Total Maximum Daily Loads and Use Attainability in Dickinson Bayou

an Update

October 12, 2009

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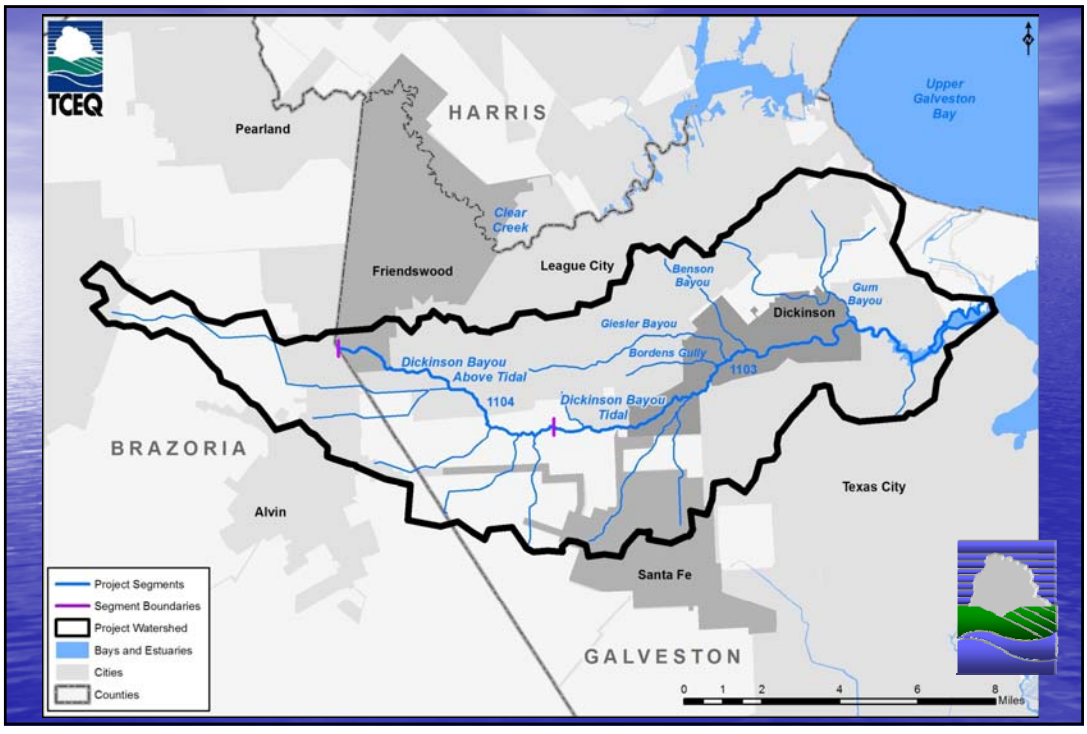
Texas Commission on Environmental Quality



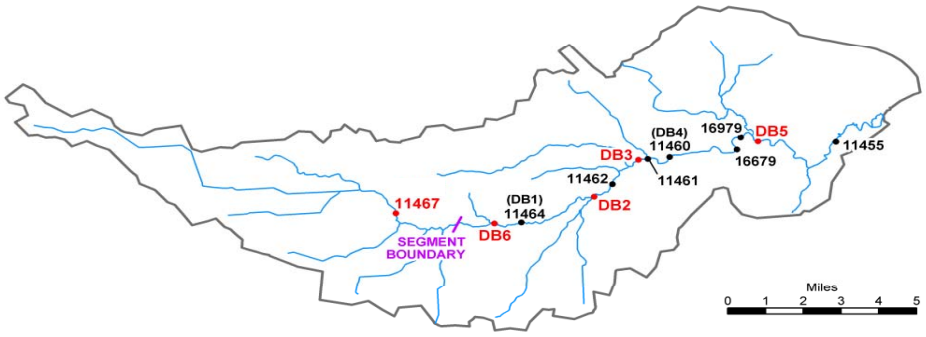
Review
Federal Clean Water Act Requirements

- Uses, Standards and Criteria
  - Aquatic Life Use
    - Designated as High in tidal segment (Segment 1103)
      (24 avg. DO = 4.0 mg/l; minimum DO = 3.0 mg/l)
    - Designated as Intermediate in segment above tidal influence (Segment 1104)
      (24 avg. DO = 4.0 mg/l; minimum DO = 3.0 mg/l)
  - Recreation (Contact Recreation in both segments)
    - Tidal (Enterococcus geometric mean = 35 CFU/100ml; Enterococcus single sample = 89 CFU/100ml)
    - Above Tidal (E. coli geometric mean = 126 CFU/100ml; E. coli single sample = 394 CFU/100ml)

Review
Federal Clean Water Act Requirements

- Assessment through monitoring
- Listing of impairments (303[d] List; listing categories 1-5c)
- Verification of impairments (listing category 5a)
- Development and adoption TMDLs for verified impairments (listing category 5a)
- Development and approval of TMDL Implementation Plans
- Implementation of TMDLs

Monitoring Stations



The 2008 Texas Clean Water Act 303(d) List
What is Dickinson Bayou listed for?

SegID: 1103 **Dickinson Bayou Tidal**
From the confluence with Dickinson Bay 2.1 km (1.3 miles) downstream of SH 146 in Galveston County to a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County

Area		Category	Year First Listed
1103_01	*From 2.5 miles downstream of FM 517 to the Bordens Gully confluence*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996
1103_02	*From the Bordens Gully confluence to the Benson Bayou confluence*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996
1103_03	*From the Benson Bayou confluence to the confluence with Gum Bayou*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996

The 2008 Texas Clean Water Act 303(d) List

What is Dickinson Bayou listed for?

SegID: 1104 **Dickinson Bayou Above Tidal**
From a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County to FM 528 in Galveston County

Area		Category	Year First Listed
1104_01	*From lower segment boundary upstream to FM 517*		
	bacteria	5a	1996
	depressed dissolved oxygen	5c	2006
1104_02	*From FM 517 upstream to FM 528*		
	bacteria	5a	1996

The 2008 Texas Clean Water Act 303(d) List

Dickinson Bayou Tributaries Listed

SegID: 1103A **Bensons Bayou (unclassified water body)**
From the confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646 in Galveston County

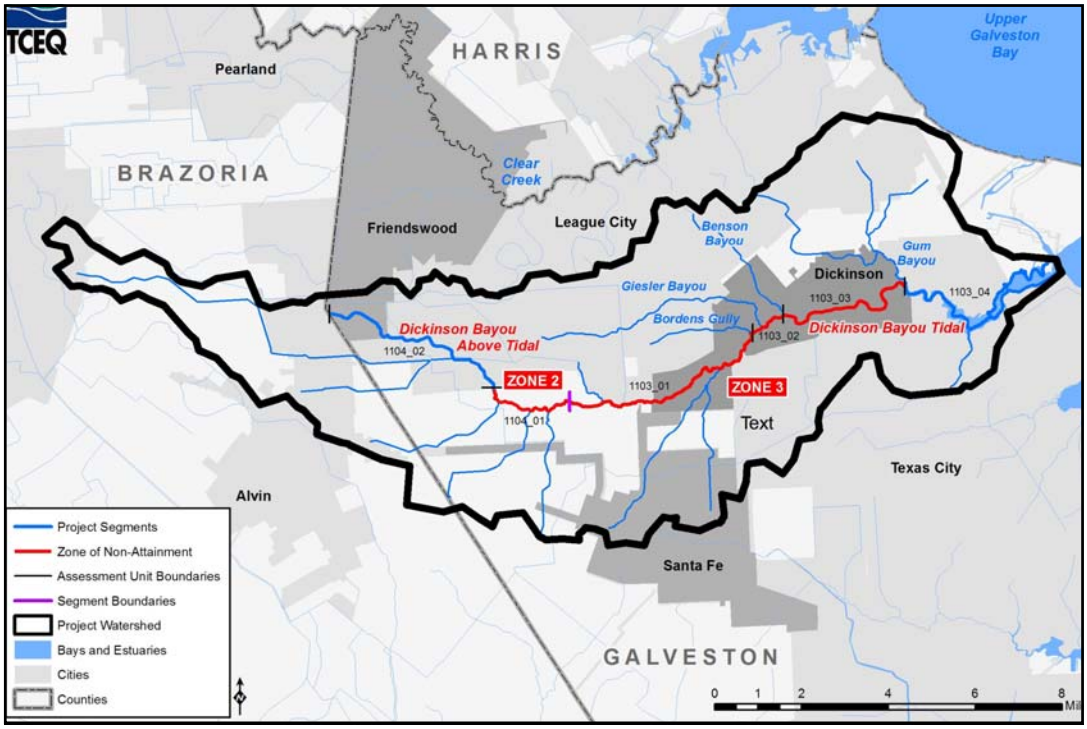
Area		Category	Year First Listed
1103A_01	*From confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646*		
	bacteria	5a	2002

SegID: 1103B **Bordens Gully (unclassified water body)**
From confluence with Dickinson Bayou Tidal to upstream of Calder Road in Galveston County

Area		Category	Year First Listed
1103B_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1103C **Geisler Bayou (unclassified water body)**
From confluence with Dickinson Bayou tidal to IH 45 in Galveston County

Area		Category	Year First Listed
1103C_01	*Entire water body*		
	bacteria	5a	2002


TCEQ
HARRIS
Pearland
BRAZORIA
Upper Galveston Bay
Clear Creek
Friendswood
League City
Benson Bayou
Gum Bayou
Dickinson
Giesler Bayou
1103_03
1103_04
Bordens Gully
Dickinson Bayou Above Tidal
1104_02
1103_02
Dickinson Bayou Tidal
ZONE 2
1103_01
ZONE 3
1104_01
Text
Texas City
Alvin
Project Segments
Zone of Non-Attainment
Assessment Unit Boundaries
Segment Boundaries
Project Watershed
Bays and Estuaries
Cities
Counties
Santa Fe
GALVESTON
0 1 2 4 6 8


DICKINSON BAYOU WATERSHED
Houston
Pearland
HARRIS
Clear Lake
Galveston Bay
Webster
Kemah
Manvel
Friendswood
Clear Creek
Gum Bayou
Chigger Creek
League City
Bensons Bayou
1103
Dickinson
16979
Dickinson Bayou Tidal
Dickinson Bay
11460
11455
11461
16679
Dickinson Bayou Above Tidal
1104
Giesler Bayou
Bordens Gully
HWY 3 BRIDGE
11462
11464
ZONE OF IMPAIRMENT 2006
Moses Lake
Moses Bayou
Tidal Boundary
Texas City
Alvin
Hillcrest
Santa Fe
Highland Bayou
La Marque
BRAZORIA
Hitchcock
GALVESTON

What is a Total Maximum Daily Load?

- The maximum amount of a specific pollutant that a water body can accept while meeting all applicable water quality standards (assimilative capacity).
- A scientific model that:
  - determines the maximum amount (or load) of a particular pollutant
  - allocates this allowable load to point and nonpoint sources of pollution in the watershed
- A document adopted by the TCEQ and subject to approval by the USEPA

What is a Total Maximum Daily Load?

$$TMDL = \Sigma WLA + \Sigma LA + MOS$$

where:
TMDL = total maximum daily load
WLA = waste load allocation (point source contributions)
LA = load allocation (nonpoint source contributions)
MOS = margin of safety (implicit)

- Total Maximum Daily Load Estimate (calculation)
- Load Allocations and…
- A Plan to Improve Water Quality Based on the TMDL
  - We will rely as much as possible on the WPP

History of TMDL Development in Dickinson Bayou

- TMDL for Dissolved Oxygen (1103 & 1104)
  - Began in July 2004
  - Released for Public Comment in June 2008
  - Adoption is pending*
- TMDL for Bacteria (1103, 1103A, 1103B, 1103C)
  - Began in July 2007
  - Scheduled for Public Comment in May or of June 2010
  - Scheduled for Adoption in August 2010

*TMDL not adopted in 2008

DO TMDL Conclusions

- Simulations show that the DO criteria applied to Dickinson Bayou are not achievable under a 95% pollutant load reduction or under a natural loading scenario
- DO dynamics in Dickinson Bayou are heavily influenced by physical factors (i.e., hydrodynamics) but respond positively to CBOD load reductions*
- A 10% decrease in the current (and permitted) CBOD loading will result in a frequency of attainment of DO criteria that is appropriate, achievable, and sustainable*

*But falls short of achieving the current DO criteria at the 90th percentile

Conclusions (cont.)

- Additional data should be collected for an Aquatic Life Use Attainability Analysis (ALUAA)
- Pending the results of the ALUAA, Aquatic Life Use and DO criteria may be de-coupled or the assessment methodology modified
- Site-specific DO criteria or frequency of attainment of DO criteria may be developed for Dickinson Bayou (i.e., frequency of attainment <90%)
- If necessary, a revised TMDL will be developed based on the new criteria

What remains to be done on DO TMDL?

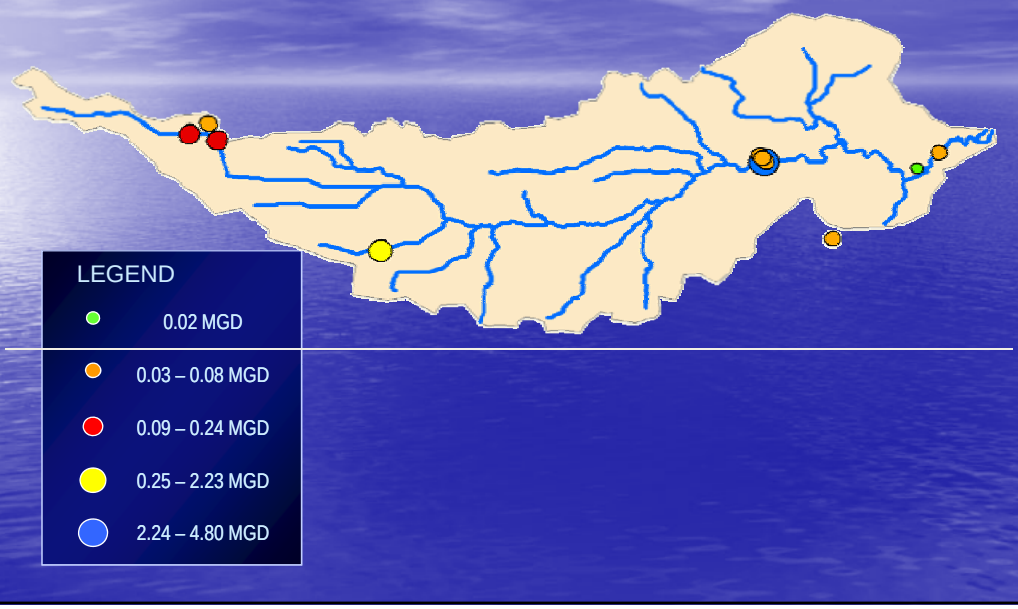
- ALUAA for Segment 1103 (at least 2 years of sampling)
- Additional Modeling (at least 1 year)
- Standards Revision (no sooner than 2013)
- Adoption of revised TMDL (no sooner than 2015)

Bacteria TMDL

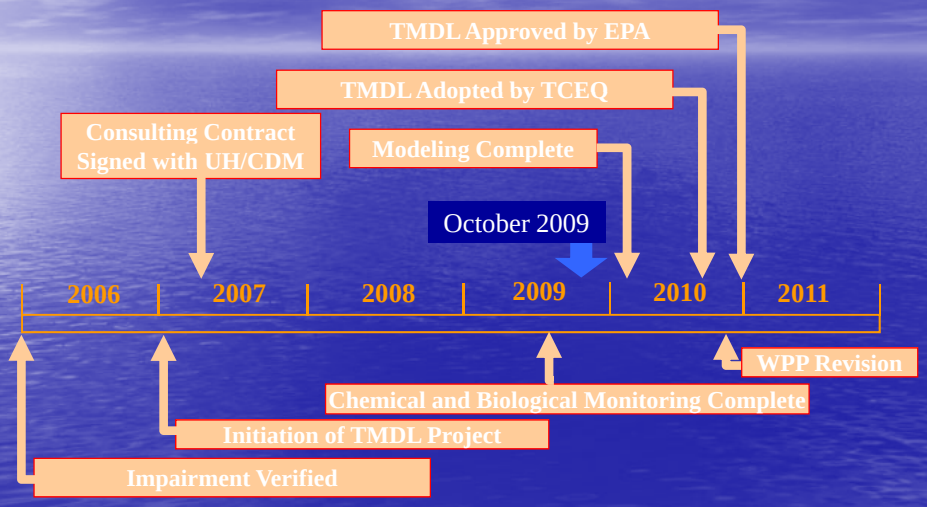
- Much progress has been made since April of 2008*

*Update on Bacteria TMDL presented to Partnership on April 30, 2008

WWTP Map, Permitted Flows



Schedule



Bacteria TMDL

- Much progress has been made since April of 2008*
- Public meeting to share preliminary TMDL results is planned for the Fall or Winter of 2009-2010
- TMDL to be released for public comment in May or June of 2010
- TCEQ Adoption of TMDL by August 2010
- EPA approval of TMDL by December of 2010

*Update on Bacteria TMDL presented to Partnership on April 30, 2008

Recreational Use Attainability Analysis

- Associated with 2010 Triennial Standards Review
- A state-wide assessment of Contact Recreational Use
- First phase (Basic Survey) recently completed for Armand Bayou Above Tidal
- Similar survey for Dickinson Bayou Above Tidal in 2010
- Preliminary results are expected by August of 2010

http://www.tceq.state.tx.us/implementation/water/tmdl/17-dickinson.html

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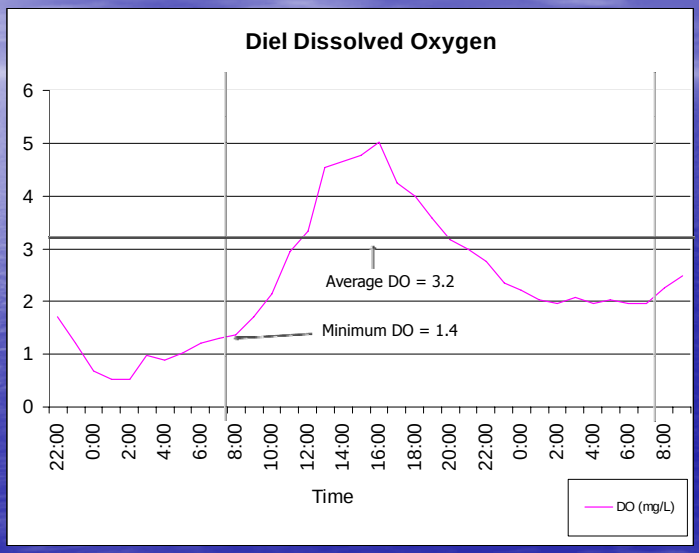
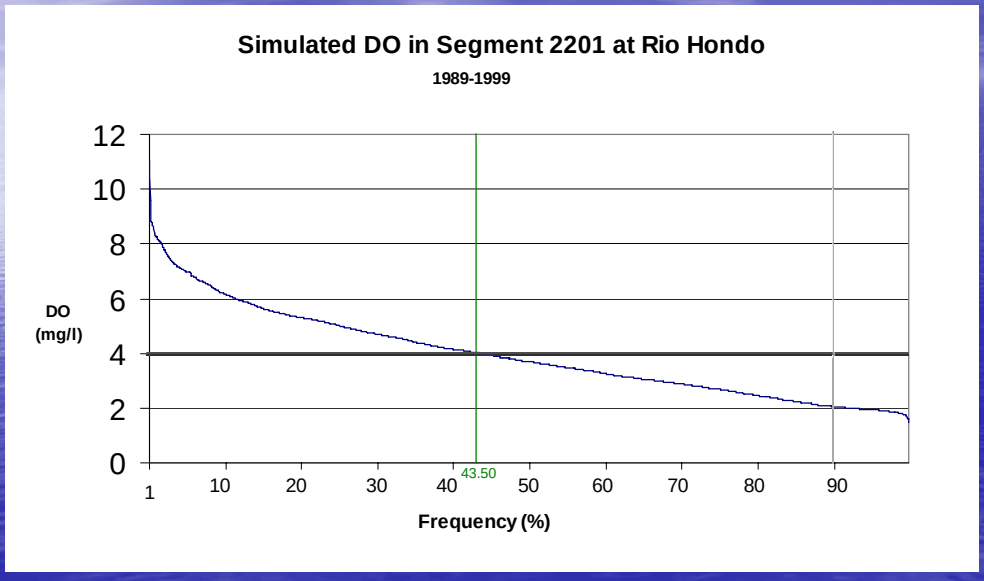
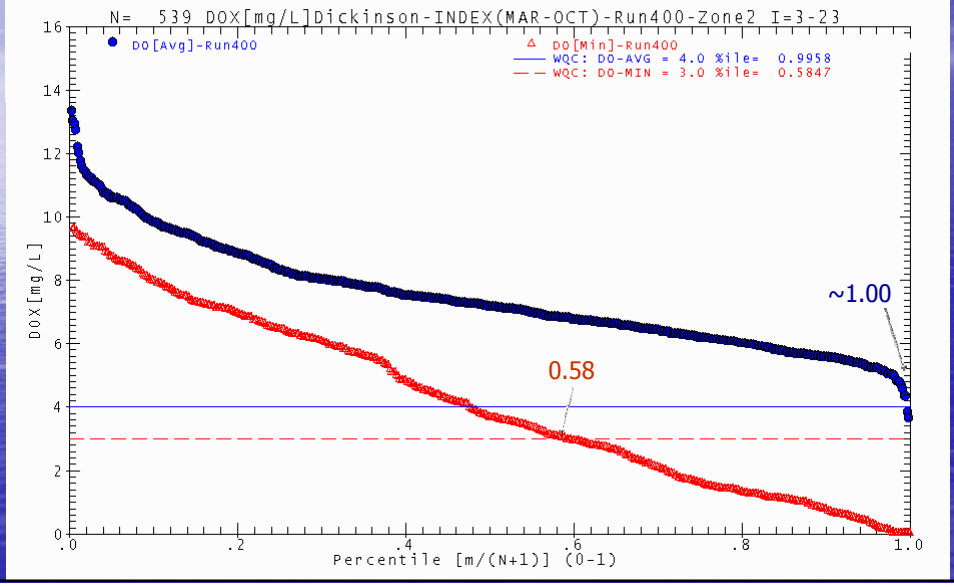
24-hr Average and Minimum Criteria

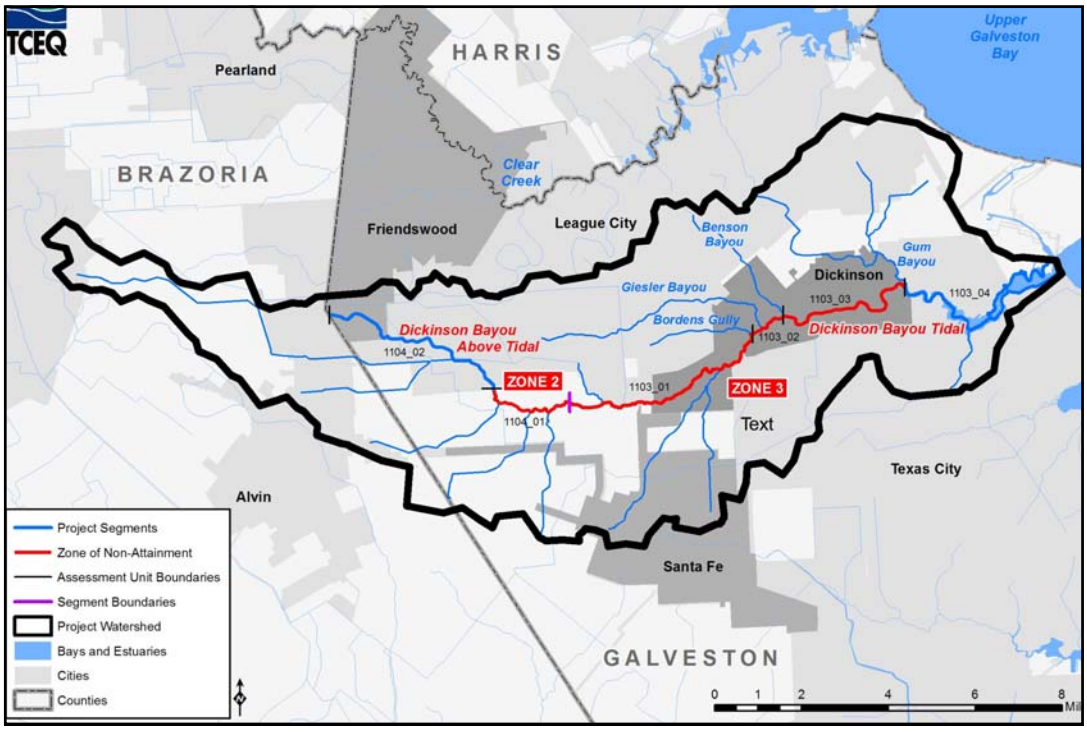


Frequency Distributions

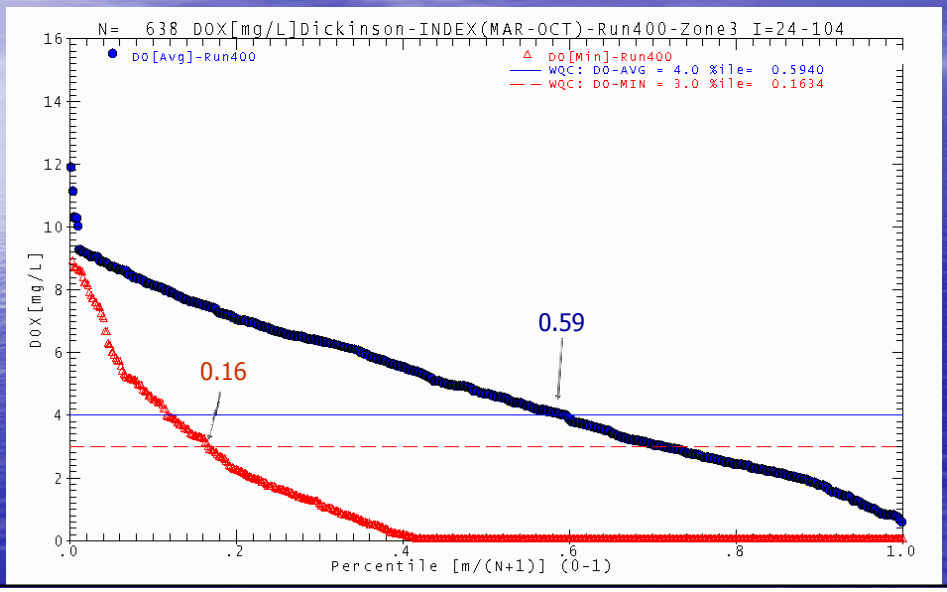


Dickinson Bayou EFDC Calibration Run Zone 2 (Segment 1104; Above Tidal)

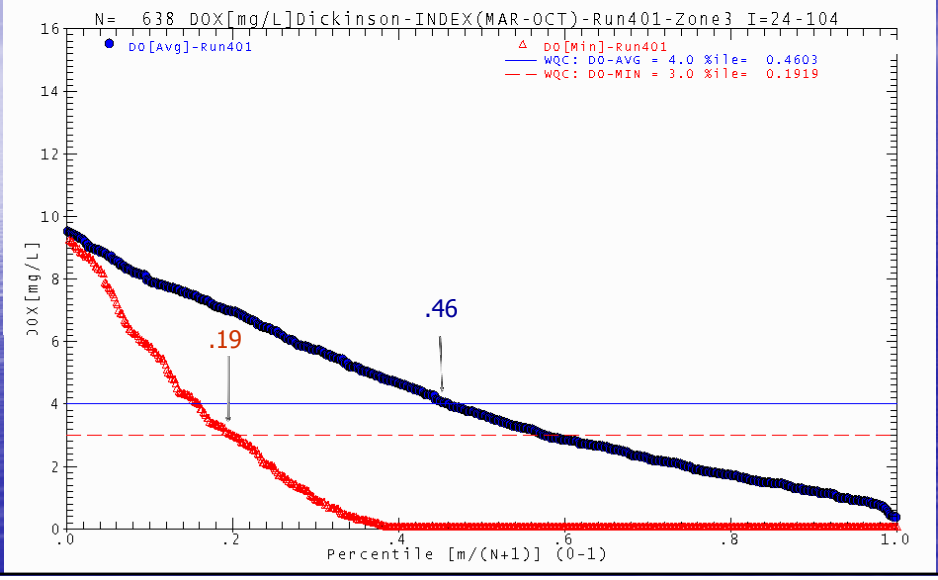




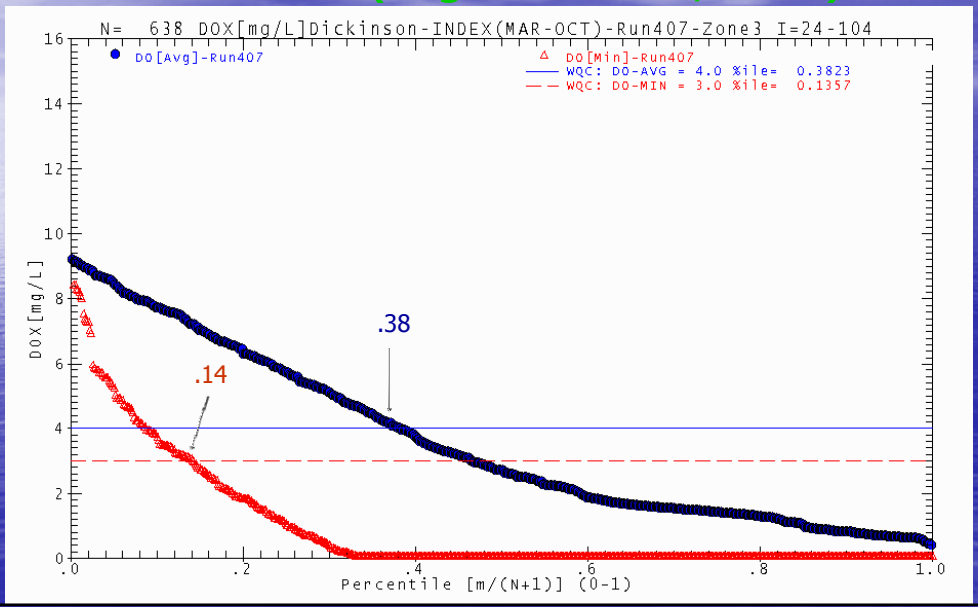
Dickinson Bayou EFDC Calibration Run Zone 3 (Segment 1103; Tidal)



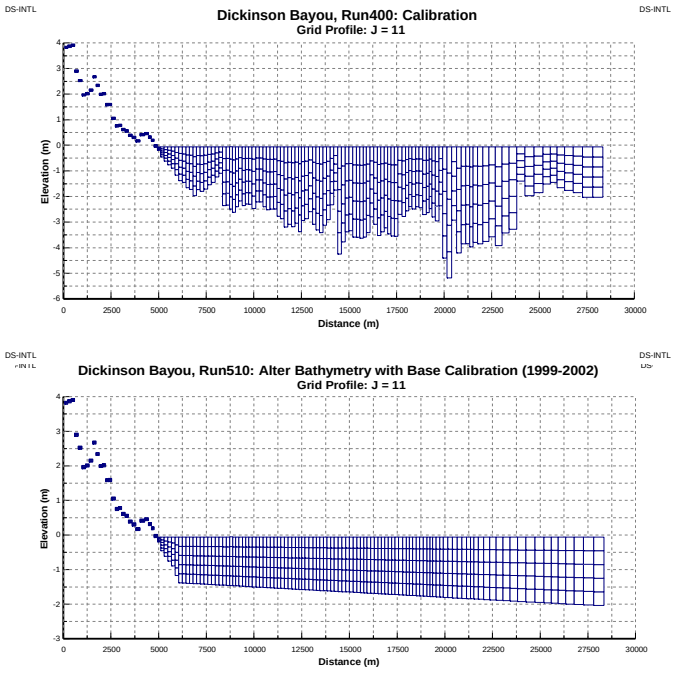
Dickinson Bayou EFDC Run 95% Load Reduction Zone 3 (Segment 1103; Tidal)



Dickinson Bayou Natural loadings
Zone 3 (Segment 1103; Tidal)



Scenario	Index Period Criteria Attainment Percentile			
	Zone 2 (Non-tidal)		Zone 3 (Tidal)	
	Avg.	Min.	Avg.	Min.
1. Validation Run	99.58	58.47	59.40	16.34
2. 95% Pollutant Reduction	99.68	58.22	46.03	19.19
3. 95% Reduction in CBOD Only	99.62	57.70	64.71	21.18
4. 95% Reduction in TN Only	99.62	58.05	38.59	11.91
5. 95% Reduction in TP Only	99.58	57.88	47.57	11.59
6. 95% Reduction in TSS Only	99.57	57.50	58.97	21.29
7. 2008 Run (full permitted wastewater flow)	92.40	25.97	53.95	15.07
8. 10% Increase in CBOD Only	99.57	58.55	58.66	16.08
9. 10% Increase in TN and TP Only	99.58	58.19	59.82	15.98
10. Natural Loading Run	100.00	63.04	38.23	13.57
11. Altered Bathymetry Run	99.57	58.37	65.04	28.48



Conceptual 2-D DO Model