

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. 22 From 1/8/09 Through 4/17/09

Progress in Meeting Project Milestones and Output Commitments

Task, Deliverables and Schedules

The Texas Water Resources Institute (TWRI), the Texas A&M University Spatial Sciences Laboratory (SSL), Alan Plummer Associates, Inc. (APAI), Espey Consultants, Inc. (EC) and the Texas AgriLife Research and Extension Urban Solutions Center have been diligently working to complete project deliverables. Efforts during the 22nd quarter focused on modeling activities, BMP scenario runs and stakeholder and workgroup activities.

The SSL continues to refine BMP scenarios and work with AgriLife Extension faculty to refine economic costs for each BMP scenario. These results are incorporated into the Cedar Creek WPP as they are completed.

SSL and EC have collaborated on efforts to refine the interactions of SWAT, QUAL2E and WASP models to predict nutrient and sediment loadings of Eagle Mountain and Richland Chambers Reservoir Watersheds.

A second draft of the Cedar Creek WPP was released to the public at the last stakeholder meeting held February 5th in Kaufman. Stakeholders provided a wide array of feedback on the plan draft representing the viewpoints and experiences of the various constituencies. A January stakeholder meeting held in Decatur provided an overview of modeling and assessment activities for the Eagle Mountain project. Additionally, stakeholders were introduced to general information regarding best management practices for water quality and erosion.

To assist stakeholders in maintaining contact with the project TWRI continues to update the project web site containing water quality information, informational materials, and meeting summaries targeted to scientists and the general public.

In looking forward to the next quarter, the research team will continue to provide input for the development of the WPP for the Cedar Creek Watershed in the form of economic performance analysis and targeting of management practice selection for identified problem subwatersheds. Modeling activities for Eagle Mountain and Richland Chambers Reservoir Watershed will continue. Additionally, development will continue of draft watershed protection plans for Cedar Creek and and Eagle Mountain Watersheds. At this point, the process will focus on stakeholder input with regard to selecting best management practices and the development of informational and outreach programming as outlined by the Environmental Protection Agency.

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 Reservoir Watershed |
| 4/1/04 | Completed | 2. Development of Watershed Databases |
| 10/1/04 | Completed | 3. Development and Evaluation of Different BMP strategies for Cedar Creek Watershed |
| 1/1/05 | Completed | 4. Model calibration and validation for Eagle Mountain Watershed |
| 9/1/05 | Initiated | 5. Development and evaluation of different BMP strategies for Eagle Mountain Watershed |
| 9/1/05 | Initiated | 6. Development of ArcGIS/ArcHydro interface for SWAT and WASP |
| 9/1/05 | Completed | 7. Development of interface for using NEXRAD weather information for SWAT |
| 7/1/06 | Initiated | 8. Model calibration and validation for Richland Chambers Watershed |
| 10/1/06 | Pending | 9. Development and evaluation of different BMP strategies for Richland Chambers Watershed |

Comments:

- The Spatial Sciences Lab (SSL), in cooperation with Blackland Agricultural Research and Extension Center (AREC), 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. This deliverable is currently 100 percent complete.
- The research team has finalized BMP scenarios runs through the SWAT/QUAL2E/WASP model to look at plausible BMPs to implement, designation of practice locations, as well as the overall predicted reduction these

BMPs will have on nutrient and sediment loading into Cedar Creek Reservoir. This deliverable is 100 percent complete.

- SSL and Blackland AREC have initiated data collection and SWAT Model development for the Richland Chambers Reservoir Watershed.
- Utilizing funds from TRWD, Baylor University conducted a sediment survey of Eagle Mountain Reservoir in order to verify storage capacity, flows and sediment size for the WASP model.
- Using stakeholder input, SSL updated the landuse information to reflect the reality of more pasture land and associated fertilizer application.
- In a modeling exercise to determine the direct effect of landuses directly adjacent to Cedar Creek Reservoir, the SSL modeled a buffer strip of 2,000 ft around the reservoir with regards to fertilizer application of yards and runoff rates in the reservoir. No significant impacts were noted.
- Developed a modeling tool to capture averaged NEXRAD weather data for the subwatershed scale on a daily basis. This tool averages rainfall over the subwatershed and spatially divides the data within the watershed. This deliverable is 100 percent complete
- Modeling activities continue for Eagle Mountain Reservoir Watershed. The SWAT model has been calibrated for flow, sediment and nutrients. This deliverable is 90% complete.
- Modeling activities continue for Richland Chambers Reservoir Watershed. Data has been gathered and analyzed and the model has been set-up. The model has been calibrated for flow and the research team is working to finalize model calibration for nutrients. This deliverable is 65% complete.

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 | Completed | 2. Development of Reservoir Modeling (WASP) for Cedar Creek Reservoir |
| 10/1/04 | Completed | 3. Development and Evaluation of Different BMP strategies for Cedar Creek Reservoir |
| 1/1/05 | Completed | 4. Data Collection for Reservoir Modeling (WASP) for Eagle Mountain |
| 7/1/05 | Initiated | 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 |
| 7/1/06 | Initiated | 7. Assist TRWD in development of In-stream Modeling (QUAL2E) for Richland Chambers Watershed |
| 7/1/06 | Initiated | 8. Development of Reservoir Modeling (WASP) for Richland Chambers Reservoir |

10/1/06 Pending 9. Development and Evaluation of Different BMP strategies for Richland Chambers Watershed

Comments:

- QUAL2E modeling has been completed and coefficients have been submitted to the SWAT modeling team. This deliverable is 100 percent complete.
- EC completed its work on the Cedar Creek WASP postprocessor, and input data related to nutrient kinetics and sediment sources of nutrients were finalized. The Cedar Creek WASP model has been validated and calibrated. This deliverable is 100 percent complete.
- The research team has identified a host of specific BMPs which will be beneficial in reducing nutrient loadings in stream segments and Cedar Creek Reservoir. A technical memo with regard to BMP suggestions has been completed. Results show a necessary reduction of nutrients entering the reservoir to be within the 30-40 percent range in order to effectively reduce chlorophyll-*a* concentrations within Cedar Creek Reservoir.
- EC has collected data and delineating Eagle Mountain Reservoir segments for WASP modeling. The group completed the reservoir's mass balance calibration for modeling runs. This task is 100 percent complete.
- EC has been working with TRWD to refine the WASP model as it relates to issues of flux within Cedar Creek Reservoir. The issue of modeling resuspension of sediment and nutrients within the reservoir has been corrected.
- EC and TRWD have refined the WASP model to more accurately account for model variation between dry and wet years and to better capture the internal dynamics of the reservoir with regard to modeling flux and resuspension of nutrients bound to sediment. This issue has been corrected.
- EC has begun collecting data and delineating Richland Chambers Reservoir segments for WASP modeling. The group is working on the reservoir's mass balance calibration for modeling runs. This task is 25 percent complete.

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 | Completed | 2. Assessment of Impact of Wastewater Treatment Plants (point source discharges) for Cedar Creek and Eagle Mountain Reservoirs |
| 4/1/05 | Completed | 3. Development of a Database for Wastewater Treatment Plants in the Richland Chambers Watershed |
| 7/1/05 | Completed | 4. Assessment of Impact of Wastewater Treatment Plants (point source discharge) for Richland Chambers Reservoir |

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| 4/1/06 | Initiated | 5. Development of a Database for Wastewater Treatment Plants in the Benbrook Watershed |
| 7/1/06 | Pending | 6. Develop information on biosolid disposal areas in the Benbrook Reservoir Watershed |

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 plant's 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. This deliverable is 100 percent complete.
- APAI has developed a flow balance program that provides modeling capability within the WASP model that is more compatible with current modeling employed using SWAT model. APAI incorporated the previously developed internal flow balance program into an Access application capable of managing extensive historical flow data and SWAT model output. The group structured the visual basic program to accommodate user-defined time periods, as small as one day (previously set up on a monthly time period), and developed input data for Eagle Mountain Reservoir. This deliverable is 100 percent complete.
- APAI, working with TRWD, has identified all wastewater treatment plants permitted to discharge waste into Richland Chambers Watershed. APAI has collected general data on all wastewater treatment plants for the database, but will only do further analysis on those whose discharge flows into Richland Chambers Reservoir. They include: Corsicana - both plants; Walden Woods (direct discharge); Pelican Isle (direct discharge); Dawson (Richland Creek); and Ennis (Chambers Creek). This deliverable is 100 percent complete.
- APAI is working with EC and TRWD to formulate flows entering the Eagle Mountain Watershed as well as to evaluate WASP modeling capabilities for reservoir flux.
- APAI has finalized WWTP reports for Eagle Mountain and Richland Chambers watersheds. These deliverables are 100 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 | |

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| 10/7/04 | Completed |
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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>
- TWRI and representatives from the Texas AgriLife Research and Extension Urban Solutions Center participated in meetings regarding the WPP Short course. It is the intent to present the North Central Texas Water Quality Project as a case study at the event.
- On September 14, 2007, TWRI coordinated a project meeting of the North Central Texas Water Quality Project team to discuss modeling activities, educational programs, stakeholder participation, economic analysis and project deliverables.
- TWRI coordinated 2 work group meetings (July 24 & 25) in the Cedar Creek to gather information for the WPP. The groups focused on the Ag NPS and urban WWTP/Stormwater management.
- TWRI conducted a stakeholder meeting of the Cedar Creek watershed partners on August 28, 2007.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on October 23, 2007. Topics of discussion included the evaluation and ranking of BMPs, modeling data review, educational programs and the nine elements of watershed planning.

- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on January 24, 2008. Topics of discussion included educational outreach, setting water quality goals and discussions on BMP effectiveness.
- On April 9, 2008, TWRI coordinated a project meeting of the North Central Texas Water Quality Project team to discuss modeling activities, educational programs, stakeholder participation, economic analysis and project deliverables.
- On July 9, 2008, TWRI coordinated a project meeting of the North Central Texas Water Quality Project team to discuss modeling activities, educational programs, stakeholder participation, economic analysis and project deliverables.
- On July 24, 2008, the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed. The meeting focused on developing a monitoring strategy and final review of the education and outreach plan.
- On September 3, 2008 Texas AgriLife Research and Extension Urban Solutions Center conducted a two stakeholder meetings in the Eagle Mountain watershed at different locations. The meetings focused on a review of water quality on the watershed and reservoir, modeling activities, causes of pollution, and BMPs.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on September 11, 2008. Topics of discussion focused on economic analysis and review of the draft watershed protection plan.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on November 20, 2008. Topics of discussion focused on economic analysis and SWAT modeling results related to BMP analysis of model runs.
- Cedar Creek Watershed Planning Process presented as a case study at the TWRI Watershed Planning Short Course January 12-16. Noteworthy is the approach economic performance data of best management practices and use of subwatershed modeling to drive stakeholder decision making.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Eagle Mountain watershed on January 21, 2009. Topics of discussion focused on watersheds in general, current water quality of Eagle Mountain Lake, overviews of the SWAT and WASP models, types of BMPs, a stakeholder survey on BMPs, WWTP study results and the 9 elements of a WPP.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on February 5, 2009. Topics of discussion focused on stakeholder feedback received, SWAT modeling results related to BMP analysis of model runs at the sub-watershed scale, a discussion of funding opportunities and setting milestones.

Problems or Obstacles Encountered and Remedial Actions Taken

The Spatial Sciences Laboratory and Texas AgriLife Research and Extension Center at Temple have been working closely with the Texas Water Resources Institute towards successful completion of project deliverables.

Work Planned for Next Quarter

Task 1: SWAT Modeling

Run the SWAT model for Eagle Mountain Reservoir and begin identifying BMPs for the watershed to meet water quality standards. Finalize data collection and model development on Richland Chambers Reservoir.

Task 2: In-Stream and Reservoir Modeling

Finalize development and integration of QUAL2E and WASP models for Eagle Mountain Reservoir. Continue data collection on Richland Chambers Reservoir will continue.

Task 3: Study of Wastewater Treatment Plants

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.

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

Use of Awarded Funds

| YEARS 1-4* | Beginning Balance | Expenditures as of 10/1/07 | Remaining Balance |
|---------------------------------|------------------------------|---------------------------------------|------------------------------|
| Texas Water Resources Institute | \$67,030 | \$67,030 | \$75.45 |
| Spatial Sciences Lab - TAMU | \$40,280 | \$39,926 | \$0 |
| Alan Plummer Associates, Inc. | \$234,600 | \$230,976 | \$3,624.49 |
| Espey Consultants, Inc. | \$290,000 | \$279,700 | \$3759.88 |
| TOTAL DIRECT | \$631,910 | \$617,632 | \$7,459.82 |

* Budget details above do not include \$63,191 in indirect cost