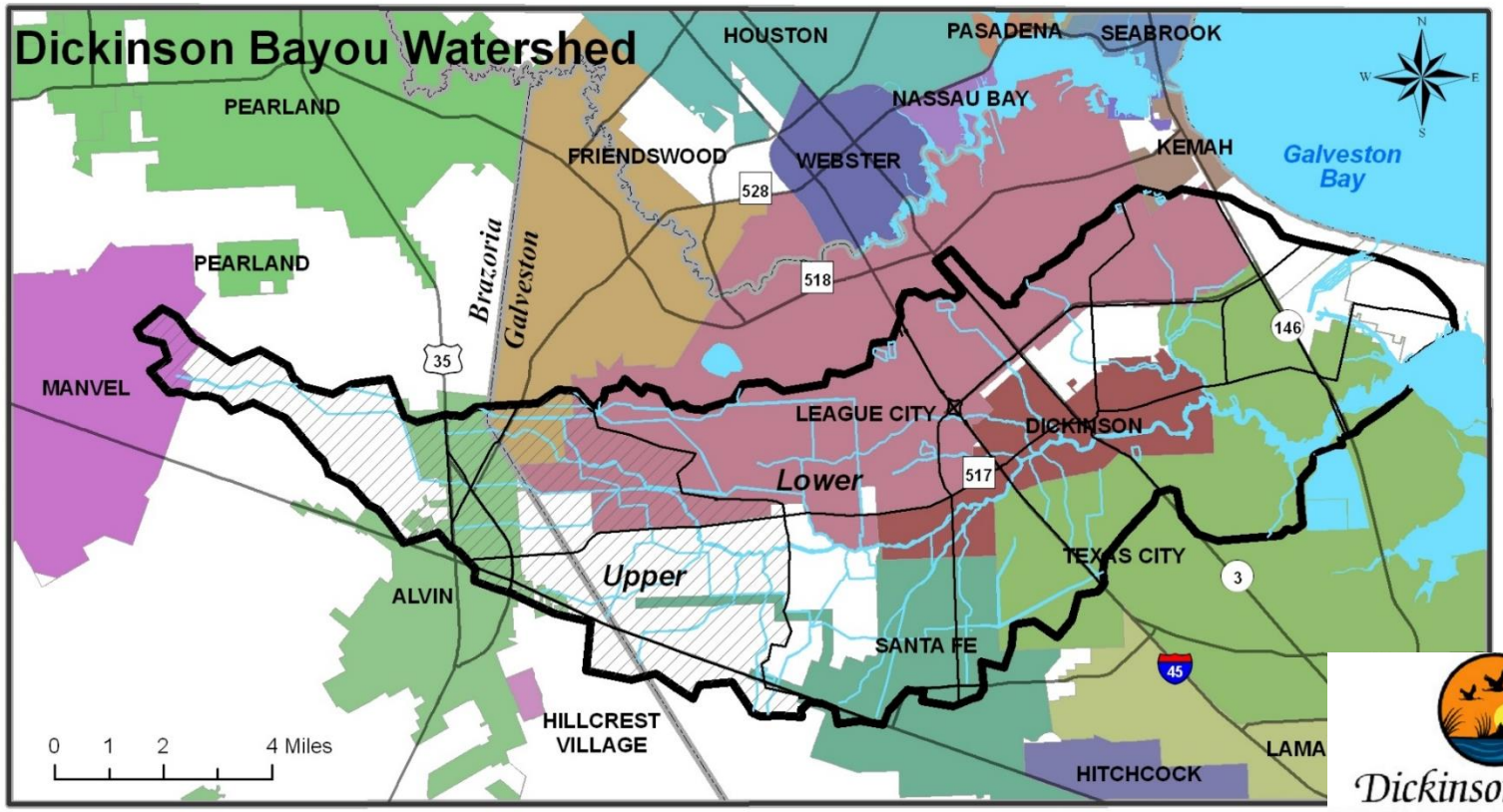
Dickinson Bayou Watershed Partnership Meeting

February 23, 2017



Dickinson Bayou
WATERSHED PARTNERSHIP

Agenda

Dickinson Bayou
WATERSHED PARTNERSHIP

- Update on the Dickinson Bayou Watershed Partnership
  - Addendum to Eight TMDLs for Indicator Bacteria in Dickinson Bayou
  - Bacteria TMDL Bridge Document
  - Bacteria Implementation Plan
- Galveston Bay Coalition of Watersheds
- Dickinson Bayou Bacteria Loadings and Reductions

Dickinson Bayou Watershed Partnership

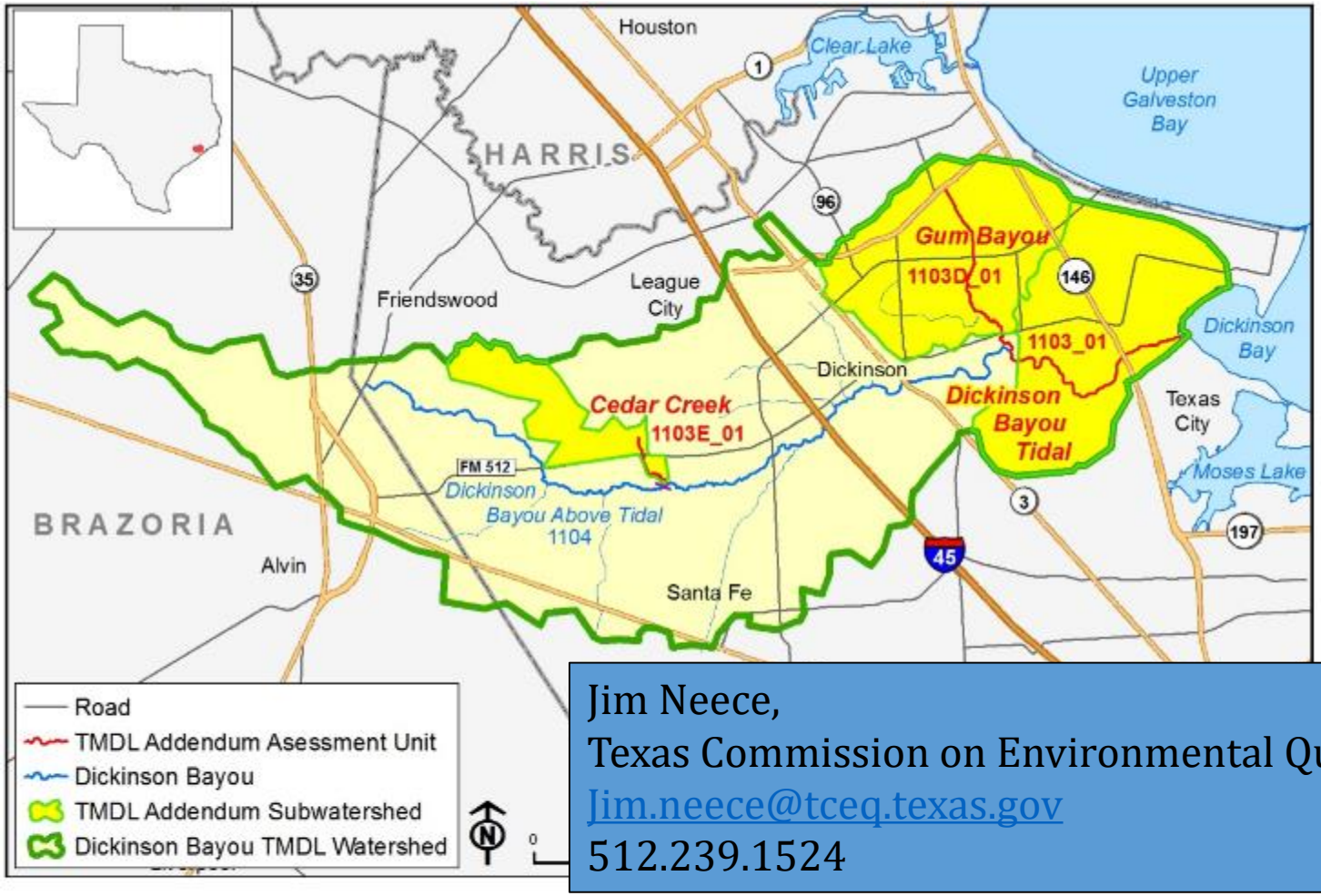
- Our website has moved: dickinsonbayou.net
- **TMDL Addendum**
- Bridge Document
- Bacteria Implementation Plan Overview

Addendum to Eight TMDLs for Indicator Bacteria in Dickinson Bayou and Tributaries

Addendum to Eight TMDLs for Indicator Bacteria in Dickinson Bayou and Tributaries

Table 1. Synopsis of Integrated Report for addendum water bodies in the subwatersheds of Dickinson Bayou

Water Body	Segment	AU	Parameter	Contact Recreation Use	Year First Impaired	Category
Dickinson Bayou Tidal	1103	1103_01	Enterococcus	Nonsupport	1996	5a
Gum Bayou	1103D	1103D_01	Enterococcus	Nonsupport	2010	5a
Cedar Creek	1103E	1103E_01	*E. coli*	Nonsupport	2010	5a



Jim Neece,
Texas Commission on Environmental Quality
Jim.neece@tceq.texas.gov
512.239.1524

Figure 1. Overview map showing the entire Dickinson Bayou watershed, along with the TMDL addendum subwatersheds, including AUs 1103_01 (Dickinson Bayou Tidal), 1103D_01 (Gum Bayou), and 1103E_01 (Cedar Creek)

Sources: Assessment Units (TCEQ, 2011), Watershed boundaries adapted from (TCEQ, 2012a)

Dickinson Bayou Watershed Partnership

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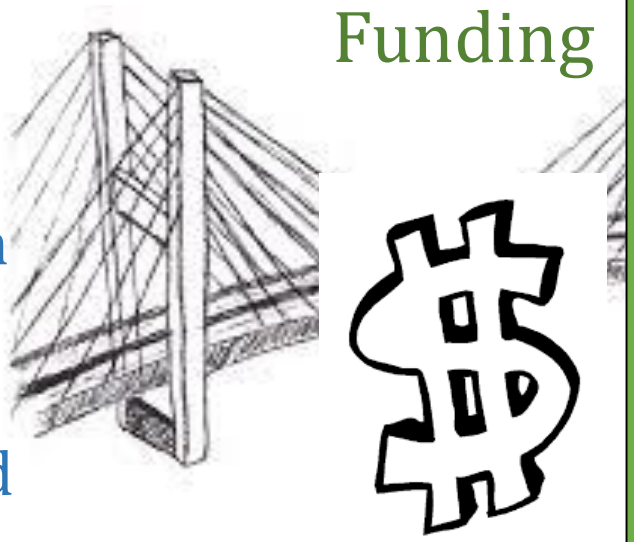
- **Bridge Document**
- Bacteria Implementation Plan Overview

Bacteria TMDL Bridge Document

Bacteria Implementation Plan

Draft Watershed Protection Plan



Funding

- About $7 million in EPA 319 Grant funds allocated to Texas annually
- "**Priority** is given to funding development and implementation of watershed protection plans and alternative watershed-based plans."
- Currently around 20 approved watershed plans in the State of Texas

Dickinson Bayou Watershed Partnership

- Our website has moved: dickinsonbayou.net
- TMDL Addendum
- Bridge Document
- **Bacteria Implementation Plan Overview**

Implementation Plan Overview

- Describes steps for TCEQ and watershed stakeholders to achieve bacteria load reductions
- Outlines a schedule for implementation
- Identifies responsible groups

Implementation Plan Overview

Control Actions (strategies required by permit or rule)

1. Implement stricter bacterial limits and enforcement measure for WWTF effluents
2. Increase compliance and enforcement by the TCEQ
3. Revise penalties and violations for SSSs and WWTFs
4. Improve reporting capabilities for SSOs

Implementation Plan Overview

Management Measures (voluntary actions)

1. Improve management of on-site sewage facilities
2. Improve wastewater treatment facilities
3. Promote participation in existing conservation and cost-share programs
4. Restore and repair riparian zones
5. Preserve and restore natural wetlands
6. Construct treatment wetlands
7. Provide demonstrations of and encourage installation of stormwater best management practices

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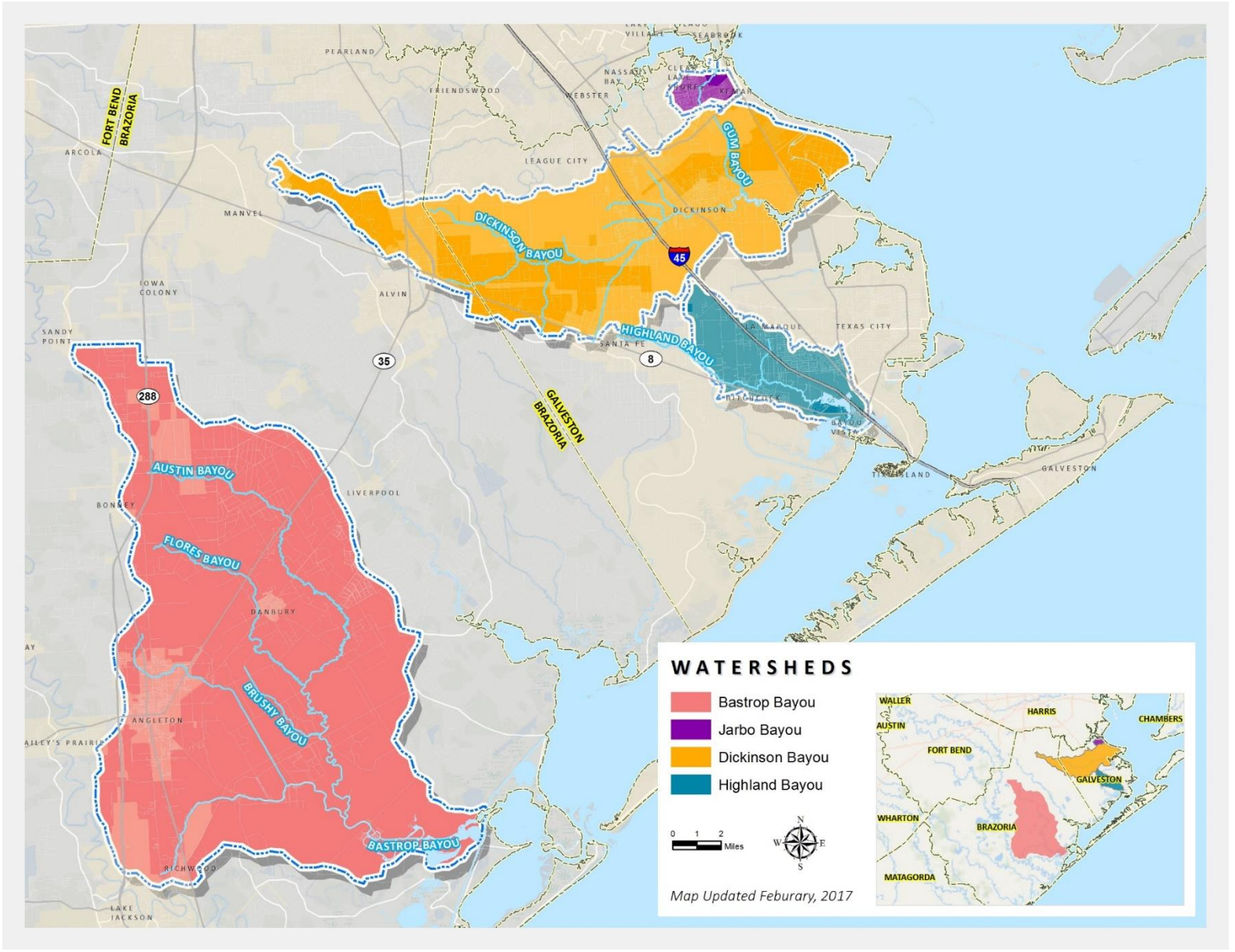
Galveston Bay Coalition of Watersheds



Galveston Bay Coalition of Watersheds

- Steering committee
- Focus on:
  - Building partnerships
  - Implementing plans
  - Combining resources
- First meeting this spring

Agenda

Dickinson Bayou
WATERSHED PARTNERSHIP

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TCEQ TMDL Program Basin Focus Approach

Dr. Larry Hauck and Stephanie Painter,
Texas Institute of Applied Natural Resources (TIAER),
at Tarleton State University

Upcoming Events

Trash Bash

Saturday March 25, 2017

Hwy 3 Boat Ramp

8:00 am - 8:30 am, Registration

9:00 am –Noon, Cleanup

Noon -1:00 pm Lunch, door prizes, activities

Galveston County Household Hazardous Waste Day

Saturday April 8, 2017

Dickinson Bayou Marsh Mania Planting

Saturday April 22, 2017

Contact Jan Culbertson to volunteer

Jan.Culbertson@tpwd.texas.gov

Dickinson Bayou
WATERSHED PARTNERSHIP

Find us online!

dickinsonbayou.net

Facebook.com/
dickinsonbayouwatershedpartnership

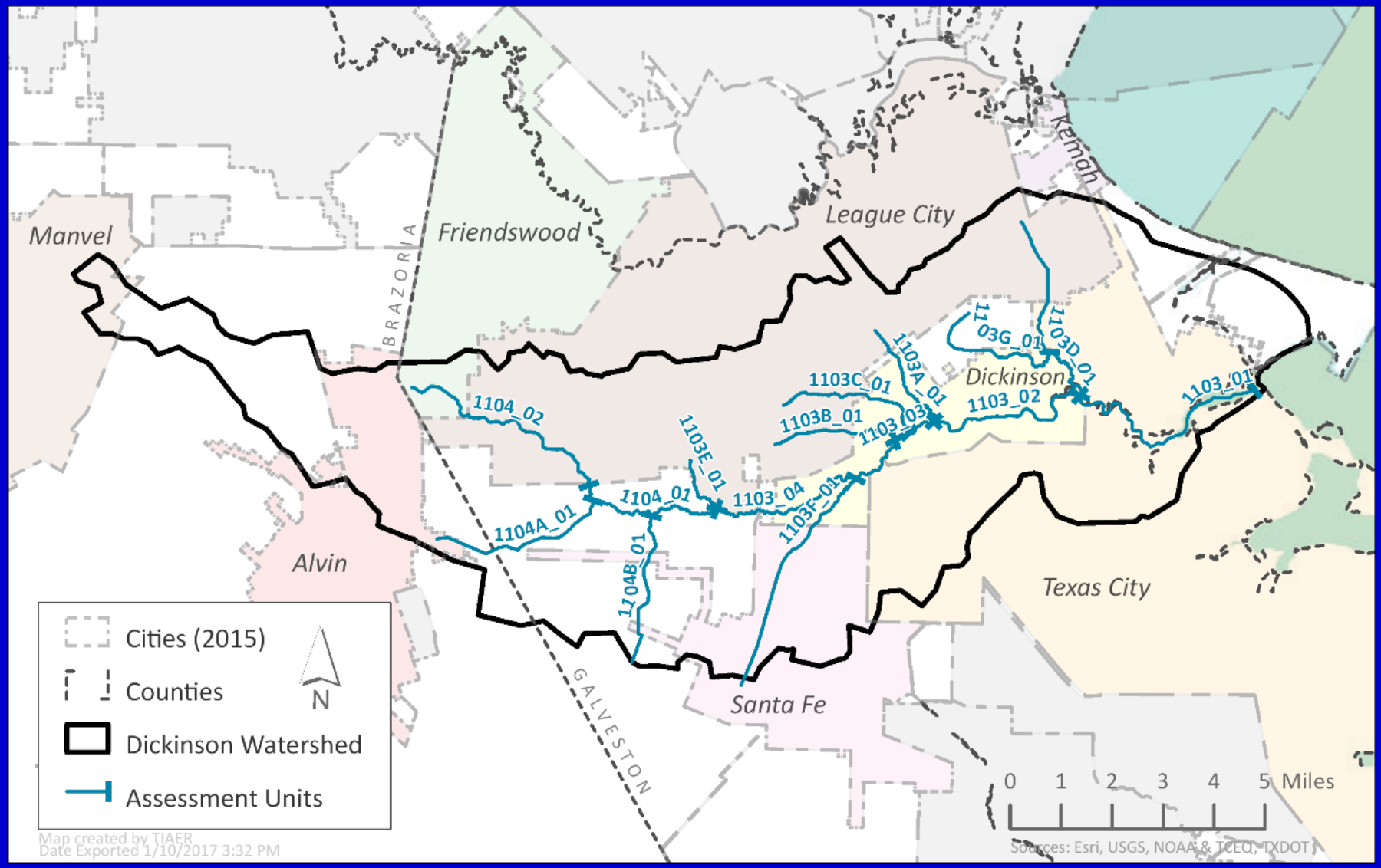
Dickinson Bayou Watershed: Computations of Bacteria Loadings and Reductions

Larry Hauck
Stephanie Painter

Texas Institute for Applied Environmental Research (TIAER)
Tarleton State University
Stephenville, Texas

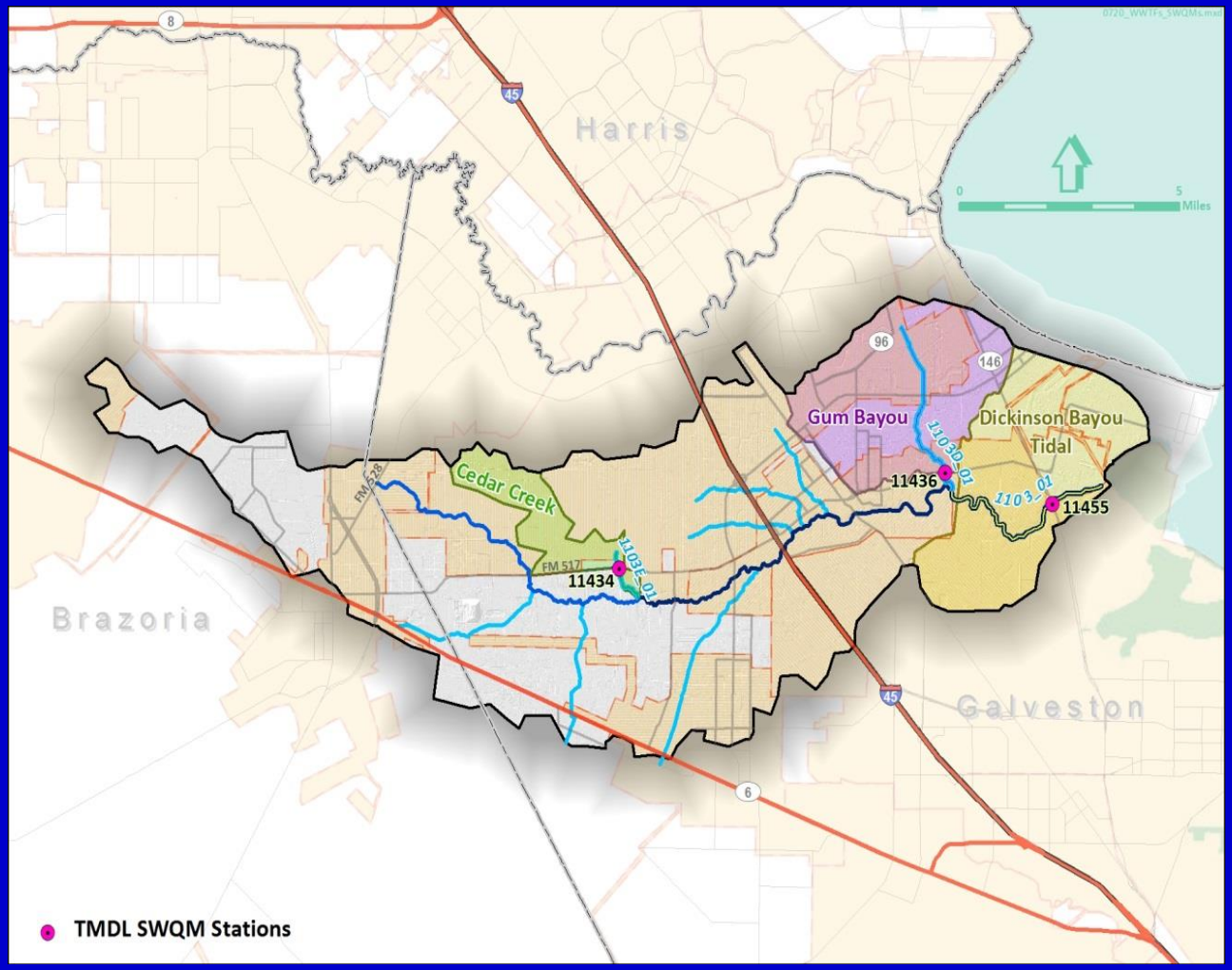
February 23, 2017

Dickinson Bayou Watershed



TMDL Addendum

TCEQ July 2016 Water Quality Management Plan: Added lowermost AU of Dickinson Bayou, Gum Bayou and Cedar Creek



TIAER's Role in Developing a "Bridge" Document

Project Goal 2: Complete modeling and load reductions to support the Bridge Document and assist in completing Elements A, B and C of the EPA Guidelines for Watershed-Based Plans

Definitions of First 3 Elements of the 9 Elements Required in a WBP

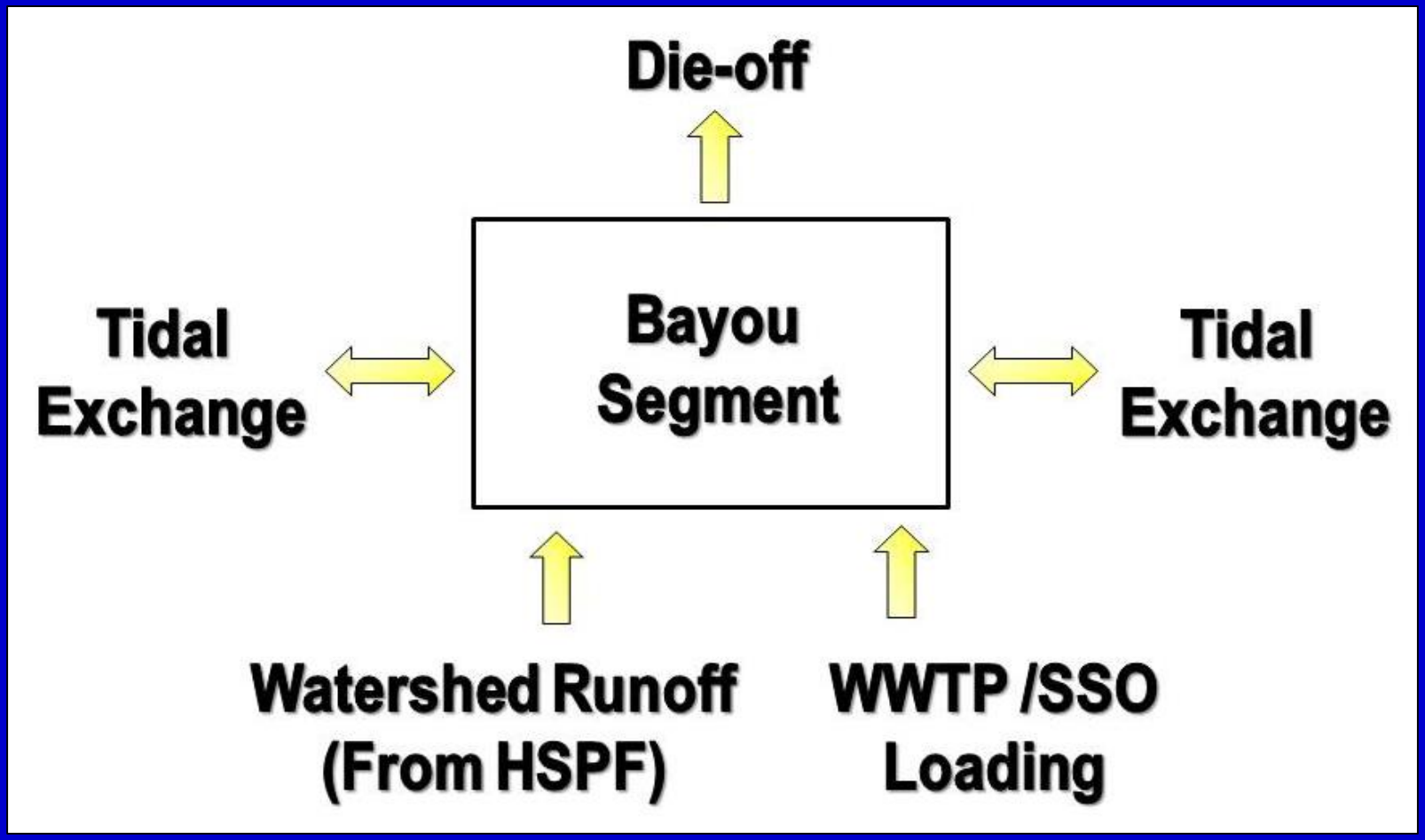
A. Identify causes and sources of pollution
B. Estimate pollutant loading into the watershed and the expected load reductions
C. Describe the management measures that will achieve the load reductions and targeted critical areas

Sources of Information

- Element A (Sources) from I-Plan
- Element B (Pollutant Loadings & Reductions) from TMDL and Addendum to TMDL
- Element C (Management Measures) from I-Plan

Element B Original Approach: Apply Modeling System

[Conceptual TIDAL PRISM MODEL Used in TMDL Development with HSPF]



Element B Final Approach: Develop and Apply Flow Duration Curves and Load Duration Curves

- FDCs/LDCs used for ABOVE TIDAL water bodies in the Dickinson Bayou Watershed TMDLs
- Methods widely accepted by EPA and Texas for development of bacteria WBPs
- Modification of FDCs/LDCs for tidal streams pioneered by State of Oregon for TMDL development.
- TMDLs adopted by TCEQ and approved by EPA in 2016 for Tidal segments of Mission & Aransas Rivers used Modified FDCs/LDCs

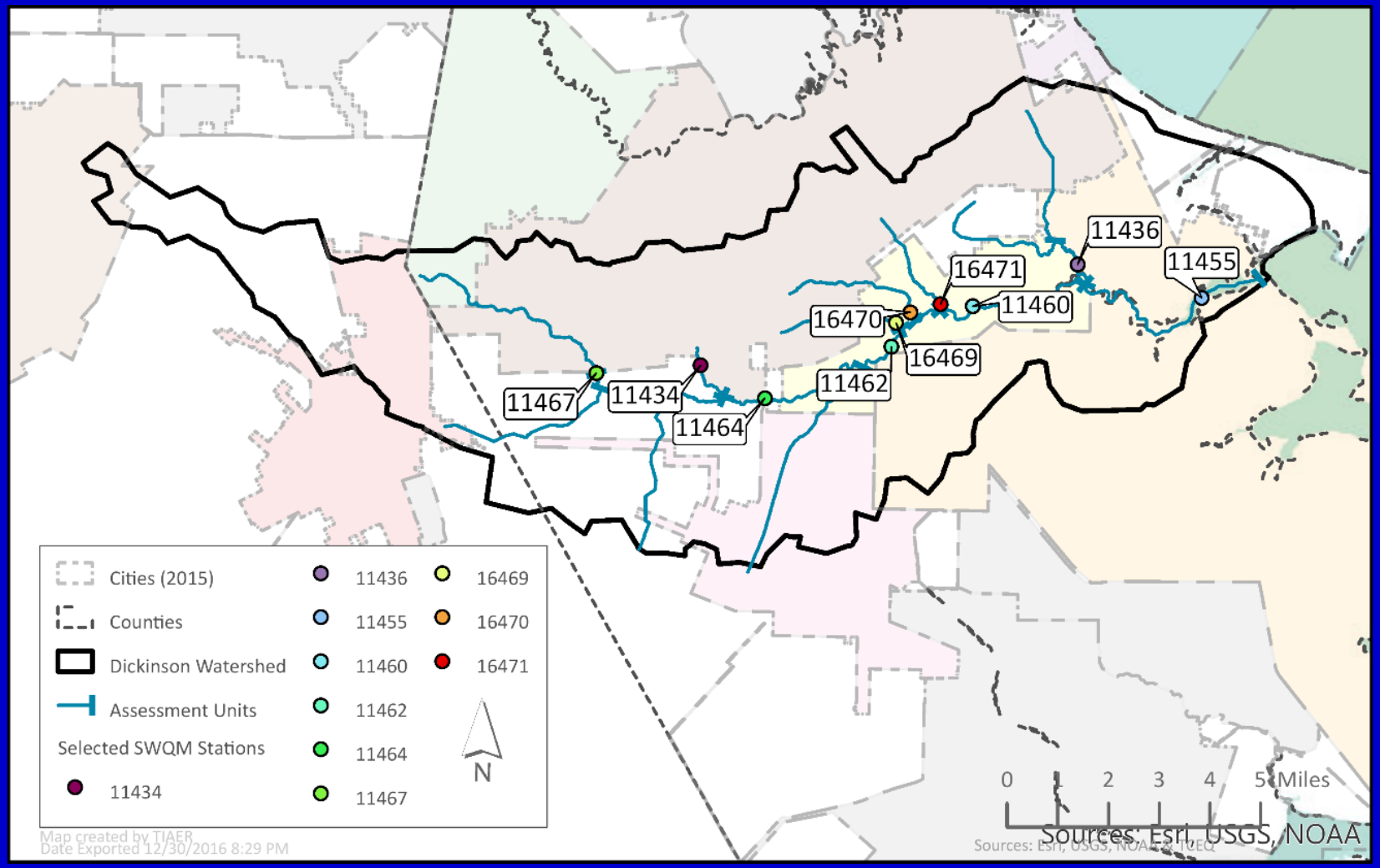
Modified FDC/LDC

- Accounts for dilution of river water with seawater, increasing the loading capacity.
- Computations based on empirical relationship to estimate dilution using relationship of salinity to streamflow.

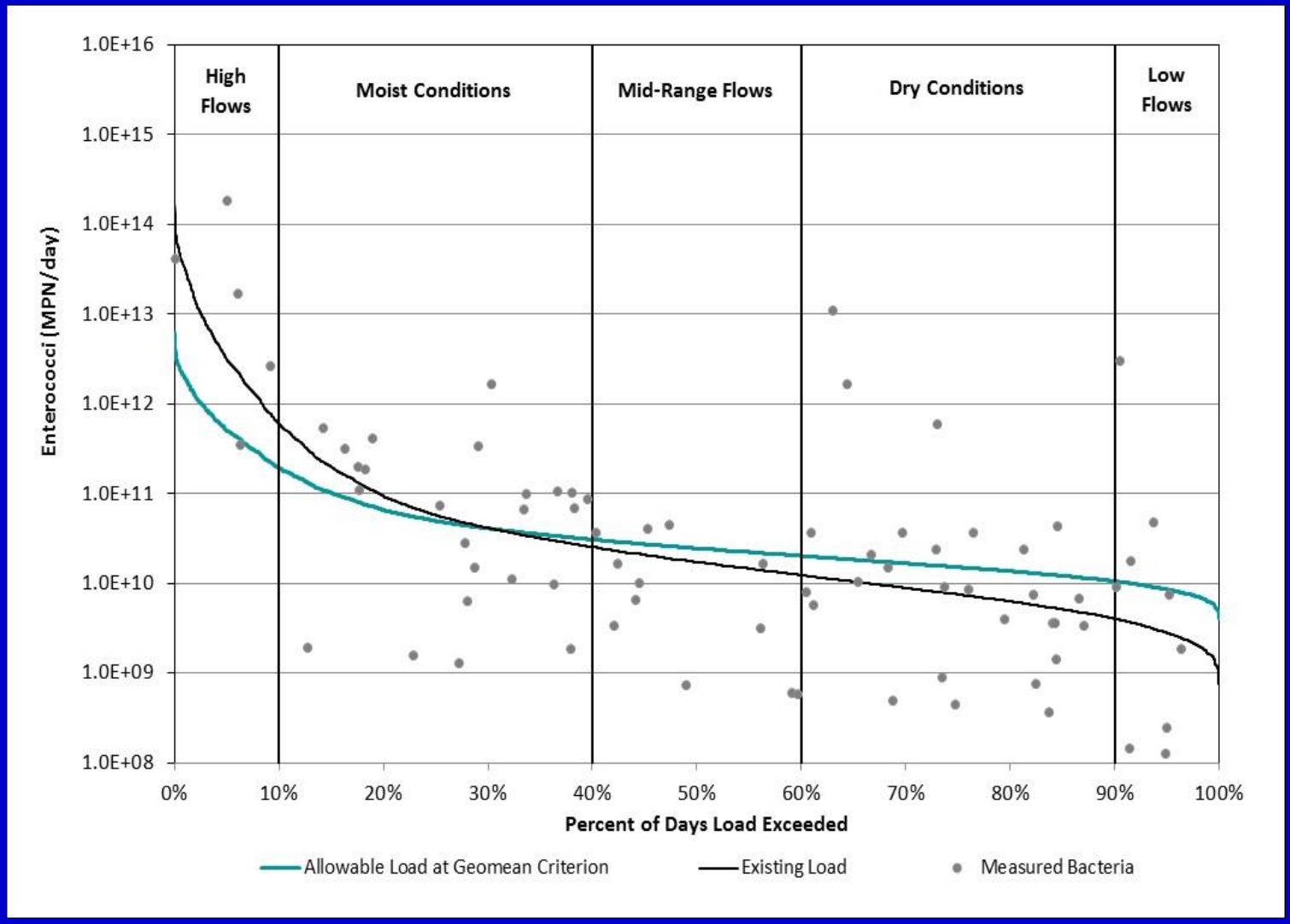
Stations and Water Bodies for FDC/LDC Development

Station	Water Body and Stream Condition	AU	Indicator Bacteria	LDC Method
11455	Dickinson Bayou Tidal (Tidal Stream)	1103_01	Enterococci	Modified
11460	Dickinson Bayou Tidal (Tidal Stream)	1103_02	Enterococci	Modified
11462	Dickinson Bayou Tidal (Tidal Stream)	1103_03	Enterococci	Modified
11464	Dickinson Bayou Tidal (Tidal Stream)	1103_04	Enterococci	Modified
16471	Bensons Bayou (Tidal Stream)	1103A_01	Enterococci	Modified
16469	Bordens Gully (Tidal Stream)	1103B_01	Enterococci	Modified
16470	Geisler Bayou (Tidal Stream)	1103C_01	Enterococci	Modified
11436	Gum Bayou (Tidal Stream)	1103D_01	Enterococci	Modified
11434	Cedar Creek (Freshwater Stream)	1103E_02	*E. coli*	Standard
11467	Dickinson Bayou Above Tidal (Freshwater Stream)	1104_03	*E. coli*	Standard

Dickinson Bayou watershed showing stations selected for development of FDCs/LDCs



Example: Modified LDC
Monitoring Station 11455
Dickinson Bayou Tidal, AU 1103_01



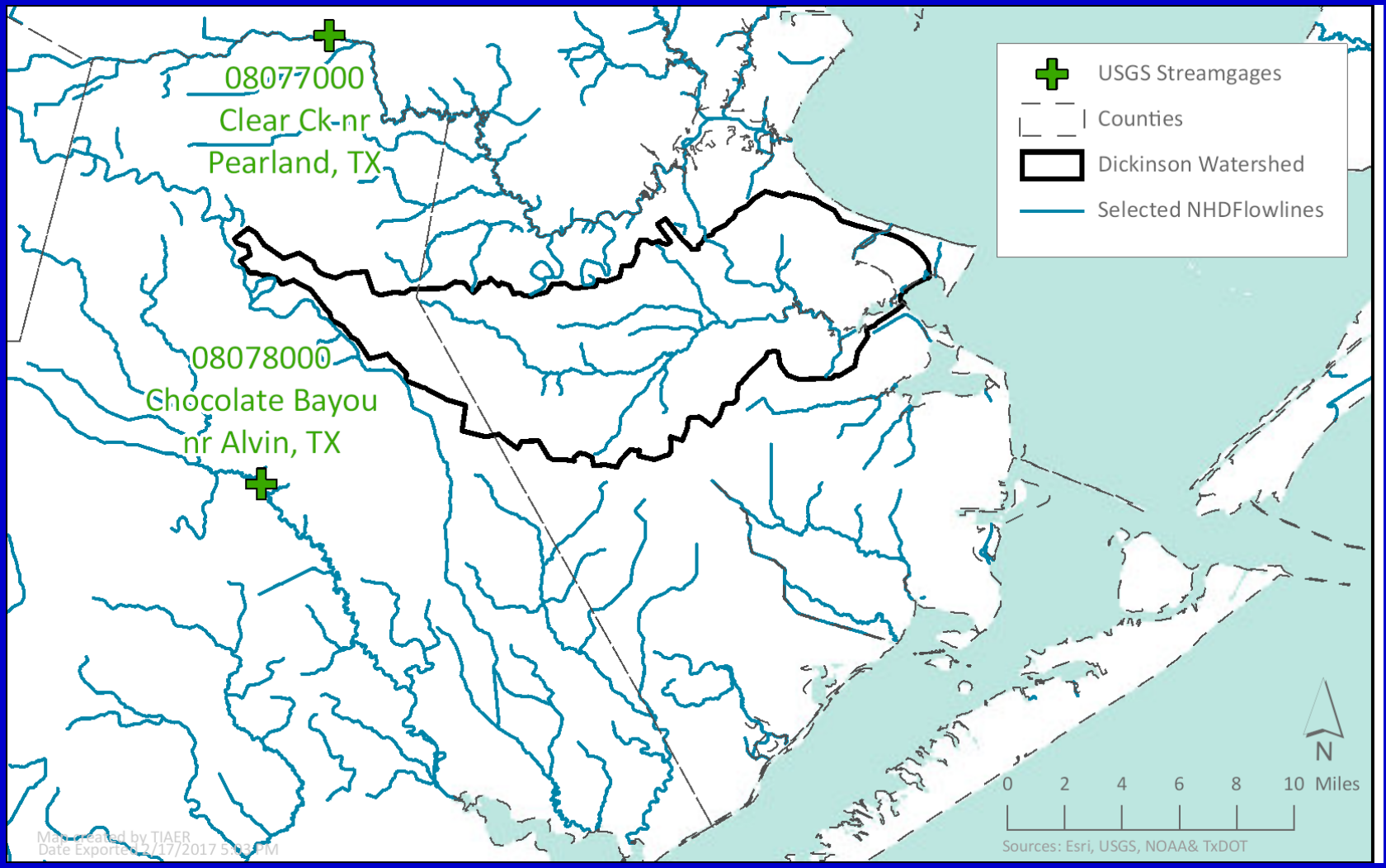
Development of a Bacteria Load Duration Curve Approach Requires

- streamflow data,
- bacteria (Enterococci & *E. coli*) data,
- salinity data (for Modified Approach)
- the relevant bacteria criterion.

Steps to Develop FDCs/LDCs for each selected station

1. Calculate daily freshwater using drainage area ratio approach & develop **freshwater** FDCs
2. Develop salinity to streamflow regression (for each tidal station)
3. Develop FDCs including **seawater** contribution (for each tidal station)
4. Develop LDCs (allowed loadings)
5. Estimate existing loading from measured bacteria data

STREAMFLOW DATA SOURCE: Project Area Showing Streamflow Gauging Stations



First Step:

Develop a daily streamflow record (typically 10 to 20 years of data)

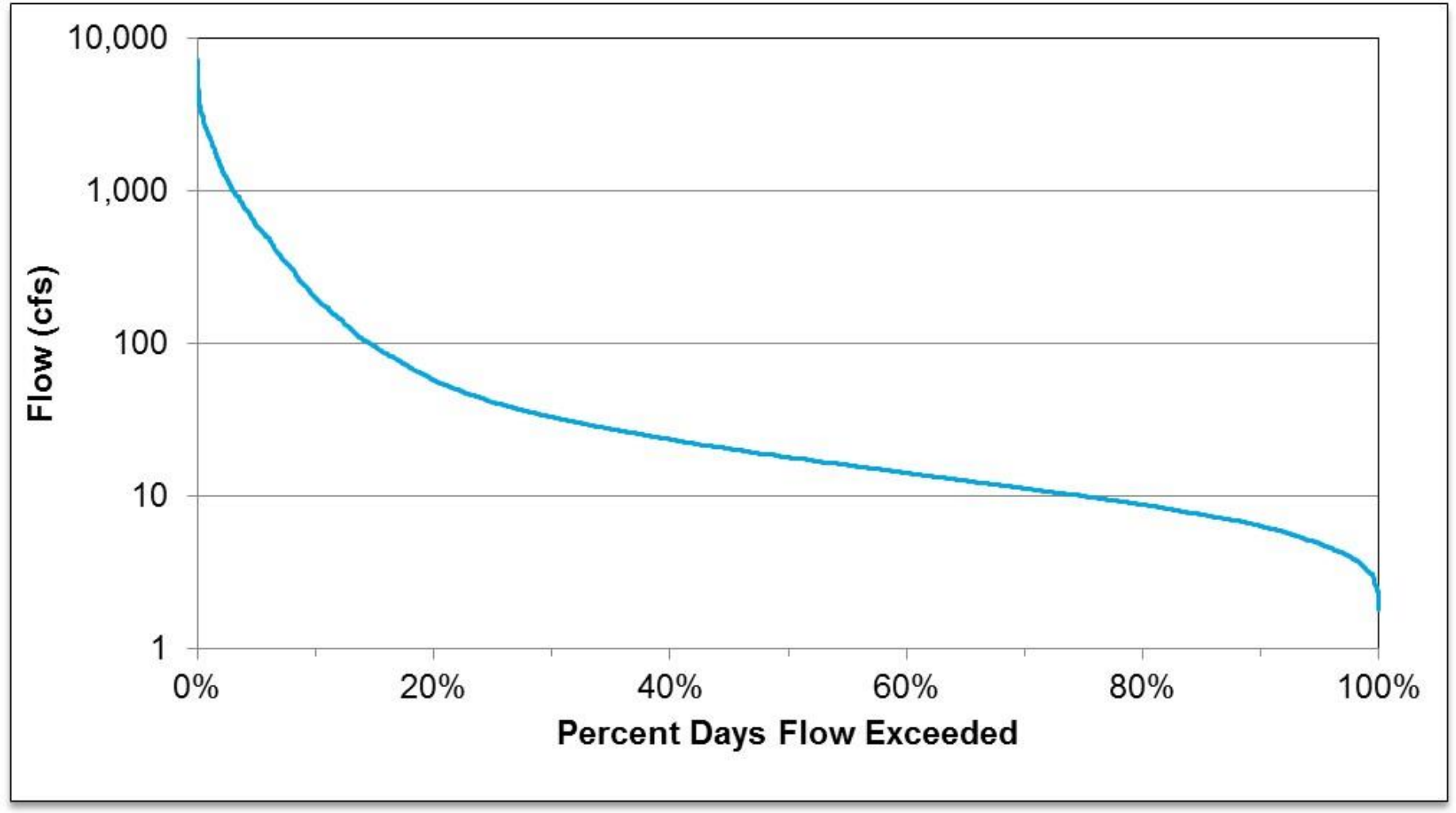
- Selected 20-year period: 1/1/1996 – 12/31/2015
- Use U.S. Geological Survey gage 08078000 (Chocolate Bay near Alvin, TX) streamflow data and drainage area ratio.
- Daily record of streamflow data ranked highest to lowest to give a flow duration curve.

DARs for locations within the Adams and Cow Bayou watersheds.

AU	Gauge/Station No.	Stream Location	Location Drainage Area (sq. mi.)	Drainage Area Ratio (DAR)
–	USGS 08031000	Chocolate Bayou	84.03	–
1103_01	11455	Dickinson Bayou Tidal	99.41	1.183
1103_02	11460	Dickinson Bayou Tidal	75.39	0.897
1103_03	11462	Dickinson Bayou Tidal	49.95	0.595
1103_04	11464	Dickinson Bayou Tidal	39.98	0.476
1103A_01	16471	Bensons Bayou	6.06	0.072
1103B_01	16469	Bordens Gully	3.15	0.037
1103C_01	16470	Geisler Bayou	8.09	0.096
1103D_01	11436	Gum Bayou	12.42	0.148
1103E_02	11434	Cedar Creek	4.54	0.054
1104_03	11467	Dickinson Bayou Above Tidal	20.63	0.246

Example Streamflow Computations for FDC (9-day record of daily USGS gauged flows)

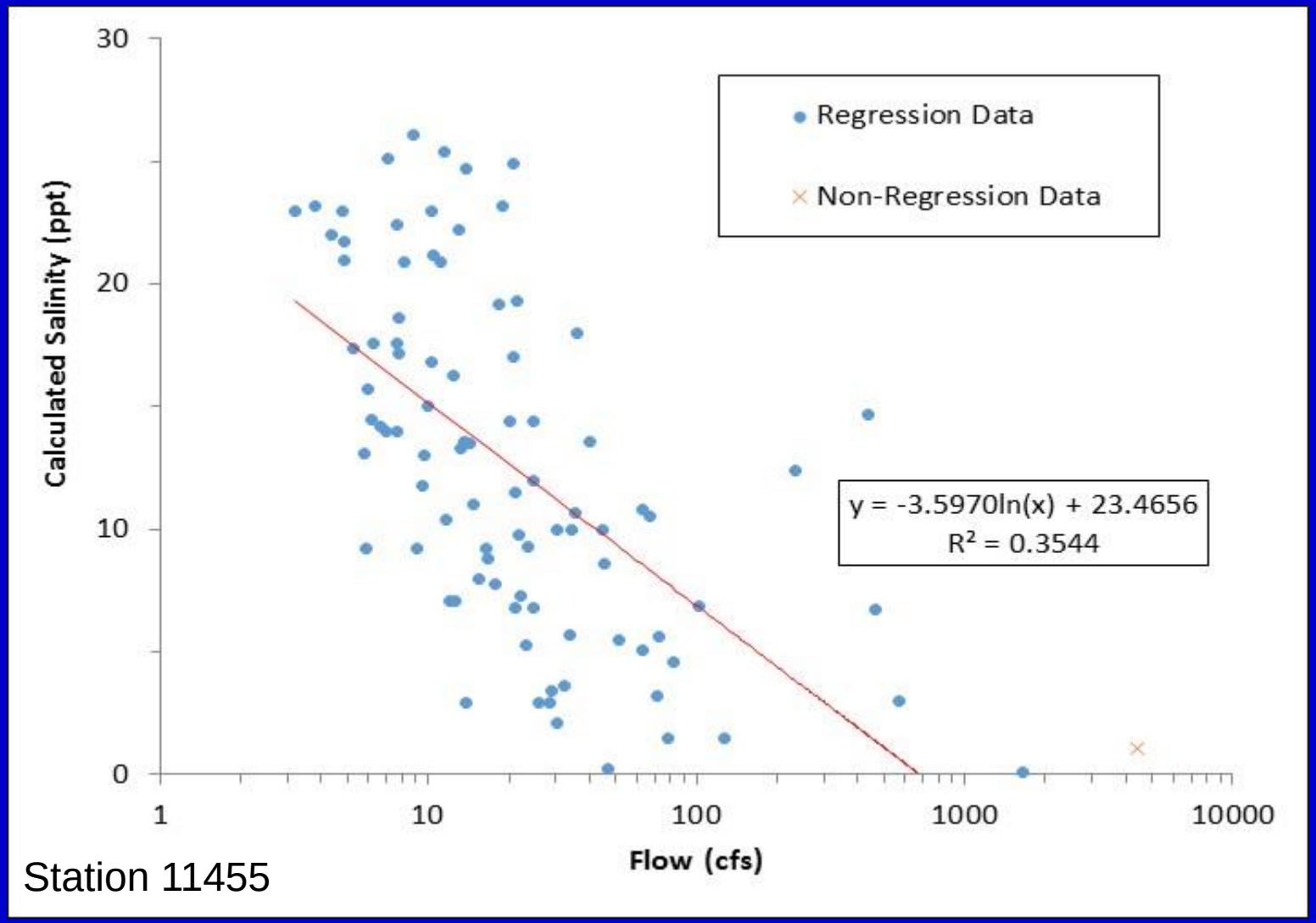
Original Data		Sorted Streamflow		DAR = 2.0	Rank	% Days Flow Exceeded
Date	Flow (cfs)	Date	Flow (cfs)	Flow (cfs)		
1/6/1998	31	1/13/1998	167	334	1	10%
1/7/1998	37	1/12/1998	136	271	2	20%
1/8/1998	121	1/8/1998	121	241	3	30%
1/9/1998	83	1/9/1998	83	166	4	40%
1/10/1998	54	1/10/1998	54	109	5	50%
1/11/1998	39	1/11/1998	39	79	6	60%
1/12/1998	136	1/7/1998	37	74	7	70%
1/13/1998	167	1/14/1998	33	66	8	80%
1/14/1998	33	1/6/1998	31	61	9	90%



Flow Duration Curve for Freshwater
Dickinson Bayou Tidal Station 11455
(1/01/1996 – 12/31/2015)

Second Step:

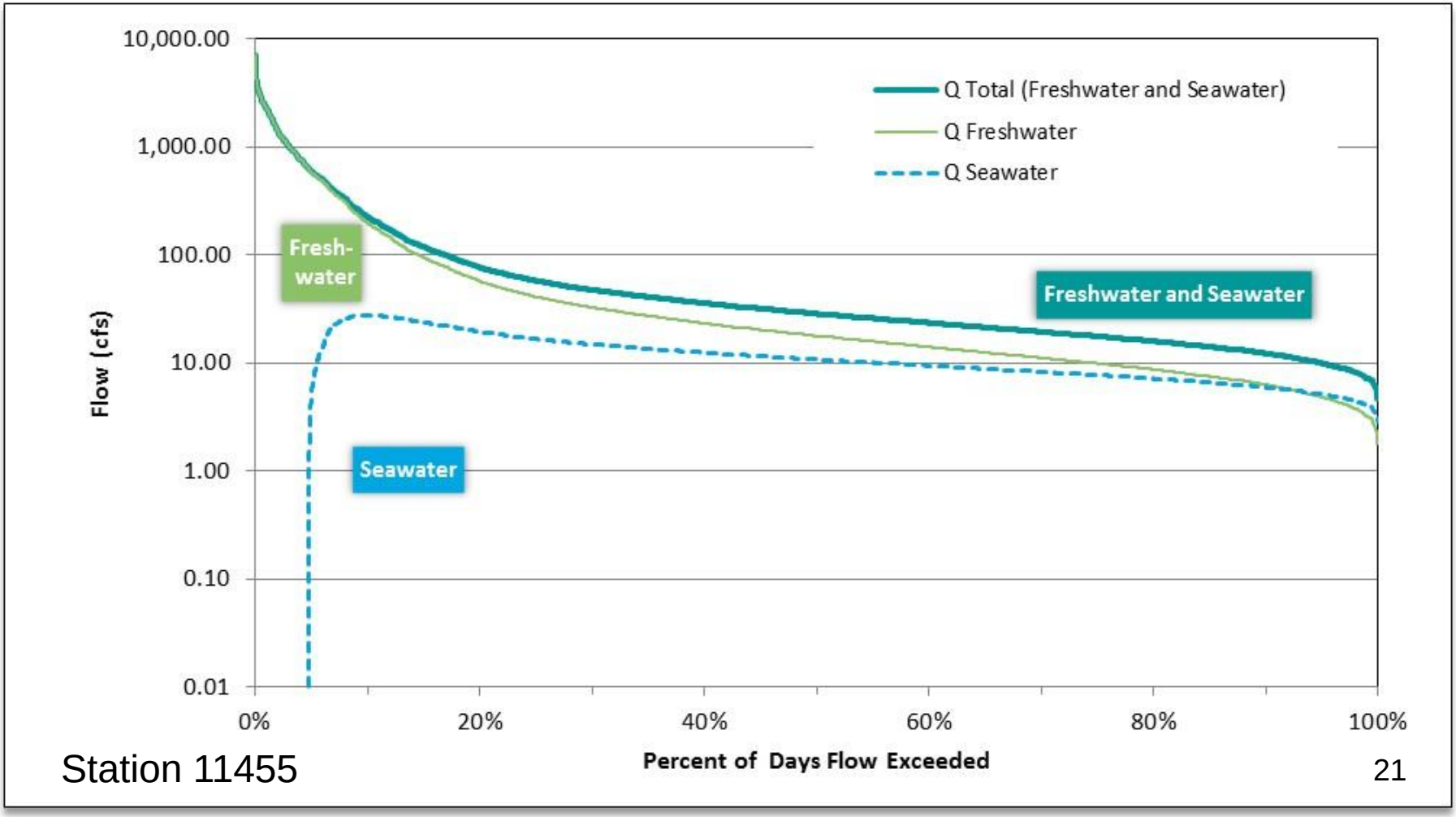
Develop relationship of measured surface salinities to streamflows from FDCs



Station 11455

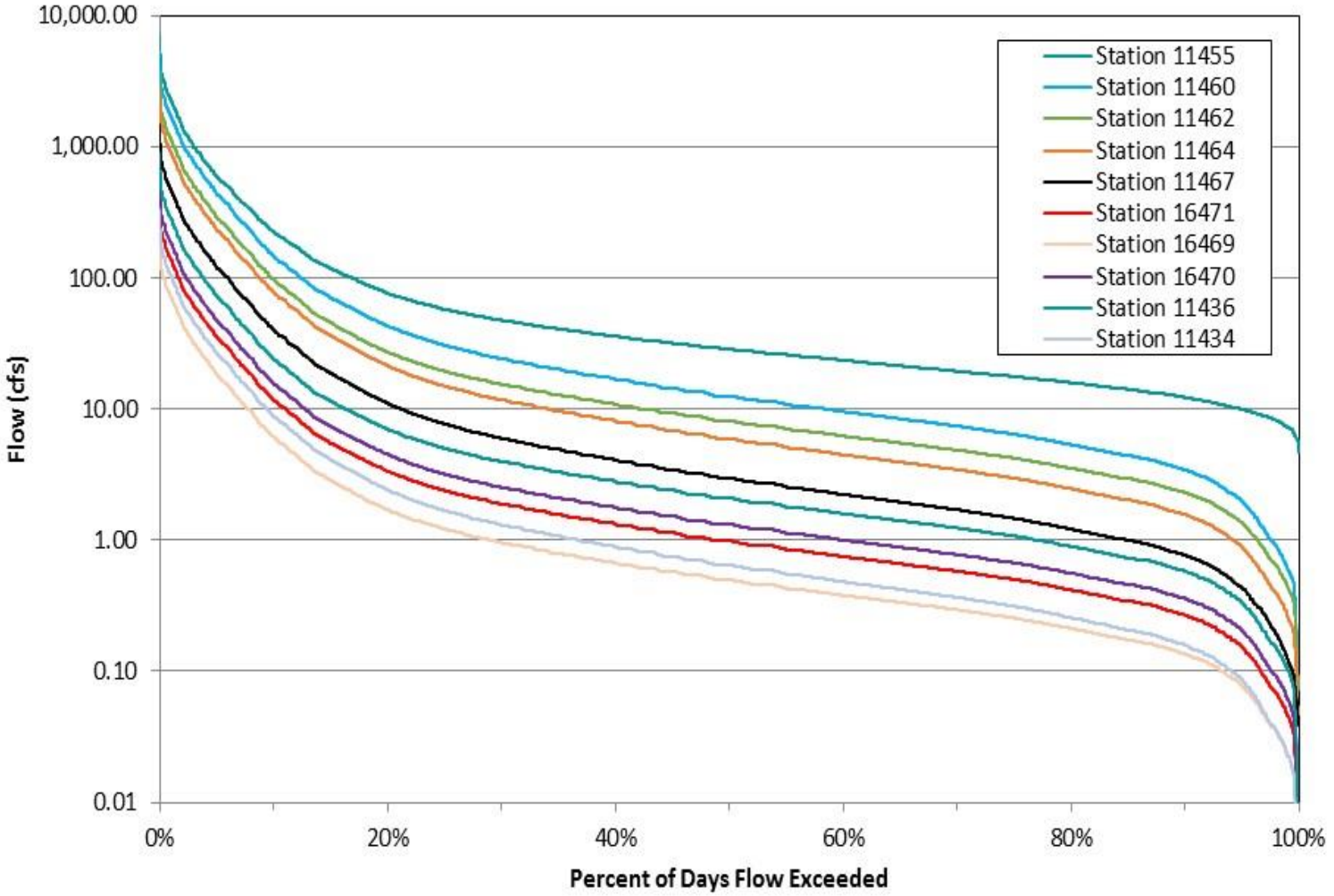
Third Step:

Flow Duration Curve with seawater contribution



Station 11455

Third Step: Flow Duration Curves for ALL stations

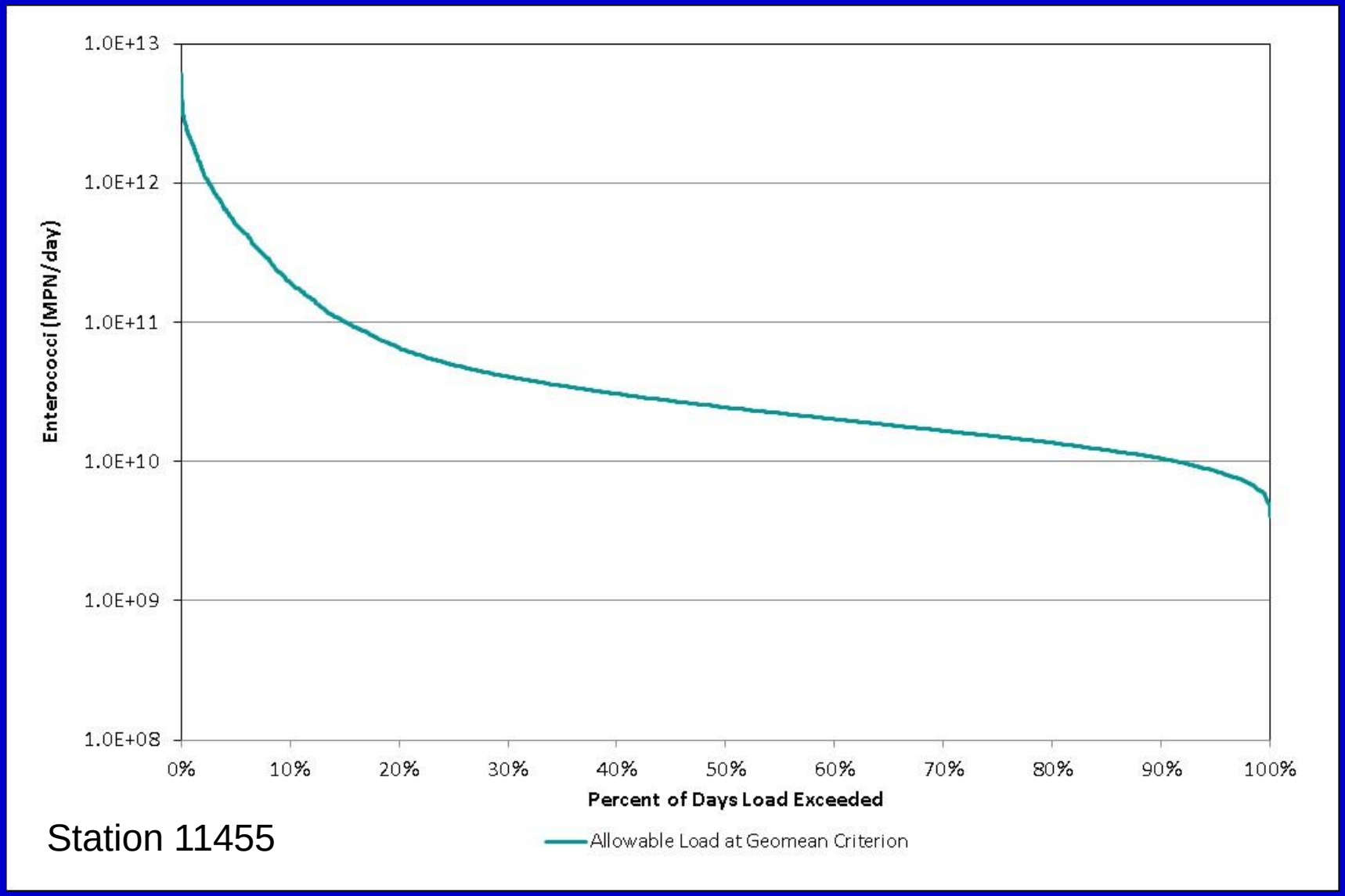


Fourth Step:

The existing Enterococci (or *E. coli*) criterion is multiplied by the flow on each day and the appropriate conversion factor to give units of MPN/day.

- Tidal geometric mean criterion = 35 MPN/100 mL of Enterococci
- Freshwater geometric mean criterion = 126 MPN/100 mL of *E. coli*

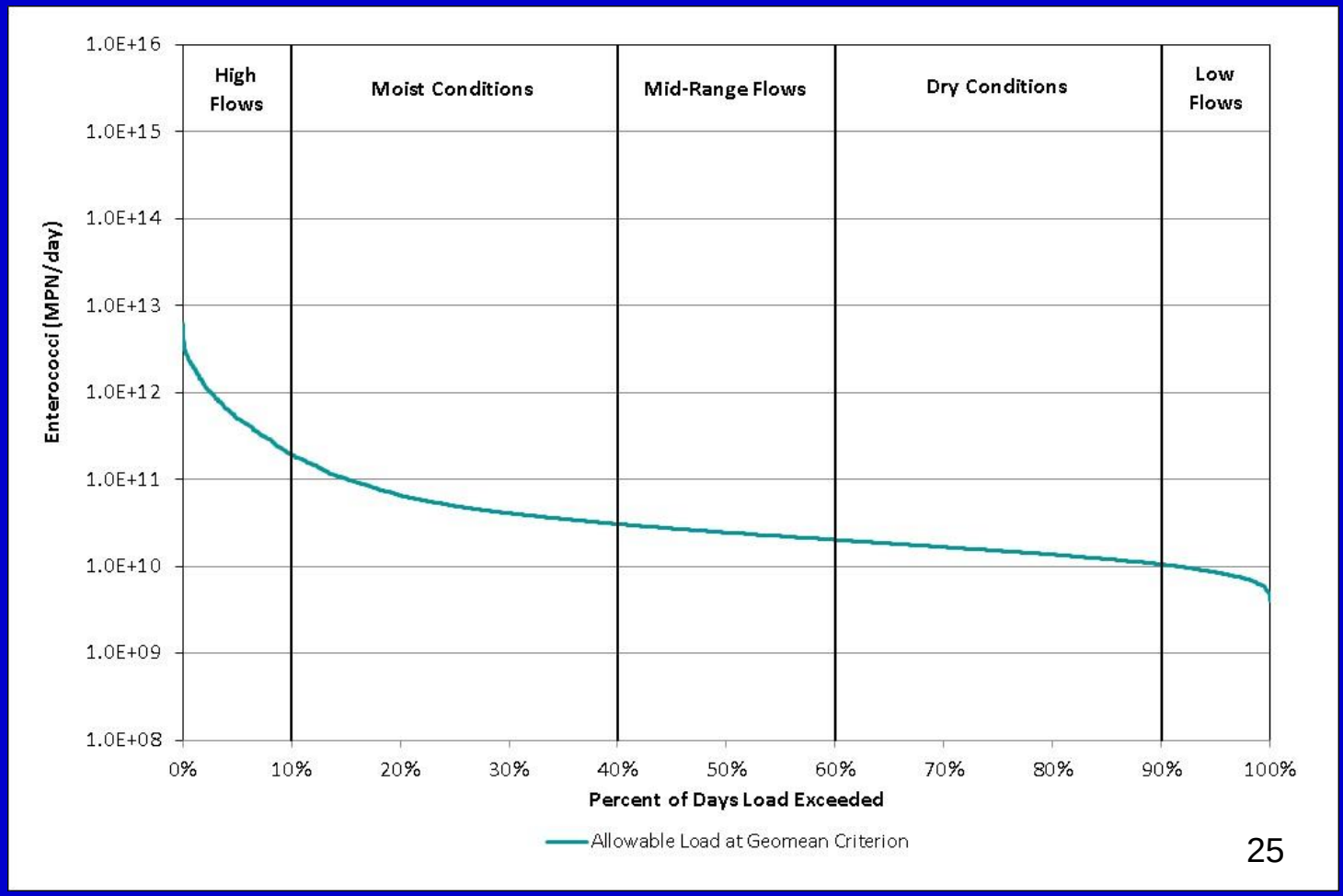
Primary contact recreation use protective criteria

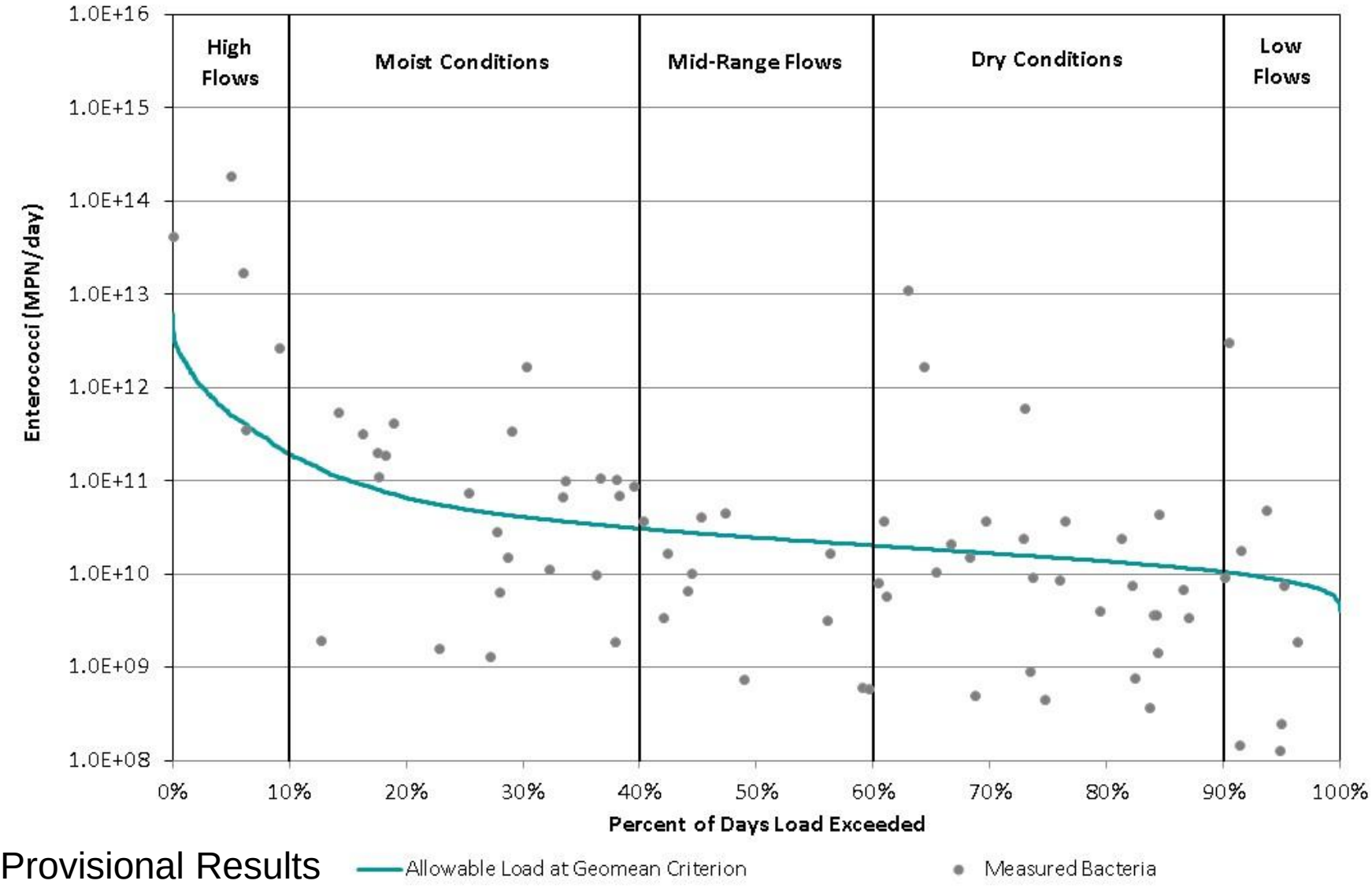


Load duration curve for Dickinson Bayou Tidal Station 11455

Add Flow Regimes:

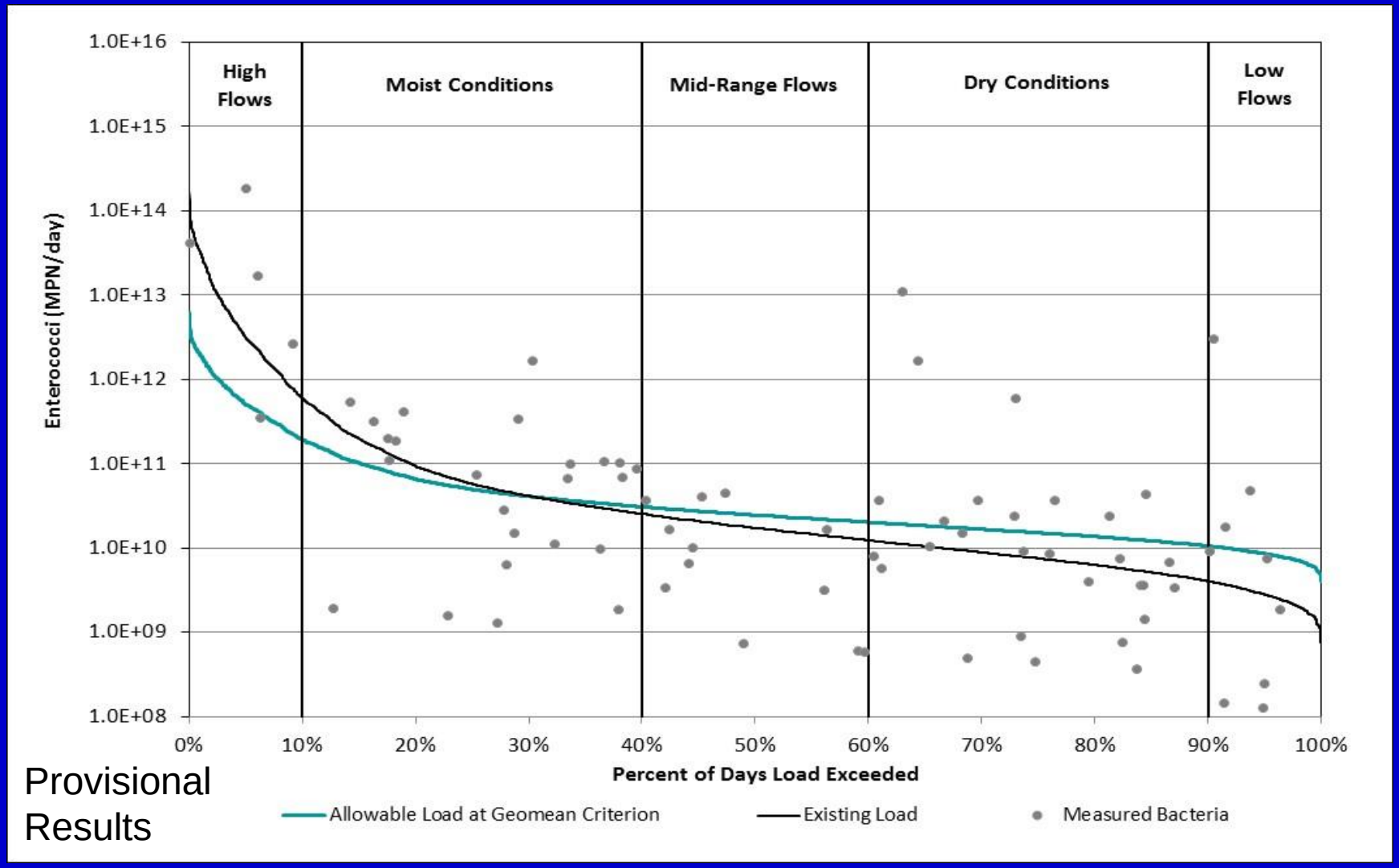
High Flows	(0 – 10%)
Moist Conditions	(10 – 40%)
Mid-Range Flows	(40 – 60%)
Dry Conditions	(60 – 90%)
Low Flows	(90 – 100%)





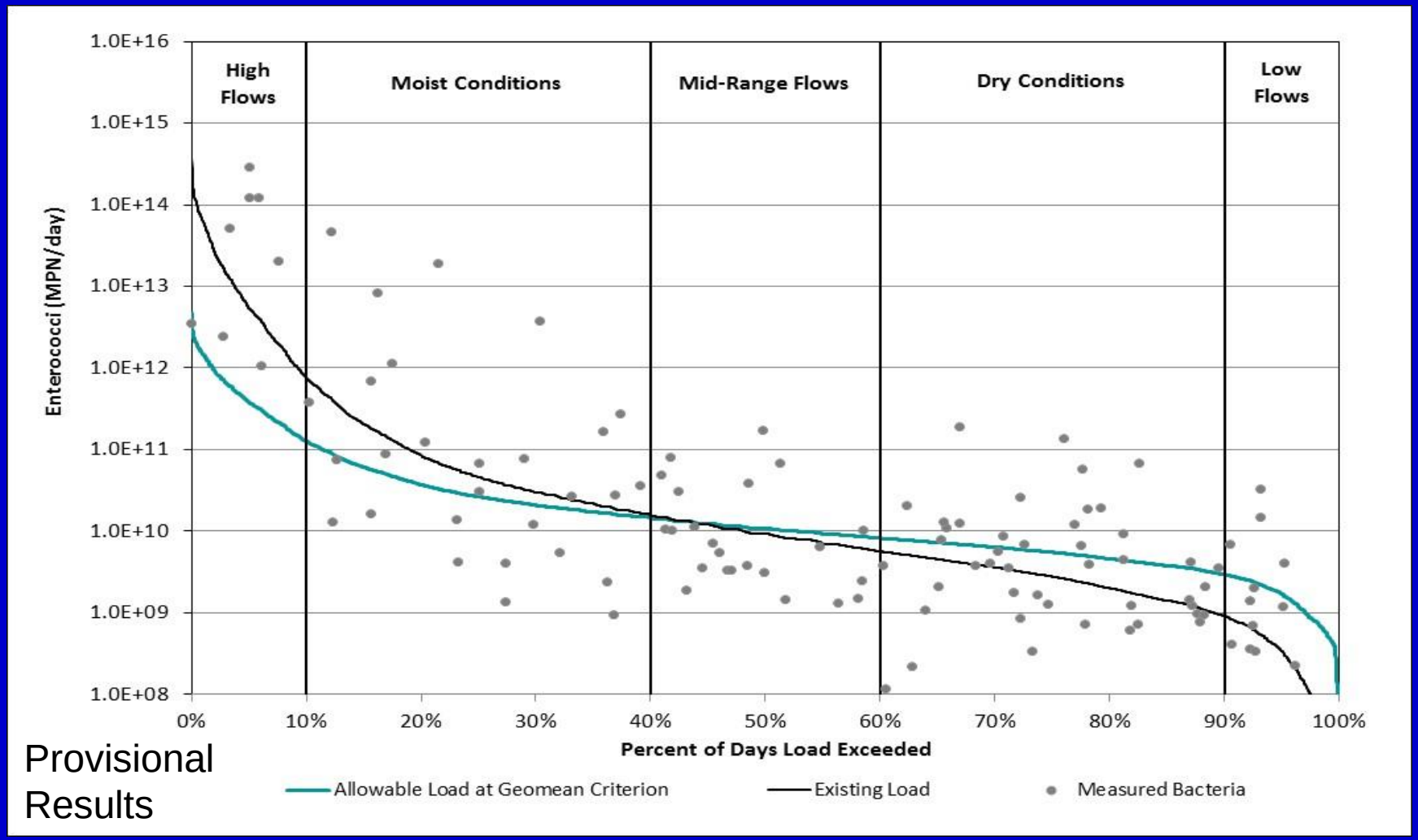
Enterococci Data Added to LDC, Station 11455, Dickinson Bayou Tidal

Completed Modified LDC with Regression Line through Measured Enterococci Loading Data Station 11455 Dickinson Bayou Tidal, AU 1103_01



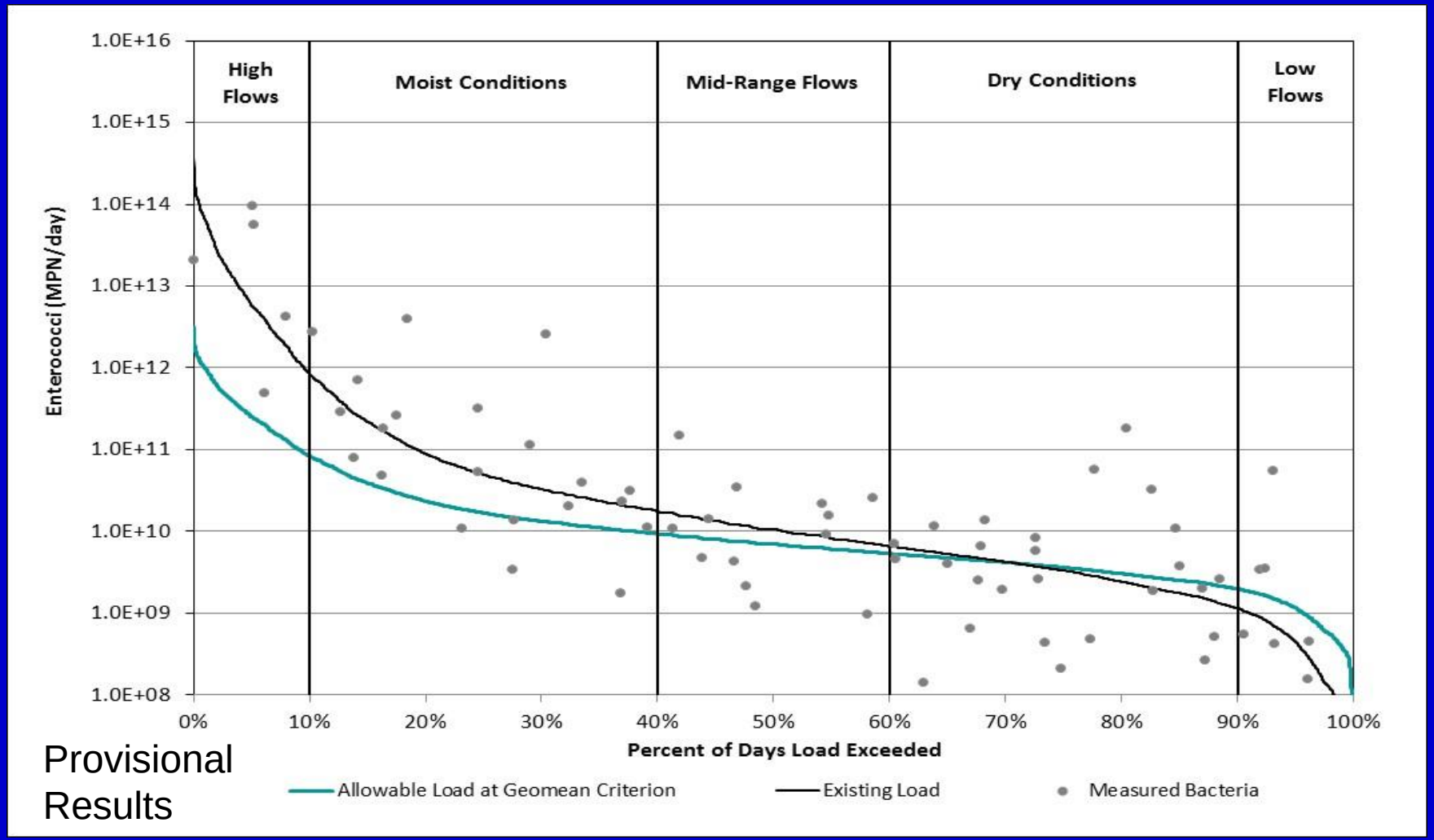
Provisional Results

Moving Upstream: Complete Modified LDC Station 11460 Dickinson Bayou Tidal, AU 1103_02



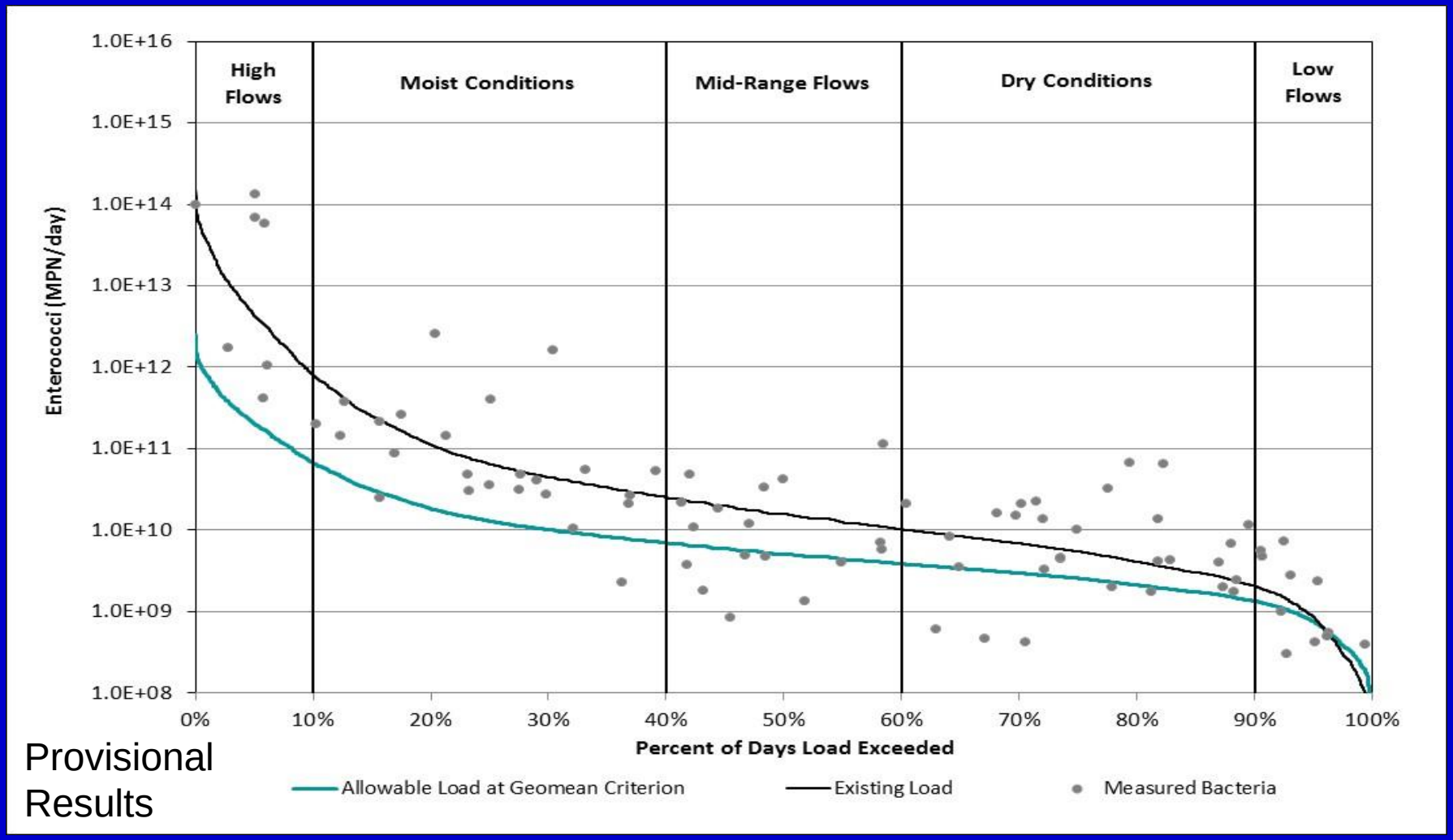
Provisional Results

Moving Upstream: Complete Modified LDC Station 11462 Dickinson Bayou Tidal, AU 1103_03



Provisional Results

Most Upstream Tidal Location: Complete Modified LDC Station 11464 Dickinson Bayou Tidal, AU 1103_04



Provisional Results

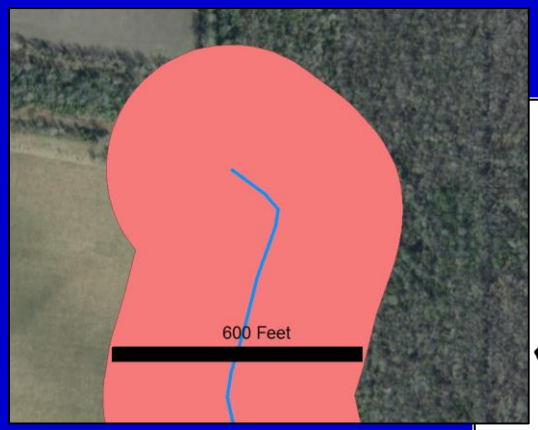
Dickinson Bayou Tidal
Downstream to Upstream Direction
Enterococci Loading Computations
(numbers rounded in computations & all results provisional and subject to change)

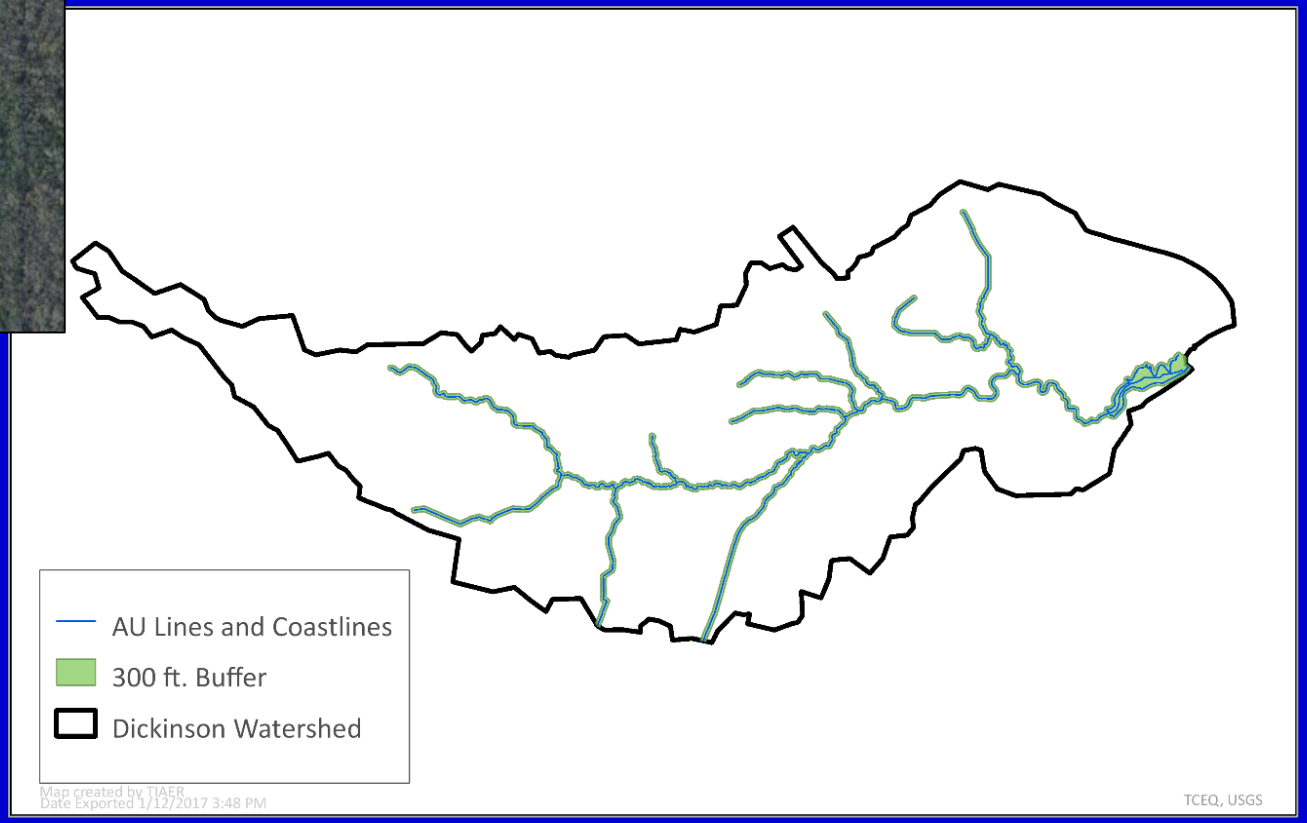
Station	AU	Allowable Load (Billion MPN/ day)	Existing Load (Billion MPN/ day)	Required Load Reduction (Billion MPN/day)
11455	1103_01	111	1,110	1,000
11460	1103_02	77.1	2,180	2,100
11462	**1103_03**	**50.8**	**2,260**	**2,210**
11464	1103_04	40.3E	1,260	1,220

List of Management Measures and Control Actions from I-Plan

I-Plan Number	Management Measures/ Control Actions	Potential Enterococci Reduction (Billion MPN/day)
MM 1 (1.1-1.6)	OSSFs	1.34
MM 2.1 (2.1, 2.3-2.5) / CA 1.0	WWTF effluents (accept 1/2 of 35 limit)	2.20
CA 2.0	WWTF effluents (non-compliant)	47.8
CA 3.0	SSOs reduction	0.403
MM 3.0	Agricultural BMPs	0.0414
MM 3.1	Feral hog control	43.5
MM 3.2-3.5	Pet waste control	4,410
MM 3.6	Animal group control	161
MM 4.0	Riparian zone controls	4.08
MM 6.0	Treatment wetlands	585
MM 7.0	Urban stormwater BMPs	292
TOTAL		5,550

Considering riparian-buffer approach from Cedar Bayou WPP to determine “actual” reductions from potential reductions





Ongoing Efforts by TIAER

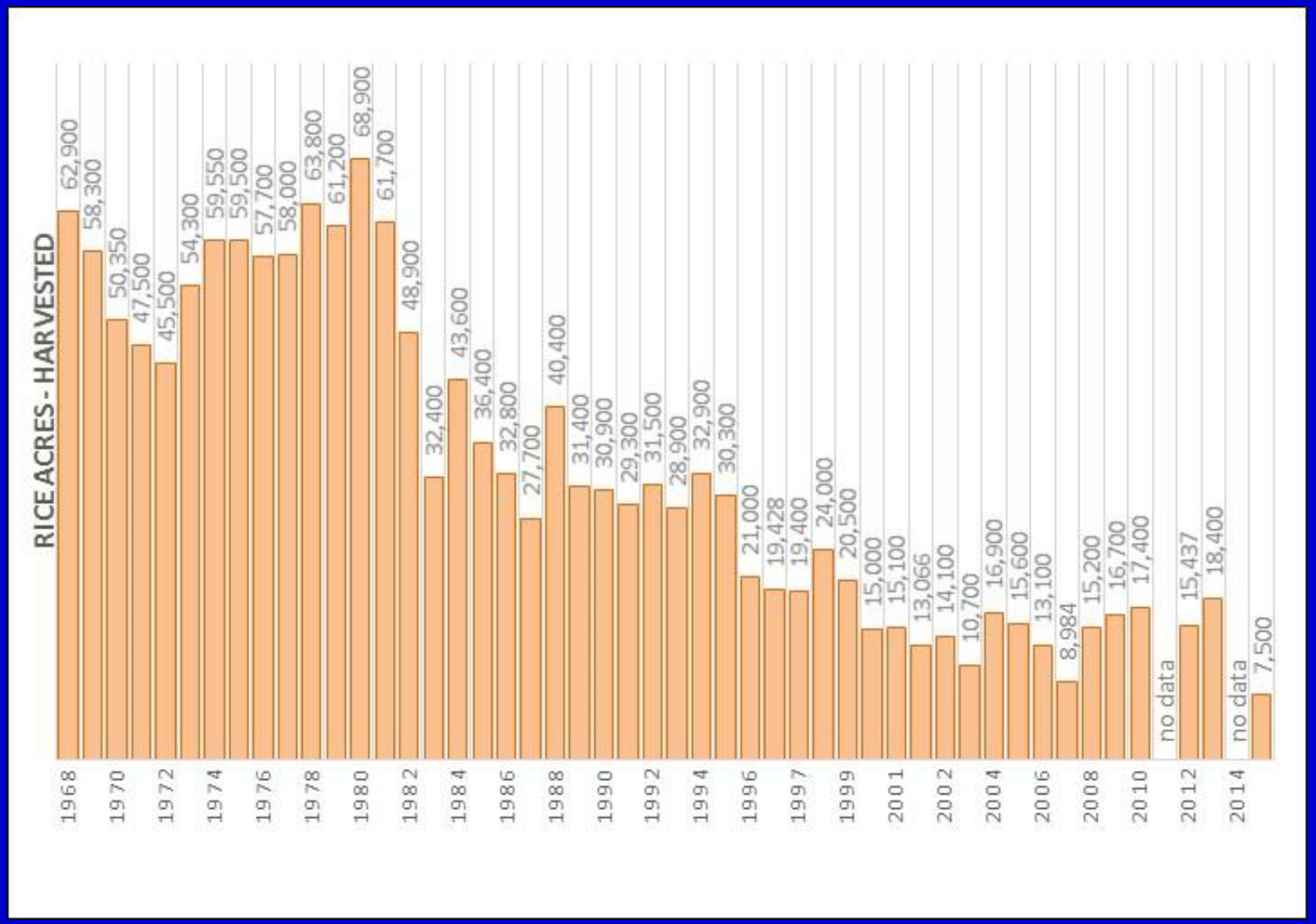
- Finalize approach to estimate actual load reductions
- Finalize report summarizing work activities

THANK YOU

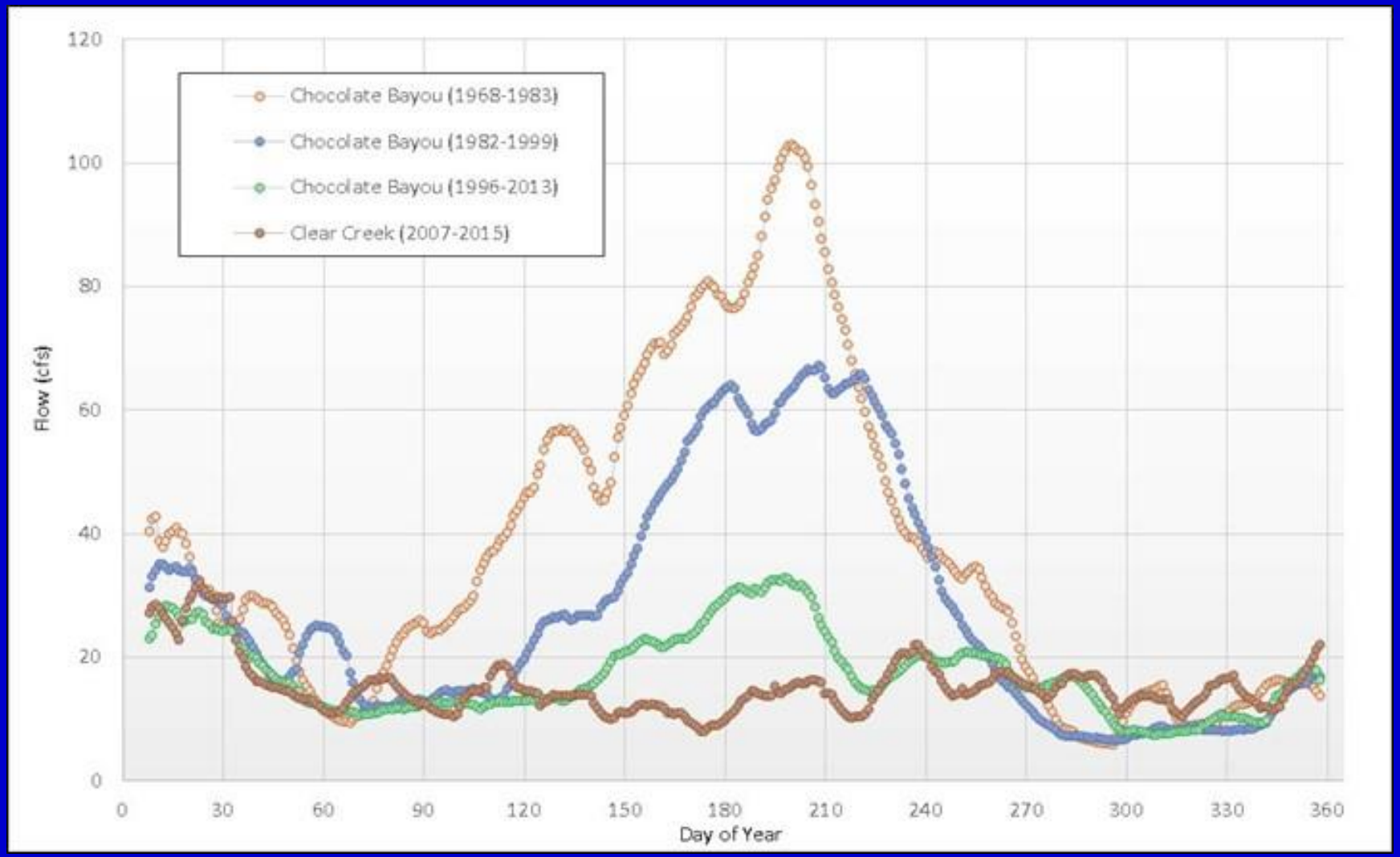
Questions?

Extra Slides

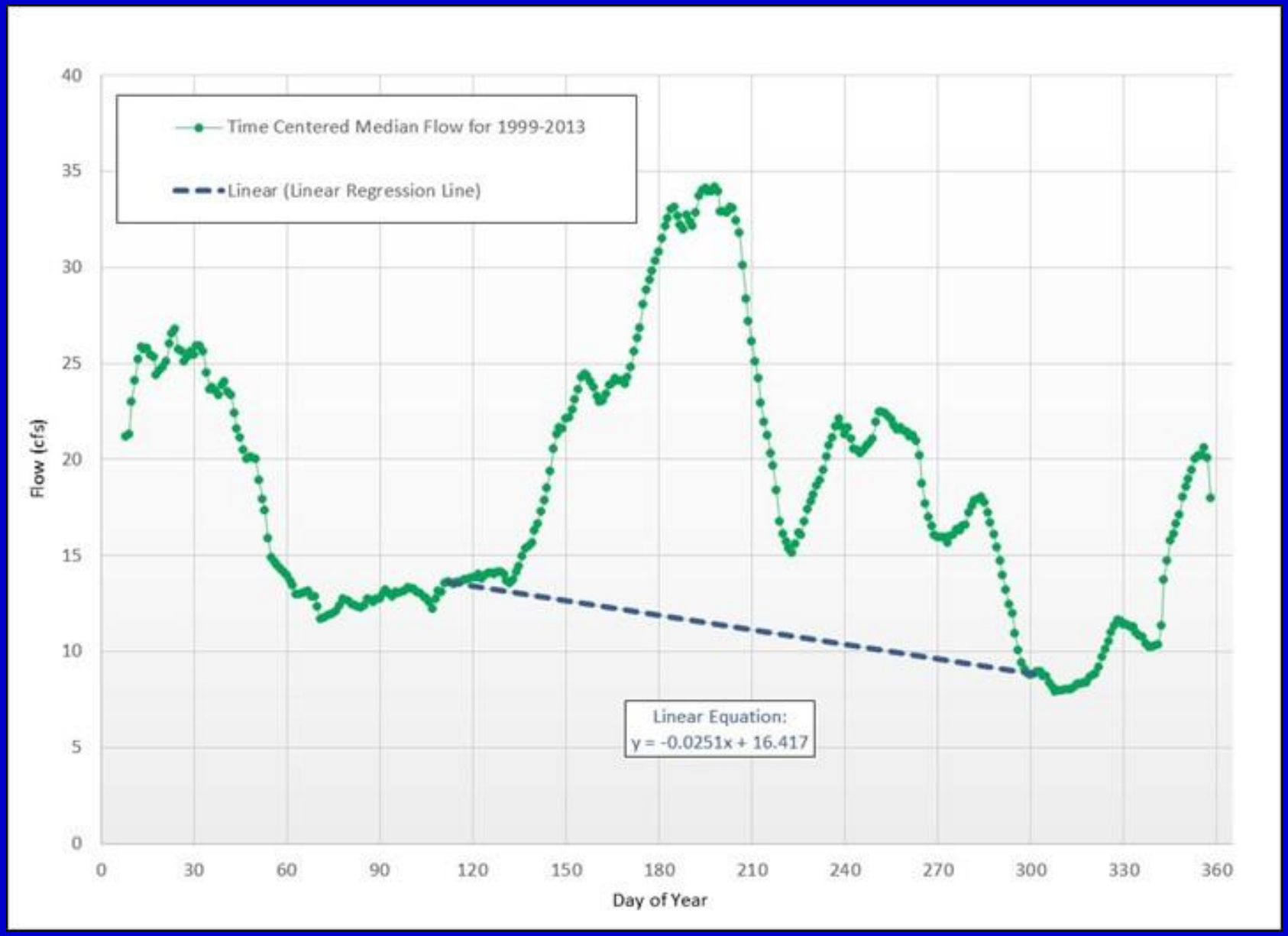
Annual Rice Irrigation – Chocolate Bayou



Time-Centered 15-Day Median Flws



Time-Centered Medians with Regression Line



15-Day Medians With and Without Naturalized Flows