SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

DOWNSTREAM RECREATION FLOW ASSESSMENT REPORT

FINAL

NOVEMBER, 2007

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

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SOUTH CAROLINA ELECTRIC & GAS COMPANY

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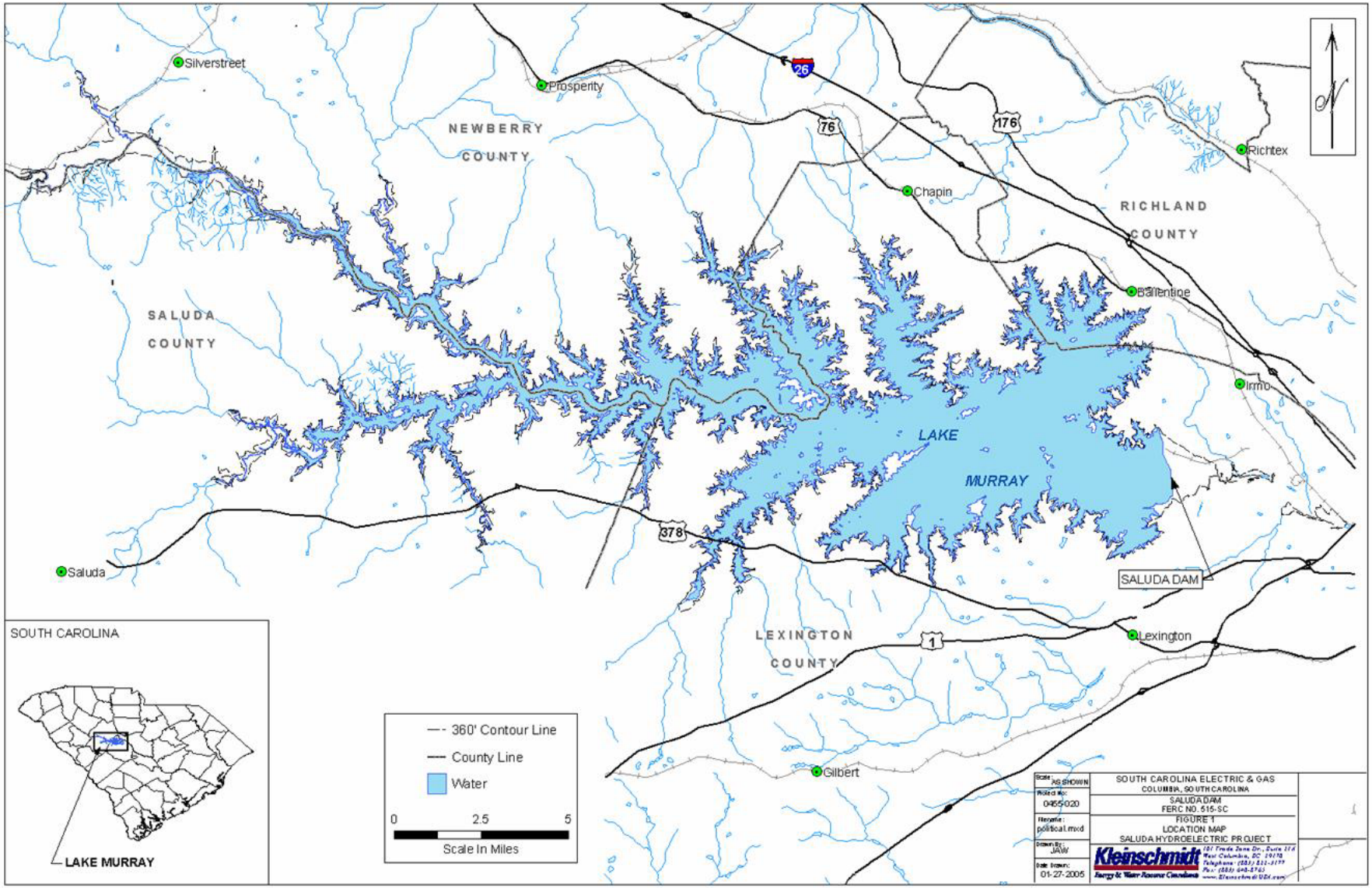
1.0 INTRODUCTION

The Saluda Hydro 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 1-1). The Saluda Hydro Project includes Lake Murray, the Saluda Dam and Spillway, the Saluda Back-up 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 Recreation and Safety Resource Conservation Groups (RCGs).

Figure 1-1. Project Location.



1.1 Study Area

For the purposes of this study, the geographic scope will be the lower Saluda River from the base of the dam to the confluence with the Broad River (Figure 1-2). 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 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 lower Saluda River. 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 lower Saluda River is 2,595 cfs with a minimum average daily flow of 285 cfs (Kleinschmidt, 2005).

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 various 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 2006 Saluda Project Recreation Assessment and Addendum, literature review, and the Downstream Flow Study Expert Panel Focus Group to identify sites

providing recreational access to the lower Saluda River and the recreation activities supported by these sites.

ii. Utilize the information collected during the Saluda Project Recreation Assessment, literature review, and the Downstream Flow Study Focus Group 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.

<u>Goal 2</u>: *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.

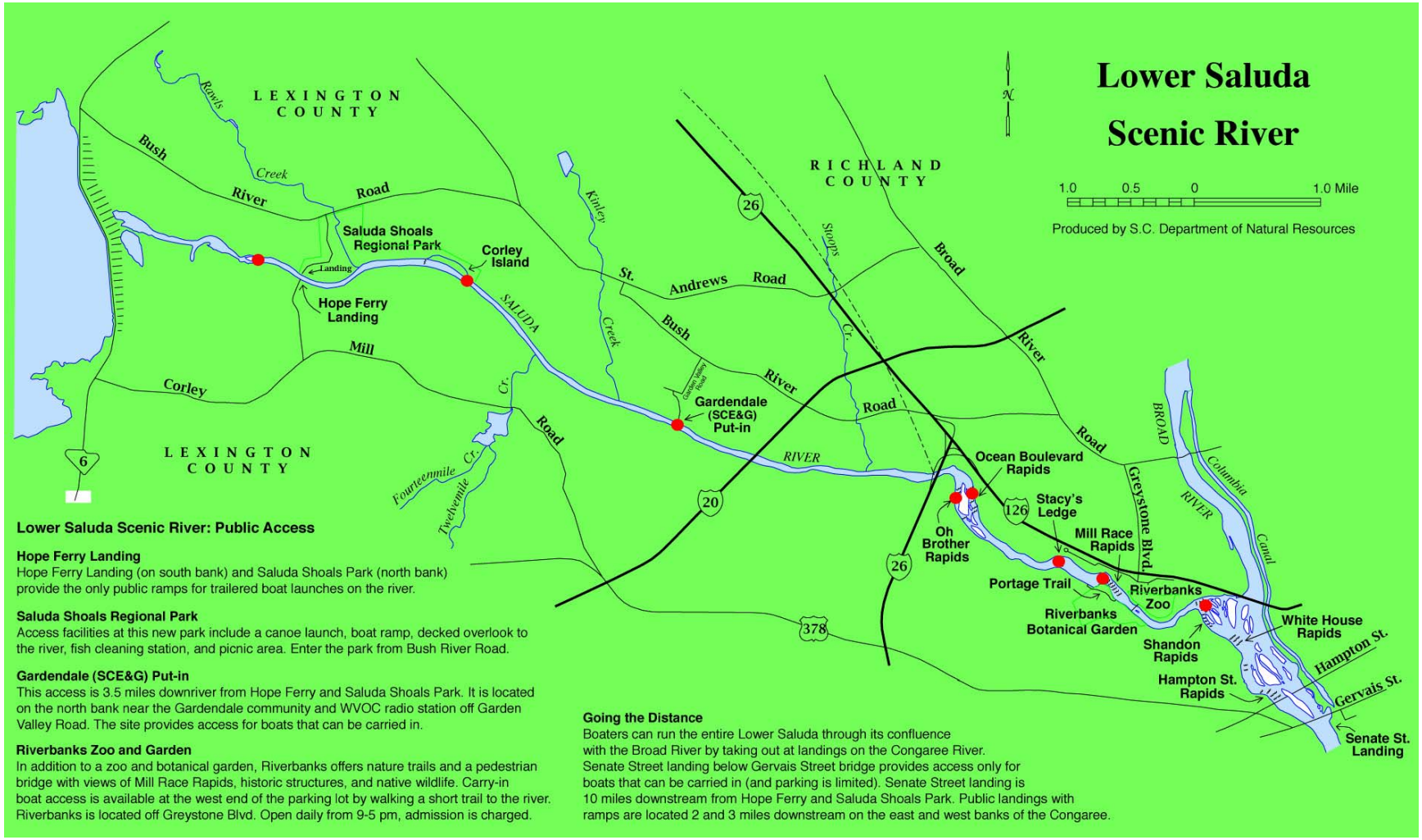
<u>Goal 3</u>: *Identify potential public safety issues associated with lower Saluda River flows. This will be accomplished by meeting the following objectives:*

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 public ingress and egress on the lower Saluda River as related to the safety of river users.

Figure 1-2. Study Area for Downstream Flow Assessment and Locations of Level Loggers



Source: South Carolina Department of Natural Resources, as modified by Kleinschmidt

2.0 METHODOLOGY

Information gathered for this study was 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 undertook a three-phase approach to meet the goals of the study through the objectives identified above. Phase I involved a literature review and desktop analysis of the recreation opportunities, patterns of use, physical characteristics, and hydrology of the lower Saluda River. Phase II involved a focus group, structured surveys and on-site reconnaissance of an expert panel of experienced wade anglers, boaters, and other recreationists, NGOs, and agency staff familiar with the river. The focus group's mission was to assess existing opportunities on the lower Saluda River 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 lower Saluda River from the dam to the confluence with the Broad River for the purposes of measuring stages and rate of change (in feet) for scheduled flow events.

2.1 Phase 1 – Literature Review and Desktop Analysis

This task involved the 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 were conducted via the web and SCE&G, stakeholder and agency collections for current river recreation, instream flow and creel studies and pertinent data such as the Lower Saluda River Instream Flow Analysis, the Three Rivers Greenway Plan, South Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP), and the Lower Saluda Scenic River Corridor Plan and Update. Consultation included representatives from American Rivers (AR), American Whitewater (AW), Saluda Chapter of Trout Unlimited (TU), the Columbia Department of Parks and Recreation, the River Alliance. South Carolina whitewater, fishing, and outdoor recreation tourism guidebooks were also reviewed in an effort to identify potential boating, angling, and other recreational opportunities on the lower Saluda River.

Relevant summary hydrology data from SCE&G and the United States Geological Survey (USGS) were collected. Historic records of minimum, maximum, and average

flow rates were reviewed and seasonal variations noted. These historical data were examined to determine the number of days the lower Saluda River may be available for each identified primary recreation activity.

The 2006 Saluda Hydro Project Recreation Assessment and Spring Addendum utilize 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 were reviewed and analyzed to determine what recreation activities are currently supported by access sites along the lower Saluda River, what recreation activities were 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 On-Site Reconnaissance

An expert panel was compiled to collect and disseminate information regarding recreation opportunities and potential flow effects on recreation on the lower Saluda River. The expert panel consisted of the experienced recreational users and resource experts that make up the Downstream Flows TWC and others, as needed (Appendix B). A focus group discussion panel was 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, boating, swimming and other recreational opportunities; existing and potential access locations; potential locations for additional safety lights/sirens; and any potential safety hazards.

An on-site reconnaissance of pre-determined flows was also conducted by participants in various recreation activities to augment information on flows, opportunities, and safety concerns. The on-site reconnaissance was conducted from May 17 through May 20, 2007 and consisted of four facilitated site visits/on-water evaluations at four flow levels. Target flow requests of 750 cfs; 1,100 cfs; 2,500 cfs; and 4,000 cfs were made of SCE&G for the facilitated site visits/on-water evaluations. These flows were selected by the expert panel focus group as being appropriate and/or optimum for a wide range of recreation activities. Flows were provided by SCE&G from 4:00 am to 2:00 pm to allow time for river stabilization and were targeted at the levels requested.

Flow ranges encountered during the on-water evaluations from 9:00 am to 2:00 pm were as follows:

Table 2-1. Lower Saluda River Flows During On-Site Evaluations

Date	Target Flow (cfs)	Maximum Flow (cfs)	Mean Flow (cfs)	Minimum Flow (cfs)
May 17, 2007	750	537	534	533
May 18, 2007	1,100	1,090	1,078	1,000
May 19, 2007	2,500	2,290	2,272	2,260
May 20, 2007	4,000	3,950	3,938	3,920

Source: USGS, 2007.

Participants were asked to either participate in recreational activities on the lower Saluda River or to observe and assess the lower Saluda at predetermined geographic intervals for each flow. Participants were asked to complete a series of surveys (Appendix C): a Pre-Flow Survey, which ascertained the individuals familiarity with the lower Saluda River and experience level with respect to the recreational activity in which they were participating and a Post-Flow Survey, which allowed review of each flow with respect to the suitability for various activities such as boating, wade angling, and swimming and potential safety hazards.

In addition to the site visits, video documentation of a rate of change event for an 18,000 cfs flow was collected. The video camera was staffed at the Mill Race A site and recorded, along with a time stamp, the entire rate of rise event until approximated stabilization. The flow event recording lasted 5.5 hours on January 31, 2007 from approximately 7:00 am to 12:30 pm.

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 Downstream Flows TWC. 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 were 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 1-2). For ease of reference, the level loggers were named according to their proximity to public access sites or notable river features. The most upstream level logger, Metts Landing, was placed at a location known as Sandy Beach, one-third mile upstream of the James R. Metts Landing public access site. The next most upstream level logger was placed just downstream of Corley Island, 1.3 miles downstream of the Metts Landing public access site. The Gardendale level logger was located adjacent to the Gardendale public access site. Ocean Boulevard and Oh Brother Rapids correlate with the locations of these sections of the river, where the river splits into two channels around an island. The Stacy's Ledge level logger location is likewise located at the river section of the same name. The Botanical Gardens level logger was placed just above Mill Race rapids, just upstream of the Riverbanks Zoo and Botantical Gardens. This section of the river is accessed from the Mill Race A recreation site. The most downstream level logger location, Shandon Rapids, correlates with that section of the lower Saluda River and is accessed from the Mill Race B recreation site.

Water level loggers recorded the barometric pressure and water depth once per minute for 30 days from January 22 through February 22, 2007 to capture the full range of flow releases necessary to complete the study. Most flows were released on or about 6:00 am, with exception of the 1,000 cfs[1]; 2,000 cfs; and 5,000 cfs flow events which were provided after 5:00 pm. Flow durations ranged from 1.5 hours to approximately 7 hours and averaged approximately 4 hours. The flow releases captured during the first 4 hours of operation were as follows:

[1] Because the 1,000 cfs flow followed a high flow event (14, 000 cfs) which had not fully recessed in time to establish a baseline prior to the release of the 1,000 cfs flow, this flow event was not analyzed to calibrate the model.

Table 2-2. Lower Saluda River Flows During Level Logger Deployment.

Flow Date	Target Flow (cfs)	Maximum Flow (cfs)	Mean Flow (cfs)	Minimum Flow (cfs)
January 22	12,000	12,092	9,670	504
January 23	10,000	10,095	8,500	465
January 24	8,000	7,827	6,479	551
January 30	14,000	14,635	12,008	1,668
January 31	18,000	16,857	14,165	3,695
February 1	16,000	15,469	13,397	5,294
February 6	14,000	12,970	10,440	1,007
February 7	2,000	2,050	1,735	823
February 8	3,000	2,724	1,326	539
February 13	4,000	3,894	2,330	733
February 14	5,000	4,956	2,898	688
February 15	6,000	7,524	5,994	680

Source: USGS, 2007

The level logger data were used to generate a model of river dynamics at pre-determined flow release levels for varying durations using the Army Corps of Engineers River Analysis System HEC-RAS (v3.1.3) (HEC RAS). This allowed for analysis of actual operational scenarios whereby flows are released during reserve calls for approximately 1.5 hours duration and for lake level management for approximately 6 hours duration. Because reserve call and lake level management operations differ from those observed during the level logger deployment, the HEC RAS operations model provides the analysis listed below for actual operational scenarios and provides a more accurate representation of the conditions encountered on the lower Saluda River during project operation scenarios. As such, a 1.5 hour duration flow was modeled at each flow release level to simulate reserve call operations, a 6 hour duration flow was modeled to simulate lake level management operations, and a 24 hour duration flow was modeled to achieve river stabilization at each level logger location.

As discussed above, level logger stage data was collected at various points along the lower Saluda River over a period of two months. During this time, different generation events with various peak flows and durations were recorded with time stamped data. Using this data, in combination with 15-minute flow data available from the nearby USGS Gage No. 02168504 (Saluda River Below Lake Murray Dam Near Columbia, SC), a hydraulic HEC RAS model was developed and calibrated to mimic the

observed stage increases along with wave arrival and recession times, allowing for one-dimensional dynamic flood wave routing.

Initial cross-sections for the model, which correlate to the level logger locations, were assembled from available Digital Elevation Model (DEM) data from the USGS. While this data provides information for overbank locations, it does not accurately define the channel bathymetry of streams. Subsequently, main channel trapezoidal geometry was developed from observed and aerial information and assembled into the sampled DEM cross-sections. Observed data for flow from the USGS gage, along with observed stage data from the level loggers, was used as a baseline for the HEC RAS model. Parameters such as channel geometry, roughness, and other factors were adjusted until the calculated hydraulic results closely matched the observed hydraulic results.

Key parameters in this assessment and calibration were the wave arrival time, stage increase over time, and rate of rise. The modeled cross-sections were adjusted until all three parameters closely resembled the observed data. Perfect correlation between the observed and calculated data is not always possible. For example, during some of the observed flow events, there may have been local inflows from recent storm events skewing the data. Additionally, some level loggers moved during high flow events resulting in an unexpected shift in the datum. These data were removed from the observed level logger data set as outliers prior to calibration of the model.

Another modeling adjustment consideration was the channel split at Oh Brother and Ocean Boulevard Rapids. Two level loggers deployed at these locations were in close proximity to each other, but on different channels, resulting in two separate stage increases, one larger than other. Because the HEC RAS model provided only a single channel analysis, a stage multiplication factor was applied to these two locations to account for the variable stage increases observed. Level logger data from Oh Brother Rapid was adjusted by a factor of 0.7 and data from Ocean Boulevard Rapids was adjusted by a factor of 1.3.

Once the HEC RAS model was calibrated, hypothetical flow scenarios were run to evaluate the arrival time and stage increases at the observed cross-section locations. The model provides valuable information within the observed flow ranges and cross-

sections, but information outside of these ranges should not be used. The HEC RAS operations model analyzed the level logger data, in conjunction with USGS flow data, to determine (for the study period):

- daily maximum river depth (in feet) for each water level data logger location;
- change (in feet) from the start of operations and from the start of water rise to maximum river depth for each water level data logger location by flow;
- change (in feet) from the start of operations and from the start of water rise to 75%, 80%, 90% and 99% of maximum river depth for each water level data logger location by flow;
- time duration from the start of operations and from the start of water rise to maximum river depth for each water level data logger location by flow;
- time duration from the start of operations and from the start of water rise to 75%, 80%, 90% and 99% of maximum river depth for each water level data logger location by flow;
- rate of change (in feet per minute) in water level from the start of operations and from that start of water rise to maximum river depth at each water level data logger location by flow;
- rate of change (in feet per minute) in water level from the start of operations to 75%, 80%, 90% and 99% of maximum river depth at each water level data logger location by flow;
- rate of change in water level by flow from start of rise after 15 minutes duration, 30 minutes duration, and 1 hour duration;
- time from maximum flow to baseline elevation (time to recession); and
- graphical analysis of observed flow events by water level logger location (stage in feet over time) for each flow event.

Several assumptions were made during the analysis of the flow model data, as well as some limitations identified. First, the model assumes that the Saluda Hydro plant starts with a baseline flow of 500 cfs, then increases flows incrementally by 850 cfs per minute regardless of operational scenario. For a flow of 3000 cfs, for example, the model assumes at minute zero the flow is 500 cfs; at minute one the flow is 500 cfs plus 850 cfs (1350 cfs); minute two gains an additional 850 cfs increase, resulting in a flow of 2200 cfs; and minute three reaches the targeted flow of 3000 cfs. In reality, reserve call operations generally require the plant to generate a targeted amount of power within 15 minutes, regardless of release. For a reserve call release of 18,000 cfs, this results in incremental increases of 1,167 cfs per minute, on average, over the course of 15 minutes to bring the plant to full generation and outflow. For lake level management operations, the plant may be brought up to the desired generation output more gradually, as low as 500 cfs per minute incremental increase from base flow. The 850 cfs used by the model is a median of observed increases during the flow release study, and is considered representative of the range of possible operational increases.

Actual flow increases depend on the purpose of operation and equipment used (individual turbine units) for generation. Due to the fact that generating units 1 and 2 share a governor system, as do units 3 and 4, the flows of only one of each pair can be adjusted at any time because the governor systems are not sized to adjust gate settings on two units simultaneously. During reserve call operations, one of each paired generating units is started at a time. Operations protocol calls for waiting until the initial the generating units are up to speed and tied-in to the grid system. Output is then gradually increased via incrementally higher gate settings. Unit 5 has its own governor system, but it takes several minutes for this unit to tie-in and balance due to excitation issues. Reserve call operations thusly require many adjustments for starting units, gate settings, and volt amps reactive (VARs), while bringing the plant up to high capacity. If the reserve call is low enough, all five units are not needed which subsequently changes the time to reach required output. The fastest rate of increase for reserve call operations is for an output requirement of 32 MW. To simulate such a scenario, we analyzed a modeled flow event whereby a baseline of 500 cfs was increased incrementally by 1,750 cfs for 10 minutes for a total flow of 18,000 cfs. This operational scenario, extreme reserve call operations, was modeled for 24 hours flow duration.

Second, because the time of the start of operations for each flow event accounts for lag time experienced from the release of water from the dam to the initial incidence of stage rise experienced at each level logger location (time of wave arrival), time durations and rates of change (in feet per minute) to maximum stage from start of operations overestimate the actual conditions experienced on the river. Therefore, time durations and rates of change to maximum stage (and percentages of maximum stage discussed below) was also estimated from the start of rise (time of wave arrival) experienced at each level logger at each flow.

Third, the model identifies the first instance of any increase in stage over baseline flow conditions (500 cfs) as the "wave arrival time". It is important to note, however, that because the initial increase in river stage experienced at each level logger location can occur gradually (increases of 0.01 feet or 0.12 inches) over several minutes, the time to maximum stage and percentages of maximum stage may be overestimated by as much as 10 to 15 minutes at downstream sites at lower flows. For example, while Metts Landing experiences a rise of 0.01 feet for the first 2 minutes at all flow releases with more significant increases experienced thereafter, Oh Brother Rapids experiences a rise of only 0.10 feet for the first 15 minutes at a flow of 1,000 cfs. The effect of this gradual initial rate of rise is attenuated as flow levels increase. The rate of rise analysis includes this initial gradual rate of rise in overall rate of rise calculations but also includes the more steep rates of rise encountered after the initial rise. The rates of rise from the start of wave arrival to maximum stage and percentages of maximum stage are calculated linearly as a function of total increase in stage over time and, therefore, accounts for any increases in stage, regardless of slope. When reviewing the results of this analysis, however, it will be important to review both the overall rate of change at each level logger location at each flow in comparison with rates of change that occur within the first 15 minutes of wave arrival.

Fourth, the model identifies the first instance of maximum stage for each operational scenario and each flow at each level logger location. However, there is an approximate assumed range of stabilization of 1 percent of maximum. The maximum stage may occur several minutes to several hours after reasonable or noticeable stabilization occurs. As a result, the time to maximum stage and subsequent rate of

change may overestimate the true time to stabilization and associated rate of change. Therefore, the time to 99% of maximum stage (or time to stabilization) and rate of change analysis is presented in Appendix E. Furthermore, analysis of percentages of maximum stage (75%, 80% and 90% of maximum stage) is presented in Section 3.3.3 and in Appendix E. Because the greatest increase in stage and greatest rate of change generally occurs at between 75% and 90% of maximum, this analysis is presented in Section 3.3.3.

Finally, time to recession is calculated as the time from maximum stage, irrespective of stabilization, to baseline stage conditions of 500 cfs. Because the time of maximum stage is estimated at the first maximum stage event and can occur anytime during stabilization, the time to recession may be overestimated. Furthermore, river stage may come within 1 percent of baseline conditions for a specific duration of time before reducing to true baseline conditions. Again, this may contribute to an overestimation of time to recession. Baseline conditions are generally not achieved during the 24 hour model run for the 6 hour operational scenario. Specifically, for most locations under most flow releases, the time of stabilization is extended such that recession to baseline conditions is not achieved within 24 hours.

3.0 RESULTS

The information gathered through the on-site reconnaissance, literature review, flow and hydrologic data analysis, and the expert panel focus group provided an assessment of recreational use and opportunities prevalent on the lower Saluda River. Issues regarding existing and potential future access, safety measures and appropriate flows form the basis of recommendations made for both the HEC Res-Sim model analysis and safety measures compiled by the Safety RCG.

The following sections provide information regarding recreational use occurring at the project. This includes characterizing the existing recreation sites and facilities that provide public access to project lands and waters, and identifying how those sites and facilities are currently used.

The analysis below also provides a basis by which to identify preferred flows for the lower Saluda River that target particular recreation activities at appropriate locations. These flows are 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 potential safety issues associated with typical and preferred flows are identified and recommendations for safety measures to be considered by the Safety RCG are provided. The results of this study 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 access sites, and determine which areas of the river may be suitable as velocity refuges.

3.1 Access Sites

3.1.1 Existing Access Sites

There are several formal and informal public access sites on the lower Saluda River, providing a range of water- and land-based recreation opportunities (Kleinschmidt, 2007a). Boating access for motorized water-craft is limited to the two most upstream access sites, Saluda Shoals Park and Metts Landing, while carry-in access is available at these sites plus Gardendale and Mill Race A

(upstream of Riverbanks Zoo) and Mill Race B (downstream of Riverbanks Zoo). Shoreline access for angling and swimming, sunbathing, sightseeing and/or picnicking is available at all public access sites on the lower Saluda River.

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

Of the public recreation sites providing access to the lower Saluda River, Saluda Shoals Park, managed by the Irmo Chapin Recreation Commission, is the largest site. Located off of Old Bush River Road, the park covers 300 acres on the river's north shore, approximately 2 miles downstream of the dam. The park provides multiple facilities in various sites around the park which support picnicking, hiking, boating, fishing and swimming, among other activities. This site has multiple picnic areas and pavilions, playgrounds, a splash park, a visitor's center and an environmental center, a boat ramp (for motorized and carry-in access), a separate canoe and kayak launch area, fishing piers, a dog park, multiple trails, concessions, and canoe/kayak rentals. The site also provides wading access to Corley Island during periods of low water. The site is open year round, from 7:00 am to sunset. The park also provides coded gate entry to the

park 24-hours a day for angling access. The park is staffed and charges a fee for entrance, though annual passes are also available.

James R. Metts Landing (also known as Hope Ferry Landing) is located directly across the river from Saluda Shoals Park and is accessed via the Hope Ferry Road off of Corley Mill Road. This site provides separate paved launches for motorized and carry-in boating access and has parking for 18 vehicles and trailers. The site is unstaffed and for day use purposes only.

Gardendale is located approximately 6 miles downstream of Saluda Dam on the north shore of the river. This site is located in a residential neighborhood and is accessed from Garden Valley Road off of the Bush River Road. The site is relatively small providing shoreline access, a carry-in boat launch, parking and a hiking/biking trail.

Mill Race A is located on the north shore of the river, adjacent to Riverbanks Zoo on the upstream side. The site is served by an overflow parking area for the zoo. It is an informal site providing a network of shoreline access trails. These trails provide access to the rocky outcroppings of Mill Race rapids, a popular spot for angling and "rock hopping", that is, sunbathing, swimming, and/or picnicking on the rocks. Mill Race B is located at the downstream side of Riverbanks Zoo and is also served by an overflow parking area for the zoo. Mill Race B is also informal, consisting of a shoreline trails providing access to the rocky outcroppings of Shandon Rapids, as well as, the Broad River. This site is primarily used by individuals sunbathing and picnicking on the rocks of the Shandon Rapids reach of the lower Saluda River. Mill Race A and B are outside of the Saluda Hydro Project boundary.

3.1.2 Future Access Sites

Recommended improvements to existing access sites and proposals for future access sites fall under two major plans associated with the lower Saluda River: the Three Rivers Greenway and the Lower Saluda River Scenic Corridor. In addition, recommendations for additional access sites and improvements to the

existing access sites on the lower Saluda River were received from the expert panel focus group and during the 2006 Recreation Assessment.

The River Alliance is spearheading the Three Rivers Greenway Project, a 12-mile linear park that would include sections of shoreline along the Saluda, Broad and Congaree Rivers (The River Alliance, 2007). A portion of the Three Rivers Greenway, the Saluda Riverwalk, would encompass lands along the lower Saluda River from the I-26 bridge to the confluence with the Broad River. Among the access and improvements for the lower Saluda River proposed as part of the Saluda Riverwalk are a pedestrian bridge connecting Richland and Lexington counties, a continuous trail along the northern shore of the river, and a park at the site of Mill Race rapids that would include trash receptacles, picnic tables, bathrooms and a ranger and rescue station. This portion of the Three Rivers Greenway is still under development.

The Lower Saluda Scenic River Corridor Plan (Plan) and Update outlines various recommendations for access and facilities, enforcement, maintenance and aesthetics, resource protection and safety for the lower Saluda River. The plan delineates the lower Saluda River, from the Saluda Dam to the confluence with the Broad River, into four main sections. Various improvements and additional public access sites are recommended for each section in the Plan as part of the Saluda River Greenway Trail, which was developed during the Plan Update as a link between Saluda Shoals Park and the Three Rivers Greenway on the Broad River. The Saluda Riverwalk portion of the Three Rivers Greenway is included in Section 4 of the Plan's Saluda River Greenway Trail (SCDAP, 2000).

Recommendations for improvements and additional public access as part of the Plan and/or Saluda River Greenway include:

- A greenway trail beginning near the dam and extending downstream along the northern shore of the river to the confluence with the Broad, including and connecting to the proposed Three Rivers Greenway, and including new pedestrian bridges, feeder trails, and overlooks.

- Improvements to Saluda Shoals Park including roads, parking, trails, bridges, a gate house and other facilities.
- Improvements to Metts Landing including additional land for parking and facilities and easements along the river for shoreline angling access.
- Improvements to Gardendale including trails, bridges, improved parking, restrooms, security fences, and a gatehouse, among other facilities.
- A new fishing pier, trail and wetlands area below I-20 on the north side of the river.
- A limited access carry-in boat launch just below I-26 on the north shore of the river just above Oh Brother rapids.
- A new access site(s) and portage trail at Stacy's Ledge on the north side of the river.
- An improved portage trail around Mill Race rapids on the south shore of the river.

The Lower Saluda Scenic River Corridor Plan Update also calls for additional emergency access sites as discussed in Section 3.4.2.

The expert panel focus group also provided input on the need for additional access to the lower Saluda River. Many of the suggested improvements mirror the recommendations made as part of the Three Rivers Greenway and the Lower Saluda Scenic River Corridor Plan and Update. Specifically, the group suggested:

- A shoreline angling access trail below Saluda Dam.
- A hand-carry access site and portage trail above Mill Race rapids.

- A hand-carry access site at Twelvemile Creek on the south shore of the river between Saluda Shoals Park/Metts Landing and Gardendale.
- A shoreline angling access trail at Sandy Beach, upstream of Saluda Shoals Park.
- A hand-carry access site below the I-26 bridge (City of Columbia is currently working on this access site).

River users were asked what improvements are needed at existing recreation sites during the 2006 Recreation Assessment. The expert panel focus group provided suggestions for improvements to existing sites, as well as, additional access on the lower Saluda River.

Of those indicating a need for additional or improved facilities during the 2006 Recreation Assessment, restrooms were identified as the most needed additional facility at lower Saluda River recreation sites 33 percent of the time. Restrooms were recommended most often for Metts Landing, Gardendale, and Mill Race B. In addition, many individuals indicated a need for trashcans (16 percent of total responses). Trashcans were requested for Mill Race A the majority of the time. Trashcans were the second most requested improvement at Mill Race B. Improved trails was cited most often at Saluda Shoals Park, in addition to other recommendations for such improvements as a swimming pool and water fountain for dogs at the dog park. Gardendale was identified as needing a boat launch and an improved access road.

Recommendations for lower Saluda River public access sites made by the expert panel focus group include:

- Trash cans and restrooms at Metts Landing
- Improvements to the carry-in ramp, trash cans, and trail improvements at Gardendale.
- Restrooms, trashcans, and trails at Mill Race A and Mill Race B.

In addition to facilities, many respondents to the 2006 Recreation Assessment and the expert panel focus group indicated a need for maintenance and aesthetic activities, such as landscaping and trash removal, at Gardendale, Mill Race A and Mill Race B. Increased security and patrols was recommended most often by respondents to the 2006 Recreation Assessment for Mill Race A and made similar recommendations for Mill Race B. Likewise, the expert panel focus group recommended increased security and patrols for all lower Saluda River sites, except Saluda Shoals Park, which is already gated and staffed.

3.2 Recreation Use

During the 2006 recreation season (April through September), public recreation sites on the lower Saluda River supported a total of approximately 232,000 recreation days (Table 3-1)[2]. The most used sites were Saluda Shoals Park (approximately 135,000 recreation days or 58 percent of total use), Mill Race B (approximately 38,000 recreation days or 16 percent of total use), and Mill Race A (approximately 23,000 recreation days or 10 percent of total use). The site with the least amount of use was Gardendale (approximately 12,000 recreation days or 5 percent of total use). About 45 percent of all use occurs during the months of June and July. Sites are busiest on holidays, which accounted for 40 percent of the total use by day type from Memorial Day through September 30, followed by weekends and weekdays.

Table 3-1. Recreation Use Estimates by Site, Month, and Day Type for Lower Saluda Recreation Sites (2006)

	Saluda Shoals Park	James R. Metts Landing	Gardendale	Mill Race A	Mill Race B	TOTAL
April	18,680	3,390	1,650	3,180	5,250	32,150
May	20,780	3,770	1,830	3,530	5,840	35,750
June	26,610	4,850	1,150	6,530	13,770	52,910
July	33,040	5,490	2,140	3,560	7,860	52,090
August	15,100	3,160	3,270	4,290	1,860	27,680
September	20,830	3,850	1,880	1,880	3,370	31,810
TOTAL	135,040	24,510	11,920	22,970	37,950	232,390

Source: Kleinschmidt, 2007a and Kleinschmidt, 2007b

[2] Recreation use estimates are provided in recreation days, which the Federal Energy Regulatory Commission (FERC) defines as "each visit by a person to a development for recreational purposes during any portion of a 24-hour period."

The lower Saluda River supports many water-based activities including boat, bank, and wade angling; pleasure boating; canoeing and kayaking; tubing; rafting and swimming. Activities that are participated in at the five public access sites on the river are generally dependent upon the support facilities provided. All sites provide shoreline access for angling and swimming; two sites provide motorized and carry-in boat launches; one site provides a carry-in launch only and two sites provide shoreline access to the water but no formal boat launch. Saluda Shoals Park also provides several opportunities for land-based and water-associated activities such as picnicking, hiking/biking, and sightseeing.

For recreation activities observed during the 2006 peak recreation season (Memorial Day weekend through September 30) boating activities were most popular at Metts Landing, which has both motorized and carry in boat launches. Canoeing and kayaking activities were most popular at Gardendale, which has a carry-in launch. Angling activities were most popular at Mill Race A and Mill Race B, which provides shoreline access only. Land-based activities make up the majority of use at Saluda Shoals Park (75 percent), which is the most developed site and offers the most amenities. Table 3-2 presents the primary recreation activities indicated by individuals interviewed at lower Saluda River sites during the 2006 peak recreation season by day type for each site.

In general, the most popular activities at Saluda Shoals Park were visitation to the splash park and playground and the dog park, both land-based activities. Boating activities, including fishing from a boat and canoeing and kayaking, comprised approximately 11 percent of all activities reported, even though this site has one of the only motorized launches on the river, a separate canoe/kayak launch and canoe and kayak rentals on site. This is not surprising given that the majority of facilities and opportunities at Saluda Shoals Park are land-based.

Use at Saluda Shoals Park differed across day types. Dog walking and walking/hiking were the most popular activities during the week, followed by attending an event such as a company picnic and use of the splashpark and playgrounds. Splashpark and playground visitation, however, was the most popular activities on weekends and holidays. Walking was the second most popular activity on weekends,

followed by bicycling. During holidays, swimming was the second most popular activity followed by walking.

Table 3-2. Primary Recreation Activity by Site and Day Type

Site	Primary Activity	Day Type			Total
		Weekday	Weekend	Holiday	
Saluda Shoals Park	Bank Fishing	5%	0%	0%	3%
	Boat Fishing	0%	3%	0%	1%
	Pier/Dock Fishing	3%	0%	0%	1%
	Flatwater Canoe/Kayak	8%	7%	11%	8%
	Tubing/Floating	3%	7%	0%	4%
	Whitewater Canoe/Kayak	0%	3%	0%	1%
	Bicycling	3%	10%	11%	7%
	Dog Walking	16%	10%	0%	12%
	Event	14%	7%	0%	9%
	Nature Study/Wildlife	3%	0%	0%	1%
	Picnicking	3%	3%	11%	4%
	Playground/Spraypark	11%	27%	22%	18%
	Sightseeing	5%	3%	0%	4%
	Swimming	5%	3%	22%	7%
	Walking/Hiking/Backpacking	3%	7%	22%	7%
	Other	19%	10%	0%	13%
	Total	100%	100%	100%	100%
	N	37	30	9	76
Metts Landing	Bank Fishing	17%	21%	0%	16%
	Boat Fishing	25%	31%	18%	27%
	Pier/Dock Fishing	0%	0%	9%	1%
	Wading Fishing	0%	0%	9%	1%
	Flatwater Canoe/Kayak	8%	21%	27%	16%
	Tubing/Floating	6%	5%	0%	5%
	Whitewater Canoe/Kayak	8%	3%	0%	5%
	Dog Walking	6%	8%	9%	7%
	Sightseeing	17%	5%	9%	10%
	Sunbathing	0%	0%	9%	1%
	Swimming	3%	3%	9%	3%
	Walking/Hiking/Backpacking	6%	3%	0%	3%
	Other	6%	3%	0%	3%
	Total	100%	100%	100%	100%
	N	36	39	11	86
Gardendale	Bank Fishing	7%	10%	0%	7%
	Boat Fishing	0%	5%	0%	2%
	Flatwater Canoe/Kayak	10%	25%	13%	16%
	Tubing/Floating	3%	5%	13%	5%
	Whitewater Canoe/Kayak	17%	20%	25%	19%
	Bicycling	0%	5%	0%	2%
	Dog Walking	3%	0%	0%	2%
	Nature Study/Wildlife	3%	0%	0%	2%
	Sightseeing	34%	10%	38%	26%
	Swimming	0%	0%	13%	2%
	Walking/Hiking/Backpacking	3%	10%	0%	5%
	Other	17%	10%	0%	12%
	Total	100%	100%	100%	100%
	N	29	20	8	57
Mill Race A	Bank Fishing	25%	22%	0%	20%

Site	Primary Activity	Day Type			Total
		Weekday	Weekend	Holiday	
	Boat Fishing	0%	5%	14%	5%
	Flatwater Canoe/Kayak	13%	10%	0%	9%
	Rafting	0%	0%	14%	2%
	Tubing/Floating	6%	5%	0%	5%
	Whitewater Canoe/Kayak	13%	17%	0%	14%
	Camping	0%	2%	0%	2%
	Dog Walking	6%	2%	14%	5%
	Nature Study/Wildlife	0%	5%	0%	3%
	Picnicking	0%	5%	0%	3%
	Sightseeing	13%	2%	29%	8%
	Sunbathing	0%	5%	14%	5%
	Swimming	19%	15%	14%	16%
	Walking/Hiking/Backpacking	6%	2%	0%	3%
	Other	0%	2%	0%	2%
	Total	100%	100%	100%	100%
	N	16	41	7	64
Mill Race B	Bank Fishing	14%	17%	50%	19%
	Boat Fishing	0%	2%	0%	1%
	Rafting	0%	5%	0%	3%
	Tubing/Floating	0%	10%	0%	6%
	Whitewater Canoe/Kayak	0%	2%	0%	1%
	Dog Walking	9%	7%	17%	9%
	Nature Study/Wildlife	9%	5%	0%	6%
	Sightseeing	0%	2%	0%	1%
	Sunbathing	23%	5%	0%	10%
	Swimming	27%	24%	17%	24%
	Walking/Hiking/Backpacking	9%	10%	17%	10%
	Other	9%	12%	0%	10%
	Total	100%	100%	100%	100%
	N	22	42	6	70

Source: Kleinschmidt, 2007a

Because Metts Landing provides parking and motorized and carry-in launches only, use of these facilities dominates the primary activities indicated by individuals interviewed at this site during the 2006 peak recreation season. Overall, boating activities, including boat fishing, canoeing and kayaking, accounted for approximately half of all use of the site. This was followed by participation in land-based activities such as sightseeing and walking. Bank fishing was the third most popular activity at Metts Landing overall.

During weekdays and weekends, boat fishing was the most popular activity and was the second most popular activity on holidays at Metts Landing. Canoeing and kayaking, both flatwater and whitewater, were the most popular activities on holidays,

the second most popular on weekends and third most popular during the week. Bank fishing was the second most popular activity during the week and third most popular on weekends at this site.

Land-based activities were also popular at Gardendale, which provides a carry-in launch and a hiking/biking trail. Sightseeing was the most popular activity at Gardendale, followed by boating activities including boat fishing and flatwater and whitewater canoeing and kayaking. For boating activities, whitewater kayaking/canoeing was the most popular. Bank fishing was the third most popular activity undertaken at Gardendale.

Activities at Gardendale were fairly consistent across day types. Canoeing and kayaking, both flatwater and whitewater, were the most popular activities on weekends and holidays, followed by sightseeing. During the week, this pattern was reversed. The majority of individuals interviewed participated in sightseeing during the week, followed by canoeing and kayaking.

Boating activities were the most popular at Mill Race A, the majority of which were comprised of canoeing and kayaking activities. Land-based activities such as hiking/walking, sightseeing, picnicking and camping were the second most popular activities at Mill Race A. Rock-hopping, consisting of sunbathing and swimming on the rocky outcroppings of Mill Race rapids, accounted for about one-fifth of total use and was tied with angling for the third most popular activity at the site.

Generally, on weekdays and weekends, canoeing and kayaking activities were the most popular, followed by bank fishing. Rock hopping activities were the third most popular activities on weekends and weekdays. On holidays, sightseeing was the most popular activity indicated by individuals interviewed at Mill Race A, followed by rock hopping activities.

At Mill Race B, land-based activities, such as dog walking and walking/hiking were the most popular overall. This was followed closely by rock hopping activities, which account for one-third of total use. Angling was the third most popular activities at this site.

Use patterns at Mill Race B differed by day type during the 2006 peak recreation season. During weekdays and weekends, rock hopping activities were the most popular, followed by bank fishing. Tubing was the third most popular activity at this site on weekends. On holidays, bank fishing accounted for half of total use. Dog walking and walking/hiking were the second most popular activities indicated on holidays, followed by rock hopping.

3.3 River Flows

3.3.1 Historical Availability of Recreation Activity-Specific Favorable Flows

The expert panel focus group provided information regarding favorable flows required for the various on-water activities participated in on the lower Saluda River. Recommended flows by activity obtained from the expert panel focus group are provided in Table 3-3.

Table 3-3. Recommended Favorable Flows (cfs) by Activity.

Activity	Flow Recommendation
Flatwater Canoeing/Kayaking	Up to 2,500 cfs
Whitewater Canoeing/Kayaking	Between 3,000 and 18,000 cfs
Wade Angling	Up to 800 cfs
Boating (including boat angling)	Between 1,000 and 4,000 cfs
Swimming (from shore or boat)	Between 500 and 1,000 cfs
Picnicking/Sunbathing	Between 500 and 1,000 cfs
Tubing	Between 1,000 cfs and 2,000 cfs
Rafting	10,000 cfs and higher

Historic daily average flows (1989 – 2006) of the lower Saluda River are provided in Table 3-4. Generally, flows to the lower Saluda River are higher in February, March and April during spring flooding and lower during the summer season (June through August). Average flows would indicate that opportunities for boating, tubing, and canoeing and kayaking are generally available during all months of the year. Maximum flows indicate that opportunities for rafting are also available at least once a month, year round. Minimum flows indicate favorable conditions for wade angling year round.

Table 3-4. Historic Daily Average Flows (January 1989 to December 2006) for USGS Gage 02168504 Saluda River Below Lake Murray Dam.

Month	Mean	Minimum	Maximum
January	2,995	162	21,800
February	3,291	223	18,100
March	3,579	163	18,600
April	2,361	196	15,400
May	1,710	214	14,900
June	1,785	175	16,000
July	2,098	166	16,600
August	2,320	242	19,500
September	2,521	155	12,900
October	2,146	158	18,700
November	1,969	163	13,000
December	2,298	222	17,200
Total	2,419	155	21,800

Source: USGS, 2007

Table 3-5 presents the ranges of hourly average flows experienced on the lower Saluda River by month from October 2000 through October 2007. Though the majority of flows, approximately 89 percent, experienced on the lower Saluda River from January through March are less than 6,000 cfs, a greater percentage of flows during that time period are between 6,000 cfs and 11,999 cfs, compared with the rest of the year. From April through December, the majority of flows, over 95 percent, experienced on the lower Saluda River are less than 6,000 cfs. Over 85 percent of the hourly average flows recorded from April through December are less than 3,000 cfs.

Given the range of hourly average flows, most of on-water recreation activities would have favorable flows available year round. Flatwater canoeing and kayaking activities would generally be available over 80 percent of the time year-round with most of the flows ranging up to 3,000 cfs between May and December. Swimming, sunbathing and wade angling, which generally require flows of less than 1,000 cfs, would be available 60 percent of the time, on average. Tubing flows of between 1,000 and 2,000 cfs occur approximately 16 percent of the time year round. Given that most tubing occurs in the summer, flows are favorable for this activity 14 percent of the time during the hottest months of June, July and August. Boating flows between 1,000 and 4,000 cfs are

reportedly available 28 percent of the time, with the greatest availability of this flow range in late summer/fall (August through October).

Lower whitewater canoeing/kayaking flows of between 3,000 and 10,000 cfs are available almost 14 percent of the time year round, with the greatest availability occurring in the spring (January through April). Higher flows (10,000 cfs and higher), suitable for whitewater canoeing/kayaking and rafting, are generally available the least amount of time, on average. These flows are only available approximately 3 percent of the time year-round on an hourly average basis. Instantaneous peak flows of 10,000 cfs and higher occur more frequently but these flows do not occur often as a sustained daily or hourly average.

Table 3-5. Historic Hourly Average Flow Ranges (October 2000 to October 2007) for USGS Gage 02168504 Saluda River Below Lake Murray Dam.

Flow Range (cfs)	Month											
	January	February	March	April	May	June	July	August	September	October	November	December
<599	23.0%	27.7%	45.9%	54.0%	69.5%	58.1%	51.6%	47.5%	47.7%	42.5%	23.1%	29.7%
600 to 999	18.5%	25.3%	14.0%	16.4%	9.6%	17.3%	13.7%	9.7%	5.9%	18.4%	39.9%	14.9%
1,000 to 1,999	20.2%	17.3%	14.7%	9.4%	6.5%	11.6%	8.2%	22.3%	26.0%	20.4%	19.0%	19.2%
2,000 to 2,999	11.2%	9.7%	4.2%	4.7%	4.6%	4.8%	6.8%	8.6%	6.7%	4.6%	2.9%	12.0%
2,999 or Less	72.8%	79.9%	78.8%	84.6%	90.2%	91.7%	80.3%	88.2%	86.3%	85.9%	84.8%	75.7%
3,000 to 3,999	3.3%	5.9%	3.0%	2.2%	1.5%	1.5%	10.9%	3.8%	4.2%	7.7%	2.8%	7.9%
4,000 to 4,999	10.4%	4.1%	2.4%	2.1%	1.0%	0.6%	2.0%	1.3%	4.2%	3.4%	8.7%	7.6%
5,000 to 5,999	2.0%	2.5%	1.4%	2.4%	0.8%	0.3%	2.3%	2.4%	3.1%	1.0%	1.2%	2.9%
3,000 to 5,999	15.7%	12.6%	6.7%	6.7%	3.2%	2.5%	15.2%	7.5%	11.5%	12.1%	12.6%	18.3%
5,999 or less	88.5%	92.5%	85.6%	91.2%	93.4%	94.2%	95.5%	95.6%	97.8%	98.0%	97.4%	94.0%
6,000 to 6,999	0.9%	1.7%	0.7%	0.6%	1.0%	0.7%	0.6%	1.0%	0.5%	0.5%	0.8%	3.3%
7,000 to 7,999	1.2%	3.3%	0.9%	1.2%	0.5%	0.3%	1.4%	0.8%	0.4%	0.4%	0.6%	0.4%
8,000 to 8,999	2.1%	1.4%	1.6%	1.0%	0.5%	0.4%	0.6%	0.7%	0.4%	0.3%	0.7%	0.5%
9,000 to 9,999	0.7%	0.4%	1.5%	0.6%	0.7%	0.6%	0.5%	0.7%	0.4%	0.3%	0.2%	0.5%
10,000 to 10,999	1.0%	0.2%	0.7%	1.0%	0.5%	0.4%	0.3%	0.4%	0.1%	0.2%	0.1%	0.2%
11,000 to 11,999	1.6%	0.2%	0.4%	0.6%	0.4%	1.0%	0.2%	0.2%	0.0%	0.1%	0.2%	0.1%
6,000 to 11,999	7.4%	7.1%	6.0%	5.0%	3.5%	3.3%	3.5%	3.8%	1.8%	1.7%	2.5%	5.0%
12,000 to 12,999	0.3%	0.1%	0.6%	1.2%	0.5%	0.4%	0.2%	0.1%	0.0%	0.3%	0.1%	0.1%
13,000 to 13,999	1.3%	0.1%	0.5%	0.5%	0.5%	0.6%	0.1%	0.1%	0.1%	0.0%	0.0%	0.2%
14,000 to 14,999	0.2%	0.1%	0.7%	1.3%	1.6%	1.4%	0.3%	0.1%	0.0%	0.0%	0.0%	0.2%
15,000 to 15,999	0.2%	0.0%	0.6%	0.5%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%
16,000 to 16,999	0.4%	0.0%	0.8%	0.2%	0.1%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.2%
17,000 to 17,999	1.1%	0.0%	2.3%	0.1%	0.2%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.1%
> 18,000	0.7%	0.0%	2.9%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12,000 or greater	4.1%	0.3%	8.5%	3.7%	3.1%	2.5%	1.0%	0.6%	0.4%	0.3%	0.1%	1.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Totals may not sum due to rounding.

Source: SCDNR, 2007

3.3.2 On-Site Flow Evaluation

The on-site flow evaluation was held on May 17 through May 20, 2007, whereby four separate flow events were observed and/or participated in. On a daily basis, the average time on the water was 4 hours with an average put-in time of 9:45 am and an average take-out time of almost 2:00 pm. Flow ranges encountered during the on-water evaluations from 9:00 am to 2:00 pm are presented in Table 2-2.

In total, there were 16 individuals participating and/or observing various activities, an average of 4 participants per day with 25 percent of respondents participating in at least 3 days. A majority of participants were local residents who do not own a seasonal or permanent waterfront home on the lower Saluda River. Participants were predominantly male (81 percent) and the average age of individuals was 45.

The experience level of participants and their familiarity with the lower Saluda River varied widely, providing a broad perspective on the suitability of flows for recreation activities. The primary activity in which individuals participate most often was whitewater canoeing/kayaking (44 percent), followed by wade angling (19 percent). Participants had an average of 19 years of experience in their activity, with a quarter of respondents indicating 20 years or more experience participating in their primary recreation activity. Over 80 percent of respondents indicated that they would consider themselves to be intermediate to expert participants in their primary recreation activity.

Participation in recreation activities on the lower Saluda River was reported as being at least once per month, on average, with 38 percent of respondents indicating that they participate in recreation activities on the river at least once per week. On average, respondents indicated that they participated in 43 days of recreation annually, with May being the most popular month. Respondents indicated being moderately to very familiar with the lower Saluda River, overall, with 63 percent of respondents indicating that they were very familiar with the river.

During each of the four study dates, participants engaged in or observed activities along the entire lower Saluda River from Metts Landing/Saluda Shoals Park to downstream of the confluence with the Broad River. The sites most often used for access were Saluda Shoals Park, Gardendale and Mill Race A. The Gervais Street Landing at the West Columbia Amphitheater, downstream of the confluence with the Broad River, was the most often used take-out point. The Ocean Boulevard to Stacy's Ledge section of the river and the Mill Race Rapids to Shandon Rapids section of the river were the two most utilized river sections by participants across the four study dates. Over sixty percent of the total activities undertaken across the four study dates was whitewater canoeing/kayaking, followed by wade angling (19 percent).

May 17, 2007 – 534 cfs mean flow

Seven individuals participated in this flow event with 57 percent whitewater canoeing/kayaking and 29 percent wade angling. Average ratings for various river characteristics by each activity are presented in Table 3-6. This flow was considered "good" for overall quality. There were no significant differences between the recreation activity groups with respect to the ratings of the various river characteristics, though whitewater canoeists/kayakers rated the characteristics slightly lower on average than flatwater paddlers and wade anglers.

For those characteristics rated marginal to unacceptable, the majority of respondents, primarily whitewater paddlers, indicated that the water was "too low" for favorable river characteristics such as navigability, depth, exposure of rocks and shoals, rapids, and current. Overall, wade anglers found the flow to be "just right" for wadeability, rapids, river depth, exposure of rocks, force of water, current, and aesthetics. In general, no significant hazards were identified for this flow level (Table 3-7).

Table 3-6. River Characteristic Ratings by Activity for May 17, 2007 Flow Date (534 cfs)

Primary Activity	Navigability	Wadeability	Rapids	River Depth	Water Craft Rate of Travel	Exposure of Rocks	Exposure of Shoals	Presence of Eddies	Force of Water	Speed of Water/ Current	Aesthetics	Overall Quality
Wade Fishing		5.00	4.50	4.50		4.00	3.50		4.00	4.50	4.50	4.50
Flatwater Canoeing/Kayaking	5.00		4.00		3.00	4.00	4.00	4.00	3.00	3.00	5.00	5.00
Whitewater Canoeing/Kayaking	3.50	5.00	3.25	3.50	2.75	2.67	3.00	3.25	2.67	2.33	3.75	3.67
Overall Rating	3.80	5.00	3.71	3.83	2.80	3.33	3.33	3.40	3.17	3.17	4.14	4.17
N	5	3	7	6	5	6	6	5	6	6	7	6

Characteristic Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Table 3-7. Hazard Characteristic Ratings by Activity for May 17, 2007 Flow Date (534 cfs)

Primary Activity	Exposed Rocks	Exposed Shoals	Rapids	Shallow Depth	Deep Depth	Swift/Strong Current	Overall Hazard Level
Wade Fishing	5.00	5.00	5.00	4.50	4.00	4.00	5.00
Flatwater Canoeing/Kayaking	3.00	4.00	4.00	3.00	4.00	3.00	5.00
Whitewater Canoeing/Kayaking	3.25	4.50	3.75	4.50	4.25	5.00	3.75
Overall Rating	3.71	4.57	4.14	4.29	4.14	4.43	4.29
N	7	7	7	7	7	7	7

Hazard Ratings were as follows: 1 = Dangerous, 2 = Fair, 3 = Neutral, 4 = Good, and 5 = Safe.

Table 3-8. Suitability of 534 cfs Flow by Primary Activity and Experience Level

Primary Activity	Novice	Intermediate	Advanced	Expert
Wade Fishing	3.50	4.50	5.00	5.00
Flatwater Canoeing/Kayaking	5.00	4.00	3.00	2.00
Whitewater Canoeing/Kayaking	4.50	3.75	2.25	2.00
Overall Rating	4.29	4.00	3.14	2.86
N	7	7	7	7

Suitability Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Overall, the 534 cfs flow was considered "good" to "excellent" for novice to intermediate level recreationists (Table 3-8). Ratings differed by activity wherein wade anglers viewed this flow as more favorable for more advanced recreationists and whitewater and flatwater boaters considered this flow more favorable for beginner recreationists. In general, 43 percent of respondents indicated that they would prefer a flow level that was about the same as the one experienced. Wade anglers and flatwater boaters indicated no change in the flow level was preferred, whereas whitewater paddlers indicated a preference for flows that were "higher" to "much higher" than the 534 cfs flow. When asked if they would choose to participate in recreation activities at this flow level again, 86 percent of respondents stated that they would, irrespective of activity.

In addition to activities that individuals participated in, some respondents were asked to complete secondary activity surveys whereby individuals rated the suitability of each flow for additional activities such as rock hopping and swimming. For the 534 cfs flow, four individuals completed surveys providing information on the suitability of this flow for tubing, swimming, and sunbathing/rockhopping. This flow was considered of "poor" overall quality and "too low" for tubing activities, with "marginal" to "unacceptable" river characteristics. Alternatively, this flow was considered "excellent" for swimming and sunbathing/rockhopping. Levels for wadeability, depth, and exposure of rocks and shoals was considered "excellent" and "just right". All other characteristics received a rating of "good" to "excellent" for swimming and sunbathing/rockhopping.

This flow was considered an "excellent" level, irrespective of experience for swimming and sunbathing/rockhopping. However, this flow was considered only "marginal" for beginner tubers and the suitability rating decreased as experience level increased. Respondents indicated exposed rock and shoals, rapids, and shallow depth as a concern for tubers. Most river hazards were considered safe for swimming and sunbathing/rock hopping at this level. A higher flow level was reportedly preferred for tubing activities, whereas no change in water level was preferred for sunbathing/rockhopping and swimming.

Participants were asked to identify any special features, unique hazards or necessary portages for the 534 cfs flow event. Four of the seven individuals noted unique or outstanding features at this flow. Aside from general observations regarding the aesthetics of the river and the flow level, "excellent swimming opportunities" were noted at Shandon Rapids. Three individuals mentioned hazards encountered at this flow, all of which were located at Mill Race Rapids. Among the hazards noted for Mill Race Rapids at this level were:

- "Navigation through Mill Race is limited at this level and presents potential for collision with rocks while running narrow, shallow routes in this rapid with higher gradient."
- "Pinning/broaching hazard at this flow – bottom of left main channel."
- "This rapid could be hazardous to novice people and needs an easy portage (*i.e*. walkway accessible from the river)."

Although the above concerns were expressed, particularly for less experienced boaters, there were no portages reported as undertaken for this flow.

May 18, 2007 – 1,078 cfs mean flow

There were eight individuals experiencing this flow on this study date: half whitewater canoeists/kayakers, 25 percent flatwater canoeists/kayakers, and 25 percent wade anglers. In general, this flow was rated "marginal" to "good" for overall quality with no significant differences between the recreation activity groups (Table 3-9). Though, overall, wade anglers rated the river characteristics as more favorable for their activity than flatwater and whitewater boaters.

Wade anglers deemed the exposure of rocks, current and force of water to be "marginal". These individuals indicated that the water was "just right" or "too high" for these river characteristics. Overall, paddlers found the flow to be "too low" for navigability, rapids, river depth, water craft rate of travel, exposure of rocks and shoals, the presence of eddies, force of water, current, and aesthetics.

Several hazards were identified for this flow level based on activity (Table 3-10). Wade anglers indicated concern with river depth and current at this level, giving each hazard a "neutral" rating but giving the lowest ratings overall to these hazards. A rating of "fair" to "neutral" was given to exposed shoals, rapids, and shallow depth by flatwater canoeists/kayakers.

Overall, this flow was considered "marginal" to "good" for novice to intermediate level recreationists and suitability ratings decreased as experience level increased (Table 3-11). As with the 534 cfs flow, ratings differed by activity wherein wade anglers viewed this flow as more favorable for more advanced recreationists and whitewater and flatwater paddlers considered this flow more favorable for beginner recreationists.

In general, 63 percent of respondents indicated that they would prefer a flow level that was higher than the one experienced; 25 percent indicated preference for a flow level that was lower than 1,078 cfs. Wade anglers and flatwater boaters generally indicated a preference for lower flows, whereas whitewater paddlers indicated a preference for flows that were "higher" to "much higher". When asked if they would choose to participate in recreation activities at this flow level again, the majority of respondents (88 percent) stated that they would, irrespective of activity.

Three individuals completed surveys providing information on the suitability of the 1,078 cfs flow for tubing, swimming, and sunbathing/rockhopping. This flow was considered of "poor" overall quality and "too low" for tubing activities, with a "poor" rating for most river characteristics and an "unacceptable" rating for rate of travel, and a "marginal" rating for the presence of shoals and aesthetics. This flow was considered "good" for swimming and "excellent" for sunbathing/rockhopping. Most river characteristics for these activities were rated as "good" to "excellent" at this water level. Exposure of shoals and the presence of eddies was considered "marginal" for swimming; this flow was considered "too high" for these characteristics but "just right" overall for swimming and sunbathing/rockhopping.

Table 3-9. River Characteristic Ratings by Activity for May 18, 2007 Flow Date (1,078 cfs)

Primary Activity	Navigability	Wadeability	Rapids	River Depth	Water Craft Rate of Travel	Exposure of Rocks	Exposure of Shoals	Presence of Eddies	Force of Water	Speed of Water/ Current	Aesthetics	Overall Quality
Wade Fishing		4.00	4.00	4.00		3.00	4.00		3.50	3.00	4.00	4.00
Flatwater Canoeing/Kayaking	4.00		2.50	3.00	4.00	3.50	3.00	3.50	3.50	3.00	3.00	4.00
Whitewater Canoeing/Kayaking	3.50	4.00	3.33	3.25	3.50	3.25	3.33	3.50	3.00	3.00	3.75	3.50
Overall Rating	3.67	4.00	3.17	3.38	3.67	3.25	3.33	3.50	3.25	3.00	3.57	3.75
N	6	4	6	8	6	8	6	6	8	7	7	8

Characteristic Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Table 3-10. Hazard Characteristic Ratings by Activity for May 18, 2007 Flow Date (1,078 cfs)

Primary Activity	Exposed Rocks	Exposed Shoals	Rapids	Shallow Depth	Deep Depth	Swift/Strong Current	Overall Hazard Level
Wade Fishing	5.00	5.00	5.00	4.00	3.50	3.00	4.00
Flatwater Canoeing/Kayaking	3.00	2.50	2.50	2.50	3.50	4.00	4.00
Whitewater Canoeing/Kayaking	3.75	4.33	4.25	3.50	4.00	4.25	4.00
Overall Rating	3.71	3.83	3.86	3.38	3.71	3.88	4.00
N	7	6	7	8	7	8	8

Hazard Ratings were as follows: 1 = Dangerous, 2 = Fair, 3 = Neutral, 4 = Good, and 5 = Safe.

Table 3-11. Suitability of 1,078 cfs Flow by Primary Activity and Experience Level

Primary Activity	Novice	Intermediate	Advanced	Expert
Wade Fishing	2.50	4.00	4.00	4.00
Flatwater Canoeing/Kayaking	4.00	3.00	2.00	1.00
Whitewater Canoeing/Kayaking	4.25	3.50	2.75	2.50
Overall Rating	3.75	3.57	3.00	2.71
N	8	7	7	7

Suitability Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

This flow was considered an "excellent" level, irrespective of experience for sunbathing/rockhopping. However, this flow was considered only "marginal" for all levels of tubers and beginner swimmers with the suitability rating for swimming increasing as experience level increased. Respondents indicated exposed rock and shoals, rapids, river depth and current depth as a concern for tubers, giving a "fair" rating for these hazards. Most river hazards were considered safe for swimming and sunbathing/rock hopping at this level. A higher flow level was reportedly preferred for tubing activities, whereas no change in water level was preferred for sunbathing/rockhopping and swimming.

With respect to special features for the 1,028 cfs flow event, three of the eight individuals noted positive features and benefits. Among those mentioned were birds, rocky shoal spider lilies and aesthetics. Half of the individuals reported hazards encountered at this flow at Mill Race Rapids, Ocean Boulevard, and Saluda Shoals. For wade anglers, deep water and high flow/force was identified for the Saluda Shoals and Corley Island Shoals area of the river. Boaters noted rocky and bony conditions in the lower portion of Ocean Boulevard that could potentially strand boaters or that would require a portage. Boaters also noted the need for portage opportunities for less experienced boaters and pinning broaching risks at the bottom of the main channel in Mill Race Rapids.

As with the 534 cfs flow, there were no portages reportedly undertaken for this flow although concerns for the need for portages were stated.

May 19, 2007 – 2,272 cfs mean flow

Of the 6 individuals participating in recreation activities for this flow event, 67 percent were whitewater canoeists/kayakers, 17 percent were boat anglers, and 17 percent were wade anglers. In general, this flow was rated "marginal" to "good" for overall quality with significant differences between the recreation activity groups (Table 3-12). Wade anglers rated the overall quality as "unacceptable" for their activity, whereas boat anglers and whitewater boaters felt the flow was favorable for their activities.

Wade anglers deemed all characteristics as "unacceptable" across the board and considered the flow "too high" for all characteristics. Overall, paddlers found the flow to be "good" to "excellent" for navigability, rapids, river depth, water craft rate of travel, and aesthetics. Whitewater boaters rated exposure of rocks and shoals, the presence of eddies, force of water, and current, as generally "marginal" to "good". Boat anglers reflected generally the same opinions, providing a "marginal" rating for rapids, exposure of shoals, force of water and current, and a rating of "good" for all other characteristics.

All hazards were identified as "dangerous" by wade anglers for this flow level (Table 3-13). Boat anglers and whitewater paddlers were not concerned about exposed rocks and shoals and rapids at this water level. Whitewater paddlers were more concerned about river depths and currents than boat anglers, rating each between "marginal" and "good".

Overall, this flow was considered "marginal" for novice to intermediate level recreationists and suitability ratings decreased as experience level increased (Table 3-14). Ratings differed by activity significantly. Wade anglers viewed this flow as "unacceptable" across the board for all experience levels and deemed this flow "too high", regardless of experience level. Boat anglers considered this flow "good" for every experience level, except beginners for whom the flow was considered "marginal". The favorability of this flow decreased as experience level increased for whitewater boaters. This flow was generally considered "just right" for novice and intermediate paddlers but "too low" for experienced boaters.

In general, half of the respondents indicated that they would prefer a flow level that was higher than the one experienced; 33 percent indicated no change. Only wade anglers preferred a flow that was much lower than 2,272 cfs. The majority of respondents (83 percent, comprised of boat anglers and whitewater canoeists/kayakers) stated that they would choose to participate in recreation activities at this flow level again, if presented with the opportunity.

Table 3-12. River Characteristic Ratings by Activity for May 19, 2007 Flow Date (2,272 cfs)

Primary Activity	Navigability	Wadeability	Rapids	River Depth	Water Craft Rate of Travel	Exposure of Rocks	Exposure of Shoals	Presence of Eddies	Force of Water	Speed of Water/ Current	Aesthetics	Overall Quality
Boat Fishing	4.00		3.00	4.00	4.00	4.00	3.00		3.00	3.00	4.00	4.00
Wade Fishing		1.00		1.00			1.00	1.00	1.00	1.00	3.00	1.00
Whitewater Canoeing/Kayaking	4.25	3.50	4.00	4.00	4.25	3.75	3.67	3.75	3.75	3.75	4.75	4.50
Total	4.20	2.67	3.80	3.50	4.20	3.80	3.00	3.20	3.17	3.17	4.33	3.83
N	5	3	5	6	5	5	5	5	6	6	6	6

Characteristic Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Table 3-13. Hazard Characteristic Ratings by Activity for May 19, 2007 Flow Date (2,272 cfs)

Primary Activity	Exposed Rocks	Exposed Shoals	Rapids	Shallow Depth	Deep Depth	Swift/Strong Current	Overall Hazard Level
Boat Fishing	4.00	4.00	4.00	5.00	5.00	5.00	4.00
Wade Fishing			1.00		1.00	1.00	1.00
Whitewater Canoeing/Kayaking	4.00	4.00	4.00	3.33	3.50	3.50	3.50
Total	4.00	4.00	3.50	3.75	3.33	3.33	3.17
N	5	3	6	4	6	6	6

Hazard Ratings were as follows: 1 = Dangerous, 2 = Fair, 3 = Neutral, 4 = Good, and 5 = Safe.

Table 3-14. Suitability of 2,272 cfs Flow by Primary Activity and Experience Level

Primary Activity	Novice	Intermediate	Advanced	Expert
Boat Fishing	3.00	4.00	4.00	4.00
Wade Fishing	1.00	1.00	1.00	1.00
Whitewater Canoeing/Kayaking	4.50	4.00	3.33	3.33
Total	3.67	3.40	3.00	3.00
N	6	5	5	5

Suitability Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Three individuals completed surveys providing information on the suitability of the 2,272 cfs flow for tubing, swimming, and sunbathing/rockhopping. For tubing, this flow was considered "excellent" for overall quality and "just right" with respect to water level. This flow was considered of "poor" overall quality and "too high" for sunbathing/rockhopping activities, but was rated as "excellent" and "just right" for swimming. Aesthetics for this flow for tubers was considered "excellent" with all other river characteristics rated "good". Most features rated for sunbathing/rockhopping activities received a "marginal" or "poor" rating, with only aesthetics receiving a "good" rating. With respect to swimming, most river characteristics were given an "excellent" rating, including aesthetics. Hazards such as exposed rocks and shoals, rapids, depth, and current were deemed "good" for tubing and "safe" for swimming but only "fair" for sunbathing/rockhopping.

Generally, the flow level rating increased as experience level increased for both activities. Sunbathing/rockhopping was considered "poor" for novices but "good" for experienced individuals. Likewise, swimming was considered "good" for beginners and "excellent" for individuals with experience and familiarity. For tubers, this flow was considered better for beginners with an "excellent" rating for novices and a "good" rating for experienced tubers.

Almost all of the participants reported unique or outstanding features associated with this flow. Among those features mentioned were bald eagles, spider lilies, good depth and outstanding whitewater opportunities. Two of the six individuals experiencing this flow reported hazards. One whitewater paddler reported that the Mill Race Rapids have small hydraulics which could flip kayaks and recirculate them. One wade angler noted that the water depth was too deep and the current too strong for wading at Mill Race Rapids and Saluda Shoals. There was one reported portage around Mill Race Rapids at this flow level.

May 20, 2007 – 3,938 cfs mean flow

Ten individuals participated in recreation activities for this flow event with 70 percent whitewater canoeists/kayakers, 20 percent were flatwater canoeists,

and 10 percent were wade anglers. In general, this flow was rated "good" for overall quality (Table 3-15). There were significant differences between the recreation activity groups; whereby wade anglers rated the overall quality as "unacceptable" for their activity and boaters felt the overall quality was very good.

Wade anglers deemed all characteristics as "unacceptable" across the board and considered the flow "too high" for all characteristics. Flatwater and whitewater paddlers concurred with wade anglers with respect to the wadeability of this flow. These boaters found the flow to be "good" to "excellent" for all other characteristics.

Table 3-16 presents the ratings of hazards encountered on the lower Saluda River at this flow level. Flatwater and whitewater paddlers were not concerned about most hazards at this water level, providing a "neutral" to "good" rating for most hazards. Flatwater canoeists/kayakers, however, rated deep river depth and swift/strong current as "marginal".

Overall, this flow was considered "marginal" to "good" for novice to intermediate level recreationists and suitability ratings increased as experience level increased (Table 3-17), dominated by whitewater paddling activities. For all experience levels, this flow was rated as "unacceptable" for wade angling and was considered "too high". Whitewater canoeists/kayakers considered this flow just above "marginal" for beginner paddlers and "good" to "excellent" for experienced boaters. Generally, whitewater canoeists/kayakers viewed this flow as "too high" for novice boaters and "just right" for intermediate to expert paddlers. Only one experience level was rated by flatwater canoeists/kayakers.

Table 3-15. River Characteristic Ratings by Activity for May 20, 2007 Flow Date (3,938 cfs)

Primary Activity	Navigability	Wadeability	Rapids	River Depth	Water Craft Rate of Travel	Exposure of Rocks	Exposure of Shoals	Presence of Eddies	Force of Water	Speed of Water/ Current	Aesthetics	Overall Quality
Wade Fishing		1.00							1.00			1.00
Flatwater Canoeing/Kayaking	4.50	1.00	4.50	4.50	4.50	4.50	4.00	4.00	4.00	4.50	5.00	4.50
Whitewater Canoeing/Kayaking	4.57	2.50	4.57	4.57	4.43	4.00	4.20	4.17	4.29	4.29	4.57	4.43
Total	4.56	2.00	4.56	4.56	4.44	4.13	4.14	4.13	3.90	4.33	4.67	4.10
N	9	6	9	9	9	8	7	8	10	9	9	10

Characteristic Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Table 3-16. Hazard Characteristic Ratings by Activity for May 20, 2007 Flow Date (3,938 cfs)

Primary Activity	Exposed Rocks	Exposed Shoals	Rapids	Shallow Depth	Deep Depth	Swift/Strong Current	Overall Hazard Level
Wade Fishing						1.00	1.00
Flatwater Canoeing/Kayaking	3.50	4.00	4.00	3.50	3.00	3.00	3.50
Whitewater Canoeing/Kayaking	3.57	3.57	3.86	3.67	3.71	3.57	3.57
Total	3.56	3.67	3.89	3.63	3.63	3.20	3.30
N	9	9	9	8	8	10	10

Hazard Ratings were as follows: 1 = Dangerous, 2 = Fair, 3 = Neutral, 4 = Good, and 5 = Safe.

Table 3-17. Suitability of 3,938 cfs Flow by Primary Activity and Experience Level

Primary Activity	Novice	Intermediate	Advanced	Expert
Wade Fishing	1.00	1.00	1.00	1.00
Flatwater Canoeing/Kayaking	4.50			
Whitewater Canoeing/Kayaking	3.33	4.00	4.86	4.83
Total	3.33	3.57	4.38	4.29
N	9	7	8	7

Suitability Ratings were as follows: 1 = Unacceptable, 2 = Poor, 3 = Marginal, 4 = Good, and 5 = Excellent.

Generally, 90 percent of respondents indicated that they would participate in recreation activities at this flow level again. Wade anglers indicated they would not participate again, whereas boaters indicated they would. Sixty percent of the respondents indicated that they would not change the flow level, 30 percent preferred a flow level that was higher than the one experienced, and 10 percent preferred a flow that was "much lower", attributable to wade anglers.

Of those individuals participating in recreation activities at this flow level, only one completed a survey providing information on the suitability of the 1,078 cfs flow for tubing. This flow was considered too high for swimming and sunbathing/rockhopping. This flow was considered of "excellent" overall quality and "just right" for tubing activities, with a "good" rating for most river characteristics and an "excellent" rating for aesthetics. Exposure of shoals and shallow depths were considered moderately safe, where as exposed rocks, rapids and current were considered "good" with respect to safety. This flow was considered an "excellent" level for tubing, irrespective of experience level.

Unique features were reported by 80 percent of respondents for this flow level. Whitewater kayakers/canoeists noted outstanding features generally at or below Mill Race Rapids, Ocean Boulevard and Stacy's Ledge such as more challenging rapids, surfing waves, play holes, and eddies. It was also noted that this flow did not inundate the spider lilies. Three individuals also noted hazards at this flow level at Mill Race Rapids. Among the hazards identified were:

- "Flow too high to wade fish."
- "The rapids/rocks, hydraulics, strong currents make Mill Race a dangerous rapid at this level not suited for novice canoers/kayakers."
- "Too big for novice boaters but Mill Race is just not a place for novice boaters at any level, anyway."

Two canoeists/kayakers reported having to portage at Mill Race Rapids due to their experience level.

3.3.3 Rate of Change and Operational Scenarios Analysis

As discussed, the level logger data obtained from field measurements during prescribed flow releases were used to generate a HEC RAS model of operational scenarios. The following flows were modeled under a simulated reserve call scenario of approximately 1.5 hours duration, a simulated lake level management scenario for approximately 6 hours duration; and a river stabilization scenario for approximately 24 hours:

1,000 cfs	8,000 cfs
2,000 cfs	10,000 cfs
3,000 cfs	12,000 cfs
4,000 cfs	14,000 cfs
5,000 cfs	16,000 cfs
6,000 cfs	18,000 cfs

Key parameters for model analysis were the daily maximum river stage (in feet) experienced under each operational scenario for each flow, total rise (in feet) experienced under each operational scenario for each flow compared with baseline stage conditions encountered at 500 cfs, the rate of change associated with each operational scenario from both the start of project operations and the start of river rise (wave arrival), and the rate of recession associated with each operational scenario.

In addition, a flow of 18,000 cfs was modeled under a simulated "extreme" reserve call scenario whereby baseline conditions of 500 cfs were incrementally increased by 1,750 cfs per minute for 10 minutes. This scenario was run for 24 hours before recession. The initial rise and rate of change experienced within the first 15 minutes, 30 minutes and 60 minutes under this simulated operational scenario are presented and discussed below.

The HEC RAS model analysis is discussed by operational scenario in the sections below and a full detailed analysis is presented in Appendix E.

Simulated Reserve Call Operation Scenario (1.5 hours)

During the simulated reserve call scenario, the HEC RAS model simulated a release of water from Saluda Dam at each flow level for a 1.5 hour duration. The model provided stage levels (in feet) for every minute of a 24 hour period under this flow scenario. The following daily maximum river stages were estimated for the eight level logger locations under the following flows (Table 3-18).

Table 3-18. Maximum Stage (feet) During 1.5 Hour Flow Duration

Flow	Metts Landing	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	5.90	4.49	4.37	2.39	1.94	2.40	2.20	2.56
6,000 cfs	6.74	5.23	4.97	2.53	2.11	2.73	2.43	2.80
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

Table 3-19. Rate of change (feet per minute) During 1.5 Hour Flow Duration From Start of Operations

Flow	Metts Landing	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	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01
6,000 cfs	0.06	0.04	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

As expected, upstream sites experienced the greatest gain in river stage during the higher flow events. The cross-section located upstream of Metts Landing encountered total gains of greater than 10 feet (range of 10.67 feet to 12.57 feet in total or 9.38 feet to 11.28 feet over baseline conditions) at flows of 12,000 cfs during the reserve call operations simulation. Downstream, these gains in stage were attenuated to less than 5 feet, even at the highest flow events.

The amount of time lapsed from the start of operations to the maximum stage varied from approximately 1.5 hours at the Metts Landing cross-section under all flow scenarios to over 5 hours at Shandon Rapids under the 1,000 cfs simulated reserve call event. This time duration accounts for lag time and partially demonstrates the length of time required for a flow event to register at downstream locations from the time the project begins operations.

The rate of change in feet per minute experienced at each level logger location for each flow is presented in Table 3-19. The maximum rate of change experienced from the start of project operations to the maximum stage at each level logger location (accounting for lag time) ranges from 0.12 feet per minute (almost 1.5 inches per minute) at Metts Landing at 18,000 cfs to a negligible rate of change experienced at sites downstream of Gardendale at all flow levels (less than 0.02 feet per minute or 0.24 inches per minute).

To account for the effects of stabilization, the time to 75% of maximum stage, 80% of maximum stage, 90% of maximum stage and 99% of maximum stage from the start of rise (wave arrival time) was estimated. Although the full analysis is presented in Appendix E, only the wave arrival to 75% of maximum stage and 90% of maximum stage is discussed below (Table 3-20 through Table 3-25).

Table 3-20. Total Rise to 75% of Maximum Stage (feet) From Baseline Stage During 1.5 Hour Flow Duration

Flow	Metts Landing	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	3.46	2.88	2.23	1.03	0.67	1.09	0.85	0.89
6,000 cfs	4.09	3.43	2.68	1.14	0.79	1.34	1.02	1.07
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

Table 3-21. Time to 75% of Maximum Stage During 1.5 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0:35	0:43	0:46	0:33	0:43	0:35	0:29	0:31
6,000 cfs	0:34	0:40	0:43	0:27	0:38	0:29	0:26	0:26
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

Table 3-22. Rate of change (feet per minute) to 75% of Maximum During 1.5 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0.10	0.07	0.05	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.12	0.09	0.06	0.04	0.02	0.05	0.04	0.04
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

Table 3-23. Total Rise to 90% of Maximum Stage (feet) From Baseline Conditions During 1.5 Hour Flow Duration

Flow	Metts Landing	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	4.15	3.46	2.68	1.24	0.80	1.31	1.02	1.07
6,000 cfs	4.91	4.12	3.22	1.37	0.95	1.61	1.22	1.29
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

Table 3-24. Time to 90% of Maximum Stage During 1.5 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0:58	0:58	0:39	0:52	0:42	0:37	0:42
6,000 cfs	0:55	0:55	0:55	0:32	0:48	0:38	0:33	0:35
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

Table 3-25. Rate of change (feet per minute) to 90% of Maximum During 1.5 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0.08	0.06	0.05	0.03	0.02	0.03	0.03	0.03
6,000 cfs	0.09	0.07	0.06	0.04	0.02	0.04	0.04	0.04
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

Although sites experienced different rates of rise from the start of rise encountered at each level logger location to 75% of maximum stage, each level logger location achieved 75% of maximum stage within 1 hour of wave arrival for all flows except 1,000 cfs (Table 3-21). Even at the lowest flow of 1,000 cfs, an increase to 75% of maximum stage was achieved between 47 minutes at Metts Landing and 1 hour 7 minutes at Botanical Gardens and Oh Brother Rapids. The rate of change associated with a rise of 75% of maximum stage varied from 0.27 feet per minute (3.24 inches per minute) at Metts Landing at flows equal to or greater than 16,000 cfs to a negligible rise (less than 0.02 feet per minute or one-quarter inch per minute) at sites downstream of Gardendale at flows of 3,000 cfs or less. For all percentages of maximum stage analyzed (75%, 80%, 90% and 99%), the highest rate of rise was experienced during the first three-quarters (75% of maximum) rise in stage.

Generally, upstream sites took longer to achieve stage levels of 90% of maximum from the start of rise compared to downstream sites. Metts Landing achieved 90% of maximum stage between 52 minutes at 12,000 cfs and 14,000 cfs and 1 hour 7 minutes at 1,000 cfs. Shandon Rapids, by comparison, achieved 90% of maximum stage between 27 minutes at 16,000 cfs and 1 hour and 25 minutes at 1,000 cfs. The rate of change in feet per minute experienced at each level logger location from the start of rise (time of wave arrival) to 90% of maximum is presented in Table 3-25. The maximum rate of change ranges from 0.20 feet per minute (2.4 inches per minute) at Corley Island at 18,000 cfs to a negligible rate of change experienced at sites downstream of Gardendale (less than 0.02 feet per minute or 0.24 inches per minute) at flows of 3,000 cfs and less.

The change in stage over baseline conditions and rate of change in feet per minute experienced at each level logger location for each flow during the first 15 minutes of start of rise (time of wave arrival) and 30 minutes of start of rise is presented in Table 3-26. Total Rise (in feet) Compared with Baseline Conditions During 1.5 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	Corley Island	Gardendale	Ocean Boulevard	Oh Brother Rapids	Stacey's Ledge	Botanical Gardens	Shandon Rapids
1,000	0.23	0.06	0.05	0.03	0.01	0.02	0.01	0.03

cfs								
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	1.68	0.40	0.32	0.22	0.07	0.17	0.14	0.42
6,000 cfs	2.13	0.67	0.50	0.39	0.13	0.30	0.31	0.67
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

Table 3-27 through Table 3-29. The maximum rate of change experienced from the start of rise during the first 15 minutes is 0.29 feet per minute (almost 3.5 inches per minute) at Metts Landing at 18,000 cfs. The total rise in river stage experienced at this location during the first 15 minutes of wave arrival at a flow of 18,000 cfs is 4.28 feet. This does not change significantly during the first 30 minutes of rise. Although the overall rise in river stage increases by an additional 4 feet to 8.28 feet, the rate of rise remains approximately 3.5 inches per minute.

The rate of rise effect is attenuated as flows continue downstream to other level logger locations. At Botanical Gardens, at Mill Race Rapids, a popular rock-hopping location, a flow of 18,000 cfs results in a total net rise of 2.03 feet for a rate of change of 0.14 feet per minute (just over 1.5 inches per minute). At 18,000 cfs at Shandon Rapids, the most downstream site and another popular rock-hopping location, a total stage increase of almost 2 feet is experienced during the first 15 minutes of river rise for a rate of change of 0.13 feet per minute (over 1.5 inches per minute). Again, although the rate of change experienced at

both of these locations remains relatively the same during the first 15 minutes as during the first 30 minutes, slowing by an average of only 0.4 inches per minute, the total rise in stage increases by approximately 47 percent at Botanical Gardens and 57 percent at Shandon Rapids.

The time to recession (Appendix E) for the simulated reserve call scenario varies from approximately 3.5 hours at Metts Landing at 1,000 cfs to greater than 24 hours at Shandon Rapids at higher flows (flows greater than or equal to 8,000 cfs). However, stage levels at Shandon Rapids at these higher flows at 24 hours is within 2 percent of baseline conditions, ranging from 1.39 feet at 8,000 cfs to 1.42 feet at 18,000 cfs.

Table 3-26. Total Rise (in feet) Compared with Baseline Conditions During 1.5 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	1.68	0.40	0.32	0.22	0.07	0.17	0.14	0.42
6,000 cfs	2.13	0.67	0.50	0.39	0.13	0.30	0.31	0.67
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

Table 3-27. Rate of change (feet per minute) During 1.5 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0.11	0.03	0.02	0.01	0.00	0.01	0.01	0.03
6,000 cfs	0.14	0.04	0.03	0.03	0.01	0.02	0.02	0.04
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

Table 3-28. Total Rise (in feet) Compared with Baseline Conditions During 1.5 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	3.15	1.89	1.31	0.87	0.36	0.91	0.84	0.85
6,000 cfs	3.82	2.61	1.80	1.26	0.54	1.34	1.13	1.15
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

Table 3-29. Rate of change (feet per minute) During 1.5 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0.10	0.06	0.04	0.03	0.01	0.03	0.03	0.03
6,000 cfs	0.13	0.09	0.06	0.04	0.02	0.04	0.04	0.04
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

Simulated Lake Level Management Operation Scenario (6 hours)

The HEC RAS model simulated a release of water from Saluda Dam at each flow level for a 6 hour duration during the simulated lake level management scenario. Under this flow scenario, the model provided stage levels (in feet) for every minute of a 24 hour period. Daily maximum river stages for each flow level estimated for the eight level logger locations are presented in Table 3-30.

As with the simulated reserve call scenario, upstream sites experienced the greatest gain in river stage during the higher flow events and these maximum stages are just slightly higher than simulated reserve call maximum stages. Metts Landing encountered gains of greater than 10 feet over baseline conditions at flows of 12,000 cfs and greater. Total rise over baseline conditions at Metts Landing ranged from just over 1 foot at 1,000 cfs to over 12.5 feet at 18,000 cfs. At Shandon Rapids, the most downstream location, total rise over baseline conditions ranged from just under 6 inches at 1,000 cfs to just over 4 feet at 18,000 cfs.

The total time to maximum stage from the start of operations, including wave arrival lag time, ranged from 3 hours 48 minutes at Metts Landing during the 4,000 cfs lake level management scenario to approximately 7 hours at Shandon Rapids under the 2,000 cfs simulated lake level management event. Because this time duration both accounts for lag time and is also based on maximum stage, which can occur several minutes to hours after stabilization, it is not a good indicator of how long it takes the river to stabilize. Likewise, rate of change, discussed below, may be overestimated.

The rate of change in feet per minute experienced at each level logger location for each flow under the simulated lake level management scenario is presented in Table 3-31. The maximum rate of change experienced from the start of project operations to the maximum stage at each level logger location (ranges from 0.04 feet per minute (almost 0.5 inches per minute) at Metts Landing at 18,000 cfs to a negligible rate of change experienced at sites downstream of

Gardendale at all flow levels (less than 0.02 feet per minute or 0.24 inches per minute).

At flows of 5,000 cfs and greater, all sites achieved 75% of maximum stage (Table 3-32) generally within 1 hour of wave arrival though different rates of rise were encountered at each level logger location (Table 3-33). Metts Landing achieved 75% of maximum stage in 40 minutes or less for flows of 6,000 cfs or higher. Times to 75% of maximum generally exceeded 1 and a half hours for all sites other than Metts Landing at 1,000 cfs. The rate of change associated with a rise of 75% of maximum stage over baseline conditions (Table 3-34) varied from 0.23 feet per minute (2.76 inches per minute) at Metts Landing at 18,000 cfs to a negligible rise (less than 0.02 feet per minute or one-quarter inch per minute) at sites downstream of Gardendale at flows of 3,000 cfs or less.

Under the lake level management simulation, level logger locations took only slightly longer to achieve 90% of maximum stage (Table 3-35) as compared with 75% of maximum stage. For example, Metts Landing achieved 90% of maximum stage (Table 3-36) between 1 hour 12 minutes at 12,000 cfs; 20 minutes longer than 75% of maximum stage. At 1,000 cfs the time difference between achieving 75% of maximum and 90% of maximum was an additional half an hour, with 90% of maximum achieved within 1 hour 37 minutes. By comparison, Shandon Rapids achieved 90% of maximum stage between 52 minutes at 10,000 cfs and 2 hours and 13 minutes at 1,000 cfs. The rate of change in feet per minute experienced at each level logger location from the start of rise (time of wave arrival) to 90% of maximum is presented in Table 3-37. The maximum rate of change ranges from 0.14 feet per minute (1.7 inches per minute) at Corley Island at 18,000 cfs to a less than 0.02 feet per minute (0.24 inches per minute) at flows of 5,000 cfs and less at sites downstream of Gardendale.

Table 3-30. Maximum Stage (feet) During 6 Hour Flow Duration

Flow	Metts Landing	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

Table 3-31. Rate of change (feet per minute) During 6 Hour Flow Duration From Start of Operations

Flow	Metts Landing	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

Table 3-32. Total Rise to 75% of Maximum Stage (feet) From Baseline Stage During 6 Hour Flow Duration

Flow	Metts Landing	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

Table 3-33. Time to 75% of Maximum Stage During 6 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-34. Rate of change (feet per minute) to 75% of Maximum During 6 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-35. Total Rise to 90% of Maximum Stage (feet) From Baseline Conditions During 6 Hour Flow Duration

Flow	Metts Landing	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

Table 3-36. Time to 90% of Maximum Stage During 6 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-37. Rate of change (feet per minute) to 90% of Maximum During 6 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-38 through Table 3-41 presents the change in stage over baseline conditions and rate of change in feet per minute experienced at each level logger location for each flow during the first 15 minutes of start of rise (time of wave arrival) and 30 minutes of start of rise under the simulated lake level management scenario. As with the simulated reserve call scenario, the maximum rate of change experienced from the start of rise during the first 15 minutes is 0.29 feet per minute (almost 3.5 inches per minute) at Metts Landing at 18,000 cfs with a total rise in river stage of 4.28 feet. At 30 minutes, the total rise in river stage is 8.28 feet with rate of change of 0.28 feet per minute (3.36 inches per minute).

In comparison, an 18,000 cfs simulated lake level management release causes a stage increase of almost 2 feet during the first 15 minutes of river rise for a rate of change of 0.13 feet per minute (over 1.5 inches per minute) at Shandon Rapids. This is in line with conditions experienced during the simulated reserve call scenario. Stacey's Ledge also experiences a similar river rise compared with reserve call operations. A flow of 18,000 cfs results in a total rise of 2.36 feet for a rate of change of 0.16 feet per minute (almost 2 inches per minute). These total rise estimates and rates of change decrease as flows decrease. Total rise is less than 6 inches at sites downstream of Corley Island and at flows equal to or less than 5,000 cfs during the first 15 minutes under the simulated lake level management scenario. Rates of change at flows of 5,000 cfs or less at these sites are generally less than 0.37 inches per minute. Although total stages increase after 30 minutes, rates of change remain relatively stable.

The time to recession for the simulated lake level scenario varies was not calculated because times to recession exceeded 24 hours, the length of time of the model run, for almost all flow levels and sites. However, river stages ranged from within achieving baseline at flows of 1,000 cfs at Metts Landing to 32 percent over baseline conditions at 18,000 cfs at Shandon Rapids.

Table 3-38. Total Rise (in feet) Compared with Baseline Conditions During 6 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-39. Rate of change (feet per minute) During 6 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-40. Total Rise (in feet) Compared with Baseline Conditions During 6 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	3.15	1.89	1.31	0.87	0.36	0.91	0.84	0.85
6,000 cfs	3.82	2.61	1.80	1.26	0.54	1.34	1.13	1.15
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

Table 3-41. Rate of change (feet per minute) During 6 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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	0.10	0.06	0.04	0.03	0.01	0.03	0.03	0.03
6,000 cfs	0.13	0.09	0.06	0.04	0.02	0.04	0.04	0.04
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

Simulated River Stabilization Scenario (24 hours)

To allow for full stabilization of river stage levels, the HEC RAS model simulated a release of water from Saluda Dam at each flow level for a 24 hour duration. Under this flow scenario, the model provided stage levels (in feet) for every minute of a 36 hour period. Daily maximum river stages for each flow level estimated for the eight level logger locations under this operating scenario are presented in Table 3-42.

Results of the river stabilization simulation are almost identical to the results produced under the simulated lake level management scenario. This indicates that river stabilization occurs under operations of 6 hours or potentially less for many flow releases. During the river stabilization scenario, Metts Landing encountered gains of greater than 10 feet over baseline conditions at flows of 12,000 cfs and greater and peaked at over 12 and a half feet over baseline conditions at 18,000 cfs. During the 1,000 cfs flow event, total rise over baseline conditions at Metts Landing were 1.1 feet. As with the lake level management scenario, Shandon Rapids experienced a total rise over baseline conditions that ranged from just under 6 inches at 1,000 cfs to just over 4 feet at 18,000 cfs.

The total time to maximum stage from the start of operations, including wave arrival lag time, ranged from just under 4 at Metts Landing during the 2,000 cfs flow to 10 hours and 49 minutes at Shandon Rapids under the 14,000 cfs flow. The rate of change in feet per minute experienced at each level logger location for each flow under the simulated lake level management scenario is presented in Table 3-43. The maximum rate of change experienced from the start of project operations to the maximum stage at each level logger location ranges from 0.03 feet per minute (0.36 inches per minute) at Metts Landing at 18,000 cfs to less than 0.01 feet per minute (0.12 inches per minute) at sites downstream of Corley Island at flows of 6,000 cfs or less.

Table 3-42. Maximum Stage (feet) During 24 Hour Flow Duration

Flow	Metts Landing	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

Table 3-43. Rate of change (feet per minute) During 24 Hour Flow Duration From Start of Operations

Flow	Metts Landing	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

Though different rates of rise were encountered at each level logger location, all sites achieved 75% of maximum stage (Table 3-44) generally within 1 hour of wave arrival (Table 3-45) at flows of 5,000 cfs and greater. Metts Landing achieved 75% of maximum stage in 40 minutes or less for flows of 6,000 cfs or higher. Times to 75% of maximum generally exceeded 1 and a half hours for all sites other than Metts Landing at 1,000 cfs. The rate of change associated with a rise of 75% of maximum stage over baseline conditions (Table 3-46) varied from 0.23 feet per minute (2.76 inches per minute) at Metts Landing at 18,000 cfs to a negligible rise (less than 0.02 feet per minute or one-quarter inch per minute) at sites downstream of Gardendale at flows of 3,000 cfs or less. Level logger locations took only slightly longer to achieve 90% of maximum stage as compared with 75% of maximum stage (Table 3-47 through Table 3-49).

The stage increase over baseline conditions and rate of change in feet per minute experienced at each level logger location for each flow during the first 15 minutes of start of rise and 30 minutes of start of rise under the river stabilization scenario are presented in Table 3-50 through Table 3-53. As with the lake level management simulation, the maximum rate of change experienced from the start of rise during the first 15 minutes is 0.29 feet per minute (almost 3.5 inches per minute) at Metts Landing at 18,000 cfs with a total rise in river stage of 4.28 feet. The total rise in river stage after 30 minutes is 8.28 feet with rate of change of 0.28 feet per minute (3.36 inches per minute).

At Shandon Rapids, the 18,000 cfs flow results in a stage increase of 1.92 feet at a rate of change of 0.13 feet per minute (1.56 inches per minute). A flow of 18,000 cfs results in a total rise of 2.36 feet for a rate of change of 0.16 feet per minute (almost 2 inches per minute) at Stacy's Ledge. Rates of change at flows of 3,000 cfs or less sites downstream of Corley Island are generally less than 0.12 inches per minute. Rates of change occurring during the first 30 minutes of stage increase remain relatively stable although overall river stage can increase by almost 50 percent.

Table 3-44. Total Rise to 75% of Maximum Stage (feet) From Baseline Stage During 24 Hour Flow Duration

Flow	Metts Landing	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

Table 3-45. Time to 75% of Maximum Stage During 24 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-46. Rate of change (feet per minute) to 75% of Maximum During 24 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-47. Total Rise to 90% of Maximum Stage (feet) From Baseline Conditions During 24 Hour Flow Duration

Flow	Metts Landing	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

Table 3-48. Time to 90% of Maximum Stage During 24 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-49. Rate of change (feet per minute) to 90% of Maximum During 6 Hour Flow Duration From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-50. Total Rise (in feet) Compared with Baseline Conditions During 24 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-51. Rate of change (feet per minute) During 24 Hour Flow Duration For 15 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-52. Total Rise (in feet) Compared with Baseline Conditions During 24 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Table 3-53. Rate of change (feet per minute) During 6 Hour Flow Duration For 30 Minutes From Start of Rise (Wave Arrival Time)

Flow	Metts Landing	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

Under the river stabilization scenario, the time to recession exceeded 24 hours because the model run exceeded 24 hours. As a result, the time from maximum stage to baseline conditions is greatly overestimated and not considered a reliable indicator of true time to recession.

3.4 Safety

On-going efforts by SCE&G, SCDNR, Columbia Fire Department, American Whitewater, Columbia Parks and Recreation, the Lower Saluda River Advisory Council and others are aimed at informing and educating the public regarding safety for on-water and near shore activities on the river. Among the existing safety measures in place for public benefit on the lower Saluda River are:

- a flow release warning system consisting of sirens and strobes;
- warning signs posted along the river and at public access points;
- river staff gages and river level markings on bridge abutments;
- a telephone ring-down notification system (under development);
- website posting of current conditions and planned operations; and
- website posting of educational materials and website links to safety information.

SCE&G maintains a warning system on the lower Saluda River to warn river users of sudden changes in water level. Sirens are located at Metts Landing, upstream of Riverbanks Zoo, and downstream of the Zoo. Sirens are activated by a float switch upstream whereby the sirens are activated for 3 minutes with river rise. The Metts landing siren is activated at an initial rate of rise of 2 inches and any rise of 2 feet thereafter or after 16 minutes if the river continues a rate of rise of another 2 inches. The Riverbanks Zoo sirens are activated at an initial rate of rise of 1 inch and any rise of 6 inches thereafter or 60 minutes if the river continues to rise another rate of rise of 1 inch. Sirens will continue to sound until stabilization and/or recession occurs. Sirens are active 24 hours per day and are calibrated such that the volume covers an area approximately

1,500 feet upstream and downstream of the Zoo sirens, and 500 feet upstream and downstream of the Metts Landing siren. Strobe lights are activated concurrently with the sirens and remain pulsing for 16 minutes once activated. The warning system will activate regardless of whether river level rise is caused by precipitation, operations or both (S&ME, 2004).

The Lower Saluda River Advisory Council and American Whitewater, with assistance from SCE&G, established a series of color-coded river markers that are positioned along the lower Saluda River for use by boaters, anglers and other recreators. The markers help users interpret danger associated with rising water levels. SCE&G is in the process of developing a telephone ring-down system that activates upon initial generation at Saluda Hydro. Once activated, a message is sent to registered individuals via e-mail and telephone, alerting them that Saluda Hydro is starting to generate.

SCE&G's website provides information on current water level conditions (with a date and time stamp) and planned operations. It is important to note, however, that planned operations are, according to SCE&G's website agreement, "…projections reflecting future electrical, mechanical, meteorological (weather), and power demand conditions expected at the time of the posting. These conditions are subject to immediate, unpredictable, unannounced, and uncontrollable change." SCE&G's website also provides links to such information as a Hazardous Waters Safety Bulletin, SCDNR Boating Safety, SCDNR Stream Data, American Whitewater Safety Code, and the USGS gage below Lake Murray Dam.

The Lower Saluda Scenic River Corridor Plan update, of which the Three Rivers Greenway Project is a part, includes additional safety measures such as additional public access sites; emergency services access; additional portage trails; security fences and gates; and strategies for law enforcement; security staffing; and policies for use, alcohol consumption, firearms, trespassing, among others.

Several safety concerns and issues have been identified on the lower Saluda River during the 2006 Recreation Assessment and the expert panel focus group, among others. Among these are:

- the rate of river rise and project operations for downstream recreational users;

- the adequacy of the existing warning system (signs, sirens, and strobes);
- the needs for additional efforts for educating the public about dangers of the river;
- the need for a call-up system or website for generation and flows information; and
- lack of security or a law enforcement presence, particularly at the Mill Race sites where alcohol consumption is a major concern.

3.4.1 Lower Saluda River Flow Warning System

During the 2006 Recreation Assessment, river users were asked to provide information regarding their familiarity and knowledge of the existing flow warning system. A majority of respondents (83 percent of 343 individuals interviewed) indicated that they are aware of the siren warning system and only 1 percent of those respondents familiar with the system were unclear as to its purpose. However, of the respondents who are aware of the system, most (60 percent) reported that they had never actually heard or seen the sirens or lights for themselves at the recreation site at which they were interviewed.

Given the locations of the existing warning systems (at Saluda Shoals Park/Metts Landing and at Mill Race Rapids), it is not surprising that the majority of respondents interviewed at Gardendale had never heard the siren there. This is also not a surprising result for Saluda Shoals Park, as it is a multi-use park and many visitors never approach the river. However, it could be considered a surprising result for Metts Landing, which only provides river access and no additional amenities, and the Mill Race sites, where visitors congregate at the water's edge, on the water, or on boulders in the river.

Of those individuals who were aware of the warning system and who had observed it, roughly half (47 percent) were on or in the water when the siren sounded. Of those, slightly more than half (60 percent) exited the water and/or left the area, while the remainder did nothing or remained where they were.

Currently SCE&G is working with the safety Resource Conservation Group to determine the potential need to install additional sirens at other locations along the lower Saluda River. Given the location of the existing sirens and the calibration of the volume to reach upstream and downstream of the existing locations, only 7 percent of the 11 miles of the lower Saluda River are currently covered by the existing warning system. However, the locations, operational settings, and decibel levels of the existing warning systems are designed to provide for public safety at high use areas of the river while attempting to minimize the effect of loudness, frequency and duration to residences and businesses located within proximity of the lower Saluda River (S&ME, 2004). Among the locations identified during the expert panel focus group for additional warning systems are:

- Corley Island
- River's Edge/Oh Brother Rapids
- Ocean Boulevard
- Sandy Beach, upstream of Metts Landing

The expert panel focus group was asked to provide feedback on the warning signs located along the lower Saluda River. Generally, everyone was familiar with the warning signs and some members of the panel were more familiar than others regarding the information that the signs convey. In general, it was noted that the signs can tend to blend into the background and become largely unnoticeable when individuals become accustomed to their presence. In addition, it was noted that the signs need to display more detailed information and better stress the dangers associated with project operations and river level rise.

3.4.2 Additional Access Sites/Portages

As discussed above and in Section 3.1.2, the need for additional access and portages was identified during the expert panel focus group, the on-site flow evaluations, and by existing river plans and efforts such as the Three Rivers

Greenway and the Lower Saluda Scenic River Corridor Plan and Update. Additional access sites and portages would provide recreation users with opportunities for egress in emergency situations, better access to the river for rescue personnel, and avenues to avoid sections of the river that may be hazardous at certain flow levels or for certain recreationist experience levels.

In addition to the public access sites and portage routes discussed in Section 3.1.2, emergency access that would be used by local law enforcement, emergency first responders, and swiftwater rescue personnel was recommended in the Lower Saluda Scenic River Corridor Plan Update for:

- north shore of river between Saluda Shoals Park/Metts Landing and Gardendale;
- south shore of river downstream of Mill Race Rapids;
- upstream of Riverbanks Zoo (existing Mill Race A site); and
- downstream of Riverbanks Zoo (existing Mill Race B site).

A portage route around Mill Race Rapids is identified as essential in the Lower Saluda Scenic River Corridor Plan Update. The need for adequate portage at Mill Race Rapids was echoed during the on-site flow evaluations, which reportedly would require portages at all flow levels for novice boaters. Portages at Ocean Boulevard were also mentioned as necessary at higher flow levels during the on-site flow evaluations.

4.0 CONCLUSIONS

Recreation use of public access sites along the lower Saluda River accounted for a total of approximately 232,000 recreation days from April through September, 2006. Saluda Shoals Park is, by far, the most popular site on the river, followed by the Mill Race sites. June and July are the most popular months for recreational use of the lower Saluda River with heaviest use on holidays. Approximately half of all use on the lower Saluda River is attributed to water-based activities, while just under half is attributed to land-based activities supported by various facilities at public access sites, such as picnic shelters and playgrounds. Across all day types and sites, the most popular on-water activities are whitewater canoeing/kayaking (13 percent of total use), boat fishing (11 percent of total use), and bank angling (9 percent of total use). Popular land-based activities include sightseeing (12 percent of total use), walking and hiking, including dog walking (12 percent of total use), and playground visitation (6 percent of total use). Generally, activities are concentrated at sites that best support such uses, however, the Mill Race sites are popular for providing access to whitewater rapids along the lower Saluda River and to rocky outcroppings for sunbathing, picnicking, swimming and rock-hopping, regardless of their informal nature and lack of facilities.

In general, about half of the recreation sites on the lower Saluda River are used at levels approaching and exceeding their capacities. Saluda Shoals Park, the most developed site and providing the most parking and support facilities, is used well within its capacity across all day types. Capacity at this site generally does not exceed 30 percent, even on holidays. The same is also true for Gardendale, which is at 55 percent use capacity overall. Although use at this site peaks to over-capacity (108 percent of use capacity) during typical weekends, use capacity at this site on holidays and weekdays is generally less than 33 percent. However, unlike holiday peak use, which is a rare occurrence and should be considered but not managed for, consistent high use levels at Gardendale on weekends should be addressed in future planning decisions for this site.

Recreation sites that routinely approach or exceed their use capacities include Metts Landing and the Mill Race sites. Metts Landing is busiest on weekends, exceeding its use capacity by 9 percent, on average. During weekday and holidays, this site experiences use capacities of 75 percent and higher, on average. A similar pattern emerges for Mill Race A and Mill Race B, though Mill Race B is not as busy as the other two high use sites during weekdays

and holidays. On weekend, Mill Race A typically exceeds its use capacity by 38 percent and Mill Race B typically exceeds its use capacity by 24 percent. It is very important to note, however, that these sites serve as overflow parking for Riverbanks Zoo. On weekends, it is likely that much of the use attributed to these sites is actually zoo patrons. The same is also likely for holidays and weekdays. Mill Race A exceeds 75 percent use capacity on weekdays and experiences slightly less (66 percent) on holidays. It is unclear how much of this use is attributable to zoo patronage, though, it is evident that the Mill Race sites are popular locations for whitewater canoeing/kayaking and rock-hopping and swimming, particularly on weekends and holidays. Because of the popularity of Mill Race A and Metts Landing, particularly on summer weekends, improvements to these existing sites should be considered in future planning efforts.

There are several additional access sites and venues in the planning stages for the lower Saluda River corridor including the Saluda Riverwalk and Three Rivers Greenway. Improvements to existing recreation sites are proposed as part of these two plans. For Saluda Shoals, the most popular yet most underutilized site, improvements such as parking and trails are recommended. Metts Landing, which routinely approaches or exceeds its use capacity, is targeted for additional parking. Other recommendations for this site include restrooms and trash receptacles which would address patron concerns, greatly improve this site's condition, and would likely contribute to increased use. Recommended improvements to Gardendale include additional parking that would expand this site's capacity, which is generally exceeded on peak weekends. Furthermore, restrooms and trash receptacles are also recommended for this site. As with Metts Landing, such improvements to Gardendale would improve the overall condition of this site and potentially contribute to increased use.

Because the Mill Race sites are not formal recreation sites and do not feature any support facilities, any recommended improvements to or development of these locations would contribute to these sites' ability to support existing use levels, which are generally high but which also may be augmented by use of Riverbanks Zoo, and to address patrons' concerns regarding the condition of these sites. Under the proposals for the Saluda Riverwalk are a park at the site of Mill Race rapids that would include trash receptacles, picnic tables, bathrooms and a ranger and rescue station.

Additional facilities proposed as part of the Saluda Riverwalk and Three Rivers Greenway include a riverside trail along the length of the lower Saluda River that would feature pedestrian bridges and feeder trails; a new fishing pier below I-20; a hand-carry boat launch just below I-26; new access and portage trail at Stacy's Ledge; and an improved portage trail around Mill Race rapids. The majority of these sites are supported by the opinions of the expert panel focus group who also recommended a shoreline angling access trail below Saluda Dam and at Sandy Beach and a hand-carry access site at Twelvemile Creek. It is expected that improvements to access and opportunities along the lower Saluda River will contribute to the corridor's ability to support recreational use of the river. It is not clear, however, if these improvements will redistribute existing use to other sites, contribute to increased use of the area, or both. Irrespective, given existing use capacities are typically exceeded on peak weekends at the majority of lower Saluda River sites, improvements to existing access sites and the addition of new access sites will enhance the recreation experience for all patrons.

As stated previously, about half of the total use at existing access sites are water-based activities. The most popular among the water-based activities are whitewater canoeing/kayaking, fishing (from a boat, from shore or wade angling), swimming, and rock-hopping. Whitewater canoeing/kayaking, primarily downstream of the Gardendale access site, is generally available at the widest range of flows. Opportunities for whitewater boating at different flows can be accommodated by various river features and "play spots" that are created at various flows along the lower half of the river to the confluence with the Broad. Although the range of acceptable flows varies by experience level, generally whitewater boating opportunities are available and favorable at flows of between 2,300 cfs (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. This upper section of the river is predominantly flatwater even at higher flows. The River Alliance Instream Flow Study identified 4,400 cfs as most favorable for travel boating in an open decked tandem or closed deck solo canoe without significant whitewater features with a range of between 1,150 cfs and 5,400 cfs as most preferred (The River Alliance, 1997). 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 the expert panel focus group and the results of the on-site reconnaissance, 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, whereas, non-boating on-water activities, such as swimming and wade angling, are best suited for flows of 1,000 cfs or less. Daily average flows of less than 1,000 cfs are generally available 38 percent of the time year-round; hourly average flows of less than 1,000 cfs are generally available 60 percent of the time year-round. Whereas flows of less than 4,000 cfs, daily average, are generally available 83 percent of the time year-round and flows of less than 4,000 cfs hourly average are generally available 27 percent of the time year-round. Higher flows, for whitewater activities such as canoeing/kayaking and rafting, of 12,000 cfs or greater are generally only available approximately 2 percent of the time year-round on a daily average and hourly average basis. However, daily average flows represent a range of flows provided on a daily basis, hourly average flows on an hourly basis, and peak flows of 12,000 cfs and higher for specific durations are provided much more often than 2 percent of the time year-round.

As use levels increase over time and/or in conjunction with improvements to existing recreation facilities and/or as a result of the construction of new sites and facilities, the safety of on-water recreationists will continue to be a concern. This is particularly true for the provision of flows to the lower Saluda River and the adequacy of the existing flow warning system. As discussed in Section 3.3.3, upstream sections of the lower Saluda River, primarily in the vicinity of Metts Landing and Corley Island, experience the greatest increase in river stage during the shortest time durations at all flow levels. During simulated reserve call operations (1.5 hours of operation) of 18,000 cfs, the first 15 minutes of the initial increase in river stage (wave arrival time) at these sites results in an overall net increase in river stage over baseline conditions of over 4 feet 3 inches. This produces a rate of change of approximately 3.4 inches per minute. A reserve call (1.5 hours operation) of 10,000 cfs would produce a net increase in river stage of 3.65 feet at Metts Landing and 2.16 feet at Corley Island during the first 15 minutes of wave

arrival. This would result in a rate of change of 0.24 feet per minute (2.9 inches per minute) and 0.14 feet per minute (1.7 inches per minute), respectively.

This rate of change is generally attenuated as flows decrease and as the river release progresses downstream. For example, at sites downstream of Corley Island, the rate of change experienced during the first 15 minutes of wave arrival for flows of 5,000 cfs under the simulated reserve call scenario is generally less than 0.02 feet per minute (0.24 inches per minute). Rates of change experienced during the first 15 minutes and first 30 minutes of wave arrival are generally consistent irrespective of operations (*i.e.* reserve call, lake level management, and river stabilization scenarios). However, there are variations in the total rise and rates of change experienced at different flows and at different locations due to upstream reaches stabilizing more slowly, complex channel geometry, overbank flooding, tributary inputs, and other physical factors. As such, the increase in stage and rates of rise along the lower Saluda River will vary along the entire reach as a result of different flow releases.

The existing warning system consists of strobes and sirens located at Metts Landing and upstream and downstream of Riverbanks Zoo. The Metts Landing siren is activated at an initial rise of 2 inches and any rise of 2 feet thereafter, and sounds continuously for 3 minutes with each activation. Under the simulated reserve call scenario, flows of 18,000 cfs can result in a lapsed time of less than 10 minutes, between the initial activation of the sirens and the secondary sounding at a rise of 2 feet, in the vicinity of Metts Landing.

Gardendale, which is not served by the existing strobe and siren warning system but which has river stage staff gages, can also experience an initial rise of 2 feet within 10 minutes at 18,000 cfs under the simulated reserve call scenario. Oh Brother Rapids and Ocean Boulevard, popular sites for wade angling activities, are also not currently served by the existing strobe and siren warning system. At Oh Brother Rapids and Ocean Boulevard the effects of any rise over baseline conditions and the rate of such a rise is further attenuated by the split in the river channel at this location. Generally, during the simulated reserve call scenario of 18,000 cfs, these sites would experience a net increase in stage over baseline conditions of 1.86 feet and 0.85 feet over the first 15 minutes of wave arrival, respectively. This results in a rate of change of 0.12 feet per minute (1.44 inches per minute) at Oh Brother Rapids and 0.06 feet per minute (0.72 inches per minute) at Ocean Boulevard.

The Mill Race sites are served by the existing strobe and siren warning system, whereby the sirens sound continuously for every 3-inch rise until stabilization and/or recession occurs. The Mill Race sites experience stage increases and rates of change that are much more tempered than upstream sites, even at higher flows and under the simulated reserve call scenario. Specifically, the Botanical Gardens level logger cross-section and Shandon Rapids cross-section experienced an increase of 2.03 feet and 1.92 feet, respectively, at flows of 18,000 cfs under the simulated reserve call scenario during the first 15 minutes of wave arrival. The rise over baseline conditions increased to 2.99 at Botanical Gardens and 3.01 at Shandon Rapids over 30 minutes. Sirens and strobes would have sounded and been activated continuously during this river rise event.

In general, any future planning decisions for providing access and opportunities along the lower Saluda River corridor should consider:

- the adequacy of existing recreation sites and potential improvements to existing that may enhance recreation opportunities along the river;
- the need for and locations of new access sites and the amenities provided by such;
- the effects of additional and improved existing access sites on recreational use levels along the lower Saluda River (*i.e.* that use may shift from existing to other improved or additional sites and/or that overall use may increase as opportunities are enhanced);
- the changing dynamics and technologies of recreation on the river and along the shoreline (*i.e*. the growing popularity of activities such as whitewater canoeing/kayaking, tubing, etc.);
- the importance in preserving traditional uses of the lower Saluda River such as for angling and flatwater boating;
- the need for maintenance at existing access sites and new maintenance needs at additional sites, such as landscaping and trash removal, and the costs and efforts associated with such;

- the need for security and patrols at existing sites, particularly at the Mill Race sites, and potentially at newly constructed sites and the costs and efforts associated with such;

- safety issues associated with on-water use of the lower Saluda River including the adequacy of the existing warning system (strobes, sirens, signage, etc.), potential locations for additional warning devices, measures for increased public awareness of safety issues on the river, continued coordination with existing law enforcement and rescue personnel, and other such issues; and

- the effects of downstream flows and operational regimes on downstream recreation uses including opportunities provided by various flow levels and the effects of the rate of rise on recreationists engaging in on-water activities.

As the popularity and overall recreational use of the lower Saluda River corridor continues to grow, SCE&G, agencies and stakeholders should continue to work cooperatively to meet the needs of the public, provide for opportunities and access to the lower Saluda River, address safety concerns, and while balancing the need for power and effects of the Project on other environmental resources.

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APPENDIX A

DOWNSTREAM FLOWS TECHNICAL WORKING COMMITTEE

NAME	CONTACT INFORMATION	AFFILIATION
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APPENDIX B

LOWER SALUDA RIVER FOCUS GROUP NOTES

SCE&G Downstream Flows Assessment
Expert Panel Focus Group

May 16, 2007

List of Attendees

Dave Lansberry, South Carolina Department of Natural Resources
Bill Marshall, South Carolina Department of Natural Resources
Stuart Greeter, South Carolina Department of Natural Resources, State Scenic Rivers Program
Tony Bebber, South Carolina Parks and Recreation
Karen Kustafik, City of Columbia Parks and Recreation
Bill Argentieri, South Carolina Electric and Gas
Mike Waddell, Trout Unlimited
Charlene Colman, American Whitewater
Kelly Maloney, Kleinschmidt Associates
Dave Anderson, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates

Kelly Maloney welcomed all attendees and noted that, as part of the Saluda Hydro Project relicensing process, South Carolina Electric and Gas (SCE&G) and various stakeholders who are assisting them would like to know about water-based recreation activities and safety issues on the lower Saluda River. Kelly explained that the information gathered tonight will be considered in decisions made during SCE&G's relicensing and the management of the project in the future.

Each participant introduced themselves, the organization they represented and the activities they participated in on the lower Saluda River. Kelly noted that the focus of the meeting will be to discuss each of the panel members' experiences recreating on the lower Saluda River, how they access the river, preferences for flows and facilities, and any opinions on safety issues associated with access or flows on the river. Below is a summary of the responses to each of the questions asked during the focus group.

What activities do you typically participate in and is there a specific month that you tend to recreate most frequently? Why? (responses are separated by activity)

Generally, the peak recreation season for all activities on the lower Saluda River is April through September.

Canoeing/Flatwater Kayaking

- Some angling from canoes and kayaks occurs
- Rentals are available at Saluda Shoals Park, Paddling Clubs also participate on the lower Saluda River
- Every Sunday year around
- Summer camp use peaks between June and July

Wade Fishing

- Trout are stocked in December each year
- Participation peaks in January, February, and March
- Use occurs in the fall as well

Whitewater Canoeing/Kayaking
- Participation peaks between May and August
- Two whitewater kayaking events occur on the lower Saluda River: Mill Race Massacre (annually in January) and the Iceman Challenge (annually in January)
- Swiftwater rescue training- year around

Swimming
- Concentrated at Mill Race section of the River (upstream and downstream of Riverbanks Zoo)
- Participation peaks in the hot months (June through August)
- Swimming also takes place at Saluda Shoals Park, and, to a lesser degree, at Gardendale, Metts Landing (Hope Ferry Landing), and Corley Island. It was noted that Ocean Boulevard and Oh Brother Rapids are also used for swimming, but are accessed by boat.

Picnicking/Sunbathing/Hopping on Rocks
- Also concentrated at the Mill Race section of the River
- Participation generally peaks in May (college students)
- Participation does take place throughout summer

Tubing
- Participation peaks from June through August
- Palmetto Outdoors and Adventure Carolina rent tubes and provide shuttling

Motor Boating (fishing)
- Generally not used by pleasure boaters; boating use is primarily fishing for striped bass but some pleasure boating does occur, as does swimming from a boat
- Participation peaks from May to June
- Participation is effected by water levels

Camping
- The island between Ocean Boulevard and Oh Brother Rapids is accessible by boat and by wading at lower flows.

Are there any months that you generally avoid? Why?
- Generally avoid Mill Race on holidays due to crowding
- Avoid peak summer months for wade fishing

What flow levels are most favorable to your activity of choice?

Canoeing/Kayaking Flatwater
- Up to 2,500 cfs

Canoeing/Kayaking Whitewater

- Generally, some amount of paddling can be done at all water levels. Some sections of the river are better at certain higher/lower flows.
- Between 3,000 cfs and 18,000 cfs

  Corley Island
  - ±1,000cfs

  Shandon Rapids
  - >500 cfs
  - best at 18,000 cfs

  Ocean Boulevard
  - 8,000 cfs to 18,000 cfs (optimum for seasonal paddlers)

  Oh Brother Rapids
  - 1,000 cfs to 2,500 cfs

  Stacy's Ledge
  - 1,000 cfs to 5,000 cfs
  - 14,000 cfs good feature

  Mill Race Rapids (advanced)
  - 3,000 cfs (river run int. brake?) others take portage trail

    Blast O-matic
    - 4,000 cfs to 18,000 cfs

    Cookie Monster
    - 2,000 cfs ± to 18,000 cfs

    Fisherman's Rock
    - 1,500 cfs ±

    Pop Hole
    - 3,300 cfs rodeo?

Wade Angling (mostly Oh Brother, Corley Island and I-20 Bridge)

- Minimum flow to 800 cfs

Boat Angling

- Between 1,000 cfs to 4,000 cfs

Swimming (shore and boat)

- Between 500 cfs to 1,000 cfs

Picnicking/Swimming/Rock Hopping

- From < 500 cfs to 1,000 cfs
- Corley Island is best at 500 cfs
- Mill Race is best at 500 cfs

Tubing

- Commercial use (Riverbanks Zoo to Gervais Street Bridge) between 1,000 to 2,000 cfs

Rafting

- Optimum at 10,000 cfs

- Runable at >8,000 cfs

What sites do you typically use to access the lower Saluda River?

All sites were indicated as being used to access the lower Saluda River: Saluda Shoals Park, Metts Landing (Hope Ferry Landing), Gardendale, Mill Race A and Mill Race B. Also, Riverview Estates used by TU members (private site) to gain access. Also, Canoeing for Kids has its own access site (private site).

Are there any additional facilities or improvements (parking, restrooms, boat launch, trash cans, lighting, etc.) needed at these sites?

Saluda Shoals Park
- Sewage discharge pipe

Metts Landing/Hope Ferry Landing
- Trash cans
- Patrol
- Restrooms

Gardendale
- Improve carry-in ramp
- Trailerable launch – this was mentioned by one member of the panel; other members disagreed with this suggestion
- Trash cans
- Patrol
- Widen path
- Bigger

Mill Race Rapids A
- Restrooms
- Trash cans
- Patrol
- Maintenance
- Walking Paths

Mill Race Rapids B
- Trash cans
- Restrooms
- Patrol
- Walking paths
- Maintenance

Are there any additional access sites needed on the lower Saluda River? Where should these be located?

Lake Murray Dam
- Walk-in angling access below the dam

Mill Race Rapids

- Hand carry boat access above Mill Race Rapids (for portaging)

Twelvemile Creek

- Hand carry boat access

Sandy Beach

- Walk-in angling access

City of Columbia

- Currently working on putting in new access below I-26 Bridge (hand carry boat access)

What additional locations would be most effective for flow release warning devices?

- Corley Island
- River's Edge/Oh Brother Rapids
- Ocean Boulevard
- Sandy Beach

Are you familiar with the warning signs on the lower Saluda River? Do you feel that they convey sufficient information, too much information, not enough information? Are there any improvements you would suggest for the signage?

Generally, everyone was familiar with the warning signs on the lower Saluda River. Some members were more familiar with what the signs say than others.

- Not really noticeable, blends into background when accustomed to seeing them
- Not as important as strobes/sirens
- Needs to display more information
- Should stress danger of water level rising

Additional Issues and Concerns

- More effort in educating the public about dangers of the river
- Ramping. Ramp to 2,000 cfs, if possible. Slow release to first 1,000 cfs incrementally to 2,000 cfs
- Call-up system/website for generation and flows information
- Require PFD's on the lower Saluda River (SCDNR and Parks and Recreation should enforce it)

APPENDIX C

LOWER SALUDA RIVER ON-SITE RECONNAISSANCE SURVEYS

Downstream Flows Assessment
Controlled Flow Evaluation – Pre-Flow Information Form

To be completed by Survey Administrator - Date:_____ Part ID#:_____

THIS SECTION ASKS ABOUT YOUR EXPERIENCE ON THE LOWER SALUDA RIVER

1. How often do you typically participate in recreation activities ***on the lower Saluda River***? *(Check one box.)*

   ☐ Weekly / At least once per week
   ☐ Monthly / At least once per month
   ☐ Several times per year
   ☐ At least once per year
   ☐ Less than one time per year

2. During what month(s) do you typically participate in recreation activities ***on the lower Saluda River***? *(Check all that apply.)*

   ☐ January
   ☐ February
   ☐ March
   ☐ April
   ☐ May
   ☐ June
   ☐ July
   ☐ August
   ☐ September
   ☐ October
   ☐ November
   ☐ December

3. In the past year, how many days have you participated in recreation activities ***on the lower Saluda River***? *(Fill in blank.)*

   _____ TOTAL DAYS PARTICIPATING IN THE PAST YEAR

4. What is the **primary** recreation activity that you typically participate in ***on the lower Saluda River***? *(Check **one** main activity.)*

Check only one main activity	Types of Activities
	FISHING:
☐	bank fishing/fishing from shore
☐	boat fishing
☐	tube fishing
☐	wade fishing
☐	pier/dock fishing
	BOATING:
☐	flat water canoeing/kayaking
☐	whitewater canoeing/kayaking
☐	motor boating/pleasure boating
☐	tubing
	OTHER:
☐	sunbathing/rock hopping
☐	swimming
☐	other:_____

5. How many total years have you been participating in the **primary** recreation activity that you indicated in Question 4? *(Fill in blank.)*

   _____ TOTAL YEARS EXPERIENCE

6. On a scale from 1 to 5, with 1 being novice/not very experienced, 3 being intermediate/moderately experienced, and 5 being expert/very experienced, how would you rate your ability for the **primary** recreation activity that you typically participate in ***on the lower Saluda River***? *(Circle one number.)*

   Novice Intermediate Expert

   1 2 3 4 5

7. What recreation site do you typically use when participating in the **primary** recreation activity that you typically participate in ***on the lower Saluda River***? *(Check one box.)*

   ☐ Metts Landing
   ☐ Saluda Shoals Park
   ☐ Gardendale
   ☐ Mill Race A – Upstream Side of Riverbanks Zoo
   ☐ Mill Race B – Downstream Side of Riverbanks Zoo
   ☐ Other – please specify:_____

8. What section(s) of ***the lower Saluda River*** do you typically use when participating in recreation activities? *(Check **all** that apply – please refer to the map.)*

   ☐ Dam to Metts Landing/Saluda Shoals Park
   ☐ Metts Landing/Saluda Shoals Park to Corley Island
   ☐ Corley Island to Gardendale
   ☐ Gardendale to Ocean Boulevard/Oh Brother Rapids
   ☐ Ocean Boulevard/Oh Brother Rapids to Stacy's Ledge
   ☐ Stacy's Ledge to Mill Race Rapids
   ☐ Mill Race Rapids to Shandon Rapids
   ☐ Other – please specify:_____

9. On a scale from 1 to 5, with 1 being not at all familiar, 3 being moderately familiar, and 5 being very familiar, how would you rate your familiarity with ***the lower Saluda River***? *(Circle one number.)*

   Not at All Familiar Moderately Familiar Very Familiar

   1 2 3 4 5

10. How many years of experience do you have participating in recreation activities ***on the lower Saluda River***? *(Fill in blank.)*

    _____ YEARS

THIS SECTION ASKS ABOUT YOUR FAMILIARITY WITH THE FLOW RELEASE WARNING SYSTEM ON THE LOWER SALUDA RIVER

11. Are you aware of a siren or flashing lights on ***the lower Saluda River***? *(Check one box.)*

    ☐ YES
    ☐ NO *(If no, skip to Question 15.)*

12. Have you ever heard the siren or seen the flashing lights ***on the lower Saluda River***? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 15.)*

13. The last time you heard the siren or saw the lights ***on the lower Saluda River***, were you on or in the water when the siren sounded? *(Check one box.)*

☐ YES
☐ NO *(If no, skip to Question 15.)*

14. What did you do? *(Fill in the blank.)*

_____

_____

_____

_____

_____

THIS SECTION ASKS ABOUT YOU PERSONALLY

15. What is your gender? *(Check one box.)*

☐ Male ☐ Female

16. Do you own a permanent or seasonal waterfront home or condominium ***on the lower Saluda River***? 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-waterfront resident → ZIP CODE: _____

17. In what year were you born? *(Fill in blank.)*

_____ YEAR

THANK YOU FOR YOUR HELP! WE APPRECIATE YOUR TIME TODAY!

Downstream Flows Assessment
Controlled Flow Evaluation – Post-Flow Survey

To be completed by Survey Administrator - Date:_____ Flow: _____ Part ID#:_____

THIS SECTON ASKS ABOUT YOUR PARTICIPATION IN OR OBSERVATION OF YOUR PRIMARY RECREATION ACTIVITY ON THE LOWER SALUDA RIVER TODAY

1. What is the primary recreation activity that you participated in or observed ***on the lower Saluda River today***? *(Check one box.)*

	Activity You Participated In/Observed Today
	FISHING:
☐	bank fishing/fishing from shore → SKIP TO QUESTION 3
☐	boat fishing
☐	wade fishing → SKIP TO QUESTION 3
☐	tube fishing → SKIP TO QUESTION 3
☐	pier/dock fishing → SKIP TO QUESTION 3
	BOATING:
☐	flat water canoeing/kayaking
☐	whitewater canoeing/kayaking
☐	motor boating/pleasure boating
☐	tubing → SKIP TO QUESTION 3
	OTHER:
☐	sunbathing/rock hopping → SKIP TO QUESTION 3
☐	swimming → SKIP TO QUESTION 3
☐	other:_____ → SKIP TO QUESTION 3

2. What type of craft did you use ***on the lower Saluda River today***? *(Check one box.)*

☐ Motor Boat (Specify Make:_____ Model:_____ Engine Size:_____)
☐ Hard Shell Kayak ☐ Inflatable Kayak
☐ Closed Deck Canoe ☐ Open Canoe
☐ Raft ☐ Other:_____

3. What recreation site did you use to gain access to ***the lower Saluda River today***? *(Check one box.)*

☐ Metts Landing/Metts Landing
☐ Saluda Shoals Park
☐ Gardendale
☐ Mill Race A – Upstream Side of Riverbanks Zoo
☐ Mill Race B – Downstream Side of Riverbanks Zoo
☐ Other – please specify:_____

4. What recreation site did you use to take-out of ***the lower Saluda River today***? *(Check one box.)*

☐ Metts Landing/Metts Landing
☐ Saluda Shoals Park
☐ Gardendale
☐ Mill Race A – Upstream Side of Riverbanks Zoo
☐ Mill Race B – Downstream Side of Riverbanks Zoo
☐ Other – please specify:_____

5. What time did you put-in on the water/arrive at the recreation site at which you are observing activities ***on the lower Saluda River today***? *(Fill in blank.)*

   _____ am / pm

6. What time did you take-out of the water/depart from the recreation site at which you are observing activities ***on the lower Saluda River today***? *(Fill in blank.)*

   _____ am / pm

THIS SECTON ASKS ABOUT YOUR EXPERIENCE ON THE LOWER SALUDA RIVER TODAY

7. What section(s) ***of the lower Saluda River*** did you spend the most time on ***today***? *(Check **all** that apply.)*

   - ☐ Dam to Metts Landing/Saluda Shoals Park
   - ☐ Metts Landing/Saluda Shoals Park to Corley Island
   - ☐ Corley Island to Gardendale
   - ☐ Gardendale to Ocean Boulevard/Oh Brother Rapids
   - ☐ Ocean Boulevard/Oh Brother Rapids to Stacy's Ledge
   - ☐ Stacy's Ledge to Mill Race Rapids
   - ☐ Mill Race Rapids to Shandon Rapids
   - ☐ Other – please specify:_____

8. Please evaluate this flow for your primary activity and experience level for each of the following characteristics of ***the lower Saluda River today***. *(Check N/A box if characteristic is not applicable to your activity. Circle one rating number for each characteristic. Check one box for flow level rating.)*

Characteristic	N/A	Please Rate Each Characteristic (Circle one number)					Flow was? (Check one box)		
		Unacceptable	Poor	Marginal	Good	Excellent	Too Low	Just Right	Too High
Navigability	☐	1	2	3	4	5	☐	☐	☐
Wadeability	☐	1	2	3	4	5	☐	☐	☐
Rapids	☐	1	2	3	4	5	☐	☐	☐
River Depth	☐	1	2	3	4	5	☐	☐	☐
Water Craft Rate of Travel	☐	1	2	3	4	5	☐	☐	☐
Exposure of Rocks	☐	1	2	3	4	5	☐	☐	☐
Exposure of Shoals (Bars)	☐	1	2	3	4	5	☐	☐	☐
Presence of Eddies	☐	1	2	3	4	5	☐	☐	☐
Force of Water	☐	1	2	3	4	5	☐	☐	☐
Speed of Water/Current	☐	1	2	3	4	5	☐	☐	☐
Aesthetic Quality	☐	1	2	3	4	5	☐	☐	☐
Overall Quality	☐	1	2	3	4	5	☐	☐	☐

9. Please provide a brief explanation of your rating of the overall quality of your experience or observation. (*Fill in the blank*.)

_____

_____

_____

_____

_____

10. Please evaluate the suitability of this flow ***on the lower Saluda River today*** for your primary activity for each experience level. *(Circle one rating number for each experience level or check "Don't Know" if you cannot provide a rating. Check one box for flow level rating.)*

Experience Level	**Please Rate the Suitability of this Flow for Each Experience Level (Circle one number)**						**Flow was? (Check one box)**		
	Unacceptable	**Poor**	**Marginal**	**Good**	**Excellent**	**Don't Know**	**Too Low**	**Just Right**	**Too High**
Novice	1	2	3	4	5	☐	☐	☐	☐
Intermediate	1	2	3	4	5	☐	☐	☐	☐
Advanced	1	2	3	4	5	☐	☐	☐	☐
Expert	1	2	3	4	5	☐	☐	☐	☐

11. Please evaluate this flow for your primary activity and experience level for each of the following hazards of ***the lower Saluda River today***. *(Check N/A box if hazard was not experienced or observed. Circle one rating number for each hazard.)*

Hazard	**N/A**	**Please Rate Each Hazard (Circle one number)**				
		Dangerous	**Fair**	**Neutral**	**Good**	**Safe**
Exposed Rocks	☐	1	2	3	4	5
Exposed Shoals	☐	1	2	3	4	5
Rapids	☐	1	2	3	4	5
Shallow Depth	☐	1	2	3	4	5
Deep Depth	☐	1	2	3	4	5
Swift/Strong Current	☐	1	2	3	4	5
Overall Hazard Level		1	2	3	4	5

12. If you participated in boating or tubing activities, did you have to portage any sections of the river during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 14
☐ I DID NOT PARTICIPATE IN BOATING OR TUBING ACTIVITIES → SKIP TO QUESTION 14

13. Please provide the location and reason for any portages during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Reason: _____

Location: _____ Reason: _____

Location: _____ Reason: _____

14. Did you experience or did you observe any significant problems or specific safety hazards associated with your primary activity during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 16

15. Please provide the location and a brief description of any experienced or observed hazards during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Description: _____

Location: _____ Description: _____

Location: _____ Description: _____

16. Did you experience or did you observe any outstanding features or opportunities associated with your primary activity during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 18

17. Please provide a brief description and location of any experienced or observed outstanding features or opportunities during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Description: _____

Location: _____ Description: _____

Location: _____ Description: _____

18. Compared to ***today's*** flow level, would you prefer a level that was higher, lower, or about the same for the activity you participated in or observed ***on the lower Saluda River***? *(Circle one number.)*

Much Lower	Lower	No Change	Higher	Much Higher
1	2	3	4	5

17. Given the opportunity, would you choose to participate in this activity ***on the lower Saluda River*** at this flow level? *(Check one box.)*

☐ YES
☐ NO

18. Why or why not? (*Fill in the blank*.)

19. Do you have any additional comments? (*Fill in the blank*.)

THANK YOU FOR YOUR HELP! WE APPRECIATE YOUR TIME TODAY!

Downstream Flows Assessment
Controlled Flow Evaluation – Post-Flow Survey (Multiple Activities)

To be completed by Survey Administrator - Date:_____ Flow: _____ Part ID#:_____

THIS SECTON ASKS ABOUT YOUR PARTICIPATION IN OR OBSERVATION OF ANY SECONDARY RECREATION ACTIVITIES ON THE LOWER SALUDA RIVER TODAY

1. What is the secondary recreation activity that you participated in or observed ***on the lower Saluda River today***? *(Check one box.)*

	Activity You Participated In/Observed Today
	FISHING:
☐	bank fishing/fishing from shore → SKIP TO QUESTION 3
☐	boat fishing
☐	wade fishing → SKIP TO QUESTION 3
☐	tube fishing → SKIP TO QUESTION 3
☐	pier/dock fishing → SKIP TO QUESTION 3
	BOATING:
☐	flat water canoeing/kayaking
☐	whitewater canoeing/kayaking
☐	motor boating/pleasure boating
☐	tubing → SKIP TO QUESTION 3
	OTHER:
☐	sunbathing/rock hopping → SKIP TO QUESTION 3
☐	swimming → SKIP TO QUESTION 3
☐	other:_____ → SKIP TO QUESTION 3

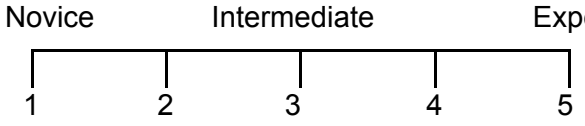
2. What type of craft did you use ***on the lower Saluda River today***? *(Check one box.)*

☐ Motor Boat (Specify Make:_____ Model:_____ Engine Size:_____)
☐ Hard Shell Kayak ☐ Inflatable Kayak
☐ Closed Deck Canoe ☐ Open Canoe
☐ Raft ☐ Other:_____

3. Did you participate in this secondary activity or did you observe this secondary activity ***on the lower Saluda River today***? *(Check one box.)*

☐ I participated in this secondary activity
☐ I observed this secondary activity while participating in/observing my primary activity

4. On a scale from 1 to 5, with 1 being novice/not very experienced, 3 being intermediate/moderately experienced, and 5 being expert/very experienced, how would you rate your ability for the secondary activity that you participated in or observed ***on the lower Saluda River today***? *(Circle one number.)*



5. Please evaluate this flow for your secondary activity and experience level for each of the following characteristics of ***the lower Saluda River today***. *(Check N/A box if characteristic is not applicable to your activity. Circle one rating number for each characteristic. Check one box for flow level rating.)*

Characteristic	**N/A**	**Please Rate Each Characteristic (Circle one number)**					**Flow was? (Check one box)**		
		Unacceptable	**Poor**	**Marginal**	**Good**	**Excellent**	**Too Low**	**Just Right**	**Too High**
Navigability	☐	1	2	3	4	5	☐	☐	☐
Wadeability	☐	1	2	3	4	5	☐	☐	☐
Rapids	☐	1	2	3	4	5	☐	☐	☐
River Depth	☐	1	2	3	4	5	☐	☐	☐
Water Craft Rate of Travel	☐	1	2	3	4	5	☐	☐	☐
Exposure of Rocks	☐	1	2	3	4	5	☐	☐	☐
Exposure of Shoals (Bars)	☐	1	2	3	4	5	☐	☐	☐
Presence of Eddies	☐	1	2	3	4	5	☐	☐	☐
Force of Water	☐	1	2	3	4	5	☐	☐	☐
Speed of Water/Current	☐	1	2	3	4	5	☐	☐	☐
Aesthetic Quality	☐	1	2	3	4	5	☐	☐	☐
Overall Quality	☐	1	2	3	4	5	☐	☐	☐

6. Please provide a brief explanation of your rating of the overall quality of your experience or observation. (*Fill in the blank*.)

_____

_____

_____

_____

7. Please evaluate the suitability of this flow ***on the lower Saluda River today*** for your secondary activity for each experience level. *(Circle one rating number for each experience level or check "Don't Know" if you cannot provide a rating. Check one box for flow level rating.)*

Experience Level	**Please Rate the Suitability of this Flow for Each Experience Level (Circle one number)**						**Flow was? (Check one box)**		
	Unacceptable	**Poor**	**Marginal**	**Good**	**Excellent**	**Don't Know**	**Too Low**	**Just Right**	**Too High**
Novice	1	2	3	4	5	☐	☐	☐	☐
Intermediate	1	2	3	4	5	☐	☐	☐	☐
Advanced	1	2	3	4	5	☐	☐	☐	☐
Expert	1	2	3	4	5	☐	☐	☐	☐

8. Please evaluate this flow for your secondary activity and experience level for each of the following hazards of ***the lower Saluda River today***. *(Check N/A box if hazard was not experienced or observed. Circle one rating number for each hazard.)*

Hazard	N/A	Please Rate Each Hazard (Circle one number)				
		Dangerous	**Fair**	**Neutral**	**Good**	**Safe**
Exposed Rocks	☐	1	2	3	4	5
Exposed Shoals	☐	1	2	3	4	5
Rapids	☐	1	2	3	4	5
Shallow Depth	☐	1	2	3	4	5
Deep Depth	☐	1	2	3	4	5
Swift/Strong Current	☐	1	2	3	4	5
Overall Hazard Level		1	2	3	4	5

9. If you participated in boating or tubing activities, did you have to portage any sections of the river during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 14
☐ I DID NOT PARTICIPATE IN BOATING OR TUBING ACTIVITIES → SKIP TO QUESTION 14

10. Please provide the location and reason for any portages during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Reason: _____

_____

_____

_____

Location: _____ Reason: _____

_____

_____

_____

Location: _____ Reason: _____

_____

_____

_____

11. Did you experience or did you observe any significant problems or specific safety hazards associated with your secondary activity during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 13

12. Please provide the location and a brief description of any experienced or observed hazards during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Description: _____

Location: _____ Description: _____

Location: _____ Description: _____

13. Did you experience or did you observe any outstanding features or opportunities associated with your secondary activity during this flow ***on the lower Saluda River today***? *(Check one box.)*

☐ YES
☐ NO → SKIP TO QUESTION 15

14. Please provide a brief description and location of any experienced or observed outstanding features or opportunities during this flow ***on the lower Saluda River today***. (*Fill in the blank*.)

Location: _____ Description: _____

Location: _____ Description: _____

Location: _____ Description: _____

15. Compared to ***today's*** flow level, would you prefer a level that was higher, lower, or about the same for your secondary activity ***on the lower Saluda River***? *(Circle one number.)*

Much Lower	Lower	No Change	Higher	Much Higher
1	2	3	4	5

16. Given the opportunity, would you choose to participate in this activity ***on the lower Saluda River*** at this flow level? *(Check one box.)*

☐ YES
☐ NO

17. Why or why not? (*Fill in the blank*.)

_____

_____

_____

_____

_____

18. Do you have any additional comments? (*Fill in the blank*.)

_____

_____

_____

_____

THANK YOU FOR YOUR HELP! WE APPRECIATE YOUR TIME TODAY!

APPENDIX D

SUMMARY OF RELEVANT RECREATION PLANS

Report: South Carolina Department of Parks, Recreation and Tourism. 2002. South Carolina State Comprehensive Recreation Plan.

Synopsis:

The South Carolina State Comprehensive Recreation Plan (SCORP) was developed to provide for a formal planning process, conserve natural and cultural resources, and contribute to the State's economic well-being and quality of life. The six main goals of the SCORP are: to continue a planning process for the administration of outdoor recreation opportunities, provide a comprehensive system of public and private recreation lands and sites, provide opportunities for enjoyment of historic and natural heritage opportunities, provide opportunities for outdoor recreation and improved quality of life to all segments of the population, encourage cooperative efforts to meet recreation needs, and encourage sustainable development. Key issues of the SCORP include:

- Issue 1: Protect significant lands for natural and cultural resources allowing public recreational use.
- Issue 2: Manage and expand trail resources (trail mileage, availability, and facilities) for multiple uses.
- Issue 3: Maintain and improve existing parks and recreational facilities.
- Issue 4: Increase funding for a variety of parks and recreational facilities.
- Issue 5: Acquire public open space for recreational use, including urban parks, neighborhood parks, and greenways.
- Issue 6: Provide more multi-use athletic complexes and active recreational facilities for youth.
- Issue 7: Create partnerships between and among government agencies and the private sector to build, maintain, and promote recreation sites and resources, and to implement existing plans.
- Issue 8: Implement existing plans.
- Issue 9: Increase opportunities for activities of high recreational demand.
- Issue 10: Increase ongoing education of users about recreation opportunities and to avoid user conflicts and protect resources.
- Issue 11: Increase public beach access.

Detailed recommendations within each of the 11 major issue categories are outlined in the SCORP. Among those pertinent to the lower Saluda River are:

- Hydropower Projects - The SCDNR, SCPRT, and others will continue to encourage utility companies to conserve open space on lakes and rivers associated with hydropower projects.
- Scenic Rivers - The SCDNR will continue to work with landowners and communities in designating significant rivers as state scenic rivers and work toward conservation of these resources.
- Multiple Use Urban Trail Resources - The Cities of Columbia, West Columbia and Cayce will continue creation of the Three Rivers Greenway. The Irmo-Chapin Recreation Commission and partners will extend trails from Saluda Shoals Park along the lower Saluda River.

- Canoe Trails - The Lower Saluda Scenic River Advisory Council will seek to establish additional canoe/kayak access on the Lower Saluda above Riverbanks Zoo.
- Implementing Existing Plans - Lower Saluda Corridor Plan - The Lower Saluda Scenic Advisory Committee, SCDNR, SCPRT, and others will continue to work together to implement the corridor plan. The coalition is working with South Carolina Electric and Gas Company (SCE&G) to improve safety and protect the scenic qualities of the river. The Irmo-Chapin Recreation Commission will continue to develop the Saluda Shoals Regional Park. SCE&G, Trout Unlimited, SCDNR, and DHEC will work toward improvements in the water quality of the river. Establishment of a public greenway has been recommended through a planning charrette update of the plan.

Report: South Carolina Department of Parks, Recreation and Tourism and the Palmetto Conservation Foundation. 2002. Expanding the Experience: Trails for South Carolina. The South Carolina State Trails Plan.

Synopsis:

The State Trails Plan was developed to promote coordination between state agencies, advocates and the public with respect to trail acquisition and development, assist resource managers in the decision making processes that affect trails development such as grant funds, and to promote the state as a leader in trails development, tourism and recreation. The goals of the Plan include:

- developing an interconnected network of trails across the state and encourage connectivity of existing trails,
- promoting sustainable trails development that minimize effects to the surrounding environment while maintaining longevity,
- develop trails to provide access to tourism destinations and points of interest,
- encourage multiple use of trails in the state,
- promote public use and access,
- encourage trails for fun, economic development, and health benefits.

Existing and proposed trails for the state are identified by county. In Richland County, the lower Saluda River is identified as a canoe trail. Proposed trails in Richland County include the Three Rivers Greenway. In Lexington County, the Saluda Shoals Greenway is identified as an existing hiking trail, the Three Rivers Greenway is identified as a hiking/biking trail, and the Woodlands Walk and River Trail at Riverbanks Zoo are identified as existing interpretive trails. Proposed trails for Lexington County include an extension of the Saluda Shoals Greenway, a Saluda Shoals Horse trail, and an 8 mile trail connecting Saluda Shoals Park to the Riverbanks Zoo.

Report: Richland County. 2004. Greenways for Richland County, Connecting Our Communities.

Synopsis:

Richland County developed the Plan to promote non-motorized use, recreation, transportation, and conservation of open lands in the County. Some of the Plans goals for greenways in the County include: coordinate greenway development with state and local agencies, promote greenways for recreation and non-motorized transportation, conserve and improve wildlife habitat. Among the resources existing in the County with respect to Greenways are the Three Rivers Greenway and the Palmetto Trail. The County seeks to expand the greenways in the County over a 20 year timeframe by: coordinating with state and local agencies, incorporating existing facilities, acquiring additional lands and sites for incorporation into the greenway, creating a Greenway Overlay District in the Country which would have specific development restrictions and protection measures, and provide grants for trail development and stream restoration.

Report: South Carolina Water Resources Commission, South Carolina Department of Parks, Recreation and Tourism and the Lower Saluda River Task Force. 1990. The Lower Saluda River Corridor Plan.

South Carolina Design Arts Partnership. 2000. Lower Saluda River Corridor Plan Update. Prepared for the Lower Saluda Scenic River Advisory Council and the South Carolina Department of Natural Resources.

Synopsis:

The Lower Saluda River Corridor Plan (1990) is comprised of two main components: a) recommendations for the lower Saluda River and b) a visual Master Plan for the corridor which identifies several parks or points of access in the corridor. Among the recommendations for the corridor are:

- Access and Facilities – patrolling, staffing and law enforcement access, to deter inappropriate behavior, ADA accessibility of facilities, obtain scenic easements, create linear trails in the corridor, recognize upper section as good canoeing, do not encourage additional public motor access, develop a canoe portage around Mill Race Rapids and Shandon Rapids, develop river access in conjunction with the Irmo-Chapin Recreation Commission, provide an additional hand-carry boat launch between Hope Ferry (Metts Landing) and I-26, provide an angler access site below I-20, improve the Gervais Street Landing, create a regional park in the vicinity of Corley Island.
- Historic and Archaeological Sites – develop the history of the corridor, conduct archaeological surveys of the corridor, identify areas suited to interpretive purposes, coordinate with other recommendations to ensure that there is no conflict with historic and archaeological resources.
- Law Enforcement – increase patrols and law enforcement access, close parks during certain hours, establish a no firearms zone, prohibit alcohol at public recreation sites, post fines for littering, train law enforcement in whitewater rescue, improve parking, establish central locations for rescue equipment, establish user laws and regulations, develop protocols for rescue operations and law enforcement, and prohibit unauthorized vehicles.
- Litter – improve public awareness, develop a management plan for litter control, provide regular receptacle maintenance, clean up existing sites, enforce existing litter laws, post litter fine signs and impose harsher penalties, and promote volunteerism.
- Resource Protection – support the protection of the lower Saluda River through the South Carolina Scenic rivers Act, support land and easement purchases, promote the formation of an Overlay Zoning District with development restrictions and resource protection measures, support the establishment of wildlife and botanical sanctuaries, enhance the scenic quality and water quality of the corridor through revegetation and buffers, support efforts to manage the river as a year round warmwater and coldwater fishery, support continued scientific studies for water quality, support efforts to minimize non-point source pollution,

eliminate wastewater discharge from the river, and support the reclassification of the river from Class A to Trout Waters.

- User Safety – improve access for rescue purposes, develop and improve a river warning system, install river map signs at all access points, pass on rescue costs to river users, train whitewater rescue personnel, coordinate with SCE&G to get periodic information on flow releases, provide a portage at Mill Race, remove rebar at rapids, control access at the Riverbanks Zoo, standardize place names, create a river map for distribution outlining hazards, and develop other public education materials.

The lower Saluda River visual concept plan consists of a map outlining existing river features, existing public access, and proposed improvements such as those outlined above.

The Lower Saluda River Corridor Plan was subsequently updated in 2000. The Plan revisits the recommendations and proposals made in the original plan.

The Update discusses various issues previously identified in the original plan by river section. Among the issues identified were: the need for improved and additional access, design considerations for trails (universal access versus more natural trails), improved signage, trash receptacles, and benches as access points, access site design considerations such as gating the sites closed at night, increased parking removed from the river, maintain natural environments and vegetation to the extent possible, maintain a natural appearance, provide appropriate landscaping at sites to minimize environmental and visual effects, designate a management group for the proposed greenway trail, and development of a public awareness and education campaign.

A key issue raised in the Update was the need to work closely with SCE&G to maintain a higher minimum flows, provide water quality to support the fishery habitat year round and increase the safety of water releases. In addition, recommendations for the transfer of management of recreational facilities on the north side of the Saluda River from SCE&G to the greenways management group was recommended. SCE&G would be expected to provide some form or financial remuneration to the group for the management of these facilities including maintenance, utilities, and coordination with law enforcement.

Featured prominently in the Update is the Three Rivers Greenway, which is identified as providing a 12-mile linear park system along the Broad, Congaree and Saluda Rivers. The Update of the concept plan consists of maps of the four sections of the river outlining existing river features (including facilities built or improved since the original Plan), existing public access, and proposed additional or continued improvements and incorporation of these four sections into a corridor Greenway Trail to be linked with the Three Rivers Greenway.

Several implementation proposals are recommended in the Update:

- Establish a Greenway Trail Task Force to secure partner commitments, negotiate easements, seek grants, provide input into the dam relicensing process, and conduct public education efforts.
- Create a Saluda River Management Committee to establish consistent policies and regulations for use of the corridor, investigate strategies for controlling trespassing and identifying additional access, and implement annual clean-up campaigns.
- Have regular meetings of the Advisory Council to work on water quality ordinances with counties and municipalities and work on flow issues with SCE&G.
- Prepare a brochure for the Greenway Trail plan.
- Schedule presentations on the Greenway Trail plan.
- Create a river map to standardize place names and educate users about the river and hazards.
- Organize a Saluda River festival to raise funds and build public support.

Among the core projects identified for the Saluda River Greenway Trail are:

- Complete construction of improvements to Saluda Shoals Park (2000 – 2001)
- Implement Section 1 (improvements, easements, access points and connectivity of Metts Landing (Hope Ferry)/Saluda Shoals to Gardendale) of the Greenway Trail (2000 – 2004).
- Implement Section 2 (improvements, easements, access points and connectivity of Dam to Metts Landing (Hope Ferry)/Saluda Shoals) of the Greenway Trail (2001 – 2004).
- Implement new take-out at Stacy's Ledge (2000 – 2006).
- Implement Section 3 (improvements, easements, access points and connectivity of Gardendale to I-26) of the Greenway Trail (2004 – 2010).

Related projects identified are:

- Implement the Three Rivers Greenway Trail including access above the zoo and below the I-26 bridge and connection across the Broad River and to West Columbia (2000 – 2010).
- Construct an improved portage trail at Mill Race Rapids (2000 – 2002).
- Conduct an inventory of flora and fauna in the corridor (2000 – 2002).
- Construct improvements at Metts Landing (Hope Ferry).

Report: The River Alliance. 1997. Instream Flow Analysis for Paddling. Lower Saluda River.

Synopsis:

The River Alliance conducted an instream flow analysis for paddling on the lower Saluda River during the spring and summer of 1997. The instream flow analysis consisted of five scheduled flow release ranges that were paddled by a minimum of 18 participants in a variety of non-motorized watercraft (canoes, kayaks, and rafts). The flow releases assessed were as follows:

April 17, 1997	1,940 cfs to 1,990 cfs
May 8, 1997	15,900 cfs to 16,500 cfs
July 1, 1997	4,390 cfs to 4,520 cfs
July 10, 1997	9,630 cfs to 10,700 cfs
July 11, 1997	6,740 cfs to 8,200 cfs

Because the upper section of the lower Saluda River is primarily flatwater, regardless of flow release, this section was not evaluated as part of this study. The rest of the lower Saluda River, beginning at Gardendale Landing, was delineated into two sections. Section 1 was considered primarily scenic without significant whitewater features and extended from Gardendale Landing to the "orange pier" just upstream of Mill Race rapids. Section 2 includes two sets of named rapids ranging from Class II to Class V, depending on water level. This section extended from the orange pier above Mill Race rapids to the Senate Street Landing, downstream of the confluence with the Broad River. Paddlers in open canoes only evaluated the two lowest flow events. All other craft paddled all flow events. Results indicated:

- Boating was generally available and "enjoyable" at every water level in every type of craft with the exception of open canoes.
- Paddlers in open tandem canoes preferred the 4,390 cfs to 4,520 cfs flow over the 1,940 cfs to 1,990 cfs even though they became swamped at the higher flow.
- Kayakers expressed moderate enjoyment at the 1,940 cfs to 1,990 cfs flow event and gave higher ratings with each increased flow event.
- The 6,740 cfs to 8,200 cfs flow event barely inundated several rocks which caught some kayakers by surprise.
- Rafting participants gave consistently high ratings for every flow event for both sections of the river.
- Respondents provided the following suggested flow ranges for optimum enjoyment of paddling activities on the lower Saluda River:

  Canoe 3,000 cfs to 13, 500 cfs
  Kayak 4,400 cfs to 14, 600 cfs
  Raft 4,000 cfs to 11,500 cfs

APPENDIX E

HEC RAS FLOW MODEL ANALYSIS TABLES

APPENDIX F

FLOW DURATION CURVES FROM HEC RAS FLOW MODEL ANALYSIS

APPENDIX G

COMMENTS ON DRAFT FLOW STUDY REPORT AND RESPONSE TO COMMENTS

Name	Date	Comment	Response
Mike Waddell, Trout Unlimited	October 17, 2007	Change Table 3-3 under wade fishing up to "1000 cfs" instead of "800 cfs"	Because Table 3-3 represents comments received during the focus group meeting and this flow level was not mentioned or discussed as acceptable at that time, no changes to Table 3-3 will be made. Furthermore, wade anglers participating in the 1,078 cfs on-site evaluation event noted that this flow was only moderately acceptable for this activity.
Mike Waddell, Trout Unlimited	October 17, 2007	Statement in an email to Mike, "The water comes up over 4 feet in 15 minutes under that operational assumption …." To be included in report	This analysis is already included in the report and discussed on pages 51 and 52 in Section 3.3.3.
Mike Waddell, Trout Unlimited	October 17, 2007	Explain where the values are coming from in tables, i.e., data recorders or model results	This statement is already made in the report in several locations. There are no analysis tables that come from the level logger data. All analysis in this report is derived from the HEC RAS flow model.
Bill Marshall, SCDNR	October 18, 2007	Page 10 paragraph explaining the hydro operational scenarios: Analysis of maximum flow scenarios that create conditions that pose the greatest risks to downstream river users should be included.	An "extreme reserve call operations scenario" was modeled to determine the rate of change in the first 15 minutes, 30 minutes and 60 minutes from the start of rise at each level logger location. This scenario models an incremental rise of 1,750 cfs for the first 10 minutes of operation to 18,000 cfs for a 24 hour duration. This analysis is included in the results section.
Bill Marshall, SCDNR	October 18, 2007	Page 13: How would the incremental flow increase of 1,167 cfs per minute, versus 850 cfs, effect the results for rate of change?	It is expected that rates of change would be fairly proportionate to flow levels. Additional analysis for the modeled "extreme reserve call operations scenario" has been included.

Name	Date	Comment	Response
Bill Marshall, SCDNR	October 18, 2007	Page 11 Second and third paragraphs that refer to matching calculated hydraulic results with the observed hydraulic results: The report needs to include more information and discussion of observed hydraulic results.	This comment has been addressed in the report.
Bill Marshall, SCDNR	October 18, 2007	Page 13 First Paragraph explains assumptions related to analysis and reports that incremental flow increases were set at 850 cfs per minute: Flow scenarios using the max. incremental flow of 1,167 cfs per minute should be used and differences between 850 & 1,167 cfs should be demonstrated and explained.	Additional analysis for the modeled "extreme reserve call operations scenario" has been included.
Bill Marshall, SCDNR	October 18, 2007	Page 13-14 regarding the paragraph explaining "wave arrival": More graphical presentation would help improve information.	Wave arrival time refers to the first instance of an increase in stage over baseline conditions experienced at each level logger location under each flow operations scenario. It is unclear what graphical presentation is requested.
Bill Marshall, SCDNR	October 18, 2007	Page 13-14 regarding the paragraph explaining "wave arrival" the last sentence of this paragraph mentions the importance of understanding the first 15 miuntes following "wave arrival" compared to overall rate of change at each location on river: The first 15 and 30-min. periods of time after wave arrival and the first 1-4 feet in rise are most important aspects in understanding "wave arrival".	Comment noted.

Name	Date	Comment	Response
Bill Marshall, SCDNR	October 18, 2007	Page 14 Second paragraph, last sentence: Sentence needs clarification. Should say "between start of rise to 75% and 90% of maximum"	The greatest increase in stage and greatest rate of change occurs at between 75% and 90% of maximum regardless of starting point: start of operations or start of rise.
Bill Marshall, SCDNR	October 18, 2007	Pages 13-14 discussion of assumptions: Explain what boundary conditions were used in the downstream side (does it always include 500 cfs flow?)	Baseline conditions are 500 cfs flow regardless of pre- or post-operation conditions. This has been clarified in the report.
Bill Marshall, SCDNR	October 18, 2007	Page 17 Second paragraph Edit: Cornerstone Presbyterian Church, located off of Old Bush River Road, owns waterfront property adjacent to the boat ramp at Saluda Shoals Park (not Rawls Creek)	This has been corrected in the report.
Bill Marshall, SCDNR	October 18, 2007	Page 21 "A hand-carry access site below the I-20 bridge (City of Columbia is currently workon on this access site)": Should say "site below I-26 bridge"	This has been corrected in the report and Appendix B.
Bill Marshall, SCDNR	October 18, 2007	Pages 27-29 Comment: Need a better way to characterize "available flows" for recreationist. Looing at hourly averages and describing when favorable flow ranges are maintained for some period of time (and not just a brief point on a dynamic hydrograph)	Hourly average analysis has replaced daily average analysis in Table 3-5 and subsequent discussion.
Bill Marshall, SCDNR	October 18, 2007	Page 73 bullet item: Is the telephone ring-down system in place or not?	The telephone ring-down system is under development. This has been updated in the report.

Name	Date	Comment	Response
Bill Marshall, SCDNR	October 18, 2007	Page 80 Third paragraph: The River Alliance study did not evaluate flows for flatwater boating. As reported on pp. 22-23 "focused only on sections of the lower Saluda which had whitewater characteristics". On page 45 a table RA reports flows as "recommended safety ranges" for "canoe" but dos not distinguish between the "open tandem canoe" and "whitewater canoe" categories.	The River Alliance Instream Flow Study identified 4,400 cfs as most favorable for travel boating in an open decked tandem or closed deck solo canoe without significant whitewater features. This has been corrected in the report.
Bill Marshall, SCDNR	October 18, 2007	Page 81-82 Comment: The rate of changes analysis and conclusions about rate of change should address a max. and sustained flow scenario from the hydro plant that produces the most rapid change effects downstream at all sites.	Additional analysis for the modeled "extreme reserve call operations scenario" has been included.