DNR

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Surface Water Availability Assessment in South Carolina
Legislative Quarterly Report, August 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. The Saluda River basin will serve as the pilot study area and will be the first basin model developed. Major accomplishments during the past quarter include development of the draft unimpaired flows (UIFs) for the Saluda basin and final modeling frameworks for the Edisto and Broad River basins. The first formal stakeholder meeting for the Edisto River basin was held on June 18 in Blackville and the first meeting for the Broad River basin was held August 5 in Spartanburg.

A technical advisory committee was established to review technical documents and procedures, and to provide data and feedback on the modeling process. The technical advisory committee consists of the following members:

Eddie Twilley
President
Twilley, Fondren & Associates, LLC

K.C. Price
Director of Water Resources
Greenville Water

Harrison Watson
Manager of Environmental/LSS - General Supt.
Florence Mill

Charles Wingard
VP, Field operations
Walter P. Rawl and Sons, Inc.

Andy Fairey
Manager of Operations
Charleston Water Systems

Ruth Albright
Senior Chemical Engineer
Synterra Corporation

Eric Krueger
Director of Science
The Nature Conservancy

Ed Bruce
Senior Engineer
Duke Energy

Heather Nix
Director Clean Air and Water Program
Upstate Forever

Julie Metts
Air and Water Quality Supervisor
Santee Cooper

Mullen Taylor
Attorney
Mullen Taylor, LLC

Progress reports are being provided by CDM Smith at monthly conference calls and at in-person meetings with DNR and DHEC. 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 fourth 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. 4

May 16, 2015 to August 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 fourth Quarterly Progress Report covers the three month period from May 16, 2015 to August 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 June 1st, July 6th and August 4th, 2015
- Project submittals to date include:
    - Draft and Final Modeling Plan
    - Draft and Final Unimpaired Flow (UIF) Methodology Technical Memorandum for the Saluda Basin
    - Draft UIF Methodology Technical Memorandum for the Edisto Basin
    - Draft and Final Modeling Framework for the Saluda Basin
    - Draft and Final Modeling Framework for the Edisto Basin
    - Draft and Final Modeling Framework for the Broad Basin
    - Draft and Final Technical Memoranda and model summarizing historical agriculture irrigation withdrawal estimates fall all basins
    - Draft UIF Dataset for the Saluda Basin

Data Collection

- CDM Smith substantially finished contacting registered and permitted water users in the Saluda, Edisto and Broad basins and continued contacting water users in the Catawba, Pee Dee, Santee and Salkehatchie basins to confirm reported withdrawal amounts, sources, and discharge

amounts; collect pre-reporting withdrawal amounts (or estimates); and confirm other operational parameters.

Data Analysis and Modeling

Saluda (Pilot Basin Model)

- Development of the Draft UIF dataset was completed, using the streamflow, water withdrawal, discharge, and other data collected for the Saluda Basin, and provided to DNR, DHEC and the Technical Advisory Committee (TAC).
- Multiple teleconference meetings were held with CDM Smith and DNR and DHEC staff to review and discuss an appropriate hierarchy of methodologies to employ when developing USGS gage flow record extensions. Additional discussions were held with regard to other aspects of UIF development, including reservoir calculations and reference gage selection. In response to DNR comments, CDM Smith conducted additional testing to compare and evaluate record extension methodology and documented the results in a memorandum. CDM Smith and DNR agreed to apply the recommended record extension methodology detailed in the memorandum, which reflected a slight change over what was used to develop the Draft UIF dataset. CDM Smith began revising the Draft UIF dataset, based on the revised methodology.
- Using the Draft UIF dataset, CDM Smith continued development of the Saluda Basin Pilot Model, including a preliminary calibration/verification using monthly time step. Based on the favorable results, no additional model calibration/verification was performed, while the Draft UIF dataset was being revised. Once complete, the Final UIF dataset will be input into the Pilot Model, and the calibration/verification will be revisited at both daily and monthly time steps.
- CDM Smith hosted a teleconference with DNR staff to discuss recent and potential future enhancements to the Simplified Water Allocation Model (SWAM), and answer questions stemming from DNR's testing of the SWAM model.
- CDM Smith began development of a report documenting the objectives, framework, model inputs, calibration results and usage guidelines for the Saluda Basin Pilot Model.

Edisto

- A Final SWAM model schematic and framework of the Edisto Basin was developed and submitted.
- CDM Smith began preparing the UIF methodology report for the Edisto Basin and organizing the collected withdrawal and discharge data to facilitate development of the UIF dataset.

Broad

- A Final SWAM model schematic and framework of the Broad Basin was developed and submitted.
- CDM Smith substantially finished collecting withdrawal and discharge data to facilitate development of the UIF dataset.

- Reservoir data was compiled and organized to determine data gaps and to begin to develop an approach for calculating UIFs downstream of the reservoirs.
- CDM Smith received approval for the amendment to develop a compatible UIF dataset for the Broad Basin. The amendment was deemed necessary because the existing UIF dataset focused only on the main stem of the Broad, and lumped the withdrawals and returns for nodes along the river. It was deemed to be inconsistent with the approved methodology that is being used to develop UIFs in the other basins.

Pee Dee

- CDM Smith continued collecting and organizing withdrawal and discharge data.
- CDM Smith began developing the Draft Pee Dee Basin framework.
- CDM Smith held a conference call with DHEC staff to review golf course withdrawals and determine significant golf course withdrawals to include in the modeling effort.

Catawba

- CDM Smith received approval for the amendment to augment the existing UIF dataset for the Catawba Basin. The existing UIF dataset will be augmented to include significant tributaries and additional UIF points along the mainstem.
- CDM Smith continued collecting and organizing withdrawal and discharge data in the basin.

Santee

- CDM Smith continued collecting and organizing withdrawal and discharge data in the basin.

Savannah

- No work was performed.

Salkehatchie

- CDM Smith continued collecting and organizing withdrawal and discharge data in the basin.

Stakeholder Involvement

- The first of two planned Stakeholder Meetings in the Edisto Basin was held on June 18th at the in Edisto Research and Education Center in Blackville.
- The project Technical Advisory Committee (TAC) was formalized and members were invited to participate in monthly progress calls. A TAC orientation meeting was held at CDM Smith's Columbia office on June 19th. At the meeting, CDM Smith provided an overview of the project and SWAM model, and answered TAC questions.
- The first of two planned Stakeholder Meetings in the Broad Basin was held on August 5th at the Cyrill-Westside Public Library in Spartanburg.

- CDM Smith provided information for a Clemson news release regarding the Edisto Stakeholder meeting.

Summary of Upcoming Work

Over the next quarter, the project team will:

- Substantially complete data collection from permitted users in the Catawba, Santee, and Salkehatchie basins, and initiate data collection in the Savannah Basin.
- Finalize development of the UIF dataset for the Saluda Basin to the confluence of the Broad River.
- Complete development and calibration of the Saluda Model.
- Complete both a Draft and Final UIF dataset for the Edisto Basin.
- Substantially complete a Draft SWAM model for the Edisto Basin.
- Begin development of the Broad UIF datasets. Once the Broad dataset is complete, the Saluda Basin UIF dataset will be completed to the terminus of the basin at Lake Marion.
- Finalize development of the Pee Dee and Catawba basins model framework.
- Hold the first Stakeholder Meeting in the Pee Dee Basin.
- Hold the second Stakeholder Meeting in the Saluda and Edisto basins (tentatively scheduled for late September and late October, respectively.

Issues Impacting Scope, Schedule, or Project Cost

Development of the UIF dataset in the Saluda Basin has taken longer than anticipated, and has pushed back the schedule for delivery of the Draft Saluda Basin Pilot Model. Issues regarding the methodology used to develop the UIF dataset, and the resulting precision of the UIFs, have been resolved following discussions between CDM Smith and DNR. As a result, a mutually agreed-to and repeatable process has been established and all of the tools and information necessary to efficiently develop the subsequent UIF datasets are in place.

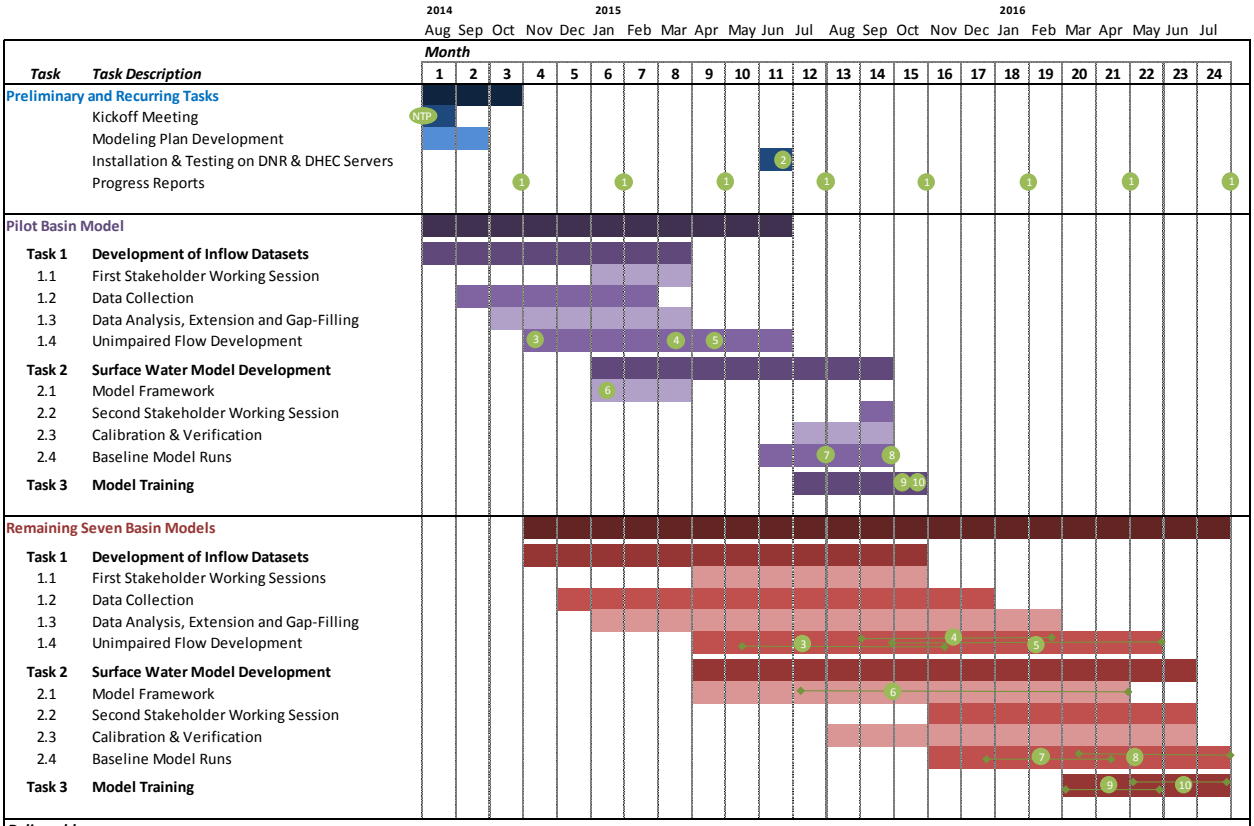
Schedule adjustments were made to reflect the project progress and more accurately account for future deliverables. An updated schedule is attached.

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. The decision on whether to implement one or more of these enhancements will likely be made once the Saluda Basin Pilot Model is completed.

Project Schedule



Deliverable

Item	*Deliverable Description*
1	Quarterly Progress Reports
2	Installation of modeling software on DNR and DHEC servers for testing purposes
3	Electronic and hardcopy documentation of unimpaired inflow development methodology for each basin being modeled
4	Electronic copy of all data collected and used to develop the unimpaired inflow datasets of each authorized basin, including all streamflow and missing flows, past water use data, and meteorological data
5	Electronic copy of the final calibrated unimpaired inflow datasets used in model development for each authorized basin
6	Draft model application for each authorized basin and installation on the DNR and DHEC servers for review
7	Draft baseline model runs for each authorized basin and installation on the DNR and DHEC servers for review
8	Installation of the calibrated models for each authorized basin approved by DNR and DHEC
9	Five printed and one electronic version of a user's manual to both DNR and DHEC for each authorized basin model that describes the model input data assumptions, default modeling parameters, and details of how to use the model
10	Training on the use and application of each authorized model for State resource agencies as described above

DNR

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

CDM Smith Invoice Number 9

Invoice Date: May 29, 2015
For Services Between: April 19, 2015 and May 16, 2015

River Basin	Contract Amount	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$4,310	$147,300	$8,626	94%
Edisto[1]	$226,034	$18,240	$171,350	$54,684	76%
Broad	$132,960	$11,450	$38,645	$94,315	29%
Pee Dee	$189,865	$13,900	$24,650	$165,215	13%
Catawba	$141,639	$12,462	$14,362	$127,277	10%
Santee	$128,775	$5,800	$7,650	$121,125	6%
Savannah	$154,637	$5,800	$7,650	$146,987	5%
Salkehatchie	$128,775	$5,800	$7,650	$121,075	6%
Total	$1,258,611	$77,762	$419,307	$839,304	33.3%

[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.

CDM Smith Invoice Number 10

Invoice Date: June 29, 2015
For Services Between: May 17, 2015 and June 20, 2015

River Basin	Contract Amount	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$3,780	$151,080	$4,846	97%
Edisto[1]	$226,034	$19,340	$190,690	$35,344	84%
Broad	$132,960	$8,450	$47,095	$85,865	35%
Pee Dee	$189,865	$13,350	$38,000	$151,865	20%
Catawba	$141,639	$7,190	$21,552	$120,087	15%
Santee	$128,775	$4,500	$12,150	$116,625	9%
Savannah	$154,637	$4,500	$12,150	$142,487	8%
Salkehatchie	$128,775	$4,500	$12,200	$116,575	9%
Total	$1,258,611	$65,610	$484,917	$773,694	38.5%

[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.

DNR

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

CDM Smith Invoice Number 11

Invoice Date: July 30, 2015
For Services Between: June 21, 2015 and July 24, 2015

River Basin	Original Contract Amount	Amended Contract Amount[2]	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$162,489	$3,100	$154,180	$8,309	95%
Edisto[1]	$226,034	$232,597	$2,620	$193,310	$39,287	83%
Broad	$132,960	$170,023	$15,900	$62,995	$107,028	37%
Pee Dee	$189,865	$196,428	$6,300	$44,300	$152,128	23%
Catawba	$141,639	$164,802	$2,750	$24,302	$140,500	15%
Santee	$128,775	$135,338	$2,600	$14,750	$120,588	11%
Savannah	$154,637	$161,200	$300	$12,450	$148,750	8%
Salkehatchie	$128,775	$135,338	$650	$12,850	$122,488	9%
Total	$1,258,611	$1,358,211	$34,220	$519,137	$839,074	38%

[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).