MEETING NOTES

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

Saluda Hydro Field Office
May 3, 2006

ATTENDEES:

Bob Olsen, NRE
Bret Hoffman, Kleinschmidt
Bud Badr, SCDNR
Feleka Arega, SCDNR
Larry Turner, SC DHEC
Michael Waddell, TU
Mike Schimpff, Kleinschmidt
Randy Mahan, SCANA Services
Ray Ammarell, SCE&G

ACTION ITEMS:

- Determine method of accounting for evaporation.

Bob Olsen, Mike Schimpff

- Complete "planning" model with USGS information on lake levels and downstream flow, and evaporation from the lake.

Mike Schimpff

- Gather un-gauged inflow, rainfall and watershed information for calibrating model.

Mike Schimpff, Bob Olsen

- Contact USGS regarding verification of data used in model.

Ray Ammarell

- Compile tailwater rating curve.

Bret Hoffman

DATE OF NEXT MEETING: **Mid-July, Final Date TBD**

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MEETING NOTES:

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

Mike S. opened the meeting with a brief discussion of the selected model, HEC-ResSim, noting that it is becoming the standard for relicensing nationwide. After going over the agenda, he explained that he had developed the model structure, and is seeking review and input on it during this meeting. The purpose of this model would be to use constraints to determine impacts to various group interests. Running the model with these constraints will result in a handful of reasonable options for diverse interests, and output information will be available to groups. It was resolved at a previous Operations RCG meeting that all issues can be tied to lake level and outflow.

The current model structure extends downstream on the Congaree River to the Congaree National Park, and up the Broad River for incorporating those inflows into the confluence. It was decided that the model would use the Broad River up to the Alston gage because it is the closest location that gives streamflow data.

Input for Model

USGS data and watershed information are used as inputs for flows when building the model. As the group discussed available hydrologic data, it became apparent that long-term watershed records of rainfall and certain inflows are not available, but lake level and outflow information is. Bob suggested using lake level information (including evaporation) and outflow to build the model, then calibrating this with lake level information combined with more recently available rainfall and inflows. Bud added that two models could be made; the first model (which uses lake levels and outflow long-term data) could serve as the a planning model, and the calibration model could serve as an operations model. The planning model would be used for the relicensing efforts, evaluating impacts of various alternatives; the operations model could serve SCE&G in the future as a guide for operating the facility, incorporating real-time data (such as rainfall in the drainage basin). Since the planning model would be for a long-term perspective, it could be run on daily increments. The operations model, used for short-term evaluations, would be run in hourly increments.

For USGS data, Mike S. explained that the program can automatically collect it from their online database. However, other information needed to calibrate the planning model and create the operations model need to be collected; this includes un-gauged inflows and rainfall. Evaporation data will also need to be collected. Ray mentioned that Bob has already generated a significant amount of information that could be incorporated into the model. It was noted that Lake Greenwood operation results in a regulated inflow, and two other gauged inflows are unregulated

(Bush River and Little River). Ray and Bob estimated that approximately 75% of the inflow is gauged. An "un-gauged inflow" input can be used to combine other inflows and rainfall runoff. The drainage areas contributing to the gauged inflows will have to be removed from the un-gauged contribution.

For the preliminary structure of the model, Mike S. has input the stage / storage curve data into the model; historical operational data was used for a preliminary guide curve, which shows drawdown levels and schedules for reservoir water levels. Evaporation needs to be incorporated, and a discussion of options for this was held. Bob has monthly evaporation data, and Mike noted that there are many days when the lake has negative inflows because of evaporation. Ray stated that the model needs to use net evaporation, which includes rainfall. Bob suggested developing algorithms to account for evaporation; Mike S. will work with Bob to determine this input.

Turbine performance, generation schedules, dissolved oxygen levels, and other operational constraints can also be incorporated into the model. A tailwater rating curve is another set of information that contributes to energy calculation. Formally, no such curve exists; however, Ray noted that one has been created from two USGS gages (one at the tailrace, the other at the SCE&G boat ramp downstream). Additionally, data exists from recent turbine venting studies that may be compiled for more accurate curves.

Locations of interest need to be provided by the RCG's and TWC's, both on the lake and in the river; they will be entered into the model as nodes with constraints or parameters. For each location, the issue of concern (water quality, temperature, etc.) will need to be related to water elevation and flow; these two parameters are required input for each point. Alan Stuart has provided Mike S. with some locations anticipated for evaluation, but they are preliminary. Randy noted that the water quality group was working on selecting points of interest for the lake and the river. At these identified points, cross-sections will be used for computational modeling, determining how operations affect flow and stage. Bob has developed many cross-sections of the project, which may contribute to the model if they are at or near selected locations.

Running the Model and Output Information

A final result of the planning model would be a new guide curve, which SCE&G could use to operate the project to target ideal lake levels. The parameters that affect the curve are impacted by stakeholder requests. The guide curve will reflect the concept of conserving the power pool while taking into account other demands from stakeholder interests.

Larry brought up the subject of years of high flows versus very low flows. As part of the relicensing process, a plan will be created for drought situations, with prioritized water allocations

outlined; generally, there is no concern about water during years of heavy flow except from a safety perspective to prevent extreme lake levels.

Mike S. explained that there were many other optional parameters associated with each node, but for our process information generated by the model at each node will always be tied back to water elevation and flow. It is an iterative process between the model output and a group's interests; if the output isn't in their format, they have to evaluate it. For example, the program will not run a W-2 model for every scenario and location for the water quality group. Generated information will have to be evaluated by each group to determine if the scenario is acceptable.

Ray noted that HEC-Res could be used to determine hydraulic parameters in addition to stage and flow at selected nodes. While other programs could do this, HEC-Res can import and export data from the model program, streamlining the process. For example, travel time for flow releases could be generated, which Mike W. noted would be useful for downstream safety warning systems. Bob mentioned that he had some data about downstream flow characteristics, explaining that the dynamics of the river are different between steady operation (such as occurs during a drawdown) and short duration heavy releases. The short-term heavy flows do not stabilize over the downstream stretch of river, and have less impact on rate of rise farther downstream.

Regarding available information created by the model, Randy brought up the need to focus on necessary information for individual points of interest. Mike W. elaborated that generating every possible parameter for every node just because it is possible would bog the process down. It was agreed that information requests needed to be specific to keep the process moving efficiently.

For the generated information, Bud said the groups should provide a frequency of exceeding constraints that was acceptable, as well as a tolerable magnitude of these infringements. He suggested bringing one person from each TWC or RCG as a judge or representative to meet with the operations group for determining a successful level of alternatives.

Items for Moving Forward

Mike will now work to complete the development of the base model, then meet with the TWC again to agree on the final model. Consideration will be given to holding a joint RCG meeting to explain the model setup to all RCG's for general acceptance. A representative from the USGS will be contacted to attend the meeting and validate the information being used in the model. Mike said his target date for completing the model was mid-July.