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## Acknowledgements

Lead Agencies:  
Texas Commission on Environmental Quality  
Texas State Soil & Water Conservation Board

Support Funding:  
U.S. Environmental Protection Agency

TIAER 2

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## Elm Creek (Segment 1803A)

From the confluence of Sandies Creek east of Smile in Gonzales County to the upstream perennial portion of the stream southwest of Smiley in Gonzales County

TIAER 3

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## Sandies Creek (Segment 1803B)

From the confluence of the Guadalupe River west of Cuero in DeWitt County to the upstream perennial portion of the stream northwest of Smile in Gonzales County

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## Sandies-Elm Map (Segments 1803 B&A)

Add Map w/o any stations

**TIAER**

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## Sandies and Elm Creeks (Segments 1803 A&B)

Uses:

Aquatic life use

Contact recreation use

**TIAER**

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## 2004 Section 303(d) Listing Sandies Creek (1803B)

Aquatic Life Use: Depressed dissolved oxygen concentrations along entire length. Initial listing 1999

Recreation Use: Elevated bacteria levels along entire length. Initial listing 2002

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## 2004 Section 303(d) Listing Elm Creek (1803A)

Aquatic Life Use: Depressed dissolved oxygen concentrations along entire length. Initial listing 1999

Recreation Use: Elevated bacteria levels along entire length. Initial listing 1999

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## Aquatic Life Use

Dissolved oxygen is the major constituent evaluated to assess aquatic life use. Toxics can be a consideration in some systems.

Most living organisms are dependent upon oxygen in one form or another to maintain metabolic processes.

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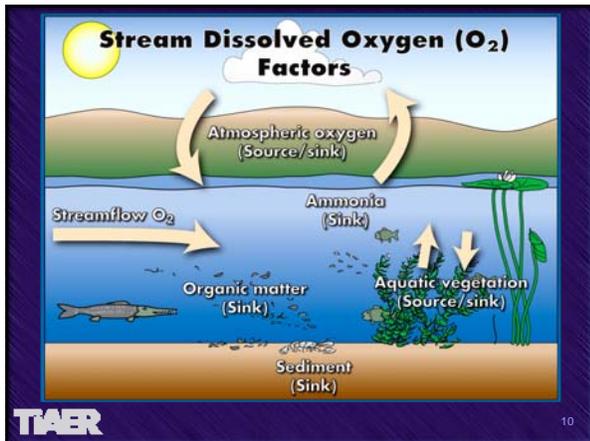
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**Dissolved Oxygen Criteria**

- A 24-hour mean concentration
- A 24-hour minimum concentration

**Sandies & Elm Creeks  
(high aquatic life use designation)**

- Mean concentration = 5.0 mg/L
- Minimum concentration = 3.0 mg/L

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**Dissolved Oxygen Criteria**

Additional spring criteria to protect fish spawning in first half of year

When water temperatures are between 63 F to 73 F

- Mean concentration = 6.0 mg/L
- Minimum concentration = 4.0 mg/L

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# Sandies-Elm Map (Segments 1803 B&A)

Add Map w/ assessment stations

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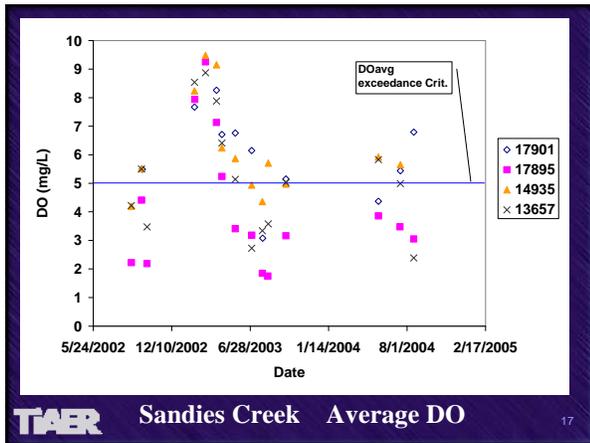
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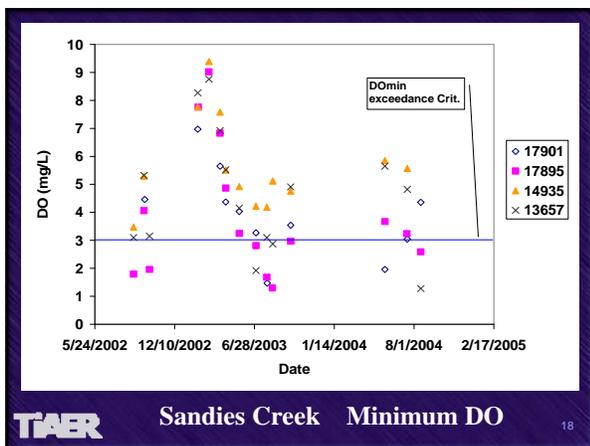
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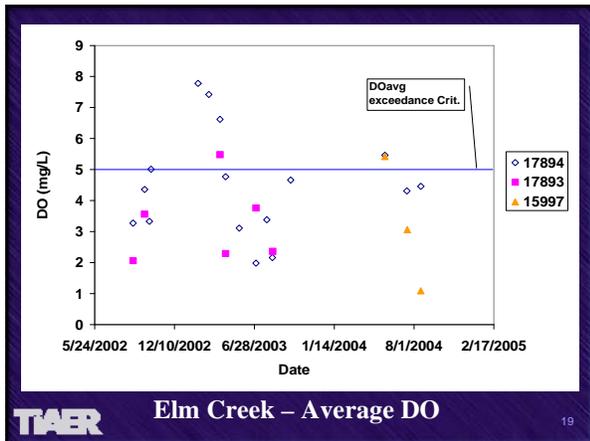
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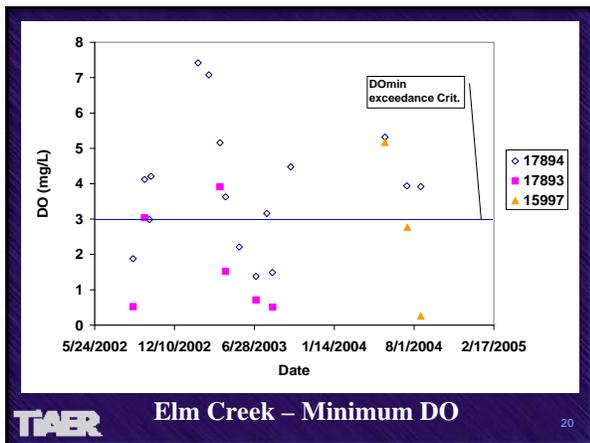
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## Conclusion of DO Assessment

- Dissolved oxygen concentrations are depressed in most of Sandies & Elm Creeks.
- The studies will continue towards development of a TMDL allocation for dissolved oxygen with a goal of restoring the high aquatic life use.

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## Contact Recreation Use

Contact recreation is assigned unless elevated concentrations of indicator bacteria frequently occur due to sources of pollution, which cannot be reasonably controlled by existing regulations or contact recreation is considered unsafe for other reasons such as ship or barge traffic.

Source: Texas Surface Water Quality Standards (2000)



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Indicator bacteria, although not generally pathogenic, are indicative of potential contamination by feces of warm blooded animals.

Source: Texas Surface Water Quality Standards (2000)



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## Indicator Bacteria for Freshwater

Fecal coliform A portion of the coliform bacteria group that is present in the intestinal tracts of warm-blooded animals; heat tolerant bacteria from other sources can sometimes be included.

E. coli *Escherichia coli*, a subgroup of fecal coliform bacteria that is present in the intestinal tracts and feces of warm-blooded animals.

Source: Texas Surface Water Quality Standards (2000)



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## Bacteria Culture



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## *E. Coli* Basics

*Escherichia coli* (*E. coli*) is a bacterium that is naturally found in the intestines and the feces of warm-blooded animals

Many different types, most harmless, but some may cause illness (e.g. hamburger restaurant outbreaks)

Commonly used as a Bacterial Indicator Organism

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## Bacterial Indicator Organisms

Generally not pathogenic themselves

Abundant in feces of warm-blooded animals

Should not reproduce naturally in the environment

Relatively long survival times in the environment

Should be present whenever a fecal pathogen is present

More easily measurable than the pathogens themselves

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## Contact Recreation Use

Specific Criteria for Sandies & Elm Creeks

*E. coli*:

- ◆ The geometric mean should not exceed 126 organisms (org) per 100 ml.
- ◆ Single samples should not exceed 394 org per 100 ml.

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## Assessment Methodology for Contact Recreational Use

Evaluate most recent 5-year period of historical data against:

geometric average criterion (126 org/100ml)

single sample criterion (394 org/100ml)

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## Fully Supporting

The long-term geometric average is less than the criterion

and

25% or less of the samples exceed the single sample criterion.

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## Not Supporting

The long-term geometric average exceeds the criterion

and/or

greater than 25% of the time, concentrations are greater than the single sample criterion.

Percentages may vary due to the application of the binomial method used to control statistical errors



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## Hypothetical Example of Methodology

### *E. coli* Data

(units: org/100 ml)

1. 90	6. 320
2. 130	7. <b>840</b>
3. 40	8. 180
4. <b>1,000</b>	9. 270
5. 260	10. 70

20 percent of samples exceed 394 criterion  
Geometric mean 202 org/100 ml



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## Hypothetical Assessment Finding

Geometric average (202 org/100ml) exceeds the criterion

25% or less of the samples exceed the single sample criterion

Conclusion: Not supporting contact recreation use



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# Bacteria Assessment Data 2002-2004

Texas Engineering Experiment Station (TEES)  
Texas A&M University  
Corpus Christi, TX

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# Sandies and Elm Creeks (Segment 1803 B&A)

Add Map w/ stations

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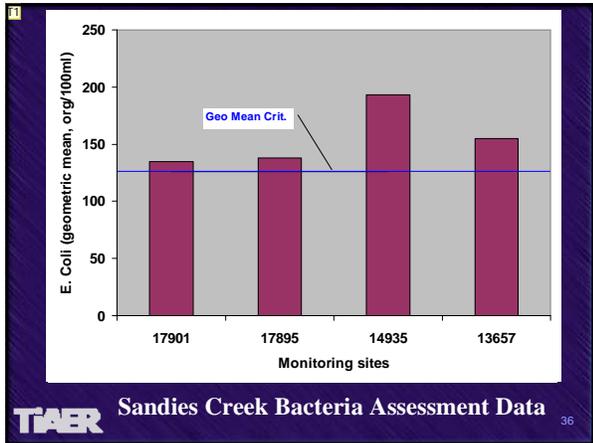
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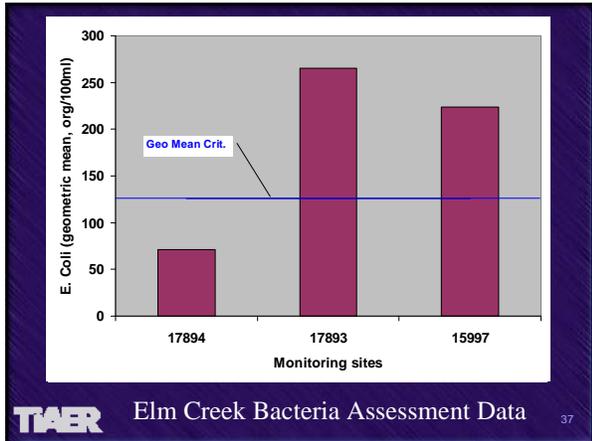
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**Slide 36**

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**T1** This graph should include the total number of samples above each of the bars.  
TCEQ, 8/16/2007




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### Conclusion of Bacteria Assessment

- Bacteria concentrations are elevated in most of Sandies & Elm Creeks indicating nonsupport of the contact recreation use designation.
- A TMDL will be developed for bacteria with a goal of restoring the contact recreation use.

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### Project Overview and Status

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## Milestones/Progress

- Assessment data collection completed in 2004 by Texas A&M at Corpus Christi
- Texas Institute for Applied Environmental Research (TIAER), Tarleton State University under contract with TCEQ in late 2005
- Quality Assurance Project Plan (QAPP) developed and approved by TCEQ and EPA on May 18, 2006

**TIAER**

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## Milestones/Progress

Additional bacteria & dissolved oxygen monitoring conducted by TIAER (July 2006 – April 2007)

Two 24-hour intensive surveys for dissolved oxygen and associated parameters:

22-26 May 2006 and 14-17 November 2006

Two wet weather surveys for dissolved oxygen, bacteria and associated parameters (approximately 72 hrs each):

5 – 8 July 2006 and 24 27 January 2007

Purpose: Provide additional data for TMDL allocation process

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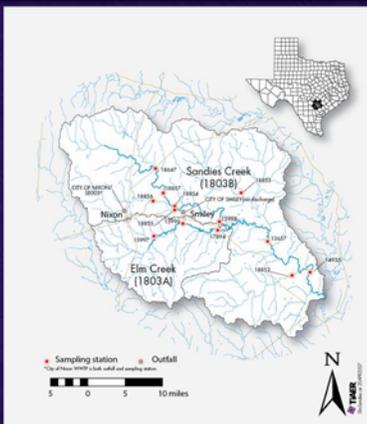
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## Sandies & Elm Creeks with TIAER Sampling Stations



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Sandies Creek at DeWitt CR 953 near Cuero, TX



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Station 18852, Clear Creek at Boldt Rd in DeWitt County



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Station 13657, Sandies Creek near Westhoff-Cheapside Rd



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Station 15998, Sandies Creek at FM 1116,  
east of Smiley



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Station 18854, Sandies Creek at CR 180,  
northwest of Smiley



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Station 17894, Elm Creek near US 87, on  
Lazy F Ranch



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## Remaining Steps in TMDL Process

Continue public participation meetings

TIAER will apply appropriate tools to determine the TMDL allocations for bacteria & dissolved oxygen

TIAER will assist TCEQ and TSSWCB in technical aspects of preparing the TMDLs



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## Remaining Steps in TMDL Process

TMDLs will undergo public comment and approval by TCEQ and EPA

TCEQ and TSSWCB responsible for developing Implementation Plans

Implementations will be put into action



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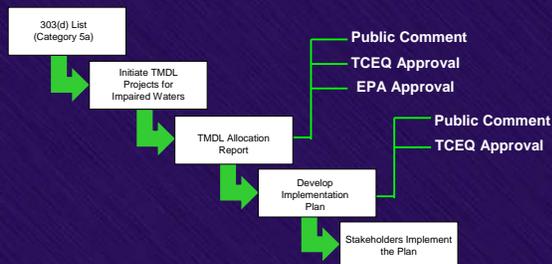
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## TMDL Development Process



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## Major Technical Aspects Remaining in TMDLs

**TMDL Allocation Process**  
The culminating step of a TMDL

Involves allocating pollutant loads among various point, nonpoint, and natural background sources in the watershed

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Allocation process equation:

$$LC = WLA + LA + MOS$$

Loading capacity (LC) is the maximum amount of pollutant loading a water body can receive without violating water quality standards.

Wasteload allocation (WLA) is the portion of the LC allocated to existing and future point sources.

Load allocation (LA) is the portion of the LC allocated to existing and future nonpoint sources and to natural background sources.

Margin of safety (MOS) is the mechanism to account for uncertainty in determining pollutant loadings.

**TIAER** 53

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### TMDL Allocation Process

Allocation process typically conducted using mathematical models.

In simplest terms, models are analytical abstractions of the real world.

For this bacteria TMDL, the Load Duration Curve method will be applied.

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## Future Activities

- Modeling Quality Assurance Project Plan approved by TCEQ, under EPA review.
- Continue public meeting process and conduct a watershed survey
- Develop bacteria and DO TMDL allocations and provide findings in technical support documents due early summer 2008
- Develop draft TMDL report – due late summer 2008

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