Texas State Soil and Water Conservation Board
CWA §319(h) Agricultural/Silvicultural Nonpoint Source Grant Program
FY 2002 Project Workplan (02-21)

NONPOINT SOURCE SUMMARY PAGE for the CWA §319(h) Agricultural/Silvicultural Nonpoint Source Grant Program						
Title of Project:	SWAT Model Simulation of the Arroyo Colorado Watershed					
Project Goals/Objectives:	(1) Obtain flow, meteorological, water quality, stream morphology, wastewater flow/loading, available information on management measures and pollutant export coefficients, land use and other applicable data for the Arroyo Colorado watershed for the period of 1999-2006. (2) Set up and calibrate a watershed model using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 1999-2003. (3) Validate watershed model using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 2004-2006. (4) Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB					
Project Tasks:	(1) Coordinate and Administer the Project (2) Watershed data compilation, analysis, and simulation using SWAT					
Measures of Success:	Characterization of flow and watershed loadings to the Arroyo Colorado for input into the EFDC model, including time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins)					
Project Type:	Statewide ( ); Watershed Implementation/Education ( ); Watershed Planning ( ); Watershed Assessment (X); Groundwater ( )					
Status of Water Body: 2004 Water Quality Inventory and 303(d) List	Segment ID: Arroyo Colorado (Tidal) 2201 Arroyo Colorado (Above Tidal) 2202		Parameters: Depressed dissolved oxygen Bacteria		Category: 5c 5c	
Project Location:	Arroyo Colorado Watershed (Segments 2201 and 2202) in Hidalgo, Cameron and Willacy Counties					
Key Project Activities:	Hire Staff (X); Monitoring ( ); Regulatory Assistance ( ); Technical Assistance ( ); Education ( ); Implementation ( ); Demonstration ( ); Modeling (X); Other ( )					
NPS Management Program Elements:	This project assists the State in achieving the Data Collection and Assessment Objective by (1) conducting special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation and (2) develop and adopt, at the state level, TMDLs, I-Plans and WPPs for watersheds identified as impacted by NPS pollution on the latest state approved CWA §303(d) List. The project also assists the State in meeting Milestones to (1) Complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point / nonpoint sources, land use data, and all known stressors influencing water quality and (2) Develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.					
Project Costs:	Federal:	$94,997	Non-Federal Match:	$64,263	Total:	$159,260
Project Management:	• Texas Water Resources Institute • Texas Agricultural Experiment Station – Blackland Research and Extension Center					
Project Period:	June 2007 through March 2009					

Part I – Applicant Information

Applicant							
Project Lead	B.L. Harris						
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Project Co-Lead	Dr. Narayanan Kannan						
Title	Postdoctoral Research Associate						
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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 TCEQ and ACWP
Texas Water Resources Institute (TWRI)	Project coordination and reporting (Task 1) and coordination with TSSWCB CWA §319(h) project 06-10.
Texas Agricultural Experiment Station – Blackland Research and Extension Center (TAES-Blackland)	SWAT Modeling (Task 2)
Texas A&M University Spatial Sciences Laboratory (SSL)	Technical Oversight and GIS (Task 2)
Texas Commission on Environmental Quality (TCEQ)	Coordination with TMDL and EFDC model efforts
Texas Cooperative Extension (TCE)	Coordination with ACWP and TSSWCB CWA §319(h) project 05-10
Arroyo Colorado Watershed Partnership (ACWP)	Coordination with WPP implementation

Part II – Project Information

Project Type							
Surface Water	X	Groundwater					
Does the project implement recommendations made in a completed Watershed Protection Plan or approved TMDL Report or Implementation Plan?				Yes	X	No	
If yes, identify the document.	*A Watershed Protection Plan for the Arroyo Colorado Phase I*						
If yes, identify the agency/group that developed and/or approved the document.	Texas Sea Grant and TCEQ			Year Developed	2007		

Watershed Information				
Watershed Name(s)	Hydrologic Unit Code (8 Digit)	Segment ID	305 (b) Category	Size (Acres)
Arroyo Colorado Watershed	12110208	2201/2202	5(c)	451,709

Project Narrative

Problem/Need Statement

The Arroyo Colorado flows through Hidalgo, Cameron and Willacy Counties in the Lower Rio Grande Valley of Texas into the Laguna Madre. As a result of low dissolved oxygen levels, the tidal segment of the Arroyo Colorado (2201) does not currently support the aquatic life use designated by the State of Texas and described in the Water Quality Standards. This has been the case for every *303(d) List* prepared by the State since 1986. There have also been concerns about high nutrient levels in this stream as documented on every *305(b) Assessment* prepared by the State since 1988. The watershed was originally modeled by TCEQ in 1999 using the HSPF model. This model indicated that a 90% reduction in nitrogen, phosphorous, oxygen demanding substances and sediment was necessary to meet the dissolved oxygen criteria at least 90% of the time during the critical period of March through October. In 2003, the TCEQ directed staff to collect additional data and increase the sophistication of the TMDL analysis to reduce uncertainty and to better characterize the watershed and then to reassess needed loading reductions. This project will help with the reassessment of the needed loading reductions by simulating current loadings using the SWAT model.

Figure 1: Project Location

The need for this project is substantiated in *A Watershed Protection Plan for the Arroyo Colorado Phase I* and specifically in the volume *Components Addressing Agricultural NPS Pollution.* This project utilizes information generated and compiled through TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* and quantifies load reductions achieved through TSSWCB CWA §319(h) projects 05-10 *Education of BMPs in the Arroyo Colorado Watershed* and 05-12 *WQMP Implementation Assistance in the Arroyo Colorado Watershed.*

Project Narrative

General Project Description

The project will consist of using a computer modeling software (SWAT model) and a geographic information system (GIS) to simulate the current sediment, BOD and nutrient loadings in the Arroyo Colorado watershed. The SWAT model will be used to quantify the sediment and nutrient loadings in the watershed. TAES-Blackland will conduct the model simulations.

Meteorological, in-stream flow, wastewater flow and loading, GIS and measured water quality data will be compiled along with information on the type and extent of management measures implemented for both agricultural and urban areas in the watershed. Examples of GIS data that may be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, landuse developed through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment*, and the USGS 30-meter resolution digital elevation model (DEM). Measured precipitation and temperature will be collected from National Weather Service climate stations for input to SWAT. Measured stream flow will be collected from USGS, IBWC and other stream gage stations. Water quality data will be compiled from USGS, IBWC, NRA, TCEQ and Clean Rivers Program sources.

Information on typical crops and management practices (e.g. tillage practices, irrigation management, and nutrient application rate and timing) will be obtained from TAES, TCE, TSSWCB, and local NRCS and SWCD field offices. Existing BMPs (e.g. land leveling, irrigation management, nutrient management methods) will be obtained through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* for the period of 1999-2006. Non-agricultural input data will be obtained from TCEQ, cities, counties, and other entities with jurisdiction over these issues. SWAT inputs will be prepared to accurately represent existing conditions and management.

After compiling all available data for the watershed, the SWAT model will be set up and calibrated using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 1999-2003 with 1999 as warm-up period. If measured data is not available for a particular sub-watershed, SWAT inputs will be selected and adjusted based on recent research and calibration in other watersheds. After calibration, the model will be validated using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 2004-2006. Existing conditions and load reduction scenarios specified by TSSWCB will be simulated to determine nutrient, BOD, and sediment loadings.

SWAT output will be provided to the TSSWCB formatted for input into the model by TCEQ. A final report for the project will also be prepared.

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).

Waterbody (Segment)	Standards not met in 2002 (parameter)	2002 Concerns
Arroyo Tidal (2201)	Aquatic Life Use Not Supporting (DO and ambient toxicity in sediment)	Nutrient Enrichment (ammonia, nitrate+nitrite) Historic Fish Kills (low DO)
Arroyo Above Tidal (2202)	Contact Recreation Not Supporting (bacteria) Fish Consumption Partially Supporting (DDE, and other organic compounds in fish tissue)	Nutrient Enrichment (ammonia, nitrate+nitrite, ortho-phosphorous, total phosphorus) Algal Growth (excessive) Aquatic Life Use (DO) Historic Fish Kills

Waterbody (Segment)	Standards not met in 2004 (parameter)	2004 Concerns
Arroyo Tidal (2201)	Aquatic Life Use Not Supporting (DO)	Nutrient Enrichment (ammonia, nitrate+nitrite) Historic Fish Kills
Arroyo Above Tidal (2202)	Contact Recreation Not Supporting (bacteria) Fish Consumption Not Supporting (DDD, DDE, DDT, chlordane, dieldrin, endrin, heptachlor epoxide, heptachlor, lindane, hexachlorobenzene, toxaphene)	Nutrient Enrichment (ammonia, nitrate+nitrite, ortho-phosphorous, total phosphorus) Algal Growth (excessive) Historic Fish Kills

Project Goals

The goal of this project is to simulate the current nutrient, BOD, and sediment loading to the Arroyo Colorado using the SWAT model. Model output will provide the needed input for the EFDC model. To achieve this, the following objectives will be accomplished:

(1) Collect meteorological, landuse, crops, flow, soils, topographic, irrigation and nutrient management, wastewater discharges, water quality, and other necessary data needed to model the Arroyo Colorado with SWAT
(2) Calibrate SWAT watershed model to measured flow, sediment, BOD and nutrients
(3) Simulate/validate flow, nutrient, BOD and sediment loads for current conditions
(4) Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB

Tasks, Objectives, and Schedules						
Task 1:	Coordinate and Administer Project					
Costs:	Federal:	$7,822	State:	$2,073	Total:	$9,895
Objective:	To effectively coordinate and monitor all work performed under this project including technical and financial supervision, preparation of status reports, and maintenance of project files and data. This project will be coordinated with ongoing efforts in the Arroyo Colorado, especially the TSSWCB CWA §319(h) project 06-10, but also the TSSWCB CWA §319(h) projects 05-10 and 05-12, and other projects with which TWRI has involvement. TWRI will perform quality assurance functions, accounting functions for project funds and will be responsible for developing timely and accurate reports. An interactive internet website will also be created and maintained to provide the most current progress.					
Subtask 1.1:	TWRI will coordinate project efforts with all project partners, as well as ongoing projects in the watershed. These projects include the *Arroyo Colorado Ag NPS Assessment*, *Education of BMPs in the Arroyo Colorado Watershed*, and the *WQMP Implementation Assistance in the Arroyo Colorado Watershed*. TWRI will participate in Arroyo Colorado Watershed Partnership meetings (steering committee and work groups) to report progress and coordinate efforts. TTVN meetings or teleconferences will be held, as appropriate, with project partners to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements.					
	Start Date:	Month 1		Completion Date:	Month 24	
Subtask 1.2:	TWRI will prepare electronic quarterly reports for submission to the TSSWCB. Progress reports shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July, and October. All progress reports will be provided to all project partners.					
	Start Date:	Month 1		Completion Date:	Month 24	
Subtask 1.3:	TWRI, with support from SSL and TAES, will develop a QAPP for activities in Task 2 consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* (May 2006) and the *TSSWCB Quality Management Plan* (July 2006).					
	Start Date:	Month 1		Completion Date:	Month 3	
Subtask 1.4:	TWRI will implement the approved QAPP and provide revisions and necessary amendments to the QAPP.					
	Start Date:	Month 3		Completion Date:	Month 24	
Subtask 1.5:	TWRI will attend meetings with the TSSWCB project manager and other meetings, as needed, to review project status, deliverables, and other project matters.					
	Start Date:	Month 1		Completion Date:	Month 24	
Subtask 1.6:	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 24	
Subtask 1.7:	TWRI will develop (Months 1-3), host and maintain (Months 3-24) an internet website for the dissemination of information.					
	Start Date:	Month 1		Completion Date:	Month 24	
Subtask 1.8:	TWRI, with assistance from SSL and TAES, will develop the final report and technical documentation of the project for submission to TSSWCB, EPA, and project partners.					
	Start Date:	Month 18		Completion Date:	Month 24	
Deliverables	• Quarterly Progress Reports in electronic format • QAPP for Task 2 approved by TSSWCB and EPA in both electronic and hard copy formats • Approved revisions and amendments to QAPP, as needed • Project Website • Reimbursement Forms • Final Report					

Tasks, Objectives, and Schedules						
Task 2:	Watershed data compilation, analysis, and simulation using SWAT					
Costs:	Federal:	$87,175	State:	$62,190	Total:	$149,365
Objective:	TAES, with technical oversight and assistance from SSL, will compile data needed for the SWAT model and characterize the flow and watershed loadings to the Arroyo Colorado for both agricultural and urban areas.					
Subtask 2.1:	Various data such as land use (current and historical), soil, BMP implementation locations, topography, sub-watershed delineation (matching earlier HSPF sub-watersheds), long-term weather data, crop management practices, stream flow and water quality data (current and historical) on sediment, BOD, and nutrients, for the Arroyo Colorado Watershed will be compiled for the period of 1999-2006 from sources such as USGS, TCEQ, TWDB, TPWD, IBWC, Nueces River Authority (NRA), TAES, TCE, and NRCS.					
	Start Date:	Month 1		Completion Date:		Month 6
Subtask 2.2:	The SWAT model will be set up and calibrated to measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 1999-2003 (with 1999 as warm-up period) using monitoring data available from USGS and IBWC stream gages, as well as data from the TWDB, TCEQ, and NRA. Model parameters related to (sub) watershed/landscape processes will be adjusted to match the measured and simulated flow, sediment, BOD and nutrient loading at key locations in each subwatershed.					
	Start Date:	Month 6		Completion Date:		Month 12
Subtask 2.3:	Subsequent to calibration, the model will be validated using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 2004-2006.					
	Start Date:	Month 12		Completion Date:		Month 18
Subtask 2.4:	Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB.					
	Start Date:	Month 12		Completion Date:		Month 18
Subtask 2.5:	Provide TSSWCB the flow and watershed loadings to the Arroyo Colorado, as determined by SWAT, for input by TCEQ into the EFDC model. SWAT output will include time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).					
	Start Date:	Month 12		Completion Date:		Month 18
Deliverables	• GIS maps related to soil, land use, and topography of the watershed • Observed water quality data compiled for 1999-2006 • Description of modeling procedures and results • Time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins) formatted for input into EFDC • Statistical measures such as means, standard deviation, coefficient of determination (r^2), and Nash-Suttcliffe simulation efficiency to show the model's prediction with respect to observed data at several locations in the watershed					

Measures of Success
• Characterization of flow and watershed loadings to the Arroyo Colorado for input into the EFDC model, including time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).

2005 Texas Nonpoint Source Management Program Document Reference
Goals &/or Milestone(s)
This project assists the State in achieving the Data Collection and Assessment Objective by conducting special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation.
This project assists the State in achieving the Data Collection and Assessment Objective by helping develop and adopt, at the state level, TMDLs, I-Plans and WPPs for watersheds identified as impacted by NPS pollution on the latest state approved CWA §303(d) List.
The project assists the State in meeting the Milestone to complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point / nonpoint sources, land use data, and all known stressors influencing water quality.
The project assists the State in meeting the Milestone to develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.

Part III – Financial Information

SWAT Model Simulation of the Arroyo Colorado Watershed Summary Revision 02/02/2009			
Federal 319(h)	$94,997	% of total project	60%
Non-Federal Match	$64,263	% of total project (≥ 40%)	40%
Total Project Cost	$159,260		

Category	Federal 319(h)	Non-Federal Match	Total
Personnel	63,793	21,230	85,023
Fringe Benefits	16,894	5,621	22,515
Subtotal Personnel & Fringe	80,687	26,851	107,538
Travel	1,853	0	1,853
Equipment	0	0	0
Supplies	66	0	66
Contractual	0	0	0
Construction	0	0	0
Other	0	0	0
Subtotal	1,919	0	1,919
Total Direct Costs	82,606	26,851	109,457
Indirect Costs (≤ 15%)	12,391	12,217	24,608
Unrecovered IDC	0	25,195	25,195
Total Project Costs	94,997	64,263	159,260

Budget Justification		
Category	Total Amount	Justification
Personnel & Fringe Benefits	$102,607	Federal • TWRI Project Manager @ 5% effort • TAES-Blackland Post Doc @ 33% effort • SSL Research Associate @ 25% effort Non-Federal Match • TAES-Blackland Assistant Professor @ 20% effort
Travel	$4,850	Federal • TWRI - $425 annually for travel to TSSWCB for quarterly meetings • TAES-Blackland - $1,000 annually for travel to Weslaco for ACWP meetings and data gathering • SSL - $1,000 annually for travel to Weslaco for ACWP meetings and data gathering
Equipment	$0	
Supplies	$2,000	Federal • TAES-Blackland – Computer and other supplies ($2,000)
Contractual	$0	
Construction	$0	
Other	$0	
Indirect	$24,608	Federal: • 15% of Total Direct Federal Non-Federal Match: • 45.5% of Total Direct Non-Federal Match
Unrecovered IDC	$25,195	Non-Federal Match: • 30.5% of Total Direct Federal