



**Texas State Soil and Water Conservation Board
 Section 319(h) Nonpoint Source Program
 FY 2006 Workplan Project 06-10**

SUMMARY PAGE

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Title of Project:	Arroyo Colorado Agricultural Nonpoint Source Assessment					
Project Goals/Objectives:	(1) Perform a complete historical data review and analysis related to water quality and agricultural best management practices implemented in the watershed; (2) Investigate site-specific differences and temporal variation of water quality in drainage from agricultural production areas; (3) Collect data for recalibration of SWAT model to better estimate the total nonpoint source loading into the river; and (4) Simulate load reduction scenarios for a suite of management measures utilizing the SWAT model.					
Project Tasks:	(1) Coordinate and Administer Project, (2) Compile and Evaluate Prior Studies and Data, (3) Inventory Conservation Practice Implementation, (4) Update Land Use / Land Cover Data, (5) Quality Assurance, (6) Perform Sub-Watershed Monitoring and Measure Pollutant Attenuation in Drainage Ditches, (7) Evaluate BMPs to Reduce NPS Pollution at the Farm Level, (8) Simulate watershed using SWAT; and (9) Develop Final Report.					
Measures of Success:	(1) Evaluation of historical water quality and previous studies; (2) Assessment of BMP implementation in the watershed; (3) Evaluation of land use in Arroyo Colorado watershed; (4) Characterize agricultural runoff at the subwatershed level; (5) Evaluation of mitigation effects of drainage ditches; (6) Demonstration of irrigation BMPs effectiveness in reducing NPS; (7) Characterize flow and watershed loadings for input into the EFDC model, including time series of average daily flow 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					
Project Type:	Statewide (); Watershed Implementation/Education (X); Watershed Planning/Assessment (X); Watershed Protection ()					
Status of Water Body: 2002 Water Quality Inventory and 303(d) List	<u>Segment ID:</u> Arroyo Colorado (Tidal) 2201 Arroyo Colorado (Above Tidal) 2202	<u>Parameters:</u> Depressed dissolved oxygen Bacteria			<u>Category:</u> 5c 5c	
Project Location:	Segments 2201 (Tidal) and 2202 (Above Tidal) of the Arroyo Colorado Watershed					
Key Project Activities:	Hire Staff (X); Monitoring (X); Regulatory Assistance (); Technical Assistance (); Education (X); Implementation (); Demonstration (X); Modeling (X); Other ()					
NPS Management Program Elements:	<ul style="list-style-type: none"> • <u>Short-Term Goal One - Data Collection and Assessment</u> • <u>Short-Term Goal Two – Implementation</u> • <u>Short-Term Three - Education</u> • <u>Milestones B, C, F, D</u> 					
Project Costs:	Federal:	\$430,650	Non-Federal Match:	\$319,497	Total:	\$750,147
			TSSWCB State GR	\$ 31,995		
			Cooperator Match	\$287,502		
Project Management:	Texas Water Resources Institute					
Project Period:	September 1, 2006 – December 31, 2011					

Part I – Applicant Information

Applicant							
Project Lead		B.L. Harris					
Title		Acting Director					
Organization		Texas Water Resources Institute					
E-mail Address		bl-harris@tamu.edu					
Street Address		1500 Research Parkway, Suite 240A 2118 TAMU					
City	College Station	County	Brazos	State	TX	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)	TSSWCB SRM Team and Harlingen Regional Office staff will be responsible for overall management of the project. Both the SRM Team and Regional Office will be included as members of the Oversight Committee. The TSSWCB project manager will also be involved in the development and approval of all press releases and workshop information (as they relate to TSSWCB programs) prior to dissemination.
Texas AgriLife Research – Weslaco (Dr. Juan Enciso) (AgriLife Research – Weslaco)	Evaluate BMPs to Reduce NPS Pollution at the Farm Level (Task 7) and serve as member of the Oversight Committee
Texas A&M University Spatial Sciences Laboratory (Dr. Srinivasan) (SSL)	Update Land Use / Land Cover Data (Task 4)
Texas AgriLife Research – Temple (Dr. Narayanan Kannan) (AgriLife Research – Temple)	Inventory Conservation Practice Implementation (Task 3), SWAT modeling (Task 8) and serve as member of the Oversight Committee
Texas A&M University-Kingsville (Dr. Venki Uddameri) (TAMU-K)	Perform Sub-Watershed Monitoring and Measure Pollutant Attenuation in Drainage Ditches (Task 6) and serve as member of the Oversight Committee
Texas Water Resources Institute (TWRI)	Project coordination, quality assurance, and reporting (Tasks 1, 2, 5, 8, and 9). Coordinate Oversight Committee.
Texas AgriLife Extension Service (AgriLife Extension)	Weslaco District Office, Hidalgo County Office, and Cameron County Office will be responsible for the educational component, crop production meetings, safety training, soil testing campaign, and serve as members of the Oversight Committee.
Texas Sea Grant	Member of Oversight Committee. Coordination with Watershed Protection Plan activities.
Texas Department of Agriculture	Member of Oversight Committee.
Texas Commission on Environmental Quality	Member of Oversight Committee.

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.		Arroyo Colorado Watershed Partnership facilitated by Texas Commission on Environmental Quality and Texas Sea Grant	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)	432,000

Project Narrative
<p>Problem/Need Statement</p> <p>The Arroyo Colorado flows through Hidalgo, Cameron and Willacy Counties in the Lower Rio Grande Valley of Texas into the Laguna Madre. Flow in the Arroyo Colorado is sustained by wastewater discharges, agricultural irrigation return flows, urban runoff, and base flows from shallow groundwater. The Arroyo Colorado is the major source of fresh water to the lower Laguna Madre, an economically and ecologically important resource to the region. The Laguna Atascosa National Wildlife Refuge and several county and city parks are located within the Arroyo Colorado watershed. The mild climate, semi-tropical plants and animals, and many recreational opportunities draw large numbers of people to the Arroyo Colorado watershed. One third of the stream is also used for shipping from the Gulf Intracoastal Waterway to the Port of Harlingen.</p>  <p>As a result of low dissolved oxygen levels, the tidal segment of the Arroyo Colorado (2201), does not currently meet 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 for high nutrient levels in this river as documented on every 305(b) assessment prepared by the State since 1988. In order to meet the dissolved oxygen criteria (24-hour average of 4.0 mg/L and minimum of 3.0 mg/L) at least 90% of the time between the critical period of March through October, TCEQ (2003) estimates a 90% reduction in nitrogen, phosphorous, oxygen demanding substances and sediment will be necessary.</p> <p>In response to this impairment, a local effort was initiated to develop a watershed protection plan (WPP) to improve conditions in the Arroyo Colorado. Working with the TCEQ, the TSSWCB, and other agencies, a local steering committee will devise and implement strategies to increase dissolved oxygen in the Arroyo Colorado and improve its environmental condition.</p>

The Arroyo Colorado Watershed Steering Committee has established several work groups to address the six major components of the WPP: wastewater infrastructure; agricultural issues; habitat restoration; refinement of the TMDL analysis; land use; and public education. The project has significant financial support from federal nonpoint source grants under CWA §319(h). Already, the stakeholders have made great progress. The Education and Outreach Work Group has developed an outstanding multimedia presentation about pollution problems in the Arroyo Colorado and how to get involved in addressing them. In May 2004, the TCEQ and the Habitat Restoration Work Group established contracts with Texas A&M University's Sea Grant Program and the Texas Parks and Wildlife Department to provide an independent watershed coordinator and a habitat restoration specialist to assist in the development of the WPP. TPWD has contracted with Alan Plummer Associates, Inc. to develop a habitat restoration feasibility study. Funding for this study was obtained from the National Oceanic and Atmospheric Administration (NOAA) through the Texas General Land Office. A draft Wastewater Infrastructure plan has been developed. In September 2005, the TSSWCB and the Agricultural Issues Work Group established contracts with (1) Hidalgo and Southmost Soil and Water Conservation Districts (SWCDs) to provide technical and financial assistance to landowners to aid in the development and implementation of WQMPs and (2) TWRI and AgriLife Extension to provide education on BMPs. The draft WPP is expected to be completed February 2006. Since this workplan was originally approved, the Arroyo Colorado WPP was published as final in January 2007.

Project Narrative

General Project Description

The primary focus of this project is to better characterize agricultural runoff in the Arroyo Colorado, assess and demonstrate the effects of BMP implementation at the field and sub-watershed level, and measure progress towards meeting WPP goals. A secondary focus is to evaluate the natural phosphorus reduction capabilities of drainage ditches on runoff from irrigated cropland in the Arroyo Colorado watershed.

This project will provide storm and routine monitoring of drainage ditches that contribute NPS loadings to the Arroyo Colorado in order to better assess agricultural NPS loadings and reductions resulting from BMP implementation. Monitoring will primarily be directed at evaluating areas with significant irrigated cropland acreage to evaluate NPS pollution contributions and determine NPS reductions resulting from BMPs.

A final report will be developed assessing the effects of the conservation practices. Soil sampling and water quality monitoring will be utilized to gauge the impacts on water quality.

This project will be consistent with the WPP and highly coordinated with the Arroyo Colorado Watershed Partnership and the Arroyo Colorado Agricultural Issues Work Group as well as the educational and implementation projects already underway in the watershed. These groups and projects will provide for a great deal of public participation and many opportunities for public input.

In this project, TAMU-K and AgriLife Research – Weslaco will provide assessment activities at 4 sub-watershed sites within the Arroyo Colorado. Proposed sites, to be finalized in the QAPP, include:

- Mile 4 North FM 491 in Hidalgo County
(Lat. 26° 06' 47.8758", Long. -97° 53' 27.8602")
- ± 3 miles north of the intersection of US Military Highway 281 and FM 493 in Hidalgo County
(Lat. 26° 06' 44.6665", Long. -98° 02' 14.9870")
- Harding Ranch Road approximately 3 miles north of FM 508 and FM 1420 in Cameron County
(Lat. 26° 16' 47", Long. -97° 43' 27")
- ABD Road and FM 1479 about 4 miles south of Highway 83 in Cameron County
(Lat. 26° 08' 06", Long. -97° 43' 27")

The monitoring effort will make use of numerous automated sampling systems in TAMU-K's possession that will be made available to this project. Historical or non-direct data obtained from other projects with QAPPs approved by EPA

or the State of Texas 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 implementation efforts and provide data to inform TSSWCB of areas where focused reduction efforts are most needed. This project will also support the educational efforts in the watershed.

The four sub-watersheds chosen for this study represent predominately irrigated cropland within the Arroyo Colorado watershed with two sites being located in Cameron County and two sites in Hidalgo County. The two stream sites in Cameron County were monitored from 2000 to 2002. The historical water quality data available at these sites will be made available as non-direct data to this project for use in the assessment of water quality.

The sub-watershed monitoring activities of this project will consist of automated stormwater sampling, monthly ambient grab sampling, and instantaneous 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 during storm events 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 solids (TSS). In addition, monthly grab samples will be analyzed for BOD5. 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.

This project will provide result demonstrations to landowners in the Arroyo Colorado watershed. This edge of field monitoring will represent both tiled and non-tiled irrigated cropland fields that drain to both drainage ditches and directly into the Arroyo Colorado. Surface runoff, along with outflow from the tile drainage system, will be monitored. Surface runoff and tile drain samples will be retrieved on a storm-event 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 solids (TSS). In addition, monthly grab samples will be analyzed for BOD5.

Project staff will also maintain equipment to record instantaneous water level information and gather the required physical measurements and flow data needed to develop, maintain and update, as needed, the stage-discharge relationships (rating curves) at all stations.

This project is dependent upon and is an important component of the larger project effort in the Arroyo Colorado described above. It is closely linked to TSSWCB project 05-10, *Education of Best Management Practices in the Arroyo Colorado Watershed*, being conducted by TWRI and AgriLife Extension, TSSWCB project 05-12, *WQMP Implementation Assistance in the Arroyo Colorado Watershed*, being conducted by the TSSWCB Harlingen Regional Office and Hidalgo and Southmost SWCDs, and the Arroyo Colorado Watershed Protection Plan Implementation Project being conducted by TCEQ through TWRI.

The results of this study will be used to support ongoing educational and implementation efforts and future modeling efforts planned for the watershed.

A final component of this project will include the completion of the recalibrated Arroyo Colorado SWAT model. The model, funded under TSSWCB project 02-21 *SWAT Model Simulation of the Arroyo Colorado Watershed*, completed and delivered a calibrated/validated SWAT model for the Arroyo Colorado based on a variety of newly collected data sources; however, the project was not able to run various BMP scenarios due the project grant period (FY2002) coming to a close in April 2009. This model utilizes information gathered in this 06-10 workplan (Task 3: Inventory Conservation Practice Implementation and Task 4: Update Land Use/ Land Cover Data) as inputs to the SWAT model. A new (no cost) Task is added to this revised workplan. Project staff will work on the remaining two tasks from project 02-21, which include simulating load reduction scenarios for a suite of management measures and providing flow and watershed loadings to the Arroyo Colorado, as determined by SWAT, for input by TCEQ into the EFDC model.

Water Quality Impairment

Describe all known causes (pollutants of concern) of water quality impairments from any of the following sources: 2002 Water Quality Inventory and 303(d) List, 2002 Summary of Waterbodies with Water Quality Concerns (Secondary Concerns List) or Other Documented Sources (ex. Clean Rivers Program Basin Summary or Basin Highlights Reports).

<u>Waterbody (Segment)</u>	<u>Standards not met in 2002 (parameter)</u>	<u>2002 Concerns</u>
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 Abv 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 (D.O.) Historic Fish Kills
<u>Waterbody (Segment)</u>	<u>Standards not met in 2004 (parameter)</u>	<u>2004 Concerns</u>
Arroyo Tidal (2201)	Aquatic Life Use Not Supporting (D.O.)	Nutrient Enrichment (ammonia, nitrate+nitrite) Historic Fish Kills
Arroyo Abv 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 primary goals of the project are to better characterize agricultural runoff in the Arroyo Colorado watershed, demonstrate and evaluate BMP effectiveness, and measure progress in achieving water quality goals in the watershed.

In order to achieve these goals, the following objectives will be completed:

1. Perform a complete historical data review and analysis related to water quality and agricultural best management practices implemented in the watershed.
2. Investigate site-specific differences and temporal variation of water quality in drainage from agricultural production areas.
3. Collect data for future recalibration of SWAT model to better estimate nonpoint source loading into the river.
4. Simulate load reduction scenarios for a suite of management measures utilizing the SWAT model

Tasks, Objectives and Schedules						
Task 1:	Coordinate and Administer Project					
Costs:	Federal:	\$36,371	Non-Federal:	\$47,904	Total:	\$84,275
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. An Oversight Committee for Agricultural Monitoring will be organized as a subgroup of the Arroyo Colorado Agricultural Issues Work Group to coordinate project efforts with all project participants. TWRI will perform accounting functions for project funds and be responsible for developing timely and accurate reports. Progress reports shall document all activities performed within a quarter and shall be submitted not later than thirty (30) days after the close of the quarter. An interactive internet website will also be created and maintained to provide the most current progress.					
Subtask 1.1:	TWRI will organize an Agricultural Monitoring Oversight Committee to coordinate project efforts with all project participants. This Committee will, at least, be composed of AgriLife Research, TAMUK, AgriLife Extension, TCEQ, TDA, Texas Sea Grant, TSSWCB, Nueces River Authority, producer groups, irrigation districts, and drainage districts. This Committee will meet at least semi-annually to discuss project status, provide input on monitoring design, coordinate project activities, and coordinate monitoring efforts with educational activities.					
	Start Date:	Month 1		Completion Date:	Month 64	
Subtask 1.2:	TWRI will prepare electronic quarterly reports for submission to the TSSWCB. All progress reports will be provided to the Agricultural Monitoring Oversight Committee [Final report provided under Task 9].					
	Start Date:	Month 1		Completion Date:	Month 64	
Subtask 1.3:	Monitoring results will be transferred to AgriLife Extension and AgriLife Research for development of educational materials and presentation to stakeholders. Based on the results of the monitoring, AgriLife Extension will hold workshops demonstrating the impacts of implementing BMPs in the watershed and coordinate periodic meetings of agricultural producers to bring awareness concerning the impact of the drainage ditches on the mitigation of pollutants from the fields (the educational activities are funded under TSSWCB project 05-10).					
	Start Date:	Month 1		Completion Date:	Month 64	
Subtask 1.4:	TWRI will attend meetings with the TSSWCB project manager and other meetings, as needed, to review project status, deliverables, etc. During quarters when no Agricultural Monitoring Oversight Committee are scheduled, TTVN meetings will be conducted with project participants to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements.					
	Start Date:	Month 1		Completion Date:	Month 64	
Subtask 1.5:	TWRI will participate in Arroyo Colorado Watershed Partnership and Arroyo Colorado Agricultural Issues Work Group Meetings.					
	Start Date:	Month 1		Completion Date:	Month 64	
Subtask 1.6	TWRI will submit appropriate Reimbursement Forms.					
	Start Date:	Month 1		Completion Date:	Month 64	

Subtask 1.7	<p>TWRI will develop (Months 1-3), host and maintain (Months 3-60) an internet website for the dissemination of information on educational, monitoring and demonstration activities taking place across the Arroyo Colorado watershed. Website delivery of information will be the most time and cost effective way to disseminate information to interested people or groups. Information presented through the website will include:</p> <ul style="list-style-type: none"> • PDF version of all reports, journal articles, faculty papers & presentations generated from project. • Links to all cooperating and/or participating agencies. • Links to all project primary investigators. • Links to university academic departments that are involved in the project. • Links to other related websites <ul style="list-style-type: none"> ○ Texas State Soil and Water Conservation Board ○ Texas Water Resource Institute. ○ U.S. Environmental Protection Agency, Office of Water, CWA §319 ○ Soil and Water Conservation Districts • Schedule of upcoming meetings/programs dealing with this project. 			
	Start Date:	Month 1	Completion Date:	Month 64
Deliverables	<ul style="list-style-type: none"> • Quarterly Progress Reports • Meeting notices, agendas, minutes, meeting materials, and lists of attendees of Agricultural Monitoring Oversight Committee Meetings • Reimbursement Forms • Website to publish results, bulletins, and reports 			

Tasks, Objectives and Schedules						
Task 2:	Compile and Evaluate Prior Studies and Data					
Costs:	Federal:	\$14,054	Non-Federal:	\$3,728	Total:	\$17,782
Objective:	<p>Compile historical water quality data and previous studies from the Arroyo Colorado Watershed, summarize the results and conclusions, identify data gaps, and organize the information for transfer to AgriLife Extension for the development of fact sheets, presentations, and other educational materials through TSSWCB project 05-10. This will help promote the implementation of cost effective conservation practices that reduce nutrient runoff by informing and educating producers about appropriate practices and the water quality problems in the watershed.</p>					
Subtask 2.1:	<p>TWRI, with assistance from members of the Agricultural Monitoring Oversight Committee, will compile historical water quality data and information from previous studies and conduct a detailed analysis of the most significant water quality parameters to investigate trends and different biological and physical process taking place in the watershed that contribute to changes in water quality in the Arroyo Colorado.</p>					
	Start Date:	Month 1	Completion Date:	Month 6		
Subtask 2.2:	<p>TWRI, with assistance from members of the Agricultural Monitoring Oversight Committee, will organize the results from the earlier NPS pollution projects conducted in the Arroyo Colorado watershed and summarize the results and conclusions of these studies.</p>					
	Start Date:	Month 1	Completion Date:	Month 6		
Subtask 2.3:	<p>TWRI, with assistance from members of the Agricultural Monitoring Oversight Committee, will identify critical data gaps that should be filled.</p>					
	Start Date:	Month 1	Completion Date:	Month 6		
Subtask 2.4:	<p>TWRI will transfer results to AgriLife Extension to be used to develop educational material through TSSWCB project 05-10.</p>					
	Start Date:	Month 1	Completion Date:	Month 6		
Deliverables	<ul style="list-style-type: none"> • Report summarizing historical water quality data, results of prior studies, and data gaps. 					

Tasks, Objectives and Schedules						
Task 3:	Inventory Conservation Practice Implementation					
Costs:	Federal:	\$15,317	Non-Federal:	\$12,208	Total:	\$27,525
Objective:	To compile information on the location and types of Conservation Practices implemented in the Arroyo Colorado Watershed.					
Subtask 3.1:	AgriLife Research – Temple, with assistance from AgriLife Extension, USDA-NRCS, USDA-FSA, the TSSWCB Harlingen Regional Office, and the SWCDs, will identify all agricultural producers in the watershed.					
	Start Date:	Month 1	Completion Date:	Month 6		
Subtask 3.2:	AgriLife Research – Temple, with assistance from AgriLife Extension, USDA-NRCS, USDA-FSA, the TSSWCB Harlingen Regional Office, and the SWCDs, will compile information on the location and types of Conservation Practices implemented in the Arroyo Colorado Watershed since 1995. This will include, but not be limited to, practices implemented through the USDA-NRCS Environmental Quality Incentives Program (EQIP) and the TSSWCB Water Quality Management Plan (WQMP) Program.					
	Start Date:	Month 1	Completion Date:	Month 12		
Subtask 3.3:	AgriLife Research – Temple will assemble a geo-referenced database and develop a map (hard copy and electronic) displaying conservation practice implementation information collected in Subtask 3.2.					
	Start Date:	Month 12	Completion Date:	Month 18		
Subtask 3.4:	AgriLife Research – Temple will transfer the information from Subtask 3.1 and Subtask 3.3 to AgriLife Extension for use in targeting educational activities.					
	Start Date:	Month 12	Completion Date:	Month 18		
Subtask 3.5:	AgriLife Research – Temple will identify areas needing priority implementation work through correlation with Task 4 and the results from Tasks 6-8.					
	Start Date:	Month 12	Completion Date:	Month 64		
Deliverables	<ul style="list-style-type: none"> • Database of all agricultural producers in the watershed • Database and map (hard copy and electronic) showing the location and types of conservation practices implemented since 1995. 					

Tasks, Objectives and Schedules						
Task 4:	Update Land Use / Land Cover Data					
Costs:	Federal:	\$34,590	Non-Federal:	\$22,455	Total:	\$57,045
Objective:	To update and revise all land use / land cover (LULC) categories for the Arroyo Colorado watershed at a level equivalent to the MRLC classification level 4. This data will be used to update and revise the SWAT model and target implementation efforts. This will include, but not be limited to, collection of LULC data from USDA-FSA, Texas Natural Resource Information System (TNRIS), USDA-APHIS, irrigation districts, USGS, and others.					
Subtask 4.1:	SSL will obtain 1998 LULC for the Arroyo Colorado Watershed from TCEQ and all data used to produce it. Coordinate with TPWD and the Habitat Work Group to obtain relevant recent LULC data. Identify the major changes from 1998 to 2005.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.2:	SSL will obtain 2003 LANDSAT ETM+ Data, Path 26/ Row 42 and Path 27/ Row 42. Proceed to image classification at a level equivalent to the MRLC classification level 2.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.3:	If available, SSL will obtain applicable digital data on cropland from USDA-FSA and add up to level 2 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.4:	If available, SSL will obtain digital location data on citrus production from USDA-APHIS and add up to level 2 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.5:	If available, SSL will obtain digital data on locations of sugarcane fields from sugar mill and add up to level 2 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.6:	SSL will obtain 2004 1m DOQ for Cameron, Hidalgo and Willacy counties. Improve the level 2 classification to a level 4 classification by manual digitalization.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.7:	SSL will obtain most recent digital data from irrigation districts and add up to level 4 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.8:	SSL will obtain 1998 tile drainage data and if available, obtain updated data from TSSWCB and AgriLife Extension.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.9:	SSL will obtain 1998 data on colonias and if available, obtain updated data from TWDB. Superimpose colonia data to level 4 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.10:	SSL will obtain 1998 data on non-colonia septic systems and if available, obtain updated data from Lower Rio Grande Valley Development Council (LRGVDC). Superimpose non-colonia septic systems data to level 4 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Subtask 4.11:	SSL will obtain 1998 data on land application of wastewater and if available, obtain updated data from NPDES Permits. Superimpose land application data to level 4 classification.					
	Start Date:	Month 6	Completion Date:	Month 18		
Deliverables	<ul style="list-style-type: none"> LULC grid for the Arroyo Colorado Watershed composed of the most recent data available 					

Tasks, Objectives and Schedules						
Task 5:	Quality Assurance					
Costs:	Federal:	\$7,027	Non-Federal:	\$1,864	Total:	\$8,891
Objective:	To develop Data Quality Objectives (DQO), a Quality Assurance Project Plan (QAPP) and provide amendments and annual revisions to the QAPP, as needed.					
Subtask 5.1:	<p>TWRI will develop a QAPP for activities in Tasks 4, 6, and 7 that will detail project goals and objectives relating to water quality monitoring activities; identify the data needed to fulfill those objectives; list field and laboratory methods; describe procedures and schedules to be followed; and specify a data management structure and the quality assurance protocols. The QAPP will be consistent with the most recent versions of <i>EPA Requirements for Quality Assurance Project Plans (QA/R-5)</i> and the <i>TSSWCB Environmental Data Quality Management Plan</i>.</p> <p>All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the <i>TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue (RG-415)</i> (October 2008) and <i>Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG- 416)</i> (June 2007).</p>					
	Start Date:	Month 1		Completion Date:	Month 6	
Subtask 5.2:	TWRI will provide annual revisions and necessary amendments to the QAPPs to TSSWCB and EPA.					
	Start Date:	Month 6		Completion Date:	Month 64	
Subtask 5.3	<p>TWRI will develop a QAPP for activities in Task 8 consistent with the most recent versions of <i>EPA Requirements for Quality Assurance Project Plans (QA/R-5)</i> and the <i>TSSWCB Environmental Data Quality Management Plan</i>. Non-substantive modification of the QAPP for TSSWCB project 02-21 should suffice.</p>					
	Start Date	Month 34		Completion Date	Month 60	
Deliverables	<ul style="list-style-type: none"> • Approved QAPP for Tasks 4, 6, and 7 • Approved QAPP for Task 8 • Approved annual revisions and amendments to QAPPs 					

Tasks, Objectives and Schedules						
Task 6:	Perform Sub-Watershed Monitoring and Measure Pollutant Attenuation in Drainage Ditches					
Costs:	Federal:	\$230,000	Non-Federal:	\$134,846	Total:	\$364,846
Objective:	To (1) perform routine grab and storm event water quality assessment activities at four sampling sites in Cameron and Hidalgo Counties in order to assess agricultural NPS loadings, (2) determine the degree to which pollutant assimilation is occurring in drainage ditches, and (3) investigate site-specific differences and temporal variation in water quality in drainage ditches representative of agricultural production areas.					
Subtask 6.1:	<p>TAMU-K will perform routine grab and storm event water quality assessment activities, including collection of flow and associated measurements for developing and maintaining stage-discharge relationships in irrigation drainage ditches draining agricultural sub-watersheds at four sampling sites in Cameron and Hidalgo Counties.</p> <p>Subtask 6.1.1 TAMU-K will perform routine monthly grab sampling at four drainage ditch sites. Water quality samples will be collected only if water is flowing. If water is not flowing when monthly 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 nutrients, TSS, and BOD. In addition, field constituents of dissolved oxygen, pH, conductivity, and water temperature will be recorded at the time grab samples are collected.</p> <p>Subtask 6.1.2 TAMU-K will periodically operate automated samplers and water-level recorders at all four drainage ditch sites to characterize the effects of run-off generated by high storm flow pulses. TAMU-K will utilize existing rain gage and remotely-sensed NEXRAD data to identify optimal periods for carrying out such sampling. Given the variable nature of the rainfall process, it is difficult to estimate the exact number of samples that will be obtained. However, attempts will be made to carryout at least one sampling campaign quarterly during the sampling period. At each drainage ditch site, individual runoff samples will be collected daily during storm events and flow composited into one sample that will be analyzed for nutrients, BOD, and TSS. Care will be taken to ensure that the data loggers are programmed to capture the effects of rainfall pulses and not respond to minor water level fluctuations caused due to irrigation flooding. The monthly water level data collected as part this task and unit hydrograph techniques will be used to identify the optimal response frequency to capture high-intensity rainfall pulses.</p> <p>Subtask 6.1.3 Stage-discharge relationships will be developed, maintained and updated, as necessary, for all drainage ditch sites by TAMU-K. This will include taking flow measurements and re-surveying stream cross-sections, if apparent changes have occurred.</p> <p>Subtask 6.1.4 TAMU-K will conduct routine general maintenance of all automated sampling and water level equipment to help ensure that these instruments will operate properly during storm flow conditions.</p> <p>Subtask 6.1.5 TAMU-K will develop a report summarizing the collected monitoring data.</p>					
	Start Date:	Month 6		Completion Date:	Month 64	

Subtask 6.2:	<p>TAMU-K will determine the degree to which pollutant assimilation is occurring in drainage ditches, site-specific differences and temporal variation in water quality in drainage ditches representative of agricultural production areas will be investigated. Assess the characteristics and the benefits of the drainage ditches in controlling agricultural pollution in order to suggest suitable BMPs in the watershed that include effective use of the drainage ditches.</p> <p>Subtask 6.2.1 In coordination with the sub-watershed monitoring sites discussed in Task 6.1, TAMU-K, with assistance from AgriLife Research – Weslaco, will assess nitrogen and phosphorous mitigation processes in drainage ditches.</p> <p>Subtask 6.2.1 TAMU-K, with assistance from AgriLife Research – Weslaco, will develop a suite of suitable BMPs that incorporates the information obtained from the investigation of agricultural drainage ditches described in Subtask 6.2.1.</p>		
	Start Date:	Month 6	Completion Date: Month 64
Deliverables	<ul style="list-style-type: none"> • Electronic copy of data collected • Report summarizing collected data • Description of mitigation effects of drainage ditches • Description of suitable BMPs that incorporate the information obtained from the study of agricultural drainage ditches 		

Tasks, Objectives and Schedules						
Task 7:	Evaluate BMPs to Reduce NPS Pollution at the Farm Level					
Costs:	Federal:	\$85,866	Non-Federal:	\$62,528	Total:	\$148,394
Objective:	To evaluate and demonstrate the effectiveness of irrigation BMPs on reducing agricultural NPS loadings.					
Subtask 7.1:	Selection of sites. AgriLife Extension, AgriLife Research – Weslaco, and TAMU-K will select suitable demonstration sites to assess loadings from agricultural runoff and leachate produced by different BMPs and compare traditional practices with innovative BMPs for the three (3) most representative crops of the watershed. Six (6) representative sites will be characterized and physical characteristics of such as topography, soil texture, salinity and fertility levels, water quality and crops will be obtained and evaluated					
	Start Date:	Month 1		Completion Date:	Month 6	
Subtask 7.2:	Installation of sensors. Flow meters, rain gauges, piezometers, and soil water sensors will be installed by AgriLife Research – Weslaco in the demonstration sites					
	Start Date:	Month 1		Completion Date:	Month 18	
Subtask 7.3:	Collection and analysis of Data. Runoff and leachate samples will be collected by AgriLife Research – Weslaco for the different practices and laboratory analyses will be performed to determine agricultural loadings such as nutrients and solutes. BMPs and traditional practices will be compared economically and their relationship with nutrient loadings will be established					
	Start Date:	Month 4		Completion Date:	Month 64	
Subtask 7.4:	Field Days and Result Demonstrations. AgriLife Extension will conduct one field day and one result demonstration per year to demonstrate and transfer the result to farmers and interested persons. Newspaper and communications media will be used to deliver the results					
	Start Date:	Month 12		Completion Date:	Month 64	
Deliverables	<ul style="list-style-type: none"> Result Demonstration Report: “Evaluation and Demonstration of Irrigation Best Management Practices on Reducing Agricultural Loadings in the Arroyo Colorado” Fact sheet: “Best Management Practices for Reducing Nonpoint Source Pollution” 					

Tasks, Objectives and Schedules						
Task 8:	SWAT Model Simulation of the Arroyo Colorado watershed					
Costs:	Federal:	\$0	Non-Federal:	\$31,995	Total:	\$31,995
Objective:	To simulate load reduction scenarios derived from the Arroyo Colorado WPP using a newly calibrated/validated SWAT model. To provide SWAT model outputs for input into the instream water quality model, EFDC, being developed by TCEQ.					
Subtask 8.1:	AgriLife Research – Temple will simulate load reduction scenarios for a suite of management measures based on the Arroyo Colorado WPP for period after the calibration and validation periods. Selected scenarios will be specified in the QAPP. Scenarios to be modeled will be determined by TSSWCB in consultation with TWRI, AgriLife Research – Temple, TCEQ, and other stakeholders, as appropriate, from the Arroyo Colorado Steering Committee and various work groups.					
	Start Date:	Month 33	Completion Date:	Month 62		
Subtask 8.2:	<p>AgriLife Research – Temple will 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, NH3-N, NO2+NO3, 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).</p> <p>Through TSSWCB project 02-21, the SWAT model was to be 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). Subsequent to calibration, the model was to be validated using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 2004-2006.</p>					
	Start Date:	Month 33	Completion Date:	Month 62		
Deliverables	<ul style="list-style-type: none"> • Technical Report (draft due November 2011) that concomitantly serves as the Final Report for TSSWCB project 02-21 and that: <ul style="list-style-type: none"> ○ generally describes the modeling procedures used and results from the calibrated/validated SWAT model, ○ describes results of simulated load reduction scenarios, ○ discusses SWAT model output of flow and watershed loadings that will be used for input into EFDC, ○ includes GIS maps related to soil, land use, topography and other important features of the watershed, ○ discusses observed water quality data compiled for 1999-2006 that was used for calibration/validation, and ○ statistical measures such as means, standard deviation, coefficient of determination (r²), and Nash-Sutcliffe simulation efficiency to show the model's prediction with respect to observed data at several locations in the watershed • Time series of average daily flow (in CMS) and sediment, BOD, NH3-N, NO2+NO3, 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, as determined by TCEQ 					

Tasks, Objectives and Schedules						
Task 9:	Develop Final Report					
Costs:	Federal:	\$7,425	Non-Federal:	\$1,969	Total:	\$9,394
Objective:	To develop a final report summarizing the results and activities of the project. Development of this report will be guided and directed by the Oversight Committee.					
Subtask 9.1:	TWRI, with assistance from AgriLife Research – Weslaco and TAMU-K, will prepare a final report for submittal to the TSSWCB. The Final Report shall not cover Task 8 explicitly; however, the Task 8 Technical Report shall be included as an appendix to the Final Report.					
	Start Date:	Month 30		Completion Date:	Month 64	
Deliverables	<ul style="list-style-type: none"> • Draft final report submitted three months before end of project • Final report at culmination of project in electronic format 					

Measures of Success

- Evaluation of historical water quality and previous studies
- Assessment of BMP implementation in the watershed
- Evaluation of land use in Arroyo Colorado watershed
- Characterize agricultural runoff at the subwatershed level
- Evaluation of mitigation effects of drainage ditches
- Demonstration of irrigation BMPs effectiveness in reducing NPS
- 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, NH₃-N, NO₂+NO₃, 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)

2005 Texas Nonpoint Source Management Program Document Reference

Goals &/or Milestone(s)

Short-Term Goal One – Data Collection and Assessment: 1) Conducting monitoring to determine effectiveness of WPPs and BMP implementation, and 2) Conducting special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation.

Short-Term Goal Two – Implementation: Developing BMPs to address constituents of concern, as well as implementing recommendations of the Arroyo Colorado WPP

Short-Term Three – Education: expediting development of technology transfer activities to be conducted upon completion of BMP implementation

Milestone B. Data Review – 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.

Milestone C. Targeted Assessment – Complete water quality monitoring, analyze data, assess loadings, and determine the origin and distribution of pollutants.

Milestone F. Implementation – Implement voluntary actions in the watershed and adjust the BMP implementation based on follow-up verification monitoring of effectiveness.

Milestone D. Modeling – Develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.

Part III – Financial Information

Budget Summary				
Federal 319(h)	\$ 430,650	% of total project		58%
Cooperator Match	\$ 287,502	% of total project		38%
TSSWCB State GR	\$ 31,995	% of total project		4%
Total \$ Cost	\$ 750,147	Total project %		100%
Category	Federal	Cooperator Match	TSSWCB State GR	Total
Personnel	\$ 105,580	\$ 56,096	\$ 20,435	\$ 182,211
Fringe Benefits	\$ 20,727	\$ 12,249	\$ 6,187	\$ 39,163
Subtotal Personnel & Fringe	\$ 126,307	\$ 68,345	\$ 26,622	\$ 221,274
Travel	\$ 11,532	\$ 0	\$ 1,200	\$ 12,732
Equipment	\$ 0	\$ 0	\$ 0	\$ 0
Supplies	\$ 30,364	\$ 0	\$ 0	\$ 30,364
Contractual	\$ 200,000	\$ 134,846	\$ 0	\$ 334,846
Construction	\$ 0	\$ 0	\$ 0	\$ 0
Other	\$ 6,275	\$ 0	\$ 0	\$ 6,275
Subtotal	\$ 248,171	\$ 134,846	\$ 1,200	\$ 384,217
Total Direct Costs	\$ 374,478	\$ 203,191	\$ 27,822	\$ 605,491
Indirect Costs (15%)	\$ 56,172	\$ 31,095	\$ 4,173	\$ 91,440
Unrecovered IDC	\$ 0	\$ 53,216	\$ 0	\$ 53,216
Total Project Costs	\$ 430,650	\$ 287,502	\$ 31,995	\$ 750,147

Budget Justification		
Category	Total Amount	Justification
Personnel & Fringe Benefits	\$ 221,274	<p><u>Federal:</u></p> <ul style="list-style-type: none"> • TWRI Project Manager @ 30% in yr 1, 5% in yr 2, and 13.3% in yr 3 Year 4: May June, July August @ 23.75% • TWRI IT Associate @ 4.167% each year • AgriLife Research – Temple Asst Prof (2 mos) • SSL Research Assoc (12 mos @ 25%) in years 1 & 2 • SSL Student Techs (2 @ 9 mos @ 100%) in years 1 & 2 • SSL Project Manager @ 1.7% in years 1 & 2 • AgriLife Research – Weslaco Research Tech II @ 33% in years 1 – 3 and 16% in year 4 <p><u>Cooperator Match:</u></p> <ul style="list-style-type: none"> • TWRI Director @ 4.5% each year • AgriLife Research – Temple Asst Prof (1 mo.) • SSL Systems Analyst @ 8.3% in years 1 & 2 • AgriLife Research – Weslaco Asst Prof & Ext Ag Eng Spec @ 10% each year <p><u>TSSWCB State GR:</u></p> <ul style="list-style-type: none"> • AgriLife Research GIS Specialist @ 1 month • AgriLife Research Scientist @4.5 months
Travel	\$ 12,732	<p><u>Federal:</u></p> <ul style="list-style-type: none"> • TWRI – \$278 annually (\$1,112) for Annual Meetings in Weslaco • AgriLife Research – Temple – \$3,320 for 6 data collection trips and follow-up to the watershed • SSL – \$500 per year in years 1 & 2 (\$1,000) • AgriLife Research – Weslaco – \$2,033.33 annually (\$6,100)for sampling & meetings <p><u>TSSWCB State GR:</u></p> <ul style="list-style-type: none"> • AgriLife Research Scientist - \$1,200 for travel to the watershed and stakeholder meetings.
Equipment	\$ 0	
Supplies	\$ 30,364	<p><u>Federal:</u></p> <ul style="list-style-type: none"> • SSL – \$2,900 for external hard drives and additional computer peripherals devices • AgriLife Research – Weslaco – \$19,300 for field demo • TWRI - \$8,164 to cover lab supplies for TAMU-K to conduct lab analysis of TAMU-K samples and Weslaco samples
Contractual	\$ 334,846	<p><u>Federal:</u></p> <ul style="list-style-type: none"> • \$200,000 contracted to TAMU-K for Task 6 <p><u>Cooperator Match:</u></p> <ul style="list-style-type: none"> • \$134,846 contracted to TAMU-K for Task 6
Construction	\$ 0	
Other	\$ 6,275	<p><u>Federal:</u></p> <ul style="list-style-type: none"> • AgriLife Research – Weslaco – \$1389 for publications, \$1386 for vehicle maintenance and repair • SSL - \$2,000 for desktop computer and \$1500 for laptop computer

Indirect	\$ 91,440	<u>Federal:</u> <ul style="list-style-type: none"> • 15% of Total Direct Federal (excluding \$175,000 contractual) <u>Cooperator Match:</u> <ul style="list-style-type: none"> • 45.5% of Total Direct Non-Federal Match (excluding \$175,000 contractual) <u>TSSWCB State GR:</u> <ul style="list-style-type: none"> • 15% of Total Direct TSSWCB State GR
Unrecovered IDC	\$ 53,216	<u>Cooperator Match:</u> <ul style="list-style-type: none"> • 30.5% of Total Direct Federal (excluding contractual)