# SOUTH CAROLINA ELECTRIC & GAS COMPANY

*COLUMBIA, SOUTH CAROLINA*

## SALUDA HYDROELECTRIC PROJECT

*(FERC NO. 516)*

## BOATING DENSITY STUDY PLAN

## FINAL

*SEPTEMBER 2006*

*Prepared by:*

Kleinschmidt

Energy & Water Resource Consultants

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## *1.0 PURPOSE OF THE STUDY*

The Saluda Project is an existing, licensed hydroelectric facility owned and operated by South Carolina Electric & Gas Company (SCE&G). The Project is located on the Saluda River 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.

In comments received on the Initial Consultation Document (ICD), the South Carolina Department of Parks, Recreation & Tourism requested a boating study of Lake Murray to examine boat densities and safety on the Lake now and into the future. The goals of this study are to:

1. Identify the area available for recreational boating on Lake Murray by lake segment.
2. Assess boat densities occurring under normal (weekend) and peak (holiday) use conditions on Lake Murray by lake segment.
3. Analysis of whether recreational boat use of Lake Murray is currently above, below, or at a desirable level by lake segment[1].

The results of this study will be provided to the Recreation Resource Conservation Group with the intent of providing necessary information for future recreation planning.

[1] As applied to this study, "desirable level" refers to the amount and type of boating the lake can accommodate without unacceptable social impacts.

## *2.0 DATA COLLECTION*

The data used for this study includes a reexamination of existing aerial photographs of recreational boating on the Project, information collected from the survey research portion of the ongoing recreation assessment, and future use estimates being developed for the recreation assessment. Combined, the information will provide SCE&G with the inputs necessary to assess recreational boating densities and user preferences on Lake Murray.

### 2.1 Aerial Photographs

Existing aerial photographs collected during the 2001 aerial boat counts (The Louis Berger Group, 2002) will be used for this analysis. Aerial photos were taken on 3 holiday weekend days and 9 non-holiday weekend days (Table 1). Photographs were taken from an elevation of approximately 3,500 ft.

**Table 1: Dates of Photographs Taken in 2001 to be Used for Estimating Boat Numbers and Locations**

| WEEKEND DATES | HOLIDAY DATES |
|---|---|
| May 5 | May 26 |
| May 19 | June 30[a] |
| June 17 | July 4 |
| June 24 | |
| July 15 | |
| August 11 | |
| September 22 | |
| October 13 | |
| October 27 | |

a June 30, 2001 was actually on the July 4th weekend since July 4 fell on a Wednesday in 2001.

Berger (2002) divided the lake into 6 unique areas and presented the number of boats observed for each area. For this study, the lake will be divided into 12 segments that correspond with the segmentation being used in the ongoing Recreation Assessment (Figure 1). The 12 segments can be easily condensed to coincide with Berger's original 6 areas.

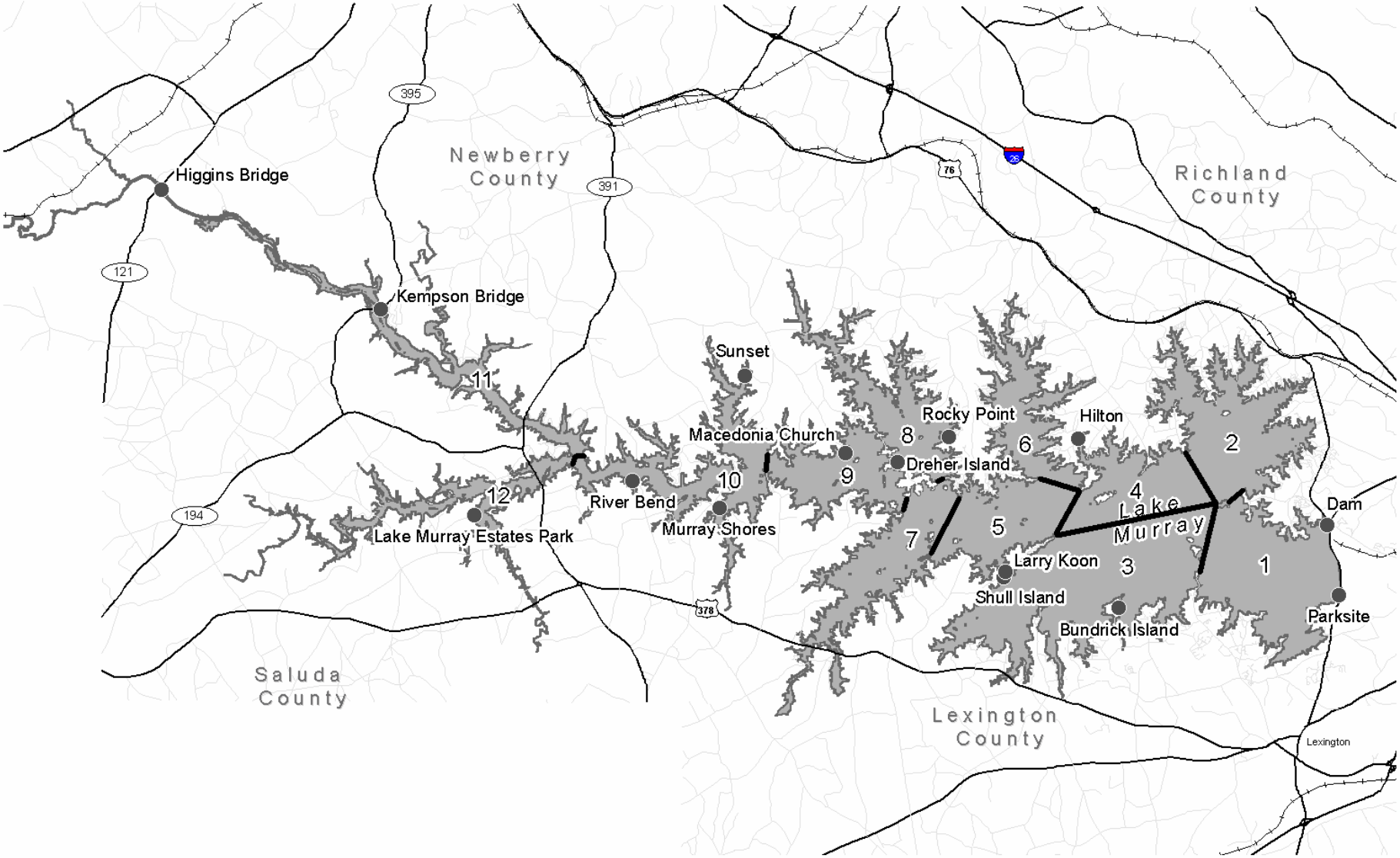


**Figure 1: Division of Lake Murray into Segments for the Recreation Assessment**

Boats appearing on each photograph will be counted and the number of boats observed will be tallied for each lake segment. Counts for each date will be stored in a Geographic Information System (GIS) as a unique record of data; records will be combined as necessary for analysis of normal (weekend) and peak (holiday) use periods. Total estimates for the 2001 recreation season will be accomplished by combining records.

## 2.2 Survey Data

As part of the Recreation Assessment being conducted concurrently with this study, exit interviews are being completed with users of SCE&G-owned recreation facilities. Respondents are asked if they spent any time on the water on Lake Murray. For those respondents that have spent time on the water, they are asked to indicate, on a segmented map of Lake Murray (Figure 1), where they spent the most time on the water and the resulting location is categorized into the corresponding lake segment. In order to ascertain perceptions of crowding on the water, respondents are also asked to rate the crowdedness of the lake on a scale from 1 to 5 (with 1 being "light," 3 being "moderate," and 5 being "heavy"). Respondents are also asked to identify their activities on the water, which will provide use estimates and distributions of activities occurring on different lake segments.

## *3.0 ANALYSIS*

To estimate the preferred recreational boating level, the lake will be segmented and, for each segment, the level of current boating use and a preferred number of boats will be estimated. The preferred, or desirable, number of boats will define the number of boats that a segment can support without detrimental impact to the boating experience. Comparison of the estimated *current* level of use with the estimated *preferred* level of use will provide guidance on whether areas of the lake are being used above, below, or at preferred levels.

### 3.1 Lake Segmentation

Lake Murray will be divided into 12 segments for analysis purposes (Figure 1). These segments correspond with the segmentation used for the Recreation Assessment survey. Although we have divided the lake into more segments in order to determine boating densities in cove areas, the six segments identified in the Berger (2002) study were retained in order to provide a quality control check (i.e., the number of boats in each segment can be compared to estimates in the Berger report).

### 3.2 Current Use Estimates

Estimates of current on-water holiday and non-holiday use will be determined from the aerial photographs, adjusted by population increases and participation rates from the South Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP), for each of the 12 lake segments. The types of activities in which people are engaged will be estimated using results of the Recreation Assessment questionnaire, and discussed in the context of the SCORP.

### 3.3 Preferred Boating Capacity

The preferred recreational boating capacity of Lake Murray will be estimated based on procedures and standards identified in Bureau of Outdoor Recreation (1977), modified for use at this project. The usable boating surface area of each lake segment

will be determined by using the total surface area at full pond excluding islands and subtracting: (1) all isolated lake areas that are segmented from the larger reservoir and not accessible by boat from the lake; and (2) all areas within 75 feet (allowable length of private docks) of privately owned shorelines. For locations where shoreline development is not permitted, the 75 foot perimeter will still be applied to provide a conservative estimate of capacity.

For each lake segment, a preferred boating acreage will be estimated using procedures developed by the Bureau of Outdoor Recreation (1977) and modified by Warren and Rea (1989). The boating acreage for each lake segment will be estimated by assessing the characteristics of each segment and determining if these characteristics influence the overall recreational boating capacity for each lake segment in a positive (+1), neutral (0), or negative (-1) way. The following characteristics, referred to as factors, were adapted from Warren and Rea (1989):

1. Multiple use of water area. Reservoirs where a mix of different activities occur generally have a lower capacity level for each activity. This is because there is a higher potential of user conflicts between activity types than there would be at a reservoir that supports few activity types. Reservoirs that support few activities typically have higher capacity levels for each activity. As Lake Murray supports multiple recreation uses, the boating acreages for all lake segments will be adjusted by a negative (-1) rating for this factor.
2. Shoreline configuration. Reservoirs with an irregular shoreline tend to accommodate fewer boats than reservoirs with uniform shorelines. Lake Murray has a large, irregular shoreline and will therefore have boating acreages for all lake segments adjusted by a negative (-1) rating for this factor.
3. Amount of open water. Large areas of open water accommodate more boats and activities such as power boating, sailing, and water skiing in a safer manner than reservoirs with little open water. Lake segments with large areas of open water will be given a positive (+1) rating. Lake

segments with a moderate amount of open water will be given a neutral (0) rating. Lake segments with small areas of open water will be given a negative (-1) rating.

4. Amount of facility and shoreline development. Reservoirs with a high degree of public access, facilities, and shoreline development can support a higher recreational boating capacity than less developed areas. Also, recreators at locations with higher levels of development are more tolerant of higher use densities than recreators at less developed locations. Lake segments with a high level of development will be given a positive (+1) rating for this factor. Lake segments with a moderate level of development will be given a neutral (0) rating. Lake segments with a few or no public facilities or development will be given a negative (-1) rating.
5. Crowding. Crowding of lake segments can affect the recreational experience of users in a variety of ways. Crowding can contribute to user conflicts, displacement, and negatively impact user satisfaction. Perceptions of crowding can affect the behavior of recreational users, such as altering the times that they visit the lake or altering the locations they visit. Users from urban areas, or who typically visit higher use areas, are more accustomed to higher use densities than users from rural areas or users of lower use areas and are, therefore, generally more tolerant of crowding than others. Each segment will be assessed using the Recreation Assessment survey data of respondent's perceived level of crowding (rated on a scale of 1 to 5). Lake segments with a mean crowding level of 1 to 1.6 will be given a negative (-1) rating for this factor. Lake segments with a mean crowding level of 1.7 to 3.3 will be given a neutral (0) crowding rating. Lake segments with a mean crowding of 3.4 to 5 will be given a positive (+1) crowding rating.

Factor ratings will be determined and summed for each lake segment. The total factor rating score will be applied as an acreage adjustment in determining the preferred recreational boating capacity for each unique lake segment for the different boating activities. For example, the Bureau of Reclamation has determined the acceptable

acreage of water per boat for power boating is 9.0 acres (Table 2). A summed factor rating score for each lake segment is referenced in the adjusted acres/boat table. For example, a total factor rating score of -4 would increase the required acres of water per boat for power boating to 16.2.

**Table 2: Acres of Water Needed Per Boat by Factor Adjustment (Source: BOR, 1977 and Warren and Rea, 1989)**

| | ACRES OF WATER/BOAT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **LOW** | **-4** | **-3** | **-2** | **-1** | **BASE** | **1** | **2** | **3** | **4** | **HIGH** |
| Power Boating | 18.0 | 16.2 | 14.4 | 12.6 | 10.8 | 9.0 | 7.8 | 6.6 | 5.4 | 4.2 | 3.0 |

The amount of useable surface area for each lake segment will be divided by the number of surface acres needed per boating activity to provide an estimate of the preferred number of boats that each segment of the reservoir might reasonably support at any given moment in time, assessed as though each activity were the only allowable use of the reservoir. To allow for multiple activity types, the number of boats will be multiplied by the distribution of boating activities that occurs at each lake segment during normal weekend use periods. Summing these provides the total recreational boating capacity for each lake segment, allowing for multiple activities to occur.

Some qualitative assessment of the findings will be required to address how different types of boating use may influence the estimated preferred recreational boating capacity of a lake segment. For example, some coves may provide excellent fishing opportunities that attract anglers, and may also be large enough to accommodate other uses such as tubing. Careful assessment of each lake segment will consider the types of recreational activities being undertaken in order to best determine the estimated preferred recreational boating capacity of that section.

### 3.4 Current Boating Density

The preferred recreational boating capacity for each lake segment will be compared with current boat densities for weekends and holidays. Using estimates of use derived from the aerial counts conducted at the project, the average number of boats at

Lake Murray on weekend days and holidays can be determined. Dividing the estimated current density by the estimated preferred recreational boating capacity will provide a percentage use density for each lake segment. For example, given a lake with 1,000 acres of usable surface area and a factor rating of -1, the preferred recreational "power boating" capacity would be 92.6 boats (1,000 acres/10.8 boats). If use estimates showed that the average number of boats on the lake is 50, then the percentage use density would be 54 percent (50/92.6).

Depending on the availability of data from the Safety RCG, the location of boating and related accidents will be assembled and plotted to determine whether there is a nexus between areas that experience high levels of boating accidents and areas with high boat densities. The location and severity of the accident, if available, will be mapped with the boating density for each lake segment.

## *4.0 REFERENCES*

Bureau of Outdoor Recreation (BOR). 1977. Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity. Department of Interior, Washington, DC.

The Louis Berger Group, Inc. 2002. Investigation of Boating Use on Lake Murray: Final Report. Prepared for South Carolina Electric & Gas Company, Columbia, SC.

Warren, Roger, and Phillip Rea. 1989. Management of Aquatic Recreation Resources. North Carolina State University, Publishing Horizons, Inc., Columbus, OH.

## *5.0 SCHEDULE*

The proposed schedule for completion of the Boat Density Study is as follows:

| TASK | DATE |
|---|---|
| Estimate number and location of boats as shown in 2001 photographs | November 2006 |
| Analyze boat densities per lake segment and for the entire lake | December 2006 |
| Estimate recreational boating capacity of each lake segment and for the entire lake | December 2006 |
| Submit draft report | January 2007 |
| Client and RCG review | February 2007 |
| Finalize report | February/March 2007 |