

Evaluating Water Quality Best Management Practices for Reservoirs in North Central Texas

Texas Water Resources Institute
FY 03 Federal Appropriated Funds
Project # X7-9764801-0

Quarter no. 4 From 7/8/04 Through 10/7/04

Progress in Meeting Project Milestones and Output Commitments

Task, Deliverables and Schedules

The Texas Water Resources Institute (TWRI) along with the Texas A&M University Spatial Sciences Laboratory (SSL), Alan Plummer Associates, Inc. (APAI) and Espey Consultants, Inc. (EC) has been diligently working to complete project deliverables. Project efforts during the forth quarter focused on modeling activities. The SSL and EC have collaborated on efforts to interact SWAT and QUAL2E models to predict loadings within Cedar Creek Reservoir. SWAT and QUAL2E has successfully been integrated. Work continues on linking these two models with WASP in order to have a model that predicts entire watershed loadings. APAI has completed collecting data from wastewater treatment plants within Cedar Creek and Eagle Mountain Reservoirs and has input this data into an Access database. TWRI continues to update its Web site containing water quality information, specifically related to project efforts, for scientist and the general public and has produced a watershed management bulletin.

In looking forward to the next quarter, SWAT, QUAL2E and WASP modeling activities should be completed, giving us a clear understanding of sediment and nutrient loadings within Cedar Creek Reservoir and Watershed. Preliminary work has begun to identify BMP's that will be effective in reducing loadings into stream segments and Cedar Creek Reservoir. Identifying BMP's and running them through the newly developed SWAT/QUAL2E/WASP model will be the focus of the fifth quarter.

The status of tasks, milestones and deliverables will be defined using the following terms:

Pending	Work has not started on the deliverable
Initiated	Work has started
Completed	Objectives were achieved and deliverables are finished
Deferred	Work has started, but further action is delayed pending other information, the completion of another objective, staff restraints, etc.
Ongoing	Work will continue throughout the term of the contract

Task 1 SWAT Modeling

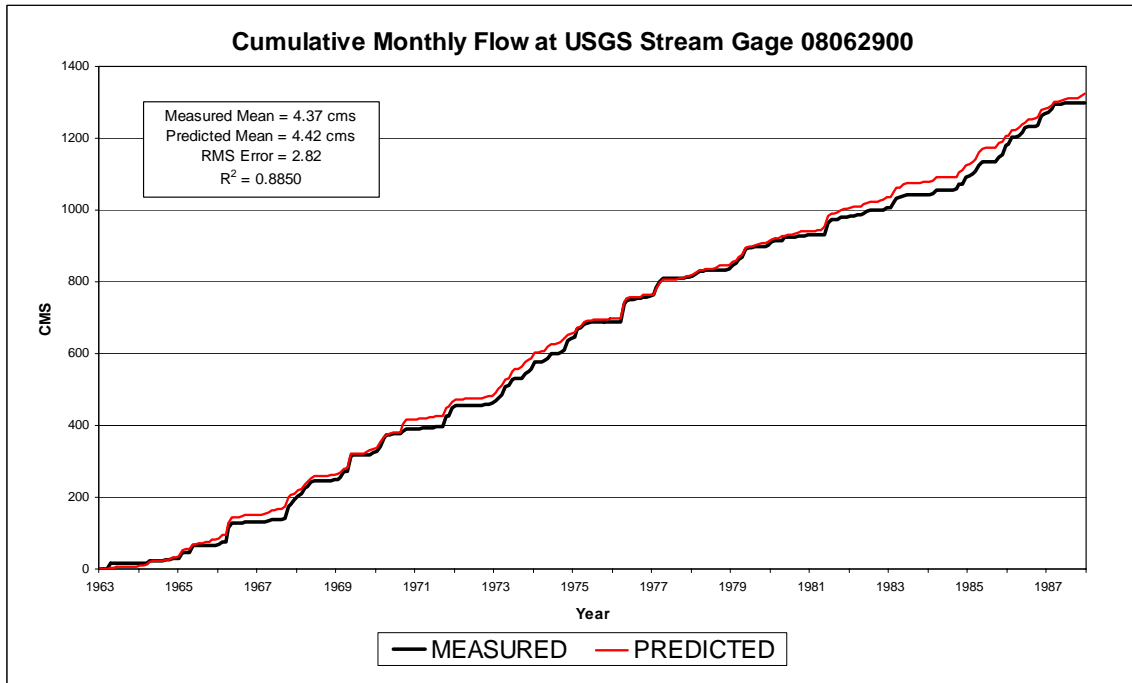
Due Date	Status	Deliverables
1/1/04	Completed	1. Complete model calibration and validation for Cedar Creek
4/1/04	Initiated	2. Development of Watershed databases
10/1/04	Initiated	3. Development and Evaluation of Different BMP strategies for Cedar Creek Watershed
1/1/05	Pending	4. Model calibration and validation for Eagle Mountain Watershed
9/1/05	Pending	5. Development and evaluation of different BMP strategies for Eagle Mountain Watershed
9/1/05	Pending	6. Development of ArcGIS/ArcHydro interface for SWAT and WASP
9/1/05	Pending	7. Development of interface for using NEXRAD weather information for SWAT

Comments:

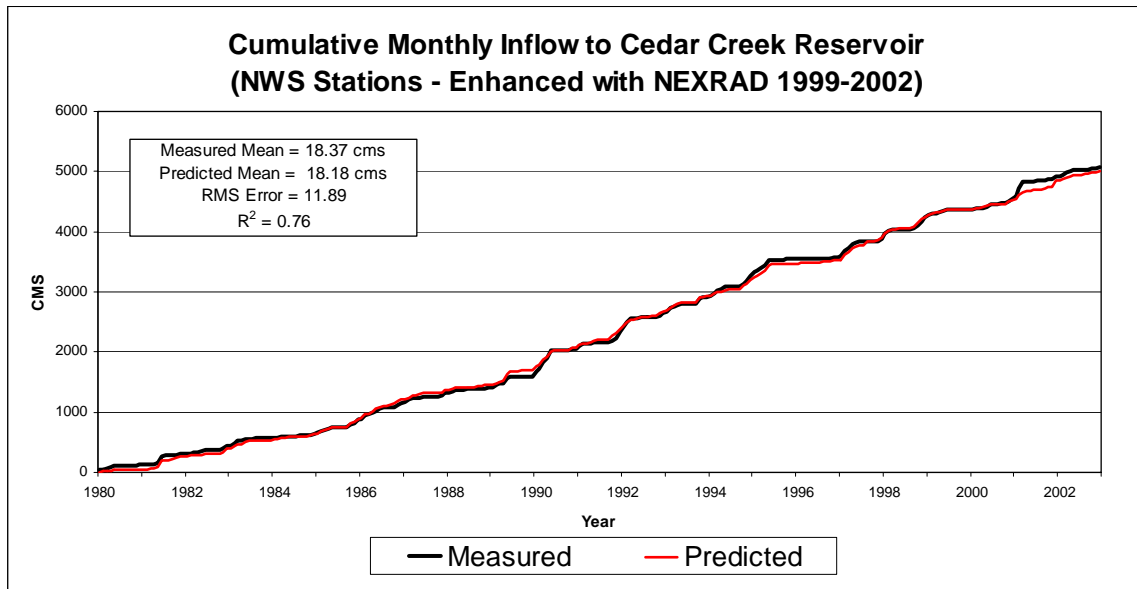
- The Spatial Sciences Lab (SSL) in cooperation with Blackland Agricultural Research and Extension Center has completed the validation and calibration of the SWAT model for Cedar Creek Watershed. This deliverable is 100 percent complete.
- SSL has been in contact with state and federal agencies (TCEQ, TRWD, NRCS and USGS) to obtain GIS data for the watershed database. The Access database, once complete, will contain information on land use, soils, elevation, weather and watershed delineation data. TWRI is working to obtain soil sample data of Cedar Creek Watershed from Texas A&M University's Soil, Water and Forage Testing Laboratory for the time period of 1990-2000. Once this information is added to the database, it will be complete. This deliverable is currently 85 percent complete.
- The research team has begun to identify specific BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir. SWAT runs have been made to get preliminary estimates as to the type of reservoir loadings (point or non point sources) and sources of contamination (stream segments, tributary flow or resuspension of reservoir sediments). These preliminary runs have helped focus BMP selection.

The charts below graphically represent actual measured data versus predicted data generated with the SWAT model.

Flow Calibration 1963-1987



Flow Validation 1980-2002



Task 2 In-Stream and Reservoir Modeling

Due Date	Status	Deliverables
4/1/04	Completed	1. Development of In-stream modeling (QUAL2E) for Cedar Creek Watershed
10/1/04	Initiated	2. Development of Reservoir Modeling (WASP) for Cedar Creek Reservoir
10/1/04	Initiated	3. Development and Evaluation of Different BMP strategies for Cedar Creek Reservoir
1/1/05	Pending	4. Data Collection for Reservoir Modeling (WASP) for Eagle Mountain
7/1/05	Pending	5. Development of Reservoir Modeling (WASP) for Eagle Mountain Watershed
9/1/05	Pending	6. Development and Evaluation of Different BMP strategies for Eagle Mountain Watershed

Comments:

- QUAL2E modeling has been completed and coefficients have been submitted to the SWAT modeling team. This deliverable is 100 percent complete.
- Work is being done to develop the five-year hydrodynamic portion of WASP 6.1 for Cedar Creek Reservoir and the five-year water quality database to be used for calibrating the model. EC has been working on balancing tributary flows with net rainfall/evaporation, water withdrawals and reservoir volume change. Atmospheric loads have been estimated using data from the NADP networks Longview station, and the vertical dispersion coefficients have been estimated using Thomann and Mueller methodology for the set five year period. Work continues to develop input data related to nutrient kinetics and sediment sources of nutrients. This deliverable is 90 percent complete. This deliverable cannot be complete until APAI completes work on the WASP postprocessor.
- The research team has begun to identify specific BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir.

Task 3 Study of Wastewater Treatment Plants

Due Date	Status	Deliverables
7/1/04	Completed	1. Development of a Database for Wastewater Treatment Plants in Cedar Creek and Eagle Mountain Watersheds
10/1/04	Initiated	2. Assessment of Impact of Wastewater Treatment Plants (point source discharges) for Cedar Creek and Eagle Mountain Reservoirs
4/1/05	Pending	3. Development of a Database for Wastewater Treatment Plants in the Richland-Chambers Watershed
7/1/05	Pending	4. Assessment of Impact of Wastewater Treatment Plants (point source discharge) for Richland-Chambers Reservoir

Comments:

- The wastewater treatment database is complete with information from both Cedar Creek and Eagle Mountain Reservoirs. This deliverable is 100 percent complete.
- APAI has developed a database containing all wastewater treatment plants in the Cedar Creek and Eagle mountain watersheds. Data contained in these databases include process diagrams of plants current capacity as well as diagrams of future upgrades that could be made to make the plant more efficient, and to meet operating demands. Also included in the database is information regarding operating capacity, permit information, quality of discharged effluent, fate of released effluent and proximity to water bodies. Cost estimates for all process recommendations are included.
- APAI has been working to develop a flow balance program that will provide modeling capability within the WASP model that is more compatible with the current modeling employed with the SWAT model. APAI will incorporate the previously developed internal flow balance program into an Access application capable of managing extensive historical flow data and SWAT model output, structure the visual basic program to accommodate user-defined time periods, as small as one day (previously set up on a monthly time period), and develop input data for Eagle Mountain Reservoir. This deliverable is 95 percent complete

Task 4 Administration

Due Date	Status	Deliverables
1/5/04	Completed	1. Write QAPP
1/7/04	Completed	2. Quarterly Progress Reports
4/7/04	Completed	
7/7/04	Completed	
10/7/04	Completed	
1/7/05	Ongoing	
4/7/05	Ongoing	
7/7/05	Ongoing	
10/7/05	Ongoing	3. Final Report

Comments:

- TWRI continually updates the Web site created specifically for the North Central Texas Water Quality Project. The Web site can be accessed at the following address: <http://nctx-water.tamu.edu>.
- On September 16, 2004, project participants met at the Fort Worth Plaza Hotel in Fort Worth to present the status of deliverables and discuss objectives for the upcoming quarter.
- TWRI worked with the department of Biological and Agricultural Engineering to create and publish a bulletin on watershed management. The bulletin describes point and nonpoint source pollution and best management practices and emphasizes a holistic approach to solve water quality issues.

Problems or Obstacles Encountered and Remedial Actions Taken

The research team has had difficulty in adapting all the parameters for the SWAT/QUAL2E/WASP model. While SWAT and QUAL2E have been successfully integrated together, work continues to incorporate WASP into the modeling mix. The challenge has been in establishing compatible parameters and coefficients for the three distinct models.

Work continues in the following areas:

- Using tributary flows from SWAT, recalculate internal flows with the APAI kinetic model to be input into WASP.
- Hydrologic balance data for the reservoir with the new SWAT flows. The APAI model depends on the hydrologic balance over time to calculate flows, and the internal flows are being calculated with updated SWAT tributary flow balances. EC will take new flow balances using NEXRAD data from years 1999-2002 and use them to run the WASP model.
- Wastewater treatment plant flows and constituent loads for those plants discharging directly into the reservoir (i.e. those not already included in the SWAT model).
- Understand the sensitivities of the APAI internal flow model that occur under certain conditions at the onset of calculations.

Great strides have been made by the modeling team to configure an accurate up-to-date model, which patterns both the watershed and the reservoir simultaneously for nutrient and sediment loading. SWAT/QUAL2E/WASP model integration should be complete very soon and BMP scenario runs should begin by the first of November 2004.

Work Planned for Next Quarter

Task 1: SWAT Modeling

Final calibration and validation of the SWAT/QUAL2E/WASP combined model. Finalize inputting data for the watershed database. Begin running the SWAT/QUAL2E/WASP model using select BMP scenarios and looking at total load reductions within the reservoir. Finalize which BMP strategies are most effective and least costly at reducing nutrient, sediment and pollutant loadings into Cedar Creek Reservoir.

Task 2: In-Stream and Reservoir Modeling

Finalize development and integration of WASP reservoir model for Cedar Creek Reservoir. Incorporate SWAT flow balances using updated NEXRAD information for the time period 1999-2002. Begin making model runs.

Task 3: Study of Wastewater Treatment Plants

Begin evaluating impacts that wastewater treatment plants and their discharges have on water quality of Cedar Creek and Eagle Mountain Reservoirs.

Task 4: Administration

Continue working with TRWD, SSL, EC and APAI in moving forward with project deliverables and reporting progress on a quarterly basis. Efforts will be made to publicize the project and raise awareness of water quality issues within the study area. Furthermore, TWRI will work to secure additional funding for this project as additional federally appropriated funds are not available at this time.

Additional funds currently used to support project activities include federally appropriated monies from USDA-NRCS to conduct economic analysis of BMPs scenarios at reducing loadings in North Central Texas Watersheds and to develop educational program materials on watershed management.

Use of Awarded Funds

YEAR 1	Beginning Balance	Expenditures as of 10/1/04	Remaining Balance
Spatial Sciences Lab	\$3,577	\$770	\$2,807
Alan Plummer Assoc.	\$115,900	\$82,814	\$33,086
Espey Consultants	\$115,000	\$100,186	\$14,814
TOTAL DIRECT	\$234,477	\$177,971	\$50,707

Expenditures listed do not include indirect cost of \$23,448.

Total project award including direct and indirect cost is \$257,925 for year one.