



Surface Water Availability Assessment in South Carolina Legislative Quarterly Report, November 2015

Background

South Carolina currently has limited scientific information about the future demands on and availability of our water supply. As a result, the General Assembly allocated \$1.5M to complement South Carolina's new surface water permitting program administered by SC Department of Health and Environmental Control (DHEC), and to gather the information necessary to update the State Water Plan developed by SC Department of Natural Resources (DNR). The two agencies are in the process of gathering data on South Carolina's eight basins: Broad, Catawba, Edisto, Pee Dee, Salkehatchie, Saluda, Santee, and Savannah.





Scientific Process for Measurement and Legislative Reporting

The availability assessment will develop a computer-generated model of each of the eight basins to evaluate existing water availability. These analyses will be used to inform the resource agencies and stakeholders if there are areas of the State where there is a “gap” or concern about the amount of water needed to meet our increasing demands over the next 50 years.

The funds appropriated above to the DNR for the State River Basin Study Project must be used for water data collection to provide scientific information on water resources in the state’s eight major river basins. The DNR shall, in cooperation with DHEC, submit to the Senate Finance Committee, the House Ways and Means Committee, the Senate Agriculture and Natural Resources Committee, and the House Agriculture, Natural Resources and Environmental Affairs Committee, a report on the project’s timeline, findings, and expenditure of funds on a quarterly basis. Additionally, this information will be posted electronically on DNR and DHEC websites.

Summary of Activities During the Past Quarter

CDM Smith’s *Simplified Water Allocation Model (SWAM)* will be used for the project. During the past quarter, the Saluda Basin Pilot Model was constructed, representing the first model completed for the project. A final review of the model by DNR, DHEC and the TAC is in progress. A draft unimpaired flow (UIF) dataset for the Edisto basin was completed and submitted to DNR and DHEC for review. To date, UIF datasets have been completed for the Saluda and Edisto basins. A technical memorandum documenting the unimpaired flow methodology for the Broad basin was prepared and submitted to DNR and DHEC for review. Model schematics and frameworks of the Pee Dee and Catawba basins were developed and submitted to DNR and DHEC. To date, model frameworks have been completed for the Saluda, Edisto, Broad, Catawba and Pee Dee basins. Registered and permitted water users in all eight basins have been contacted to confirm current and historic water withdrawals, sources, and discharges, and to confirm other operational parameters.

The first of two planned stakeholder meetings in the Pee Dee Basin was held on November 3rd at the Clemson Pee Dee Research and Education Center in Florence, and the first of two planned stakeholder meetings in the Catawba-Wateree Basin was held on November 4th at the City of Rock Hill Operations Center in Rock Hill.

Progress reports are being provided by CDM Smith at monthly conference calls and at in-person meetings with DNR, DHEC, and the Technical Advisory Committee. Written monthly progress reports and meeting notes are being posted on the DNR webpage. In addition to the monthly progress reports, CDM Smith is required to prepare quarterly progress reports, the fifth of which



is provided below. Financial statements can be found at the end of this report. Additional information on the project can be found at the following websites:

<http://dnr.sc.gov/water/waterplan/surfacewater.html>

<http://www.scwatermodels.com/>

South Carolina Surface Water Quantity Models Quarterly Progress Report No. 5

August 16, 2015 to November 15, 2015

Introduction

The South Carolina Departments of Natural Resources (DNR) and Health and Environmental Control (DHEC) have contracted with CDM Smith to develop surface water quantity models in the eight major river basins in South Carolina. Per the requirements of the contract, CDM Smith will prepare and submit Quarterly Progress Reports summarizing work completed on each basin model. This fifth Quarterly Progress Report covers the three month period from August 16, 2015 to November 15, 2015.

The Quarterly Progress Report provides a bulleted summary of activities and accomplishments; identifies upcoming work and deliverables; highlights issues that have the potential to impact scope, schedule or costs; and provides the current project schedule. Activities and accomplishments are presented for the following categories: (1) project planning and management; (2) data collection; (3) data analysis and modeling; and (4) stakeholder involvement.

Activities and Accomplishments

Project Planning and Management

- Monthly Progress meetings attended by CDM Smith and DNR/DHEC project staff were held on September 8th, October 7th and November 2nd, 2015
- Project submittals to date include:
 - Draft and Final Modeling Plan
 - Draft and Final Unimpaired Flow (UIF) Methodology Technical Memorandum for the Saluda and Edisto basins
 - Draft UIF Methodology Technical Memorandum for the Broad Basin
 - Draft and Final Modeling Framework for the Saluda, Edisto, Broad, Catawba-Wateree and Pee Dee basins
 - Draft and Final Technical Memoranda and model summarizing historical agriculture irrigation withdrawal estimates fall all basins
 - Draft and Final UIF Dataset for the Saluda Basin (not including the Congaree River); Draft UIF Dataset for the Edisto River
 - Draft Modeling Report for the Saluda SWAM Model
 - An updated version of the SWAM User's Manual (v3.0)
 - Various additional memoranda summarizing methodology

Data Collection

- CDM Smith substantially finished contacting registered and permitted water users in the Saluda, Edisto, Broad, Catawba, Pee Dee, Salkehatchie and Santee basins to confirm reported withdrawal amounts, sources, and discharge amounts; collect pre-reporting withdrawal amounts (or estimates); and confirm other operational parameters.
- Mainstem UIFs, and the existing Catawba-Wateree Basin CHEOPS model were received from HDR, Inc. The existing mainstem UIFs will be incorporated, to the extent possible, into the UIF dataset being developed for the Catawba-Wateree Basin.
- Information clarifying current and historical reservoir operations were received from Duke Energy and Spartanburg CPW in the Broad Basin.

Data Analysis and Modeling

Saluda (Pilot Basin Model)

- Development of the Draft and Final UIF dataset was completed up to the confluence of the Broad River. The dataset will be finalized when the Broad River UIFs are finalized.
- Using the Final UIF dataset, and gaged flows from the Broad, CDM Smith completed development of the Saluda Basin Pilot Model and documented the results in the Saluda Basin Modeling Report.
- CDM Smith hosted a teleconference with DNR staff to discuss how reservoir operation rules are handled in the models. A scope of work was prepared outlining proposed enhancements to SWAM which would give model users increased flexibility when evaluating existing and proposed reservoir operating rules.
- Based on comments and additional information received from DNR, the historical rule curves for Lake Murray and Lake Greenwood that were in place during the calibration were reviewed and adjusted in the SWAM model. The calibration results workbooks were updated.
- The draft report documenting the Saluda Basin model was updated, reflecting the minor changes to Lake Murray, Lake Greenwood, and downstream nodes (gages) during the calibration period.

Edisto

- A Draft UIF dataset was completed and submitted to DNR and DHEC for review. Based on comments received, the draft UIF dataset was revised. A final UIF dataset will be submitted once model calibration is complete.
- The calibration model was developed and the calibration process was initiated.

Broad

- A UIF Methodology memorandum was prepared and submitted to DNR and DHEC for review
- Withdrawals and discharges were hindcasted, and UIF development began.

- CDM Smith began organizing UIF workbooks, which include USGS streamflow data and hindcasted withdrawals and discharges.

Pee Dee

- A Final SWAM model schematic and framework of the Pee Dee Basin was developed and submitted.
- Withdrawals and discharges were hindcasted, in preparation for developing UIFs.
- CDM Smith began organizing UIF workbooks, which include USGS streamflow data and hindcasted withdrawals and discharges.
- Work was initiated on the Pee Dee Basin UIF Methodology Memorandum.

Catawba-Wateree

- The draft model framework for the basin was submitted for review. Based on comments received from DNR, the TAC, and the Catawba-Wateree Water Management Group (CWWMG) administrators (HDR Inc.), the framework was revised and a final model framework memo was submitted.
- CDM Smith substantially completed collection of withdrawal and discharge data in the basin.

Santee

- CDM Smith continued collecting and organizing withdrawal and discharge data in the basin. Data collection is now substantially complete.
- Hindcasting of operational records continued.

Savannah

- CDM Smith began reviewing GIS, withdrawal and discharge data collected from DHEC.

Salkehatchie

- CDM Smith continued collecting and organizing withdrawal and discharge data in the basin. Data collection is now substantially complete.
- Hindcasting of operational records continued.

Stakeholder Involvement

- The first of two planned Stakeholder Meetings in the Pee Dee Basin was held on November 3rd at the Clemson Pee Dee Research and Education Center in Florence.
- The first of two planned Stakeholder Meetings in the Catawba-Wateree Basin was held on November 4th at the City of Rock Hill Operations Center in Rock Hill.
- The project Technical Advisory Committee (TAC) was included on monthly progress calls and given the opportunity to review and comment on various deliverables and interim work products.

Summary of Upcoming Work

Over the next quarter, the project team will:

- Substantially complete data collection from permitted users in the Savannah Basin.
- Finalize development of the UIF dataset for the Edisto Basin.
- Complete development and calibration of the Edisto Model.
- Complete Draft UIF datasets for the Broad and Pee Dee basins.
- Substantially complete Draft SWAM models for the Broad and Pee Dee basins.
- Develop the model framework for the Santee and Salkehatchie basins.
- Hold second Stakeholder Meetings in the Saluda (December 2nd) and Edisto (December 1st) Basins.
- Hold the first Stakeholder Meeting in the Santee Basin.
- Conduct training for the Edisto and Saluda models for DNR, DHEC and TAC members on December 3rd.

Issues Impacting Scope, Schedule, or Project Cost

Additional discussions were held between CDM Smith and DNR regarding how reservoir operating rules are incorporated in SWAM. DNR indicated the preference for additional flexibility in SWAM to allow the user to evaluate more complex alternative management rules. CDM Smith prepared a summary of proposed model enhancements for DNR's review that will allow for increased flexibility with regard to reservoir operating rules. This additional work will result in a minor increase in scope and project cost.

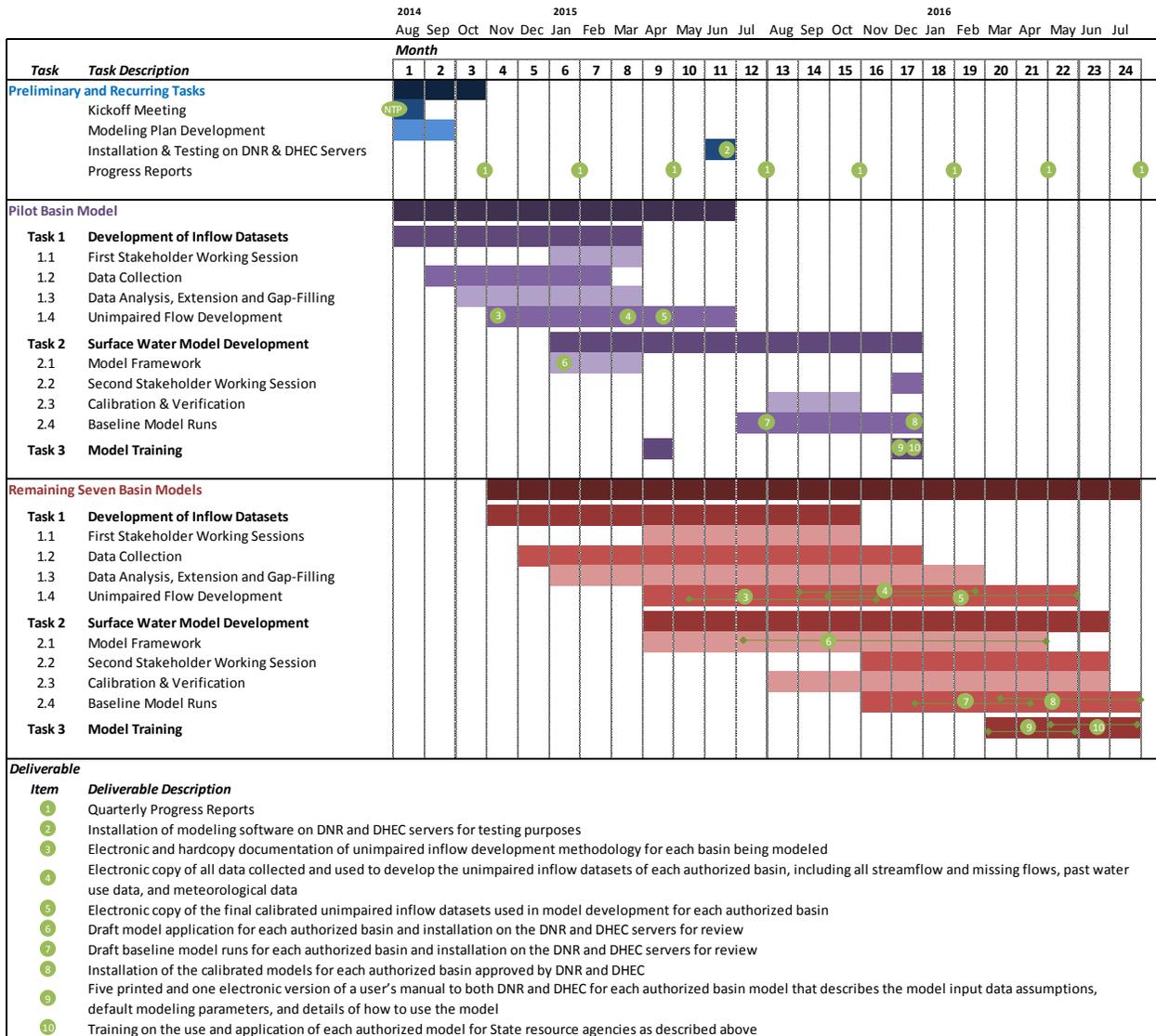
Schedule adjustments were made to reflect the project progress and more accurately account for future deliverables. The updated schedule is provided on the following page.

During the project kickoff meeting, and based on DNR and DHEC review of the draft Modeling Plan, several potential out-of-scope model enhancements were identified. These include:

- A "Current Situation Analysis" for quasi-real time operational support. This functionality would provide a probabilistic analysis of current conditions at any future point in time and how conditions are likely to change within 6 or 12 months based on projected use and management patterns.
- The ability to use near-term hydrologic flow forecasts (for example, 60-day streamflow forecasts from NOAA) for month-to-month operational planning.
- Use of HEC DSSVue for and DSS files for results display and analysis.

CDM Smith has presented a scope for implementing these enhancements to DNR and DHEC, and will prepare cost following completion of the pilot (Saluda) model. The decision on whether to implement one or more of these enhancements will likely be made once the pilot model is completed.

Project Schedule





CDM Smith Invoice Number 12

Invoice Date: August 28, 2015
 For Services Between: July 25, 2015 and August 28, 2015

River Basin	Original Contract Amount	Amended Contract Amount ²	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	\$155,926	\$162,489	\$3,600	\$157,780	\$4,709	97%
Edisto ¹	\$226,034	\$232,597	\$12,890	\$206,200	\$26,397	89%
Broad	\$132,960	\$170,023	\$21,670	\$84,665	\$85,358	50%
Pee Dee	\$189,865	\$196,428	\$27,150	\$71,450	\$124,978	36%
Catawba	\$141,639	\$164,802	\$8,450	\$32,752	\$132,050	20%
Santee	\$128,775	\$135,338	\$2,500	\$17,250	\$118,088	13%
Savannah	\$154,637	\$161,200	\$450	\$12,900	\$148,300	8%
Salkehatchie	\$128,775	\$135,338	\$2,100	\$14,950	\$120,388	11%
Total	\$1,258,611	\$1,358,211	\$78,810	\$597,947	\$760,264	44%

¹ Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

² The amended contract amount includes an additional (1) \$30,500 for the Broad River Basin unimpaired flow development; (2) \$16,600 for the Catawba Basin unimpaired flow development; and (3) \$52,500 for additional meetings, divided equally between all eight basins (\$6,562.50 each).

CDM Smith Invoice Number 13

Invoice Date: September 30, 2015
 For Services Between: August 29, 2015 and September 30, 2015

River Basin	Original Contract Amount	Amended Contract Amount ²	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	\$155,926	\$162,489	\$2,650	\$160,430	\$2,059	99%
Edisto ¹	\$226,034	\$232,597	\$9,670	\$215,870	\$16,727	93%
Broad	\$132,960	\$170,023	\$16,340	\$101,005	\$69,018	59%
Pee Dee	\$189,865	\$196,428	\$18,340	\$89,790	\$106,638	46%
Catawba	\$141,639	\$164,802	\$4,230	\$36,982	\$127,820	22%
Santee	\$128,775	\$135,338	\$3,500	\$20,750	\$114,588	15%
Savannah	\$154,637	\$161,200	\$0	\$12,900	\$148,300	8%
Salkehatchie	\$128,775	\$135,338	\$4,300	\$19,250	\$116,088	14%
Total	\$1,258,611	\$1,358,211	\$59,030	\$656,977	\$701,234	48%

¹ Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

² The amended contract amount includes an additional (1) \$30,500 for the Broad River Basin unimpaired flow development; (2) \$16,600 for the Catawba Basin unimpaired flow development; and (3) \$52,500 for additional meetings, divided equally between all eight basins (\$6,562.50 each).



CDM Smith Invoice Number 14

Invoice Date: October 30, 2015
 For Services Between: October 1, 2015 and October 30, 2015

River Basin	Original Contract Amount	Amended Contract Amount ²	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	\$155,926	\$162,489	\$600	\$161,030	\$1,459	99%
Edisto ¹	\$226,034	\$232,597	\$7,200	\$223,070	\$9,527	96%
Broad	\$132,960	\$170,023	\$21,270	\$122,275	\$47,748	72%
Pee Dee	\$189,865	\$196,428	\$21,170	\$110,960	\$85,468	56%
Catawba	\$141,639	\$164,802	\$12,900	\$49,882	\$114,920	30%
Santee	\$128,775	\$135,338	\$1,340	\$22,090	\$113,248	16%
Savannah	\$154,637	\$161,200	\$0	\$12,900	\$148,300	8%
Salkehatchie	\$128,775	\$135,338	\$650	\$19,900	\$115,438	15%
Total	\$1,258,611	\$1,358,211	\$65,130	\$722,107	\$636,104	53%

¹ Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

² The amended contract amount includes an additional (1) \$30,500 for the Broad River Basin unimpaired flow development; (2) \$16,600 for the Catawba Basin unimpaired flow development; and (3) \$52,500 for additional meetings, divided equally between all eight basins (\$6,562.50 each).