

A Watershed Protection Plan for the Arroyo Colorado Phase I 2007



A Report of the Arroyo Colorado Watershed Partnership and Texas Sea Grant Pursuant to a 2003 USEPA Clean Water Act Section 319(h) Grant Awarded through Texas Commission on Environmental Quality Contract Agreement 583-4-65618

EXECUTIVE SUMMARY

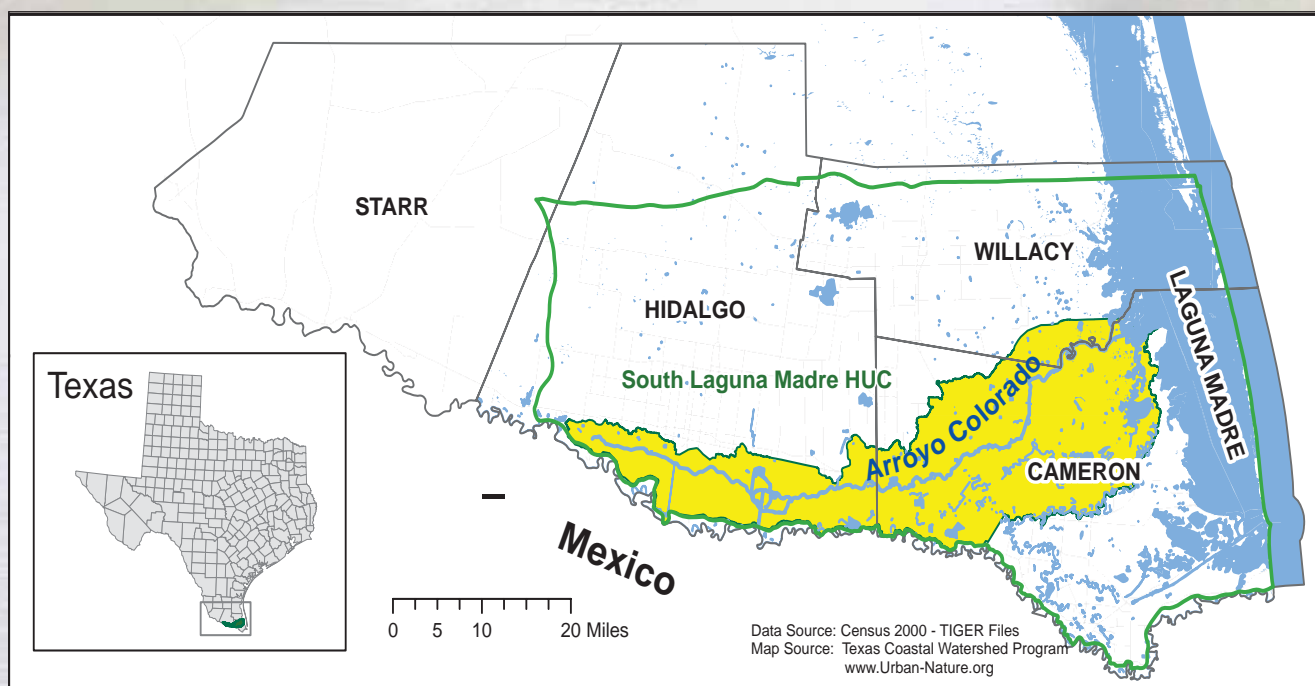
The Arroyo Colorado Watershed (ACW) Protection Plan is a comprehensive watershed-based strategy to improve water quality and aquatic and riparian habitat in the Arroyo Colorado. Developed by the Arroyo Colorado Watershed Partnership, a coalition of public and private organizations and concerned individuals known collectively as “stakeholders,” the ACW Protection Plan is designed to address impairments and concerns identified in the 2004 Texas Water Quality Inventory and 303(d) List (TCEQ 2004a). The implementation period for Phase I of the ACW Protection Plan is 2006-2015. However, the plan is considered a “living” document subject to revision and modification every 5 years in coordination with revisions made to the Rio Grande (Region M) Regional Water Plan. Phase I of the ACW Protection Plan describes the state of the watershed, presents a strategic plan to improve environmental conditions, and proposes a monitoring plan to document improvements during, and following, implementation of the Plan. Subsequent phases of the Plan will make use of the knowledge gained during implementation of Phase I of the Plan to further improve conditions in the Arroyo Colorado.

The ACW Protection Plan considers the current uses of the Arroyo Colorado, including flood control, navigation, conveyance of municipal/industrial wastewater discharges and irrigation return flows

(i.e., tail water), recreation, and environmental uses and presents a detailed strategy to restore and protect these uses. Furthermore, the plan describes the institutional framework for current management programs and proposes a strategy for improving management of water quality in the future in the Arroyo Colorado.

The ACW Protection Plan presents a history and background of water quality in the Arroyo Colorado, identifies the physical characteristics of the watershed, and addresses the nine elements required for Federal Clean Water Act Section 319 grant funding, including:

- a. Identifying the causes and sources of pollution
- b. Estimating pollution reductions
- c. Describing the management measures proposed in the plan
- d. Estimating the amount of technical and financial assistance required
- e. Establishing a plan for educating and informing the public
- f. Establishing a schedule of implementation
- g. Describing interim milestones to verify implementation of management measures



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- h. Describing the criteria for assessing load reductions and water quality improvement
- i. Establishing a water quality monitoring plan

The goal of the ACW Protection Plan is to reduce the addition (*i.e.*, loading) of pollutants such as oxygen-demanding substances, nitrogen, phosphorus and sediment to the Arroyo Colorado and to improve natural habitat to the degree necessary to meet the uses designated by the State of Texas and specified in the State's Water Quality Standards (30 TAC §§307.1-307.10). Although not specifically targeted for reduction, fecal bacteria loading to the Arroyo Colorado is also expected to diminish as an ancillary effect of ACW Protection Plan implementation.

Basing decisions on sound science, but also on social and economic reality, the Arroyo Colorado Watershed Partnership (ACW Partnership) set the following realistic load reduction targets for pollutants of concern over the 10-year period of Phase I of the Plan:

Pollutant	Load Reduction (% of current load)
Biochemical Oxygen Demand (BOD)	7%
Sediment	19%
Total Nitrogen	11%
Total Phosphorus	9%

The ACW Partnership expects water quality to improve as a result of implementation of Phase I of the ACW Protection Plan and will assess the success of the Plan over the 10-year implementation period. If necessary, the ACW Partnership will propose additional reductions in pollutant loading and habitat improvements in subsequent phases of the plan in order to achieve State Water Quality Standards.

The Arroyo Colorado Watershed (ACW) Partnership

The ACW Partnership is an organization of more than 400 dedicated individuals who share an interest in the welfare of the Arroyo Colorado and the Lower Laguna Madre. The strategy to protect and restore the Arroyo Colorado described in the ACW Protection



Plan was developed by the ACW Partnership. The Partnership grew out of smaller groups of local stakeholders involved in the Total Maximum Daily Load process and is now the leading stewardship organization in the watershed.

The ACW Partnership formed Work Groups to investigate and address topic-specific issues and develop recommendations for the ACW Protection Plan. The seven Work Groups formed were the following:

- Wastewater Infrastructure
- Agricultural Issues
- Habitat Restoration
- Further Study/Phase II TMDL Analysis
- Outreach and Education
- Land Use and Development
- Water Quality Monitoring

Work Group members included technical experts in the various disciplines associated with the specific Work Group topics as well as private individuals and representatives of organizations that are part of the ACW Partnership. The Work Groups developed topic-specific recommendations for consideration by the ACW Partnership and for inclusion into the Plan.

State of the Watershed

The current state of the Arroyo Colorado watershed is not good. Decades of human use have degraded habitat and water quality in the Arroyo Colorado and have strained its ability to assimilate pollutants. The Arroyo Colorado watershed is experiencing rapid urban growth (the population is expected to triple within the next 40 years in the upper portion of the watershed) signifying a future increase in urban wastewater and storm water contributions with time. Improvement of water quality in the Arroyo Colorado necessitates actions and measures that include habitat restoration as well as a reduction in the loading of pollutants from the watershed. Significant wastewater and storm water infrastructure has been installed and more is planned in the Arroyo Colorado watershed over the next 10 years. The ACW Protection Plan includes improved wastewater infrastructure, enhanced treatment of wastewater, large-scale and small-scale habitat restoration projects, implementation of agricultural best management practices on irrigated crop land and a comprehensive Education and Outreach campaign.



Habitat

Approximately 95% of the natural habitat in the Arroyo Colorado Watershed has been cleared to make room for agriculture and urban development. In addition to the clearing of stream bank habitat, the main channel of the stream itself has been modified to accommodate functional uses of the stream such as

navigation and conveyance of flood waters. Habitat alterations in the Arroyo Colorado include modification of hydrology, dredging, stream bank destabilization, and the loss or degradation of wetlands and riparian environments along the stream. The combined impacts of these actions contribute to the occurrence of low dissolved oxygen (DO) in the tidal segment of the Arroyo Colorado. The straightening, widening and deepening of the tidal segment of the Arroyo Colorado, to facilitate barge traffic effectively reduces the velocity of the stream, reduces instream circulation, and lowers re-aeration rates in the stream. Removal of sand bars and woody debris has also eliminated potential areas of turbulence that would facilitate re-aeration of the water column.

Invasive plant species, both native and introduced, are plentiful in the land and aquatic habitats associated with the Arroyo Colorado and the Lower Rio Grande Valley. These invasive species have a negative impact on native plant and wildlife populations in the Arroyo Colorado.

The Arroyo Colorado's natural ability to assimilate pollutants and to meet state aquatic life use criteria is limited by habitat loss and by the physical modifications made to the stream for flood control and navigation. Improving natural habitat in the Arroyo Colorado will improve water quality by reducing erosion, removing nutrients, and increasing dissolved oxygen in the stream. The ACW Protection Plan includes the following Actions for habitat improvement in the Arroyo Colorado:

- Action 1 -** Support the ongoing efforts of the federal, state and local agencies to implement terrestrial habitat conservation objectives in the Arroyo Colorado watershed through partnerships and funding.
- Action 2 -** Protect and restore existing riparian areas, *resacas* and freshwater wetlands.
- Action 3 -** Work with drainage districts to modify drainage ditches and maintenance practices to reduce channel and stream bank erosion.
- Action 4 -** Participate with IBWC during development of maintenance or new work projects for the Arroyo Colorado.

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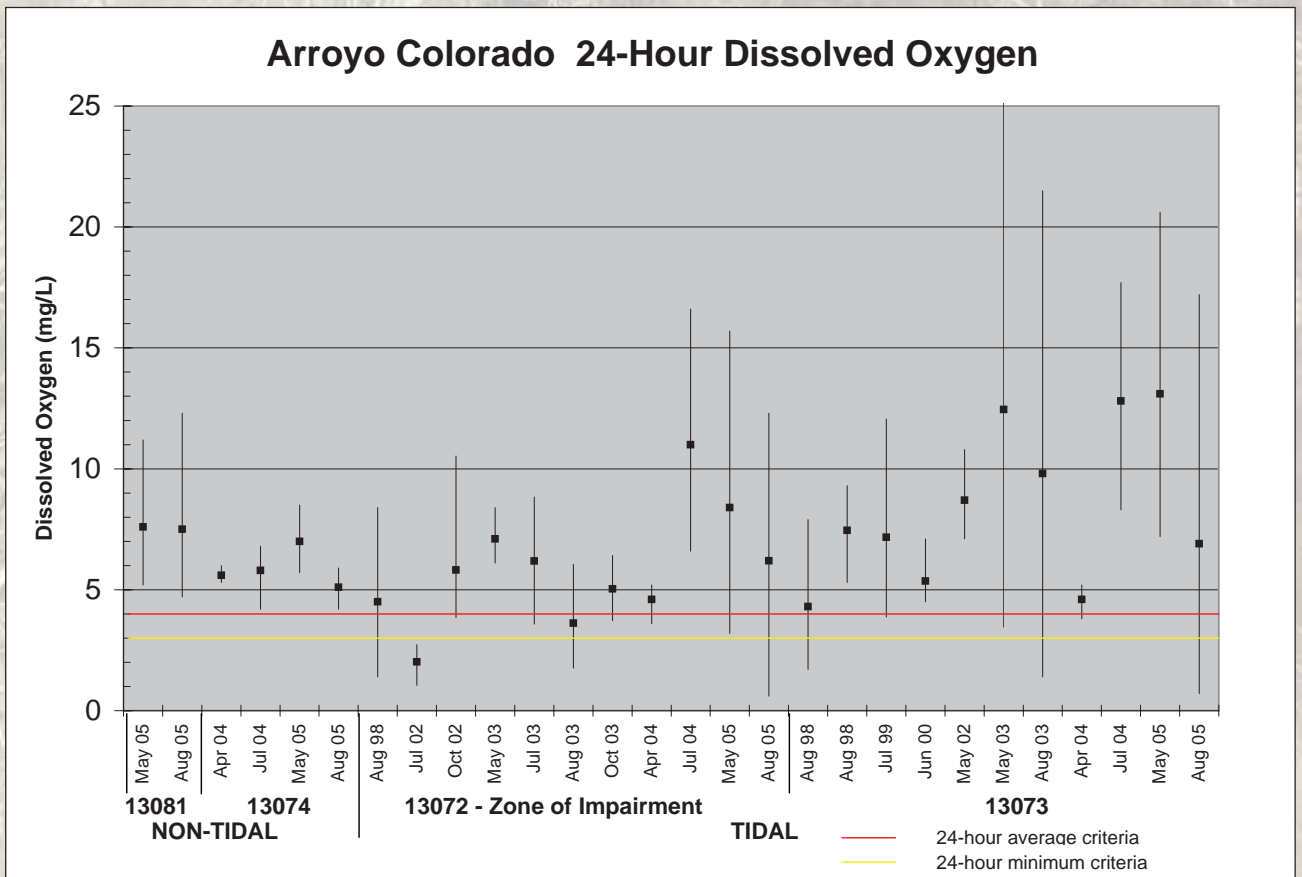
- Action 5 -** Develop partnerships with the IBWC, drainage districts, and private landowners to implement bank/slope stabilization projects along the Arroyo Colorado or in drainages within the watershed.
- Action 6 -** Implement projects intended to reduce storm water runoff, reduce sediment load and reduce the volume and velocity of the flow of the runoff in drainage ditches and the Arroyo Colorado.
- Action 7 -** Support increased use of vegetated filter strips around agricultural production and urban development areas to slow storm water runoff from these areas.
- Action 8 -** Construct storm water wetland systems in urban developments, redevelopments and areas under agricultural production.
- Action 9 -** Build wetlands for tertiary treatment of waste streams from individual

wastewater treatment plants and/or for polishing flows from multiple wastewater treatment plants in close proximity (incorporating habitat features when feasible).

- Action 10 -** Build large off-channel wetlands capable of treating flows from multiple sources including wastewater treatment facilities and non-point source runoff from urban and agricultural areas.

Water Quality

Water quality in the tidal segment of the Arroyo Colorado does not support aquatic life because of occasional occurrences of low dissolved oxygen (DO). Water quality in the non-tidal segment of the Arroyo Colorado does not support contact recreation because of high fecal bacteria concentrations. Nutrient concentrations (nitrogen and phosphorus compounds) are high in both segments of the Arroyo Colorado. The concentration of nitrogen compounds such as





Colonia

Ammonia and nitrate in the Arroyo Colorado are among the highest in the state, exceeding the 85th percentile of all other tidal water bodies in the state, and historical water quality data indicate an increasing trend over time for these pollutants. Chlorophyll-*a* concentrations, a measure of the stream's algal productivity, consistently exceed the screening criteria in the tidal segment of the Arroyo Colorado and have reached very high levels within recent years (2000-2006), displaying a trend similar to that of nitrogen-containing compounds. Productivity overall is high in the tidal segment of the Arroyo Colorado, and algal blooms, indicative of ecological imbalance, are common in the spring and summer months. Wide daily swings in DO often accompany periods of high algal productivity. A reduction in nutrients in the Arroyo Colorado will help control excessive algal growth and will improve dissolved oxygen levels in the Arroyo Colorado's Zone of Impairment.

Wastewater Infrastructure

The Arroyo Colorado receives treated wastewater from fourteen municipalities and two water supply corporations located in the watershed. The Arroyo Colorado also receives substantial volumes of untreated or poorly treated wastewater generated in *colonias*, which are low income, unincorporated border communities lacking adequate water and wastewater infrastructure. The most recent population estimates

(2003) show there are approximately 200,000 residents living in *colonias* in Hidalgo, Cameron and Willacy counties. Most of these residents live within the Arroyo Colorado watershed.

Since the year 2000, compliance with state effluent limits has improved substantially among wastewater treatment facilities in the Arroyo Colorado, and 11 municipalities have significantly increased their wastewater infrastructure, providing new sanitary sewer services to over 37,000 *colonia* residents. During that period (2000-2006), two new wastewater treatment facilities were built and one facility was upgraded.

As part of the ACW Protection Plan, municipalities in the Arroyo Colorado watershed will provide wastewater services to an additional 68,000 *colonia* residents (approximately 42% of the current *colonia* population in the Rio Grande Valley) and six new wastewater treatment facilities and nine upgrades and/or expansions to existing wastewater facilities are planned.

The ACW Protection Plan also includes 11 enhanced wastewater treatment projects (small wetlands and pond systems designed to remove nutrients from treated wastewater), a 500-acre regional wetland system and a 300-acre regional wetland system planned for construction between 2008 and 2015.

Agriculture

The Arroyo Colorado watershed contains approximately 333,000 acres of agricultural land. This land area amounts to approximately half of the land use in the Arroyo Colorado watershed. Cotton and grain sorghum are the primary crops. However, corn, sugarcane and citrus are also commonly grown in the area.

Agricultural production contributes approximately 41% of the BOD, 68% of the total nitrogen, 49% of the total phosphorus, and 87% of the sediment entering the Arroyo Colorado. The goal of the ACW Protection Plan is to achieve the voluntary adoption of agricultural best management practices (BMPs) on 33% of the irrigated cropland (approximately 100,000 acres) by 2010 and 50% (approximately 150,000 acres) by 2015.

Storm Water Management

Until recently, pollution from urban storm water was largely unregulated in the Arroyo Colorado watershed. Since 2003, efforts to control urban storm water runoff in the Arroyo Colorado watershed have been limited to outreach and education for municipalities in the Rio Grande Valley in efforts to familiarize them with the requirements of the recent federal (Phase II) storm water regulations for small Municipal Separate Storm Sewers (MS4s). However, in 2007, local governments will begin developing Storm Water Management Programs (SWMPs) for more than 60 urbanized areas located in the Arroyo Colorado watershed. The ACW Partnership will work with the Lower Rio Grande Valley TPDES Storm Water Task Force, a local partnership of 18 municipalities and Texas A&M University–Kingsville established to ensure compliance with Phase II Storm Water requirements for small MS4s in the Rio Grande Valley, to focus SWMPs on preventing

nonpoint source pollution of the Arroyo Colorado. The SWMPs are expected to reduce loading of pollutants of concern to the Arroyo Colorado. The ACW Partnership will also work with the TCEQ to complete demonstration projects showing the effectiveness of non-structural BMPs in reducing urban nonpoint source pollution.

Education and Outreach

Prior to 2000, only limited outreach and education (E&O) efforts were conducted by state and local governments in the Rio Grande Valley focusing specifically on the water quality issues associated with the Arroyo Colorado.

Since 2004, the ACW Partnership has provided E&O to stakeholders and citizens about topics and issues that affect water quality and habitat in the Arroyo Colorado. In 2006, the ACW Partnership commissioned a social marketing report to guide outreach efforts in the watershed. The report forms the basis for the E&O campaign described in the ACW Protection Plan. The campaign consists of nine major **Strategies** and uses a combination of broad and targeted outreach efforts with a variety of message delivery vehicles. The **Strategies** are the following:

Strategy 1 - Establish a Brand.

Strategy 2 - Deliver Basic Facts about the Arroyo Colorado.

Strategy 3 - Raise Awareness and Increase

Community Involvement in the Arroyo Colorado Watershed Partnership Initiative.

Strategy 4 - Develop Partnership Agreements for Message Distribution.

Strategy 5 - Create Micro-Campaigns for Specific Target Audiences.

Strategy 6 - Institutionalize a Practice of Ongoing Campaign Evaluation.



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- Strategy 7** - Establish Volunteer Monitoring Programs on the Arroyo Colorado and Associated Drainages.
- Strategy 8** - Collaborate with Government Agencies Offering Environmental E&O.
- Strategy 9** - Collaborate with Non-Governmental Organizations (NGOs) Supporting Environmental Education and Conservation Programs in the Watershed.



Sources and Causes of Pollution

A thorough review of the sources and causes of poor water quality in the Arroyo Colorado reveals high nutrient loading from municipal wastewater, agriculture, and urban storm water. These loadings, along with the loss of natural habitat and the physical modifications made to the stream, cause low dissolved oxygen in the tidally influenced portion of the Arroyo Colorado.

Permitted wastewater outfalls account for 20-40% of the loading of pollutants of concern to the Arroyo Colorado; 18 municipal wastewater treatment facilities account for more than 95% of the permitted point source load. These 18 facilities are considered to be the “Principal Point Source Contributors” of pollutants in the Arroyo Colorado Watershed. The

Arroyo Colorado also receives pollutant loading (approximately 4%) from poorly treated and essentially untreated wastewater generated by *colonias*. Urban storm water contributes 6-26% of the loading of pollutants of concern to the Arroyo Colorado and agriculture accounts for approximately 49-68% of the nutrient loading to the Arroyo Colorado and 87% of the sediment loading.

Since 2000, investments in wastewater infrastructure and the implementation of agricultural BMPs have reduced both point and nonpoint source loadings of pollutants to the Arroyo Colorado. However, high ammonia and nitrate nitrogen concentrations in the Arroyo Colorado indicate excessive loading of nutrients continues to be a problem in the watershed.

Institutional Framework

Federal, state and local governments share responsibility for managing water quality and habitat in the Arroyo Colorado. Federal, state, regional and local government agencies involved in developing and implementing the ACW Protection Plan include the following:

Federal Agencies

- U.S. Environmental Protection Agency (USEPA)
- U.S. International Boundary and Water Commission (USIBWC)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Army Corps of Engineers (USACE)
- U.S. Geological Survey (USGS)

State Agencies

- Coastal Coordination Council (CCC)
- Texas General Land Office (GLO)
- Texas Parks and Wildlife Department (TPWD)
- Texas State Soil and Water Conservation Board (TSSWCB)
- Texas Commission on Environmental Quality (TCEQ)
- Texas Sea Grant, Texas Cooperative Extension and the Texas A&M University System (TAMU)
- Texas Water Resource Institute (TWRI)

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Local/Regional Agencies

Nueces River Authority (NRA)

Local Drainage Districts

Local Irrigation Districts

Rio Grande River Water Authority (RGWA)

Lower Rio Grande Valley Development Council
(LRGVDC)

Lower Rio Grande Valley TPDES Storm Water Task
Force

Port of Harlingen Authority (POH)

Although state and federal governments play an important role in protecting water quality and habitat in the Arroyo Colorado, local stewardship and the actions of local governments have the greatest direct impact on the overall health of the stream. Irrigation districts and drainage districts play a particularly important role in the management of water quality in the Arroyo Colorado because they control conveyance of water to the stream. Regional entities such as The Lower Rio Grande Valley Development Council (LRGVDC) and the Lower Rio Grande Valley (LRGV) Texas Pollution Discharge Elimination System (TPDES) Storm Water Task Force often provide direction in planning and implementation efforts. These efforts are enhanced by the coordination efforts of the ACW Partnership.

Elements of the Watershed Protection Plan

The ACW Protection Plan is composed of seven principal components, including wastewater infrastructure, agriculture, industrial practices, urban storm water runoff, land use, education and outreach (E&O) and monitoring. Each component or element of the plan relates to a particular need or concern identified by the stakeholders or a requirement under state or federal regulations.

The measures contained in the Plan include:

- Construction of small wetland cells and pond systems for removal of nutrients from treated wastewater,



- Construction of regional wetland systems to improve habitat and remove nutrients from urban and agricultural runoff,
- Revised effluent limits for existing and proposed wastewater treatment systems permitted by the State of Texas,
- Improved wastewater infrastructure for municipalities and rural communities in the watershed,
- Floodplain and stream stabilization to reduce bank erosion and improve riparian and aquatic environments,
- Increased implementation of agricultural management practices designed to mitigate pollutants from farming in the watershed,
- Improved management measures at and near the Port of Harlingen designed to mitigate unauthorized releases of fertilizer and raw sugar into the tidally influenced portion of the Arroyo Colorado,
- Water quality monitoring to assess the health of the Arroyo Colorado and gain additional knowledge of the pollutant sources and water quality problems, and

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- Increased E&O efforts to inform and engage stakeholders and the public.



Monitoring and Measuring Progress

The most direct indicator of the success of the ACW Protection Plan is the quality of water in the Arroyo Colorado; specifically, lower nutrient concentrations for the entire Arroyo Colorado and higher levels of dissolved oxygen in the tidally influenced portion of the Arroyo Colorado, where the levels of dissolved oxygen are persistently low under warm and dry conditions. Research has shown that nutrient and sediment inflows into the tidally-influenced portion of the Arroyo Colorado contribute significantly to the low dissolved oxygen observed in this area of the stream. The Water Quality Monitoring Plan detailed in the ACW Protection Plan is an important tool to help assess the effectiveness of the Plan, to gain a greater understanding of causes of low dissolved oxygen in the Arroyo Colorado, and to better characterize the sources of pollution in the watershed. The ACW Partnership acknowledges that watershed planning and water quality management is an iterative and adaptive process that will continue to evolve with time. As more is learned about the causes and the solutions to environmental degradation, the ACW Partnership will do everything in its power to institute the measures

necessary to restore, protect and preserve water quality and habitat in the Arroyo Colorado and the Lower Laguna Madre. The Water Quality Monitoring Plan contained in the ACW Protection Plan is comprised of three principal components.

Watershed-scale Water Quality Monitoring

Twelve monitoring sites were chosen by the ACW Partnership to assess water quality and evaluate the ACW Protection Plan's effectiveness on a watershed scale. The sites are long-term monitoring stations with robust volumes of historical data; the majority of the watershed-scale monitoring stations are located at sub-basin boundaries facilitating spatial and temporal trend analysis of data. Watershed-scale water quality monitoring will be conducted on a quarterly basis (four times per year) in the Arroyo Colorado.

Wastewater Effluent Monitoring

Two different types of effluent quality monitoring are planned under the ACW Protection Plan. In addition to reporting flow and effluent concentrations of parameters required under existing TPDES discharge permits, 13 municipalities and two water supply corporations participating in the Plan will collect and report nutrient and bacteria parameters. Additionally, wastewater treatment facility operators implementing enhanced treatment projects under the ACW Protection Plan will also monitor flow, biochemical oxygen demand, total suspended solids and nutrients at the polished outfall locations downstream of the enhanced treatment areas.



Project Specific Monitoring

Project-specific monitoring includes data collection for specific activities and interests of the ACW Partnership. These activities include:

- Data collection efforts associated with the development of Total Maximum Daily Loads (TMDLs) for the Arroyo Colorado or to fill known data gaps, and
- Projects assessing the impact of agriculture or the effectiveness of agricultural BMPs.

In addition to water quality monitoring and the associated environmental indicators measured as part of the monitoring plan (*i.e.*, levels of dissolved oxygen, nutrient concentrations, etc.), the ACW Partnership established a set of milestones and measures of success for the ACW Protection Plan

that include programmatic, social and environmental indicators. Programmatic indicators will measure the relative success achieved in implementing the individual actions and measures included in the plan; these include estimates of acres of restored or created wetlands, number and types of BMPs installed, number of *colonia* residents provided with centralized water services, number of voluntary water quality monitors trained, etc. Social indicators include the number of watershed residents surveyed with increased knowledge of watershed issues, number of ACW Partnership participants, etc. Finally, environmental indicators will measure the overall health of the Arroyo Colorado as the ACW Protection Plan is implemented; these include in-stream chemical parameters as well as occurrences of algal blooms, occurrences of fish kills, etc.



ARROYO COLORADO
Know it. Respect it. Enjoy it.
Conócelo. Respétalo. Disfrútaló.

