

**Extending TMDL Efforts in the North Bosque River Watershed**  
**Revision January 4, 2007**  
**Texas State Soil and Water Conservation Board**  
**FY01 CWA Section 319(h) Project**  
**FY01-17**

**WORKPLAN**

April 1, 2006 – March 31, 2008

1. **Title of Project:** Extending TMDL Efforts in the North Bosque River Watershed.
2. **Project Goals/Objectives:** This project will provide storm and routine monitoring of tributaries that contribute nonpoint source loadings to an impaired water body in order to assess agricultural NPS reductions. A final report will be developed assessing preexisting and post-TMDL implementation effects.
3. **Project Tasks:** (1) Perform project administration, (2) Develop and maintain a Quality Assurance Project Plan, and (3) Conduct tributary monitoring, and (4) Develop final report assessing pre- and post-TMDL implementation effects on water quality.
4. **Measures of Success:** Demonstrate significant improvement in water quality associated with implementation of BMPs on agricultural operations that land-apply animal waste through the evaluation of monitoring data from tributaries of the North Bosque River comparing pre- and post-TMDL implementation time periods.
5. **Project Type:** Statewide (); Watershed (); Demonstration (); Other ().
6. **Waterbody Type:** River (); Groundwater (); Other ().
7. **Project Location:** North Bosque River, Segment 1226; Upper North Bosque River, Segment 1255.
8. **NPS Management Program Reference:** State of Texas Agricultural/Silvicultural Nonpoint Source Management Program.
9. **NPS Assessment Report Status:** Impaired (); Impacted (); Threatened (); TMDL (); Other ().
10. **Key Project Activities:** Hire Staff (); Monitoring (); Regulatory Assistance (); Technical Assistance (); Education (); Implementation (); Demonstration (); Other ().
11. **NPS Management Program Elements:** Milestones from the “1999 Texas Nonpoint Source Pollution Assessment Report and Management Program” that will be implemented include:
  - a. Coordinating watershed and microwatershed monitoring and modeling for agricultural/silvicultural NPS pollution;
  - b. Utilizing data derived from monitoring and modeling to support NPS pollution abatement and prevention activities in priority watersheds;
  - c. Coordinating with federal, state, and local programs;
  - d. Committing to technology transfer, technical support, administrative support, and cooperation between agencies and programs for the prevention of NPS pollution.
12. **Project Costs:** Federal (\$441,755); Non-Federal Match (\$294,504); Total Project (\$736,259).
13. **Project Management:** Texas Institute of Applied Environmental Research (TIAER) Cooperating Entities: the Texas State Soil and Water Conservation Board (TSSWCB).
14. **Project Period:** April 1, 2006 through March 31, 2008.

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**Problem/Need Statement:** The basis for this project is to provide assessment activities in the North Bosque River watershed to support the Texas State Soil and Water Conservation Board (TSSWCB) and local Soil and Water Conservation Districts (SWCDs) in efforts to reduce agricultural nonpoint source (NPS) pollution loadings. According to the 1999 State of Texas 303(d) List, Segments 1226 (North Bosque River) and 1255 (Upper North Bosque River) in the Brazos River Basin are impaired. Both segments appeared on the Texas Natural Resource Conservation Commission (TNRCC, now the Texas Commission on Environmental Quality) Total Maximum Daily Load (TMDL) Development Basin Schedule for 1998 under narrative water quality criteria related to nutrients and aquatic plant growth. Within the TMDL process, phosphorus was identified as the nutrient most often limiting aquatic plant growth in the North Bosque River watershed, and dairy operations and municipal wastewater treatment plant effluents were considered the major controllable sources of phosphorus to the river. The TNRCC approved two TMDLs for phosphorus in the North Bosque River for Segments 1226 and 1255 on February 9, 2001 that were submitted and approved by the United States Environmental Protection Agency (USEPA) in December 2001. The Implementation Plan for the two North Bosque River segments was accepted by the TCEQ in December 2002 and by the TSSWCB in January 2003.

Also, although bacteria were also listed as a concern with regard to supporting the use of contact recreation along the North Bosque River, the TMDL process did not directly consider bacteria. Many of the control practices for phosphorus outlined in the Implementation Plan should also help reduce bacterial loadings to the North Bosque River.

This project represents a continuation of an effort outlined in the Implementation Plan<sup>1</sup> using a microwatershed approach to target water quality monitoring and agricultural producer assistance to help reduce phosphorus loadings to the North Bosque River. This specific effort focuses on the monitoring microwatersheds to target areas needing BMP implementation. As indicated in the Implementation Plan, “Monitoring microwatersheds will enable more precise identification of areas with waste management problems or inadequacies and better support efforts to improve management.”

As the lead agency for the State of Texas for the abatement of agricultural NPS pollution, the TSSWCB works closely with local SWCDs to reduce NPS pollution. The TSSWCB addresses the prevention or abatement of NPS pollution from various agricultural activities through the Water Quality Management Plan (WQMP) Program. A certified WQMP is a site-specific plan which includes appropriate land-treatment practices, production practices, technologies and combinations thereof, and an implementation schedule. This program is administered by the TSSWCB and provides agricultural producers in priority areas such as the North Bosque River watershed an opportunity to comply with state water quality laws through traditional voluntary incentive-based programs. The TSSWCB oversees and is responsible for the cost-share component of the program. The local SWCDs are required to provide or arrange for technical assistance to applicants to implement Best Management Practices (BMPs) through certified WQMPs. In many of the SWCDs in Texas, the Natural Resources Conservation Service (NRCS) also provides technical assistance in the development of WQMPs. Through this project, water quality assessment

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<sup>1</sup> TSSWCB Projects #01-13 and #01-14, Technical and Financial Assistance to Dairy Producers and Landowners of the North Bosque River Watershed within the Cross-Timbers and Upper Leon Soil and Water Conservation Districts.

data would be used to help target and support the need for WQMPs focusing on phosphorus reduction efforts to meet water quality goals within the North Bosque River.

This project would also assess the impact of another effort within the TMDL Implementation Plan that focuses on the removal of dairy-generated manure from the watershed. To aid the removal of dairy-generated manure, TSSWCB and TCEQ have complementary programs that support the composting and export of dairy manure from the North Bosque River watershed. The TSSWCB Dairy Manure Export Support (DMES) program provides financial incentives to commercial manure haulers for the transport of raw manure from dairies to commercial composting facilities. The TCEQ Composted Manure Incentive Project (CMIP) provides oversight of commercial compost facilities and provides rebates to Texas State agencies that use the manure compost. From November 2000 through October 2005, 924,000 tons of raw manure have been taken to composting facilities.

Preliminary water quality evaluations at microwatershed stream sites indicate that these complementary dairy manure haul-off and composting export programs are having a positive impact on water quality. Within microwatersheds with the highest levels of participation (as measured by manure removed per cow and drainage area) statistically significant decreases in soluble phosphorus have been measured. Improvements in water quality were not seen at microwatershed stream sites with lower levels of manure hauled off in part, because of the relatively short assessment period after the start of the manure-composting program (only about three years). A longer post-implementation assessment period is needed to measure the success of the variety of Implementation Plan activities within the North Bosque River watershed.

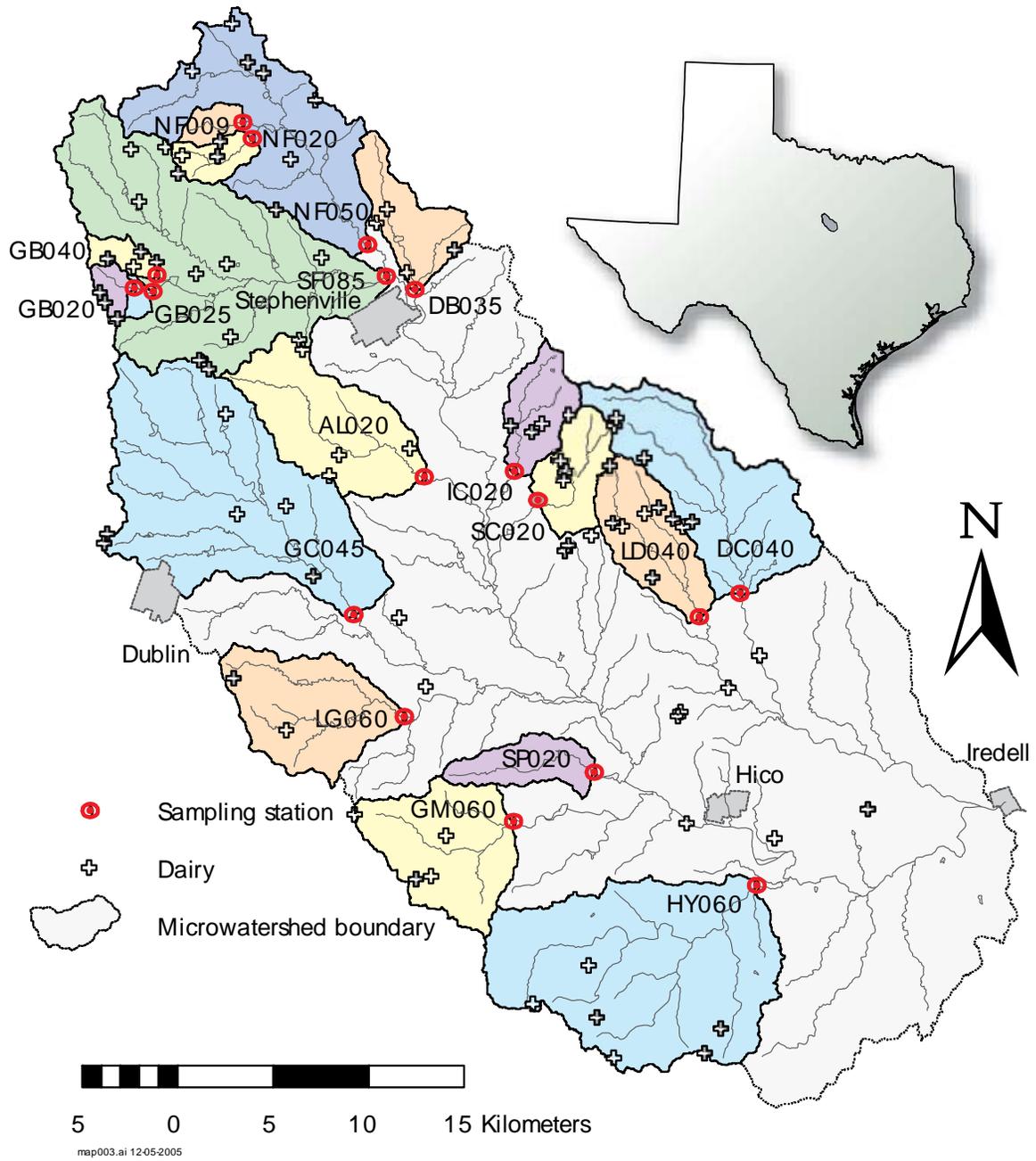
**General Project Description:** The primary focus of this 319(h) project is to assess the preexisting and post-TMDL implementation effects at the microwatershed level. A secondary focus is to provide TSSWCB and local SWCDs with support in targeting areas needing water quality improvement.

In this project, TIAER will provide assessment activities at 18 microwatershed sites within the North Bosque River (Figure 1). The monitoring effort will make use of numerous automated sampling systems in TIAER's possession that will be made available to this project. Historical or nondirect data obtained from other projects with approved EPA or the State of Texas QAPPs will also be used to supplement this project. The data collected for this project will be used to determine the reduction of NPS pollution associated with post-TMDL implementation efforts and provide data to inform TSSWCB of areas where focused reduction efforts are most needed.

These 18 microwatersheds represent a variety of land uses within the watershed and provide focused monitoring in the upper portion of the North Bosque River watershed where most of the dairy operations are located (Table 1). Most of these stream sites have been monitored since April or May 2001, although some sites have a monitoring history extending back to 1991 (Table 2). The historical water quality data available at these sites has been collected by TIAER and will be made available as non-direct data to this project for use in the assessment of water quality improvements.

The monitoring activities of this project will consist of automated stormwater sampling, biweekly (once every two weeks) ambient grab sampling, and continuous streamflow measurements. Field measurements of dissolved oxygen, water temperature, specific conductance, and pH will occur with all grab sampling. Stormwater samples will be retrieved on a daily basis and flow composited into a single sample. All water samples will be analyzed for various nutrient forms (i.e., total phosphorus, dissolved orthophosphate phosphorus [frequently referred to as soluble reactive phosphorus], total Kjeldahl nitrogen, dissolved ammonia, dissolved nitrite plus nitrate), and total suspended sediments (TSS). In addition, biweekly grab samples will be analyzed for *E. coli*. The nitrogen forms are included in the laboratory analyses to provide a more complete indication of macronutrient conditions in the watershed, to evaluate whether agricultural BMPs are reducing both nutrients (nitrogen and phosphorus), and to ensure that efforts to reduce one nutrient is not inadvertently increasing another. In addition starting in early 2007 with approval of an amendment to the QAPP, grab samples will be collected during elevated flows associated with storm events for analysis of *E. coli*. Because of the extremely dry weather conditions during the first seven months of the project, very few grab samples of *E. coli* have been collected at any of the sampling sites. Storm monitoring of bacteria is being added to the work plan to allow some characterization of bacteria levels in these highly intermittent systems.

Project staff will also maintain equipment to record continuous water level information and take required measurements to maintain and update, as needed, existing state-discharge relationships (rating curves) at all stations.



**Figure 1. Location of microwatershed sampling sites within the upper portion of the North Bosque River watershed.**

**Table 1. Estimated land use and drainage area above sampling sites.**

TIAER Site ID	Wood & Range (%)	Pasture (%)	Cropland (%)	Dairy Waste App. Fields (%) <sup>a</sup>	Urban (%)	Other (%)	Total Area (Hectares)
AL020	57.6	23.0	7.4	11.4	0.7	0.0	4,720
DB035	46.2	24.1	12.8	14.0	2.3	0.6	2,130
DC040	72.5	4.8	7.1	14.9	0.6	0.0	6,250
GB020	40.6	17.7	0.6	40.6	0.6	0.0	440
GB025	29.5	13.5	0.6	55.9	0.5	0.0	660
GB040	21.1	42.8	4.9	30.2	0.7	0.1	540
GC045	61.5	22.2	8.4	6.4	0.9	0.5	11,900
GM060	78.1	13.3	2.8	5.7	0.1	0.0	4,410
HY060	71.7	12.9	12.3	2.9	0.1	0.1	11,800
IC020	64.9	16.8	6.1	11.8	0.3	0.0	1,740
LD040	59.3	5.4	5.5	29.6	0.1	0.1	2,960
LG060	66.2	16.7	9.4	7.1	0.1	0.5	4,260
NF009 <sup>b</sup>	58.4	27.2	11.4	2.7	0.2	0.0	520
NF020	29.7	14.2	3.3	52.6	0.1	0.1	800
NF050	45.6	34.1	8.3	11.2	0.3	0.6	8,370
SC020	68.7	9.4	1.4	20.0	0.1	0.4	1,900
SF085	50.6	26.5	5.6	14.3	2.2	0.7	12,900
SP020 <sup>c</sup>	82.6	12.0	5.2	0.0	0.1	0.1	1,560

<sup>a</sup> Information on dairy waste application fields within microwatersheds was obtained from dairy permits and dairy waste management plans on record with the TCEQ as of May 2000.

<sup>b</sup> Site NF009 represents a microwatershed stream site with minimal impact from dairies but with impact from other agricultural practices for comparison.

<sup>c</sup> Site SP020 represents a least impacted or reference microwatershed stream sites for comparison as a control.

**Table 2. Location and sampling history of monitoring sites.**

TIAER Site ID	TCEQ ID	Watershed and General Location	Date of First Grab Sample	Date of First Automatic Storm Sample
AL020	17604	Alarm Creek at FM 914	14-May-01	5-Sep-01
DB035	17603	Dry Branch near FM 8	2-Apr-02	5-Feb-02
DC040	17607	Duffau Creek at FM 2481	16-Apr-01	7-May-01
GB020	17214	Unnamed tributary to Goose Branch between CR 541 and CR 297	11-May-95	5-May-95
GB025	17213	Unnamed tributary to Goose Branch near end of CR 297	12-Feb-97	19-May-97
GB040	17215	Goose Branch downstream of FM 8	12-Feb-97	6-Feb-97
GC045	17609	Green Creek upstream of SH 6	16-Apr-01	26-May-01
GM060	17610	Gilmore Creek at bend of CR 293	5-Feb-01	31-Aug-01
HY060	17611	Honey Creek at FM 1602	16-Apr-01	4-May-01
IC020	17235	Indian Creek downstream of US 281	8-Jun-94	18-Oct-93 <sup>a</sup>
LD040	17608	Little Duffau Creek at FM 1824	14-May-01	31-Aug-01
LG060	17606	Little Green Creek at FM 914	14-May-01	14-Jul-01
NF009	17223	Unnamed tributary of Scarborough Creek at CR 423	18-Apr-91	16-May-92 <sup>b</sup>
NF020	17222	North Fork North Bosque River Scarborough Creek at CR 423	30-Oct-91	19-May-92
NF050	17413	North Fork of North Bosque River at SH 108	4-Apr-91	7-Jun-91 <sup>c</sup>
SC020	17240	Sims Creek upstream of US 281	21-Sep-94	17-Jan-95 <sup>a</sup>
SF085	17602	South Fork of North Bosque River at SH 108	30-Apr-01	26-May-01
SP020	17242	Spring Creek at CR 271	8-Jun-94	20-Oct-93 <sup>a</sup>

<sup>a</sup> Storm sampling suspended from March 3, 1998 to May 3, 2001 at IC020 and SP020 and from March 3, 1998 through May 12, 2001 at SC020.

<sup>b</sup> Storm sampling at NF009 was suspended from March 25, 1998 through June 12, 1998.

<sup>c</sup> Storm sampling at NF050 was suspended from February 9, 1997 through May 4, 2001.

Historical data obtained from the microwatershed monitoring will be used to establish baseline nutrient concentrations within these smaller streams and tributaries that contribute flow to 303(d) listed waterbodies within the watershed. As implementation of BMPs progresses, the direct microwatershed monitoring associated with this project will more effectively measure the success of agricultural BMPs by removing the cumulative effect of urban NPS pollution and wastewater treatment plant contributions associated with stream sites along the main stem of the North Bosque River.

**Tasks, Objectives, Schedules, and Estimated Costs:**

**Task 1: Project Administration**

**(Estimated Cost: \$19,730 Federal; \$13,757 Non-Federal; Total \$33,487)**

**Objective:** To effectively coordinate and monitor all work performed under this contract including technical and financial supervision, preparation of status reports, and maintenance of project files and data. Progress reports shall document all activities performed within a quarter. Quarterly reports are due by the 15<sup>th</sup> of January, April, July, and October.

**Task 1.1:** Internal project kick-off meeting to organize project team, establish meeting schedule and project milestones.

**Task 1.2:** Submit quarterly Progress Reports, which will include the status of deliverables for each objective and a narrative description of the progress on each task.

**Task 1.3:** Submit appropriate Reimbursement Forms.

**Deliverables**

- Quarterly progress reports
- Reimbursement forms

**Task 2: Quality Assurance Project Plan**

**(Estimated Cost: \$6,498 Federal; \$4,560 Non-Federal; Total \$11,058)**

**Objective:** To develop Data Quality Objectives (DQO), a Quality Assurance Project Plan (QAPP) and provide amendments and annual revisions to the QAPP, as needed. Because this project is an extension of a previous 319(h) project, the QAPP will be developed with the goal of having it approved by the start date of this project, so sampling may continue seamlessly between projects without a gap in time. The previous project ends March 31, 2006 and this project should initiate April 1, 2006.

**Task 2.1:** Develop data quality objectives and submit a draft Quality Assurance Project Plan for review by the TSSWCB and EPA at least two months prior to the initiation of the project.

**Task 2.2:** Revise QAPP for approval by the TSSWCB and EPA and finalize by the time the project is initiated.

**Task 2.3:** Provide annual revisions to the QAPP and amendments, as necessary, to the TSSWCB and EPA.

**Deliverables**

- Approved QAPP
- Approved annual revisions and amendments to QAPP

**Task 3: Water Quality Monitoring and Data Collection**

**(Estimated Cost: \$377,689 Federal; \$249,858 Non-Federal; Total \$627,547)**

**Objective:** To perform routine grab and storm assessment activities at stream sampling sites including collection of flow and associated measurements for maintaining stage-discharge relationships. Direct sampling under this project is planned to start in April 1, 2006, assuming an approved QAPP is in place.

**Task 3.1:** TIAER will perform routine biweekly grab sampling at all 18 stream sites (Figure 1). Water quality samples will be collected only if water is flowing. If water is not flowing when biweekly sampling is scheduled, a water quality sample will not be collected, but it will be documented that the stream was pooled or dry. Routine grab samples will be analyzed for nutrient forms, TSS, and *E. coli*. In addition, field constituents of dissolved oxygen, pH, conductivity, and water temperature will be recorded at the time grab samples are collected.

**Task 3.2:** TIAER will maintain and operate automated samplers and water-level recorders at all 18 stream sites. Automated samplers will be set to activate sampling upon a small rise in water level and collect individual samples at sequential time intervals. At each stream site, individual stormwater samples will be collected daily and flow composited into one sample that will be analyzed for nutrient forms and TSS. Project funds were originally budgeted for the collection and analysis of 770 wet weather samples per year for all 18 sampling sites based on historical data. Due to the unpredictable nature of wet weather monitoring, TIAER is not able to guarantee a set number of wet weather samples from each station. Due to very dry weather conditions, only about a third of the anticipated storm samples were collected during the first nine months of the project. To accommodate these fewer than anticipated storm samples and the capacity of the laboratory to handle a given number of samples during the remaining portion of the project, the project will collect and analyze a maximum of 1140 rather than 1540 storm samples. If stream conditions such as resulting from appreciably greater than average rainfall result in the likelihood of more samples than budgeted, corrective measures, such as discarding samples from small runoff events, will be implemented to reduce sample load and yet provide representative sampling over the duration of the project sampling period.

**Task 3.3:** Stage-discharge relationships will be maintained and updated, as necessary, for all stream sites. This will include taking flow measurements and re-surveying stream cross-sections, if apparent changes have occurred.

**Task 3.4:** TIAER will conduct routine general maintenance of all automated sampling and water level equipment to help ensure that these instruments will operate properly during storm water conditions.

**Task 3.5:** TIAER will collect grab samples for analysis of *E. coli* during elevated flows associated with storm events. Samples will be collected once per day during elevated flows with sampling continuing at least one day after flow levels have receded (assuming flow is still occurring) to evaluate changes in *E. coli* concentrations with changes in flow. To accommodate lab and field staff due to the relatively short holding times associated with bacteria samples (8 hours), storm sampling of bacteria will occur only during the standard work week (Monday – Friday) and not on weekends. Modifications to this sampling regime may also occur to accommodate available incubator and laboratory space, if an extended wet-weather period is encountered.

## **Deliverables**

- A water quality data summary for each site will be submitted to the TSSWCB as part of TIAER's semiannual water quality report of assessment activities in the Bosque River watershed.

## **Task 4: Development of Final Report Assessing the Preexisting and Post-TMDL Implementation Effects (Estimated Cost: \$37,838 Federal; \$26,329 Non-Federal; Total \$64,167)**

**Objective:** Develop a report assessing the impact of post-TMDL implementation activities on stream water quality.

**Task 4.1:** Mid-way through the project, TIAER will develop an interim project report that will evaluate the success of post-TMDL implementation activities on water quality at microwatershed stream sites for data collected through December 2006. A draft of this interim report will be submitted to the TSSWCB in June 2007, and all TSSWCB comments will be considered and addressed before finalizing the interim report.

**Task 4.2:** During the last four months of the project, TIAER will develop a final project report that will evaluate the success of post-TMDL implementation activities on water quality at microwatershed stream

sites. A draft of this report will be submitted to the TSSWCB for review at the end of the project. All TSSWCB comments will be considered and addressed before finalizing the report.

**Deliverables**

- Draft and final interim project report.
- Draft and final project report.

**Coordination, Roles and Responsibilities:**

Cooperating Entities and a summary of their roles in this project:

- **Texas Institute for Applied Environmental Research – Project Lead:** Responsible for 1) submitting quarterly reports, 2) developing Data Quality Objectives and a Quality Assurance Project Plan for approval by TSSWCB and USEPA, 3) performing microwatershed stream monitoring, and 4) compiling and analyzing monitoring data for an interim report and a final report.
- **Texas State Soil & Water Conservation Board:** Responsible for project management and assisting TIAER in development of the final report.

**Project Milestones and Budget:**

The project milestones are provided in Table 3 for each objective and its tasks. The revised project budget showing the transfer between budget categories is provided in Table 4. The project budget remains the same with \$441,755 federal, \$294,504 non-federal and \$736,259 total.

**Table 3. Schedule of Milestones.**

<b>Task #</b>	<b>Description</b>	<b>Start Date</b>	<b>End Date</b>
<b>1</b>	<b>Project Administration</b>	April 2006	April 2008
1.1	Internal kick off meeting	April 2006	May 2006
1.2	Quarterly progress reports	July 2006	April 2008
1.3	Reimbursement forms	April 2006	April 2008
<b>2</b>	<b>Quality Assurance</b>	January 2006	April 2008
2.1	Develop draft QAPP	January 2006	February 2006
2.2	Revise QAPP and finalize	February 2006	March 2006
2.3	Provide annual QAPP revisions	January 2007	March 2007
<b>3</b>	<b>Water quality monitoring</b>	April 2006	April 2008
3.1	Biweekly grab sampling	April 2006	April 2008
3.2	Storm sampling	April 2006	April 2008
3.3	Stage-discharge measurements	April 2006	April 2008
3.4	General maintenance	April 2006	April 2008
3.5	Bacteria storm sampling	February 2007 <sup>a</sup>	April 2008
<b>4</b>	<b>Development of final report</b>	November 2007	April 2008
4.1	Draft interim report	March 2007	June 2007
4.2	Draft final report	November 2007	April 2008

<sup>a</sup> Contingent on approval of QAPP amendment adding bacterial storm sampling.

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**Table 4. Revised Budget showing Transfers between Categories  
Extending TMDL Efforts in the North Bosque River Watershed  
Texas State Soil and Water Conservation Board  
FY01 CWA Section 319(h) Project**

**April 1, 2006 – April 1, 2008**

Description	Federal	Non-Federal	Total
1. Personnel/Salary:	\$239,456	\$72,174	\$311,630
2. Fringe Benefits:	\$55,075	\$16,600	\$71,675
3. Travel:	\$8,094	\$5,396	\$13,490
4. Equipment:	\$14,500	\$9,667	\$24,167
5. Supplies:	\$79,532	\$53,022	\$132,554
6. Contractual:	\$0	\$0	\$0
7. Construction:	\$0	\$0	\$0
8. Other:	\$4,938	\$3,292	\$8,230
9. Total Direct Costs: (Sum 1-8)	\$401,595	\$160,151	\$561,746
10. Indirect Costs: Calculated as a percent of Personnel**	\$40,160	\$134,353	\$174,513
11. Total:(Sum 9-10)	\$441,755	\$294,504	\$736,259

\*\* Indirect cost for the federal portion of the grant is equal to 10% of the total direct costs. The total indirect cost is equal to total salaries multiplied by 56% (Tarleton State University's indirect rate).