Cotton Bayou Watershed Characterization

Webinar
April 28, 2020

Meeting Outline

- Introductions
- Watershed Overview
- Project Purpose and Methods
- Preliminary Findings
- Next Steps
- Discussion

Who We Are

Texas Commission on Environmental Quality (TCEQ)

lead state environmental management agency

Houston-Galveston Area Council (H-GAC)

regional council of governments

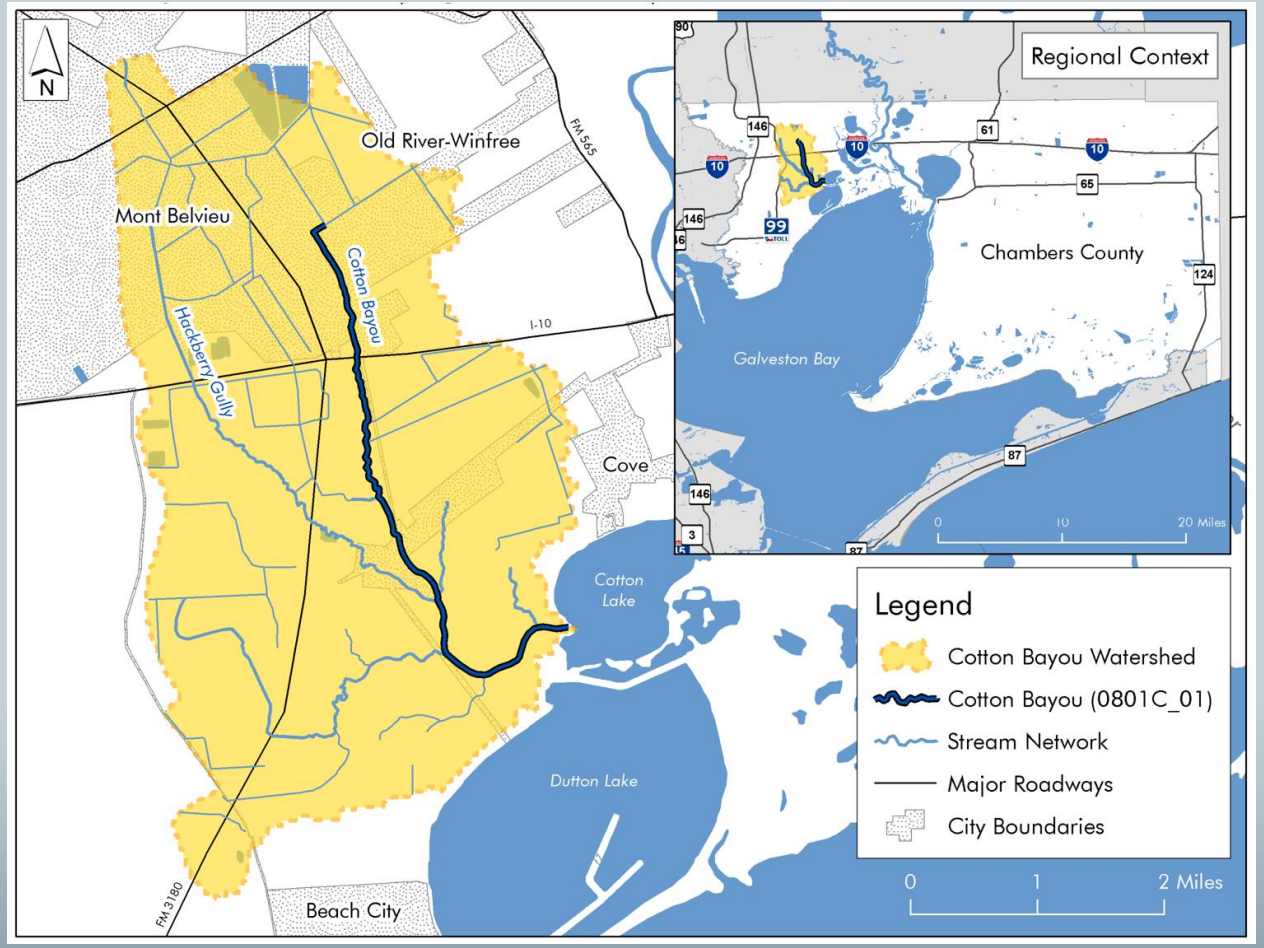
What We Do

We work to improve surface water quality concerns in regional water bodies by using sound scientific practices and local knowledge to identify sources of pollution and develop effective reduction strategies.

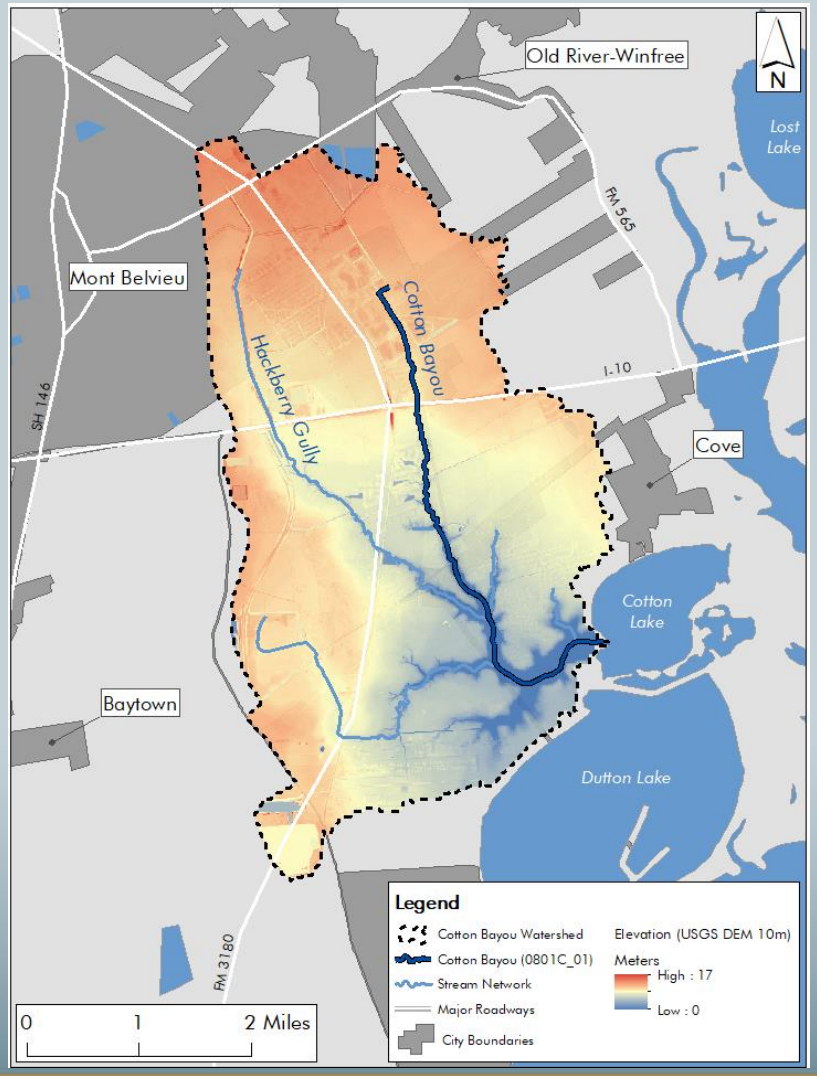
Watershed Overview

Watershed Area

- 16 square mile area
- 47 miles of stream network
  - Main tributary is Hackberry Gully
- Overlaps jurisdictions of Mont Belvieu, Old River-Winfree, Cove, Baytown, and Beach City
- Population estimate ~3,300

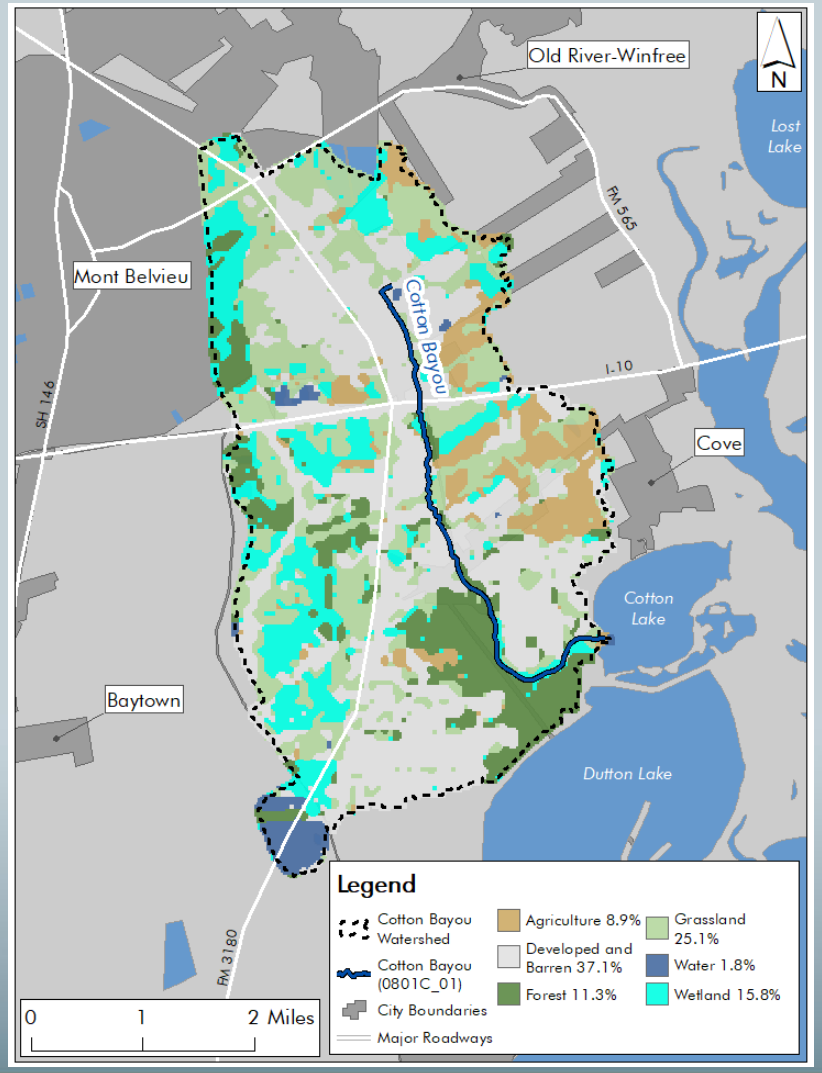


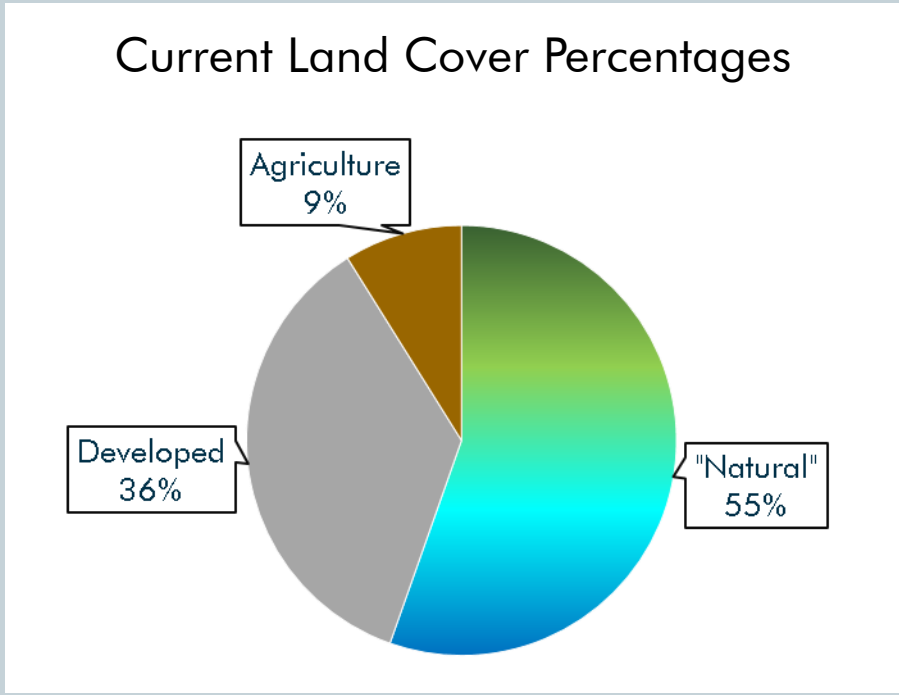
Elevation



- Relatively flat,17 meters (56 feet) of elevation
- Stream flows less likely to be driven by natural elevation change
- Channelization and other modifications may be more influential

Land Cover

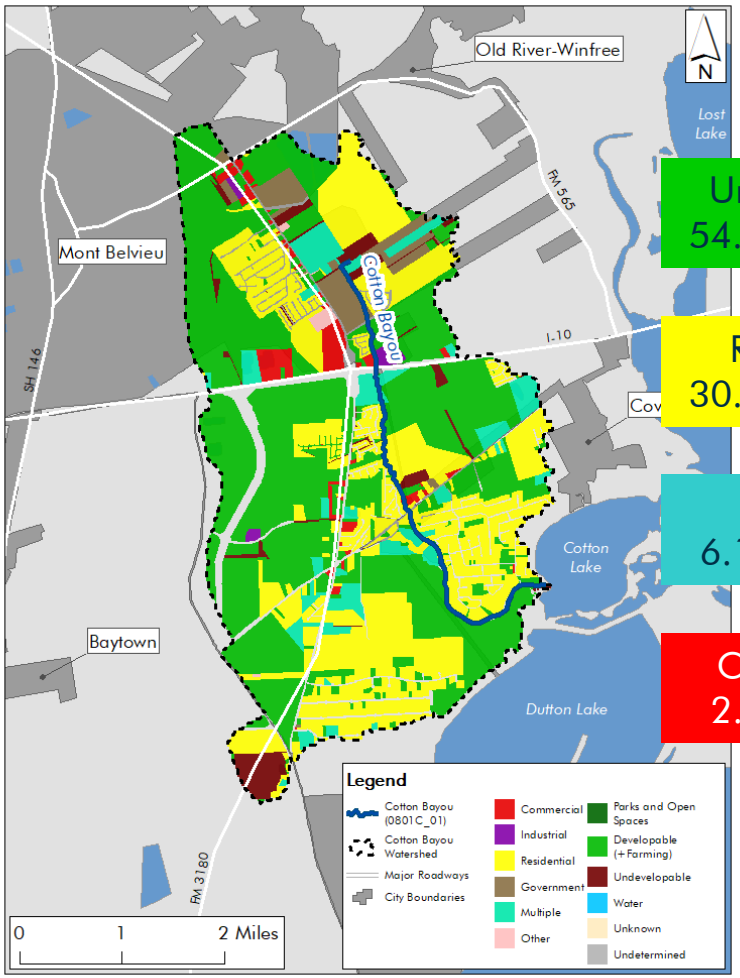




Developed areas forecasted to expand

Land Use

Land Use in the Cotton Bayou Watershed (2018)



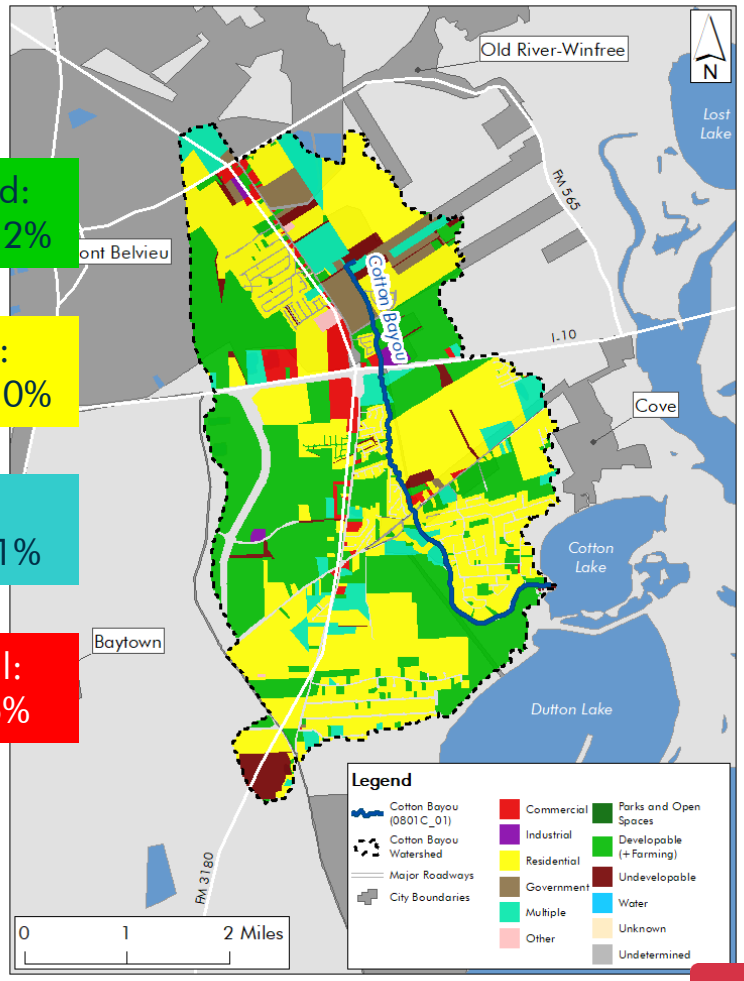
Undeveloped:
54.6% → 35.2%

Residential:
30.3% → 43.0%

Multiple:
6.1% → 12.1%

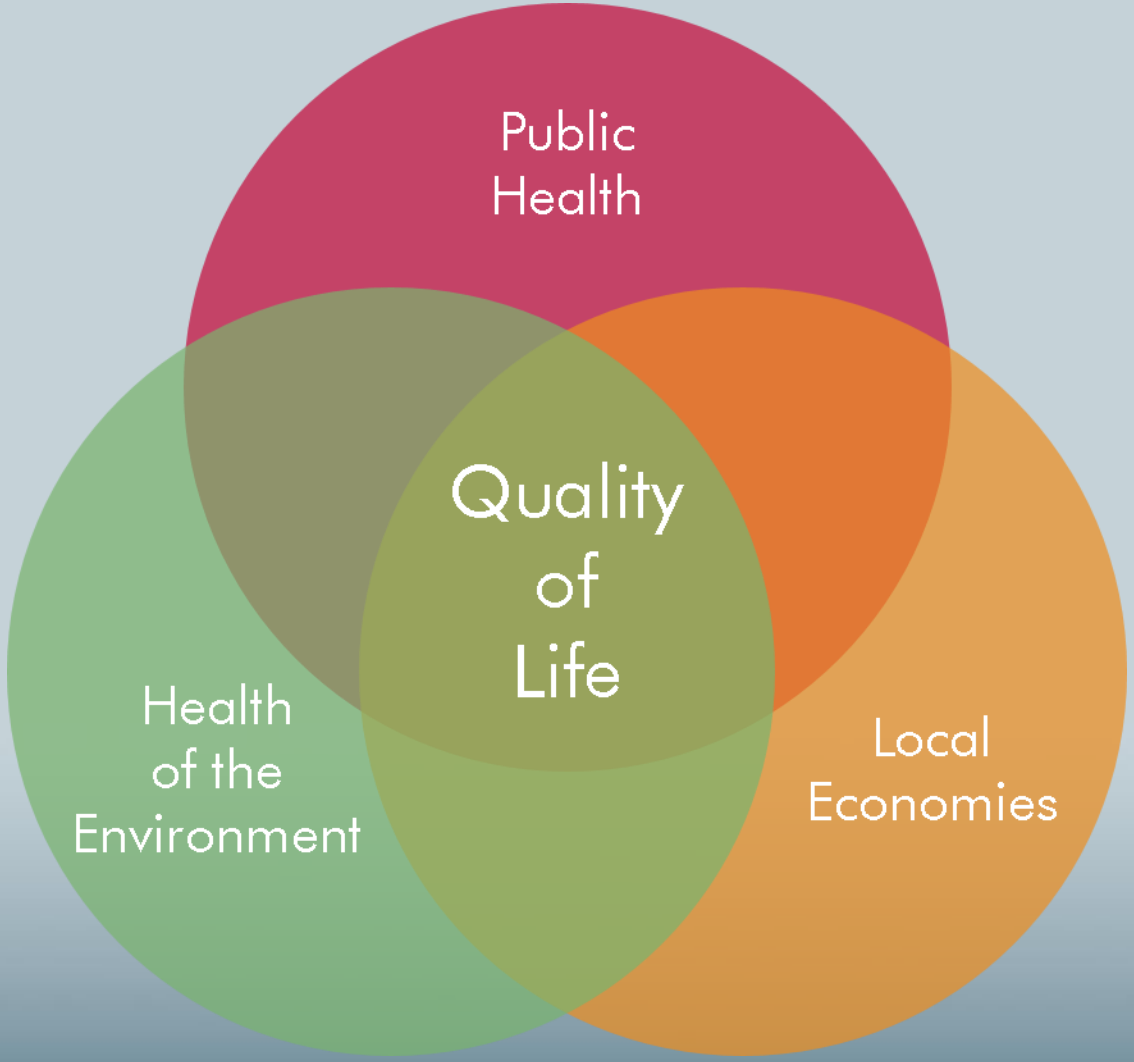
Commercial:
2.0% → 2.6%

Land Use in the Cotton Bayou Watershed (2045)

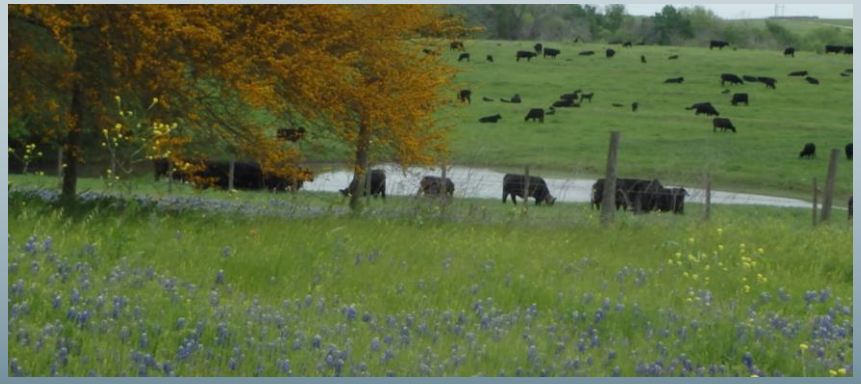


Water Quality

Why Water Quality Matters



Surface Water Uses



- Agricultural
- Municipal
- Industrial
- Recreational
- Natural

Determining Water Quality

- Statewide monitoring conducted to observe compliance with water quality standards for different uses (recreation, aquatic life, etc.)
- TCEQ produces integrated report of results every two years
- Waterways exceeding standards are **impaired**

Status of Cotton Bayou

- **Impaired** for aquatic life use and contact recreation
  - Low oxygen levels
  - High bacteria concentrations

- This project will focus on characterizing sources of **bacteria** in Cotton Bayou

Bacteria Sources





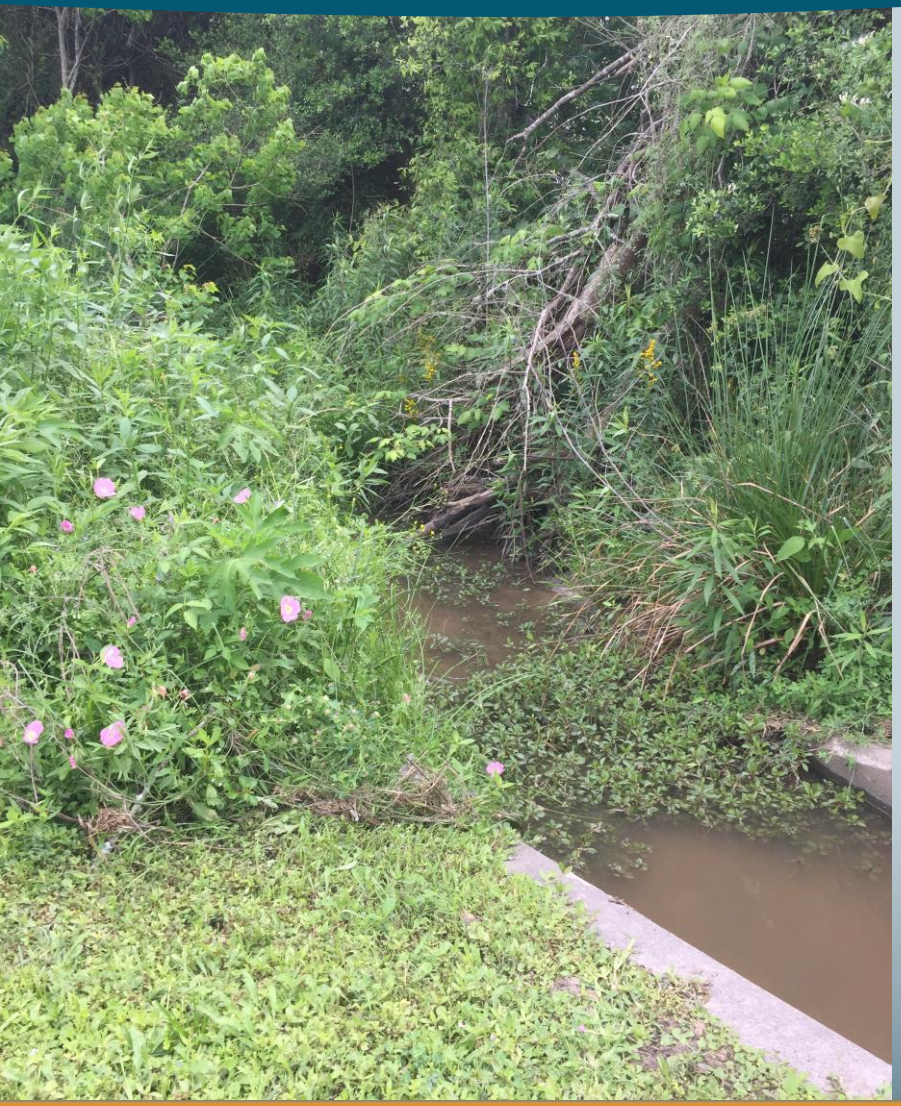

- **Human Waste**
  - Wastewater
  - Septic/Aerobic Systems
  - Illicit Sewage
  - Dumping
- **Domestic Animal Waste**
  - Pets
  - Livestock
- **Waste from Wildlife**
  - Mammals (deer, feral hogs, etc.)
  - Birds

Other Challenges

- **Sediment**
  - Changes hydrology and flooding
  - Impacts aquatic life
- **Trash/Dumping**
  - Introduces pollutants
  - Impacts hydrology and habitat
- **Invasives**
  - Plants and animals that can impact hydrology and water quality
- **Growth**
  - Increase in contaminant sources
  - Decrease in open space

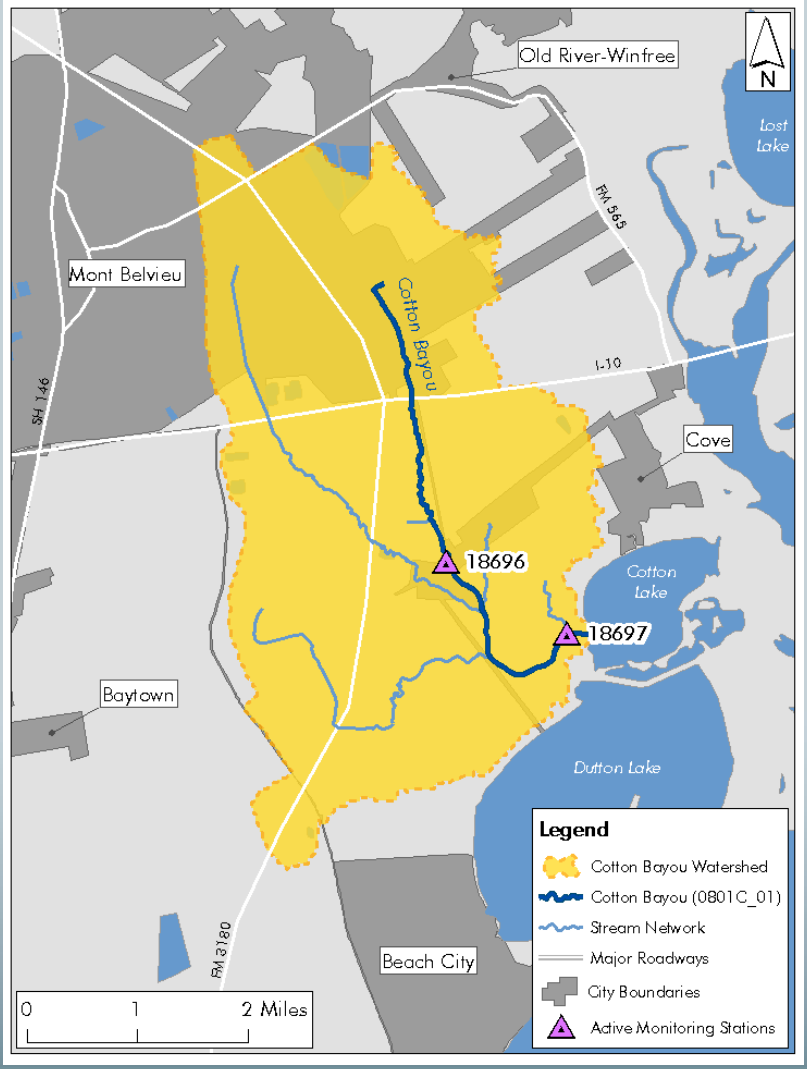
Watershed Characterization Report

Report Purpose



- Describes water quality and pollutant sources impacting water quality in the watershed
- Preliminary step in determining a **Total Maximum Daily Load (TMDL)** for a water body
- Sound science and stakeholder knowledge combine to create roadmap for improvement

Monitoring in the Watershed



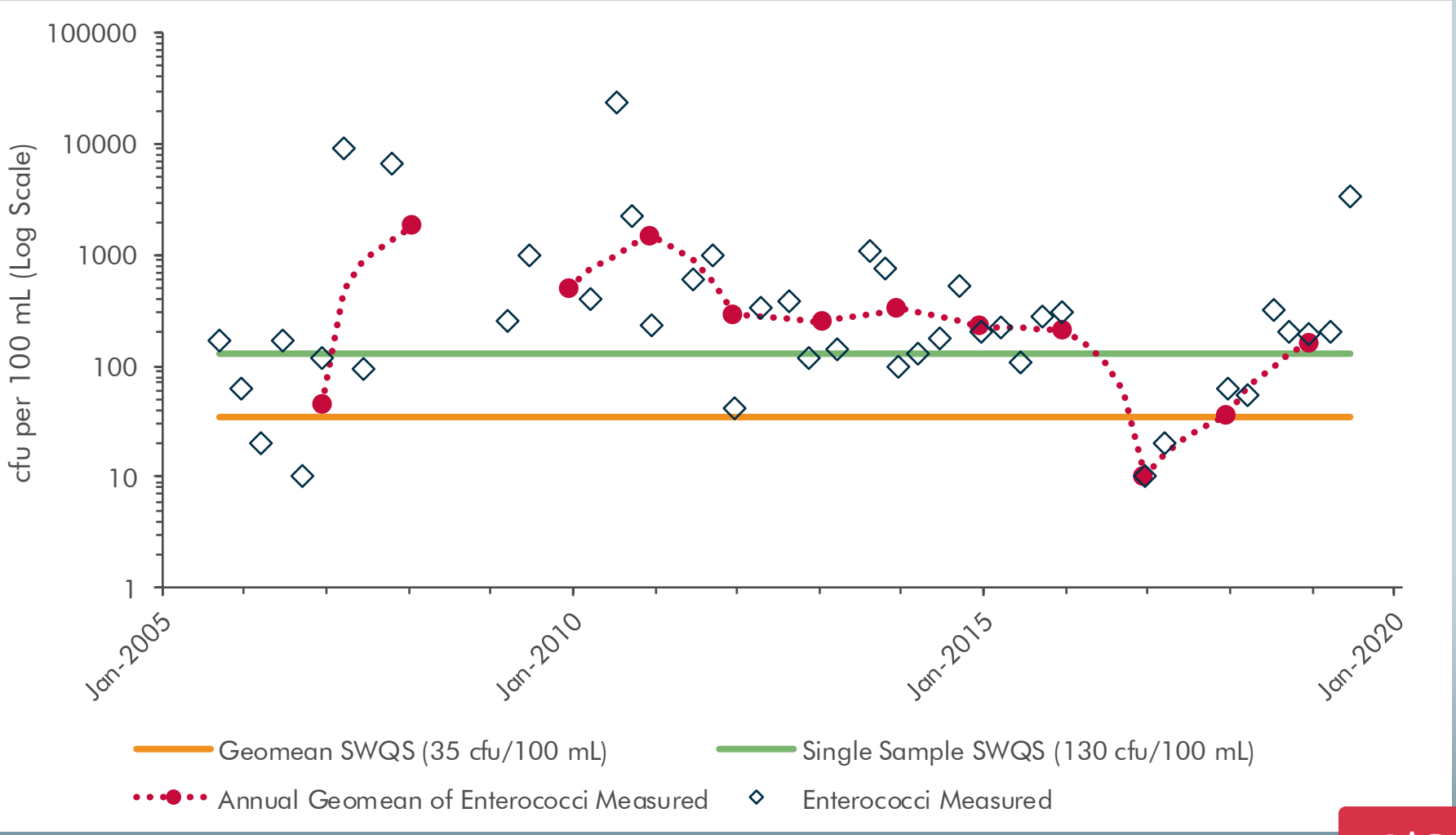
- 2 active stations monitored quarterly for Enterococci levels
- Upstream station 18696 at FM 565 near Cove
- Downstream station 18697 at confluence with Cotton Lake

Characterizing Impairments

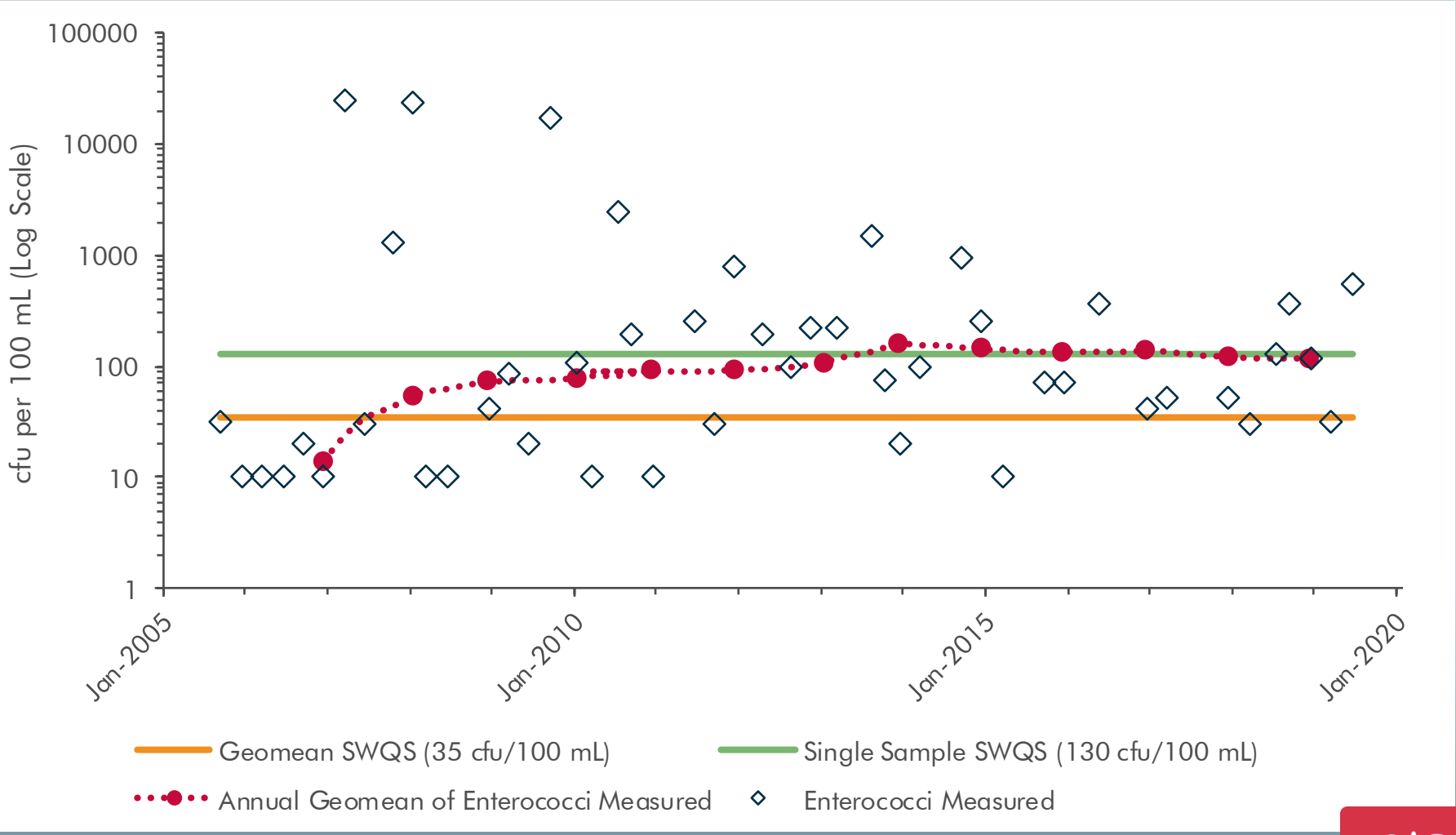
- Results of Cotton Bayou monitoring data show high levels of fecal indicator bacteria, Enterococci

- How do Enterococci concentrations in Cotton Bayou compare to state water quality standards?

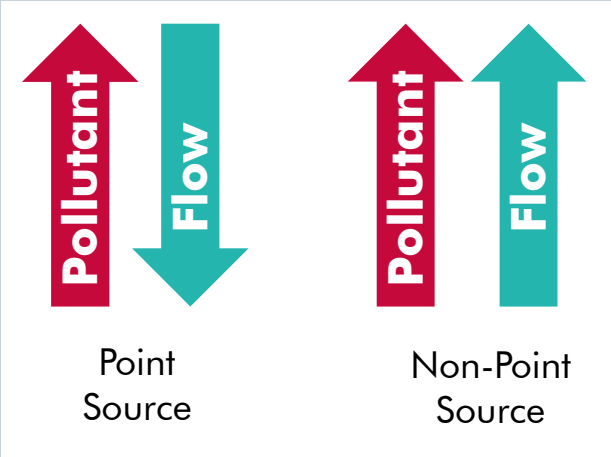
Bacteria Levels (18696, upstream)



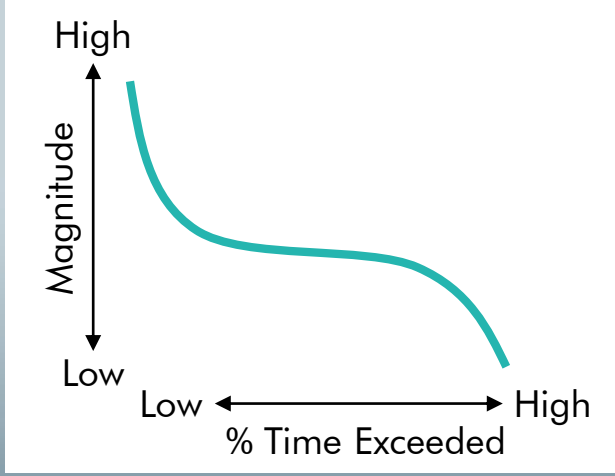
Bacteria Levels (18697, downstream)



Streamflow and Pollutant Loads

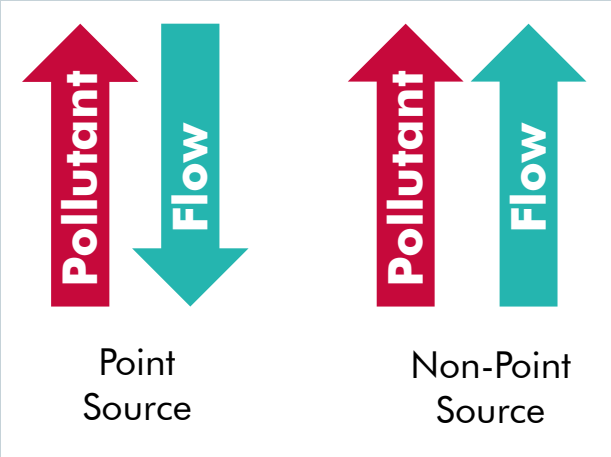


- Comparing observed pollutant levels to corresponding stream flow conditions can help us estimate sources of impairment



- A flow duration curve (FDC) represents daily flows ranked by magnitude
  - Ranked flows converted to percent of the study period that flows of each successive magnitude were exceeded

Streamflow and Pollutant Loads



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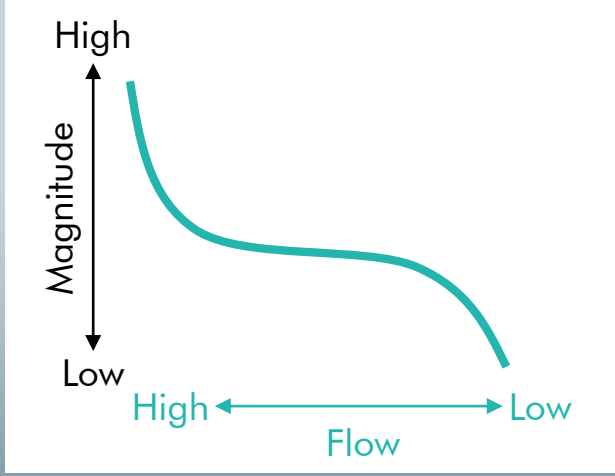

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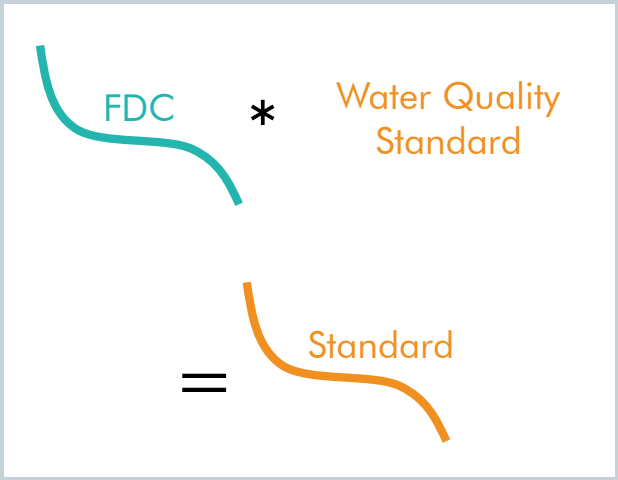
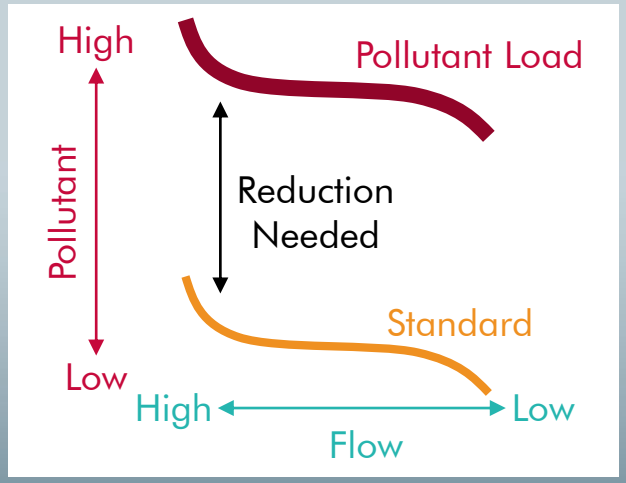
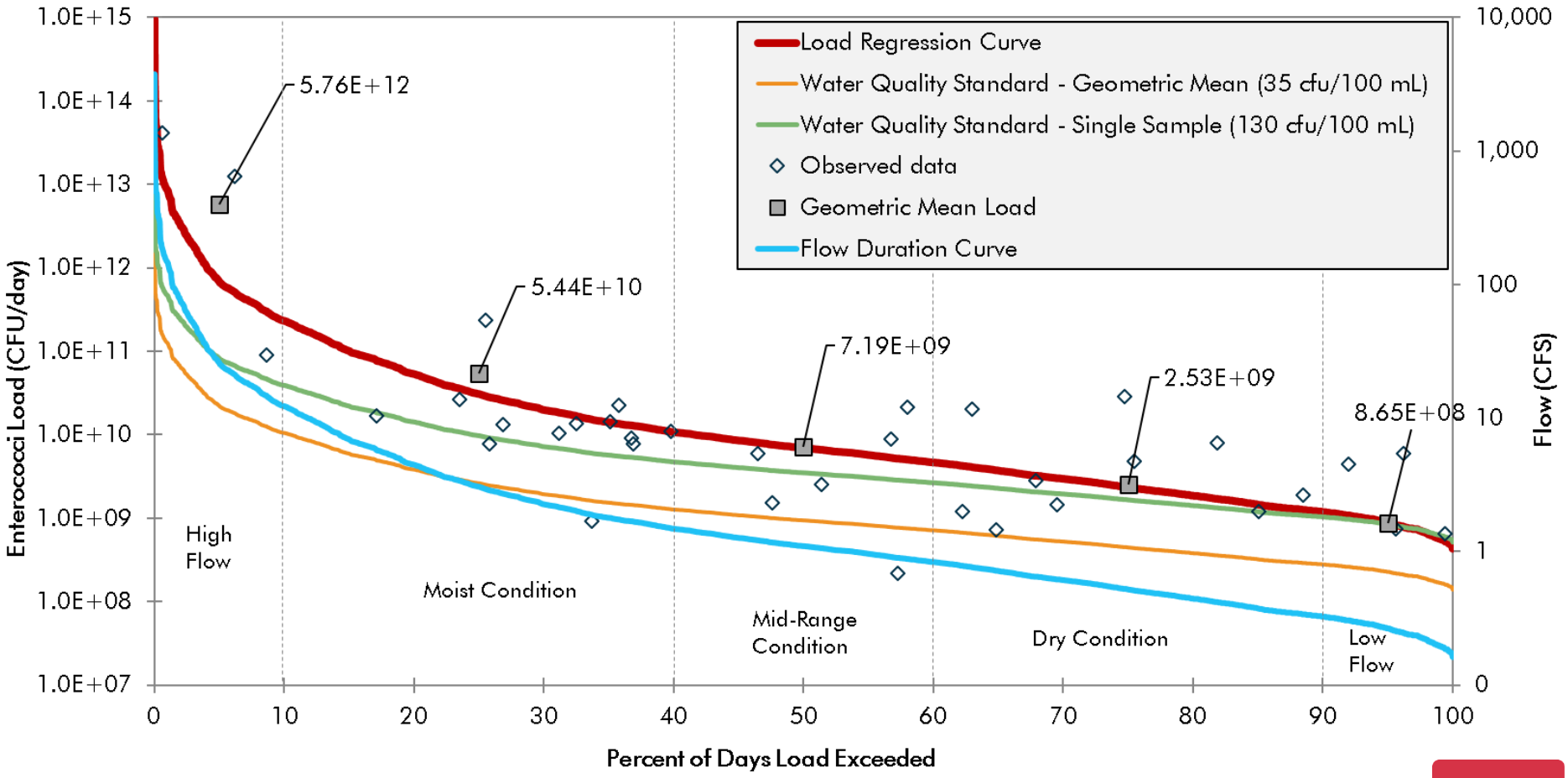
Load Duration Curves (LDCs)



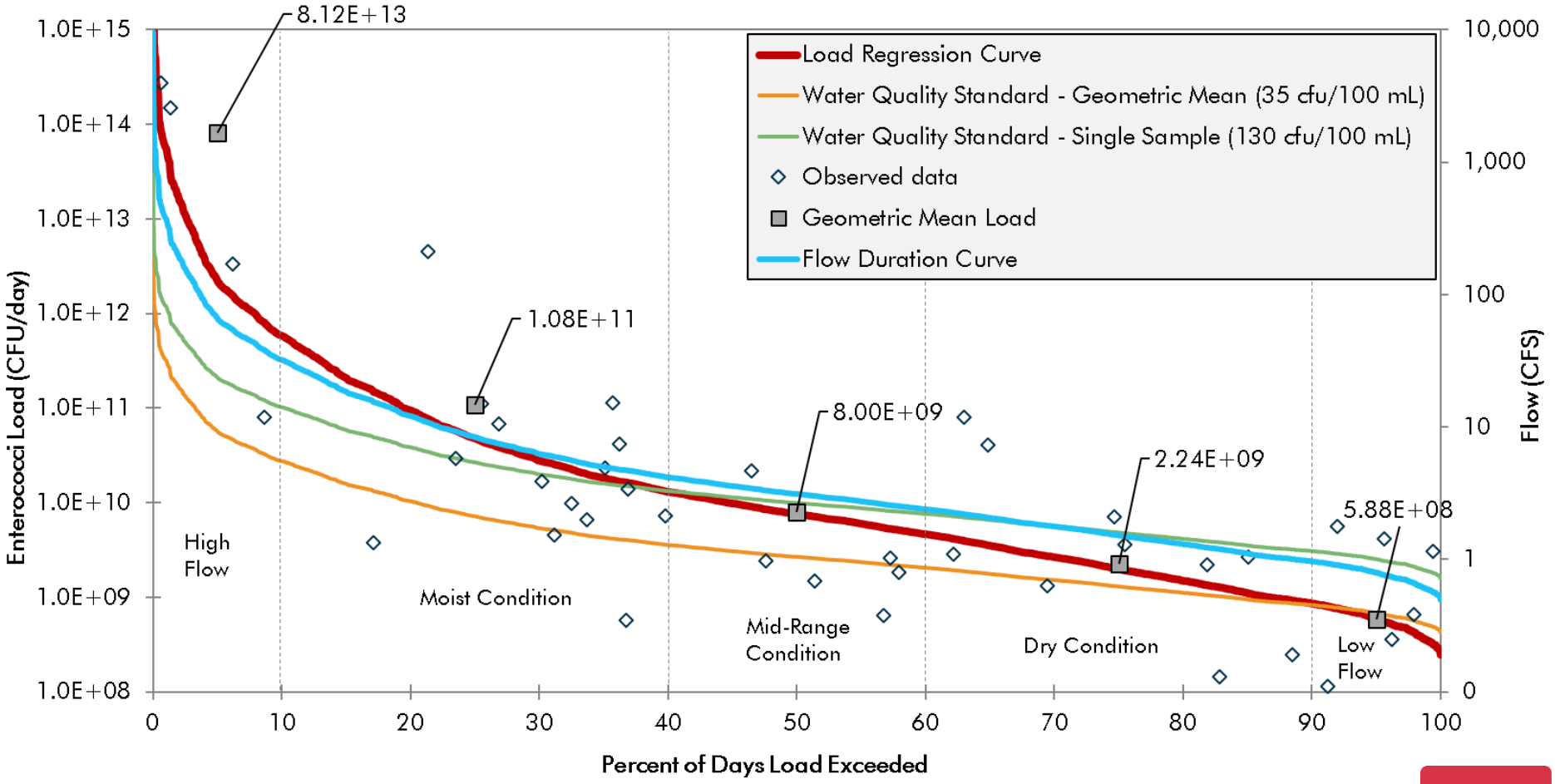


- FDCs can be used to calculate the maximum pollutant load in compliance with the standard at different rates of flow
- Comparing a curve modeled from observed pollutant levels to the standard curve can help us estimate reductions needed for compliance

LDC Assessment (18696, upstream)



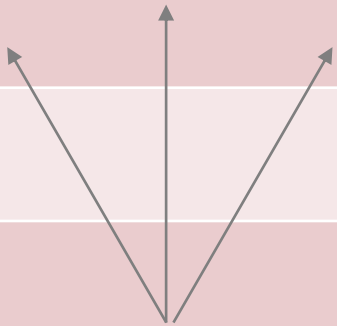
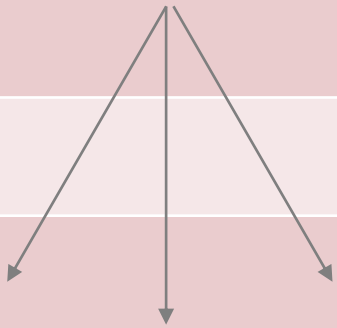
LDC Assessment (18697, downstream)



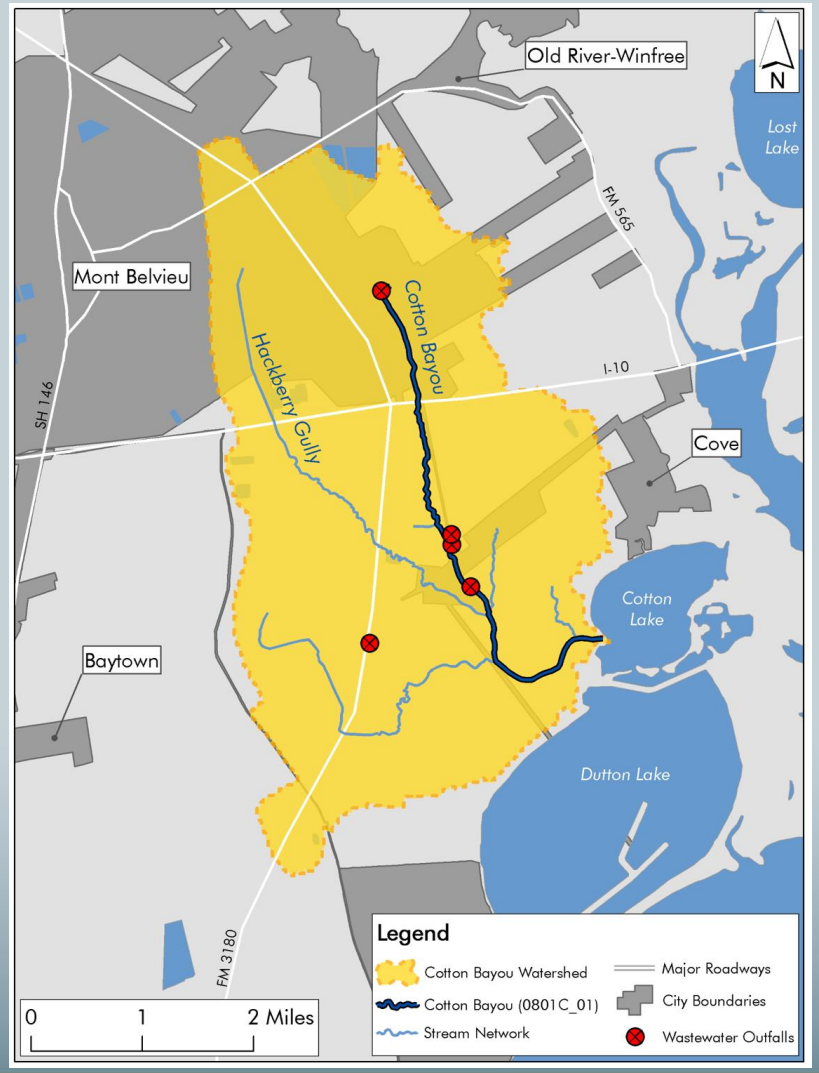
Analysis Summary

- Enterococci levels in Cotton Bayou frequently exceed the surface water quality standard
  - Station 18696 (upstream) consistently higher than 18697 (downstream)
- LDC for 18696 suggests significant reductions are needed to meet the standard for all flow conditions
- LDC for 18697 suggests standard is being met in low flow conditions but surface water is increasingly impaired by increasing levels of flow
- These results indicate:
  - Impairment upstream is complex and may result from a combination of point and non-point source pressures
  - Impairment downstream is more likely affected by non-point sources during high flow events

Potential Sources

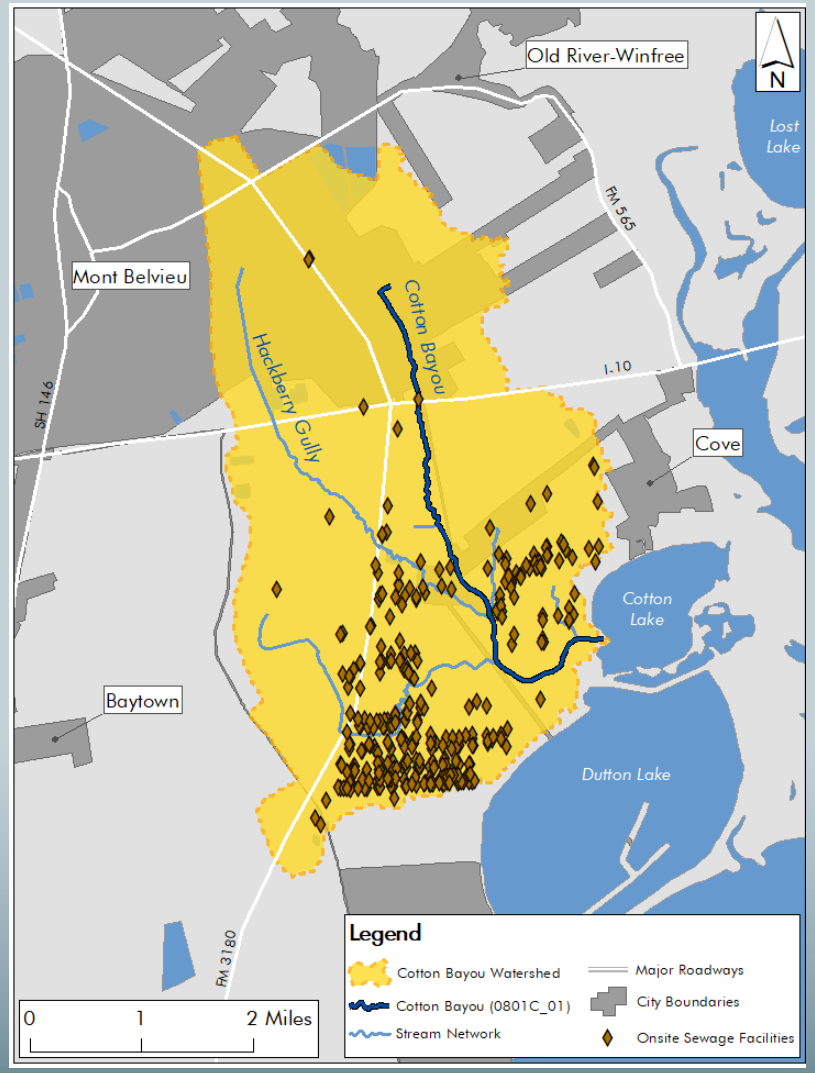
Potential Source	Means of Measurement	Contribution? Minor Moderate Major
Sanitary Sewer Overflows (SSOs)	• SSO reports • Discharge Monitoring Reports	
Onsite Sewage Facilities (OSSFs)	• Permitted OSSF database • Presence of houses outside service areas	
Domestic Pets	• Based on literature value and actual households (1.6 dogs /dog-owning household)	
Livestock	• USDA data • Stakeholder feedback	Please keep these classifications in mind
Feral Hogs	• Literature values • Stakeholder feedback	
Other Wildlife	• Literature values • Anecdotal	
Landfills	• Regulatory compliance • Stakeholder feedback	
Illegal Dumping	• Anecdotal	

Wastewater Treatment



Discharge Monitoring Report Data, 2011-2019		
Parameter	Enterococci	*E. coli*
Geomean Standard	35 cfu/100 mL	126 cfu/100 mL
Single Sample Standard	104 cfu/100 mL	399 cfu/100 mL
Samples	29	285
Percent Exceedance – Geomean	0%	8%
Percent Exceedance – Single Sample	0%	22%

Onsite Sewage Facilities



- 212 permitted OSSFs
- H-GAC estimates additional 143 units for a total of 355
- Assuming 10-15% failure rate, 36 to 54 OSSFs are projected to be failing

Dog Ownership Estimates

- The American Veterinary Medical Association estimates 38.4% of all households are dog owning households

- 1.6 dogs are estimated per dog owning household

Statistic	2018
Total Households	1,182
Dog Owning Households	454
Dogs	726

How is dog waste managed in your watershed?

Livestock Estimates

Estimates based on the United States Department of Agriculture 2017 Agricultural Census for Chambers County adjusted for percentage of watershed area

Farms	Cattle	Pigs/Hogs	Sheep	Goats	Poultry	Horses
14	608	2	12	14	33	21

Wildlife and Feral Hog Estimates

- The Texas Parks and Wildlife Department estimates one deer per 40.2 acres

- Feral hog populations vary depending on land cover type:
  - ~1.3 per square mile in low intensity development
  - ~2 per square mile in developed open space, bare land and cultivated land
  - ~2.45 per square mile in grasslands, forests and wetlands
  - no hogs in developed areas or open water

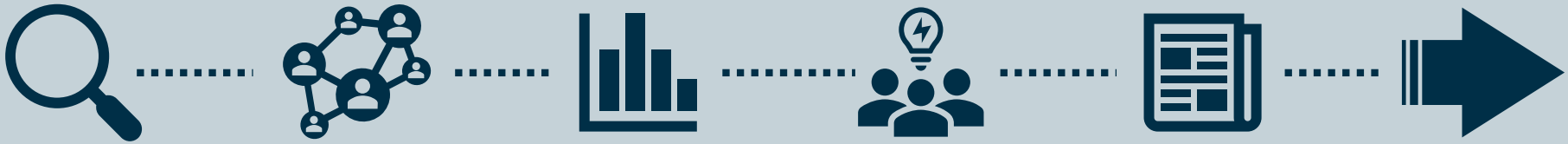
Animal	Population
Deer	258
Feral Hogs	31

Others?
(birds, etc.)

Next Steps

TMDL Timeline

You Are Here



Identify Water Quality Issues

Receive & Incorporate Feedback

Determine TMDL

Identify Reduction Strategies

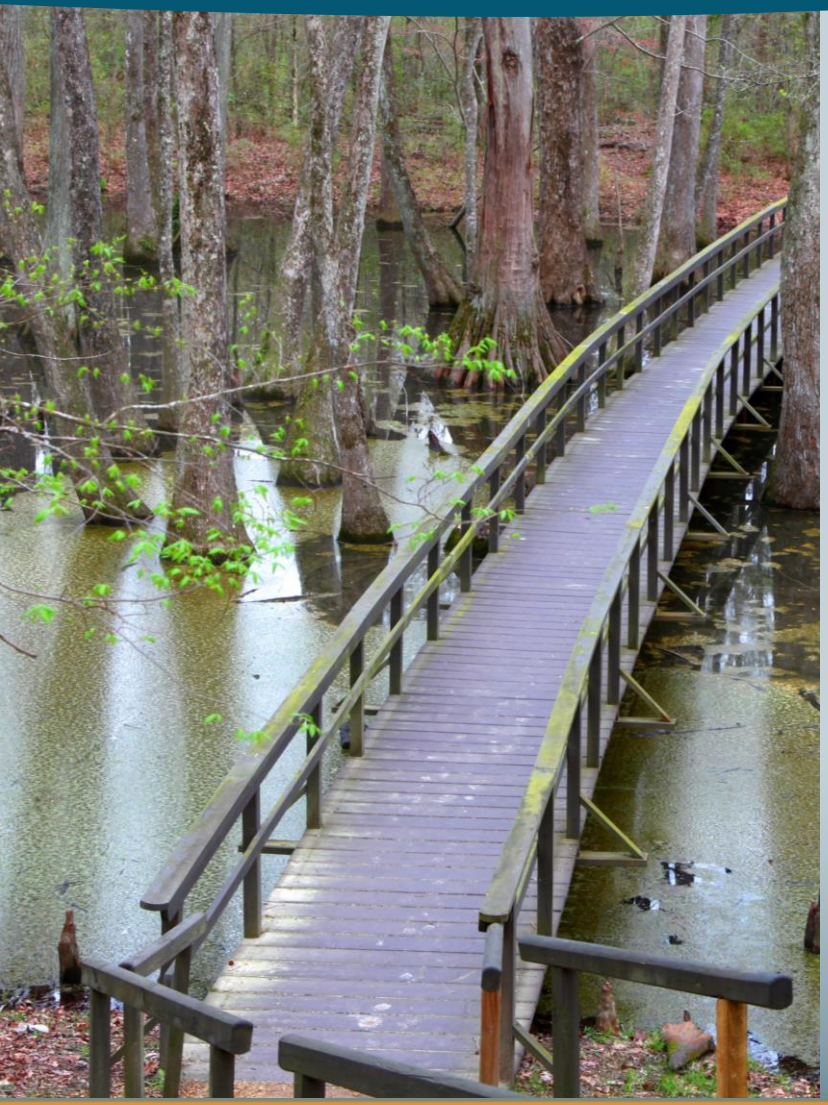
Develop Implementation Plan

Implement!

Participation Opportunities

- Attend meetings
- Share your knowledge
- Give us your feedback
- Help us coordinate with local efforts

Short Term Goals



- Refine technical information, receive your insight and feedback
- One-on-one meetings with stakeholders
- Final Watershed Characterization Report completed by summer 2020

This project is funded by the Texas Commission on Environmental Quality and facilitated locally by the Houston-Galveston Area Council.

Discussion and Questions

For more information, please contact:

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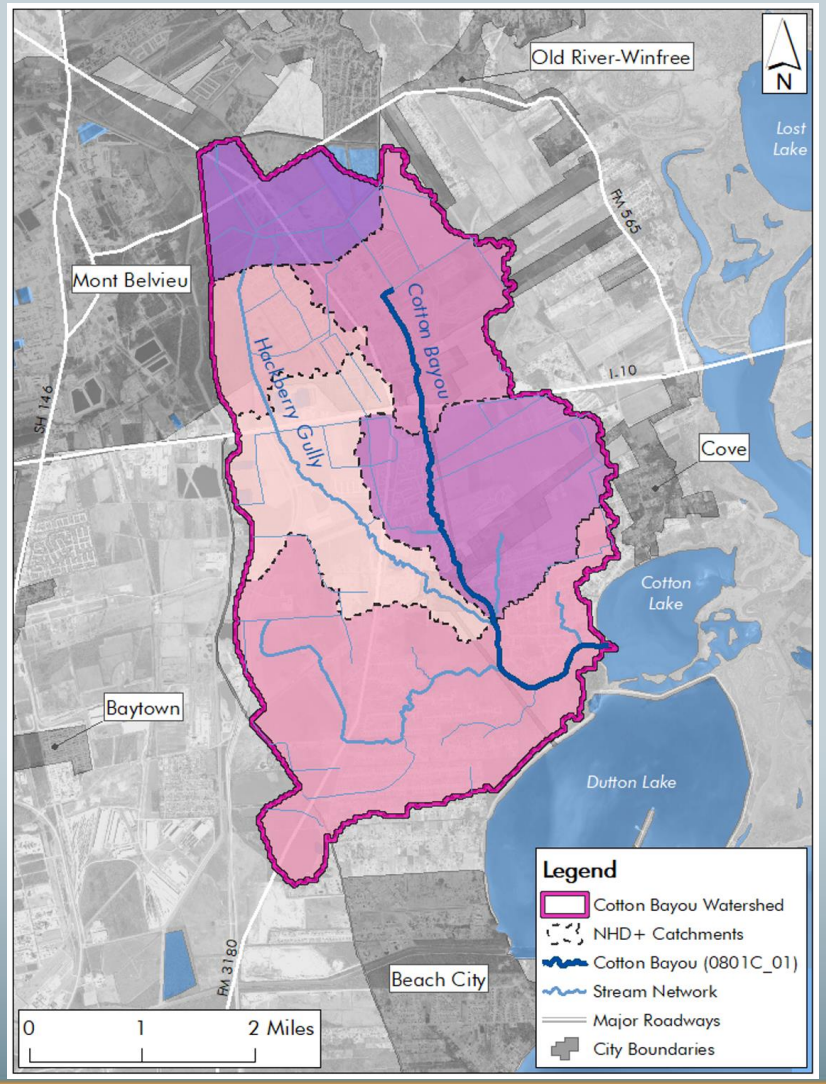
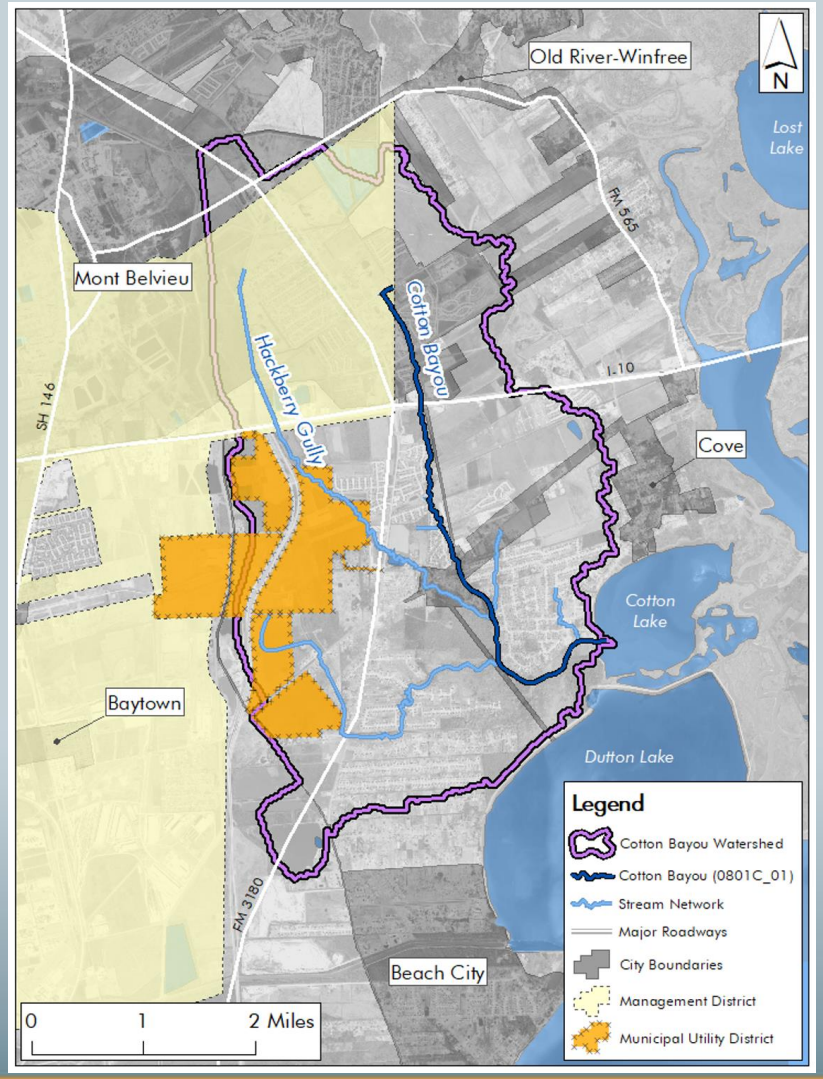
Supplemental
Slides

Watershed Delineation



Management Districts and MUDs



Water Quality

Station	Number of Enterococci Samples	Maximum Value (cfu/100 mL)	Geomean of All Samples (cfu/100 mL)	% in Violation
18696	42	24,000	247.5	90.5%
18697	47	24,192	105.9	63.8%

Station	Violations of Criteria/Screening Levels by Parameter (number and percent of total samples)			
	Nitrogen	Total Phosphorous	DO (grab, minimum)	DO (grab, screening level)
18696	42 (84.0%)	34 (75.6%)	6 (11.5%)	8 (15.4%)
18697	10 (19.2%)	3 (6.5%)	5 (8.6%)	12 (20.7%)