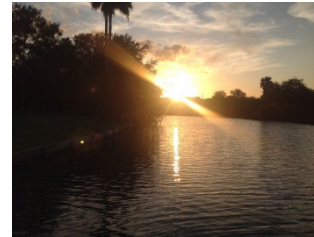


# Watershed Protection Planning and Research Efforts in the Arroyo Colorado and LRGV



Jaime Flores, P.G.

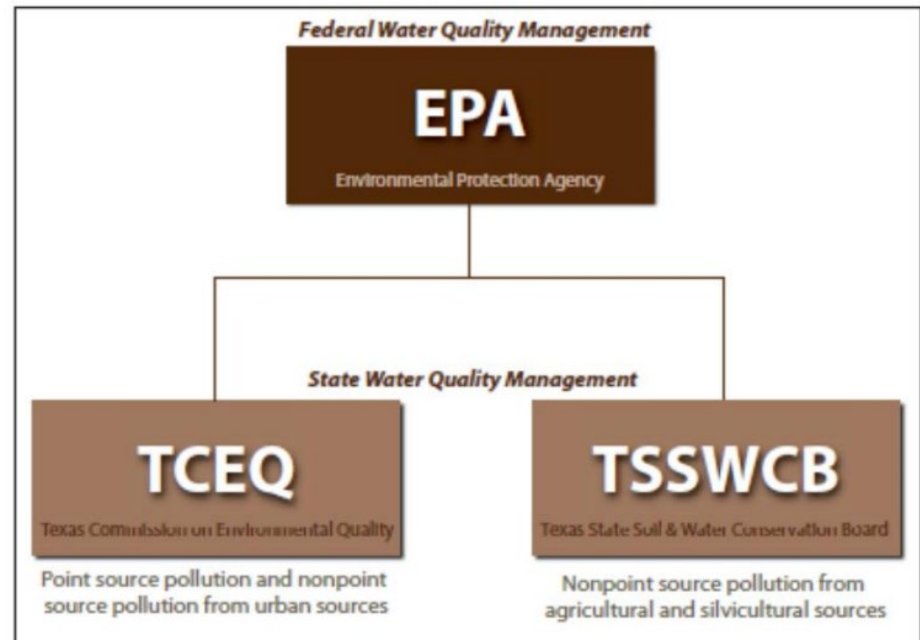
Jude A. Benavides, Ph.D.

7/25/2024



# Water Quality Policy 101

- Federal Clean Water Act requires states to assess and monitor the health of waterbodies
- CWA is administered by two state agencies:
  - Texas Commission on Environmental Quality (TCEQ)
  - Texas State Soil and Water Conservation Board (TSSWCB)



# Water Quality Policy 101 slide 2

- Compliance with the CWA:
  - Set water quality standards
  - Assess surface water bodies
  - Address pollution concerns for waterbodies identified as impaired

Texas Integrated  
Report for Clean  
Water Act,  
Sections 305(b)  
and 303(d)

## Texas Integrated Report

- Describes the status of ALL surface water bodies in the state that were evaluated, tested, and monitored over the last 5 years

## CWA 303(d) List

- Identifies ALL “impaired” surface water bodies not meeting criteria for specified designated uses

# What is “Watershed Protection Planning?”

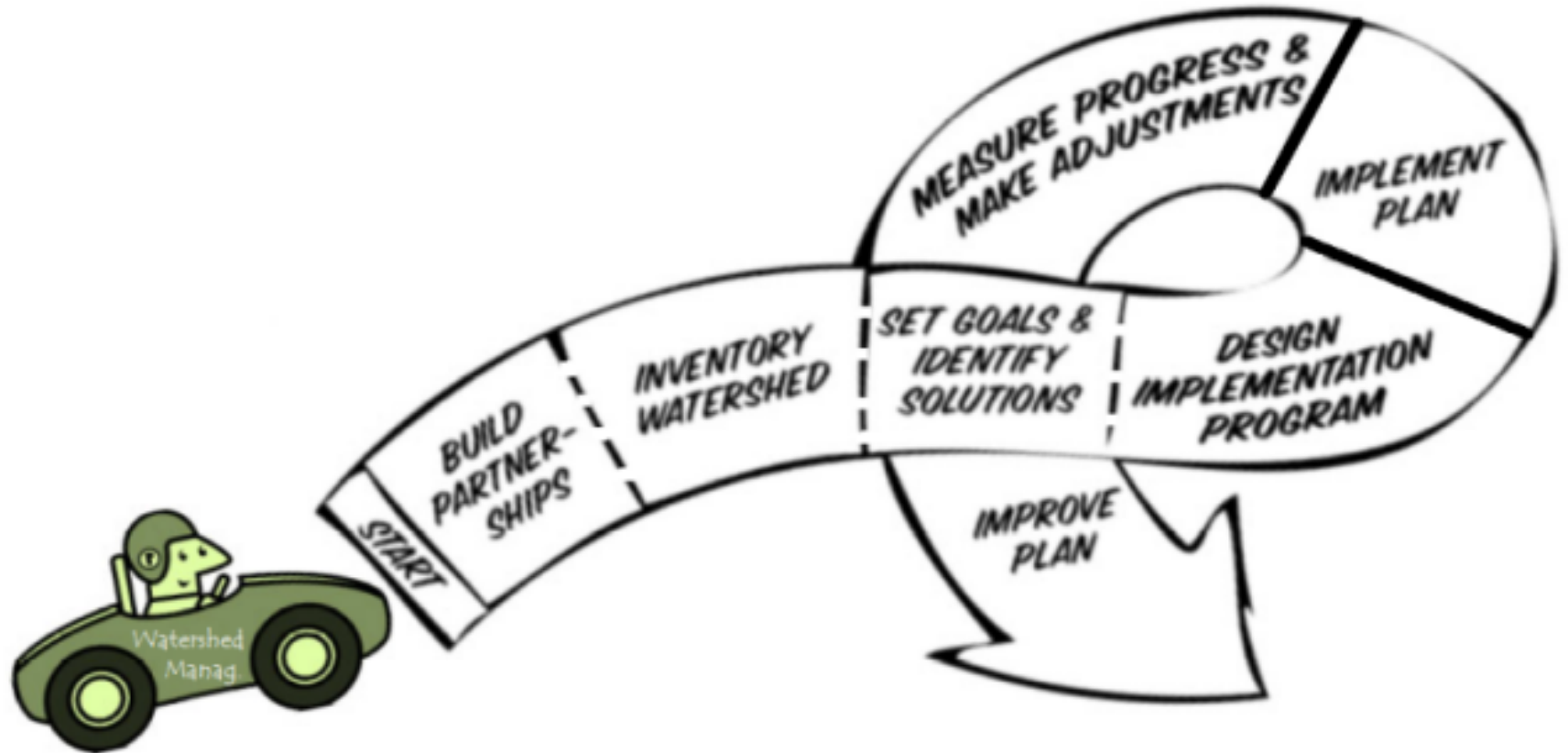


## Update to the Arroyo Colorado Watershed Protection Plan

August 2017  
TWRI TR-504

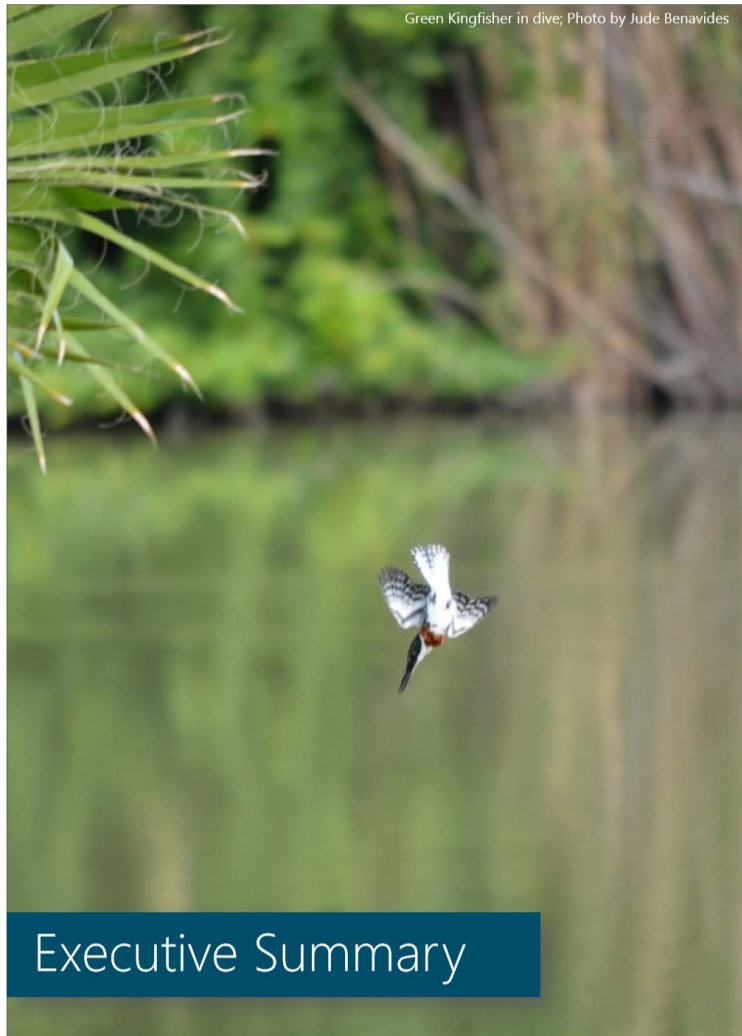
- A framework for implementing water quality protection and restoration strategies:
  - Driven by environmental objectives and stakeholder participation
  - Address sources and causes of impairments and threats to surface and groundwater – identified earlier
  - Partnership effort
  - Assures the long-term 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.



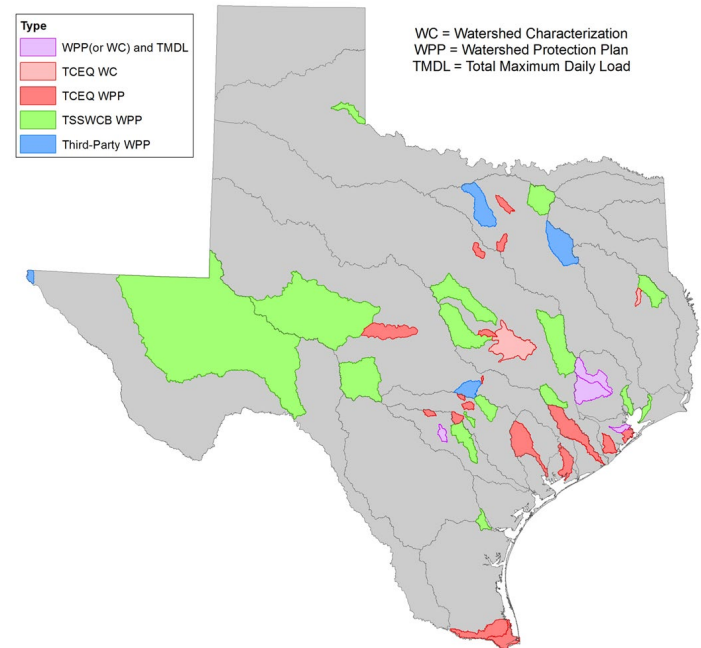


**Figure 2:** The cooperative and iterative watershed management steps: planning, implementation, and evaluation [5]

# The Watershed Protection Plan for the Arroyo Colorado was approved by the State of Texas in 2017

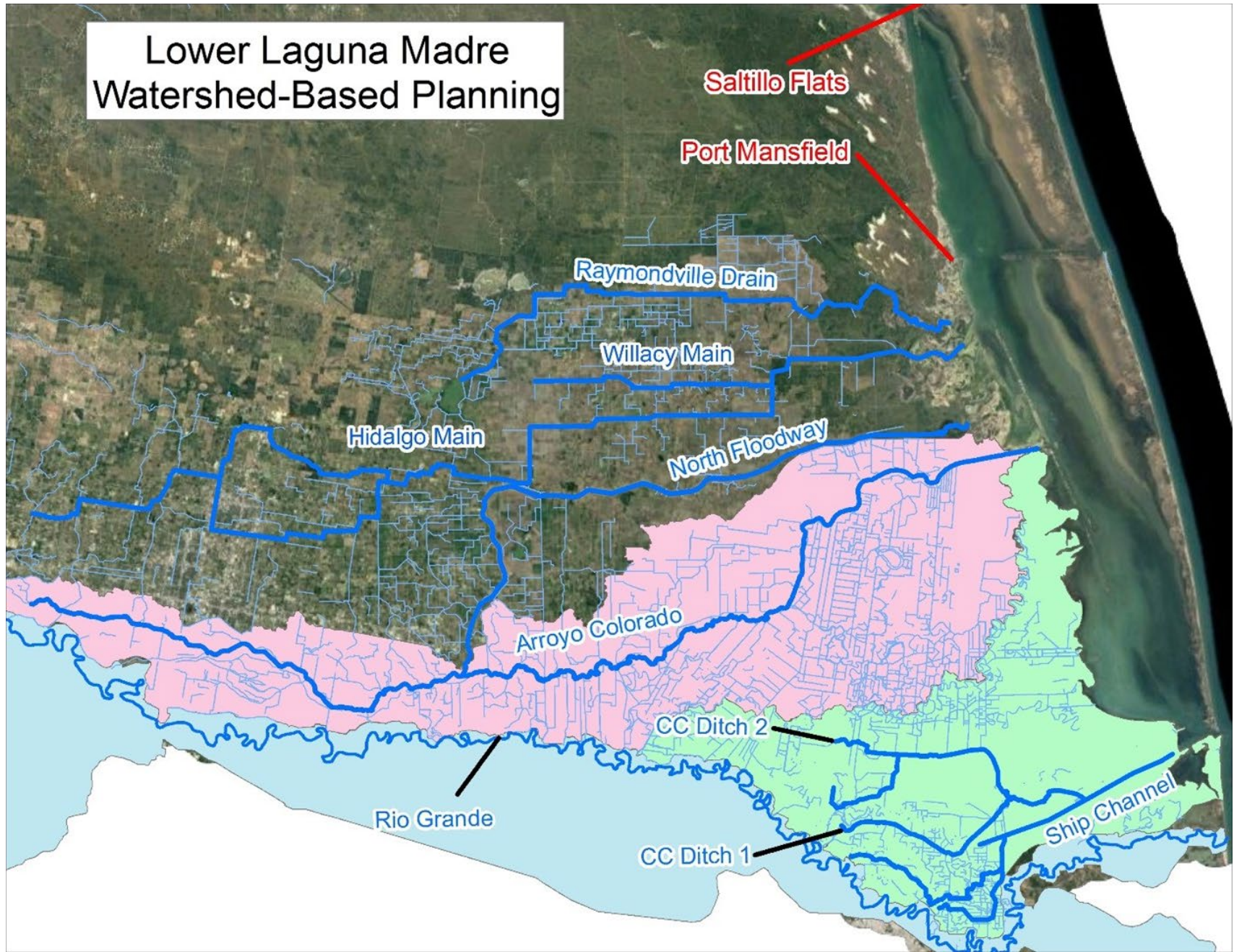


- A significant accomplishment
- Long-term effort from the early 2000's
- Has enabled us to leverage Non-Point Source (Section 319) funds from TCEQ / EPA through the Clean Water Act
- Higher priority given to those watersheds that have an approved plan.





# Lower Laguna Madre Watershed-Based Planning







Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



# The 9 Elements of Watershed Planning

Element a

Element b

Element c

Element f

Element g

Element h

Element i

## Six Steps in Watershed Planning and Implementation Process

### 1. Build partnerships

- Identify key stakeholders
- Identify issues of concern to be included in the watershed plan
- Set preliminary goals
- Conduct public outreach

### 2. Characterize the Watershed

- Collect existing data and create a watershed inventory
- Analyze data
- Identify causes and sources of pollution that need to be controlled
- Identify data gaps and collect additional data if needed
- Quantify pollutant loads

### Characterization and Analysis Tools

- GIS
- Statistical packages
- Monitoring
- Load calculations

### 3. Finalize Goals and Identify Solutions

- Set overall goals and management objectives
- Develop indicators/targets
- Determine load reductions needed
- Identify critical areas
- Develop management measures to achieve goals

Element e  
Element d

### 4. Design an Implementation Program

- Develop implementation schedule
- Develop interim milestones to track implementation of management measures
- Develop criteria to measure progress towards meeting watershed goals
- Develop monitoring component
- Develop information/education component
- Develop evaluation process
- Identify technical and financial assistance needed to implement plan
- Assign responsibility for reviewing and revising the plan

### Watershed Plan Document

### 5. Implement Watershed Plan

- Implement management strategies
- Conduct monitoring
- Conduct information/education activities

### 6. Measure Progress and Make Adjustments

- Review, evaluate information
- Prepare annual workplans
- Report back to stakeholders and others
- Make adjustments to program

# 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

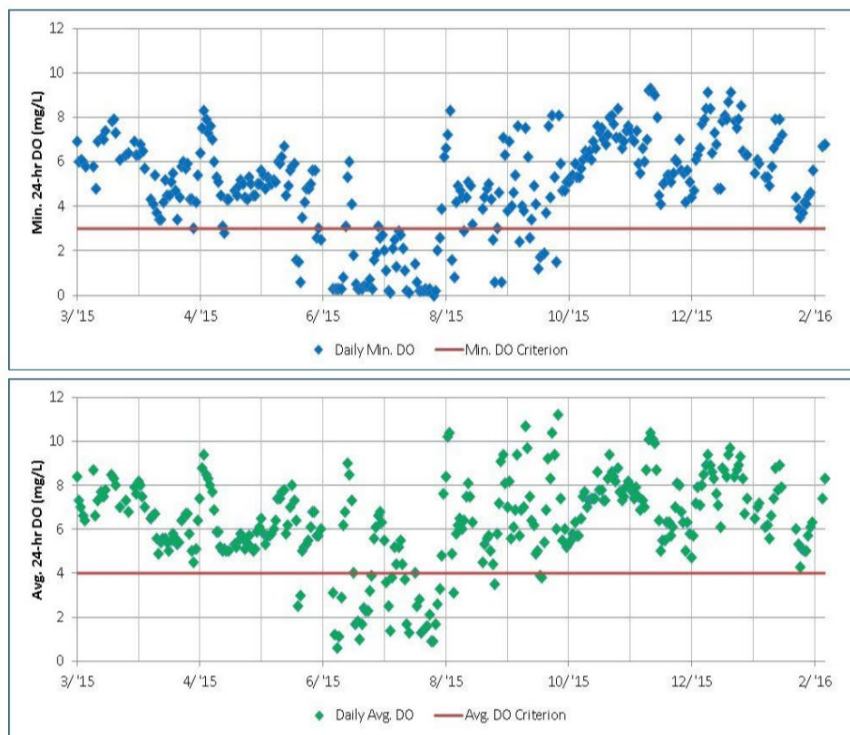


Figure 4.3. Time series of daily minimum DO and daily average DO at the USGS station on Arroyo Colorado Tidal at FM 106, Rio Hondo, TX for the period of March 1, 2015 – February 29, 2016



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).

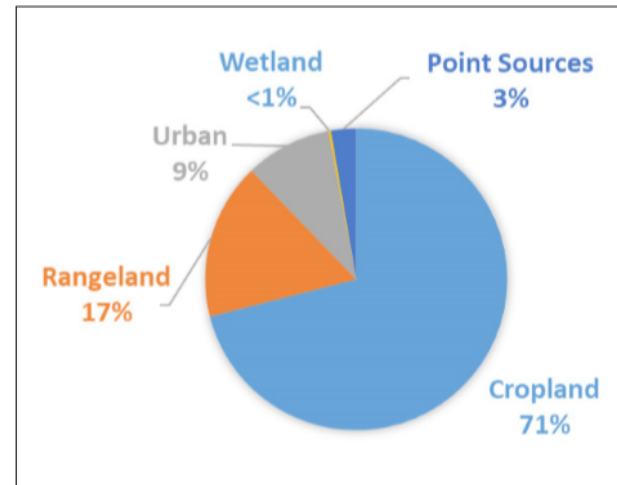


Figure 6.2. Predominant sources of sediment loads in the Arroyo Colorado watershed

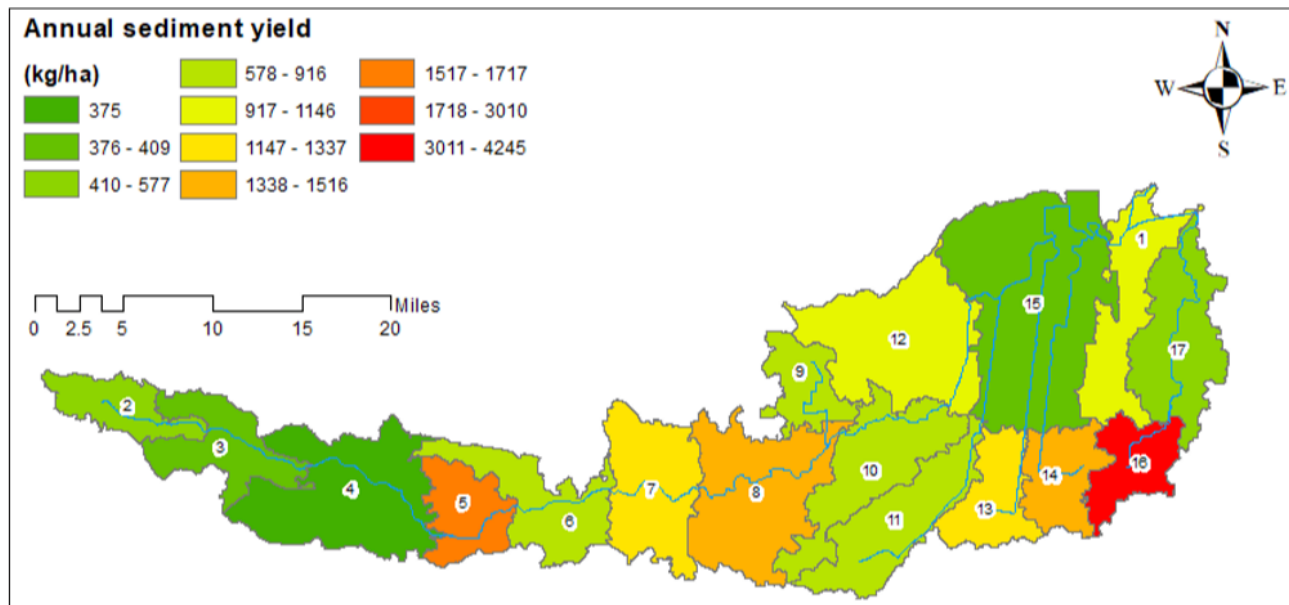


Figure 6.3. Estimated sediment export (kg/ha) from upland nonpoint sources by subbasin

## *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.

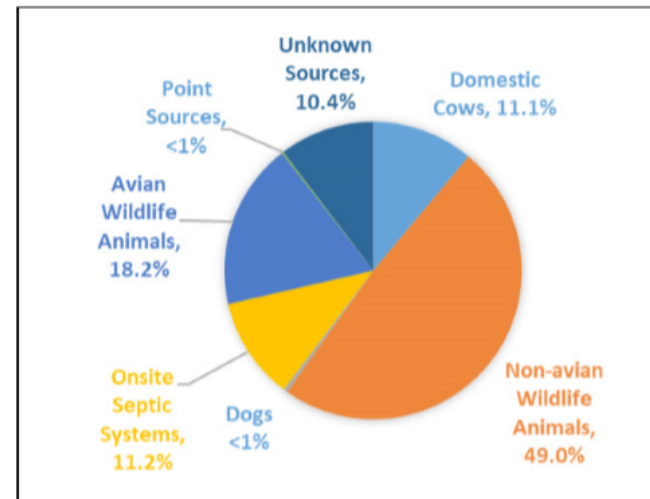


Figure 6.8. Primary *E. coli* sources estimated by SWAT

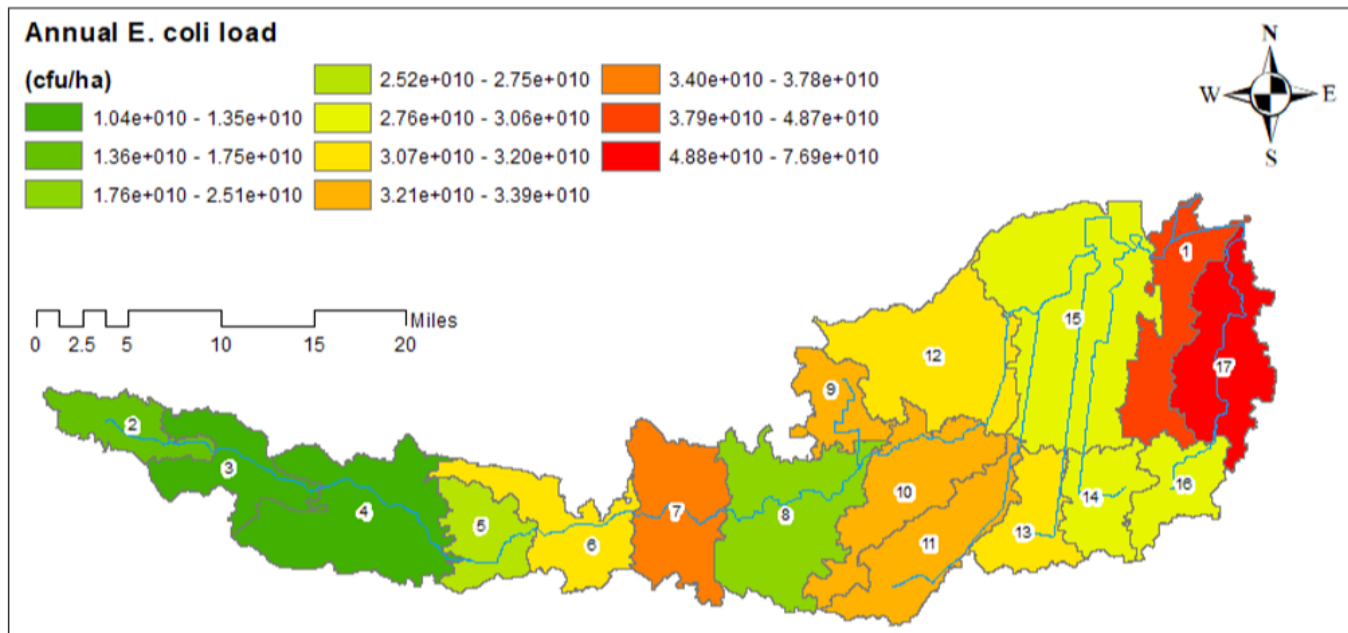


Figure 6.9. Estimated *E. coli* loads (cfu/ha) from upland nonpoint sources by subbasin



# Bacterial Source Tracking

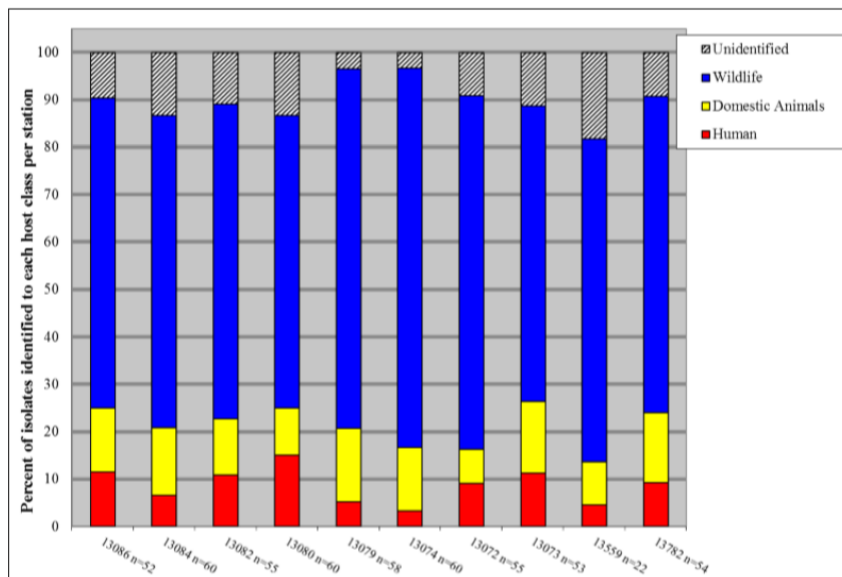


Figure 6.12. Three-way split of *E. coli* BST results for each station as percent of isolates per sampling station

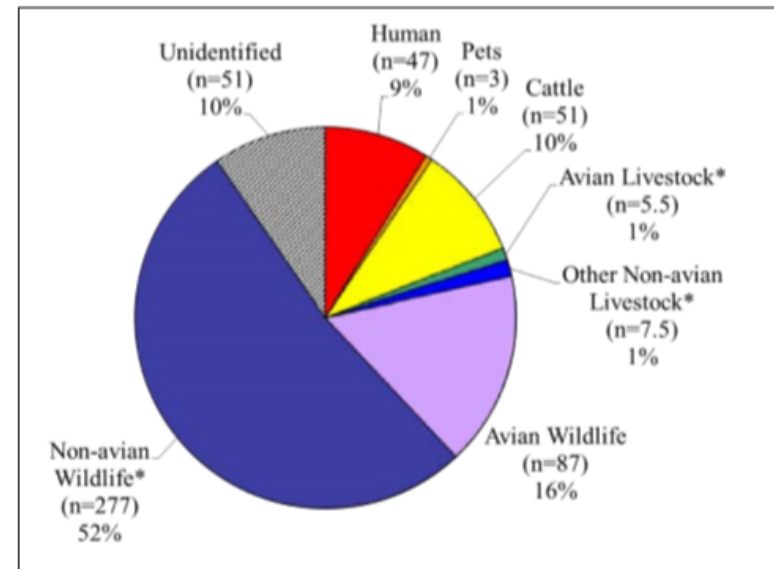


Figure 6.11. BST results for the Arroyo Colorado watershed (\* indicates presence of cosmopolitan species)

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> <u>WQMPs:</u> TSSWCB WQMP program, CWA §319(h) grant program <u>RMS:</u> NRCS EQIP program <u>Education:</u> 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

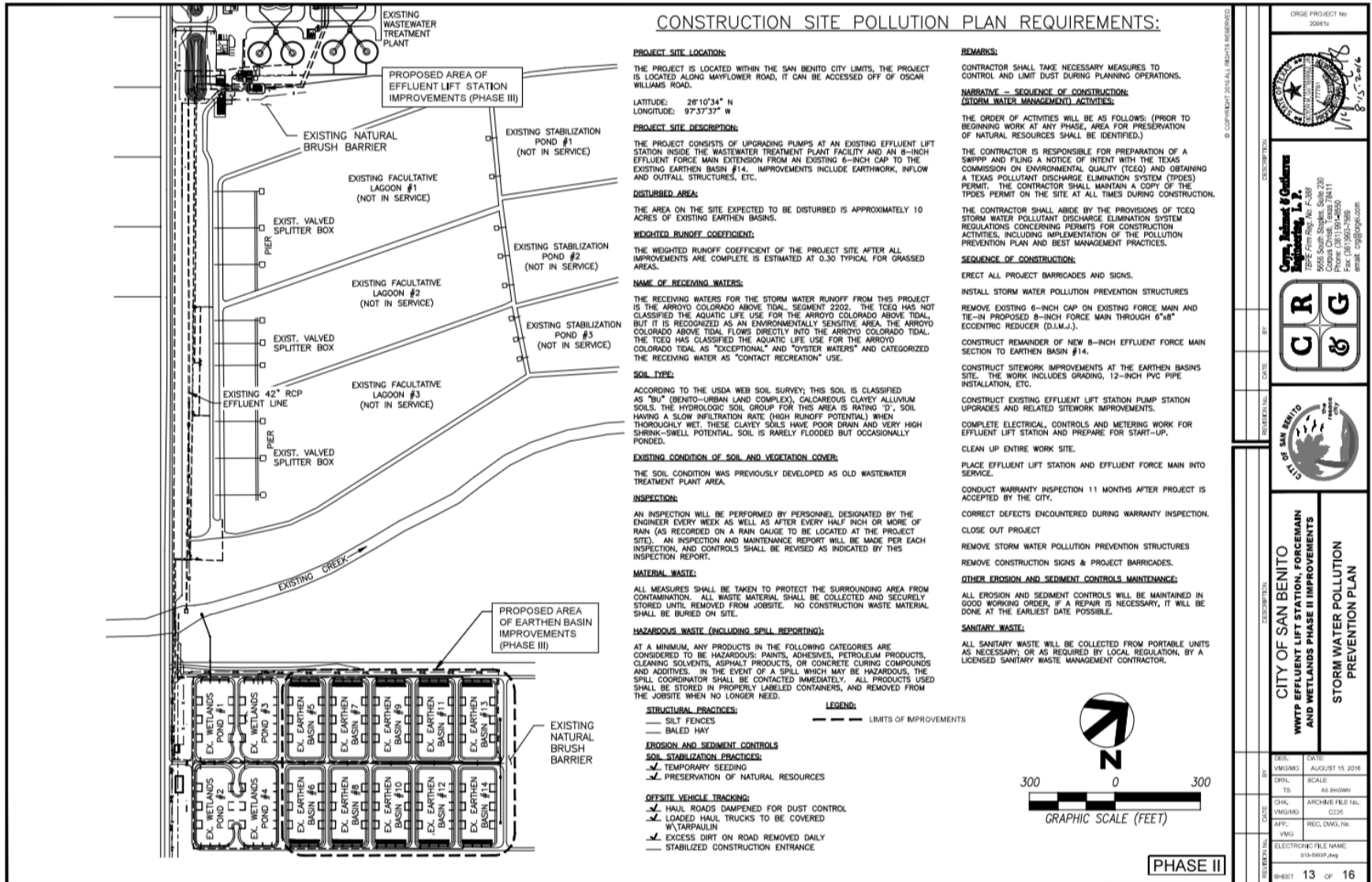
# Municipal Permit Changes

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





# Education and Outreach



Brownie troop member installing storm drain marker



Watershed Coordinator Jaime Flores installing an Arroyo Colorado Watershed Boundary sign



Arroyo Colorado watershed model on display at the Coastal Expo

# Physical Models – Total of 4 available for use by schools

- Our two physical models have been used for many years and are showing some wear and tear.
- Completed repair of the models in June 2020
- Two new physical models constructed (2022)
  - Enhanced outreach
  - Very popular with local schools and environmental events
- Physical Model:
  - Robust
  - Real (not virtual)
  - This means something to kids
  - Our Rivers and Streams are not virtual.... They are real.





# Model Repairs



# Water Quality Monitoring – Are We Making Progress?

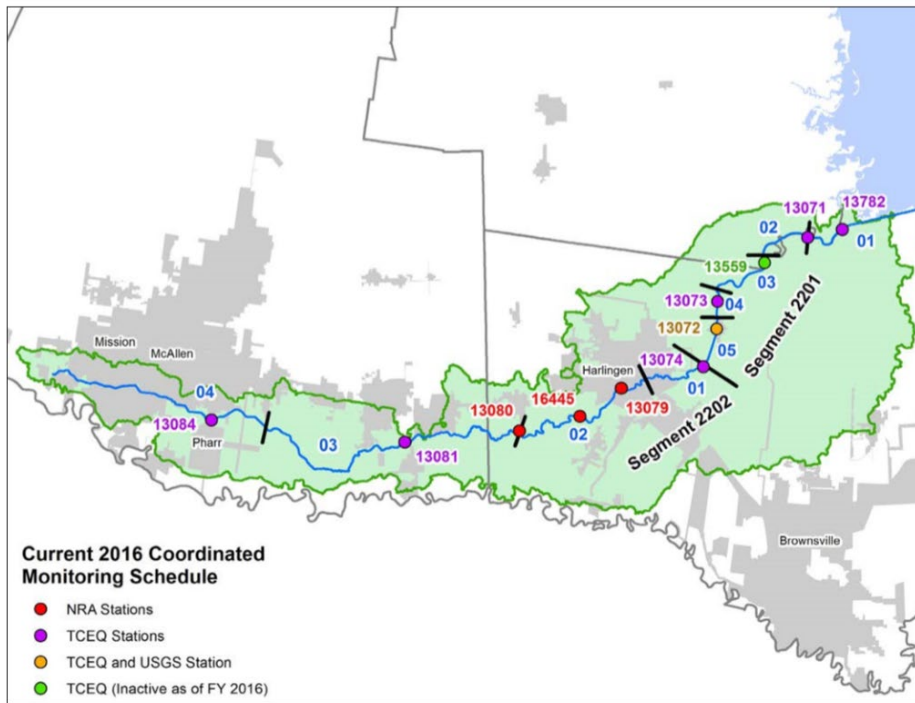
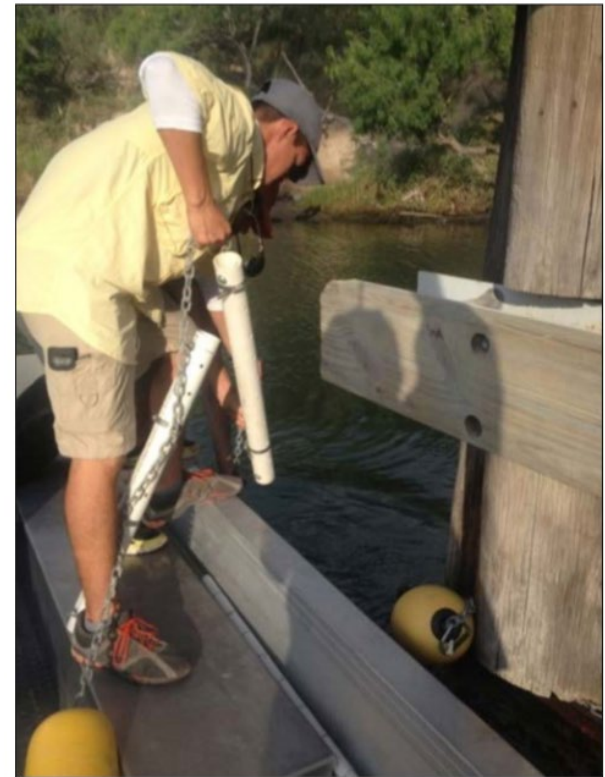


Figure 11.1. Location of water quality monitoring stations on the Arroyo Colorado currently monitored routinely by TCEQ and NRA



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



# Arroyo Colorado Website



## The Arroyo Colorado Watershed Partnership

A Lower Rio Grande Valley Story Map



## The Arroyo Colorado Watershed

The Arroyo Colorado watershed covers an extensive 420,000 acres, where it serves a wide array of functions and benefits.





## Water Quality Monitoring Stations



## San Benito

The Arroyo Colorado WPP identifies treatment wetlands and water reuse as important management strategies to reduce pollutant loading into the arroyo.



A "Keep San Benito Beautiful" sign posted in San Benito's wetlands.

Through collaborative efforts between the partnership and the city of San Benito, old abandoned ponds were transformed into a 64-acre treatment wetland system.





City staff and volunteers help plant native plants into the bio-retention basin.

Once the bio-retention basin and parking lot were complete, attention shifted towards the expansion of Ramsey park's wetland system. Clearing and grubbing, installing liners and pipes, and digging out ponds were some of the many hard tasks performed in order to expand and interconnect the wetlands.



The expansion of wetlands involved clearing brushes, installing liners and pipes, and digging out ponds.

# New Arroyo Colorado Website



The Arroyo Colorado Watershed Partnership

[Watershed](#) [Partnership](#) [Monitoring](#) [San Benito](#) [Harlingen](#) [Los Fresnos](#) [Arroyo Colorado Watershed Partnership](#)



Volunteers break off into groups during the final wetland planting phase of the project.

Approximately 180 volunteers from Texas State Technical College showed up and planted over 6,000 wetland plants and trees around the perimeter of the newly expanded wetland ponds.





The Arroyo Colorado Partnership partnered with the City of Los Fresnos to develop a 20-acre nature park directly south of Los Fresnos High School.

This provided an unique opportunity to implement stormwater Best Management Practices (BMPs) for the city of Los Fresnos.

## Los Fresnos Nature Park



Los Fresnos Nature Park Project Plan





## Los Fresnos Nature Park

Bio-swales, bio-retention ponds, pervious walking trails, and rainwater collection systems were installed to help divert, slow down, and treat stormwater.



Rainwater collection systems help store stormwater while serving as a water supply.



Pervious trails reduce stormwater runoff and filter out nutrients.



Bio-swales help detain and treat stormwater runoff.



# For More Information:

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



## **ARROYO COLORADO**

**Know it. Respect it. Enjoy it.**  
**Conócelo. Respétalo. Disfrútalo.**



