



Memorandum

To: SCDES

From: CDM Smith

Date: January 12, 2026

Subject: 2025 Santee SWAM Model Updates

1.0 Introduction and Overview

The Santee Basin baseline water quantity model was updated to incorporate newly available water use and return data and to extend the baseline hydrologic period of the model. Model updates included recalculating baseline 10-year average water demands (2014 to 2023) for all water users, adding new water users, removing water users with inactive registrations, and updating reservoir rules to reflect reservoir operational changes. The baseline simulation period was also extended. Extending the baseline simulation period required using recent USGS streamflow gage data, combined with water use and return data and area transposition methods to generate model headwater boundary condition flows.

The result of this work is an updated model with more recent representation of water demands in the basin and a larger range of hydrologic variability captured by the simulation period. Previously calibrated hydrologic parameters throughout the basin were reviewed with comparisons of modeled and gaged flows.

The Santee Basin baseline water quantity model was also updated to incorporate recent enhancements to SWAM, the most significant being the addition of a scenario planning module.

2.0 Model Object Changes

Through conversations with South Carolina Department of Environmental Services (SCDES), it was determined that the Santee model should be adjusted to start just downstream of where the Saluda and Broad Rivers combine to form the Congaree River. In the previous configuration, the Santee model began just upstream of the confluence of the Wateree and Congaree Rivers, and the portion of the Congaree upstream of this confluence was captured by the Saluda model. All tributaries, gages, and water user objects downstream of SLD27 (which is near the confluence of the Saluda and Broad Rivers) in the Saluda model were brought into the Santee model. Outputs from the Saluda Model at SLD27 now form the headwaters for the Santee model. Gage names originally in the Saluda model still contain the "SLD" prefix.

As part of the updating the model, several new water users were added to the model and several inactive users/intakes were removed. New water users represent those that are newly registered

or have just recently surpassed the minimum water use threshold for inclusion in the model of 3 million gallons per month (MGM). The water user and discharge objects added and removed are listed below. Several objects also changed ownership while retaining the same permit number; these are listed below with updated object names.

Objects added*

- IR: Wiles Farm
- IR: Dargan Culclasure Farm
- IR: Palmetto Farms
- IR: Ricard Farms

*Note – this list does not include already existing objects that were transferred from the Saluda Basin to the Santee Basin, only objects that represent new registrations

Objects removed

- IR: Parsons Nursery
- IN: Navy
- St. Matthews (Discharge Object)

Objects that changed names (Old Name → New Name)

- IN: Kapstone → IN: Ingevity (Kapstone)
- IN: BP Amoco → IN: INEOS (BP Amoco)
- IN: Celanese → IN: Celanese (DAK)
- IN: DAK Congaree → IN: Alpek (DAK Congaree)
- MI: Martin Marietta → MI: Martin Marietta Quarry (Note: this object on the Congaree River was originally in the Saluda model, and the name was changed to distinguish this object from the IN: Martin Marietta object located on the Santee River.)

In addition to adding, removing, or renaming objects, water demand estimates were updated to more accurately reflect current conditions. New baseline water demand, discharge, and consumptive use estimates for the 10-year period 2014 through 2023 were developed using the SCDES reported water use and discharge data. These calculations were consistent with methodologies employed for the original baseline model development (CDM Smith 2017). Updated mean monthly water demands and discharge parameters were entered into the model for all water user objects.

In 2023, the Federal Energy Regulatory Commission (FERC) issued a new 50-year license order to Santee Cooper for the continued operation of Lakes Marion and Lake Moultrie. The updated FERC license also came with updated instream flow requirements that needed to be reflected in the model. Through discussions with Santee Cooper staff, a simplified version of the new FERC rules was included in the SWAM Model. Per the updated FERC license, the target weekly minimum release from Lake Marion to the Santee River is 2,400 cfs in December through April and 1,200 cfs the rest of the year. When Lake Marion drops below its operating curve range for an extended time period, the target minimum release drops to 600 cfs. The required weekly average minimum release from Lake Moultrie to the Cooper River is 4,500 cfs. An additional 5,600 cfs is released from Lake Moultrie into the Santee River via the Rediversion Canal to support fish passage operations at the St. Stephen Hydroelectric Station in March, April, and part of May. The 4,500 cfs weekly average discharge from the Jefferies Hydroelectric Generating Station into the Cooper River is intended to prevent saltwater from migrating up the Cooper River. The 5,600 cfs release from the St. Stephen Hydroelectric Generating Station is for fish passage and is routed through the re-diversion canal back to the Santee River. Santee Cooper has the ability to reduce the 5,600 cfs release when necessary to preserve reservoir levels, meet the other target minimum releases, or ensure adequate water is available for the Lake Marion and Lake Moultrie RWS withdrawals. Operators of the lakes are able to adjust release rates on an hourly basis, which provides more flexibility in downstream flow maintenance than what is approximated in the model. **Figure 1** shows Lake Marion's operating curve, taken from the Santee Low Flow and Contingency Plan (Santee Cooper 2024) and with notes detailing how the SWAM release rules are based on lake elevation.

Santee Cooper Project P-199
 Low Inflow & Drought Contingency Plan
 Last Revised 11/13/2024

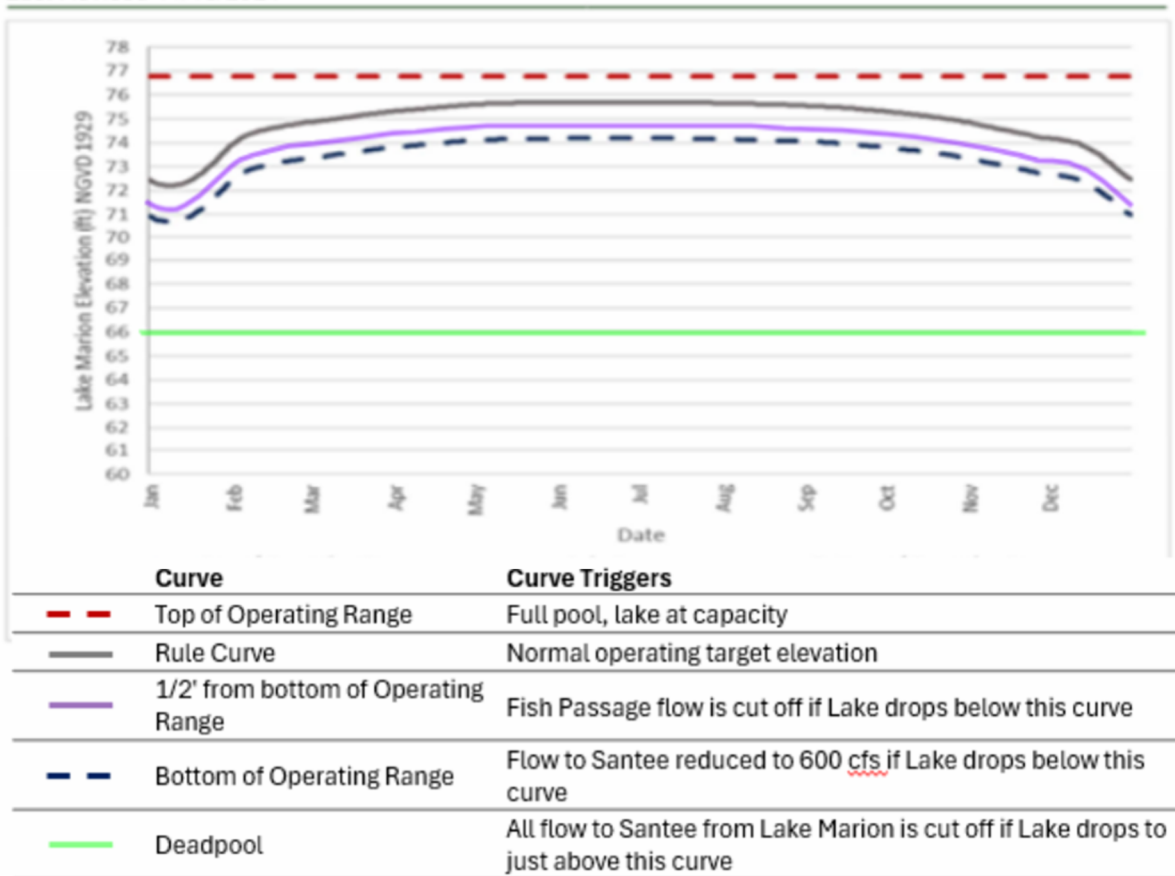


Figure 1 Rule Curves of Lakes Marion and Moultrie, and how the Curves affect the SWAM Model.

The deadpool and stage-storage relationships of the lakes were also revisited during review of the reservoir rule changes. The deadpool of Lakes Marion and Moultrie were adjusted from 60 ft to 66 ft based on feedback from Santee Cooper. The stage-storage relationships were also updated, although their values remained close to the previous model's values.

3.0 Baseline Period Extension

With other river basin models, the baseline simulation period is typically extended to include the latest gage, water use, and discharge data. However, the Santee model is located downstream of the Saluda, Broad, and Catawba basins. As such, outputs of these models are used as model boundary condition (headwater) flows to the Santee model. The Santee model's baseline simulation period can only extend through 2019, the last year that falls within the simulation period of all upstream models. Thus the model baseline simulation period was extended from 2010 to 2019.

Headwater flows not formulated from outputs of an upstream model were also extended nine years, on both a monthly and daily timestep. As done for the original model development, un-

impaired gaged flow data were used to estimate flows at ungaged model input locations. The statistical methods employed, and the assignment of reference gages, are described elsewhere (CDM Smith 2016a, 2016b).

The USGS gages serve as key reference points for ungaged flow estimates at model input points. Area transposition methods, based on ratios of drainage areas, were used to estimate monthly and daily flows for the period extension, for key model headwater input locations. The assignment of reference gages for this exercise matched that employed during the original model development.

4.0 Model Validation

Existing model hydrologic parameters throughout the basin were validated using data associated with the extended simulation period. In the Santee, validation is difficult because there are relatively few USGS Flow Gages in the basin. Furthermore, the flow to these gages is governed by canals that artificially transfer flows, and the rules that govern the transfer of flows recently changed with the updated FERC licensing. Still, a simple visual comparison of modeled and gaged flow for the extension period (2010 to 2019) returned satisfactory results for basin gages used in the initial calibration and verification, thereby validating previous calibration work. Validation also came through conversations with large stakeholders in the basin confirming baseline model results as representative of current operating conditions and consistent with their on-the-ground understanding of system behavior.

5.0 References

CDM Smith, 2016a. Technical Memorandum – Methodology for Unimpaired Flow Development Santee River Basin, South Carolina

CDM Smith, 2016b. Technical Memorandum - Unimpaired Flow Dataset for the Santee River Basin.

CDM Smith, 2017. South Carolina Surface Water Quantity Models – Santee River Basin Model.

Santee Cooper. 2024. Low Inflow & Drought Contingency Plan. Santee Cooper Project – FERC Project No. 199.