



**Texas State Soil and Water Conservation Board
 Total Maximum Daily Load Program
 FY 2009 Project 09-52**

TMDL PROJECT SUMMARY PAGE		
Title of Project	Bacterial Source Tracking for Little Brazos River Tributaries Bacteria Assessment [Short Title: BST for LBR Tributaries Bacteria Assessment]	
Project Goals/Objectives	To assess contact recreation use impairments and support watershed planning for five tributaries of the Little Brazos River by conducting bacterial source tracking.	
Project Tasks	1) Project Administration and Coordination; 2) Quality Assurance; 3) Bacterial Source Tracking	
Measures of Success	1) Decision-making for watershed planning activities, including bacterial source tracking, is founded on local stakeholder input. 2) Bacterial source tracking in the five segments in the study area is conducted using data of known and acceptable quality. 3) Various contributing sources of bacteria are identified for each of the five segments in the study area through bacterial source tracking. 4) Critical loading areas for various contributing sources of bacteria within the watersheds are identified for targeted best management practice implementation based on bacterial source tracking.	
Project Type	Implementation (); Education (); Planning (); Assessment (X)	
Status of Waterbody on 2008 Texas Water Quality Inventory and 303(d) List	<u>Segment ID:</u> 1242I – Campbells Creek 1242K – Mud Creek 1242L – Pin Oak Creek 1242M – Spring Creek 1242O – Walnut Creek	<u>Parameter:</u> bacteria bacteria bacteria bacteria bacteria
		<u>Category:</u> 5c 5a 5a 5a 5c
Project Location (Statewide or Watershed and County)	Robertson County, Little Brazos River Watershed	
Key Project Activities	Hire Staff (X); Surface Water Quality Monitoring (); Technical Assistance (); Education (); Implementation (); BMP Effectiveness Monitoring (); Demonstration (); Planning (); Modeling (); Bacterial Source Tracking (X); Other ()	
Texas NPS Management Program Elements	<ul style="list-style-type: none"> • Element One (STG 1B; STG 1C; STG 1D; STG 2A; STG 3B; STG 3D) • Element Two • Element Five 	
Project Costs	\$92,200 (TSSWCB TMDL GR)	
Project Management	Texas A&M AgriLife – Texas Water Resources Institute	
Project Period	September 1, 2008 – May 31, 2010	

Part I – Applicant Information

Applicant							
Project Lead		Terry Gentry, Ph.D.					
Title		Assistant Professor of Soil and Aquatic Microbiology					
Organization		Texas AgriLife Research – Department of Soil and Crop Sciences					
E-mail Address		tgentry@ag.tamu.edu					
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City	College Station	County	Brazos	State	Texas	Zip Code	77843-2474
Telephone Number	(979) 845-5323			Fax Number	(979) 845-0456		
Co-Applicant							
Project Co-Lead		Bill Harris, Ph.D.					
Title		Associate Director					
Organization		Texas A&M AgriLife – Texas Water Resources Institute					
E-mail Address		bharris@ag.tamu.edu					
Street Address		1500 Research Parkway, Suite A240 2118 TAMU					
City	College Station	County	Brazos	State	Texas	Zip Code	77843-2118
Telephone Number	(979) 845-1851			Fax Number	(979) 845-8554		

Project Partners	
Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with related projects and the Texas Commission on Environmental Quality (TCEQ).
Texas AgriLife Research – Department of Soil and Crop Sciences (SCSC)	Bacterial Source Tracking (Task 3).
Texas A&M AgriLife – Texas Water Resources Institute (TWRI)	Project Administration and Coordination (Task 1), and Quality Assurance (Task 2).
Brazos River Authority (BRA)	Facilitate public participation and coordinate stakeholder involvement, conduct watershed source survey (Subtask 3.4), and collect water quality monitoring samples (Subtask 3.3) through TSSWCB project 08-54.
Texas A&M AgriLife – Texas Water Resources Institute (TWRI) and Texas AgriLife Research – Department of Biological and Agricultural Engineering (BAEN)	Perform spatially explicit modeling (Subtask 3.5) through TSSWCB project 08-55.
Robertson County Soil and Water Conservation District (SWCD 451)	Collaborate as a critical local stakeholder and play a lead role in communicating with other local stakeholders

Part II – Project Information

Watershed Information				
Watershed Name	Hydrologic Unit Code (8 Digit)	Segment ID	305(b) Category	Size (Acres)
Campbells Creek	12070101	1242I	5c	22,598
Mud Creek		1242K	5a	49,886
Pin Oak Creek		1242L	5a	25,979
Spring Creek		1242M	5a	23,174
Walnut Creek		1242O	5c	87,538

Water Quality Impairment

Describe all known causes of water quality impairments from any of the following sources: 2008 Texas Water Quality Inventory and 303(d) List, Clean Rivers Program Basin Summary/Highlights Reports, or other documented sources.

2008 Texas Water Quality Inventory and 303(d) List

- 1242I – bacteria impairment – source unknown
- 1242K – bacteria impairment – municipal point source discharges; source unknown
- 1242L – bacteria impairment – livestock NPS (grazing or feeding operations)
- 1242M – bacteria impairment – livestock NPS (grazing or feeding operations)
- 1242O – bacteria impairment – source unknown

2008 BRA Clean Rivers Program Basin Highlights Report

Many of the [bacterial] impaired sub-segments in 1242 are small, rural streams with little to no flow for most of the year whose water is primarily generated by storm events and the associated runoff. The task of addressing bacteria...is particularly daunting because...of the...many potential nonpoint sources that may contribute to the impairment. In many of these small, rural streams compliance with the contact recreation standard is hindered by the natural features of the microwatershed.

2007 BRA Clean Rivers Program Basin Summary Report

Sources of elevated bacteria levels prevalent through much of the watershed have not been determined. Rangeland runoff may be the main contributor, given the rural nature of most of the drainage area. Most of the unclassified waterbodies are small, rural streams with low to intermittent flow.

2006 BRA Clean Rivers Program Basin Highlights Report

The potential sources of elevated bacteria levels prevalent throughout this watershed have not been investigated. A review of land use and potential sources of bacteria is recommended with additional monitoring locations as needed to isolate potential sources of impacts.

2005 BRA Quality Water for the Brazos Community – Final Draft Management Plan

Possible sources [of fecal contamination] include inadequately treated sewage, improperly managed livestock waste, pet waste, aquatic birds and mammals, failing septic systems, and wildlife.

Project Narrative

Problem/Need Statement

The central watershed of the Brazos River consists of one classified waterbody, the Brazos River above Navasota River (Segment 1242), and a number of unclassified waterbodies on tributary systems. This segment extends from the Lake Brazos Dam in Waco 183 miles downstream to its confluence with the Navasota River southeast of College Station and its watershed encompasses approximately 2,705 mi². With the exception of the Waco and Bryan/College Station urban areas, land use in the watershed is generally agricultural with a few large industrial facilities and quarries.

In 2002, a water quality data analysis determined that seven unclassified waterbodies within the central watershed had bacteria concentrations that exceed state water quality standards for contact recreation. As a result, these waterbodies were placed on the *Texas 303(d) List*. Four additional unclassified segments were added to the *2006 303(d) List* bringing the total number of water quality impairments (bacteria) on segment 1242 to eleven. All 11 unclassified waterbodies remain on the *2008 303(d) List*.

Of those waterbodies impaired for bacteria, five are located within a very close proximity of each other in Robertson County and share similar land use and water quality characteristics. In addition, they are all tributaries to the Little Brazos River (Segment 1242E). The five waterbodies in this project's study area are Campbells Creek (Segment 1242I), Mud Creek (Segment 1242K), Pin Oak Creek (Segment 1242L), Spring Creek (Segment 1242M), and Walnut Creek (Segment 1242O). The study area encompasses 327 mi², almost entirely within Robertson County. The land use in the area is primarily agricultural (range and pastureland with mixed areas of cultivated cropland) with several small communities.

The *2008 303(d) List* identifies three segments in the study area as Category 5a and two segments in the study area as Category 5c, meaning that the waterbody does not meet applicable water quality standards for one or more designated uses by one or more pollutants and that either (5a) a TMDL is underway, scheduled, or will be scheduled, or (5c) additional data and information will be collected before a TMDL is scheduled.

The TCEQ and the TSSWCB established a joint, technical Task Force on Bacteria TMDLs in September 2006 charged with making recommendations on cost-effective and time-efficient bacteria TMDL development methodologies. The Task Force recommended the use of a three-tier approach that is designed to be scientifically credible and accountable to watershed stakeholders. The tiers move through increasingly aggressive levels of data collection and analysis in order to achieve stakeholder consensus on needed load reductions and strategies to achieve those reductions. In June 2007, the TCEQ and the TSSWCB adopted the principles and general process recommended by the Task Force and directed agency staff to incorporate the principles of the recommendations into an updated joint-agency TMDL guidance document.

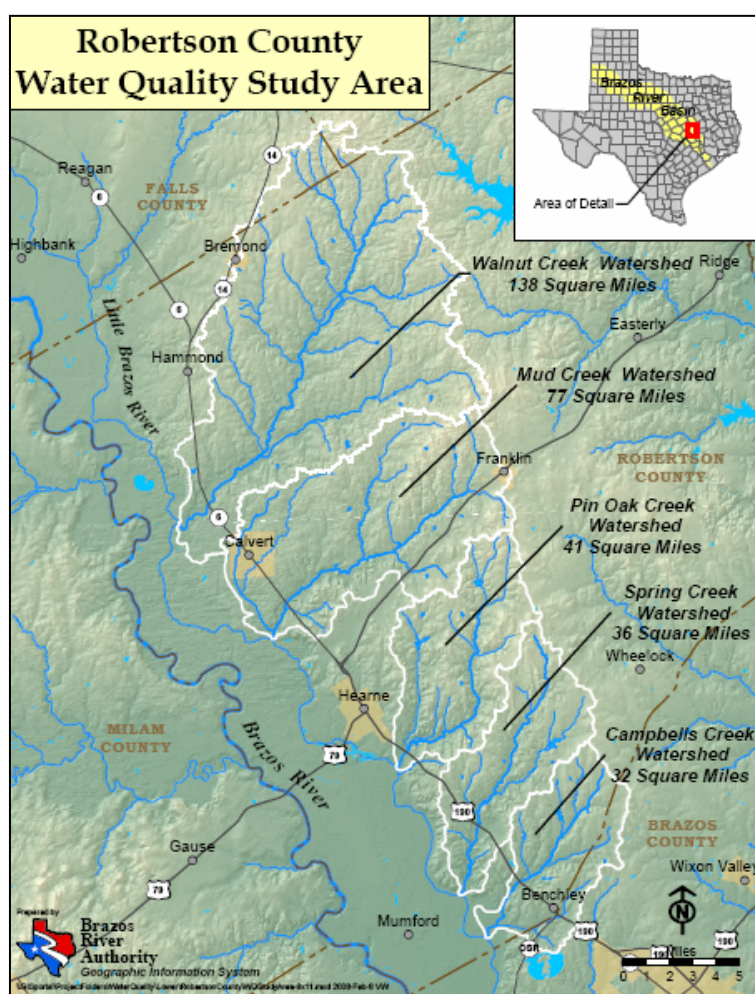
In accordance with the *Memorandum of Agreement Between the TCEQ and the TSSWCB Regarding TMDLs, Implementation Plans, and Watershed Protection Plans*, the TSSWCB has agreed to take the lead role in addressing the bacteria impairments for the five segments in the study area. Through this and associated projects, the TSSWCB and SCSC will work with local stakeholders to progress through the data collection and analysis components of the first two tiers of the Task Force recommended three-tier approach.

Project Narrative

General Project Description

In order to communicate project goals, activities, results and accomplishments to affected parties, SCSC and TWRI will participate in public stakeholder meetings as needed. At a minimum, public stakeholder meetings shall consist of an organizational/kick-off meeting, a source survey design meeting, a meeting presenting results from initial data analysis, a Texas Watershed Steward Program workshop, two project update meetings during the middle of the project, a meeting presenting data analysis results, and a meeting presenting final technical reports.

TWRI will develop a Quality Assurance Project Plan (QAPP) to ensure data of known and acceptable quality are generated and used in this project. The QAPP shall be consistent with the *TSSWCB Environmental Data Quality Management Plan*.



To assess and identify different sources contributing to bacteria loadings, SCSC will conduct Bacterial Source Tracking (BST). SCSC will conduct library-independent BST utilizing the *Bacteroidales* polymerase chain reaction (PCR) genetic test for human, ruminant, horse, and swine markers. Additionally, SCSC will conduct limited library-dependent BST and analyze *E. coli* isolates utilizing the enterobacterial repetitive intergenic consensus PCR (ERIC-PCR) and RiboPrinting (RP) combination method (ERIC-RP). This will serve to confirm that the sources of *E. coli* and *Bacteroidales* are comparable and assess the spatial and temporal adequacy of the Texas Known Source Library in order to determine the need for collection of local known source library samples if intensive library-dependent BST is employed in the future.

To provide sufficient water quality data to characterize bacteria loadings in the study area, BRA, through TSSWCB project 08-54, *Assessment of Contact Recreation Use Impairments and Watershed Planning for Five Tributaries of the Little Brazos River*, will conduct routine ambient monitoring, effluent monitoring, and biased-flow monitoring under high flow conditions. BRA will provide SCSC a subset of these samples for BST. BRA will work with SCSC to ensure sample collection activities employ adequate quality assurance/control mechanisms for BST.

BRA will design and conduct a watershed source survey, through TSSWCB project 08-54, that better characterizes the possible sources of bacteria loadings in the study area. SCSC will assist BRA in designing the watershed source survey. Results from the source survey will be used by SCSC to make appropriate adjustments to the BST sampling design and to assess the adequacy of the Texas Known Source Library.

To estimate loadings from various sources and to identify critical loading areas within the watersheds, BAEN will conduct watershed modeling for the study area through TSSWCB project 08-55, *Modeling Support for Little Brazos River Tributaries Bacteria Assessment*. SCSC will work with BAEN to integrate BST results into the model, to the extent possible, and address and reconcile discrepancies between BST and modeling results.

Project Goals (Expand from Summary Page)

To assess contact recreation use impairments and support watershed planning for five tributaries of the Little Brazos River by conducting BST.

Measures of Success (Expand from Summary Page)

- Decision-making for watershed planning activities, including BST, is founded on local stakeholder input.
- BST in the five segments in the study area is conducted using data of known and acceptable quality.
- Various contributing sources of bacteria are identified for each of the five segments in the study area through BST.
- Critical loading areas for various contributing sources of bacteria within the watersheds are identified for targeted BMP implementation based on BST.

2005 Texas Nonpoint Source Management Program Reference (Expand from Summary Page)

- **Element 1** – Explicit short-...term goals, objectives and strategies that protect surface...water.
 - **Short-Term Goal One – Data Collection and Assessment – Objective B** – Ensure that...procedures meet quality assurance requirements...
 - **Short-Term Goal One – Data Collection and Assessment – Objective C** – Conduct special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation.
 - **Short-Term Goal One – Data Collection and Assessment – Objective D** – Develop...TMDLs, I-Plans and WPPs to maintain and restore water quality in waterbodies...impacted by NPS pollution.
 - **Short-Term Goal Two – Implementation – Objective A** - ...determine priority areas and develop...strategies to address NPS pollution in those areas.
 - **Short-Term Goal Three – Education – Objective B** – Administer programs to educate citizens about water quality and their potential role in causing NPS pollution.
 - **Short-Term Goal Three – Education – Objective D** – Enable stakeholders...to participate in decision-making and provide a more complete understanding of water quality issues and how they relate to each citizen.
- **Element 2** – Working partnerships...[with] appropriate state,...regional, and local entities, private sector groups, and federal agencies.
- **Element 5** – The State...identifies waters...impaired by NPS pollution and...establishes a process to progressively address these...waters by conducting more detailed watershed assessments...

Tasks, Objectives and Schedules			
Task 1	Project Administration and Coordination		
Costs	\$4,668		
Objective	To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.		
Subtask 1.1	TWRI will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15 th of December, March, June and September. QPRs shall be provided to all project partners.		
	Start Date	Month 1	Completion Date Month 21
Subtask 1.2	TWRI will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.		
	Start Date	Month 1	Completion Date Month 21
Subtask 1.3	TWRI and SCSC will participate in coordination meetings or conference calls with TSSWCB, and any project partners as appropriate, at least quarterly to discuss project activities, project schedule, communication needs, deliverables and other requirements. Coordination with TSSWCB projects 08-54, <i>Assessment of Contact Recreation Use Impairments and Watershed Planning for Five Tributaries of the Little Brazos River</i> , and 08-55, <i>Modeling Support for Little Brazos River Tributaries Bacteria Assessment</i> , will be especially critical to achieve project goals.		
	Start Date	Month 1	Completion Date Month 21
Subtask 1.4	In order to communicate project goals, activities, results and accomplishments to affected parties, TWRI and SCSC will participate in public stakeholder meetings as needed. At a minimum, public stakeholder meetings shall consist of an organizational/kick-off meeting (month 2), a source survey design meeting (Subtask 3.4) (month 3), a meeting presenting results from initial data analysis (month 4), Texas Watershed Steward Program workshop (month 6), two project update meetings (months 9 and 15), a meeting presenting data analysis results (month 18), and a meeting presenting final technical reports (month 21).		
	Start Date	Month 1	Completion Date Month 21
Deliverables	<ul style="list-style-type: none"> Quarterly Progress Reports in electronic format Reimbursement Forms in either electronic or hard copy format 		

Tasks, Objectives and Schedules			
Task 2	Quality Assurance		
Costs	\$4,830		
Objective	To develop and implement data quality objectives (DQOs) and quality assurance/control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project.		
Subtask 2.1	TWRI will develop a QAPP for activities in Task 3 consistent with <i>EPA Requirements for Quality Assurance Project Plans (QA/R-5)</i> and the <i>TSSWCB Environmental Data Quality Management Plan</i> .		
	Start Date	Month 1	Completion Date Month 3
Subtask 2.2	TWRI will submit revisions and necessary amendments to the QAPP as needed.		
	Start Date	Month 4	Completion Date Month 21
Deliverables	<ul style="list-style-type: none"> QAPP approved by TSSWCB in both electronic and hard copy formats Approved revisions and amendments to QAPP, as needed. Data of known and acceptable quality as reported through Task 3. 		

Tasks, Objectives and Schedules			
Task 3	Bacterial Source Tracking		
Costs	\$82,702		
Objective	To conduct Bacterial Source Tracking to assess and identify different sources contributing to bacteria loadings.		
Subtask 3.1	SCSC will conduct library-independent BST on 50-100 water samples per segment utilizing the <i>Bacteroidales</i> PCR genetic test for human, ruminant, horse, and swine markers. The number of samples may be adjusted depending on the size of each watershed in the study area and the complexity of sources as identified in the source survey (Subtask 3.4). Specific genetic markers for various species are continually being developed by the scientific community and as new markers are identified, they should be included in this analysis, as the budget allows. Water samples for this subtask shall be a subset of those collected by BRA through TSSWCB project 08-54.		
	Start Date	Month 4	Completion Date Month 18
Subtask 3.2	SCSC will conduct limited library-dependent BST and analyze <i>E. coli</i> isolates from 50-100 water samples (1 isolate per water sample) from across the study area utilizing the ERIC-RP combination method. This will serve to 1) confirm that the sources of <i>E. coli</i> and <i>Bacteroidales</i> are comparable and 2) assess the spatial and temporal adequacy of the Texas Known Source Library in order to determine the need for collection of local known source library samples if intensive library-dependent BST is employed in the future. Water samples for this subtask shall be a subset of those collected by BRA through TSSWCB project 08-54.		
	Start Date	Month 4	Completion Date Month 18
Subtask 3.3	BRA will conduct water quality monitoring in the study area through TSSWCB project 08-54. BRA will provide a subset of collected water samples to SCSC for BST (Subtasks 3.1-3.2).		
	Start Date	Month 4	Completion Date Month 18
Subtask 3.4	SCSC will assist BRA in designing a watershed source survey, to be conducted through TSSWCB project 08-54, that better characterizes possible sources of bacteria loadings in the study area. Results from the source survey will be used by SCSC to make appropriate adjustments to the library-independent BST sampling design (Subtask 3.1) and assess the adequacy of the Texas Known Source Library (Subtask 3.2).		
	Start Date	Month 1	Completion Date Month 21
Subtask 3.5	BAEN will conduct watershed modeling for the study area through TSSWCB project 08-55. SCSC will work with BAEN to 1) integrate BST results into the model, to the extent possible, and 2) address and reconcile discrepancies between BST and modeling results.		
	Start Date	Month 1	Completion Date Month 21
Deliverables	<ul style="list-style-type: none"> Technical Report detailing the results of Bacterial Source Tracking 		

Part III – Financial Information

Budget Summary	
Category	Costs
Personnel	\$ 33,992
Fringe Benefits	\$ 10,109
Travel	\$ 2,023
Equipment	\$ 0
Supplies	\$ 34,050
Contractual	\$ 0
Construction	\$ 0
Other	\$ 0
Total Direct Costs	\$ 80,174
Indirect Costs (≤15%)	\$ 12,026
Total Project Costs	\$ 92,200

Budget Justification		
Category	Costs	Justification
Personnel	\$ 33,992	M.S.-level Laboratory Technician or Postdoctoral Associate (SCSC) (50% time for 15 months plus 12.5% time for 1 month) to process samples, analyze data, and assist in preparing reports. Additional support provided for through TSSWCB project 08-51, <i>Increased Analytical Infrastructure and Further Development of a Statewide Bacterial Source Tracking Library at Texas AgriLife Research – College Station</i> . TWRI Project Manager (8% FTE year 1 and 2% FTE year 2) to administer and coordinate project and develop QAPP.
Fringe Benefits	\$ 10,109	Calculated at 17.6% of salary, plus \$471/month (pro-rated) for medical insurance. Additional support provided for through TSSWCB project 08-51.
Travel	\$ 2,023	For ~8 trips to watershed for participation in stakeholder meetings.
Equipment	\$ 0	
Supplies	\$ 34,050	Costs of media, reagents, and other consumables for enumeration of <i>E. coli</i> are estimated at \$15/sample (3 dilutions per sample at \$5/dilution) for 250 samples (\$3,750). Costs of media, reagents, and other consumables for ERIC-RP combination fingerprinting are estimated at \$5/isolate for isolation and confirmation, \$8/isolate for ERIC-PCR, and \$40/isolate for RiboPrinting of 100 isolates (\$5,300). Costs of media, reagents, and other consumables for <i>Bacteroidales</i> PCR are estimated at \$100/sample for 250 samples (\$25,000).
Contractual	\$ 0	
Construction	\$ 0	
Other	\$ 0	
Indirect	\$ 12,026	15% of Total Direct Costs
SOURCE	TSSWCB will provide \$92,200 in non-federal funds sourced from state appropriations (FY2009 General Revenue) through a TMDL Program Grant to the Texas Water Resources Institute.	