

# Bosque/Leon Rivers Perchlorate Study



**United States Army Corps of Engineers**



**Texas Commission on Environmental Quality**



**Brazos River Authority**



**The Institute of Environmental and Human Health at Texas Tech University**



**MWH**



**United States Environmental Protection Agency**



**City of Waco**

***Public Meetings***

***Temple - April 14, 2003***

***Waco - April 15, 2003***



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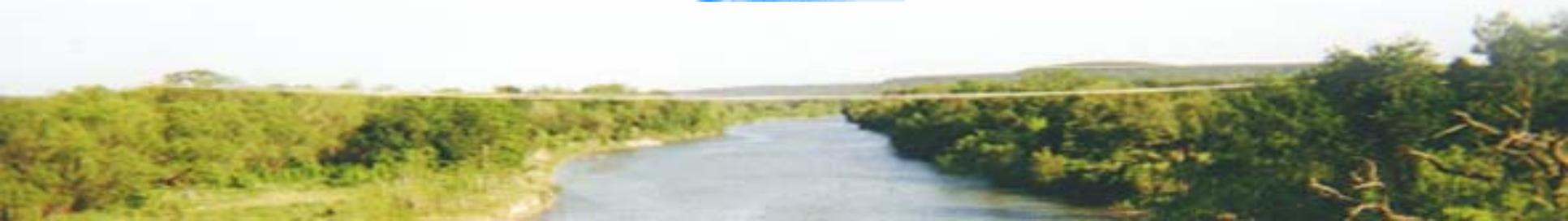
# *Agenda*

- **Introduction** *Kyle Headley (BRA)*
- **Project Overview** *Brian Condike (USACE)*
- **Ecological Evaluation** *Todd Anderson (TIEHH)*
- **Watershed Studies** *Ronald Hartline (MWH)*
- **Conclusion** *Brian Condike (USACE)*



# *Introduction*

**Kyle Headley**  
**Regional Environmental Planner**  
**(Central Basin)**  
**Brazos River Authority**



# *Project Team Members*

- **U.S. Army Corps of Engineers** – project management and technical support
- **Brazos River Authority (BRA)** – technical services and stakeholder coordination
- **The Institute of Environmental and Human Health (TIEHH) at Texas Tech University** – toxicological and ecological studies
- **MWH** – watershed hydrological studies, fate and transport, GIS
- **Stakeholder Alliance** – advisory to study team, community interface
- **Texas Commission on Environmental Quality (TCEQ)** - advisory to study team, liaison with Interagency Perchlorate Steering Committee
- **U.S. Environmental Protection Agency** – advisory to study team, regulatory liason



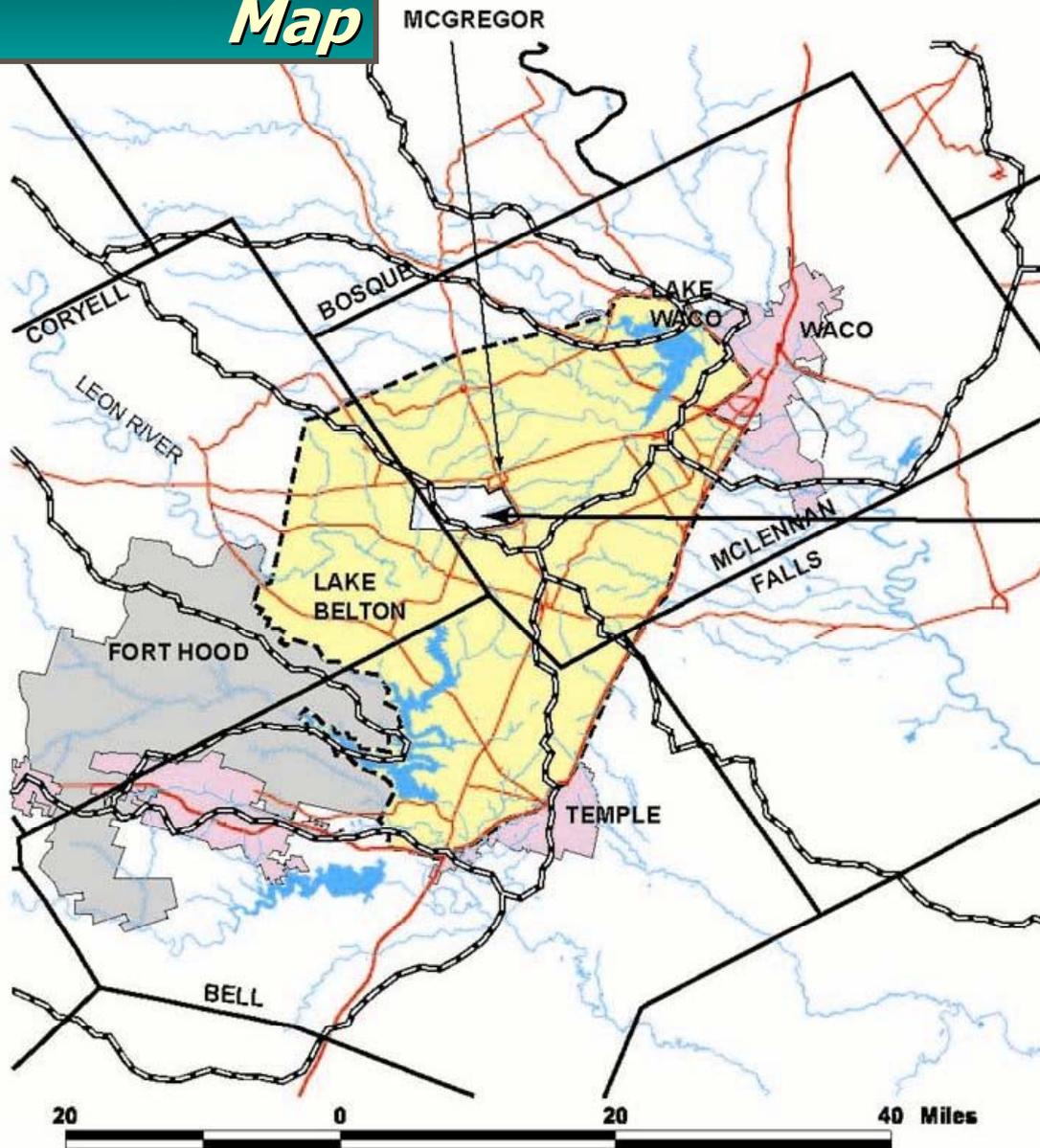


# ***The Bosque/Leon River Watershed Stakeholders Alliance***

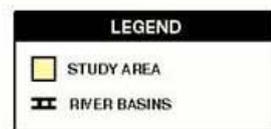
- **Brazos River Authority**
- **City of Belton**
- **City of Bruceville-Eddy**
- **City of Copperas Cove**
- **City of Gatesville**
- **City of Harker Heights**
- **City of Hewitt**
- **City of Killeen**
- **City of Lorena**
- **City of Moody**
- **Bluebonnett Water Supply Corporation**
- **Bell County and McLennon County Health Districts**
- **Central Texas American Water Works Association**
- **City of McGregor**
- **City of Morgan's Point**
- **City of Nolanville**
- **City of Robinson**
- **City of Temple**
- **City of Troy**
- **City of Waco**
- **City of Woodway**
- **Bell County WCID #1**
- **Bell County WCID #3**



# Study Area Map



NAVAL WEAPONS  
INDUSTRIAL RESERVE  
PLANT



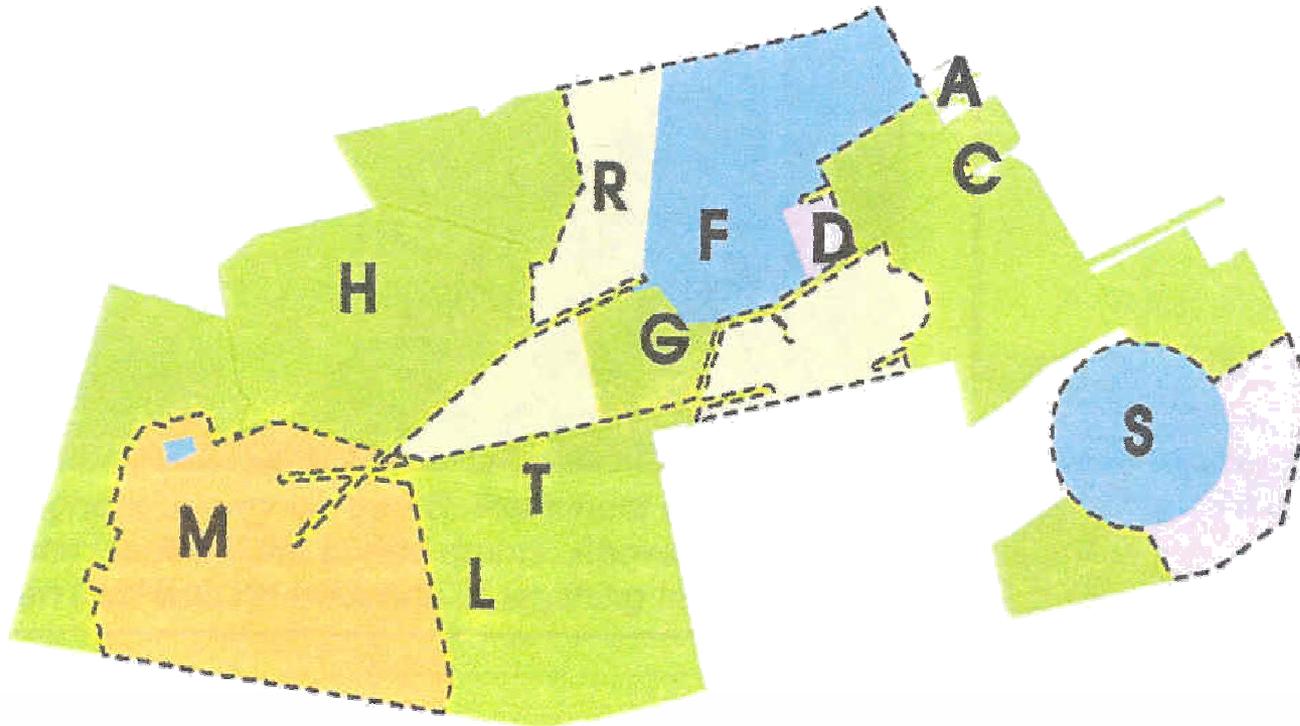
BRAZOS RIVER BASIN, TEXAS  
**BOSQUE & LEON RIVER BASINS**  
1 JANUARY 2001  
U.S. ARMY ENGINEER DISTRICT, FORT WORTH, TEXAS  
SOUTHWESTERN DIVISION



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# General Site Map - NWIRP McGregor

City of McGregor



*This map shows the location of the various areas on the property as well as the current transfer status.*

#### Transfer Status

|  |             |
|--|-------------|
|  | Transferred |
|  | Transferred |
|  | Optional    |
|  | Dec 03      |
|  | Nov 04      |
|  | Sep-Dec 05  |
|  | Sep-Dec 06  |

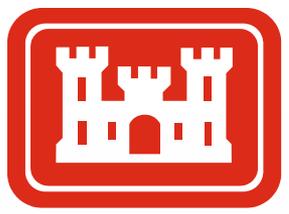
*Navy McGregor Project Update 2003*





# *Project Overview*

**Brian J. Condike**  
**Project Manager**  
**US Army Corps of Engineers**  
**Fort Worth District**





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# ***Project Overview***

- **Authority and Funding**
- **Project Goal**
- **Community Outreach**
- **Objectives**





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# *Authority and Funding*

Congress appropriated \$4,000,000 in FY 2001

\$2,100,000 in FY 2002

**Total**

**\$6,100,000**

*“...for the Corps of Engineers, in coordination with other Federal agencies and the Brazos River Authority, ...to assess the impact of perchlorate associated with the former NWIRP (Naval Weapons Industrial Reserve Plant) at McGregor, Texas.”*

- Public Law 106-377





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# *Project Goal*

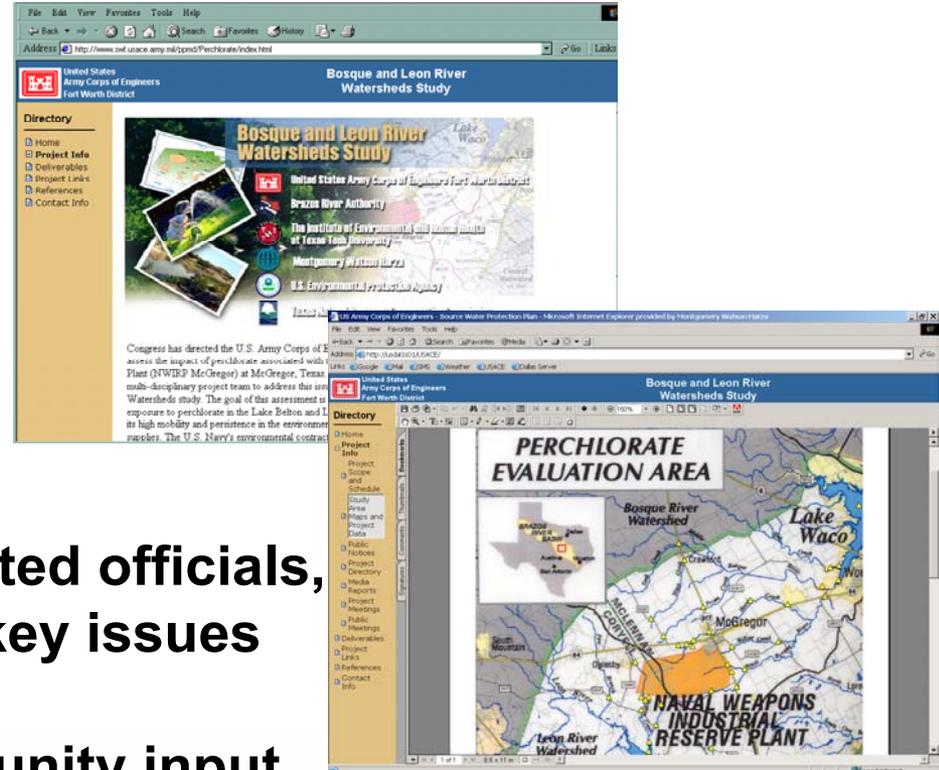
**Evaluate potential human and environmental exposure to perchlorate in the lakes Waco and Belton study area.**

*--- Project Team (February 2000)*



# Community Outreach

- Stakeholder interviews
- Community Relations Plan
- Stakeholder meetings
- Public meetings
- Briefings for elected official's
- Web site



[www.swf.usace.army.mil/ppmd/Perchlorate/index.html](http://www.swf.usace.army.mil/ppmd/Perchlorate/index.html)

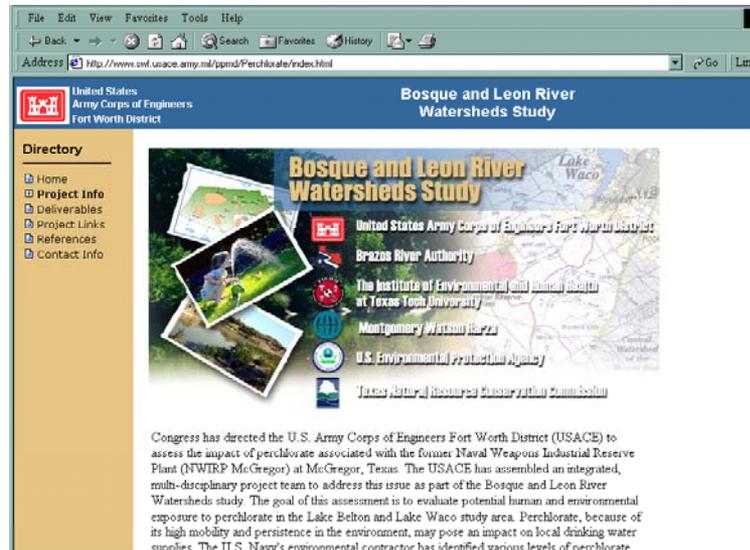
## Benefits:

- Ensures that stakeholders, elected officials, and the public are informed of key issues and project progress.
- Provides opportunity for community input



# Community Outreach Website

[www.swf.usace.army.mil/ppmd/Perchlorate/index.html](http://www.swf.usace.army.mil/ppmd/Perchlorate/index.html)



The screenshot shows a web browser window displaying the website for the "Bosque and Leon River Watersheds Study". The browser's address bar shows the URL: <http://www.swf.usace.army.mil/ppmd/Perchlorate/index.html>. The website header includes the US Army Corps of Engineers logo and the text "United States Army Corps of Engineers Fort Worth District" and "Bosque and Leon River Watersheds Study".

**Directory**

- Home
- Project Info
- Deliverables
- Project Links
- References
- Contact Info

**Bosque and Leon River Watersheds Study**

United States Army Corps of Engineers Fort Worth District  
Brazos River Authority  
The Institute of Environmental and Human Health at Texas Tech University  
Montgomery Watson Harza  
U.S. Environmental Protection Agency  
Texas Natural Resource Conservation Commission

Congress has directed the U.S. Army Corps of Engineers Fort Worth District (USACE) to assess the impact of perchlorate associated with the former Naval Weapons Industrial Reserve Plant (NWIRP McGregor) at McGregor, Texas. The USACE has assembled an integrated, multi-disciplinary project team to address this issue as part of the Bosque and Leon River Watersheds study. The goal of this assessment is to evaluate potential human and environmental exposure to perchlorate in the Lake Belton and Lake Waco study area. Perchlorate, because of its high mobility and persistence in the environment, may pose an impact on local drinking water supplies. The U.S. Navy's environmental contractor has identified various levels of perchlorate.





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# *Objectives*

## Completed

- **Develop effective community relations plan.** ✓
- **Compile existing study area information.** ✓
- **Identify data gaps in existing information.** ✓
- **Define and Develop the Conceptual Study Model (CSM).** ✓
- **Based on data gaps, develop Field Sampling Plans.** ✓
- **Field Investigation to fill the key data gaps.** **In Progress**
- **Evaluate fate and transport pathways.** **In Progress**



# *Objectives (Cont'd)*

## Completed

- Evaluate potential environmental exposure to perchlorate in the study area. **In Progress**
- Evaluate potential human exposure to perchlorate in the study area. **In Progress**
- Assess exposure pathways to vegetation, fish, birds, mammals. **In Progress**
- Assess impact on amphibians, fish, and large and small mammals. **In Progress**
- Integrate data and assess ecological risk **In Progress**



# ***TCEQ Regulatory Perspective***

- **Drinking water**
  - No MCL
  - TCEQ Interim Action Level = 4 ppb
- **Groundwater**
  - 4 ppb *Residential*
  - 7 ppb *Commercial/ Industrial*
- **Surface water**
  - 4 ppb
- **No Federal MCL**





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# *Ecological Evaluation*

**Todd Anderson**

**The Institute of Environmental and  
Human Health**

**Texas Tech University**



# ***Ecological Objectives***

- **Identify Points and Pathways of Exposure**
- **Assess Impacts on Fish and Amphibians**
- **Assess Impacts on Mammals and Birds**
- **Model Long-Term Exposure and Effects**





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# *Points and Pathways of Exposure*

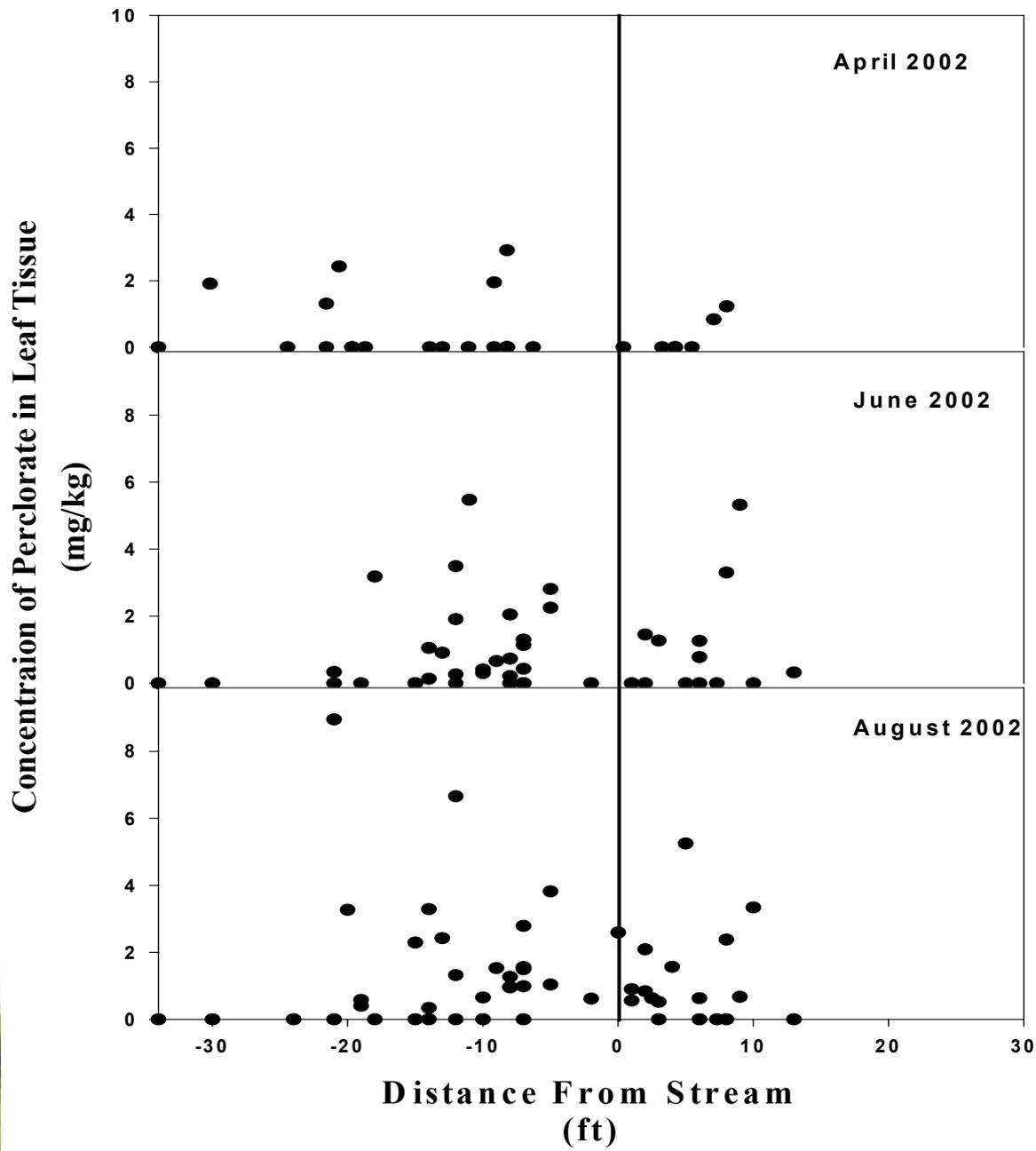
- **Water**
  - *varies with season*
- **Sediment**
  - *persistent*
- **Vegetation**
  - *perchlorate is present*
- **Fish**
  - *human exposure unlikely*





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# Perchlorate in Leaf Tissue





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# *Points and Pathways of Exposure*

## **Current Focus**

- Release of perchlorate from vegetation***
- Transformation of perchlorate in  
vegetation***
- Market basket-type survey***

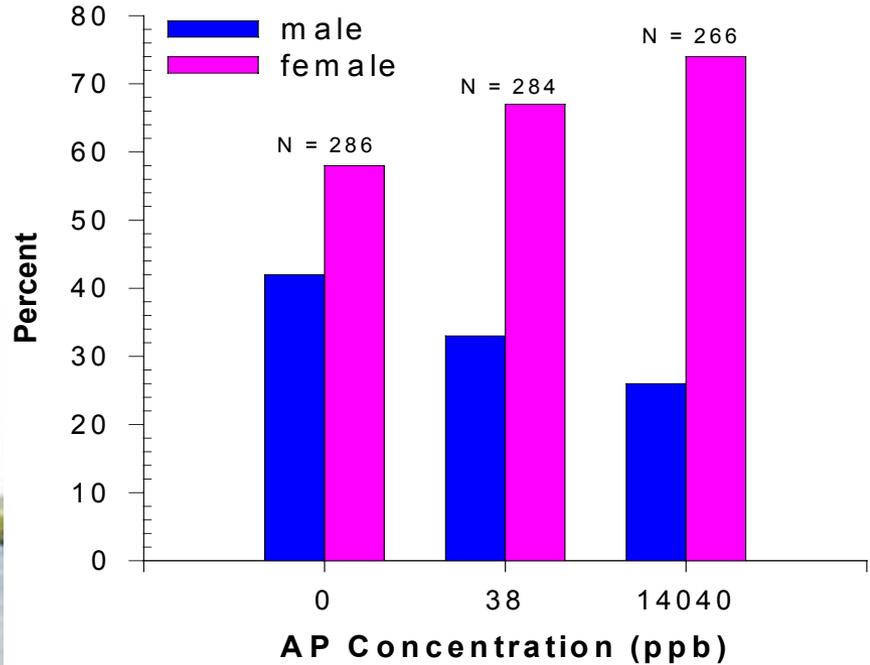
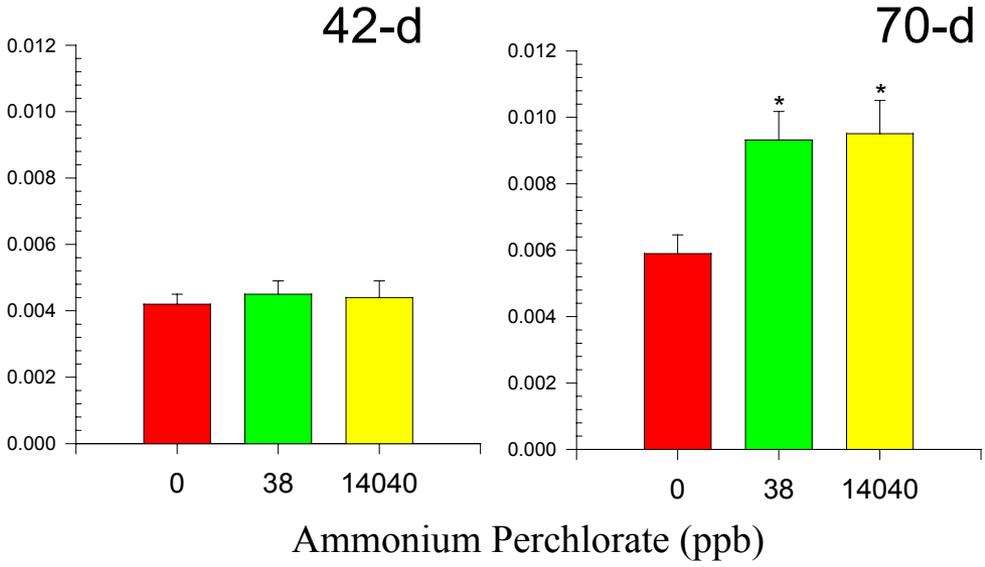


# Impacts on Fish and Amphibians



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- **Frogs and Fish**
  - *thyroid histology*
- **Frogs**
  - *male offspring*
- **Frogs**
  - *effects are reversible*

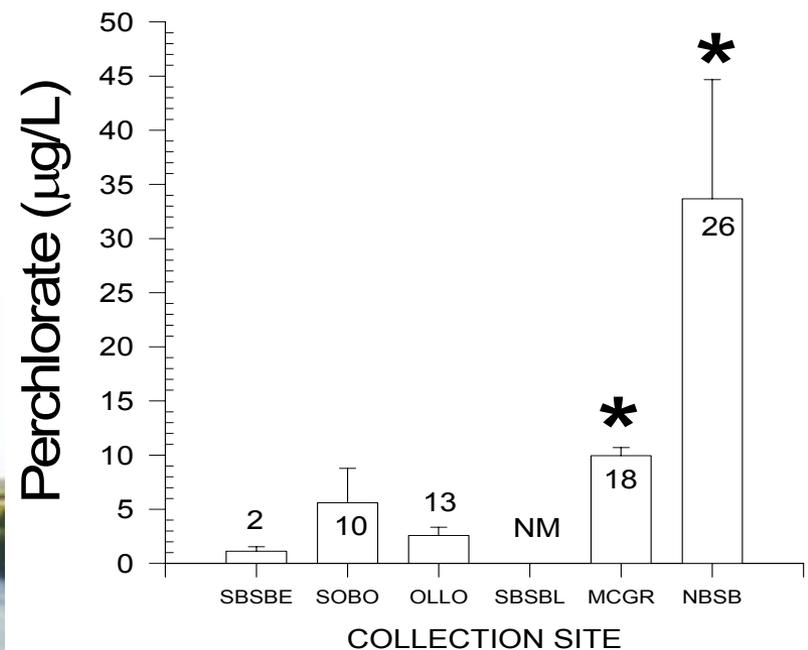
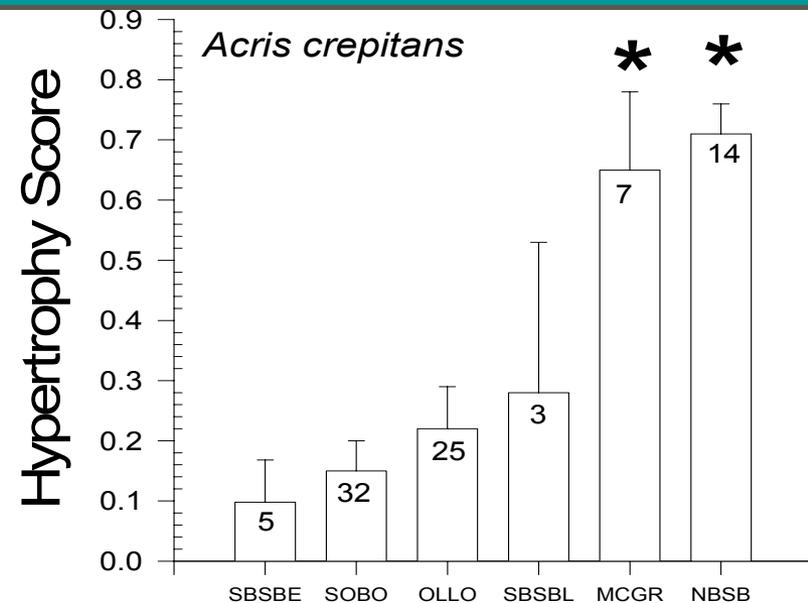


# Impacts on Fish and Amphibians



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- **Native Frogs and Fish**
  - *thyroid histology*





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# ***Impacts on Fish and Amphibians***

## **Current Focus**

- Continue thyroid histopathological assessment***
- Frog development in water from study area***
- Perchlorate in edible fish tissues***





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# *Impacts on Mammals and Birds*

- **Small Mammals**
  - *significant exposure risk*
- **Small Birds**
  - *perchlorate is present*
- **Tissue Distribution**
  - *no definite pattern*





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# ***Impacts on Mammals and Birds***

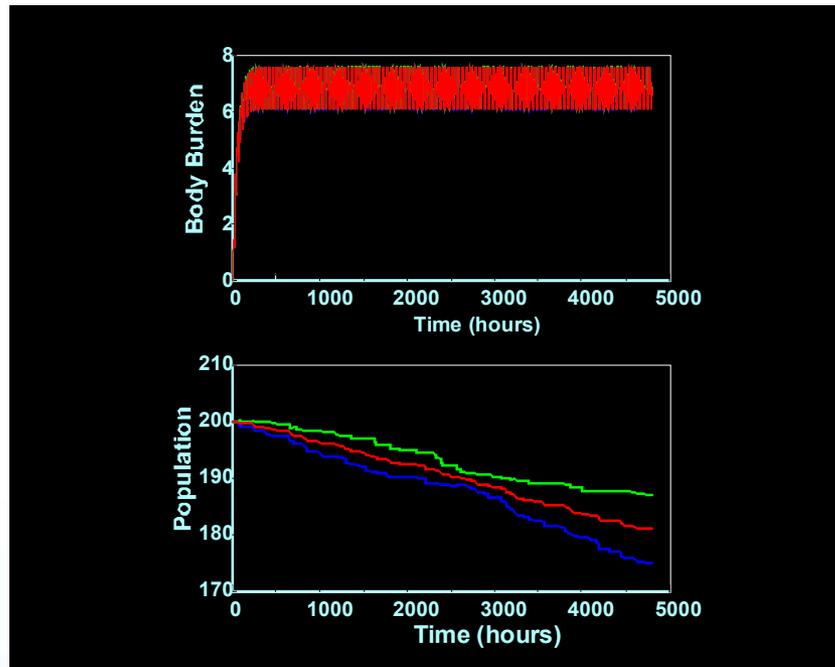
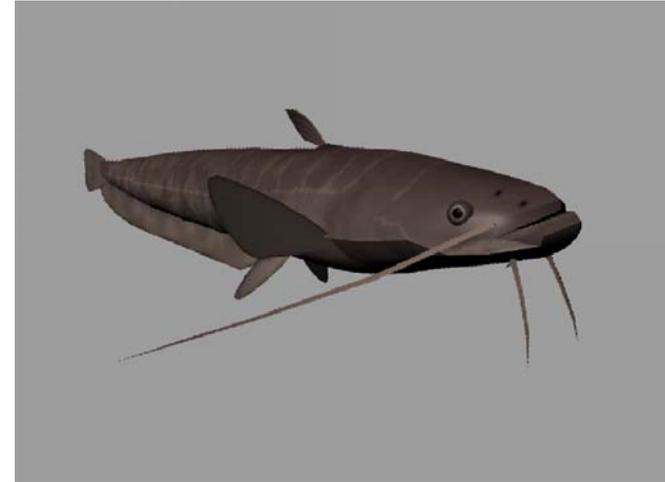
## **Current Focus**

- Perchlorate assessment in large mammals (cows)***
- Laboratory tissue distribution studies***
- Potential impacts on thermal regulation***



# Model Long-Term Exposure and Effects

- Exposure and Effects Simulations





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# ***Model Long-Term Exposure and Effects***

## **Current Focus**

- Model refinement using collected data***





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# ***Watershed Studies***

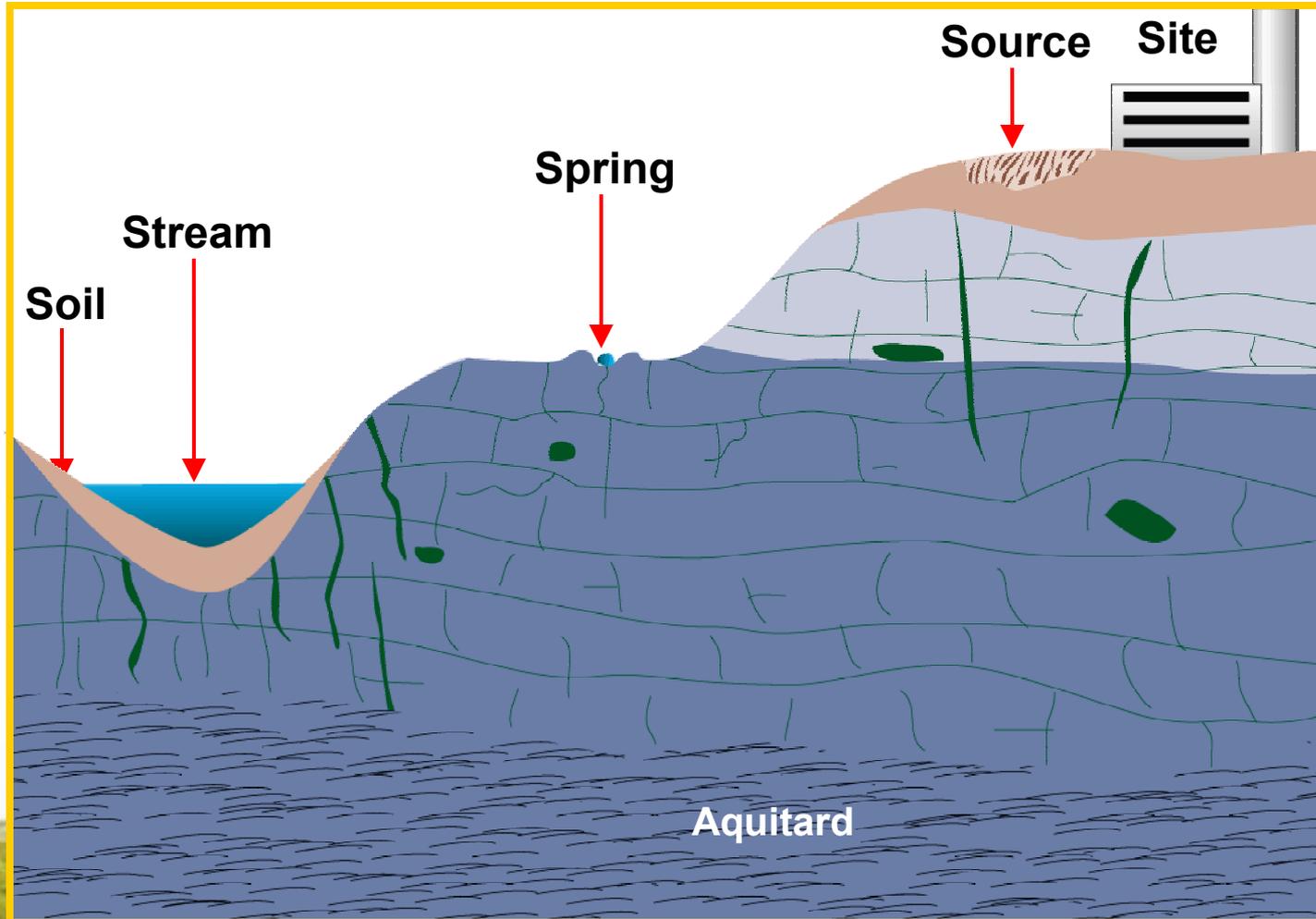
**Ronald Hartline P.E.  
Principal Engineer  
MWH**





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# *Conceptual Site Model Summary*





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# ***Watershed Study Components***

- **Longitudinal stream sampling (bi-weekly and storm events)**
- **Belton & Waco delta area sampling (surface water, sediment pore water, algae, & golf course intake sampling from Lake Waco)**
- **Lake Belton Acoustic Doppler Current Profiler flow analysis**
- **Groundwater dye tracer study**
- **Lake Belton anoxic study**





# *Field Sampling Plans (FSP)*

## **Completed:**

- Overall Sampling and Analysis Plan
- Longitudinal Stream Sampling Study FSP
- Lake Belton and Lake Waco Delta Areas FSP
- Lake Belton Acoustic Doppler Current Profiler Survey FSP
- Lake Belton Anoxic Study FSP

## **Under Development:**

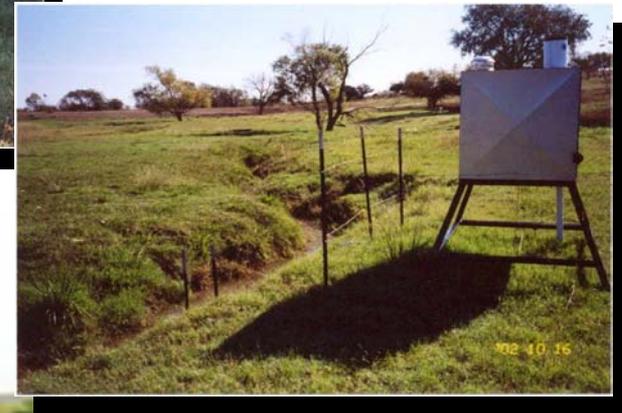
- Groundwater Dye Tracer Study FSP



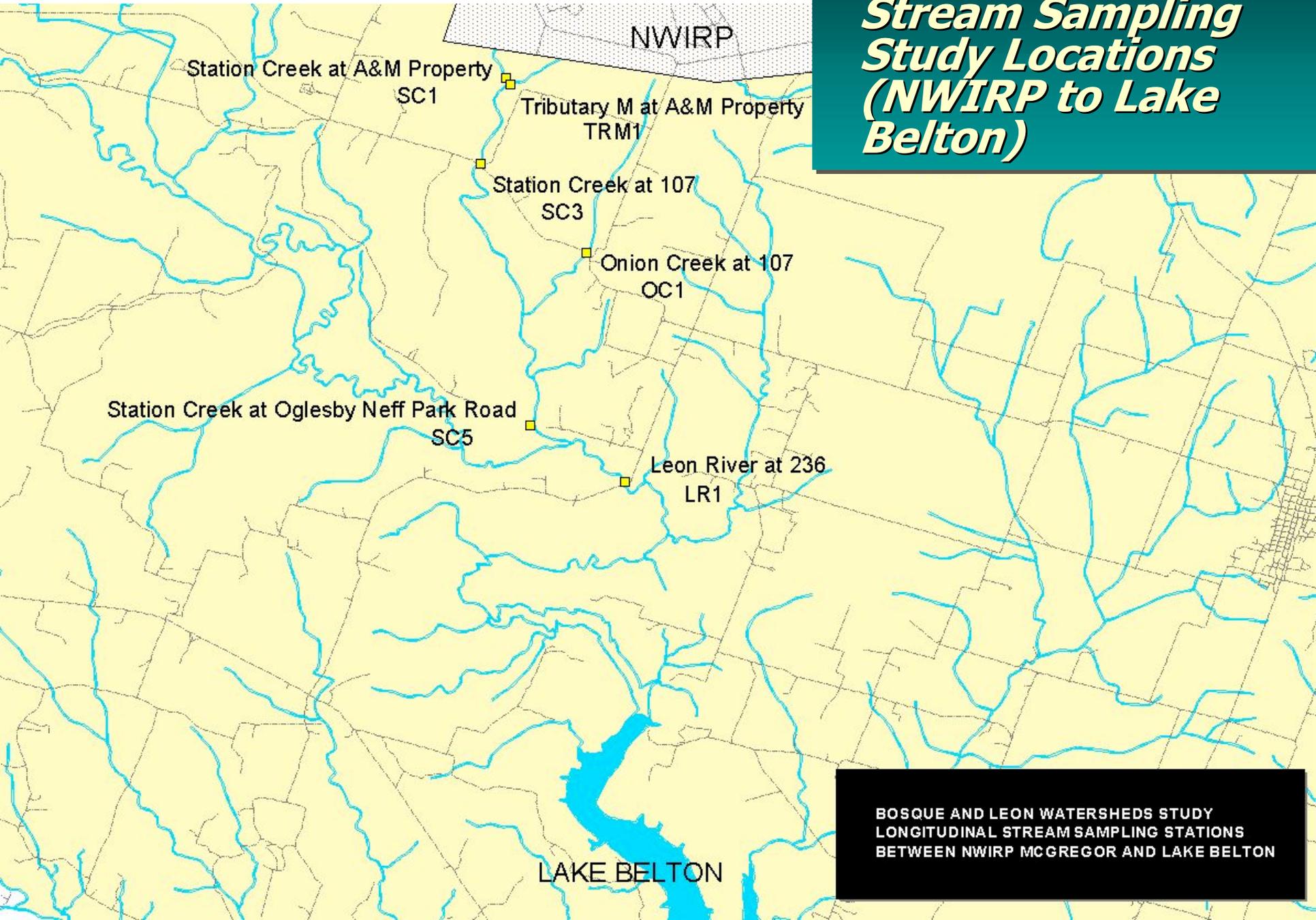


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# *Automated Sampling Stations installed throughout watersheds*

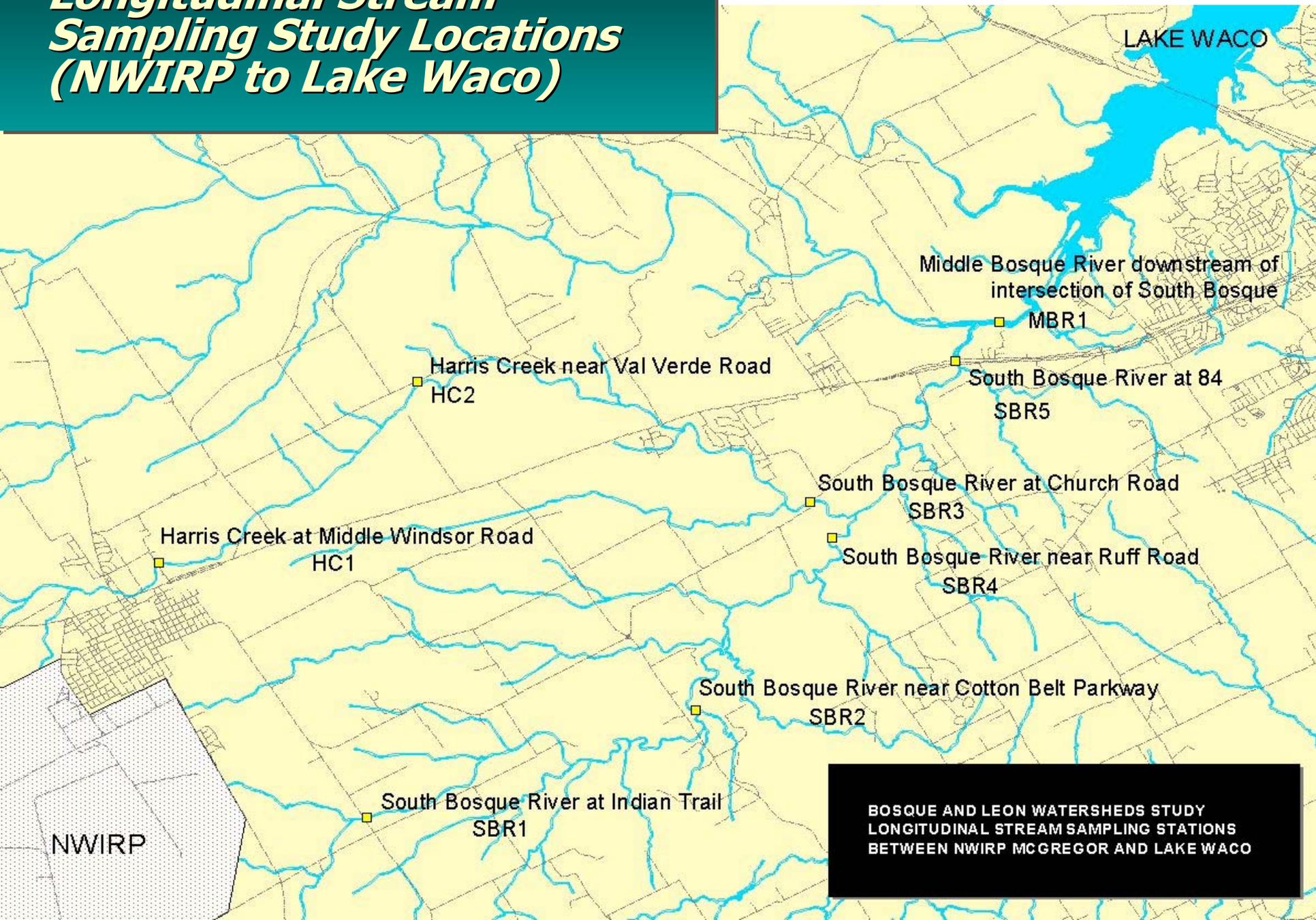


# *Longitudinal Stream Sampling Study Locations (NWIRP to Lake Belton)*



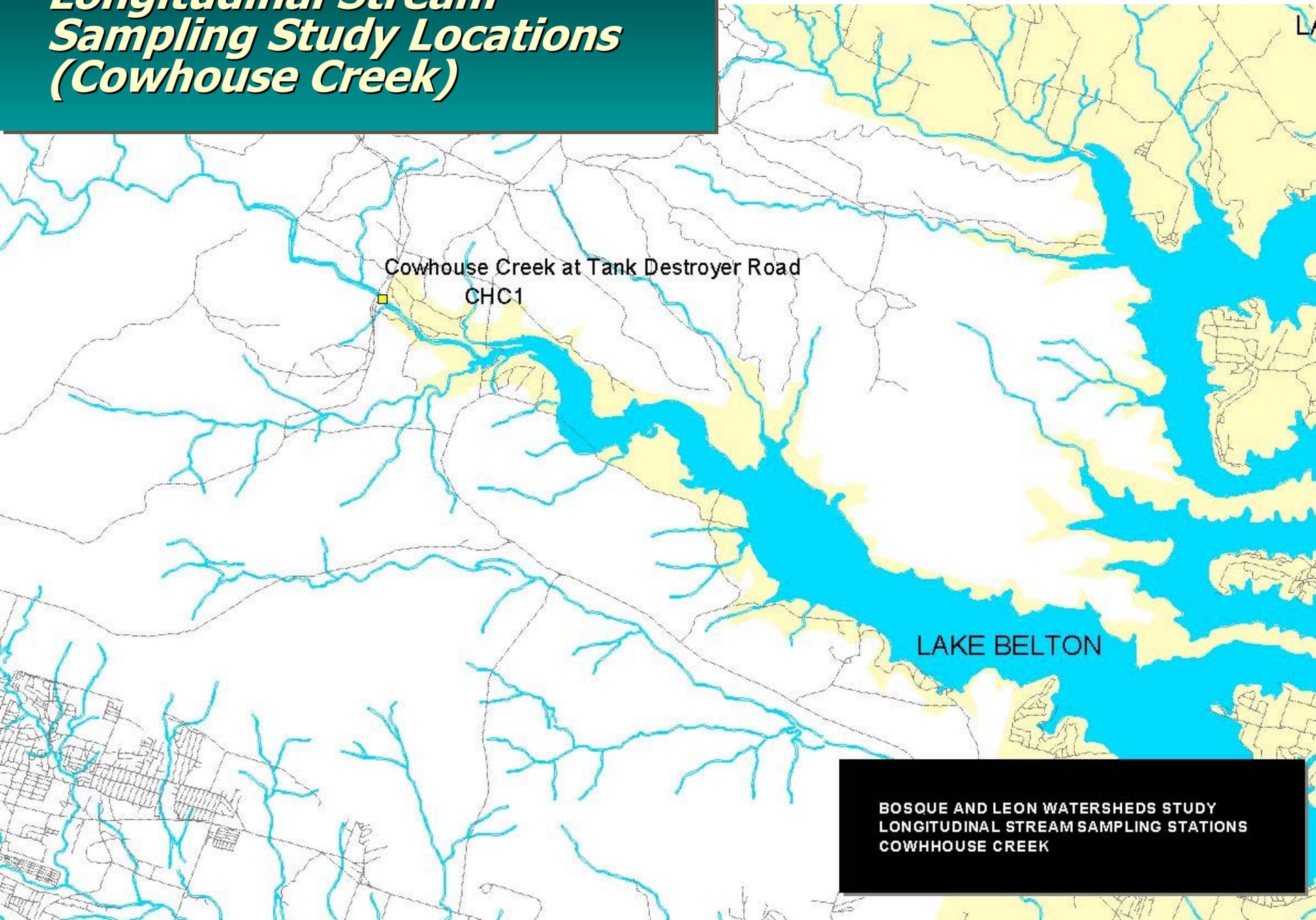
BOSQUE AND LEON WATERSHEDS STUDY  
LONGITUDINAL STREAM SAMPLING STATIONS  
BETWEEN NWIRP MCGREGOR AND LAKE BELTON

# *Longitudinal Stream Sampling Study Locations (NWIRP to Lake Waco)*



**BOSQUE AND LEON WATERSHEDS STUDY  
LONGITUDINAL STREAM SAMPLING STATIONS  
BETWEEN NWIRP MCGREGOR AND LAKE WACO**

# *Longitudinal Stream Sampling Study Locations (Cowhouse Creek)*

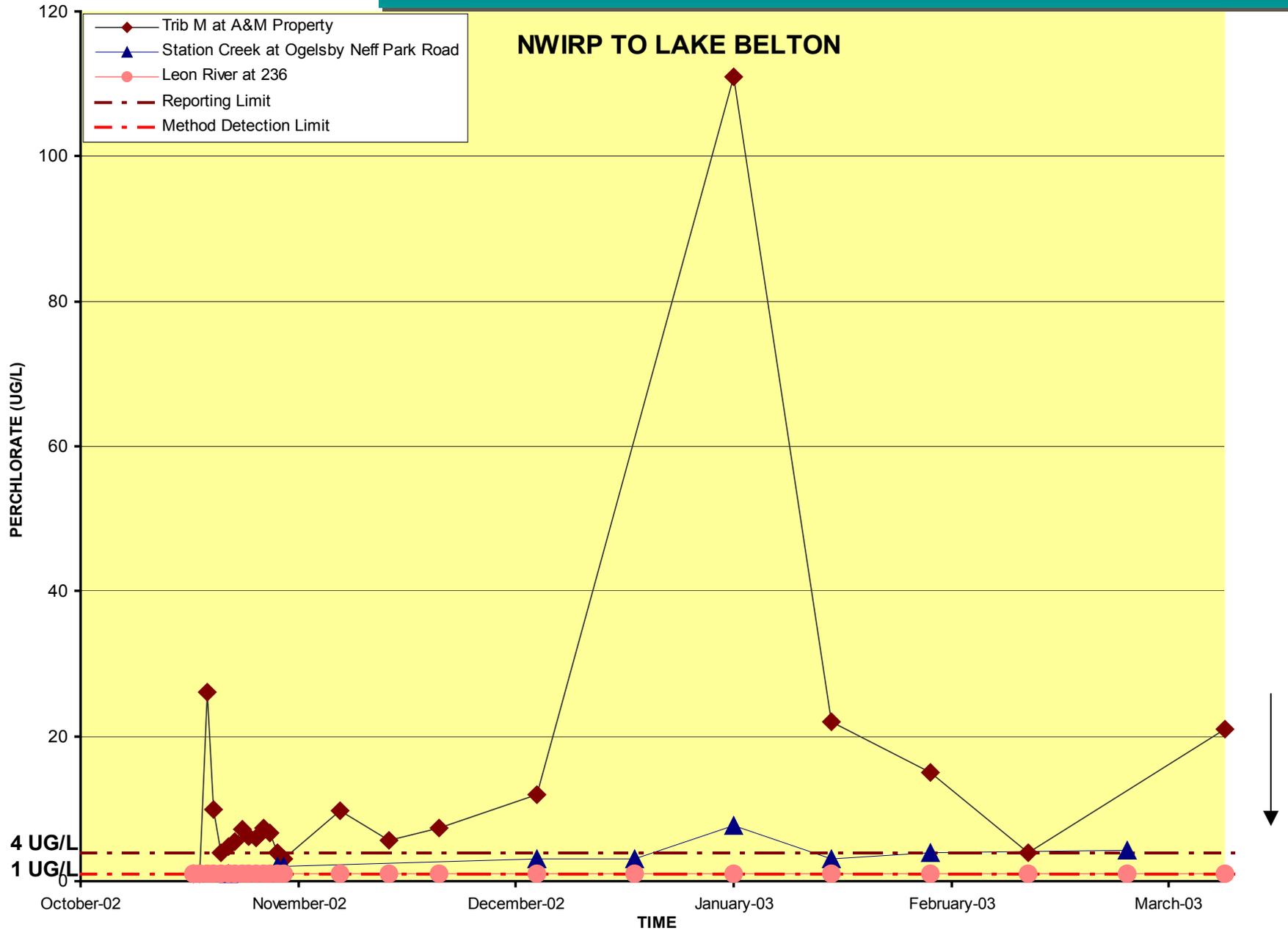


Cowhouse Creek at Tank Destroyer Road  
CHC1

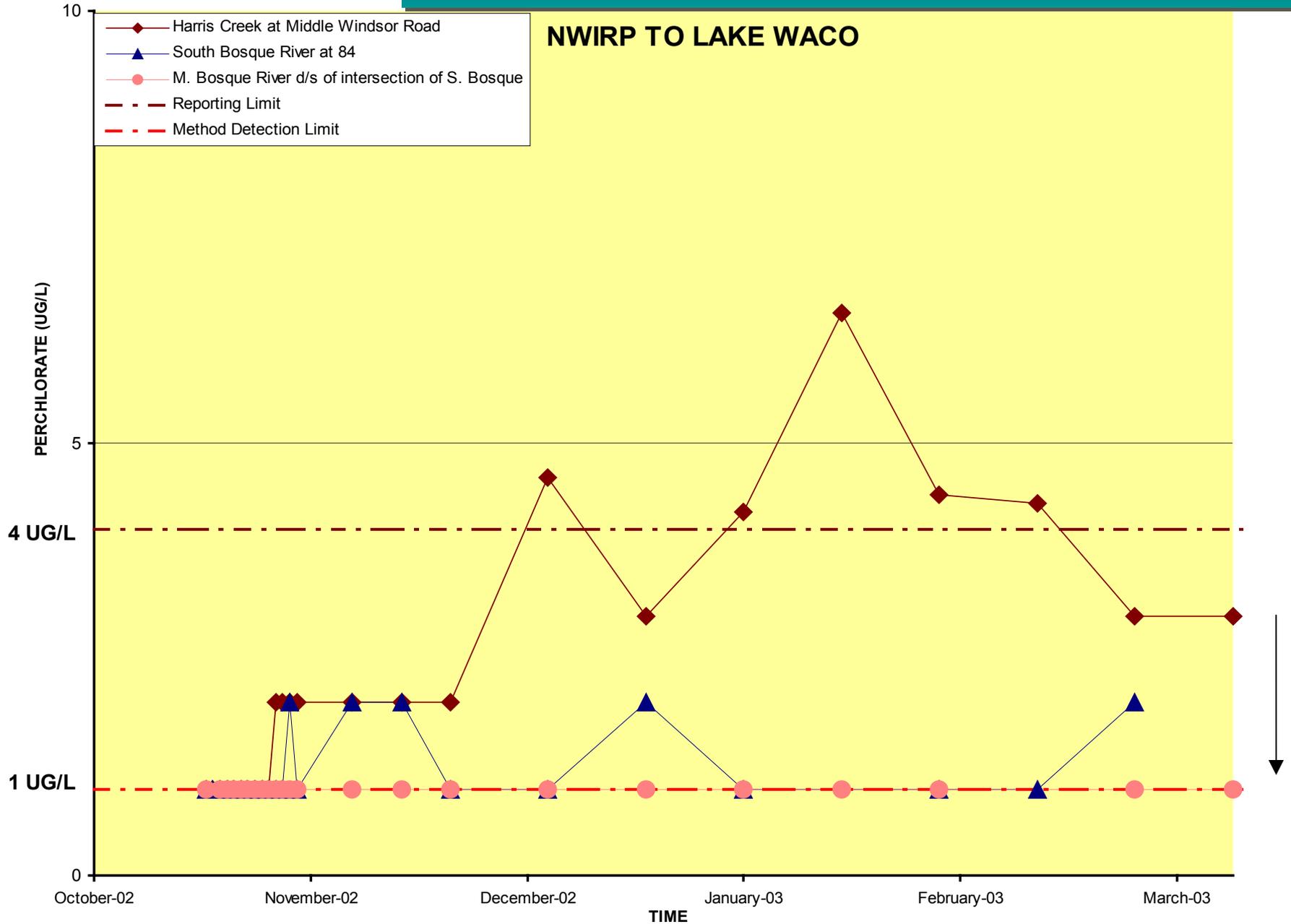
LAKE BELTON

BOSQUE AND LEON WATERSHEDS STUDY  
LONGITUDINAL STREAM SAMPLING STATIONS  
COWHOUSE CREEK

# Longitudinal Stream Sampling Study Perchlorate Concentrations

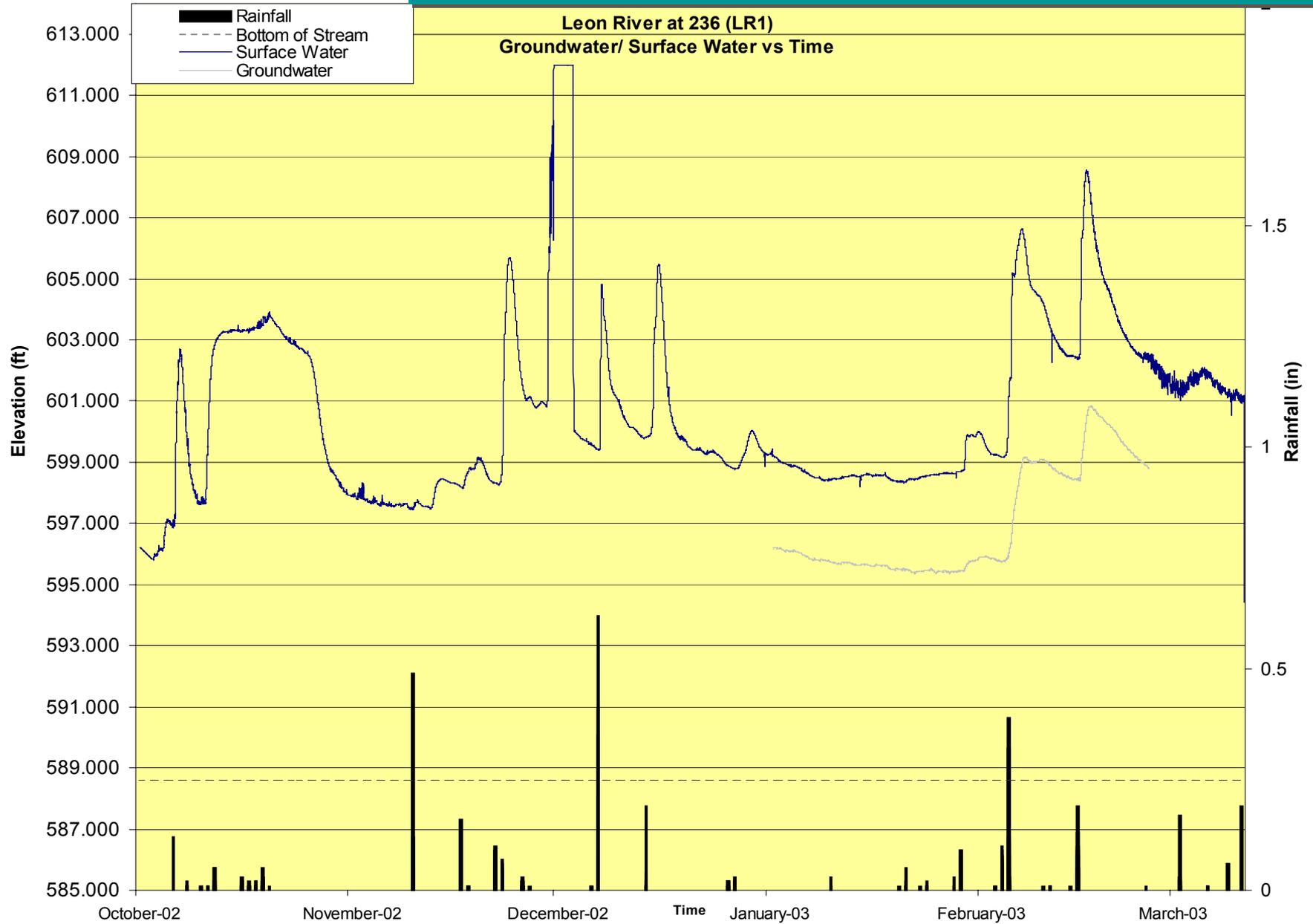


# Longitudinal Stream Sampling Study Perchlorate Concentrations





# Surface Water levels, Groundwater levels and Rainfall Relationships





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# *Lake Belton ADCP Study*

## **Objective:**

To better understand the flow patterns within Lake Belton.

## **Activities completed:**

Spring 2003 event

## **Activities to be conducted:**

Summer 2003 event

Fall 2003 event

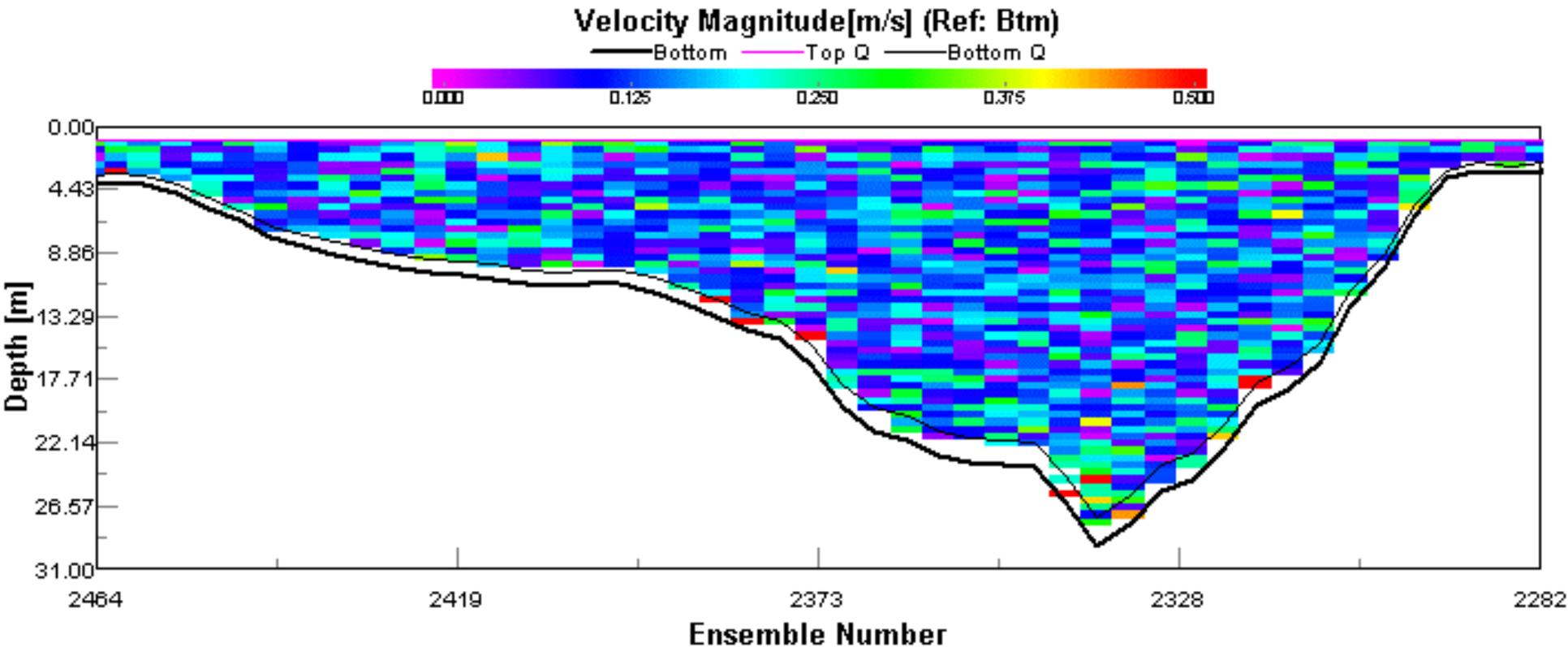
Winter 2003 event





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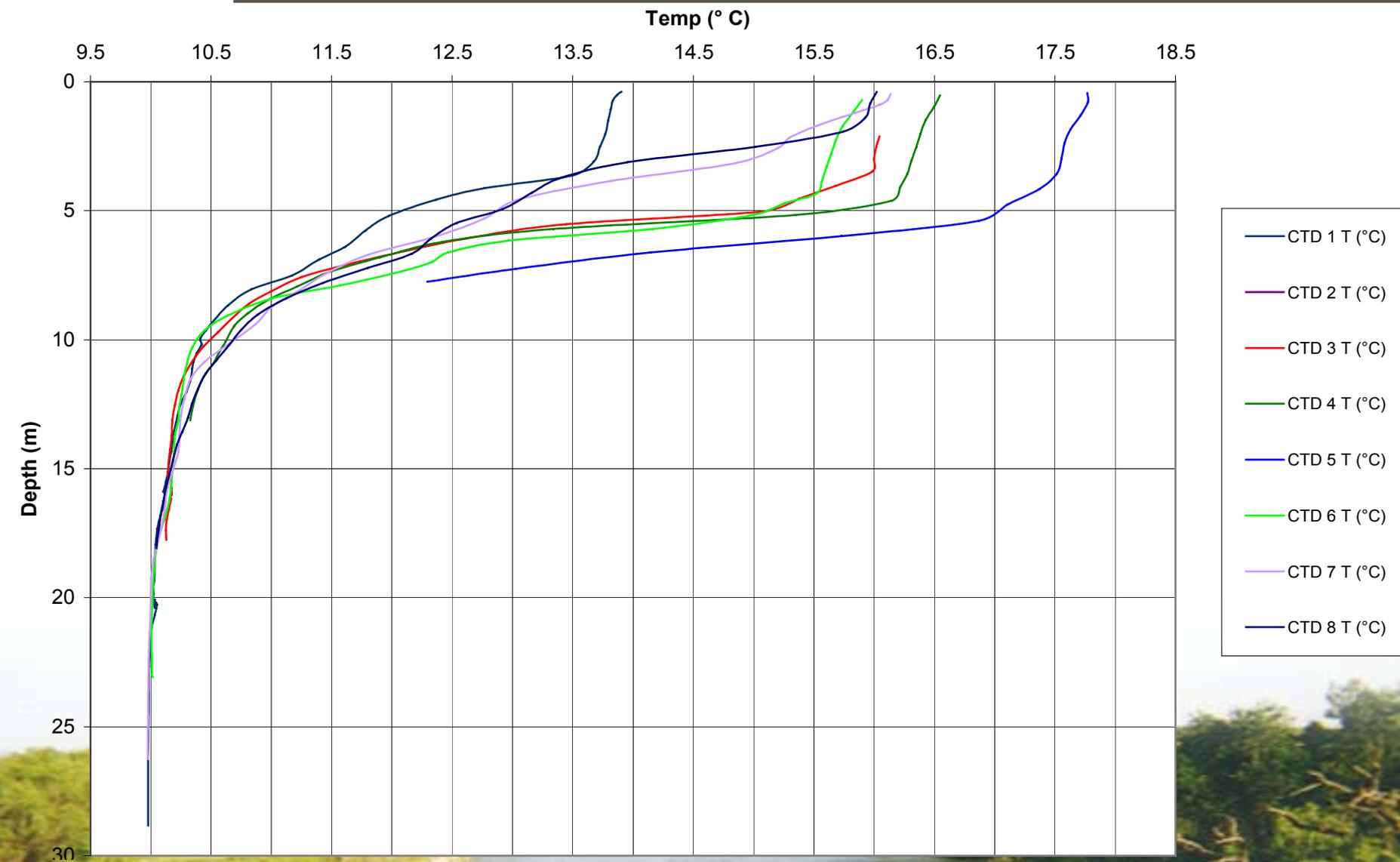
# *Transect Cross Section and Flow Patterns*





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# Temperature Profile in Lake Belton





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# *Geographic Information System*

**Allows for the integration of the following information and data:**

- **Monitoring wells**
- **Surface water sample locations**
- **Analytical data**
- **Selected watershed features**
- **Topography**

## **Demonstrations**

- **Sampling Stations and Wells**
- **Lake Belton ADCP Study**

**Benefits:**

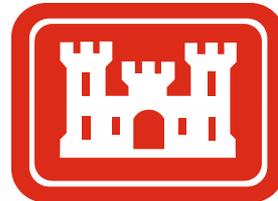
- **Integrates the Navy's, stakeholder's and other information**
- **Used as analytical tool in the fate and transport analysis**





# *Conclusion*

**Brian J. Condike**  
**Project Manager**  
**US Army Corps of Engineers**  
**Fort Worth District**





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# *Intake Sampling Locations*





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# *Intake Sampling Results*

## **LAKE BELTON INTAKE SAMPLING RESULTS (Conducted by BRA)**

|                      |                              |
|----------------------|------------------------------|
| <b>January 2003</b>  | <b>ND</b>                    |
| <b>February 2003</b> | <b>No sampling conducted</b> |
| <b>March 2003</b>    | <b>ND</b>                    |

## **LAKE WACO INTAKE SAMPLING RESULTS (Conducted by City of Waco)**

|                      |           |
|----------------------|-----------|
| <b>January 2003</b>  | <b>ND</b> |
| <b>February 2003</b> | <b>ND</b> |
| <b>March 2003</b>    | <b>ND</b> |





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# *Remaining Work to be Accomplished*

- **Complete field investigations to gain needed information.**
- **Geographic Information System (GIS) database.**
- **Ecological and toxicological assessment of study area.**
- **Complete a comprehensive evaluation of the potential threat to human and environmental health.**
- **Prepare final project report**





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# *Preliminary Results*

## **Perchlorate:**

- Varies in surface water with location, season, and rainfall
- Is persistent in sediment
- Is found in various plant species
- Is found in small mammals and birds
- Is not affecting amphibian metamorphosis
- Is affecting fish thyroid tissues
- Can affect frog reproduction (male/ female ratio)



# *Preliminary Results*

- Gaining and losing streams have been identified.
- Preferential flow patterns have been identified in Lake Belton during ADCP spring study.
- Perchlorate concentrations dilute significantly as they travel downstream from NWIRP.
- All samples collected from the Leon River, Middle Bosque and Cowhouse creek are below detection levels.
- All intake sampling performed by the study team have been below detection limits.





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# *Conclusion*

# Questions?

