Texas State Soil and Water Conservation Board
Section 319(h) Nonpoint Source Program
FY 2007 Project 07-13

NONPOINT SOURCE SUMMARY PAGE for the CWA, Section 319(h) Agricultural/Silvicultural Nonpoint Source Program						
Title of Project:	Identify and Characterize NPS Bacteria Pollution to Support Implementation of Bacteria TMDLs in the Oso Bay Watershed					
Project Goals/Objectives:	To provide information on nonpoint sources of enterococci in the upstream section of Oso Creek to state agencies and local planning entities in support of the Implementation Phase of the Oso Creek/Oso Bay watershed TMDL					
Project Tasks:	(1)Project administration and coordination, (2) Preparation of a comprehensive sampling design to determine sources of enterococci in the upstream section of Oso Creek, (3) Development of a QAPP and submission for approval by TSSWCB and EPA, (4) Field sampling (and lab analysis for enterococci) of potential sources of enterococci, (5) Bacteria source tracking to determine animal sources of contamination, (6)Data management and submit a final report to the TSSWCB.					
Measures of Success:	(1)Enterococci levels in the upper section of Oso Creek will be explained by identification of nonpoint sources of fecal contamination (2) Enterococci levels in the upper sections of the creek, sediments and subsurface waters will be quantified (3) Enterococci isolated from the creek under dry and wet conditions will be categorized by source type (human/non human etc.) (4)Additional data on enterococci levels in the creek will be collected					
Project Type:	Implementation (X); Education ( ); Watershed Planning (X); Assessment (X); Groundwater ( )					
Status of Water Body: 2004 Water Quality Inventory and 303(d) List	Segment ID: 2485(A)		Parameter: Bacteria		Category: 5A	
Project Location: (Statewide or County and Watershed Name)	Nueces County, Oso Bay/Oso Creek watershed					
Key Project Activities:	Hire Staff (X); Monitoring (X); Regulatory Assistance (X); Technical Assistance ( ); Education ( ); Implementation (X); Demonstration ( ); Planning (X); Other ( )					
NPS Management Program Elements:	Element 1: project addresses short and long term goals of the NPS program Element 2: working in partnership with federal, state and local state agencies Element 3: management of local watershed Elements 4 and 5: addresses a segment on the 303(d) list and its impairment listed as 5a Element 8: project will be managed efficiently, contractors have satisfactory performance records.					
Project Costs:	Federal:	$406,731	Non-Federal Match:	$331,266	Total:	$737,997
Project Management:	TAMU-CC - P.I. Joanna Mott, Ph.D., Co-P.I. Mr. Richard Hay, P.G. TSSWCB					
Project Period:	October 2007 – December 2011					

Part I – Applicant Information

Applicant							
Project Lead	Dr. Joanna Mott / Richard Hay, P.G.						
Title	Professor and Chair / Assistant Director Center for Water Supply Studies						
Organization	Texas A&M University-Corpus Christi						
E-mail Address	Joanna.mott@tamucc.edu / Richard.hay@tamucc.edu						
Street Address	6300 Ocean Drive, Unit 5800						
City	Corpus Christi	County	Nueces	State	Texas	Zip Code	78412
Telephone Number	(361) 825-6024 / (361) 825-3347			Fax Number	(361) 825-3719 / (361) 825-3345		

Project Partners	
Names	**Roles & Responsibilities**
Center for Water Supply Studies (CWSS)	Provide non-federal match through similar concurrent project.
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities, and provide federal funding.
Coastal Bend Bays and Estuary Program, Inc. (CBBEP)	Provide non-federal match through CWSS project funding, coordination of monitoring plan.
Nueces River Authority (NRA) Texas A&M Agricultural Experiment Station	Provide coordination of monitoring plan.
Texas Commission on Environmental Quality (TCEQ)	Provide state oversight and project coordination.
Texas A&M University – Corpus Christi	Provide non-federal match through waiver of indirect costs, faculty and staff support.

Part II – Project Information

Project Type							
Surface Water	X	Groundwater					
Does the project implement recommendations made in a Watershed Protection Plan or TMDL Report or Implementation Plan?				Yes	X	No	
If yes, identify the document. (Approved or Draft)	A draft TMDL Report for the Oso Bay Watershed is currently being compiled						
If yes, identify the agency/group that developed and/or approved the document.	TCEQ			Year Developed	2007		

Watershed Information				
Watershed Name(s)	Hydrologic Unit Code (8 Digit)	Segment ID	305 (b) Category	Size (Acres)
Nueces-Rio Grande Coastal Basin (Basin 22) (Oso Creek Watershed)	1211020	2485A	5a	57792

Project Narrative

Problem/Need Statement

Oso Creek (Segment 2485 A) is listed on the 2004 Water Quality Inventory and 303(d) List as impaired, parameter: bacteria. A TMDL report is currently being compiled by TCEQ and stakeholders have met to begin discussion of the implementation phase. Results of a modeling study of bacteria loading for Oso Creek (Segment 2485A) recently submitted by the Co-P.I.s to TCEQ for use in the TMDL process, showed that loading occurs throughout the length of the creek, including the upper reaches and that there is "dry day" loading in addition to wet weather runoff and inflows. Modeling efforts demonstrated that the removal of the relatively small dry day loading could nearly achieve the geometric mean water quality standards in the creek. Modeling work was unable to discern the source of the "dry day" loading. While there are several identified inflows downstream (stormwater etc.) carrying runoff, the upper sections of the creek run through primarily rural agricultural row crop fields with no obvious sources of fecal bacteria. The creek is effluent driven, receiving water from the Robstown treatment plant. The plant is permitted and bacterial levels meet standards. However, sampling of the creek showed elevated enterococci levels and loading is occurring in the upstream sections. An ongoing study which includes limited bacterial sampling of agricultural land runoff has indicated elevated levels of enterococci in this runoff.

Thus the previous studies to support the TMDL (monitoring data and modeling) have provided information on the levels of enterococci in the creek and bacteria loading for the TMDL but have not answered the key questions needed to plan for the implementation phase of the TMDL: what and where are the source(s) of the bacteria – neither the nonpoint (physical) sources for the upstream section nor the animal sources have been identified. In order for effective planning by local and state agencies the questions of where the bacteria are originating from in the upper creek and whether the sources are controllable (human, cow etc.) or non-controllable (wildlife, including birds) need to be answered.
This project plans to address both these issues through two investigations – one focused on the upper creek watershed and the possible types of nonpoint sources of bacteria (soil, sediment, subsurface flow, livestock etc.) and the second focused on bacteria source tracking to determine the animal/human sources of the bacteria in the creek.

A recent presentation (Feb. 8, 2007) at a stakeholder meeting made by the TCEQ Oso watershed TMDL Project Manager included some suggested implementation measures which are incorporated into our study - e.g. scientific studies to determine why crop and rangeland runoff concentrations are high so that appropriate management practices can be

developed, an initial focus in the implementation plan to define and reduce dry day loading and continued monitoring of the creek. There was also discussion of the role and possible contribution of enterococci in the sediments.
Thus our proposal will provide critical information for understanding the bacteria loading in the Oso watershed to aid in the planning and development of the implementation phase of the TMDL.

Project Narrative

General Project Description (Include Project Location Map)

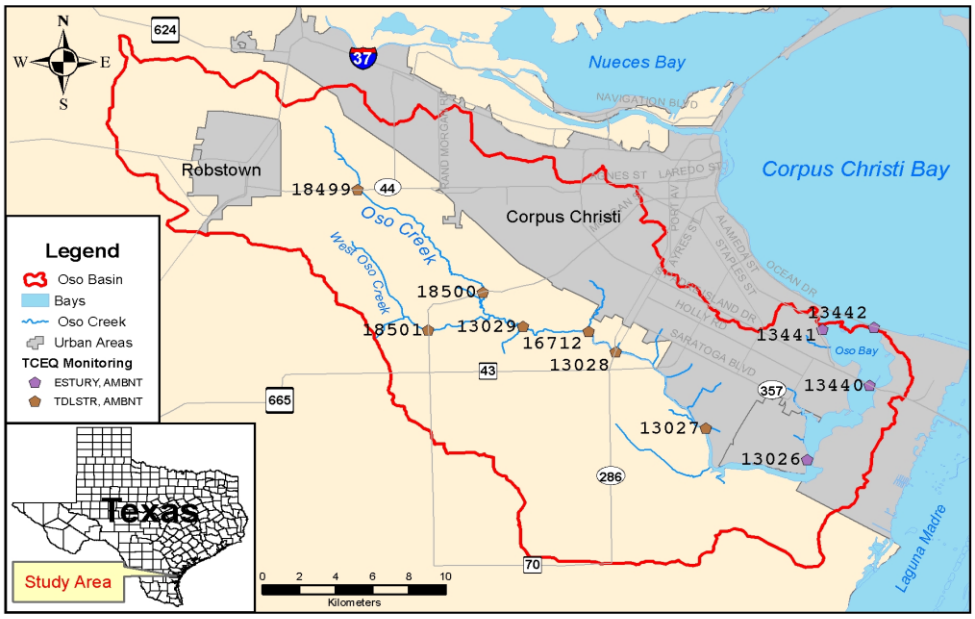
The project will focus on the Oso Creek watershed to answer key questions that have arisen during the initial phase of the TMDL – what are the nonpoint sources of enterococci in the upper sections of the creek and what are the animal sources contributing to the contamination. This information will also be of use for other similar watersheds (e.g. contributions of sediment and agricultural runoff).

Year 1-2. Prior to writing the Quality Assurance Project Plan (QAPP), a sampling strategy will be developed to elucidate the contributions of possible nonpoint sources of fecal bacteria (enterococci) with consultation and input from state (TCEQ) and local entities including the Coastal Bend Bays and Estuaries Program (CBBEP), the USGS, the Nueces River Authority (Clean Rivers Program), the Texas A&M Agricultural Research and Experiment Station and local stakeholders (e.g. Cities of Corpus Christi and Robstown, local farmers, developers, discharge permit holders, homeowners). Several letters of support are attached at the end of this proposal. Maps of the area will be utilized to help identify potential sources e.g. rural residences, livestock etc. and to determine accessible sites. A QAPP will then be developed detailing the sampling plan and all field and lab analysis protocols. Field collection and lab analysis for enterococci will follow approved TCEQ procedures (SWQM 2003) and approved EPA lab analysis methods. Once the QAPP has been submitted and approved by TSSWCB and EPA field sampling will be initiated. Sampling will include agricultural land runoff, dry soil sampling from representative locations, and in-creek sediment and water sampling at multiple stations along the creek to identify any points of potential inflow and to determine the possible role of sediment as a contributor. Existing stations will be sampled quarterly to maintain a record of bacteria levels at those sites (18499, 18500, 18501). Sampling of subsurface water will also be conducted to examine the potential role of groundwater in the bacterial loading. Dr. Egon Weber, Director of the Center for Water Supply Studies, TAMU-CC will provide technical expertise (consultant) in examining the extent of contributions from groundwater discharge. Wells being constructed and maintained at a number of locations in the watershed through another project (funded by CBBEP) will be sampled at multiple depths, seasonally, under both dry and wet weather conditions. The CBBEP matching project will also provide data on nutrient and pesticide levels, as well as groundwater levels in the watershed. Temperature is being used as a proxy for effective flow to establish surface and groundwater connections.

Year 3.
In year three monitoring of the wells, soils, sediments and creek water will continue and bacteria source tracking (BST) of the enterococci will be initiated to determine whether the creek is contaminated by controllable (human, livestock) or noncontrollable (wildlife) sources of bacteria. Enterococci isolates will be characterized using the Biolog Microbial Identification System, which provides a species level identification and a carbon source utilization (CSU) profile for each isolate. Speciation provides some information about sources as certain species are associated with specific animals. An existing small library of enterococci isolates will be supplemented with additional known source enterococci in order to categorize the unknown source isolates by discriminant analysis. Antibiotic resistance profiles will also be developed for each isolate to provide a composite data set with the CSU. While Texas BST work has focused on *E. coli* (as it is the recommended indicator for freshwater bodies), for coastal (marine) waters where the recommended indicator is enterococci it is more appropriate to use this group in TMDL related studies, to correlate directly with the indicator being used to evaluate the water quality. Although the upper creek is freshwater, the Oso Creek/Oso Bay TMDL (Segments 2485 and 2485A) is based on enterococci as the segment includes marine and tidal sections. Enterococci have been approved as an alternative indicator for freshwaters. Enterococci have been used in previous studies in other states for

BST work and can provide at least equivalent (and sometimes better) discrimination between sources. A subset of samples will also be analyzed for detection of the *esp* gene, which is a marker for human source enterococci. This will provide an additional level of confidence in the data.
Additional small scale studies of survival and re-growth in sediments and/or agricultural soil will be initiated, in year three dependent on the initial sampling results. A few sediment cores collected at a downstream station of the creek have contained enterococci but work has not been conducted upstream or in any depth.

Year 4.
Year four will complete the study. Monitoring of the wells, sediments, soils and creek stations and bacteria source tracking analysis will be completed. A final report will be prepared to include the results of the project for use in the implementation phase of the Oso Creek/Oso Bay TMDL.



Water Quality Impairment

Describe all known causes (pollutants of concern) of water quality impairments from any of the following sources: 2004 Water Quality Inventory and 303(d) List, 2004 Summary of Waterbodies with Water Quality Concerns (Secondary Concerns List) or Other Documented Sources (ex. Clean Rivers Program Basin Summary or Basin Highlights Reports).

2004 Water Quality Inventory and 303(d) List

SegID: 2485A Oso Creek (un classified water body)
Water body location: From the confluence with Oso Bay in southern Corpus Christi to a point 3 miles upstream of SH 44, west of
Corpus Christi in Nueces County

Area	Parameter	PS	NPS	Category	Rank
Lower 25 miles of water body	bacteria	Y		5a	M

2004 Summary of Water Bodies with Water Quality Concerns for Use Attainment

Bacteria:

Water Body ID	**Water Body Name**	**Concern Location**	**Use**	**Level of Concern**	**Parameter of Concern**
2485A	Oso Creek (unclassified water body)	Lower 25 miles of water body	Contact Recreation Use	Use Concern	bacteria
			Aquatic Life Use	Use Concern	Depressed dissolved oxygen

Project Goals

The overall goal of the project is to provide information on nonpoint sources of enterococci in the upstream section of Oso Creek to state agencies and local planning entities in support of the Implementation Phase of the Oso Creek./Oso Bay TMDL.

The project will assess potential nonpoint sources of enterococci in the upper Oso Creek watershed and determine which sources are contributing to the bacteria impairment of the water.

The project will also provide information on the human and controllable contribution of these bacteria for implementation planning purposes.

Tasks, Objectives and Schedules

Task 1:	Project Administration and Coordination					
Costs:	Federal:	$43,334	State:	$85,295	Total:	$128,629
Objective:	Effectively coordinate and monitor all work performed under this project including technical and financial supervision and preparation of status reports.					
Subtask 1.1:	Prepare quarterly progress reports for submittal to the TSSWCB. These reports will document all activities preformed within the quarter.					
	Start Date:	10/01/07		Completion Date:	12/31/11	
Subtask 1.2:	Order all laboratory and field supplies and perform accounting functions for project funds and submit appropriate Reimbursement Forms to TSSWCB at least quarterly.					
	Start Date:	10/01/07		Completion Date:	12/31/11	
Subtask 1.3:	Perform technical oversight of the microbiology laboratory, including training of personnel, quality assurance, data control and management.					
	Start Date:	10/01/07		Completion Date:	12/31/11	
Subtask 1.4:	Participate in the Oso Bay/ Oso Creek TMDL stakeholder meetings.					
	Start Date:	10/01/07		Completion Date:	12/31/11	
Deliverables	• quarterly reports • quarterly invoices • final reports					

Tasks, Objectives and Schedules						
Task 2:	To prepare a comprehensive sampling design to determine sources of enterococci in the upstream section of Oso Creek					
Costs:	Federal:	$2,653	State:	$14,473	Total:	$17,126
Objective:	To develop a comprehensive sampling strategy using expertise from local groups					
Subtask 2.1:	To meet with local entities (CBBEP, NRA, USGS, TAES and local stakeholders) to determine potential sources of enterococci in the upstream creek					
	Start Date:	10/01/07		Completion Date:	06/30/08	
Subtask 2.2:	To use the information in the preparation of a field sampling plan					
	Start Date:	10/01/07		Completion Date:	06/30/08	
Deliverables	• quarterly report • (information to be included in QAPP – Task 3)					

Tasks, Objectives and Schedules

Task 3:	To develop a QAPP and submit for approval by TSSWCB and EPA					
Costs:	Federal:	$7,229	State:	$18,019	Total:	$25,248
Objective:	To obtain an approved QAPP in order to initiate data collection (field sampling and lab analysis)					
Subtask 3.1:	Write QAPP, using information from Task 2 for the sampling plan and include the planned bacteria source tracking component of the project, make revisions as needed for approval					
	Start Date:	06/01/08	Completion Date:	03/31/09		
Deliverables	•QAPP					

Tasks, Objectives and Schedules						
Task 4:	To conduct field sampling (and lab analysis for enterococci) of potential sources of enterococci					
Costs:	Federal:	$127,198	State:	$169,683	Total:	$296,881
Objective:	To identify nonpoint sources of enterococci in the upper section of Oso Creek under both dry and wet conditions					
Subtask 4.1:	To perform sampling of subsurface waters (wells) at different depths and seasons, under dry and wet conditions (matching project adds data on nutrients, pesticides and temperature – effective flow)					
	Start Date:	05/01/09	Completion Date:	05/31/11		
Subtask 4.2:	To perform quarterly sampling at historic stations in the creek for enterococci and field parameters					
	Start Date:	04/01/09	Completion Date:	08/31/11		
Subtask 4.3:	To perform field sampling of creek sediments, agricultural soils, runoff (as determined by initial discussions) – in year 1 a comprehensive sampling design, in years 2-3 limited focused sampling					
	Start Date:	05/01/09	Completion Date:	05/31/11		
Subtask 4.4:	To conduct small scale lab testing of soils and/or sediments under dry and wetting conditions for enterococci (to evaluate survival, regrowth) dependent on initial field results					
	Start Date:	09/01/10	Completion Date:	05/31/11		
Deliverables	• quarterly reports • final report					

Tasks, Objectives and Schedules	
Task 5:	To conduct bacteria source tracking to determine animal sources of contamination

Costs:	Federal:	$205,759	State:	$33,120	Total:	$238,879
Objective:	To identify sources of enterococci for use in implementation plans					
Subtask 5.1:	To expand a current library of known source enterococci carbon source utilization profiles (CSU) by fecal sampling of animals in the watershed area and to construct an antibiotic resistance profile library of known source isolates.					
	Start Date:	12/01/09		Completion Date:	02/28/11	
Subtask 5.2:	To collect water samples (and other source samples e.g. sediment, soil etc dependent on Task 3 results) for isolation of unknown source enterococci					
	Start Date:	04/01/10		Completion Date:	02/28/11	
Subtask 5.3:	To use the Biolog Microbial Identification System to identify enterococcus isolates to species and to obtain carbon source utilization (CSU) profiles and to determine antibiotic resistance profiles (ARP) for source identification.					
	Start Date:	04/01/10		Completion Date:	04/30/11	
Subtask 5.4:	To use statistical analyses to categorize unknown source isolates into sources based on the CSU and ARA profiles.					
	Start Date:	03/01/11		Completion Date:	08/31/11	
Subtask 5.5:	To analyze a subset of samples for identification of the human marker *esp* gene to provide added confidence in the CSU data					
	Start Date:	07/01/10		Completion Date:	02/28/11	
Deliverables	• quarterly reports • final report					

Tasks, Objectives and Schedules (Replicate or modify table as needed)						
Task 6:	To complete a final report and submit it to the TSSWCB.					
Costs:	Federal:	$20,558	State:	$10,676	Total:	$31,234
Objective:	To present the findings of the project to the funding agency					
Subtask 6.1:	Complete and submit a rough draft of the report					
	Start Date:	09/01/11		Completion Date:	11/30/11	
Subtask 6.2:	To revise the draft report and submit a final report					
	Start Date:	12/01/11		Completion Date:	12/31/11	
Deliverables	• draft final report • final report					

Measures of Success

1. Enterococci loading in the upper section of Oso Creek will be explained by identification of non-point sources of fecal contamination
2. Enterococci levels in the upper sections of the creek, sediments and subsurface waters will be quantified.
3. Enterococci isolated from the creek under dry and wet conditions will be categorized by source type (human/non human etc.)
4. Additional data on enterococci levels in the creek will be collected

2005 Texas Nonpoint Source Management Program Document Reference
Goals &/or Milestone(s)
The project addresses specific long term goal and short term goals outlined in the 2005 document that protect surface and ground water.
Under the Long Term Goal p. 13 (bullets 1-3, 7) The project focuses on a watershed identified on the 303(d) list as impacted by NPS pollution, supports the implementation of state, regional and local programs to prevent NPS pollution through assessment, implementation and education including strategies defined in state approved TMDL plans and enhances public participation and outreach by including input into the sampling plan.
Under Short-term Goals and Milestones: The project contributes to Goal One – Data Collection and Assessment – coordinating with appropriate agencies and targeting a high priority, nonpoint source impacted watershed where additional information is needed. In particular monitoring will be conducted and will meet EPA QA requirements and the project can be categorized as a special study to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation.
Goal Two – Implementation is addressed as the project targets an area impacted by NPS pollution which will be moving into the TMDL Implementation Phase. The project will provide data to facilitate development of implementation strategies and BMPs
Goal Three – Education will be indirectly involved as the data obtained will be provided to and used by other agencies for public outreach activities, based on the findings of our project. Data and findings will be periodically presented at Oso TMDL stakeholder meetings to provide additional information and understanding of the NPS bacteria loadings in the watershed.
Milestones – Project addresses 2nd bullet: completion of assessment of pollutant problems, adds information on inventory of point/nonpoint sources and data will be used (land use data, stressors influencing water quality) for development of sampling plan. Also addresses 3rd bullet: water quality monitoring, assessing loadings and determining the origin and distribution of pollutants.

Part III – Financial Information

Budget Summary			
Federal 319(h)	$406,731	% of total project	55%
Non-Federal Match	$331,266	% of total project (at least 40%)	45%
Total $ Cost	$737,997	Total project %	100%

Category	Federal	Non-Federal Match	Total
Personnel	$187,396	$145,343	$332,739
Fringe Benefits	$24,500.62	$16,577	$41,077.62
Subtotal Personnel & Fringe	$211,896.62	$161,920	$373,816.62
Travel	$10,169.13	$4,900	$15,069.13
Equipment	$0	$39,480	$39,480
Supplies	$130,013.25	$500	$130,513.25
Contractual	$0	$28,600	$28,600
Construction	$0	$0	$0
Other	$1,600	$0	$1,600
Subtotal	$141,782.38	$73,480	$215,262.38
Total Direct Costs	$353,679	$235,400	$589,079
Indirect Costs (15%)	$53,052	$57,996	$111,048
Unrecoverable IDC		$37,870	$37,870
Total Project Costs	$406,731	$331,266	$737,997

The §319(h) Nonpoint Source Program has a 60/40% match requirement. Your entity will be reimbursed 60% from federal funds and must contribute a minimum of 40% of the costs to conduct your project. The 40% match must be from non-federal sources and should be described in your budget detail. Indirect costs are limited to 15%. The project budget generally covers a three year period.

Budget Justification (Federal)		
Category	Total Amount	Justification

Personnel & Fringe Benefits	$211,896.62	P.I. 1 mo/yr, Research Sp. 50% oversight, 2 M.S. students, wages for field and lab analyses
Travel	$10,169.13	Field work, meetings
Equipment	$0	Non requested
Supplies	$130,013.25	For field and lab analyses (enterococci, BST – CSU, ARA , field)
Contractual	$0	N/A
Construction	$0	None requested
Other	$1,600	Image analysis software update for BST (ARA)
Indirect	$53,052	15% of TDC

Budget Justification (Non-Federal)		
Category	Total Amount	Justification
Personnel & Fringe Benefits	$161,920	P.I. and Co P.I. time (CBBEP and TAMU-CC), Consultant for groundwater contribution, M.S. student (yr 1) wages (yr 1)
Travel	$4,900	Field for well construction activities (CBBEP)
Equipment	$39,480	Installation of wells (CBBEP)
Supplies	$500	well installation (CBBEP)
Contractual	$28,600	Nutrient, pesticide etc. testing by outside labs (CBBEP)
Construction	$0	None requested
Other	$0	None requested
Indirect	$57,996	CBBEP at 15% S+W, TAMU-CC at 51% S+W
Unrecoverable IDC	$37,870	Difference between TAMU-CC rate and TSSWCB allowable rate