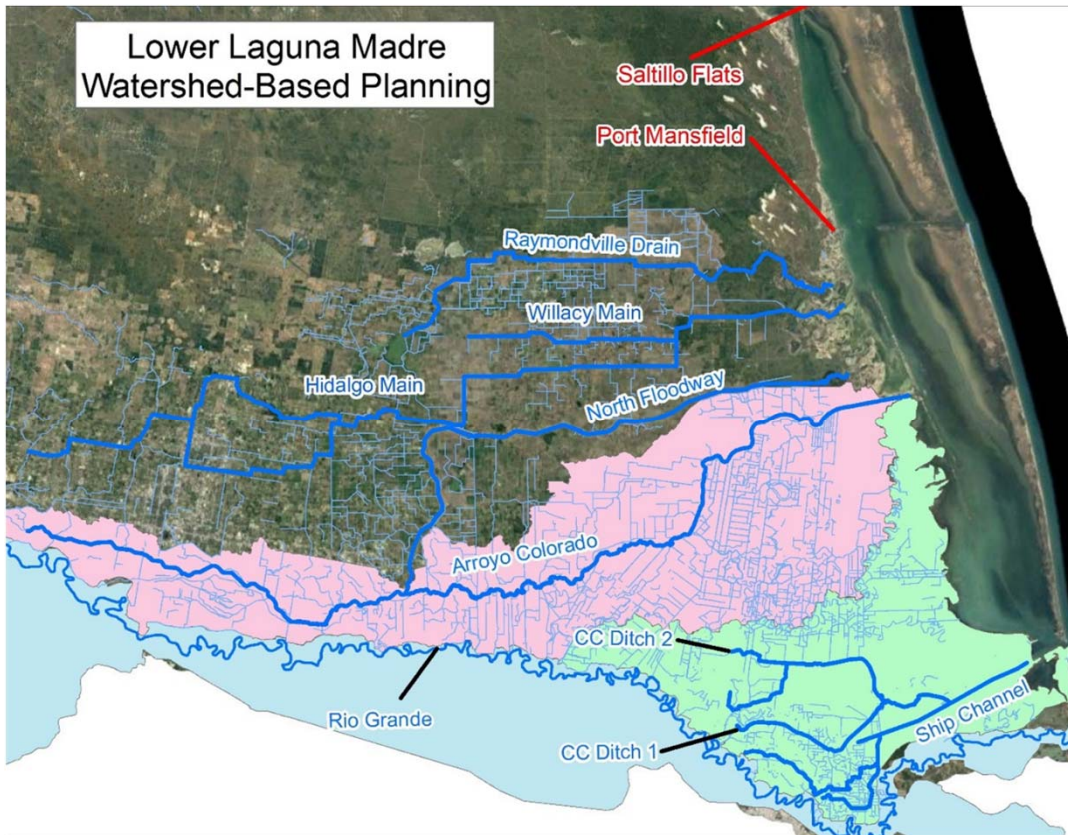


# Watershed Protection Planning and Characterization Efforts in the LRGV – A Focus on the Arroyo Colorado



**UTRGV**  
The University of Texas  
Rio Grande Valley

  
Texas Water  
Resources Institute  
*make every drop count*

Jaime Flores, P.G.

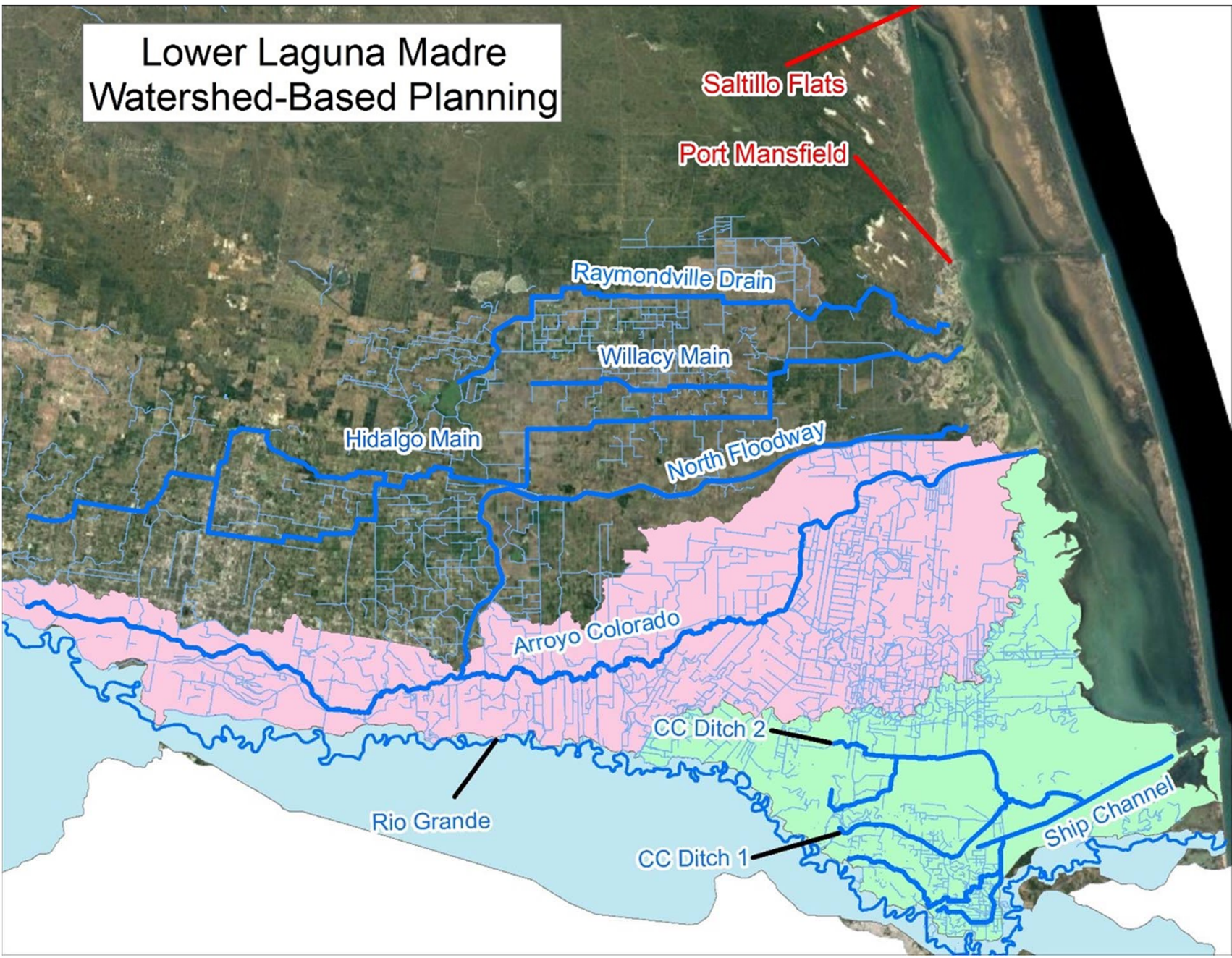
Jude A. Benavides, Ph.D.

7/10/2019

 **TIAER**  
Texas Institute for Applied Environmental Research  
Tarleton State University

  
**ARROYO COLORADO**

# Lower Laguna Madre Watershed-Based Planning



# What is “Watershed Protection Planning?”



## Update to the Arroyo Colorado Watershed Protection Plan

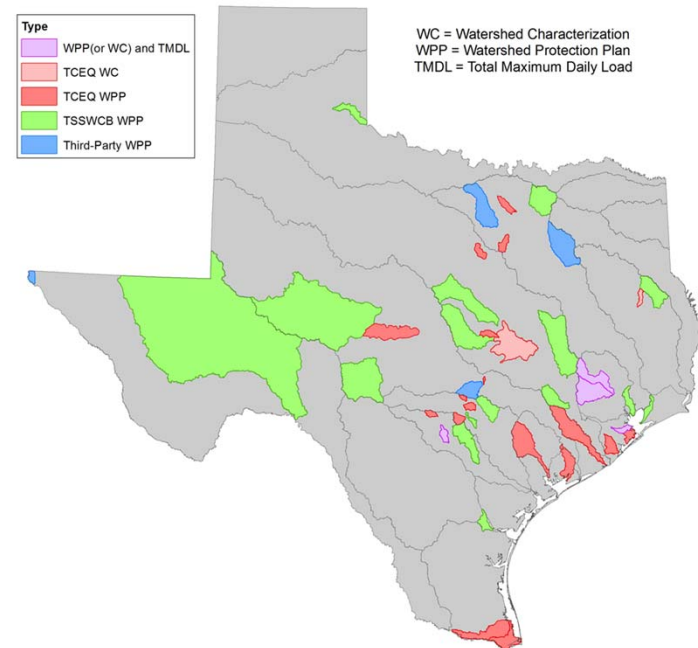
August 2017  
TWRJ TR-504

- A framework for implementing water quality protection and restoration strategies:
  - Driven by environmental objectives and stakeholder participation
  - Address sources and causes of impairments and threats to surface and groundwater – identified earlier
  - Partnership effort
  - Assures the long-term health of the watershed through:
    - Strategies for protecting unimpaired waterbodies
    - Strategies to restore impaired waters
  - Watershed Partnership works together to leverage the Plan – approved by the State of Texas – to obtain external funding to accomplish the goals set out in each strategy.

# The Watershed Protection Plan for the Arroyo Colorado was recently approved by the State of Texas



- A significant accomplishment
- Long-term effort from the early 2000's
- Will enable us to leverage Non-Point Source (Section 319) funds from TCEQ / EPA through the Clean Water Act
- Higher priority given to those watersheds that have an approved plan.



**Agency (EPA) Guidelines. These guidelines describe nine elements fundamental to a potentially successful WPP:**

1. Identification of the causes that will need to be controlled to achieve the load reductions described in (b)
2. Estimate of the load reductions expected for the management measures described in (c)
3. Description of management measures that will need to be implemented to achieve the load reductions described in (b)
4. Estimate of technical and financial assistance needed to implement this plan
5. Information/education component that will be used to enhance public understanding of this plan
6. Schedule for implementing management measures described in (c)
7. Description of interim, measurable milestones for determining whether management measures described in (c) are being implemented
8. Set of criteria that can be used to determine whether load reductions described in (b) are being achieved
9. Water quality monitoring component to evaluate effectiveness of implementation measured against the established criteria described in (h)

# Arroyo Colorado Plan Lists Clear and Actionable Strategies to Improve Water Quality

Table 4.4. Number of days with DO below the 24-hour minimum and average criteria at the USGS station on Arroyo Colorado Tidal at FM 106, Rio Hondo, TX for March 1, 2015 – February 29, 2016

DO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Min.	0	0	0	0	1	5	23	24	5	7	0	0	65
Avg.	0	0	0	0	0	2	16	17	2	2	0	0	39

- Several years of dedicated work by stakeholders developed these strategies based on:

- Sound science
- Work groups focused on:
  - Habitat
  - Agriculture
  - Wastewater
  - Water Quality Assessment
  - Education and Outreach
  - Stormwater
  - Others

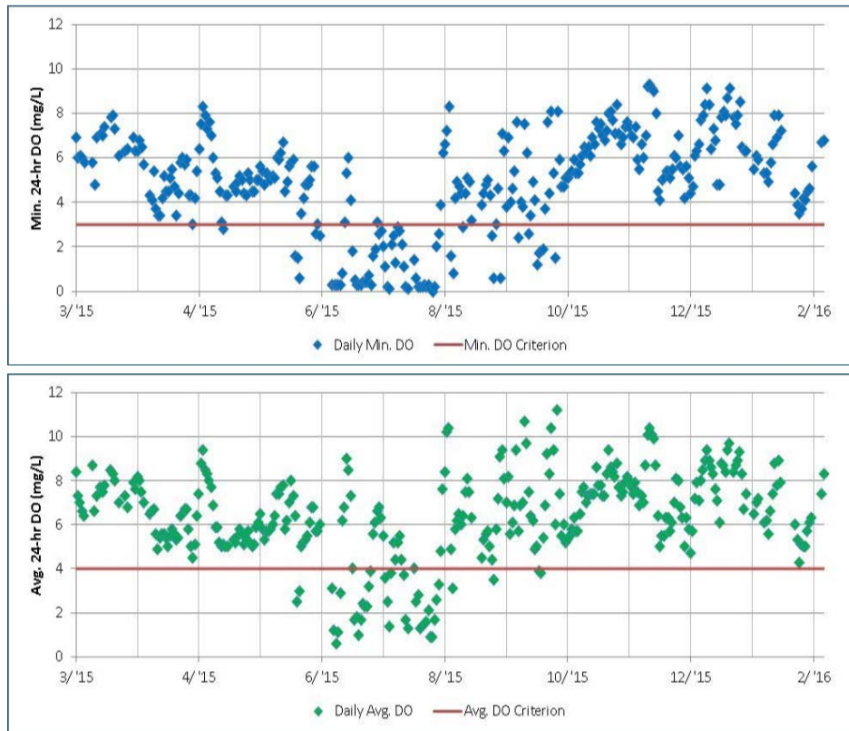


Figure 4.3. Time series of daily minimum DO and daily average DO at the USGS station on Arroyo Colorado Tidal at FM 106, Rio Hondo, TX for the period of March 1, 2015 – February 29, 2016



Dr. Jude Benavides (left) and students Robert Figueroa-Downing, Rachele Maldonado, Monica Delgado and Guadalupe Garcia III collecting water quality samples within the tidal portion of the Arroyo Colorado.

## Sediment

As previously shown in Table 6.2, total sediment loads (including sediment from runoff and WWTFs) were highest in subbasins 7, 8, 12 and 16. To evaluate non-point source (NPS) sediment contributions, upland loading coefficients were determined by subbasin. This indicated that upland NPS sediment contributions were highest in subbasins 5, 8, 14 and 16 (Figure 6.3). Although the predominant source of loading varied by subbasin, on the watershed scale, approximately 88% of the sediment loading resulted from cropland and rangeland erosion (Figure 6.2).

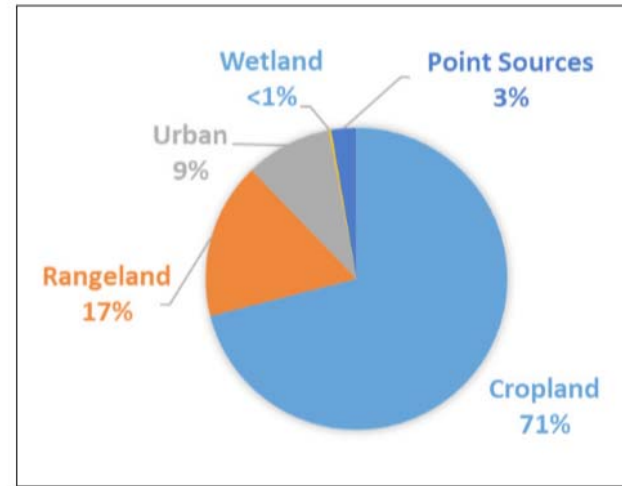


Figure 6.2. Predominant sources of sediment loads in the Arroyo Colorado watershed

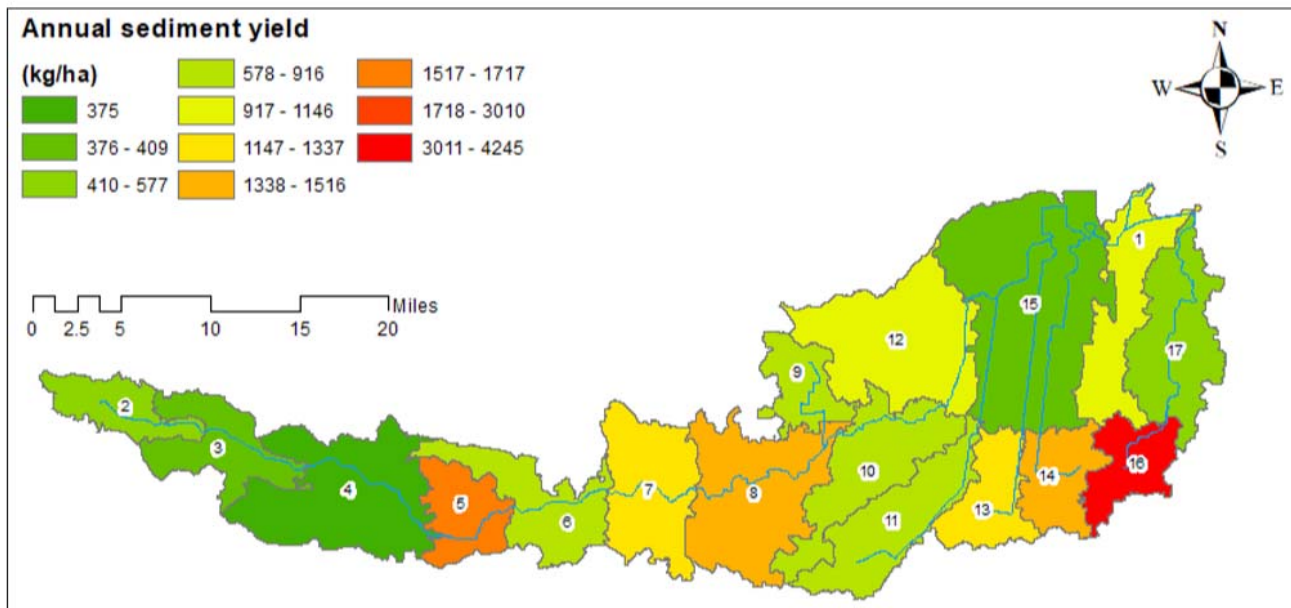


Figure 6.3. Estimated sediment export (kg/ha) from upland nonpoint sources by subbasin

## *E. coli*

Total *E. coli* loads (including both point source and NPS contributions) were generally highest in the lower subbasins, particularly subbasins 1, 8, 15 and 17 (Table 6.2). When only upland NPS contributions are considered, however, the highest *E. coli* export were observed in subbasins 1, 7, 9-11, 12-13 and 17 (Figure 6.9) and are thus of highest priority for NPS management. Dominant *E. coli* sources vary by subbasin; however, SWAT estimates suggest that the primary source of *E. coli* (Figure 6.8) is wildlife, with smaller contributions from cattle and OSSFs.

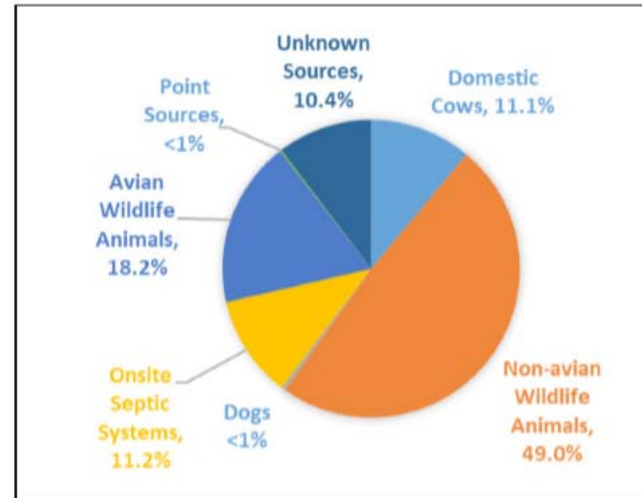


Figure 6.8. Primary *E. coli* sources estimated by SWAT

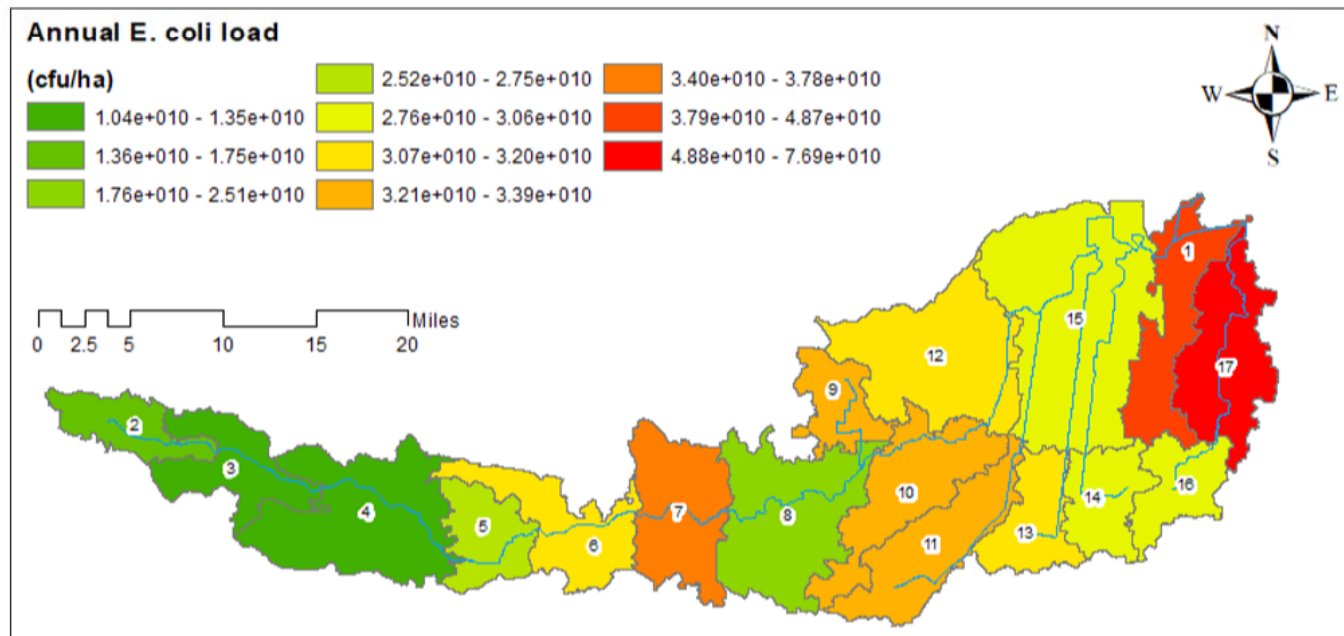


Figure 6.9. Estimated *E. coli* loads (cfu/ha) from upland nonpoint sources by subbasin



# Bacterial Source Tracking

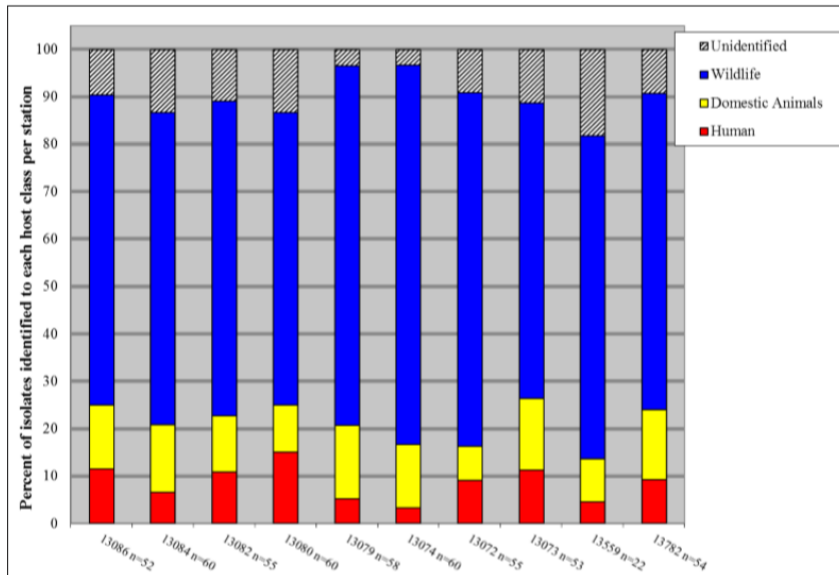


Figure 6.12. Three-way split of *E. coli* BST results for each station as percent of isolates per sampling station

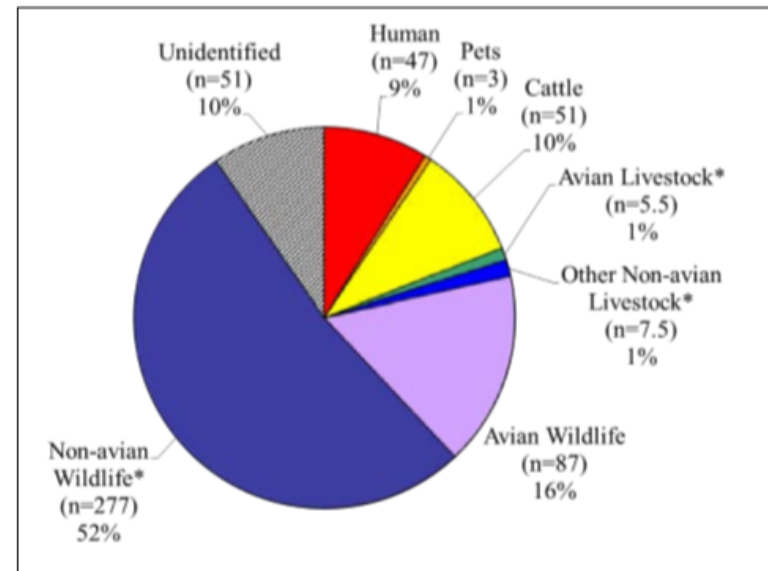


Figure 6.11. BST results for the Arroyo Colorado watershed (\* indicates presence of cosmopolitan species)

Table 8.4. Goals for new and updated conservation plans for new 10-year implementation period

Land use	Total acres	Original goal (ac)	Current acres under plan	New goal acres (%)	Update plans > 10 yrs old
Cropland	219,051	150,000 (est. 50%)	130,000 (59%)	165,000 (75%)	45,000
Pasture	24,805	NA	NA	10,000 (40%)	
Range	48,867	NA	NA	7,500 (15%)	
<b>Total ac</b>	<b>292,723</b>	<b>150,000</b>	<b>130,000</b>	<b>182,500</b>	<b>45,000</b>

## • Agriculture Goals, Strategies, and Management Measures



### Chapter 8 Management Measures

Conservation Plan Development and Implementation	
<b>Objectives:</b>	
<ul style="list-style-type: none"> <li>• Work with agricultural producers/farmers and ranchers to develop WQMPs and RMS</li> <li>• Provide producers with technical and financial assistance</li> <li>• Implement and maintain WQMPs and RMS</li> <li>• Reduce fecal loading from grazing livestock</li> <li>• Reduce nutrient and sediment loading from cropland</li> </ul>	
<b>Critical Areas:</b> Subbasins with highest upland NPS nutrient loadings (i.e. 5-8) and cropland in closest proximity to the impaired segments and their tributaries. Subbasins with highest upland NPS bacteria loadings (i.e. 1, 7-9, 11, 12-13 and 17) and range and pasture in closest proximity to the impaired segments and their tributaries	
<b>Goal:</b> The voluntary implementation and maintenance of 300 additional WQMPs or RMS to bring the total number of acres under a conservation plan to 227,500 acres in the watershed	
<b>Description:</b> WQMPs will be developed, adopted and implemented in priority subwatersheds and fields and pastures in closest proximity to the river.	
<b>Potential Funding Sources:</b>	
WQMPs: TSSWCB WQMP program, CWA §319(h) grant program	
RMS: NRCS EQIP program	
Education: CWA §319(h) grant program	
Implementation Strategies	
Participation	Recommended Strategies
SWCDs, NRCS, TSSWCB, Landowners	<b>WQMPs</b> - Develop, implement and provide financial assistance for 300 WQMPs and RMS at an estimated average cost of \$30,000 per plan for a total cost of \$9,000,000
Texas A&M Agrilife Extension Service	<b>Education</b> - Deliver education programs to producers throughout the watershed on BMPs and cost share programs available
Texas A&M Agrilife Extension Service	<b>Lone Star Healthy Streams</b> - Deliver Lone Star Healthy Streams programming to watershed landowners

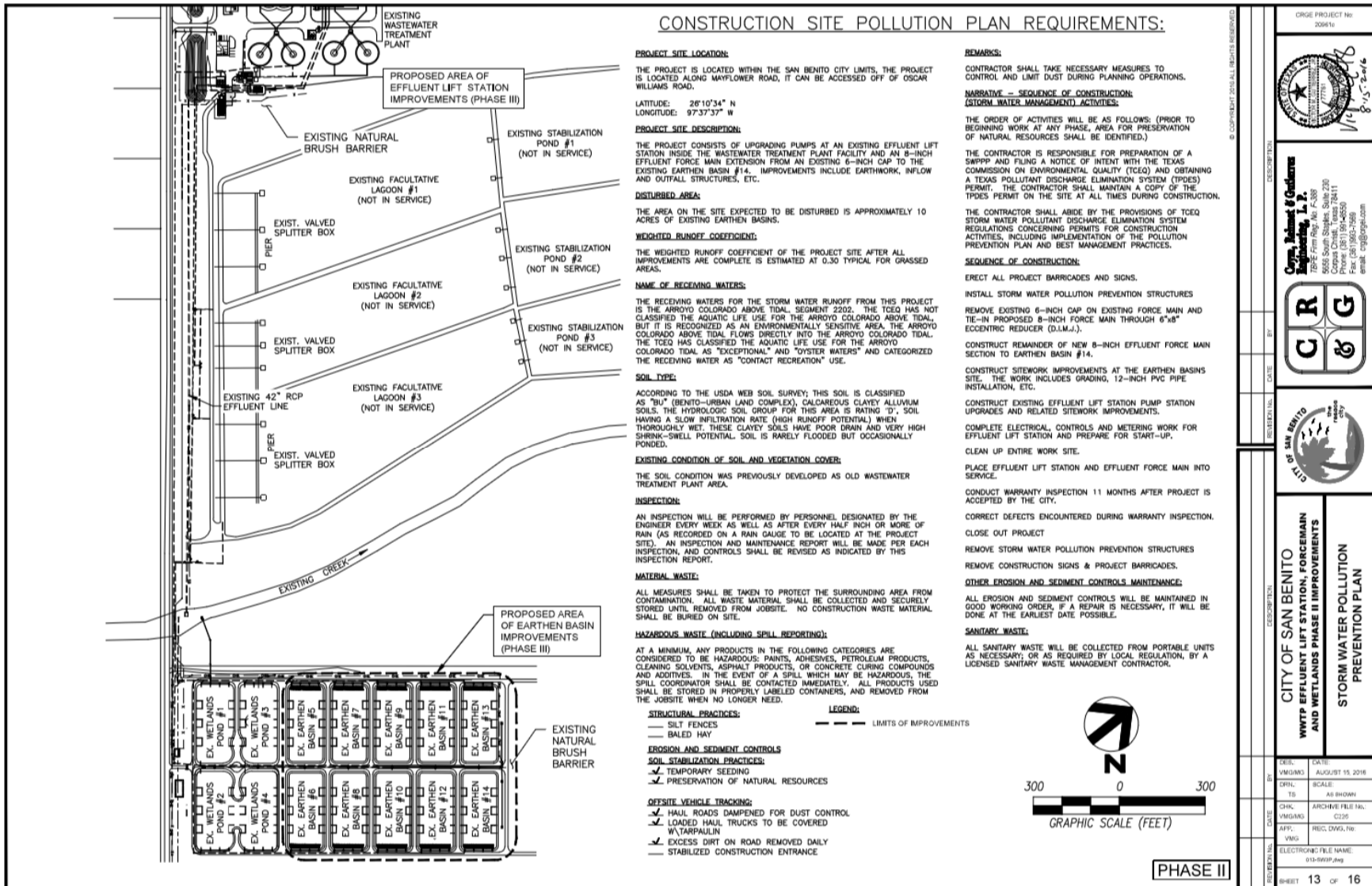
# Municipal Permit Changes

Table 8.5. Summary of municipal permit changes (Source: Arroyo Colorado PRP)

Facility Name	TPDES Permit No.	2000 Flow and Effluent Set*	2005 Flow and Effluent Set*	2016 Flow and Effluent Set
City of Mission	WQ0010484-001	(4.6) 10/15/3	(9) 10/15/2	(9) 7/15/2
City of McAllen WWF #2	WQ0010633-003			(10) 10/15/2
City of Hidalgo	WQ0011080-001	(0.41) 30/90/NA	(1.2) 10/15/3	(1.2) 10/15/3
Military Hwy WSC (Balli Rd.)	WQ0013462-006			(0.51) 20/20/NA
City of Pharr	WQ0010596-001		(5.0) 10/15/3	(8.0) 7/15/2
City of San Juan	WQ0011512-001	(1.15) 20/20/NA	(4.0) 10/15/3	(4.0) 10/15/3
City of Alamo	WQ0013633-001		(2.0) 30/90/NA	(2.0) 30/90/NA
City of Donna	WQ0010504-001		(2.7) 20/20/NA	(1.8) 10/15/3
City of Weslaco	WQ0010619-005	(2.0) 10/15/3	(2.5) 10/15/3	(2.5) 10/15/3
Military Hwy WSC (Progreso)	WQ0013462-001		(0.4) 30/90/NA	(0.75) 10/15/3
City of Mercedes	WQ0010347-001		(2.3) 10/15/3	(5) 7/15/2
City of La Feria	WQ0010697-001/2		(0.5) 30/90/NA	(1.25) 10/15/3
Harlingen Water Works WWF #2	WQ0010490-003		(3.1) 20/20/NA	(7.25) 10/15/3
City of San Benito	WQ0010473-002 WQ0014454-001	(2.16) 30/30/NA	(2.5) 10/15/3	(3.75) 10/15/3
Military Hwy WSC (Lago)	WQ0013462-008	No permit	(0.5) 20/20/3	(0.5) 20/20/3
City of Rio Hondo	WQ0010475-002		(0.4) 20/20/NA	(0.4) 20/20/NA
East Rio Hondo WSC	WQ0014558-001	No permit	(0.16) 10/15/3	(0.08) 10/15/3

\* Flow is mgd and effluent set is BOD<sub>5</sub>/TSS/NH<sub>3</sub>-N reported in mg/L.

# Wetland Polishing Ponds for WWTF



## CONSTRUCTION SITE POLLUTION PLAN REQUIREMENTS:

### PROJECT SITE LOCATION:

THE PROJECT IS LOCATED WITHIN THE SAN BENITO CITY LIMITS. THE PROJECT IS LOCATED ALONG MAYFLOWER ROAD, IT CAN BE ACCESSED OFF OF OSCAR WILLIAMS ROAD.

LATITUDE: 26°10'34" N  
LONGITUDE: 97°37'37" W

### PROJECT SITE DESCRIPTION:

THE PROJECT CONSISTS OF UPGRADING PUMPS AT AN EXISTING EFFLUENT LIFT STATION INSIDE THE WASTEWATER TREATMENT PLANT FACILITY AND AN 8-INCH EFFLUENT FORCE MAIN EXTENSION FROM AN EXISTING 6-INCH CAP TO THE EXISTING EARTHEN BASIN #14. IMPROVEMENTS INCLUDE EARTHWORK, INFLOW AND OUTFALL STRUCTURES, ETC.

### DISTURBED AREA:

THE AREA ON THE SITE EXPECTED TO BE DISTURBED IS APPROXIMATELY 10 ACRES OF EXISTING EARTHEN BASINS.

### WEIGHTED RUNOFF COEFFICIENT:

THE WEIGHTED RUNOFF COEFFICIENT OF THE PROJECT SITE AFTER ALL IMPROVEMENTS ARE COMPLETE IS ESTIMATED AT 0.30 TYPICAL FOR GRASSED AREAS.

### NAME OF RECEIVING WATERS:

THE RECEIVING WATERS FOR THE STORM WATER RUNOFF FROM THIS PROJECT IS THE ARROYO COLORADO ABOVE TIDAL, SEGMENT 2202. THE TCEQ HAS NOT CLASSIFIED THE AQUATIC LIFE USE FOR THE ARROYO COLORADO ABOVE TIDAL, BUT IT IS RECOGNIZED AS AN ENVIRONMENTALLY SENSITIVE AREA. THE ARROYO COLORADO ABOVE TIDAL FLOWS DIRECTLY INTO THE ARROYO COLORADO TIDAL. THE TCEQ HAS CLASSIFIED THE AQUATIC LIFE USE FOR THE ARROYO COLORADO TIDAL AS "EXCEPTIONAL" AND "OYSTER WATERS" AND CATEGORIZED THE RECEIVING WATER AS "CONTACT RECREATION" USE.

### SOIL TYPE:

ACCORDING TO THE USDA WEB SOIL SURVEY; THIS SOIL IS CLASSIFIED AS "TUL" (BENTON-URBAN LAND COMPLEX), CALCAREOUS CLAYEY ALLUVIUM SOILS. THE HYDROLOGIC SOIL GROUP FOR THIS AREA IS RATING "D", SOIL HAVING A SLOW INFILTRATION RATE (HIGH RUNOFF POTENTIAL) WHEN THOROUGHLY WET. THESE CLAYEY SOILS HAVE POOR DRAIN AND VERY HIGH SHRINK-SWELL POTENTIAL. SOIL IS RARELY FLOODED BUT OCCASIONALLY PONDED.

### EXISTING CONDITION OF SOIL AND VEGETATION COVER:

THE SOIL CONDITION WAS PREVIOUSLY DEVELOPED AS OLD WASTEWATER TREATMENT PLANT AREA.

### INSPECTION:

AN INSPECTION WILL BE PERFORMED BY PERSONNEL DESIGNATED BY THE ENGINEER EVERY WEEK AS WELL AS AFTER EVERY HALF INCH OR MORE OF RAIN (AS RECORDED ON A RAIN GAUGE TO BE LOCATED AT THE PROJECT SITE). AN INSPECTION AND MAINTENANCE REPORT WILL BE MADE PER EACH INSPECTION, AND CONTROLS SHALL BE REVISED AS INDICATED BY THIS INSPECTION REPORT.

### MATERIAL WASTE:

ALL MEASURES SHALL BE TAKEN TO PROTECT THE SURROUNDING AREA FROM CONTAMINATION. ALL WASTE MATERIAL SHALL BE COLLECTED AND SECURELY STORED UNTIL REMOVED FROM JOBSITE. NO CONSTRUCTION WASTE MATERIAL SHALL BE BURIED ON SITE.

### HAZARDOUS WASTE (INCLUDING SPILL REPORTING):

AT A MINIMUM, ANY PRODUCTS IN THE FOLLOWING CATEGORIES ARE CONSIDERED TO BE HAZARDOUS: PAINTS, ADHESIVES, PETROLEUM PRODUCTS, CLEANING SOLVENTS, ASPHALT PRODUCTS, OR CONCRETE CURING COMPOUNDS AND ADDITIVES. IN THE EVENT OF A SPILL WHICH MAY BE HAZARDOUS, THE SPILL COORDINATOR SHALL BE CONTACTED IMMEDIATELY. ALL PRODUCTS USED SHALL BE STORED IN PROPERLY LABELED CONTAINERS, AND REMOVED FROM THE JOBSITE WHEN NO LONGER NEEDED.

### STRUCTURAL PRACTICES:

- SILT FENCES
- BALED HAY

### EROSION AND SEDIMENT CONTROLS

#### SOIL STABILIZATION PRACTICES:

- ✓ TEMPORARY SEEDING
- ✓ PRESERVATION OF NATURAL RESOURCES

#### OFFSITE VEHICLE TRACKING:

- ✓ HAUL ROADS DAMPENED FOR DUST CONTROL
- ✓ LOADED HAUL TRUCKS TO BE COVERED W/ TARP/AULLIN
- ✓ EXCESS DIRT ON ROAD REMOVED DAILY
- STABILIZED CONSTRUCTION ENTRANCE

### LEGEND:

- — — — — LIMITS OF IMPROVEMENTS

### REMARKS:

CONTRACTOR SHALL TAKE NECESSARY MEASURES TO CONTROL AND LIMIT DUST DURING PLANNING OPERATIONS.

### NARRATIVE - SEQUENCE OF CONSTRUCTION:

#### (STORM WATER MANAGEMENT) ACTIVITIES:

THE ORDER OF ACTIVITIES WILL BE AS FOLLOWS: (PRIOR TO BEGINNING WORK AT ANY PHASE, AREA FOR PRESERVATION OF NATURAL RESOURCES SHALL BE IDENTIFIED.)

THE CONTRACTOR IS RESPONSIBLE FOR PREPARATION OF A SWPPP AND FILING A NOTICE OF INTENT WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) AND OBTAINING A TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM (TPDES) PERMIT. THE CONTRACTOR SHALL MAINTAIN A COPY OF THE TPDES PERMIT ON THE SITE AT ALL TIMES DURING CONSTRUCTION.

THE CONTRACTOR SHALL ABIDE BY THE PROVISIONS OF TCEQ STORM WATER POLLUTANT DISCHARGE ELIMINATION SYSTEM REGULATIONS CONCERNING PERMITS FOR CONSTRUCTION ACTIVITIES, INCLUDING IMPLEMENTATION OF THE POLLUTION PREVENTION PLAN AND BEST MANAGEMENT PRACTICES.

#### SEQUENCE OF CONSTRUCTION:

- ERECT ALL PROJECT BARRICADES AND SIGNS.
- INSTALL STORM WATER POLLUTION PREVENTION STRUCTURES
- REMOVE EXISTING 6-INCH CAP ON EXISTING FORCE MAIN AND TIE-IN PROPOSED 8-INCH FORCE MAIN THROUGH 6" x 8" ECCENTRIC REDUCER (D.I.M.J.).
- CONSTRUCT REMAINDER OF NEW 8-INCH EFFLUENT FORCE MAIN SECTION TO EARTHEN BASIN #14.

CONSTRUCT SITEWORK IMPROVEMENTS AT THE EARTHEN BASINS SITE. THE WORK INCLUDES GRADING, 12-INCH PVC PIPE INSTALLATION, ETC.

CONSTRUCT EXISTING EFFLUENT LIFT STATION PUMP STATION UPDATES AND RELATED SITEWORK IMPROVEMENTS.

COMPLETE ELECTRICAL CONTROLS AND METERING WORK FOR EFFLUENT LIFT STATION AND PREPARE FOR START-UP.

CLEAN UP ENTIRE WORK SITE.

PLACE EFFLUENT LIFT STATION AND EFFLUENT FORCE MAIN INTO SERVICE.

CONDUCT WARRANTY INSPECTION 11 MONTHS AFTER PROJECT IS ACCEPTED BY THE CITY.

CORRECT DEFECTS ENCOUNTERED DURING WARRANTY INSPECTION.

CLOSE OUT PROJECT

REMOVE STORM WATER POLLUTION PREVENTION STRUCTURES

REMOVE CONSTRUCTION SIGNS & PROJECT BARRICADES.

OTHER EROSION AND SEDIMENT CONTROLS MAINTENANCE:

ALL EROSION AND SEDIMENT CONTROLS WILL BE MAINTAINED IN GOOD WORKING ORDER. IF A REPAIR IS NECESSARY, IT WILL BE DONE AT THE EARLIEST DATE POSSIBLE.

### SANITARY WASTE:

ALL SANITARY WASTE WILL BE COLLECTED FROM PORTABLE UNITS AS NECESSARY, OR AS REQUIRED BY LOCAL REGULATION, BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR.

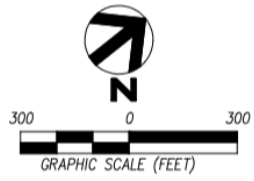


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**CITY OF SAN BENITO**  
WWTP EFFLUENT LIFT STATION, FORCE MAIN  
AND WETLANDS PHASE II IMPROVEMENTS  
STORM WATER POLLUTION  
PREVENTION PLAN

DATE	DATE
DESIGNED BY: VMG	DATE: AUGUST 15, 2016
DRAWN BY: VMG	SCALE: AS SHOWN
CHECKED BY: VMG	ARCHIVE FILE NO.: C235
APP. BY: VMG	REC. DWG. NO.
PROJECT FILE NAME:	ELECTRONIC FILE NAME:
	013-00197.dwg
SHEET 13 OF 16	



PHASE II

# Education and Outreach



Brownie troop member installing storm drain marker



Arroyo Colorado watershed model on display at the Coastal Expo



Watershed Coordinator Jaime Flores installing an Arroyo Colorado Watershed Boundary sign

# Water Quality Monitoring – Are We Making Progress?

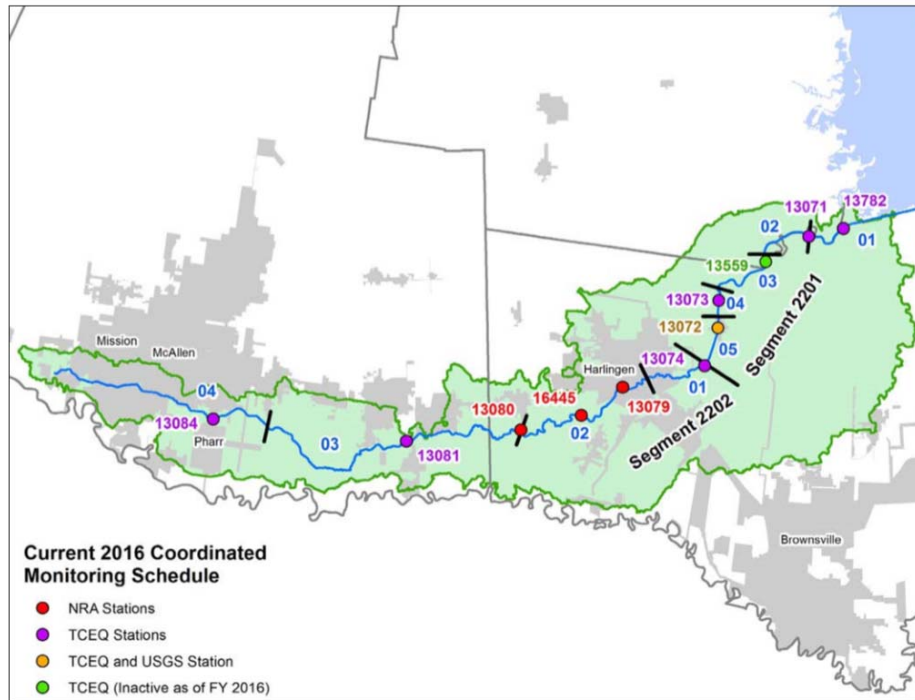
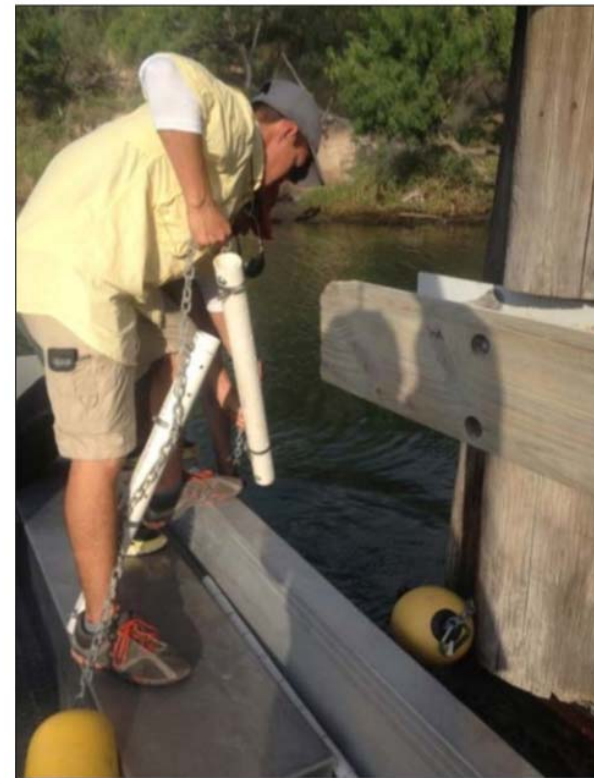
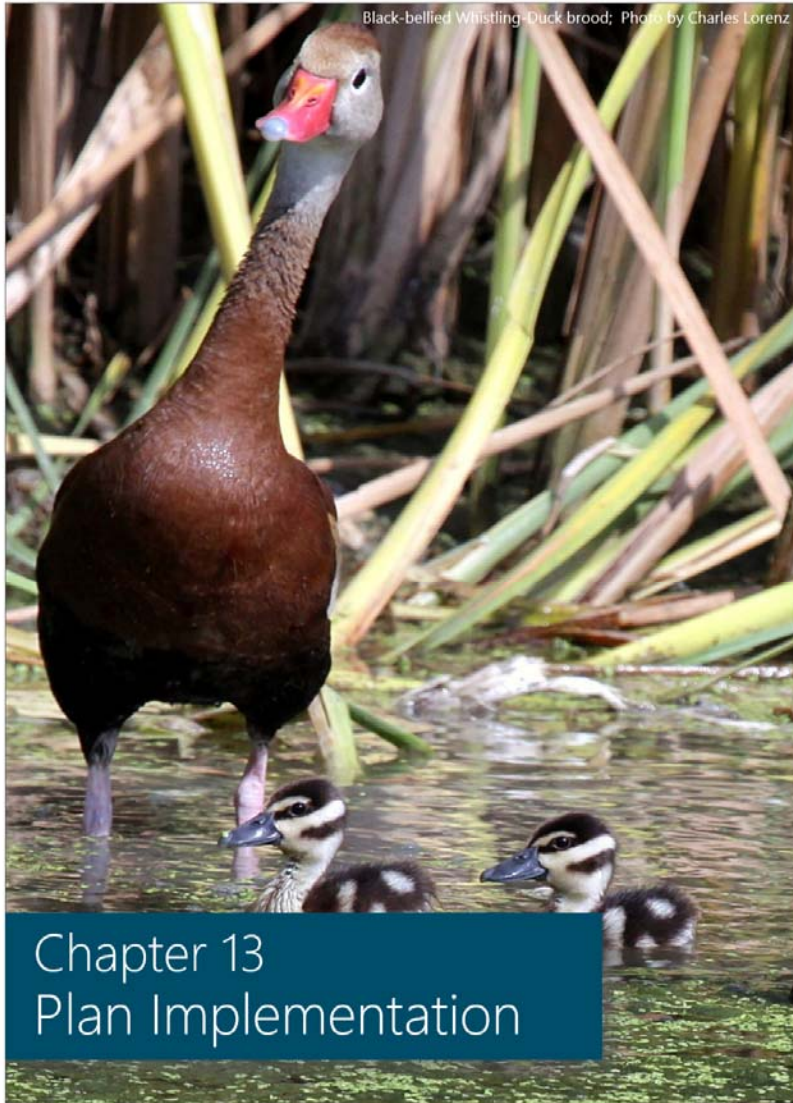


Figure 11.1. Location of water quality monitoring stations on the Arroyo Colorado currently monitored routinely by TCEQ and NRA



A UTB/UTRGV student deploys a continuous sampling water quality sonde near the Rio Hondo bridge in the Arroyo Colorado.

# Plan Implementation --- Time and \$\$\$



## Chapter 13 Plan Implementation

Table 13.1. Management measure implementation schedule and responsible parties

Management Measure	Responsible Party	Planned Implementation Goal			Units
		Year 0-3	Year 4-6	Year 7-10	
<b>Agriculture and Livestock Management Measures</b>					
WQMPs/RMS	NRCS, TSSWCB, SWCD, Producers	90	90	120	New/updated WQMP/RMS
SWCD technician (technical assistance)	TSSWCB, NRCS, SWCDs	1			SWCD technician (FTEs)
<b>WWTF Permits</b>					
Update remaining 30/90 permit	WWTFs, TCEQ	0	1	0	Permits updated
>1 mgd facilities' permits updated to 10/15	WWTFs, TCEQ	0	1	0	Permits updated
>1 mgd facilities' permits updated to 7/12/3	WWTFs, TCEQ	0	0	10	Permits updated
Improve/expand wastewater treatment	WWTFs	5			Facilities
<b>SSOs and Infrastructure</b>					
Reduce SSOs by 5% from FY 2015 total	WWTFs	1%	2%	2%	% Reduction
Increase participation in TCEQ SSO initiative	WWTFs and TCEQ	1	1	1	WWTFs participating
<b>OSSF and Colonias Management Measures</b>					
OSSF inventory/database development/inspection	Counties	Plan	Develop	Complete	
OSSFs repaired/replaced	Counties	50	125	125	OSSF
Households connected to WWTF	WWTFs	50	50	50	Households
<b>Habitat Management Measures</b>					
Wetland creation	Landowners, NRCS, USFWS, TPWD	50	50	50	Acres created
Land protected through purchase or easement	USFWS, TPWD, Landowners	50	50	50	Acres
<b>Enhanced Wastewater Treatment and Reuse</b>					
San Benito Phase II	San Benito, GLO	10			Acres
San Benito Phase III	San Benito, GLO	65			Acres
Pharr Reuse Retention Facility/Reverse Osmosis program	Pharr			1	Facility
Ramsey Park	Harlingen	5			Acres
Wetland/ponds for dredge spoils	POH	Design wetland	Construct wetland		

# Responsible Parties and Cost Estimates

<b>SSOs and Infrastructure</b>				
Reduce SSOs by 5% from FY 2015 total	WWTFs	5%	TBD	TBD
Increase participation in TCEQ SSO Initiative	WWTFs and TCEQ	3	\$15,000	\$45,000
<b>OSSF and Colonias Management Measures</b>				
OSSF inventory/database development/inspection	Counties	1	\$42,000/yr	\$420,000
OSSFs repaired/replaced	Counties	300	\$7500/OSSF	\$2,250,000
Households connected to WWTF	WWTFs	150	\$2,000 ea	\$300,000
<b>Habitat Management Measures</b>				
Wetland creation	Landowners, NRCS, USFWS, TPWD	150 ac	\$229-\$343/ac based on 2017 NRCS cost list	\$42,900
Land protected through purchase or easement	USFWS, TPWD, landowners	150 ac	\$20,000/ac	\$3,000,000
<b>Enhanced Wastewater Treatment and Reuse</b>				
San Benito Phase II	San Benito	10		\$200,000
San Benito Phase III	San Benito	65		\$200,000
Pharr Reuse Retention Facility/ Reverse Osmosis program	Pharr	1		\$10,000,000
Ramsey Park	Harlingen	5		\$400,000
Wetland for dredge spoils	POH	1		\$10,000,000
<b>Stormwater Detention Projects</b>				
Hickery Hill Park	Harlingen	46		\$2,500,000
Palm Valley stormwater pond rehabilitation	Palm Valley	20		\$2,500,000



# Timelines for WPP's

- Watershed Protection Planning – by design, is a long process
- Time scale is YEARS.
  - Properly characterizing is hard. Particularly in relatively flat, complex watersheds like those found in and around the LRGV delta region.
  - Other steps:
    - Real cross-sector public participation that is representative of the watershed's population and major water players;
    - Water quality monitoring;
    - Computer modeling;
    - Developing consensus amongst stakeholders for proposed action plans;
    - Writing the plan;
    - Getting the plan accepted by EPA.
    - Last but not least – PLAN IMPLEMENTATION.



# Timelines for WPP's

- In smaller watersheds, the average is about 4-6 years. In larger watersheds, the average time is 8-10 years and that is dependent on data, monitoring and funding.
- In the Arroyo, we have worked hard over a decade and more to now be in the implementation phase, for the 2<sup>nd</sup> time, of the WPP process.
- The Arroyo Colorado plan is accepted by EPA and we have taken the ball and run with it.



# Actions post EPA approval

- Los Fresnos Nature Park that included a bio-swale, rain harvesting system and rain garden;
- San Benito wetlands Phase II & III, creating an additional 60 acres of wetlands with reuse effluent;
- Ag Education and Cost Share programs throughout the year;
- Small acreage/beginning Farmers workshops-6/year;
- Continued E&O activities year round;
- Building 2 new watershed models for a total of 4;
- And we just received notification that we were awarded a Bureau of Reclamation grant for the Bayview Irrigation District-Canal lining project-\$300,000 with additional TWDB funding=\$500,000.
- Much more in the pipeline.....



Llano Grande Lake, circa 1925

## Flood Abatement BMPs

Flooding is a big issue in the watershed and it creates numerous health concerns. When there is a large storm event or hurricane, flooding can occur across the entire LRGV at the same time. Some portions of the watershed are more prone to flooding due to soil types and low-lying areas. In many cases, the floodwater has no place to go and various pollutants collect in the floodwater creating a perfect environment for diseases, mosquitoes and vermin to thrive. The Partnership proposes identifying flood-prone areas of the watershed and implementing flood event BMPs that will help alleviate flooding.

## Tio Cano Lake

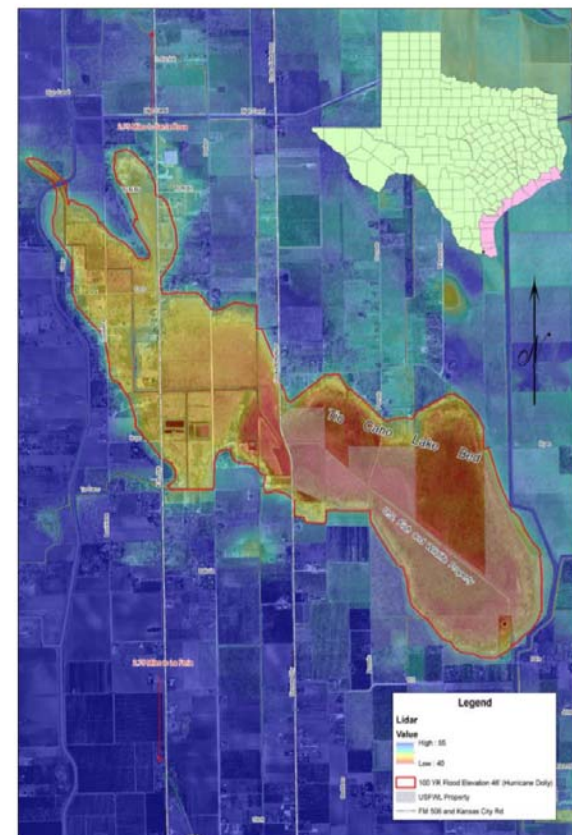
The Tio Cano Lake Bed Regional Stormwater Ecological Enhancement Project will consist of developing improved drainage on 460 acres of agricultural land, colonias and rural homes that are prone to flooding. The properties surrounding the project site are known as Tio Cano Lake. Tio Cano Lake is a natural depression that was once part of a natural wetland system before it was drained and developed for agricultural use and subdivided for homes. All the areas that drain into Tio Cano Lake are agricultural fields, colonias or homes that have OSSFs. Stormwater drains into the lake from seven ditches, flooding homes, septic tanks and drainfields and making roads impassable in times of storm events. This project will consist of using a series of ditches/canals to

# Actions post EPA approval

- Los Fresnos Nature Park that included a bio-swale, rain harvesting system and rain garden;
- San Benito wetlands Phase II & III, creating an additional 60 acres of wetlands with reuse effluent;
- Ag Education and Cost Share programs throughout the year;
- Small acreage/beginning Farmers workshops-6/year;
- Continued E&O activities year round;
- Building 2 new watershed models for a total of 4;
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drain the Tio Cano Lake stormwater into an adjacent 440-acre USFWS-managed property that is a protected wetland system and part of the Texas Tropical Trail Birding route. The stormwater on the USFWS property remains in the wetland system until it evaporates naturally and is not discharged into the Arroyo Colorado.

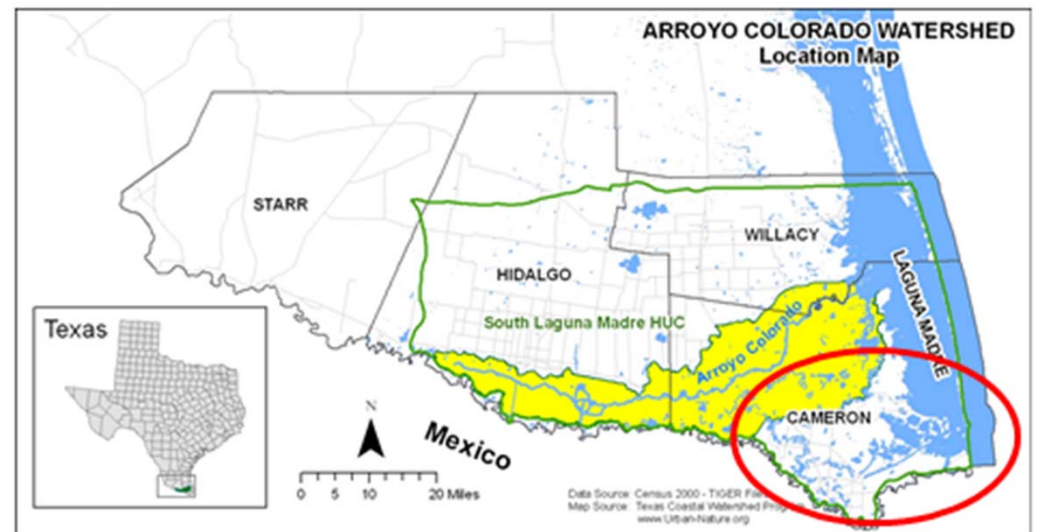
This project will alleviate flooding in the area and provide stormwater detention and treatment thus reducing NPS pollution into the Arroyo Colorado. The project will also provide recreational, economic and educational opportunities for the Arroyo Colorado watershed.



Tio Cano Lake Site map showing elevation

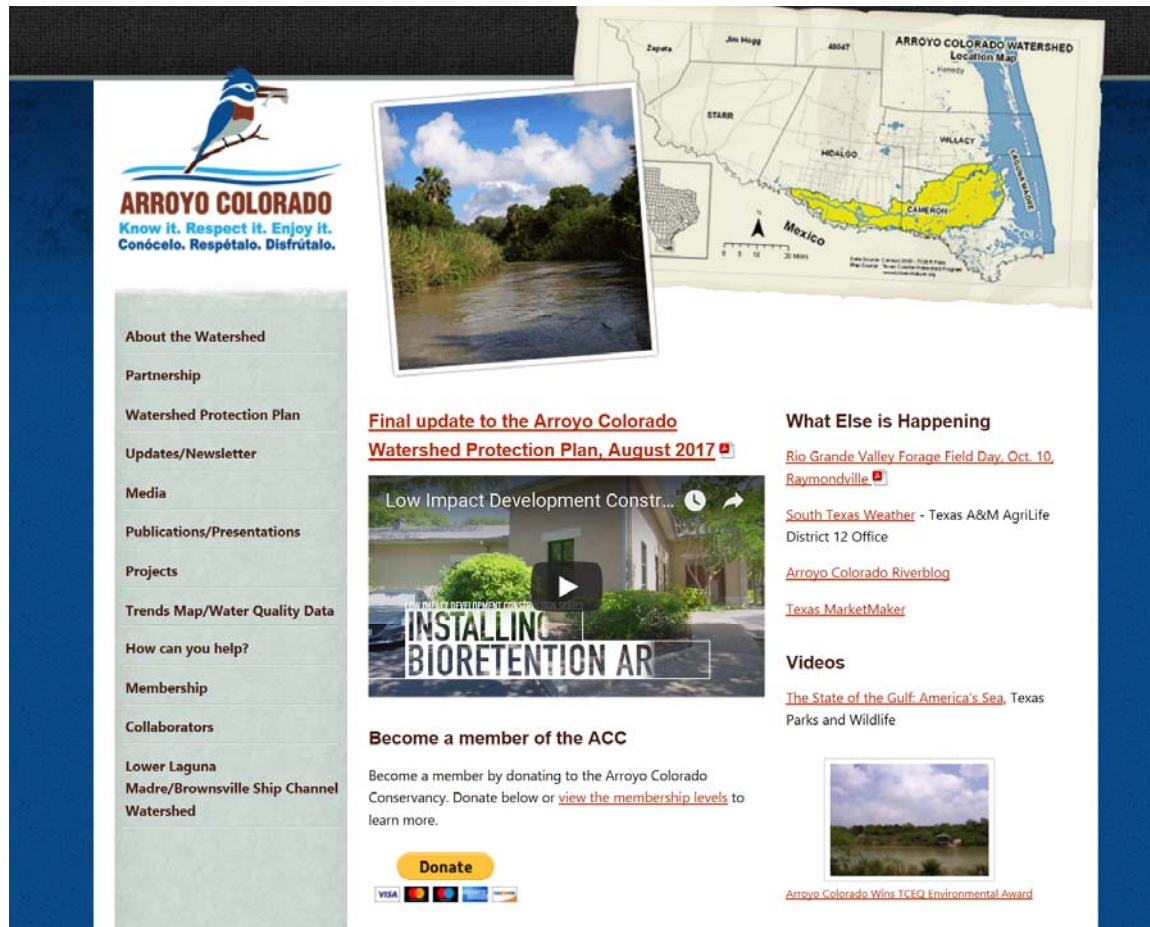
# Well-reviewed plan and looking forward and around...

- EPA Region 6, who reviewed and accepted the Update AWPPP made many positive comments.
- Amongst them:
  - stated that the Update was the most comprehensive and complete WPP they had reviewed after having reviewed over 60 WPPs.
- We all feel that the Update should be used as a template for other WPPs being developed in the State of Texas.
- NOTE: Region 6 consists of Texas, Louisiana, Oklahoma, Arkansas, New Mexico & 66 tribes.



# For More Information:

- [www.arroyocolorado.org](http://www.arroyocolorado.org)



The screenshot shows the homepage of the Arroyo Colorado website. At the top left is the logo featuring a blue bird perched on a branch, with the text "ARROYO COLORADO" and the tagline "Know it. Respect it. Enjoy it. Conócelo. Respétalo. Disfrútalo." Below the logo is a vertical navigation menu with the following items: "About the Watershed", "Partnership", "Watershed Protection Plan", "Updates/Newsletter", "Media", "Publications/Presentations", "Projects", "Trends Map/Water Quality Data", "How can you help?", "Membership", "Collaborators", and "Lower Laguna Madre/Brownsville Ship Channel Watershed". To the right of the menu is a large photograph of a river flowing through a lush green landscape. Further right is a map titled "ARROYO COLORADO WATERSHED Location Map" showing the watershed area in yellow across several Texas counties: Starr, Hidalgo, Willacy, and Cameron. A smaller inset map shows the location of the watershed within the state of Texas. Below the main navigation menu, there are several content sections: "Final update to the Arroyo Colorado Watershed Protection Plan, August 2017" with a red notification icon; a video player titled "Low Impact Development Constr..." with a play button and the text "INSTALLING BIORETENTION AR"; "Become a member of the ACC" with a "Donate" button and logos for Visa, Mastercard, American Express, and Discover; "What Else is Happening" with links to "Rio Grande Valley Forage Field Day, Oct. 10, Raymondville", "South Texas Weather - Texas A&M AgriLife District 12 Office", "Arroyo Colorado Riverblog", and "Texas MarketMaker"; and "Videos" with a link to "The State of the Gulf: America's Sea, Texas Parks and Wildlife" and a small thumbnail image of a river scene.