

Watershed Assistance to Improve Water Quality in North Central Texas

Texas Water Resources Institute
FY 03 Federal Appropriated Funds
Project # 03-60768

Quarter no. 9 From 10/1/05 Through 1/10/06

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), Blackland Agricultural Research and Extension Center (BAREC) and Texas Cooperative Extension (TCE) have been diligently working to complete project deliverables. Project efforts during the ninth quarter focused on modeling activities and education. The SSL and BAREC have completed efforts to calibrate and validate the SWAT model for Cedar Creek Reservoir. TCE has assisted in collection of soil samples to assess background nutrient concentrations in various land use types. TCE staff have educated 3,900 youth using the Stream Trailer Demonstration and have completed 90 percent of the Cedar Creek fact sheet and 90 percent of the curriculum for the Stream Trailer.

The two-day watershed training was held November 17-18, 2006, in Ft. Worth. The event was attended by over 110 participants and was very well received. TWRI continues to update its Web site containing water quality information, specifically related to project efforts, for scientists and the general public, and to provide project oversight and financial management for the project.

In looking forward to the next quarter, with SWAT modeling activities completed for Cedar Creek Reservoir and Watershed, work will continue on developing BMP scenarios to correct sediment and nutrient loadings. Work associated with Eagle Mountain Reservoir modeling activities will continue. The economics team will initiate the cost effectiveness of different BMP scenarios. TCE specialists will begin identifying and forming stakeholder groups and publishing the Cedar Creek publication.

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	The 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

Date	Status	Deliverables
1/1/04	Completed	1. Complete model calibration and validation for Cedar Creek Reservoir
1/1/05	Initiated	2. Finish calibration and validation for Eagle Mountain Reservoir
9/1/05	Pending	3. Collect GIS data on wastewater treatment plant discharge required for SWAT modeling of Eagle Mountain and Bridgeport Watersheds

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.
- The research team has identified BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir. SWAT runs have been made to get 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 model runs have helped focus BMP selection.
- The research team has begun to run BMP scenarios through the SWAT/QUAL2E/WASP model to look at plausible BMPs to implement and at which locations, as well as the overall reduction these BMPs will have on nutrient and sediment loading into Cedar Creek Reservoir. This deliverable is 75 percent complete.
- SSL has collected water quality data and weather station data for Eagle Mountain Reservoir. Basins and sub-basins have been delineated for the SWAT model and the process is under way to calibrate and validate the model. The SWAT model has been calibrated for flow at this time. Water quality parameters are being evaluated.

Task 2 Economic Analysis

Date	Status	Deliverables
9/1/04	Initiated	1. Begin developing input data for economic analysis of alternative BMPs for Cedar Creek Reservoir and Watershed
4/1/05	Initiated	2. Conduct economic analyses of alternative BMPs for Cedar Creek Reservoir Watershed
10/1/05	Initiated	3. Begin developing input data for economic analyses of Eagle Mountain Watershed

Comments:

- Preliminary work has begun to identify BMPs to be input into the SWAT model to look at reducing nutrient and sediment loadings in Cedar Creek Watershed.
- BMPs being evaluated include: terraces, contour farming, crop residue management, conversion of cropland to grass or urban, grazing management – rotational grazing, fencing of water supply, fertilizer/nutrient management, pasture planting/range seeding, streambank stabilization, sediment retention structures and improving pasture conditions from fair to good.
- Work has begun on developing the economic model. Background data on cost and effectiveness of suggested BMPs is being gathered. The model is 85 percent complete. The model is being developed so that additional BMPs can be added in the future.
- The Economic model for Cedar Creek Reservoir will be finalized once the SWAT model determines the most effective BMPs.

Task 3 Extension Education

Date	Status	Deliverables
4/1/04	Completed	1. Develop generalized watershed management program bulletin
7/1/04	Completed	2. Conduct two-day watershed management training program for County Extension Agents and other selected resource personnel
10/1/05	Initiated	3. Recruit Cedar Creek stakeholder committee
1/1/05	Initiated	4. Develop Cedar Creek Watershed characteristics fact sheet
1/1/05	Completed	5. Construct demonstration trailer
4/1/05	Completed	6. Hold Cedar Creek public meeting on watershed characteristics and pollution problems
4/1/05	Pending	7. Recruit Eagle Mountain stakeholder committee
4/1/05	Completed	8. Conduct two-day training program on stream erosion for County Extension Agents and other resource personnel
4/1/05	Pending	9. Hold two Cedar Creek stakeholder committee meetings
7/1/05	Deferred	10. Develop Eagle Mountain Watershed characteristics fact sheet
7/1/05	Initiated	11. Conduct two Cedar Creek Extension education meetings on urban storm water quality, agricultural nonpoint source pollution prevention and wastewater
7/1/05	Initiated	12. Develop general fact sheets on:
	Completed	1) Wastewater management options around lakes,
	Pending	2) Urban storm water management, and
		3) Lawn management
10/1/05	Pending	13. Hold Eagle Mountain stakeholder committee meetings
10/1/05	Pending	14. Hold Eagle Mountain public meeting on watershed characteristics and pollution problems

Comments:

- TCE developed a generalized watershed management bulletin entitled “The Watershed Management Approach.” This deliverable is 100 percent complete.
- Extension personnel held a two-day watershed management training on September 16-17, 2004 in Fort Worth. Participants included County Extension Agents and other Extension personnel, TRWD staff, NRCS and SWCD personnel from counties within Cedar Creek and Eagle Mountain Watersheds.
- Cedar Creek Watershed fact sheet development is in the intermediate stage. This deliverable will be completed once BMP runs have been made through the SWAT model and recommendations have been made on how to reduce loadings into the reservoir. This deliverable is 80 percent complete.
- TCE developed a generalized bulletin on Stormwater Management. This deliverable is 100 percent complete.

- Educational materials for the trailer are under development. The demonstration trailer has been used at more than 36 events with over 2,918 participants.
- TCE personnel developed a generalized, interactive presentation on the North Central Texas Water Quality Project highlighting project goals and objectives. This informative presentation is auto-narrated and can be used by Extension Agents in presentations to individual county groups. This presentation is available through the North Central Texas Water Quality project Web site.
- TCE worked with County Extension Agents in Kaufman, Henderson, Van Zandt and Rockwall counties to gather soil samples as part of a soil sampling campaign aimed to collect data to verify findings of the SWAT model. Over 100 samples were collected.
- Conducted three water quality programs in the Cedar Creek Watershed geared toward agricultural stakeholders on the issues of non-point source pollution.
- Presented a poster on the project at the United States Water Quality Conference in San Diego and at Texas A&M University's Water Week.
- Stream Trailer curriculum project (additional deliverable) is under development and 90 percent complete.
- TCE worked with TRWD to collect stream bank soil samples used to verify loadings being predicted in the SWAT model.
- Extension personnel held a two-day watershed management training on November 17-18, 2005 in Fort Worth. Participants included County Extension Agents and other Extension personnel, TRWD staff, NRCS and SWCD personnel from counties within Cedar Creek and Eagle Mountain Watersheds, EPA, city personnel and engineering consulting firms.

Task 4 Administration

Date	Status	Deliverables
1/7/04	Completed	1. Quarterly Progress Report
4/7/04	Completed	
7/7/04	Completed	
10/7/04	Completed	
1/7/05	Completed	
4/7/05	Completed	
7/7/05	Completed	
10/7/05	Completed	
1/7/06	Completed	
4/4/06		
7/7/06		
10/7/06		2. 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>.
- Program material presented at the project sponsored watershed management training has been added to the North Central Texas Water Quality Web site. Also included is a generalized, interactive presentation highlighting project goals and objectives. This informative presentation is auto-narrated and can be used by Extension agents in presentations to individual county groups.
- On January 5, 2006, project participants met at the Blackland Agricultural Research and Extension Center in Temple, TX to discuss project deliverables and outcomes to date.

Problems or Obstacles Encountered and Remedial Actions Taken

The Spatial Sciences Laboratory and Blackland Agricultural Research and Extension Center have been working closely with Texas Water Resources Institute (TWRI) towards successful completion of project deliverables. Significant progress has been made in modeling Cedar Creek and Eagle Mountain Watersheds. For the Cedar Creek watershed, hydrology calibration and validation is 100 percent complete, and for Eagle Mountain watershed, hydrology calibration and validation is about 90 percent complete. Efforts continue to complete the calibration during the low-flow periods for Eagle Mountain watershed.

Originally, calibrations for sediment and water quality in the Cedar Creek watershed were completed using SWAT and QUAL2E. However, a few shortcomings of the SWAT model were identified and needed correcting. They are as follows: 1) Overestimation of flow velocity in small sub-watershed downstream of two intersecting big watersheds, 2) Overestimation of stream bank erosion at these small watersheds due to high flow velocity, and 3) Sediment mass balance errors due to stream channel erosion. These problems were identified when the model results for Cedar Creek were spatially mapped to look at the spatial distribution of sediment and nutrient loading to the watershed.

These shortcomings of the model were fixed immediately. The hydrology calibration and validation of Cedar Creek was not affected due to this error. However, the model was predicting less sediment erosion than the measured sediment erosion of 45 million tons during a 30 year period (1965-1994). The 45 million ton estimate is based on the 1995 volumetric lake survey conducted by the Texas Water Development Board (TWDB). This averages to approximately 1.5 million tons of sediment erosion per year and the model prediction was only 1 million tons of sediment erosion per year. Of the 1 million tons, close to 0.45 million tons are predicted to come from stream channel erosion every year.

Field visits and observations also showed considerable channel erosion in some portions of the watershed. Hence, the sediment calibration was put on hold until TWDB conducted another volumetric survey in Cedar Creek Reservoir during the Summer 2005. The results of this study showed surprisingly more lake volume than the 1995 survey, which means less volume loss due to sediment erosion than was estimated in the 1995 survey. TWDB survey only provides the volume loss of the lake due to sedimentation. In order to estimate the mass from this volume, a density of 50 lbs/ft³ is currently assumed for the sediment. However, the sediment density estimate is very uncertain which could lead to errors in quantifying erosion. Hence, we are working with sediment and geology experts at Baylor University to conduct field and watershed surveys to estimate sediment density. The group will use historical air photo analysis to identify the time and locations of erosion. This field study will be conducted during the December 2005 to January 2006 time frame. The information gathered from the field and watershed

survey will be of immense use to the extensive modeling efforts of this project and to verify model outputs.

As explained above, sediment from channel erosion is a significant portion (45 percent) of the total erosion in the watershed. However, sediment from the stream channel was assumed not to contribute to the nutrient load of the stream and was not part of the SWAT modeling algorithm. This assumption was viewed as a shortcoming of the model and hence a modeling component was added to SWAT to model nutrient loadings from stream channel erosion. Given that there was no stream bank sediment data available relating to the estimate of nutrient concentrations within the watershed, a field campaign was undertaken by Texas Cooperative Extension Specialists to collect stream bank soil samples and analyze them for Nitrate, Organic N, Organic P, and Labile P. Soil samples were also collected from various land uses and are currently being analyzed for these nutrient concentrations. These nutrient concentrations will be compared with model default values and used to initialize the model. A similar field campaign has been done in the Eagle Mountain Watershed.

The lake and watershed sediment survey and the soil survey was not originally foreseen and planned for this study. However, as the study progressed, modeling issues and discrepancies in lake volumetric results warranted these field surveys to improve the model and increase the confidence in model results. The goal is to have the most accurate information possible to use in developing a scientifically sound watershed protection plan.

Work Planned for Next Reporting Period

Task 1: SWAT Modeling

Finalize inputting data for the watershed database. Continue 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. Continue model calibration and validation for Eagle Mountain Reservoir.

Task 2: Economics

Finalize data collection of BMP cost and effectiveness for the economic model. Begin running different scenarios with SWAT/QUAL2E/WASP output.

Task 3: Education

Publish watershed specific bulletin relating to Cedar Creek Watershed. Recruit and interact with the Cedar Creek Watershed stakeholder group. Develop program for the scheduled watershed management training meeting. Publish Stream trailer Curriculum to accompany demonstration trailer. Initiate soil testing campaign in Eagle Mountain watershed.

Task 4: Administration

TWRI will continue working with TRWD, SSL, BAREC and TCE 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.