

Arroyo Colorado Agricultural Nonpoint Source Assessment Scope of Work

I. Background

The Arroyo Colorado flows through Hidalgo, Cameron and Willacy Counties in the Lower Rio Grande Valley of Texas into the Laguna Madre (Figure 1). Flow in the Arroyo Colorado is sustained by wastewater discharges, agricultural irrigation return flows, urban runoff, and base flows from shallow groundwater. The Arroyo 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 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.

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.

In response to this impairment, a local effort has been 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 and improve its environmental condition.

The Arroyo Colorado Watershed Steering Committee has established several work groups to address the six major components of the watershed plan: 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 Section 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 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'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 NOAA through GLO. 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 SWCDs to provide technical and financial assistance to

landowners to aid in the development and implementation of WQMPs and (2) the Texas Water Resources Institute and Texas Cooperative Extension to provide education on best management practices. The Draft WPP is expected to be completed February 2006.

II. Project Description

The primary focus of this 319(h) 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 nonpoint source 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 nonpoint source pollution (NPS) 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 Watershed Protection Plan and highly coordinated with the Arroyo Partnership and Arroyo Ag Steering Committee 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, TAMUK and TAES will provide assessment activities at 4 sub-watershed sites within the Arroyo Colorado:

- 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 493 in Hidalgo County (Lat. 26 06 44.6665, Long -98 02 14.987)
- Harding Ranch Road approximately 3 miles north of 508 and 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 TAMUK's possession that will be made available to this project. Historical or nondirect 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 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 sediments (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 tilled and non-tiled irrigated cropland fields that drain to both drainage ditches and directly into the Arroyo. Surface runoff, along with outflow from the tile drainage system, will be monitored. Surface runoff and tile drain samples will be retrieved on an 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 sediments (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 the CWA §319 funded FY05 Arroyo BMP Education Project being conducted by TWRI and TCE, the FY05 Arroyo WQMP Implementation Project being conducted by the TSSWCB and Hidalgo and Southmost SWCDs, and the Arroyo Watershed Coordination Project being conducted by TCEQ and Texas Sea Grant.

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

III. Tasks

TASK 1: Project Coordination and Administration

Subtask 1.1: TWRI will organize an Ag Monitoring Oversight Committee to coordinate project efforts with all project participants. This Committee will be composed of TAES, TAMUK, TCE, 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.

Subtask 1.2: TWRI will prepare electronic quarterly reports for submission to the TSSWCB. All progress reports will be provided to the Ag Monitoring Oversight Committee [Final report provided under Task 8].

Subtask 1.3: Monitoring results will be transferred to TCE and TAES for development of educational materials and presentation to stakeholders. Based on the results of the monitoring, TCE will hold workshops demonstrating the impacts of implementing BMPs in the watershed and coordinate periodic meetings of ag 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 a FY05 project).

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 Ag 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

Subtask 1.5: TWRI will participate in Arroyo Colorado Partnership and Arroyo Colorado Agricultural Issues Work Group Meetings.

Subtask 1.6: TWRI will submit appropriate Reimbursement Forms.

Subtask 1.7: TWRI will develop (Months 1-3), host and maintain (Months 3-36) 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.

TASK 2: Compilation and Evaluation of Prior Studies and Data

Subtask 2.1: TWRI, with assistance from members of the Ag 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 the trends and the different biological and physical process taking place in the watershed that contribute to changes in water quality in the Arroyo

Subtask 2.2: TWRI, with assistance from members of the Ag Monitoring Oversight Committee, will organize the results from the earlier non-point source pollution projects conducted in the Arroyo Colorado watershed and summarize the results and conclusions of these studies.

Subtask 2.3: TWRI, with assistance from members of the Ag Monitoring Oversight Committee, will identify critical data gaps that should be filled.

Subtask 2.4: TWRI will transfer results to TCE to be used to develop educational material through the FY05 Arroyo Education Project.

TASK 3: Inventory Conservation Practice Implementation

Subtask 3.1: TAES-Temple, with assistance from TCE, USDA-NRCS, USDA-FSA, the TSSWCB Harlingen Regional Office, and the SWCDs, will identify all producers in the watershed.

Subtask 3.2: TAES-Temple, with assistance from TCE, 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 Environmental Quality Incentives Program (EQIP) and the Water Quality Management Plan (WQMP) Program.

Subtask 3.3: TAES-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.

Subtask 3.4: TAES-Temple will transfer the information from Subtask 3.1 and Subtask 3.3 to TCE for use in targeting educational activities.

Subtask 3.5: TAES-Temple will identify areas needing priority implementation work through correlation with Task 4 and the results from Tasks 6-9.

TASK 4: Update Land Use/Land Cover Data

Subtask 4.1: The Spatial Sciences Lab (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.

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 to level 2.

Subtask 4.3: If available, SSL will obtain applicable digital data on cropland from USDA – FSA and add up to level 2 classification.

Subtask 4.4: If available, SSL will obtain digital location data on citrus production from USDA-APHIS and add up to level 2 classification.

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.

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.

Subtask 4.7: SSL will obtain most recent digital data from irrigation districts and add up to level 4 classification.

Subtask 4.8: SSL will obtain 1998 tile drainage data and if available, obtain updated data from TSSWCB and TCE.

Subtask 4.9: SSL will obtain 1998 data on colonia and if available, obtain updated data from TWDB. Superpose colonia data to level 4 classification.

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). Superpose non-colonia septic systems data to level 4 classification.

Subtask 4.11: SSL will obtain 1998 data on land Application and if available, obtain updated data from NPDES Permits. Superpose land application data to level 4 classification.

TASK 5: Develop Quality Assurance Project Plan

Subtask 5.2: TWRI will provide annual revisions and necessary amendments to the QAPP to the TSSWCB and EPA.

TASK 6: Perform Sub-Watershed Monitoring and Measure Pollutant Attenuation in Drainage Ditches

Subtask 6.1.1: TAMUK will perform routine monthly grab sampling at four drainage ditch sites.

Subtask 6.1.2: TAMUK 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.

Subtask 6.1.3: Stage-discharge relationships will be developed, maintained and updated, as necessary, for all drainage ditch sites.

Subtask 6.1.4: TAMUK 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.

Subtask 6.1.5: TAMUK will develop a report summarizing the monitoring data.

Subtask 6.2.1: In coordination with the sub-watershed monitoring sites discussed in Task 6.1, TAMUK, with assistance from TAES, will assess nitrogen and phosphorous mitigation processes in drainage ditches.

Subtask 6.2.2: TAMUK, with assistance from TAES, 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 above.

TASK 7: Evaluate BMPs to Reduce NPS Pollution at the Farm Level

Subtask 7.1: Selection of sites. Texas Cooperative Extension (TCE), Texas Agricultural Experiment Station-Weslaco (TAES-Weslaco), and Texas A&M University-Kingsville (TAMUK) will select suitable demonstration sites to assess loadings from agricultural runoff and leachate produced by different BMPs and compare traditional practices with innovative BMP 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

Subtask 7.2: Installation of sensors. Flow meters, rain gauges, piezometers, soil water sensors will be installed by TAES-Weslaco in the demonstration sites

Subtask 7.3: Collection and analysis of Data. Runoff and leachate samples will be collected by TAES-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

Subtask 7.4: Field Days and Result Demonstrations. TCE 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 divulge the results

TASK 8: Develop Final Report

Subtask 8.1: TWRI, with assistance from TAES and TAMUK, will prepare final report for submittal to the TSSWCB.