanes

_____ Gravel _____ Carry In _____ Boat Prep Area?

Courtesy/Fishing Docks:

Courtesy/Fishing	Dimensions	ADA Compliant
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____
__________	__________	_____

Notes: ____

____

____

____

____

____

____

____

Picture Number From _____ To _____

Lake Murray Recreation Study
Public Access Site Questionnaire

Clerk: ________	**Site:** ____________	**Date:** ________	**Time:** _____am/pm	
Weather: ☐ **Sunny**	☐ **Partly Cloudy**	☐ **Cloudy**	☐ **Light Rain**	☐ **Heavy Rain**

IN QUESTIONS 1 THROUGH 7B, WE'D LIKE TO LEARN ABOUT YOUR TRIP TODAY:

1. Including yourself, how many people are in your party today? *(Please fill in blank.)*

 _____ people in party

2. What time did you arrive ***at Lake Murray*** today? *(Please fill in blank.)*

 _____ am / pm

3. What is the primary recreation activity you participated in today ***at Lake Murray***? *(Please check one box. If boating or fishing from a boat are indicated as primary activities, skip to Question 5A.)*

Check only one main activity	Type of Activity	Check only one main activity	Type of Activity
	FISHING:		**OTHER:**
☐	boat fishing	☐	bicycling
☐	pier/dock fishing	☐	tent or vehicle camping
☐	bank fishing	☐	horseback riding
☐	stream fishing	☐	walking/hiking/backpacking
	BOATING:	☐	sightseeing
☐	motor boating	☐	hunting
☐	pontoon/party boating	☐	nature study/wildlife viewing
☐	water skiing/tubing/other tow	☐	lake swimming
☐	jet skiing	☐	picnicking
☐	sailing	☐	sunbathing
☐	canoeing/kayaking	☐	other:___________________
☐	windsurfing		

4. Considering you did not boat or fish, did you spend any time on the water? *(Please check one box.)*

 ☐ YES
 ☐ NO *(If no, skip to Question 5C.)*

5A. How far away did you travel **from this site** in your boat **on the water**? *(Please fill in blank.)*

 _____ miles

5B. On a scale from 1 to 5, with 1 being light, 3 being moderate, and 5 being heavy, how would you rate the crowdedness ***on the water on Lake Murray*** today? (*Please circle one number.*)

Light		Moderate		Heavy
1	2	3	4	5

5C. On a scale from 1 to 5, with 1 being light, 3 being moderate, and 5 being heavy, how would you rate the crowdedness ***at this recreation site*** you are at today? *(Please circle one number.)*

Light		Moderate		Heavy
1	2	3	4	5

6A. On a scale from 1 to 5, with 1 being poor and 5 being excellent, how would you rate the overall condition ***at this recreation site*** today? *(Please circle one number.)*

Poor				Excellent
1	2	3	4	5

6B. Using the same scale, with 1 being poor and 5 being excellent, please rate the condition of the facilities ***at this recreation site*** today. *(Please circle all that apply. If a facility is not available at this site, please indicate whether or not it is needed.)*

	Poor				**Excellent**	**Is Facility Needed at this Site?**	
restrooms	1	2	3	4	5	Yes	No
swimming area	1	2	3	4	5	Yes	No
fishing pier/dock	1	2	3	4	5	Yes	No
picnic tables/shelter	1	2	3	4	5	Yes	No
trash cans	1	2	3	4	5	Yes	No
boat launch	1	2	3	4	5	Yes	No
boat dock	1	2	3	4	5	Yes	No
camping area	1	2	3	4	5	Yes	No
signs	1	2	3	4	5	Yes	No
lighting	1	2	3	4	5	Yes	No
fish cleaning station	1	2	3	4	5	Yes	No
access road	1	2	3	4	5	Yes	No
parking lot	1	2	3	4	5	Yes	No
lighting	1	2	3	4	5	Yes	No
boat fueling	1	2	3	4	5	Yes	No
pump outs	1	2	3	4	5	Yes	No
trails	1	2	3	4	5	Yes	No

7A. Are there any additional facilities or improvements needed at this recreation site? *(Please fill in the blank.)*

☐ YES
☐ NO *(If no, skip to Question 8.)*

7B. Please indicate which additional improvements are needed at the particular recreation site you are at today. *(Please check all that apply.)*

- ☐ better access road
- ☐ better lake access at low water
- ☐ paving/grading of parking area
- ☐ navigation aids
- ☐ paving/grading of access road
- ☐ better maintenance *(emptying trash cans, cleaning restrooms, etc.)*
- ☐ increased security/patrolling
- ☐ ADA compliant facilities
- ☐ other – *(please describe ____)*

WE'D LIKE TO LEARN A LITTLE BIT ABOUT YOU:

8. Do you own a permanent or seasonal home on Lake Murray? *(Please check one box.)*

   ☐ YES – Permanent Home
   ☐ YES – Seasonal Home
   ☐ NO

9. What is your zip code? If you are a seasonal resident, please provide the zip code of your seasonal home. *(Please fill in the blank.)*

   ___________ ZIP CODE

10. In what year were you born? *(Please fill in blank.)*

   ___________ YEAR

11. Do you have any additional comments? Please be as specific as possible.

____

____

____

____

____

Thank you for your help with this important study! We appreciate your time today.

12. *Please record gender of respondent. (Please check one box.)*

   ☐ MALE
   ☐ FEMALE

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MMANAGEMENT TECHNICAL WORKING COMMITTEE

CONFERENCE CALL
April 7, 2006

final dka 04-25-06

ATTENDEES:

Name	**Organization**	**Name**	**Organization**
Tommy Boozer	SCE&G	Steve Bell	Lake Murray Watch
Van Hoffman	SCE&G	Tony Bebber	SCPRT
David Hancock	SCE&G	Dave Anderson	Kleinschmidt Associates
Kelly Maloney	Kleinschmidt Associates	Marty Phillips	Kleinschmidt Associates
Patrick Moore	AR/CCL	Jennifer Summerlin	Kleinschmidt Associates

HOMEWORK ITEMS:

- Tommy B. – review lease agreements for Dreher Island and Saluda Shoals
- Tim V. – provide group with number and location of regatta permits
- Dave A. – locate and distribute recreation site maps and future recreation properties
- Dave A. – distribute draft study plan
- Dave A. – check with Malcolm about next meeting date

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **April 17, 2006 at 2:00 p.m.**
Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave A. opened the meeting by mentioning that Tommy B. had provided an updated map of existing recreation sites and future recreation lands and that he would be distributing the map to the group and posting it to the web site. Dave then directed attention to the draft Lake Murray Public Access Site Questionnaire (attached). Someone asked about the time frame the surveys would be conducted. Dave replied that the study is being planned for Memorial Day to September 30th. There was some discussion as to how we would collect information from waterfowl hunters, who typically use access areas during the winter. Dave replied that it is being proposed to conduct a focus group with selected waterfowl hunters, where the same type of information would be collected. There was some discussion about whether the on-site surveys should be conducted for an entire year. Dave felt that concentrating effort during the peak recreation season provided the best information for the money expended. Tony thought that missing the March/April timeframe would skew the results towards skiers and boaters. After this discussion, the group agreed to keep the time frame as it currently stands, but to examine the data next fall to see how many anglers were interviewed. If the group decides that there were not enough anglers surveyed during the peak recreation season, the sampling frame could be modified to “pick up” March and April of next year.

The group then examined specific questions on the Lake Murray questionnaire. David H. asked if we could ask a question about off season usage to deal with the sampling frame issue. Dave A. said we could, but the questionnaire is at the maximum length. There was some discussion about the time of day the interviews would take place. Kelly M. replied that the day was defined as 6:00 am to 7:00 pm. The group agreed this was good since anglers typically use the lake during the early morning hours.

Steve B. asked if we could record if the respondent was disabled to get an idea of how many disabled people are using the sites. Marty replied that this could lead to assumptions about what is and what is not a disability, and that we will not be able to tell whether some people have them or not. She would not feel comfortable with letting the interviewers make this determination.

Steve B. asked about Question 5A and if we could get respondents to specifically locate where they went. Kelly M. replied that we could try it in the pretest. Marty replied that we could break out the lake into smaller segments, as long as the segments lined up with the segments used in the boating density study. Kelly also talked about how many on-the-water activities take place over large geographic areas and a dot might not really mean anything. Dave A. mentioned that we could get some of this same information from the aerial photographs, but we would not know where the boats came from. Tony B. thought the individual maps would be most useful. Marty stated that we could obtain the information but would not be able to correlate individual responses to dots on a map. The group agreed to try having respondents indicate their location on the lake by placing a dot on a map during the pre-test and see if this format works.

Tony B. had a couple of specific suggestions for the questionnaire. He wanted to change "Tent or Vehicle Camping" to "Camping," take out "Hunting" and move "Swimming," "Picknicking," and "Sunbathing" to the top of the list (Question 3). For Question 7D, he thought "Tent Camping" and "RV Camping" should be separate items and the "Bilingual Signs" should be added to the list. Tony also suggested combining Questions 7E and 7F. Marty replied that we need to keep 7E and 7F the way they are to tell the difference between a non-response and a "no."

Kelly M. mentioned that Karen K. had submitted comments about asking if the respondents have alcoholic beverages with them. Tommy replied that we should not consider it. Kelly mentioned that this would likely shut off the interview process because of the nature of the question. Steve B. stated that it would gather information about people drinking on the rocks on the LSR. Tommy replied that it is an issue that SCE&G can not do anything about. Steve replied that it is an issue that SCE&G brings up when they discuss the safety issues on the LSR. Dave A. suggested that it is not an issue for this TWC and he thinks we should refer the issue to the Safety RCG.

Dave then focused attention on the Lower Saluda River Public Access Site Questionnaire (attached). He mentioned that it is very similar to the Lake questionnaire, except for a few questions about the sirens on the river. Patrick M. liked the questions on the siren and asked if we could ask about behavior associated with the sirens. Marty said they could try to develop a question concerning how people typically behave when the sirens go off.

Dave A. asked if the siren questions are applicable at the other sites being sampled on the river (besides the Zoo). The group thought they were. Patrick M. asked where people would be intercepted at the Zoo. Dave replied that they would be intercepted by the west parking lot. Patrick mentioned that there is another access site at the opposite side of the parking lot. Dave agreed that the best way to intercept people would not be determined until the pre-test and site inventories are completed. Dave questioned if the same recreation season would capture most of the use in this area. Patrick thought a lot of use occurred during April and May. The group agreed that they can reexamine this area once the peak recreation results are available to determine if we need to complete more interviews next year.

There was some further discussion about asking about safety issues on the LSR. Tony wondered if we could ask if people have enough time to get off the river. Marty wondered if we just need to observe behavior associated with the sirens. Patrick mentioned this is something he suggested but the logistics were too many to overcome. There was some discussion about other possible questions such as “Did you feel safe on the river today” (which would then be tied to flow conditions), or “Did flows impact your experience today.” Dave suggested that Kleinschmidt craft new questions about safety on the LSR and distribute a new questionnaire for review. Dave mentioned that we don’t need to meet face-to-face to take comments, we need to get this done as soon as possible so that we can get the study in place. The group agreed to make electronic comments to the questionnaire after Kleinschmidt distributes it.

Dave directed attention to the remaining agenda items and suggested we postpone the other topics (due to time). Steve B. mentioned that the “Public Lands Open to the Public” did not need to be discussed as long as the group has listing of public access and that these areas would be indicated on classification maps. The group agreed to table this discussion. Steve also asked about remaining issues to be dealt with in this TWC/RCG. Dave pointed him to the “Cataloged Study Request” document available on the web site. Steve expressed his concern that we might be missing some issues. The group agreed to review the “Cataloged Study Request” document and make any comments on other issues to Dave. Dave indicated he would send out the draft study plan after the call and the TWC needed to meet to finalize the plan. The group agreed to meet after the RCG meeting on the 17th and would attempt to accommodate Malcolm and meet later in the day. Dave agreed to contact Malcolm before setting the next meeting date.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MMANAGEMENT TECHNICAL WORKING COMMITTEE

CONFERENCE CALL
April 7, 2006

final dka 04-25-06

Saluda Hydro Relicensing
Recreation Management Technical Working Committee

Meeting Agenda

April 7, 2006
9:30 AM
Conference Call

- **9:30 to 10:00** Discussion of User Questionnaires
- **10:00 to 10:30** Discussion of "Project Lands Open to the Public"
- **10:30 to 10:45** Identifying Other Issues
- **10:45 to 11:00** Setting Next Meeting Date and Moving Forward

Additional Comments Received

Malcolm Leaphart: Sorry I could not participate in the teleconference call last Friday when I was out of town, and also this morning when I have conflicting meetings at work (between them at this moment in fact...). I suggest a face-to-face session next, and a late afternoon or evening time would be appreciated as morning meetings are difficult to get away from work for.

I am honestly anxious for the TWC to get past the survey preparations and to begin to address key project recreational access issues, especially those for the lower Saluda River. In my absence, I defer to Tony Bebber's expertise and support whatever recommendations he makes in getting the surveys wrapped up. As for the river recreational management issues, I will follow up as soon as I can with a list of those items that need to be discussed. Hopefully that will be helpful as a starting point for discussions of improved access and recreational sites along the lower Saluda. As a lake user, I am also concerned that the recreational and access sites there are inadequate and look forward to participating in discussing those.

Tony Bebber: Here's some additional comments on the LSR draft. When looking through it, I realized that we have only asked about the specific site. Don't we want to ask if there are other recreational needs on Lake Murray or Lower Saluda, sort of like 7A on the LSR form? Maybe I'll know for sure after I see the study plan? Will it include a mail or phone survey of area residents (4+ counties)?

Steve Bell: I agree with Tony, that while the site surveys will provide some useful information, additional studies and/or information will be needed to address specific stakeholder issues. As I explained at the end of the meeting, we need to review all issues to determine what if any additional studies or info is needed to address stakeholder concerns. The study plan will have to be amended at that time.

Malcolm Leaphart: Please clarify for me how we are going to identify NEW recreation sites since neither of the questionnaires ask those surveyed 'if' and 'where' they would like to see some on the river and the lake? This is of course a key issue for the Rec RCG and committees and I want to make sure that we do fail to address it... Thanks.

Lake Murray Recreation Study
Public Access Site Questionnaire

Clerk: _______________	**Site:** _______________	**Date:** ______________	**Time:** __________ **am/pm**
Weather:	**☐ Sunny**	**☐ Partly Cloudy**	**Record Respondent Gender: ☐ Male ☐ Female**
(Check all	**☐ Cloudy**	**☐ Light Rain**	**RESPONDENT REFUSED INTERVIEW: ☐**
that apply)	**☐ Heavy Rain**	**☐ Windy**	**RESPONDENT DOES NOT SPEAK ENGLISH: ☐**

THE FIRST FEW QUESTIONS ASK ABOUT YOUR EXPERIENCE HERE TODAY

1. Including yourself, how many people are in your party today? *(Fill in blank.)*

   _____ people in party

2. What time did you arrive ***at Lake Murray*** today? *(Fill in blank.)*

   __________ am / pm

3. What is the primary recreation activity that you participated in today ***at Lake Murray***? *(Read the list to respondents. Check only one main activity in the first column.)*

   What other activities did you participate in today? *(Check all that apply in the second column. If boating or fishing from a boat are indicated as primary activities, skip to Question 5A.)*

Check only one main activity	Check all other activities	Types of Activities
		FISHING:
☐	☐	boat fishing
☐	☐	pier/dock fishing
☐	☐	bank fishing
		BOATING:
☐	☐	motor boating
☐	☐	pontoon/party boating
☐	☐	water skiing/tubing/other tow
☐	☐	jet skiing
☐	☐	sailing
☐	☐	canoeing/kayaking
☐	☐	windsurfing
		OTHER:
☐	☐	bicycling
☐	☐	tent or vehicle camping
☐	☐	horseback riding
☐	☐	walking/hiking/backpacking
☐	☐	sightseeing
☐	☐	hunting
☐	☐	nature study/wildlife viewing
☐	☐	swimming
☐	☐	picnicking
☐	☐	sunbathing
☐	☐	other:________________________________
	☐	None

4. Did you spend any time ***on the water on Lake Murray*** today? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 6.)*

5A. Here is a map of Lake Murray. Can you show me where you spent the most time ***on the water*** today? *(Check one box.)*

☐ Segment 1	☐ Segment 7
☐ Segment 2	☐ Segment 8
☐ Segment 3	☐ Segment 9
☐ Segment 4	☐ Segment 10
☐ Segment 5	☐ Segment 11
☐ Segment 6	☐ Segment 12

5B. Why did you go there? *(Fill in the blank.)*

____
____
____

5C. On a scale from 1 to 5, with 1 being light, 3 being moderate, and 5 being heavy, how would you rate the crowdedness overall ***on the water on Lake Murray*** today? *(Circle one number.)*

Light Moderate Heavy
1 2 3 4 5

6. On a scale from 1 to 5, with 1 being light, 3 being moderate, and 5 being heavy, how would you rate the crowdedness ***at this recreation site*** today? *(Circle one number.)*

Light Moderate Heavy
1 2 3 4 5

7A. On a scale from 1 to 5, with 1 being poor and 5 being excellent, how would you rate the overall condition ***of this recreation site*** today? *(Circle one number.)*

Poor Excellent
1 2 3 4 5

7B. Why did you choose to come to this site today? *(Fill in the blank.)*

____
____
____

7C. Are there any additional facilities needed ***at this recreation site***? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 8.)*

7D. What do you recommend? *(Do not read this list. Allow respondent to answer and check all that apply and/or fill in the blanks.)*

☐ access road	☐ camping area	☐ rest rooms
☐ bank fishing area	☐ fish cleaning station	☐ signs & information
☐ boat dock	☐ fishing pier/dock	☐ swimming area
☐ boat fueling	☐ lighting	☐ trails
☐ boat launch	☐ parking lot	☐ trash cans
☐ boat pump outs	☐ picnic tables/shelter	☐ RV camping
☐ other (please specify:______________________________)		

7E. Are there any other improvements that you would recommend for this site? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 8.)*

7F. What improvements do you recommend? (*Fill in the blank*.)

____

____

____

I HAVE JUST A FEW MORE QUESTIONS

8. Do you own a permanent or seasonal lakefront home or condominium ***on Lake Murray***? What is your zip code? *(Check one box and fill in the blank for zip code.)*

☐ YES – Permanent Home→ ZIP CODE: ____________
☐ YES – Seasonal Home → ZIP CODE: ____________
☐ NO - Non-lakefront resident → ZIP CODE: ____________

9. In what year were you born? *(Fill in blank.)*

___________ YEAR

10. Do you have any additional comments about the recreation facilities at ***Lake Murray***? *(Fill in blank and be as specific as possible.)*

____

____

____

____

THANK YOU FOR YOUR HELP! WE APPRECIATE YOUR TIME TODAY!

Lower Saluda River Recreation Study
Public Access Site Questionnaire

Clerk: _______________	**Site:** _______________	**Date:** ______________	**Time:** __________ **am/pm**
Weather:	**☐ Sunny**	**☐ Partly Cloudy**	**Record Respondent Gender: ☐ Male ☐ Female**
(Check all	**☐ Cloudy**	**☐ Light Rain**	**RESPONDENT REFUSED INTERVIEW: ☐**
that apply)	**☐ Heavy Rain**	**☐ Windy**	**RESPONDENT DOES NOT SPEAK ENGLISH: ☐**

THE FIRST FEW QUESTIONS ASK ABOUT YOUR EXPERIENCE HERE TODAY

1. Including yourself, how many people are in your party today? *(Fill in blank.)*

    _____ people in party

2. What time did you arrive ***at the Lower Saluda River*** today? *(Fill in blank.)*

    __________ am / pm

3. What is the primary recreation activity that you participated in today ***at the Lower Saluda River***? *(Read the list to respondents. Check only one main activity in the first column.)*

    What other activities did you participate in today? *(Check all that apply in second column.)*

Check only one main activity	**Check all other activities**	**Types of Activities**
		FISHING:
☐	☐	boat fishing
☐	☐	pier/dock fishing
☐	☐	wading fishing
☐	☐	bank fishing
		BOATING:
☐	☐	tubing/floating
☐	☐	flatwater canoeing/kayaking
☐	☐	whitewater canoeing/kayaking
☐	☐	rafting
		OTHER:
☐	☐	bicycling
☐	☐	tent or vehicle camping
☐	☐	horseback riding
☐	☐	walking/hiking/backpacking
☐	☐	sightseeing
☐	☐	hunting
☐	☐	nature study/wildlife viewing
☐	☐	swimming
☐	☐	picnicking
☐	☐	sunbathing
☐	☐	other:________________________________
	☐	None

4. On a scale from 1 to 5, with 1 being light, 3 being moderate, and 5 being heavy, how would you rate the crowdedness ***at this recreation site*** today? *(Circle one number.)*

Light		Moderate		Heavy
1	2	3	4	5

5A. On a scale from 1 to 5, with 1 being poor and 5 being excellent, how would you rate the overall condition ***of this recreation site*** today? *(Circle one number.)*

Poor				Excellent
1	2	3	4	5

6A. Why did you choose to come to this site today? *(Fill in the blank.)*

____

____

____

7A. Are there any additional facilities needed ***at this recreation site***? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 8.)*

7B. What do you recommend? *(Do not read this list. Allow respondent to answer and check all that apply and/or fill in the blank.)*

☐ access road	☐ camping area	☐ rest rooms
☐ bank fishing area	☐ fish cleaning station	☐ signs & information
☐ boat dock	☐ fishing pier/dock	☐ swimming area
☐ picnic tables/shelter	☐ lighting	☐ trails
☐ boat launch	☐ parking lot	☐ trash cans
☐ other (please specify:____________________)		

7C. Are there any other improvements that you would recommend for this site? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 8.)*

7D. What improvements do you recommend? *(Fill in the blank.)*

____

____

____

8A. Are you aware of the siren on ***the Lower Saluda River***? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 9.)*

8B. Do you know what the siren is for? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 9.)*

8C. What do you think the siren is for? *(Fill in the blank.)*

____

____

____

I HAVE JUST A FEW MORE QUESTIONS

9. Do you own a permanent or seasonal lakefront home or condominium ***on Lake Murray***? What is your zip code? *(Check one box and fill in the blank for zip code.)*

☐ YES – Permanent Home→ ZIP CODE: ____________

☐ YES – Seasonal Home → ZIP CODE: ____________

☐ NO – Non-lakefront resident → ZIP CODE: ____________

10. In what year were you born? *(Fill in blank.)*

___________ YEAR

11. Do you have any additional comments about the recreation facilities at ***the Lower Saluda River***? *(Fill in blank and be as specific as possible.)*

____

____

____

____

____

____

THANK YOU FOR YOUR HELP! WE APPRECIATE YOUR TIME TODAY!

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TECHNICAL WORKING COMMITTEE

LAKE MURRAY TRAINING CENTER
April 17, 2006

final dka 05-15-2006

ATTENDEES:

Name	Organization	Name	Organization
Dave Anderson	Kleinschmidt Associates	Randy Mahan	SCANA Services
Jeni Summerlin	Kleinschmidt Associates	David Hancock	SCE&G
Marty Phillips	Kleinschmidt Associates	Tom Eppink	SCANA Services
Kelly Maloney	Kleinschmidt Associates	Tommy Boozer	SCE&G
Tim Vinson	SCDNR	Patrick Moore	CCL/AR
Bill Marshall	SCDNR & LSSRAC	Steve Bell	Lake Watch
Malcolm Leaphart	Trout Unlimited	Tony Bebber	SCPRT
George Duke	LMHOC		

HOMEWORK ITEMS:

- Dave Anderson – draft a study plan for the analysis of Lake Murray aerial photographs
- Dave Anderson – draft a “straw man” of the Saluda Project Recreation Plan

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shortly after the Recreation Resource Conservation Group (RCG) meeting, the group agreed to proceed with the Recreation Management Technical Working Committee (TWC) meeting. Dave Anderson opened the meeting by discussing the Recreation Assessment Study Plan. Dave A. noted that the purpose of this and other study plans is to address the current recreational needs and accommodate the future use of the Project for recreation. Marty noted that this TWC needs to remember another RCG is presently working on a lake and shoreline management plan. She mentioned that we are also working on a recreation user study and boat density study. She added that the combination of these two studies will be used to obtain the information necessary to address the objectives of the TWC. Marty mentioned that Table 2-1 in the Recreation Assessment Study Plan has not been completely written because some information is not available at this time.

There was a brief discussion about shoreline management and Steve B. asked if we could put together a survey to determine the amount of project lands that should be set aside for the future. Marty replied that we will be able to determine this with the studies that we already have planned and input from the RCG. Steve B. also mentioned that the studies we are focusing on are for formal recreation sites and asked how we can focus on non-formal recreation sites. Patrick noted that Catawba-Wateree had a recreation survey that found most people are involved in non-traditional recreational use. Tony B. noted that Catawba-Wateree conducted their survey through the mail and got a high response.

Steve B. noted that a list of questions should be developed to ask the public what they want to do with the undeveloped shoreline. There was some further discussion about protecting additional shoreline for the future and Dave H. noted that SCE&G's management will decide what to do with the land. The group decided that most people would prefer to set aside additional undeveloped land for recreation and the Recreation RCG, acting as a focus group, would make recommendations to the Lake and Land Management RCG to set aside land for future recreational use.

George mentioned that we need to look at people who are not passionate lake users and find out what they want and how we can make the land more usable to them. The group agreed and Dave A. noted that he will send out a draft "straw man" for the Saluda Project Recreation Plan to spell out the how we will determine future recreational needs of the Project.

Dave A. then focused attention on the Lake Murray questionnaire. The group briefly examined comments made by Tony B. Dave then went over the lower Saluda River questionnaire and the group discussed questions pertaining to sirens on the river. Through some discussion, the group agreed to the changes made pertaining to the siren questions.

Dave A. noted that he would like to draft out the "straw man" before scheduling the next TWC meeting and the group agreed. He added that he would examine the aerial photographs of Lake Murray and would draft a study plan for the boat density analysis.

Saluda Hydro Relicensing
Recreation Management Technical Working Committee

Meeting Agenda

April 17, 2006
2:30 pm
Lake Murray Training Center

There was no set agenda for this meeting as it was intended to finalize comments on the Recreation Assessment Study Plan.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TECHNICAL WORKING COMMITTEE

LAKE MURRAY TRAINING CENTER
July 19, 2006

final dka 08-14-06

ATTENDEES:

Name	**Organization**	**Name**	**Organization**
Alison Guth	Kleinschmidt Associates	David Hancock	SCE&G
Dave Anderson	Kleinschmidt Associates	Steve Bell	Lake Watch
Bill Argentieri	SCE&G	Regis Parsons	landowner
Alan Stuart	Kleinschmidt Associates	Marty Phillips	Kleinschmidt Associates (by phone)
Tom Eppink	SCANA Services, Inc.	Tony Bebber	SCPRT
Tommy Boozer	SCE&G	Joy Downs	LMA

HOMEWORK ITEMS:

- Tommy Boozer – contact Berger for study information
- Joy Downs – distribute LMA survey results to group

PARKING LOT ITEMS:

- None

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave welcomed the group and noted that the sole purpose of the meeting would be to discuss the Boat Density Study Plan. He explained that the goal for the meeting would be to leave with a very near final version of the plan. The group began an interactive session reviewing the document as it was projected on the screen and changes were made in real time.

As the group reviewed the document, Tommy Boozer asked how future boat densities would be determined. Dave noted that although they were only examining current boat densities they would be able to make some estimates regarding future densities. Dave continued to explain that future boat densities are very difficult to predict due to the many factors that could affect them. In reference to the study in general, Steve Bell asked how the information was going to be used. Dave replied that it will be useful in discussions on the future development of lands. Tony agreed and added that it will be helpful in determining where new access points should be located. Marty Phillips further pointed out that the information that comes out of this analysis is really just one factor of many that SCE&G will be using to make management decisions in the future. Tommy Boozer asked if this study would provide information on whether Lake Murray was at optimum levels of recreation, or below. Dave noted that it would, using standards commonly used in FERC relicensing.

Dave took this opportunity to explain a little about the study to the group. He noted that they would be using aerial photography from 2001 and classify different types of activities on the Lake. Dave pointed out that jet skiing would be considered under the water skiing classification. It was noted that in the Berger study, which used the same 2001 photographs in the analysis, boat counts were broken down into smaller segments. Tommy agreed to call Berger to see if more detailed information is still available. Marty agreed to send Tommy an email describing the information needed from Berger.

Tony asked if there was any way to extrapolate 2006 data from the 2001 photographs by looking at boater registrations. Marty noted that Kleinschmidt had considered that possibility but concluded that we have no way to determine whether those individuals with boats registered in the vicinity of Lake Murray actually boat on Lake Murray. She stated that it has been documented that changes in recreation participation is influenced by population growth. Marty suggested that the 2001 information could be combined with the SCORP data and population growth estimates to provide a range of boating estimates that would likely approximate current levels of boating. The group agreed that this was acceptable. Tony also noted that he would try to break the SCORP information down by county.

The group continued through the document making changes interactively. Steve Bell noted that he would be especially interested in knowing the counts in the cove and creek areas. Dave continued to explain the calculations to the group. Joy Downs noted that the LMA received results of the survey they implemented last year and shared that fishing was listed as the recreation activity with the highest rates of participation around the lake. She noted that she would distribute this information to the group.

The group reviewed the schedule and concluded the meeting. The group agreed to continue with the course of the study.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TWC

Panera Bread
September 13, 2007

Final JMS 10-29-07

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates
Bill Marshall, SCDNR
Tony Bebber, SCDRT
Suzanne Rhodes, SCWF
Tommy Boozer, SCE&G
George Duke, LMHC
Randy Mahan, SCANA
Regis Parsons, Private Land Owner
Steve Bell, Lake Watch
Joy Downs, LMA
Dave Anderson, Kleinschmidt Associates
Jeni Hand, Kleinschmidt Associates

DATE: September 13, 2007

<u>DATE OF NEXT MEETING:</u> **TBA**

<u>HOMEWORK ITEMS:</u>

- Make CD's that contain example recreation plans and send them to committee members that request them.

Dave Anderson
- Distribute a strawman to committee members that will describe subjects that will be covered in the Saluda Recreation Plan.

Dave Anderson
- Send Dave A. the Saluda recreation maps that contain marinas and informal sites that SCE&G has identified.

Tommy Boozer
- Find out who owns the islands in the vicinity of Ocean Boulevard area on the LSR.

Tommy Boozer
- Incorporate changes into the Standard Process Form and send out to committee members for final comments.

Dave Anderson
- Draft the Saluda Recreation Plan and send out to committee members for review and comment.

Dave Anderson

- Draft a recommendation for protection of lands in the future development for protection. The recommendation will be sent to the LLM TWC

Dave Anderson

DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson of Kleinschmidt Associates welcomed everyone and noted that the purpose of this meeting was to review and discuss: (1) the Saluda recreation studies (recreation assessment, boat density, draft spring addendum); (2) the example recreation plans; (3) standard process questions 6 through 11; and (4) the draft recreation plan.

Saluda Recreation Studies

Dave A. welcomed the group and directed attention to the Saluda Recreation Assessment study and noted that responses to comments received from committee members will be included in a revised version as an appendix to the report. Steve Bell reminded the members that the committee had a responsibility to evaluate all project lands and make recommendations back to the Lake and Land Management TWC on which lands should be set aside for "informal" recreation areas. Tommy Boozer noted that the LLM Natural Resource sub-committee had evaluated undeveloped tracts in the "future development" classification" and had scored the tracts on their informal recreational values. Dave A. noted that he would draft a recommendation to protect natural undeveloped lands at the project.

Dave A. noted that the Saluda Boat Density Study report was finalized in July and posted to the Saluda Hydro relicensing website. He noted that after it was posted to the website, there were some concerns about how the report was written. To address these concerns, he explained that a few changes were made in the methods and conclusions sections of the report , but the results did not change. There was a brief discussion on future recreation facilities and Tommy B. noted that Bundrick Island may possibly support boat launching facilities in the future. Tony B. explained that boat access for Lake Murray is sufficient, however, there should be more recreational areas for non-boaters. Tommy B. noted that an island on Lake Murray has been set aside for pier fishing and explained that it would not have boat launching. Dave A. explained to the group that during the first three to five years of the new license, the recreation plan will concentrate on enhancing existing recreational facilities. Tommy B. noted that the most important thing will be to set aside land for recreational use for the next 40 to 50 years.

Dave A. noted the Spring Addendum Study is the only report in draft form and is currently out for review and comment. He explained that recreation for the Saluda Project follows the Bell Curve during peak season. Dave mention that remaining issues that still need to be addresses are striped bass fishing on Lake Murray and trout fishing on the lower Saluda River.

Review of Example Recreation Plans

After a short break, Dave A. noted that the group should have enough information to draft a recreation plan for the Saluda Project. Tony B. noted that the Lake Murray Association's Study may also be used for informational purposes during the development of the Saluda recreation plan. Dave A. noted that to give the group an idea of what a recreation plan should look like, he put together 10 example recreation plans that had been approved by the FERC. Dave A. explained that these example recreation plans contain descriptions of recreation site improvements, scheduling, and a record of consultation. Dave A. noted that he would distribute a strawman to committee members that will describe subjects that will be covered in the recreation plan for the Saluda Hydro Project. Steve Bell noted that the FERC guideline "Recreation Development at Licensed Hydro Projects" has recommendations on developing a plan and suggest that all project lands and other recreation sites be listed in the inventory and project safety issues should be included as part of the plan. Dave A. noted by the end of 2007, a description of improvements needed for each recreation site will be distributed to committee members. Tony B. noted that canoe access sites in the upper creeks of Lake Murray should be included in the recreation plan.

Review of Standard Process Questions 6 through 11

The group began reviewing the Standard Process Form and Dave A. noted that it was updated on September 10, 2007 and it included comments from February of this year. Dave informed the group that questions from Step 1 are considered to be final. The group reviewed and discussed pages 3 through 12 of the Standard Process Form (the Standard Process Form used during the meeting may be viewed in Attachment A). The group requested that courtesy rules should be established for boaters on Lake Murray. Dave noted that he would make changes to the Standard Process Form and send out to committee members for review.

Draft Recreation Plan

Dave A. noted that Kleinschmidt will write up a draft recreation plan and will distribute to committee members by the end of December 2007. Dave noted that the plan will include recreational flows for the lower Saluda River . Dave mentioned that committee members will have 30 days to review and comment and a meeting will be scheduled to discuss changes and/or additions to be made to the recreation plan.

Additional Comments by Lake Murray Watch

So far the group has focused primarily on assessing the project's formal recreational facilities. I think we should now take time to look at the other issues relating to recreation:

An assessment of informal recreational resources and opportunities which would include an evaluation of the inventory of undeveloped projects lands. (note a survey of these lands is available from the LLM TWC) Recommendations should be provided to the LLM TWC

An assessment of impacts lake level management has on recreational resources. A recommendation should be made to Operations.

An assessment of buffer zones to determine whether these areas are available for public access and protect the recreational and aesthetic values of the project. Recommendations should be made to the LLM TWC

An assessment of developed and undeveloped easement lands to evaluate public access and recreational opportunities. Recommendations regarding better protection in these areas be provided to LLM TWC.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TWC

SCE&G Training Center
February 20, 2008

Final acg 4/15/08

ATTENDEES:

Alison Guth, Kleinschmidt Associates
Randy Mahan, SCANA Services, Inc.
Tommy Boozer, SCE&G
Alan Stuart, Kleinschmidt Associates
Joy Downs, LMA
Jim Cumberland, CCL
Dave Anderson, Kleinschmidt Associates
Dave Landis, LMA
Steve Bell, Lake Watch
Dick Christie, DNR
Tony Bebber, SCPRT

MEETING NOTES:

Dave opened the meeting and noted the first item on the agenda would be to review the memo from the Recreation Focus Group. Jim Cumberland led the discussions from the Recreation Focus Group. Jim presented the group with a PowerPoint of the proposal from the Recreation Focus Group. He explained that they were putting this out for the Recreation Management TWC's consideration and requested that the Recreation Management TWC forward the recommendations in the memo to the Lake and Land TWC for consideration in rebalancing.

Jim began the presentation and discussed background information with the group. Jim noted the importance of passive recreational values, such as hiking, walking, and nature watching. He explained that as the Recreation Management TWC reviewed through issues, they began with the natural resource subcommittee's review of future development lands. He pointed out that there was a need to educate property owners on the public's right to access fringelands. Jim also noted that they wanted to see priority given to one multi-slip docking facility for a community over multiple individual docks. Jim explained that they were also looking at enhancing the scenic values of the shoreline by implementing vegetation restoration.

On future development lands, Jim explained, that they would like a plan developed to establish nature trails, informal picnic areas, etc. Jim noted that the tracts that scored 3 or higher in the shoreline survey should be reclassified as recreation lands and included in the recreation plan. He explained that lands that scored a 1 should be protected for their scenic values by reclassifying them to natural areas. Jim continued to note that under their proposal, the lands that did not receive a score would be okay to sell.

For forest and game management lands, Jim noted that they would like to encourage recreational use, and on parcels adjacent to public roads, provide informal parking areas with paths leading to the shoreline. Jim also explained that one thing that was important for the CCL and American Rivers was the lands along the lower Saluda River. He continued to note that they would like all

SCE&G owned lands along the river that are not required for power production to be classified as natural/recreation lands.

Jim concluded the presentation and the TWC began to discuss the topic. Steve noted that he would like to see the Recreation TWC make a recommendation to the Lake and Land TWC on shoreline protection. Dave asked what the recreation focus group hoped to gain by sending this from the Recreation TWC to the Lake and Land Management TWC, instead of simply issuing it from the focus group. Jim responded that they hoped that if it was sent from the Recreation TWC it would have a greater weight with the Lake and Land Management TWC.

Tommy Boozer pointed out that there were many things in the presentation that were similar to what has already been recommended, however, it eliminates SCE&G's ability to make revenue off of land sales. Dave noted that he was concerned that sending the proposal from the TWC would imply that it has SCE&G support. Randy Mahan pointed out the he did not see a problem with the Recreation Management TWC sending this on to the Lake and Land group, however recommending it for adoption would not be something the whole group could agree to. Jim replied that they were not looking for the group to endorse this proposal in its entirety; it would be more of a procedural motion than a substantive motion.

Dick Christie asked if the Recreation Management TWC could add caveats to the proposal for clarification. Dick also noted that during the scoring process in the natural resources subcommittee, the tracts were often scored 1-5 based on their proximity to a road and not necessarily if they were adequate for hiking, birding, and fishing. Dick further suggested that it be clarified that these tracts may have recreation potential, possibly unevaluated potential.

Jim clarified that he believed as long as the potential was there it was important to conserve the lands. He noted that the lake was a great public resource and he was concerned that it was becoming a closed, private lake. Steve Bell noted that at some point there are going to be no more places to build on the lake, so why not stop at this point.

Tommy presented information on SCE&G's proposal to the group (presentation is attached to the December 14, 2007 and January 22, 2008 meeting notes). There was discussion on docks and Randy noted that SCE&G would prefer to allow individuals to choose whether they would prefer a common dock, multi-slip or individual dock. The group also discussed the proposed dock policy on forest management lands.

After lunch the group went through the Recreation Focus group's proposal. Dave noted that it was up to the focus group as to whether they wanted to send this to the Lake and Land Management TWC as is, or try to find some common ground with the Recreation Management TWC. The group discussed making multi-slips mandatory over individual docks. Tommy pointed out that there are incentives in SCE&G's proposal that would encourage a developer to put in multi-slips.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TWC

SCE&G Training Center
February 20, 2008

Final acg 4/15/08

The group continued discussions on the Recreation Focus Group proposal and discussed the identification of recreation areas. Dave noted that they had discussed a map that identifies recreation areas. Tommy explained that they currently have signage from the property owner's side identifying fringelands, but not from the lake side. The group discussed the best ways to identify recreation lands. Joy Downs noted her concern with publishing and encouraging the use of fringelands in front of back property owners. Dave Landis suggested accentuating the lands that should be encouraged for public use. Dave Anderson noted that the compromise would be to not publicize the fringelands, or place them on a map, but to let the public know they are available for use. Steve Bell suggested marking the trees. Tommy noted that putting signage up was a maintenance issue.

Collectively the group edited the memo proposal from the Recreation Focus Group. With some minor modifications the group could send it to the Lake and Land Management TWC with neither endorsement nor objection, noting that the Recreation Management TWC has addressed it, and edited it as a group. Randy added that an official recommendation from the TWC implies consensus. SCE&G, being a member of the TWC, does not believe that this recommendation is best, and that stopping all land sales goes too far. Dave noted he would draft up a memo that included the Recreation Focus Group's proposal.

The group also discussed lake level recommendations. Dave addressed Steve Bell and asked if a compromise had been reached on lake levels. Steve noted that the recommendation as provided by Lake Watch would be to have an optimum of 356 to 354.
The group discussed and modified the TWC recommendation. Joy Downs noted that there was specific wording in the LMA recommendation that could be used. The group worked to incorporate the wording from LMA into the recommendation. It was also suggested that the LMA lake user survey be referenced in the recommendation. Dave noted that he would make the recommended changes and send it back out to the group.

The group briefly touched on the coldwater trout fishery. Dave noted that the recommendation was not very extensive. After discussion, the group decided to leave the document fairly unchanged, with a few edits to the title and to the specific wading flows.

The group wrapped up discussions and Dave pointed out that the next meeting would be on March 3.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RECREATION MANAGEMENT TWC

SCE&G Training Center
March 3, 2008

Final acg 8/11/08

ATTENDEES:

Alison Guth, Kleinschmidt Associates	Dave Anderson, Kleinschmidt Associates
Randy Mahan, SCANA Services, Inc.	Mark Davis, SCPRT
Bill Argentieri, SCE&G	Malcolm Leaphart, TU
Tommy Boozer, SCE&G	Steve Bell, Lake Watch
Alan Stuart, Kleinschmidt Associates	Dick Christie, DNR
Joy Downs, LMA	Tony Bebber, SCPRT
Jim Cumberland, CCL	Vivianne Vejdani, SCDNR
Suzanne Rhodes, SCWF	Bill Marshall, LSSRAC, SCDNR

MEETING NOTES:

These notes serve as summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson opened the meeting and noted that the main purpose of the meeting was to review the draft Recreation Plan and Tommy Boozer would lead discussions on specific recreation sites included in the plan. Dave noted that the group would also review the trout fishery and lake level recommendation. Dave further explained the main meeting purpose would be to provide a forum to clear up any questions with the plan. It was noted that any written comments or alternative proposals were due by March 14th.

Tommy began the presentation on existing, future and proposed recreation sites. During the review, it was noted that the terms “existing”, “undeveloped” and “future” recreation could get confusing. It was also suggested that the terms “existing informal” and “existing undeveloped” recreation be used. The group reviewed through Park Site and Bundrick Island. Tommy noted that at Bundrick Island, their current plans are to leave it as it is. Steve Bell noted that he believes Bundrick Island would be a good area for parking and passive recreation.

Tommy continued to review the existing recreation sites and future recreation sites (those sites that have been classified for recreation but are not yet developed at this time). The group reviewed Shull Island and it was noted that it was one of the most heavily used facilities on the lake. As the group continued to review through the sites, the group reviewed Dreher Island State Park. Tommy noted that Dreher Island State Park would be a good site for a larger marina. Tommy also explained that Long Pine recreation area would be a good place for nature trails. The group also discussed the islands, and lower Saluda River. It was noted that 9 miles of the lower Saluda river shoreline was in the state scenic river program. Tommy described Metts Landing and it was noted that this was one of the few areas on the LSR that one can put in a boat with an outboard motor. Tommy also explained that there were additional areas on the lower Saluda that were proposed for future recreation sites. It was noted that there was a proposed area along Candy Lane that would be a good take-out for canoes and kayaks above the Millrace rapids.

Steve Bell asked if the sites that are designated for future development in the relicensing will be developed right away. Dave noted that they would not be developed within the first 10 years; however they will be reevaluated during the 10 year review.

In review, Tommy presented a table of existing park sites, existing future development park sites and proposed future development park sites. After the presentation, Dave went through the recreation plan with the group. The group reviewed through each of the existing sites noting improvements or changes, as well as the existing sites for future recreational development. After reviewing the sites, Steve noted that he would like to see signage placed on future recreation sites. Tommy noted that they would be identified on a map.

After lunch the group discussed the trout fishery recommendation. The group reviewed through the document and discussed changes. Malcolm Leaphart of Trout Unlimited had made a few changes to the document and the group discussed those. Dave explained that when discussing protecting the trout fishery, this memo looks at the human side of the resource rather than the ecological side. The group continued to edit the document and Dave noted he would clean it up and send it around for final comments. It was explained that it would be included in a memo issued to the Fish and Wildlife RCG as well as SCE&G on the Recreation TWC's recommendation on how to protect the trout fishery.

The group also discussed the lake level recommendation. Dave asked the group how the recommendation will account for minor fluctuations in water levels. It was noted that the recommendation would simply be an input for the model and not account for fluctuations. LMA and Lake Watch expressed that the model input should include a minimum of 354' Plant Datum (PD), with a preferred level of 356' PD.

During discussions, Steve also recommended that a white paper be written by SCE&G on how the lake level is managed, and what levels would be of concern.

As the group closed, Dave reminded everyone that written comments or emails on the Recreation Plan were due by March 14th. Steve noted that they would like to provide comments on the recreation plan regarding lake level fluctuations. Steve also noted that he believed safety issues should be referenced in the Recreation Plan.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO RELICENSING PROJECT
RECREATION TECHNICAL WORKING COMMITTEE MEETING

SCE&G Training Center
March 20, 2008

final JSH 3-24-08

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates
Dave Anderson, Kleinschmidt Associates
Dick Christie, SCDNR
Bill Marshall, SCDNR
Jim Cumberland, CCL
Tommy Boozer, SCE&G
Malcolm Leaphart, Trout Unlimited
Tony Bebber, SCPRT
Alison Guth, Kleinschmidt Associates
Vivianne Vejdani, SCDNR
Tim Vinson, SCDNR
Steve Bell, Lake Watch
Joy Downs, Lake Murray Association
Randy Mahan, SCE&G

DATE: *March 20, 2008*

ACTION ITEMS

- Seek additional sites nearby as well as the additional parking for Larry Koon Landing
SCE&G
- Develop a list of agency proposals and cost estimates to be included in the Recreation Plan
Dave Anderson
- Send Dave Anderson proposals on buffer zones
Steve Bell and Jim Cumberland

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Dave Anderson of Kleinschmidt Associates opened the meeting and welcomed everyone. He noted that the purpose of today's meeting was to have a true working meeting to discuss and address comments on the draft recreation plan. He explained that he wanted to go through each recreation site in the plan to discuss individual comments.

SCE&G's Public Recreation Sites

Larry Koon Landing
The group began discussing issues with SCE&G's Larry Koon Landing recreation site. It was noted that people would park at the Shull Island site if there were no available parking spaces at

Kleinschmidt
Energy & Water Resource Consultants

Larry Koon Landing. There was discussion on the need to figure out how to alleviate congestion at Larry Koon Landing. Tommy noted that there was a lot of opposition to development of this site and explained that they could implement a buffer zone. Tommy noted that there is a pine beetle problem at this site, which means that there would be very few trees. Steve Bell asked if the county or the residents in that area would come into agreement about developing it into a park. Tommy noted about 15 years ago the county wanted to put tennis courts in this area and there was so much opposition to it that they did not build them. Steve noted that maybe the homeowners could come into an agreement about putting in some sort of walking paths. Steve asked how many additional parking spaces would be needed for Larry Koon. Tim Vinson noted that overflow parking will work. Tony Bebber suggested making an action item for Larry Koon to seek additional sites nearby as well as the additional parking for this recreation area. Steve noted that if Larry Koon is getting crowded, then SCE&G may want to look at developing Bundrick Island. Tony noted that Shealy Tract and Shealy Point would be the next closest recreation site. Dick Christie noted that five acres should be set aside as future recreation, even though it may not be high in priority for development at this point. Dave asked the group if this was an immediate need. Jim Cumberland noted that it is something that needs to be looked at fairly quickly.

There was discussion about widening the entrance/exit to the recreation area. Tommy noted that SCE&G could discuss options with the county and go from there.

Dave noted that the other issue was whether or not to put in a fishing pier. Tommy noted that there is not a lot of room for a pier and that people currently fish off the bank. He further explained that it probably would not be feasible because of the amount of activity at that site.

Shull Island

For the Shull Island recreation site, SCE&G is proposing to add picnic tables. The SCDNR is suggesting to pave and delineate the parking area. Jim and Joy Downs suggested incorporating impervious parking. Dave asked if overflow parking was provided offsite at Larry Koon, would it be more beneficial to take the parking away and make it just a boat ramp. Tommy noted that it is a good facility and the ramp does need to be widened a little bit.

Murray Shores

The group moved the discussion to Murray Shores recreation site and Dave listed SCE&G's proposal. Tommy noted that he looked into this proposal but the area is solid rock and there is no sewer nearby. Tim noted that if an ADA accessible fishing pier is built at this recreation site, then you will need access to get to it.

River Bend

Dave reviewed SCE&G's proposal for River Bend. SCDNR requested paving the overflow parking lot for that site. Tommy noted that this is one of the parks that camping is permitted in and SCE&G would like to have the overflow parking paved because it is typically used on the weekends.

Sunset

The group discussed suggestions and proposals for Sunset recreation site. It was noted that it was a well used site. Tony pointed out that there may be areas behind the site that could be used for overflow parking. Dave suggested that if the parking lot is paved and striped, then more spaces may be attained.

Hilton
The group then discussed the Hilton recreation site. Tony recommended making the ADA restrooms for this site a low priority. He explained that improvement or installation of ADA restrooms at other recreation sites should be a higher priority. Tommy noted that ADA restrooms will be included in any new parks that are built as long as there is a sewer near the site. Dick mentioned that he thought there was some kind of ditch that catches runoff from this site and directs it into Lake Murray.

Dam Site
The group discussed the Dam Site recreation area. Dave asked if this recreation area received most of its use from people using the boat ramp and picnic area. Tommy noted people will use the boat ramp and will come back later that day to picnic at this site. Tommy explained that after looking at the expansion, they have created a wide enough space for people to get out of this area. Tommy noted that starting April 1st people will have to pay a fee to use this site. Tommy explained that if they get there before 10 am or after 8 pm they won't have to pay. Dave noted that the other recommendation for this site is providing a paved path to the restrooms. There was a brief discussion on rehabilitating the floating courtesy dock and fishing pier to allow deep water access down to 345'. Tommy noted that this may not be possible. Tommy explained that there is 8-10 ft of water right now and SCE&G is not able to put a floating dock out there at this time. He added that the dock needs to be repaired.

Higgins Bridge
Dave briefly explained the proposals for Higgins Bridge. Dave asked if paving the access drive to this recreation area was something that SCE&G could do. Tommy noted that SCE&G does not own it, it is a private road. Dave asked if the agencies wanted to designate this site as a canoe portage. Dick noted that SCDNR is not set on designating it as a canoe portage, but that area could be emphasized for paddling. He added that they are not proposing to eliminate outboard motor boats. Dick further proposed to restrict upstream development for boat access. He explained that if any upstream access is made, it should be designated as canoe portage.

Kempson Bridge
Tommy noted that it would cost more in comparison to other recreation sites to make Kempson Bridge ADA compliant because of the slope. Tommy explained that he would rather pick another recreation site and concentrate on that because this area is too challenging. Dick asked if a courtesy dock would be feasible. Tommy noted that because of the slope at this site, it would be too difficult to make the dock ADA compliant.

Clouds Creek
Tony noted that his only comment was to make sure parking was sufficient so canoe trailers could turn around in this site.

Little Saluda Point
It was noted that more acres would be added into the property, which is to be completed in the first five years.

Shealy Point
Steve suggested adding public access around this area. It was noted that back property will be added into the project, and public access is something that can be evaluated .

It was noted that all of the formal improvements will take place within the first 10 years of the new license as proposed by SCE&G.

Other Sites on Lake Murray
The group discussed future recreation lands, which include Shealy Recreation Area, Craynes Bridge, etc. It was noted that there are existing sites with no plans. The group discussed these sites in reference to comments by SCPRT. It was noted that there is a possibility of designating a spot near Dreher Island as mooring for sailboats. Steve suggested getting away from any sort of designation. Tony noted that because of the congested area at the upper end of the lake, it seems that Bundrick Island may need to be developed into some sort of a recreation area. Tommy recommended leaving Bundrick Island undeveloped, so boaters are able to enjoy it. Randy Mahan noted that SCE&G may have to put some sort of restroom facilities out there. Tony suggested not putting in a boat ramp at this site.

Mett's Landing
Tim noted that for Mett's Landing, SCDNR suggests incorporating some sort of designated fishing area away from the ramp. Bill M. noted that this site receives a lot more use than Kempson's Bridge and suggested restroom facilities at this site. Dave suggested costing out the addition of a bathroom to this site, take it to Lexington County, and let them know we have identified the need.

Gardendale
The group began discussing SCE&G's Gardendale recreation site, and it was noted that SCE&G would like to lease this site to the Irmo-Chapin Recreation Commission. Jim asked if enhancements to this site would be paid for by SCE&G. Dave noted that it would be negotiated and that there would be cost sharing opportunities. Malcolm noted that if the ramp was widened, then it would be easier to carry in a canoe. Randy noted that the only problem is if it is in the scenic river easement, it would have to have a 100 ft setback. Bill M. noted that if recreational flows were provided by SCE&G, the use numbers will go up for this site.

Twelvemile Creek
It was noted that this site is proposed to be a riverside park, but at the moment it will be placed in recreation and developed later.

Candy Lane
Dave discussed the proposal for this site and noted that there would be a takeout area provided for this recreation site.

It was recommended by SCDNR to add another bank access area for deep water fishing upstream around Sandy Beach. They would also like to add an ADA accessible fishing pier downstream of existing ADA fishing pier at Saluda Shoals. Malcolm noted that there doesn't seem to be a need for another ADA fishing pier. Dave noted that realistically, if a handicapped individual parks in the parking lot, they will probably not want to go very far to get to a fishing pier.

Malcolm asked about opening up the area by the spillway and Randy noted that they would not be able to open up Project works property.

Dave asked the group if there were any more items to discuss on the areas inside the Project Boundary Line. Jim asked if there were any other company owned lands on the LSR. Dave explained that in the focus group proposal, they suggest reclassifying all project lands on the LSR as recreation and wanted to know if there is any benefit to classifying it as such. Dick noted that SCDNR recommends widening the buffer zone.

Malcolm noted that he feared development around the LSR and would like to put the lands around the LSR in a protected status. Randy noted that for the most part it is in a protected status and 90 plus percent of what SCE&G owns is in the State Scenic River classification.

Steve recommended putting a 200 ft buffer zone on the river. Malcolm noted that he agreed with Steve, because he does not want what happened on the lake to happen on the river. Randy explained that with the scenic easement, property owners must take care of the shoreline. Dick noted that SCE&G could possibly classify all the properties on the LSR as recreation. The group discussed classifying the lands according to the Shoreline Management Plan (SMP) classifications. Dick noted that by formally classifying the lands around LSR, SCE&G would gain credit and also protect the lands. The group continued discussing classification of LSR shorelines and it was agreed that verbiage on land classification should be added to the SMP. It was also agreed that the lands would be dealt with in the recreation plan as properties.

Steve noted that this group has looked at formal recreation sites, but have not looked at other project lands and their values as far as recreation. Steve noted that this committee needs to discuss and evaluate the need to do more with these informal recreation sites. Steve noted that this committee needs to evaluate whether these areas are important, whatever is necessary to ensure that the public has use of the shorelines, and can enjoy it without too many private amenities. He recommended setting up a time and agenda for having a meeting to discuss these issues. Dave noted that these issues should have been discussed under the Lake and Land Management Technical Working Committee. Steve noted that he thinks this committee should be dedicated to looking at recreation. He explained that he thinks there are a lot of recreation areas that have not been looked at, so the group needs to evaluate them and the access to shoreline. Tommy noted that SCE&G is coming up with a plan that is significant to recreation. Steve noted that he has concerns about buffer zones and widening the buffer zones and spacing of docks. Dave noted that the mission statement of the group does not include these issues. Dave noted that if there are specific properties that a group member is concerned about then they should identify those and bring them forward. Dave noted that an action item for Steve and Jim is to go through the issues and make a proposal to SCE&G. Dave noted that he would like to see these issues as soon as possible, as they will be putting together costs in the near future.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
LAKE AND LAND MANAGEMENT TWC

SCE&G Training Center
June 10, 2008

final ACG 8-11-08

ATTENDEES:

Alan Stuart, Kleinschmidt Associates
Alison Guth, Kleinschmidt Associates
Tommy Boozer, SCE&G
David Hancock, SCE&G
Regis Parsons, Landowner
Ron Ahle, SCDNR
Randy Mahan, SCANA Services
Dick Christie, SCDNR
John Frick, Landowner
Jim Cumberland, SCCCL
Amanda Hill, USFWS
Mike Summer, SCE&G
Bob Perry, SCDNR
Steve Bell, LW
Bill Argentieri, SCE&G
Tony Bebber, SCPRT
Van Hoffman, SCANA
Phil Hamby, Landowner
Mark Davis, SCPRT
Vivianne Vejdani, SCDNR
Roy Parker, LMA
James Leslie, Lake Murray Docks
Suzanne Rhodes, SCWF
Dave Anderson, Kleinschmidt Associates
Tim Vinson, SCDNR

DATE: June 10, 2008

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan opened the meeting and noted that the purpose of the meeting would be to review the new proposal for future development lands and rebalancing that was being presented by SCE&G. Alan explained that SCE&G had given consideration to the proposals that had been presented thus far by stakeholders for rebalancing.

Randy Mahan began with the introduction to the presentation. He noted that he hoped that the group would find that SCE&G had listened to what has been requested. Randy further noted that although this proposal may not satisfy the desires of everyone, he hoped that this would help them achieve a consensus. Randy further explained that, considering all of the competing desires, SCE&G feels that this is the best that they can do, and what they will submit to the FERC. As the lake and land issues were also tied in with other issues in the relicensing, Randy noted that if for some reason a comprehensive settlement is not reached, then there may be some push-back from management on the level proposed in this current plan.

Tommy Boozer and David Hancock began the presentation. David noted that in reference to rebalancing, they would be proposing both Project and non-Project lands. David initially began by showing the total number of acres that SCE&G was proposing to protect, which was 9204.24 acres and 184.74 miles of shoreline.

David then began explaining how this number was achieved. He noted that this included current Project lands, which are future development lands, recreation lands (both Project and non-Project), lands inside the PBL on the LSR, and large, non-Project lands adjoining the lake. To begin, David discussed Project lands for future development. David reviewed the current management prescriptions and the current acreage and shoreline miles associated with the prescriptions. He also pointed out that there were currently 763.61 acres of land associated with public recreation, which included the islands.

The group also reviewed the future development lands spreadsheet that was utilized during the rebalancing exercises. David noted that 299 tracts were evaluated during the process. Of the 299 tracts, David pointed out that SCE&G was proposing that a portion or all of 83 tracts go to natural areas, a portion or all of 15 tracts go to recreation, and a portion or all of 14 tracts go to Forest Management.

The group reviewed several tables depicting what was proposed and what the current numbers were for the particular land classifications. David again point out that this was strictly evaluating only the future development lands inside the PBL, which was evaluated during the rebalancing exercise.

Next, Tommy began to discuss the recreation lands with the group. He presented the group with a brief recap of current recreation lands that included existing developed sites, and those set aside for recreation that were yet undeveloped. Tommy also listed the acreage and shoreline miles associated with each site. The islands on Lake Murray were also included, along with the lands that were on the lower Saluda River.

After the review of the current recreation sites, Tommy reviewed the proposed recreation sites with the group. Tommy explained that there were a few sites, such as Sunset, where they were proposing to add property that was outside the PBL into the Project for recreation. The group reviewed the aerial views of each tract and Tommy presented the group with a summary of the proposed future recreation sites. Tommy also briefly reviewed the Lake Murray state and regional parks. In reference to Bundrick Island, he noted that their proposal is to currently leave it as it is. At some future date, Tommy explained, this island may be developed a little more with parking and such.

Tommy also discussed the SCE&G Saluda River Property, which include scenic river easements and SCE&G properties. Tommy explained that in the late 1980's, SCE&G placed much of the LSR shoreline that they owned into a Scenic River Easement. Tommy noted that SCE&G is further proposing to classify 14 tracts, totaling 275.14 acres, plus the 45.04 acres already in the Scenic River, as recreation. It was pointed out that this would bring the grand total of these tracts to 320.18 acres along the Lower Saluda River.

The next item the group discussed was non-Project timber tracts. Tommy explained that SCE&G plans to continue to manage the timber on these tracts under the BMPs; however they are proposing to lease these tracts to SCDNR for the life of the license. Tommy continued to note that DNR could put these parcels into the WMA, and all but one of these tracts were adjacent to the lake. Bill Argentieri pointed out that these areas were outside the Project boundary; therefore, SCE&G was not proposing to bring them into the Project boundary. Ron Ahle noted that DNR currently has WMA leases on much of these lands. Randy replied that those leases can be pulled within 30 days, and this proposal was granting a lease for the life of the license.

The group again reviewed the summary tables showing the acreage and shoreline miles associated with the proposal, showing how the 9204.24 acres was achieved.

After a short break the group discussed what recommendations from stakeholder groups SCE&G has incorporated into the proposal for future development lands. Tommy also pointed out that the proposal for the future development lands does not apply to easement property.

Tommy reviewed a few of the recommendations, which are listed below.

- Increase Lot Size
- Multi-slip docks in lieu of individual docks
- Non disturbance buffer zone
- Establish a full 75' Buffer Zone
- Establish Natural Areas
- Restrict development within the PBL
- Protect additional Forest Management & Recreation Lands
- Manage remaining Future Development Property under restrictive and protective plan
- Dock Policy for Forest Management Lands
- Support Hunting by participating in the SCDNR WMA program
- State Park on the Lexington Side of Lake Murray
- Protect property on Lower Saluda River
- Provide additional recreational properties on Lake Murray and the lower Saluda River
- Update and improve existing Park Sites

Tommy then explained the land sales and dock permitting policies that were being proposed for the remaining future development lands. The group reviewed through these policies and commented. Tommy pointed out that there were requirements for a multi-slip dock if the landowner had over 400 ft of shoreline. However, there was still flexibility for exceptions if the landowner only wanted a single dock on the property, as opposed to a multi-slip. The group also reviewed figures depicting the proposed policy. It was noted that SCE&G was proposing that deed restrictions be placed on the property that would not allow development below the PBL and require special vegetation protection and maintenance conditions on purchased property. Ron pointed out that he believed the true value of this proposal was the deed restriction that was placed on this area above the 75 ft. Ron also noted that there should be a definition for limited brushing. Ron further suggested using the current criteria for limited brushing that was in the Buffer Zone management plan that was approved by the FERC.

There was some concern that was expressed regarding the enforcement of the deed restrictions. Randy explained that the restrictions would be tied to the property itself and SCE&G would have the enforcement authority because the de-vegetation were to the detriment of the company.

The group continued to ask questions regarding the proposal, and Suzanne Rhodes asked if boat lifts would be permitted. David noted that they were still in discussion regarding this issue as they were having some problems with common dock owners and boatlifts. As the group continued to ask questions, Randy pointed out that SCE&G would prefer to send this out to the TWC to review and comment on; however, he believed that it may be a little premature to place on the website. Randy noted that they would like the TWC members to go to their constituents to discuss the proposal; however it was important to point out that this was still being discussed and reviewed.

Phil Hamby asked if the back property owners behind the property that changes were proposed on had been notified. If they have not been notified, Phil noted that he believed that this presentation should be placed on the website. Randy noted that this presentation would be placed on the website at some point, however not until there was more discussion among the group. Regis Parsons and Phil noted that they believed that it was very tough for an individual property owner to have a say in the decisions of the TWC. Dick Christie asked the group to keep in mind that this was at minimum a 5 year process, where they were closing in on the first 3 years, where a stakeholder group has made a recommendation that is going to go to FERC. Dick further explained that FERC will conduct its own evaluation where input from individuals would also be taken account through scoping meetings.

John Frick noted that he believed that there were a lot of designations on the lake that were not appropriate, such as areas that are classified as shallow coves, when he considers that they are not shallow coves. On the issue of sensitive areas, Ron added that classifying the ESA areas has been a dynamic process, and changes have been made when discrepancies were found.

After lunch, David noted that there needed to be one correction to the spreadsheet; FDID 337 was supposed to be classified as natural areas. Therefore, all of the numbers needed to be updated and the spreadsheet would be re-sent out.

Steve Bell noted that he needed to bring this proposal back to his organization. Alan concurred and noted that they would certainly like to get comment on the proposal into the record.

Bill then noted that the SCE&G technical services and fossil hydro management has asked that an acknowledgement sheet be passed around for individuals to sign to acknowledge that they will take this proposal back to their constituents. Bill further noted that signing this document would not be an agreement to the proposal, simply an acknowledgement that the individual would bring it back for consideration.

Ron noted that there may be more detail that the group needed to consider, such as the protection of the lands above the 75 ft to the PBL. Ron further noted that he would need to know that the deed covenants have enforceable rights, and what is going to be maintained and allowed in these areas. Ron added that he believed that the best approach may be to take the plans that have already been developed and apply them to this land.

Jim Cumberland also asked if permanent structures could be further defined and Tommy noted that they would put together a list on what was prohibited. Phil also asked if there was a way to see how the value of a dock was offset by the lack of a lake view. Phil added that this was a significant devaluation of the property. Tommy pointed out that the current status of the land was non-disturbance. He further pointed out that the property may not have a view, but there was still lake access.

Phil further asked if there has been any consideration for a compromise between non-disturbance and limited brushing. Randy noted that that is what they had in place before, however the FERC ruled that there should be total non-disturbance. Phil noted that he does believe there is quite a bit of public access being proposed that far exceeds what is needed. Tommy noted that although it is a good point, they were looking at access for the next 30 or 40 years. Phil also noted that providing the public with access to restaurants, coffee shops, and bed and breakfasts on the lake was an important component as well, that may not be available with new restrictions.

Alan then asked the group if there were any further comments on the proposal that was presented. Jim Leslie added that he believed the concept of limited brushing from the 75 ft setback to the PBL was a good plan. Steve noted that he believed the proposal was something that he would take back to the group for consideration. Randy replied that they understood that there were specific aspects that individuals are not going to be agreeable to. Jim Leslie noted that although he would not like to see any more fringelands sold, if SCE&G was going to sell land, he believed this was a good way to do it.

Alan noted that the group would see preliminary recommendations in the license application in some areas such as instream flows. However this will all be tied together as the group goes through settlement negotiations, which will probably begin in August or September.

The group brought discussions to a close and decided that the TWC would reconvene to discuss this proposal on July 14th. Specific information requests on the proposal were due to Alison by June 24th.

APPENDIX C

RECREATION RESOURCE CONSERVATION GROUP WORKING DOCUMENTS

Recreation Resource Conservation Group

Working Documents

December 11, 2008

Recreation Resource Conservation Group Work Plan

FINAL

Facilitator:		
Dave Anderson	Kleinschmidt Associates	dave.anderson@kleinschmidtusa.com
Members:		
Name	Organization	E-mail
Alan Axson	Columbia Fire Department	cfdwaxson@columbiasc.net
Alan Stuart	KA	alan.stuart@kleinschmidtusa.com
Alison Guth	KA	alison.guth@kleinschmidtusa.com
Amanda Hill	USFWS	amanda_hill@fws.gov
Bill Argentieri	SCE&G	bargentieri@scana.com
Bill Marshall	Lower Saluda Scenic River Advisory Council, DNR	marshallb@dnr.sc.gov
Charlene Coleman	American Whitewater	cheetahtrk@yahoo.com
Charles (Charlie) Rentz		flyhotair@greenwood.net
David Hancock	SCE&G	dhancock@scana.com
Dick Christie	SCDNR	dchristie@infoave.net
George Duke	LMHC	kayakduke@bellsouth.net
Gerrit Jobsis	Coastal Conservation League & American Rivers	gerritj@scccl.org; gjobsis@americanrivers.org
Guy Jones	River Runner Outdoor Center	guyjones@sc.rr.com
Irvin Pitts	SCPRT	ipitts@scprt.com
James A. Smith	LMA	bkawasi@sc.rr.com
Jeff Duncan	National Park Service	jeff_duncan@nps.gov
Jennifer O'Rourke	South Carolina Wildlife Federation	jenno@scwf.org
Jennifer Summerlin	Kleinschmidt Associates	jennifer.summerlin@kleinschmidtusa.com
Jim Devereaux	SCE&G	jdevereaux@scana.com
JoAnn Butler	resident	jbutler@scana.com
Joy Downs	Lake Murray Assn.	elymay2@aol.com
Karen Kustafik	City of Columbia Parks and Recreation	kakustafik@columbiasc.net
Keith Ganz-Sarto		keith_ganz_sarto@hotmail.com
Kelly Maloney	Kleinschmidt Associates	kelly.maloney@kleinschmidtusa.com
Larry Michalec	Lake Murray Homeowners Coalition	lmichalec@aol.com
Larry Turner	SCDHEC	turnerle@dhec.sc.gov
Leroy M. Barber Jr.	LMA	lbarber@sc.rr.com
Malcolm Leaphart	Trout Unlimited	malcolml@mailbox.sc.edu
Mark Leao	USFWS	mark_leao@fws.gov
Marty Phillips	Kleinschmidt Associates	marty.phillips@kleinschmidtusa.com
Michael Waddell	TU - Saluda River Chapter	mwaddell@esri.sc.edu
Miriam S. Atria	Capitol City Lake Murray Country	miriam@lakemurraycountry.com
Norman Ferris	Trout Unlimited	norm@sc.rr.com
Patricia Wendling	LMA	wwending@sc.rr.com
Patrick Moore	SCCCL AR	patrickm@scccl.org
Ralph Crafton	LMA	crafton@usit.net
Randy Mahan	SCANA	rmahan@scana.com
Richard Mikell	Adventure Carolina	adventurec@mindspring.com
Stanley Yalicki	LMA	joyyalicki@aol.com
Steve Bell	Lake Murray Watch	bellsteve9339@bellsouth.net
Suzanne Rhodes	SC Wildlife Federation	suzrhodes@juno.com
Tim Vinson	SCDNR	vinsont@dnr.sc.gov
Tom Brooks	Newberry Co.	tbrooks@newberrycounty.net
Tommy Boozer	SCE&G	tboozer@scana.com
Tony Bebber	SCPRT	tbebber@scprt.com
Van Hoffman	SCANA Land Mgt.	vhoffman@scana.com

Recreation Resource Conservation Group Work Plan

FINAL

Mission Statement

The mission of the Recreation RCG is to ensure adequate and environmentally-balanced public recreational access and opportunities related to the Saluda Hydroelectric Project for the term of the new license. The objective is to assess the recreational needs associated with the lower Saluda River and Lake Murray and to develop a comprehensive recreation plan to address the recreation needs of the public for the term of the new license. This will be accomplished by collecting and developing necessary information, understanding interests and issues, and developing consensus-based recommendations.

Identified Issues

- ensure that recreational facilities and opportunities are protected and enhanced for current and future users, on and near the lake and river
    - boating access, including future access on Lexington side of lake
    - non-boating access
    - paddling access
    - security at recreation facilities
    - sufficient egress points on lower Saluda River
    - fishing opportunities for non-boaters
- conservation of lands
    - protect the scenic integrity of the Project
    - provide wildlife habitat areas
    - provide formal and informal (impromptu areas) recreational opportunities
        - consideration of special recreation designation areas classification (e.g., Two Bird Cove and Hurricane Hole)
- using the concept of adaptive management in future recreation planning
- river flows
    - safe recreational opportunities should be available on the lower Saluda River through daily flow release schedules and consensus-based flow rates
    - lack of <u>scheduled</u> recreation flows for the lower Saluda River
    - management of river flows to improve safety for river users (coordinate with Safety RCG)
    - minimum flows to provide for recreational navigation and to protect and enhance aquatic life in river (coordinate with Fish and Wildlife RCG)
- lack of a communication system that would encompass information to better inform the public of existing and projected conditions regarding lake levels and river flows as related to anticipated hydro operations and maintenance
- protection of the cold water fishery on the lower Saluda River
- impacts of lake level on recreational use of the lake
- consideration of The Lower Saluda River Corridor Plan and the Lower Saluda Scenic River Corridor Plan Update and their related public access sites and greenway-trail concepts

RCG Responsibilities

- Utilizing and modifying the Standard Process for evaluating and addressing recreation management and access issues specific to the Saluda Project, including developing a vision statement for the Project.
- Identifying specific areas where lake and river levels, river flows, and/or lake and river level fluctuations may be adversely affecting recreation including the nature and timing of the effect (e.g., access to sections of water, access to facilities, and aesthetics).
- Working with the Operations Resource Conservation Group to identify "reasonable" (based on hydrologic, structural, and other limitations identified) changes in Project operations that would benefit recreation.
- Working with appropriate RCGs to coordinate actions on issues of mutual interests such as river flows, lake levels, conservation of lands, and the siting and management of recreational facilities.
- Identifying any studies, if applicable, that need to be performed for identifying and/or evaluating (1) changes to Project operations, (2) enhancements to existing facilities, and (3) creation of new facilities to provide for public recreational access and opportunities.
- Presenting a range of reasonable alternatives or recommendations to the Saluda Hydro Relicensing Group (SHRG) regarding modifications to facilities or current Project operations, and provide recommendations for future recreation access and facilities.

Tasks and Products

- **Task 1 –** Utilize the stepwise process diagram and solution principles to guide the planning process for addressing recreation management issues at the Saluda Project.
    - Final Process Diagram and Solution Principles
- **Task 2 –** Develop a Vision Statement for the Saluda Project.
    - Final Vision Statement
- **Task 3 –** Review the operational constraints and current operations of the Saluda Project (see Initial Consultation Document).
- **Task 4 –** Answer the list of questions on the Standard Process Form in order to characterize the existing and potential future condition of access and lake levels and river flows – from a recreation setting perspective.
    - Final Standard Process Form
- **Task 5 –** Review stakeholder requests for particular studies and/or enhancement measures to ensure that these are incorporated into study planning, if applicable
    - Final Study Plans and Possible Mitigation Measures
- **Task 6 –** Develop and recommend operation scenarios to the Operations RCG for analysis. These scenarios should reflect initial thinking on potential solutions and be designed to narrow the focus of Task 10 below. Analysis by the Operations RCG will focus on an assessment of potential recreational impacts associated with any suggested changes to operations.
    - RCG Recommendations
- **Task 7 –** Discuss results of the Operations RCG analyses.

- **Task 8 –** Develop study designs/methods/plans and review agreed upon studies, literature reviews, etc.
  - Final Study Plans
- **Task 9 –** Check the solution principles to ensure proposed study plans are consistent.
  - Final Study Plans
- **Task 10 –** Provide recommendations for Project operations and recreation access and facilities to be considered in conjunction with all ecological (including water quality), recreational, and safety issues.
  - RCG Recommendations
- **Task 11 –** Develop a consensus based Recreation Plan for the Saluda Project that addresses all of the issues and tasks identified above.
  - Final Recreation Plan

Schedule

Late 2005/Early 2006—Finalize Mission Statement, Standard Process Form, Solution Principles, and Work Plan
Mid-2006—Complete identification of studies, literature reviews, etc. that need to be completed to address issues and tasks identified in the Work Plan
Late 2006—Begin compilation of existing information, review preliminary study results, and draft an outline of the Recreation Plan
2007—Complete any studies identified in Task 8 and review results; draft recommendations to SHRG, complete draft Recreation Plan
2008—Finalize Recreation Plan and provide comments on Draft License Application

Possible Mitigation Measures to be Considered

- creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on the north bank of the river connecting Saluda Shoals Park to Gardendale Landing and Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek
- creation of a state park on the south side of the reservoir
- creation of a multi-lane boating facility that can accommodate large tournaments
- consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Hopes Ferry. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.
- consideration of conservation easements on large tracts of land within the PBL

Recreation Vision Statement for the Saluda Project

FINAL

The long-term vision for the Saluda Project is to recognize, protect, and enhance the fishery, water quality, aesthetic values, cultural resources, and public recreational opportunities on the reservoir and the lower Saluda River, while recognizing the need to protect habitat supporting threatened, endangered, and sensitive species of Lake Murray and the lower Saluda River, and ensure adequate facilities and public access are provided. Given the size of the reservoir/hydro-project area, it is felt that it can continue to support a diversity of recreation opportunities. Recognizing that needs and demands will change, recreational uses will be monitored and managed to balance access/uses with the protection of natural resources and environmental quality; and planning for new facilities and management schemes will remain adaptive to changes.

Recreational opportunities for Lake Murray and the lower Saluda River over the next 30 to 50 years of the pending new FERC license for SCE&G should incorporate the following attributes:

- Recreational sites and access areas on the lake and the river should be adequate to allow for the continued rapid population growth in the Midlands over the term of the new license based on surveys of the public and input from the stakeholders and public.

- Sites should be spaced around the lake and along the river corridor to provide legal public access to the different geographic sections of both.

- Uncrowded conditions should be available most of the time at the sites, with natural viewscapes and provisions for most of the current and anticipated popular recreational activities incorporated into the overall provisions.

- Patrols and/or assistance for emergencies should be provided, though not necessarily manned, such as adequate phone boxes.

- Safe recreational opportunities should be available for boaters on the lake with adequate lake levels for the navigational markers, and on the river with release levels that are not life-threatening to the average person.

- The recommendations of the Lower Saluda Scenic River Advisory Council should be implemented to reflect the broad community-based consensus for river access, with consideration of additional river access to areas where trespassing is now the only way to enter an area.

Improvements to be considered at the Saluda Project include:

- Evaluation of SCE&G-owned Project lands for possible reclassification for recreation activities.

- Providing appropriate operations and maintenance of public recreation facilities.

- Optimizing the capacity of existing public recreation facilities to accommodate existing and future demand.

- Improving access and safety in the public waters below the dam and minimizing impacts of project operations on downstream recreation, recognizing the need to meet power generation, and downstream flow responsibilities of Saluda.

- Managing lake level drawdowns so as to optimize safety and recreational opportunities.

- Managing river flows so as to optimize safety and recreational opportunities.

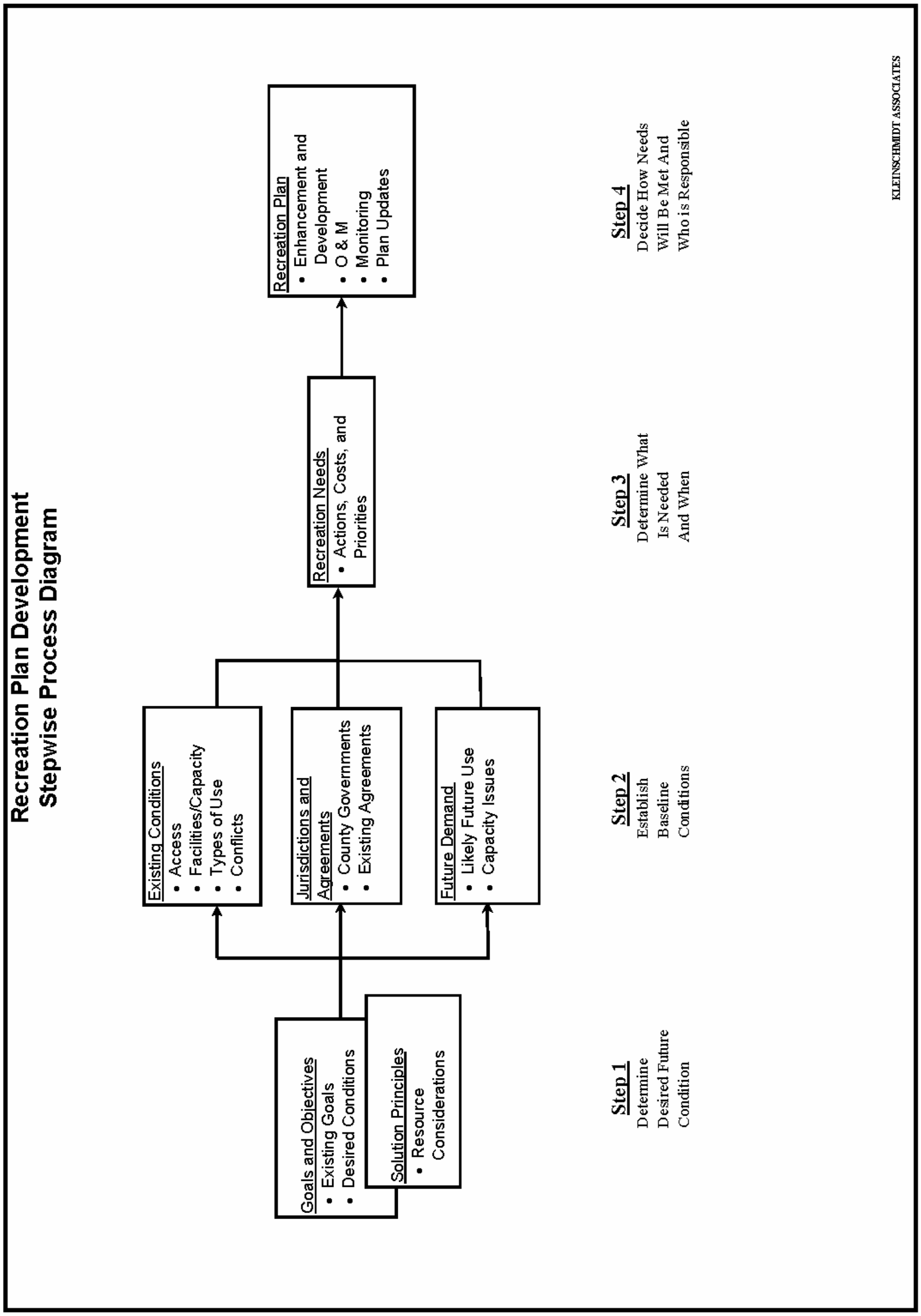
- Ensuring public access areas for the non-boating public remain available along the lake and river shorelines.

- Development of new facilities in accordance with the comprehensive plan as the need arises.

- Evaluation of other properties and potential partnerships as needed to meet the mission statement.

Stepwise Process Diagram

FINAL



Solution Principles

FINAL

Consideration of new recreational facilities should be based on demonstrated need and the potential impact on existing facilities.

1. Priority should be given to demonstrated need within the FERC project boundary.
2. Priority should be given to recreational proposals where multiple stakeholders offer significant participation.
3. Recreational facilities should appeal to a broad public.
4. Reasonable access for the disabled should be provided.
5. Recreational needs should be prioritized for the project including a schedule of proposed improvements so that all costs are not in the first few years of the new license.
6. The improvement or expansion of existing recreational facilities should be considered first.
7. Additional recreational studies (if needed) should be only of sufficient scope and duration to provide necessary information to develop issue solutions.
8. Consensus based solutions are preferred over studies, unless solutions cannot be developed with existing information.
9. A process should be developed to adjust proposed improvements over the 30+ year time frame approximately every 7 to 10 years to account for changing needs. This should include the ability to trade a new needed facility for a proposed (but not built) facility of approximately the same cost.
10. Sufficient “future recreational” land should be set aside now to handle the recreational needs of 30+ years.

Preferred consideration will be given to ideas that:

- do not promote facilities that would adversely impact existing commercial operations;
- identify actual recreational needs that are not filled by existing facilities;
- receive broad public support;
- expand existing recreational facilities prior to developing green field sites;
- require doing recreational studies only if consensus cannot be reached with existing information (It is preferred to put financial resources into recreational facilities and opportunities that benefit the overall Project, rather than fund unnecessary/subjective studies).

Standard Process Form

DRAFT

The following is a list of standard questions designed to help characterize existing recreation resources and aid in development of an appropriate recreation plan for the Saluda Project. Questions pertaining to recreation management are categorized according to the four-step recreation plan stepwise process diagram developed for the project. Questions pertaining to reservoir levels and downstream flows are listed following the facility management material.

<u>STEP 1 – DETERMINE DESIRED FUTURE CONDITION</u>

1. *Identify Lake Murray and/or Lower Saluda River (LSR) qualities important to keep and any qualities that need changes.*

Qualities to keep include the fishing, hunting, and wildlife watching opportunities associated with the Project. The presence of natural shoreline, islands, and riverbanks are aesthetically pleasing and promote a sense of solitude. The balance between public/private recreational access to the project should be maintained. The shoreline management program is an important means of protecting these qualities and should continue for the term of the new license. The safety and security of recreational users should also be preserved as part of the overall recreational experience. While the lake has good water quality at the present time, we should strive to maintain and improve the water quality of the lake.

There are other qualities that some stakeholders would like to change. These include the water level stability on the lake to provide year-round access to a majority of shoreline property owners. The quality of amenities and access should be improved for recreational users. The recreational experience on the lower Saluda River could also be enhanced by providing minimum flows to protect the health of the river. These flows should be targeted at meeting state standards for dissolved oxygen in the tailrace and river and providing aquatic habitat. The impacts of unscheduled releases from the Project should also be addressed through some combination of providing more predictable flows, managing the rate of water level rise, and/or improving the warning system on the river.

The Project should also continue to provide reasonably affordable, reliable energy to SCE&G's service area.

2. *Are there unique characteristics of Lake Murray and/or the LSR relative to other reservoirs/tailraces in the area?*

The location of Lake Murray and the lower Saluda River near the metropolitan area of Columbia, SC is a unique characteristic of the Project. Due to the extensive shoreline of the reservoir and the amount of Project lands, the Shoreline Management Plan provides a variety of recreational access. The reservoir is also relatively uninterrupted by bridges, unlike other lakes in the vicinity.

Other distinguishing characteristics of the Project include the purple martin habitat on Lunch Island and the trout and striped bass fishery and whitewater paddling opportunities in the lower Saluda River.

3. *What is the overall vision for Lake Murray and/or the LSR, in terms of recreation experiences and opportunities?*

The long-term vision for the Saluda Project is to recognize, protect, and enhance the fishery, water quality, aesthetic values, cultural resources, and public recreational opportunities on the reservoir and the lower Saluda River, while recognizing the need to protect habitat supporting threatened, endangered, and sensitive species of Lake Murray and the lower Saluda River, and ensure adequate facilities and public access are provided. Given the size of the reservoir/hydro-project area, it is felt that it can continue to support a diversity of recreation opportunities. Recognizing that needs and demands will change, recreational uses will be monitored and managed to balance access/uses with the protection of natural resources and environmental quality; and planning for new facilities and management schemes will remain adaptive to changes.

4. *Are there sensitive biological or cultural resources associated with the Project that need to be considered? Where are these resources located and are there seasonal sensitivities (e.g., nesting or spawning times, etc.)?*

There lands in environmentally sensitive areas that have been identified in the current shoreline management plans. There are also natural/undeveloped lands that provide valuable wildlife habitat.

There is some concern over migrating fish on the lower Saluda and Congaree Rivers. A unique cold water fishery also exists in the lower Saluda River. Rocky shoals spider lilies have also been located in the confluence area. There are also bald eagles, woodstorks, and purple martins in the vicinity of the Project.

Numerous cultural resources also exist in the Project vicinity.

Details about these resources will be described in the various resource conservation groups.

5. *Identify specific goals and objectives for managing recreation at Lake Murray and/or in the LSR.*

Recreational sites and access areas on the lake and the river should be adequate to allow for the continued rapid population growth in the Midlands over the term of the new license based on surveys of the public and input from the stakeholders and public.

Sites should be spaced around the lake and along the river corridor to provide legal public access to the different geographic sections of both.

Uncrowded conditions should be available most of the time at the sites, with natural viewscapes and provisions for most of the current and anticipated popular recreational activities incorporated into the overall provisions.

Patrols and/or assistance for emergencies should be provided, though not necessarily manned, such as adequate phone boxes.

Safe recreational opportunities should be available for boaters on the lake with adequate lake levels for the navigational markers, and on the river with release levels that are not life-threatening to the average person.

The recommendations of the Lower Saluda Scenic River Advisory Council should be implemented to reflect the broad community-based consensus for river access, with consideration of additional river access to areas where trespassing is now the only way to enter an area.

STEP 2 – ESTABLISH BASELINE CONDITIONS

6. *What is the nature of existing recreational access to Lake Murray and the LSR?*
    a. *How many publicly accessible, developed recreation sites are there?*

As of 2007, there are 14 SCE&G owned "Existing Recreation Sites" and 31 public marinas on Lake Murray.

As of 2007, there are 3 SCE&G owned "Existing Recreation Sites" on the lower Saluda River. There are an additional 2 public sites outside the project boundary (the Mill Race sites).

  b. *Where are they located/how are they distributed around the Project?*

See the Saluda Hydro Project Existing Recreation Sites Map

  c. *Of these publicly accessible access sites how many are owned and operated by public versus private entities and how are they supervised?*

2 of the SCE&G owned "Existing Recreation Sites" on Lake Murray are managed by other entities: Dreher Island State Park is managed by South Carolina Parks, Recreation and Tourism and Larry L. Koon Boat Landing is managed by the Lexington County Recreation and Aging Commission.

2 of the SCE&G owned "Existing Recreation Sites" on the LSR are managed by other entities: Saluda Shoals Regional Park is managed by the Irmo-Chapin Recreation Commission and Mett's Landing is managed by the Lexington County Recreation and Aging Commission.

The 31 public marinas are managed by various commercial entities.

  d. *How many sites, open to the public, provide boat access to the reservoir and the LSR?*

12 of the SCE&G owned "Existing Recreation Sites" on Lake Murray provide boat access; 21 of the public marinas provide boat access.

3 of the sites on the LSR provide boat access.

e. How many provide shoreline fishing?

6 of the SCE&G owned “Existing Recreation Sites”on Lake Murray have formal fishing docks/piers.

1 of the SCE&G owned sites on the LSR has a formal fishing dock/pier.

f. Identify the most heavily used facilities.

The most used “Existing Recreation Sites” (plus Bundrick Island) during the 2006 recreation season were Dreher Island State Park (116,670 recreation days or 25 percent of total use), Bundrick Island (94,570 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 most used “Existing Recreation Sites” (including the Mill Race sites) on the LSR were Saluda Shoals Park (135,050 recreation days or 58 percent of total use on the lower Saluda River), 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).

g. Are there informal, undeveloped use areas? Where are they?

There are 10 informal sites on Lake Murray. There are also 64 islands (100 acres) available for public recreation on Lake Murray. In addition, there are 1.57 shoreline miles (42.17 acres) classified as Conservation Areas in the Lake Murray Shoreline Management Plan available for passive public recreation. The 10 “Existing Future Sites” are also available for passive public recreation.

There are 2 informal access areas on the LSR, but they are located outside the project boundary. They are located upstream of the Riverbanks Zoo (Mill Race A) and downstream of the Zoo (Mill Race B).

7. *What types of existing developed facilities are there?*
   a. Enumerate boat ramps, restrooms, docks, and other facilities.

There are a total of: 351 picnic tables, 201 grills, 55 shelters, 44 trash cans, 38 toilets (34 permanent), 12 boat launches (with 24 lanes), 10 courtesy docks and 6 fishing piers at “Existing Recreation Sites” on Lake Murray.

There are a total of: 50 picnic tables, 6 grills, 4 shelters, 21 trash cans, 6 toilets (6 permanent), 2 boat launches (with 3 lanes), 3 carry-in launches, and 1 fishing pier within the project boundary at “Existing Recreation Sites” on the LSR.

b. What is the existing capacity at each site?

Public Access Sites	Vehicle Spaces	Vehicle/Trailer Spaces	ADA Spaces	Total Number of Parking Spaces
Dam	72	106	3	181
Parksite	339	0	4	343
Larry Koon	8	39	2	49
Shull Island*	0	8	0	8
Murray Shores*	26	24	0	50
Riverbend*	49	35	0	84
Higgins Bridge*	0	8	0	8
Kempson Bridge	16	16	0	16
Lake Murray Estates Park	0	22	0	22
Macedonia Church	12	0	0	12
Sunset*	12	14	0	28
Rocky Point	2	1	0	3
Dreher Island State Park	418	177	14	619
Hilton	8	27	2	37
Saluda Shoals Park	435	10	18	463
Mett's Landing	5	18	2	25
Gardendale*	40	0	0	40
Millrace A	45	0	0	45
Millrace B*	64	0	0	64

* estimated

c. What is the general condition of each site and its facilities?

Condition at SCE&G owned sites were rated by public access sites users on a scale from 1 to 5 where 1 equals “poor” and 5 equals “excellent”.

Public Access Sites	Poor	2	3	4	Excellent
Dam	2%	3%	29%	31%	35%
Parksite	5%	5%	22%	36%	31%
Larry Koon	4%	2%	17%	28%	50%
Shull Island	8%	5%	10%	29%	48%
Bundrick Island	6%	12%	33%	28%	22%
Murray Shores	1%	6%	25%	39%	30%
Riverbend	5%	7%	25%	35%	29%
Higgins Bridge	3%	11%	49%	24%	14%
Kempson Bridge	0%	0%	0%	18%	82%

Public Access Sites	Poor	2	3	4	Excellent
Lake Murray Estates Park	0%	0%	6%	51%	43%
Macedonia Church	0%	0%	17%	8%	75%
Sunset	0%	0%	5%	32%	63%
Rocky Point	0%	0%	0%	100%	0%
Dreher Island State Park	1%	3%	6%	20%	71%
Hilton	0%	1%	0%	11%	88%
Saluda Shoals Park	0%	0%	5%	17%	78%
Mett's Landing	0%	1%	17%	48%	34%
Gardendale	3%	7%	34%	38%	17%
Millrace A	17%	8%	43%	19%	13%
Millrace B	6%	13%	40%	27%	14%

d. Ideas for improving existing facilities.

Parksite (1-01)

- Expand the parking area **(Lake Murray Watch)**

Larry L. Koon Boat Landing (1-02)

- Evaluate alternatives to increase parking capacity **(SCE&G)**
    - overflow parking at Shull Island (1-02A)
- Identify substitute sites through education (web site, maps, etc.) **(SCE&G)**
- Improve barrier free access **(SCE&G)**
    - restroom facilities
- Provide ADA accessible fishing pier with hard surfaced walkway from parking area to fishing pier that meets ADA Standards **(SCDNR)**
- Widen existing driveway entrance to eliminate the “trailer drop” into the drainage ditch **(SCDNR)**
- Expand the parking area **(Lake Murray Watch)**

Shull Island (1-02B)

- Add two picnic tables **(SCE&G)**
- Rehabilitate existing ramp to provide steeper slope and access deeper water **(SCDNR)**
- Provide an ADA accessible floating courtesy dock system to allow use at low lake levels **(SCDNR)**
- Pave and delineate parking area to eliminate the migration of sediments into the lake and to provide organized traffic flow and parking **(SCDNR)**
- Expand the parking area **(Lake Murray Watch)**

<u>Murray Shores (1-03)</u>

- Improve directional signs to the site (working with Lexington and/or Saluda counties) **(SCE&G)**
- Improve barrier free access **(SCE&G)**
  - o courtesy dock not ADA - too high at low water, gaps between ramp and dock/pier, etc.
- Stripe parking lot **(SCE&G)**
- Improve lighting **(SCE&G)**
- Add restroom facilities (ADA compliant) **(SCE&G)**
  - o Depending on availability of sewer
- Provide ADA accessible fishing pier with hard surfaced walkway from parking area to fishing pier that meets ADA Standards **(SCDNR)**
- Improve access drive by paving to eliminate the migration of sediments into the lake and control dust **(SCDNR)**
- Expand the parking area or add additional overflow parking **(Lake Murray Watch)**

<u>River Bend (1-04)</u>

- Improve barrier free access **(SCE&G)**
  - o fishing pier not ADA - no trail, rails too high, etc.
  - o courtesy dock not ADA - too high at low water, gaps between ramp and dock/pier, etc.

- Add 5.6 acres for future use **(SCE&G)**
- Pave and delineate parking areas to eliminate the migration of sediments into the lake and to provide organized traffic flow and parking **(SCDNR)**
- Expand the parking area or add additional overflow parking **(Lake Murray Watch)**

<u>Sunset (1-05)</u>

- Improve barrier free access **(SCE&G)**
  - fishing pier not ADA - no trail, rails too high, etc.
  - courtesy dock not ADA - too high at low water, gaps between ramp and dock/pier, etc.
- Stripe parking lot **(SCE&G)**
- Add restroom facilities (ADA compliant) **(SCE&G)**
- Pave parking lot **(SCE&G)**
- Expand parking lot **(SCE&G)**
- Add approximately 31.7 acres for future use **(SCE&G)**
- Eliminate drop-off conditions on sides of ramp either by adding stabilization material of rehabilitating the ramp **(SCDNR)**

<u>Rocky Point (1-06)</u>

- Monitor site conditions over time to check on user perceptions of the condition ratings **(SCE&G)**
- Expand the parking area **(Lake Murray Watch)**

<u>Hilton (1-07)</u>

- Improve barrier free access **(SCE&G)**
  - courtesy dock not ADA - too high at low water, gaps between ramp and dock/pier, etc.
- Add restroom facilities (ADA compliant) **(SCE&G)**

- Improve lighting **(SCE&G)**
- Add ADA compliant fishing pier **(SCE&G)**
- Provide hard surfaced walkway from parking area to fishing pier that meets ADA Standards **(SCDNR)**
- Improve access drive by paving to eliminate the migration of sediments into the lake and control dust **(SCDNR)**
- Expand the parking area or add additional overflow parking **(Lake Murray Watch)**

<u>Dam Site (1-08)</u>

- Increase and/or expand courtesy docks **(SCE&G)**
- Improve barrier free access **(SCE&G)**
  - pier (by launch) - ADA access trails but railings high - would depend on use
  - courtesy dock not ADA - too high at low water, gaps between ramp and pier/dock
  - fishing pier not ADA - trail access but railing too high, etc.
- Pave path to restroom **(SCE&G)**
- Provide ADA accessible fishing pier to allow deep-water fishing during lake drawdowns to level 345’ **(SCDNR)**

<u>Saluda Shoals Park (1-09)</u>

- Provide bank access area to deep water for fishing opportunities up-stream **(SCDNR)**
- Provide ADA accessible fishing pier with a hard surface area ADA accessible **(SCDNR)**
- Extend the trail network into the additional property recently acquired by ICRC **(SCPRT)**
- Expand the parking area **(Lake Murray Watch)**

<u>James R. Metts Landing (1-10)</u>

- Add two picnic tables **(SCE&G)**
- Provide bank access area to deep water for fishing opportunities **(SCDNR)**

- With the cooperation of the LCRAC, add restroom facilities that meet ADA Standards **(SCDNR)**
- Expand the parking area **(Lake Murray Watch)**

<u>Dreher Island State Park (1-11)</u>

- Install additional slips at marina **(SCPRT)**
- Create a sailboat mooring area **(SCPRT)**
- Install fishing piers **(SCPRT)**
- Expand the parking area **(Lake Murray Watch)**
- Expand wet storage to accommodate 200 slips **(Lake Murray Watch)**

<u>Macedonia Church (1-12)</u>

- Expand the parking area or add additional overflow parking **(Lake Murray Watch)**

<u>Higgins Bridge (1-13)</u>

- Add two picnic tables **(SCE&G)**
- Pave access drive and existing parking area to eliminate the migration of sediments into the lake and to provide organized parking and traffic flow **(SCDNR)**
- Access drive should allow for two-way traffic flow for safety concerns **(SCDNR)**
- Expand the parking area **(Lake Murray Watch)**

<u>Kempson Bridge (1-14)</u>

- Add restroom facilities (ADA compliant) **(SCE&G)**
- Add two picnic tables **(SCE&G)**
- Provide hard surfaced walkway from parking area to fishing pier that meets ADA Standards **(SCDNR)**

- Provide additional paved, organized parking for vehicle/trailer use **(SCDNR)**
- Provide proper number of handicap parking spaces for both vehicle/trailers and car only spaces. There are currently none provided **(SCDNR)**
- Expand the parking area or add additional overflow parking **(Lake Murray Watch)**

Gardendale (1-15)

- Explore lease to the Irmo-Chapin Recreation Commission with the following conditions: **(SCE&G)**
  - Pave access road
  - Add picnic tables
  - Add restroom facilities (ADA compliant)
  - Increase capacity
  - Pave parking lot
  - Improve carry-in access (reduce distance from parking area to launch)
- Share cost with ICRC **(SCPRT)**
- Expand the parking area **(Lake Murray Watch)**

Lake Murray Estates Park (1-22)

- Improve directional signs to the site (working with Saluda County) **(SCE&G)**
- Add restroom facilities (ADA compliant) **(SCE&G)**
- Pave parking lot **(SCE&G)**
- Expand parking lot **(SCE&G)**
- Provide hard surfaced walkway from parking area to fishing pier that meets ADA Standards **(SCDNR)**
- Rehabilitate the existing floating courtesy dock system to comply with ADA Standards for use at low lake levels **(SCDNR)**

8. *Describe notable recreation activities on Lake Murray and/or the LSR.*
    a. *List recreation activities currently occurring and identify most prominent activities.*

The distribution of activities taking place at SCE&G owned “Existing Recreation Sites” (including Bundrick Island) on Lake Murray is as follows:

Activity	**% of Use**
Water-Based Activities	
Bank Fishing	14%
Boat Fishing	37%
Pier/Dock Fishing	2%
Canoeing/Kayaking	0%
Jet Skiing	3%
Motor Boating	8%
Pontoon/Party Boating	6%
Sailing	0%
Waterskiing/Tubing/Tow	2%
Swimming	8%
Water-Based Activities Total	***80%***
Land-Based Activities	
Bicycling	0%
Camping	3%
Event	0%
Picnicking	5%
Playground	0%
Sightseeing	3%
Sunbathing	1%
Walking/Hiking/Backpacking	2%
Other	4%
Land-Based Activities Total	***20%***

Other activities that were not seen at public recreation sites, but occur on the reservoir include sailing and waterfowl hunting.

The Lake Murray Association also identified fishing, pleasure boating, and swimming as significant activities participated in by shoreline residents.

Upon completion of the renovation of Parksite (Lexington Side), a walking trail across the Saluda Dam has been completed and appears to be used well.

The distribution of activities taking place within the project boundary at SCE&G owned “Existing Recreation Sites” on the LSR is as follows (does not include Mill Race A and Mill Race B, which are outside the project boundary):

Activity	**% of Use**
Water-Based Activities	
Bank Fishing	9%
Boat Fishing	11%
Pier/Dock Fishing	1%
Wading Fishing	0%
Flatwater Canoe/Kayak	13%
Rafting	0%
Tubing/Floating	5%
Whitewater Canoe/Kayak	7%
Swimming	4%
Water-Based Activities Total	***51%***
Land-Based Activities	
Bicycling	3%
Camping	0%
Dog Walking	7%
Event	3%
Nature Study/Wildlife	1%
Picnicking	1%
Playground/Spraypark	6%
Sightseeing	12%
Sunbathing	0%
Walking/Hiking/Backpacking	5%
Other	9%
Land-Based Activities Total	***49%***

The distribution of activities taking place at Mill Race A and Mill Race B is as follows:

Site	**Activity**	**Total**
Mill Race A	Bank Fishing	20%
	Boat Fishing	5%
	Flatwater Canoe/Kayak	9%
	Rafting	2%
	Tubing/Floating	5%
	Whitewater Canoe/Kayak	14%
	Camping	2%
	Dog Walking	5%
	Nature Study/Wildlife	3%
	Picnicking	3%
	Sightseeing	8%
	Sunbathing	5%
	Swimming	16%

Site	Activity	Total
	Walking/Hiking/Backpacking	3%
	Other	2%
		100%
Mill Race B	Bank Fishing	19%
	Boat Fishing	1%
	Rafting	3%
	Tubing/Floating	6%
	Whitewater Canoe/Kayak	1%
	Dog Walking	9%
	Nature Study/Wildlife	6%
	Sightseeing	1%
	Sunbathing	10%
	Swimming	24%
	Walking/Hiking/Backpacking	10%
	Other	10%
		100%

In general, SCPRT reports the following activities are most popular in the four county area surrounding the Project (participants age 12 and older):

Activity	Four County Area (Percent)	State (Percent)
1. Walking for pleasure or exercise	81.8	83.2
2. Attending outdoor sporting events	70.3	63.4
3. Weights or exercise machines	68.9	57.1
4. Ocean Beach swimming/sunbathing	68.3	62.5
5. Visiting a zoo	58.8	34.1
6. Pool swimming	54.1	53.2
7. Driving for pleasure	53.5	58.2
8. Picnicking	52.1	53.4
9. Visiting historical sites	51.5	52.1
10. Bicycling	51.1	42.8
11. Visiting a museum	45.2	38.4
12. Playing basketball	45.0	34.5
13. Jogging/running	42.7	33.9
14. Motor boating	35.4	34.1
15. Fresh water fishing	34.8	37.2
16. Visiting an unusual natural feature	34.4	34.7
17. Watching wildlife	34.0	33.4
18. Lake/river swimming	29.3	28.0
19. Playing football	28.8	22.4
20. Golf	26.1	21.1

Activity	Four County Area (Percent)	State (Percent)
21. Guided nature trail/study	26.1	20.2
22. Playing volleyball	24.5	17.2
23. Off-road vehicle riding	23.8	23.5
24. Camping	22.2	23.1
25. Hiking	20.9	18.2

b. Where are these uses occurring, and are they concentrated in certain areas?

See Table D-1 and Table E-1 in the Recreation Assessment Study Report.

There are some unique activities that were not captured in the surveys of public site users. These include waterfowl hunting, which takes place mostly in the upper reservoir due to legislative restrictions regarding hunting near residential development, and wade fishing, which is concentrated at Sandy Beach, Corley Island, and the Oh Brother/Ocean Boulevard rapids section below the I-26 bridge on the LSR.

c. Identify existing impediments to these activities, if any.

Dramatic river fluctuations are impediments to water-based recreational activities along the lower Saluda River.

The Lake Murray Association and other lake stakeholders report that access from private boat docks for the majority of shoreline residents is not possible at lake levels below 354’ PD.

9. Are there known management issues associated with use?

a. Are there areas of congestion, and if so where?

Results of the boating density study (Kleinschmidt, 2007c) showed that Lake Murray is currently utilized well below its recreational boating capacity. 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.

b. Are there known conflicts between users, and if so where and when?

Fishing tournaments are disruptive to other boaters and residents. There needs to be an established, enforced protocol for organized fishing tournaments.

Jet skis and large motorboats are disruptive to anglers, other boaters, and residents.

Kayakers are often called upon to rescue rock people near Zoo.

The area known as "Two Bird Cove", designated as a Special Recreation Area (for overnight anchorage), is creating conflicts between shoreline property owners in the area and boats that are anchoring for long periods of time. The property owners are also concerned about the use of the buffer zone in this area.

c. Are there other known management issues, such as littering, trespassing, etc.?

Enforcement of established rules are limited by funding, staffing, and political boundaries.

Littering on the islands in Lake Murray is becoming a problem.

The effects of boat wakes in the coves of Lake Murray is a concern for many of the stakeholders.

d. Are there known issues regarding recreational safety?

Wade fishing, canoeing/kayaking, and other water contact and bank use is often dangerous due to river fluctuations in water levels on the lower Saluda River.

Some stakeholders contend that the shoal marker program for Lake Murray is inefficient due to lack of manpower and funding.

The lack of law enforcement is generally a problem at the more remote recreation sites, especially Metts Landing and Gardendale on the LSR and Sunset and River Bend on Lake Murray. On-the-water enforcement of boating laws is also an issue.

Swimming takes place near boat ramps, which is against the law, but was an observed activity during the recreation assessment.

10. What is the expected future demand for recreation activities at Lake Murray?

a. Will existing facility capacity likely be exceeded, and if so where and when?

Results of the Recreation Assessment Study suggested that Dam Site, Parksite, Rocky Point and Dreher Island State Recreation Area 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, River Bend, Higgins Bridge, and Kempson Bridge, are currently used at rates approaching capacity, though this trend was only observed on holidays for River Bend 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 L. Koon Boat Landing 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, and 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.

b. Would accommodating this demand be consistent with the long-term vision for the reservoir?

Yes.

c. Will demand introduce new or additional congestion, conflicts, or other management issues?

The Recreation Solutions Principles, if followed in any future planning efforts, should reduce congestion, conflicts, and other management issues.

11. Identify current local benefits from recreation and any local detriments.

Better quality of life, outdoor experiences, physical fitness, and mental health benefits.

Commercial enterprises rent and/or sell boating, fishing, and other equipment, provide services, and stimulate the local/regional economy.

More local benefits can be found at the Capital City Lake Murray Country website at http://www.lakemurraycountry.com.

STEP 3 – DETERMINE WHAT IS NEEDED AND WHEN

12. Ideas for better or different access, consistent with Step 2 above.

- creation of public access sites and greenway-trail concepts as proposed in the Lower Saluda River Corridor Plans of 1990 and 2000, which include a linear park and trail system on the north bank of the river connecting Saluda Shoals Park to Gardendale Landing and Riverbanks Zoo; and a park/preserve on the south side of river at Twelve-mile Creek
- creation of a state park on the south side of the reservoir
- creation of a multi-lane boating facility that can accommodate large tournaments
- consideration of a boat ramp for small trailered boats at Gardendale or further downstream, but above I26, to allow safer upstream motoring towards Metts Landing. Many boaters have carried in their heavy rigs for years at the Gardendale 'throw-in' to be able to more safely boat the Saluda.

13. Potential facility enhancements or upgrades, consistent with Step 2 above.

See Question 7d.

14. Potential new facilities, or other management actions, consistent with Step 2 above.

<u>Cloud's Creek (1-18)</u>

- Install a gravel parking lot to accommodate approximately 8 to 10 vehicles (and trailers) **(SCE&G)**
- Install carry in access **(SCE&G)**

<u>Little Saluda Point (1-20)</u>

- Add 14.2 acres for future use **(SCE&G)**
- Install two fishing piers **(SCE&G)**
- Develop a walking path to the fishing piers **(SCE&G)**
- Expand the parking area **(Lake Murray Watch)**

<u>Bundrick Island (1-21)</u>

- Explore lease /development alternatives with the LCRAC and/or SCPRT **(SCPRT)**
- Develop into a formal site **(Lake Murray Watch)**
  - A small portion should be utilized for parking area and boat launching facilities should be constructed. Walking trails with an occasional picnic area would protect the natural setting. The Sandy Beach area should remain pristine to continue to protect this unique setting.

<u>Old Corley Bridge Road Canoe Access</u>

- Install a gravel parking lot to accommodate approximately 8 to 10 vehicles (with trailers) **(SCE&G)**
- Install carry in access **(SCE&G)**
- Install directional signs to the site (working with Saluda County) **(SCE&G)**

<u>Shealy Tract</u>

- Install a gravel parking lot to accommodate approximately 8 to 10 vehicles (no trailers) (**Lake Murray Watch**)
- Install fishing piers **(SCPRT)**
- Install picnic shelters **(SCPRT)**
- Create walking trails **(SCPRT)**

<u>Twelve-mile Creek</u> (SCPRT)

- Explore lease to the Lexington County Recreation and Aging Commission **(SCE&G)**

<u>Candi Lane</u>

- Explore lease to the City of Columbia with the following conditions: **(SCE&G)**
  - Install a gravel parking lot to accommodate approximately 20 vehicles (no trailers)
  - Install carry in access

15. What are the priorities regarding identified needs both in terms of resources and time? How do priorities compare across the entire Project?

THIS SECTION WILL BE COMPLETED AFTER THE FINAL ROUND OF CONSULTATION WITH THE RECREATION MANAGEMENT TWC.

<u>STEP 4 – DECIDE HOW NEEDS WILL BE MET AND WHO IS RESPONSIBLE</u>

<u>QUESTIONS REGARDING RESERVOIR LEVELS</u>

16. How is the Project currently operated and what are the typical reservoir levels during key recreation seasons?

- SCE&G operates Saluda Hydroelectric Project as a multi-purpose project. The seasonal changes in elevations provide hydroelectric generation, maintenance of downstream water quality, a unique tailrace fishery, and municipal/industrial water supply.

- SCE&G has an agreement with SCDHEC for a minimum flow of 180 cfs.
- During the low DO season which generally runs from late June to early December, SCE&G will try to maintain a minimum flow of 400 – 500 cfs to help maintain a higher level of DO in the lower Saluda River.
- From April through the end of August the lake is operated near the normal operating high water level of el. 358 ft Plant Datum (PD). Maximum full pool is el. 360 PD.
- Drawdown begins near the end of August or early September and ends in late December near the winter pool level of 350 - 352 ft PD. This allows additional storage capacity in anticipation of the late winter and early spring rainy season. In recent years, the lake has been managed for a minimum winter pool level of approximately 354 ft PD in response to the requests of stakeholder groups.
- At the beginning of January the lake is allowed to refill so it will be at the normal operating high water level of 358 ft. PD by April.
- The plant normally operates for contingency reserve to meet our obligation to the Virginia/Carolinas Reserve Sharing Group (VACAR), which is located within the Southeastern Electric Reliability Council (SERC), which is governed by the North American Electric Reliability Council (NERC). This agreement requires that SCE&G provide up to 200 MW within 15 minutes of a plant trip. Saluda Hydro has this capability and is the primary facility that SCE&G chooses to use to meet this requirement.
- In anticipation of heavy rains from a tropical storm or hurricane, the plant will generate as necessary to manage the lake level. Power generation is increased to provide lake level management normally from September through December.
- Low lake levels can cause concern for lake residents, commercial establishments, and boaters due to their impacts on recreation. As the lake levels drop, more impacts are recognizable. A lake elevation of 356 ft PD was recognized as optimal in the Lake Murray Association September 2005 Lake Murray User Survey and in Lake Murray Homeowners Coalition surveys. According to these surveys, when the lake drops below elevation 352 ft PD more serious impacts to recreation occur.

17. Are there changes to Project operations that you would like to see addressed to improve the overall value of the reservoir, and how specifically would such changes benefit recreation?

- Current reservoir level operations balance the multi-purpose use of the reservoir. Maintaining the existing reservoir level fluctuations would allow for continued water level management through daily and weekly power generation operations however recreation would see no additional benefits. Conversely, limiting the seasonal fluctuation may have recreational benefits but other project purposes would be compromised (power generation, water level management, water quality maintenance, and aquatic weed control).
- Higher lake levels could increase, improve and enhance recreational opportunities.

18. What are the impacts of seasonal and/or daily variations in reservoir level?

- There are no large daily fluctuations in reservoir levels at the Saluda Hydroelectric Project (there are large fluctuations in the lower Saluda River water level). However, daily fluctuations in lake level could create a potential safety issue.
- Weekly and seasonal fluctuations in lake level may have an effect on recreation access.

19. What are the reservoir levels at which recreation problems tend to occur (may be different for different locations or problems)?

- All but one of the public (SCE&G owned) boat ramps were extended to the 345' PD elevation during the Saluda Dam Remediation Project in 2003. During this same period, most of the commercial and private boat ramps were extended to the 345' PD to 347'PD elevation. Since the proposed new guide curve will maintain a higher lake elevation throughout the year, accessibility to all boat ramps will be better during the proposed new guide curve than the current license guide curve.
- Buoys function more appropriately when lake levels are at 352 ft PD or higher.

20. When (i.e., what time of year) and how frequently do recreational problems occur related to reservoir levels?

- In general, the operation of Saluda Hydroelectric Project has been consistent throughout the years except for 1990, 1996, 2002 – 2004, and 2006. During those years the lake level was lowered to around el. 345 – 348 ft PD for the following project maintenance requirements:
  1990 – Intake towers maintenance
  1996 – Hydrilla control as requested by SCDNR
  2002 – 2004 – FERC Order for safety during dam remediation project
  2006 – Upstream riprap repair
- It may be necessary to lower the lake level to around el. 345 ft PD in the future for maintenance of project structures , managing lake resources, installing new recreational access, or other extraordinary circumstances.
- Seasonal variations occur depending on rainfall and upstream water flow.

21. Why are operating water levels important to the operation of the project and the overall system?

- The Saluda Hydroelectric Project is a multi-purpose reservoir. The changes in water level have many beneficial impacts both upstream and downstream of the dam.
- The project is used to meet our contingency reserve capacity obligation as part of the VACAR agreement. This is for a loss on our own system or by one of our neighboring Reserve Sharing Group utilities.
- Electricity (inexpensive, clean, renewable)
- Electric system ancillary services (transmission line maintenance & overload protection, security resource for VCS Nuclear Station)
- Navigation support
- Boating opportunities
- Municipal and industrial water supply

22. Are there state or federal operating requirements that stipulate specific operating goals?

- SCE&G and SCDHEC have an agreement to discharge a minimum flow or 180 cfs from the project.

- Article 12 of the FERC license requires that reservoir levels and discharge from storage be controlled by reasonable rules and regulations of the Commission for the protection of life, health, and property and for other beneficial public uses including recreational purposes.
- Exhibit H of the latest FERC license application identifies the lower lake level to be Elev. 350 ft PD during normal flow years and 345 ft PD during low flow years.
- Our McMeekin Generating Station NPDES permit requires a minimum of 2,500 cfs discharge from Saluda Hydro prior to discharging the fossil plant circulating water return directly into the lower Saluda River.
- NERC/SERC/VACAR Agreements – SCE&G primarily uses Saluda to meet its reserve capacity requirements. This agreement requires that SCE&G provide up to 200 MW within 15 minutes of a plant trip. Saluda Hydro has this capability and is the primary facility that SCE&G chooses to use to meet this requirement.

QUESTIONS REGARDING DOWNSTREAM FLOWS

23. Are there riverine recreation opportunities below the dam? If yes, move to additional questions, if not, stop.

Yes, trout fishing (wading, bank, boat), striper fishing (wading, bank, boat), canoeing/kayaking, tubing, sunbathing/swimming/rock hopping, picnicking, walking/hiking, bicycling, wildlife watching.

24. Do we know how different flow levels affect recreation opportunities and specific recreation activities?

Based on the results of Downstream Recreation Flow Assessment, the range of acceptable flows for water-based activities varies by experience level. Generally, whitewater boating opportunities are available at all water levels ranging from 500 cfs and up and are 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. 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. Wade angling, swimming, and rock-hopping are best enjoyed at flows between 500 and 1,100 cfs.

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. Non-boating on-water activities, such as swimming and wade angling, are best suited for flows of 1,000 cfs or less.

25. Can opportunities be enhanced by modifying releases, and in what way?

Predictable flows would make it safer, easier to fish/boat/swim in the river. It would also enhance the commercial aspects of boating/fishing in the river (allow outfitters/guides known times they could take paying customers into the water safely).

26. How would modified releases affect upstream lake levels?

During normal inflow years, the proposed recreational releases will not have an effect on lake levels in Lake Murray. However, lake levels may be affected by the recreational releases during low inflow years. The reduction of the recreational releases (depending on the final Low Inflow Protocol) should minimize these effects.

27. How would suggested modified downstream flows affect project operations at the project and at upstream and downstream projects?

The scheduled recreation flow releases should not affect any upstream or downstream hydropower projects. The only effect on Saluda Hydro Project operations is that Saluda will be removed from "reserve operations" status during recreational flow scheduled times.

28. Are there additional concerns with regard to state and federal requirements or existing ecological issues that limit suggested changes to downstream flows?

There are concerns about bank erosion due to high flows.
There are concerns about water quality/habitat for aquatic organisms due to low flows or continuous flows.

29. How binding is the VACAR agreement and when does it expire?

The VACAR Reserve Sharing Arrangement ("Agreement") is an agreement among certain electric utility companies in the Carolinas and Virginia that structures operating reserves for the electric utility companies. These operating reserves allow the companies to assist one another in instances of losses of generation. The Agreement is binding, and there is no expiration date. The Agreement is tied to each Company's two-party Interchange Agreements which remain in effect until termination, usually with at least four years notice. The Agreement provides the companies the reliability of sharing of reserves to ensure compliance with NERC Electric Reliability Organization (ERO) Reliability Standards for recovery from losses of generation resulting in a Disturbance Control Standard event. Without this structure, each company would be required to hold reserves in an amount greater than its largest unit at all times in order to ensure recovery from the loss of a unit. Under the Agreement, each company may hold less in reserve and can then call on assistance from the other companies when needed and when appropriate. Therefore, the Agreement also benefits the companies economically. Non-delivery of reserves would violate the agreement and would potentially violate NERC ERO Standards. Maximum potential assessable penalties for an ERO Standard violation are $1 million per day per violation.

APPENDIX D

MAPS OF PROPOSED FUTURE RECREATION SITES

Figure D-1
Lake Murray Proposed Future Recreation Sites

Proposed Future Park Sites	Number
Shull Island	1-02A
Simpson's Ferry	1-05A
Long Pine	1-06A
Hilton	1-07A
Water Treatment Plant	1-16
Stone Mountain	1-17
Cloud's Creek	1-18
Big Creek	1-19
Little Saluda Point	1-20
Bundrick Island	1-21
Old Corley Bridge Road	1-25
Shealy Point Tract	1-26
Shealy Road Access Area	1-27
Rocky Creek	1-28
Little River/Harmon's Bridge	1-29
Crayne's Bridge Public Park	1-30

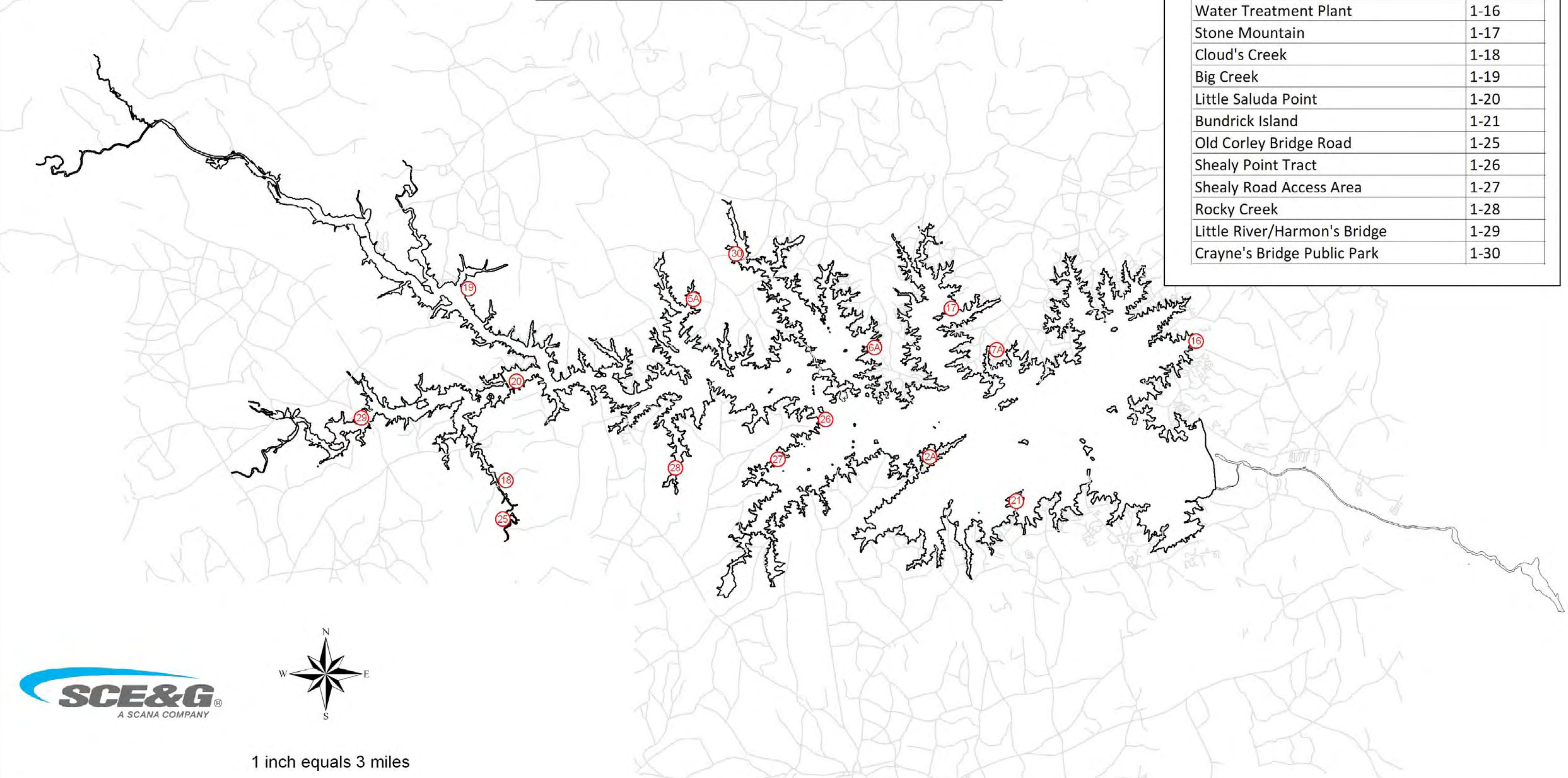
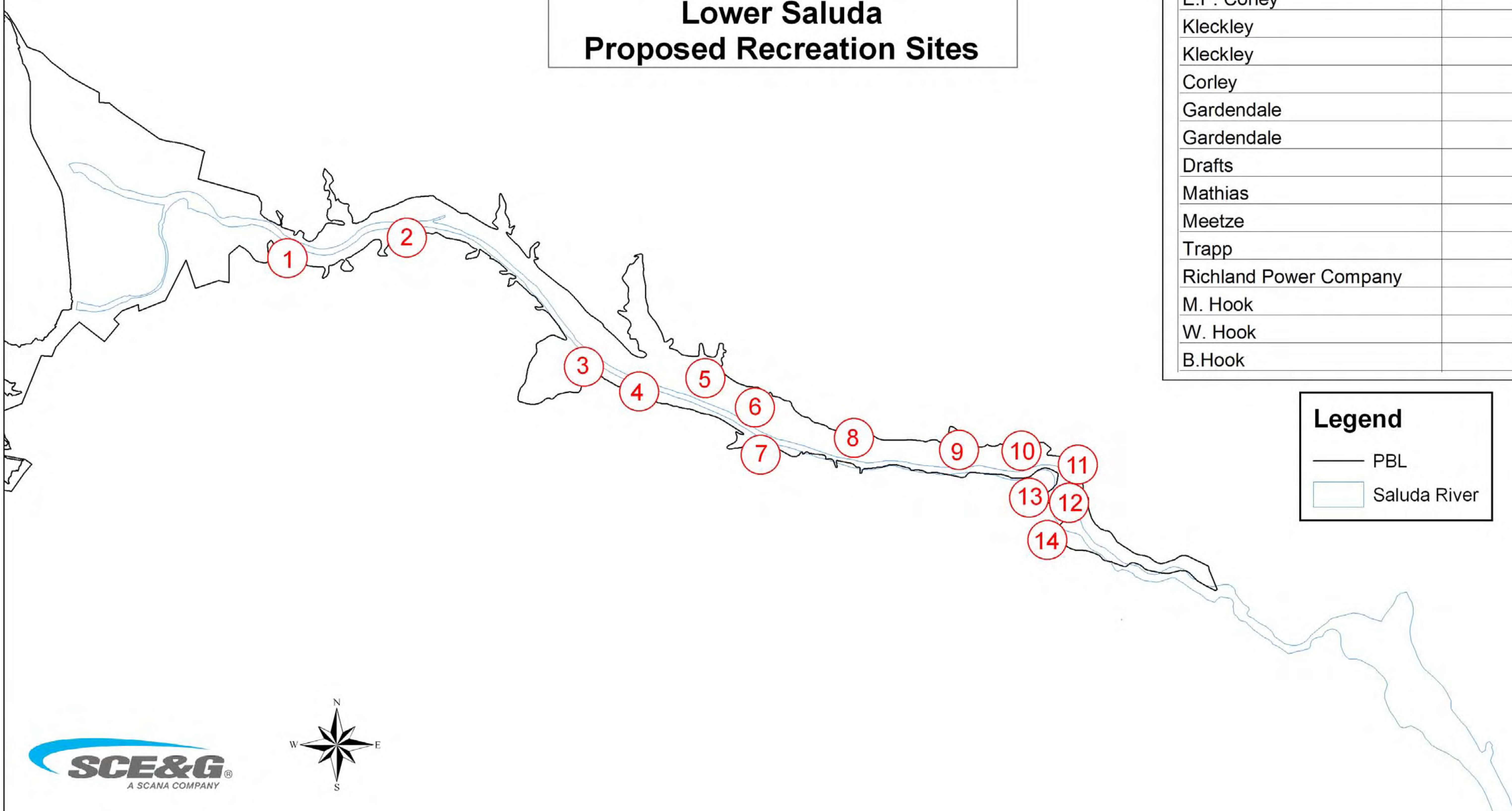


Figure D-2
Lower Saluda
Proposed Recreation Sites

Proposed Future Rec Site	Number
E.P. Corley	1
Kleckley	2
Kleckley	3
Corley	4
Gardendale	5
Gardendale	6
Drafts	7
Mathias	8
Meetze	9
Trapp	10
Richland Power Company	11
M. Hook	12
W. Hook	13
B.Hook	14



SCE&G®
A SCANA COMPANY

1 inch equals 1 mile

APPENDIX E

RECREATION RESOURCE CONSERVATON GROUP ISSUE RECOMMENDATIONS

Recreation Resource Conservation Group

Issue Recommendation
Minimum Lake Levels for Lake Murray

FINAL March 24, 2008

Issue:

The Saluda Project License sets a minimum reservoir elevation of 345 ft. Plant Datum (PD) and a maximum reservoir elevation of 360 ft. PD. In the past, SCE&G normally has operated the reservoir in the range of 350 ft. PD to 358 ft. PD. Occasionally, the reservoir has been drawn down to near 345 ft. PD for vegetation control and project maintenance work. Referencing a guide curve, SCE&G sets target reservoir elevations for each month of the year to account for historic, expected seasonal inflow variations. Target elevations may vary from year to year, depending on inflow projected and/or available, planned and emergency maintenance activities, unit availability, etc.

The lake typically reaches 358 ft. PD at the beginning of June. Beginning in September, water is released, via generation, to achieve 350 ft. PD by December 31. Rising lake levels begin again around January 1 with the objective to continue to allow the rise so as to reach approximately 358 ft. PD by June 1.

The Lake Murray Association (LMA), Lake Murray Homeowners Coalition (LMHOC), and Lake Murray Watch (LMW) have expressed concerns that elevations less than 354 ft. PD at Lake Murray impede recreational use of the reservoir. According to a 2005 survey of Lake Murray users conducted by LMA, over half (51%) of lake users who responded, responded that 354 ft. PD was the minimum lake level needed for "year around safe lake use" at their "normal site or dock"; 98% of respondents indicated 356 ft. PD.

Recommendation:

The Recreation RCG recommends that:

1. A normal operating range of Lake Murray for recreational purposes should be modeled as between 354 ft. PD to 358 ft. PD, with a target elevation of 358 ft. PD being reached by April 1 of each year and being maintained through the first Monday of September (to coincide with Labor Day) of each year.
2. A normal operating range of Lake Murray for recreational purposes should be modeled as between 356 ft. PD to 358 ft. PD, with a target elevation of 358 ft. PD being reached by April 1 of each year and being maintained through the first Monday of September (to coincide with Labor Day) of each year.

Recreation Resource Conservation Group

Issue Recommendation
Protection of Natural/Undeveloped Lands for Public Recreation

DRAFT February 5, 2008

Issue:

SCE&G manages its lands around Lake Murray according to a Shoreline Management Plan (SMP), which is designed to comply with the terms of the Project License, regulations, and orders of the FERC. Its aim is to provide a balance between shoreline development, recreational use, and environmental protection.

SCE&G has identified eight distinct land management classifications for the land within the Project boundary line (PBL). The classifications consist of Easement, Forest and Game Management, Public Recreation, Commercial Recreation, Future Development, Conservation Areas, 75-Foot Setback, and Project Operations. Although SCE&G aims to manage their lands according to this classification system, the public has the right to access SCE&G-owned lands regardless of classification, with the exception of lands reserved and used for Project Operations.

The Lower Saluda Scenic River Advisory Council, South Carolina Department of Parks, Recreation and Tourism, Lake Murray Watch, and Coastal Conservation League/American Rivers have expressed concerns regarding the conservation of lands to enhance recreational use around Lake Murray and in the lower Saluda River corridor, protect the scenic integrity of the Project, protect wildlife habitat, and provide informal recreational opportunities.

Recommendation:

In order to enhance recreational use around Lake Murray and in the lower Saluda River corridor, protect the scenic integrity of the Project, protect wildlife habitat, and provide informal recreational opportunities, the Recreation RCG recommends that:

1. Shoreline lands classified as “Easement”, but undeveloped, be available for passive recreation opportunities inside the PBL;

2. Shoreline lands classified as “Forest and Game Management” be available for passive recreation opportunities;

3. Shoreline lands classified as “Future Development” be available for passive recreation opportunities;

4. Shoreline lands within the “75-Foot Setback” be available for passive recreation opportunities;

5. Statements be included in the SMP and recreation brochure/map that identify lands available for passive recreation opportunities.

Issue Recommendation
Warning System for Rising Water on the Lower Saluda River

DRAFT July 1, 2008

Issue:

South Carolina Electric & Gas (SCE&G) currently operates the Saluda Project in order to provide reserve capacity for the company's utility obligations. Project generators are typically offline, i.e., not operating, but can be started and synchronized to the electrical grid and can increase output immediately in response to a generator or transmission outage on SCE&G's system or in response to a call for reserve power from neighboring utilities, with which the company has reserve agreements and obligations. As a result, flows from the Saluda Project are generally unscheduled.

The Lower Saluda Scenic River Advisory Council, American Whitewater, Trout Unlimited, and American Rivers have expressed concern over the safety of river users due to the unscheduled flows from the Project, as well as the rates that the river level changes due to the higher flows (> 10,000 cfs). SCE&G currently has a warning system in place that covers the area from the Riverbanks Zoo to the confluence with the Broad River, as well as the area from the Saluda Hydro powerhouse to James R. Metts Landing/Saluda Shoals Park. In 2008, SCE&G installed additional sirens and strobe lights between the Saluda Hydro powerhouse and Saluda Shoals Park. Sirens and strobe lights are located at the U.S. Geological Survey (USGS) gauge platform below the Saluda Hydro powerhouse, between the USGS gauge platform and James R. Metts Landing, at James R. Metts Landing, upstream of Riverbanks Zoo, and two locations downstream of the Zoo (Shandon Rapids and confluence with the Broad River). Along with stand alone strobe lights at the spillway discharge and Saluda Shoals Park, the sirens located at the USGS gauge platform, between the USGS platform and James R. Metts Landing, and at James R. Metts Landing are activated automatically by the plant Distributed Control System (DCS) equipment when Saluda Hydro starts to generate 5 MW or 800 cfs. The sirens sound for three minutes once activated. Subsequent siren activation is made automatically after a six minute delay from the initial activation. All strobe lights activate and remain on for 16 minutes concurrently with the initial siren activation. These sirens can be activated manually from a push button inside the Saluda powerhouse. At the Zoo location, the siren activates with a 1 inch rate of rise (ROR). The sirens sound for three minutes once activated. There is a hold-off period of 60 minutes at the Zoo location sirens and an override if the water level rises three inches during that 60-minute hold-off period; the sirens will activate again and then reset for the next 60-minute hold-off period. A strobe light activates and remains on for 16 minutes concurrently with the siren activation. Sirens are active 24 hours per day, and were tested in 2004 to calibrate the volume to cover an area 1500 feet upstream and downstream of the Zoo siren, and 500 feet upstream and downstream of the Metts Landing siren. Since 2004 two additional sirens and strobe lights were installed downstream of the Zoo. The Zoo location float switch activates these new sirens on a three-minute delay. Prominent warning signs posted near the strobe lights and sirens warn people that the activation of the sirens and/or the light signals potentially dangerous conditions caused by a rising water level. These two new sirens were tested for volume level and coverage area as part of their installation. SCE&G manages an electronic ring-down call system (operational on April 14, 2008) that is activated by the SCE&G System Dispatchers upon initiation of significant generation at Saluda. Upon activation, a message is sent to registered individuals via e-mail and telephone, alerting them to the initiation of generation. Registration for this ring-down service can be made at SCE&G's website (http://www.sceg.com/en/my-community/lower-saluda-river/). This system was developed in response to Safety RCG member requests for notification of initiation of Saluda Hydro generation Information about current and planned operations is also provided on a website maintained by SCE&G.

Recommendation:

In order to mitigate the effects of rising water in the lower Saluda River due to project operation, the Recreation RCG recommends that SCE&G:

1. Continue to work with river users to make the current warning system on the river more effective;

2. Implement the electronic call system for the general public to alert of generation releases;

3. Install additional warning devices on the lower Saluda River that will provide auditory and/or visual warning from the tailrace of the dam to the confluence with the Broad River (initial proposal is detailed in the Safety RCG Meeting Presentations in the Saluda Hydro Project License Application);

4. Continue to implement and improve the website providing current and planned operations of the Saluda Project; and

5. Coordinate with swiftwater rescue training agencies to determine an annual schedule for training personnel.

Issue Recommendation
Recreational Flow Releases on the Lower Saluda River

DRAFT February 5, 2008

Issue:

South Carolina Electric & Gas (SCE&G) currently operates the Saluda Hydro Project in order to provide reserve capacity for the company's utility obligations, a mode of operation that the company proposes to continue under the new license. Project generators are typically offline, i.e., not operating, but can be started and synchronized to the electrical grid and can increase output immediately in response to a generator or transmission outage on SCE&G's system or in response to a call for reserve power from neighboring utilities, with which the company has reserve agreements and obligations. As a result, flows from Saluda Hydro to the lower Saluda River (LSR) are generally unscheduled.

Although there is no minimum flow requirement for the Project, SCE&G has an informal agreement with the South Carolina Department of Health and Environmental Control (SCDHEC) to provide a minimum of 180 cfs at the Project to maintain downstream water quality of the LSR. SCE&G typically releases a minimum flow of approximately 500 cfs to enhance water quality during the low dissolved oxygen (DO) season (July – November). The average annual flow from the Saluda Dam to the LSR is 2,595 cfs with a minimum average daily flow of 285 cfs.

The Lower Saluda Scenic River Advisory Council, South Carolina Department of Parks, Recreation and Tourism, South Carolina Department of Natural Resources, American Whitewater, Saluda River Chapter of Trout Unlimited, and Coastal Conservation League/American Rivers have requested instream flows for the LSR to support recreational uses such as small boat navigation, swimming, wade and boat fishing, and other downstream uses.

American Whitewater, the Coastal Conservation League/American Rivers, and the City of Columbia Parks and Recreation Department have also requested scheduled recreational releases for whitewater boating, wade fishing, and special events.

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.

Daily average flows of less than 4,000 cfs are generally available 83 percent of the time year-round. Hourly average flows of less than 4,000 cfs 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.

Recommendation:

Based on the results of the Downstream Recreation Flow Assessment, the Recreation RCG recommends:

1. SCE&G releases approximately 45,000 acre feet of water for recreational flows in the LSR. These flows will occur on no more than 51 days. The Saluda Hydro Project will be removed from reserve status during the recreational flow hours on those 51 days. The initial recreational flow schedule is attached to this recommendation.

2. SCE&G hosts an annual meeting during October of each year to review the previous year's flows, set the specific dates for the following year's flows (with the understanding that the volume of water and number of days will remain consistent from year to year, even if the schedule varies), and discuss any outstanding issues with appropriate stakeholders;

3. SCE&G hosts a tri-annual meeting to comprehensively review the recreation flow schedule for the purpose of reviewing recreation trends, trout reproduction and holdover, etc.;

4. Once the Low Inflow Protocol (LIP) has been finalized, SCE&G will meet with the Recreation Flow Technical Working Committee to determine a schedule for the reduction and elimination of recreational flows based on criteria from the final LIP. This issue has not been resolved at this time.

5. SCE&G will continue release patterns for reservoir management favoring lower flows for longer periods of time within the operating efficiency of the units as opposed to higher flows for shorter and more frequent periods.

6. The proposed recreational flows are recommended as follows:

Hours

• Wade Fishing/Swimming (November-April)	12:00 PM – 5:00 PM (Saturdays) 7:00 AM – 12:00 PM (Sundays)
• Wade Fishing/Swimming (May-October)	8:00 AM – 5:00 PM
• High or Low Boating Flows	10:00 AM – 4:00 PM

Target Release Ranges (unless otherwise noted):

• Low Boating Flow	1,800 cfs – 2,400 cfs
• High Boating Flow	3,800 cfs – 4,500 cfs
• Wade Fishing Flow	Seasonal Minimum Flow

Initial Schedule of Recreational Flow Releases in the Lower Saluda River

Flows will be measured at the USGS gage below the Saluda Dam (02168504). Actual flows may vary ± 10%. Make-up days will be allowed; no more than 5 recreational days per year can be lost to operational or maintenance emergencies before make up days will be required to be scheduled; make-up days must occur within three months of the scheduled flow. The annual flow release schedule will be posted on the SCE&G website.

		Rec. Flows					
	Event Name	**Days Allocated**	**Hours/ Day**	**Start Time**	**End Time**	**CFS**	**Ac-Ft***
January	Iceman Race	1	6	8:00	14:00	4,000	1,636
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	MLK Day	1	5	7:00	12:00	700	0
February	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	President's Day	1	5	7:00	12:00	700	0
March	WW Festival	1	6	8:00	14:00	8,650	3,941
	WW Festival	1	3	10:00	13:00	3,300	644
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
April	General Recreation (Sat.)	1	5	12:00	17:00	1,000	0
	General Recreation (Sun.)	1	5	7:00	12:00	1,000	0
May	CFK	1	9	7:30	16:30	10,000	6,470
	General Recreation	1	9	8:00	17:00	1,000	0
	Memorial Day/ General Recreation	1	9	8:00	17:00	1,000	0
June	Rescue Rodeo	2	9	7:00	16:00	2,111	2,099
	Wade Fishing (Sat.)	1	9	8:00	17:00	700	0
	Wade Fishing (Sun.)	1	9	8:00	17:00	700	0
	Wade Fishing (Sat.)	1	9	8:00	17:00	700	0
	Wade Fishing (Sun.)	1	9	8:00	17:00	700	0
July	WW Rodeo	2	8	9:00	17:00	3,300	3,437
	Wade Fishing (Sat.)	1	9	8:00	17:00	700	0
	Wade Fishing (Sun.)	1	9	8:00	17:00	700	0
	Ind. Day/ General Recreation	1	9	8:00	17:00	1,000	223

August	USTWWR Prac.	2	8	8:00	16:00	10,000	12,295
	Wade Fishing (Sat.)	1	9	8:00	17:00	700	0
	Wade Fishing (Sun.)	1	9	8:00	17:00	700	0
September	High Boating (Sat. and Sun.)	2	6	10:00	16:00	4,500	3,768
	Labor Day/ General Recreation	1	9	8:00	17:00	1,000	223
October	CFK	1	7	9:30	16:30	2,400	983
	High Boating (Sat. and Sun.)	2	6	10:00	16:00	4,500	3,768
November	Low Boating (Sat.)	1	6	10:00	16:00	2,400	843
	High Boating (Sun.)	1	6	10:00	16:00	4,500	1,884
December	Low Boating (Sat.)	1	6	10:00	16:00	2,400	843
	High Boating (Sun.)	1	6	10:00	16:00	4,500	1,884
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	Wade Fishing (Sat.)	1	5	12:00	17:00	700	0
	Wade Fishing (Sun.)	1	5	7:00	12:00	700	0
	Totals>>>>	51					44,940

*Increment Above Minimum Flow

Recreation Resource Conservation Group

Issue Recommendation
Placement and Maintenance of Shoal Markers

DRAFT July 1, 2008

Issue:

Lake Murray is a large reservoir and, like many other reservoirs, has hazards that present a danger to boaters and other recreationists. The Lake Murray Watch and the Lake Murray Association have raised the issue of the responsibility for marking these hazards to make Lake Murray safer for the boating public. South Carolina Electric & Gas (SCE&G) has historically depended on the South Carolina Department of Natural Resources (SCDNR) to bear responsibility for the marking of hazards. Stakeholders contend that the SCDNR system is not as effective as it could be because of the yearly fluctuations in water level, unmarked hazards, and missing/damaged shoal markers.

Recommendation:

In order to make the shoal marker program on Lake Murray more effective, the Recreation RCG recommends that:

1. A description of the shoal marker program be included in the Saluda Project Safety and Outreach Program;

2. SCE&G provide the attached "Navigation Aids Marking Assistance Program Report Form" on their website and produce a magnet that will be available free-of-charge that contains contact and other relevant information on the shoal marker program;

3. Navigation Aids Marking Assistance Program Report Forms submitted to SCDNR be evaluated on criteria including fluctuations in water level, amount of boater traffic, etc. If the SCDNR determines a condition is a true hazard, the SCDNR will install and maintain appropriate marker(s). Applications that are denied will be returned with an explanation for the decision and contact information should the applicant wish to discuss the matter further.

4. SCDNR encourage the public to communicate regularly with its officers on Lake Murray, in order to have questions answered and to provide public safety related comments.

Lake Murray Navigation Aids Marking Assistance Program Report Form

Reporting Person's Contact Information

Name ______________________________ Date _____________________________________

Telephone Number ____________________ Email Address _____________________________

Nature of Problem (check one or more if applicable)

Damaged Marker ___________ Marker Free of its Mooring ___________
Unmarked Area ___________ Displaced Marker ___________
Illegally Marked Area (i.e., no wake zones, non-DNR buoy or Navigation Aid, etc.) ___________
Other (describe in detail) _________

____

____

____

Missing/Displaced Marker Number (if known or can be obtained from a map) _________________

Lake Elevation at Time of Detection _________ County ___________________________________

Location of Unmarked Area or Marker GPS Coordinates ___________ Lat. ________ Long.

(Note: If GPS coordinates are not available, identify area on a topographic map and remit.)

Nearest Landmark (Island, Marina, Landing, etc.) ____

Additional Information:

____

____

____

____

Forms should be faxed to SCDNR, Attention: **Lt. Gary Sullivan** at **843-953-9376** or emailed to SullivanG@SCNDR.gov. Information may be called into **Lt. Gary Sullivan** at **843-953-9378** or **1-800-922-5403**.

Saluda HYDRO RELICENSING PROJECT

Recreation Resource Conservation Group

Issue Recommendation
Protection of the Trout Fishery in the Lower Saluda River

FINAL March 24, 2008

Issue:

The lower Saluda River (LSR) is successfully managed (and classified by the South Carolina Department of Health and Environmental Control) as a put, grow, and take trout fishery by the South Carolina Department of Natural Resources (SCDNR). Currently, annual stockings of brown and rainbow trout species are necessary to support the trout fishery in the LSR.

Trout stockings vary in number depending primarily on availability of fish from the SCDNR Walhalla Fish Hatchery. Stocking records suggest that typically the SCDNR stocks approximately 30,000 to 34,000 trout annually in the LSR, with approximately 60% being rainbow trout. The length of the fish at the time of stocking is typically 6-8" for brown trout and 9-10" for rainbow trout.

Trout are typically stocked from November – March throughout the LSR after the dissolved oxygen (DO) levels in the releases of water from Lake Murray have improved to safer levels for fish. The initial stocking event is typically done by the use of helicopter to facilitate distribution of both species along the LSR. Subsequent stockings are conducted by truck with stocking limited to 3 locations along the LSR. Intense fishing pressure, predation, potential late-summer and fall low DO concentrations, and thermal regimes affect both carryover and incidental reproductive success of adult trout in the LSR. However, while continued stocking efforts by the SCDNR will be required to support the trout fishery, changes in project operations (i.e., minimum flows) should facilitate increased carryover of stocked trout. Increased adult carryover could provide increased opportunities for natural reproduction of trout, further enhancing the LSR trout fishery.

Recommendation:

The Recreation RCG recommends that SCE&G continue to support the trout fishery as a significant recreational activity in the LSR by:

1. Sharing relevant data (generation records, DO monitoring, temperature monitoring, etc.) with the SCDNR to facilitate information gathering on the trout fishery;

2. Providing sufficient access points on the LSR to enter/exit the river for recreation and safety;

3. Implementing the "Rising Water Warning System" as recommended by the Safety RCG;

4. Maintaining state water quality standards year round in the LSR;

5. Maintaining flow levels as determined by science based studies in conjunction with state and federal fishery agencies, such as the current 'IFIM' study undertaken during relicensing;

6. Continuing relationships with relevant state and federal resource management agencies to support the health and survival of trout in the LSR;

7. Working with SCDNR and interested stakeholders to develop a trout management plan for the LSR, including periodic evaluations as determined by the Fish and Wildlife Technical Working Committee;

8. Implementing scheduled flows for wade fishing.

APPENDIX F

AS BUILT AND CONCEPT DESIGN DRAWINGS

Appendix 23

Lower Saluda River Recreational Flow Studies Appendices E & F

Maximum Stage Analysis

1.5 Hour Flow Duration Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	2.26	1.37	1.94	1.32	1.21	1.19	1.28	1.63
2,000 cfs	3.77	2.60	2.88	1.71	1.49	1.63	1.67	1.97
3,000 cfs	4.94	3.61	3.67	2.17	1.75	2.03	1.94	2.27
4,000 cfs	5.90	4.49	4.37	2.39	1.94	2.40	2.20	2.56
5,000 cfs	6.74	5.23	4.97	2.53	2.11	2.73	2.43	2.80
6,000 cfs	7.51	5.89	5.51	2.66	2.28	3.02	2.62	2.99
8,000 cfs	8.79	7.07	6.46	3.03	2.57	3.54	3.01	3.40
10,000 cfs	9.85	8.15	7.29	3.25	2.81	4.01	3.41	3.81
12,000 cfs	10.67	9.34	8.04	3.49	3.03	4.39	3.73	4.13
14,000 cfs	11.34	10.33	8.76	3.71	3.18	4.78	3.96	4.32
16,000 cfs	11.98	11.18	9.43	3.88	3.31	5.09	4.20	4.49
18,000 cfs	12.57	11.90	10.03	4.00	3.43	5.38	4.44	4.73

6 Hour Flow Duration Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	2.39	1.61	2.27	1.45	1.32	1.38	1.49	1.82
2,000 cfs	4.04	2.99	3.57	2.15	1.77	2.05	1.96	2.37
3,000 cfs	5.25	4.05	4.54	2.40	2.03	2.58	2.33	2.79
4,000 cfs	6.24	4.94	5.33	2.62	2.28	3.02	2.62	3.05
5,000 cfs	7.17	5.72	6.01	2.90	2.50	3.41	2.91	3.37
6,000 cfs	8.01	6.43	6.63	3.12	2.68	3.77	3.20	3.68
8,000 cfs	9.36	7.69	7.71	3.48	3.03	4.39	3.73	4.19
10,000 cfs	10.58	9.28	8.86	3.79	3.23	4.92	4.03	4.38
12,000 cfs	11.39	10.52	9.80	4.03	3.45	5.41	4.47	4.80
14,000 cfs	12.22	11.55	10.67	4.38	3.71	5.87	4.83	5.16
16,000 cfs	12.99	12.48	11.48	4.81	3.97	6.28	5.16	5.51
18,000 cfs	13.82	13.37	12.26	4.85	4.01	6.69	5.22	5.58

24 Hour Flow Duration Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	2.39	1.61	2.27	1.45	1.32	1.38	1.50	1.83
2,000 cfs	4.04	2.99	3.58	2.17	1.77	2.06	1.96	2.37
3,000 cfs	5.25	4.05	4.54	2.40	2.03	2.58	2.33	2.79
4,000 cfs	6.25	4.94	5.33	2.62	2.28	3.02	2.62	3.05
5,000 cfs	7.17	5.72	6.02	2.90	2.50	3.42	2.91	3.37
6,000 cfs	8.01	6.43	6.64	3.12	2.68	3.77	3.20	3.68
8,000 cfs	9.36	7.69	7.72	3.49	3.03	4.39	3.73	4.20
10,000 cfs	10.58	9.29	8.87	3.79	3.23	4.93	4.04	4.38
12,000 cfs	11.40	10.53	9.81	4.03	3.45	5.42	4.47	4.80
14,000 cfs	12.23	11.55	10.68	4.38	3.71	5.88	4.83	5.17
16,000 cfs	13.00	12.49	11.50	4.82	3.97	6.30	5.17	5.52
18,000 cfs	13.84	13.39	12.28	4.85	4.01	6.69	5.22	5.58

Start of Operations Analysis

1.5 Hour Flow Duration Time to Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:33	2:02	2:50	3:43	3:54	4:19	4:26	5:22
2,000 cfs	1:31	1:51	2:32	3:15	3:27	3:45	3:41	4:24
3,000 cfs	1:31	1:44	2:20	2:59	3:09	3:25	3:26	3:59
4,000 cfs	1:32	1:43	2:13	2:33	2:57	3:04	3:07	3:39
5,000 cfs	1:32	1:42	2:08	2:26	2:48	2:59	2:58	3:26
6,000 cfs	1:32	1:41	2:06	2:22	2:43	2:52	2:51	3:15
8,000 cfs	1:32	1:41	2:03	2:33	2:37	2:46	2:47	3:11
10,000 cfs	1:32	1:42	2:02	2:19	2:34	2:42	2:44	3:06
12,000 cfs	1:32	1:42	2:06	2:33	2:34	2:43	2:43	3:02
14,000 cfs	1:32	1:41	2:04	2:28	2:28	2:32	2:31	2:46
16,000 cfs	1:32	1:41	2:05	2:31	2:33	2:39	2:40	2:50
18,000 cfs	1:32	1:42	2:06	2:33	2:33	2:41	2:41	2:52

6 Hour Flow Duration Time to Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	4:20	4:30	5:34	6:30	6:01	6:36	6:28	6:52
2,000 cfs	3:59	4:43	5:22	5:30	6:23	5:55	6:03	6:59
3,000 cfs	4:19	4:50	5:32	4:26	5:10	5:49	5:44	6:09
4,000 cfs	3:42	4:36	5:32	4:44	5:11	5:44	5:23	5:26
5,000 cfs	4:52	4:25	5:04	5:21	5:15	5:34	5:32	6:15
6,000 cfs	4:24	4:52	5:12	4:44	5:47	6:09	5:46	6:19
8,000 cfs	4:46	5:33	5:15	5:03	5:28	6:04	5:37	5:41
10,000 cfs	5:50	5:24	6:08	5:44	5:26	5:55	5:21	5:01
12,000 cfs	4:56	5:28	6:00	6:30	6:19	6:02	6:27	6:28
14,000 cfs	5:11	6:04	6:08	6:05	5:49	6:10	6:10	6:23
16,000 cfs	5:38	5:44	5:54	5:55	6:19	6:03	6:02	6:31
18,000 cfs	5:29	5:36	6:09	3:30	5:57	5:56	3:32	6:19

24 Hour Flow Duration Time to Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	4:20	4:30	5:34	6:30	6:01	6:26	7:48	9:59
2,000 cfs	3:59	4:43	7:09	7:21	6:23	7:23	6:03	6:59
3,000 cfs	4:19	4:50	5:32	4:26	6:42	5:49	5:44	6:08
4,000 cfs	6:50	4:36	5:32	4:44	5:11	5:44	5:23	5:26
5,000 cfs	4:52	4:25	6:15	5:21	5:15	8:02	5:32	6:15
6,000 cfs	4:24	4:52	7:07	4:44	5:47	6:09	5:46	6:18
8,000 cfs	4:46	5:33	6:37	6:54	5:28	6:04	5:37	6:55
10,000 cfs	5:50	6:10	7:14	5:44	5:26	7:09	6:42	5:01
12,000 cfs	6:56	8:43	7:25	6:28	6:19	7:12	6:28	6:28
14,000 cfs	6:36	6:04	7:18	6:07	7:02	8:17	6:15	10:49
16,000 cfs	9:03	7:09	7:36	6:34	7:44	8:38	6:43	7:38
18,000 cfs	8:09	7:07	7:22	3:30	5:57	5:56	3:32	6:19

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.04	0.03	0.02	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.06	0.04	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.07	0.05	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.08	0.06	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.09	0.07	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.10	0.09	0.05	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.11	0.10	0.06	0.02	0.01	0.03	0.02	0.02
16,000 cfs	0.12	0.10	0.06	0.02	0.01	0.03	0.02	0.02
18,000 cfs	0.12	0.11	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.12	0.11	0.07	0.02	0.02	0.03	0.02	0.02

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
4,000 cfs	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.01
5,000 cfs	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.01
6,000 cfs	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.01
8,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
12,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
14,000 cfs	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01
16,000 cfs	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01
18,000 cfs	0.04	0.04	0.03	0.02	0.01	0.02	0.02	0.01
Maximum	0.04	0.04	0.03	0.02	0.01	0.02	0.02	0.01

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
4,000 cfs	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.01
5,000 cfs	0.02	0.02	0.01	0.01	0.00	0.01	0.01	0.01
6,000 cfs	0.03	0.02	0.01	0.01	0.00	0.01	0.01	0.01
8,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
12,000 cfs	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
14,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
16,000 cfs	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01
18,000 cfs	0.03	0.03	0.02	0.02	0.01	0.02	0.02	0.01
Maximum	0.03	0.03	0.02	0.02	0.01	0.02	0.02	0.01

Start of Rise Analysis

1.5 Hour Flow Duration Time to Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:28	1:31	1:34	1:25	1:35	1:36	1:34	1:49
2,000 cfs	1:26	1:24	1:27	1:16	1:26	1:22	1:09	1:19
3,000 cfs	1:27	1:19	1:20	1:09	1:17	1:11	1:04	1:08
4,000 cfs	1:28	1:19	1:16	0:49	1:11	0:57	0:52	0:58
5,000 cfs	1:28	1:18	1:13	0:46	1:06	0:57	0:49	0:52
6,000 cfs	1:28	1:17	1:13	0:46	1:04	0:54	0:46	0:47
8,000 cfs	1:28	1:18	1:12	1:01	1:03	0:54	0:48	0:52
10,000 cfs	1:28	1:19	1:13	0:51	1:04	0:54	0:50	0:54
12,000 cfs	1:28	1:19	1:18	1:08	1:07	0:59	0:52	0:55
14,000 cfs	1:28	1:18	1:17	1:05	1:03	0:50	0:43	0:43
16,000 cfs	1:28	1:18	1:19	1:09	1:10	0:59	0:54	0:50
18,000 cfs	1:28	1:19	1:20	1:12	1:11	1:03	0:57	0:54

6 Hour Flow Duration Time to Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	4:15	3:59	4:18	4:12	3:42	3:53	3:36	3:19
2,000 cfs	3:54	4:16	4:17	3:31	4:22	3:32	3:31	3:54
3,000 cfs	4:15	4:25	4:32	2:36	3:18	3:35	3:22	3:18
4,000 cfs	3:38	4:12	4:35	3:00	3:25	3:37	3:08	2:45
5,000 cfs	4:48	4:01	4:09	3:41	3:33	3:32	3:23	3:41
6,000 cfs	4:20	4:28	4:19	3:08	4:08	4:11	3:41	3:51
8,000 cfs	4:42	5:10	4:24	3:31	3:54	4:12	3:38	3:22
10,000 cfs	5:46	5:01	5:19	4:16	3:56	4:07	3:27	2:49
12,000 cfs	4:52	5:05	5:12	5:05	4:52	4:18	4:36	4:21
14,000 cfs	5:07	5:41	5:21	4:42	4:24	4:28	4:22	4:20
16,000 cfs	5:34	5:21	5:08	4:33	4:56	4:23	4:16	4:31
18,000 cfs	5:25	5:13	5:23	2:09	4:35	4:18	1:48	4:21

24 Hour Flow Duration Time to Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	4:15	3:59	4:18	4:12	3:42	3:43	4:56	6:26
2,000 cfs	3:54	4:16	6:04	5:22	4:22	5:00	3:31	3:54
3,000 cfs	4:15	4:25	4:32	2:36	4:50	3:35	3:22	3:17
4,000 cfs	6:46	4:12	4:35	3:00	3:25	3:37	3:08	2:45
5,000 cfs	4:48	4:01	5:20	3:41	3:33	6:00	3:23	3:41
6,000 cfs	4:20	4:28	6:14	3:08	4:08	4:11	3:41	3:50
8,000 cfs	4:42	5:10	5:46	5:22	3:54	4:12	3:38	4:36
10,000 cfs	5:46	5:47	6:25	4:16	3:56	5:21	4:48	2:49
12,000 cfs	6:52	8:20	6:37	5:03	4:52	5:28	4:37	4:21
14,000 cfs	6:32	5:41	6:31	4:44	5:37	6:35	4:27	8:46
16,000 cfs	8:59	6:46	6:50	5:12	6:21	6:58	4:57	5:38
18,000 cfs	8:05	6:44	6:36	2:09	4:35	4:18	1:48	4:21

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.01
3,000 cfs	0.04	0.04	0.03	0.02	0.01	0.02	0.01	0.01
4,000 cfs	0.05	0.05	0.04	0.03	0.01	0.03	0.02	0.02
5,000 cfs	0.06	0.06	0.05	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.07	0.07	0.06	0.04	0.02	0.04	0.03	0.03
8,000 cfs	0.09	0.08	0.07	0.03	0.02	0.05	0.04	0.04
10,000 cfs	0.10	0.09	0.08	0.04	0.03	0.06	0.05	0.04
12,000 cfs	0.11	0.11	0.09	0.04	0.03	0.06	0.05	0.05
14,000 cfs	0.11	0.12	0.10	0.04	0.03	0.08	0.07	0.07
16,000 cfs	0.12	0.13	0.10	0.04	0.03	0.07	0.06	0.06
18,000 cfs	0.13	0.14	0.11	0.04	0.03	0.07	0.06	0.06
Maximum	0.13	0.14	0.11	0.04	0.03	0.08	0.07	0.07

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00
3,000 cfs	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01
4,000 cfs	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.03	0.03	0.02	0.01	0.01	0.02	0.01	0.02
12,000 cfs	0.03	0.03	0.03	0.01	0.01	0.02	0.01	0.01
14,000 cfs	0.04	0.03	0.03	0.01	0.01	0.02	0.01	0.01
16,000 cfs	0.04	0.04	0.03	0.01	0.01	0.02	0.02	0.02
18,000 cfs	0.04	0.04	0.03	0.03	0.01	0.02	0.04	0.02
Maximum	0.04	0.04	0.03	0.03	0.01	0.02	0.04	0.02

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01
4,000 cfs	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.02
12,000 cfs	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
14,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
16,000 cfs	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01
18,000 cfs	0.03	0.03	0.03	0.03	0.01	0.02	0.04	0.02
Maximum	0.03	0.03	0.03	0.03	0.01	0.02	0.04	0.02

75% of Maximum Stage Analysis

1.5 Hour Flow Duration Total Rise to 75% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.73	0.54	0.41	0.23	0.12	0.19	0.16	0.20
2,000 cfs	1.86	1.46	1.12	0.53	0.33	0.52	0.45	0.45
3,000 cfs	2.74	2.22	1.71	0.87	0.52	0.82	0.65	0.67
4,000 cfs	3.46	2.88	2.23	1.03	0.67	1.09	0.85	0.89
5,000 cfs	4.09	3.43	2.68	1.14	0.79	1.34	1.02	1.07
6,000 cfs	4.67	3.93	3.09	1.24	0.92	1.56	1.16	1.22
8,000 cfs	5.63	4.81	3.80	1.51	1.13	1.95	1.46	1.52
10,000 cfs	6.42	5.63	4.42	1.68	1.32	2.30	1.75	1.83
12,000 cfs	7.04	6.52	4.99	1.86	1.49	2.59	1.99	2.07
14,000 cfs	7.54	7.26	5.53	2.03	1.60	2.88	2.17	2.21
16,000 cfs	8.02	7.90	6.03	2.15	1.70	3.11	2.35	2.34
18,000 cfs	8.46	8.44	6.48	2.24	1.79	3.33	2.53	2.52

6 Hour Flow Duration Total Rise to 75% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.83	0.72	0.66	0.33	0.20	0.33	0.32	0.34
2,000 cfs	2.06	1.75	1.64	0.86	0.54	0.83	0.67	0.75
3,000 cfs	2.97	2.55	2.36	1.04	0.73	1.23	0.94	1.06
4,000 cfs	3.71	3.22	2.96	1.21	0.92	1.56	1.16	1.26
5,000 cfs	4.41	3.80	3.47	1.41	1.08	1.85	1.38	1.50
6,000 cfs	5.04	4.33	3.93	1.58	1.22	2.12	1.60	1.73
8,000 cfs	6.05	5.28	4.74	1.85	1.49	2.59	1.99	2.12
10,000 cfs	6.97	6.47	5.60	2.09	1.63	2.98	2.22	2.26
12,000 cfs	7.58	7.40	6.31	2.26	1.80	3.35	2.55	2.57
14,000 cfs	8.20	8.17	6.96	2.53	1.99	3.70	2.82	2.84
16,000 cfs	8.78	8.87	7.57	2.85	2.18	4.00	3.07	3.10
18,000 cfs	9.40	9.54	8.15	2.88	2.22	4.31	3.11	3.16

24 Hour Flow Duration Total Rise to 75% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.83	0.72	0.66	0.33	0.20	0.33	0.32	0.34
2,000 cfs	2.06	1.75	1.64	0.87	0.54	0.84	0.67	0.75
3,000 cfs	2.97	2.55	2.36	1.04	0.74	1.23	0.94	1.06
4,000 cfs	3.72	3.22	2.96	1.21	0.92	1.56	1.16	1.26
5,000 cfs	4.41	3.80	3.47	1.41	1.08	1.86	1.38	1.50
6,000 cfs	5.04	4.33	3.94	1.58	1.22	2.12	1.60	1.73
8,000 cfs	6.05	5.28	4.75	1.86	1.49	2.59	1.99	2.12
10,000 cfs	6.97	6.48	5.61	2.09	1.63	2.99	2.23	2.26
12,000 cfs	7.58	7.41	6.31	2.26	1.80	3.36	2.55	2.57
14,000 cfs	8.21	8.17	6.97	2.53	2.00	3.71	2.82	2.85
16,000 cfs	8.78	8.88	7.58	2.86	2.19	4.02	3.08	3.11
18,000 cfs	9.41	9.55	8.17	2.88	2.22	4.31	3.11	3.16

Start of Operations Analysis

1.5 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:52	1:32	2:18	3:14	3:26	3:43	3:59	4:38
2,000 cfs	0:46	1:20	2:01	2:49	3:00	3:13	3:17	3:52
3,000 cfs	0:41	1:12	1:50	2:32	2:42	2:54	2:56	3:28
4,000 cfs	0:39	1:07	1:43	2:17	2:29	2:42	2:44	3:12
5,000 cfs	0:38	1:04	1:38	2:07	2:20	2:31	2:35	3:00
6,000 cfs	0:37	1:01	1:35	2:00	2:15	2:25	2:27	2:51
8,000 cfs	0:36	0:58	1:30	1:53	2:08	2:16	2:18	2:41
10,000 cfs	0:35	0:56	1:27	1:48	2:03	2:12	2:15	2:35
12,000 cfs	0:35	0:57	1:26	1:48	2:01	2:08	2:12	2:32
14,000 cfs	0:34	0:56	1:26	1:47	1:58	2:06	2:09	2:26
16,000 cfs	0:34	0:55	1:26	1:46	1:56	2:05	2:07	2:21
18,000 cfs	0:35	0:55	1:26	1:44	1:54	2:04	2:05	2:19

6 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:04	1:58	3:02	3:37	4:03	4:33	4:42	5:13
2,000 cfs	0:55	1:34	2:31	3:20	3:29	3:41	3:39	4:19
3,000 cfs	0:48	1:22	2:14	2:39	2:59	3:14	3:15	3:46
4,000 cfs	0:45	1:15	2:04	2:21	2:46	2:57	2:58	3:24
5,000 cfs	0:45	1:10	1:57	2:14	2:38	2:47	2:48	3:13
6,000 cfs	0:44	1:08	1:54	2:11	2:32	2:43	2:46	3:09
8,000 cfs	0:42	1:05	1:48	2:11	2:26	2:34	2:39	2:58
10,000 cfs	0:43	1:08	1:49	2:06	2:17	2:29	2:30	2:46
12,000 cfs	0:41	1:09	1:50	2:03	2:15	2:29	2:29	2:41
14,000 cfs	0:41	1:07	1:48	2:11	2:13	2:21	2:22	2:35
16,000 cfs	0:43	1:05	1:48	2:19	2:15	2:18	2:27	2:38
18,000 cfs	0:45	1:05	1:49	2:13	2:09	2:23	2:19	2:32

24 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:04	1:58	3:02	3:37	4:03	4:33	4:47	5:17
2,000 cfs	0:55	1:34	2:32	3:20	3:29	3:42	3:39	4:19
3,000 cfs	0:48	1:22	2:14	2:39	3:00	3:14	3:15	3:46
4,000 cfs	0:45	1:15	2:04	2:21	2:46	2:57	2:58	3:24
5,000 cfs	0:45	1:10	1:58	2:14	2:38	2:48	2:48	3:13
6,000 cfs	0:44	1:08	1:54	2:11	2:32	2:43	2:46	3:09
8,000 cfs	0:42	1:05	1:48	2:12	2:26	2:34	2:39	2:59
10,000 cfs	0:43	1:08	1:49	2:06	2:17	2:29	2:30	2:46
12,000 cfs	0:41	1:09	1:50	2:03	2:15	2:29	2:29	2:41
14,000 cfs	0:41	1:07	1:48	2:11	2:13	2:21	2:22	2:35
16,000 cfs	0:43	1:05	1:48	2:20	2:15	2:19	2:28	2:39
18,000 cfs	0:46	1:05	1:49	2:13	2:09	2:23	2:19	2:32

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 75% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.07	0.03	0.02	0.01	0.00	0.00	0.00	0.00
4,000 cfs	0.09	0.04	0.02	0.01	0.00	0.01	0.01	0.00
5,000 cfs	0.11	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.13	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.16	0.08	0.04	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.18	0.10	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.20	0.11	0.06	0.02	0.01	0.02	0.02	0.01
14,000 cfs	0.22	0.13	0.06	0.02	0.01	0.02	0.02	0.02
16,000 cfs	0.24	0.14	0.07	0.02	0.01	0.02	0.02	0.02
18,000 cfs	0.24	0.15	0.08	0.02	0.02	0.03	0.02	0.02
Maximum	0.24	0.15	0.08	0.02	0.02	0.03	0.02	0.02

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 75% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.06	0.03	0.02	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.08	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.10	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.11	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.14	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.16	0.10	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.18	0.11	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.20	0.12	0.06	0.02	0.01	0.03	0.02	0.02
16,000 cfs	0.20	0.14	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.21	0.15	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.21	0.15	0.07	0.02	0.02	0.03	0.02	0.02

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 75% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.06	0.03	0.02	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.08	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.10	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.11	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.14	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.16	0.10	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.18	0.11	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.20	0.12	0.06	0.02	0.02	0.03	0.02	0.02
16,000 cfs	0.20	0.14	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.20	0.15	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.20	0.15	0.07	0.02	0.02	0.03	0.02	0.02

Start of Rise Analysis

1.5 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:47	1:01	1:02	0:56	1:07	1:00	1:07	1:05
2,000 cfs	0:41	0:53	0:56	0:50	0:59	0:50	0:45	0:47
3,000 cfs	0:37	0:47	0:50	0:42	0:50	0:40	0:34	0:37
4,000 cfs	0:35	0:43	0:46	0:33	0:43	0:35	0:29	0:31
5,000 cfs	0:34	0:40	0:43	0:27	0:38	0:29	0:26	0:26
6,000 cfs	0:33	0:37	0:42	0:24	0:36	0:27	0:22	0:23
8,000 cfs	0:32	0:35	0:39	0:21	0:34	0:24	0:19	0:22
10,000 cfs	0:31	0:33	0:38	0:20	0:33	0:24	0:21	0:23
12,000 cfs	0:31	0:34	0:38	0:23	0:34	0:24	0:21	0:25
14,000 cfs	0:30	0:33	0:39	0:24	0:33	0:24	0:21	0:23
16,000 cfs	0:30	0:32	0:40	0:24	0:33	0:25	0:21	0:21
18,000 cfs	0:31	0:32	0:40	0:23	0:32	0:26	0:21	0:21

6 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:59	1:27	1:46	1:19	1:44	1:50	1:50	1:40
2,000 cfs	0:50	1:07	1:26	1:21	1:28	1:18	1:07	1:14
3,000 cfs	0:44	0:57	1:14	0:49	1:07	1:00	0:53	0:55
4,000 cfs	0:41	0:51	1:07	0:37	1:00	0:50	0:43	0:43
5,000 cfs	0:41	0:46	1:02	0:34	0:56	0:45	0:39	0:39
6,000 cfs	0:40	0:44	1:01	0:35	0:53	0:45	0:41	0:41
8,000 cfs	0:38	0:42	0:57	0:39	0:52	0:42	0:40	0:39
10,000 cfs	0:39	0:45	1:00	0:38	0:47	0:41	0:36	0:34
12,000 cfs	0:37	0:46	1:02	0:38	0:48	0:45	0:38	0:34
14,000 cfs	0:37	0:44	1:01	0:48	0:48	0:39	0:34	0:32
16,000 cfs	0:39	0:42	1:02	0:57	0:52	0:38	0:41	0:38
18,000 cfs	0:41	0:42	1:03	0:52	0:47	0:45	0:35	0:34

24 Hour Flow Duration Time to 75% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:59	1:27	1:46	1:19	1:44	1:50	1:55	1:44
2,000 cfs	0:50	1:07	1:27	1:21	1:28	1:19	1:07	1:14
3,000 cfs	0:44	0:57	1:14	0:49	1:08	1:00	0:53	0:55
4,000 cfs	0:41	0:51	1:07	0:37	1:00	0:50	0:43	0:43
5,000 cfs	0:41	0:46	1:03	0:34	0:56	0:46	0:39	0:39
6,000 cfs	0:40	0:44	1:01	0:35	0:53	0:45	0:41	0:41
8,000 cfs	0:38	0:42	0:57	0:40	0:52	0:42	0:40	0:40
10,000 cfs	0:39	0:45	1:00	0:38	0:47	0:41	0:36	0:34
12,000 cfs	0:37	0:46	1:02	0:38	0:48	0:45	0:38	0:34
14,000 cfs	0:37	0:44	1:01	0:48	0:48	0:39	0:34	0:32
16,000 cfs	0:39	0:42	1:02	0:58	0:52	0:39	0:42	0:39
18,000 cfs	0:42	0:42	1:03	0:52	0:47	0:45	0:35	0:34

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 75% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.07	0.05	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.10	0.07	0.05	0.03	0.02	0.03	0.03	0.03
5,000 cfs	0.12	0.09	0.06	0.04	0.02	0.05	0.04	0.04
6,000 cfs	0.14	0.11	0.07	0.05	0.03	0.06	0.05	0.05
8,000 cfs	0.18	0.14	0.10	0.07	0.03	0.08	0.08	0.07
10,000 cfs	0.21	0.17	0.12	0.08	0.04	0.10	0.08	0.08
12,000 cfs	0.23	0.19	0.13	0.08	0.04	0.11	0.09	0.08
14,000 cfs	0.25	0.22	0.14	0.08	0.05	0.12	0.10	0.10
16,000 cfs	0.27	0.25	0.15	0.09	0.05	0.12	0.11	0.11
18,000 cfs	0.27	0.26	0.16	0.10	0.06	0.13	0.12	0.12
Maximum	0.27	0.26	0.16	0.10	0.06	0.13	0.12	0.12

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 75% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.07	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.09	0.06	0.04	0.03	0.02	0.03	0.03	0.03
5,000 cfs	0.11	0.08	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.13	0.10	0.06	0.04	0.02	0.05	0.04	0.04
8,000 cfs	0.16	0.13	0.08	0.05	0.03	0.06	0.05	0.05
10,000 cfs	0.18	0.14	0.09	0.05	0.03	0.07	0.06	0.07
12,000 cfs	0.20	0.16	0.10	0.06	0.04	0.07	0.07	0.07
14,000 cfs	0.22	0.19	0.11	0.05	0.04	0.09	0.08	0.09
16,000 cfs	0.22	0.21	0.12	0.05	0.04	0.11	0.07	0.08
18,000 cfs	0.23	0.23	0.13	0.06	0.05	0.10	0.09	0.09
Maximum	0.23	0.23	0.13	0.06	0.05	0.11	0.09	0.09

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 75% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.07	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.09	0.06	0.04	0.03	0.02	0.03	0.03	0.03
5,000 cfs	0.11	0.08	0.05	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.13	0.10	0.06	0.04	0.02	0.05	0.04	0.04
8,000 cfs	0.16	0.13	0.08	0.05	0.03	0.06	0.05	0.05
10,000 cfs	0.18	0.14	0.09	0.05	0.03	0.07	0.06	0.07
12,000 cfs	0.20	0.16	0.10	0.06	0.04	0.07	0.07	0.07
14,000 cfs	0.22	0.19	0.11	0.05	0.04	0.09	0.08	0.09
16,000 cfs	0.22	0.21	0.12	0.05	0.04	0.10	0.07	0.08
18,000 cfs	0.22	0.23	0.13	0.06	0.05	0.10	0.09	0.09
Maximum	0.22	0.23	0.13	0.06	0.05	0.10	0.09	0.09

80% of Maximum Stage Analysis

1.5 Hour Flow DurationTotal Rise to 80% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.78	0.58	0.44	0.25	0.13	0.20	0.17	0.21
2,000 cfs	1.98	1.56	1.19	0.56	0.35	0.55	0.48	0.48
3,000 cfs	2.92	2.37	1.82	0.93	0.55	0.87	0.70	0.72
4,000 cfs	3.69	3.07	2.38	1.10	0.71	1.17	0.90	0.95
5,000 cfs	4.36	3.66	2.86	1.22	0.85	1.43	1.09	1.14
6,000 cfs	4.98	4.19	3.30	1.32	0.98	1.66	1.24	1.30
8,000 cfs	6.00	5.14	4.06	1.61	1.21	2.08	1.55	1.62
10,000 cfs	6.85	6.00	4.72	1.79	1.41	2.46	1.87	1.95
12,000 cfs	7.50	6.95	5.32	1.99	1.58	2.76	2.13	2.21
14,000 cfs	8.04	7.74	5.90	2.16	1.70	3.07	2.31	2.36
16,000 cfs	8.55	8.42	6.43	2.30	1.81	3.32	2.50	2.50
18,000 cfs	9.02	9.00	6.91	2.39	1.90	3.55	2.70	2.69

6 Hour Flow Duration Total Rise to 80% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.88	0.77	0.70	0.35	0.21	0.35	0.34	0.36
2,000 cfs	2.20	1.87	1.74	0.92	0.57	0.89	0.71	0.80
3,000 cfs	3.17	2.72	2.52	1.11	0.78	1.31	1.01	1.14
4,000 cfs	3.96	3.43	3.15	1.29	0.98	1.66	1.24	1.34
5,000 cfs	4.70	4.06	3.70	1.51	1.15	1.98	1.47	1.60
6,000 cfs	5.38	4.62	4.19	1.68	1.30	2.26	1.70	1.85
8,000 cfs	6.46	5.63	5.06	1.98	1.58	2.76	2.13	2.26
10,000 cfs	7.43	6.90	5.98	2.23	1.74	3.18	2.37	2.41
12,000 cfs	8.08	7.90	6.73	2.41	1.92	3.58	2.72	2.74
14,000 cfs	8.74	8.72	7.42	2.69	2.12	3.94	3.01	3.03
16,000 cfs	9.36	9.46	8.07	3.04	2.33	4.27	3.27	3.31
18,000 cfs	10.02	10.18	8.70	3.07	2.36	4.60	3.32	3.37

24 Hour Flow Duration Total to 80% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.88	0.77	0.70	0.35	0.21	0.35	0.34	0.37
2,000 cfs	2.20	1.87	1.75	0.93	0.57	0.90	0.71	0.80
3,000 cfs	3.17	2.72	2.52	1.11	0.78	1.31	1.01	1.14
4,000 cfs	3.97	3.43	3.15	1.29	0.98	1.66	1.24	1.34
5,000 cfs	4.70	4.06	3.70	1.51	1.15	1.98	1.47	1.60
6,000 cfs	5.38	4.62	4.20	1.68	1.30	2.26	1.70	1.85
8,000 cfs	6.46	5.63	5.06	1.99	1.58	2.76	2.13	2.26
10,000 cfs	7.43	6.91	5.98	2.23	1.74	3.19	2.38	2.41
12,000 cfs	8.09	7.90	6.74	2.41	1.92	3.58	2.72	2.74
14,000 cfs	8.75	8.72	7.43	2.69	2.13	3.95	3.01	3.04
16,000 cfs	9.37	9.47	8.09	3.05	2.34	4.29	3.28	3.32
18,000 cfs	10.04	10.19	8.71	3.07	2.36	4.60	3.32	3.37

Start of Operations Analysis

1.5 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:58	1:36	2:23	3:21	3:30	3:50	4:02	4:42
2,000 cfs	0:51	1:24	2:05	2:52	3:04	3:16	3:18	3:56
3,000 cfs	0:47	1:16	1:53	2:35	2:45	2:57	2:59	3:32
4,000 cfs	0:44	1:11	1:46	2:19	2:31	2:44	2:47	3:15
5,000 cfs	0:43	1:08	1:41	2:08	2:22	2:34	2:36	3:03
6,000 cfs	0:43	1:05	1:38	2:02	2:17	2:27	2:29	2:53
8,000 cfs	0:41	1:02	1:34	1:55	2:11	2:18	2:21	2:44
10,000 cfs	0:41	1:01	1:31	1:53	2:06	2:15	2:18	2:38
12,000 cfs	0:40	1:02	1:31	1:52	2:04	2:11	2:15	2:34
14,000 cfs	0:39	1:01	1:31	1:51	2:02	2:10	2:12	2:28
16,000 cfs	0:40	1:00	1:31	1:50	2:00	2:09	2:10	2:23
18,000 cfs	0:41	0:59	1:31	1:50	1:57	2:05	2:07	2:21

6 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:12	2:07	3:13	3:46	4:16	4:45	4:52	5:25
2,000 cfs	1:03	1:42	2:41	3:28	3:36	3:48	3:50	4:27
3,000 cfs	0:56	1:29	2:24	2:42	3:05	3:20	3:21	3:52
4,000 cfs	0:52	1:21	2:13	2:23	2:53	3:04	3:03	3:28
5,000 cfs	0:52	1:17	2:06	2:21	2:45	2:54	2:55	3:19
6,000 cfs	0:52	1:15	2:03	2:25	2:40	2:52	2:56	3:16
8,000 cfs	0:50	1:11	1:57	2:19	2:34	2:41	2:47	3:05
10,000 cfs	0:51	1:18	2:00	2:14	2:25	2:39	2:37	2:51
12,000 cfs	0:49	1:18	2:00	2:19	2:22	2:33	2:34	2:45
14,000 cfs	0:50	1:15	1:59	2:19	2:21	2:27	2:37	2:44
16,000 cfs	0:52	1:14	1:58	2:43	2:31	2:33	2:37	2:51
18,000 cfs	0:56	1:14	2:00	2:30	2:22	2:37	2:28	2:42

24 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:12	2:07	3:13	3:46	4:16	4:45	4:58	5:25
2,000 cfs	1:03	1:42	2:42	3:30	3:36	3:50	3:50	4:27
3,000 cfs	0:56	1:29	2:24	2:42	3:06	3:20	3:21	3:52
4,000 cfs	0:52	1:21	2:13	2:23	2:53	3:04	3:03	3:28
5,000 cfs	0:52	1:17	2:07	2:21	2:45	2:55	2:55	3:19
6,000 cfs	0:52	1:15	2:03	2:25	2:40	2:52	2:56	3:16
8,000 cfs	0:50	1:11	1:57	2:19	2:34	2:41	2:47	3:06
10,000 cfs	0:51	1:18	2:01	2:14	2:25	2:40	2:37	2:51
12,000 cfs	0:49	1:19	2:00	2:19	2:22	2:33	2:34	2:45
14,000 cfs	0:50	1:15	1:59	2:19	2:21	2:27	2:37	2:44
16,000 cfs	0:52	1:14	1:59	2:44	2:32	2:33	2:38	2:51
18,000 cfs	0:56	1:14	2:01	2:30	2:22	2:37	2:28	2:42

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 80% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.06	0.03	0.02	0.01	0.00	0.00	0.00	0.00
4,000 cfs	0.08	0.04	0.02	0.01	0.00	0.01	0.01	0.00
5,000 cfs	0.10	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.12	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.15	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.17	0.10	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.19	0.11	0.06	0.02	0.01	0.02	0.02	0.01
14,000 cfs	0.21	0.13	0.06	0.02	0.01	0.02	0.02	0.02
16,000 cfs	0.21	0.14	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.22	0.15	0.08	0.02	0.02	0.03	0.02	0.02
Maximum	0.22	0.15	0.08	0.02	0.02	0.03	0.02	0.02

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 80% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.06	0.03	0.02	0.01	0.00	0.01	0.01	0.00
4,000 cfs	0.08	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.09	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.10	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.13	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.15	0.09	0.05	0.02	0.01	0.02	0.02	0.01
12,000 cfs	0.16	0.10	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.17	0.12	0.06	0.02	0.02	0.03	0.02	0.02
16,000 cfs	0.18	0.13	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.18	0.14	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.18	0.14	0.07	0.02	0.02	0.03	0.02	0.02

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 80% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.06	0.03	0.02	0.01	0.00	0.01	0.01	0.00
4,000 cfs	0.08	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.09	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.10	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.13	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.15	0.09	0.05	0.02	0.01	0.02	0.02	0.01
12,000 cfs	0.17	0.10	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.18	0.12	0.06	0.02	0.02	0.03	0.02	0.02
16,000 cfs	0.18	0.13	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.18	0.14	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.18	0.14	0.07	0.02	0.02	0.03	0.02	0.02

Start of Rise Analysis

1.5 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0:53	1:05	1:07	1:03	1:11	1:07	1:10	1:09
2,000 cfs	0:46	0:57	1:00	0:53	1:03	0:53	0:46	0:51
3,000 cfs	0:43	0:51	0:53	0:45	0:53	0:43	0:37	0:41
4,000 cfs	0:40	0:47	0:49	0:35	0:45	0:37	0:32	0:34
5,000 cfs	0:39	0:44	0:46	0:28	0:40	0:32	0:27	0:29
6,000 cfs	0:39	0:41	0:45	0:26	0:38	0:29	0:24	0:25
8,000 cfs	0:37	0:39	0:43	0:23	0:37	0:26	0:22	0:25
10,000 cfs	0:37	0:38	0:42	0:25	0:36	0:27	0:24	0:26
12,000 cfs	0:36	0:39	0:43	0:27	0:37	0:27	0:24	0:27
14,000 cfs	0:35	0:38	0:44	0:28	0:37	0:28	0:24	0:25
16,000 cfs	0:36	0:37	0:45	0:28	0:37	0:29	0:24	0:23
18,000 cfs	0:37	0:36	0:45	0:29	0:35	0:27	0:23	0:23

6 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:07	1:36	1:57	1:28	1:57	2:02	2:00	1:52
2,000 cfs	0:58	1:15	1:36	1:29	1:35	1:25	1:18	1:22
3,000 cfs	0:52	1:04	1:24	0:52	1:13	1:06	0:59	1:01
4,000 cfs	0:48	0:57	1:16	0:39	1:07	0:57	0:48	0:47
5,000 cfs	0:48	0:53	1:11	0:41	1:03	0:52	0:46	0:45
6,000 cfs	0:48	0:51	1:10	0:49	1:01	0:54	0:51	0:48
8,000 cfs	0:46	0:48	1:06	0:47	1:00	0:49	0:48	0:46
10,000 cfs	0:47	0:55	1:11	0:46	0:55	0:51	0:43	0:39
12,000 cfs	0:45	0:55	1:12	0:54	0:55	0:49	0:43	0:38
14,000 cfs	0:46	0:52	1:12	0:56	0:56	0:45	0:49	0:41
16,000 cfs	0:48	0:51	1:12	1:21	1:08	0:53	0:51	0:51
18,000 cfs	0:52	0:51	1:14	1:09	1:00	0:59	0:44	0:44

24 Hour Flow Duration Time to 80% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:07	1:36	1:57	1:28	1:57	2:02	2:06	1:52
2,000 cfs	0:58	1:15	1:37	1:31	1:35	1:27	1:18	1:22
3,000 cfs	0:52	1:04	1:24	0:52	1:14	1:06	0:59	1:01
4,000 cfs	0:48	0:57	1:16	0:39	1:07	0:57	0:48	0:47
5,000 cfs	0:48	0:53	1:12	0:41	1:03	0:53	0:46	0:45
6,000 cfs	0:48	0:51	1:10	0:49	1:01	0:54	0:51	0:48
8,000 cfs	0:46	0:48	1:06	0:47	1:00	0:49	0:48	0:47
10,000 cfs	0:47	0:55	1:12	0:46	0:55	0:52	0:43	0:39
12,000 cfs	0:45	0:56	1:12	0:54	0:55	0:49	0:43	0:38
14,000 cfs	0:46	0:52	1:12	0:56	0:56	0:45	0:49	0:41
16,000 cfs	0:48	0:51	1:13	1:22	1:09	0:53	0:52	0:51
18,000 cfs	0:52	0:51	1:15	1:09	1:00	0:59	0:44	0:44

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 80% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.07	0.05	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.09	0.07	0.05	0.03	0.02	0.03	0.03	0.03
5,000 cfs	0.11	0.08	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.13	0.10	0.07	0.05	0.03	0.06	0.05	0.05
8,000 cfs	0.16	0.13	0.09	0.07	0.03	0.08	0.07	0.06
10,000 cfs	0.18	0.16	0.11	0.07	0.04	0.09	0.08	0.07
12,000 cfs	0.21	0.18	0.12	0.07	0.04	0.10	0.09	0.08
14,000 cfs	0.23	0.20	0.13	0.08	0.05	0.11	0.10	0.09
16,000 cfs	0.24	0.23	0.14	0.08	0.05	0.11	0.10	0.11
18,000 cfs	0.24	0.25	0.15	0.08	0.05	0.13	0.12	0.12
Maximum	0.24	0.25	0.15	0.08	0.05	0.13	0.12	0.12

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 80% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.08	0.06	0.04	0.03	0.01	0.03	0.03	0.03
5,000 cfs	0.10	0.08	0.05	0.04	0.02	0.04	0.03	0.04
6,000 cfs	0.11	0.09	0.06	0.03	0.02	0.04	0.03	0.04
8,000 cfs	0.14	0.12	0.08	0.04	0.03	0.06	0.04	0.05
10,000 cfs	0.16	0.13	0.08	0.05	0.03	0.06	0.05	0.06
12,000 cfs	0.18	0.14	0.09	0.04	0.03	0.07	0.06	0.07
14,000 cfs	0.19	0.17	0.10	0.05	0.04	0.09	0.06	0.07
16,000 cfs	0.19	0.19	0.11	0.04	0.03	0.08	0.06	0.06
18,000 cfs	0.19	0.20	0.12	0.04	0.04	0.08	0.08	0.08
Maximum	0.19	0.20	0.12	0.05	0.04	0.09	0.08	0.08

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 80% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.08	0.06	0.04	0.03	0.01	0.03	0.03	0.03
5,000 cfs	0.10	0.08	0.05	0.04	0.02	0.04	0.03	0.04
6,000 cfs	0.11	0.09	0.06	0.03	0.02	0.04	0.03	0.04
8,000 cfs	0.14	0.12	0.08	0.04	0.03	0.06	0.04	0.05
10,000 cfs	0.16	0.13	0.08	0.05	0.03	0.06	0.06	0.06
12,000 cfs	0.18	0.14	0.09	0.04	0.03	0.07	0.06	0.07
14,000 cfs	0.19	0.17	0.10	0.05	0.04	0.09	0.06	0.07
16,000 cfs	0.19	0.19	0.11	0.04	0.03	0.08	0.06	0.06
18,000 cfs	0.19	0.20	0.12	0.04	0.04	0.08	0.08	0.08
Maximum	0.19	0.20	0.12	0.05	0.04	0.09	0.08	0.08

90% of Maximum Stage Analysis

1.5 Hour Flow Duration Total Rise to 90% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.87	0.65	0.50	0.28	0.14	0.23	0.19	0.23
2,000 cfs	2.23	1.75	1.34	0.63	0.39	0.62	0.54	0.54
3,000 cfs	3.29	2.66	2.05	1.04	0.62	0.98	0.78	0.81
4,000 cfs	4.15	3.46	2.68	1.24	0.80	1.31	1.02	1.07
5,000 cfs	4.91	4.12	3.22	1.37	0.95	1.61	1.22	1.29
6,000 cfs	5.60	4.72	3.71	1.49	1.10	1.87	1.40	1.46
8,000 cfs	6.75	5.78	4.56	1.81	1.36	2.34	1.75	1.83
10,000 cfs	7.70	6.75	5.31	2.01	1.58	2.76	2.11	2.20
12,000 cfs	8.44	7.82	5.98	2.23	1.78	3.10	2.39	2.48
14,000 cfs	9.05	8.71	6.63	2.43	1.92	3.46	2.60	2.65
16,000 cfs	9.62	9.48	7.24	2.59	2.03	3.73	2.82	2.81
18,000 cfs	10.15	10.13	7.78	2.69	2.14	4.00	3.03	3.02

6 Hour Flow Duration Total Rise to 90% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.99	0.86	0.79	0.40	0.24	0.40	0.38	0.40
2,000 cfs	2.48	2.11	1.96	1.03	0.64	1.00	0.80	0.90
3,000 cfs	3.56	3.06	2.83	1.25	0.88	1.48	1.13	1.28
4,000 cfs	4.46	3.86	3.55	1.45	1.10	1.87	1.40	1.51
5,000 cfs	5.29	4.56	4.16	1.70	1.30	2.22	1.66	1.80
6,000 cfs	6.05	5.20	4.72	1.90	1.46	2.55	1.92	2.08
8,000 cfs	7.26	6.34	5.69	2.22	1.78	3.10	2.39	2.54
10,000 cfs	8.36	7.77	6.72	2.50	1.96	3.58	2.66	2.71
12,000 cfs	9.09	8.88	7.57	2.71	2.16	4.02	3.06	3.09
14,000 cfs	9.84	9.81	8.35	3.03	2.39	4.44	3.38	3.41
16,000 cfs	10.53	10.65	9.08	3.42	2.62	4.81	3.68	3.73
18,000 cfs	11.28	11.45	9.78	3.45	2.66	5.18	3.73	3.79

24 Hour Flow Duration Total Rise to 90% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.99	0.86	0.79	0.40	0.24	0.40	0.39	0.41
2,000 cfs	2.48	2.11	1.97	1.04	0.64	1.01	0.80	0.90
3,000 cfs	3.56	3.06	2.83	1.25	0.88	1.48	1.13	1.28
4,000 cfs	4.46	3.86	3.55	1.45	1.10	1.87	1.40	1.51
5,000 cfs	5.29	4.56	4.17	1.70	1.30	2.23	1.66	1.80
6,000 cfs	6.05	5.20	4.73	1.90	1.46	2.55	1.92	2.08
8,000 cfs	7.26	6.34	5.70	2.23	1.78	3.10	2.39	2.55
10,000 cfs	8.36	7.78	6.73	2.50	1.96	3.59	2.67	2.71
12,000 cfs	9.10	8.89	7.58	2.71	2.16	4.03	3.06	3.09
14,000 cfs	9.85	9.81	8.36	3.03	2.39	4.45	3.38	3.42
16,000 cfs	10.54	10.66	9.10	3.43	2.63	4.82	3.69	3.73
18,000 cfs	11.30	11.47	9.80	3.45	2.66	5.18	3.73	3.79

Start of Operations Analysis

1.5 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:12	1:45	2:32	3:29	3:39	4:00	4:11	4:58
2,000 cfs	1:06	1:34	2:14	2:59	3:12	3:25	3:24	4:05
3,000 cfs	1:01	1:26	2:01	2:42	2:53	3:05	3:08	3:40
4,000 cfs	0:59	1:22	1:55	2:23	2:38	2:49	2:52	3:23
5,000 cfs	0:59	1:19	1:50	2:12	2:30	2:40	2:42	3:09
6,000 cfs	0:59	1:17	1:47	2:06	2:25	2:33	2:34	2:59
8,000 cfs	0:58	1:14	1:44	2:09	2:19	2:27	2:30	2:51
10,000 cfs	0:58	1:14	1:42	2:03	2:14	2:22	2:25	2:45
12,000 cfs	0:56	1:17	1:43	2:01	2:14	2:21	2:24	2:42
14,000 cfs	0:56	1:15	1:42	2:07	2:10	2:19	2:20	2:33
16,000 cfs	0:57	1:14	1:42	2:05	2:07	2:12	2:13	2:27
18,000 cfs	0:58	1:13	1:42	2:02	2:05	2:09	2:17	2:27

6 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:42	2:36	3:48	4:22	4:52	5:19	5:20	5:46
2,000 cfs	1:30	2:05	3:12	3:57	4:02	4:12	4:18	4:56
3,000 cfs	1:21	1:50	2:52	2:51	3:29	3:44	3:45	4:12
4,000 cfs	1:17	1:43	2:40	2:42	3:20	3:28	3:24	3:43
5,000 cfs	1:19	1:39	2:33	3:01	3:11	3:23	3:26	3:46
6,000 cfs	1:19	1:38	2:30	2:54	3:04	3:18	3:23	3:41
8,000 cfs	1:17	1:34	2:25	2:52	3:03	3:09	3:14	3:28
10,000 cfs	1:21	1:54	2:37	2:50	2:47	3:01	2:57	3:04
12,000 cfs	1:16	1:47	2:32	2:40	2:46	3:04	3:17	3:25
14,000 cfs	1:21	1:44	2:31	3:12	3:06	3:08	3:13	3:25
16,000 cfs	1:24	1:44	2:34	3:23	3:10	3:09	3:13	3:25
18,000 cfs	1:31	1:47	2:36	2:55	2:49	3:12	2:53	3:06

24 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:42	2:36	3:48	4:22	4:52	5:19	5:30	5:54
2,000 cfs	1:30	2:05	3:14	4:02	4:02	4:16	4:18	4:56
3,000 cfs	1:21	1:50	2:52	2:51	3:32	3:44	3:45	4:12
4,000 cfs	1:18	1:43	2:40	2:42	3:20	3:28	3:24	3:43
5,000 cfs	1:19	1:39	2:34	3:01	3:11	3:25	3:26	3:46
6,000 cfs	1:19	1:38	2:31	2:54	3:04	3:18	3:23	3:41
8,000 cfs	1:17	1:34	2:25	2:52	3:03	3:09	3:14	3:29
10,000 cfs	1:21	1:54	2:38	2:50	2:47	3:02	2:58	3:04
12,000 cfs	1:16	1:47	2:32	2:40	2:46	3:06	3:17	3:25
14,000 cfs	1:21	1:44	2:32	3:12	3:06	3:09	3:13	3:26
16,000 cfs	1:24	1:44	2:34	3:24	3:11	3:10	3:14	3:27
18,000 cfs	1:32	1:48	2:37	2:55	2:49	3:12	2:53	3:06

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 90% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.05	0.03	0.02	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.08	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.09	0.06	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.12	0.08	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.13	0.09	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.15	0.10	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.16	0.12	0.07	0.02	0.01	0.02	0.02	0.02
16,000 cfs	0.17	0.13	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.18	0.14	0.08	0.02	0.02	0.03	0.02	0.02
Maximum	0.18	0.14	0.08	0.02	0.02	0.03	0.02	0.02

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 90% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.04	0.03	0.02	0.01	0.00	0.01	0.01	0.01
4,000 cfs	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.07	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.08	0.05	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.09	0.07	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.10	0.07	0.04	0.01	0.01	0.02	0.02	0.01
12,000 cfs	0.12	0.08	0.05	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.12	0.09	0.06	0.02	0.01	0.02	0.02	0.02
16,000 cfs	0.13	0.10	0.06	0.02	0.01	0.03	0.02	0.02
18,000 cfs	0.12	0.11	0.06	0.02	0.02	0.03	0.02	0.02
Maximum	0.13	0.11	0.06	0.02	0.02	0.03	0.02	0.02

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 90% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.04	0.03	0.02	0.01	0.00	0.01	0.01	0.01
4,000 cfs	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.07	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.08	0.05	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.09	0.07	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.10	0.07	0.04	0.01	0.01	0.02	0.02	0.01
12,000 cfs	0.12	0.08	0.05	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.12	0.09	0.06	0.02	0.01	0.02	0.02	0.02
16,000 cfs	0.13	0.10	0.06	0.02	0.01	0.03	0.02	0.02
18,000 cfs	0.12	0.11	0.06	0.02	0.02	0.03	0.02	0.02
Maximum	0.13	0.11	0.06	0.02	0.02	0.03	0.02	0.02

Start of Rise Analysis

1.5 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:07	1:14	1:16	1:11	1:20	1:17	1:19	1:25
2,000 cfs	1:01	1:07	1:09	1:00	1:11	1:02	0:52	1:00
3,000 cfs	0:57	1:01	1:01	0:52	1:01	0:51	0:46	0:49
4,000 cfs	0:55	0:58	0:58	0:39	0:52	0:42	0:37	0:42
5,000 cfs	0:55	0:55	0:55	0:32	0:48	0:38	0:33	0:35
6,000 cfs	0:55	0:53	0:54	0:30	0:46	0:35	0:29	0:31
8,000 cfs	0:54	0:51	0:53	0:37	0:45	0:35	0:31	0:32
10,000 cfs	0:54	0:51	0:53	0:35	0:44	0:34	0:31	0:33
12,000 cfs	0:52	0:54	0:55	0:36	0:47	0:37	0:33	0:35
14,000 cfs	0:52	0:52	0:55	0:44	0:45	0:37	0:32	0:30
16,000 cfs	0:53	0:51	0:56	0:43	0:44	0:32	0:27	0:27
18,000 cfs	0:54	0:50	0:56	0:41	0:43	0:31	0:33	0:29

6 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:37	2:05	2:32	2:04	2:33	2:36	2:28	2:13
2,000 cfs	1:25	1:38	2:07	1:58	2:01	1:49	1:46	1:51
3,000 cfs	1:17	1:25	1:52	1:01	1:37	1:30	1:23	1:21
4,000 cfs	1:13	1:19	1:43	0:58	1:34	1:21	1:09	1:02
5,000 cfs	1:15	1:15	1:38	1:21	1:29	1:21	1:17	1:12
6,000 cfs	1:15	1:14	1:37	1:18	1:25	1:20	1:18	1:13
8,000 cfs	1:13	1:11	1:34	1:20	1:29	1:17	1:15	1:09
10,000 cfs	1:17	1:31	1:48	1:22	1:17	1:13	1:03	0:52
12,000 cfs	1:12	1:24	1:44	1:15	1:19	1:20	1:26	1:18
14,000 cfs	1:17	1:21	1:44	1:49	1:41	1:26	1:25	1:22
16,000 cfs	1:20	1:21	1:48	2:01	1:47	1:29	1:27	1:25
18,000 cfs	1:27	1:24	1:50	1:34	1:27	1:34	1:09	1:08

24 Hour Flow Duration Time to 90% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:37	2:05	2:32	2:04	2:33	2:36	2:38	2:21
2,000 cfs	1:25	1:38	2:09	2:03	2:01	1:53	1:46	1:51
3,000 cfs	1:17	1:25	1:52	1:01	1:40	1:30	1:23	1:21
4,000 cfs	1:14	1:19	1:43	0:58	1:34	1:21	1:09	1:02
5,000 cfs	1:15	1:15	1:39	1:21	1:29	1:23	1:17	1:12
6,000 cfs	1:15	1:14	1:38	1:18	1:25	1:20	1:18	1:13
8,000 cfs	1:13	1:11	1:34	1:20	1:29	1:17	1:15	1:10
10,000 cfs	1:17	1:31	1:49	1:22	1:17	1:14	1:04	0:52
12,000 cfs	1:12	1:24	1:44	1:15	1:19	1:22	1:26	1:18
14,000 cfs	1:17	1:21	1:45	1:49	1:41	1:27	1:25	1:23
16,000 cfs	1:20	1:21	1:48	2:02	1:48	1:30	1:28	1:27
18,000 cfs	1:28	1:25	1:51	1:34	1:27	1:34	1:09	1:08

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 90% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.08	0.06	0.05	0.03	0.02	0.03	0.03	0.03
5,000 cfs	0.09	0.07	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.10	0.09	0.07	0.05	0.02	0.05	0.05	0.05
8,000 cfs	0.12	0.11	0.09	0.05	0.03	0.07	0.06	0.06
10,000 cfs	0.14	0.13	0.10	0.06	0.04	0.08	0.07	0.07
12,000 cfs	0.16	0.14	0.11	0.06	0.04	0.08	0.07	0.07
14,000 cfs	0.17	0.17	0.12	0.06	0.04	0.09	0.08	0.09
16,000 cfs	0.18	0.19	0.13	0.06	0.05	0.12	0.10	0.10
18,000 cfs	0.19	0.20	0.14	0.07	0.05	0.13	0.09	0.10
Maximum	0.19	0.20	0.14	0.07	0.05	0.13	0.10	0.10

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 90% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.05	0.04	0.03	0.02	0.01	0.02	0.01	0.02
4,000 cfs	0.06	0.05	0.03	0.02	0.01	0.02	0.02	0.02
5,000 cfs	0.07	0.06	0.04	0.02	0.01	0.03	0.02	0.02
6,000 cfs	0.08	0.07	0.05	0.02	0.02	0.03	0.02	0.03
8,000 cfs	0.10	0.09	0.06	0.03	0.02	0.04	0.03	0.04
10,000 cfs	0.11	0.09	0.06	0.03	0.03	0.05	0.04	0.05
12,000 cfs	0.13	0.11	0.07	0.04	0.03	0.05	0.04	0.04
14,000 cfs	0.13	0.12	0.08	0.03	0.02	0.05	0.04	0.04
16,000 cfs	0.13	0.13	0.08	0.03	0.02	0.05	0.04	0.04
18,000 cfs	0.13	0.14	0.09	0.04	0.03	0.05	0.05	0.06
Maximum	0.13	0.14	0.09	0.04	0.03	0.05	0.05	0.06

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 90% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.05	0.04	0.03	0.02	0.01	0.02	0.01	0.02
4,000 cfs	0.06	0.05	0.03	0.02	0.01	0.02	0.02	0.02
5,000 cfs	0.07	0.06	0.04	0.02	0.01	0.03	0.02	0.02
6,000 cfs	0.08	0.07	0.05	0.02	0.02	0.03	0.02	0.03
8,000 cfs	0.10	0.09	0.06	0.03	0.02	0.04	0.03	0.04
10,000 cfs	0.11	0.09	0.06	0.03	0.03	0.05	0.04	0.05
12,000 cfs	0.13	0.11	0.07	0.04	0.03	0.05	0.04	0.04
14,000 cfs	0.13	0.12	0.08	0.03	0.02	0.05	0.04	0.04
16,000 cfs	0.13	0.13	0.08	0.03	0.02	0.05	0.04	0.04
18,000 cfs	0.13	0.13	0.09	0.04	0.03	0.05	0.05	0.06
Maximum	0.13	0.13	0.09	0.04	0.03	0.05	0.05	0.06

99% of Maximum Stage Analysis

1.5 Hour Flow Duration Total Rise to 99% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.96	0.71	0.54	0.31	0.16	0.25	0.21	0.26
2,000 cfs	2.46	1.93	1.48	0.69	0.43	0.68	0.59	0.59
3,000 cfs	3.61	2.93	2.26	1.15	0.69	1.08	0.86	0.89
4,000 cfs	4.56	3.80	2.95	1.36	0.88	1.45	1.12	1.18
5,000 cfs	5.40	4.53	3.54	1.51	1.05	1.77	1.35	1.42
6,000 cfs	6.16	5.19	4.08	1.63	1.21	2.06	1.53	1.60
8,000 cfs	7.43	6.36	5.02	1.99	1.50	2.57	1.92	2.01
10,000 cfs	8.47	7.43	5.84	2.21	1.74	3.04	2.32	2.42
12,000 cfs	9.29	8.60	6.58	2.46	1.96	3.42	2.63	2.73
14,000 cfs	9.95	9.58	7.30	2.68	2.11	3.80	2.86	2.92
16,000 cfs	10.58	10.42	7.96	2.84	2.24	4.11	3.10	3.09
18,000 cfs	11.17	11.14	8.55	2.96	2.36	4.40	3.34	3.33

6 Hour Flow Duration Total Rise to 99% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1.09	0.95	0.87	0.44	0.26	0.44	0.42	0.45
2,000 cfs	2.72	2.32	2.16	1.13	0.71	1.10	0.88	0.99
3,000 cfs	3.92	3.37	3.12	1.38	0.96	1.62	1.25	1.41
4,000 cfs	4.90	4.25	3.90	1.60	1.21	2.06	1.53	1.66
5,000 cfs	5.82	5.02	4.57	1.87	1.43	2.45	1.82	1.98
6,000 cfs	6.65	5.72	5.19	2.08	1.61	2.80	2.11	2.29
8,000 cfs	7.99	6.97	6.26	2.45	1.96	3.42	2.63	2.79
10,000 cfs	9.20	8.54	7.40	2.75	2.16	3.94	2.93	2.98
12,000 cfs	10.00	9.77	8.33	2.99	2.38	4.43	3.37	3.40
14,000 cfs	10.82	10.79	9.19	3.33	2.63	4.88	3.72	3.75
16,000 cfs	11.58	11.71	9.99	3.76	2.88	5.29	4.05	4.10
18,000 cfs	12.40	12.59	10.76	3.80	2.92	5.69	4.11	4.17

24 Hour Flow Duration Total Rise to 99% of Maximum Stage (ft)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1.09	0.95	0.87	0.44	0.26	0.44	0.43	0.46
2,000 cfs	2.72	2.32	2.17	1.15	0.71	1.11	0.88	0.99
3,000 cfs	3.92	3.37	3.12	1.38	0.97	1.62	1.25	1.41
4,000 cfs	4.91	4.25	3.90	1.60	1.21	2.06	1.53	1.66
5,000 cfs	5.82	5.02	4.58	1.87	1.43	2.46	1.82	1.98
6,000 cfs	6.65	5.72	5.20	2.08	1.61	2.80	2.11	2.29
8,000 cfs	7.99	6.97	6.27	2.46	1.96	3.42	2.63	2.80
10,000 cfs	9.20	8.55	7.41	2.75	2.16	3.95	2.94	2.98
12,000 cfs	10.01	9.78	8.34	2.99	2.38	4.44	3.37	3.40
14,000 cfs	10.83	10.79	9.20	3.33	2.63	4.89	3.72	3.76
16,000 cfs	11.59	11.72	10.01	3.77	2.89	5.31	4.06	4.11
18,000 cfs	12.42	12.61	10.78	3.80	2.92	5.69	4.11	4.17

Start of Operations Analysis

1.5 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:31	2:00	2:48	3:41	3:52	4:17	4:24	5:20
2,000 cfs	1:27	1:48	2:28	3:13	3:25	3:43	3:39	4:22
3,000 cfs	1:26	1:41	2:15	2:57	3:07	3:19	3:24	3:57
4,000 cfs	1:27	1:39	2:09	2:30	2:51	3:00	3:03	3:35
5,000 cfs	1:26	1:37	2:03	2:21	2:44	2:54	2:54	3:22
6,000 cfs	1:26	1:36	2:01	2:16	2:39	2:45	2:47	3:12
8,000 cfs	1:26	1:35	1:57	2:27	2:32	2:41	2:43	3:04
10,000 cfs	1:27	1:36	1:57	2:13	2:30	2:36	2:39	2:59
12,000 cfs	1:26	1:36	1:59	2:28	2:30	2:36	2:38	2:56
14,000 cfs	1:26	1:36	1:58	2:22	2:22	2:28	2:28	2:42
16,000 cfs	1:26	1:36	1:58	2:23	2:25	2:31	2:35	2:43
18,000 cfs	1:27	1:36	1:59	2:24	2:26	2:32	2:34	2:46

6 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	3:06	4:28	5:32	6:28	5:59	6:34	6:26	6:50
2,000 cfs	3:05	3:33	4:37	5:28	5:28	5:27	6:01	6:14
3,000 cfs	2:55	3:15	4:19	3:52	4:45	5:14	5:05	5:31
4,000 cfs	2:43	3:04	4:15	4:09	4:43	4:46	4:44	4:56
5,000 cfs	2:56	3:02	4:03	4:37	4:28	4:48	5:00	5:30
6,000 cfs	2:54	3:11	3:59	4:01	4:41	4:59	4:49	5:13
8,000 cfs	2:48	3:08	3:57	4:35	4:37	4:46	4:44	4:58
10,000 cfs	3:17	3:51	4:31	4:28	4:16	4:52	4:33	3:57
12,000 cfs	3:01	3:35	4:18	4:40	4:48	4:52	5:01	5:14
14,000 cfs	3:15	3:39	4:23	5:08	4:53	5:00	5:04	5:15
16,000 cfs	3:24	3:41	4:24	5:15	5:03	4:57	4:58	5:17
18,000 cfs	3:36	3:52	4:40	3:26	3:26	5:31	3:30	6:17

24 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Operations

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	3:06	4:18	4:18	4:18	4:18	4:18	4:18	4:18
2,000 cfs	3:05	3:33	4:53	7:19	5:28	5:54	6:01	6:14
3,000 cfs	2:55	3:15	4:19	3:52	5:09	5:14	5:05	5:31
4,000 cfs	2:51	3:04	4:15	4:09	4:43	4:46	4:44	4:56
5,000 cfs	2:56	3:02	4:12	4:37	4:28	5:05	5:00	5:30
6,000 cfs	2:54	3:11	4:07	4:01	4:41	4:59	4:49	5:13
8,000 cfs	2:48	3:08	4:03	5:02	4:37	4:46	4:44	5:14
10,000 cfs	3:17	3:57	4:37	4:28	4:16	4:59	4:50	3:57
12,000 cfs	3:05	3:40	4:24	4:40	4:48	5:02	5:01	5:14
14,000 cfs	3:20	3:39	4:28	5:08	5:08	5:13	5:02	5:31
16,000 cfs	3:29	3:45	4:33	5:31	5:14	5:15	5:09	5:27
18,000 cfs	3:45	4:01	4:49	3:26	3:26	5:31	3:30	6:17

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 99% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.04	0.03	0.02	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.06	0.05	0.03	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.07	0.05	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.09	0.07	0.04	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.10	0.08	0.05	0.02	0.01	0.02	0.01	0.01
12,000 cfs	0.11	0.09	0.06	0.02	0.01	0.02	0.02	0.02
14,000 cfs	0.12	0.10	0.06	0.02	0.01	0.03	0.02	0.02
16,000 cfs	0.12	0.11	0.07	0.02	0.02	0.03	0.02	0.02
18,000 cfs	0.13	0.12	0.07	0.02	0.02	0.03	0.02	0.02
Maximum	0.13	0.12	0.07	0.02	0.02	0.03	0.02	0.02

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 99% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.01
5,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01
12,000 cfs	0.06	0.05	0.03	0.01	0.01	0.02	0.01	0.01
14,000 cfs	0.06	0.05	0.03	0.01	0.01	0.02	0.01	0.01
16,000 cfs	0.06	0.05	0.04	0.01	0.01	0.02	0.01	0.01
18,000 cfs	0.06	0.05	0.04	0.02	0.01	0.02	0.02	0.01
Maximum	0.06	0.05	0.04	0.02	0.01	0.02	0.02	0.01

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Operations to 99% of Max

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.00
4,000 cfs	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.01
5,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01
10,000 cfs	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01
12,000 cfs	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01
14,000 cfs	0.05	0.05	0.03	0.01	0.01	0.02	0.01	0.01
16,000 cfs	0.06	0.05	0.04	0.01	0.01	0.02	0.01	0.01
18,000 cfs	0.06	0.05	0.04	0.02	0.01	0.02	0.02	0.01
Maximum	0.06	0.05	0.04	0.02	0.01	0.02	0.02	0.01

Start of Rise Analysis

1.5 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	1:26	1:29	1:32	1:23	1:33	1:34	1:32	1:47
2,000 cfs	1:22	1:21	1:23	1:14	1:24	1:20	1:07	1:17
3,000 cfs	1:22	1:16	1:15	1:07	1:15	1:05	1:02	1:06
4,000 cfs	1:23	1:15	1:12	0:46	1:05	0:53	0:48	0:54
5,000 cfs	1:22	1:13	1:08	0:41	1:02	0:52	0:45	0:48
6,000 cfs	1:22	1:12	1:08	0:40	1:00	0:47	0:42	0:44
8,000 cfs	1:22	1:12	1:06	0:55	0:58	0:49	0:44	0:45
10,000 cfs	1:23	1:13	1:08	0:45	1:00	0:48	0:45	0:47
12,000 cfs	1:22	1:13	1:11	1:03	1:03	0:52	0:47	0:49
14,000 cfs	1:22	1:13	1:11	0:59	0:57	0:46	0:40	0:39
16,000 cfs	1:22	1:13	1:12	1:01	1:02	0:51	0:49	0:43
18,000 cfs	1:23	1:13	1:13	1:03	1:04	0:54	0:50	0:48

6 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	3:01	3:57	4:16	4:10	3:40	3:51	3:34	3:17
2,000 cfs	3:00	3:06	3:32	3:29	3:27	3:04	3:29	3:09
3,000 cfs	2:51	2:50	3:19	2:02	2:53	3:00	2:43	2:40
4,000 cfs	2:39	2:40	3:18	2:25	2:57	2:39	2:29	2:15
5,000 cfs	2:52	2:38	3:08	2:57	2:46	2:46	2:51	2:56
6,000 cfs	2:50	2:47	3:06	2:25	3:02	3:01	2:44	2:45
8,000 cfs	2:44	2:45	3:06	3:03	3:03	2:54	2:45	2:39
10,000 cfs	3:13	3:28	3:42	3:00	2:46	3:04	2:39	1:45
12,000 cfs	2:57	3:12	3:30	3:15	3:21	3:08	3:10	3:07
14,000 cfs	3:11	3:16	3:36	3:45	3:28	3:18	3:16	3:12
16,000 cfs	3:20	3:18	3:38	3:53	3:40	3:17	3:12	3:17
18,000 cfs	3:32	3:29	3:54	2:05	2:04	3:53	1:46	4:19

24 Hour Flow Duration Time to 99% of Maximum Stage (ft) from Start of Rise (Wave Arrival)

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	3:01	3:47	3:02	2:00	1:59	1:35	1:26	0:45
2,000 cfs	3:00	3:06	3:48	5:20	3:27	3:31	3:29	3:09
3,000 cfs	2:51	2:50	3:19	2:02	3:17	3:00	2:43	2:40
4,000 cfs	2:47	2:40	3:18	2:25	2:57	2:39	2:29	2:15
5,000 cfs	2:52	2:38	3:17	2:57	2:46	3:03	2:51	2:56
6,000 cfs	2:50	2:47	3:14	2:25	3:02	3:01	2:44	2:45
8,000 cfs	2:44	2:45	3:12	3:30	3:03	2:54	2:45	2:55
10,000 cfs	3:13	3:34	3:48	3:00	2:46	3:11	2:56	1:45
12,000 cfs	3:01	3:17	3:36	3:15	3:21	3:18	3:10	3:07
14,000 cfs	3:16	3:16	3:41	3:45	3:43	3:31	3:14	3:28
16,000 cfs	3:25	3:22	3:47	4:09	3:51	3:35	3:23	3:27
18,000 cfs	3:41	3:38	4:03	2:05	2:04	3:53	1:46	4:19

1.5 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 99% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.01
3,000 cfs	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01
4,000 cfs	0.05	0.05	0.04	0.03	0.01	0.02	0.02	0.02
5,000 cfs	0.06	0.06	0.05	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.07	0.06	0.05	0.04	0.02	0.04	0.03	0.03
8,000 cfs	0.08	0.08	0.07	0.03	0.02	0.05	0.04	0.04
10,000 cfs	0.09	0.09	0.08	0.04	0.03	0.06	0.05	0.05
12,000 cfs	0.10	0.11	0.08	0.03	0.03	0.06	0.05	0.05
14,000 cfs	0.11	0.12	0.09	0.04	0.03	0.07	0.06	0.07
16,000 cfs	0.12	0.13	0.10	0.04	0.03	0.07	0.06	0.06
18,000 cfs	0.12	0.14	0.11	0.04	0.03	0.07	0.06	0.06
Maximum	0.12	0.14	0.11	0.04	0.03	0.07	0.06	0.07

6 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 99% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00
3,000 cfs	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
4,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.04	0.04	0.03	0.01	0.01	0.02	0.01	0.02
10,000 cfs	0.04	0.04	0.03	0.01	0.01	0.02	0.02	0.03
12,000 cfs	0.05	0.05	0.04	0.01	0.01	0.02	0.02	0.02
14,000 cfs	0.05	0.05	0.04	0.01	0.01	0.02	0.02	0.02
16,000 cfs	0.05	0.05	0.04	0.01	0.01	0.02	0.02	0.02
18,000 cfs	0.05	0.05	0.04	0.03	0.02	0.02	0.03	0.01
Maximum	0.05	0.05	0.04	0.03	0.02	0.02	0.03	0.03

24 Hour Flow Duration Rate of Change (feet per minute) from Start of Rise to 99% of Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
2,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
3,000 cfs	0.02	0.02	0.01	0.01	0.00	0.01	0.01	0.01
4,000 cfs	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
5,000 cfs	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
8,000 cfs	0.04	0.04	0.03	0.01	0.01	0.02	0.01	0.01
10,000 cfs	0.04	0.04	0.03	0.01	0.01	0.02	0.02	0.03
12,000 cfs	0.05	0.05	0.03	0.01	0.01	0.02	0.02	0.02
14,000 cfs	0.05	0.05	0.04	0.01	0.01	0.02	0.02	0.02
16,000 cfs	0.05	0.05	0.04	0.01	0.01	0.02	0.02	0.02
18,000 cfs	0.05	0.05	0.04	0.03	0.02	0.02	0.03	0.01
Maximum	0.05	0.05	0.04	0.03	0.02	0.02	0.03	0.03

Operations Analysis - 15 Minutes, 30 Minutes and 1 Hour From Start of Rise

1.5 Hour Flow Duration Total Rise After 15 minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.23	0.06	0.05	0.03	0.01	0.02	0.01	0.03
2,000 cfs	0.74	0.15	0.12	0.08	0.03	0.04	0.03	0.07
3,000 cfs	1.18	0.26	0.20	0.14	0.04	0.09	0.06	0.19
4,000 cfs	1.68	0.40	0.32	0.22	0.07	0.17	0.14	0.42
5,000 cfs	2.13	0.67	0.50	0.39	0.13	0.30	0.31	0.67
6,000 cfs	2.51	1.02	0.66	0.48	0.20	0.58	0.68	0.86
8,000 cfs	3.17	1.52	1.10	0.94	0.31	1.11	1.15	1.11
10,000 cfs	3.65	2.16	1.46	1.31	0.44	1.62	1.46	1.29
12,000 cfs	4.02	2.77	1.92	1.51	0.57	1.85	1.66	1.43
14,000 cfs	4.22	3.32	2.30	1.68	0.71	2.13	1.79	1.53
16,000 cfs	4.27	3.85	2.58	1.78	0.76	2.27	1.93	1.62
18,000 cfs	4.28	4.27	2.93	1.86	0.85	2.36	2.03	1.92

1.5 Hour Flow Duration Rate of Change After 15 minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.01	0.01	0.01	0.00	0.00	0.00	0.00
3,000 cfs	0.08	0.02	0.01	0.01	0.00	0.01	0.00	0.01
4,000 cfs	0.11	0.03	0.02	0.01	0.00	0.01	0.01	0.03
5,000 cfs	0.14	0.04	0.03	0.03	0.01	0.02	0.02	0.04
6,000 cfs	0.17	0.07	0.04	0.03	0.01	0.04	0.05	0.06
8,000 cfs	0.21	0.10	0.07	0.06	0.02	0.07	0.08	0.07
10,000 cfs	0.24	0.14	0.10	0.09	0.03	0.11	0.10	0.09
12,000 cfs	0.27	0.18	0.13	0.10	0.04	0.12	0.11	0.10
14,000 cfs	0.28	0.22	0.15	0.11	0.05	0.14	0.12	0.10
16,000 cfs	0.28	0.26	0.17	0.12	0.05	0.15	0.13	0.11
18,000 cfs	0.29	0.28	0.20	0.12	0.06	0.16	0.14	0.13

6 Hour Flow Duration Total Rise After 15 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.23	0.06	0.05	0.03	0.01	0.02	0.01	0.03
2,000 cfs	0.74	0.15	0.12	0.08	0.03	0.04	0.03	0.07
3,000 cfs	1.18	0.26	0.20	0.14	0.04	0.09	0.06	0.20
4,000 cfs	1.68	0.40	0.32	0.22	0.07	0.17	0.15	0.44
5,000 cfs	2.13	0.67	0.50	0.39	0.13	0.30	0.31	0.70
6,000 cfs	2.51	1.02	0.66	0.48	0.20	0.58	0.68	0.88
8,000 cfs	3.17	1.52	1.10	0.94	0.31	1.11	1.15	1.12
10,000 cfs	3.65	2.16	1.46	1.31	0.44	1.62	1.46	1.29
12,000 cfs	4.02	2.77	1.92	1.51	0.57	1.85	1.66	1.43
14,000 cfs	4.22	3.32	2.30	1.68	0.71	2.13	1.79	1.53
16,000 cfs	4.27	3.85	2.58	1.78	0.76	2.28	1.94	1.63
18,000 cfs	4.28	4.27	2.93	1.86	0.85	2.36	2.03	1.92

6 Hour Flow Duration Rate of Change After 15 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.01	0.01	0.01	0.00	0.00	0.00	0.00
3,000 cfs	0.08	0.02	0.01	0.01	0.00	0.01	0.00	0.01
4,000 cfs	0.11	0.03	0.02	0.01	0.00	0.01	0.01	0.03
5,000 cfs	0.14	0.04	0.03	0.03	0.01	0.02	0.02	0.05
6,000 cfs	0.17	0.07	0.04	0.03	0.01	0.04	0.05	0.06
8,000 cfs	0.21	0.10	0.07	0.06	0.02	0.07	0.08	0.07
10,000 cfs	0.24	0.14	0.10	0.09	0.03	0.11	0.10	0.09
12,000 cfs	0.27	0.18	0.13	0.10	0.04	0.12	0.11	0.10
14,000 cfs	0.28	0.22	0.15	0.11	0.05	0.14	0.12	0.10
16,000 cfs	0.28	0.26	0.17	0.12	0.05	0.15	0.13	0.11
18,000 cfs	0.29	0.28	0.20	0.12	0.06	0.16	0.14	0.13

24 Hour Flow Duration Total Rise After 15 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.23	0.06	0.05	0.03	0.01	0.02	0.01	0.03
2,000 cfs	0.74	0.15	0.12	0.08	0.03	0.04	0.03	0.07
3,000 cfs	1.18	0.26	0.20	0.14	0.04	0.09	0.06	0.20
4,000 cfs	1.68	0.40	0.32	0.22	0.07	0.17	0.15	0.44
5,000 cfs	2.13	0.67	0.50	0.39	0.13	0.30	0.31	0.70
6,000 cfs	2.51	1.02	0.66	0.48	0.20	0.58	0.68	0.88
8,000 cfs	3.17	1.52	1.10	0.94	0.31	1.11	1.15	1.12
10,000 cfs	3.65	2.16	1.46	1.31	0.44	1.62	1.46	1.29
12,000 cfs	4.02	2.77	1.92	1.51	0.57	1.85	1.66	1.43
14,000 cfs	4.22	3.32	2.30	1.68	0.71	2.13	1.79	1.53
16,000 cfs	4.27	3.85	2.58	1.78	0.76	2.28	1.94	1.63
18,000 cfs	4.28	4.27	2.93	1.86	0.85	2.36	2.03	1.92

24 Hour Flow Duration Rate of Change After 15 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.01	0.01	0.01	0.00	0.00	0.00	0.00
3,000 cfs	0.08	0.02	0.01	0.01	0.00	0.01	0.00	0.01
4,000 cfs	0.11	0.03	0.02	0.01	0.00	0.01	0.01	0.03
5,000 cfs	0.14	0.04	0.03	0.03	0.01	0.02	0.02	0.05
6,000 cfs	0.17	0.07	0.04	0.03	0.01	0.04	0.05	0.06
8,000 cfs	0.21	0.10	0.07	0.06	0.02	0.07	0.08	0.07
10,000 cfs	0.24	0.14	0.10	0.09	0.03	0.11	0.10	0.09
12,000 cfs	0.27	0.18	0.13	0.10	0.04	0.12	0.11	0.10
14,000 cfs	0.28	0.22	0.15	0.11	0.05	0.14	0.12	0.10
16,000 cfs	0.28	0.26	0.17	0.12	0.05	0.15	0.13	0.11
18,000 cfs	0.29	0.28	0.20	0.12	0.06	0.16	0.14	0.13

1.5 Hour Flow Duration Total Rise After 30 minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.50	0.20	0.15	0.09	0.04	0.06	0.03	0.07
2,000 cfs	1.50	0.64	0.43	0.27	0.11	0.20	0.16	0.24
3,000 cfs	2.36	1.22	0.80	0.51	0.21	0.54	0.58	0.53
4,000 cfs	3.15	1.89	1.31	0.87	0.36	0.91	0.84	0.85
5,000 cfs	3.82	2.61	1.80	1.26	0.54	1.34	1.13	1.15
6,000 cfs	4.38	3.24	2.22	1.47	0.73	1.69	1.39	1.40
8,000 cfs	5.41	4.20	3.02	1.70	1.01	2.16	1.71	1.75
10,000 cfs	6.23	5.18	3.66	1.87	1.20	2.59	2.05	2.05
12,000 cfs	6.92	6.04	4.24	2.04	1.34	2.86	2.30	2.27
14,000 cfs	7.50	6.80	4.67	2.20	1.48	3.11	2.50	2.62
16,000 cfs	7.94	7.52	5.00	2.31	1.56	3.37	2.95	2.88
18,000 cfs	8.28	8.12	5.37	2.38	1.66	3.88	2.99	3.01

1.5 Hour Flow Duration Rate of Change After 30 minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.02	0.01	0.01	0.00	0.01	0.01	0.01
3,000 cfs	0.08	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.10	0.06	0.04	0.03	0.01	0.03	0.03	0.03
5,000 cfs	0.13	0.09	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.15	0.11	0.07	0.05	0.02	0.06	0.05	0.05
8,000 cfs	0.18	0.14	0.10	0.06	0.03	0.07	0.06	0.06
10,000 cfs	0.21	0.17	0.12	0.06	0.04	0.09	0.07	0.07
12,000 cfs	0.23	0.20	0.14	0.07	0.04	0.10	0.08	0.08
14,000 cfs	0.25	0.23	0.16	0.07	0.05	0.10	0.08	0.09
16,000 cfs	0.26	0.25	0.17	0.08	0.05	0.11	0.10	0.10
18,000 cfs	0.28	0.27	0.18	0.08	0.06	0.13	0.10	0.10

6 Hour Flow Duration Total Rise After 30 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey’s Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.50	0.20	0.15	0.09	0.04	0.06	0.03	0.07
2,000 cfs	1.50	0.64	0.43	0.27	0.11	0.20	0.16	0.26
3,000 cfs	2.36	1.22	0.80	0.51	0.22	0.55	0.59	0.58
4,000 cfs	3.15	1.89	1.31	0.87	0.36	0.92	0.86	0.94
5,000 cfs	3.82	2.61	1.80	1.26	0.54	1.35	1.16	1.26
6,000 cfs	4.38	3.24	2.22	1.47	0.73	1.70	1.41	1.47
8,000 cfs	5.41	4.20	3.02	1.70	1.01	2.17	1.73	1.82
10,000 cfs	6.23	5.18	3.66	1.87	1.20	2.60	2.06	2.08
12,000 cfs	6.92	6.04	4.24	2.04	1.34	2.85	2.30	2.30
14,000 cfs	7.50	6.80	4.67	2.20	1.48	3.11	2.51	2.71
16,000 cfs	7.94	7.52	5.00	2.31	1.56	3.37	2.96	2.90
18,000 cfs	8.28	8.12	5.37	2.38	1.66	3.88	2.99	3.01

6 Hour Flow Duration Rate of Change After 30 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey’s Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.02	0.01	0.01	0.00	0.01	0.01	0.01
3,000 cfs	0.08	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.10	0.06	0.04	0.03	0.01	0.03	0.03	0.03
5,000 cfs	0.13	0.09	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.15	0.11	0.07	0.05	0.02	0.06	0.05	0.05
8,000 cfs	0.18	0.14	0.10	0.06	0.03	0.07	0.06	0.06
10,000 cfs	0.21	0.17	0.12	0.06	0.04	0.09	0.07	0.07
12,000 cfs	0.23	0.20	0.14	0.07	0.04	0.09	0.08	0.08
14,000 cfs	0.25	0.23	0.16	0.07	0.05	0.10	0.08	0.09
16,000 cfs	0.26	0.25	0.17	0.08	0.05	0.11	0.10	0.10
18,000 cfs	0.28	0.27	0.18	0.08	0.06	0.13	0.10	0.10

24 Hour Flow Duration Total Rise After 30 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.50	0.20	0.15	0.09	0.04	0.06	0.03	0.07
2,000 cfs	1.50	0.64	0.43	0.27	0.11	0.20	0.16	0.26
3,000 cfs	2.36	1.22	0.80	0.51	0.22	0.55	0.59	0.58
4,000 cfs	3.15	1.89	1.31	0.87	0.36	0.92	0.86	0.94
5,000 cfs	3.82	2.61	1.80	1.26	0.54	1.35	1.16	1.26
6,000 cfs	4.38	3.24	2.22	1.47	0.73	1.70	1.41	1.47
8,000 cfs	5.41	4.20	3.02	1.70	1.01	2.17	1.73	1.82
10,000 cfs	6.23	5.18	3.66	1.87	1.20	2.60	2.06	2.08
12,000 cfs	6.92	6.04	4.24	2.04	1.34	2.85	2.30	2.30
14,000 cfs	7.50	6.80	4.67	2.20	1.48	3.11	2.51	2.71
16,000 cfs	7.94	7.52	5.00	2.31	1.56	3.37	2.96	2.90
18,000 cfs	8.28	8.12	5.37	2.38	1.66	3.88	2.99	3.01

24 Hour Flow Duration Rate of Change After 30 Minutes From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.05	0.02	0.01	0.01	0.00	0.01	0.01	0.01
3,000 cfs	0.08	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.10	0.06	0.04	0.03	0.01	0.03	0.03	0.03
5,000 cfs	0.13	0.09	0.06	0.04	0.02	0.04	0.04	0.04
6,000 cfs	0.15	0.11	0.07	0.05	0.02	0.06	0.05	0.05
8,000 cfs	0.18	0.14	0.10	0.06	0.03	0.07	0.06	0.06
10,000 cfs	0.21	0.17	0.12	0.06	0.04	0.09	0.07	0.07
12,000 cfs	0.23	0.20	0.14	0.07	0.04	0.09	0.08	0.08
14,000 cfs	0.25	0.23	0.16	0.07	0.05	0.10	0.08	0.09
16,000 cfs	0.26	0.25	0.17	0.08	0.05	0.11	0.10	0.10
18,000 cfs	0.28	0.27	0.18	0.08	0.06	0.13	0.10	0.10

1.5 Hour Flow Duration Total Rise After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.82	0.52	0.38	0.23	0.10	0.17	0.12	0.17
2,000 cfs	2.21	1.60	1.18	0.61	0.32	0.60	0.57	0.53
3,000 cfs	3.31	2.61	2.00	1.10	0.61	1.04	0.85	0.86
4,000 cfs	4.22	3.49	2.73	1.37	0.85	1.45	1.12	1.18
5,000 cfs	5.01	4.24	3.36	1.49	1.03	1.77	1.34	1.42
6,000 cfs	5.71	4.90	3.87	1.64	1.20	2.06	1.52	1.59
8,000 cfs	6.94	6.05	4.82	1.99	1.49	2.58	1.91	1.99
10,000 cfs	7.90	7.04	5.57	2.22	1.73	3.05	2.31	2.40
12,000 cfs	8.72	8.07	6.19	2.43	1.93	3.44	2.64	2.72
14,000 cfs	9.33	9.10	6.85	2.67	2.11	3.79	2.82	2.86
16,000 cfs	9.89	9.92	7.42	2.82	2.22	4.14	3.11	3.09
18,000 cfs	10.38	10.63	7.98	2.93	2.32	4.42	3.36	3.34

1.5 Hour Flow Duration Rate of Change After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.01	0.01
4,000 cfs	0.07	0.06	0.05	0.02	0.01	0.02	0.02	0.02
5,000 cfs	0.08	0.07	0.06	0.02	0.02	0.03	0.02	0.02
6,000 cfs	0.10	0.08	0.06	0.03	0.02	0.03	0.03	0.03
8,000 cfs	0.12	0.10	0.08	0.03	0.02	0.04	0.03	0.03
10,000 cfs	0.13	0.12	0.09	0.04	0.03	0.05	0.04	0.04
12,000 cfs	0.15	0.13	0.10	0.04	0.03	0.06	0.04	0.05
14,000 cfs	0.16	0.15	0.11	0.04	0.04	0.06	0.05	0.05
16,000 cfs	0.16	0.17	0.12	0.05	0.04	0.07	0.05	0.05
18,000 cfs	0.17	0.18	0.13	0.05	0.04	0.07	0.06	0.06

6 Hour Flow Duration Total Rise After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.82	0.52	0.39	0.23	0.11	0.18	0.13	0.19
2,000 cfs	2.21	1.60	1.18	0.66	0.34	0.66	0.62	0.64
3,000 cfs	3.31	2.61	2.01	1.22	0.65	1.22	1.00	1.10
4,000 cfs	4.22	3.49	2.74	1.44	0.91	1.69	1.33	1.48
5,000 cfs	5.01	4.24	3.37	1.61	1.11	2.06	1.55	1.72
6,000 cfs	5.71	4.90	3.88	1.75	1.28	2.34	1.78	1.96
8,000 cfs	6.94	6.05	4.83	2.14	1.58	2.91	2.25	2.43
10,000 cfs	7.90	7.04	5.57	2.29	1.79	3.31	2.60	2.81
12,000 cfs	8.72	8.07	6.19	2.50	1.99	3.83	2.93	3.00
14,000 cfs	9.33	9.10	6.85	2.74	2.16	4.09	3.12	3.19
16,000 cfs	9.89	9.92	7.42	2.86	2.25	4.37	3.37	3.42
18,000 cfs	10.38	10.63	7.98	2.94	2.35	4.61	3.58	3.64

6 Hour Flow Duration Rate of Change After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.07	0.06	0.05	0.02	0.02	0.03	0.02	0.02
5,000 cfs	0.08	0.07	0.06	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.10	0.08	0.06	0.03	0.02	0.04	0.03	0.03
8,000 cfs	0.12	0.10	0.08	0.04	0.03	0.05	0.04	0.04
10,000 cfs	0.13	0.12	0.09	0.04	0.03	0.06	0.04	0.05
12,000 cfs	0.15	0.13	0.10	0.04	0.03	0.06	0.05	0.05
14,000 cfs	0.16	0.15	0.11	0.05	0.04	0.07	0.05	0.05
16,000 cfs	0.16	0.17	0.12	0.05	0.04	0.07	0.06	0.06
18,000 cfs	0.17	0.18	0.13	0.05	0.04	0.08	0.06	0.06

24 Hour Flow Duration Total Rise After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.82	0.52	0.39	0.23	0.11	0.18	0.13	0.19
2,000 cfs	2.21	1.60	1.18	0.66	0.34	0.66	0.62	0.64
3,000 cfs	3.31	2.61	2.01	1.22	0.65	1.22	1.00	1.10
4,000 cfs	4.22	3.49	2.74	1.44	0.91	1.69	1.33	1.48
5,000 cfs	5.01	4.24	3.37	1.61	1.11	2.06	1.55	1.72
6,000 cfs	5.71	4.90	3.88	1.75	1.28	2.34	1.78	1.96
8,000 cfs	6.94	6.05	4.83	2.14	1.58	2.91	2.25	2.43
10,000 cfs	7.90	7.04	5.57	2.29	1.79	3.31	2.60	2.81
12,000 cfs	8.72	8.07	6.19	2.50	1.99	3.83	2.93	3.00
14,000 cfs	9.33	9.10	6.85	2.74	2.16	4.09	3.12	3.19
16,000 cfs	9.89	9.92	7.42	2.86	2.25	4.37	3.37	3.42
18,000 cfs	10.38	10.63	7.98	2.94	2.35	4.61	3.58	3.64

24 Hour Flow Duration Rate of Change After 1 Hour From Start of Rise

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2,000 cfs	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
3,000 cfs	0.06	0.04	0.03	0.02	0.01	0.02	0.02	0.02
4,000 cfs	0.07	0.06	0.05	0.02	0.02	0.03	0.02	0.02
5,000 cfs	0.08	0.07	0.06	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.10	0.08	0.06	0.03	0.02	0.04	0.03	0.03
8,000 cfs	0.12	0.10	0.08	0.04	0.03	0.05	0.04	0.04
10,000 cfs	0.13	0.12	0.09	0.04	0.03	0.06	0.04	0.05
12,000 cfs	0.15	0.13	0.10	0.04	0.03	0.06	0.05	0.05
14,000 cfs	0.16	0.15	0.11	0.05	0.04	0.07	0.05	0.05
16,000 cfs	0.16	0.17	0.12	0.05	0.04	0.07	0.06	0.06
18,000 cfs	0.17	0.18	0.13	0.05	0.04	0.08	0.06	0.06

Recession Analysis

1.5 Hour Flow Duration Time to Recession (Baseline Stage) from Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	3:48:00	4:14:00	4:48:00	4:01:00	4:27:00	3:53:00	3:46:00	3:52:00
2,000 cfs	4:36:00	5:31:00	5:54:00	5:19:00	5:44:00	5:16:00	5:21:00	5:44:00
3,000 cfs	4:56:00	5:38:00	6:27:00	5:56:00	6:23:00	5:58:00	5:58:00	6:30:00
4,000 cfs	5:09:00	5:53:00	6:48:00	6:36:00	6:49:00	6:33:00	6:30:00	7:05:00
5,000 cfs	5:19:00	6:04:00	7:03:00	6:53:00	7:08:00	6:48:00	6:50:00	7:28:00
6,000 cfs	5:28:00	6:14:00	7:14:00	7:06:00	7:22:00	7:04:00	7:05:00	#N/A
8,000 cfs	5:41:00	6:27:00	7:30:00	7:08:00	7:41:00	7:23:00	7:23:00	#N/A
10,000 cfs	5:52:00	6:38:00	7:43:00	7:34:00	7:56:00	7:38:00	7:37:00	#N/A
12,000 cfs	6:02:00	6:47:00	7:48:00	7:29:00	8:05:00	7:47:00	7:47:00	#N/A
14,000 cfs	6:09:00	6:55:00	7:57:00	7:41:00	8:18:00	8:05:00	8:06:00	#N/A
16,000 cfs	6:17:00	7:04:00	8:05:00	7:47:00	8:21:00	8:06:00	8:06:00	#N/A
18,000 cfs	6:24:00	7:09:00	8:11:00	7:51:00	#N/A	8:11:00	8:12:00	#N/A

6 Hour Flow Duration Time to Recession (Baseline Stage) from Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	5:36:00	6:22:00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
2,000 cfs	6:43:00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
3,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
4,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
5,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
6,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
8,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
10,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
14,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
16,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
18,000 cfs	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

24 Hour Flow Duration Time to Recession (Baseline Stage) from Maximum Stage

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000 cfs	23:36:00	24:22:00	24:40:00	23:51:00	24:57:00	24:23:00	23:01:00	21:55:00
2,000 cfs	24:43:00	24:54:00	23:53:00	23:48:00	25:23:00	24:14:00	25:35:00	25:45:00
3,000 cfs	24:42:00	25:07:00	25:49:00	27:03:00	25:24:00	26:08:00	26:13:00	26:56:00
4,000 cfs	22:25:00	25:34:00	26:03:00	26:59:00	27:09:00	26:27:00	26:48:00	27:52:00
5,000 cfs	24:34:00	25:56:00	25:31:00	26:33:00	27:16:00	24:19:00	26:51:00	27:14:00
6,000 cfs	25:10:00	25:38:00	24:48:00	27:19:00	26:53:00	26:21:00	26:45:00	27:20:00
8,000 cfs	25:02:00	25:10:00	25:31:00	25:22:00	27:25:00	26:40:00	27:08:00	26:56:00
10,000 cfs	24:12:00	24:47:00	25:08:00	26:46:00	27:41:00	25:49:00	26:16:00	29:04:00
12,000 cfs	23:15:00	22:23:00	25:06:00	26:12:00	26:57:00	25:55:00	26:41:00	27:47:00
14,000 cfs	23:43:00	25:10:00	25:22:00	26:40:00	26:22:00	24:58:00	27:01:00	23:34:00
16,000 cfs	21:25:00	24:14:00	25:13:00	26:23:00	25:49:00	24:46:00	26:42:00	26:54:00
18,000 cfs	22:27:00	24:25:00	25:35:00	29:35:00	27:45:00	27:36:00	30:01:00	28:21:00

Total Rise After 15 Minutes From Start of Rise - Extreme Reserve Operating Conditions

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	6.51	5.18	2.97	1.81	0.85	2.37	2.04	1.94

Rate of Change After 15 Minutes From Start of Rise - Extreme Reserve Operating Condition

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	0.43	0.35	0.20	0.12	0.06	0.16	0.14	0.13

Total Rise After 30 Minutes From Start of Rise - Extreme Reserve Operating Conditions

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	8.86	8.45	5.39	2.37	1.67	3.90	2.99	3.02

Rate of Change After 30 Minutes From Start of Rise - Extreme Reserve Operating Conditions

Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	0.30	0.28	0.18	0.08	0.06	0.13	0.10	0.10

Total Rise After 1 Hour From Start of Rise - Extreme Reserve Operating Conditions

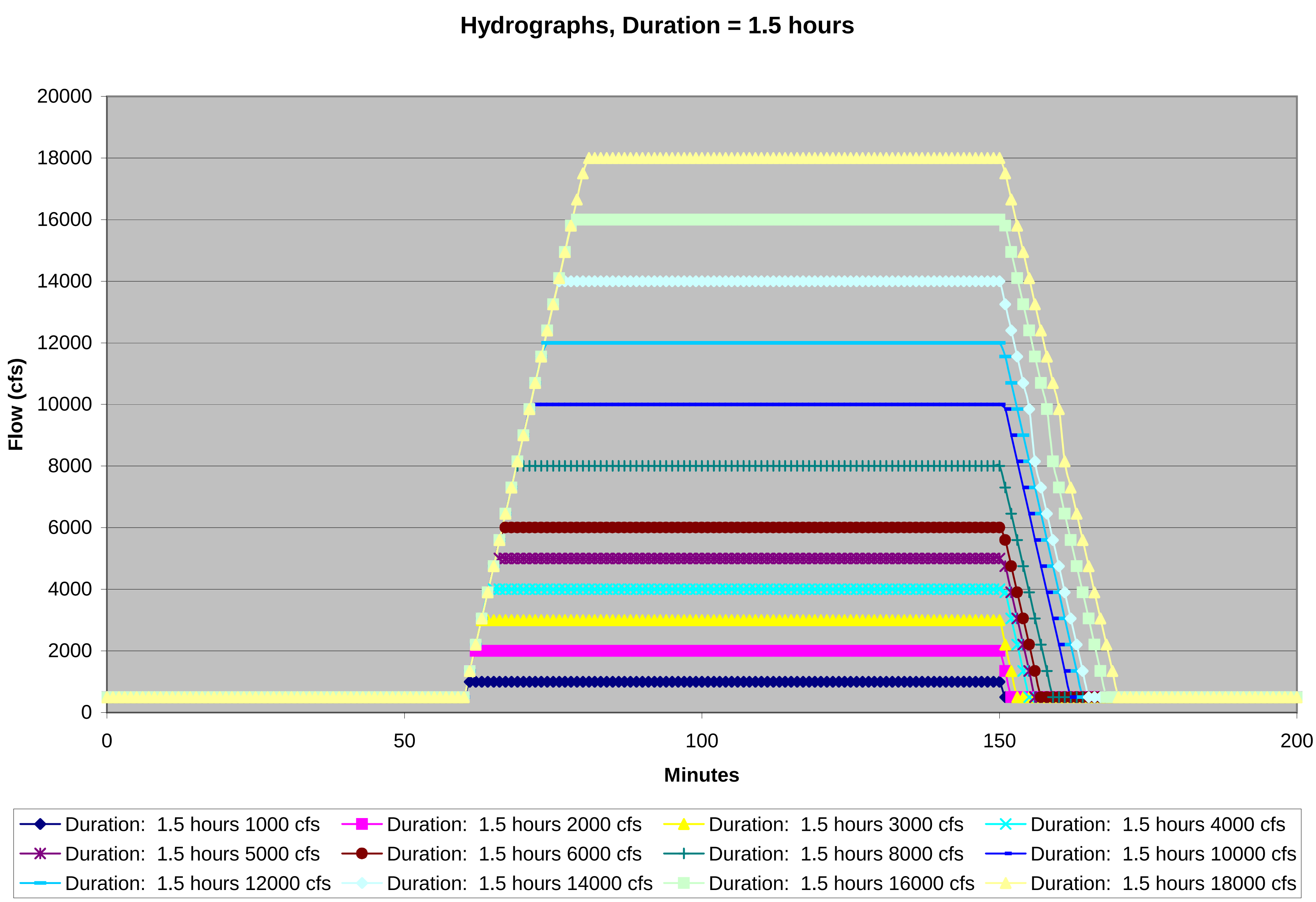
Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	10.60	10.73	7.99	2.94	2.35	4.62	3.58	3.64

Rate of Change After 1 Hour From Start of Rise - Extreme Reserve Operating Conditions

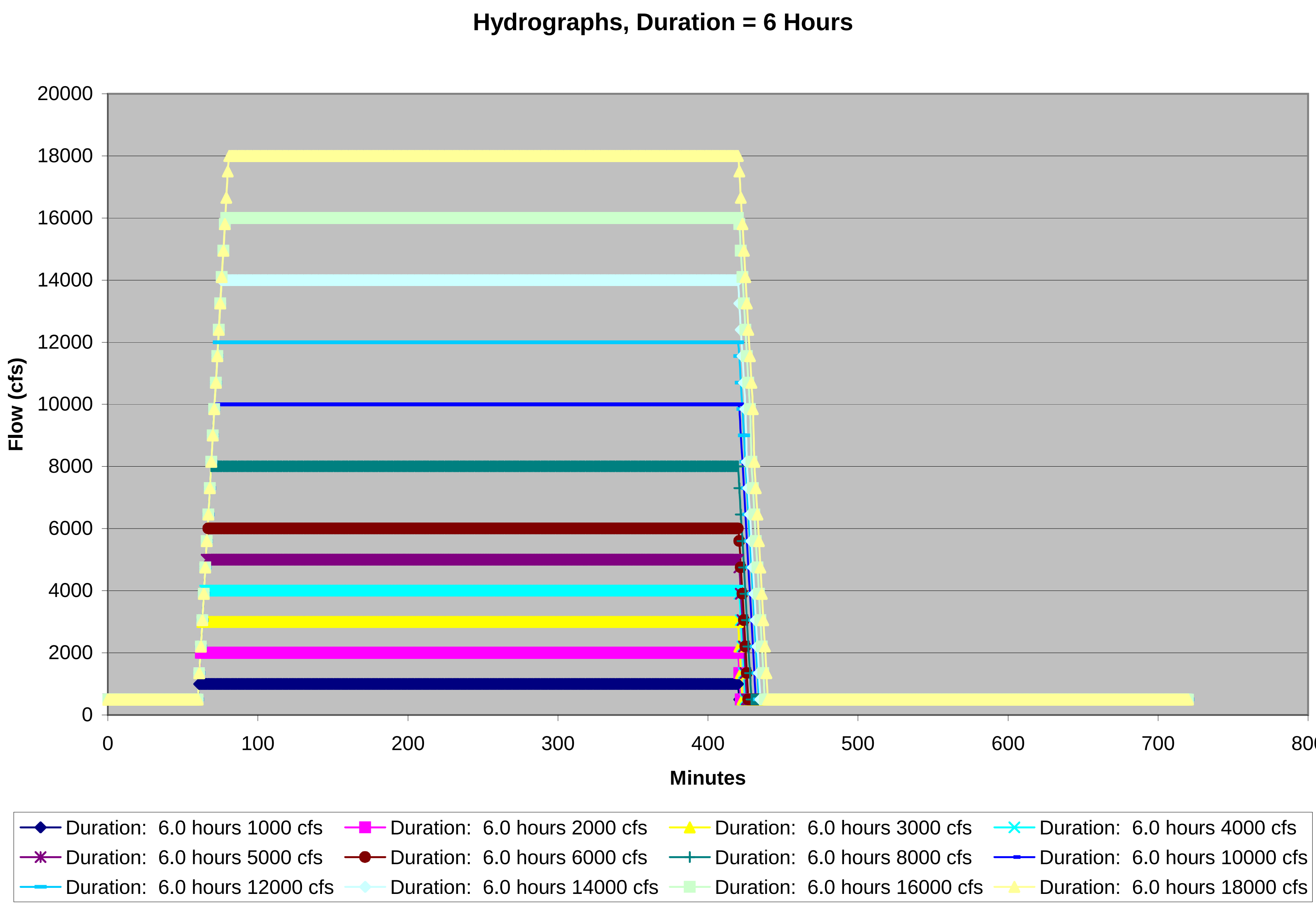
Flow	Upstream of Hope Ferry	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
18,000 cfs	0.18	0.18	0.13	0.05	0.04	0.08	0.06	0.06

Appendix 23

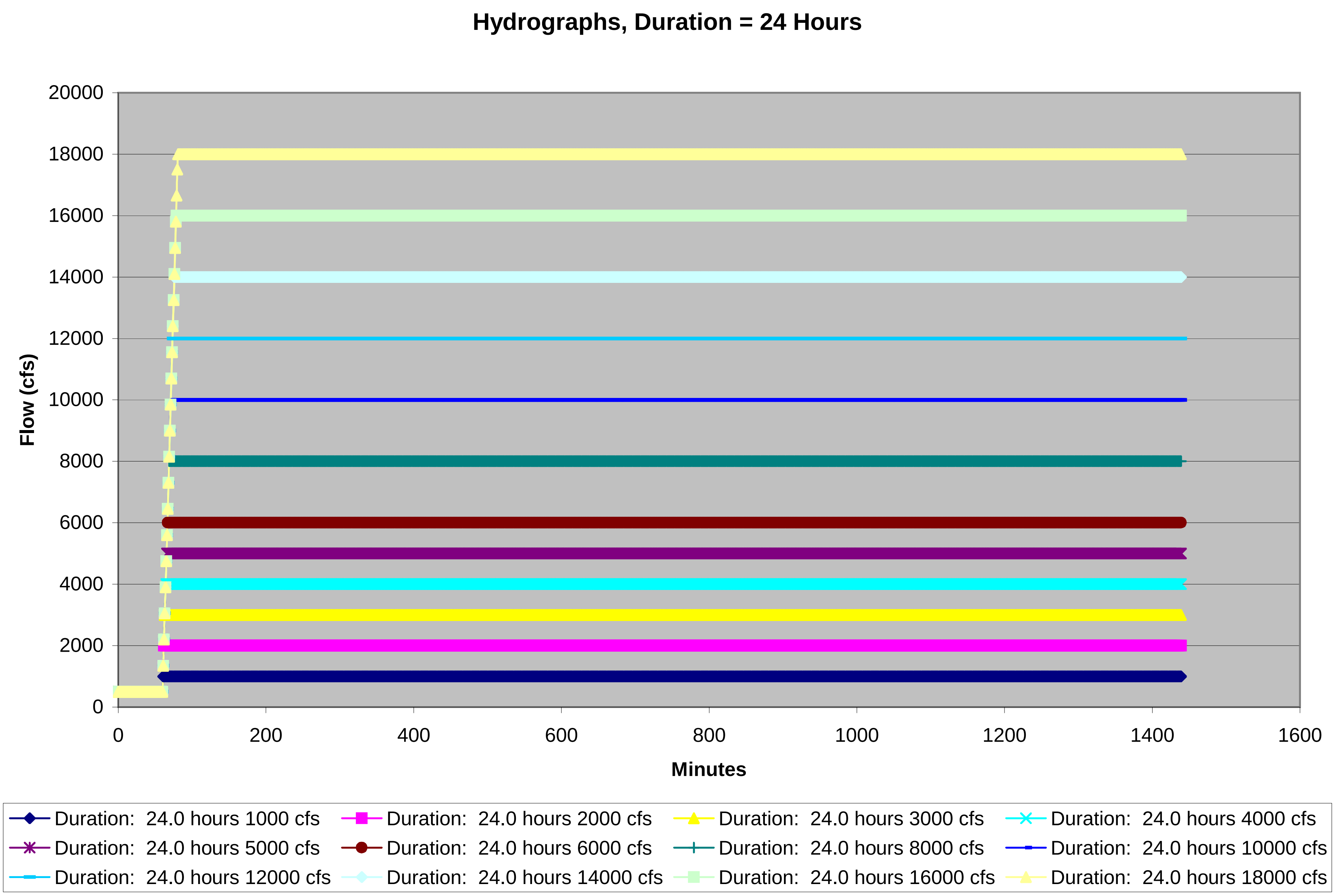
Lower Saluda River Recreational Flow Studies Appendices - F



Hydrographs, Duration = 1.5 hours
Flow (cfs)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
50
100
150
200
Minutes
Duration: 1.5 hours 1000 cfs
Duration: 1.5 hours 2000 cfs
Duration: 1.5 hours 3000 cfs
Duration: 1.5 hours 4000 cfs
Duration: 1.5 hours 5000 cfs
Duration: 1.5 hours 6000 cfs
Duration: 1.5 hours 8000 cfs
Duration: 1.5 hours 10000 cfs
Duration: 1.5 hours 12000 cfs
Duration: 1.5 hours 14000 cfs
Duration: 1.5 hours 16000 cfs
Duration: 1.5 hours 18000 cfs



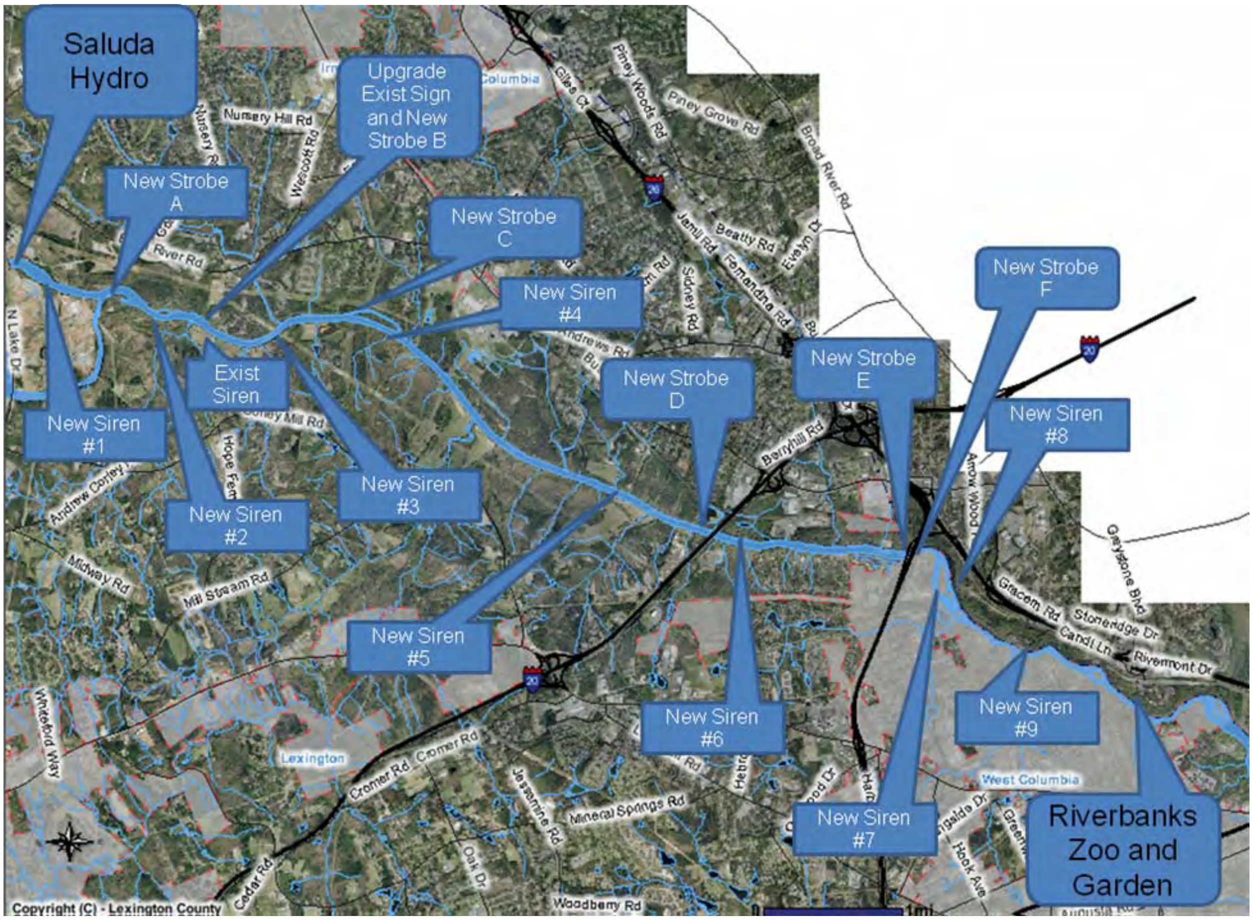
Hydrographs, Duration = 6 Hours
Flow (cfs)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
0
100
200
300
400
500
600
700
800
Minutes
Duration: 6.0 hours 1000 cfs
Duration: 6.0 hours 2000 cfs
Duration: 6.0 hours 3000 cfs
Duration: 6.0 hours 4000 cfs
Duration: 6.0 hours 5000 cfs
Duration: 6.0 hours 6000 cfs
Duration: 6.0 hours 8000 cfs
Duration: 6.0 hours 10000 cfs
Duration: 6.0 hours 12000 cfs
Duration: 6.0 hours 14000 cfs
Duration: 6.0 hours 16000 cfs
Duration: 6.0 hours 18000 cfs


Hydrographs, Duration = 24 Hours
Flow (cfs)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
200
400
600
800
1000
1200
1400
1600
Minutes
Duration: 24.0 hours 1000 cfs
Duration: 24.0 hours 2000 cfs
Duration: 24.0 hours 3000 cfs
Duration: 24.0 hours 4000 cfs
Duration: 24.0 hours 5000 cfs
Duration: 24.0 hours 6000 cfs
Duration: 24.0 hours 8000 cfs
Duration: 24.0 hours 10000 cfs
Duration: 24.0 hours 12000 cfs
Duration: 24.0 hours 14000 cfs
Duration: 24.0 hours 16000 cfs
Duration: 24.0 hours 18000 cfs

Appendix 24

Proposed New Lower Saluda River Siren Installation Schedule - DRAFT

Proposed New Lower Saluda River Siren Installation Schedule - DRAFT



Overview:

Installation of the proposed siren and strobe light stations, including warning signs similar to Type D-1 or D-2 as identified in the Saluda Public Safety Plan (submitted August 29, 2008, submittal number 20080910-0057) will be broken into three phases. The first phase was installed and operational in 2008. This phase consisted of new sirens #1 and #2, new strobe lights A and B, and upgrade of existing sign at Saluda Shoals Park. The second phase will be installed within one year after issuance of the new license. This phase will consist of new sirens #3, #4, and #5, and new strobe lights C and D. The third phase will be installed within two years after issuance of a new license. This phase will consist of new sirens #6, #7, #8, and #9, and new strobe lights E and F. If it is determined that a siren or strobe light is not needed due to the coverage of the other siren or strobe light equipment, then that siren or strobe light will not be installed. This will be determined through field volume level testing. For budgeting purposes, this installation schedule is based on receiving the new license in 2011, installing Phase 2 in 2012 and Phase 3 in 2013.

Appendix 25

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES
DRAFT

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

DRAFT

South Carolina Electric & Gas Company
Lake Management Department
Columbia, South Carolina 29218
Telephone: (803) 217-9221

NOVEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

DRAFT

NOVEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK PERMITTING GUIDELINES
DRAFT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

1.0 INTRODUCTION

Work of clearing the site for the Saluda River Hydroelectric Development was started in April of 1927 under a permit granted by the Federal Power Commission to the Lexington Water Power Company. In July of 1930 Lake Murray reached an elevation of 300' Plant Datum (PD). The following December, the first electric power, 10,000 kilowatts, was delivered.

At the time of its completion, Saluda Dam was the largest earthen dam for power purposes in the world. The dam itself is 213 feet high and contains over 11 million cubic yards of material. Lake Murray is approximately 41 miles long with a maximum width of 14 miles and contains 650 billion gallons of water. It has a shoreline of approximately 691 miles including the islands.

Lake Murray experiences considerable water level fluctuations. In the Saluda River watershed, about 75 percent of the normal rainfall comes in the first six months of the calendar year. The full pool lake level can reach 360' PD; however the normal high lake level is approximately 358' PD. Saluda Hydro is primarily used by South Carolina Electric & Gas Company (SCE&G) to provide reserve generation in response to system emergencies. However, the reservoir is also managed in a manner that provides appropriate downstream flows and responds to pass inflows from precipitation within the drainage basin. More information on operations can be found at www.sceg.com/en/my-community/lower-saluda-river.

Over the years, Lake Murray has been, and still is, a major source of power generation and provider of recreational and commercial resources for South Carolina residents and visitors. In the late 1960's a rapid change in the character and rate of development began to take place. Today, there are numerous formal recreation sites dispersed around Lake Murray that support boat launches, marinas, boat slips, wet and dry storage, campgrounds, picnic areas, beaches, fishing areas and piers, trails, and playgrounds. The irregular shoreline perimeter, with its numerous forested peninsulas, inlets and islands, provides excellent outdoor recreational opportunities. The shoreline also supports many permanent residences.

As development increases, however, the very values that attract families and visitors to the lake may be threatened unless a substantial effort is made to protect the lake environment from degradation. South Carolina Electric & Gas Company (SCE&G), as owner and licensee of Federal Energy Regulatory Commission Project No. 516, realizes the need for formulation of rules and regulations to promote and enhance the recreational potential of Lake Murray and protect its environmental quality.

SCE&G manages its lands around Lake Murray according to a Shoreline Management Plan (SMP) and the Shoreline Management Handbook and Permitting Guidelines (Handbook), both of which are designed to comply with the terms of the Project License, regulations, and FERC orders. The aim is to provide a balance among shoreline development, recreational use, and environmental protection. A component of the SMP is SCE&G's Permitting Program, which is operated in compliance with a general permit (GP) issued to SCE&G by the US Army Corps of Engineers and the South Carolina Department of Health and Environmental Control (SCDHEC), pursuant to the Clean Water Act (CWA), and the FERC license. The GP authorizes SCE&G to be the residential permitting authority for the lands comprising Lake Murray's shoreline. Project applicants and lake users must obtain the appropriate permit(s) for various activities and developments, and must adhere to the established regulations that help protect the lake shoreline and waters. SCE&G's Lake Management Department is responsible for enforcing FERC directives regarding authorized and unauthorized uses of Lake Murray waters and land within the project boundary. FERC directives require SCE&G to prevent or halt unauthorized actions by taking measures to stop such actions.

This Handbook details guidelines and policies protecting the Lake Murray shoreline and waters, and the specifics of SCE&G's Permitting Program. More information is available by contacting the Lake Management Department. It is a requirement to consult with the Lake Management Department before beginning any project around the lake. The telephone number for the Lake Management Department is (803) 217-9221.

2.0 LAND USE CLASSIFICATIONS

SCE&G has identified four distinct land management classifications for the land within the Project boundary line (PBL). Although SCE&G aims to manage its lands according to this classification system, the public has the right of entry on SCE&G-owned lands within the Project Boundary Line regardless of classification, with the exception of lands reserved and used for Project operations and certain leased properties that are operated under a fee agreement. The classifications, which are described below, consist of Multi-purpose, Public Recreation, Forest Management, Natural Areas, and Project Operations.

2.1 Multi-Purpose

Multi-purpose lands include lands owned by SCE&G, lands sold by SCE&G, and lands never owned by SCE&G but over which SCE&G retained certain easement rights. All of these lands are contained within the PBL. Generally, SCE&G divides them into four sub-classifications: easement, commercial, buffer zone, and future development lands.

2.1.1 Easement

Lands that SCE&G has sold/or never owned 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.

2.1.2 Commercial

SCE&G manages lands within this sub-classification primarily through its permitting program, which guides new or modified developments (e.g., expansion of existing facilities) as detailed in this document (see Section 7.0). Such uses include the following:

- Commercial and private marinas and yacht clubs (for-profit and nonresidential);

- Commercial docks, boat ramps, bulkheads, and other supporting facilities;
- Commercial RV parks, hotels, resorts, bait shops, boat tours, etc.;
- Restaurants with shoreline access such as docks, decks, etc.;
- Golf courses with lake access facilities; and
- Industrial facilities.

2.1.3 Buffer Zone

A 75-foot wide vegetated buffer zone, located between the 360’ PD contour and the back property development, is maintained adjacent to all easement lands sold by SCE&G after the issuance of the 1984 license. SCE&G maintains the Buffer Zone lands as vegetated areas intended to protect and enhance the Project’s scenic, recreational, and environmental values in the area bordering the Lake Murray shoreline. SCE&G will manage Buffer Zones associated with lands sold after 2007 as non-disturbance areas.

Use of SCE&G’s buffer zone is entirely at the discretion of SCE&G as landowner. Owners of adjoining lands (back property owners) are given the right of access, by foot, to and from the lake through the buffer zone, but are not permitted to encroach on the land without written consent from SCE&G (see Section 7.11 for information on prohibited activities in the Buffer Zones). For lands sold after 2007, lake access for back property owners is limited to a narrow meandering path in accordance with a dock permit and as specified in Section 7.13. See Section 7.14 for further information regarding limited brushing.

2.1.4 Future Development

Lands classified as future development are SCE&G-owned and located between the 360’ PD contour and the PBL. They are available for sale only to the back property owner with certain restrictions encompassed in SCE&G’s permitting program, as detailed in this document (See Section 7.0 and Figures 2.1-1 through 2.1-3), and as regulated by FERC.

Figure 2.1-1: Land Management Prescriptions for Future Development Properties (a)

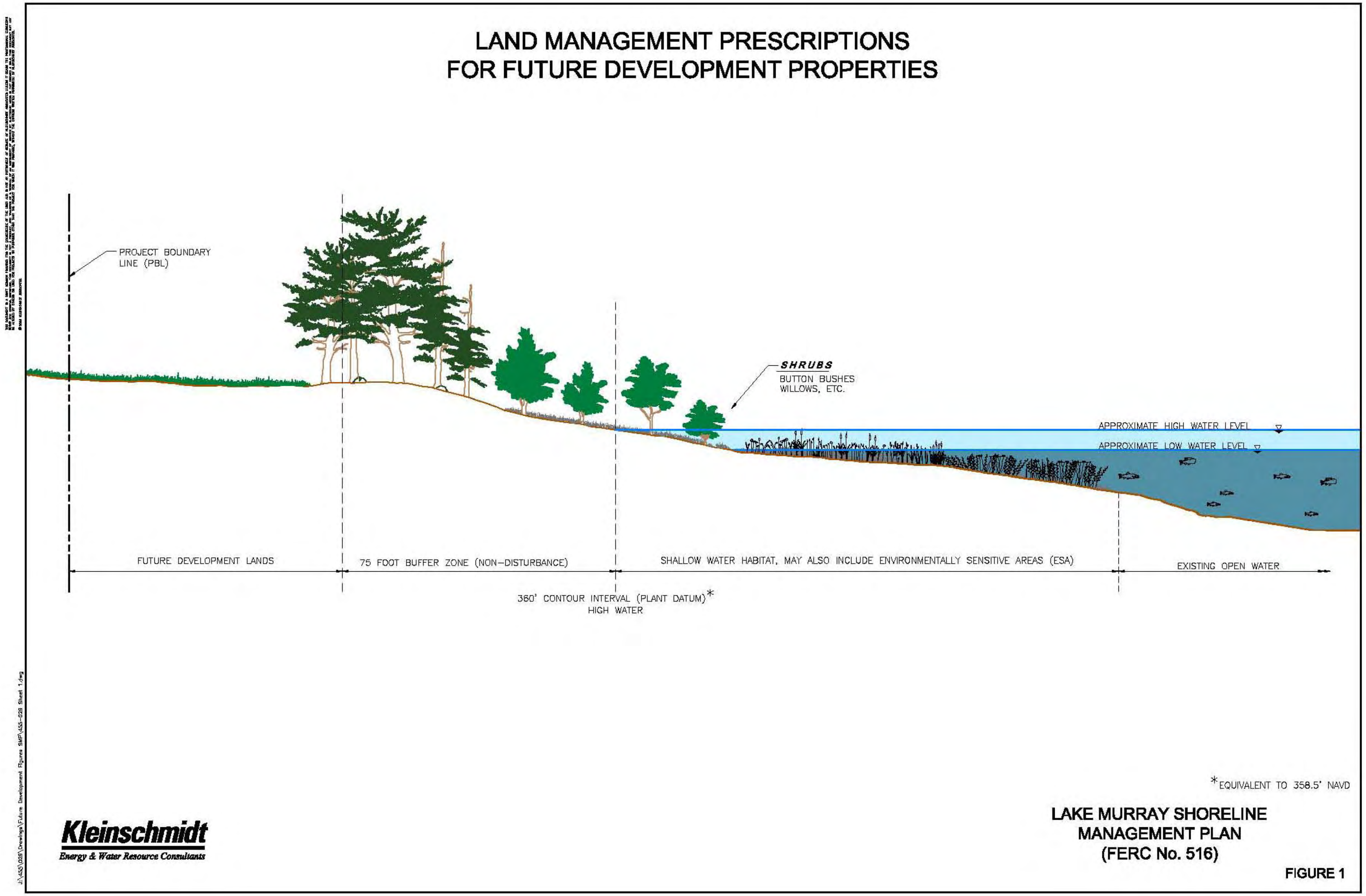


Figure 2.1-2: Land Management Prescription For Future Development Properties (b)

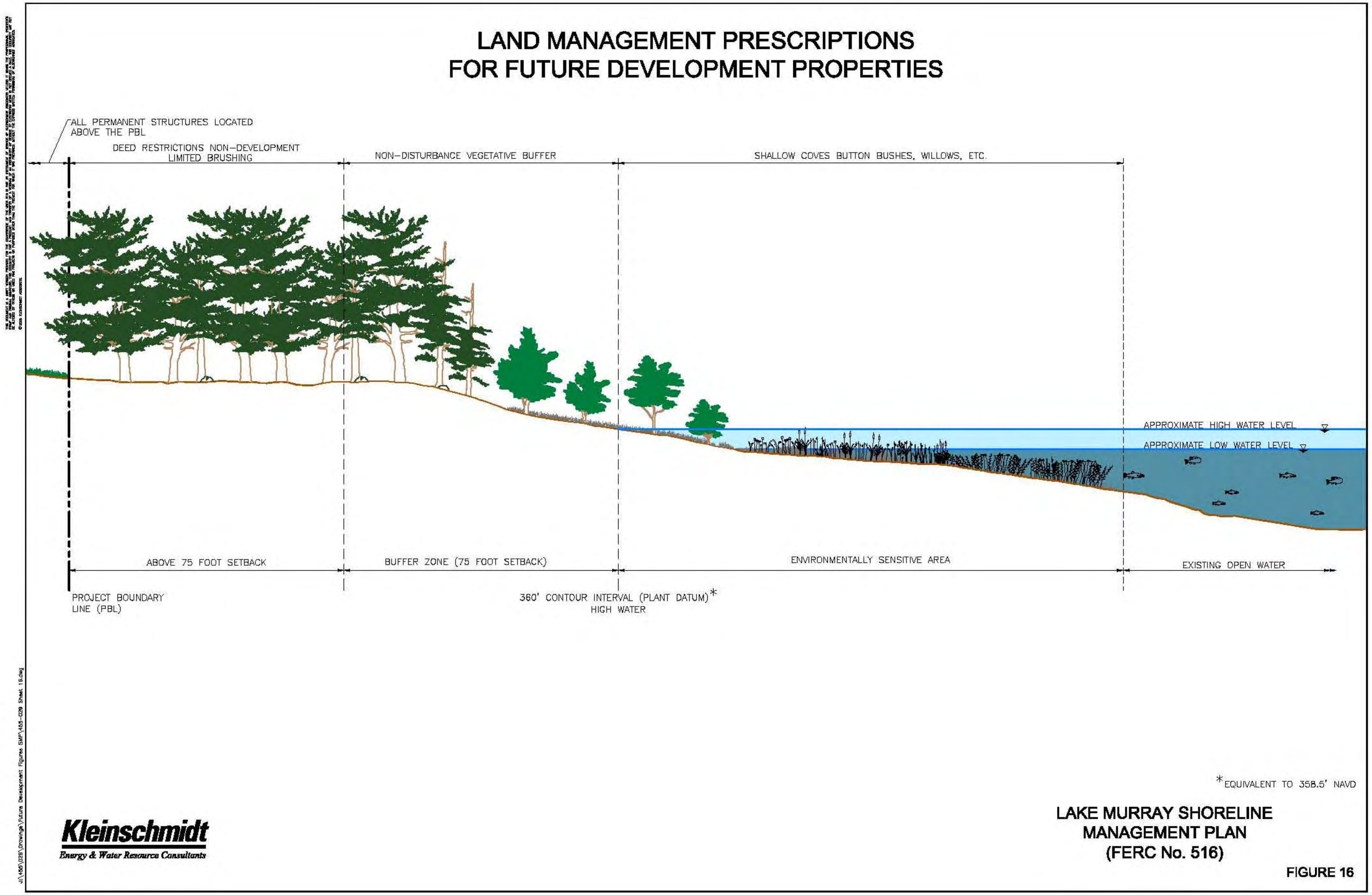
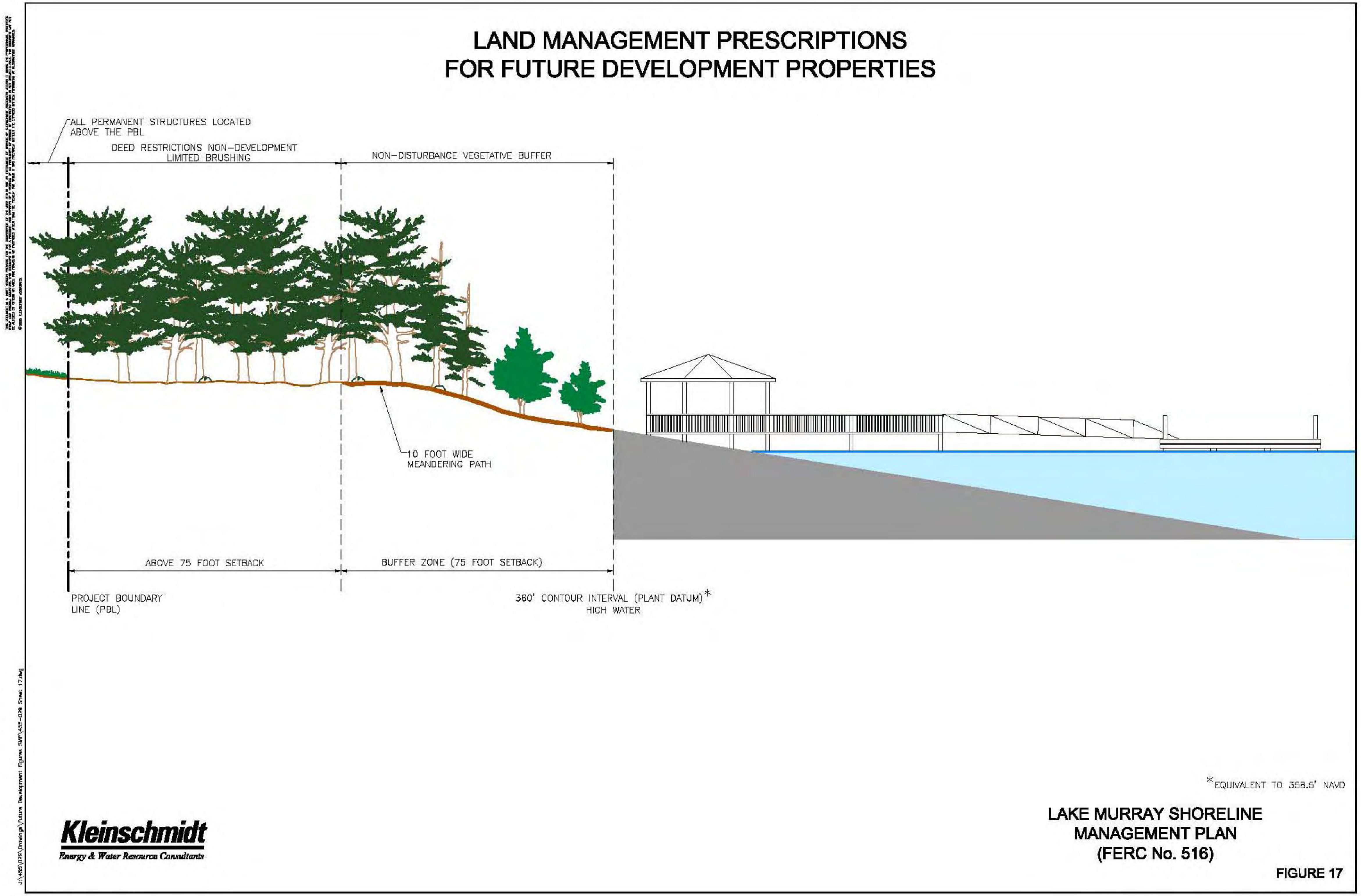


Figure 2.1-3: Land Management Prescriptions for Future Development Properties (c)



2.2 Public Recreation

Recreation lands include existing parks, properties set aside for future recreation, and publicly available islands owned by SCE&G. SCE&G manages the areas individually based on the specific, designated recreational activities they support, including swimming, picnicking, and boat launching. Dreher Island State Park is the only public site that provides formal camping; however, individuals can also camp on SCE&G-owned islands and other lands such as Bundrick Island, River Bend, and Sunset, unless otherwise posted.

2.3 Forest Management

SCE&G manages forest resources on its lands that are available for public recreation, although recreation is only one of several uses for these lands. These lands have been set aside for compatible recreation, scenic, aesthetic, and timber management purposes. SCE&G forest resources are managed according to the South Carolina Forestry Commission's Best Management Practices. SCE&G restricts its timber management operations in certain areas, such as on cliffs or steep slopes, or in atypical groups of trees.

2.4 Natural Areas

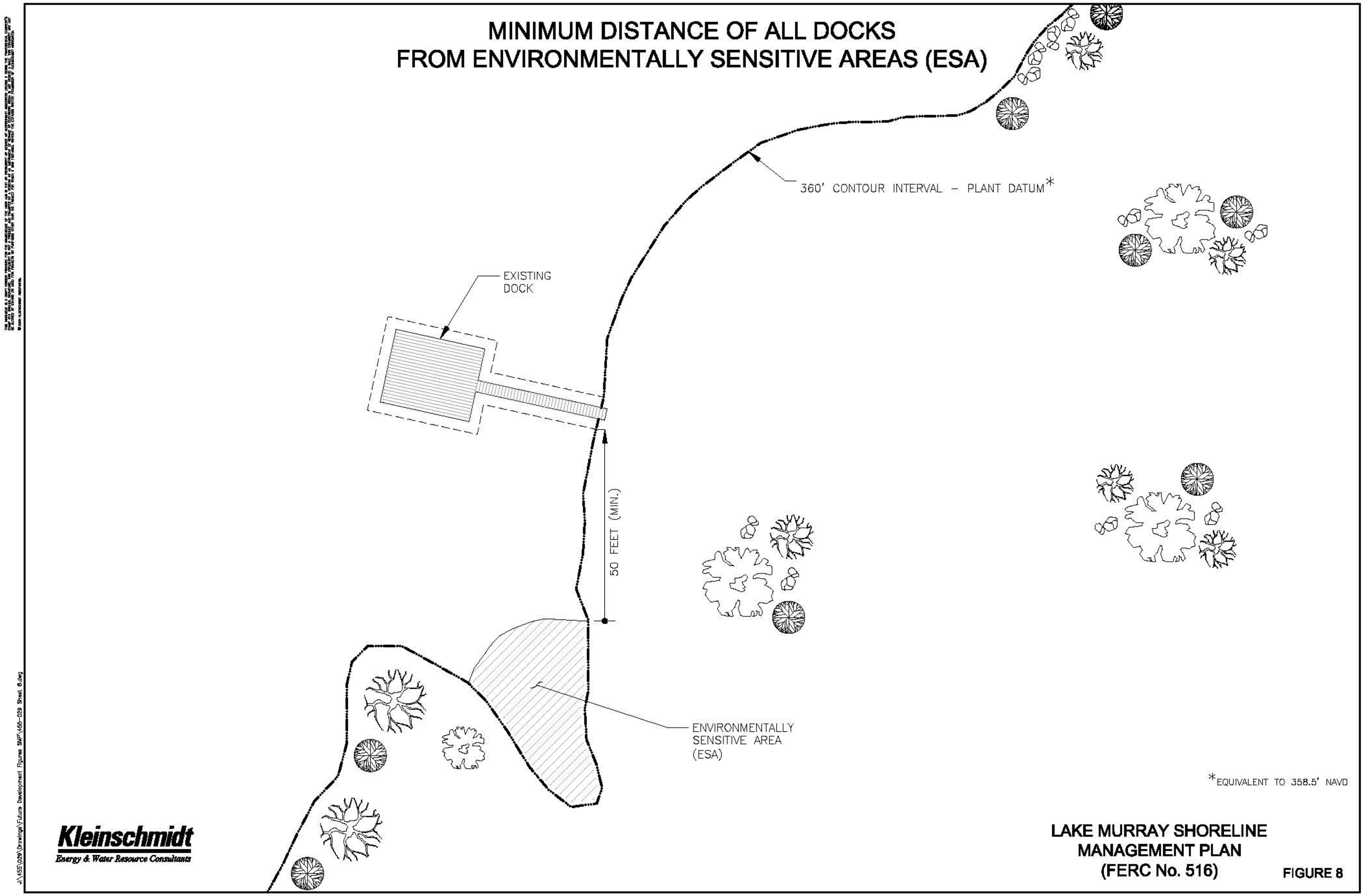
Natural areas consist of lands that warrant special protection because they provide important habitat for various wildlife species, including the recreational fishery. Shallow, shoreline waters; large wetland areas; areas having cultural and/or historical significance; and Environmentally Sensitive Areas (ESAs) are included in the natural areas classification and are protected.

ESAs are areas that have been designated as warranting special protection because they contain one or more of a variety of characteristics. They consist of habitat areas known to be occupied by rare, threatened, or endangered species; rare or exemplary natural communities; significant land forms and geological features; wetlands and shallow coves; and other areas determined to be critical to the continued existence of native species, such as spawning and nesting habitat. SCE&G has identified five types of ESAs, which are described in more detail in the SMP and are summarized here. They consist of the following:

1) **Continuous Vegetated Shoreline**, which is vegetated land composed primarily of buttonbush and willow species for at least 66 feet of linear shoreline length.
2) **Intermittent Vegetated Shoreline**, which is vegetated shoreline at least 66 feet in length where between 16 and 40 percent of the length is composed of gaps of unvegetated land measuring more than 20 feet long.
3) **Shallow Coves with Stream Confluences where streams enter the lake and** form coves and lake water is above the 355' PD contour line.
4) **Bottomland Hardwood** consisting of continuous linear shoreline at least 66 feet in length with coverage of bottomland hardwood.
5) **Wet Flats** consisting of continuous linear shoreline at least 66 feet in length with coverage of wet flats.
6) **Shallow shoals and rocky shores** generally consist of submerged ridges and hill tops located above the 352' PD contour.

In general, Natural Areas are not available for sale, and docks, excavations, and shoreline activity are not permitted in these areas. Also, ESAs have protective non-disturbance setbacks associated with them where vegetation clearing and developments including docks and other structures are prohibited, see Section 7.12 for more information on ESAs. No docks (Figure 2.4-1), excavations, or other developments are allowed within 50 feet of the ESA. After 2007, changes to the SMP prohibit brushing of any sort within newly established 75-ft buffer zones. Thus, ESAs in such buffers zones established after 2007 are protected by the entire buffer zone around them.

Figure 2.4-1: Minimum Distance of All Docks From ESA's



2.5 Project Operations

SCE&G-owned and managed lands are required for operation of the Saluda Project. Public access to these lands is restricted to ensure public safety or to assure the security of the infrastructure system.

3.0 ENVIRONMENTAL POLICIES

3.1 General Policy and Purpose

The Lake Murray Shoreline Management Plan shall maintain and conserve the area's natural and human-made resources.

The purpose of the policy is to comply with the terms of the Project No. 516 License, the regulations, and the orders of the FERC, while providing recreational opportunities and environmental protections.

3.2 Water Quality Standards

SCE&G will conduct a continuing water quality monitoring program at Lake Murray. SCDHEC classifies Lake Murray's waters as "Freshwater," which means they are suitable for swimming, fishing, and other water-related recreational activities.

3.3 Effluent Discharges

Lake Murray is classified as a "no sewage discharge" lake. SCE&G personnel will continue to notify appropriate government officials of any unauthorized effluent discharges which are discovered by SCE&G personnel or others. Anyone found to have an unauthorized discharge source within the project boundary line will be required to remove it.

Commercial public marinas providing facilities to remove effluent wastes from boats must meet SCDHEC regulations. See requirements for marinas in Section 7.2.5.

3.4 Aquatic Plants

Invasive and exotic aquatic plants can become a significant nuisance to recreation and project operations if their populations are not properly maintained. Some of the common problem species found in Lake Murray include hydrilla, water primrose, and several species of pondweed. When managing invasive and exotic aquatic plants it is important to also protect the native plant species, aquatic ecosystems, and fish habitat. This requires the integration and use of specific Best Management Practices (BMPs) appropriate to the regional and local conditions.

SCE&G's Lake Management Department, in cooperation with the South Carolina Aquatic Plant Management Council, manages the Aquatic Weed Program on Lake Murray. Because aquatic weed control techniques can harm fish and native plant species, it is unlawful, per state and federal regulations, for individuals to spray or treat aquatic plant growth with herbicides in the waters of Lake Murray. Thus, SCE&G asks that any aquatic vegetation problems recognized by lake visitors or back property owners be reported to SCE&G's Lake Management Department and the SCDNR. In addition, to help curb the spread of invasive aquatic species, SCE&G asks that lake visitors remove all vegetation from boats and trailers before and after placing them into the waters of Lake Murray.

3.5 Undeveloped Areas

Undeveloped SCE&G-owned land around the lake is managed by the Land Department. These properties will be maintained through a sound forest management program to ensure forest health. SCE&G will manage timber in a multiple use manner in compliance with the S. C. Forestry Commission Best Management Practices to maintain a balance of quality watershed conditions, recreational opportunities, wildlife habitat, and promotion of new timber growth.

3.6 Wildlife and Game Management

Portions of Project lands may be leased to the SCDNR as part of the statewide Wildlife Management Area (WMA) Program. If leased to SCDNR, they are open to the public for hunting or other recreational activities in accordance with WMA regulations.

4.0 EXCLUSION ZONE

Lands categorized as Project Operations house the various Project facilities, buildings, and structures. Public access to these lands is restricted to ensure public safety or to assure the security of the infrastructure systems. These areas include but are not limited to Project powerhouse, spillway, intake towers and associated lands.

5.0 PUBLIC FISHING, BOATING & HUNTING

The SCDNR is responsible for enforcing state rules and regulations regarding fishing, boating, and hunting activities at Lake Murray. Recreators are encouraged to contact SCDNR at the following address and/or visit their website for information regarding regulations of these activities.

S.C. Department of Natural Resources
Division of Law Enforcement
1000 Assembly Street
Columbia, South Carolina 29201
(800)922-5431
http://www.dnr.sc.gov

5.1 Fishery Management

The SCDNR maintains an annual stocking program in Lake Murray and the lower Saluda River. Since 1971, over 30 million striped bass have been stocked in Lake Murray at annual rates varying from a low of 8,800 in 1986 to a high of 1,771,761 in 1983. SCDNR maintains an active trout fishery in the lower Saluda River through stocking of sub-adult rainbow and brown trout. Trout are not native to the lower Saluda River. The total number of trout stocked annually averages around 35,000, with variation based primarily on availability of fish from the Walhalla State Fish Hatchery. Anglers are required to abide by state fishing and safety regulations, which are available through SCDNR at the address above. Anglers in the Lower Saluda River must be aware of the possibility of rapidly rising waters at any time that occur because of releases from the Project. Anglers should be prepared, in advance of entering the river, for the possibility of needing to exit the river quickly because of rapidly rising waters.

5.2 Boating Safety

Buoys, signs, and access restrictions may be placed throughout the project as part of the Public Safety Plan, which is on file with FERC. Public safety measures include warning signs near hazardous areas of the project, buoys in the impoundment that serve to warn or inform boaters of conditions that warrant caution, and restraining devices such as fences around the powerhouse and downstream project area.

Due to Project operation and climatic conditions, the water level of Lake Murray can fluctuate. Changes in depth may affect boating conditions and overhead power-line clearances. These aspects of the aquatic environment make it important for boaters and other recreators to assume a high degree of personal responsibility for their own safety by being aware and cautious, and by following posted warnings. Boaters should always approach power-lines with caution. In addition, recreators must follow the SCDNR's boating rules and regulations. These rules and regulations are available through SCDNR at the address above. Boaters in the lower Saluda River should be aware of the possibility of rapidly rising water that occurs because of releases from the Project at any time. Boaters should be prepared, in advance of entering the river, for the possibility of needing to exit the river quickly because of rapidly rising waters.

5.3 Public Hunting

Approximately 6,000 acres of watershed land within and adjacent to Project No. 516 are leased to the SCDNR by SCE&G as a part of the statewide Wildlife Management Area (WMA) Program. Most of this land is located adjacent to the western portions of Lake Murray and, in many cases, to other privately held lands that are also in the WMA program. Public hunting areas are shown on WMA maps available from the SCDNR. Boundaries are marked with SCDNR signage. Waterfowl hunting is also available around Lake Murray in accordance with federal migratory bird hunting regulations as published annually by SCDNR and applicable county ordinances. Hunters must familiarize themselves with state hunting rules and regulations, which are available from SCDNR at the address above.

6.0 PUBLIC ACCESS

SCE&G owns 15 formal public access sites on Lake Murray and has set aside 62 SCE&G-owned islands in Lake Murray 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 for use as public recreation. Information on SCE&G maintained facilities can be found at http://www.sceg.com/en/my-community/lake-murray/lake-management. Dreher Island State Park is the only public site to offer overnight uses such as campground facilities and villa rentals. More information on recreation opportunities including private and commercial recreation sites is available from the South Carolina Department of Parks, Recreation and Tourism (SCDPRT) at www.discoversouthcarolina.com.

7.0 SHORELINE ACTIVITIES/DEVELOPMENT PERMITTING

7.1 General

It is the policy of the SCE&G Lake Management Department to authorize certain private uses of and/or acts upon Project lands by permit when such uses or acts are compatible with the public interest and comply with the requirements of the license for Project 516. It is the Company's position that the shorelines of Lake Murray are to be managed and protected in a manner that will protect the environmental and aesthetic integrity of the existing shoreline. The Lake Murray Shoreline Management Plan and the Shoreline Management Handbook and Permitting Guidelines play an integral part in protecting the area's natural and human-made resources.

SCE&G reserves the right to approve final design and placement of docks, marinas, etc. and other permitted activities. Be advised, SCE&G does not guarantee daily or annual usable water access to the waters of the Lake Murray. Each lot along the shoreline will have different slopes and contours that will determine water depth in front of the lot. The fluctuation of the reservoir will, at times, limit or restrict the use of some docks on the lake shoreline.

7.2 Docks and Private Access

Prior to initiating any project, property owners must contact SCE&G's Lake Management Department at 803-217-9221and the appropriate county offices. SCE&G requires that anyone desiring to make major repairs, replace, add to, or construct a dock must file an application for a permit with SCE&G. In addition to the application, the applicant is required to apply to SCE&G in writing and submit the following; a sketch showing the location, design and dimension of the proposed structure, the permitting fee, specific directions by land to applicant's property on Lake Murray, and the plat of the property. Construction shall not begin until written permission has been granted by SCE&G. Dock construction is not to endanger health, create a nuisance, or otherwise be incompatible with overall Project recreation use. Use of common docks will be encouraged where practical. SCE&G requires that all docks, fixed, floating or combinations, be inspected by SCE&G Lake Management Department, and that an inspection decal be prominently displayed on the approved dock. Ultimately, the placement and design of all docks is under the authority of SCE&G Lake Management Department.

The following guidelines apply to permits for the construction, replacement, or addition of any dock. Drawings depicting dock specifications are provided below in the following sections.

7.2.1 Private Individual Docks

As discussed above, the design and final placement of docks is under the discretion of SCE&G Lake Management Department. General requirements for individual docks are as follows and depicted in Figures 7.2-1, 7.2-2 and 7.2-3:

- A minimum lot width of 100 feet (200 feet for a slip dock) along the 360' PD contour is required before an individual residential dock application will be considered. Where a SCE&G owned buffer zone exists, a minimum lot width of 100 feet (200 feet for a slip dock) at the common boundary line is required.
- All docks must be kept in good repair.
- Lots measuring 50-100 feet in width platted prior to 1989 where the adjacent lots have existing docks may be considered for limited size docks.
- No watercraft exceeding 34 feet in length can be permanently docked at a residential or common area dock and may not interfere with navigation.
- Private docks, whether fixed, floating, or any combination of the two, generally cannot exceed 750 sq. feet in overall size and 75 feet in length and may not interfere with navigation (exceeds no more than 1/3 the distance across a cove or channel) or restrict access to adjoining property.

- Floating docks may be moved out as the lake level recedes provided they do not interfere with an adjacent property owner's access and may not interfere with navigation.
- Docks may be longer where conformity with existing structures would be practical and in cases where exception would be desirable due to curvature or slope of the shoreline.
- All fixed walkways must be built above the 360'PD contour.
- Docks must be located a minimum of 15 feet from adjacent property iron and the proposed dock extension should not cross over the imaginary projected property lines. The projection of the imaginary property line is a management tool to assist Lake Management Representatives and may be waived under certain circumstances. Final dock location will be determined by SCE&G Lake Management Personnel.
- Covers on docks are not permissible unless the covered portion is located within 16 feet of the 360' PD contour.
- Hand railings are permissible provided the sides are not enclosed.
- Flotation for docks must be approved encased or encapsulated flotation.
- No permanent screening or enclosures are permitted.
- Docks must be single story structures.
- Docks may be allowed in intermittent ESAs at limited locations per the discretion of SCE&G Lake Management Department. Docks are prohibited in continuous ESAs.
- All docks must be at least 50 feet from an ESA, unless otherwise approved by SCE&G.

Figure 7.2-1: Typical Layout of Individual Docks on Future Development Properties

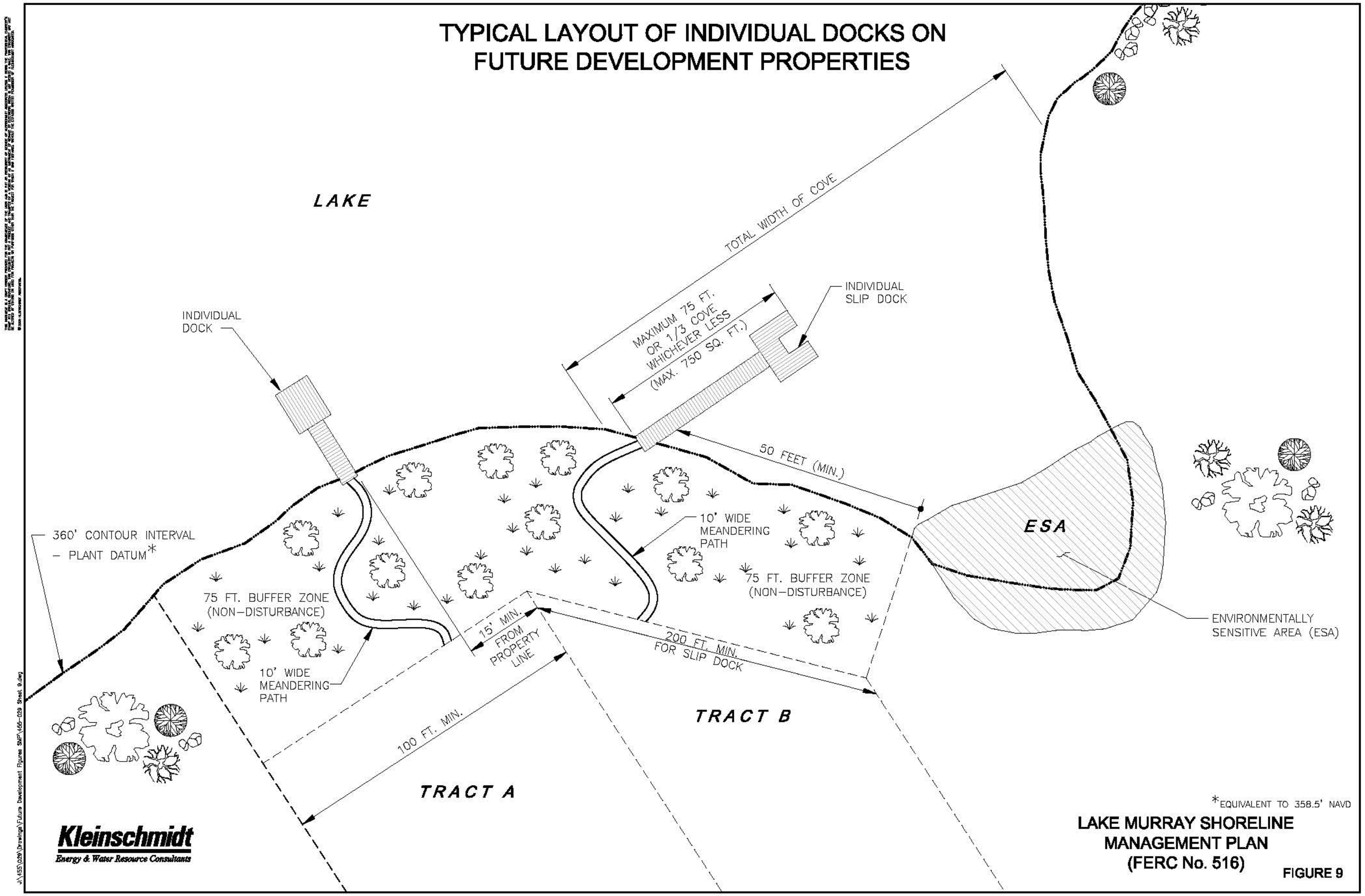


Figure 7.2-2: Permanent Structures Located Above PBL for Individual Docks

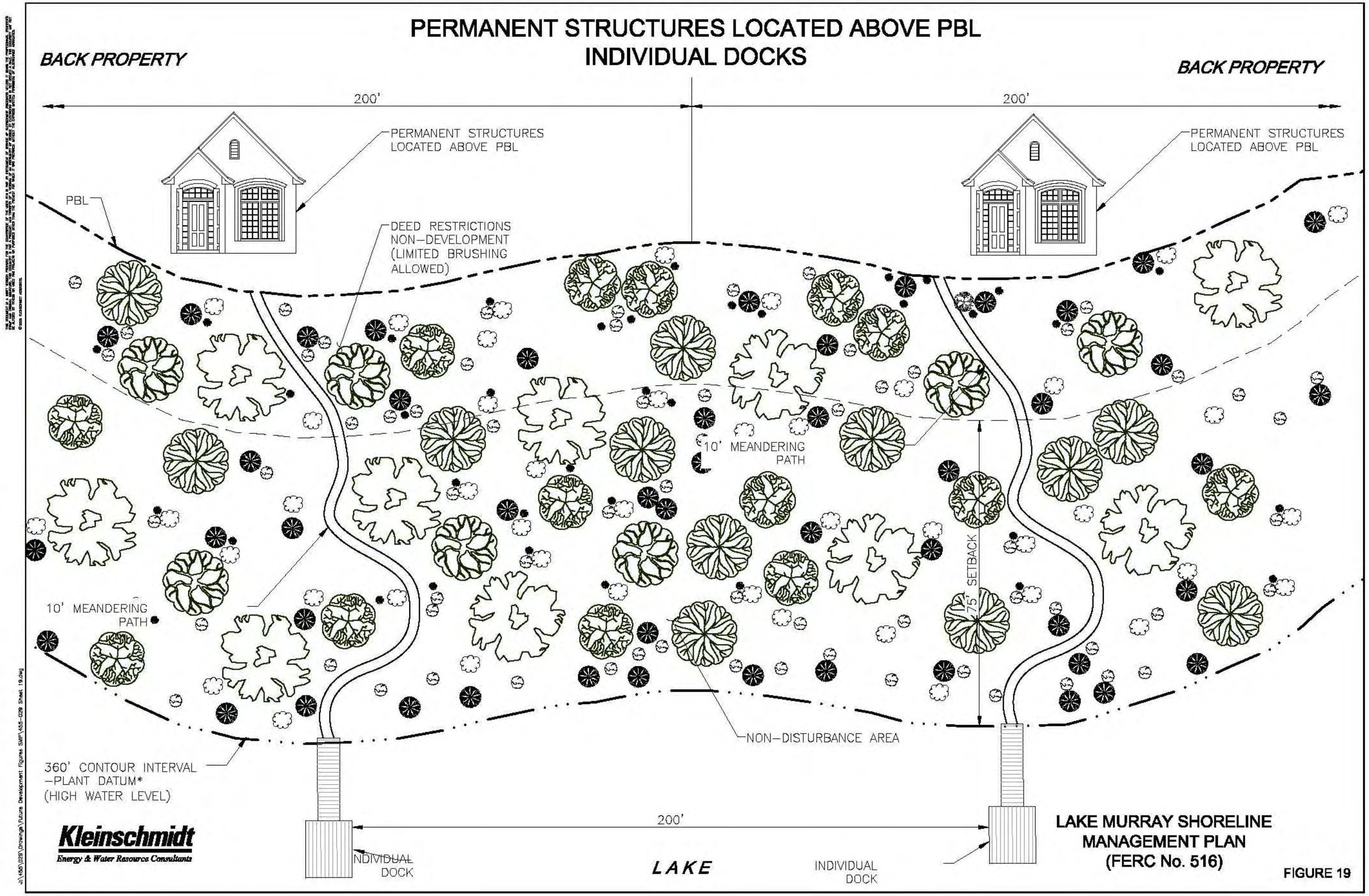
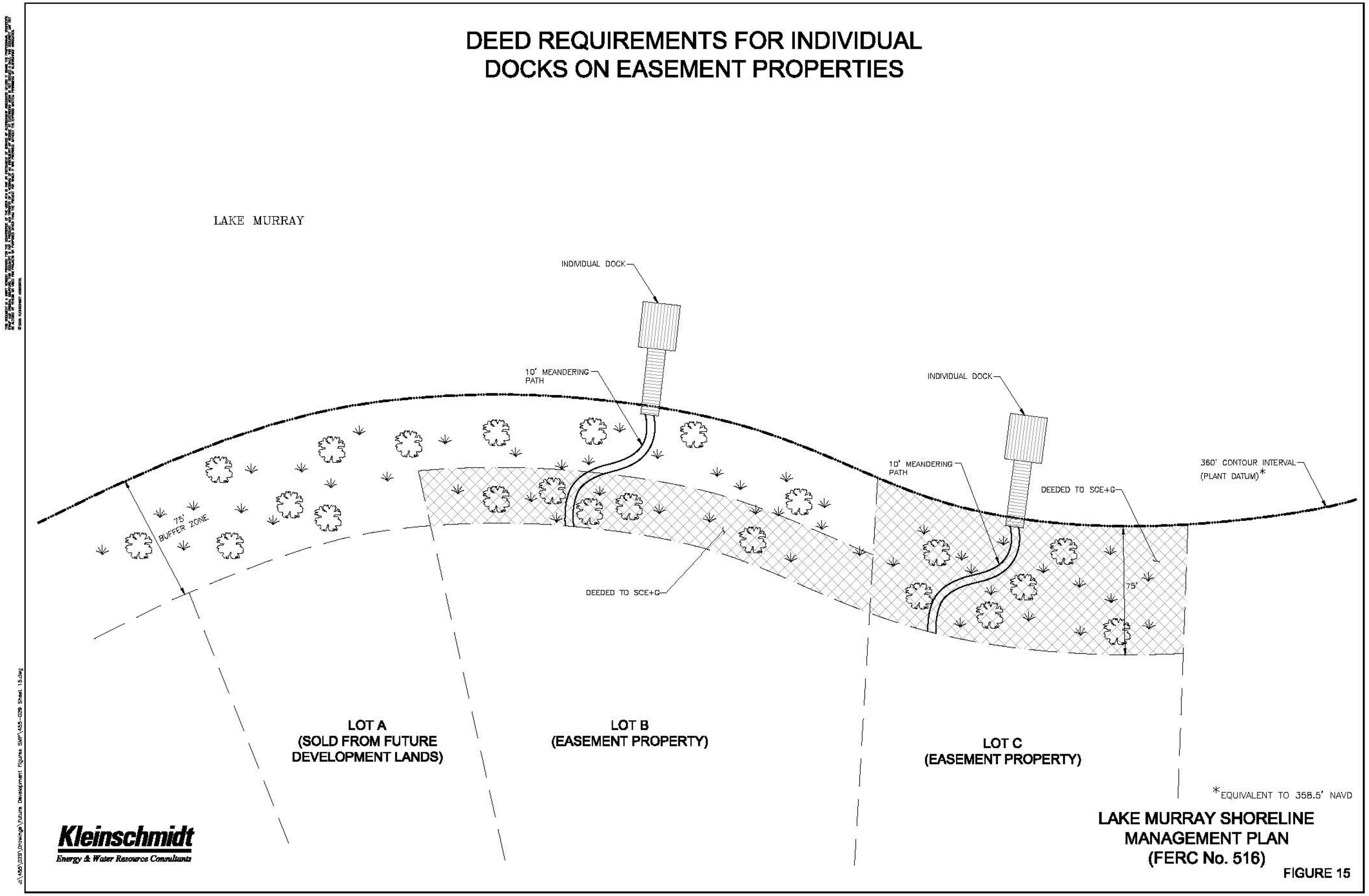


Figure 7.2-3: Deed Requirements for Individual Docks on Easement Properties



7.2.2 Private Common Docks

Common docks are encouraged and may be mandated in certain circumstances as an alternative to individual docks. A common dock may be permitted for any two adjacent residential lots. Each property owner participating in a common dock must have a minimum of 75 feet along the 360’ PD contour or the SCE&G buffer zone, whichever applies (Figures 7.2-4 and 7.2-5). Private common docks shall follow all of the guidelines described for private individual docks.

Figure 7.2-4: Example of Common Dock Layout

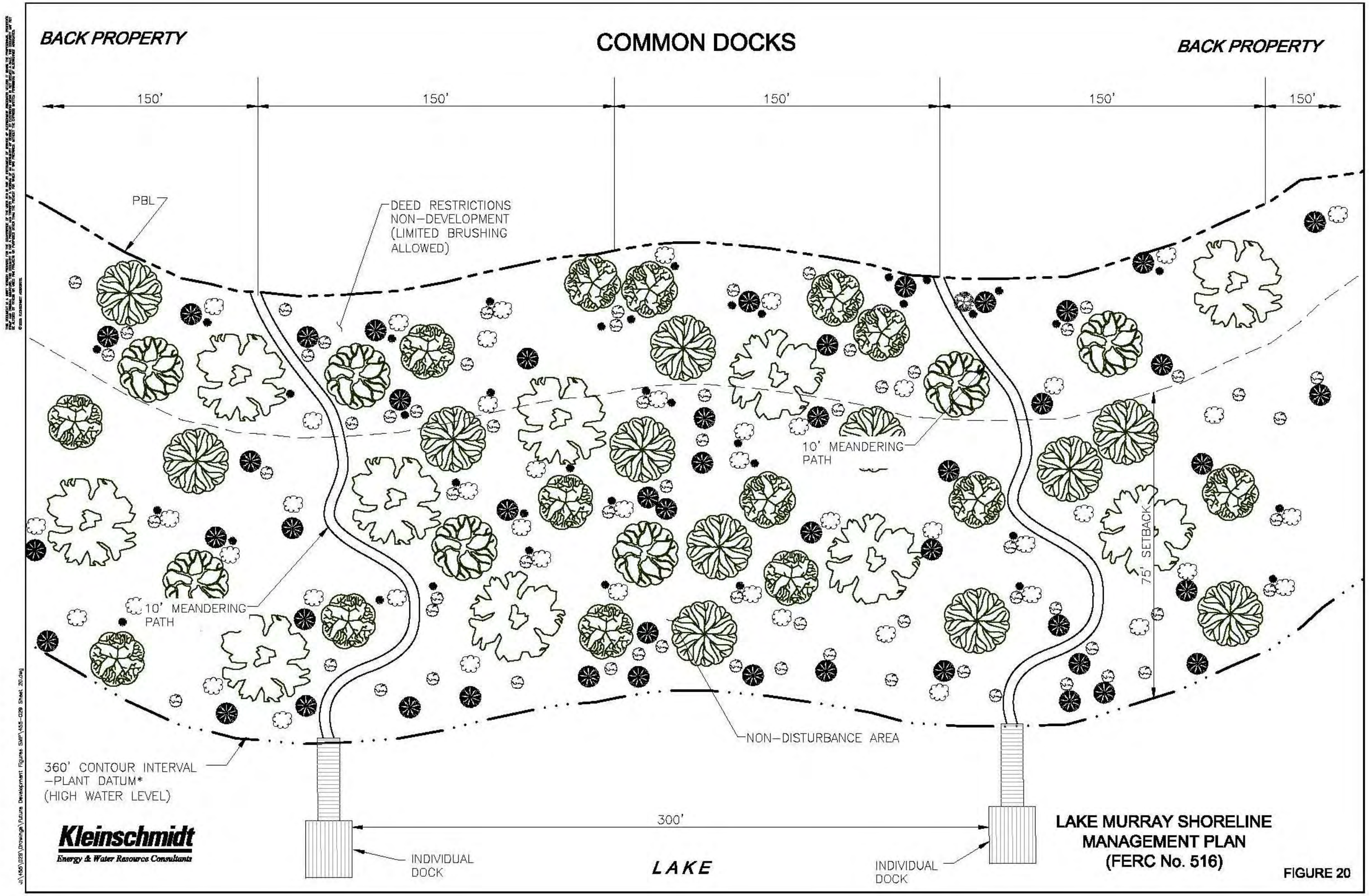
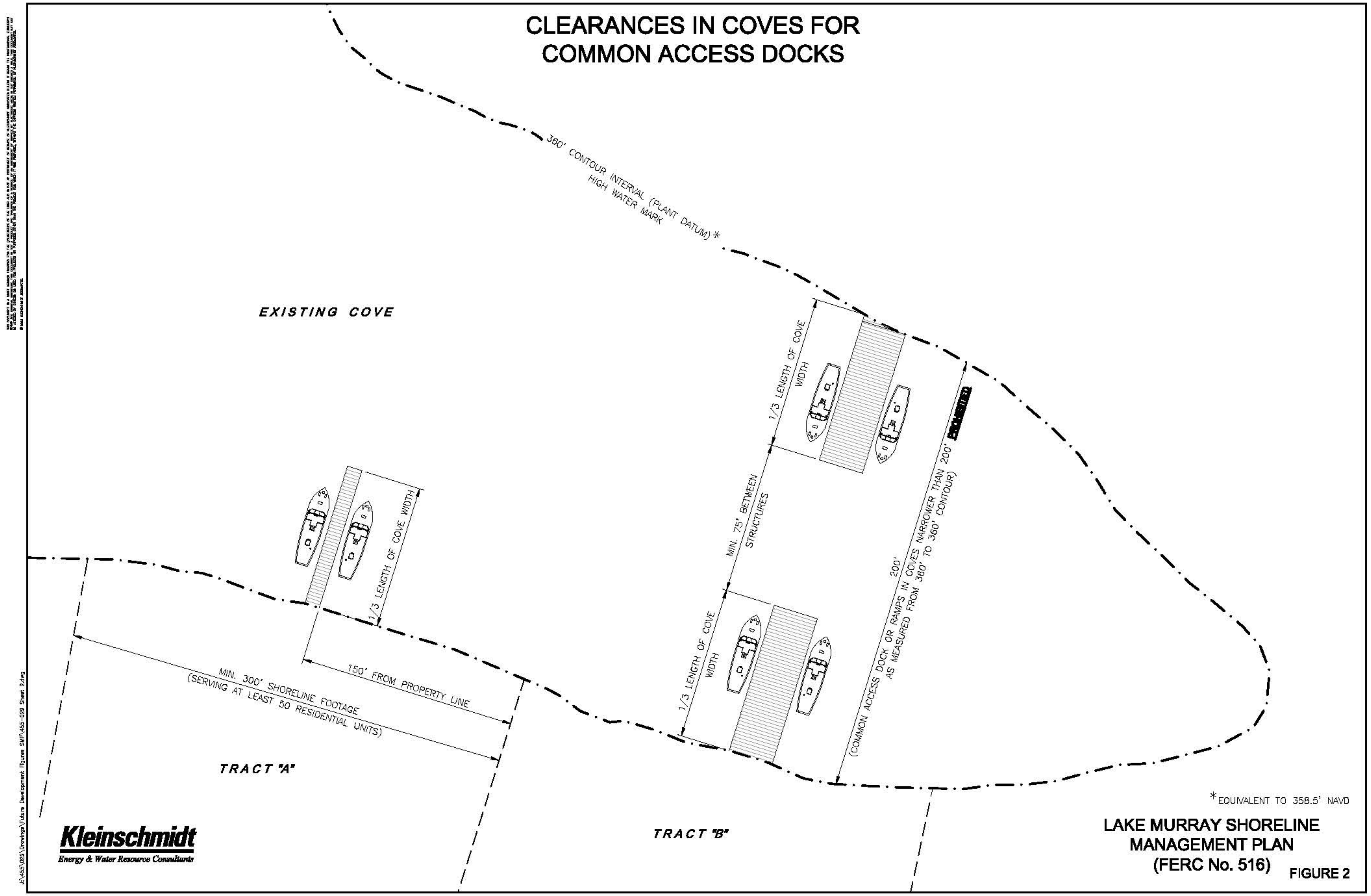


Figure 7.2-5: Clearances in Coves for Common Docks



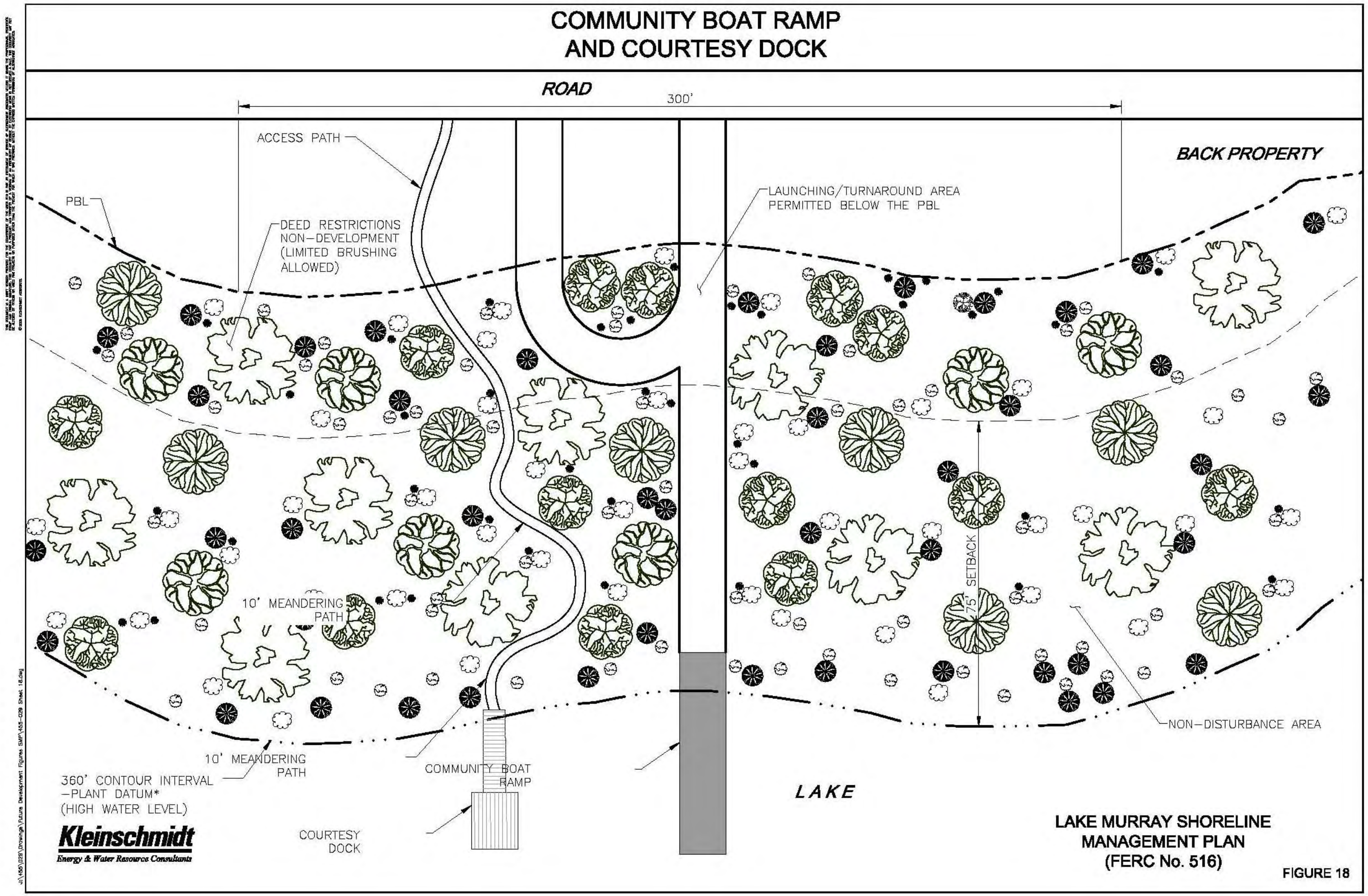
7.2.3 Community Access Areas – Boat Ramps and Courtesy Docks

A community access area consists of a boat ramp and courtesy dock open to property owners within a lakeside development who have deeded lake access . General requirements for community access development are as follows and depicted in Figure 7.2-6:

- Initial consultation and site inspection by a SCE&G Lake Management representative is required for development of community access areas.
- Existing slope and water depth must accommodate any ramp and dock at a minimum lake level elevation of 352' PD.
- Qualification for a Community Boat Ramp will be heavily influenced by evaluations of any necessitated impact to existing trees and other vegetation.
- Lots qualifying for a community access area must have a minimum width of 100 ft along the 360' PD contour or 75 ft buffer zone, whichever applies, along with a 100' lot on each side of the community access lot. Community access areas serving more than 50 property/residential units must have an additional 1.5 feet of linear shoreline per property/residential unit served.
- Community access areas must be located within the confines of the proposed development with a minimum of 100 feet to the nearest adjoining property, or a buildable lot designated on both sides of the common area with a minimum linear shoreline footage of 100 feet.
- No community access area, dock, or ramp will be permitted in a cove less than 200 feet wide measured from the 360' PD to 360' PD contour across the cove.
- County Zoning Requirements: SCE&G requires a letter from the County Zoning Administration stating that the proposed site location meets existing county regulations to construct a boat ramp or courtesy dock.

- Ramps will be constructed of reinforced concrete and may not exceed 12 feet wide.
- Parking areas and turnarounds cannot be located in SCE&G buffer zones, i.e., they must be located above the 75-ft buffer zone. In areas where the property owner owns down to the 360' PD contour, a minimum of 75' must be established between the parking area and the 360' PD contour. For buffer zone restrictions see Section 2.1.3 of this document.
- Community access areas serving 10 or fewer property/residential units will meet the established general guidelines for docks, generally permitting up to 750 square feet in size and 75 feet in length. Common access areas serving more than 10 property/residential units may be eligible for a slip dock (see Figure 7.2-1 for a diagram of a slip dock).
- No destruction or removal of critical shoreline vegetation growing below the 360' PD contour will be permitted for the installation of a boat ramp or dock. Critical vegetation includes, but is not limited to; button bush, willows, and significant hardwood species (consult with SCE&G Lake Management and see Section 7.14 for information on critical vegetation).
- Courtesy docks are only allowed in coves or along waterways that are at least 200 feet wide, measured from the 360' PD contour of the shore to the 360' PD contour of the opposite shore. Clearance between structures on opposing banks may not exceed 1/3 the distance across the waterway.
- All community access docks are approved for short-term day use only. No overnight docking will be allowed.
- Final placement of all docks is at the discretion of SCE&G Lake Management Department.

Figure 7.2-6: Example of Community Boat Ramp and Courtesy Dock



7.2.4 Private Multi-Slip (Inclusive of Private Boating Clubs)

In lieu of individual docks, multi-slip docks may be permitted based on shoreline footage and other factors. SCE&G requires the developer to establish, a homeowner's association to administer, the neighborhood multi-slip dock program. Private land owners owning property down to the 360' PD contour (i.e., easement property owners) may voluntarily establish 'Greenspaces' along the shoreline (Figures 7.2-8 and 7.2-9). Because lands sold from the Future Development classification will already have a 75-ft buffer zone associated with them, the concept of Greenspaces does not apply.

Greenspaces established by Easement property owners are undeveloped lands that have been set aside by and maintained as naturally vegetated areas. The Greenspace must be deeded to the homeowner's association. SCE&G encourages the homeowner's association to create an environmental stewardship committee within the homeowner's association to help monitor the Greenspace. A Greenspace Plan must be prepared and submitted to SCE&G and the plan should be consistent with SCE&G's buffer zone management guidelines (see Section 2.1.3). The presence of Greenspace is used to help determine eligibility for multi-slip development.

The following specifications apply to private multi slip docks:

- Developments on SCE&G Future Development lands must have a minimum of 400 feet of shoreline to participate in the multi-slip dock program. A maximum of 1.5 slips will be allowed per 200 ft of property measured along the PBL. Property with less than 400 feet will be evaluated for individual or shared docks.
- For easement properties, a minimum of 1000 ft of shoreline footage is required for approval of a multi-slip dock. The number of slips permitted will depend on establishment of Greenspaces along the shoreline:

- With min. 50 ft Greenspace -Two slips per 100 feet of shoreline.
- Without Greenspace – Up to 1.5 slips for each 100 feet of shoreline.
- With ESA but no Greenspace – One slip for each 100 feet of shoreline restricted by an ESA.
- With 50 ft Greenspace and ESA – 1.5 slips per 100 feet of shoreline restricted by an ESA.

- Fractions of slips for properties *without* a Greenspace will be rounded down to an even number of slips (i.e., between 14 and 15 slips will be rounded down to 14 slips). Fractions of slips for properties *with* Greenspace will be rounded up (i.e., between 14 and 15 slips will be rounded up to 15 slips).
- Multi-slip facilities associated with *less* than 4,000 ft. of shoreline frontage do not require FERC approval.
- No individual dock will be permitted within a multi-slip dock development.
- The outside edge of all multi-slip docks at the 360’ PD contour line must be a minimum of 150 feet from the nearest common property line (e.g., adjoining properties), and meet minimum county zoning requirements; which ever provides for greater distance. A graphic illustration of this requisite is provided in Figure 7.2-7.
- Docks may not extend more than 1/3 the distance across a cove or channel, as measured from the 360’ PD contour of one shore to the 360’ PD contour of the opposite shore.
- Access to multi-slip docks must be provided by the developer.
- A narrow, meandering access path may be allowed in the Greenspace and should be identified in the Greenspace Landscape Plan.
- Multi-slip dock facilities that accommodate watercraft with marine sanitation facilities will be required to install, operate, and

maintain sewer pump-out disposal systems in accordance with State regulations.

- Final placement of the multi-slip facility will be subject to SCE&G Lake Management approval.

Figure 7.2-7: Example of Multi-slip Dock Layout

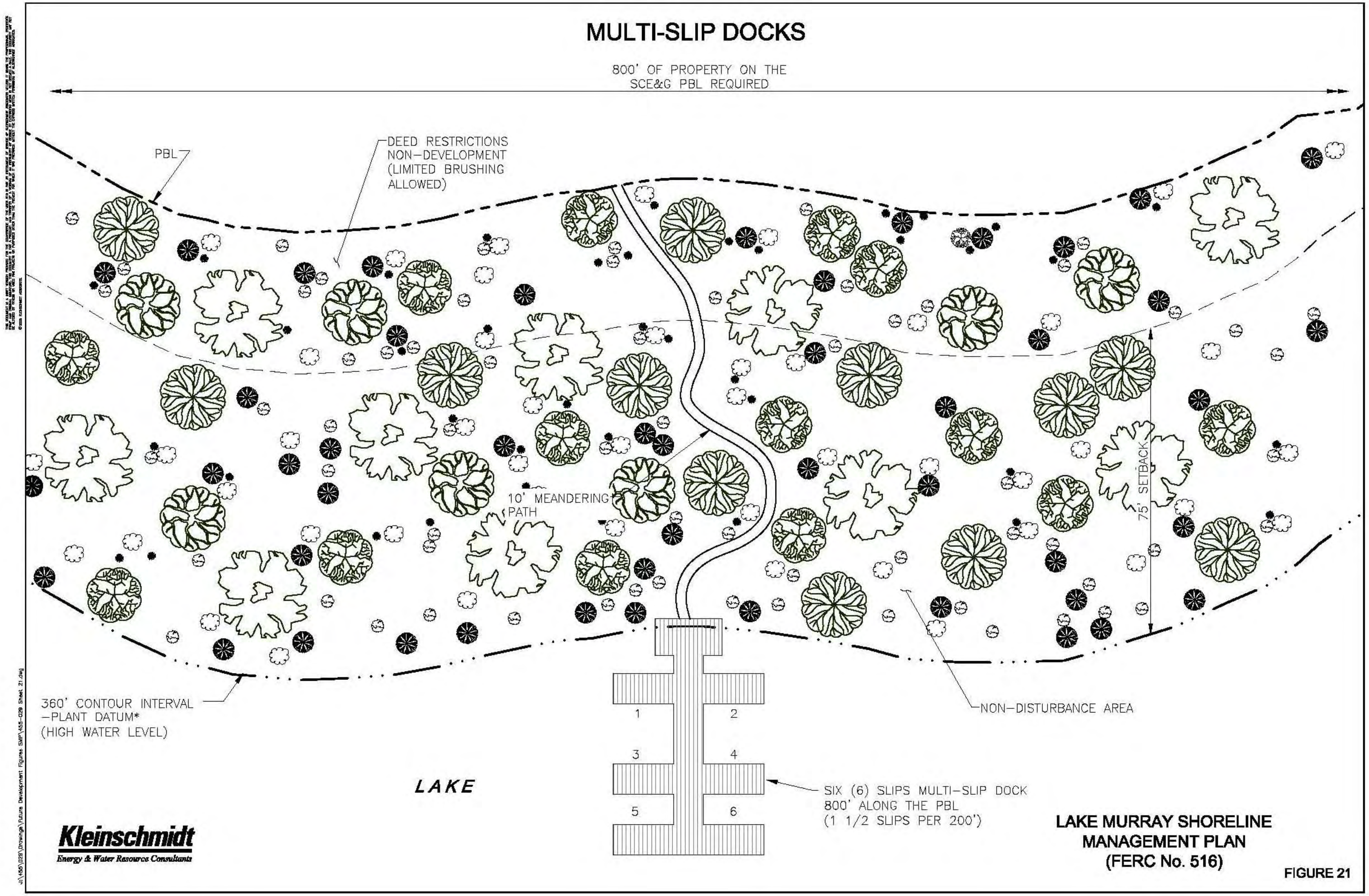


Figure 7.2-8: Allowable Multi-slips On Private Easement Properties Containing ESA's

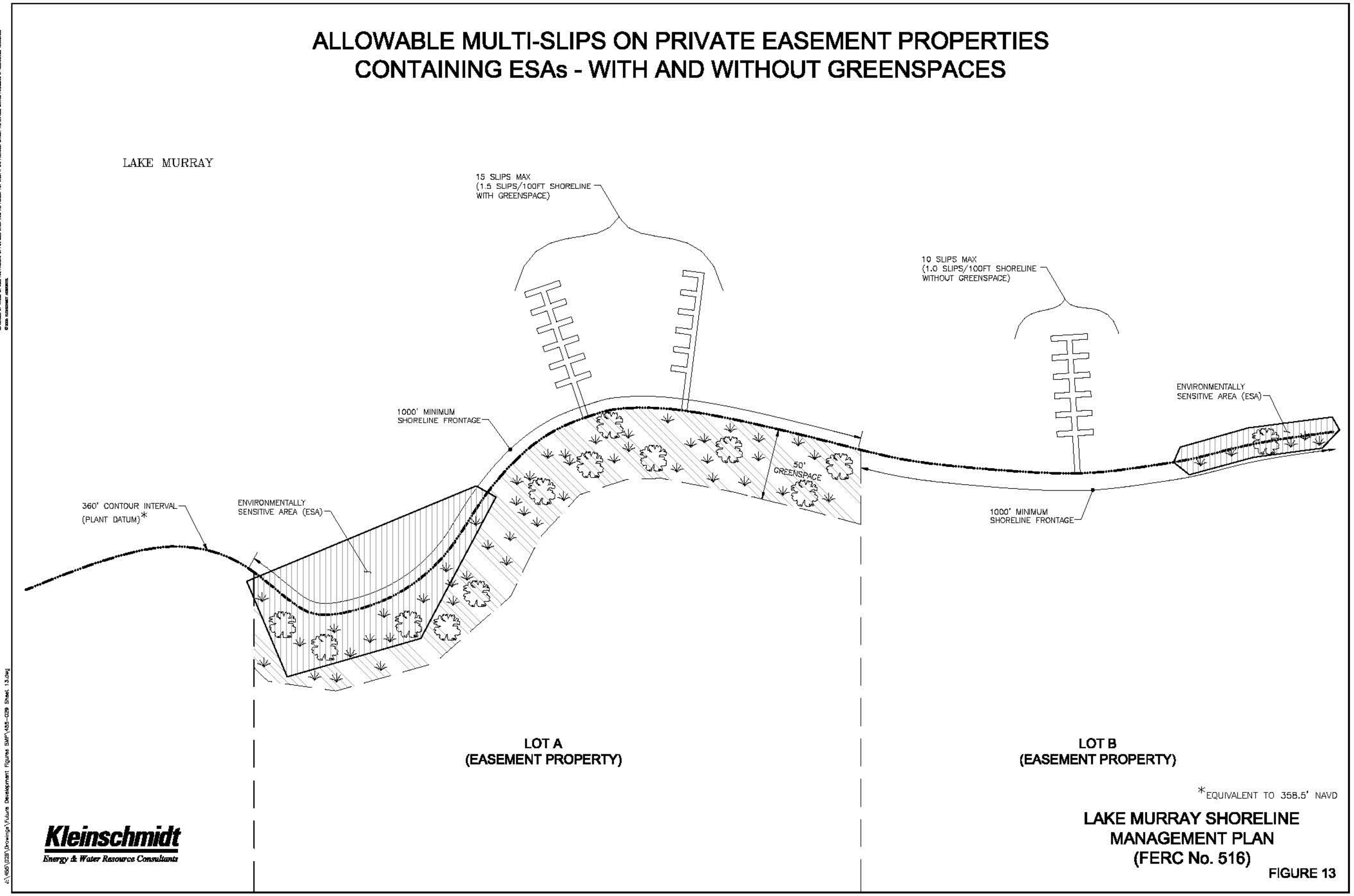
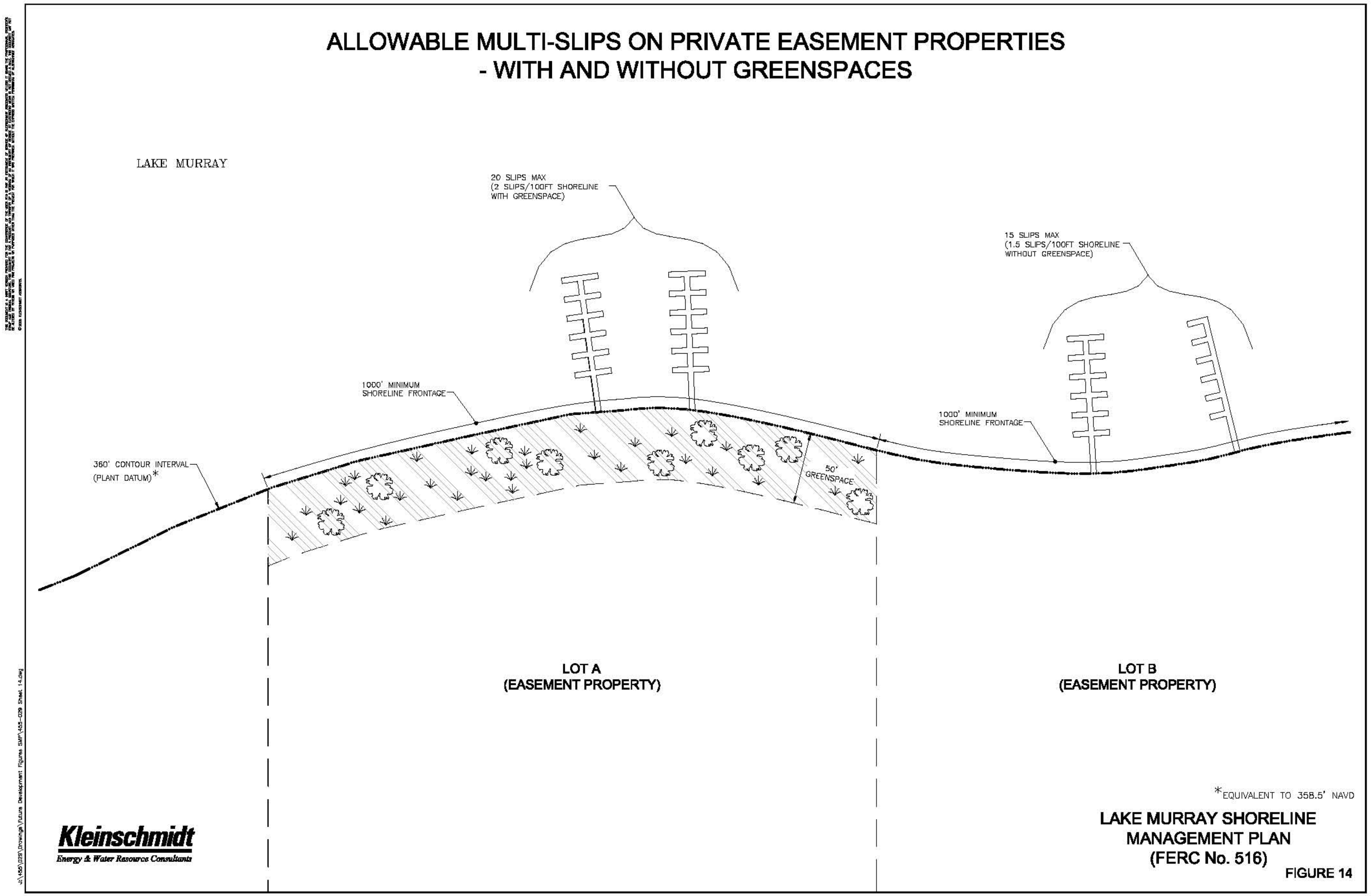


Figure 7.2-9: Allowable Multi-slips on Private Easement Properties



7.2.5 Commercial Public Marinas (Inclusive of Public Boating Clubs)

A Commercial Public Marina is a facility that provides non-discriminatory access for the general public to boat launching facilities, multi-slip docks (i.e. wet storage), dry storage, food, gas, restrooms and/or other amenities, for a fee. A commercial public marina must be independent from any off water development with no reserved docking rights designated for any particular development.

The development and expansion of new or existing commercial docks that are open to the general public for profit will be negotiated on a case-by-case basis. Each permit request will be submitted for review and comment to a Lake Murray commercial public Marina Review Committee (MRC). The MRC is made up of county, state, regional, and federal agency representatives in addition to SCE&G representatives. In addition to the MRC, there shall be a marina advisory committee (MAC) with membership appropriate to represent the residential, commercial, and other non-governmental interests of lakeside property owners. Before any determination by the MRC is made, the plan will be sent to the MAC and their input will be considered. The MAC will have a maximum of 30 days to review and provide input to the MRC. The MRC will have a maximum of 30 days after receiving comments from the MAC to provide comments on the plan. Final approval by SCE&G is required for all marina projects.

It is advised that applicants for development of a commercial public marina contact the SCE&G's Lake Management Department for an initial consultation early in the planning stage. In addition to FERC, other federal as well as state agencies have regulatory jurisdiction or resource management responsibilities with regard to the waters and shoreline of Lake Murray. Each agency's specific requirement(s) must be satisfied as a prerequisite to permit issuance for a commercial public marina. A commercial public marina applicant bears all responsibility for determining fully what governmental and other requirements beyond SCE&G's permit are required. Opinions expressed or statements made by SCE&G personnel cannot create a waiver as to any governmental requirements.

Applicants are responsible for all legal and administrative costs associated with SCE&G's preparation of the FERC filing.

An example of the agencies and their role in permitting and regulating development of a commercial public marina is provided in Table 7.2-1 as reference.

Table 7.2-1: Agency's Involved in Permitting Process for Commercial Public Marina

AGENCY	ADDRESS	REQUIREMENT
County Zoning Administration	(Dependent on county)	Letter certifying that marina site location and activity proposed do not conflict with existing zoning regulations
U. S. Army Corps of Engineers (COE)	69A Hagood Ave. Charleston, S.C. 29403-5107	Section 10 Navigable Waters Permit[1] Section 404 of Clean Water Act
S. C. Department of Health and Environmental Control (DHEC)	2600 Bull Street Columbia, S.C. 29201	401 Clean Water Certificate State Navigable Waters Permit
S. C. Department of Natural Resources (SCDNR)	Rembert C. Dennis Building 1000 Assembly Street, Columbia, SC 29201	Commenting Resource Agency in state and federal permitting processes
State Historic Preservation Office (SHPO)	South Carolina Department of Archives and History P. O. Box 11669 Columbia, SC 29211	Commenting Resource Agency in state and federal permitting processes
U.S. Fish and Wildlife Service (USFWS)	176 Croghan Spur Road, Suite200 Charleston, SC 29407	Commenting Resource Agency in state and federal permitting processes
SCE&G Lake Management Department	Columbia, SC 29218 Telephone (803) 217-9221	Issues/Denies Permit
Federal Energy Regulatory Commission (FERC)	888 First Street, NE Washington, DC 20426	Approves/Denies proposed commercial public marina based on application submitted by SCE&G

Additional governmental permits or authorizations may be required depending on particular circumstances of project.

[1] After submittal of a joint application form by an applicant, the COE and DHEC will issue joint public notices in their coordinated permitting processes through which each makes its own permit decision.

General requirements for a commercial public marina vary depending on the size or the facility, or the number of watercraft it accommodates. Facility size has been categorized as those supporting (1) 20 or fewer watercraft (Figure 7.2-10), (2) 21-100 watercraft (7.2-11), or (3) 101 to 250 watercraft (7.2-12). A maximum development limit of two hundred fifty (250) on-water slips to accommodate watercraft will be permitted. All marina facilities must comply with all local, county, state, and federal regulations. Construction must commence within one year from the date of the SCE&G permit. The build out period must conform to the ACOE, FERC and DHEC permit conditions, and such additional constraints as may be contained in the FERC Order approving SCE&G's issuance of a permit. The following sections provide the required specifications for each facility size.

Commercial Public Marinas Accommodating Twenty (20) or Fewer Watercraft (Figure 7.2-10)

- Except when involving a peninsula (see following bullet item), no commercial public marina accommodating twenty (20) or fewer watercraft at a time will be permitted any closer than ¼ mile from (i.e. within a ¼ mile radius of) an existing facility.
- A commercial public marina proposed to be located at a site within the ¼ or ½ mile radius of an existing facility, but separated by a peninsula from the existing facility on the opposite side of the peninsula, will be required to have a minimum linear shoreline distance along the 360' PD contour of 2 miles between the existing and the proposed public marina.
- Commercial public marinas accommodating twenty (20) or fewer watercraft at a time must have a minimum of 400 feet of shoreline and be located or constructed such that the docks and watercraft will not unduly restrict or limit navigation through the area or access to adjoining properties.
- No commercial public marina accommodating twenty (20) or fewer docks may encroach or extend more than one-third of the

distance across the cove or waterway. Distance will be measured from the 360' PD contour to 360' PD contour, and will be determined on a case-by-case basis.

- No dock at a commercial public marina accommodating twenty (20) or fewer watercraft may extend more than 175 feet lake-ward from the 360' PD contour high water mark or one third distance across the cove whichever is less (Figure 7.2-13).
- Commercial public marinas accommodating twenty (20) or fewer watercraft at a time may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 400 feet, measured from the 360' PD contour on one side to the 360' PD contour across the cove or waterway on the other side.
- Multi-slip dock facilities that accommodate watercraft with marine sanitation facilities will be required to install, operate, and maintain sewer pump-out disposal systems in accordance with State regulations.
- Multi-slip docks will not be permitted to have covers or roofs over the docks or slips. Walkways may be covered as long as they are above the 360' PD contour line.
- No multi-slip dock may encroach within 50 feet of a Natural Area or identified ESA, as determined by SCE&G.
- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.

Public Marinas Accommodating Twenty One to One Hundred (21 - 100) Watercraft (Figure 7.2-11)

- Except when involving a peninsula (see following bullet), no commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time will be permitted any closer than ½ mile radius from an existing Public Marina.
- Any commercial public marina facility proposed to be located

within a ¼ or ½ mile radius of an existing marina, but separated by a peninsula, and which will be located on the opposite side of the peninsula, will be required to have a minimum linear shoreline distance of 2 miles along the 360’ PD contour between the existing and the proposed commercial public marina.

- Commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time must have a minimum of 800 feet of shoreline and be located or constructed in such a way that the docks and watercraft will not unduly restrict or limit navigation in the area or encroach within 150 feet of adjoining properties.
- No dock at a commercial public marina accommodating twenty-one to one hundred (21 - 100) docks may encroach or extend more than ⅓ the distance across any cove area or waterway measured from the 360’ PD contour to 360’ PD contour.
- No dock at a commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft, may extend more than 300 feet lake-ward from the 360’ PD contour high water mark or ⅓ the distance across the cove, whichever is less.
- Commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time must be located in areas where water depths are adequate for boating access and may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 900 feet, measured from the 360’ PD contour on one side to the 360’ PD contour across the cove or waterway on the other side.
- Commercial public marinas accommodating twenty-one to one hundred (21 - 100) watercraft will be required to provide a marine pump-out facility.
- No commercial public marinas will be permitted to have covers or roofs over the docks or slips.
- No commercial public marinas may encroach within 50 feet of a Natural Area or identified ESA as determined by SCE&G.

- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.
- Applicants will be required to perform a Baseline Environmental Water Quality Monitoring Plan and conduct such water quality sampling as required therein annually for five years during the month of August.

Public Marinas Accommodating One Hundred One to Two Hundred Fifty (101 - 250) Watercraft (Figure 7.2-12)

- No commercial public marina facility accommodating one hundred one to two hundred fifty (101 - 250) watercraft at a time will be permitted any closer than ½ mile radius to an existing Public Marina facility.
- Any commercial public marina facility proposed to be located within the ¼ or ½ mile radius of an existing facility, but separated by a peninsula, must be located on the opposite side of the peninsula, and must have a minimum linear shoreline distance along the 360’ PD contour of 2 miles between the existing and the proposed facility.
- Commercial public marinas accommodating one hundred one to two hundred fifty (101 - 250) watercraft at a time must have a minimum of 1000 feet of shoreline and be located or constructed in such a way that the docks and watercraft will not unduly restrict or limit navigation in the area or encroach within 200 feet of adjoining properties.
- No dock at a commercial public marina accommodating one hundred one to two hundred fifty (101 - 250) docks, may encroach or extend more than one third the distance across any cove area or waterway measured from the 360’ PD contour to 360’ PD contour.
- No dock at a commercial public marina accommodating one hundred and one to two hundred-fifty (101 - 250) watercraft, may extend more than 400 feet lake-ward from the 360’ PD contour or

1/3 the distance across any cove whichever is less.

- Commercial public marinas accommodating one hundred one to two hundred fifty (101 - 250) watercraft must be located in areas where water depths are adequate for boating access and may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 1000 feet, measured from the 360’ PD contours of both shores.
- Commercial public marinas that accommodate watercraft with marine sanitation facilities will be required to install, operate, and maintain sewer pump-out disposal systems in accordance with State regulations.
- No commercial public marinas will be permitted to have covers or roofs over the docks or slips.
- No commercial public marinas may encroach within 50 feet of a Natural Area or identified ESA as determined by SCE&G.
- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.
- Applicants will be required to perform a Baseline Environmental Water Quality Monitoring Plan and conduct such water quality sampling as required therein annually for five years during the month of August.

Additional Specifications for all Public Marinas

- Marinas permitted for commercial use after 2007 cannot be converted to private multi-slip use without re-applying for a new permit from SCE&G.
- The proposed commercial public marina should be located within the confines of the imaginary projected property lines as they extend lake-ward.
- Excavations for commercial public marina facilities to improve public access is discouraged but may be considered on a case-by-case basis with consultation with SCE&G, and appropriate state

and federal resource agencies and regulatory authorities.

- Commercial public marina facilities must at a minimum provide public restrooms, and are encouraged to provide public fishing access areas.
- The applicant must sign and complete the Commercial Public Marina Application Agreement before SCE&G will process a permit request.
- Existing marinas may remodel, rebuild, or repair within their existing footprint with the approval of the appropriate local, state, and federal agencies. To avoid additional permitting requirements, the facility would need to maintain or reduce the number of slips originally permitted.
- Additions to existing marinas that increase the number of slips or expand the existing footprint of the facility will require a permit for the additional slips.
- Expansion projects of existing marinas are evaluated on a case-by-case basis and must go through the MRC. SCE&G will have final approval of all projects.
- If damage to an existing marina caused by storm or other natural events requires maintenance and repair, the work completed on the facility must comply with the original permit conditions and specifications, and is not required to meet new standards.

Figure 7.2-10: Potential Layout for Commercial Marina Facility Accommodating 20 or Fewer Watercraft

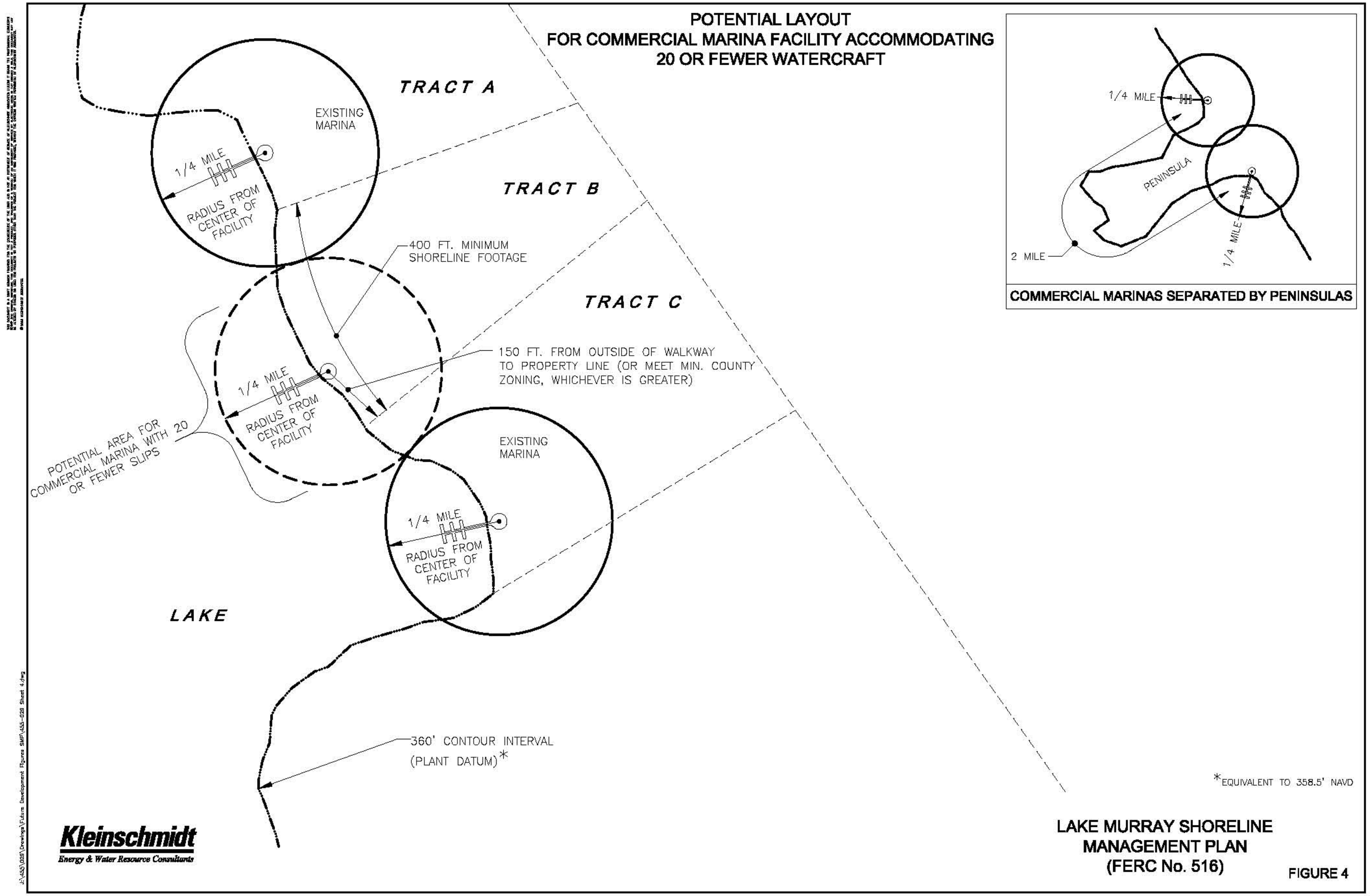


Figure 7.2-11: Potential Layout for Commercial Marina Facility Accommodating 21 to 100 Watercraft

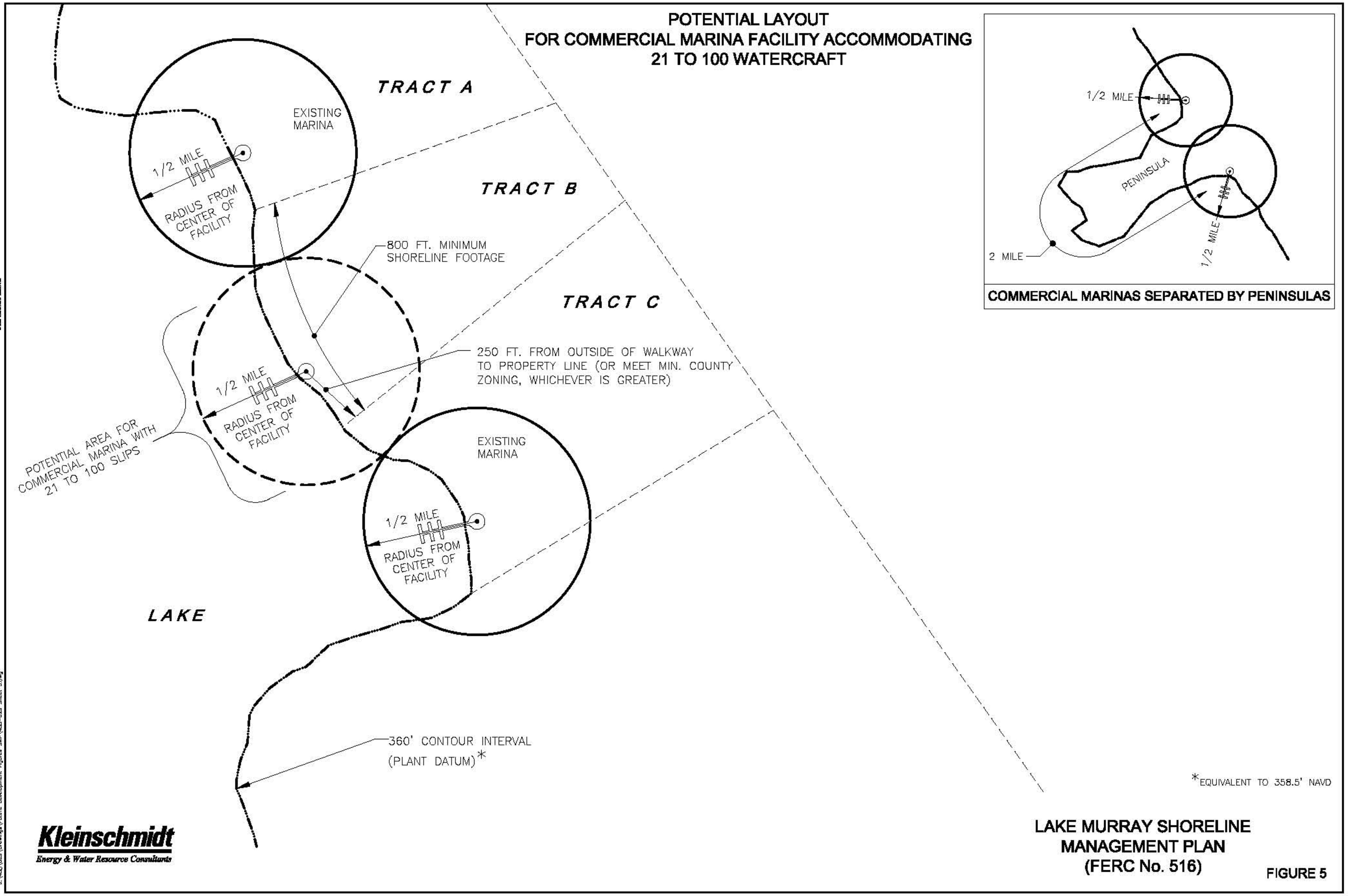


Figure 7.2-12: Potential Layout for Commercial Marina Facility Accommodating 101 to 250 Watercraft

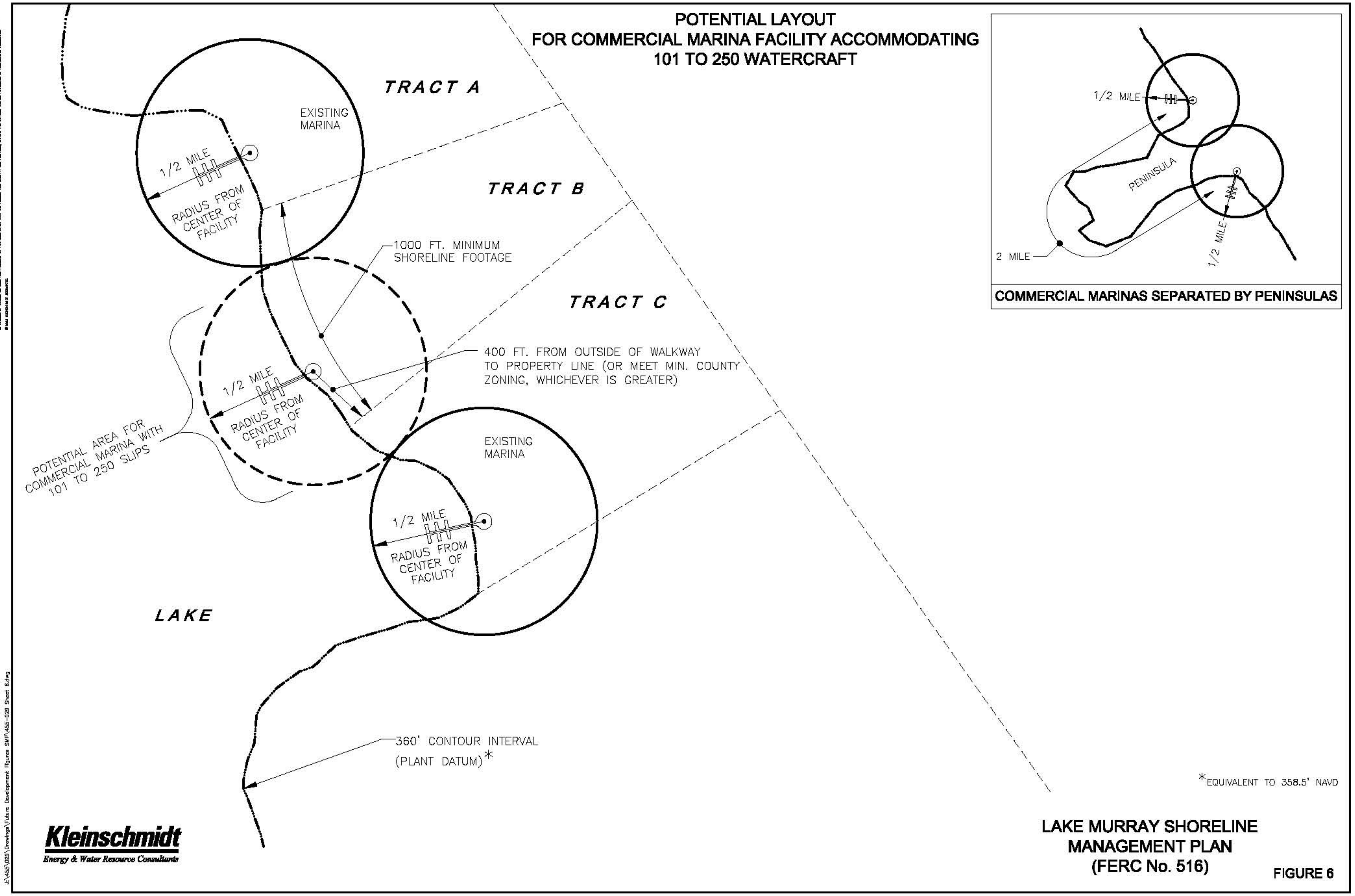
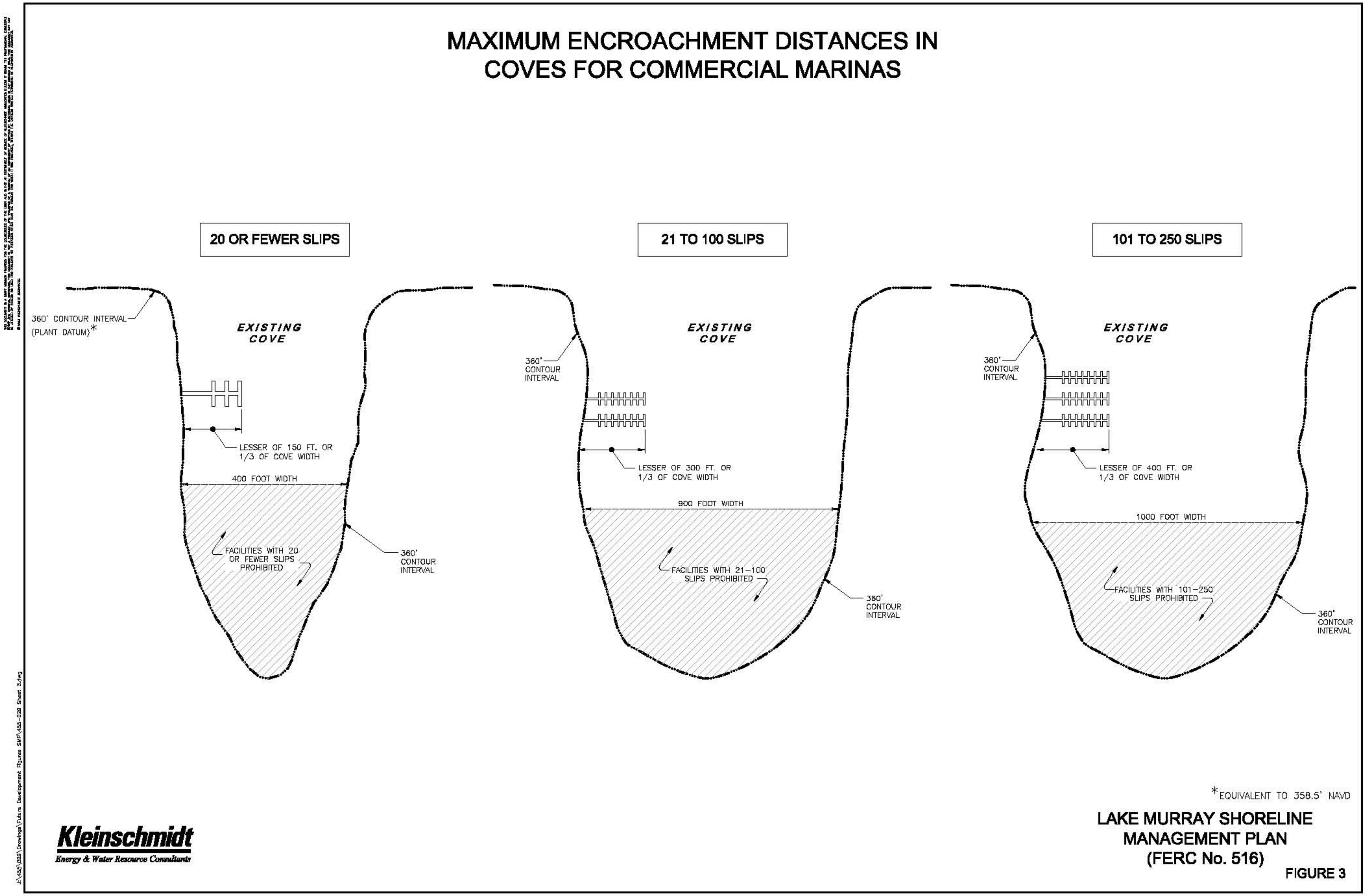


Figure 7.2-13: Maximum Encroachment Distances in Coves for Commercial Marina Facilities



7.2.6 Watercraft Limitations

No watercraft exceeding 34 feet in length will be allowed to permanently dock at a residential or common area dock. Permanently docked is defined as any 14 day consecutive period in any 30 day period. Watercraft exceeding 34 feet must be docked at a commercial public marina or multi-slip facility with pump-out facilities.

7.2.7 Dock Modifications

Prior to initiating any project, property owners should contact SCE&G's Lake Management Department at 803-217-9221. Major dock modifications that may temporarily or permanently affect the land or water of the shoreline require submittal of a permit application to SCE&G and approval of the application prior to the commencement of any such modifications. However, general maintenance and repairs of docks such as replacing boards, etc. does not require permitting. Dock owners must contact SCE&G's Lake Management Department for more information and guidance regarding the need for a permit to conduct dock work.

7.2.8 Dock Policy on Forest Management Property

The SCE&G Forest Management Classification identifies SCE&G timberlands located within the (PBL) Project Boundary line of the Lake Murray Saluda Hydro Project. The Forest Management Classification property will not be available for sale and is protected from shoreline (dock/ramp) development. The timber is managed under the S. C. Forestry Commission (BMP) Best Management Practices with restriction of any timber harvesting within 100 feet of the high water mark (360 contour).

SCE&G has approximately 100 miles of shoreline and 3,570 acres classified as Forest Management property around Lake Murray. The majority of the Forest Management property is located in the upper western end of the project along the Big and Little Saluda Rivers.

The Forest Management Classification has been in effect since 1979 when SCE&G was ordered by the (FERC) Federal Energy Regulatory Commission to establish a Land Use Shoreline Management Plan for the Saluda Hydro Electric Project.

The land being identified as Forest Management Property was protected from shoreline development by prohibiting the sale of any available lands within the PBL that were identified under the Forest Management Classification.

Over the years many property owners with land adjoining the SCE&G shoreline property identified as Forest Management, have expressed concerns of the restriction of no docks within the Forest Management Classification. Many of the current property owners are family members of the original property owners from whom SCE&G purchased their land for the development of the Lake. The majority of the Forest Management Properties were originally timber, pasture, and farm lands and have not changed very much over the years. This policy would address the possibility of permitting some type of limited dock access within the Forest Management Classification to existing back property owners who could meet the established criteria for dock approval.

Requirements:

Individual Residential Dock

- Eligibility for dock consideration restricted to property owners of record as of January 1, 2007. SCE&G has County documentation for property ownership for Newberry, Saluda, Lexington, and Richland Counties.
- Only one residential dock will be permitted for each identified tract of land.
- To be eligible for a dock, the property must first have a minimum of 500 feet on the Project Boundary Line (PBL).

- No dock will be permitted in narrow coves or shall water areas or areas identified as Environmental Sensitive Area (ESA).
- A minimum width of 100 feet from the 360 contour must be established prior to dock approval. If the PBL is less than100 feet the property owner would be required to deed SCE&G enough of their property to create a minimum 100 foot Buffer Zone to qualify for a dock.
- Dock site selection will typically be located in close proximity to the narrowest distance from the 360 contour and being a minimum of 100 feet.
- A single residential access path, approximately 10 feet wide, may be cleared for access to a permitted dock from the adjacent back property owner's land. The access path must follow a meandering route to prevent erosion and to protect the aesthetics of the shoreline. No trees larger than 8 inches at breast height can be removed within the 10 foot access path. No removal or clearing of trees or vegetation cover within the Forest Management Property will be permitted, with the exception being within the permitted access path.
- Be advised that any unauthorized removal of trees or vegetation on SCE&G property will result in the immediate cancellation of the dock.
- Each permit will be evaluated on a case- by-case basis with final approval at the sole discretion of the SCE&G Lake Management Department.
- No docks will be permitted on the SCE&G Forest management Land located on the Big Saluda River above Kempson Bridge on Hwy 395. This area, identified as the headwater of Lake Murray, has significant environmental, ecological, and aesthetic values that warrant protection.

7.3 Boat Ramps

SCE&G encourages the use of boat ramps at public facilities versus construction of private ramps. Moreover, individual private boat ramps are not permitted in SCE&G buffer zones. In cases where private boat ramps are allowed, the following specifications apply to boat ramp construction:

- Ramps may be up to 12 feet wide and the required length to be functional at various water levels. Public ramps may be granted a variance from these conditions.
- Ramps must be constructed of concrete. Asphalt compounds or petroleum based products are prohibited.
- All ramps should be located so as not to interfere with neighboring property owners. Adjoining shoreline property owners may agree to common use of the ramp. The permit reflecting an agreement between the two participating shoreline property owners will be provided by SCE&G.
- If a community access ramp is permitted, individual ramps will not be permitted.

7.4 Boat Lifts

The following specifications apply to the construction of boat lifts:

- All boat lifts must adjoin the owner's dock. Pilings cannot extend beyond the lakeward end of the dock.
- Boat lifts should be located so as not to interfere with the adjacent property owners' access.
- Only one boat lift will be approved per individual dock. On a case by case basis SCE&G Lake Management Department will consider 2 boat lifts for a common dock that is shared by two property owners.
- No covers are to be constructed over boatlifts.
- All boat lifts are to be low profile style lifts.

7.5 Personal Watercraft Lifts

Personal Watercraft lifts will require a permit from SCE&G. Facilities for lifting up to two personal watercrafts may be permitted per dock. The following specifications apply to the construction of personal watercraft lifts:

- Personal watercraft lifts should be located so as not to interfere with the adjoining property owners' access; and
- No covers are to be constructed over personal watercraft lifts.

7.6 Marine Railways

- Marine railways are permitted for access to the lake from facilities located above the 360' PD contour; and
- Railways constructed below the 360' PD contour area are restricted to no more than two-foot elevation above the natural lake basin.

7.7 Floating Platforms or Tubes and Other Water Toys

- These items are not allowed to be permanently installed and must be removed before sunset each day; and
- These items must not inhibit navigation or extend more than 1/3 the width of the cove at the high water mark (360' PD contour).

7.8 Water Removal

Residential Withdrawals

Residential requests for water withdrawals require a permit from SCE&G. Water removal permits for residential property will be for irrigation purposes only. All irrigation pumps and wiring must be located behind the 360' PD contour. Combustion or diesel pumps will not be permitted. SCE&G reserves the right to prohibit irrigation during times of drought or low water conditions. Applicants should contact the SCE&G Lake Management Department for permit applications and additional information.

Commercial Withdrawals

Commercial/Municipality request for water withdrawals require a permit from SCE&G. SCE&G may authorize water withdrawals up to 1 MGD without the requirement of FERC approval. SCE&G will impose limits (such as pump size or pipe size) in granting permits for approved applications. The applicant will be required to compensate SCE&G for water withdrawn and to bear expenses of filing the application.

A commercial application to withdraw water from the lake must include the following information:

- a complete description of the purpose for the removal;
- removal processes to be used;
- volumes to be withdrawn;
- copies of all required local, state, and federal permits and reports;
- the required fee; and
- any additional information as required by SCE&G.

7.9 Erosion Control (Shoreline Stabilization)

All shoreline stabilization efforts, including construction or repair of rip-rap, seawalls, retaining walls, and bioengineering, must be approved in writing by SCE&G Lake Management prior to implementation and/or construction. Furthermore, there are some areas of the lake where facilities may not be permitted because of environmental considerations, development patterns, physical lake characteristics, impacts to cultural resources, or other reasons.

Property owners should be aware that conducting any shoreline stabilization activities at a federally licensed hydroelectric project (e.g., Saluda Hydroelectric Project, FERC Project No. P-516) is a privilege that can only be granted with authorization from the Licensee. Because every possible situation cannot be anticipated, SCE&G Lake Management reserves the right to make special rulings in cases not specifically covered by these guidelines. Shoreline stabilization projects must adhere to the following specifications and is depicted in Figure 7.9-1.

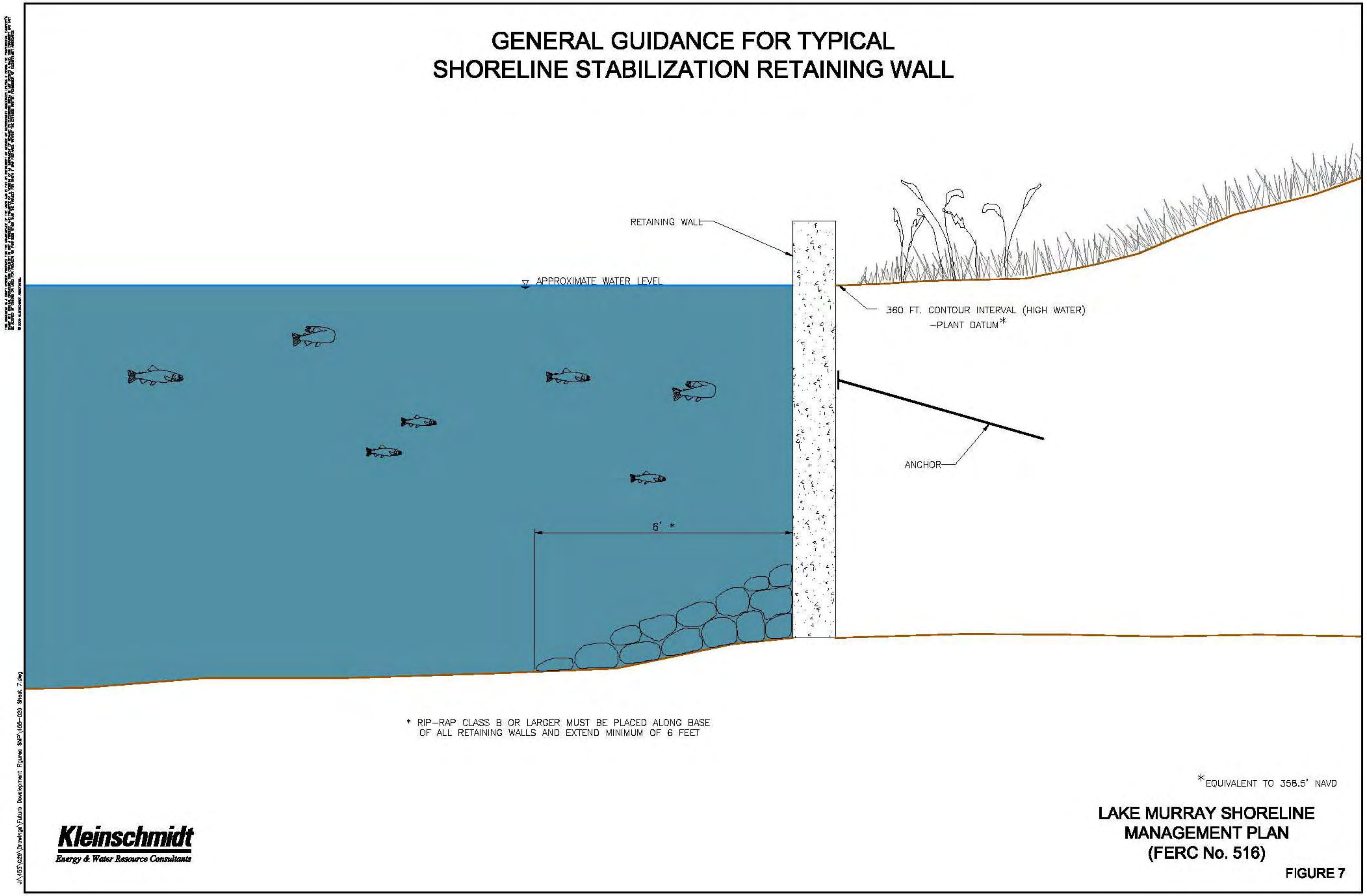
General Requirements:

- Silt fencing must be properly installed on the 360' PD contour or buffer zone, where applicable, before any land disturbance activities take place.
- The applicant must be the owner of the tract of land immediately adjoining the high water mark (360' PD contour) or SCE&G-owned buffer zone, or have the written permission of the easement property owner on water rights tracts (e.g., where SCE&G only has a flowage easement).
- SCE&G Lake Management will hold the applicant fully responsible for ongoing adherence with the current SMP and Handbook, including maintaining structures in good repair. This responsibility transfers automatically along with ownership.
- Prior to beginning any activity/construction within the high water mark (360' PD contour), the applicant must obtain all necessary governmental permits or approvals, and written authorization from SCE&G Lake Management.
- Consultation with SCDNR and U.S. Fish and Wildlife Service (USFWS) will be required for stabilization that exceeds 500 linear feet of shoreline.
- In order to protect aquatic resources, shoreline stabilization activities shall typically be performed September through February. In emergency situations, for repairs necessary to ensure integrity of existing structures, work may be performed outside September-February time period upon approval by SCE&G.
- The applicant shall make every reasonable effort to minimize any adverse impact(s) on fish, wildlife, shoreline vegetation, and other natural resources.

- New or expanding stabilization activities (excluding bio-engineering) may not be undertaken within a 50-foot offset from an ESA classification as identified in the SMP. All shoreline stabilization activities affecting an ESA will be assessed on a case-by-case basis.
- Minimal clearing below the high water mark (360' PD contour) may be allowed to create corridors for equipment access for stabilization projects. Access corridors should be incorporated into fixed pier/dock access corridors (*i.e.* foot paths) where practical. Vegetation removed to accommodate construction access for shoreline stabilization shall be replaced with native vegetation.
- Shoreline stabilization activities are limited to the eroded bank. Any unavoidable impacts to existing emergent aquatic vegetation, as a result of stabilization installation, require the replanting of vegetation in the impacted area(s).
- Bio-Engineering Stabilization is a preferred shoreline stabilization technique and is encouraged, especially in eroded areas associated with emergent aquatic vegetation. Applicants are encouraged to avoid activities (including stabilization) that could have an adverse impact(s) upon existing native aquatic plants.
- Approved bioengineering techniques are generally required for eroded banks of two feet or less of erosional scarp. Approved bioengineering and/or vegetated riprap techniques are preferred for eroded banks exceeding two feet of erosional scarp.
- The type of plantings utilized in bioengineering and landscape-planting projects should be native to South Carolina, and must be reviewed and approved by SCE&G Lake Management prior to introduction. Desirable species include grasses such as switchgrass and maidencane, and shrub and saplings such as water willow, black willow, button bush, and river birch.
- Riprap stabilization installed below the high water mark (360' PD contour) in vegetated areas must be limited to one layer deep to allow spaces between the stone for vegetation recruitment.

- Riprap material must be SCDOT Class B, or larger, quarry-run stone, natural stone, or other material approved by SCE&G. The use of tires, scrap metal, crushed block, construction/demolition debris, or other such types of material, is not allowed.
- Riprap use should be limited to only that area necessary to adequately stabilize the existing eroded bank. Riprap should be confined to a linear distance of 6 feet below the high water mark (360' PD contour) except where the entire placement is on/above severely eroded banks. These areas must be sloped back or terraced to provide minimum bank stability.
- Stabilization of eroded banks that are 2 feet in height or higher, or that are not associated with emergent aquatic vegetation, can be stabilized using SCDOT Class B or larger size riprap with filter cloth, bio-engineering using significant live staking and planting, or other forms of bio-engineering within the riprap.
- Retaining wall stabilization is only allowed for erosion control where the average eroded bank height is greater than 3 feet and the wall is constructed at the high water mark (360' PD contour). Earth fills below the high water mark (360' PD contour) are prohibited.
- A layer of rip-rap (SCDOT Class B or larger) extending 6 feet lake-ward from the high water mark (360' PD contour) must be placed along the entire base of all retaining walls. The 6-foot requirement is measured horizontally as shown on Figure 7.9-1.
- No sand shall be placed below the 360' PD contour. Effective measures must be used to keep sand from migrating below the 360' PD contour.

Figure 7.9-1: General Guidance for Typical Shoreline Stabilization Retaining Wall



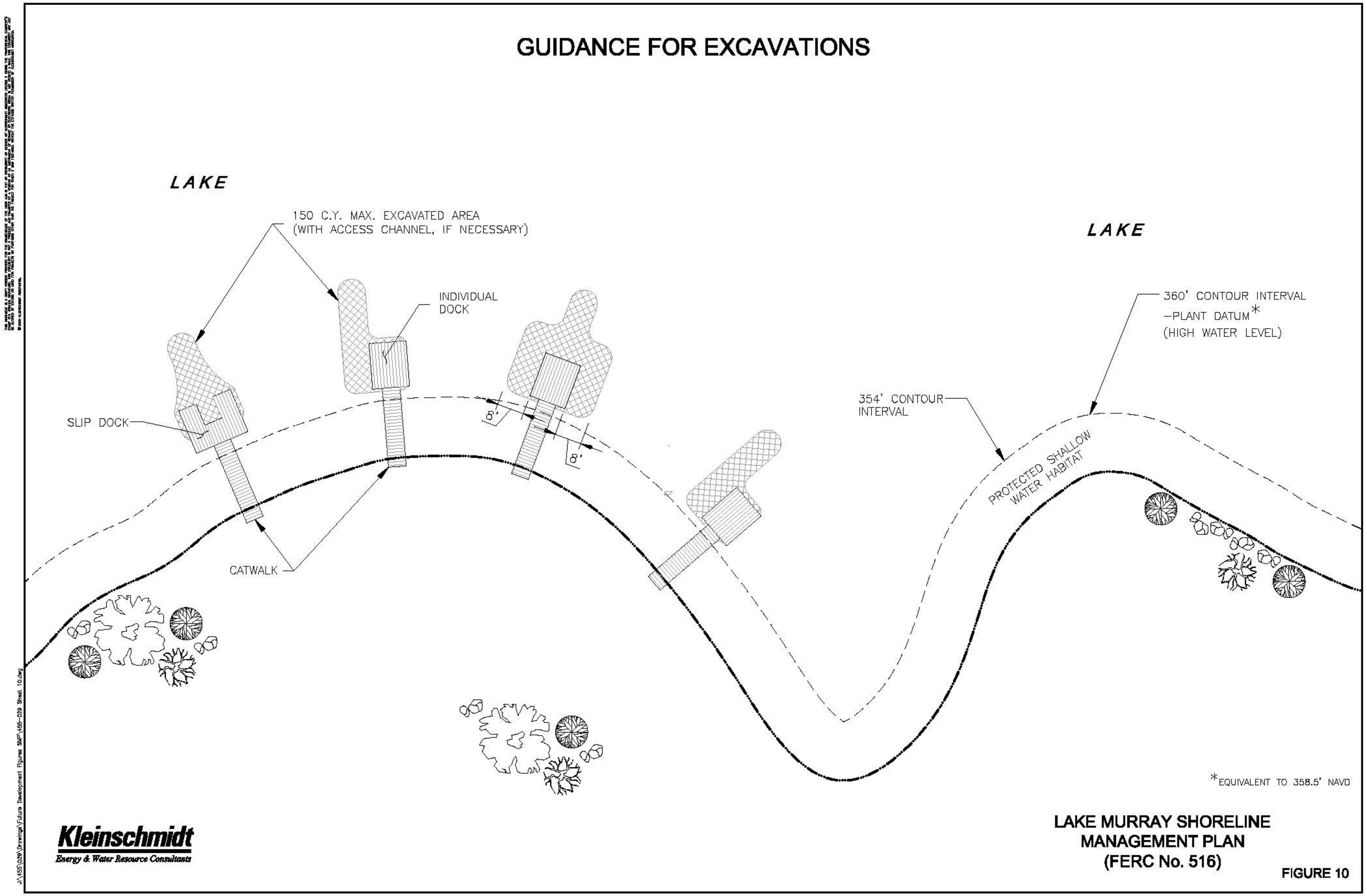
7.10 Excavation Activities

Excavation activities below the 360’ PD contour are discouraged. Excavating of soils can release erodable earth material into the environment if precautions are not taken. SCE&G monitors excavation activities by requiring that a permit be obtained from SCE&G for work performed below the 360’ PD contour. All authorized excavations must be in accordance with SCE&G specifications and requirements, which may include an environmental assessment plan or report. Figure 7.10-1 depicts general guidance for excavations. Any permitted excavation work must meet the following specifications:

- SCE&G Lake Management Department must be notified prior to commencement and upon completion of work.
- All displaced soil must be taken off site or otherwise stabilized above the 360’ PD contour in accordance with SCE&G requirements if in Richland, Saluda and Newberry Counties, and in accordance with recommendations of the Lexington County Sediment Control Representative if in Lexington County.
- A 4 to 1 slope is the maximum slope allowed.
- All excavating must be done directly in front of the applicant's property and below the 354’ PD contour, unless the adjoining property owner signs off on the project, or unless otherwise approved by SCE&G in consultation with SCDNR.
- No excavation will be permitted in a wooded or vegetated area, within 50 feet of an ESA, or other areas that may be identified by SCE&G in consultation with SCDNR. The protection of shallow water habitat must be considered at all times. A Lake Management representative will designate the area to be excavated.
- Excavation activities generally will not be allowed between January 15 and October 1. Exceptions may be granted by SCE&G based on hydrological or meteorological conditions. Permits are valid for only one (1) year from the date of issue. See date on approved permit.
- Water must not cover the excavation site during excavation activities.

- The contractor must have a copy of the approved permit and drawing while on the job site at all times.
- All excavation should be completed by using the following equipment: (1) dragline; (2) track backhoe; (3) bulldozer; or other equipment approved by Lake Management personnel.

Figure 7.10-1: Guidance for Excavations



7.11 Prohibited Activities/Structures

The following activities/structures are prohibited **below** the 360’ PD contour or in the 75-ft buffer zone on Lake Murray. These prohibitions will be enforced by SCE&G or an appropriate state or federal agency.

- No sand or earth fill encroachments. Any unauthorized earth fill or structures that occurred prior to January 1, 1974, will be handled on a case-by-case basis.
- No seawalls or retaining walls.
- No fences.
- No fixed or land-based structures (boathouses, storage buildings, shelters, patios, brick barbeques, fences, swimming pools, satellite dish, signs, dog pens or invisible fencing, boat storage).
- No septic tanks and/or drain fields.
- No planting of grass except as a permitted erosion control measure.
- No storage or stockpiling of construction material.
- No vegetation removal of any type except in a permitted 10-foot wide access path to the shoreline.
- No limbing or trimming or cutting of Buffer Zone vegetation to create views or visual corridors.
- No fires or overnight camping.
- No unauthorized removal of trees or vegetation.
- Unless specifically authorized by the Lake Management Department, no all-terrain vehicles (ATV’s), motorcycles, or off road vehicles are allowed.
- No roofs or covers over any dock unless the dock is within 16 feet of the 360’ PD contour.
- No roofs or covers over any boat lifts.
- No fueling facilities permitted on dock.
- No permanent mooring.

- No water craft exceeding 34 feet in length will be permitted to be permanently docked at a private dock. Docking for more than 14 days in any consecutive 30-day period is considered to be permanent.
- No excavation/dredging above the 354’ PD contour or in shallow water habitat and ESA’s.
- No effluent discharges, such as sinks, showers, toilets, etc.
- No drive-on docks unless it is taking the place of the traditional floating dock that is made of wood and is no larger than 12’X 20’.
- Permanent screening or enclosures will not be allowed on fixed seating areas of docks.
- No upland water gardens will be permitted to drain into the lake.
- No spraying of herbicides into the waters of Lake Murray or onto property where the herbicides may end up in Lake Murray.
- Dock lighting should be focused downward and should not intrude on adjacent property owners, or impact navigation.

7.12 Environmentally Sensitive Area (ESA) Restrictions

- SCE&G prohibits clearing of vegetation within ESAs or within associated buffer.
- Commercial public marina facilities must be located a minimum of 50 feet from an ESA.
- New or expanding stabilization activities (excluding bio-engineering) may not be undertaken within a 50-foot offset from an ESA classification. All shoreline stabilization activities affecting an ESA will be assessed on a case-by-case basis.
- No excavation/dredging in ESAs or shallow water habitat.
- Areas where intermittent ESAs have been identified may accommodate limited docks, with approval from SCDNR and USFWS.

7.13 Access Path

Back property owners of land adjoining buffer zones are given the right of access by foot to and from the lake through the buffer zone. Creation of a single 10-foot wide access trail that leads down to the lake is allowed. To prevent erosion and to protect the aesthetics of the shoreline the route should not be direct and instead will have a meandering design. No trees larger than 8 inches in diameter at breast height (dbh) can be removed within the access path. Paths must consist of approved materials such as: woodchips, mulch, pine straw, pervious concrete with tinted color, fieldstone, river stone, and native grasses. A Lake Management representative must identify and designate the location of access paths.

7.14 Limited Brushing

For buffer zones established ***prior*** to 2007, limited brushing of the buffer zone may be allowed by the back property owner to remove exotic and invasive vegetation (Figure 7.14-1). Permission for limited brushing will only be granted by SCE&G Lake Management after a site visit with the applicant to assess the need for brushing. Once limited brushing is completed according to the permit, the applicant shall maintain the site in said condition.

In general, certain critical vegetation cannot be removed even when limited brushing is permitted. Some species and types of vegetation provide important benefits such as bank stabilization, water quality functions, habitat, shade in near shore environments, and terrestrial input for aquatic ecosystems. For the purposes of a limited brushing permit, the following vegetation cannot be cleared:

- Black Gum
- Black Willow
- Buttonbush
- Cottonwood
- Green Ash
- Oak
- Persimmon
- River Birch
- Water Hickory
- Wax Myrtle
- Sycamore
- Tag Alder
- Tulip Poplar
- Certain hardwood species
- Dogwood

Plants that can be cleared through limited brushing generally are undesirable species that are invasive and in some cases exotic. Included in this group are the following:

- Vines such as green briars, Japanese honey suckle, poison ivy, poison oak, wisteria, and kudzu;
- Shrubs such as black berry and privet;
- Trees such as mimosa and Bradford Pear; and
- Trees that are dead, diseased and create a hazard.

Some selective clearing of native, non-invasive species will be allowed through limited brushing. Generally, this will include certain softwood species that are less than 3 inches diameter at breast height (dbh). Species that could be cleared in this category include the following:

- Loblolly Pine
- Longleaf Pine
- Red Cedar
- Red Maple
- Sweetgum
- Virginia Pine

Any vegetation that does not meet the above listed criteria, but that the back property owner would still like removed, must be addressed individually with SCE&G Lake Management Department. It is likely that any vegetation or tree removal that is not consistent with limited brushing, as outlined above, will have to be mitigated and may include revocation of the property owner's dock permit.

For buffer zones that are established ***after*** 2007, SCE&G will maintain a policy of no-disturbance of vegetation. Limited brushing will not be allowed on these lands under any circumstances. No vegetation below the 360' PD contour may be removed without prior approval from SCE&G. Only vegetation removal associated with creating a single 10-foot wide access trail leading to the lake is allowed (Figure 7.14-2).

Figure 7.14-1: Target Coverage for Understory Vegetation

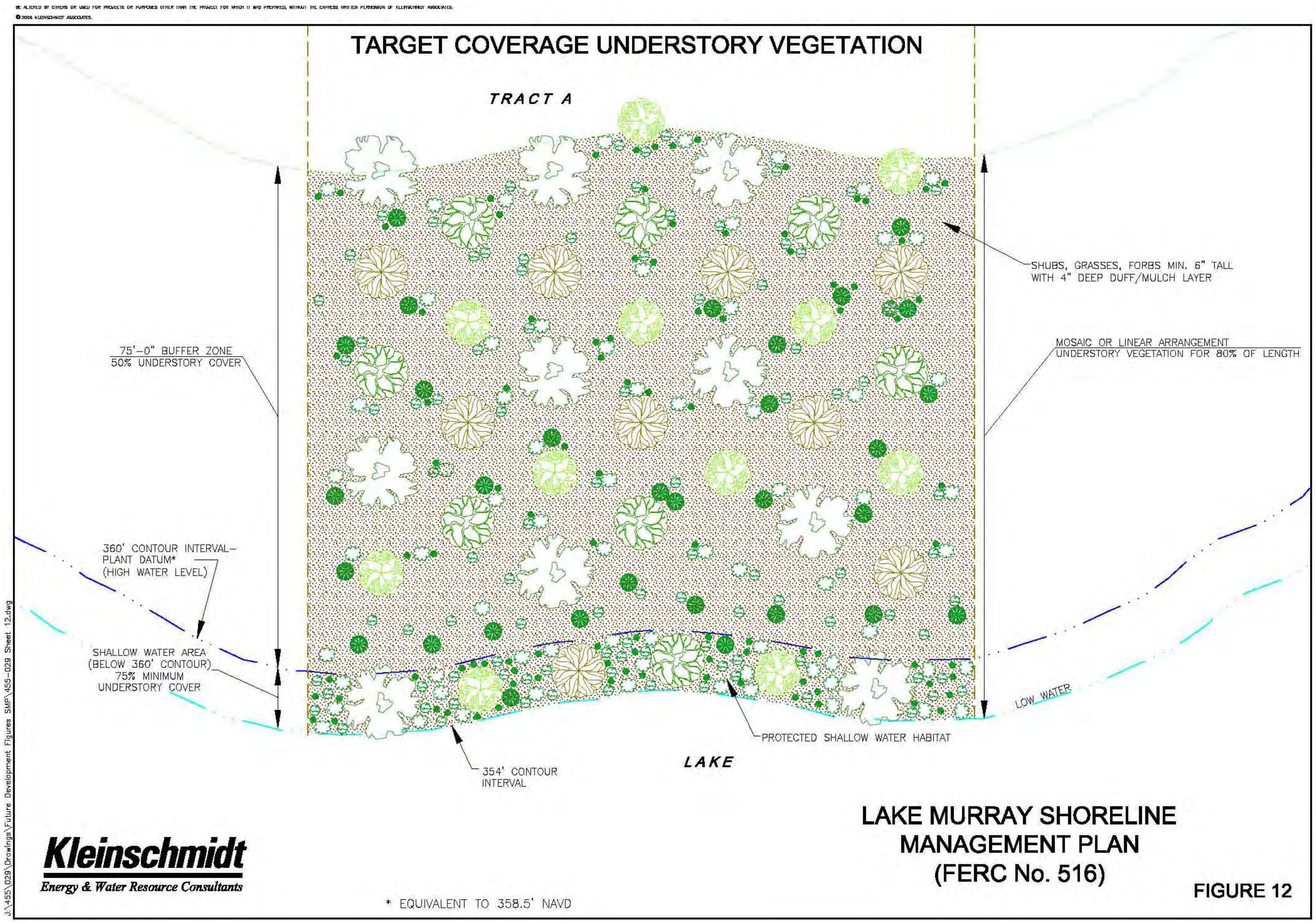
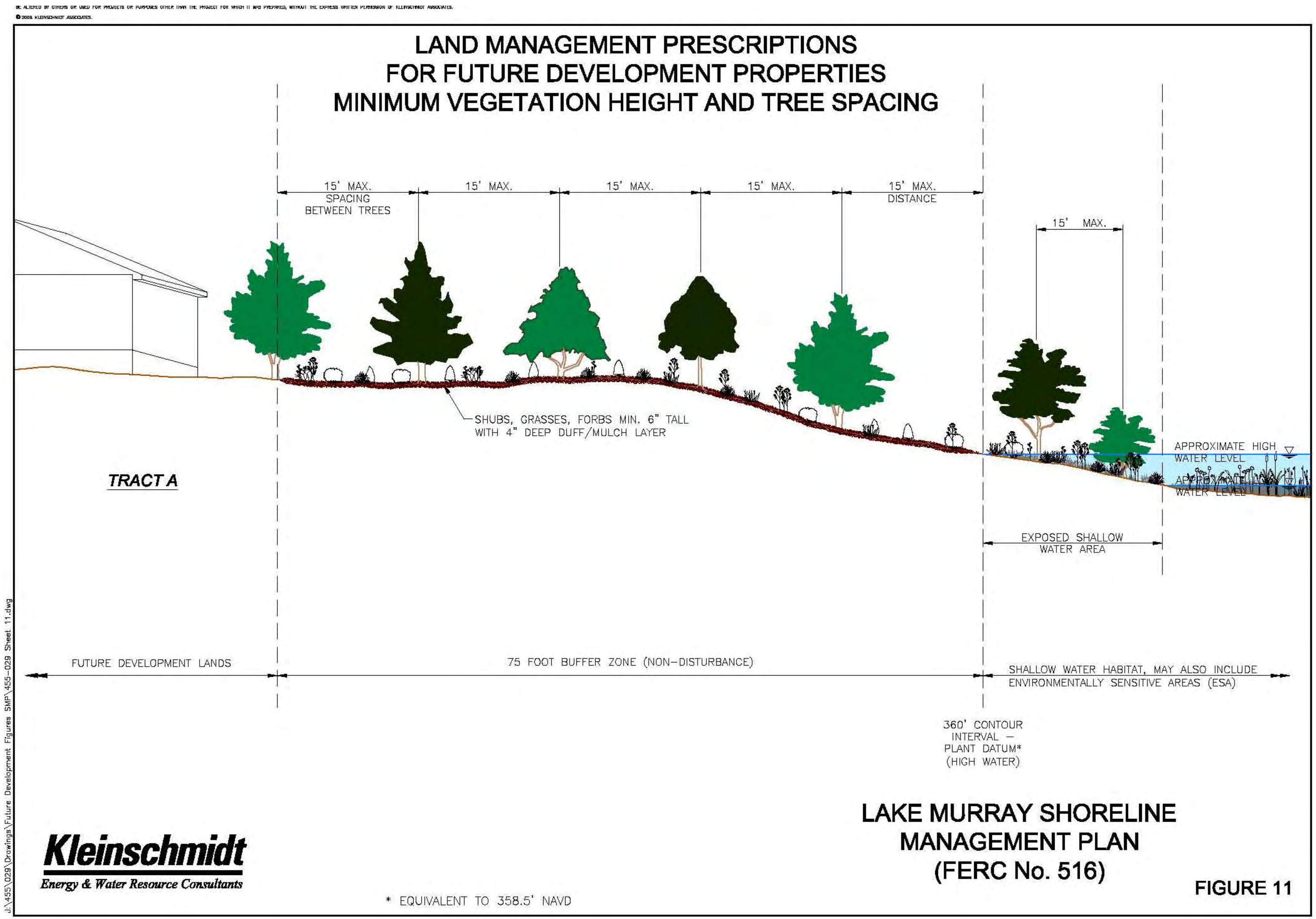


Figure 7.14-2: Land Management Prescriptions for Future Development Properties - Minimum Vegetation Height and Tree Spacing



7.15 Woody Debris Management

Submerged and shoreline woody debris provides habitat for many species of fish, macroinvertebrates, birds, reptiles, and mammals. This debris also helps protect the shoreline from erosion. SCE&G maintains a policy of non-disturbance for any and all woody debris unless its removal is necessary for reasons of health and human safety, or the debris is so minimal that it is insignificant in the provision of fish or wildlife habitat. Under some conditions, approval may be granted to remove woody material. SCE&G's woody debris management policy may allow the removal of woody debris below the 360' PD contour if it poses a clear safety or navigation concern, is brought to the attention of SCE&G's Lake Management Department personnel and is approved by Lake Management. Guidelines for the removal of woody debris are as follows:

7.15.1 Submerged Woody Debris

- SCE&G's Shoreline Management Plan allows limited removal of shoreline vegetation necessary for the construction and installation of docks and other permitted shoreline amenities.
- Shoreline property owners must obtain permission from SCE&G prior to removing shoreline woody debris below the 360' PD contour.
- If a dock is proposed for an area that contains significant, stable woody debris, SCE&G may propose an alternate location for the dock or prohibit the dock altogether.
- For tree stumps that pose a material threat to safety, landowners may be allowed to cut them off to an appropriate level, depending on expected water depth and proximity to docks and other activity-related facilities.

7.15.2 Floating Woody Debris

- Floating woody debris may be removed by SCE&G, SCDNR, or any member of the boating public when encountered if it is reasonably considered a material public safety issue or impediment to navigation.
- The debris should be removed from open water areas and taken to the shoreline.
- SCE&G encourages that it be secured onshore in undeveloped areas, such as the backs of coves and/or undeveloped lands.

7.15.3 Shoreline Woody Debris

Shoreline woody debris is managed in a manner similar to submerged woody debris:

- Limited removal of shoreline woody debris may be permitted to accommodate construction and installation of docks or other permitted shoreline amenities.
- Should a dock be proposed for an area that contains significant shoreline woody debris, SCE&G may propose an alternate location for the dock or prohibit the dock altogether.
- Shoreline property owners must obtain permission from SCE&G to remove shoreline woody debris below the 360’ PD contour.
- Unauthorized removal of stable shoreline woody debris may result in the cancellation of dock permits and/or other shoreline amenity permits and a requirement that there be appropriate mitigation for the improper woody debris removal.
- Shoreline woody debris that may be a navigation hazard may be removed.

7.16 Permitting Application Procedure

The applicant will be required to submit to SCE&G a completed application along with the following:

- A copy of applicant's plat to the property reflecting county tax map information.
- Specific directions by land to applicant's property on Lake Murray.
- Sketch showing the location, design, and dimensions of the proposed structure, or the type and location of erosion control proposed. Excavation projects will require a drawing to scale of the area to be excavated.
- Applications for excavation not exceeding 150 cubic yards can be processed by SCE&G Lake Management Department. Any commercial excavation or individual excavation exceeding 150 cubic yards must also be processed through the U. S. Army Corps of Engineers and state agencies.
- Commercial applications to withdraw water from the lake also must include a complete description of the purpose for the removal and processes to be used, the volumes to be withdrawn.
- A permitting fee is required.
- Required local, state and federal permits and/or reports. The Lake Management Department will assist in the preparation of required local, state and federal permit applications.

7.17 Permitting Fees

SCE&G charges individual processing fees for its efforts in managing various permitting activities around the lakes. Permit fees are listed on the permit applications and are due at the time of application submission to SCE&G. If an application is denied the permit fee will be returned.

An annual Administrative Fee may be implemented, as FERC allows SCE&G the right to charge a reasonable fee to cover the costs of administering its Shoreline Permitting Program, which adds significant management responsibilities and costs to SCE&G's operation. SCE&G will give adequate public notice through appropriate communication avenues before changing the fee structure. Failure to comply with this policy may result in the revocation of existing permits, fines, or legal action, as well as loss of consideration for future permits.

7.18 Violations

SCE&G conducts annual surveys of the lake shoreline to inventory and inspect docks built and permitted throughout the year. Dock applicants are responsible for maintaining their structures in good repair and safe condition. If at any time a dock is determined by a SCE&G Lake Management representative to be in disrepair or a hazardous condition, it must be repaired or removed from the Lake Murray waters immediately. SCE&G reserves the right to remove any dock on its property as conditions warrant.

SCE&G also makes note of unauthorized structures during its surveys, and urges residents and other lake visitors to report what they believe may be unauthorized activity below the 360' PD contour and in the buffer zones. SCE&G Lake Management representatives will issue Stop Work Directives for any violations that are detected on SCE&G property. Any unauthorized clearing of the trees or underbrush will result in the immediate cancellation of an individual's dock permit as well as action to require re-vegetation of the affected area. Removal of merchantable timber will require reimbursement to SCE&G Company subject to valuation of the SCE&G Forestry Operations Department. Additional, consequences for violations may include loss of consideration for future permits, fines, and/or legal action.

7.19 Miscellaneous

- Deeds, permits, or other instruments affecting Lake Murray lands and waters will contain all standard covenants customarily imposed upon project property and such other covenants as in the sole discretion of SCE&G may be desirable or appropriate. The instrument may contain indemnity clauses and insurance provisions.
- Permitting fees do not constitute a charge for admission to Project lands.
- SCE&G retains the right to vary the amount of application fees.
- No vested right or rights enforceable by third parties are created by SCE&G's Policies or Procedures.

Maps of Lake Murray showing public and commercial landings, parks, navigational markings, and other information are available free of charge from SCE&G. Inquiries concerning policies, procedures, applications or regulations as outlined in this booklet, or requests for maps or applications, should be directed to SCE&G:

South Carolina Electric & Gas Company
Lake Management Department
Columbia, South Carolina 29218
Telephone (803) 217-9221

South Carolina Electric & Gas Company

Lake Murray Management Department

Mail Code MZ-6

Columbia, South Carolina 29218

Published	**1-75**
Revised	**5-80**
Revised	**5-84**
Revised	**6-88**
Revised	**2-90**
Revised	**8-95**
Revised	**11-07**
Revised	**12-08**

Appendix 26

LAKE MURRAY SHORELINE MANAGEMENT PLAN
DRAFT

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

LAKE MURRAY SHORELINE MANAGEMENT PLAN

DRAFT

NOVEMBER 2008

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

LAKE MURRAY SHORELINE MANAGEMENT PLAN

DRAFT

NOVEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

LAKE MURRAY LAND USE AND SHORELINE MANAGEMENT PLAN

DRAFT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

LAKE MURRAY SHORELINE MANAGEMENT PLAN

DRAFT

EXECUTIVE SUMMARY

The Saluda Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 516) (Project) is an existing, federally licensed hydroelectric project owned and operated by South Carolina Electric & Gas Company (SCE&G) located in central South Carolina, on the Saluda River. The Project generates clean renewable energy for use by SCE&G customers, as well as maintains Lake Murray, as a popular fishing and recreation destination that is used and enjoyed by residents and visitors of the state.

In conjunction with its relicensing activities, SCE&G has assembled a diverse group of stakeholders to develop a revised comprehensive Shoreline Management Plan (SMP). A SMP is a comprehensive plan to manage the multiple resources and uses of the Project's shorelines in a manner that is consistent with license requirements and Project purposes, and to address the needs of the public.

The Saluda Hydroelectric Project is one of the very first licensed projects to create a shoreline management plan. This plan, originally conceived in 1979, has seen many revisions over time. The 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, 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). Today the SMP identifies existing land uses and provides a program for responsible and balanced future use and management of project lands and the flora and fauna using those lands.

This SMP covers approximately 650 miles of shoreline and 15,837 acres of project land (both inundated and non-inundated). Because of development, new strategies have been introduced to rebalance shoreline uses. While it introduces some new strategies regarding the management and permitting of shoreline activities and facilities within the Project boundary, it is based on management practices established by SCE&G over the years. SCE&G maintains its commitment to balancing all uses within the Project boundary. In order to consider all relative factors, they have utilized a collaborative process that entails gaining input from multiple stakeholders.

To aid in the understanding of the Project Area, this SMP provides a review of the existing shoreline resources. As described further in section 4.0, the Project area is characterized by silty-loam surface soils, to clayey subsoils. Plant species are typical of Southern piedmont hardwood forests, with shoreline dominated by a combination of woody tree and shrub species. Water quality in the Project Area is generally good, and unit and operational modifications have been made in the past few years to increase the quality of water that passes into the lower Saluda River. A diversity of aquatic and terrestrial wildlife species exist within the Project Area. Many terrestrial species that occur in the Lake Murray area are typical of forested second-growth and woody successional habitats of the Piedmont region. Aquatic species are diverse and over the years, there have been forty fish species, representing 12 different families, documented in Lake Murray (SCE&G, 2005).

Land management classifications are described in detail in Section 6.0 and have been separated into four distinctive management classifications. These classifications include Multi-purpose, Public Recreation, Natural Areas, and Project Operations. Multi-purpose lands fall into several sub-classifications which include easement properties, commercial properties, Buffer Zone, and Future Development lands (or “fringelands”). Public Recreation lands include lands such as State parks, public beaches, forest management lands, and islands that are owned by SCE&G. Natural areas are those areas that warrant special protection because they provide important habitat for various wildlife species, including the recreational fishery. Lastly, lands reserved for Project operations are those lands that are specifically required for operation of the Saluda Project.

SCE&G developed land management prescriptions over time in consultation with agencies and the public. They consist of the guiding principals regarding management of the SCE&G-owned lands within each classification. Section 7.0 specifically details management prescriptions as they relate to each classification. Moreover, prescriptions are administered though the Shoreline Permitting Program.

In addition to the SMP, a Permitting Handbook was developed in consultation with stakeholders and agencies to address certain activities that require permits and consultation with SCE&G. These activities include excavation; construction, maintenance, and placement of docks, boatlifts, boat ramps, retainer walls, and rip rap; limited brushing; and other shoreline activities. SCE&G will reconvene with stakeholders and agencies on a yearly basis to review the Permitting Handbook and to address issues that have arisen.

SCE&G considers maintaining a strong commitment to managing the Lake Murray shoreline for multiple resources by considering the impact of various activities on the environmental, aesthetic, and recreational character of the lands. Section 8.0 details the activities and structures that are compatible with the goals of the Shoreline Management Program. The activities consist of items requiring SCE&G approval through the permitting program. Also, property owners considering new shoreline facilities or activities within the Project boundary will follow a standard procedure for initiating, permitting, and completing their proposed projects. These procedures are detailed in more depth in section 9.0 and in the Permitting Handbook.

SCE&G is currently evaluating, and will adopt, a fee structure for recovering a portion of the costs of administering the shoreline management program. This will ensure that activities occurring on Project lands are consistent with the overall goals for the project. Such fees can be a one-time or annual cost.

Annual surveys of the land below the 360’ PD contour are conducted by SCE&G and also allow for an inventory and inspection of docks built and permitted throughout the year. SCE&G also makes note of unauthorized structures below the 360’ PD contour as well as in Buffer Zones at that time. Violations may be dealt with in several manners as deemed appropriate to SCE&G. Consequences of violations could range from dock permit cancellations, to fines, or legal action.

Best Management Practices (BMPs) are actions taken to lessen potential impacts to a particular resource resulting from its direct or indirect use. SCE&G has developed several management plans designed to preserve the health of the shoreline, and they also promote the use of BMPs through their Shoreline Permitting Program. BMPs are further described in Section 12.0 of this document.

Public education and outreach on the protection of valuable shoreline resources remains an important goal of the SMP. Section 13.0 of this document details specific measures that will be undertaken in order to help educate both lake residents and users. Specific items include SMP education, BMP education, Public Service Announcements, and Safety Programs.

In the Application for New License, SCE&G is proposing a 10 year review period for the SMP. The previous process of a 5 year review and revision, which included gathering input and addressing issues from stakeholders, required several years to complete in and of itself. The ten-year SMP review period allows for SCE&G to assess new issues that arise as a result of development around the lake, and allows for the analysis of cumulative affects. Concurrently with the SMP review, SCE&G will review the Shoreline Permitting Program to ensure its effectiveness; however, changes to the permitting process may be made periodically, as needed, outside of the scheduled review periods. Also, a review process that includes the use of GIS data will be used to address the modified land management classification system to ensure the new system is appropriate.

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

LAKE MURRAY SHORELINE MANAGEMENT PLAN

DRAFT

1.0 INTRODUCTION

The Saluda Hydroelectric Project (Saluda Project) is located on the Saluda River approximately 10 miles west of Columbia, SC (Figure 1.0-1). Lake Murray, the Project's hydroelectric reservoir, is largely located within Lexington County, though it also spans Saluda, Newberry, and Richland Counties. The 2,420 square mile watershed area, drained by the Saluda River and its tributaries above Saluda Dam, provides water for Lake Murray, which covers a maximum water surface area of approximately 79.5 square miles or approximately 50,900 acres at full pool. Saluda Dam is nearly a mile and a half long and supports state highway SC Route 6, which is built along the top of the Dam.

The South Carolina Electric & Gas Company (SCE&G) manages the Lake Murray shoreline and SCE&G-owned lands within the Project boundary to comply with its Federal Energy Regulatory Commission (FERC) operating license. The goal in land management is to serve the greater public interest by providing recreational access and opportunities, protecting wildlife habitat, water quality, producing low cost electricity, and preserving cultural as well as aesthetic resources.

In 1980, pursuant to a FERC order in FERC Docket No. E-7791, SCE&G established a shoreline management plan (SMP). Since its inception, the SMP has seen several revisions, which are described in Section 5.0 (*History of the Lake Murray Shoreline Plan*). To ensure that it maintains relevance and effectiveness under current environmental and developmental pressures, SCE&G has again revised the SMP for the Saluda Project. This SMP was developed in accordance with established FERC guidelines for developing Shoreline Management Plans and in cooperation with relicensing stakeholders, including federal and state regulatory agencies, interested non-governmental organizations, and concerned citizens. This SMP is submitted as a part of SCE&G's Saluda Project Application for a New License, to be filed with FERC in 2008.

The management guidelines set forth in this SMP are applicable to all SCE&G-owned lands within the Saluda Project boundary. Project lands are those lands within the FERC project boundary owned by SCE&G in fee title and those lands for which SCE&G has acquired or retained an easement. Although this SMP is the latest in a series of revisions, it is significant in that it documents the results of recent rebalancing whereby SCE&G-owned lands within the Project boundary have been re-classified. The rebalancing process, which considered natural resource, recreation, and economic values, is discussed in more depth in Section 5.0. Among other things, the current document includes the following components:

- Summary inventory of existing resources covered by this shoreline management plan;
- Results of rebalancing of lands among classifications;
- Detailed inventory, descriptions, management prescriptions and mapping of land classifications;
- Summary information on the shoreline permitting program and fee policies;
- Best management practices;
- Public education and outreach;
- Monitoring and outreach;
- A proposed review process; and
- Land management plans (including those revised by the Lake and Land Management Technical Working Committee as described in Section 3.1):
    - Woody Debris & Stump Management Plan – Revised by TWC (Appendix A)
    - Buffer Zone Management Plan – Revised by TWC (Appendix B)
    - Sedimentation and Erosion Control Management Plan – (118 FERC ¶ 62,041) (Appendix C)
    - Baseline Environmental Monitoring Plan for Lake Murray Marinas (Exhibit 29 in 12/27/89 SCE&G filing)(Appendix D)
    - Lake Murray Water Quality Monitoring Plan (Exhibit 30 in 12/27/89 SCE&G filing)(Appendix E)
    - Environmentally Sensitive Areas Drawings (116 FERC ¶ 62,087) (Appendix F)

Figure 1.0-1: Location Map

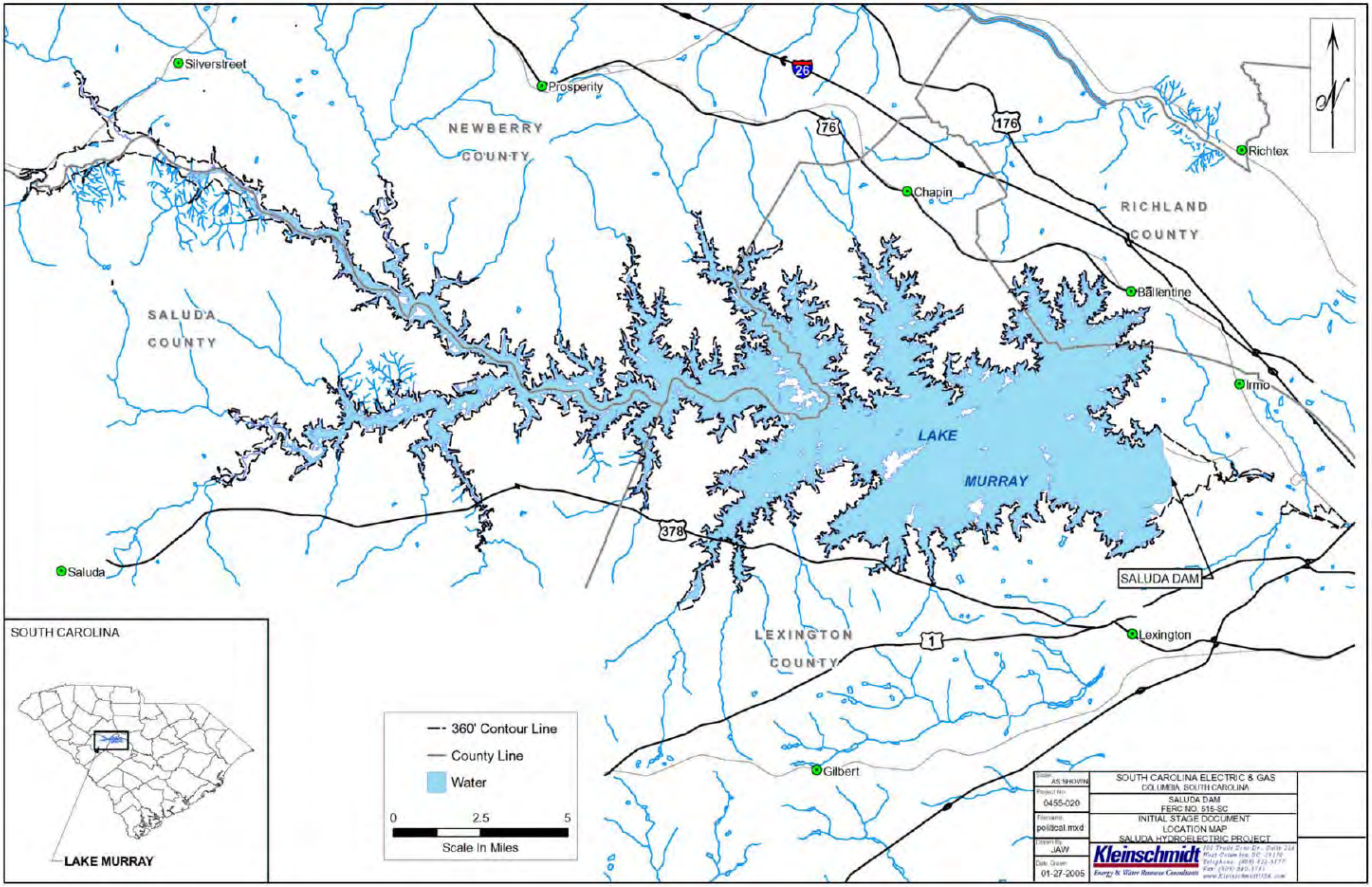


Figure 1.0-2: Project Boundary

2.0 PURPOSE AND SCOPE OF THE LAND USE AND SHORELINE MANAGEMENT PLAN

Lake Murray has served as a major power generator and source of recreation and commercial opportunity for resident and visitors to South Carolina for several decades. As development increases in the Columbia metropolitan area, so too does stress placed upon Lake Murray and the surrounding watershed. Thus, a comprehensive SMP that recognizes and addresses sources of potential environmental degradation is essential to managing the lake for the benefit of all interests.

Its purpose is to protect public access to project lands and water and to protect environmental values. Specifically, it will assist in providing a balance between shoreline development, recreational use, and environmental protection.

3.0 SHORELINE MANAGEMENT PLAN GOALS AND OBJECTIVES

The overall goal of this SMP is to formalize the process and criteria that SCE&G will use to manage and balance private, public, and hydroelectric uses of the Saluda Project lands and Lake Murray shoreline. The SMP serves as a reference document for SCE&G in implementing the Standard Land Use Article, which authorizes SCE&G to permit certain non-project uses of project lands and waters (see Appendix E) for license articles pertaining to the SMP. This SMP will help to ensure the protection and enhancement of the Project's scenic, environmental, recreational, natural and cultural resources over the term of the license.

This SMP represents a consensus-based, updated management plan intended for submittal in the Project 516 License Application. It has taken into consideration not just the land and properties within the Project boundary line (PBL), but lands upstream and downstream, and such areas beyond the PBL, which SCE&G, through its SMP, can materially influence.

Specific goals relative to the SCE&G relicensing process that are discussed under this SMP include the following:

1) Provide for reasonable current and future public access;
2) Preserve the opportunity to meet recreational needs within the project;
3) Protect fish and wildlife habitat;
4) Protect cultural resources;
5) Protect operational needs;
6) Facilitate compliance with license articles;
7) Minimize adverse impacts to water quality;
8) Minimize erosion;
9) Minimize adverse scenic impacts;
10) Guide the permitting of shoreline development;
11) Provide a summary of the types and locations of existing recreational opportunities and future enhancements that are set to occur as a requirement of the new Project license;

12) Establish Shoreline Management Classifications (SMC) and Allowable Uses to help in the management of non-Project uses of the Lake Murray shoreline lands within the Project boundary;

13) Describe the SMP amendment and monitoring process; and

14) Educate and encourage lakefront property owners on the use of voluntarily Best Management Practices (BMP) on their non-Project lands. Inform them of the direct benefits of BMP use to their property, as well as to their enjoyment of the Project land and waters.

3.1 Consultation

SCE&G recognizes that successfully completing the relicensing process involves identifying and resolving project issues in consultation with Federal and State resource agencies, local and national non-governmental organizations (NGOs), home and boat owner associations, and individuals who have an interest in the Saluda Hydro Project. SCE&G began soliciting input on project-related concerns through public workshops in October 2004. Since that time, they have sought active public involvement in the process and fostered commitment to issue resolution among SCE&G and stakeholders. Stakeholder involvement has been extensive with the following groups participating in the relicensing project (Table 3.1-1).

Table 3.1-1: Participating Groups in Saluda Project Relicensing Project

STAKEHOLDER GROUPS
American Rivers
American Whitewater
Catawba Indian Nation
Coastal Conservation League
Columbia Audubon Society
Columbia Fire and Rescue
Greenville Striper Kings
Lake Murray Association

STAKEHOLDER GROUPS
Lake Murray Historical Society
Lake Murray Homeowner Coalition
Lake Murray Power Squadron
Lake Murray Southside Community Association
Lake Murray Watch
League of Women Voters
Lower Saluda River Scenic River Advisory Council
Midlands Striper Club
National Marine Fisheries Service
National Park Service
National Striped Bass Association
National Wildlife Federation
Newberry County
River Runner Outdoor Center
Saluda County
SCANA Corporation
South Carolina Council Trout Unlimited
South Carolina Department of Health and Environmental Control
South Carolina Department of Natural Resources
South Carolina Department of Parks, Recreation and Tourism
South Carolina Electric & Gas Company
South Carolina Historic Preservation Office
South Carolina Wildlife Federation
Trout Unlimited - Saluda River Chapter
United States Fish and Wildlife Service
University of South Carolina, Department of Biological Sciences

3.1.1 Lake and Land Management Resource Conservation Group

In support of the relicensing effort, seven Resource Conservation Groups (RCG) were developed that are comprised of interested stakeholders committed to working together and with SCE&G to identify project issues related to various resources within the PBL. Their goal is to develop consensus-based strategies for issue resolution. The Lake and Land Management Resource Conservation Group is assigned with the mission of gathering and synthesizing relevant information, developing required studies, and addressing issues relevant to this SMP. The RCG was a highly diverse group consisting of over 24 entities from federal, state, and local government; utilities; industry; academia; non-governmental organizations; homeowner associations; and private citizens (Table 3.1-2).

Table 3.1-2: Organizations with Representation on Lake & Land Management RCG (updated 3/31/06)

ORGANIZATION
American Rivers
Coastal Conservation League
Coastal Conservation League
Columbia Audubon Society
Lake Murray Association
Lake Murray Historical Society
Lake Murray Homeowner's Coalition
Lake Murray Power Squadron
Lake Murray Southside Community Association
Lake Murray Watch
League of Women Voters
Lexington County
Lower Saluda Scenic River Advisory Council
Newberry County
Saluda County
SCANA Corporation
South Carolina Department of Health and Environmental Control
South Carolina Department of Natural Resources
South Carolina Department of Parks, Recreation & Tourism

ORGANIZATION
South Carolina Electric & Gas Company
South Carolina Wildlife Federation
Trout Unlimited - Saluda River Chapter
United States Fish and Wildlife Service
University of South Carolina

3.1.2 Technical Working Committees

Within each RCG, smaller teams, or Technical Working Committees (TWC), were developed. The TWCs focused on resolving specific ecological issues and conducting related studies. The Lake and Land Management TWC consists of members from the following organizations (Table 3.1-3).

Among the objectives of the Lake and Land Management TWC was to revise the land use and shoreline management plan to more effectively protect shoreline resources. In working collaboratively, the members of the TWC aimed to blend the objectives of the state and federal resource agencies with other stakeholder interests. Plans revised by the TWC, which are discussed in more detail in Sections 7.0 and 9.0, consist of the Buffer Zone Management Plan, Sedimentation and Erosion Control Management Plan, Baseline Environmental Monitoring Plan for Lake Murray Marinas, Forest Management Plan, and the Woody Debris and Stump Management Plan.

Table 3.1-3: Organizations with Representation on Lake & Land Management TWC

ORGANIZATION
Lake Murray Association
Lake Murray Watch
Lexington County
SCANA Corporation
South Carolina Department of Natural Resources
South Carolina Department of Parks, Recreation & Tourism
South Carolina Electric & Gas Company
United States Fish and Wildlife Service

3.1.3 Meeting Schedule

Between November 2005 and October 2008, 41 public meetings were held on a roughly bimonthly schedule by the Lake and Land Management RCG and TWC groups. These meetings were held to work out the details of the Saluda SMP, and to allow interested parties opportunity to provide input on resource issues and the overall future management of the shoreline resources. Results of this collaboration contributed valuable information from entities familiar with the Project. The forum was instrumental in addressing important issues as part of the relicensing process for the operation and management of the Project over the term of the new license.

4.0 INVENTORY OF EXISTING RESOURCES

To understand the intent of the SMP, it is important to be familiar with the existing resources in the vicinity of the Lake Murray shoreline. The following section briefly describes the existing resources in the Project area. For more detailed information on these topics, refer to the *Final Application for New License Saluda Hydro Document* (SCE&G, 2008).

4.1 Geology and Soils

The Saluda Project is centrally located within the Piedmont physiographic province of South Carolina. To the north lies the Blue Ridge province (e.g., Blue Ridge Mountains). To the south is the Atlantic portion of the Coastal Plain province. The Piedmont is typically hilly country with isolated hills of bedrock that rise above a general level surrounding area. Saluda Dam is located in west central South Carolina along the Eastern Piedmont fault system (Hatcher et al., 1977), which extends from Western Georgia through Virginia.

The soils of the Project Area are predominantly Ultisols of the Carolina Slate Belt. These soils are highly weathered with low fertility, which makes them well-suited for pasture or forest use (Mead and Hunt, 2000). 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 a clayey subsoil (USDA, 1962). The thickness of the soils is dependent upon the rock type; soils overlying the Gneiss unit are thick (30 to 90 feet) whereas, the soil over the schist unit is thinner (10 to 30 feet). The thinnest soil zones are on the tops of hills.

The Project shoreline totals 691 miles including the islands and is characterized by deep coves and prominent peninsulas. Approximately 386 miles of shoreline is privately owned down to the 360' PD contour. The irregular shoreline is gently sloped and coursed by many creek beds and drainage ways that cut through the terrain (FERC 2002; Mead and Hunt 2000). The soils are typically not susceptible to creep or slumping; however, soil limitations generally occur along drainage ways or other areas where bedrock is close to the surface (Mead and Hunt, 2000).

Bank erosion is occurring in some lakeshore areas, particularly along exposed shores where prevailing westerly winds create waves that strike the shoreline (Mead and Hunt, 2000). Also, soil slumping may occur in areas where bedrock is located close to the surface. Over the past 20 years, however, voluntary shoreline stabilization projects have been implemented by private landowners to reduce the effects of shoreline erosion around the Lake. (Mead and Hunt, 2000; Tommy Boozer, SCANA personal communication).

4.2 Water Quality

Water quality affects the aquatic and terrestrial wildlife and habitats of Lake Murray, as well as the health and well-being of individuals and communities that surround the lake. Water quality impairment of the lake can occur in several ways because of the introduction of both point and non-point sources of pollutants. Point source discharges in inflow tributary streams may include wastewater treatment plant effluents, leachate from septic systems around the lake, and other miscellaneous activities within the watershed. Non-point sources include water runoff from various land use activities, including residential, industrial, agriculture, forestry, and construction. When water runs off surrounding lands, it picks up sediment, bacteria, oil, grease, chemicals, and other pollutants as well as nutrients such as nitrogen and phosphorus. Excessive levels of introduced pollution (from point and non-point sources) can overwhelm a reservoir's natural filtering abilities and lead to impaired water quality.

4.2.1 Water Quality Standards

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

In addition to the standards for FW waterbodies, Lake Murray also is subject to water quality standards regarding nutrient levels for large lakes (40 acres or larger) based on its location within the Piedmont and Southeastern Plains ecoregion of the state. These numeric nutrient criteria were developed based on an ecoregional approach that takes into account the geographic location of the lake within the state.

4.2.2 Water Quality Conditions of Lake Murray

Data on water quality for Lake Murray, its tributaries, and the tailwaters (the area immediately downstream of the dam) have been collected over the last 30 years in support of the Saluda Hydroelectric Project (SCE&G, 2005). Input to the lake originates primarily from the Saluda River, which contributes 68% of the mean streamflow. Six other tributaries make up the remaining 32% of inflow to Lake Murray (Little Saluda River, Bush River, Little River, Clouds Creek, Rocky Creek, and Ninety-Six Creek) (Table 4.2-1).

While the lake itself covers approximately 75 square miles, the drainage area for Lake Murray encompasses 2,420 square miles (SCE&G, 2005). Currently no direct point source discharges into Lake Murray exist. However, there are point source pollution discharges into tributaries that contribute to Lake Murray as well as non-point runoff of the surrounding landscape. Thus, the lake is affected by its position within a large watershed with high levels of residential and commercial developments. In general, Lake Murray experiences thermal stratification with associated DO depletion during the summer months, not unlike many reservoirs of its size in the region (SCE&G, 2005). Recreational uses within the lake, however, have typically not been limited by water quality concerns.

In 2002 SCDHEC issued a formal notice that the DO standard for the LSR would be revised. Upon review of the comprehensive water quality report for the Saluda Hydro relicensing, it was shown that phosphorous trend data indicates potential problems with nutrient loading into Lake Murray. In order to comply with a new DO standard, SCE&G sought to evaluate the potential effects that nutrient reduction would have on the DO levels in Lake Murray and the releases from Saluda Hydro. A CE-QUAL-W2 model was chosen among industry accepted models to be used in water quality evaluations on Lake Murray. Temperature, DO, algal levels, and phosphorus were the primary water quality constituents studied using this modeling technique.

Data derived from the CE-QUAL-W2 model predicted that the most likely cause for water quality problems in Lake Murray stems from the point source discharges of phosphorus into Ninety-Six Creek and the Bush River. 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 other smaller tributaries together only make up 32% of the mean streamflow into Lake Murray but contribute 85% of the total phosphorus load.

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 discharges from point sources outside of the Project boundary.

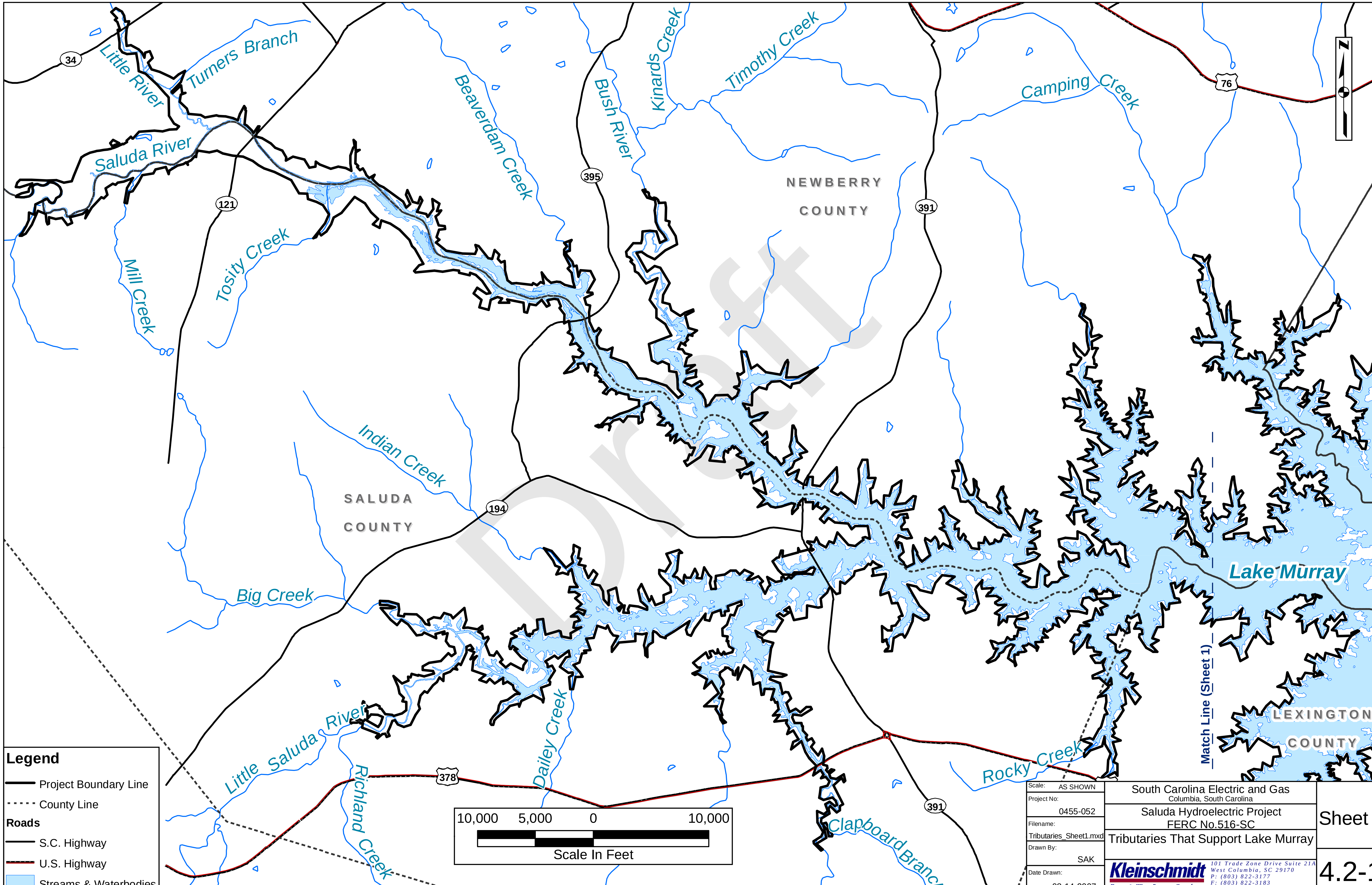
4.2.3 Water Quality Conditions of the Lower Saluda River

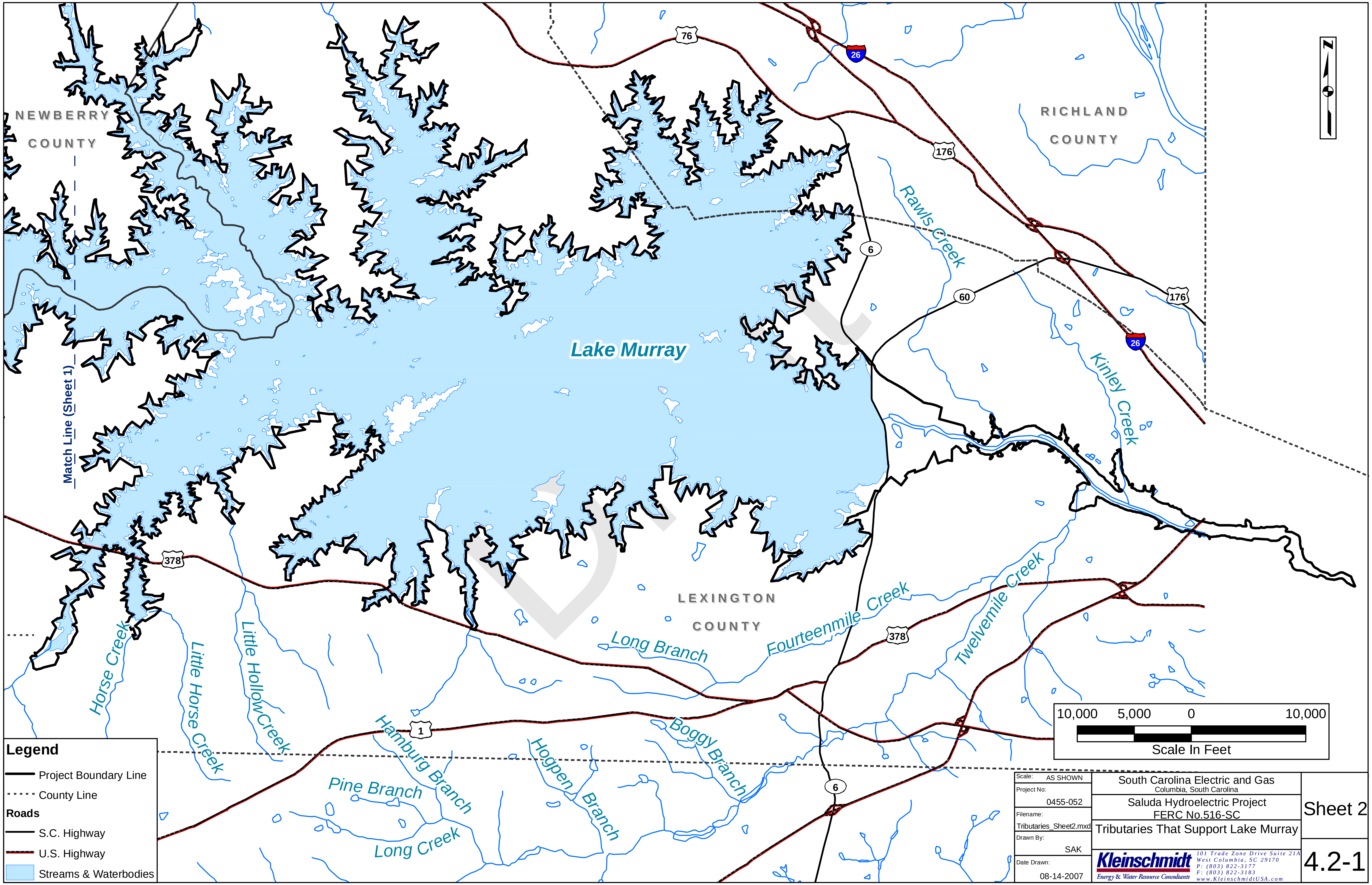
SCE&G began monitoring DO and temperature in the releases from the Project turbines in 1989 and continues the effort to the present day. These monitoring efforts have determined that nutrient loading from the tributaries and the thermal stratification of Lake Murray from May through approximately October 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.

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. 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. In 2005, SCE&G implemented operational protocols that further assist in maintaining enhanced DO levels in the LSR.

Table 4.2-1: Percent Contributions to the Upper Regions of Lake Murray (Ruane, 2004)

LAKE MURRAY TRIBUTARY	MEAN STREAMFLOW (percent)
Bush River	4
Little Saluda River	7
Clouds and West Creeks	4
Ninety-Six Creek	5
Little River	7
Saluda River	68
All Other Flows	5


Turners Branch
Little River
Saluda River
Beaverdam Creek
Bush River
Kinards Creek
Timothy Creek
Camping Creek
NEWBERRY
COUNTY
Tosity Creek
Mill Creek
Indian Creek
SALUDA
COUNTY
Big Creek
Draft
Lake Murray
Little Saluda River
Richland Creek
Dailey Creek
Clapboard Branch
Rocky Creek
LEXINGTON
COUNTY
Match Line (Sheet 1)
34
121
395
391
76
194
378
10,000 5,000 0 10,000
Scale In Feet
Legend
Project Boundary Line
County Line
Roads
S.C. Highway
U.S. Highway
Streams & Waterbodies
Scale: AS SHOWN
Project No: 0455-052
Filename: Tributaries_Sheet1.mxd
Drawn By: SAK
Date Drawn: 08-14-2007
South Carolina Electric and Gas
Columbia, South Carolina
Saluda Hydroelectric Project
FERC No.516-SC
Tributaries That Support Lake Murray
Kleinschmidt
Energy & Water Resource Consultants
101 Trade Zone Drive Suite 21A
West Columbia, SC 29170
P: (803) 822-3177
F: (803) 822-3183
www.KleinschmidtUSA.com
Sheet 1
4.2-1



NEWBERRY COUNTY
RICHLAND COUNTY
LEXINGTON COUNTY
Lake Murray
Match Line (Sheet 1)
Rawls Creek
Kinley Creek
Horse Creek
Little Horse Creek
Little Hollow Creek
Hamburg Branch
Pine Branch
Long Creek
Hogpen Branch
Boggy Branch
Long Branch
Fourteenmile Creek
Twelvemile Creek
76
26
176
6
60
378
1
10,000 5,000 0 10,000
Scale In Feet
Legend
Project Boundary Line
County Line
Roads
S.C. Highway
U.S. Highway
Streams & Waterbodies
Scale: AS SHOWN
Project No: 0455-052
Filename: Tributaries_Sheet2.mxd
Drawn By: SAK
Date Drawn: 08-14-2007
South Carolina Electric and Gas
Columbia, South Carolina
Saluda Hydroelectric Project
FERC No.516-SC
Tributaries That Support Lake Murray
Kleinschmidt
Energy & Water Resource Consultants
101 Trade Zone Drive Suite 21A
West Columbia, SC 29170
P: (803) 822-3177
F: (803) 822-3183
www.KleinschmidtUSA.com
Sheet 2
4.2-1

4.3 Aquatic Resources

There are a diversity of aquatic habitats available within and around Lake Murray, including shallow coves, an extensive littoral fringe, shoreline wetlands, and a vast open, deepwater section (Mead and Hunt, 2000; SCE&G, 2005). But past intense development has resulted in a significant loss of habitat on approximately. one half of the project's shoreline. As a result, the lake's diverse fisheries are dependent on resources primarily located in the upper lake regions. Over the years, there have been forty fish species, representing 12 different families, documented in Lake Murray (SCE&G, 2005). Of these, seven species are considered game fish. At least 16 resident species of forage fish occur in the Project waters, with 10 of these species belonging to either the minnow or perch families. Fish growth in these waters is generally considered to be good and has produced several current state record fish (Mead and Hunt, 2002a).

Shallow coves, littoral fringe areas, and shoreline wetlands provide significant habitat for many fish species and valuable areas for spawning and recruitment below the 360' PD contour. These areas may be comprised of vegetation such as forbs, grasses, and rushes, and are often below button bush and black willow flats which are categorized as Environmentally Sensitive Areas. This vegetation can greatly aid in the spawning success of shallow water spawning fish species and provides cover for the young of year (YOY). Fish species that utilizes these areas for spawning include bass and sunfish species.

In 1994, SCDNR prepared a comprehensive fishery management plan for Lake Murray, which identified a number of species with particular importance to the lake's sport fishery. According to SCDNR, the most sought after game species in Lake Murray are largemouth bass, black crappie, red-ear sunfish, bluegill sunfish, and stocked striped bass. The most important prey species for the lake include threadfin shad, gizzard shad, and blueback herring.

4.4 Terrestrial Resources

4.4.1 Botanical Resources and Habitats

Approximately 50% of the shoreline is privately owned down to the high water mark (360' PD contour) resulting in a significant loss of terrestrial resources. The upland habitat located above the 360' PD 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. The most common tree species is loblolly pine, which is a quick and dominating colonizer in disturbed, well-drained sites. This tree is also prized by the regional forestry industry and its growth is managed in various areas (Mead and Hunt, 2000). In areas not managed for this pine, succession to deciduous tree species, particularly oaks, sweetgum, and hickory, typically occurs. These upland forested areas function mostly in support of forestry, wildlife or game management, fisheries, water quality, bank stability and recreation or aesthetic values.

In addition to these forested areas, the land surrounding Lake Murray contains areas below the 360' PD contour that have been identified by SCE&G as Environmentally Sensitive Areas (ESA). ESAs consist of habitat areas known to be occupied by rare, threatened, or endangered species; rare or exemplary natural communities; significant land forms or geological features; wetlands and shallow coves; and other areas determined to be critical to the continued existence of native species, such as spawning and nesting habitat. 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 a 1991 FERC *Order to Amend the Land Use and Shoreline Management Plan* (SCE&G, 1994; FERC, 1991). Since then, the ESAs have been resurveyed and their classifications have been revised (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 ESA survey and classification system is provided in Section 6.3.

In the 1994 inventory undertaken by SCE&G, ESAs below the 360' PD high water contour were classified into 11 habitat types (SCE&G, 1994). They included ten vegetated classes, and two unvegetated classes (e.g., shallow shoals and rocky shores having littoral buffer or fishery values). The vegetated classes are described below.

Mature hardwood forest – The riparian slopes in the upper region of the lake are characterized by mature oak-dominated forest with a diverse and dense canopy and sub-canopy layer, and a sparse herbaceous layer (SCE&G, 1994). Lower slopes have white oak, red oak, swamp chestnut oak, red maple, American beech, and sweet gum. Higher slopes are dominated by chinkapin oak, southern red oak, red oak, white oak, shagbark hickory, and red cedar. These forests are important mainly as wildlife habitat. They cover 20.6 acres of land and over a mile of shoreline (Mead and Hunt, 2002a; SCE&G, 2005).

Islands – Numerous islands exist within the project and support a variety of plant communities depending on elevation and land-use history. They range in character from open habitat with scattered trees and shrubs over a dense herbaceous layer of grasses and forbs; to upland pine/hardwood forested islands with closed canopies and no herbaceous layer; to riverine islands of bottomland hardwood forest wetlands (see description below for bottomland forest). These islands provide important wildlife habitat for a number of species and are a major recreational and aesthetic resource for the lake.

Shallow coves – These areas consist of palustrine emergent wetland habitat that occurs in the zone between the 354' PD contour interval to about 6 feet below annual mean high-water mark on flats and gentle slopes. They provide shallow water habitat or exposed shoreline habitat, depending on water level and time of year, but are generally inundated or saturated from late winter through spring. Shallow coves support an assemblage of forbs, grasses, sedges and rushes, and are important spawning habitat form most of the lakes centrarchid species (bass, crappie, and sunfish).

Buttonbush and willow flats – These areas generally occur in shallow coves and consist of palustrine scrub-shrub wetland habitat along the lake fringe. Although composed predominantly of buttonbush and black willow shrubs, this habitat may also support persimmon and water willow. The dense root system provided by the shrubs effectively reduces the effects of erosion caused by wave action and function to stabilize the lake shoreline. They also provide important spawning habitat for centrarchids, and shelter for larval and juvenile fishes.

Bottomland hardwood – This forested wetland habitat can be found within the riparian zone around the entire lake, particularly at the confluence with tributaries. In the upper portion of the lake, it occurs on riverine islands or lakeshore between wet flats and upland forest. In the lower lake sections, it lies between shallow coves or buttonbush/willow flats and upland forest. These forests are dominated by a variety of southern red oak but also include swamp chestnut oak, willow oak, water oak, shumard oak, and sweet gum. Understory may include red maple, American hornbeam, and swamp dogwood, with herbaceous species including switch cane and sedges. This forested wetland habitat is important foraging and nesting habitat for many wildlife species. It also performs runoff filtration and sedimentation functions, which help buffer the lake and protect water quality.

Exposed bars – Exposed bar areas occur in the upper section of the lake and are associated with the riverine islands. They are remnants of the old river system and consist primarily of sand and larger substrate deposited along the river banks during flood events - before the Saluda River was impounded. Exposed bars are still heavily influenced by river currents and the inflow of nutrients, and are inundated during most of the year. They are classified as wetlands under the National Wetlands Inventory (NWI) mapping system. The plant community is dominated by grasses that colonize the sediment deposits between larger substrate. Upstream portions of the bars usually have limited fish habitat due to high water velocity and nutrient loading in the upper portion of the reservoir. The more protected downstream areas of the bars offer more favorable spawning locations for nest-building bass, crappie, and sunfishes.

Water tupelo stands – Small, monotypic stands of water tupelo (*Nyssa aquati*ca), a type of forested wetland community, occur in the upper section of the lake in low wet flats. These wooded wetland areas are consistently inundated and lack a shrub layer although swamp beggar-tick grows on the trunks of the trees at or just above the high water mark and false pimpernel is found in areas with exposed substrate (SCE&G, 2005). These stands are unique because they are the northern most occurrences of water tupelo known to exist in the Saluda River.

Wet flats – This forested wetland type exists between the bottomland hardwoods and the shallow coves, and has two distinct forest cover types depending on elevation. Low wet flats have canopies dominated with sweet gum, green ash, American elm, overcup oak, water hickory, red maple, sugarberry, water tupelo, and sycamore. It has an open shrub layer, mostly buttonbush and deciduous holly, with a patchy herbaceous layer. Slightly higher flats are dominated by willow oak and sweet gum, red maple, sugarberry, tulip poplar, and loblolly pine. The shrub layer is dominated by holly, whereas switch cane dominates the herb layer. The wet flats are important habitat for migratory waterfowl and provide prime feeding areas when submerged.

4.4.2 Invasive Aquatic Vegetation

Like many lakes in the Piedmont, Lake Murray suffers from infestations of nonnative aquatic plants. Of particular concern is hydrilla (*Hydrilla verticillata*), which is considered a noxious aquatic weed by both the USDA and SCDNR. This species inhabits the littoral and near littoral zone (7 to 15 feet) and is an aggressive and swift colonizer. One factor for hydrilla's success is the multiple modes through which it reproduces. Not only does hydrilla spread through seeds, it also reproduces through tubers, plant fragments, and turions (overwintering buds). Boat traffic and waterfowl also contribute to the spread of populations throughout bodies of water (Access Washington, 2004).

Following its discovery in Lake Murray in 1993, hydrilla infestation increased rapidly in various locations around the lake. Its populations and spread was subsequently controlled cooperatively by SCE&G and SCDNR using water level drawdowns and chemical treatment (Mead and Hunt, 2000). Currently, hydrilla populations appear to be declining further due to introduction of triploid Chinese grass carp to the lake. Grass carp forage almost exclusively on aquatic plants and can drastically reduce the biomass of invasive plant species in a system. In 2003, 64,500 grass carp were stocked in Lake Murray and provided excellent control of hydrilla, which has continued through 2006, when surveys failed to identify direct evidence of hydrilla growth.

4.4.3 Wildlife Resources and Habitats

The Lake Murray shoreline contains wildlife habitat and a diverse assemblage of wildlife species. Many of the species that occur in the Lake Murray area are typical of forested second-growth and woody successional habitats of the Piedmont region. Such species include 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-shoulder 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 including eastern box turtle, green anole, broad-headed skink, gray rat snake, southern toad, green tree frog, and marbled salamander (SCE&G, 2005; Mead and Hunt, 2000).

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 and wading birds (e.g. wood duck, great blue heron, great egret). These areas also provide important breeding habitat for most amphibian species (e.g. marbled salamander, red salamander, bullfrog), and year-round habitat for aquatic reptiles (e.g. red-bellied water snake, brown water snake, musk turtle). Open water areas are often utilized by such species as bald eagle, kingfisher, osprey, and various gulls for foraging (SCE&G, 2005).

A particularly notable wildlife habitat exists at Lunch Island on Lake Murray, also known as Doolittle or Bomb Island, which 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). Each year this species uses Lunch Island during the summer months as a breeding site and communal roost. Congregations may number up to 800,000 individuals at this time (Mead and Hunt, 2000). As a result, SCE&G, SCDNR, and the Columbia Chapter of the National Audubon Society have designated the eastern end of the island as North America’s first purple martin sanctuary (SCE&G, 2005).

4.4.4 Rare, Threatened, and Endangered Species

An assessment of federally listed rare, threatened, and endangered (RT&E) species was conducted in support of relicensing the Saluda Project. This RT&E Report is included in the Final Application for New License for the Project, and indicates that only two species have the potential of occurring in the Lake Murray area (within the PBL). They consist of two birds: the bald eagle and the wood stork. Recently, the bald eagle was removed from protection under the Endangered Species Act of 1973 (ESA) (72 Fed. Reg. 37345, 37372). However, it is still protected under the Bald and Golden Eagle Protection Act of 1938, as well as by the State of South Carolina. The wood stork is protected both federally, under the ESA, and by the State of South Carolina. Although there are several more RT&E species known to occur within the four counties where the Saluda Project is situated (Lexington, Richland, Saluda, and Newberry), the habitats necessary for their support are absent within the Project boundaries (SCE&G, 2005). Brief descriptions of the bald eagle and wood stork follow.

Bald eagle (*Haliaeetus leucocephalus*) Federally Protected, State Endangered – This large raptor is found throughout North America, typically around water bodies, where they feed and scavenge primarily on fish and carrion. 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). Bald eagles have used Lake Murray for foraging and nesting since its construction in 1930, with peak usage likely occurring during the winter months. A substantial increase in nesting activity and productivity (young produced) by bald eagles on Lake Murray has been documented between 1996 and 2003 (Wilde et al., 1996; Wilde et al., 2003).

Wood stork *(Mycteria Americana)* Federally Endangered, State Threatened – These colonially-nesting birds feed in flocks around freshwater and brackish wetlands along the coastal plain (USFWS, 1996). They typically use tall cypresses or other trees near waterbodies for colonial nest sites.

Storks feed primarily on small fish. They capture prey using sense of touch, or tactilocation. They are particularly drawn to depressions where fish become concentrated during periods of falling water levels (USFWS, 1996). Declines in wood stork populations are 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 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 SCE&G, 2005). Aerial surveys conducted during the summer of 2004 documented approximately 60 storks feeding at various locations in the middle Saluda River area and the upper portion of Lake Murray (SCE&G and Kleinschmidt, 2004a). SCE&G, in coordination with the USFWS and SCDNR, has initiated a 5-year study to document wood stork use within the Saluda PBL and in the Project vicinity (SCE&G and Kleinschmidt, 2004a). Results of the first two years of the five-year study (2005-2006), have failed to identify use of the Project area by wood stork. Further, it is suggested that the 2004 sighting of a large group of individuals feeding in Lake Murray was an atypical event, and likely attributable to the favorable feeding conditions created by the drawdown of the lake during construction of the Saluda Backup Dam. The USFWS and SCDNR concurred that use of the area by woodstorks was limited to post-dispersal/ feeding activities and that no critical rookery or similar habitats were utilized within the project area (Kleinschmidt, 2007).

4.4.5 Cultural Resources

In recent years, numerous archaeological and historical studies have been conducted within the Project boundary: Trinkley and Southerland (2001), Hendrix and Bailey (2003), Lansdell and Bailey (2003), Norris et al. (2005), and Green et al. (2007). 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). As a result of these studies, 156 archaeological sites, 42 isolated finds, and eight aboveground historic resources were investigated. Of these resources, three archaeological sites and one historic structure 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 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).

Currently, SCE&G has worked with all relevant agencies, including the State Historic Preservation Office and any federally-recognized Indian tribes that have a traditional connection to the land, to form Historic Properties Management Plan (HPMP). The HPMP is designed to provide appropriate protection to historic resources and archaeological sites during the life of the Project License. The HPMP will include provisions for future consultation in the event of discovery of previously unrecorded cultural resources and will outline the necessary steps to allow compliance with Section 106 of the National Historic Preservation Act.

4.4.6 Land Use and Aesthetics

Land uses for the Project area consist of residential, commercial, recreation, and conservation uses. In order to guide Future Development and land management, there is a Land Management Classification system that classifies all project lands according to their approved uses. See Section 6.0 for an explanation of this system. Richland and Lexington Counties are among the most densely populated counties in the state. Lexington County, in particular, is served by several major transportation routes connected to the capital city (South Carolina Association of Counties, 2004). Due to its close proximity to the Columbia Metropolitan area, Lake Murray provides a primary source for recreation to the surrounding communities as well as to visitors of the state.

Lake Murray is characterized by an irregularly shaped perimeter with numerous peninsulas, inlets and islands; most of which are either developed or forested. It is the fifth largest lake in South Carolina, following Lakes Marion, Thurmond, Hartwell, and Moultrie. Since the lake's development in 1930, it has become a valued recreational destination for both residents and tourists. During the early 1970s, development pressure on the lake began to increase significantly. Today, residential and commercial developments, Project operations, and recreation properties make up a large part of the shoreline.

The eastern, main body portion of Lake Murray affords an expansive view over several miles of open water and a few large inlets. The shoreline is sporadically tree-covered and interspersed with extensive 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 view of shoreline development (FERC, 2002). The Project's dam and five large intake towers are clearly visible from the main body of the reservoir.

The western portion of the lake branches out into narrow arms that extend up into many drainage ways and creeks. Views in this area are varied and reduced by the encroaching shoreline and the increased number of small coves, creek beds, and drainage ways. Overall, the western 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.

Highway 6, a state highway with north and southbound lanes, crosses over the dam and provides a generally pleasing view of the open water and distant reservoir shoreline.

During normal water levels, portions of the lake bottom along the periphery of the reservoir shoreline and islands and bars are exposed. At elevation 350’ PD, the reservoir has a surface area of about 40,066 acres and about 10,800 acres of lake bottom is exposed. The lake bottom appears as a dark band of organic 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, has a gentle gradual slope. The shoreline along upper reaches of the lake, including the longer, narrower coves and inlets, tends to have moderate to highly steeped slopes.

4.4.7 Recreation Facilities and Use

Numerous private, public, and commercial recreation sites have been developed around the shoreline of Lake Murray. There are numerous formal recreation sites dispersed around Lake Murray that support boat launches, marinas, boat slips, wet and dry storage, campgrounds, picnic areas, beaches, fishing areas and piers, trails, and playgrounds. Fifty-seven 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 condominium associations. There are 15 public access sites on Lake Murray, 11 of which are boat launch sites. One site, Dreher Island, is a State Park and is the only site to offer both day use opportunities such as boat launches, picnic facilities, and beaches, and overnight uses such as camping and villa rentals. Commercial sites around Lake Murray offer significant lake access and services to the public, and include marinas, campgrounds, restaurants, cabins and resorts. There are 30 public marinas and landings dispersed along Lake Murray that typically provide boat ramps and launching facilities, fuel services, groceries and food, boat sales, rentals and/or repair, bait and tackle, and boat storage (SCE&G, 2007).

According to the 2006 Recreation Survey, Lake Murray supported an estimated 316,810 recreation days from data gathered at SCE&G public access areas during the period from May 27 (Memorial Day) through September 30, 2006 (SCE&G, 2007). Lake Murray supports both land and water-based recreational opportunities although water-based activities are most common. Fishing and boating are the most popular activities of users of Lake Murray and the lake is widely known to be a superb fishing locale (SCE&G, 2007). Lake Murray is host to numerous national and local fishing tournaments, most of which are hosted at Dreher Island State Park. In addition, the lake is used as a focal point for holiday and tourist events.

The shoreline around Lake Murray is used primarily to access the lake water; land-based activities are considerably less common than are water-based activities. However, there are a few notable recreational opportunities afforded by Project lands. Along the western section of Lake Murray, there are approximately 6000 acres leased to the S.C. Department of Natural Resources as part of the statewide Wildlife Management Areas Program, which provide hunting opportunities to the general public. Around Lake Murray, hunting is primarily focused on waterfowl species including mallard, scaup, and ring-neck duck; Canada goose; and coot (SCWA, 2007). In addition, bird watching at Lunch Island (a.k.a. Bomb Island) is a unique experience due to the fact that the island hosts one of the largest documented roosting colonies of purple martins in the country. It is the first designated sanctuary for this species in North America. Also, picnicking, sightseeing, and camping are supported at a variety of sites, both informally and at designated locations such as Dreher Island State Park. All project lands excluding those used for project operations are open and available for public recreational opportunities.

5.0 HISTORY OF THE LAKE MURRAY SHORELINE MANAGEMENT PLAN

Construction of the Saluda Hydroelectric Project was started in 1927 by the Lexington Water Power Company. Construction was completed in 1930, and the Lexington Water Power Company was issued a 50-year operating license by the Federal Energy Regulatory Commission. The license was transferred to SCE&G in 1943. Since that time, several advancements have been made in the management of project lands. These milestones are summarized in Table 5.0-1, and described in the following sections.

The 1940s and 1950s saw increased development pressure along the shoreline of the land such that by the mid-1970s, FERC hosted hearings to identify the effects of development on public use of project lands and waters. In 1979, FERC ordered SCE&G to prepare a shoreline management plan (7 FERC ¶ 61,180). SCE&G subsequently filed the project's first shoreline management plan with FERC, which included five general land classifications and seven sub-classifications and associated mapping. The plan identified permissible uses for each land classification, control measures for environmental protection, and conveyance conditions to be attached to any interests in project lands that are sold . This plan was designed to compliment an already existing program for permitting docks, marinas, launching facilities and other shoreline development. The plan has been reviewed and modified since initial implementation.

FERC approved the plan in 1981 (16 FERC ¶ 62,479), and in doing so, required SCE&G to examine future use of project lands in consultation with agencies. SCE&G complied with this order in 1983, recommending no amendments to the plan at that time, but committed to review the plan every five years, in consultation with appropriate state and local agencies. When the project's new license was issued in 1984 (27 FERC ¶ 61,332), the shoreline management plan was included as part of Exhibit R.

Table 5.0-1: Lake Murray Land Use Management Plan Milestones

		1927	Lexington Water Power Company is issued a license by the Federal Power Commission for the construction of the Saluda Hydro Project.
Lexington Water Power Company merges with SCE&G. SCE&G acquires license to the Saluda Hydroelectric Project.	1943		
		1979	FERC orders SCE&G to prepare the Project's first shoreline management plan.
First Land Use Management Plan for Lake Murray is approved. The plan must be updated every 5 years.	1981		
		1984	Land Use Management Plan is incorporated into new project license.
First update of Land Use Management Plan approved as part of the 5-year review cycle.	1991		
		1994	Second update of Land Use Management Plan approved, which includes a GIS database created by SCE&G to facilitate land management.
Third update of Land Use Management Plan is approved as part of the 5-year review cycle.	2004		
		2004	SCE&G initiates relicensing activities for the Saluda Project. A special team is created to assist in review of the Land Use Management Plan.
Woody Debris Management Plan takes effect, to support Land Use Management Plan. Submittal of ESA Inventory of Easement Property per FERC Order, June 23, 2004.	2006		
		2007	Erosion and Sediment Control Plan takes effect, to support Land Use Management Plan.
Rebalancing process results in modification of land management classifications.	2007		
		2009	SCE&G Submits the fourth update of the Shoreline Management Plan as part of the new license application.

Saluda Hydroelectric Project (FERC NO. 516). Dates shown represent the dates of FERC orders of approval.

5.1 Past SMP Reviews

During 1988 and in consultation with agencies, SCE&G engaged in an extensive review of the Shoreline Management Plan, that included discussions on re-balancing shoreline uses, detailing additional shoreline management goals, defining criteria for review of permit requests, and identifying information needs for and associated data collection requirements. SCE&G subsequently filed an application for license amendment on January 2, 1990, with the results of this consultation, which comprised the first five-year review. In the application, SCE&G proposed to reclassify selected lands in support of the development of new recreation sites, and transfer of lands from those reserved for Future Development to forest management. In addition, SCE&G proposed to modify procedures for reviewing and processing permits, and introduced a proposed water quality monitoring program. The revised shoreline management plan was approved in 1991 (56 FERC ¶ 62,194) with the requirement that SCE&G inventory shoreline properties and propose revisions for better management of Future Development and public recreational needs, and to ensure protection of environmental resources.

During their second five-year review in 1994, SCE&G made significant improvements in land management with the development of a GIS database for project lands. This database allowed better mapping and a more comprehensive inventory of project lands. The inventory was filed in late 1994 and was approved by FERC in 1997 (Letter dated September 22, 1997).

The third five-year update occurred in 2000. Again, revisions to the shoreline management plan were recommended. These included refinements to the common dock policy, boatlift restrictions, slip dock requirements, new flotation requirements (for encapsulated flotation), establishment of Environmentally Sensitive Areas, revisions to silviculture practices within the forest management classification, and re-balancing land use classifications. After provision of additional information to FERC in 2002, FERC issued an Environmental Assessment on the proposed shoreline management plan update in 2003 and subsequent approval of the revised plan in June of 2004 (107 FERC ¶ 62,273). In approving the revised plan, FERC required

SCE&G to accomplish the following: prepare a sedimentation and erosion control plan; identify and protect intermittent streams on lands classified for future development; update the list of environmentally sensitive areas; prepare a woody debris and stump management plan for areas classified as Future Development; establish a procedure for land reclassification (part of rebalancing); prepare a Buffer Zone restoration plan; identify and designate wood stork roosting and foraging habitats as natural areas; establish Two Bird Cove and Hurricane Hole Cove as special recreation areas; and designate waterfowl hunting areas. In the above stated order, FERC required in Ordering Paragraph F that re-balancing of shoreline uses to take place during the comprehensive relicensing process.

In addition, FERC required SCE&G to file a comprehensive consolidated shoreline management plan as part of its relicensing application (109 FERC ¶ 61,083). FERC further stated that during prefiling consultation SCE&G was to inventory all developed shoreline within the project boundary for structural encroachments and determine if the property is still needed for project purposes.

5.2 Current Document

This document, submitted in conjunction with SCE&G’s license application, represents a consolidated, comprehensive shoreline management plan for project lands surrounding Lake Murray. Land use classifications have been consolidated and renamed to simplify the management plan and clarify its intent, while adhering to the historical management prescriptions agreed to and developed with agencies and stakeholders.

5.2.1 Rebalancing

In fall of 2006, the Lake and Land Management TWC began discussing reclassification of project lands according to more appropriate, updated land use designations; a process called ”land rebalancing.” In particular, the group sought to reevaluate and reclassify lands to better balance the distribution of developed and undeveloped lands on the project shoreline.

Roughly 60 percent of the project shoreline is considered developed, and most of that development is on the mid to downstream section of the lake. Rebalancing allowed SCE&G to protect remaining, selected lands identified as providing recreation, natural resource and scenic values.

The focus of the rebalancing process was to determine the appropriate land use classifications of primarily Future Development parcels based on their suitability to serve overall Project needs and purposes. Examples of functions that serve Project purposes are public recreation access and opportunities; flowage maintenance; shoreline control; aesthetics; and the protection of environmental resources including fish and wildlife habitat.

During rebalancing, the Lake and Land Management TWC sought to consider relevant interests, including economics, wildlife and fisheries, and recreation, among others, when assigning new land use classifications. When possible, the TWC emphasized preservation of large, contiguous blocks of lands to minimize land use fragmentation. The rebalancing process began with creation of two sets of evaluation criteria to numerically score land parcels according to economic and natural resource considerations. Aerial photos were used to assess the parcels and assign scores. The following table lists the factors that were agreed to provide the best basis on which to evaluate the land parcels (Table 5.1-1).

Table 5.1-1: Rebalancing Evaluation Criteria for Lands Reserved for Future Development on Lake Murray

NATURAL RESOURCE VALUE FACTORS	ECONOMIC VALUE FACTORS
Fish spawning and nursery habitat	Local government interests (property tax revenue, recreation, economic growth, etc.)
Length of shoreline	SCE&G interest (land sale value, recreation, ESA)
Mean width of lands reserved for future development	Back property owners interest (lake access, dock permit, developmental potential)

NATURAL RESOURCE VALUE FACTORS	ECONOMIC VALUE FACTORS
Waterfowl hunting opportunity	Proximity to utilities
Regional importance	Proximity to road access
Land use (amount of natural habitat present)	Proximity to amenities (fire protection, schools, groceries, etc.)
Recreational values	Water usability and topography for boating
Adjacency (to undeveloped land)	Market value
Environmentally sensitive areas and other natural areas	Size/width
Unique habitat, threatened or endangered species	Dock qualifications

Source: (Meeting notes 1-26-2007)

Rebalancing Project lands as ordered by the FERC has resulted in the reclassification of approximately 1135 acres of SCE&G owned lands along approximately 40 miles of shoreline. In addition, approximately 658 acres are being brought into the project for Public Recreation, and approximately 2754 acres of non project property that borders the PBL will made available to the public for public recreation. Rebalancing has resulted in protecting from development almost 9,200 acres of land and 185 miles of currently undeveloped shoreline. These lands are identified as natural areas, recreation, and forest management. A summary of the acreage and mileage of lands rebalanced can be viewed in Tables 5.1-2 and 5.1-3. Descriptions of the shoreline management classification structure and the lands within each classification are provided below.

Table 5.1-2: Rebalancing Summary in Miles

	NATURAL AREAS	RECREATION	FOREST MANAGEMENT	AREAS LEASED TO SCDNR
Lake Murray Protected Shoreline	22.58	47.03	109.59	
Non-Project Lands				
LSR Lands		5.8		
Sub-totals	22.58	52.83	109.59	
Grand Total of Protected Shoreline Miles: **185 Miles**				

Table 5.1-3: Rebalancing Summary in Acres

	NATURAL AREAS	RECREATION	FOREST MANAGEMENT	AREAS LEASED TO SCDNR
Lake Murray Protected Acreage	506.23	955.17	3776.39	
Non-Project Lands		658.2		2754
LSR Lands		540.86		
Sub-totals	506.23	2154.23	3776.39	2754
Grand Total of Protected Lands on Lake Murray and the LSR: **9190.85 Acres**				

5.2.2 Project Boundary

It has been the standard practice of SCE&G, dating back to before the first shoreline management plan, to retain lands sold for private development within the project boundary. Except for the removal of the property below the project dam that accommodates the McMeekin Steam Station and lands used for the construction village, the project boundary remains basically the same as it was established under the Project's initial license issued in 1927.

Though transfers of interest in project lands for non-project uses do not necessarily require the project boundary to be redrawn, it is generally preferable for private residential development to be excluded from the project boundary unless the lands are clearly needed for project purposes. In 2004, FERC ordered (109 FERC ¶ 61,083) that during pre-filing consultation in its relicensing proceeding, SCE&G was to inventory all developed shoreline within the project boundary for structural encroachments and determine if the property is needed to serve the project purpose.

After consultation with legal counsel, and performing the required inventory of the developed shoreline properties, SCE&G determined that removing from the Project boundary, shoreline properties which have been sold, may detrimentally affect flowage rights on some or all of the properties in question, and could expose SCE&G to additional liability should the reservoir surcharge at some future time due to flood conditions beyond SCE&G's control.

6.0 LAND MANAGEMENT CLASSIFICATIONS

To identify and redefine land management classifications, the TWC analyzed existing resources and land use patterns adjacent to the Lake Murray shoreline. The TWC also evaluated existing classifications established in previous SMP efforts to determine where redefinition and/or new classification might be more relevant to current and anticipated development patterns and uses. Existing land use patterns reflect areas where particular types of facilities and activities are concentrated. The TWC identified five distinct land management classifications consisting of Forest Management, Public Recreation, Natural Areas, Project Operations, and Multi-purpose. Multi-purpose is further divided into four sub-classifications: 75' Buffer Zone, commercial, easement, and Future Development. The acreages and parcels for each of the classifications is provided in Table 6.0-1.

Table 6.0-1: Shoreline Miles and Acreages by Land Use Classification Following Rebalancing
Source (SCE&G, 2008)

CLASSIFICATION			SHORELINE MILES	ACRES
Public Recreation			47.03	955.17
Forest Management			109.59	3,776.39
Natural Areas			22.58	506.23
Project Operations			1.63	1,057.53
Multi-purpose:	<u>Miles</u>	<u>Acres</u>	474.72	9,583.45
75' Buffer Zone	29.95	263.77		
Commercial	6.05	114.28		
Easement*	387.61	8,247.22		
Future Development	51.11	958.18		
		Total	655.55	15,878.77

*Easement property values include mileage and acres associated with causeways

Although SCE&G aims to manage their lands according to this classification system, the public has the right to access SCE&G-owned lands regardless of classification, with the exception of lands reserved and used for Project operations. The sections below explain/define the land management classifications. Figure 6.0-1 depicts their distribution around the lake. Section 7.0 describes management prescriptions for SCE&G-owned lands within each classification.

Figure 6.0-1 Shoreline Classification Map

6.1 Forest Management

SCE&G manages forest resources on its lands that are available for public recreation, although recreation is only one of several uses for these lands. These lands have been set aside for compatible recreation, scenic, aesthetic, and timber management purposes. SCE&G forest resources are managed according to the South Carolina Forestry Commission's Best Management Practices. SCE&G restricts its timber management operations in certain areas, such as on cliffs or steep slopes, or in atypical groups of trees. Limited dock access may be allowable on Forest Management property under very specific situations as determined by SCE&G Lake Management (see Permitting Handbook).

6.2 Public Recreation

Project lands under this classification serve as recreational resources for the public and include areas that are managed expressly for recreation as well as those with recreation as a secondary usage. Public recreation lands include the following:

- State parks;
- Public beaches, public boat launches, and other areas currently being managed as public access;
- Islands owned by SCE&G;
- Forest management lands leased to SCDNR as part of the statewide Wildlife Management Area (WMA) Program that are open to the public for hunting or other recreational activities. These areas may also be managed for timber production, recreation, wildlife habitat, new timber growth, and quality watershed conditions. For additional information on these areas please visit the SCDNR website at www.scdnr.gov;
- Forest management lands managed by SCE&G for timber production, recreation, wildlife habitat, new timber growth, and quality watershed conditions; and

- Properties owned by SCE&G that are set aside for future recreational development.

6.3 Natural Areas

Natural areas consist of lands that warrant special protection because they provide important habitat for various wildlife species, including the recreational fishery. Large wetland areas, areas protected because they have cultural and/or historical significance, and Environmentally Sensitive Areas (ESA)'s are also included in the Natural Areas classification. Natural Areas consist of 22.58 miles of shoreline encompassing 506.23 acres within the Project boundary.

ESAs are areas that have been designated as warranting special protection because they contain one or more of a variety of characteristics. They consist of habitat areas known to be occupied by rare, threatened, or endangered species; rare or exemplary natural communities; significant land forms and geological features; wetlands and shallow coves; and other areas determined to be critical to the continued existence of native species, such as spawning and nesting habitat. SCE&G identifies and evaluates Natural Areas, including ESAs. As SCE&G identifies these special areas, it transfers the lands from other land management classifications to the Natural Areas classification where SCE&G retains and protects them.

Since their first inventory in 1994, the classification of ESAs has undergone revisions. The latest survey for ESAs occurred in 2005, in response to FERC's June 23, 2004, (107 FERC ¶62,273) Order requiring that SCE&G update the list of ESAs at the Saluda Project (ordering paragraph 'D'). At this time, SCE&G submitted an updated set of ESA maps identified during surveys conducted by SCE&G and SCDNR representatives (USFWS was invited but could not attend). Mileage for the surveyed ESAs is provided in Appendix F.

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

- 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 between 8 and 20 feet in length with little or no vegetation below the normal high water mark (360' PD contour). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline. The vegetation community is primarily buttonbush and willow species, as described in Section 4.4.1.
- Intermittent Vegetated Shoreline - The vegetation community is also primarily buttonbush and willow species (as described in Section 4.4.1), however, linear shoreline coverage of vegetation in this group is at least 66 feet in length where 16 to 40 percent of the linear footage is a gap.
- Shallow Coves with Stream Confluence - Includes areas where streams enter the lake and form coves where lake water are predominately above the 355' PD 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. The vegetation community is described under Shallow Cove in Section 4.4.1.
- Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood and wet flats at least 66 feet in length (see Section 4.4.1 Terrestrial Resources for definitions of Bottomland Hardwood and Wet Flats).

6.4 Project Operations

Areas under this classification include SCE&G-owned and managed lands required for operation of the Saluda Project. Public access to these lands is restricted to ensure public safety or to assure the security of the infrastructure system.

6.5 Multi-Purpose Development

Project lands under this classification include lands owned by SCE&G as well as lands that have been sold by SCE&G but which remain within the PBL. Generally, SCE&G divides them into four general types: a) easement, b) commercial c) Buffer Zone, and d) Future Development lands.

6.5.1 Easement

This sub-classification includes lands that SCE&G has sold but holds and retains easements on within the PBL. These lands may support a variety of uses including privately run commercial ventures, residential developments, and causeways. Easement property may or may not be developed at this time. They include the following:

- Single and multi-family residential developments;
- Residential docks and trails or paths used for shoreline access;
- Private undeveloped, non-residential lands;
- Privately owned, for profit, commercial recreational facilities (*e.g.* campgrounds etc.); and
- Privately-owned industrial facilities.

6.5.2 Commercial

This sub-classification includes the following:

- Commercial and private marinas and boat clubs (for-profit and nonresidential);
- Commercial RV parks, hotels, resorts, bait shops, boat tours, etc.;
- Restaurants, eateries and bars with shoreline access such as docks, decks, etc.;
- Golf courses with lake access facilities;
- Industrial facilities; and
- Commercial docks, boat ramps, bulkheads, and other supporting facilities.

6.5.3 Buffer Zone (Historical 75 – Foot Setback est. between 1984-2007)

The 1984 FERC license order required SCE&G to maintain ownership up to a 75-foot-wide[1] Buffer Zone between the 360' PD contour (high water mark) and the adjoining back property line (Project boundary line). Buffer Zone lands are protected under the SCE&G permitting program as vegetated areas. The goal is to protect and enhance the Project's scenic, recreational, and environmental values in the area bordering the Lake Murray shoreline. These areas serve many functions including trapping and filtering runoff and contaminants, providing habitat and woody debris for fish and wildlife species, reducing bank erosion, and preserving the shoreline's scenic and recreational values.

[1] There are some areas where the width of land between the 360' PD contour and the PBL is less than 75', and thus the buffer zone is less than 75'.

SCE&G delineates and documents the Buffer Zone as part of the sale of "Future Development" properties. The Buffer Zone is the property between the 360' PD contour and the adjoining back property line. Buffer zones come into existence as a result of a land sale only and do not exist on unsold properties. That is, as land is sold from Future Development, a portion of it is transferred to the Buffer Zone sub-classification.

Management of the land within the Buffer Zone depends on the purchase date of the adjoining property and establishment of the setback. After issuance of the 1984 license, SCE&G placed particular restrictions on the Buffer Zone, which have been revised with the submittal of the current SMP. More information on management restrictions for the Buffer Zone is provided in the Section 7.1.3.

6.5.4 Future Development

Lands classified as Future Development are SCE&G-owned and located between the 360' PD contour 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. Once SCE&G sells lands within the Future Development sub-classification, they are transferred to the commercial or easement sub-classifications. In addition, SCE&G retains ownership and manages a portion of the land sale as Buffer Zone. Properties classified as Future Development have historically also been referred to as "fringeland." Fringeland is any land owned by SCE&G that is within the PB and above the 360' PD elevation. It is not restricted to Future Development.

7.0 LAND MANAGEMENT PRESCRIPTIONS

SCE&G developed land management prescriptions over time in consultation with agencies and the public. They consist of the guiding principals regarding management of the SCE&G-owned lands within each classification.

SCE&G administers management prescriptions through its Shoreline Permitting Program. Activities that require permits and consultation with SCE&G include excavation; construction, maintenance and placement of docks, boatlifts, boat ramps, retainer walls, and rip rap; limited brushing; and other shoreline activities (SCE&G, 1995). SCE&G provides a detailed Permitting Handbook that contains the permitting processes and specifications for various shoreline developments. Project proponents interested in shoreline development should contact SCE&G's Land Management Department to obtain permitting guidance and a copy of the Permitting Handbook. Section 9.3 of this document discusses the Shoreline Permitting Program in greater depth. General information regarding permitting requirements is included where applicable within the scope of each management prescription below.

7.1 <u>Multi-purpose Prescriptions</u>

Management of properties within the Multi-purpose classification is dependent on sub-classification as follows:

7.1.1 <u>Easement</u>

SCE&G does not own lands classified as "easements" and thus does not manage them. SCE&G only maintains flowage rights on the properties with shoreline frontage. Because restrictions apply to land use in the Buffer Zone and below the 360' PD contour (high water mark); back property owners wishing to construct or modify shoreline structures, or perform limited brushing in the land bordering their property must submit an application through SCE&G's permitting program. Examples of allowable multi-slip facilities and associated deed requirements are also depicted in Figures 7.1-1, 7.1-2 and 7.1-3 and described in more detail in the Permitting Handbook.

More information on land management of SCE&G-owned properties that border easements (i.e., Buffer Zone and below 360’ PD contour) is provided below.

Figure 7.1-1: Allowable Multi-slips On Private Easement Properties Containing ESA's

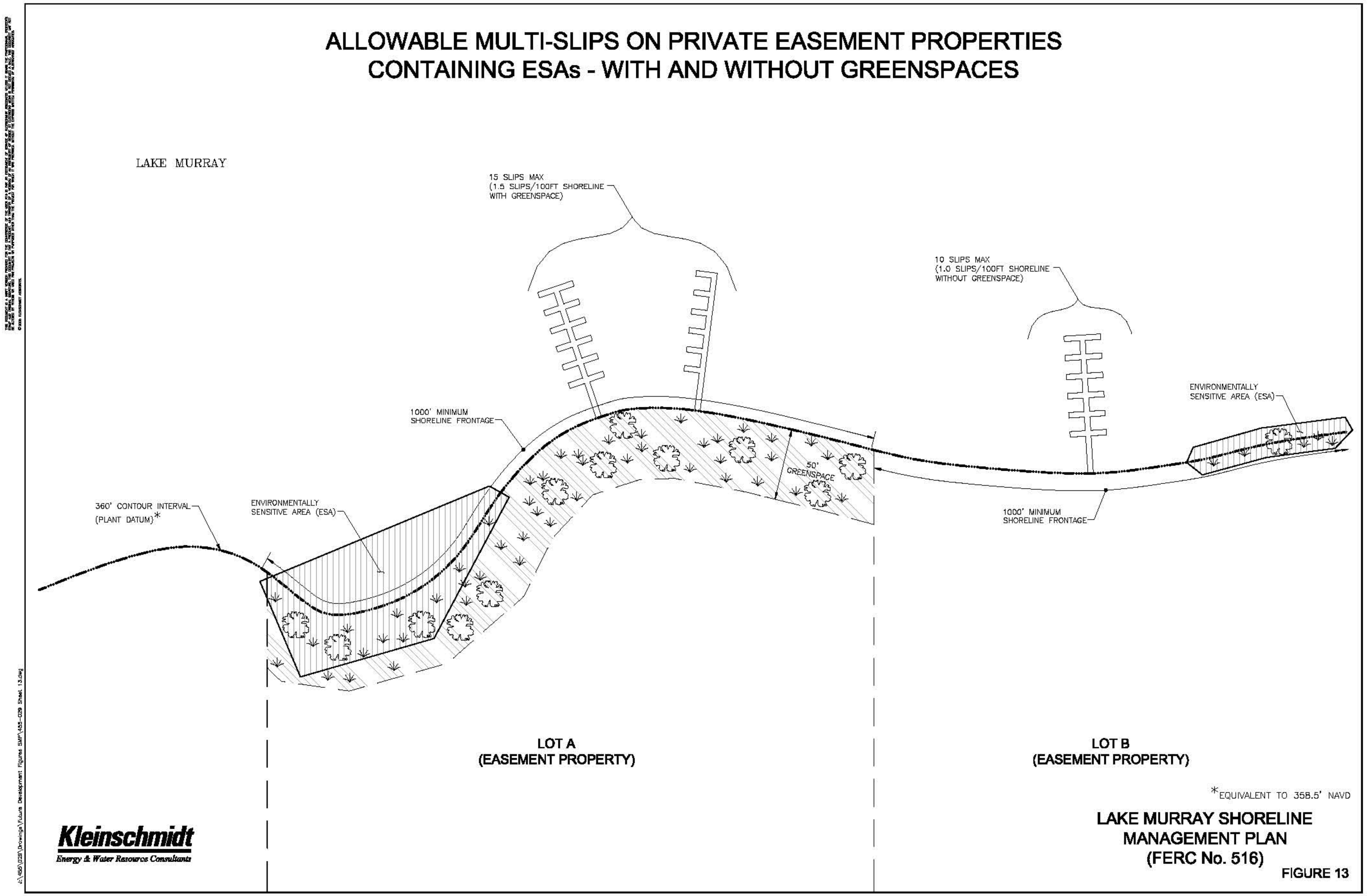


Figure 7.1-2: Allowable Multi-slips on Private Easement Properties

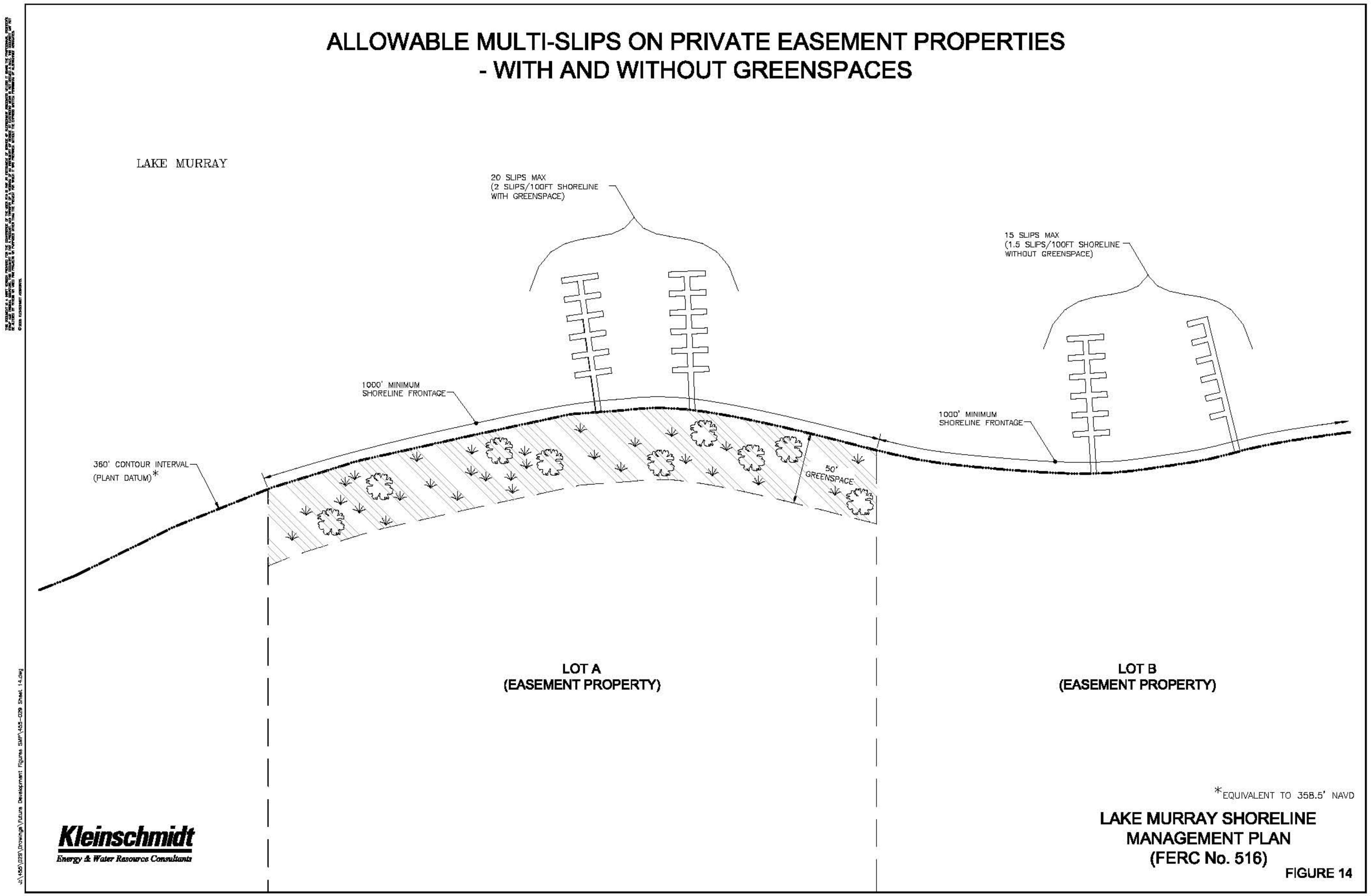
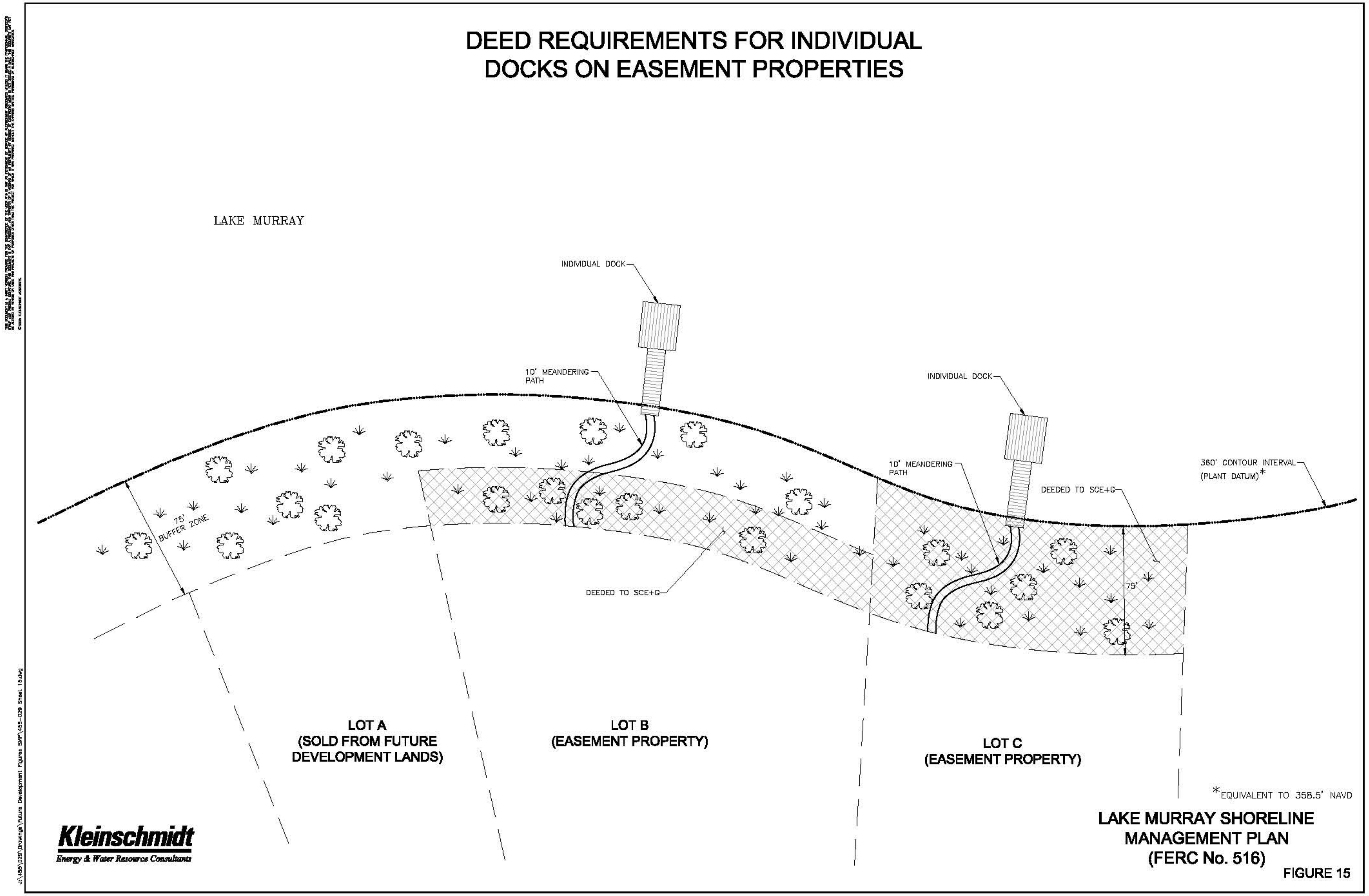


Figure 7.1-3: Deed Requirements for Individual Docks on Easement Properties



7.1.2 Commercial Prescriptions

SCE&G manages lands they own within this sub-classification primarily through their permitting program, which guides new or modified developments (e.g., expansion of existing facilities). During permitting review, new commercial-related uses of SCE&G-owned lands must meet SCE&G requirements, as outlined in the SCE&G Permitting Handbook (available at www.sceg.com/en/my-community/lake-murray/lake-management). The necessary federal, state and local permits must be obtained before final approval by SCE&G and FERC.

It is the responsibility of the commercial project applicant to provide SCE&G with all information necessary for its application to the FERC.

7.1.3 Buffer Zone (Historical 75 – Foot Setback est. from 1984-2007)

As explained, a Buffer Zone, located between the 360' PD contour and the back property development, is maintained adjacent to all easement lands sold by SCE&G after the issuance of the 1984 license. Use of SCE&G's Buffer Zone is entirely at the discretion of SCE&G as landowner. Owners of adjoining lands (back property owners) are given the right of access by foot to and from the lake through the Buffer Zone, but are not permitted to encroach with improvements, place any water-oriented encroachments (docks, ramps, etc.), change the contour of the land, or post the property, without written consent from SCE&G. Access to Buffer Zone lands by the public is allowed for passive activities such as bird and wildlife viewing and shoreline fishing. However, prohibited uses include overnight camping, building fires, hunting, discharge of firearms, motorized vehicles, or any activity that may adversely impact the land.

SCE&G intends to maintain well-vegetated lands within all areas designated as Buffer Zones, and has developed specific principles and guidelines for vegetation management. Vegetation management, however, varies according to the date the adjoining property was sold and the Buffer Zone established. Easement lands sold by SCE&G fall into three groups that affect how the Buffer Zones are managed: 1) lands sold prior to the 1984 license that lack Buffer Zones, 2) lands sold after 1984 but before approval of the 2007 SMP, and 3) lands sold after approval of this 2007 SMP. A summary of the central differences among management of Buffer Zones is as follows.

(1) Land purchased prior to 1984 – Owners who purchased their land prior to 1984 do not have a Buffer Zone associated with their properties. Prior to this date, SCE&G sold land within the PBL that extended to the 360' PD contour interval (high water mark). Above the 360' PD contour, property owners are encouraged to plant or allow native vegetation to flourish to protect and enhance the Project's scenic, recreational, and environmental values. Dock permitting requirements and vegetation management on SCE&G-owned lands are explained in greater detail in the Permitting Handbook, and also in Appendix B and Section 9.3 of this document.

(2) Buffer Zones established between 1984 and 2007 – As explained above, SCE&G began a program to establish vegetated Buffer Zones on the lakeward side of all SCE&G properties sold between 1984 and 2007. Management of these Buffer Zones allowed for limited brushing by back property owners within the Buffer Zone to remove only exotic and invasive vegetation, which is managed by SCE&G through their permitting program (See Permitting Handbook and Section 9.3 and Appendix B of this document for information on limiting brushing). Property owners are encouraged to plant or allow native vegetation to flourish to protect and enhance the project's scenic, recreational, and environmental values.

(3) Buffer Zones established after 2007 – For lands sold after approval of the current SMP, SCE&G will maintain a ‘no disturbance’ policy on all Buffer Zones established after that date. Thus, for newly established Buffer Zones, limited brushing will not be allowed. Only construction of a meandering path, designed according to SCE&G specifications, will be allowed through the Buffer Zone to provide access to the shoreline. This “no disturbance” policy will allow native vegetation to flourish and will protect and enhance the project’s scenic, recreational, and environmental values.

Back property owners who own land closer than 75 feet from the 360’ PD contour and wish to construct a dock along the shoreline are required to deed SCE&G so much of their property as to create a uniformly 75-foot deep Buffer Zone. The deeded land is subsequently subject to the environmentally protective measures and requirements outlined for Buffer Zones. Subject to meeting this condition, SCE&G will consider permitting a dock, if the property and dock meets all other permitting requirements. Dock permitting requirements and vegetation management on SCE&G-owned lands are explained in greater detail in the Permitting Handbook, and also in Appendix B and Section 9.3 of this document.

Management prescriptions regarding Buffer Zones were submitted as the Buffer Zone and Riparian Zone Management Plan (FERC Order issued August 8, 2007, 120 FERC ¶ 62,105). It provides details on management of Buffer Zones. The Buffer Zone and Riparian Zone Management Plan has since been revised from input from the TWC and is included as Appendix C for approval.

7.1.4 Future Development Prescriptions

Future Development lands are saleable real estate and, as such, fall under the responsibility of the SCE&G. As landowner, SCE&G retains the discretion to determine availability of parcels for sale on an individual basis, however, the lands are available for purchase only by the adjoining back property owner. Purchased Future Development lands will have non-development and vegetation management restrictions included in each deed. Also, SCE&G generally retains title to the Buffer Zone, adjacent to and on the lakeward side of Future Development lands.

Residential landowners whose property adjoins SCE&G Future Development lands may be issued a permit to construct an access to and from the lake by a single, 10 foot wide meandering path. However, SCE&G will not allow back property owners to encroach with shoreline improvements, cut any trees or shrubs, place any water-oriented encroachments (dock or ramp) or otherwise alter the lands without written consent from the Lake Management Department. SCE&G will initiate appropriate action to address violations. Enforcement of the SMP and consequences of violations are discussed in more detail in Section 11.0. An exception to the open access of parcels under this sub-classification is in the case of municipality operations involved with water withdrawal activities. These areas have restricted public access.

SCE&G may perform selective timber harvesting in Future Development areas. However, SCE&G maintains a no-cut policy within 100 ft of the 360' PD contour elevation. An exception may be made, with the approval of SCE&G, for the removal of dying or diseased trees and trees determined to pose a safety hazard to the public. This practice is to ensure a suitable buffer exists around the lake.

Figures displaying future development land management prescriptions are included as Figures 7.1-4 through 7.1-8 and described in more detail in the Permitting Handbook.

Figure 7.1-4: Land Management Prescriptions for Future Development Properties (a)

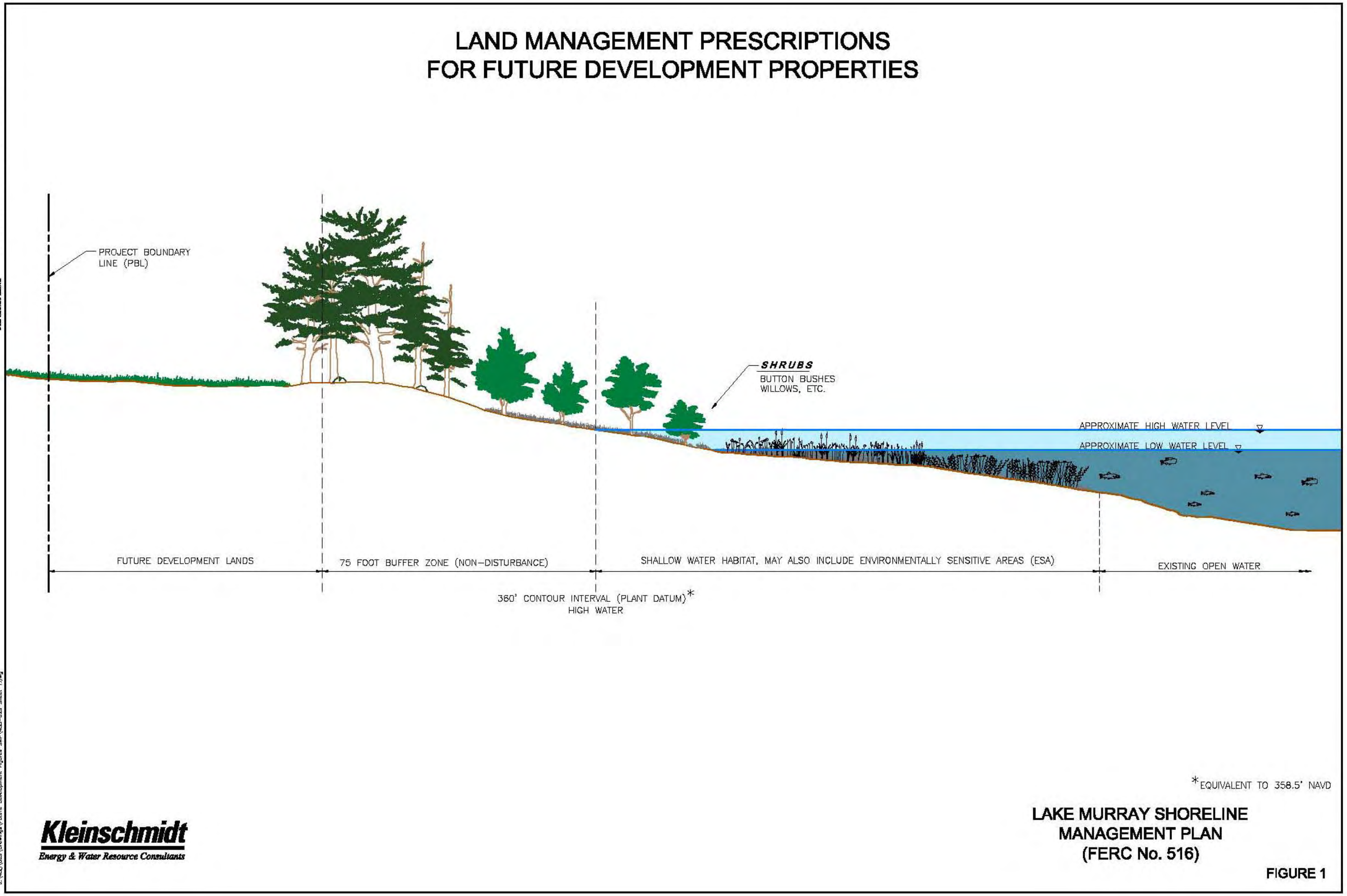


Figure 7.1-5: Land Management Prescription For Future Development Properties (b)

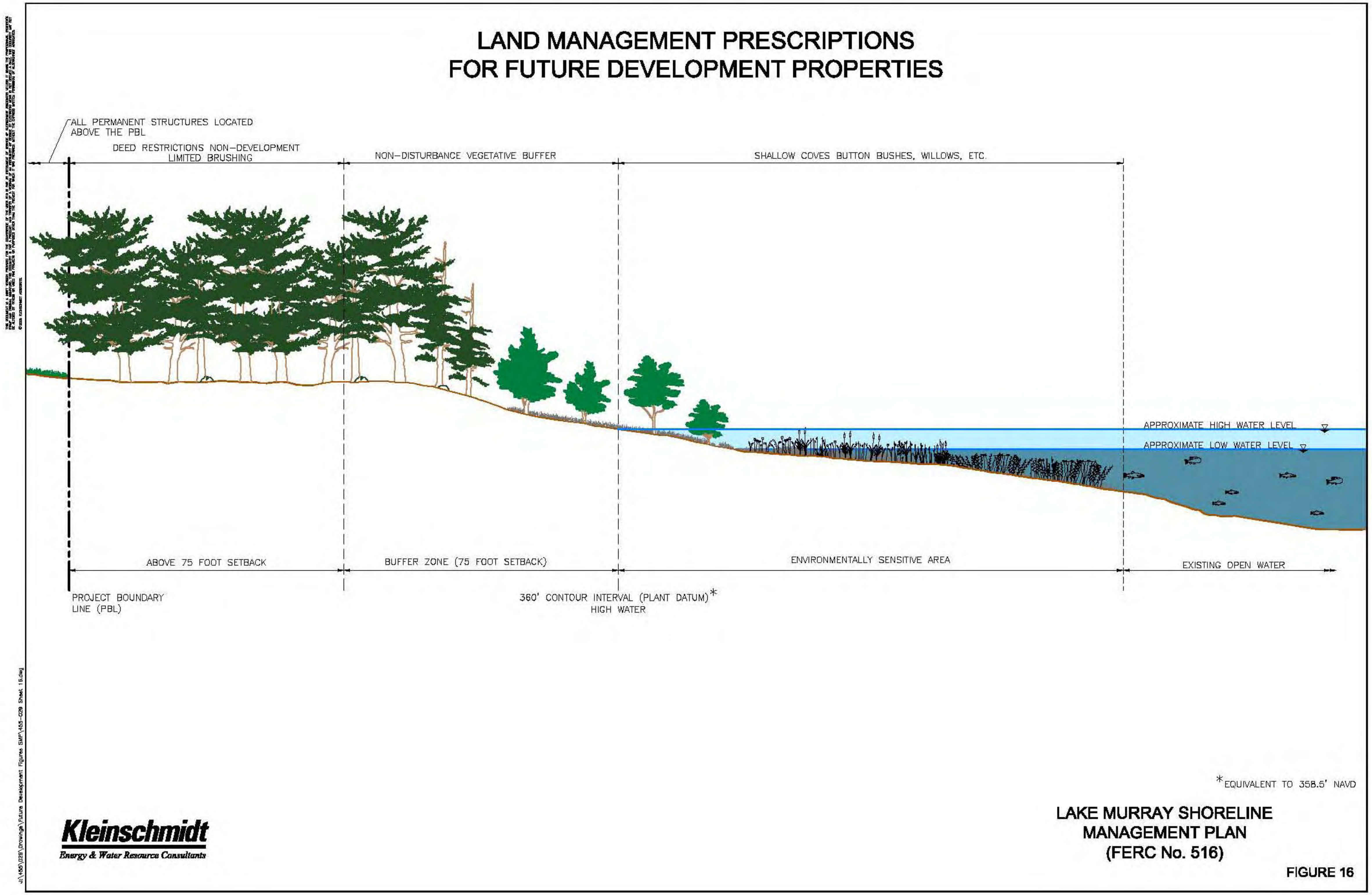


Figure 7.1-6: Land Management Prescriptions for Future Development Properties (c)

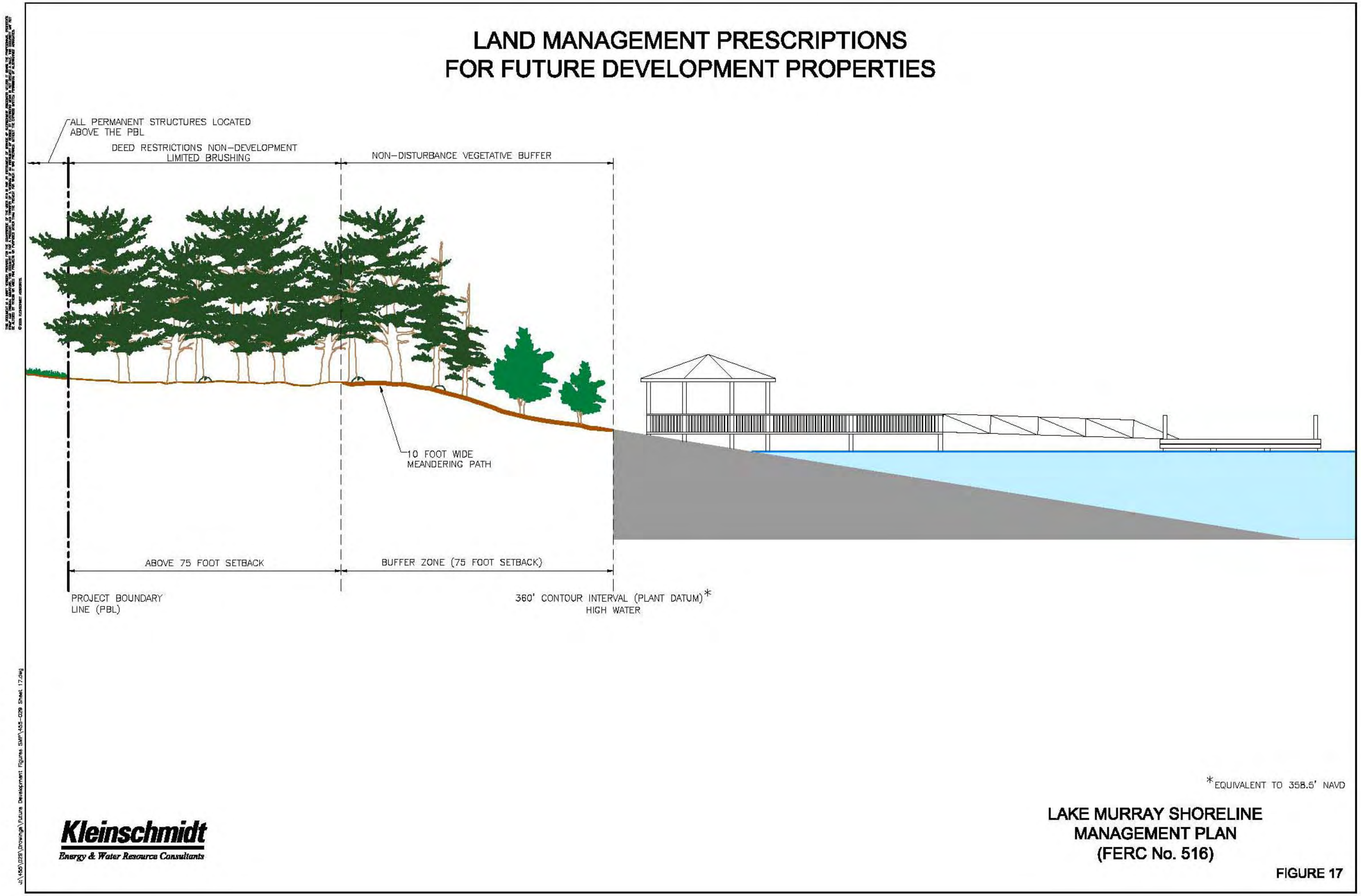


Figure 7.1-7: Typical Layout of Individual Docks on Future Development Properties

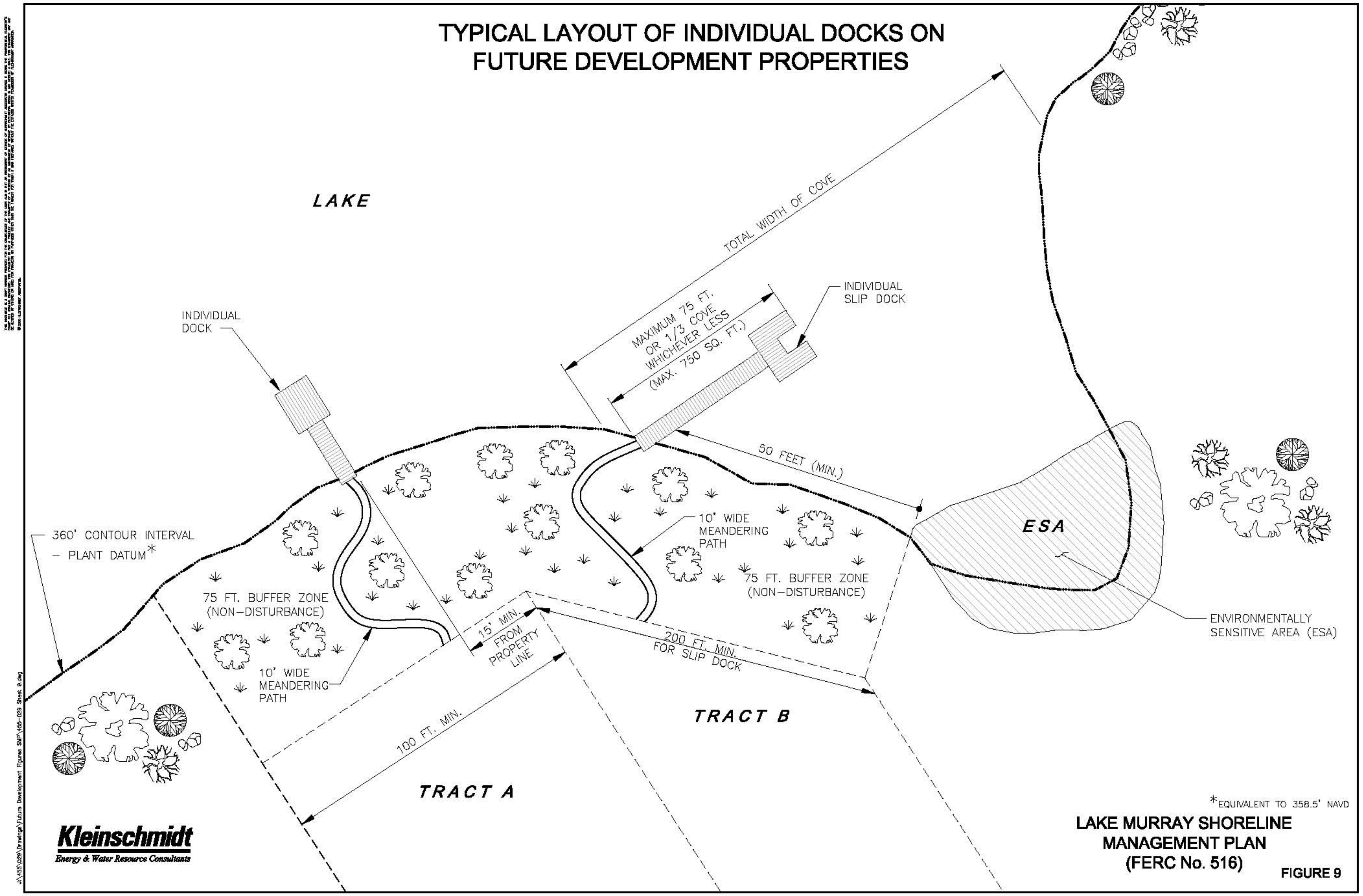
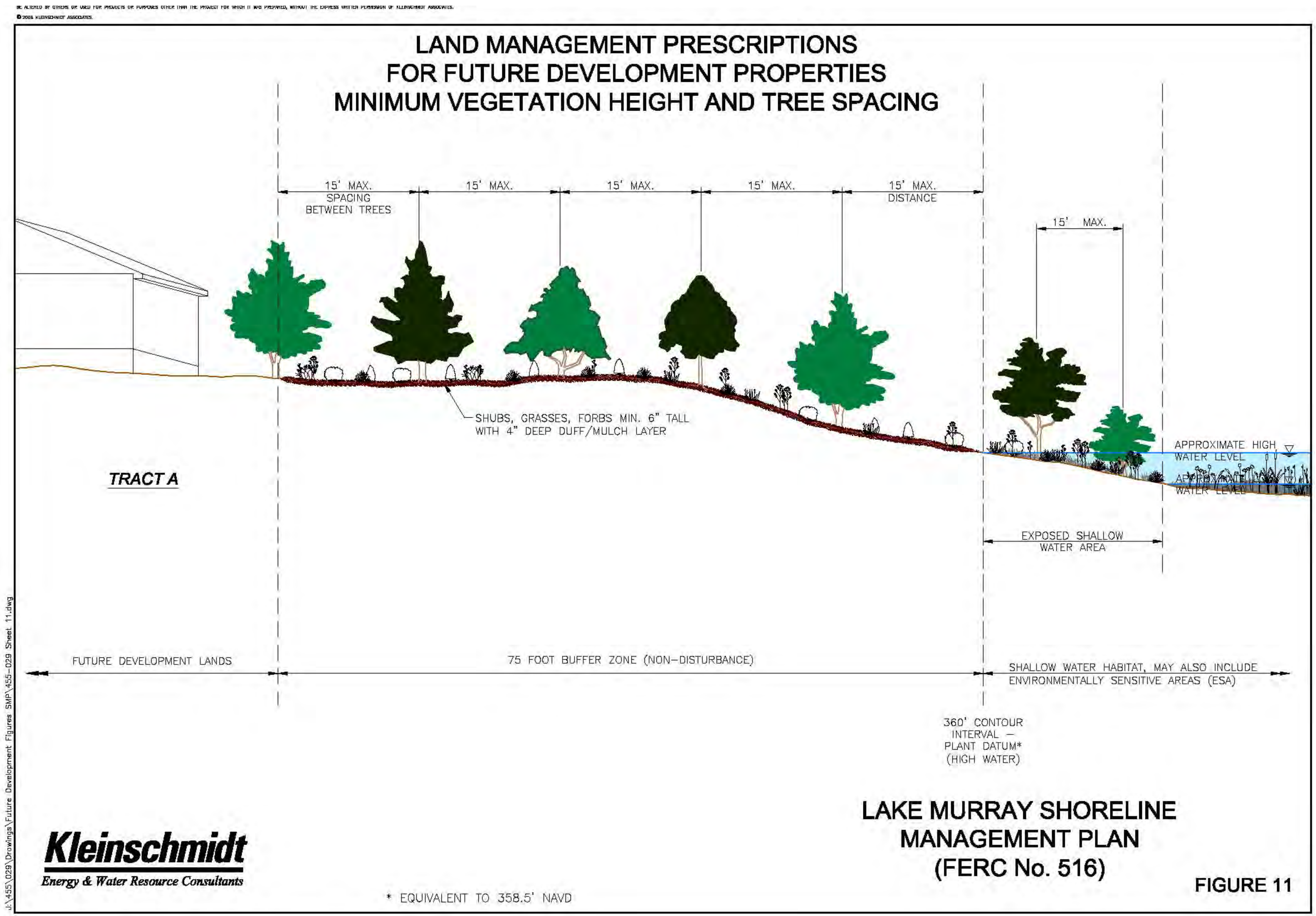


Figure 7.1-8: **Land Management Prescriptions for Future Development Properties - Minimum Vegetation Height and Tree Spacing**



7.2 Public Recreation Prescriptions

Project lands devoted to public recreation include developed parklands, properties set aside for future recreational development, and publicly available islands owned by SCE&G. SCE&G manages the areas individually based on the specific, designated recreational activities including swimming, fishing, picnicking, and boat launching. SCE&G designs and manages all areas to support public access to the lake. Dreher Island State Park is the only site that provides formal camping; however, individuals may also camp on SCE&G-owned islands and other lands such as Bundrick Island, River Bend, and Sunset (SCE&G, 2007). Camping on SCE&G-owned lands is limited to no more than seven consecutive days.

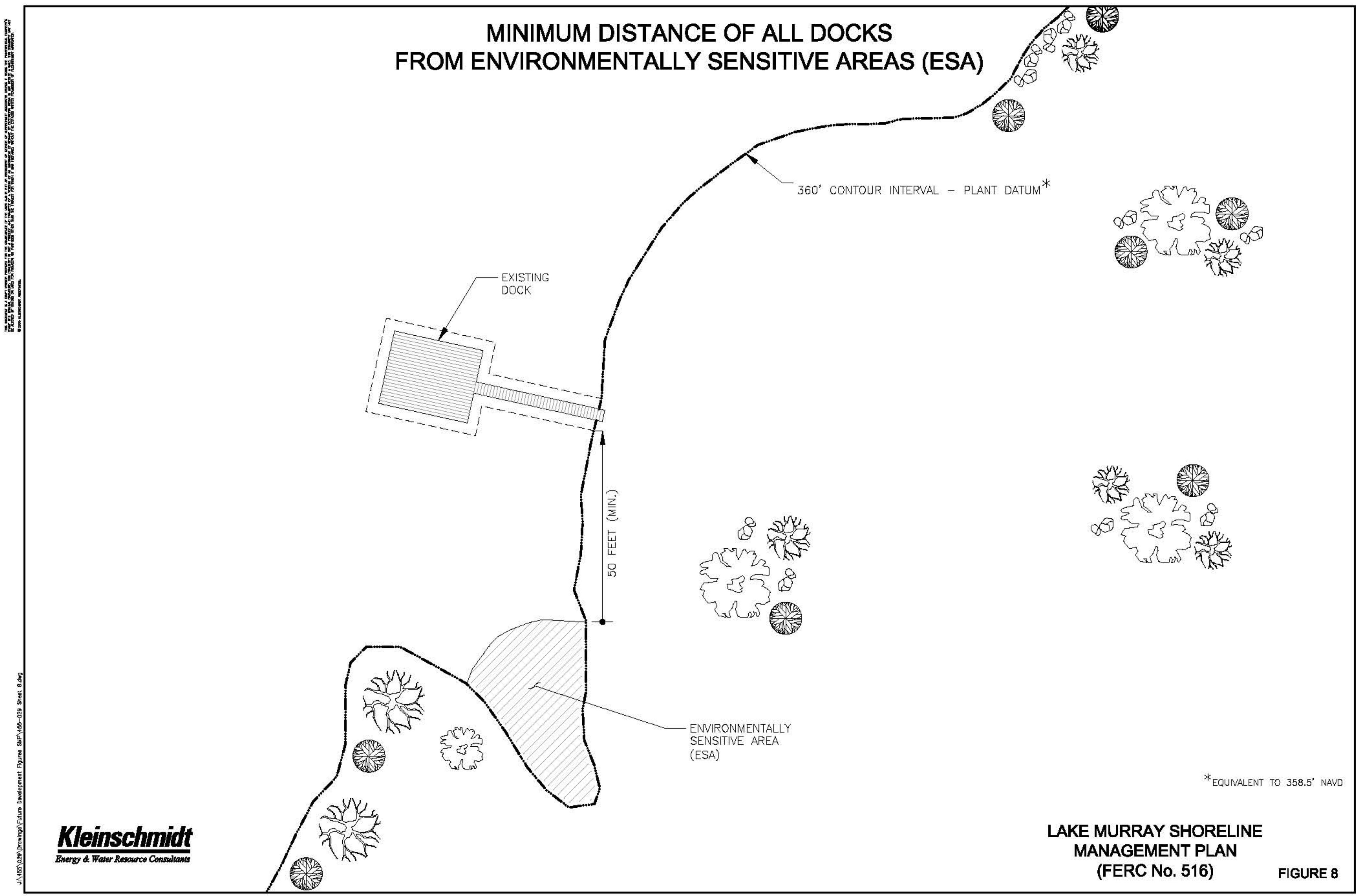
On its lands, SCE&G also manages forest resources that are available for public recreation although recreation is only one of several uses. All SCE&G forest resources are managed according to the South Carolina Forestry Commission's Best Management Practices. SCE&G does not allow logging in certain areas, such as cliffs, steep slopes, or atypical groups of trees.

7.3 Natural Areas Prescriptions

As described above, natural areas consist of lands that warrant special protection because they provide important habitat for various wildlife species, including the recreational fishery. Large wetland areas, areas having cultural and/or historical significance, and Environmentally Sensitive Areas (ESAs) also are included in the natural areas classification and are protected. ESAs consist of habitat areas known to be occupied by rare, threatened, or endangered species; rare or exemplary natural communities; significant land forms or geological features; wetlands and shallow coves; and other areas determined to be critical to the continued existence of native species, such as spawning and nesting habitat.

Natural Areas are not available for sale. Docks, excavations, or shoreline activities that require permits are not allowed in these areas. In addition, ESAs have a 50-foot natural Buffer Zone designated around them (Figure 7.3-1). SCE&G prohibits clearing of vegetation within ESAs or within the associated buffer.

Figure 7.3-1: Minimum Distance of All Docks From ESA's



7.4 Project Operations Prescriptions

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.

7.5 Shoreline Structures

Back property owners that desire access to, or wish to construct shoreline structures such as docks, boat ramps, and multi-slips may apply for a permit through SCE&G's permitting program. SCE&G may allow such structures but strictly regulates their placement and construction.

To address aspects of shoreline structures, SCE&G has developed permitting application procedures and associated dock specifications guidelines. These guidelines are summarized in Section 9.0 and are detailed in SCE&G's Shoreline Permitting Handbook.

8.0 ACTIVITIES AND STRUCTURES PERMITTED WITH SCE&G APPROVAL

Through its permitting program, SCE&G maintains a strong commitment to managing the Lake Murray shoreline for multiple resources by considering the impact of various activities on the environmental, aesthetic, and recreational character of the lands. As a result of careful consideration, they have determined the following activities and structures to be compatible with the goals of the Shoreline Management Program. The activities consist of items requiring SCE&G approval through the permitting program.

<u>Activities/Structures Requiring SCE&G Approval Through the Shoreline Permitting Program:</u>

- Construction or modifications to docks
- Boat ramps
- Marine railways
- Boat lifts
- Erosion Control Methods (including rip-rap, bio-engineering, and retaining walls)
- Limited brushing
- Commercial and residential water withdrawals (for irrigation only) that require shoreline structures for water access

9.0 EVALUATION PROCESS FOR NEW SHORELINE FACILITIES OR ACTIVITIES

Property owners considering new shoreline facilities or activities within the Project boundary will follow a standard procedure for initiating, permitting, and completing their proposed projects. These procedures are described in depth in SCE&G's Permitting Handbook, which was developed by the Lake and Land Management TWC to support the SMP (available at www.sceg.com/en/my-community/lake-murray/lake-management or by calling (803) 217-9221). The Permitting Handbook is the framework for the General Permit, and as such must go through the public review process and be approved by SCDNR.

As described in Section 6.0, land management classifications and their distribution around the Lake Murray shoreline have been identified, defined, and mapped. Further, there are associated management prescriptions for each classification that help guide its development and land use. In order to carry out a project, the project proponents must obtain the following information:

- Land management classification and management prescriptions for the proposed project location;
- Types of shoreline facilities and activities allowed and prohibited at the proposed project location; and
- Relevant permitting procedures for their project.

9.1 Land Management Classification of Proposed Project Location

The first step a project applicant must take in planning a new shoreline facility/activity is to determine the land management classification for their proposed project location. The location must be proposed in a Multi-purpose or Public Recreation classification as new developments are not permitted in either Project Operations or Natural Area classifications. Property locations have been mapped according to land management classification, which are available from the SCE&G Lake Management Department, to assist project proponents in this first step. The maps will show whether the location is in a Buffer Zone or below the 360’ PD contour, and thus subject to specific regulations. Project proponents are urged to consult the maps early in the planning stage to determine where the subject property is in relation to protected environmental resources and other land management types. The Lake Management Department will provide assistance in understanding the type, location, and specific requirements for proposed shoreline facilities and activities.

If a proposed facility/activity is intended to support a commercial use, and meets SCE&G permitting requirements, FERC regulation will require that additional analysis be undertaken prior to assessing conformity of use and may require FERC review and approval. In deciding whether or not to approve such commercial applications, FERC may require that the project proponent show that the project will meet certain criteria. Such criteria include, but are not limited to, showing that the project will not be a detriment to general public safety or navigation, that it will not contribute to new or ongoing shoreline soil erosion, that it will be aesthetically blended with surrounding uses, and that it will be environmentally defensible. It is the responsibility of the commercial project applicant to provide SCE&G with all information necessary for its application to the FERC.

9.2 Allowable and Prohibited Facilities and Uses for Proposed Project Location

After determining the land management classification of the subject property, the project proponent must determine what type of facility or activity defines their project and whether it is allowed at the proposed location. Some activities may be allowed within a specific land management classification, but not at the precise location proposed. For example, development is not allowed within the Buffer Zone on properties sold after 1984 (as described in Section 7.0).

Most new projects can be grouped according to the most commonly permitted activity. Although many projects will fall into one category, some may include facilities or activities that fall into more than one. In such cases, further clarification and review may be necessary to establish whether a particular facility or activity is allowed at the proposed location. In general, most proposed shoreline facilities and activities fall into one of the following activities types:

- *Construction and modification of docks* - These activities include all new dock installations (both floating and pier supported) as well as any modifications to the size, shape, or location of existing structures.
- *Bank stabilization* - Bank stabilization to prevent shoreline erosion and slumping may include rip-rap, or bioengineered methods such as plantings. Shoreline stabilization techniques are discussed in Appendix D.
- *Excavation* - Removal of materials/soils from the lakebed; typically performed during drawdowns.
- *Atypical erosion control activities* - Areas undergoing unusual or unanticipated erosion that may require special attention or stabilization efforts. Identified erosion areas will be addressed on a case by case basis.
- *Landscape modification/enhancements (including limited incidental clearing of vegetation on Project land adjacent to private properties)* - Subject to conditions that will be specified in the permit, SCE&G may permit limited clearing of brush or vegetation from Project shoreline lands for the above activities.

9.3 Shoreline Permitting Procedures

SCE&G operates its shoreline permitting activities under a general permit issued by the US Corps of Engineers and the South Carolina Department of Health and Environmental Control. This permit authorizes SCE&G to be the residential permitting authority on Lake Murray. Project proponents must obtain the proper permit(s), per the SCE&G's Shoreline Permitting Program, prior to the initiation of any construction or activity on the Lake Murray shoreline, which consists of the lands below the 360' PD contour interval or designated Buffer Zones. In addition, some activities also have local, state, and/or federal permit requirements.

Different uses of project lands have different associated permit and review processes, as defined by the Standard Land Use Article contained in SCE&G's FERC license. FERC has delegated to SCE&G the authority to review and approve certain types of uses such as those that involve relatively routine activities, such as docks, and erosion control. Uses that involve the conveyance of easements, right-of-ways, or leases and include uses such as the replacement or maintenance of bridges and roads; storm drains and water mains; telephone, gas, and electric distribution lines; minor access roads; and other similar activities require consultation with the appropriate state and federal agencies, and can ultimately be approved by SCE&G after these reviews and consultations are complete. Finally, uses that involve the conveyance of fee title, easements or right-of-ways, and leases, and typically include more substantial activities such as the construction of new roads and bridges, sewer lines that discharge into project waters, marinas, and other similar uses also require review by SCE&G and consultation with the appropriate local, state, and federal agencies, but also must be submitted to the FERC for their review.

Whether the non-project use is approved under the Standard Land Use article or through prior FERC approval, SCE&G is responsible for ensuring that the use is consistent with the purposes of protecting or enhancing the scenic, recreational, and other environmental values of the project. To assist project proponents in the permitting process, the staff at the SCE&G Lake Management Department is available to answer questions regarding documentation, permits, and specification requirements for their particular project. Specifically, permits are required for the following activities or to construct/modify the following structures:

- perform limited brushing in Buffer Zones and below 360' PD contour where an approved dock will be located;
- remove lake water (for irrigation purposes only);
- excavate soil/earth;
- apply shoreline stabilization;
- install rip-rap;
- install retaining walls;

- install docks;
- install ramps;
- install marine railways; and
- install boat lifts.

It is advisable to begin the consultation process with SCE&G Lake Management staff at the conceptual stage of larger complex or resource-sensitive projects. SCE&G staff are available to address inquiries regarding the location of specific resources and the proximity of proposed new facilities or activities. SCE&G staff will also be able to discuss specific permitting requirements with the property owner. Depending on the proposed new facility or activity, local, state and federal resource agencies may impose requirements on construction start/stop dates, the placement of erosion control devices, treatment plans, remedial measures, submittal of start construction notifications, and/or best management practices. Any permit applicant should be aware of such conditions, as violations may nullify a permit.

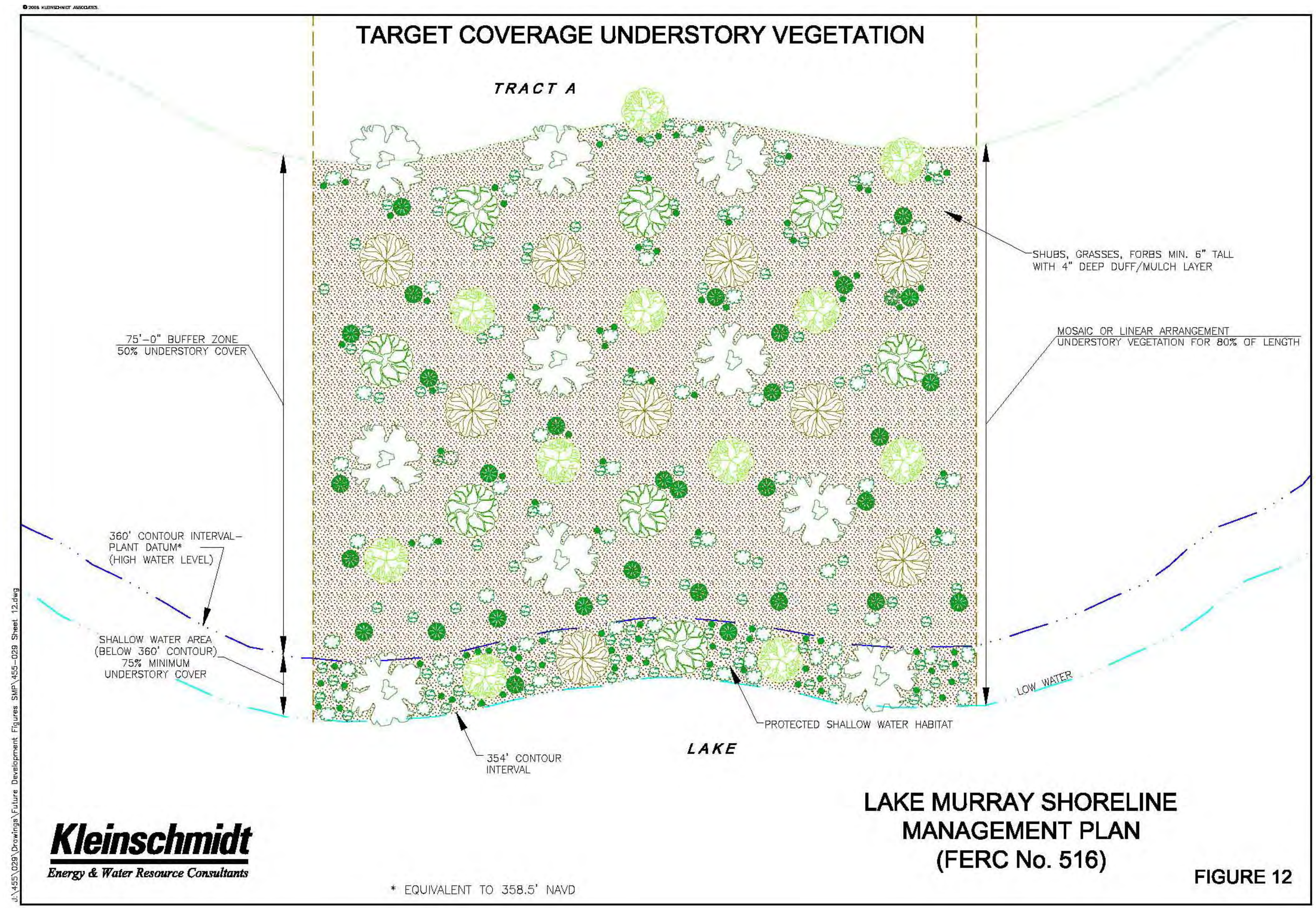
A summary of permits required to perform the above listed activities or construct/modify structures are summarized below. Detailed information on SCE&G's Shoreline Permitting Program, which includes the permitting process, guidelines, and specifications, are provided in SCE&G's Shoreline Permitting Handbook (available at www.sceg.com/en/my-community/lake-murray/lake-management or by calling (803) 217-9221).

9.3.1 Limited Brushing Below 360' PD Contour or in Buffer Zones

In general, SCE&G maintains a policy of non-disturbance of any vegetation below the 360' PD contour or within a Buffer Zone without approval from SCE&G. Furthermore, for Buffer Zones established after approval of the 2007 SMP, limited brushing will not be allowed and SCE&G will implement a **non-disturbance** policy. In some cases, however, limited brushing of adjacent properties by the back property owner will be allowed to remove exotic and invasive vegetation that occurs adjacent to their property.

Permission will only be granted by SCE&G Lake Management after a site visit with the applicant to assess the need for brushing. Once limited brushing is completed according to the permit, the applicant may maintain the site in said condition. However, back property owners are encouraged to allow native vegetation to flourish (See Appendix B for more detailed information on limited brushing regulations and Figure 9.3-1 for an example of target coverage for understory vegetation).

Figure 9.3-1: Target Coverage for Understory Vegetation



9.3.2 Woody Debris & Stump Management

In 2006, in accordance with FERC requirements (FERC, 2004), SCE&G developed and filed a plan for managing woody debris below the 360' PD contour of Lake Murray for fish habitat restoration and public safety. The plan was subsequently approved by FERC (117 FERC ¶ 62,213). During the current relicensing process, the plan was revised by the Lake and Land Management TWC. The revised plan is included as Appendix A.

As a baseline, SCE&G maintains a policy of no disturbance for any woody debris. However, woody debris may pose a boating hazard or be an impediment to navigation. Also, debris just below water level, particularly stumps, can pose serious safety risks, especially during recreation performed at high speeds such as with water skiing and jet skiing, or with activities such as swimming, where jumping from fixed or floating facilities such as docks might occur. Consideration for safety and navigation is a priority and so selective woody debris removal may be approved if it is judged necessary to remedy safety or navigation concerns. In such case, the hazardous woody debris must be reviewed by SCE&G's Lake Management Department personnel, who may permit the removal of only the portion of woody debris that poses the concern (the remaining woody debris must be left intact). A copy of the Woody Debris and Stump Management Plan is contained in Appendix A.

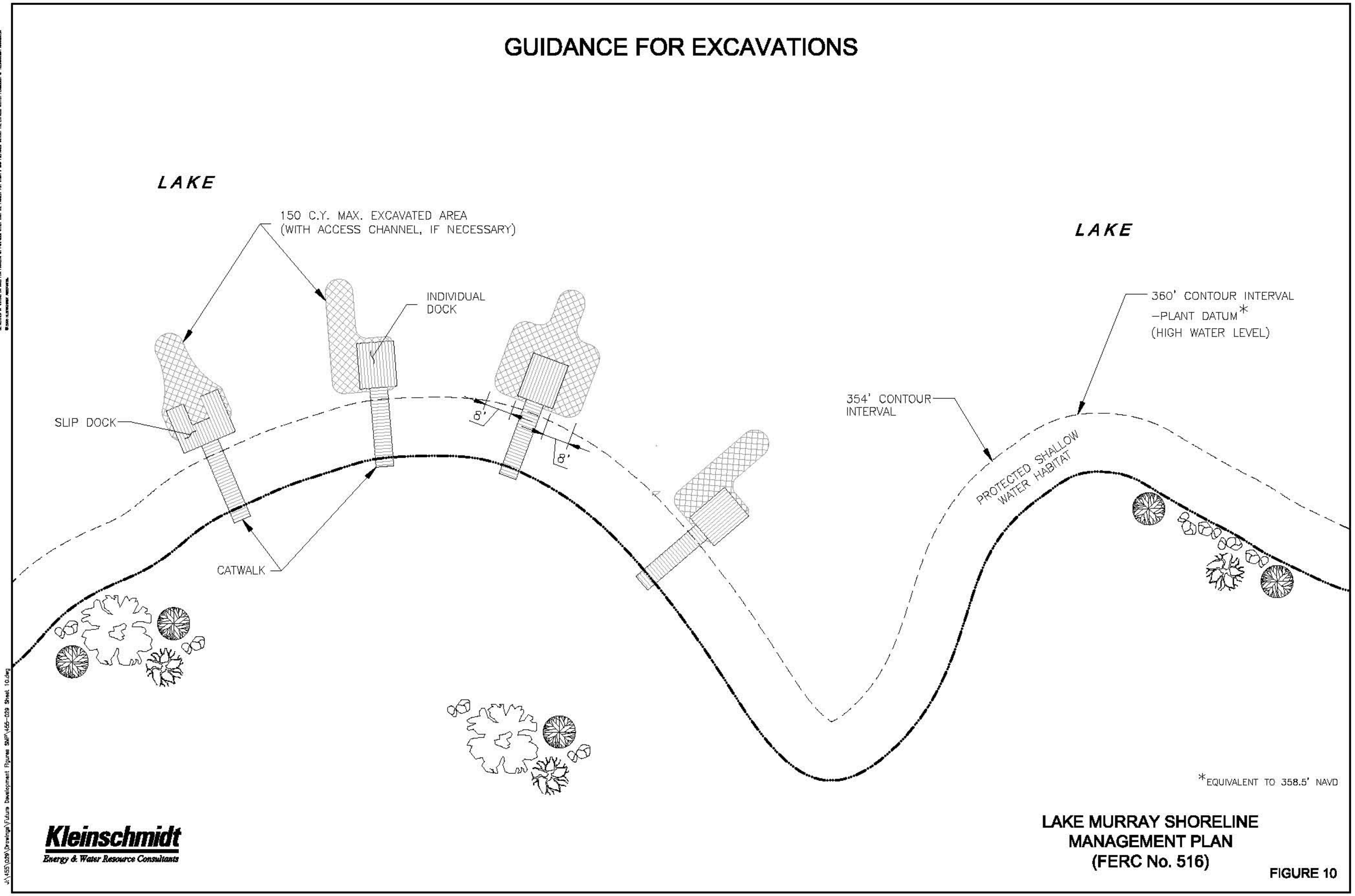
9.3.3 Residential & Commercial Water Withdrawals

Commercial and residential water withdrawals that require piping and other delivering equipment placed along the shoreline or in the littoral zone fall under the management of this SMP. Water removal permits for residential property will be for irrigation purposes only. Applications for a commercial permit to remove water must be submitted to SCE&G for review. Large commercial water withdrawal applications will be forwarded to the FERC for approval. SCE&G may authorize water withdrawals up to 1 million gallons per day (MGD) without the requirement of FERC approval. SCE&G will impose limits in granting permits for approved applications (see Permitting Handbook). The applicant will be required to bear the expenses of filing the application and to compensate SCE&G for water withdrawn. SCE&G reserves the right to prohibit irrigation during times of drought or water drawdown.

9.3.4 Excavation

Because eroded soil from construction and other activities can threaten the lake's aquatic and shoreline environments, as well as the watershed, SCE&G monitors excavation activities by requiring a permit be obtained for work performed below the 360' PD contour. All authorized excavations must be in accordance with SCE&G specifications and requirements, which may include an environmental assessment plan or report. Any permitted excavation work must meet the specifications outlined in the Permitting Handbook. Figure 9.3-2 also depicts general guidance for excavations.

Figure 9.3-2: Guidance for Excavations



9.3.5 Bank Stabilization

All shoreline stabilization efforts within the 360’ PD contour must be approved in writing by SCE&G Lake Management and all necessary governmental permits must be obtained prior to implementation. Bioengineering methods of stabilization are preferred, however, rip-rap or possibly retaining walls may be approved to resolve serious erosion problems. Regardless of techniques proposed, prior approval of work by SCE&G is required. More information on bank stabilization is provided in Section 12.0.

9.3.6 Docks

A permit must be obtained for the creation, replacement, or addition of any dock. At a minimum, dock construction is not to create a nuisance, or otherwise be incompatible with overall Project recreation use. Impact on navigation will be a strong determining factor. These types of docks include private individual, private common, community access areas, private multi-slip, and commercial public marinas. Figures describing permitting policies for docks are included below (Figures 9.3-3 through 9.3-11). See Permitting Handbook for more details.

Figure 9.3-3: Permanent Structures Located Above PBL for Individual Docks

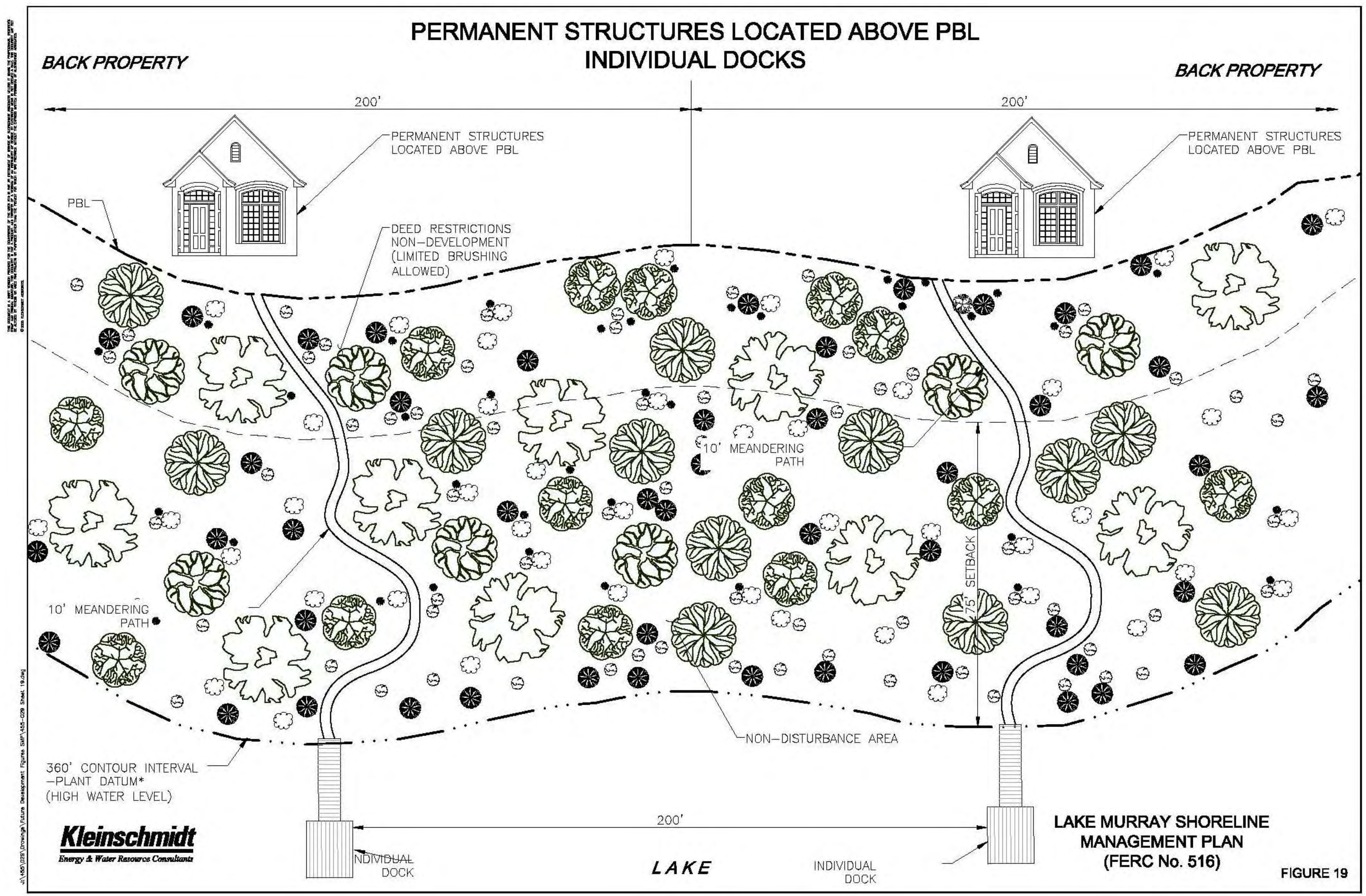


Figure 9.3-4: Example of Common Dock Layout

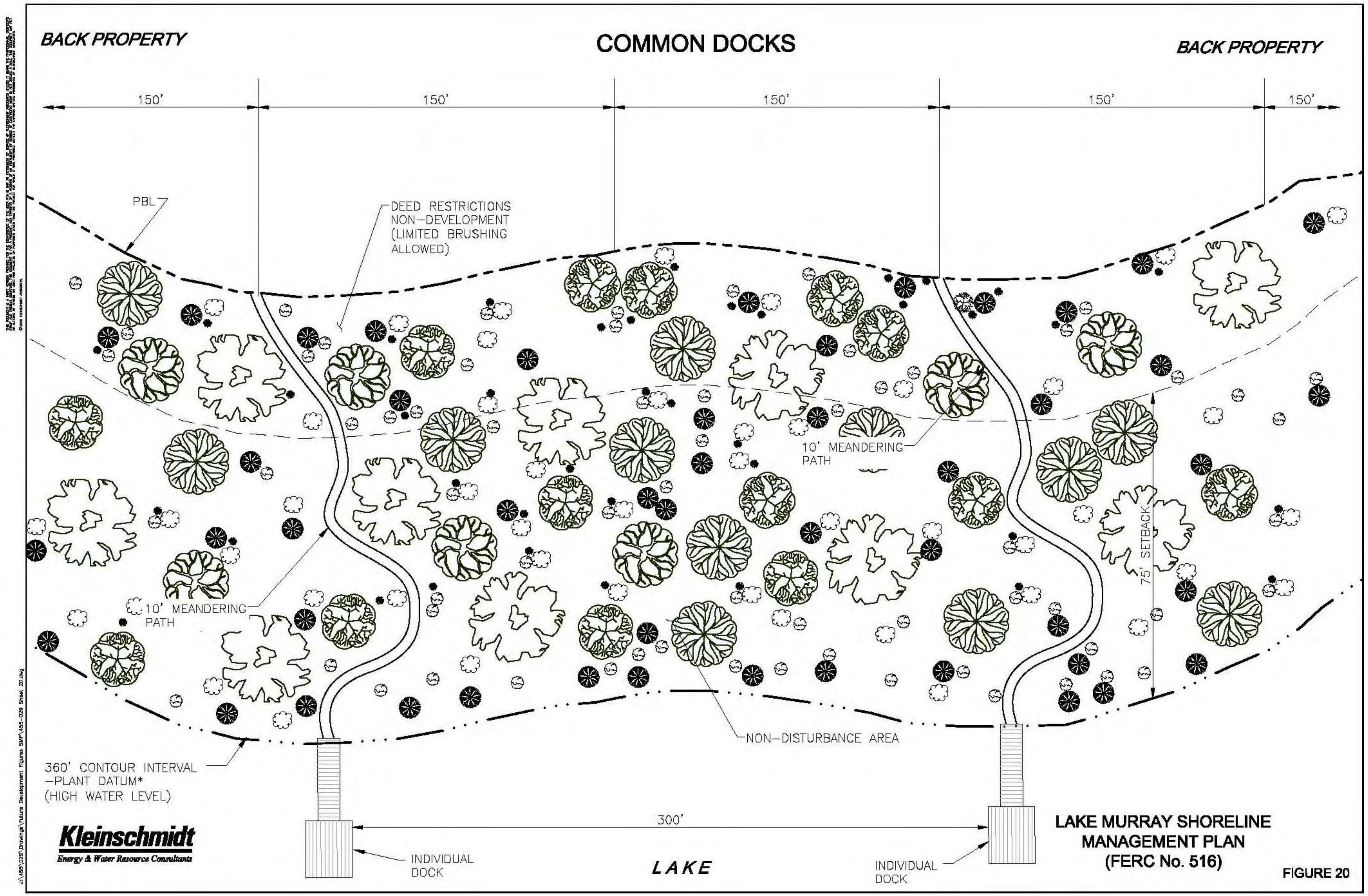


Figure 9.3-5: Clearances in Coves for Common Docks

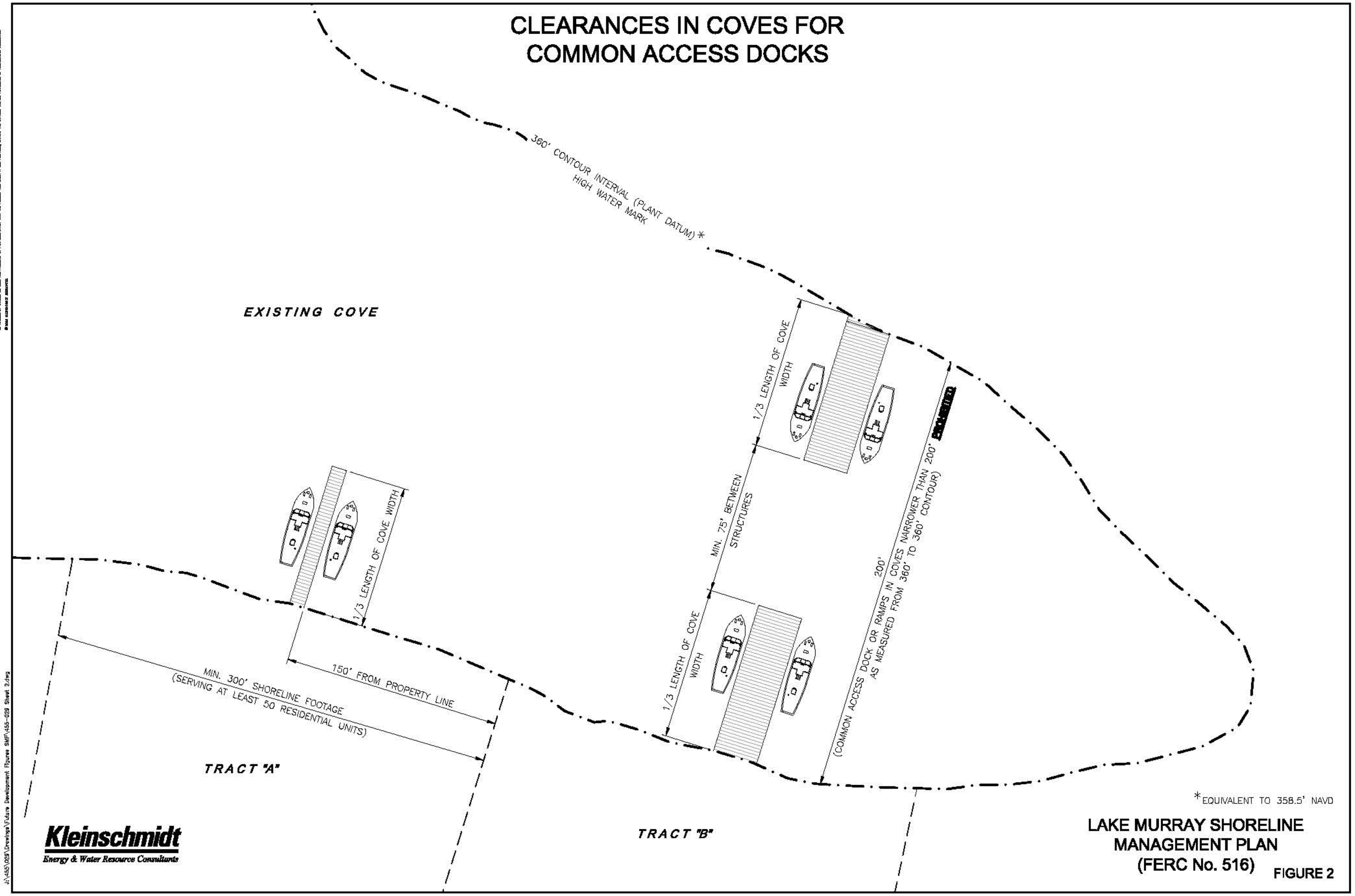


Figure 9.3-6: Example of Community Boat Ramp and Courtesy Dock

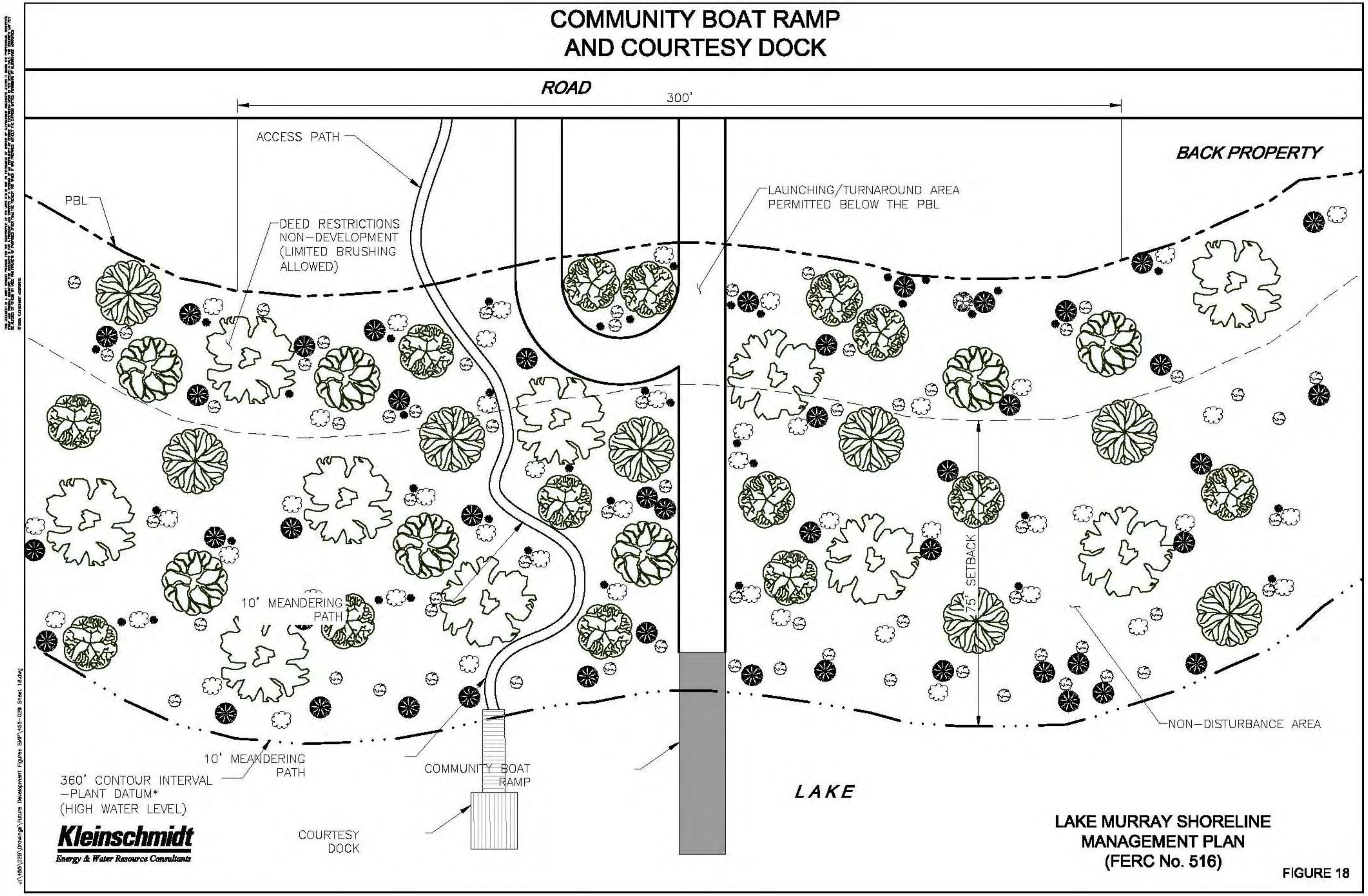


Figure 9.3-7: Example of Multi-slip Dock Layout

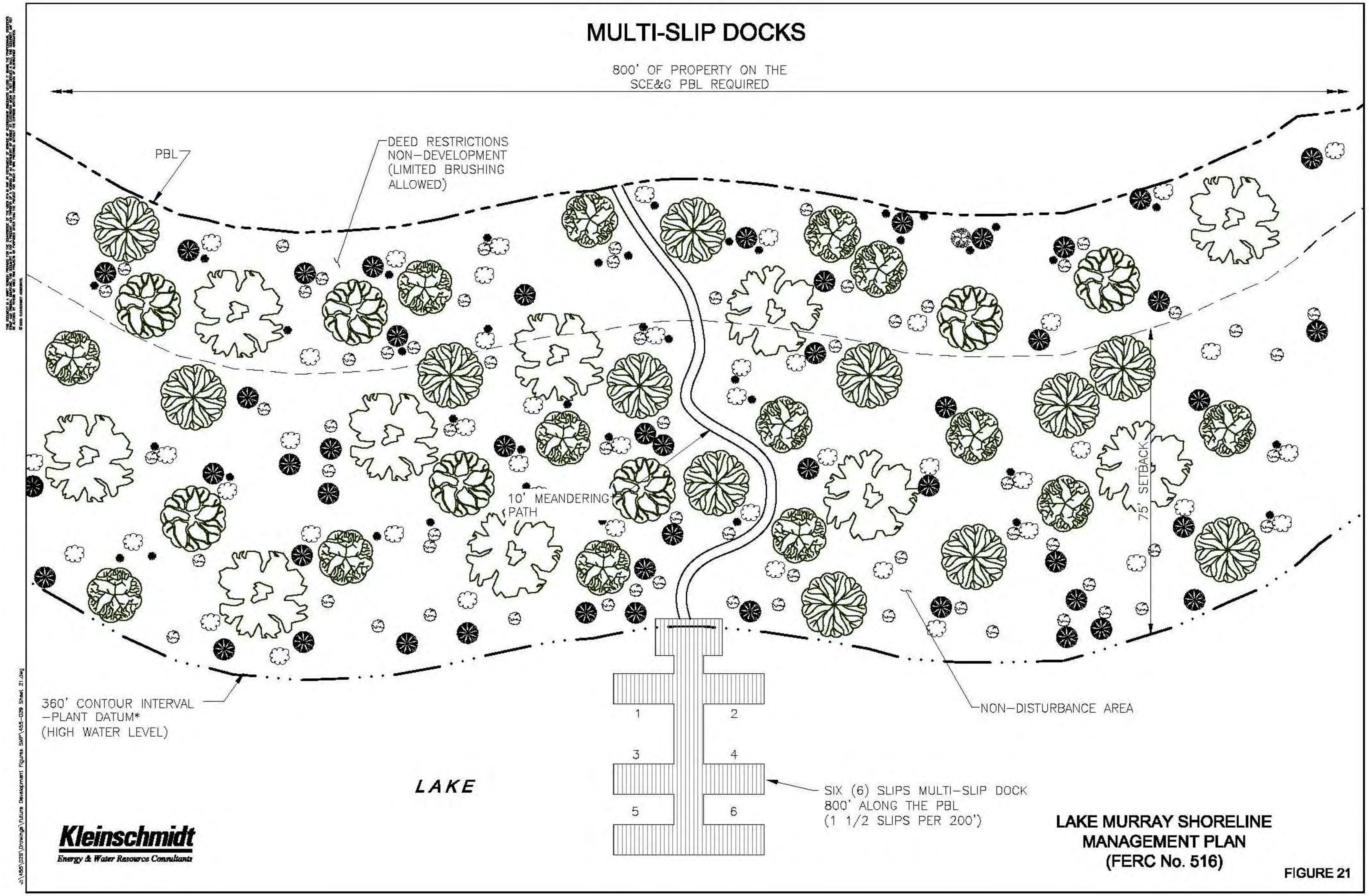


Figure 9.3-8: Potential Layout for Commercial Marina Facility Accommodating 20 or Fewer Watercraft

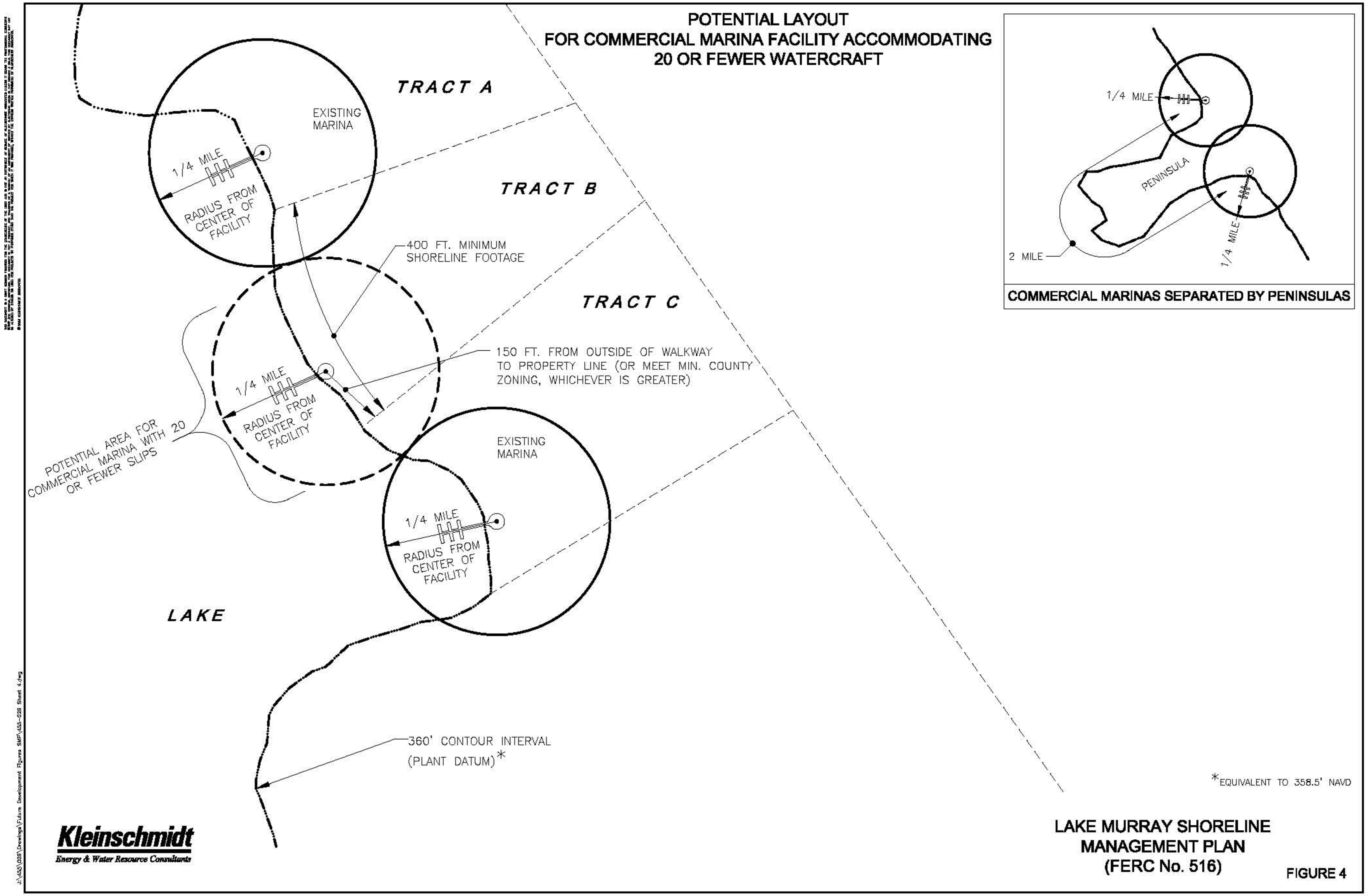


Figure 9.3-9: Potential Layout for Commercial Marina Facility Accommodating 21 to 100 Watercraft

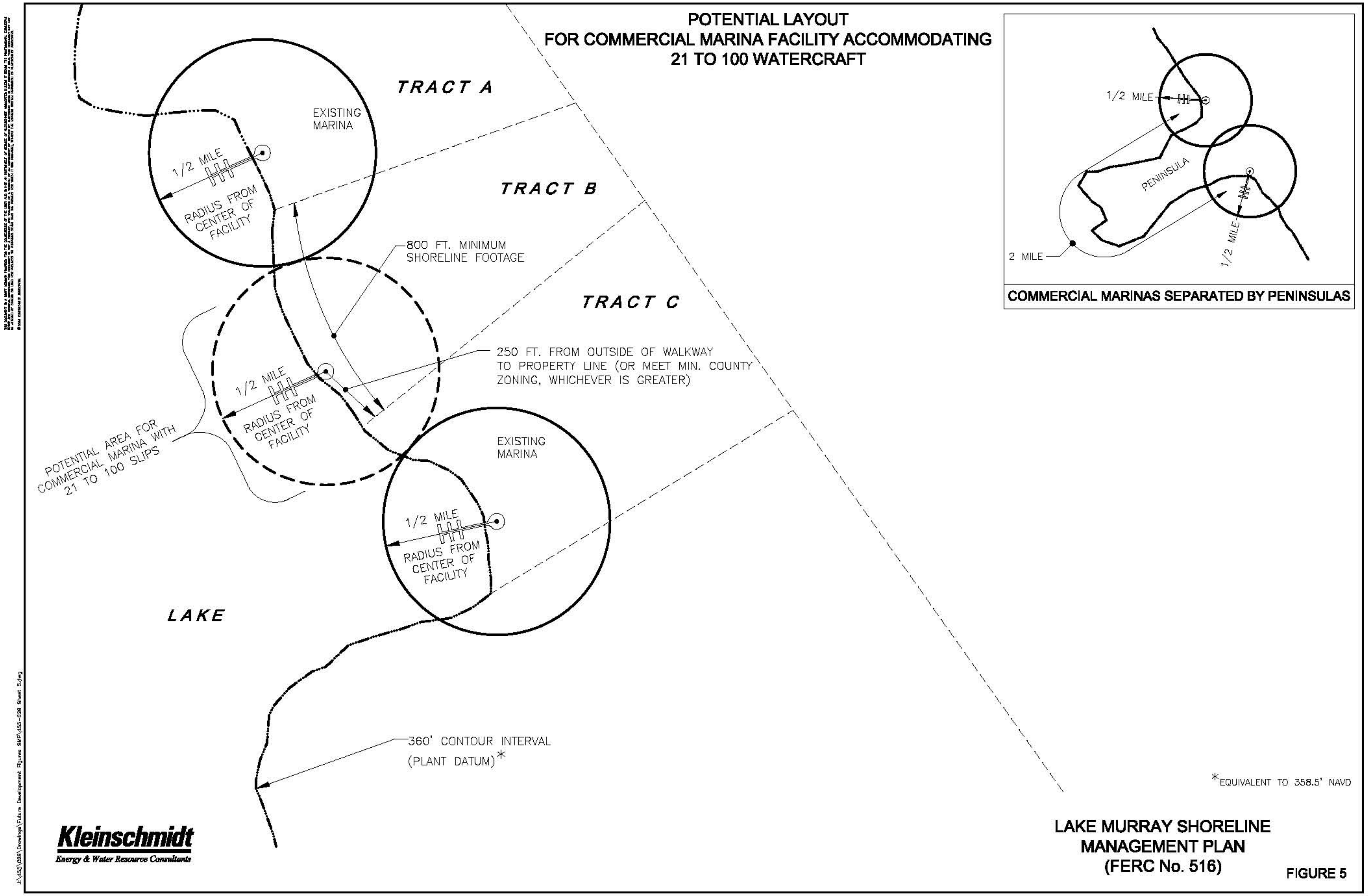


Figure 9.3-10: Potential Layout for Commercial Marina Facility Accommodating 101 to 250 Watercraft

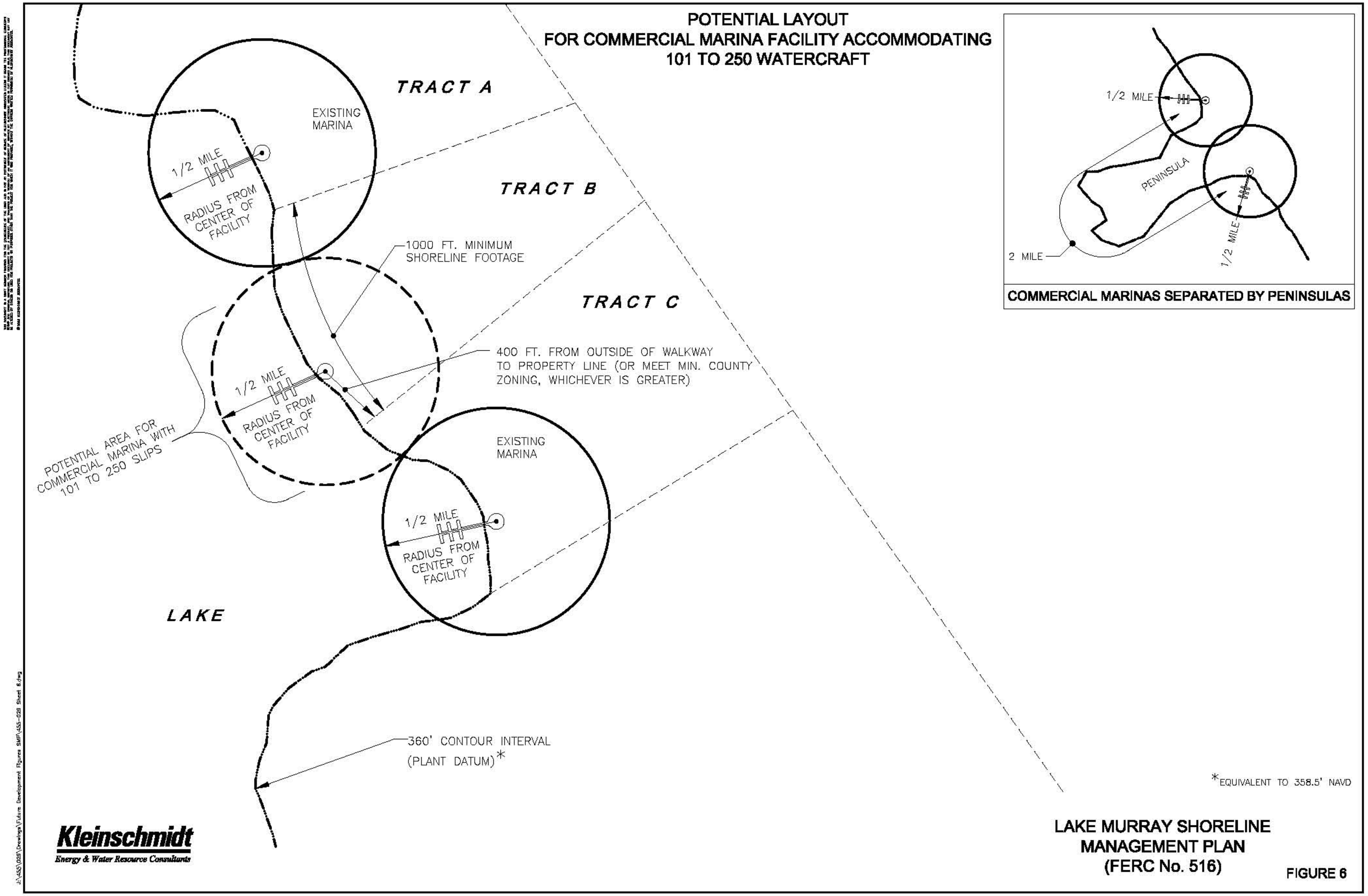
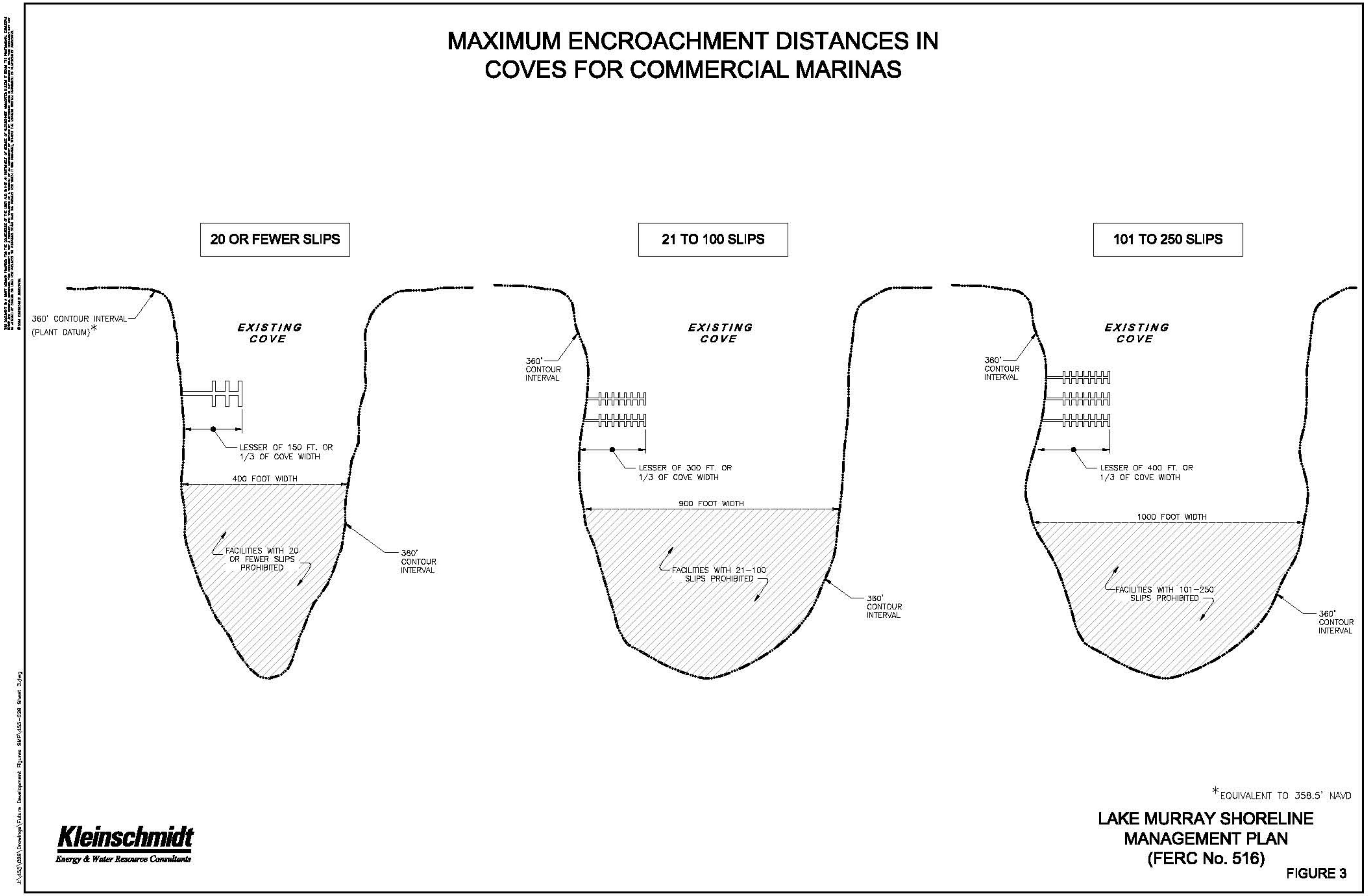


Figure 9.3-11: Maximum Encroachment Distances in Coves for Commercial Marina Facilities



9.3.7 Boat Ramps, Boat Lifts, Marine Railways, Etc.

A permit application must be submitted to SCE&G for the construction or modification of boat ramps, boat lifts, personal watercraft lifts and/or marine railways. SCE&G encourages the use of boat ramps at public and semi-public facilities versus construction of private ramps. No individual boat ramps will be permitted on Buffer Zone property and where a subdivision has a common access area with a ramp.

10.0 SCE&G PERMITTING FEE POLICIES

FERC allows SCE&G the right to charge a reasonable fee to cover the costs of administering its Shoreline Permitting Program, which adds significant management responsibilities and costs to SCE&G's operation. This will ensure that activities occurring on Project lands are consistent with the overall goals for the project. Such fees can be a one-time or annual cost.

SCE&G will give adequate public notice through appropriate communication avenues before changing the fee structure. Failure to comply with this policy may result in the revocation of existing permits, fines, or legal action, as well as loss of consideration for future permits.

11.0 ENFORCEMENT OF SHORELINE MANAGEMENT PLAN

11.1 Violations of Shoreline Management Plan

SCE&G conducts annual surveys of the land below the 360’ PD contour to inventory and inspect docks built and permitted throughout the year. They also make note of unauthorized structures and urge residents and other lake visitors to report what they believe may be unauthorized activity below the 360’ PD contour as well as in Buffer Zones. If one believes that an activity that violates the Shoreline Management Plan is occurring, one should contact SCE&G Lake Management at (803) 217-9221.

SCE&G Lake Management representatives will issue Stop Work Directives for any violations detected on SCE&G property. Any unauthorized clearing of the trees or underbrush will result in the immediate cancellation of an individual’s dock permit as well as possible legal action to require re-vegetation of the affected area. Removal of merchantable timber will require reimbursement to SCE&G subject to valuation of the Forestry Operations Department. Additionally, consequences for violations may include legal action, fines, and loss of consideration for future permits.

12.0 BEST MANAGEMENT PRACTICES

In its ongoing commitment to protect natural resources at the Project, SCE&G actively supports programs to protect and improve the Lake Murray shoreline through the use of Best Management Practices (BMPs). BMPs are actions taken to lessen potential impacts to a particular resource resulting from its direct or indirect use. SCE&G has developed several management plans designed to preserve the health of the shoreline, and they also promote the use of BMPs through their Shoreline Permitting Program, which has been discussed previously in Section 9.3. In addition, SCE&G encourages property owners to protect the shoreline by incorporating voluntary BMPs. Below are management plans that support SCE&G's goal to employ greater use of BMPs as well as voluntary landowner-recommended BMPs.

12.1 SCE&G Shoreline Management

12.1.1 Shoreline Permitting Program

As described previously, SCE&G maintains a Shoreline Permitting Program as a means to monitor and regulate development and other activities along the Lake Murray shoreline. As a part of its permitting process, SCE&G requires that BMPs be employed when a permit recipient seeks to construct or perform any permitted activity or development. In particular, permits and consultation with SCE&G are required to build structures, perform excavation, apply any erosion control means, or remove vegetation or woody debris below the 360' PD contour and in Buffer Zones. If activities such as these are not carried out carefully, they can threaten shoreline and lake resources through soil erosion, water pollution, and habitat degradation. Removal of vegetation and woody debris weakens shoreline stability and eliminates valuable wildlife habitat.

12.1.2 Erosion Control

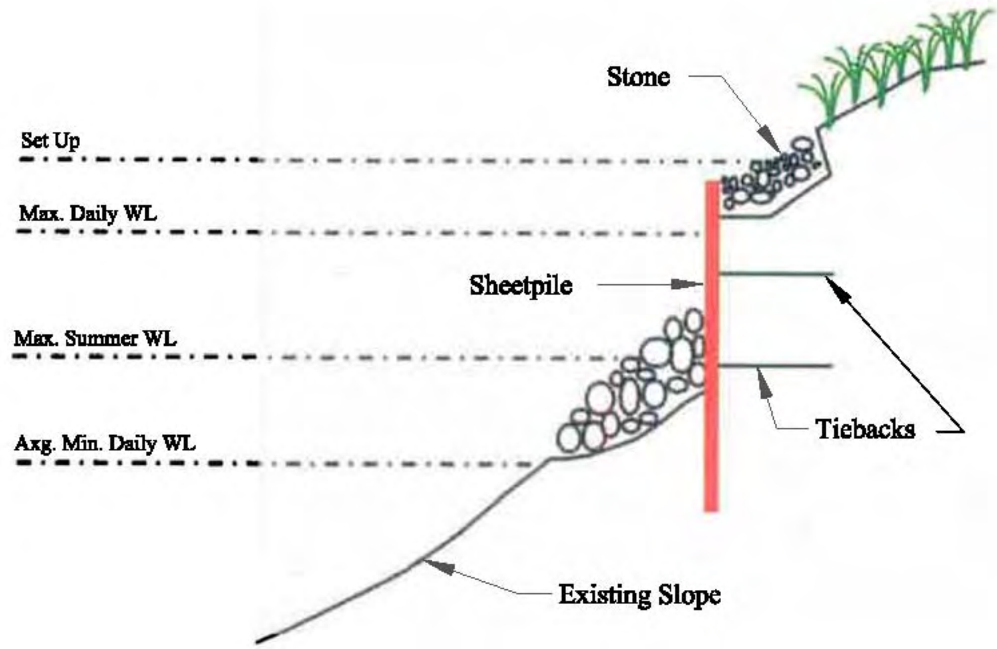
Shoreline erosion is a concern in some areas where the lakeshore is exposed to prolonged or recurrent wind and wave action. Such erosion, if in excess, can lead to sedimentation of the lake destroying aquatic habitats and clogging drainage ditches, stream channels, water intakes, and the reservoir in general. In 2002, SCE&G instituted a Sedimentation and Erosion Control Plan that is aimed at identifying, prioritizing, and stabilizing severely eroded shoreline on recreation lands and SCE&G-owned islands. A new Sedimentation and Erosion Plan, which recently has been revised by the Lake and Land Management TWC (Appendix C), was filed with the FERC in 2006.

In addition, SCE&G supports voluntary efforts to address shoreline erosion by back property owners. To ensure that appropriate and effective techniques are used, SCE&G monitors erosion control projects through their Shoreline Permitting Program, as discussed in Section 9.3. Private property owners who wish to employ erosion control measures must use SCE&G-approved methodologies appropriate for the specific situation.

Because shoreline vegetation serves several important functions (i.e., soil integrity, wildlife habitat, water cleansing functions, and aesthetic value) it is preferable to implement vegetative bank stabilization techniques to address soil erosion problems, whenever possible. These techniques are referred to as *soil bioengineering*, and consist of installing living plant material as a main structural component in controlling problems of land instability. Plants used should consist of native species that, ideally, have been collected in the immediate vicinity of a project site to ensure that they are well-adapted to site conditions. The ultimate goal in using bioengineering techniques is for the natural establishment of a diverse plant community to stabilize the site through development of a vegetative cover and a reinforcing root matrix.

Bioengineering techniques are most effective at sites with limited exposure to strong currents or wind-generated waves. Areas experiencing strong erosional pressure may also warrant the use of structural erosion control methods, such as rip-rap, seawalls, or retainer walls. Areas with high-gradient banks or those in advanced stages of erosion may also benefit from a structural component. The optimal solution at a given location often involves using a combination of techniques that provides both structural and environmental benefits to the shoreline. Numerous bioengineering methodologies and devices are available to address various erosion problems. Examples of erosion control designs that utilize both vegetation and structural elements are provided in Figures 12.1-1 and 12.1-2. As depicted in the figures, sheetpile and rip rap can provide immediate shoreline stability while plantings become established to add root-based soil integrity. The number of erosion control designs is numerous, and the most appropriate methodology depends on the slope and erosion pressure at a particular spot as well as homeowner preferences. SCE&G's Lake Management Department is available to provide technical assistance and help homeowners choose the design right for them and the lake environment.

Figure 12.1-1: Examples of Shoreline Erosion Control Designs Utilizing Bioengineering and Structural Technologies (a)



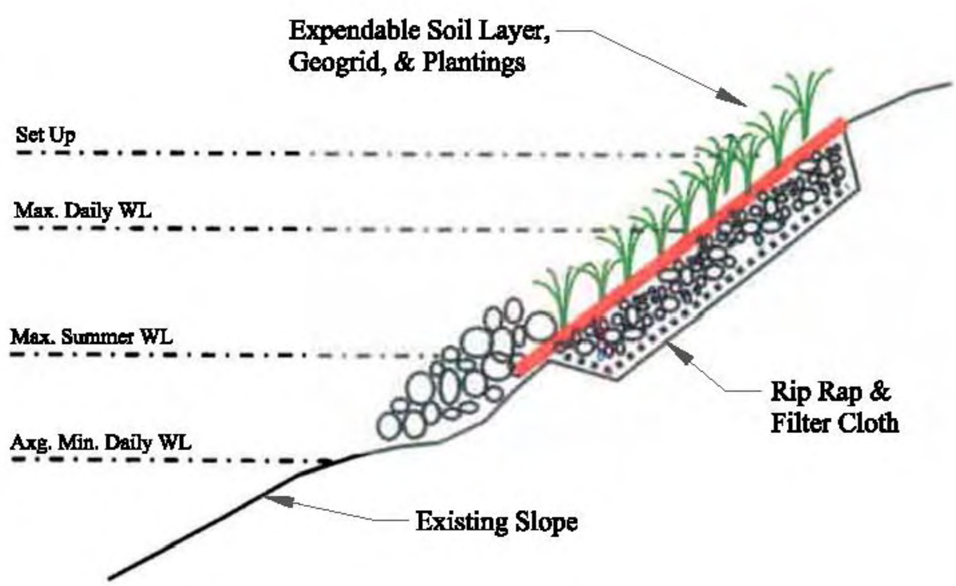
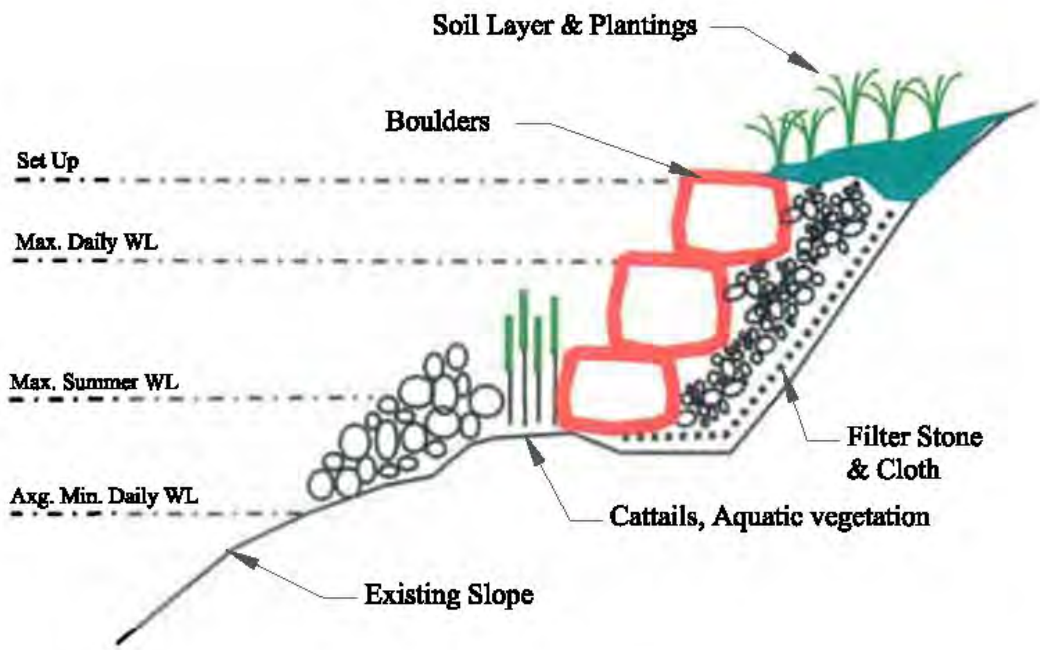


Figure 12.1-2: Examples of Shoreline Erosion Control Designs Utilizing Bioengineering and Structural Technologies (b)



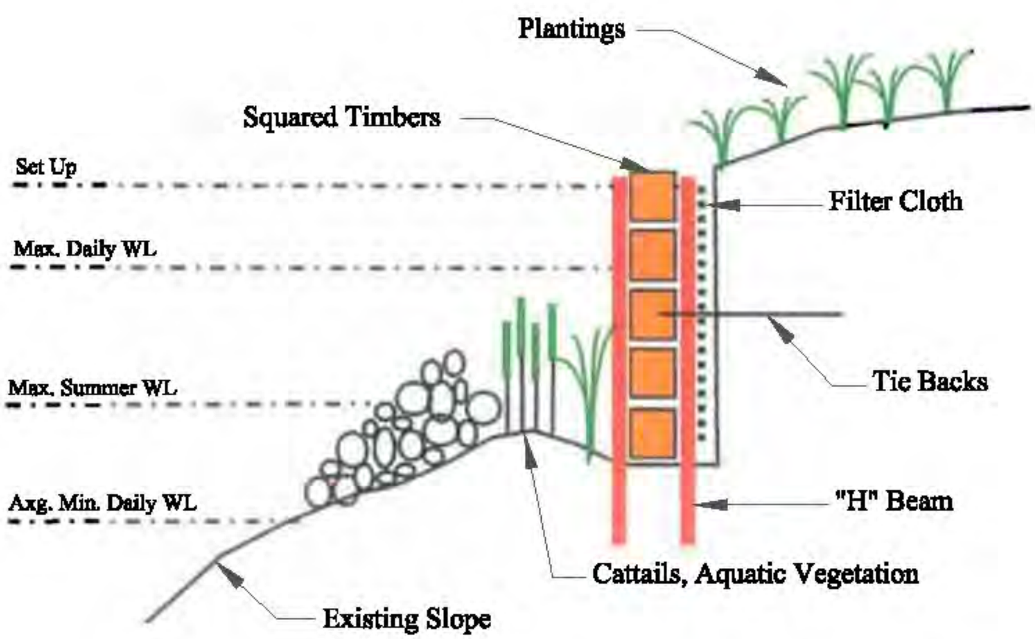
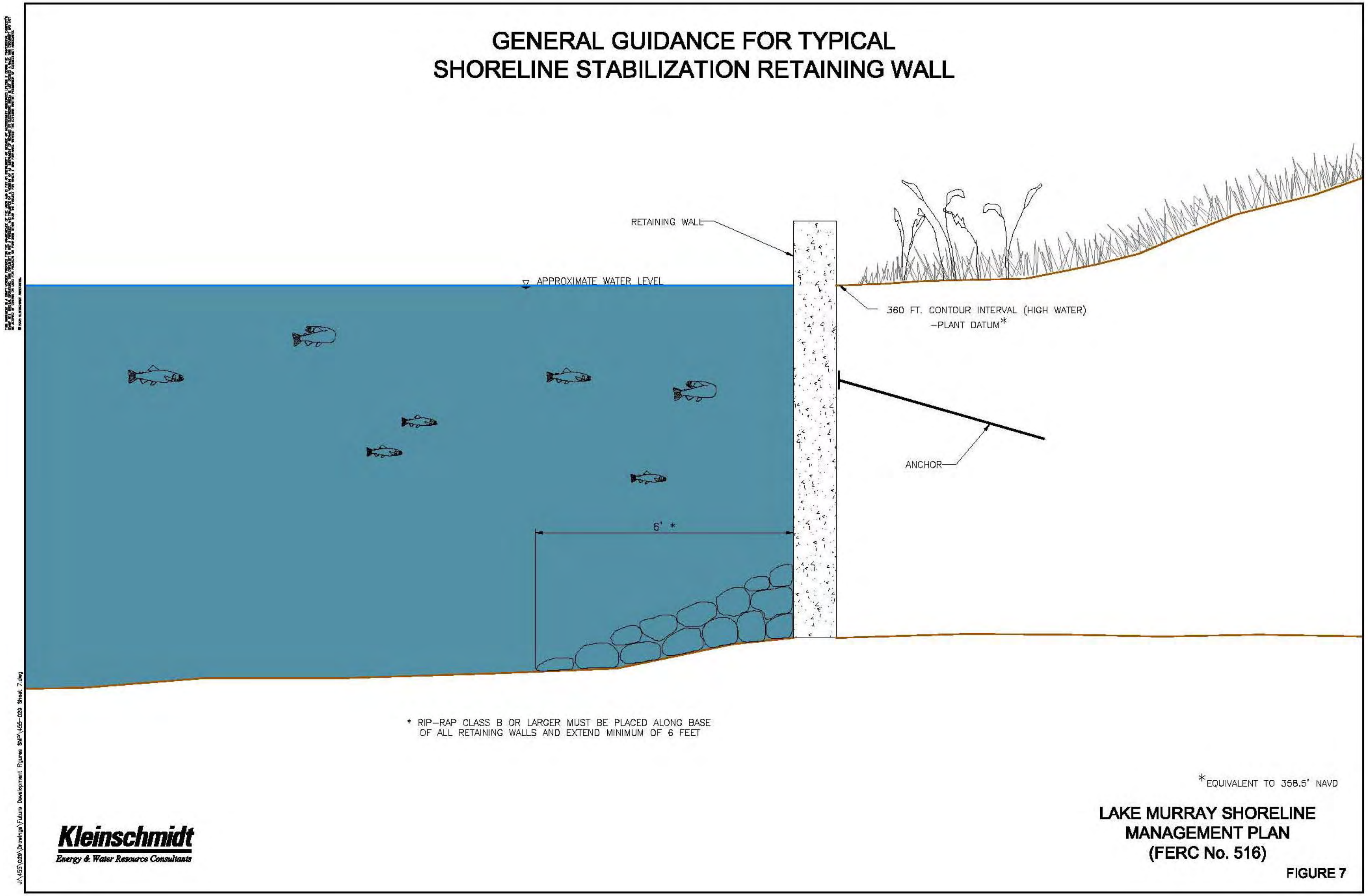


Figure 12.1-3: General Guidance for Typical Shoreline Stabilization Retaining Wall



12.1.3 Re-Vegetation of Disturbed Areas

Vegetation along the shoreline is an important component of a healthy reservoir ecosystem. SCE&G sets limits for clearing vegetation below the 360' PD contour and in Buffer Zones. Occasionally, however, vegetation in these areas is disturbed beyond what is permitted in the guidelines. Regardless of whether a disturbance is man-made or natural, intentional or unintentional, SCE&G encourages re-vegetation of these areas. Implementation of a re-vegetation plan is recommended to enhance vegetated buffers, thereby improving biodiversity, providing erosion protection, adding or maintaining filtering capacity, and protecting the aesthetics of a "natural" shoreline.

In the event of disturbance within the Buffer Zones, the landowner is encouraged to submit a site-specific re-vegetation plan to SCE&G for approval and complete replanting during the subsequent growing season. Essentially, the plan will serve as a guiding document to ensure that the disturbed areas are stabilized using native forbs, grasses, shrubs and trees as needed, and to allow natural succession to continue.

A re-vegetation plan must, at a minimum, comply with guidelines set forth by SCE&G (see Appendix B). Plant species and density used to re-vegetate a particular location will be determined based on the inherent properties of the area, such as topographic slope, as well as whether it is in the riparian or upland zone. The re-vegetation guidelines also provide requirements on percent plant cover, mulch depth, recommended native species, and tree removal. Buffer Zones that have been restored are inspected annually to check survival of planted species and compliance with the re-vegetation plan. Landowners are required to provide annual photo documentation of planted area for a period of 5 years. Failure to comply with the re-vegetation plan could result in the termination of the violator's dock permit.

12.1.4 Shoreline Enhancement Program

Since 1995, SCE&G has worked with the SCDNR and other lake interest groups to improve the Lake Murray shoreline through the *Lake Murray Shoreline Habitat Enhancement Project*, which was designed to re-establish shoreline vegetation, protect water quality, and provide improved habitat for fish and other wildlife. Through this program, SCE&G gives away and/or plants thousands of trees annually along the Lake Murray shoreline. In particular, it actively sponsors an annual planting of native, aquatic plants such as water willow, bald cypress trees, and button bushes along the shoreline as part of a joint effort with the Lake Murray Association (LMA), Lake Murray FISH, Bassmasters of South Carolina, and the SCDNR. Information on SCE&G's Lake Murray Shoreline Enhancement Project can be found www.sceg.com/en/my-community/lake-murray/lake-management.

12.1.5 Aquatic Plant Management Activities

Certain species of aquatic plants can become a significant nuisance to recreation and project operations if their populations are not kept in check. Some of the common problem species found in Lake Murray include hydrilla, water primrose, and several species of pondweed. When managing invasive and exotic aquatic plants it is important to also protect the aquatic ecosystems and fish habitat. This requires the integration and use of specific BMPs appropriate to the regional and local conditions.

SCE&G's Lake Management Department, in cooperation with the South Carolina Aquatic Plant Management Council, manages the Aquatic Weed Program on Lake Murray. Because aquatic weed control techniques can harm fish and native plant species, it is unlawful, per state and federal regulations, for individuals to spray or treat aquatic growth in the waters of Lake Murray. Thus, SCE&G asks that any aquatic vegetation problems recognized by lake visitors or back property owners should be reported to SCE&G's Lake Management Department and the SCDNR. In addition, to help curb the spread of invasive aquatic species, SCE&G asks that lake visitors remove all vegetation from boats and trailers before and after placing them into the waters of Lake Murray.

12.2 Recommended Land Owner Best Management Practices (BMPs)

In addition to development activities, the environment around Lake Murray is susceptible to degradation due to residential and recreational activities that include improper fertilizer/pesticide use, boat maintenance, and debris disposal. Back property owners can make a significant positive contribution to the lake environment, and ultimately the watershed, by employing BMPs that preserve bank integrity and minimize non-point sources of pollution and contamination. It is important for back property owners to understand that using BMPs will preserve the scenic, environmental, and recreational qualities of the lake that they so highly value. Examples of effective BMPs recommended to back property owners are provided in the following sections. SCE&G is available to provide more information and to assist landowners in determining appropriate BMPs for activities on their properties. Also, contact the Natural Resource Conservation Service or local county extension office (http://www.sc.nrcs.usda.gov/contact/).

12.2.1 Minimizing Non-Point Source Pollution

Lake pollution is attributable to various activities related to residential development, agriculture, forestry, and construction. Pollutants and contaminants enter the lake and tributaries from overland flows that accumulate substances following rain events. This runoff water contains sediment, bacteria, oil, grease, detergents pesticides, fungicides, fertilizers, and other pollutants. Excessive amounts of pollution can overwhelm a lake’s natural ability to filter and process chemicals and nutrients, which leads to degraded water quality and aquatic environments.

Although a single person or action may seem insignificant in its effect on the lake, the additive effects of the volume of people that live and use the resource are considerable. With this in mind, SCE&G encourages adjacent land owners to be mindful that they are a member of a larger community that uses the lake. Employing the following BMPs can go a long way in preserving and improving lake water quality:

- Use permeable paving materials and reduce the amount of impervious surfaces, particularly driveways, sideways, walkways, and parking areas;
- Dispose of vehicle fluids, paints, and/or household chemicals as indicated on their respective labels and do not deposit these products into storm drains, project waters, or onto the ground;
- Use soap sparingly when washing your car and wash your car on a grassy area so the ground can filter the water naturally;
- Use a hose nozzle with a trigger to save water and pour your bucket of used soapy water down the sink, not in the street;
- Maintain septic tanks and drain fields according to the guidelines and/or regulations established by the appropriate regulatory authority;
- Remove and dispose of pet waste properly in an area that does not drain to the lake; and
- Use only low or no phosphorous fertilizer on lawns near the lake.

12.2.2 Vegetation Management

As mentioned previously, vegetated shorelines are an important component of a healthy lake ecosystem. Their root systems help to stabilize the shoreline and to trap and filter runoff pollutants. Vegetation also provides valued wildlife habitat and increases the natural aesthetic quality of the shoreline. However, not all vegetation is equally beneficial, and many gardening and lawn maintenance activities can harm the lake ecosystem if not applied properly. Some relatively simple ways that back property owners can ensure that their property contributes to the health of the lake environment include employing the following BMPs:

- Maintain native vegetation near the lake and drainage ways;
- Plant native trees, shrubs, and flowers for landscaping and gardens. Native species adapted to the climate will require less watering and chemicals (i.e., fertilizers, pesticides, herbicides, fungicides);
- Grow plants that provide food, shelter and habitat for birds, butterflies, and other wildlife, which play a part in maintaining a healthy, natural environment;
- Enrich the soil by using natural soil amendments such as compost, manure, and mulch;
- Minimize the area of lawn located near the shoreline. When planting lawn, use a low maintenance, slow growing grass that is recommended for your soil conditions and climate;
- Maintain the grass as high as possible to shade out weeds and improve rooting so less fertilizing and watering are required;
- Avoid dumping leaves or yard debris on or near the shoreline;
- Avoid applying excessive herbicides, fungicides, and pesticides. Apply them according to the instructions on their labels and never apply them just before a precipitation event; and
- Create and maintain a *rain garden* in the landscape to naturally filter runoff. A rain garden is an infiltration technique that captures water in specialized gardens containing native plantings. Rain gardens allow the water to slowly filter into the ground rather than run off into storm sewers.

13.0 PUBLIC EDUCATION AND OUTREACH

As explained previously, the Standard land use article within SCE&G's license directs them to oversee shoreline activities and to take action to prevent unauthorized uses of Project shorelines. This SMP is intended to establish proper shoreline use and development consistent with the FERC license, as well as the protection of public safety and environmental quality (water quality, natural habitat, aesthetics, etc.). To garner support and compliance from the public and lake users, it is key to educate them of the need to protect shoreline resources. Additionally, the public must be aware of the management and permitting programs put in place to provide this protection. To accomplish the task of increasing public awareness of the goals and objectives of this SMP SCE&G has developed an education and outreach program that includes the components described below.

13.1 <u>SMP Education</u>

SCE&G's Public Education and Outreach program aims to educate the public on various aspects of the management of Lake Murray, including the Shoreline Permitting Program, recommended BMP use, relevant Project Operations information, and the Safety Program. To accomplish this, SCE&G uses various public education measures including informational pamphlets, public meetings, newsletters, and an internet webpage.

The Internet, in particular, offers an excellent opportunity for disseminating information and improving awareness. Currently, SCE&G maintains a website that is designed to provide information on the SMP and the Shoreline Permitting Program. Hard copies of the following materials can also be obtained by contacting SCE&G Lake Management at (803) 217-9221. Information and materials that will be available at the website include the following:

- Permitting Handbook;
- Permit application forms;
- Examples and information on Best Management Practices (BMPs);

- Alternative and example designs for bank stabilization; and
- Useful links and other related information.

Additional outreach mechanisms that SCE&G intends to use to help implement the SMP are the following:

- Conduct a SMP Implementation Workshop;
- Conduct annual training workshops for construction contractors, realtors, and property owners;
- Speak at homeowner and other organizations' meetings;
- Continue to provide information to realtors and encourage that this information be provided to all potential lake shore property buyers; and
- Develop and distribute a new "user friendly" brochure that will include general lake information, permitting process, shoreline BMPs, and relevant contact information.

13.2 BMP Education

Because the use of BMPs outside of the Shoreline Permitting Program is voluntary, SCE&G recognizes that educating the public to their necessity is vital. With assistance from relicensing stakeholders and other interested parties, SCE&G supports public education efforts to encourage the adoption of shoreline BMPs as well as any other BMPs promoted by state and/or regulatory authorities.

As a means to encourage BMP use by all back property owners, SCE&G hosts annual information meetings with local contractors, home owner organizations, and other interested parties to ensure all are made aware of the notification and permit requirements prior to work and encouraging the use of all BMPs for sustainable shoreline management. Appropriate literature will be given to property owners and their contractors illustrating BMPs suggested practices for any construction work. SCE&G will also provide technical assistance during the permitting process for any construction projects. In addition, literature will be provided advising property owners about buffers, protecting native vegetation and native weed beds and other shoreline management BMPs.

13.3 Backyard Habitat Programs

Natural vegetation that provides habitat and filtering qualities can be administered by the homeowner under the South Carolina Wildlife Federation's (SCWF) Backyard Wildlife Habitat Program. The SCWF in association with the National Wildlife Federation provides information to South Carolina residents on ways to enhance and restore wildlife habitat on their property and in the community. Various combinations of native vegetation are suggested to provide cover, food, nursery and wetlands habitat for wildlife species. These habitat projects can be certified by the National Wildlife Federation through an application process. Further details on the Backyard Wildlife Habitat Program can be found at www.scwf.org/index.php?option=com_content&task=view&id=14&Itemid=29.

13.4 Public Access Area Maps

A figure depicting existing and future Public Access Areas is included below.

Figure 13.4-1 Public Access Areas Map

Public Access Areas

Saluda Hydroelectric Project No. 516
South Carolina Electric & Gas Company

Existing Park Sites	Number	Acres
Dreher Island State Recreation Area	11	348
Dam Site - Irmo Side	8	6.8
Higgins Bridge	13	1.1
Hilton	7	4.4
Kempson Bridge	14	2.9
Lake Murray Estates Park	22	7.5
Macedonia Church	12	4.8
Murray Shores	3	1.6
Park Site - Lexington Side	1	17.9
River Bend	4&4A	11.6
Rocky Point	6	1.7
Larry L. Koon Boat Landing	2	1.8
Shull Island	2B	0.36
Sunset	5	2.3

Special Recreation Areas	Number	Acres
Two-Bird Cove	23	0
Hurricane Cove	24	0

Existing Future Park Sites	Number	Acres
Shull Island	2A	22.4
Simpson's Ferry	5A	11.58
Long Pine	6A	31.4
Hilton	7A	27.86
Water Treatment Plant	16	4.3
Stone Mountain	17	26.47
Cloud's Creek	18	3.04
Big Creek	19	22.34
Little Saluda Point	20	15.4
Bundrick Island	21	87.89

Lower Saluda Park Sites	Number	Acres
James R. Metts Landing	10	1
Gardendale	15	4.7
Saluda Shoals Park	9	160

13.5 Public Service Announcements (PSA)

SCE&G will periodically issue Public Service Announcements through the use of the SCANA website, and/or the news media, on an as needed basis. Public Service Announcements may include topics regarding Lake and Land Management, as well as other issues affecting the Project.

13.6 Safety Programs

During the most recent Saluda Relicensing Process, the Safety Technical Working Committee, which was inclusive of agencies and public representatives, developed a Safety Program to be filed with FERC. This Safety Program was designed to complement the SMP and can be found at www.sceg.com/en/my-community/lake-murray/lake-management.

14.0 MONITORING AND REVIEW PROCESS

14.1 Overall Land Use Monitoring

Because SCE&G has recently modified its land management classification system, it will be important to monitor land use in the future to ensure the new system is appropriate. Also, as demographics and user groups change within the Project area, changes in residential and commercial areas may occur. Often this type of use change is incremental and cumulative, occurring over a period of years or decades. To monitor land use around Lake Murray, SCE&G will use a geographic information system (GIS) to compare new and existing permit applications against GIS data for the land management classifications. Such monitoring will provide long-term data useful in identifying areas experiencing change. Every ten years, during the SMP review process (see Section 14.2 on Review Process below), SCE&G will report on changes in land use for the various land management classifications in conjunction with Form 80 surveys. If it is found that major changes within the Project boundary have occurred that are not consistent with the current SMP goals, amendments to the SMP may be warranted. Such situations include large changes in land ownership, major commercial upgrades or uses, or new residential uses or pressures.

14.2 Review Process

Prior to the current License Application, SCE&G conducted a review of the SMP every five years, per the original license requirements. This small time interval proved to be ineffective because the review and revision process, which included gathering input and addressing issues from stakeholders, required several years to complete. In addition, it resulted in viewing conditions and activities around the lake at too fine a scale to identify true trends rather than temporary circumstances. In the new License Application, SCE&G proposed a change in the SMP review cycle to a 10 year interval. As in the past, SCE&G will solicit input from interested parties in addressing issues that arise and have a bearing on lake management. This includes keeping lines of communication open during the time between review periods. Concurrently with the FERC SMP review process, SCE&G will review annually with interested stakeholders the Shoreline Permitting Program to ensure its effectiveness; however, changes to the permitting process may be made periodically, as needed, outside of the scheduled review periods.

The ten-year SMP review period allows for SCE&G to assess new issues that arise as a result of development around the lake, and allows for the analysis of cumulative affects. The review process will begin sufficiently in advance so that it will be completed within the 10 year time frame. One month prior to the scheduled start of the review process, its occurrence will be advertised in various media formats (e.g., web site, newsletter, contact with homeowner associations, etc.). SCE&G will use the same media avenues to issue a report on the outcome of the review process. Although SMP reviews will be scheduled every 10 years, SCE&G is always willing to listen to concerned stakeholders, particularly if unforeseeable circumstances warrant a review of particular sections of the SMP.

15.0 REFERENCES

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.

Aulbach, C.A. 2001b. Summary of Hydrilla and Pondweed Survey, Lake Murray, SC. SCE&G Unpubl. Rpt.

Aulbach, C. A. 2006. Hydrilla Survey. Lake Murray, SC. October 2006. Prepared for South Carolina Electric & Gas Company prepared by Cynthia A. Aulbach, Botanical Services of South Carolina, Lexington, SC.

Aulbach-Smith, C. 1998. Distribution of Aquatic Plants in Lake Murray, SC, 1989-1997. SCE&G Unpubl. Rpt.

Beard, H. 2000. Fisheries Investigations in Lakes and Streams, District VIII. South Carolina Department of Natural Resources Study Progress Report F-49.

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.

Degraff, R.M. and D.D. Rudis. 1986. New England Wildlife: Habitat, Natural History and Distribution. Gen. Tech. Rep. NE-108. U.S. Department of Agriculture, Forest Service, Northeast Forest Experiment Station, PA. 491pp.

Federal Energy Regulatory Commission (FERC). July 22, 2002. Final Environmental Assessment; Saluda Dam Seismic Remediation.

Frankenberg, D. 2006. Lonely mountains: The monadnocks of the inner Piedmont. Carolina Environmental Diversity Explorations. LEARN NC, by the University of North Carolina at Chapel Hill. Available on-line at http://www.learnnc.org/lp/editions/cede_lonemts. Accessed February 8, 2007.

Hatcher, R.D., Howell, D., and P. Talwani. 1977. Eastern Piedmont Fault System: Speculations on its Extent. Geology, Vol. 5, pp. 636-640.

Hendrix, M. P., and R. Bailey. 2003. Overview of Known and Potential Cultural Resources in the Saluda Project at Lake Murray; Lexington, Newberry, Richland and Saluda Counties, South Carolina. Prepared for South Carolina Electric & Gas by Brockington and Associates, Inc., Charleston, SC.

Kleinschmidt. 2007. Rare, Threatened, and Endangered Species Assessment for the Saluda Hydroelectric Project. FERC No. 516. Dated August 2007.

Lansdell, B., and R. Bailey. 2003. Assessment of Known and Potential Archaeological Sites in the Saluda Dam Remediation Project at Lake Murray; Lexington, Newberry, Richland and Saluda Counties, South Carolina. Prepared for South Carolina Electric & Gas Company by Brockington and Associates, Inc., Charleston, SC.

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.

Mead and Hunt. 2002b. Recreational Element: Initial Consultation Package. Mead & Hunt, Madison, WI. 21pp.

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.

South Carolina Association of Counties. 2004. County Profiles: Land Area and Population Density. http://www.sccounties.org. August 19, 2004.

South Carolina Department of Natural Resources. 2006. Saluda Hydroelectric Project, FERC Project No. 516. Shoreline Management Plan - June 23, 2004 FERC Order. Section D - Updated List of Environmentally Sensitive Areas.

South Carolina Department of Parks, Recreation & Tourism (SCDPRT). 2007. South Carolina State Parks – Park Finder. Available on line at http://www.southcarolinaparks.com/park-finder/state-park/1371/camping.aspx. Accessed May 14, 2007.

South Carolina Electric & Gas Company (SCE&G). 1994. Shoreline Inventory Saluda Hydroelectric Project FERC 516 Lake Murray. Columbia, SC.

South Carolina Electric and Gas Company (SCE&G). 2002. Licensed Hydropower Development Recreation Report, FERC Form 80; Saluda Hydroelectric Project.

South Carolina Electric & Gas Company (SCE&G). 2005. Final Saluda Hydro Initial Consultation Document. Saluda Hydro Project FERC No.516. Prepared by Kleinschmidt Associates April 2005.

South Carolina Electric & Gas Company (SCE&G). 2007. Recreation Assessment Study Report – Final. April 2007. Saluda Hydroelectric Project. FERC No. 516. Columbia, SC.

South Carolina Waterfowl Association (SCWA). 2007. Public Hunting Systems – Lake Murray. Available online at http://www.scwa.org/feature/public%20hunting.html. Accessed May 14, 2007.

Purple Martin Society (PMS). 2005. Purple Martin Festival at Lake Murray, SC June 4 2005 Available on-line at http://www.purplemartins.com/News/cat5.asp?dismode=article&artid=77. Accessed may 15, 2007.

Trinkley, M. and N. Southerland. 2001. Cultural Resources Survey of the SCE&G Saluda Dam Complex. Prepared by Chicora Foundation.

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 Fish and Wildlife Service (USFWS). 1996. Species Account for Wood Stork. *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 1/96. Available on-line at http://www.fws.gov/Endangered/i/b/sab5z.html. Accessed February 13, 2007.

Wilde, S.B., T.M. Murphy, and C. Hope. Lake Murray Monitoring Project: 2002-2003. Report prepared by South Carolina Department of Natural Resources and University of South Carolina, Baruch Institute. 34 pp.

APPENDIX A

WOODY DEBRIS & STUMP MANAGEMENT PLAN

SOUTH CAROLINA GAS & ELECTRIC COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

FERC COMPLIANCE ARTICLES

WOODY DEBRIS MANAGEMENT PLAN

JANUARY 2006

SOUTH CAROLINA GAS & ELECTRIC COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

FERC COMPLIANCE ARTICLES

WOODY DEBRIS MANAGEMENT PLAN

JANUARY 2006

SOUTH CAROLINA ELECTRIC & GAS
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

WOODY DEBRIS MANAGEMENT PLAN

TABLE OF CONTENTS

11/4/05 – CLB
455-027-99-00
Z:\SCO\455\027\Draft Saluda Woody Debris Management Plan 2005-11-04.doc

SOUTH CAROLINA ELECTRIC & GAS
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

WOODY DEBRIS MANAGEMENT PLAN

This plan was prepared in compliance with the requirements of the Federal Energy Regulatory Commission's (FERC or Commission) Order Approving Land Use and Shoreline Management Plan for FERC Project No. 516, issued and effective June 23, 2004 and subsequent Order Clarifying and Modifying the June Order, issued and effective October 28, 2004. Paragraph E of the June 23 Order and Paragraph F of the October 28 Order require South Carolina Electric & Gas (SCE&G) to develop and file a plan, by June 23, 2005, for managing large woody debris, for fish habitat restoration and public safety on Lake Murray. On May 31, 2005, SCE&G requested a time extension until January 31, 2006.

This plan addresses management of woody debris below the 360' foot contour (Plant Datum) (the 360).

1.0 BACKGROUND

In 1980, pursuant to a FERC order in FERC Docket No. E-7791, SCE&G established a shoreline management plan (SMP), a part of which consisted of a shoreline classification system. Among other things, this classification system included a category of lands classified as "future private development." In 1984, as part of the new license issued by the FERC for Project No. 516, the Commission re-approved, with modification, the 1980 SMP. Future private development lands (Future Development Lands) include properties classified such that they could be considered for future sale.

Woody debris consists of both large and small woody vegetation that is floating or submerged, stationary or transitory, exposed or transported by lake fluctuations and flows, and is subject to decay.

- *Submerged woody debris* is stationary and generally consists of submerged or partially submerged tree stumps or deadfalls.
- *Floating woody debris* is considered transitory and enters the watershed either through flooding or by felling of shoreline vegetation. Floating debris is generally distributed by wind and wave action and collects in coves and inlets on the lake.
- *Shoreline woody debris* is generally considered to include trees and other woody litter that falls partially into the water from the shoreline (trees fall over or snap off). Shoreline woody debris may remain high enough on the bank so that it is not dislodged during periods of high water. Shoreline woody debris that does not remain stable is considered "floating" woody debris; shoreline woody debris that falls completely in the water and rests on the bottom of the lake is considered "submerged" woody debris.

Submerged and shoreline woody debris provides habitat for many species of fish, macroinvertebrates, birds, reptiles and mammals. Even floating debris may eventually settle and provide aquatic habitat for some species. Woody debris may also pose a boating hazard or be an impediment to navigation.

2.0 GOAL

The goal of this plan is to identify and implement options to manage woody debris to maintain fish and wildlife habitat value and to minimize potential navigational and safety hazards. This plan provides management guidelines below the 360 foot contour for (a) areas of stable (stationary and established for more than 2 years) submerged woody debris that may be sufficient in area and density to provide significant fish and wildlife habitat adjacent to future development areas; (b) transitory (floating) woody debris in Lake Murray; and (c) shoreline woody debris adjacent to lands classified for future development. Existing woody debris located on property identified as Forest and Game Management property and some Recreation property will not be disturbed.

Management strategies undertaken for woody debris management must comply with SCE&G's permitting program, erosion and sedimentation program, buffer zone management and other management prescriptions detailed in the Shoreline Management Plan. Additional restrictions may apply if the woody debris is in an area identified as an environmentally sensitive area (ESA).

3.0 MANAGEMENT ACTIONS

As a baseline, SCE&G maintains a policy of no disturbance for any and all woody debris unless its removal is necessary for reasons of health and human safety, or the debris is so minimal that it is insignificant in the provision of fish or wildlife habitat.

3.1 Submerged Woody Debris

SCE&G's Shoreline Management Program allows limited removal of shoreline vegetation necessary for the construction and installation of docks and other permitted shoreline amenities. Shoreline property owners must obtain permission from SCE&G prior to removing shoreline woody debris below the 360 foot contour. If a dock is proposed for an area that contains significant, stable woody debris, SCE&G may propose an alternate location for the dock. For tree stumps which pose a material threat to safety, landowners may be allowed to cut them off to an appropriate level, depending on expected water depth and proximity to docks and other activity-related facilities.

While the presence of woody debris is considered to provide some fish and wildlife habitat, it can also present a safety hazard to those engaged in activities on the lake. Debris just below water level, particularly stumps, can pose serious safety risks, especially at the high speeds associated with water skiing and jet skiing, or with activities such as swimming, where jumping from fixed or floating facilities such as docks might occur. As such, consideration for safety and navigation needs is given priority with respect to woody debris management. SCE&G's woody debris management policy prohibits the removal of woody debris below elevation 360' unless it poses a clear safety or navigation concern, is brought to the attention of SCE&G's Lake Management Department personnel (Lake Management), and is approved by Lake Management. SCE&G will only allow removal of the portion of woody debris that poses the concern; the remaining woody debris is to be left intact.

3.2 Floating Woody Debris

Floating woody debris, may be removed by SCE&G, SCDNR, or any member of the boating public when encountered if it is reasonably considered a material public safety issue or impediment to navigation. The debris is typically removed from open water areas and taken to the shoreline. SCE&G encourages that it be secured onshore in undeveloped areas, preferably in areas not readily available to boaters for high speed navigation, such as the backs of coves and/or undeveloped lands.

3.3 Shoreline Woody Debris

Shoreline woody debris is managed in a manner similar to submerged woody debris. Limited removal of shoreline woody debris may be permitted to accommodate construction and installation of docks or other permitted shoreline amenities. However, should a dock be proposed for an area that contains significant shoreline woody debris, SCE&G may propose an alternate location for the dock or prohibit the dock altogether. Shoreline property owners must obtain permission from SCE&G to remove shoreline woody debris below the 360' foot contour. Unauthorized removal of stable shoreline woody debris may result in the cancellation of dock permits and/or other shoreline amenity permits and a requirement that there be appropriate mitigation for the improper woody debris removal.

Shoreline woody debris agreed by SCE&G to be a navigation hazard may be removed.

APPENDIX B

BUFFER ZONE MANAGEMENT

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC PROJECT NO. 516

BUFFER ZONE AND SHALLOW WATER HABITAT MANAGEMENT PLAN

DRAFT

SEPTEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC PROJECT NO. 516

BUFFER ZONE AND SHALLOW WATER HABITAT MANAGEMENT PLAN

DRAFT

SEPTEMBER 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

BUFFER ZONE AND SHALLOW WATER HABITAT MANAGEMENT PLAN DRAFT

TABLE OF CONTENTS

LIST OF APPENDICES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

BUFFER ZONE MANAGEMENT PLAN

DRAFT

1.0 INTRODUCTION

This plan addresses management and re-vegetation of areas within the 75' foot buffer zone above the 360' foot contour (Plant Datum) ("the 360," or "El. 360") adjacent to lands sold after 1984.

Shoreline vegetation along Lake Murray primarily consists of buttonbush, alder, willow, river birch, green ash, and loblolly pine with limited occurrence of oaks and other hardwood trees. Forested, riparian buffers along reservoir shorelines are generally acknowledged to provide a variety of environmental functions and ecological values. These environmental functions include trapping and/or filtering sediment runoff, reducing bank erosion, removing phosphorous and other nutrients and sequestering contaminants such as pesticides. Ecological values include contribution of leaves and other nutrient sources to the lake, maintenance of habitat for fish and aquatic organisms by moderating near shore water temperature, providing woody debris and providing habitat for amphibians and other terrestrial organisms. Buffers also provide societal values such as maintaining a more "natural" aesthetic appearance of shoreline.

In 1981, FERC approved the first Shoreline Management Plan (16 FERC62,479), however, it was not until issuance of the 1984 Saluda Hydroelectric Project license that FERC required SCE&G to establish and maintain a 75-foot vegetated buffer zone on all Fringeland conveyed after the issuance of the 1984 license. The buffer zone, which extends inland from the 360 foot (Plant Datum) contour, creates an expanded vegetated, aesthetic buffer between back property development and the Lake Murray shoreline that protects and enhances the Project's scenic, recreational and environmental values. The 75-foot vegetated buffer zone represents the normal limit to which SCE&G may sell land between the PBL and the lake. SCE&G retains ownership of the 75-foot setback area. It comes into existence "in front of" (between the PBL and the 360’ contour) all Fringeland sold. In addition, buffer zones exist along all perennial and intermittent streams in both Future Development and Forest and Game Management land as a result of the June and October 2004 FERC Orders.

Although the 360 foot contour is the normal maximum surface elevation specified in the license, historically, the pool elevation has been managed for normal operations between the 350-352 foot level and the 358-358½ foot elevation. Depending upon the shoreline contour in a particular area, this means that the water can be a few feet to hundreds of feet away from the 360 foot contour. Accordingly, the “buffer” between shoreline development and the water of Lake Murray may be from slightly more to several times more than 75 feet in width. Some of these areas below the 360 foot contour are heavily timbered and otherwise vegetated.

2.0 GOALS

The goal of the Buffer Zone Management Plan is to maintain and to encourage vegetated areas along the shoreline. A natural, vegetated shoreline provides numerous critical functions that contribute to the health and integrity of the lake ecosystem. Vegetated buffers provide water quality functions by trapping and filtering run-off and contaminants from upland sites. The shrubs, hollow logs, and tree branches provide nesting, denning, and refugia for birds, mammals, reptiles, and amphibians. For aquatic species such as fish and invertebrates, a vegetated shoreline provides important habitat elements including woody debris, leaves, and seeds/fruits. Perhaps one of the more critical functions of a well established vegetated shoreline is that it helps to maintain shoreline integrity by providing a root system that binds soil and decreases the risk of bank erosion and bank collapse. Finally, the vegetated shoreline has aesthetic and recreational value. For many people, a visit to the lake is an opportunity to take a break from an urban environment and enjoy more natural scenery, as well as to participate in activities such as wildlife viewing, fishing, and hunting.

3.0 DEFINITIONS

- Buffer Zone – As defined in 18 CFR 4.41(f) (7) (iii) is an area within the project boundary, above the normal maximum surface elevation of the project reservoir, and of sufficient width to allow public access to project lands and waters and to protect the scenic, public recreational, cultural, and other environmental values of the reservoir shoreline.

– Future Development Lands - Licensee-owned properties within the project boundary that have been identified as lands available for possible sale and/or use up to and including development.

– Easement Property – The term used to describe Fringeland that has been sold to the back-property owner, over which, therefore, Licensee maintains only easement and shoreline management rights

– Environmentally Sensitive Areas (ESAs) - Generally located below the 360-foot contour. ESAs include areas of wetlands and shallow coves, typically populated by willow trees and buttonbushes, and other areas determined to be critical to the continued existence of indigenous or threatened species, such as spawning and nesting habitat. Willow trees and buttonbushes are the “target vegetation” for defining which shoreline areas are to be considered ESAs by virtue of vegetative cover; ESAs are sub-classified as follows:

  - *Shallow Coves with Stream Confluence* – Areas where streams enter the lake to form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The up gradient portion of shallow coves is typically vegetated with buttonbush and willow.
  - *Continuous Vegetated Shoreline* – Continuous vegetated linear shoreline at least 66 feet in length, with vegetation greater than 5 feet deep (horizontal depth of strip not vertical depth of water), measured perpendicular to the shoreline.
  - *Intermittent Vegetated Shoreline* – Linear shoreline coverage of vegetation at least 66 feet in length. This class can have gaps. (Gap is defined as 8 to 20 feet in length where there is little or no vegetation below the normal

high water mark.) Areas with gaps more than 20 feet in length are termed "breaks" and are not to be considered vegetated shoreline.

- *Bottomland Hardwood and Wet Flats* – Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

4.0 MANAGEMENT ACTIONS

Shoreline Property: Generally speaking, prior to 2004, SCE&G managed its properties within and adjacent to the PBL, including Future Development Lands, according to its Forest Management Plan. Where applied, the Forest Management Plan provided for the protection of the watershed and its wildlife and fishery habitat and reduced insect- and disease-related tree mortality. Since 2004, SCE&G forestry practices prohibit selective thinning or timber management within 100 feet of the 360-foot contour on Future Development Lands.

Buffer Zone: A Buffer Zone, located between the 360-foot contour and the back property development, was delineated and documented adjacent to all easement lands sold by SCE&G after the issuance of the 1984 license. The buffer zone extends upland from the edge of the 360-foot contour elevation a minimum distance of 75 feet measured horizontally. This area can include fast growing softwood trees, but generally should include at least 20% deciduous hardwoods or shrubs. The buffer zone also contains filter strips comprised of grasses, legumes and/or other forbs. This vegetation is an important component of a buffer zone where protection from excessive sediment or nutrients is needed.

SCE&G intends to maintain well-vegetated lands within all areas designated as Buffer Zones, and has developed specific principles and guidelines for vegetation management. Vegetation management, however, varies according to the date the adjoining property was sold and the Buffer Zone was established: 1) lands sold prior to the 1984 license that lack Buffer Zones, 2) lands sold after 1984 but before approval of the 2007 SMP, and 3) lands sold after approval of this 2007 SMP.

Land purchased prior to 1984 – Owners that purchased their land prior to 1984 do not have a Buffer Zone associated with their properties. Prior to this date, SCE&G sold land within the PBL that extended to the 360-ft contour interval (high water mark). Following is the specifications for these back property owners:

- For lands that adjoin their property and are below the 360-foot contour, they are allowed to conduct limited brushing, which involves voluntarily removing only exotic and invasive vegetation, Such vegetation removal is monitored by SCE&G through there their permitting program.

- Above the 360' contour, property owners are encouraged to plant or allow native vegetation to flourish to protect and enhance the project's scenic, recreational, and environmental values.
- Back property owners who own land closer than 75 feet from the 360' contour and wish to construct a dock along the shoreline are required to deed SCE&G so much of their property as to create a uniformly 75-foot deep buffer zone. The deeded land is subsequently subject to the environmentally protective measures and requirements outlined for Buffer Zones after 2007 (see below)(dock permitting requirements on SCE&G-owned lands is explained in greater detail in the Permitting Handbook)

<u>Buffer Zone (1984 license - 2007 SMP)[1]:</u> As part of the sale of Future Development property, the 75-foot buffer zone, became the lake-ward property boundary for the Easement Property owner. SCE&G maintains GIS based maps of each established 75-foot vegetated buffer zone. Where available, aerial photography may have been used for site documentation. This provided a baseline to assist in future monitoring.

SCE&G maintains special use restrictions within the 75-foot vegetated buffer zone. The use of SCE&G's 75-foot vegetated buffer zone is entirely permissive and at the discretion of SCE&G as landowner. Owners of adjoining lands (back property owners) are given the right of access by foot to and from the lake over the buffer zone, and are allowed access for passive activities such as bird and wildlife viewing and shoreline fishing. However, prohibited uses include overnight camping, building fires, hunting, discharge of firearms, motorized vehicles, or any activity that may adversely impact the land. Also prohibited, without written consent from SCE&G, are any improvements to the land that involve cutting significant trees or shrubs, placing water-oriented encroachments (docks, ramps, etc.), changing the contour of the land, or posting the property. Any modification to the lands within the buffer zone approved by SCE&G

[1] The initial Shoreline Management Plan was approved in 1981, however buffer zones did not exist prior to 1984.

has to comply with all applicable requirements of SCE&G's Shoreline Management Program.

Special use restrictions within the 75-foot vegetated buffer zone established after 1984 and before the 2007 SMP included the following (additional restrictions may have applied if the property was adjacent to ESAs):

- Upon the sale of any Fringeland, a purchaser was allowed to perform limited brushing so long as the purchaser adhered to SCE&G's established guidelines as described below. Once a purchaser had completed the permissible limited brushing, a subsequent property owner only could maintain the work that had been completed. No further brushing or clearing was allowed, whether by permit or otherwise.

- Trimming or limbing of trees higher than ten feet above the ground was prohibited without prior approval and permits.

- "Privatization" and structural encroachments were prohibited.

- After 1994, individual boat ramps were prohibited. However, community boat ramps were encouraged and approved, provided existing guidelines were met.

- Removal of vegetation greater than 3 inches in diameter measured at breast high (4') was prohibited without a permit.

- Boat docks were allowed provided they complied with SCE&G's standard boat dock guidelines and appropriate permits were obtained.

- Additional restrictions may apply if the property is adjacent to ESAs.

<u>Buffer Zones (after 2007 SMP - Present)</u> - For lands sold after approval of the current SMP, SCE&G will maintain a ‘No Disturbance’ policy on all Buffer Zones established after that date. This “No Disturbance” policy will allow and encourage native vegetation to flourish so that it may provide the numerous potential functions of a vegetated shoreline and, ultimately, protect the project’s environmental, scenic, and recreational values. Thus, for newly established Buffer Zones, no removal of vegetation, including limited brushing, will be allowed. Only construction of a meandering path through the Buffer Zone, designed according to SCE&G specifications, will be allowed to provide access to the shoreline. Specifications of trail design are as follows:

- To prevent erosion and to protect the aesthetics of the shoreline the route used to create an access trail should not be direct and instead will have a meandering design.
- No trees larger than 10 inches in diameter at breast height (dbh) can be removed within the access path.
- A Lake Management representative must identify and designate the location of access paths.

5.0 SHALLOW WATER HABITAT MANAGEMENT

“Shallow water habitat” is the term used to describe the vegetated, shallow water area located below the 360-ft contour elevation. With few exceptions, lands below El. 360 are owned and managed by SCE&G who maintain a policy of no disturbance for any and all target vegetation below El. 360’, unless its removal is necessary for reasons of health and human safety or in compliance with the Woody Debris Management Plan. Furthermore, ESAs are generally located below the 360-foot contour interval and SCE&G maintains a strict policy of non-disturbance for vegetation within ESAs. This non disturbance policy applies to the 50-foot setback areas associated with all ESAs as well.

6.0 MONITORING & COMPLIANCE

Bffer zones and lands below the 360-foot contour are inspected annually by SCE&G staff for compliance with approved management practices. Boundaries have been painted and signs have been posted to identify these areas. On approximately a five-year rotation, a physical inspection of the buffer zones to monitor for violations and replace damaged or worn signs is conducted. At all times, upon observation or notification that a property owner may be in violation of these management criteria, SCE&G field checks the property and, in cases of confirmed violations, provides written notification of the violations and requests for corrective actions to the land owners

7.0 RE-VEGETATION PLAN

Occasionally, vegetation in protected areas (i.e., buffer zones, setbacks, and below the 360-foot contour) is disturbed beyond what is permitted in the guidelines. Regardless of whether a disturbance is man-made or natural, intentional or unintentional, it is the intent of the SCE&G to require re-vegetation of such areas. The principal objective in requiring re-vegetation projects is to stabilize disturbed areas along the shoreline by planting forbs, grasses, shrubs and trees as needed, and to allow natural succession to continue. Protected vegetated areas that have been restored are inspected annually to check survival of planted species and compliance with the re-vegetation plan. The re-vegetation guidelines will be used to encourage all landowners to develop a buffer zone or correct any violations of existing buffer zones. The re-vegetation guidelines are provided as Appendix A.

8.0 CORRECTIVE ACTIONS AND PENALTIES

8.1 <u>Corrective Actions</u>

Affected landowners are required to submit re-vegetation plans to SCE&G for review and approval, and to complete re-vegetation during the next growing season. A re-vegetation plan must, at a minimum, comply with the following specifications and the guidelines set forth in Attachment A, which details approved species and arrangement of plantings. A five year monitoring period will be set by SCE&G following written approval of the re-vegetation plan. The requirements of submitting and implementing a re-vegetation plan are as follows. is provided in Appendix A:

- Landowners found to have violated the buffer zone requirements or landowners adjacent to buffers that have been significantly affected by natural conditions (storm, pestilence, fire, etc.) must submit a re-vegetation plan to SCE&G within 30 days of being notified by SCE&G of the violation or "natural" conditions warranting mitigation.

- SCE&G reserves the right to take legal action to require re-vegetation of the affected areas, seek damages, and seek its administrative and legal costs for doing so.

- If the buffer has been significantly affected by natural conditions, then SCE&G will work with the landowner to restore vegetation in the buffer zone.

- SCE&G's Lake and Land Management Department will review the final plan for adequacy and completeness and provide the landowner with a request for modifications and/or approval within 30 days of receipt of the plan.

- If the plan requires modification, the landowner may be given no more than fifteen business days following SCE&G's modification request to make the modifications and re-submit a conforming plan.

- The landowner must submit an approvable plan to SCE&G as soon as reasonably possible and, in no case, longer than 50 days for violations or 90 days for natural condition mitigation. The submission timeframes shall be measured from the date of SCE&G's notification letter to the landowner.

- SCE&G reserves the right to require more than the minimum re-vegetation requirements should it determine that additional vegetation is needed, based on site characteristics or extenuating circumstances.

- The nature of the violation or the response of the landowner are two such extenuating circumstances that will be considered.

- The landowner must comply with these changes or risk penalties.

- Once a re-vegetation plan has been approved, the landowner must implement the plan during the next planting season. SCE&G defines the planting season to be from November to February.

- Should the landowner not implement the plan within the specified time frame, the plan will become null and void and the landowner will be found in violation and subject to penalties.

- Individuals are required to provide photo documentation of planted areas for a period of 5 years following re-vegetation. Photos will be taken during the spring, at roughly the same time each year, and from stationary locations used consistently during each monitored year so as to photograph the same perspective for comparison purposes.

- SCE&G will perform a follow-up inspection after the 5 year improvement period.

8.2 Penalties

In most cases, SCE&G is able to work with the landowner to resolve areas of nonconformance, particularly if the buffer zone modification is a result of natural causes. SCE&G reserves the right to require additional plantings that go beyond the minimum guidelines in Attachment A.

Landowners found in violation of the 75-foot buffer zone management restrictions or management restrictions below El. 360, as a result of the removal of vegetation, encroachment into the buffer zone, or un-permitted changes to property contours, may be subject to any or all of the following:

- Repeat violations by landowners may result in the permanent cancellation of their dock permit and loss of lake access across SCE&G property.

- Revocation of existing shoreline dock and/or ramp permits for a period of no less than five years.

- Denial of future permits and denial of access across SCE&G's property to the lake, perhaps even in the form of positive barriers.

- Removal of marketable timber within the buffer zone by the landowner will require, in addition to such other penalties prescribed herein as SCE&G determines to be appropriate, payment equal to triple stumpage, according to valuation by SCE&G's Land Department.

- Reimbursement of costs, in cases where SCE&G finds it necessary to undertake itself to restore affected buffer zones. Such a decision may result from landowners' failure to submit a re-vegetation plan in a timely fashion, or from SCE&G's determination that conditions require immediate attention to prevent serious shoreline problems.

9.0 VOLUNTARY IMPROVEMENT PROGRAM

In those areas where landowners own down to the 360' PD contour, SCE&G encourages the improvement of buffer areas through voluntary action. Property owners are encouraged to plant or allow native vegetation to flourish above the 360' PD contour to protect and enhance the Project's scenic, recreational, and environmental values. Examples of recommended native plantings are included in Table 1 of Appendix A, below. Landowners can receive more information on the voluntary improvement of their property by contacting the SCE&G Lake Management Department.

ATTACHMENT A

75-FOOT BUFFER ZONE GOALS AND CRITERIA FOR

RE-VEGETATION OF DISTURBED AREAS

BUFFER ZONE GOALS AND MINIMUM CRITERIA
FOR RE-VEGETATION OF DISTURBED AREAS

FERC PROJECT NO. 516

LAKE MURRAY – SCE&G

MINIMUM BUFFER ZONE AND SHORELINE VEGETATION

1. Improvement Goals and Recommendations

The following guidelines shall be adhered to as minimum criteria for application in the restoration of disturbed vegetation in protected areas along the shoreline perimeter of Lake Murray. The protected vegetated areas consist of two zones: (1) the shallow water habitat along below the high water mark, also referred to as the '360-foot contour' elevation, and (2) the 75-foot buffer zone, which is the land adjacent to the 360-foot contour extending inland 75 feet. Each zone will be managed with the desired plant species, based on the inherent properties and ecological functions of each zone.

As protected vegetated areas, the 75-foot Buffer Zone and the land below the 360-foot contour elevation are protected from any activities that would cause disturbance to their vegetated nature. Removal of target vegetation is strictly forbidden. In cases where disturbances to the vegetated status of these lands occurs, SCE&G will require re-vegetation of the lands according to specific criteria, as outlined here and coordinated with SCE&G. The following criteria applies to re-vegetation of the Buffer zone and lands below the 360-foot contour that have a slope of ***2 to1 or flatter***. In cases where the topography is steeper than 2 to 1, there is greater concern for potential erosion and sedimentation, thus, a specialized plan developed in conjunction with SCE&G must be developed for steep areas. Further, although re-vegetation plans may be approved for the shallow water areas below the 360-ft contour interval, this is critical and sensitive habitat and projects will be assessed on a case-by-case basis and involve significant oversight and consultation with SCE&G.

Implementation of the management goals below is recommended to enhance vegetated buffers, thereby improving biodiversity, providing erosion protection, adding or maintaining filtering capacity, and protecting the aesthetics of a “natural” shoreline.

2. Minimum Criteria for Re-vegetation of Disturbed Areas

A. *Shallow Water Habitat - Below the 360-foot Contour Interval*

Because this zone is inundated during portions of the year, timing of re-vegetation and methods to ensure establishment are of primary importance, and it is necessary to develop the re-vegetation plan with site-specific factors in mind. For example, specific topographic, soil, and energy inputs (i.e., amount of wave action, etc.) of a particular location must be considered when determining the most effective plant species to use and their arrangement. When at all possible, the re-vegetation plan of a particular location should be developed based on a reference condition. This may be information of the pre-disturbance condition at the location in terms of species, arrangements, and density of plants, or information on such factors obtained by assessing a nearby location under the same setting but with similar attributes (slope, aspect, soil, etc.).

As explained previously, re-vegetation of shallow water habitat areas requires significant oversight by SCE&G and projects will be developed based on site-specific factors on a case-by-case basis. These guidelines apply generally to areas that have a slope of 2 to 1 or flatter. Slopes exceeding 2:1 require special design and stabilization considerations that take into account an unstable shoreline and increased potential of land sloughing, erosion, and sedimentation of the lake. SCE&G will provide guidance on acceptable measures that may be used to stabilize the shoreline.

B. *Buffer Zone*

The buffer zone exists upland of the high water mark (360-foot contour), as such it does not become inundated or experience fluctuating water levels. The buffer zone is generally characterized by riparian species that function to protect the shoreline and lake waters. As the interface between the water and upland development, the vegetation in the buffer zone is important as it provides shoreline stabilization and water quality protection as well as wildlife habitat.

C. *Understory Vegetation*

Re-vegetation of protected areas will include establishing a suitable understory cover of native plantings of grasses, forbs, and shrubs with a height of at least 6 inches, with a layer of duff or natural mulch layer at least 4 inches thick applied between plantings. All shrubs, grasses and forbs used to meet the understory requirement must be native species from the approved species list in Table 1. The leaves from the leaf drop of the trees must be left on the surface to provide ground cover and filtering, although dead limbs in the buffer zone may be removed. No pesticides or nutrients are to be applied within the buffer or below the 360-foot contour zones without written approval from SCE&G.

Required area coverage of understory vegetation depends on the zone where disturbance occurs. For areas below the 360-foot contour interval, the understory layer must provide at least 75% coverage. The buffer zone must have an understory layer of least 50% coverage. In addition to these cover requirements, the understory cover in both shallow water habitat (below 360-ft contour) and in buffer zones shall be in a mosaic or linear arrangement that extends across at least 80% of the length of the buffer. Figure 1 depicts the understory cover requirements of re-vegetation plans.

C. *Replacement Trees*

A tree-lined shoreline is the desired condition for the Lake Murray shoreline. As such, removal of trees below the 360-foot contour or in the buffer zone is strictly forbidden with the exception of dead or diseased specimens approved by SCE&G. Unless an exception is granted by SCE&G, any tree removed in these zone must be replaced.

To maintain desired tree densities, replacement trees and other trees planted during re-vegetation projects must meet minimum spacing distances. Spacing between any two trees shall not exceed 15 feet. Further, trees are to be maintained along the 360-foot contour elevation and plantings should be within 15 feet of the 360-ft contour interval. As mentioned previously, dead trees or trees weakened by disease, insects, natural events, etc. may be selectively cut. However, cut trees must be replaced, regardless of their spacing, to meet these spacing requirements. Existing pines may be credited towards meeting the spacing requirements. However, pines are not included in the list of acceptable replacements because they tend to experience higher mortality due to pest and climate extremes than hardwood species. All replanted trees must be of a height between 6 to 8 feet above the ground (measure from the first sign of exposed bark exiting the soil to the top of the tree). Specifications for minimum tree spacing and tree height are depicted graphically in Figure 1. A table listing recommended species is provided in Table 1 in the following section.

3. Recommended Species for Planting in the Vegetated Buffer

The particular species used in re-vegetation projects is an important consideration and should consist of local native plants that provide the specific food, habitat and structural attributes that naturally occur at Lake Murray. Using local native plant stocks will facilitate successful establishment as local species are adapted to temperature and other environmental conditions of the area. Below is a list of tree, shrub and herbaceous species recommended for re-vegetation of buffer zones and below the 360-foot contour (Table 1). The list includes only native species that are commercially available, with the most readily available species indicated by an asterisk "*". Note that the native botanical community may include other acceptable species that typically are not commercially available.

Table 1. Recommended Plant Species for Use During Re-vegetation Projects.

ZONE	RECOMMENDED SPECIES		
	Trees	**Shrubs**	**Grass & Forbs**
Shallow water habitat - Below 360 feet elevation	Black Willow* Cottonwood* Cypress, Bald* Cypress, Pond Green Ash* River Birch* Swamp Tupelo Willow Oak* Water Oak*	Buttonbush* Silky Dogwood* Swamp Azalea Wax Myrtle* Alder	Maidencane Switchgrass (Alamo)* Bushy Bluestem Switchcane Hibiscus Water willow
Buffer Zone - from 360-foot contour upland a distance of 75 feet	American Elm* Bitter-nut Hickory Crabapple* Dogwood* Eastern Redbud* Eastern Redcedar* Green Ash* Hackberry/Sugarberry Laurel Oak* Paw Paw Persimmon* Red Maple* Red Mulberry Sycamore* Water Oak* White Ash* Willow Oak* Yellow Poplar*	American Strawberry Bush American Beautyberry* American Holly* Carolina Rose Native Azaleas Wax Myrtle*	Big Bluestem* Broomsedge Eastern Gamagrass* Little Bluestem* Indiangrass* Purpletop Switchgrass* Illinois Bundleflower* Partridge Pea* Purple Coneflower*

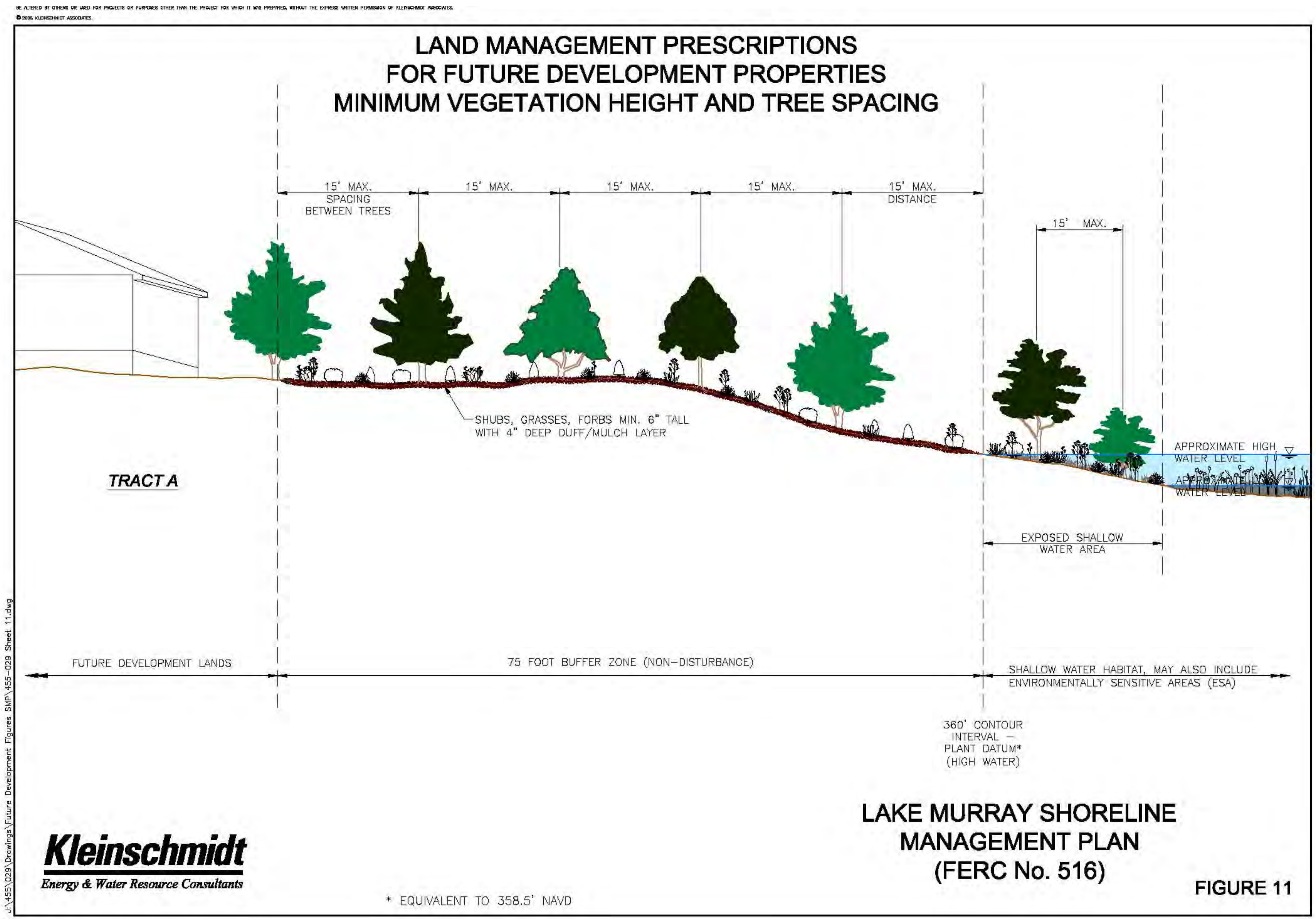
4. Maintenance and Monitoring

The monitoring period for re-vegetation plans will be established at five years. This provides adequate time to ensure that the new plantings have become established and the restored vegetation community is thriving. Because re-vegetation will be accomplished through plantings instead of by seeding, losses through such problems as germination failure are lessened, and thus there is some degree of predictability. Nevertheless, the restored areas need to be monitored so potential problems affecting the vegetated condition and/or shoreline integrity can be addressed early and resolved.

SCE&G requires that the back-property owners responsible for re-vegetation projects conduct annual photo-documentation of the restored areas. Stationary photo-points should be establish where photographs can be taken at the same angle and perspective and at the same time each year. This will allow comparisons of the site between years. Photo-documentation must be thorough enough to reflect the condition of the entire restored site.

Potential problems that may arise during the monitoring period include planting failures, where plants perish and the required vegetation coverage or tree spacing is not maintained, or invasion by weeds and nuisance vegetation. Plants that fail to establish must be replaced during the season that failure is detected. Non-native and nuisance vegetation that becomes established and appears to be or has the potential to be problematic must be removed using the effective methods for the particular species. Most likely this will involve manual removal. As mentioned previously, no pesticides, fungicides or nutrients may to be applied within the buffer or below the 360-foot contour zones without written approval from SCE&G. Depending on the particular problems encountered, the responsible individual will work with SCE&G to address the problem. In general, it is the responsibility of the back-property landowner to ensure that the re-vegetation project is successful and meets the approval of SCE&G who may conduct periodic site inspections during the five-year monitoring period.

Figure 1: **Land Management Prescriptions for Future Development Properties - Minimum Vegetation Height and Tree Spacing**



APPENDIX C

SEDIMENTATION AND EROSION CONTROL PLAN

SOUTH CAROLINA GAS & ELECTRIC COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

FERC COMPLIANCE ARTICLES

SEDIMENTATION AND EROSION CONTROL PLAN

JANUARY 2006

Prepared by:

Kleinschmidt Associates
21 Trade Zone Drive, Suite 21A
West Columbia, SC 29170

SOUTH CAROLINA GAS & ELECTRIC COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

FERC COMPLIANCE ARTICLES

SEDIMENTATION AND EROSION CONTROL PLAN

JANUARY 2006

Prepared by:

Kleinschmidt Associates
21 Trade Zone Drive, Suite 21A
West Columbia, SC 29170

SOUTH CAROLINA ELECTRIC & GAS
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

SEDIMENTATION AND EROSION CONTROL PLAN

TABLE OF CONTENTS

LIST OF APPENDICES

01/30/06 – CLB
455-028-99-00
Z:\SCO\455\028\FINAL SALUDA SEDIMENTATION AND EROSION PLAN 2006-01-25.DOC

SOUTH CAROLINA ELECTRIC & GAS
SALUDA HYDROELECTRIC PROJECT
(FERC PROJECT NO. 516)

FERC COMPLIANCE ARTICLES

SEDIMENTATION AND EROSION CONTROL PLAN

This plan was prepared in compliance with the requirements of the Federal Energy Regulatory Commission's (FERC or Commission) Order Approving Land Use and Shoreline Management Plan for FERC Project No. 516, issued and effective June 23, 2004 and subsequent Order Clarifying and Modifying the June Order, issued and effective October 28, 2004. Paragraph B of the June 23 Order and Paragraph B of the October 28 Order require South Carolina Electric & Gas (SCE&G) to develop and file a plan, by June 23, 2005, for addressing erosion and sedimentation on Lake Murray. On May 31, 2005, SCE&G requested a time extension until January 31, 2006.

1.0 BACKGROUND

In 2002, SCE&G completed a shoreline erosion survey for Lake Murray to identify and prioritize certain areas (existing and future recreation sites) susceptible to erosion and in need of monitoring for possible protective measures. In total, 60 areas were identified as areas of concern. SCE&G ranked the severity of the erosion (light, moderate, severe) at each site, and designated top priority to those sites where erosion is severe and may potentially significantly damage property or habitat, or cause a safety concern. The design of the Shoreline Erosion Survey Plan was developed in consultation with the United States Fish and Service (USFWS) and South Carolina Department of Natural Resources (SCDNR). The Shoreline Erosion Survey Plan is found in Appendix A.

2.0 GOAL

The primary purpose of this Sedimentation and Erosion Control Plan (Plan) is to identify and provide management guidelines for erosion on existing and future recreation areas and SCE&G owned islands and to address possibly related sedimentation and the potential for material impacts to fish and wildlife habitat and water quality of Lake Murray. This plan includes identification, mitigation, and monitoring strategies for those identified areas exhibiting significant erosion.

3.0 MANAGEMENT ACTIONS

SCE&G has a variety of programs in place designed at least in part to address shoreline erosion around Lake Murray. These programs, incorporated here by reference, include:

1. <u>Shoreline Management Program:</u> On non-SCE&G private lakeside property (Private Property), erosion issues are addressed through a permitting process. Compliance with related permit conditions is the responsibility of the shoreline property owner permittees. SCE&G requires Private Property owners to apply for and receive permits from its Lake Management Department prior to their initiation of shoreline construction or land/vegetation disturbing activity, such as the installation of boat docks or ramps, walls or riprap (bulkheads are not allowed and retaining walls are not permitted below the 360 ft contour) SCE&G requires Private Property owners to sign a Shoreline and Vegetative Protection Agreement as a pre-condition to the issuance of permits. Private Property owners who wish to employ erosion control measures not previously identified as appropriate by SCE&G are required to provide explanations and justifications of such "alternative" shoreline stabilization measures. These alternative shoreline stabilization measures must be approved by SCE&G. If they are not, they may not be used.

2. <u>Public Outreach and Education</u>: SCE&G provides public education materials and opportunities for Private Property owners. This is accomplished through collaboration with governmental agencies such as the Natural Resources Conservation Service (NRCS), the South Carolina Department of Natural Resources (SCDNR), and non-governmental organizations (NGO's) such as the Lake Murray

Association and Harbor Watch, and from time to time, others. In coordination with the NRCS, SCE&G developed and offers a demonstration project at its Boat Ramp #3. This demonstration project illustrates conservation alternatives for shoreline stabilization using a combination of open cell block rip-rap and native vegetation.

3. Tree Planting and Giveaway: SCE&G actively sponsors an annual planting of native aquatic-friendly/compatible plants such as bald cypress trees and button bushes along the shoreline of Lake Murray as part of a joint effort periodically with the Lake Murray Association, Lake Murray FISH, Bassmasters of South Carolina and the SCDNR. One principal objective of this effort is to reduce shoreline erosion and improve fish habitat. SCE&G also gives away and/or plants thousands of trees annually through its shoreline enhancement program, initiated in 1995.

4. Forest and Game Management Property: Approximately 106 miles of shoreline have been classified as Forest and Game Management property and will not be sold or developed.

4.0 MITIGATION

Even with these management actions, significant erosion can occur. The significance of specific areas of shoreline erosion, more often than not, is highlighted by potentially affected adjoining Private Property owners. To protect their property interests, they often seek permission and guidance to address areas of the shoreline adjacent to their fringe land property. That permission is usually granted. Peripheral to, but nevertheless potentially important to the erosion issue, as a part of the current relicensing process, all SCE&G owned islands have been designated as sites needing Stage II (intensive) archeological investigations under Section 106 Historic Preservation Act consultation requirements. As a result of those archaeological investigations, SCE&G may determine a need to mitigate areas on some islands that are shown to contain important archaeological sites at significant risk from erosion. In that limited circumstance, it may be determined that there is a need to address the erosion issue for that site.

SCE&G also provides Private Property owners with a list of vegetation species best suited for replanting and revegetating the Lake Murray shoreline. SCE&G is currently developing and will implement an enhanced outreach program to better educate the public on buffer zones and their environmental benefits to the overall lake and land management needs of the shoreline of Lake Murray. SCE&G plans to offer and to incorporate this expanded program into the next revision of the Shoreline Management Plan, which will be prepared during the current relicensing and must be submitted to the Commission by August 31, 2008.

Where the Company is requested by Private Property owners, on islands as described above, or at designated public access points it determines a desire or need to address an erosion circumstance, SCE&G will work with homeowners, public agencies, or through its own shoreline management personnel as appropriate to mitigate erosion. For all such shoreline, the following steps are taken:

1. Assessments are made to select appropriate shoreline stabilization methodologies, based on the severity of the erosion and other shoreline circumstances/conditions. When possible, control methods employ best management practices and planting of appropriate native vegetation:

    a. Areas with light or moderate erosion are more likely to be encouraged to be maintained by enhancing the vegetative cover or employing bioengineering methods, i.e. combining the use of rock or engineered block/mats and vegetation for shoreline stabilization.
    b. Areas of heavy erosion are almost universally to be controlled by riprap. Rip-rap for erosion control at and below the 360 foot contour must be comprised of aesthetically and structurally acceptable materials (no solid concrete blocks, bricks, or building materials).

2. SCE&G has implemented a non-disturbance buffer policy for properties currently designated for future development and not already approved for sale by the FERC under preexisting policy guidelines. Where applied, this forward-looking policy allows Private Property owners only to have a 10 foot wide meandering path through the buffer area to a dock or other permitted shoreline amenity. There may be no other removal of vegetation in the buffer area. Where applied this should provide a robust buffer zone, thereby significantly limiting the potential for landside activity related

erosion. This will help to insure, going forward, a proper balance in shoreline uses, and will directly affect approximately 95 miles of shoreline around Lake Murray.

5.0 MONITORING OF COMPLIANCE WITH EXISTING POLICIES AND OF SHORELINE STABILIZATION PROJECTS

Shoreline erosion control permitting is managed by SCE&G, with coordination with jurisdictional resource and regulatory authorities as appropriate.

Compliance with SCE&G's management prescriptions for its various land classifications is monitored and enforced by SCE&G, as detailed in the Buffer Zone Management Plan, and the Shoreline Management Plan.

SCE&G currently evaluates and updates the shoreline management plans as a part of its FERC-mandated five year review process in consultation with appropriate agencies and NGO's.

Once identified, SCE&G plans to survey the highly erodable areas every five (5) years and the light to moderate areas every ten (10) years. Surveying of these properties will be conducted under the guidelines established in the March 2002 Shoreline Erosion Survey Plan prepared in coordination with the SCDNR and USFWS. Those areas classified as future or existing public recreation areas exhibiting severe erosion would be considered for a stabilization project. SCE&G would coordinate any stabilization activities with the SCDNR, USFWS and other appropriate state or federal agency as necessary.

6.0 REFERENCES

South Carolina Department of Natural Resources. 2000. News Release #00 – 52, DNR News. March 6, 2000. [Online] URL: http://www.dnr.state.sc.us/cec/news/mar0600.html. Accessed May 18, 2005.

APPENDIX A

SHORELINE EROSION SURVEY PLAN

APPENDIX D

BASELINE ENVIRONMENTAL MONITORING PLAN FOR LAKE MURRAY MARINAS

EXHIBIT #29

BASELINE ENVIRONMENTAL MONITORING PLAN
LAKE MURRAY MARINAS

Prior to beginning construction of a marina, baseline water quality and aquatic biology data shall be collected in the vicinity of the proposed development. Baseline sampling of all parameters shall be collected prior to any construction on a weekly basis for the month of August. The number of sampling locations is site specific and will be determined by South Carolina Electric & Gas Company and the appropriate regulatory agencies when a site is selected.

Annual sampling shall be conducted subsequent to the baseline sampling on a weekly basis during the month of August. The annual sampling shall be conducted for a minimum of five (5) years after all construction is completed and 100% slip occupancy has occurred. The need to continue beyond this point shall be determined by SCE&G and the appropriate regulatory agencies.

The following parameters shall be sampled at all locations.

WATER QUALITY

WATER COLUMN

Dissolved Oxygen Temperature Conductivity	Each shall be monitored weekly at the surface, mid-depth, and bottom of the water column three times during the day; before 8:00 a.m., mid day, and 4:00 - 6:00 p.m.
Fecal Coliform pH	Each shall be monitored weekly at mid-day within one foot of the surface

AQUATIC BIOLOGY

Benthic Macroinvertebrates - Ponar grab samples shall be collected at two locations - one in the area impacted by the marina and one in the vicinity with similar substrate characteristics not impacted by the marina. Benthic sampling shall coincide with a water quality sampling during August. The total number of benthic fauna shall be quantified by Taxon and diversity index values calculated. If results indicate an adverse impact on the benthic community, then sediment sampling may be required.

APPENDIX E

LAKE MURRAY WATER QUALITY MONITORING PLAN

EXHIBIT #30

LAKE MURRAY WATER QUALITY MONITORING PLAN

PARAMETER	FREQUENCY	WATER COLUMN LOCATION
Temperature	M	P
Dissolved Oxygen	M	P
pH	M	T,B
Conductivity	M	T,B
Secchi Disc	S	
Alkalinity	S	T,B
Turbidity	S	T,B
Total Dissolved Solids (TDS)	S	T,B
Hardness ($CaCO_3$)	S	T,B
Chlorophyll a	S	T
Fecal Colifrom	S	T
Ammonia	S	T,B
Nitrite & Nitrate	S	T,B
Total Phospherous	S	T,B
Fe	S	T,B
Cd	S	T,B
Cu	S	T,B
Zn	S	T,B
Cr	S	T,B
Pb	S	T,B
Hg	S	T,B
Ni	S	T,B

M = Monthly S = Semiannually (February and August)
P = Profile in water column at 1 meter intervals including T
T = Top (.3 meters) B = Bottom (1.0 meters off bottom)

LAKE MURRAY SAMPLING LOCATIONS

LMWQ001	South side of #5 Penstock at old river bed
LMWQ002	Tailrace Saluda Hydro
LMWQ003	Marker 131
LMWQ004	Marker 25
LMWQ005	Marker 111
LMWQ006	Marker 100A
LMWQ007	Marker 43
LMWQ008	Little Saluda River at Hwy. 391 Bridge

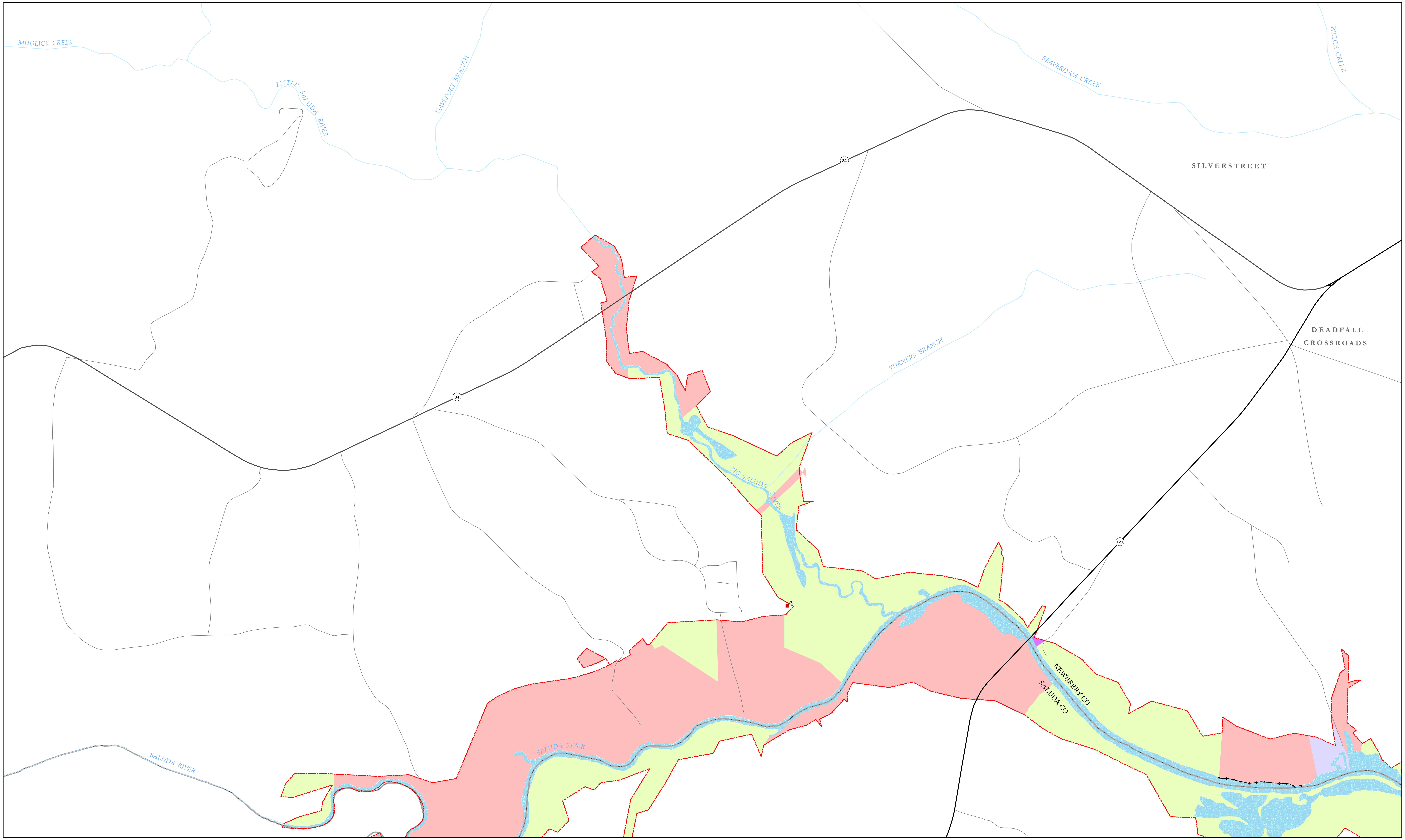
APPENDIX F

ENVIRONMENTALLY SENSITIVE AREAS REPORT

Due to the sensitive nature of this material, the Environmentally Sensitive Areas Report is not included in the public version of this document.

Appendix 27

Land Classification Maps



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

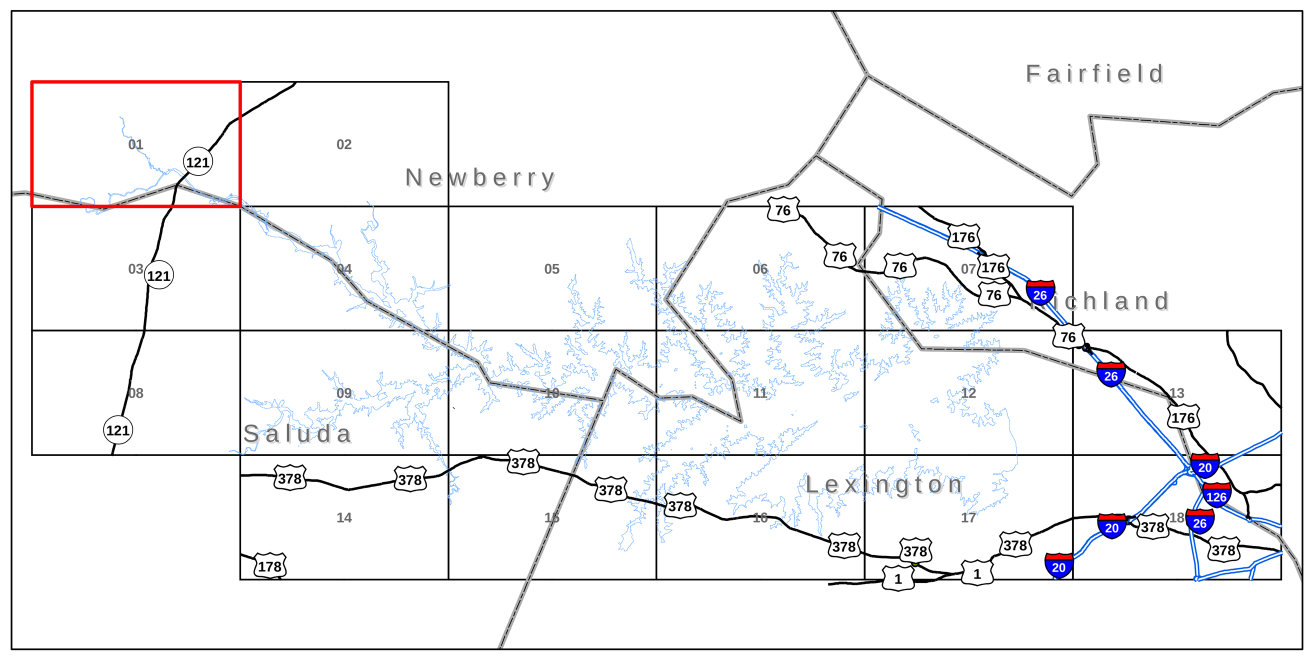
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost



NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 01 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

Bottomland Hardwood and Wet Flats
Continuous Button Bush
Intermittent Button Bush
Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

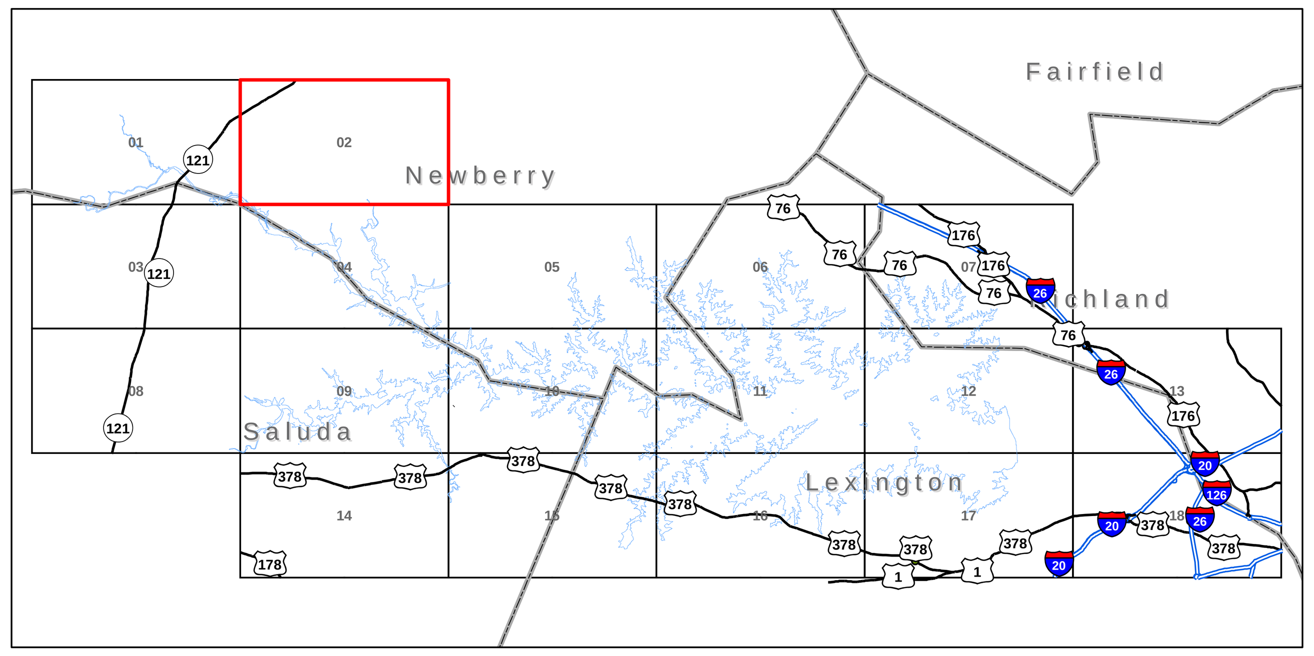
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

75-Foot Setback
Causeway
Commercial Recreation
Conservation Area
Easement
Easement with 75-Foot Setback
Forest and Game Management
Future Development
Project Operations
Public Recreation
Archaeological and Historical Sites
Streams
County Boundary
Project Boundary Line
Purple Martin Roost

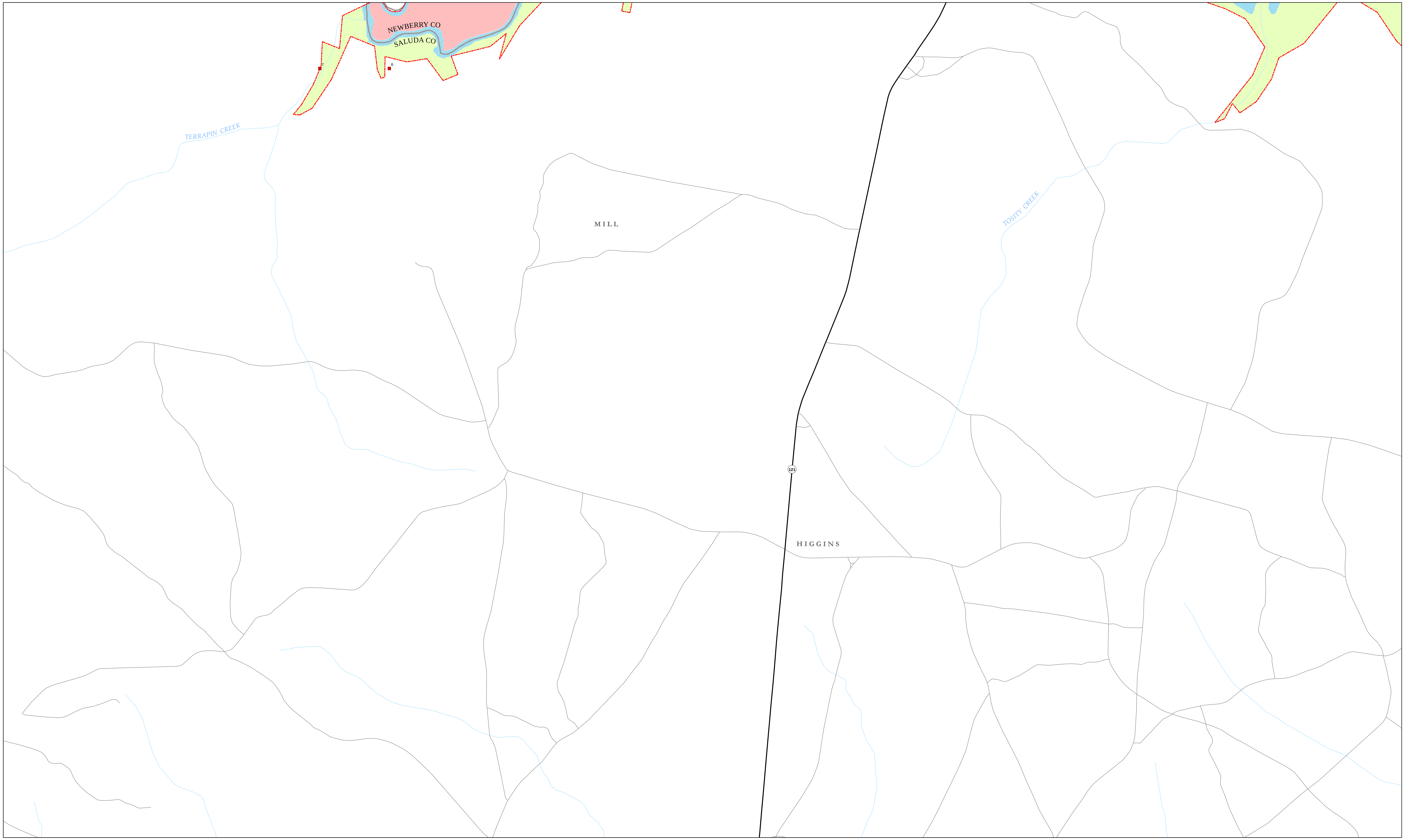


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 02 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



Bottomland Hardwood and Wet Flats
Continuous Button Bush
Intermittent Button Bush
Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

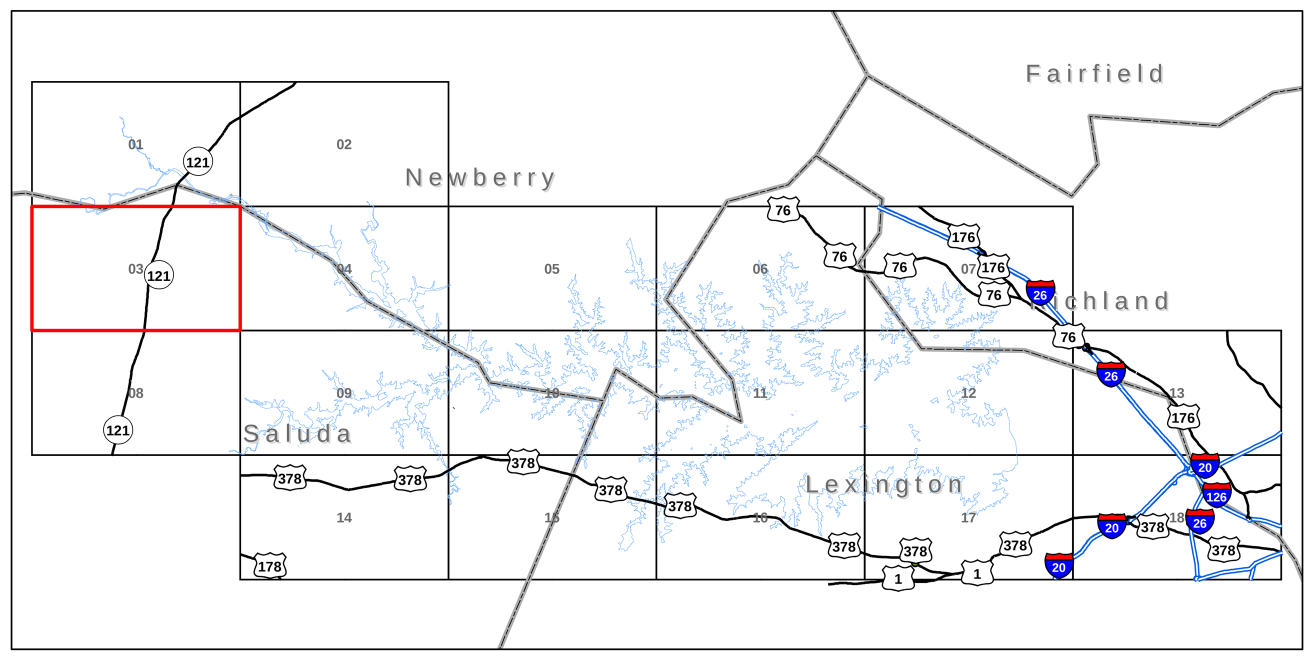
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

75-Foot Setback
Causeway
Commercial Recreation
Conservation Area
Easement
Easement with 75-Foot Setback
Forest and Game Management
Future Development
Project Operations
Public Recreation
Archaeological and Historical Sites
Streams
County Boundary
Project Boundary Line
Purple Martin Roost

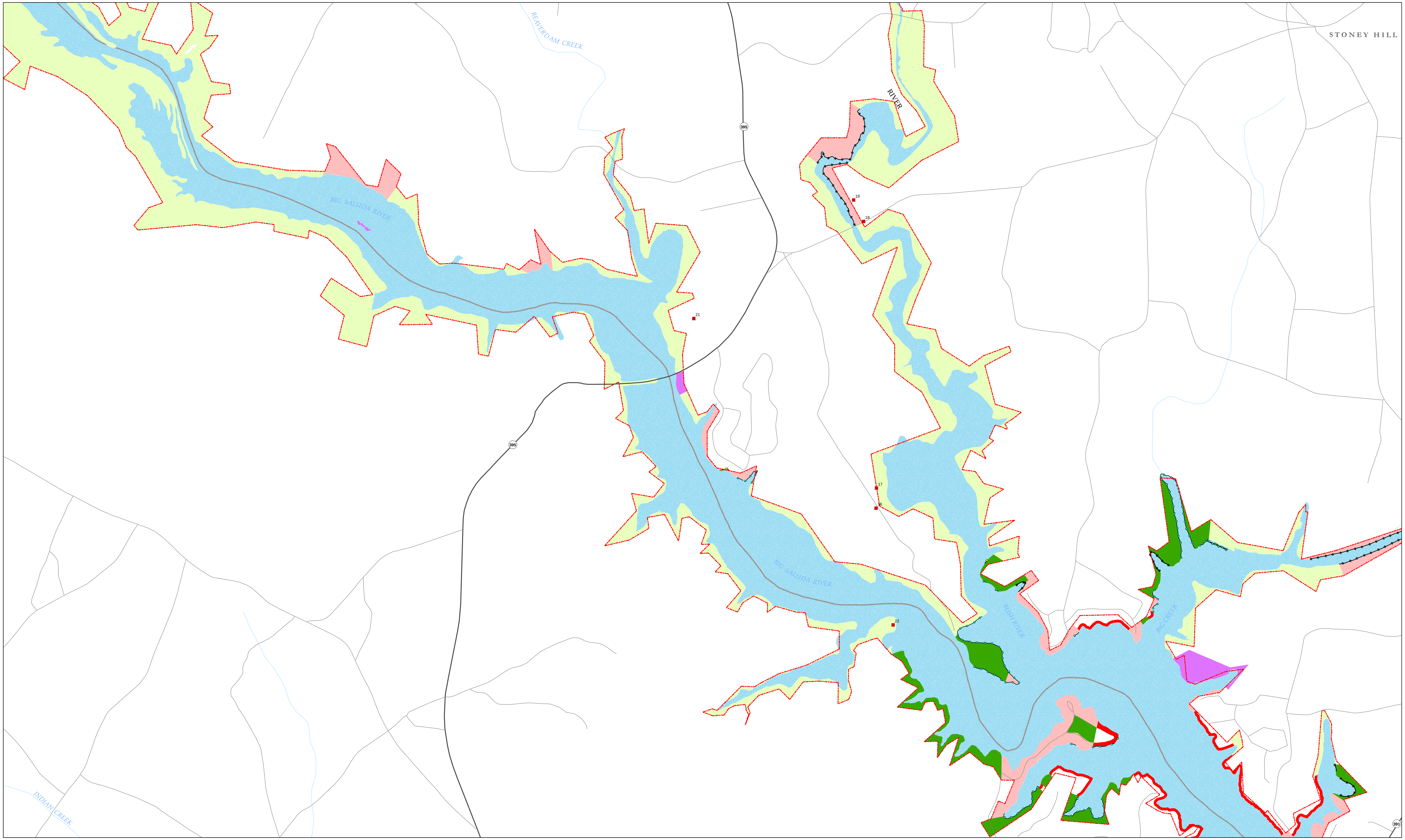


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 03 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

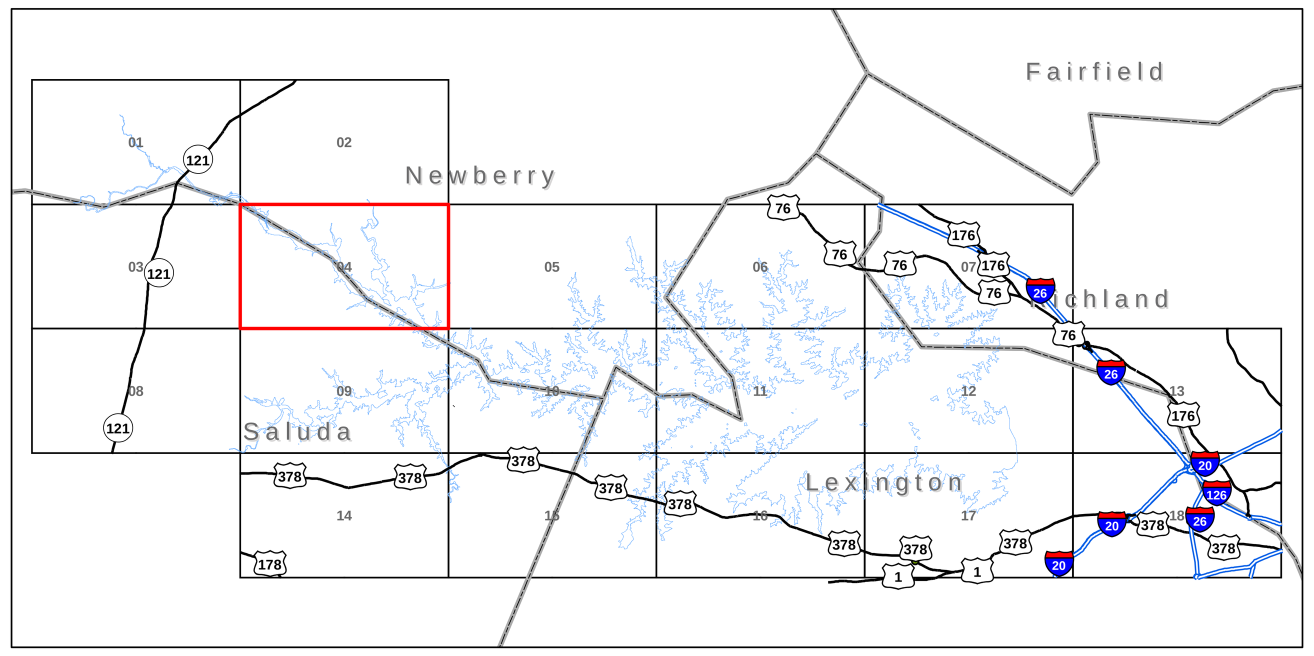
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.
South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost



N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 04 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

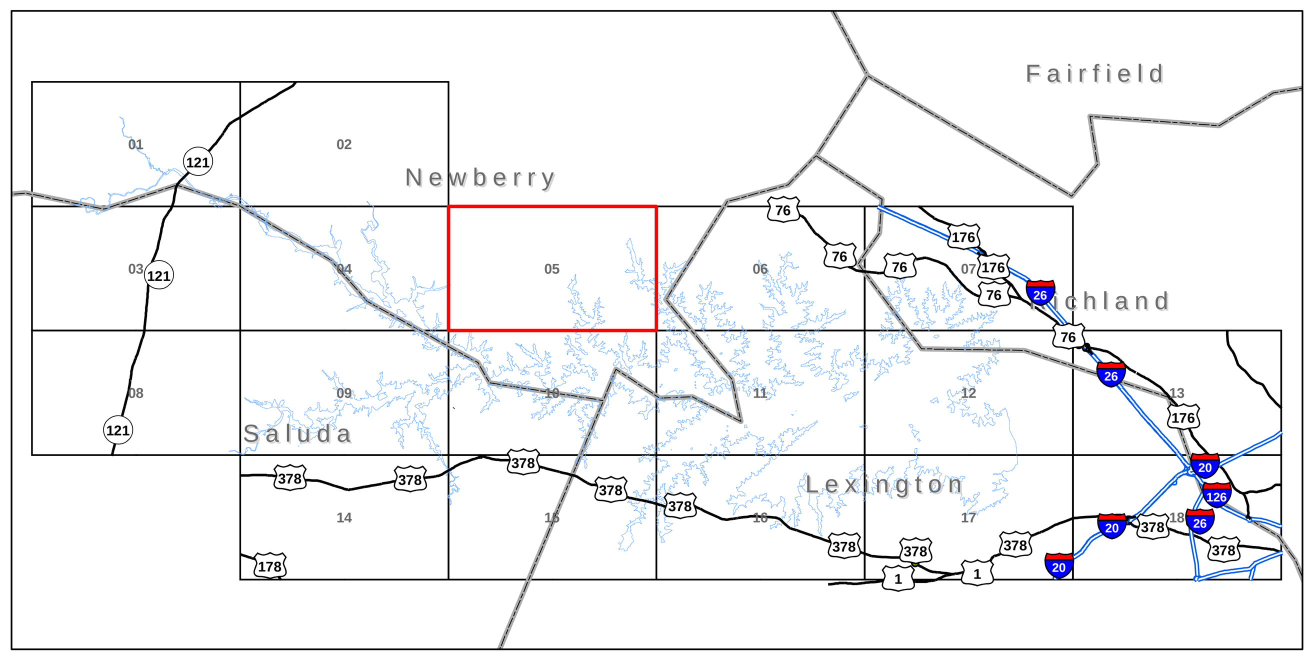
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

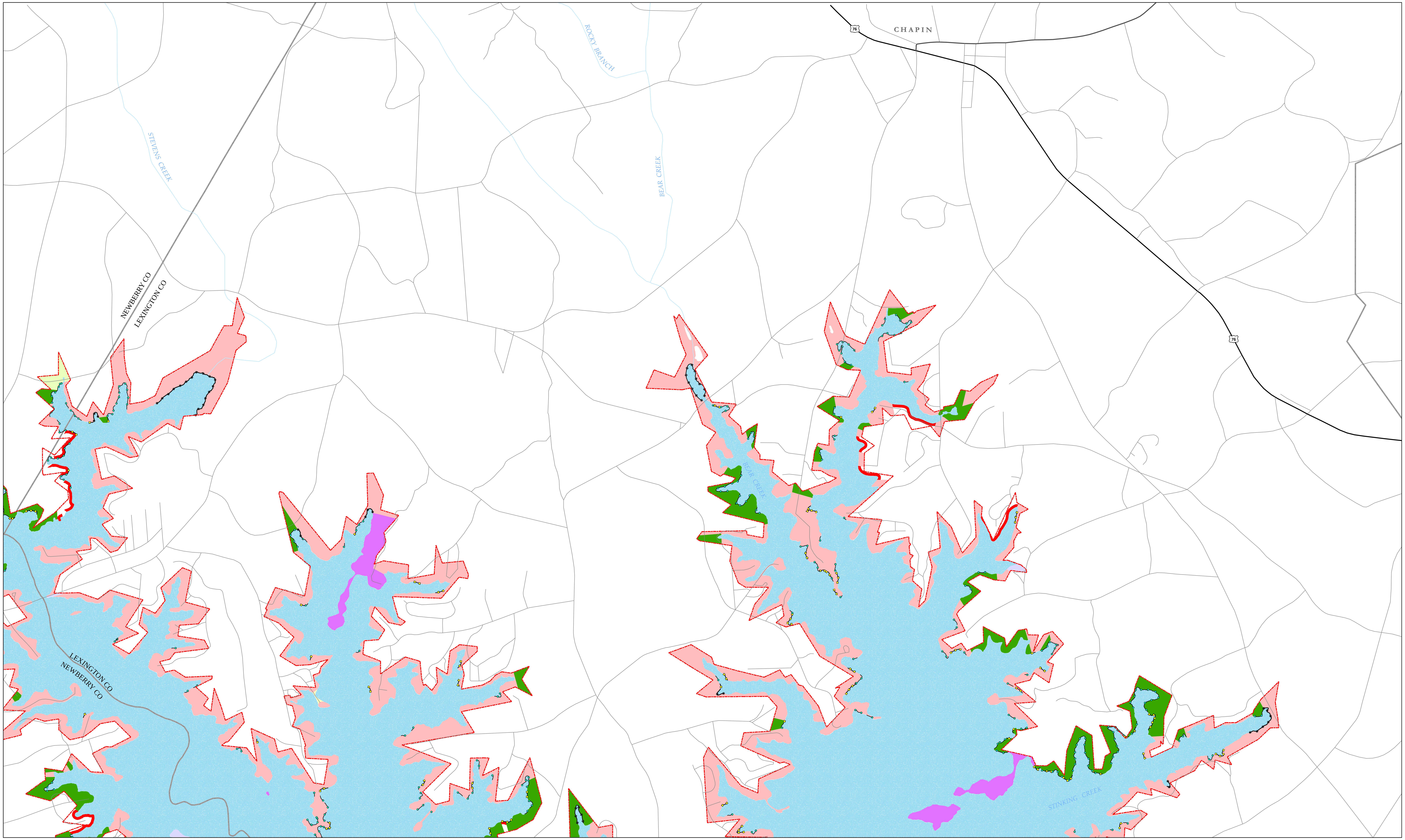


N
W
E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 05 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

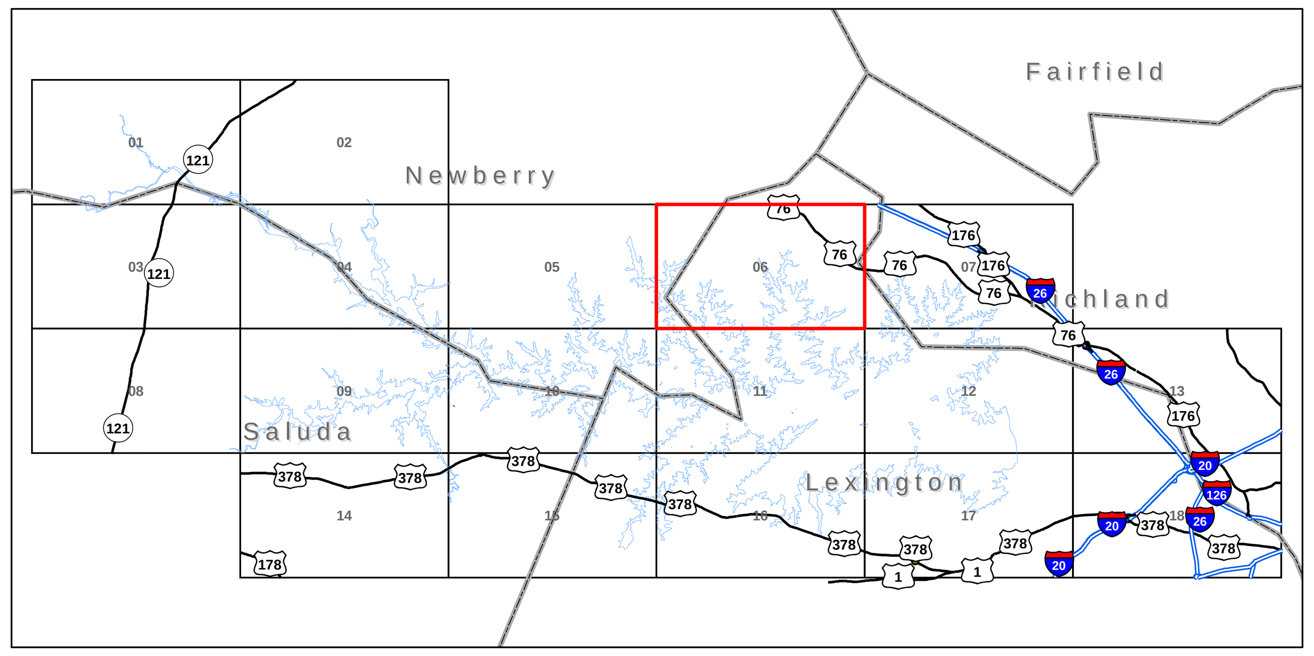
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost



N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 06 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

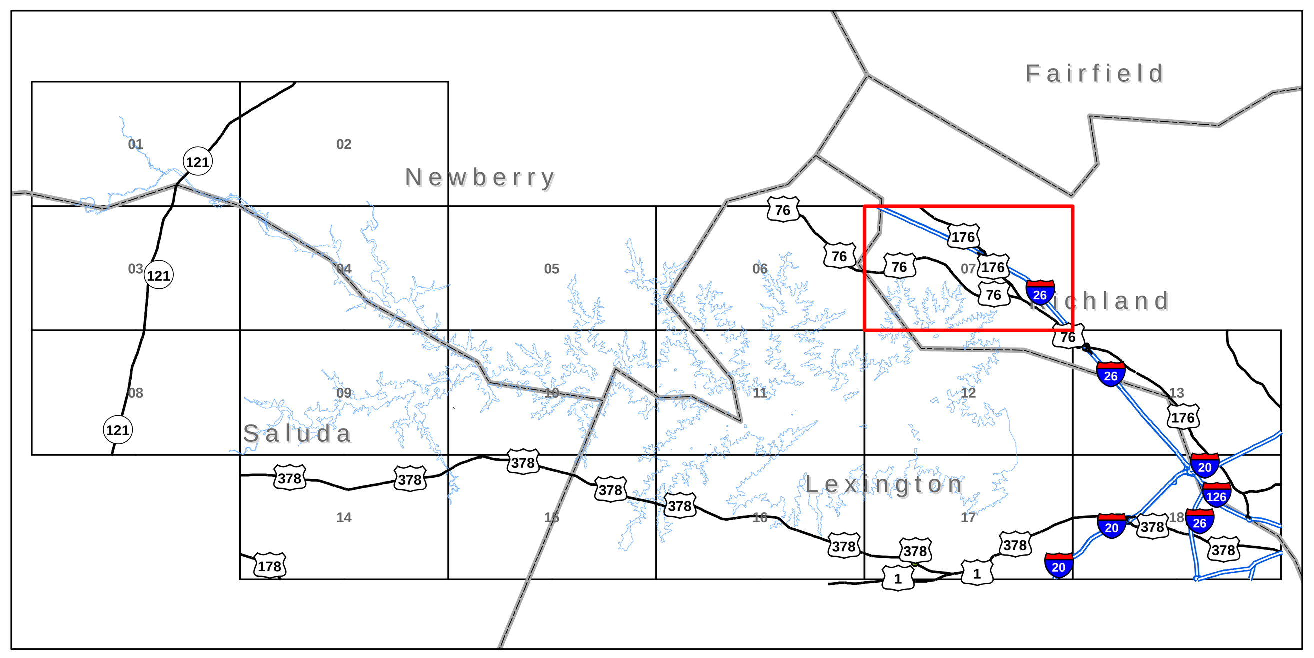
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost



N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 07 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

Bottomland Hardwood and Wet Flats
Continuous Button Bush
Intermittent Button Bush
Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

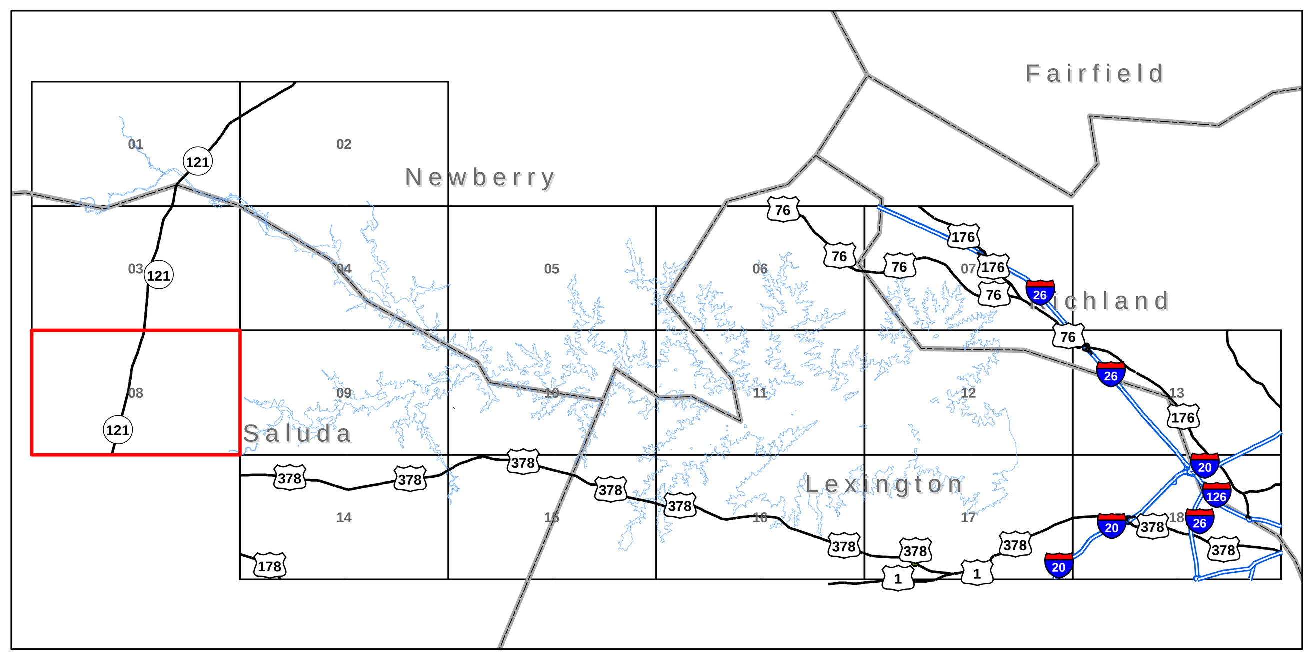
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

75-Foot Setback
Causeway
Commercial Recreation
Conservation Area
Easement
Easement with 75-Foot Setback
Forest and Game Management
Future Development
Project Operations
Public Recreation
Archaeological and Historical Sites
Streams
County Boundary
Project Boundary Line
Purple Martin Roost

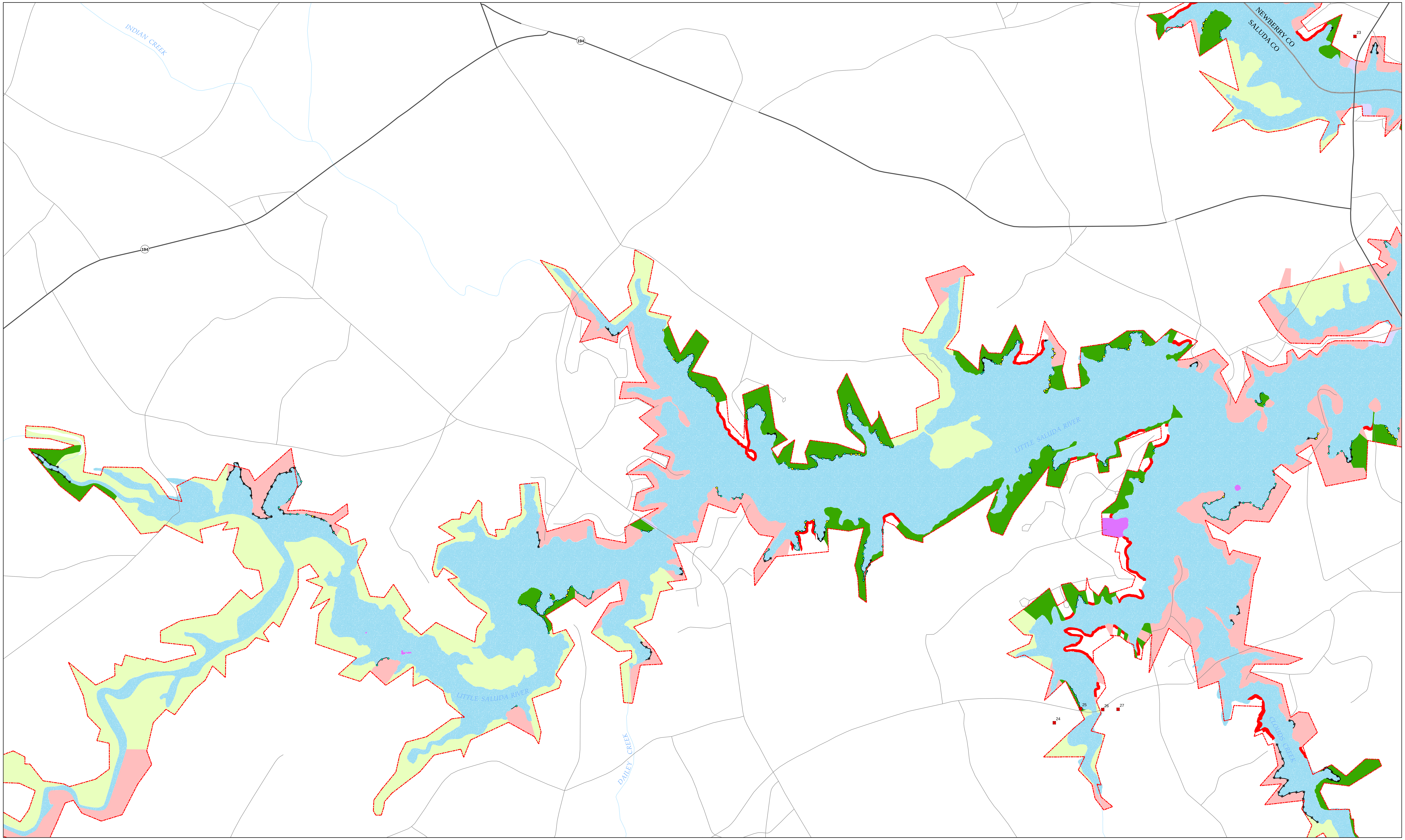


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 08 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

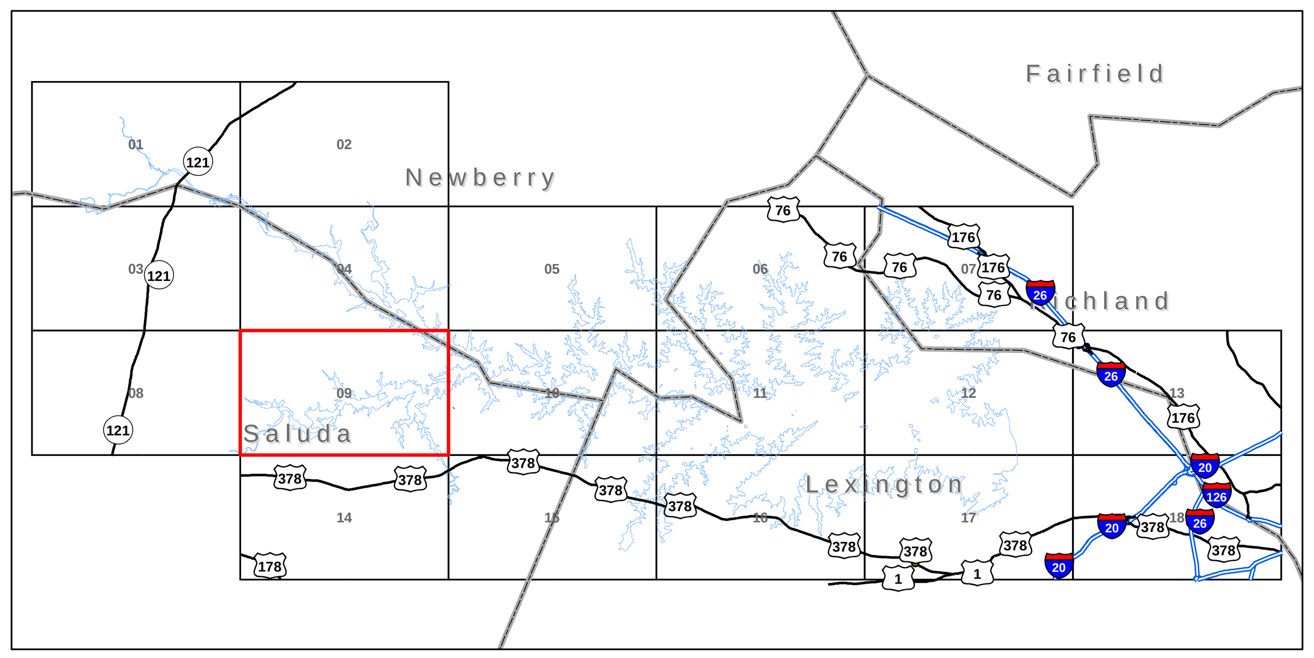
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

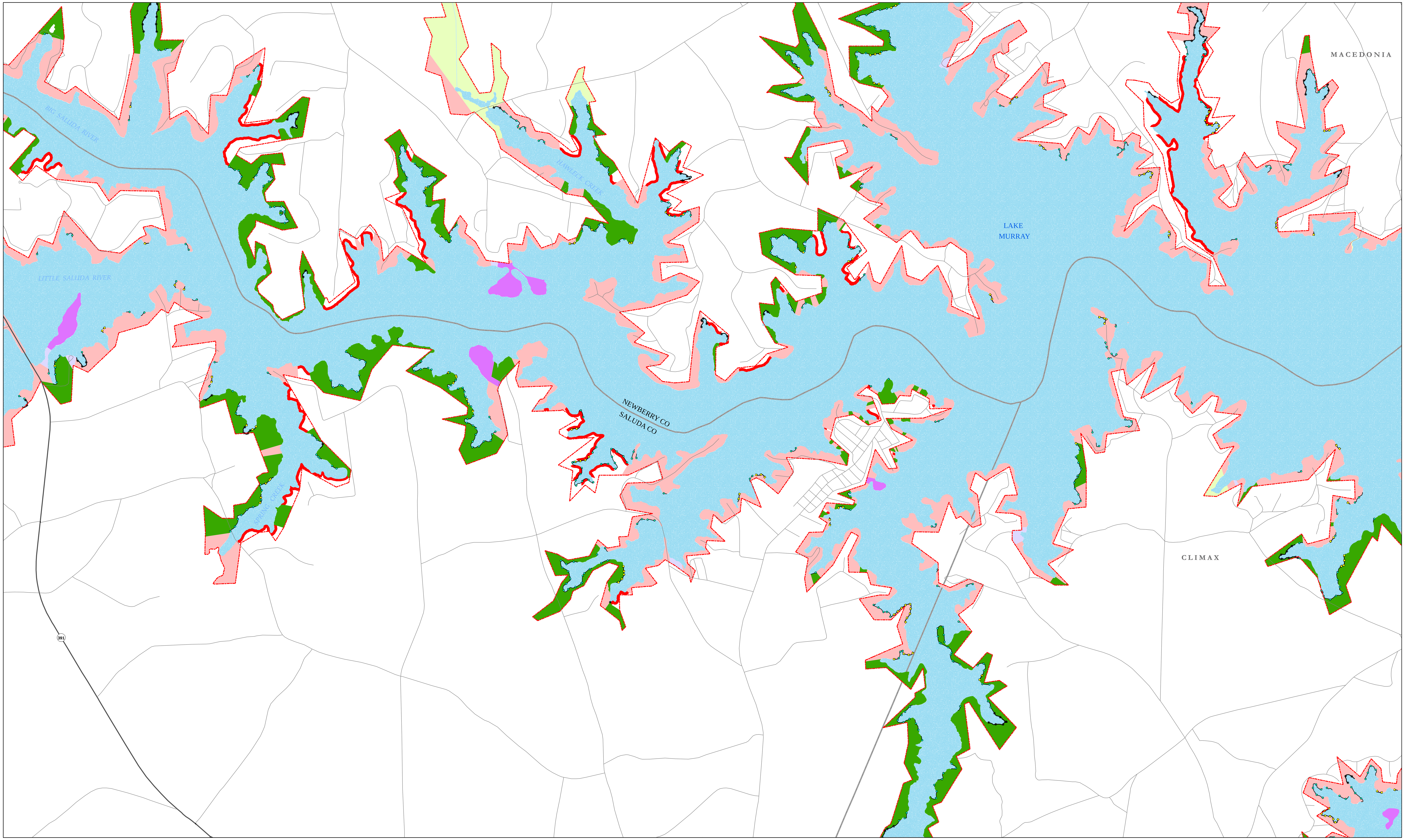


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 09 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

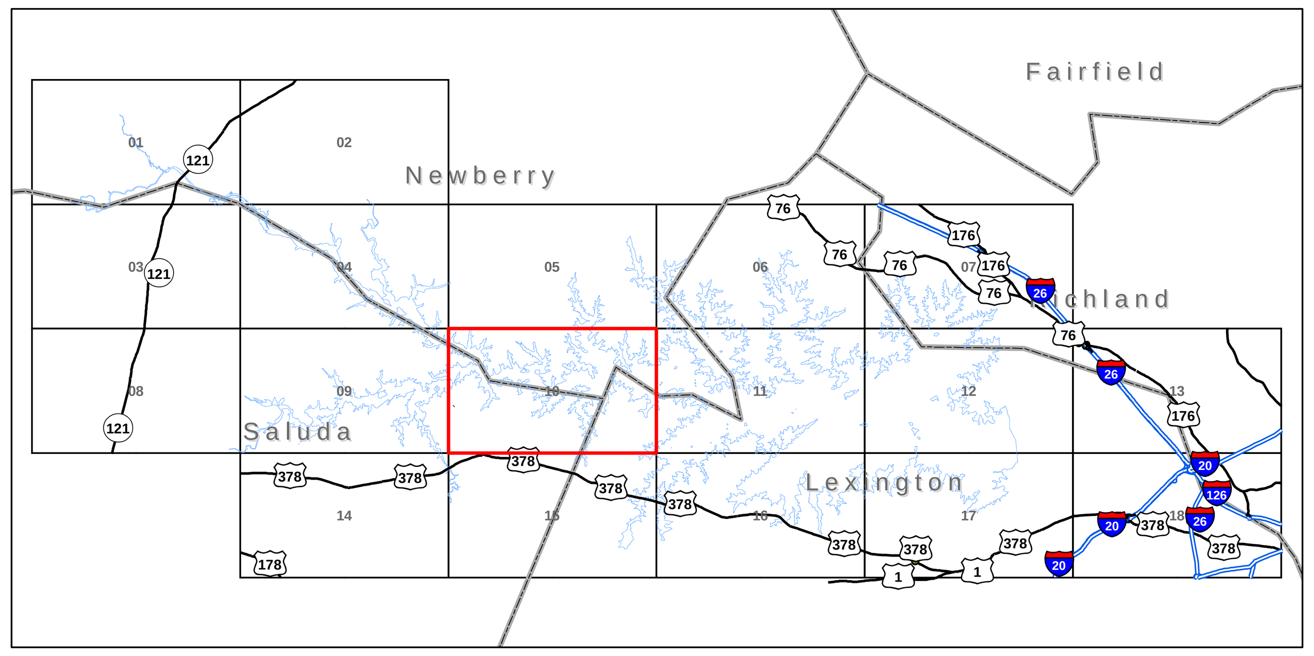
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

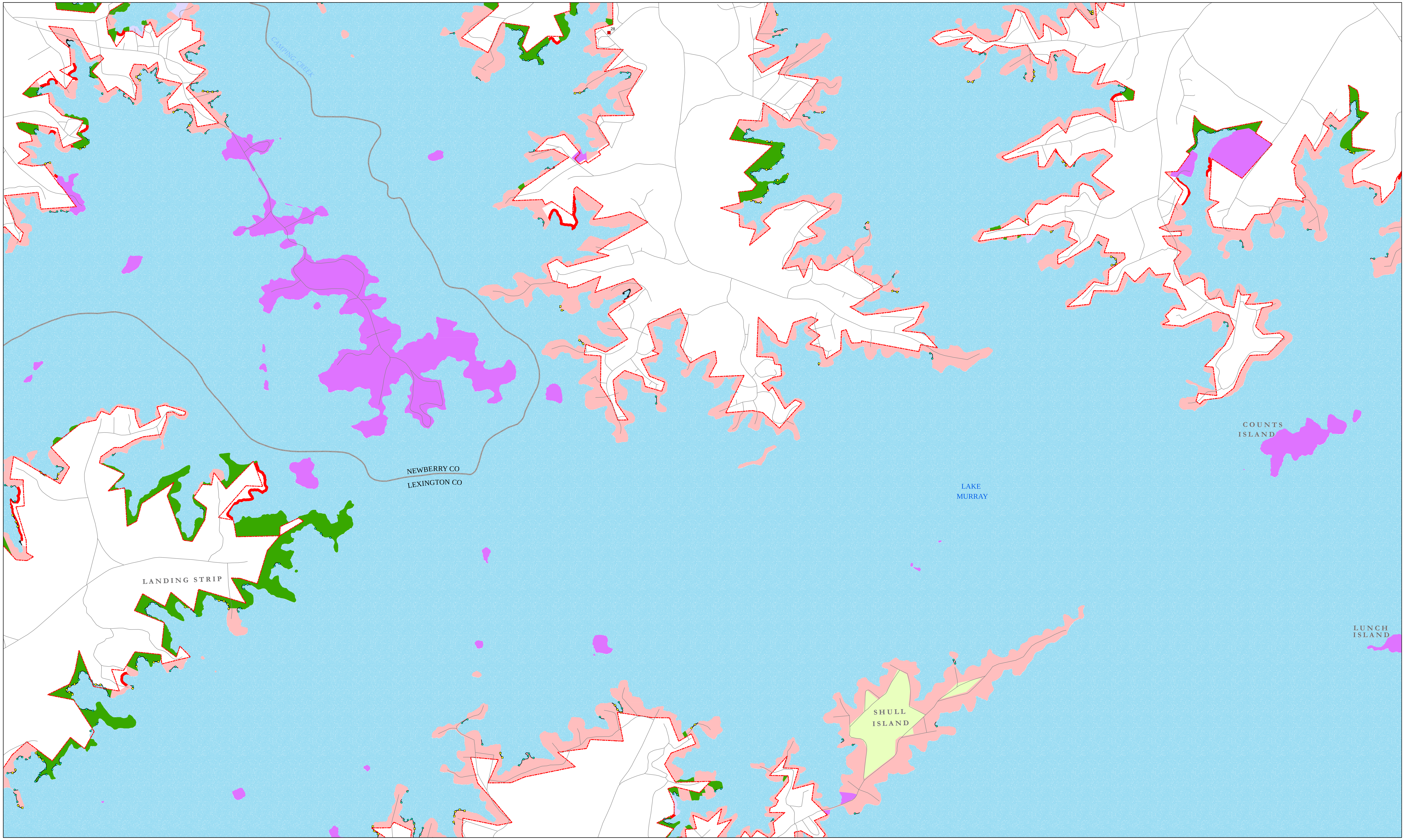


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 10 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

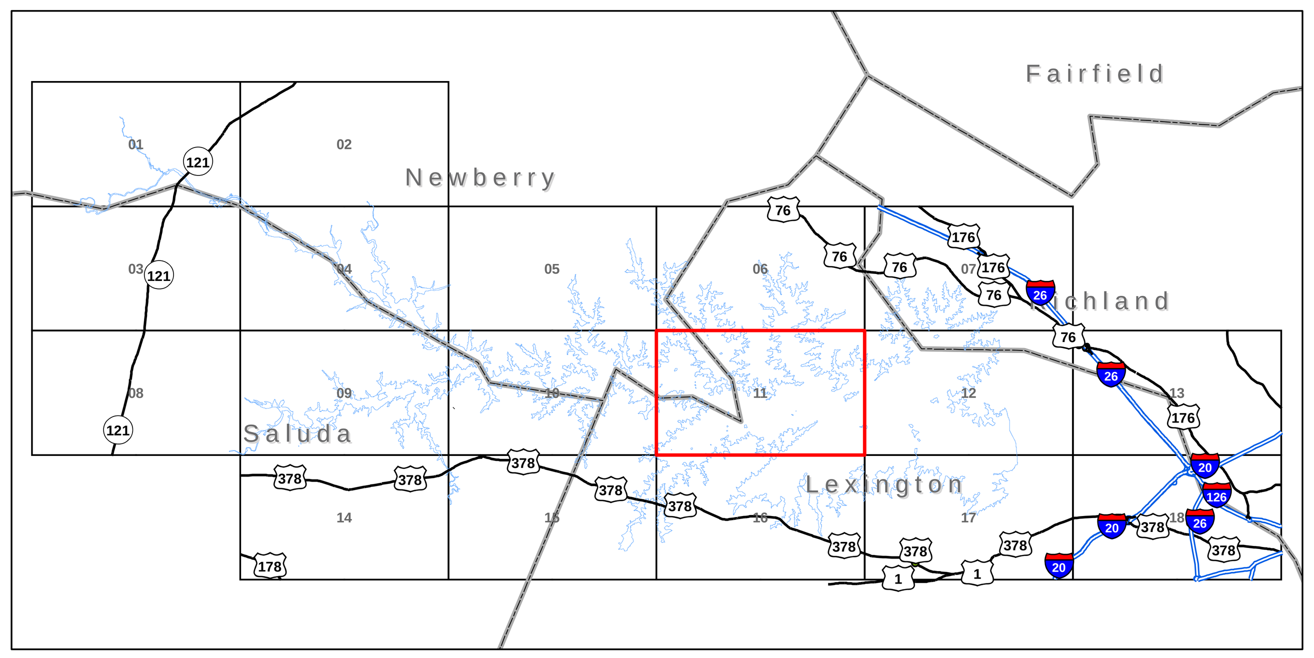
Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.
2. Vegetated Shoreline - This classification is divided into two sub classes:
   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

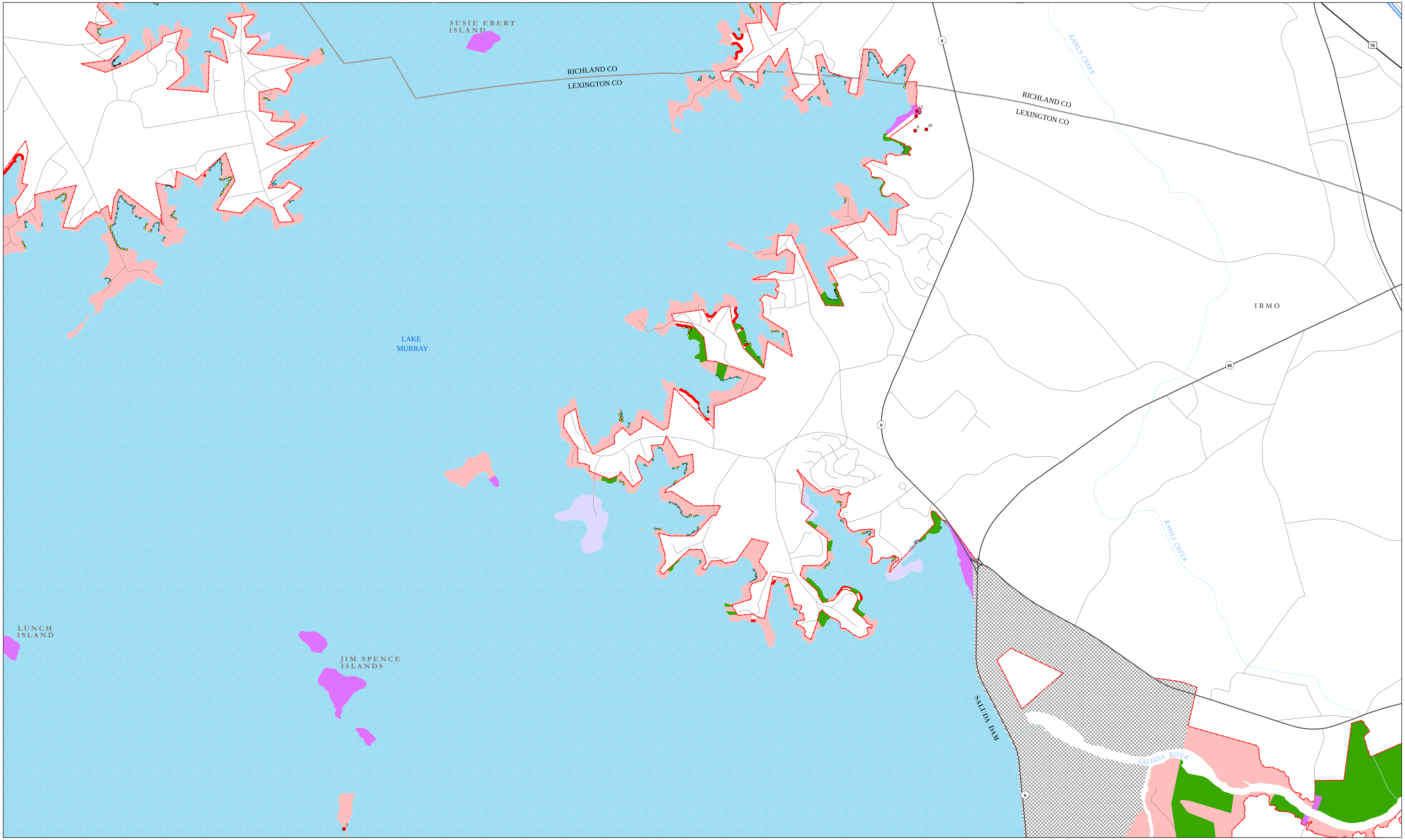


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 11 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

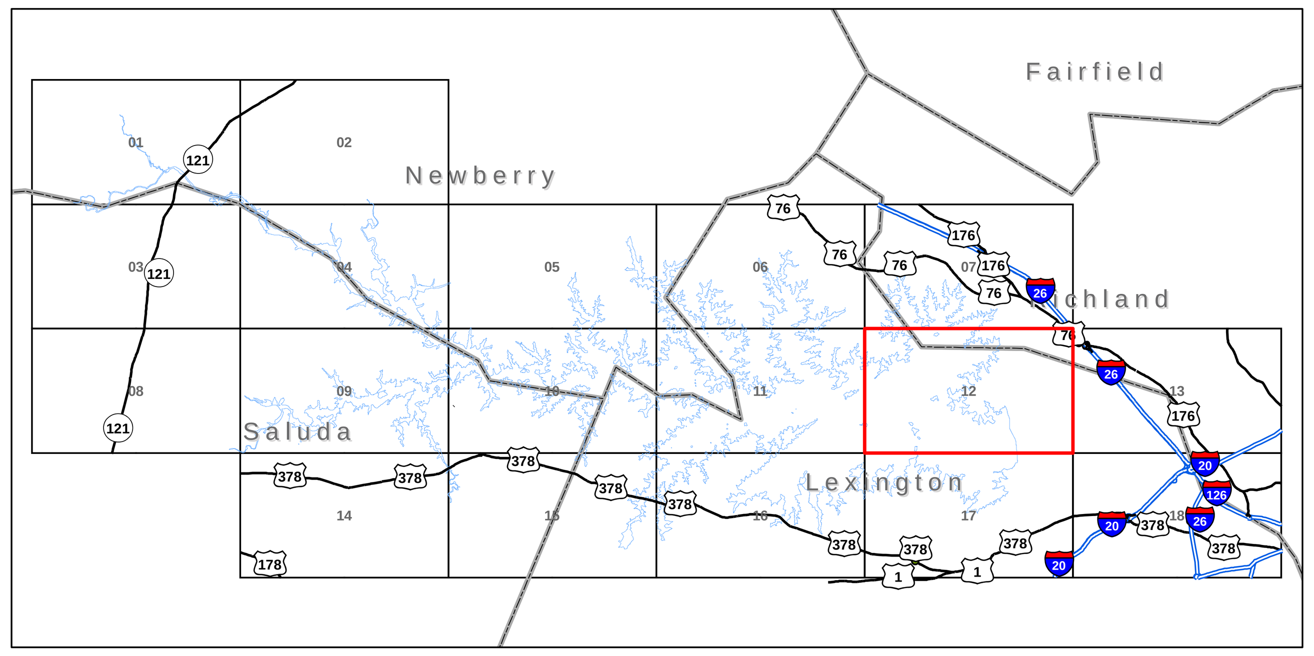
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

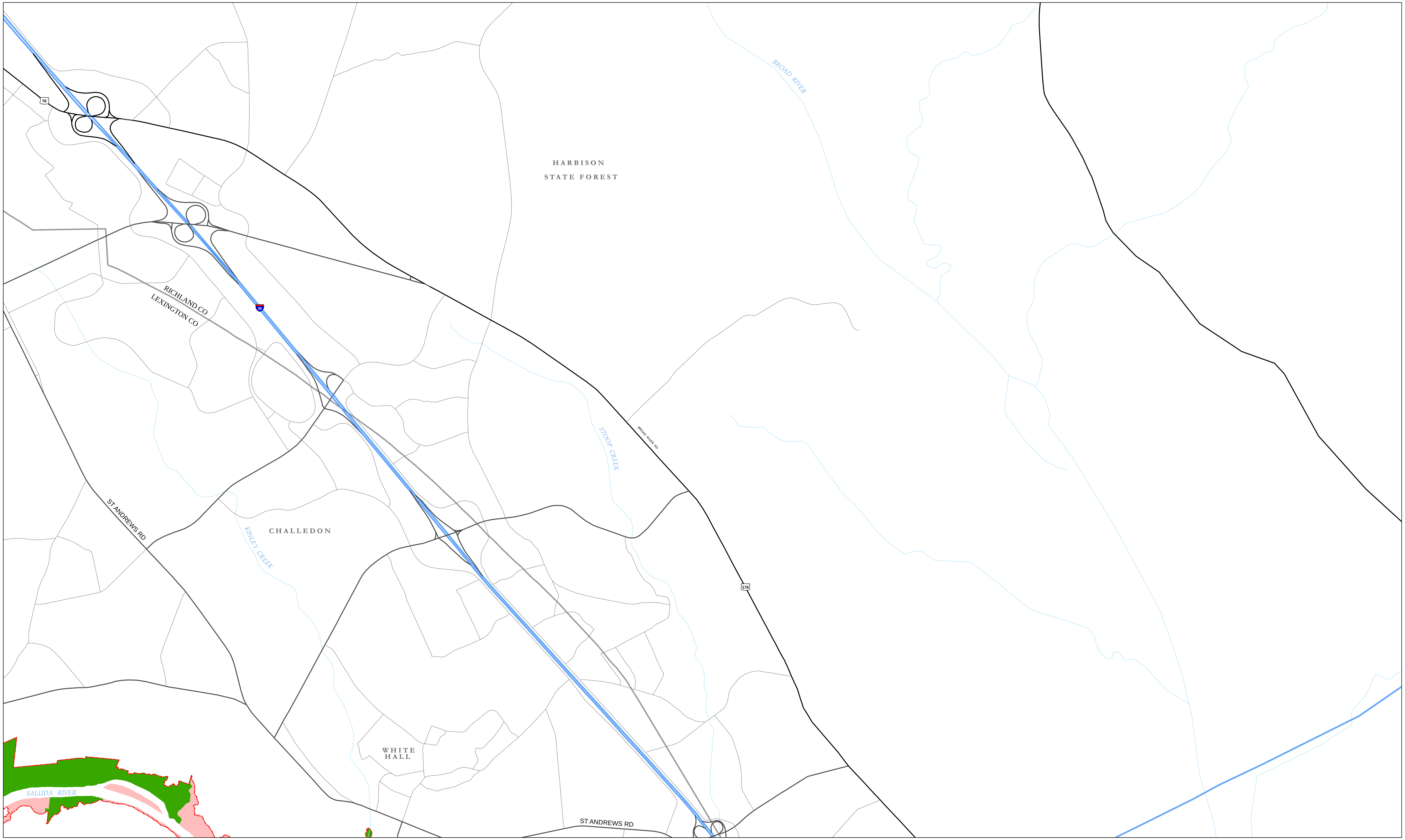


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 12 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

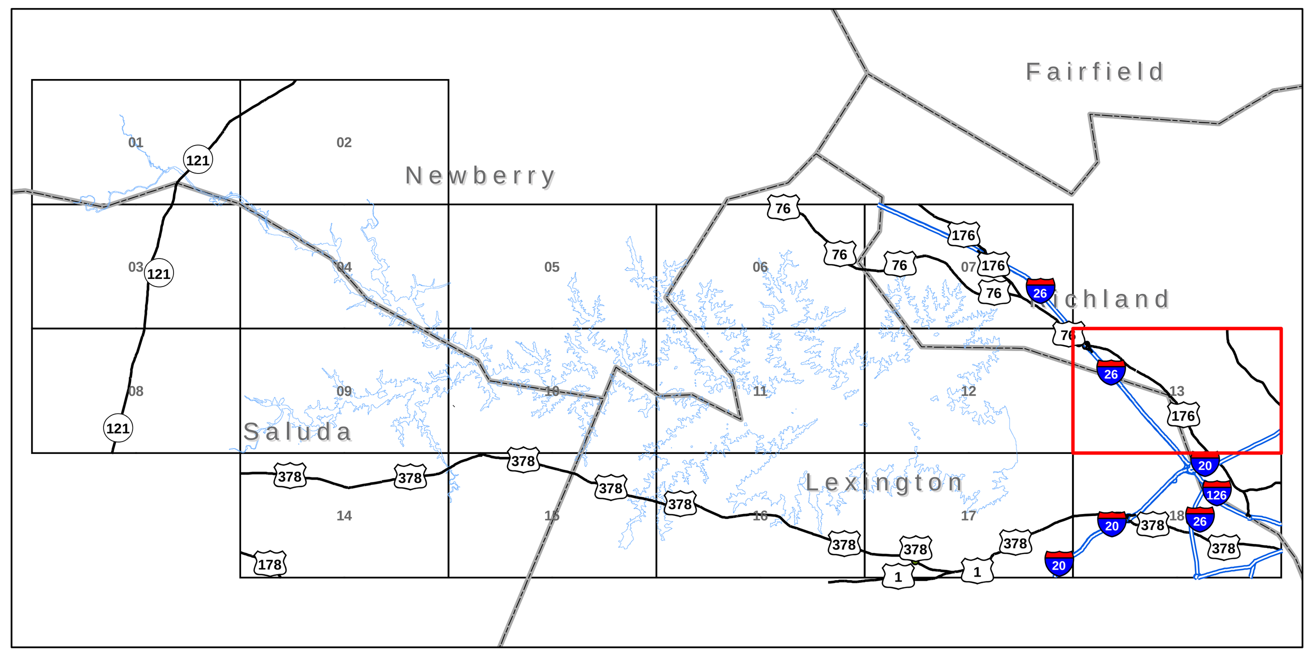
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost



N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 13 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

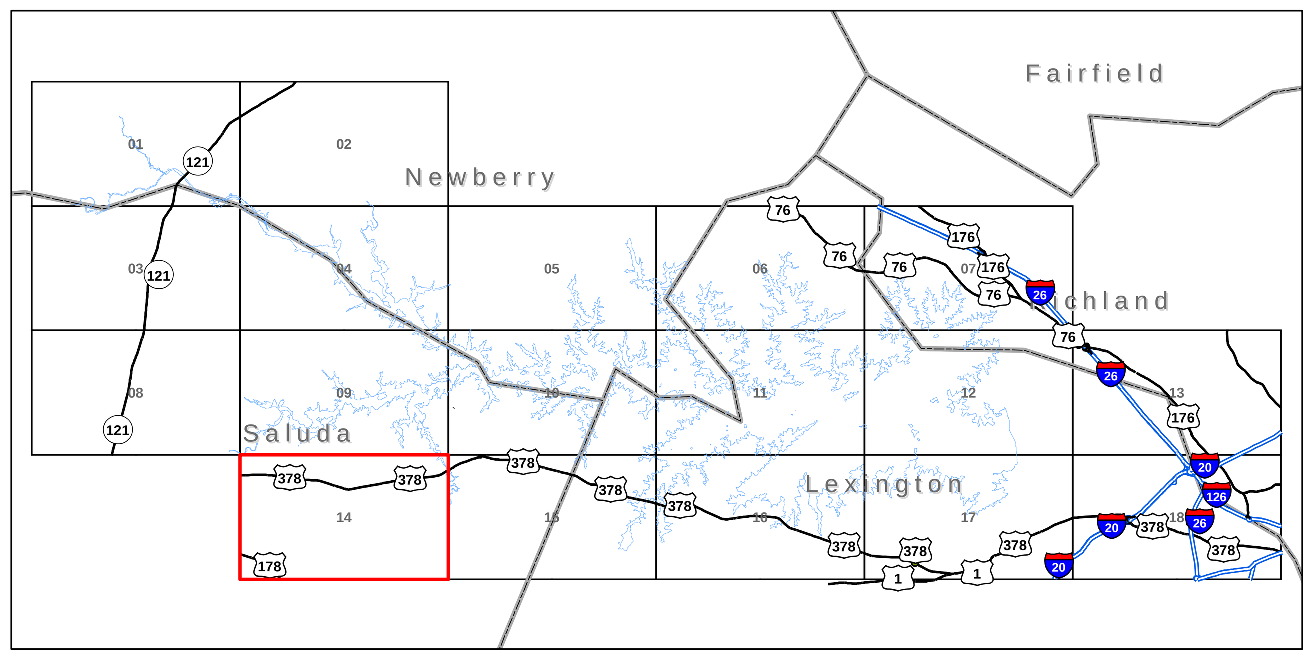
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

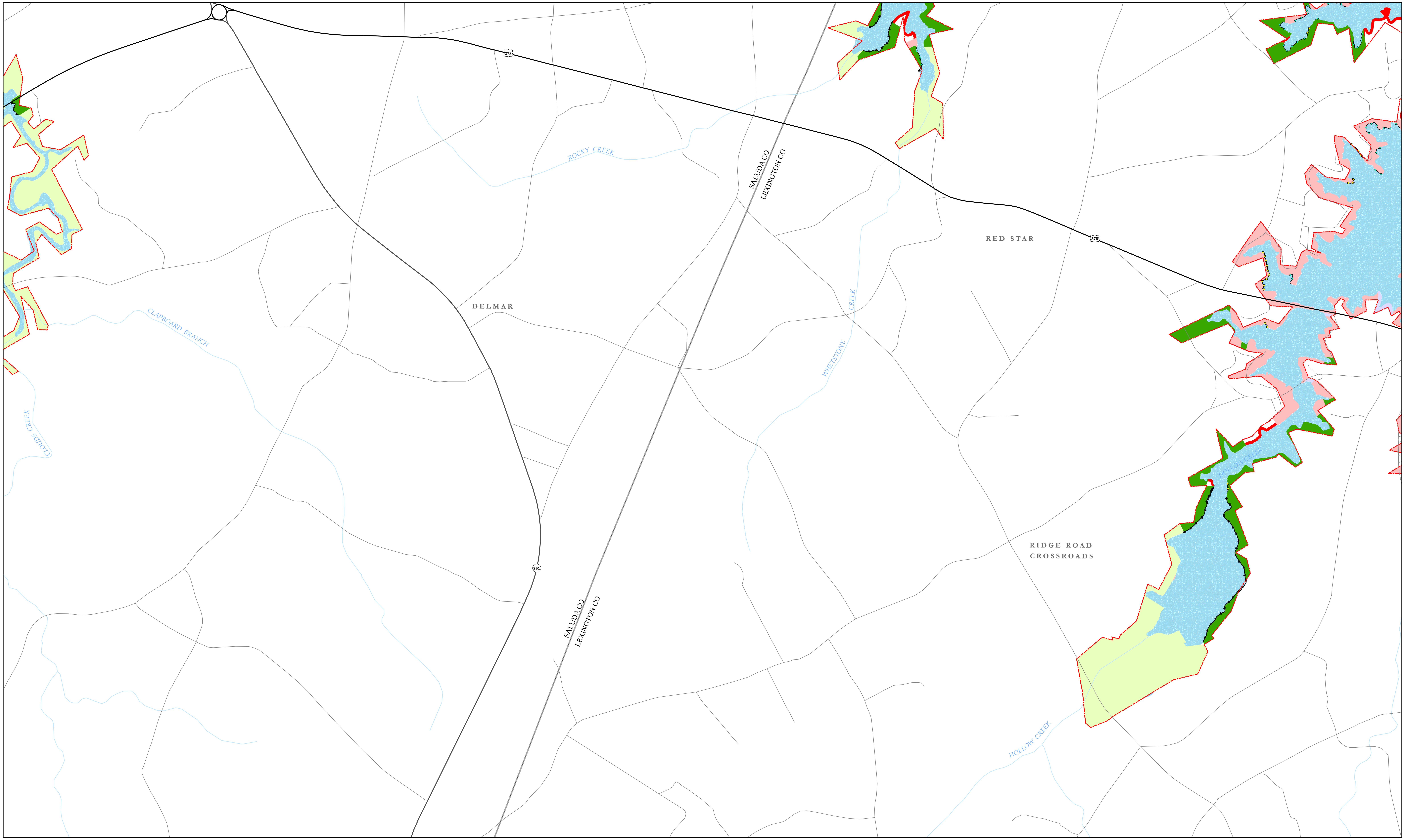


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 14 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

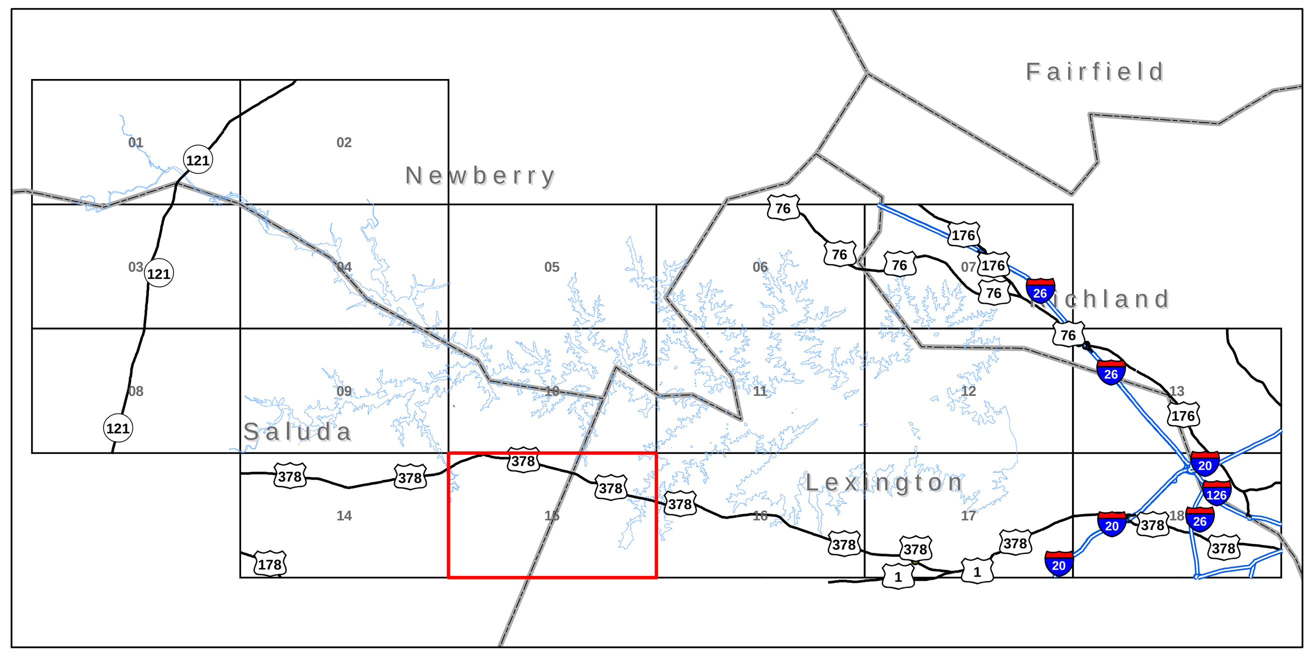
1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.
2. Vegetated Shoreline - This classification is divided into two sub classes:
   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

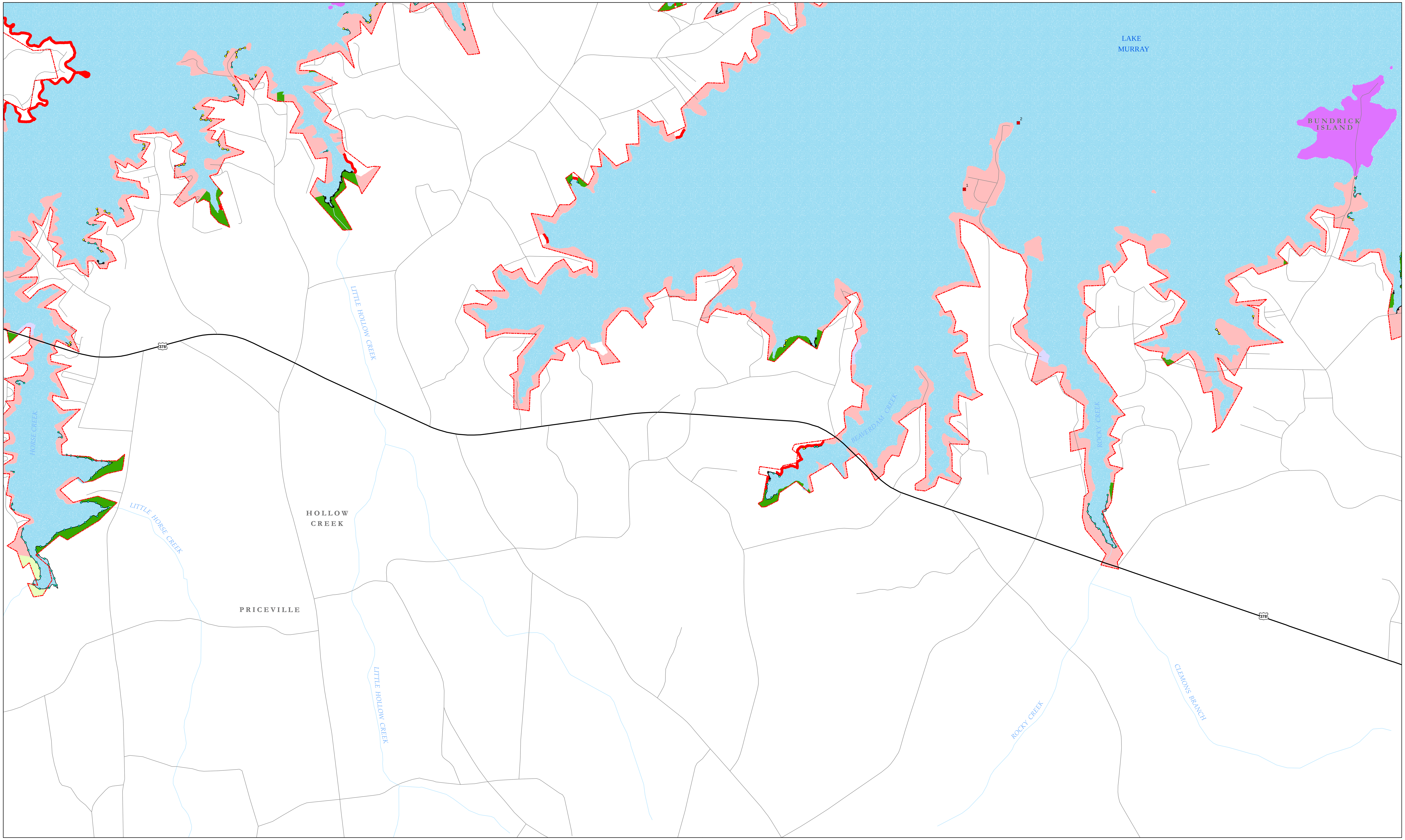


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 15 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



Bottomland Hardwood and Wet Flats
Continuous Button Bush
Intermittent Button Bush
Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

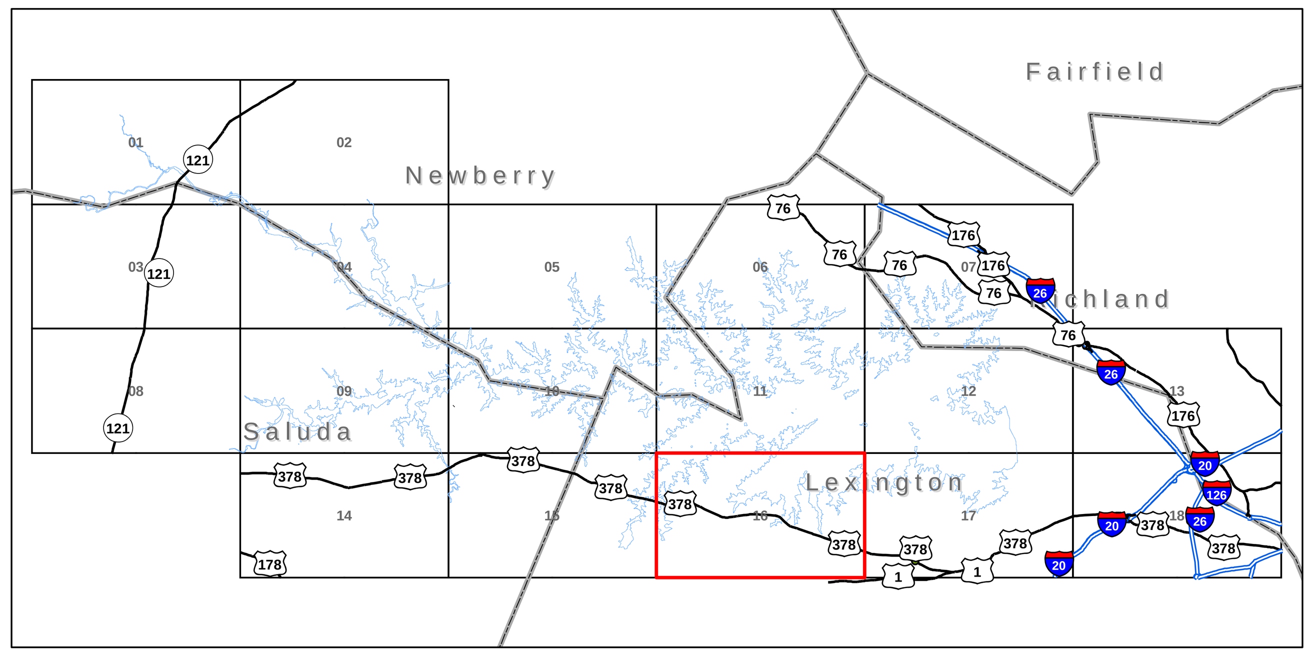
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

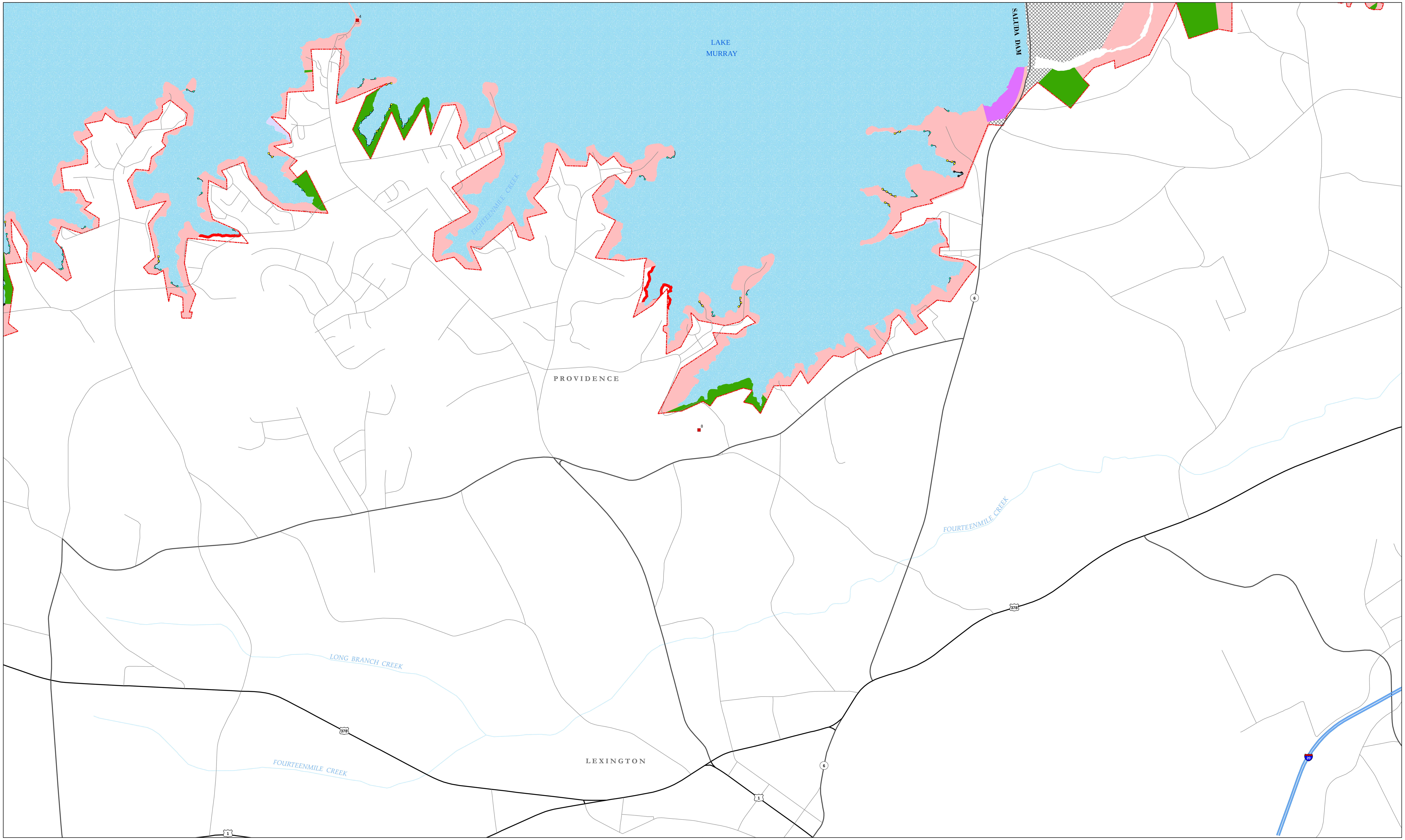
75-Foot Setback
Causeway
Commercial Recreation
Conservation Area
Easement
Easement with 75-Foot Setback
Forest and Game Management
Future Development
Project Operations
Public Recreation
Archaeological and Historical Sites
Streams
County Boundary
Project Boundary Line
Purple Martin Roost



NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 16 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



- Bottomland Hardwood and Wet Flats
- Continuous Button Bush
- Intermittent Button Bush
- Shallow Cove

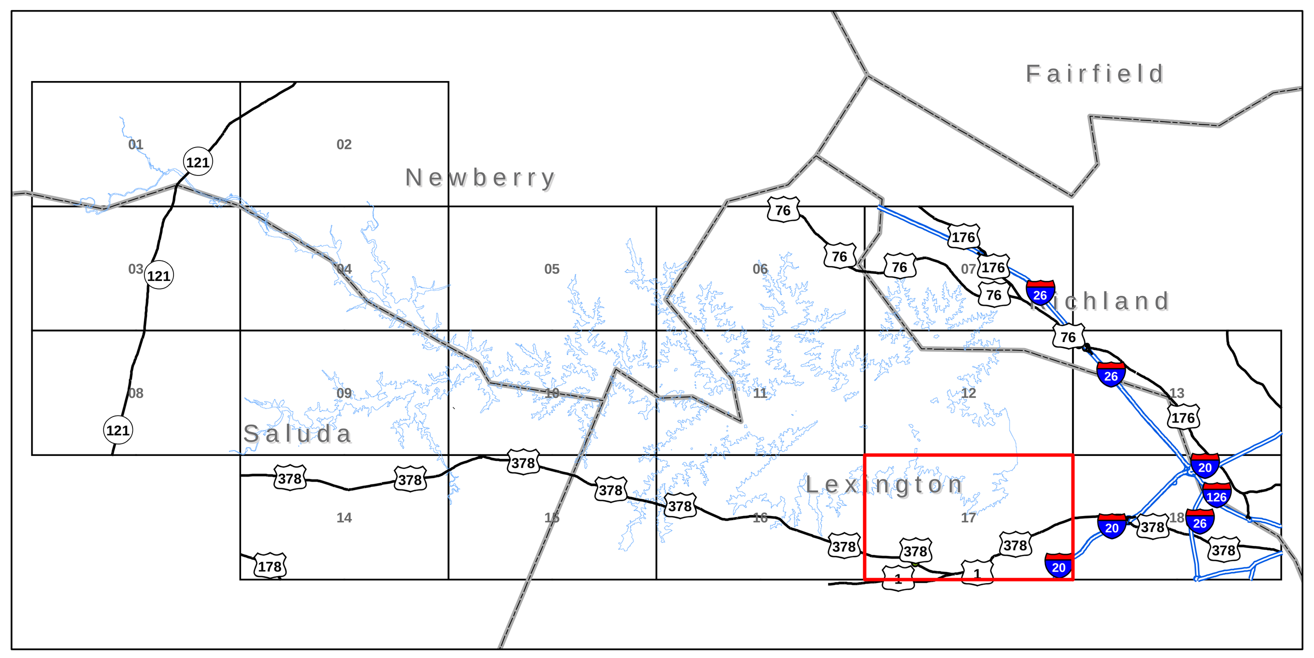
Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.
2. Vegetated Shoreline - This classification is divided into two sub classes:
   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.
   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.
South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

- 75-Foot Setback
- Causeway
- Commercial Recreation
- Conservation Area
- Easement
- Easement with 75-Foot Setback
- Forest and Game Management
- Future Development
- Project Operations
- Public Recreation
- Archaeological and Historical Sites
- Streams
- County Boundary
- Project Boundary Line
- Purple Martin Roost

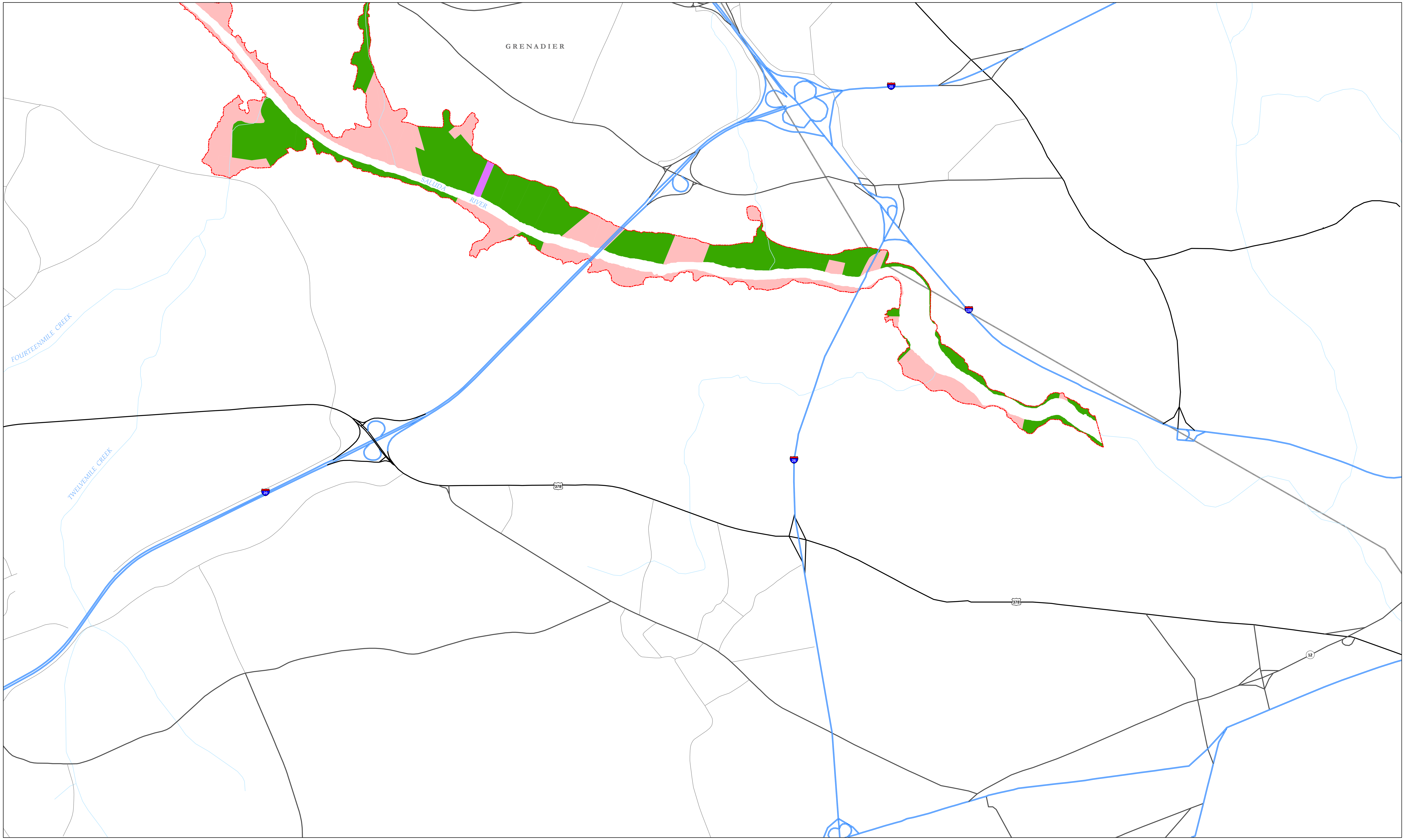


N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 17 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet



Bottomland Hardwood and Wet Flats
Continuous Button Bush
Intermittent Button Bush
Shallow Cove

Environmentally Sensitive Areas (ESA) are defined in the following classifications:

1. Shallow Coves with Stream Confluence - Areas where streams enter the lake and form coves where water elevations in areas outside the historical stream channel are predominately above the 355 foot contour line. The upgradient portion of shallow coves is typically vegetated with button bush and willow. Where this overlap occurs, the shoreline will be given a vegetated shoreline classification.

2. Vegetated Shoreline - This classification is divided into two sub classes:

   a. Continuous - Continuous vegetated linear shoreline at least 66 feet in length with vegetation > 5 foot wide measured perpindicular to the shoreline. This class can have gaps, provided the total gap length is less than 16 percent of the total linear footage of the area. (Note: Gap is defined as an area at least 8-20 feet in length with little or no vegetation below the normal high water mark). Areas with gaps larger than 20 feet in length are termed "breaks" and will not be considered vegetated shoreline.

   b. Intermittent - Linear shoreline coverage of vegetation at least 66 feet in length where sixteen (16) to forty (40) percent of the total linear footage is gap.

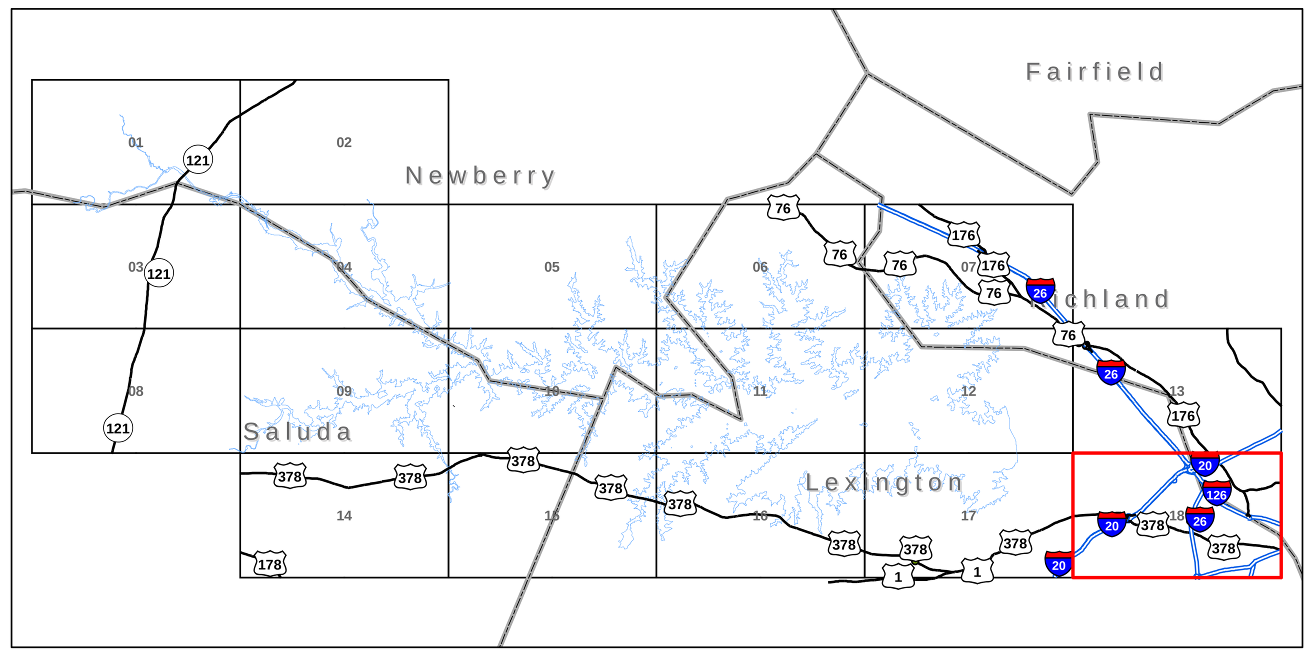
3. Bottomland Hardwood and Wet Flats - Continuous linear shoreline coverage of bottomland hardwood (excluding sweetgum) and wet flats at least 66 feet in length.

Field work and map complied by:

Orbis GIS, INC.

South Carolina Electric and Gas Company &
Orbis GIS Inc.
11709 Fruehauf Dr.
Charlotte, NC 28273
(704) 587-0031

75-Foot Setback
Causeway
Commercial Recreation
Conservation Area
Easement
Easement with 75-Foot Setback
Forest and Game Management
Future Development
Project Operations
Public Recreation
Archaeological and Historical Sites
Streams
County Boundary
Project Boundary Line
Purple Martin Roost



N
W E
S

NO.	DATE	BY	REVISION	CHKD	APPD	APPD
1	12/2008		Environmentally Sensitive Areas in front of Easement Property			

Management Prescriptions/Environ. Sensitive Areas
Sheet 18 of 18
Saluda Hydroelectric FERC Project No. 516
South Carolina Electric and Gas Company

0 625 1,250 2,500 3,750 5,000
Feet

Appendix 28

Meeting Notes from the Lake and Land Management TWC Meetings
September 30, 2008
October 15, 2008

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
LAKE AND LAND MANAGEMENT TWC

Lake Murray Training Center
September 30, 2008

final ACG 10-31-08

ATTENDEES:

Alan Stuart, Kleinschmidt Associates
Alison Guth, Kleinschmidt Associates
Tommy Boozer, SCE&G
David Hancock, SCE&G
Ron Ahle, SCDNR
Randy Mahan, SCANA Services
Bob Perry, SCDNR
Carl Sundius, Marina Owner
Tom Brooks, Saluda County
Carl Shealy, Landowner
Donna Shealy, Landowner
Tanjenique Paulin, SCDNR
Joy Downs, LMA
Linda Schneider, Landowner
George Schneider, Landowner
Steve Bell, LW
Bill Argentieri, SCE&G
Tony Bebber, SCPRT
Van Hoffman, SCANA
Phil Hamby, Landowner
Vivianne Vejdani, SCDNR
Roy Parker, LMA
James Leslie, Lake Murray Docks
Suzanne Rhodes, SCWF

DATE: *September 30*, 2008

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

The group opened the Lake and Land Management TWC meeting and began by reviewing the Permitting Handbook. The document was projected on the screen and the group collectively made edits to the document (document attached below). Comments on the Permitting Handbook were provided by Jim Cumberland, Bill Argentieri, David Hancock, Tommy Boozer, and Tony Bebber prior to the meeting.

As the group reviewed through the Permitting Handbook and made changes, there were a few items discussed in detail. The group discussed the Forest Management Classification, and whether or not to pull it out from under the Recreation Classification and categorize it separately. Because it is a significant classification, the group decided to pull it out into its own category. The group briefly discussed what could be done on Forest Management Land. David noted that a lot of what could be done on the land depended on the characteristics of the land. Van Hoffman added that if the land was 8,000 feet wide then there likely could be hunting on it. Bob Perry noted that DNR reserves the right to restrict the activities on the Wildlife Management Area (WMA) lands, such as safety zones, where there is no hunting.

As the group continued to review the SMP, Tony Bebber noted that many organizations have concern about the loss of so much boatable river due to the security barrier. Randy Mahan responded that it was required, located, installed, and paid for by Homeland Security. Steve Bell changed the subject and asked that once rebalancing is complete, he would like to look at the issue of dock spacing on easement property. He continued to note that he would like to investigate how SCE&G could have leverage to minimize docks in easement areas. David noted that they were already doing this in essence by allowing 1.5 slips for property being set aside. Steve suggested placing wording in the Permitting Handbook that notes that priority will be given to the environment as it applies to dock siting.

Ron Ahle brought up the topic of reservoir fisheries. Ron explained that they have found there has been a drop in the populations of sunfish species in the Lake. Ron continued that the problem was that there have been impacts to the shoreline habitat. Ron suggested that there may be areas of the lake that are known to be important spawning areas and they may want to restrict the placement of structures in these areas. Tommy noted that this was similar to what SCE&G was required to do in an area with a cultural resource mark.

The group discussed boat lengths, and Tommy noted that they currently have a 30 foot limit for docking at individual docks. However, he explained that they are beginning to see quite a few 32 and 34 ft boats, and he noted that they feel they need to increase boat limits to accommodate this change. There was discussion about how much more a 34 foot boat would project from a 12x20 dock. David explained that the dock sizes would not change and the dock would limit what size boat could be placed there. Alan asked the group if there was any opposition to the 34 ft boat limitation, and no one in the group voiced opposition to the change.

Carl Sundius and Jim Leslie noted the need for a review process for docks or marina's considered non-compliant. The group discussed this issue and Tommy noted that issues of non compliance will be reported to the resource agencies who issue the permits to impact navigable waters, not a committee.

As the group continued to review through the Permitting Handbook, they discussed what would happen under the scenario of a disbanded homeowners association that was in charge of maintaining a Greenspace. There was the suggestion that the individual permit note that if the homeowners association is disbanded then the Greenspace property be deeded over to SCE&G. It was noted that it was more likely that SCE&G would have to deal with a non-functional homeowners association rather than a disbanding one. It was decided that if a homeowner association disbanded or was non-functional, SCE&G could revoke the dock permit, have the docks removed, and then the Greenspace could revert back to however the homeowner association wanted to maintain it. At this time, SCE&G is not interested in owning the Greenspace.

The group also discussed dock lighting, and determined that any dock lights should be focused down and should not intrude on adjacent property owners, or impact navigation.

Discussions were completed on the Permitting Handbook and it was determined that the group would meet on October 15, at 9:00 to begin discussion on the SMP.

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

DRAFT

South Carolina Electric & Gas Company
Lake Management Department
Columbia, South Carolina 29218
Telephone: (803) 217-9221

SEPTEMBER, 2008

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

Deleted: Murray

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

DRAFT

SEPTEMBER, 2008

Prepared by:

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK PERMITTING GUIDELINES
DRAFT

TABLE OF CONTENTS

Comment: Re-format TOC when finalized

Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2
Deleted: 2

LIST OF TABLES

LIST OF ATTACHMENTS

0455052.01-92-00
\\Wren\sc_job\455-029\Saluda Relicensing\Permitting Handbook
001-Permitting Handbook updated 9-5-08.doc

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

LAKE MURRAY SHORELINE MANAGEMENT HANDBOOK AND PERMITTING GUIDELINES

DRAFT

1.0 INTRODUCTION

Work of clearing the site for the Saluda River Hydroelectric Development was started in April of 1927 under a permit granted by the Federal Power Commission to the Lexington Water Power Company. In July of 1930 Lake Murray reached an elevation of 300 feet. The following December, the first electric power, 10,000 kilowatts, was delivered.

At the time of its completion, Saluda Dam was the largest earthen dam for power purposes in the world. The dam itself is 213 feet high and contains over 11 million cubic yards of material. Lake Murray is approximately 41 miles long with a maximum width of 14 miles and contains 650 billion gallons of water. It has a shoreline of approximately 691 miles including the islands.

Deleted: 211
Deleted:
Deleted: 763
Deleted: 650

Lake Murray experiences considerable water level fluctuations. In the Saluda River watershed, about 75 percent of the normal rainfall comes in the first six months of the calendar year. The full pool lake level can reach 360 feet Plant Datum (PD); however the normal high lake level is approximately 358 feet PD. Saluda Hydro is primarily used by South Carolina Electric & Gas Company (SCE&G) to provide reserve generation in response to system emergencies. However, the reservoir is also managed in a manner that provides appropriate downstream flows and responds to pass inflows from precipitation within the drainage basin. More information on operations can be found at www.sceg.com/en/my-community/lower-saluda-river .

Deleted: of
Deleted: plant
Deleted: datumdatum
Deleted: datumdatum
Deleted: usually is reached in May.
Deleted: During the summer months, the elevation begins to drop, with a normal fall minimum level of about 354 feet elevation. Normal winter water level elevations are
Deleted: 348.5
Deleted: 350 in order to accommodate anticipated spring rains.
Inserted: 350
Inserted:

Over the years, Lake Murray has been, and still is, a major source of power generation and provider of recreational and commercial resources for South Carolina residents and visitors.

In the late 1960's a rapid change in the character and rate of development began to take place. Today, there are numerous formal recreation sites dispersed around Lake Murray that support boat launches, marinas, boat slips, wet and dry storage, campgrounds, picnic areas, beaches, fishing areas and piers, trails, and playgrounds. The irregular shoreline perimeter, with its numerous forested peninsulas, inlets and islands, provides excellent outdoor recreational opportunities. The shoreline also supports many permanent residences.

As development increases, however, the very values that attract families and visitors to the lake may be threatened unless a substantial effort is made to protect the lake environment from degradation. South Carolina Electric & Gas Company (SCE&G), as owner and licensee of Federal Energy Regulatory Commission Project No. 516, realizes the need for formulation of rules and regulations to promote and enhance the recreational potential of Lake Murray and protect its environmental quality.

SCE&G manages its lands around Lake Murray according to a Shoreline Management Plan (SMP) and the Shoreline Management Handbook and Permitting Guidelines (Handbook), both of which are designed to comply with the terms of the Project License, regulations, and FERC orders. The aim is to provide a balance among shoreline development, recreational use, and environmental protection. A component of the SMP is SCE&G's Permitting Program, which is operated in compliance with a general permit (GP) issued to SCE&G by the US Army Corps of Engineers and the South Carolina Department of Health and Environmental Control (SCDHEC), pursuant to the Clean Water Act (CWA), and the FERC license. The GP authorizes SCE&G to be the residential permitting authority for the lands comprising Lake Murray's shoreline. Project applicants and lake users must obtain the appropriate permit(s) for various activities and developments, and must adhere to the established regulations that help protect the lake shoreline and waters. SCE&G's Lake Management Department is responsible for enforcing FERC directives regarding authorized and unauthorized uses of Lake Murray waters and land within the project boundary. FERC directives require SCE&G to prevent or halt unauthorized actions by taking measures to stop such actions.

This Handbook details guidelines and policies protecting the Lake Murray shoreline and waters, and the specifics of SCE&G's Permitting Program. More information is available by

Comment: The handbook is not referred to this way in the SMP. Also, the acronym is shown here but not used later in the document (its called the 'Handbook'). Need to check for consistency.

Deleted: SMHPG

Formatted: Not Highlight

Formatted: Not Highlight

contacting the Lake Management Department. It is a requirement to consult with the Lake Management Department before beginning any project around the lake. The telephone number for the Lake Management Department is 803-217-9221.

2.0 LAND USE CLASSIFICATIONS

SCE&G has identified four distinct land management classifications for the land within the Project boundary line (PBL). Although SCE&G aims to manage its lands according to this classification system, the public has the right of entry on SCE&G-owned lands within the Project Boundary Line regardless of classification, with the exception of lands reserved and used for Project operations and certain leased properties that are operated under a fee agreement. The classifications, which are described below, consist of Multi-purpose, Public Recreation, Forest Management, Natural Areas, and Project Operations.

Comment: Add section describing Forest Management land.

1.1 Multi-Purpose

Multi-purpose lands include lands owned by SCE&G, lands sold by SCE&G, and lands never owned by SCE&G but over which SCE&G retained certain easement rights. All of these lands are contained within the PBL. Generally, SCE&G divides them into four sub-classifications: easement, commercial, buffer zone, and future development lands.

Deleted: types

2.1.1 Easement

Lands that SCE&G has sold/or never owned 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.

2.1.2 Commercial

SCE&G manages lands within this sub-classification primarily through its permitting program, which guides new or modified developments (e.g., expansion

Formatted: Not Highlight

of existing facilities) as detailed in this document (see Section 7.0). Such uses include the following:

- Commercial and private marinas and yacht clubs (for-profit and nonresidential);
- Commercial docks, boat ramps, bulkheads, and other supporting facilities.
- Commercial RV parks, hotels, resorts, bait shops, boat tours, etc.;
- Restaurants with shoreline access such as docks, decks, etc.;
- Golf courses with lake access facilities; and
- Industrial facilities.

2.1.3 Buffer Zone

A 75-foot wide vegetated buffer zone, located between the 360-foot PD contour and the back property development, is maintained adjacent to all easement lands sold by SCE&G after the issuance of the 1984 license. SCE&G maintains the Buffer Zone lands as vegetated areas intended to protect and enhance the Project's scenic, recreational, and environmental values in the area bordering the Lake Murray shoreline. SCE&G will manage Buffer Zones associated with lands sold after 2007 as non-disturbance areas.

Comment: Use "PD" after any elevation or contour in this document. Also be consistent, use either the foot symbol or spell out feet or foot throughout document.

Use of SCE&G's buffer zone is entirely at the discretion of SCE&G as landowner. Owners of adjoining lands (back property owners) are given the right of access, by foot, to and from the lake through the buffer zone, but are not permitted to encroach on the land without written consent from SCE&G (see Section 7.11 for information on prohibited activities in the Buffer Zones). For lands sold after 2007, lake access for back property owners is limited to a narrow meandering path in accordance with a dock permit and as specified in Section 7.13. See Section 7.14 for further information regarding limited brushing.

Deleted: for

Formatted: Not Highlight

Deleted: limited brushing policies

Deleted: established with lands sold prior to 2006

Deleted: dock

Deleted: 7.12 and 7.13

2.1.4 Future Development

Lands classified as future development are SCE&G-owned and located between the 360 foot contour and the PBL. They are available for sale only to the back property owner with certain restrictions encompassed in SCE&G's permitting program, as detailed in this document (See Section 7.0), and as regulated by FERC.

Deleted: 75 foot buffer zone

Formatted: Not Highlight

Formatted: Not Highlight

2.2 Public Recreation

Recreation lands include existing parks, properties set aside for future recreation, and publicly available islands owned by SCE&G. SCE&G manages the areas individually based on the specific, designated recreational activities they support, including swimming, picnicking, and boat launching. Dreher Island State Park is the only public site that provides formal camping; however, individuals can also camp on SCE&G-owned islands and other lands such as Bundrick Island, River Bend, and Sunset, unless otherwise posted.

Deleted: devoted to public

Deleted: SCE&G lands devoted to public r

2.3 Forest Management

SCE&G manages forest resources on its lands that are available for public recreation, although recreation is only one of several uses for these lands. These lands have been set aside for compatible recreation, scenic, aesthetic, and timber management purposes. SCE&G forest resources are managed according to the South Carolina Forestry Commission's Best Management Practices. SCE&G restricts its timber management operations in certain areas, such as on cliffs or steep slopes, or in atypical groups of trees.

Formatted: Indent: First line: 0"

Deleted: also

Deleted: undeveloped

Deleted: does not allow

Deleted: logging

Deleted: logging

2.3 Natural Areas

Comment: Reformat section numbers.

Natural areas consist of lands that warrant special protection because they provide important habitat for various wildlife species, including the recreational fishery. Shallow, shoreline waters; large wetland areas; areas having cultural and/or historical significance; and Environmentally Sensitive Areas (ESAs) are included in the natural areas classification and are protected.

ESAs are areas that have been designated as warranting special protection because they contain one or more of a variety of characteristics. They consist of habitat areas known to be occupied by rare, threatened, or endangered species; rare or exemplary natural communities; significant land forms and geological features; wetlands and shallow coves; and other areas determined to be critical to the continued existence of native species, such as spawning and nesting habitat. SCE&G has identified five types of ESAs, which are described in more detail in the SMP and are summarized here. They consist of the following:

1) **Continuous Vegetated Shoreline**, which is vegetated land composed primarily of buttonbush and willow species for at least 66 feet of linear shoreline length,
2) **Intermittent Vegetated Shoreline**, which is vegetated shoreline at least 66 feet in length where between 16 and 40 percent of the length is composed of gaps of unvegetated land measuring more than 20 feet long,
3) **Shallow Coves with Stream Confluences where streams enter the lake and** form coves and lake water is above the 355' PD contour line,
4) **Bottomland Hardwood** consisting of continuous linear shoreline at least 66 feet in length with coverage of bottomland hardwood
5) **Wet Flats** consisting of continuous linear shoreline at least 66 feet in length with coverage of wet flats.
6) **Shallow shoals and rocky shores** generally consist of submerged ridges and hill tops located above the 352-foot PD contour.

In general, Natural Areas are not available for sale, and docks, excavations, and shoreline activity are not permitted in these areas. Also, ESAs have protective non-disturbance setbacks associated with them where vegetation clearing and developments including docks and other structures are prohibited, see Section 7.12 for more information on ESAs. No docks or other developments are allowed within 50 feet of the ESA. After 2007, changes to the SMP prohibit brushing of any sort within newly established 75-ft buffer zones. Thus, ESAs in such buffers zones established after 2007 are protected by the entire buffer zone around them.

Deleted: For ESAs located within 75-ft buffer zones established after the June 2004 FERC Order (but before 2007), the non-disturbance setback is 50-foot with limited brushing allowed in the remaining 25-ft of the 75-ft buffer zone.

Deleted: , or by a 50-ft setback area, whichever is the greater area

Deleted: One exception to the 'no disturbance' restriction of Natural Areas exists for select intermittent ESAs. Upon approval by SCE&G, a limited number of locations at intermittent ESAs may be approved for docks.

2.4 Project Operations

SCE&G-owned and managed lands are required for operation of the Saluda Project. Public access to these lands is restricted to ensure public safety or to assure the security of the infrastructure system.

3.0 ENVIRONMENTAL POLICIES

3.1 General Policy and Purpose

The Lake Murray Shoreline Management Plan shall maintain and conserve the area's natural and human-made resources.

Comment: This document is titled Plan, so be consistent throughout this document and refer to it as Plan.

Deleted: Program

The purpose of the policy is to comply with the terms of the Project No. 516 License, the regulations, and the orders of the FERC, while providing recreational opportunities and environmental protections.

3.2 Water Quality Standards

SCE&G will conduct a continuing water quality monitoring program at Lake Murray. SCDHEC classifies Lake Murray's waters as "Freshwater," which means they are suitable for swimming, fishing, and other water-related recreational activities.

3.3 Effluent Discharges

Lake Murray is classified as a "no sewage discharge" lake. SCE&G personnel will continue to notify appropriate government officials of any unauthorized effluent discharges which are discovered by SCE&G personnel or others. Anyone found to have an unauthorized discharge source within the project boundary line will be required to remove it.

Installation of Sewage Pumping Stations at Marinas – Commercial public marinas providing facilities to remove effluent wastes from boats must meet SCDHEC regulations. See requirements for marinas in Section xxx.

Deleted: (

Inserted: (See requirements for marinas in s

Deleted: s

Formatted: Highlight

Deleted:).

3.4 Aquatic Plants

Certain species of aquatic plants can become a significant nuisance to recreation and project operations if their populations are not kept in check. Some of the common problem species found in Lake Murray include hydrilla, water primrose, and several species of pondweed. When managing invasive and exotic aquatic plants it is important to also protect the native plant species, aquatic ecosystems, and fish habitat. This requires the integration and use of specific Best Management Practices (BMPs) appropriate to the regional and local conditions.

SCE&G's Lake Management Department, in cooperation with the South Carolina Aquatic Plant Management Council, manages the Aquatic Weed Program on Lake Murray. Because aquatic weed control techniques can harm fish and native plant species, it is unlawful, per state and federal regulations, for individuals to spray or treat aquatic growth in the waters of Lake Murray. Thus, SCE&G asks that any aquatic vegetation problems recognized by lake visitors or back property owners be reported to SCE&G's Lake Management Department and the SCDNR. In addition, to help curb the spread of invasive aquatic species, SCE&G asks that lake visitors remove all vegetation from boats and trailers before and after placing them into the waters of Lake Murray.

Deleted: should

3.5 Undeveloped Areas

Undeveloped SCE&G-owned land around the lake is managed by the Land Department. These properties will be maintained through a sound forest management program to ensure forest health. SCE&G will manage timber in a multiple use manner in compliance with the S. C. Forestry Commission Best Management Practices to maintain a balance of quality watershed conditions, recreational opportunities, wildlife habitat, and promotion of new timber growth.

3.6 Wildlife and Game Management

Portions of Project lands may be leased to the SCDNR as part of the statewide Wildlife Management Area (WMA) Program. If leased to SCDNR, they are open to the public for hunting or other recreational activities in accordance with WMA regulations.

4.0 EXCLUSION ZONE

Lands categorized as Project Operations house the various Project facilities, buildings, and structures. Public access to these lands is restricted to ensure public safety or to assure the security of the infrastructure systems. These areas include but are not limited to Project powerhouse, spillway, intake towers and associated lands.

5.0 PUBLIC FISHING, BOATING & HUNTING

The SCDNR is responsible for enforcing state rules and regulations regarding fishing, boating, and hunting activities at Lake Murray. Recreators are encouraged to contact SCDNR at the following address and/or visit their website for information regarding regulations of these activities.

S.C. Department of Natural Resources
Division of Law Enforcement
1000 Assembly Street
Columbia, South Carolina 29201
(800)922-5431
http://www.dnr.sc.gov

Deleted: Wildlife and Fresh Water Fisheries

Deleted: 803

Deleted: 734-3886

Deleted: /regulations.html

5.1 Fishery Management

The SCDNR maintains an annual stocking program in Lake Murray and the lower Saluda River. Since 1971, over 30 million striped bass have been stocked in Lake Murray at annual rates varying from a low of 8,800 in 1986 to a high of 1,771,761 in 1983. SCDNR maintains an active trout fishery in the lower Saluda River through stocking of sub-adult rainbow and brown trout. Trout are not native to the lower Saluda River. The total number of trout stocked annually averages around 35,000, with variation based primarily on availability of fish from the Walhalla State Fish Hatchery. Anglers are required to abide by state fishing and safety regulations, which are available through SCDNR at the address above. Anglers in the Lower Saluda River must be aware of the possibility of rapidly rising waters at any time that occur because of releases from the Project. Anglers should be prepared, in advance of entering the river, for the possibility of needing to exit the river quickly because of rapidly rising waters.

5.2 Boating Safety

Buoys, signs, and access restrictions may be placed throughout the project as part of the Public Safety Plan, which is on file with FERC. Public safety measures include warning signs near hazardous areas of the project, buoys in the impoundment that serve to warn or inform boaters of conditions that warrant caution, and restraining devices such as fences around the powerhouse and downstream project area.

Due to Project operation and climatic conditions, the water level of Lake Murray can fluctuate. Changes in depth may affect boating conditions and overhead power-line clearances. These aspects of the aquatic environment make it important for boaters and other recreators to assume a high degree of personal responsibility for their own safety by being aware and cautious, and by following posted warnings. Boaters should always approach power-lines with caution. In addition, recreators must follow the SCDNR's boating rules and regulations. These rules and regulations are available through SCDNR at the address above. Boaters in the lower Saluda River should be aware of the possibility of rapidly rising water that occurs because of releases from the Project at any time. Boaters should be prepared, in advance of entering the river, for the possibility of needing to exit the river quickly because of rapidly rising waters.

5.3 Public Hunting

Approximately 6,000 acres of watershed land within and adjacent to Project No. 516 are leased to the SCDNR by SCE&G as a part of the statewide Wildlife Management Area (WMA) Program. Most of this land is located adjacent to the western portions of Lake Murray and, in many cases, to other privately held lands that are also in the WMA program. Public hunting areas are shown on WMA maps available from the SCDNR. Boundaries are marked with SCDNR signage. Waterfowl hunting is also available around Lake Murray in accordance with federal migratory bird hunting regulations as

Deleted: s

Deleted: and the lower Saluda River

Deleted: rapidly

Inserted: rapidly

Formatted: Not Highlight

Deleted: management

Deleted: areas away from buildings and marinas published annually by SCDNR and applicable county ordinances. Hunters must familiarize themselves with state hunting rules and regulations, which are available from SCDNR at the address above.

6.0 PUBLIC ACCESS

SCE&G owns 15 formal public access sites on Lake Murray and has set aside 62 SCE&G-owned islands in Lake Murray 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 for use as public recreation. Information on SCE&G maintained facilities can be found at http://www.sceg.com/en/my-community/lake-murray/lake-management. Dreher Island State Park is the only public site to offer overnight uses such as campground facilities and villa rentals. More information on recreation opportunities including private and commercial recreation sites is available from the South Carolina Department of Parks, Recreation and Tourism (SCDPRT) at www.discoversouthcarolina.com,

7.0 SHORELINE ACTIVITIES/DEVELOPMENT PERMITTING

7.1 General

It is the policy of the SCE&G Lake Management Department to authorize certain private uses of and/or acts upon Project lands by permit when such uses or acts are compatible with the public interest and comply with the requirements of the license for Project 516. It is the Company's position that the shorelines of Lake Murray are to be managed and protected in a manner that will protect the environmental and aesthetic integrity of the existing shoreline. The Lake Murray Shoreline Management Plan and the Shoreline Management Handbook and Permitting Guidelines play an integral part in protecting the area's natural and human-made resources.

SCE&G reserves the right to approve final design and placement of docks, marinas, etc. and other permitted activities. Be advised, SCE&G does not guarantee daily or annual usable water access to the waters of the Lake Murray. Each lot along the

Deleted: for

shoreline will have different slopes and contours that will determine water depth in front of the lot. The fluctuation of the reservoir will, at times, limit or restrict the use of some docks on the lake shoreline.

7.2 Docks and Private Access

Prior to initiating any project, property owners must contact SCE&G's Lake Management Department at 803-217-9221and the appropriate county offices. SCE&G requires that anyone desiring to make major repairs, replace, add to, or construct a dock must file an application for a permit with SCE&G. In addition to the application, the applicant is required to apply to SCE&G in writing and submit the following; a sketch showing the location and design and dimension of the proposed structure, permitting fee, specific directions by land to applicant's property on Lake Murray, plat of the property. Construction shall not begin until written permission has been granted by SCE&G. Dock construction is not to endanger health, create a nuisance, or otherwise be incompatible with overall Project recreation use. Use of common docks will be encouraged where practical. SCE&G requires that all docks, fixed, floating or combinations, be inspected by SCE&G Lake Management Department, and that an inspection decal be prominently displayed on the approved dock. Ultimately, the placement and design of all docks is under the authority of SCE&G Lake Management Department.

The following guidelines apply to permits for the construction, replacement, or addition of any dock. Drawings depicting dock specifications are provided as Attachment XX.

7.2.1 Private Individual Docks

General requirements for individual docks are as follows, and depend upon SCE&G Lake Management Department approval:

- A minimum lot width of 100 feet (200 feet for a slip dock) along the 360' PD contour is required before an individual residential

Deleted: should

Deleted:

Deleted: Docks, whether fixed or floating, must not interfere with surface water activities or navigation and must be compatible with scenic values in the vicinity

Deleted: to comply with Section 7 of this document

Formatted: Not Highlight

Deleted: as landowner

Deleted: SCE&G will work with applicants to develop an acceptable configuration and location plan

Deleted: creation

Deleted: They are to be adhered to as closely as possible; however, SCE&G acknowledges that there may arise circumstances where they are unnecessarily prohibitive. SCE&G will consider some flexibility in the requirements based on a case-by-case basis.

Comment: Need to beef this up to make sure SCE&G has authority to make changes to the SMP.

dock application will be considered. Where a SCE&G owned buffer zone exists, a minimum lot width of 100 feet (200 feet for a slip dock) at the common boundary line is required.

- All docks must be kept in good repair.
- Lots measuring 50-100 feet in width platted prior to 1989 where the adjacent lots have existing docks may be considered for limited size docks.
- No watercraft exceeding 34 feet in length can be permanently docked at a residential or common area dock and may not interfere with navigation.
- Private docks, whether fixed, floating, or any combination of the two, generally cannot exceed 750 sq. feet in overall size and 75 feet in length and may not interfere with navigation (exceeds no more than 1/3 the distance across a cove or channel) or restrict access to adjoining property.
- Floating docks may be moved out as the lake level recedes provided they do not interfere with an adjacent property owner's access and may not interfere with navigation.
- Docks may be longer where conformity with existing structures would be practical and in cases where exception would be desirable due to curvature or slope of the shoreline.
- All fixed walkways must be built above the 360'PD contour.
- Docks must be located a minimum of 15 feet from adjacent property iron and the proposed dock extension should not cross over the imaginary projected property lines. The projection of the imaginary property line is a management tool to assist Lake Management Representatives and may be waived under certain circumstances. Final dock location will be determined by SCE&G Lake Management Personnel.
- Covers on docks are not permissible unless the covered portion is located within 16 feet of the 360' PD contour.
- Hand railings are permissible provided the sides are not enclosed.

Deleted: If

Deleted: 32

Formatted: Not Highlight

Deleted:

Deleted: a

Inserted: a

Deleted: fixed walkway

Deleted: walkways

Deleted: must be built above the 360'

Inserted: walkway

Inserted: s

Deleted:

Deleted: contour

Deleted: lines

Deleted: made

Deleted: lake

- Flotation for docks must be approved encased or encapsulated flotation.
- No permanent screening or enclosures are permitted.
- Docks must be single story structures.
-

Deleted: Decking of fixed walkway must be above the 360' contour

- Docks may be allowed in intermittent ESAs at limited locations per the discretion of SCE&G Lake Management Department. Docks are prohibited in continuous ESAs.

Deleted: lake

- All docks must be at least 50 feet from an ESA, unless otherwise approved by SCE&G.

7.2.2 Private Common Docks

Common docks are encouraged and may be mandated in certain circumstances as an alternative to individual docks. A common dock may be permitted for any two adjacent residential lots. Each property owner participating in a common dock must have a minimum of 75 feet along the 360 contour or the SCE&G buffer zone, whichever applies. Private common docks shall follow all of the guidelines described for private individual docks.

Deleted: 150

Deleted: PBL

Deleted: A space of at least 200 feet is required between common docks and/or a common dock and an existing individual dock

Deleted: Common docks are encouraged and may be mandated in certain circumstances as an alternative to individual docks

7.2.3 Community Access Areas – Boat Ramps and Courtesy Docks

A community access area consists of a boat ramp and courtesy dock open to property owners within a lakeside development who have deeded lake access. General requirements for community access development are as follows:

Deleted: C

Deleted: s

Deleted: consist

Deleted: s

Deleted: s

Deleted: associated with a lakeside development

- Initial consultation and site inspection by a SCE&G Lake Management representative is required for development of community access areas.

Deleted: common

- Existing slope and water depth must accommodate any ramp and dock at a minimum lake level elevation of 352 feet PD.

- Qualification for a Community Boat Ramp will be heavily influenced by evaluations of any necessitated impact to existing trees and other vegetation.
-
- Lots qualifying for a community access area must have a minimum width of 100 ft along the 360’ PD contour or 75 ft buffer zone whichever applies along with a 100’ lot on each side of the community access lot. Community access areas serving more than 50 property/residential units must have an additional 1.5 feet of linear shoreline per property/residential unit served.
- Community access areas must be located within the confines of the proposed development with a minimum of 100 feet to the nearest adjoining property, or a buildable lot designated on both sides of the common area with a minimum linear shoreline footage of 100 feet.
- No community access area, dock, or ramp will be permitted in a cove less than 200 feet wide measured from the 360’ PD to 360’ PD contour across the cove.
- County Zoning Requirements: SCE&G requires a letter from the County Zoning Administration stating that the proposed site location meets existing county regulations to construct a boat ramp or courtesy dock.
-
- Ramps will be constructed of reinforced concrete and may not exceed 12 feet wide.
- Parking areas and turnarounds cannot be located in SCE&G buffer zones, i.e., they must be located above the 75-ft buffer zone. In areas where the property owner owns down to the 360’ PD contour, a minimum of 75’ must be established between the parking area and the 360’ PD contour. For buffer zone restrictions see 2.1.3 of this document.
- Community access areas serving 10 or fewer property/residential units will meet the established general guidelines for docks,

Deleted: as well as the distance from the PBL to the 360’ contour.

Deleted: A minimum of three participating shoreline property owners are required for a common access area ramp

Deleted: common

Deleted: support

Deleted: of

Deleted: 50 units and measure 300 feet along the PBL

Deleted: .

Inserted: .

Deleted: Common

Deleted: Common

Deleted: Common

Inserted: Common

Deleted: 150

Comment: Develop a schematic to help homeowners better understand. Currently being drafted

Deleted: 150

Deleted: common

Deleted: Existing slope and water depth must accommodate any ramp and dock at a minimum lake level elevation of 352 feet.

Deleted: buffer zone

Deleted: or turnaround

Deleted: Common

generally permitting up to 750 square feet in size and 75 feet in length. Common access areas serving more than 10 property/residential units may be eligible for a slip dock (see xxx diagram of a slip dock).

Formatted: Highlight

- No destruction or removal of critical shoreline vegetation growing below the 360' PD contour will be permitted for the installation of a boat ramp or dock. Critical vegetation includes, but is not limited to; button bush, willows, and significant hardwood species (consult with SCE&G Lake Management and see Section V. E. for information on critical vegetation).

Formatted: Highlight

- Courtesy docks are only allowed in coves or along waterways that are at least 200 feet wide, measured from the 360' PD contour of the shore to the 360' PD contour of the opposite shore. Clearance between structures on opposing banks may not exceed 1/3 the distance across the waterway.

Deleted: must be a minimum of 75 feet

- All community access docks are approved for short-term day use only. No overnight docking will be allowed.

Deleted: common

- Final placement of all docks is at the discretion of SCE&G Lake Management Department.

Deleted: m

Deleted: d

7.2.4 Private Multi-Slip

In lieu of individual docks, multi-slip docks may be permitted based on shoreline footage and other factors. SCE&G requires the developer to establish, a homeowner's association to administer, the neighborhood multi-slip dock program. Private land owners owning property down to the 360' PD contour (i.e., easement property owners) may voluntarily establish 'Greenspaces' along the shoreline. Because lands sold from the Future Development classification will already have a 75-ft buffer zone associated with them, the concept of Greenspaces does not apply.

Deleted: Under certain conditions, p

Greenspaces established by Easement property owners are undeveloped lands that have been set aside by and maintained as naturally vegetated areas. The Greenspace must be deeded to the homeowner's association. SCE&G encourages the homeowner's association to create an environmental stewardship committee within the homeowner's association to help monitor the Greenspace. A Greenspace Plan must be prepared and submitted to SCE&G and the plan should be consistent with SCE&G's buffer zone management guidelines (see Section 2.1.3). The presence of Greenspace is used to help determine eligibility for multi-slip development.

Deleted: should

Deleted: Landscape

Formatted: Not Highlight

The following specifications apply to private multi slip docks:

- Developments on SCE&G Future Development lands must have a minimum of 400 feet of shoreline to participate in the multi-slip dock program. A maximum of 1.5 slips will be allowed per 200 ft of property measured along the PBL. Property with less than 400 feet will be evaluated for individual or shared docks.
- For easement properties, a minimum of 1000 ft of shoreline footage is required for approval of a multi-slip dock. The number of slips permitted will depend on establishment of Greenspaces along the shoreline:
  - With min. 50 ft Greenspace -Two slips per 100 feet of shoreline.
  - Without Greenspace – Up to 1.5 slips for each 100 feet of shoreline.
  - With ESA but no Greenspace – One slip for each 100 feet of shoreline restricted by an ESA.
  - With 50 ft Greenspace and ESA – 1.5 slips per 100 feet of shoreline restricted by an ESA.
- Fractions of slips for properties *without* a Greenspace will be rounded down to an even number of slips (i.e., between 14 and 15 slips will be rounded down to 14 slips). Fractions of slips for

Deleted: impacted

Deleted: ESA

Deleted: impacted

properties *with* Greenspace will be rounded up (i.e., between 14 and 15 slips will be rounded up to 15 slips).

- Multi-slip facilities associated with *less* than 4,000 ft. of shoreline frontage do not require FERC approval.
- No individual dock will be permitted within a multi-slip dock development.
- The outside edge of all multi-slip docks at the 360’ PD contour line must be a minimum of 150 feet from the nearest common property line (e.g., adjoining properties), and meet minimum county zoning requirements; which ever provides for greater distance. A graphic illustration of this requisite is provided in Attachment XY.
-
- Docks may not extend more than 1/3 the distance across a cove or channel, as measured from the 360’ PD contour of one shore to the 360’ PD contour of the opposite shore.
- Access to multi-slip docks must be provided by the developer.
- A narrow, meandering access path may be allowed in the Greenspace and should be identified in the Greenspace Landscape Plan.
- Multi-slip dock facilities that accommodate watercraft with marine sanitation facilities will be required to install, operate, and maintain sewer pump-out disposal systems in accordance with State regulations.
- Final placement of the multi-slip facility will be subject to SCE&G Lake Management approval.

Deleted: Final placement of the multi-slip facility will be subject to SCE&G Lake Management approval.

Deleted: A minimum distance of 500 feet, measured from the 360’ contour elevation, is required across coves

7.2.5 Commercial Public Marinas (Inclusive of Sail Clubs)

Deleted: <#>Final placement of all docks is at the discretion of SCE&G

Deleted: <#> Lake Management Department..

Inserted: <#> Lake Management Department.

Inserted: <#>.

Deleted: <#>¶

Deleted: <#>¶

A Commercial Public Marina is a facility that provides non-discriminatory access for the general public to boat launching facilities, multi-slip docks (i.e. wet storage), dry storage, food, gas, restrooms and/or other amenities, for a fee. A commercial public marina must be independent from any off water development with no reserved docking rights designated for any particular development.

The development and expansion of new or existing commercial docks that are open to the general public for profit will be negotiated on a case-by-case basis. Each permit request will be submitted for review and comment to a Lake Murray commercial public Marina Review Committee (MRC). The MRC is made up of county, state, regional, and federal agency representatives in addition to SCE&G representatives. In addition to the MRC, there shall be a marina advisory committee (MAC) with membership appropriate to represent the residential, commercial, and other non-governmental interests of lakeside property owners. Before any determination by the MRC is made, the plan will be sent to the MAC and their input will be considered. The MAC will have a maximum of 30 days to review and provide input to the MRC. The MRC will have a maximum of 30 days after receiving comments from the MAC to provide comments on the plan. Final approval by SCE&G is required for all marina projects.

Deleted: application

Deleted: minimum

It is advised that applicants for development of a commercial public marina contact the SCE&G's Lake Management Department for an initial consultation early in the planning stage. In addition to FERC, other federal as well as state agencies have regulatory jurisdiction or resource management responsibilities with regard to the waters and shoreline of Lake Murray. Each agency’s specific requirement(s) must be satisfied as a prerequisite to permit issuance for a commercial public marina. A commercial public marina applicant bears all responsibility for determining fully what governmental and other requirements beyond SCE&G’s permit are required. Opinions expressed or statements made by SCE&G personnel cannot create a waiver as to any governmental requirements. Applicants are responsible for all legal and administrative costs associated with SCE&G’s preparation of the FERC filing.

An example of the agencies and their role in permitting and regulating development of a commercial public marina is provided in Table 1 as reference.

Table 1: Agency's Involved in Permitting Process for Commercial Public Marina.

Agency	Address	Requirement
County Zoning Administration	(Dependent on county)	Letter certifying that marina site location and activity proposed do not conflict with existing zoning regulations
U. S. Army Corps of Engineers (COE)	69A Hagood Ave. Charleston, S.C. 29403-5107	Section 10 Navigable Waters Permit[1] Section 404 of Clean Water Act
S. C. Department of Health and Environmental Control (DHEC)	2600 Bull Street Columbia, S.C. 29201	401 Clean Water Certificate State Navigable Waters Permit
S. C. Department of Natural Resources (SCDNR)	Rembert C. Dennis Building 1000 Assembly Street, Columbia, SC 29201	Commenting Resource Agency in state and federal permitting processes
State Historic Preservation Office (SHPO)	South Carolina Department of Archives and History P. O. Box 11669 Columbia, SC 29211	Commenting Resource Agency in state and federal permitting processes
U. S. Fish and Wildlife Service (USFWS)	217 Fort Johnson Road P. O. Box 12559 Charleston, SC 29412	Commenting Resource Agency in state and federal permitting processes
SCE&G Lake Management Department	Columbia, SC 29218 Telephone (803) 217-9221	Issues/Denies Permit
Federal Energy Regulatory Commission (FERC)	888 First Street, NE Washington, DC 20426	Approves/Denies proposed commercial public marina based on application submitted by SCE&G

Additional governmental permits or authorizations may be required depending on particular circumstances of project.

Comment: Check on the correct wording for this.

Formatted: Indent: Left: 0", First line: 0"

[1] After submittal of a joint application form by an applicant, the COE and DHEC will issue joint public notices in their coordinated permitting processes through which each makes its own permit decision.

General requirements for a commercial public marina vary depending on the size or the facility, or the number of watercraft it accommodates. Facility size has been categorized as those supporting (1) 20 or fewer watercraft, (2) 21-100 watercraft, or (3) 101 to 250 watercraft. A maximum development limit of two hundred fifty (250) on-water slips to accommodate watercraft will be permitted. All marina facilities must comply with all local, county, state, and federal regulations. The buildout period must conform to the U. S. Army Corps of Engineers, SCDHEC permit, and the FERC order time frame. The following sections provide the required specifications for each facility size.

Deleted: and

Deleted: time frame

Deleted: .

Commercial Public Marinas Accommodating Twenty (20) or Fewer Watercraft (Figure cc)

Comment: Need to provide Figure Number.

- Except when involving a peninsula (see following bullet item), no commercial public marina accommodating twenty (20) or fewer watercraft at a time will be permitted any closer than ¼ mile from (i.e. within a ¼ mile radius of) an existing facility.
- A commercial public marina proposed to be located at a site within the ¼ or ½ mile radius of an existing facility, but separated by a peninsula from the existing facility on the opposite side of the peninsula, will be required to have a minimum linear shoreline distance along the 360 ft. PD contour of 2 miles between the existing and the proposed public marina.
- Commercial public marinas accommodating twenty (20) or fewer watercraft at a time must have a minimum of 400 feet of shoreline and be located or constructed such that the docks and watercraft will not unduly restrict or limit navigation through the area or access to adjoining properties.
- No commercial public marina accommodating twenty (20) or fewer docks may encroach or extend more than one-third of the distance across the cove or waterway. Distance will be measured from the

360 ft. PD contour to 360 ft. PD contour, and will be determined on a case-by-case basis.

- No dock at a commercial public marina accommodating twenty (20) or fewer watercraft may extend more than 175 feet lake-ward from the 360 foot PD contour high water mark or one third distance across the cove whichever is less.
- Commercial public marinas accommodating twenty (20) or fewer watercraft at a time may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 400 feet, measured from the 360 foot PD contour on one side to the 360 foot PD contour across the cove or waterway on the other side.
- Commercial public marinas accommodating twenty (20) or fewer watercraft will be required to provide a marine pump-out facility.
- Multi-slip docks will not be permitted to have covers or roofs over the docks or slips. Walkways may be covered as long as they are above the 360-ft PD contour line.
- No multi-slip dock may encroach within 50 feet of a Natural Area or identified ESA, as determined by SCE&G.
- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.

Deleted: 150

Comment: Copy State regulations from previous section.

Deleted: not

Deleted: unless DHEC's requirements are changed to require such

Comment: The group agreed the ESA boundary should be better defined (per meeting notes) – SEE EARLIER SECTION

Public Marinas Accommodating Twenty One to One Hundred (21 - 100) Watercraft (Figure dd)

Comment: Need to provide Figure Number

- Except when involving a peninsula (see following bullet), no commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time will be permitted any closer than ½ mile radius from an existing Public Marina.
- Any commercial public marina facility proposed to be located within a ¼ or ½ mile radius of an existing marina, but separated by a peninsula, and which will be located on the opposite side of the

peninsula, will be required to have a minimum linear shoreline distance of 2 miles along the 360 foot PD contour between the existing and the proposed commercial public marina.

- Commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time must have a minimum of 800 feet of shoreline and be located or constructed in such a way that the docks and watercraft will not unduly restrict or limit navigation in the area or encroach within 150 feet of adjoining properties.
- No dock at a commercial public marina accommodating twenty-one to one hundred (21 - 100) docks may encroach or extend more than ⅓ the distance across any cove area or waterway measured from the 360 foot PD contour to 360 foot PD contour.
- No dock at a commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft, may extend more than 300 feet lake-ward from the 360 foot contour high water mark or ⅓ the distance across the cove, whichever is less.
- Commercial public marina accommodating twenty-one to one hundred (21 - 100) watercraft at a time must be located in areas where water depths are adequate for boating access and may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 900 feet, measured from the 360 foot PD contour on one side to the 360 foot PD contour across the cove or waterway on the other side.
- Commercial public marinas accommodating twenty-one to one hundred (21 - 100) watercraft will be required to provide a marine pump-out facility.
- No commercial public marinas will be permitted to have covers or roofs over the docks or slips.
- No commercial public marinas may encroach within 50 feet of a Natural Area or identified ESA as determined by SCE&G.
- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.

Deleted: No multi-slip docks

Deleted: Fixed (non-floating) w

Deleted: W

Deleted: alkways may be covered as long as they are above the 360-

Deleted: ft

Inserted: Fixed (non-floating) w

Deleted: contour line

Deleted: No multi-slip dock

- Applicants will be required to perform a Baseline Environmental Water Quality Monitoring Plan and conduct such water quality sampling as required therein annually for five years during the month of August.

Deleted: five (5) year

Deleted: during the month of August annually for 5 years

Inserted: during the month of August annually for 5 years

Public Marinas Accommodating One Hundred One to Two Hundred Fifty (101 - 250) Watercraft (Figure ee)

Comment: Need to provide Figure Number.

- No commercial public marina facility accommodating one hundred one to two hundred fifty (101 - 250) watercraft at a time will be permitted any closer than ½ mile radius to an existing Public Marina facility.
- Any commercial public marina facility proposed to be located within the ¼ or ½ mile radius of an existing facility, but separated by a peninsula, must be located on the opposite side of the peninsula, and must have a minimum linear shoreline distance along the 360 foot contour of 2 miles between the existing and the proposed facility.
- Commercial public marinas accommodating one hundred one to two hundred fifty (101 - 250) watercraft at a time must have a minimum of 1000 feet of shoreline and be located or constructed in such a way that the docks and watercraft will not unduly restrict or limit navigation in the area or encroach within 200 feet of adjoining properties.
- No dock at a commercial public marina accommodating one hundred one to two hundred fifty (101 - 250) docks, may encroach or extend more than one third the distance across any cove area or waterway measured from the 360 foot PD contour to 360 foot PD contour.
- No dock at a commercial public marina accommodating one hundred and one to two hundred-fifty (101 - 250) watercraft, may extend more than 400 feet lake-ward from the 360 foot PD contour

or 1/3 the distance across any cove whichever is less.

- Commercial public marinas accommodating one hundred one to two hundred fifty (101 - 250) watercraft must be located in areas where water depths are adequate for boating access and may not be located at a point in a cove or on another waterway area having a distance from shore to shore of less than 1000 feet, measured from the 360 foot PD contours of both shores.
- Commercial public marinas accommodating one hundred one to two hundred fifty (101 - 250) watercraft will be required to provide a marine pump-out facility.
- No commercial public marinas will be permitted to have covers or roofs over the docks or slips.
- No commercial public marinas may encroach within 50 feet of a Natural Area or identified ESA as determined by SCE&G.
- Final placement of all marinas is determined by the MRC and must be approved by SCE&G.
- Applicants will be required to perform a Baseline Environmental Water Quality Monitoring Plan and conduct such water quality sampling as required therein annually for five years during the month of August.
- Construction must commence within one year from the date of the SCE&G permit. The build out period must conform to the ACOE, FERC and DHEC permit conditions, and such additional constraints as may be contained in the FERC Order approving SCE&G's issuance of a permit.

Additional Specifications for all Public Marinas

- Marinas permitted for commercial use after 2007 cannot be converted to private multi-slip use without re-applying for a new permit from SCE&G.
- The proposed commercial public marina should be located within

Comment: Copy comment from above consistent with State regulations.
Deleted: .
Deleted: .
Deleted: multi-slip docks
Deleted: Fixed (non-floating) w
Inserted: Fixed (non-floating) w
Deleted: W
Deleted: alkways may be covered as long as they are above the 360-ft
Deleted: contour line
Deleted: multi-slip dock
Deleted: five (5) year
Deleted: .
Comment: Move to General requirements
Deleted: reviewed
Deleted: re-
Inserted: re-
Deleted: reviewed
Deleted: applying for a new permit
Deleted: with review by
Inserted: review by
Deleted: the MRC
Deleted: with
Deleted: SCE&G
Deleted: .

the confines of the imaginary projected property lines as they extend lake-ward.

- Excavations for commercial public marina facilities to improve public access is discouraged but may be considered on a case-by-case basis with consultation with SCE&G, and appropriate state and federal resource agencies and regulatory authorities.
- Commercial public marina facilities must at a minimum provide public restrooms, and are encouraged to provide public fishing access areas.
- The applicant must sign and complete the Commercial Public Marina Application Agreement before SCE&G will process a permit request.
-
- Existing marinas may remodel, rebuild, or repair within their existing footprint with the approval of the appropriate local, state, and federal agencies. To avoid additional permitting requirements, the facility would need to maintain or reduce the number of slips originally permitted.
- Additions to existing marinas that increase the number of slips or expand the existing footprint of the facility will require a permit for the additional slips.
- If damage to an existing marina caused by storm or other natural events requires maintenance and repair, the work completed on the facility must comply with the original permit conditions and specifications, and is not required to meet new standards.
- Expansion projects of existing marinas are evaluated on a case-by-case basis and must go through the MRC. Non-compliance issues may be reviewed on a case by case basis by the MRC. SCE&G will have final approval of all projects.

Deleted: No local, state, or federal agency, or SCE&G, may construct, operate, or lease a marina within ten (10) miles of an existing marina

Deleted: .

Deleted: ..

Deleted: .

Deleted: .

Deleted: change

Deleted: change the

Deleted: would

Deleted: new

Deleted: of

Comment: Move up in front of previous bullet

7.2.6 Watercraft Limitations

No watercraft exceeding 34 feet in length will be allowed to permanently dock at a residential or common area dock. Permanently docked is defined as any 14 day consecutive period in any 30 day period. Watercraft exceeding 34 feet must be docked at a commercial public marina or multi-slip facility with pump-out facilities.

Deleted: 30
Deleted: 30
Deleted: 30
Deleted: 30

7.2.7 Dock Modifications

Prior to initiating any project, property owners should contact SCE&G's Lake Management Department at 803-217-9221. Major dock modifications that may temporarily or permanently affect the land or water of the shoreline require submittal of a permit application to SCE&G and approval of the application prior to the commencement of any such modifications. However, general maintenance and repairs of docks such as replacing boards, etc. does not require permitting. Dock owners must contact SCE&G's Lake Management Department for more information and guidance regarding the need for a permit to conduct dock work.

7.3 Boat Ramps

SCE&G encourages the use of boat ramps at public facilities versus construction of private ramps. Moreover, individual private boat ramps are not permitted in SCE&G buffer zones. In cases where private boat ramps are allowed, the following specifications apply to boat ramp construction:

Deleted: and semi-public

- Ramps may be up to 12 feet wide and the required length to be functional at various water levels. Public ramps may be granted a variance from these conditions.
- Ramps must be constructed of concrete. Asphalt compounds or petroleum based products are prohibited.
- All ramps should be located so as not to interfere with neighboring property owners. Adjoining shoreline property owners may agree to

Deleted: Ramps
Deleted: of
Deleted: .
Deleted: .
Deleted: and semi-public
Deleted: may
Deleted: are encouraged to

common use of the ramp. The permit reflecting an agreement between the two participating shoreline property owners will be provided by SCE&G.

- If a community access ramp is permitted, individual ramps will not be permitted.

Deleted: ..

Deleted: .

Deleted: furnished

7.4 Boat Lifts

The following specifications apply to the construction of boat lifts:

- All boat lifts must adjoin the owner's dock. Pilings cannot extend beyond the lakeward end of the dock.
- Boat lifts should be located so as not to interfere with the adjacent property owners' access.
- Only one boat lift will be approved per individual dock. On a case by case basis SCE&G Lake Management Department will consider 2 boat lifts for a common dock that is shared by two property owners.
- No covers are to be constructed over boatlifts.
- All boat lifts are to be low profile style lifts.

Deleted: adjoining

Deleted: nearby

Inserted: nearby

Deleted:

Inserted:

Deleted:

7.5 Personal Watercraft Lifts

Personal Watercraft lifts will require a permit from SCE&G. Facilities for lifting up to two personal watercrafts may be permitted per dock. The following specifications apply to the construction of personal watercraft lifts:

Deleted: will

- Personal watercraft lifts should be located so as not to interfere with the adjoining property owners' access
- No covers are to be constructed over personal watercraft lifts.

7.6 Marine Railways

- Marine railways are permitted for access to the lake from facilities located above the 360 foot PD contour.
- Railways constructed below the 360 foot PD contour area are restricted to no more than two-foot elevation above the natural lake basin.

7.7 Floating Platforms or Tubes and Other Water Toys

- These items are not allowed to be permanently installed and must be removed before sunset each day.
- These items must not inhibit navigation or extend more than 1/3 the width of the cove at the high water mark (360 ft PD contour).

Deleted: after 24 consecutive hours

Deleted: .

Deleted: .

7.8 Water Removal

Residential Withdrawals

Residential requests for water withdrawals require a permit from SCE&G. Water removal permits for residential property will be for irrigation purposes only. All irrigation pumps and wiring must be located behind the 360' PD contour. Combustion or diesel pumps will not be permitted. SCE&G reserves the right to prohibit irrigation during times of drought or low water conditions. Applicants should contact the SCE&G Lake Management Department for permit applications and additional information.

Deleted: Commercial and

Deleted: r

Deleted: SCE&G may authorize water withdrawals up to 1 MGD without the requirement of FERC approval

Deleted:

Commercial Withdrawals

Deleted: ¶

Commercial/Municipality request for water withdrawals require a permit from SCE&G. SCE&G may authorize water withdrawals up to 1 MGD without the requirement of FERC approval. SCE&G will impose limits (such as pump size or pipe size) in granting permits for approved applications. The applicant will be required to compensate SCE&G for water withdrawn and to bear expenses of filing the application.

Deleted: Municpality

Deleted: If there is a conflict between the proposed water removal and the public interest, the application will be rejected. If no conflict is identified, the application may be forwarded to FERC for approval.

Deleted: However, SCE&G will not endorse such applications.

Deleted: SCE&G reserves the right to prohibit irrigation during times of drought or water drawdown

A commercial application to withdraw water from the lake must include the following information:

- a complete description of the purpose for the removal;
- removal processes to be used;
- volumes to be withdrawn
- copies of all required local, state, and federal permits and reports;
- the required fee; and
- any additional information as required by SCE&G.

Deleted: and ultimately to be returned to the project waters;

Deleted: and

Deleted: .

7.9 Erosion Control (Shoreline Stabilization)

All shoreline stabilization efforts, including construction or repair of rip-rap, seawalls, retaining walls, and bioengineering, must be approved in writing by SCE&G Lake Management prior to implementation and/or construction. Furthermore, there are some areas of the lake where facilities may not be permitted because of environmental considerations, development patterns, physical lake characteristics, impacts to cultural resources, or other reasons.

Deleted: ping

Property owners should be aware that conducting any shoreline stabilization activities at a federally licensed hydroelectric project (e.g., Saluda Hydroelectric Project, FERC Project No. P-516) is a privilege that can only be granted with authorization from the Licensee. Because every possible situation cannot be anticipated, SCE&G Lake Management reserves the right to make special rulings in cases not specifically covered by these guidelines. Shoreline stabilization projects must adhere to the following specifications.

Deleted: Adjoining

Deleted: P

Inserted: P

Deleted: p

Deleted: roperty owners

General Requirements:

Deleted: ¶
General Requirements:¶

- Silt fencing must be properly installed on the 360' PD contour elevation or buffer zone, where applicable, before any land disturbance activities take place.
- The applicant must be the owner of the tract of land immediately adjoining the high water mark (360' PD contour elevation) or SCE&G-owned buffer zone, or have the written permission of the easement property owner on water rights tracts (e.g., where SCE&G only has a flowage easement).
- SCE&G Lake Management will hold the applicant fully responsible for ongoing adherence with the current SMP and SMHPG, including maintaining structures in good repair. This responsibility transfers automatically along with ownership.
- Prior to beginning any activity/construction within the high water mark (360' PD contour), the applicant must obtain all necessary governmental

Deleted: '

Deleted: elevation

permits or approvals, and written authorization from SCE&G Lake Management.

- Consultation with SCDNR and U.S. Fish and Wildlife Service (USFWS) will be required for stabilization that exceeds 500 linear feet of shoreline.
- In order to protect aquatic resources, shoreline stabilization activities shall typically be performed September through February. In emergency situations, for repairs necessary to ensure integrity of existing structures, work may be performed outside September-February time period upon approval by SCE&G.
- The applicant shall make every reasonable effort to minimize any adverse impact(s) on fish, wildlife, shoreline vegetation, and other natural resources.
- New or expanding stabilization activities (excluding bio-engineering) may not be undertaken within a 50-foot offset from an ESA classification as identified in the SMP. All shoreline stabilization activities affecting an ESA will be assessed on a case-by-case basis.
- Minimal clearing below the high water mark (360' PD contour) may be allowed to create corridors for equipment access for stabilization projects. Access corridors should be incorporated into fixed pier/dock access corridors (*i.e.* foot paths) where practical. Vegetation removed to accommodate construction access for shoreline stabilization shall be replaced with native vegetation.
- Shoreline stabilization activities are limited to the eroded bank. Any unavoidable impacts to existing emergent aquatic vegetation, as a result of stabilization installation, require the replanting of vegetation in the impacted area(s).
- Bio-Engineering Stabilization is a preferred shoreline stabilization technique and is encouraged, especially in eroded areas associated with emergent aquatic vegetation. Applicants are encouraged to avoid activities (including stabilization) that could have an adverse impact(s) upon existing native aquatic plants.

Deleted: <#>The SCDHEC may require an individual permit for large shoreline stabilization projects.¶

Deleted: in the dry season– typically August

Inserted: August

Deleted: July

Inserted: season

Deleted: July

Deleted: August

Inserted: August

Deleted: July

Deleted: July

Deleted: Environmentally Sensitive Area (

Deleted:)

- Approved bioengineering techniques are generally required for eroded banks of two feet or less of erosional scarp. Approved bioengineering and/or vegetated riprap techniques are preferred for eroded banks exceeding two feet of erosional scarp.
- The type of plantings utilized in bioengineering and landscape-planting projects should be native to South Carolina, and must be reviewed and approved by SCE&G Lake Management prior to introduction. Desirable species include grasses such as switchgrass and maidencane, and shrub and saplings such as water willow, black willow, button bush, and river birch.
- Riprap stabilization installed below the high water mark (360' PD contour) in vegetated areas must be limited to one layer deep to allow spaces between the stone for vegetation recruitment.
- Riprap material must be SCDOT Class B, or larger, quarry-run stone, natural stone, or other material approved by SCE&G. The use of tires, scrap metal, crushed block, construction/demolition debris, or other such types of material, is not allowed.
- Riprap use should be limited to only that area necessary to adequately stabilize the existing eroded bank. Riprap should be confined to a linear distance of 6 feet below the high water mark (360' PD elevation) except where the entire placement is on/above severely eroded banks. These areas must be sloped back or terraced to provide minimum bank stability.
- Stabilization of eroded banks that are 2 feet in height or higher, or that are not associated with emergent aquatic vegetation, can be stabilized using SCDOT Class B or larger size riprap with filter cloth, bio-engineering using significant live staking and planting, or other forms of bio-engineering within the riprap.
- Retaining wall stabilization is only allowed for erosion control where the average eroded bank height is greater than 3 feet and the wall is constructed at the high water mark (360' PD contour elevation). Earth fills below the high water mark (360' PD contour elevation) are prohibited.

Deleted: '

Deleted: elevation

Deleted: are

- A layer of rip-rap (SCDOT Class B or larger) extending 6 feet lake-ward from the high water mark (360' PD contour) must be placed along the entire base of all retaining walls. The 6-foot requirement is measured horizontally as shown on Figure xx.
- No sand shall be placed below the 360' PD contour. Effective measures must be used to keep sand from migrating below the 360' PD contour.

Deleted: full pond

Deleted: in

Deleted: figure

7.10 Excavation Activities

Excavation activities below the 360' PD contour are discouraged. Excavating of soils can release erodable earth material into the environment if precautions are not taken. SCE&G monitors excavation activities by requiring that a permit be obtained from SCE&G for work performed below the 360' PD contour. All authorized excavations must be in accordance with SCE&G specifications and requirements, which may include an environmental assessment plan or report. Any permitted excavation work must meet the following specifications:

- SCE&G Lake Management Department must be notified prior to commencement and upon completion of work.
- All displaced soil must be taken off site or otherwise stabilized above the 360' PD contour in accordance with SCE&G requirements if in Richland, Saluda and Newberry Counties, and in accordance with recommendations of the Lexington County Sediment Control Representative if in Lexington County.
- A 4 to 1 slope is the maximum slope allowed.
- All excavating must be done directly in front of the applicant's property and below the 354' PD contour, unless the adjoining property owner signs off on the project, or unless otherwise approved by SCE&G in consultation with SCDNR.
- No excavation will be permitted in a wooded or vegetated area, or other areas that may be identified by SCE&G in consultation with SCDNR. The protection of shallow water habitat must be considered at all times. A Lake Management representative will designate the area to be excavated.

- Excavation activities generally will not be allowed between January 15 and October 1. Exceptions may be granted by SCE&G based on hydrological or meteorological conditions. Permits are valid for only one (1) year from the date of issue. See date on approved permit.
- Water must not cover the excavation site during excavation activities.
- The contractor must have a copy of the approved permit and drawing while on the job site at all times.
- All excavation should be completed by using the following equipment: (1) dragline; (2) track backhoe; (3) bulldozier; or other equipment approved by Lake Management personnel.

Deleted: must

Deleted: ;

7.11 Prohibited Activities/Structures

The following activities/structures are prohibited **below** the 360' PD contour or in the 75-ft buffer zone on Lake Murray. These prohibitions will be enforced by SCE&G or an appropriate state or federal agency.

- No sand or earth fill encroachments
- No seawalls or retaining walls
- No fences
- No fixed or land-based structures (boathouses, storage buildings, shelters, patios, , brick barbeques, fences, swimming pools, satellite dish, signs, dog pens or invisible fencing, boat storage)
- No septic tanks and/or drain fields.
- No planting of grass except as a permitted erosion control measure.
- No storage or stockpiling of construction material.
- No vegetation removal of any type except in a permitted 10-foot wide access path to the shoreline.
- No limbing or trimming or cutting of Buffer Zone vegetation to create views or visual corridors.
- No fires or overnight camping
- No unauthorized removal of trees or vegetation

Deleted: s

Deleted: gazebos

Deleted: without written consent from the Lake Management Department.

Deleted: .

Deleted: merchantable timber

- Unless specifically authorized by the Lake Management Department, no all-terrain vehicles (ATV's), motorcycles, or off road vehicles are allowed.

Deleted:)

- No roofs or covers over any dock unless the dock is within 16 feet of the 360' PD contour.
- No roofs or covers over any boat lifts.
- No fueling facilities permitted on dock.
- No permanent mooring.

Deleted: Temporary mooring upon ACOE approval

- No water craft exceeding 34 feet in length will be permitted to be permanently docked at a private dock. Docking for more than 14 days in any consecutive 30-day period is considered to be permanent.

Deleted: 30

- No excavation/dredging above the 354' PD contour or in shallow water habitat and ESA's.
- No effluent discharges, such as sinks, showers, toilets, etc.
- No drive-on docks unless it is taking the place of the traditional floating dock that is made of wood and no larger than 12'X20'.
- Permanent screening or enclosures will not be allowed on fixed seating areas of docks.
- No upland water gardens will be permitted to drain into the lake.
- No spraying of herbicides into the waters of Lake Murray or onto property where the herbicides may end up in Lake Murray.
- Any unauthorized earth fill or structures that occurred prior to January 1, 1974, will be handled on a case-by-case basis.

Comment: Ask Randy Mahan about date Move to second bullet or combine with first bullet

Comment: Add section on lighting – should contain - any lights must not intrude on neighbors or impact navigation

7.12 Environmentally Sensitive Area (ESA) Restrictions

- SCE&G prohibits clearing of vegetation within ESAs or within associated buffer.
- Commercial public marina facilities must be located a minimum of 50 feet from an ESA.

Deleted: 100

- New or expanding stabilization activities (excluding bio-engineering) may not be undertaken within a 50-foot offset from an ESA classification. All shoreline stabilization activities affecting an ESA will be assessed on a case-by-case basis.

- No excavation/dredging in ESAs or shallow water habitat.
- Areas where intermittent ESAs have been identified may accommodate limited docks, with approval from SCDNR and USFWS.

7.13 Access Path

Back property owners of land adjoining buffer zones are given the right of access by foot to and from the lake through the buffer zone. Creation of a single 10-foot wide access trail that leads down to the lake is allowed. To prevent erosion and to protect the aesthetics of the shoreline the route should not be direct and instead will have a meandering design. No trees larger than 8 inches in diameter at breast height (dbh) can be removed within the access path. Paths must consist of approved materials such as; woodchips, mulch, pine straw, pervious concrete with tinted color, fieldstone, river stone, and native grasses. A Lake Management representative must identify and designate the location of access paths.

7.14 Limited Brushing

For buffer zones established ***prior*** to 2007, limited brushing of the buffer zone may be allowed by the back property owner to remove exotic and invasive vegetation. Permission for limited brushing will only be granted by SCE&G Lake Management after a site visit with the applicant to assess the need for brushing. Once limited brushing is completed according to the permit, the applicant shall maintain the site in said condition.

In general, certain critical vegetation cannot be removed even when limited brushing is permitted. Some species and types of vegetation provide important benefits such as bank stabilization, water quality functions, habitat, shade in near shore environments, and terrestrial input for aquatic ecosystems. For the purposes of a limited brushing permit, the following vegetation cannot be cleared:

Deleted: Owners of adjoining lands (back property owners)

Deleted: 10

Comment: SCE&G to provide statement about managing dead, dying, or dangerous trees.

Deleted: For buffer zones that are established ***after*** 2007

Deleted:

Deleted: , SCE&G will maintain a policy of no-disturbance of vegetation. Limited brushing will not be allowed on these lands under any circumstances.

Deleted: There may be n

Deleted: No

Inserted: No

Deleted: no

Deleted: vegetation

Deleted: removal

Deleted: below the 360' ft contour may be removed without prior approval from SCE&G. Only vegetation removal associated with creating a single 10-foot wide access trail leading to the lake is allowed.¶

Inserted: may be removed

Inserted: single

Deleted: adjacent to the back property

Comment: Use contour or elevation, not both.

Deleted: However, buffer zones established after June 2004 have a 'no disturbance area' within 25 feet of the

Deleted: 360'

Deleted: contour

Deleted: elevation

Deleted: where no brushing is allowed

- Black Gum
- Black Willow
- Buttonbush
- Cottonwood
- Green Ash
- Oak
- Persimmon
- River Birch
- Water Hickory
- Wax Myrtle
- Sycamore
- Tag Alder
- Tulip Poplar
- Certain hardwood species
- Dogwood

Plants that can be cleared through limited brushing generally are undesirable species that are invasive and in some cases exotic. Included in this group are the following:

- Vines such as green briars, Japanese honey suckle, poison ivy, poison oak, wisteria, and kudzu;
- Shrubs such as black berry and privet;
- Trees such as mimosa and Bradford Pear; and
- Trees that are dead, diseased and create a hazard .

Some selective clearing of native, non-invasive species will be allowed through limited brushing. Generally, this will include certain softwood species that are less than 3 inches diameter at breast height (dbh). Species that could be cleared in this category include the following:

- Loblolly Pine
- Longleaf Pine
- Red Cedar
- Red Maple
- Sweetgum
- Virginia Pine

Any vegetation that does not meet the above listed criteria, but that the back property owner would still like removed, must be addressed individually with SCE&G Lake Management Department. It is likely that any vegetation or tree removal that is not consistent with limited brushing, as outlined above, will have to be mitigated and may include revocation of the property owner's dock permit.

For buffer zones that are established ***after*** 2007, SCE&G will maintain a policy of no-disturbance of vegetation. Limited brushing will not be allowed on these lands under any circumstances. No vegetation below the 360' PD contour may be removed without prior approval from SCE&G. Only vegetation removal associated with creating a single 10-foot wide access trail leading to the lake is allowed.

7.15 Woody Debris Management

Submerged and shoreline woody debris provides habitat for many species of fish, macroinvertebrates, birds, reptiles, and mammals. This debris also helps protect the shoreline from erosion. SCE&G maintains a policy of non-disturbance for any and all woody debris unless its removal is necessary for reasons of health and human safety, or the debris is so minimal that it is insignificant in the provision of fish or wildlife habitat. Under some conditions, approval may be granted to remove woody material. SCE&G's woody debris management policy may allow the removal of woody debris below elevation 360' PD if it poses a clear safety or navigation concern, is brought to the attention of SCE&G's Lake Management Department personnel and is approved by Lake Management. Guidelines for the removal of woody debris are as follows:

7.15.1 Submerged Woody Debris

- SCE&G's Shoreline Management Plan allows limited removal of shoreline vegetation necessary for the construction and installation of docks and other permitted shoreline amenities.
- Shoreline property owners must obtain permission from SCE&G prior to removing shoreline woody debris below the 360 foot PD contour.
- If a dock is proposed for an area that contains significant, stable woody debris, SCE&G may propose an alternate location for the dock or prohibit the dock altogether.
- For tree stumps that pose a material threat to safety, landowners may be allowed to cut them off to an appropriate level, depending on expected water depth and proximity to docks and other activity-related facilities.

7.15.2 Floating Woody Debris

- Floating woody debris may be removed by SCE&G, SCDNR, or any member of the boating public when encountered if it is reasonably considered a material public safety issue or impediment to navigation.
- The debris should be removed from open water areas and taken to the shoreline.
- SCE&G encourages that it be secured onshore in undeveloped areas, such as the backs of coves and/or undeveloped lands.

7.15.3 Shoreline Woody Debris

Shoreline woody debris is managed in a manner similar to submerged woody debris:

- Limited removal of shoreline woody debris may be permitted to accommodate construction and installation of docks or other permitted shoreline amenities.
- Should a dock be proposed for an area that contains significant shoreline woody debris, SCE&G may propose an alternate location for the dock or prohibit the dock altogether.
- Shoreline property owners must obtain permission from SCE&G to remove shoreline woody debris below the 360’ PD foot contour.
- Unauthorized removal of stable shoreline woody debris may result in the cancellation of dock permits and/or other shoreline amenity permits and a requirement that there be appropriate mitigation for the improper woody debris removal.
- Shoreline woody debris that may be a navigation hazard may be removed.

Deleted: is

Deleted: viewed

Deleted: agreed by SCE&G

Deleted: to

Inserted: viewed

Formatted: Indent: Left: 1.25", No bullets or numbering

7.16 Permitting Application Procedure

The applicant will be required to submit to SCE&G a completed application along with the following:

- A copy of applicant's plat to the property reflecting county tax map information.

- Sketch showing the location, design, and dimensions of the proposed structure, or the type and location of erosion control proposed. Excavation projects will require a drawing to scale of the area to be excavated.
- Commercial applications to withdraw water from the lake also must include a complete description of the purpose for the removal and processes to be used, the volumes to be withdrawn.
- Applications for excavation not exceeding 150 cubic yards can be processed by SCE&G Lake Management Department. Any commercial excavation or individual excavation exceeding 150 cubic yards must also be processed through the U. S. Army Corps of Engineers and state agencies.
- A permitting fee is required.
- Specific directions by land to applicant's property on Lake Murray.
- Required local, state and federal permits and/or reports. The Lake Management Department will assist in the preparation of required local, state and federal permit applications.

7.17 Permitting Fees

SCE&G charges individual processing fees for its efforts in managing various permitting activities around the lakes. Permit fees are listed on the permit applications and are due at the time of application submission to SCE&G. If an application is denied the permit fee will be returned. An annual Administrative Fee may be implimented.

Deleted: The following application procedure applies

Deleted: for all

Deleted: projects requiring a permit issued by SCE&G. Such activities or developments include the following:¶
¶
<#>New construction, additions, or replacement of structures¶
<#>Erosion control projects¶
<#>Excavations¶
<#>Water removal¶

Deleted: apply t

Deleted: in writing and submit

Deleted: deed and

Deleted: and ultimately to be returned to the project waters

Deleted: personnel.

Comment: Move up one bullet

Deleted: generally

Comment: Move up to second bullet

Deleted: Currently SCE&G is considering implementing a

7.18 Violations

Comment: Ad penalty for not adhering to annual fees.

SCE&G conducts annual surveys of the lake shoreline to inventory and inspect docks built and permitted throughout the year. Dock applicants are responsible for maintaining their structures in good repair and safe condition. If at any time a dock is determined by a SCE&G Lake Management representative to be in disrepair or a hazardous condition, it must be repaired or removed from the Lake Murray waters immediately. SCE&G reserves the right to remove any dock on its property as conditions warrant.

Deleted: land below the 360-

Deleted: ft

Deleted: contour

SCE&G also makes note of unauthorized structures during its surveys, and urges residents and other lake visitors to report what they believe may be unauthorized activity below the 360-ft PD contour and in the buffer zones. SCE&G Lake Management representatives will issue Stop Work Directives for any violations that are detected on SCE&G property. Any unauthorized clearing of the trees or underbrush will result in the immediate cancellation of an individual's dock permit as well as action to require re-vegetation of the affected area. Removal of merchantable timber will require reimbursement to SCE&G Company subject to valuation of the SCE&G Forestry Operations Department. Additional, consequences for violations may include loss of consideration for future permits, fines, and/or legal action.

Deleted: Land

7.19 Miscellaneous

- Deeds, permits, or other instruments affecting Lake Murray lands and waters will contain all standard covenants customarily imposed upon project property and such other covenants as in the sole discretion of SCE&G may be desirable or appropriate. The instrument may contain indemnity clauses and insurance provisions.
- Permitting fees do not constitute a charge for admission to Project lands.
- SCE&G retains the right to vary the amount of application fees.
- No vested right or rights enforceable by third parties are created by SCE&G's Policies or Procedures.

Deleted: Project

Deleted: 516516

Deleted: 516516

Deleted: inspection

Maps of Lake Murray showing public and commercial landings, parks, navigational markings, and other information are available free of charge from SCE&G. Inquiries concerning policies, procedures, applications or regulations as outlined in this booklet, or requests for maps or applications, should be directed to SCE&G:

Comment: Check on this Map Situation

South Carolina Electric & Gas Company
Lake Management Department
Columbia, South Carolina 29218
Telephone (803) 217-9221

Deleted: Murray

South Carolina Electric & Gas Company

Lake Murray Management Department

Mail Code MZ-6

Columbia, South Carolina 29218

Published	**1-75**
Revised	**5-80**
Revised	**5-84**
Revised	**6-88**
Revised	**2-90**
Revised	**8-95**
Revised	**11-07**
Revised	**09-08**

Comment: Change Logo

Deleted: 096

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
LAKE AND LAND MANAGEMENT TWC

Lake Murray Training Center
October 15, 2008

final ACG 10-16-08

ATTENDEES:

Alan Stuart, Kleinschmidt Associates	Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates	Tony Bebber, SCPRT
Tommy Boozer, SCE&G	Van Hoffman, SCANA
David Hancock, SCE&G	Vivianne Vejdani, SCDNR
Ron Ahle, SCDNR	Roy Parker, LMA
Randy Mahan, SCANA Services	James Leslie, Lake Murray Docks
Joy Downs, LMA	Suzanne Rhodes, SCWF
Linda Schneider, Landowner	Jim Cumberland, SCCCL
Steve Bell, LW	Dick Christie, SCDNR

DATE: *October 15,* 2008

INTRODUCTIONS AND DISCUSSION

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan opened the meeting and noted that they would begin by reviewing the comments on the Shoreline Management Plan (SMP). Jim Cumberland and SCE&G staff provided comments prior to the meeting for review. Several TWC members, however, provided comments as the group reviewed the document.

The document was projected overhead so that the group was able to make changes collectively. The SMP wording was revised in several areas and changes can be viewed in the attached document. There was also brief discussion on a several issues during the SMP revision. These discussions are briefly summarized below.

The group conferred on private marinas, and Joy Downs asked if there would be the potential for more private marinas and sailing clubs under the new SMP. Tommy noted that due to the new restrictions there would probably not by many more large private multi-slips and sailing clubs. He noted that if someone owned 1000 feet of shoreline or more, there would be the potential for multi-slips based on shoreline footage. However, marinas established under the new commercial marina guidelines needed to operate with facilities that benefited the public as described in the Permitting Handbook.

Jim Leslie noted that he would like a section included in the SMP regarding the licensed authority's operation under the principles of due process of equal protection.

The group discussed the annual fee for the implementation of the Shoreline Permitting Program. Randy Mahan explained that SCE&G needs to consider administrative fees, and the cost of the programs that benefit shoreline landowners in order to determine the amount of the fee. It was also noted that the fees would be reviewed by the FERC. Joy asked if individuals who currently have a dock would be grandfathered in and not be required to pay an administrative fee. Randy replied that there would be no grandfathering under this policy. The group continued to discuss the costs involved with administering the SMP and the inspection of docks.

During a discussion on easement properties, the group discussed how many feet of native vegetation should be recommended near a waterway. Dick Christie noted that he would recommend 300 feet of native vegetation be kept along a waterway for wildlife purposes. The group, however, chose to leave the verbiage in the SMP vague in order to allow for case by case review.

Van Hoffman and the group discussed that it may be appropriate on a case-by-case basis to permit one dock on each parcel of land classified as Forest Management, based on ownership as of a specific date in 2007.

Once the TWC completed review of the SMP, it was noted that the next step would be review of the SMP and the Permitting Handbook with the RCG. Bill Argentieri explained that the FERC has suggested the SMP also be released for public review. The group determined that after review by the RCG the SMP would then be made available for public review at a public meeting. It discussed that a presentation by Tommy and David on the major changes to the SMP and the Permitting Handbook would be beneficial at this forum. Alan noted that he would like to send the SMP and Permitting Handbook out to the RCG for review by the end of October and schedule an RCG meeting for the beginning of December.

The group also reviewed the figures developed for the SMP before adjourning. Several edits were made and the TWC was satisfied with the results.

Meeting Adjourned

Appendix 29

Archaeological Site Monitoring

Due to the sensitive nature of the contents of this document, it is considered Privileged, and is only being provided to SC SHPO and Indian Tribes

Appendix 30

Tree House Site Data Recovery

Due to the sensitive nature of the contents of this document, it is considered Privileged, and is only being provided to SC SHPO and Indian Tribes