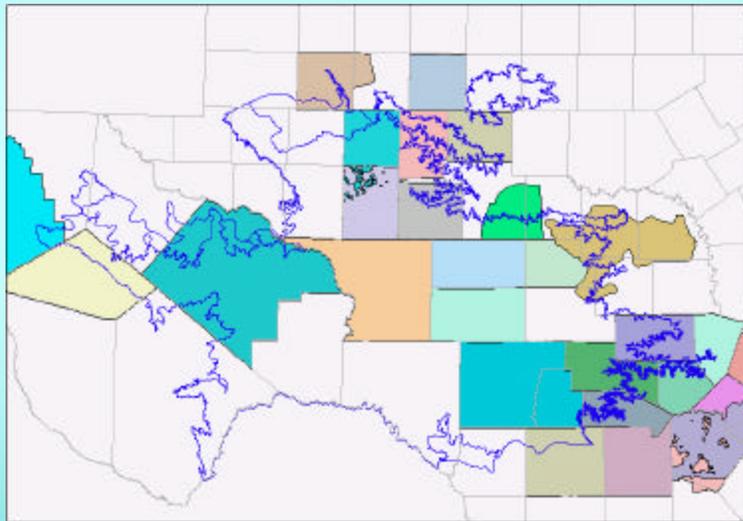




# Welcome To The First Quarterly Edwards-Trinity Aquifer Model Stakeholders Advisory Forum



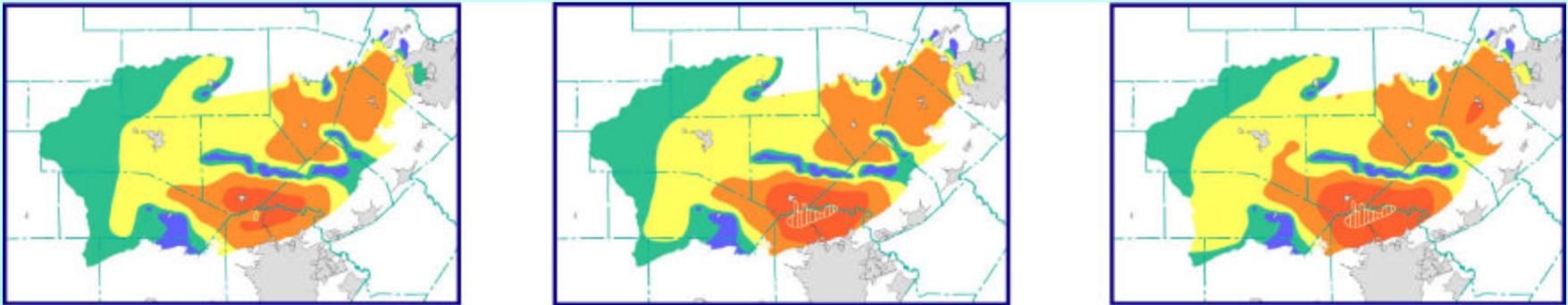
**ET SAF 1**

**May 16, 2001**

**Texas Water Development Board  
Groundwater Availability Modeling**



# **An Example GAM Model - The Trinity Aquifer Model For The Hill Country Of Texas**

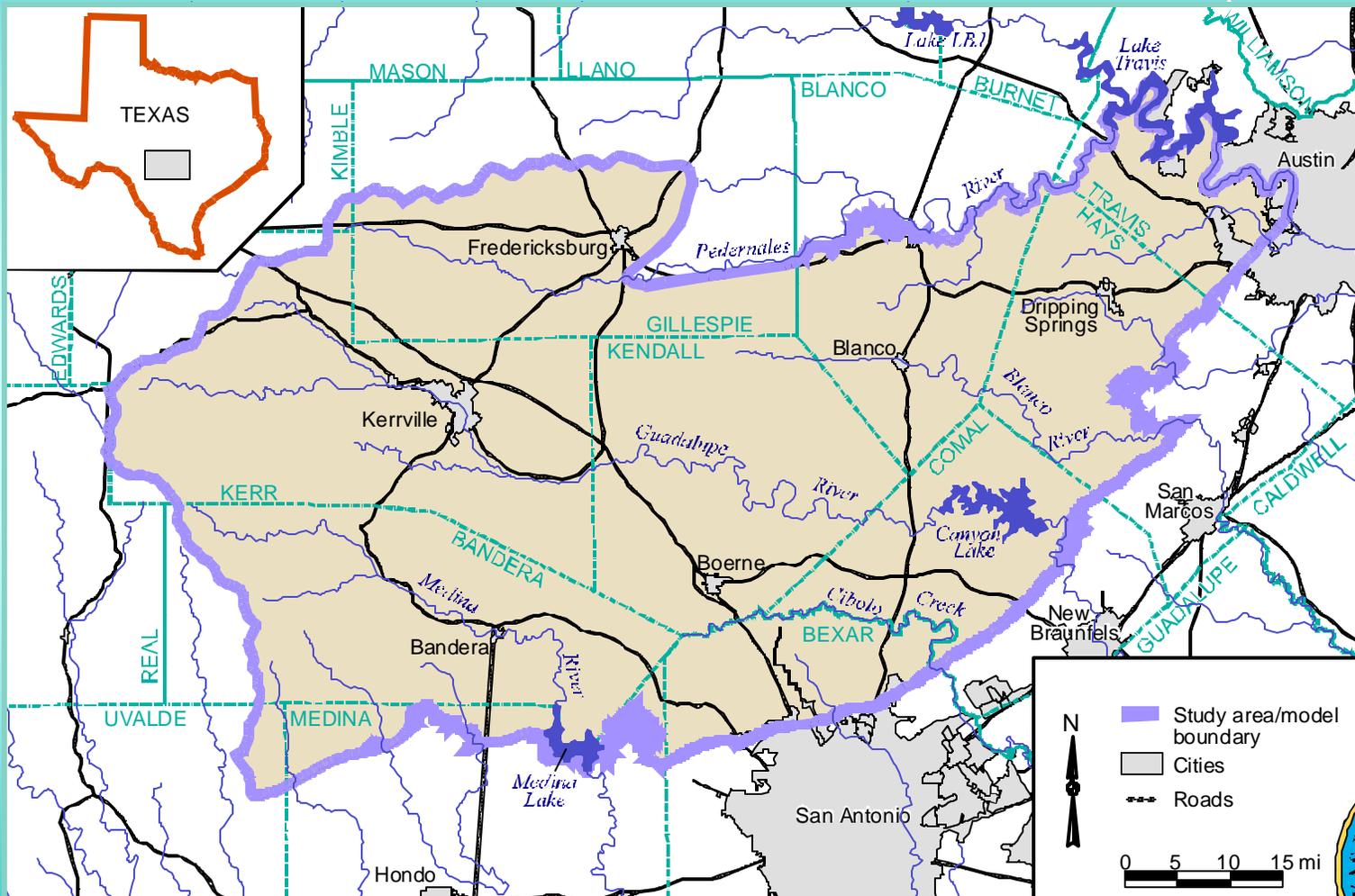


**Roberto Anaya**

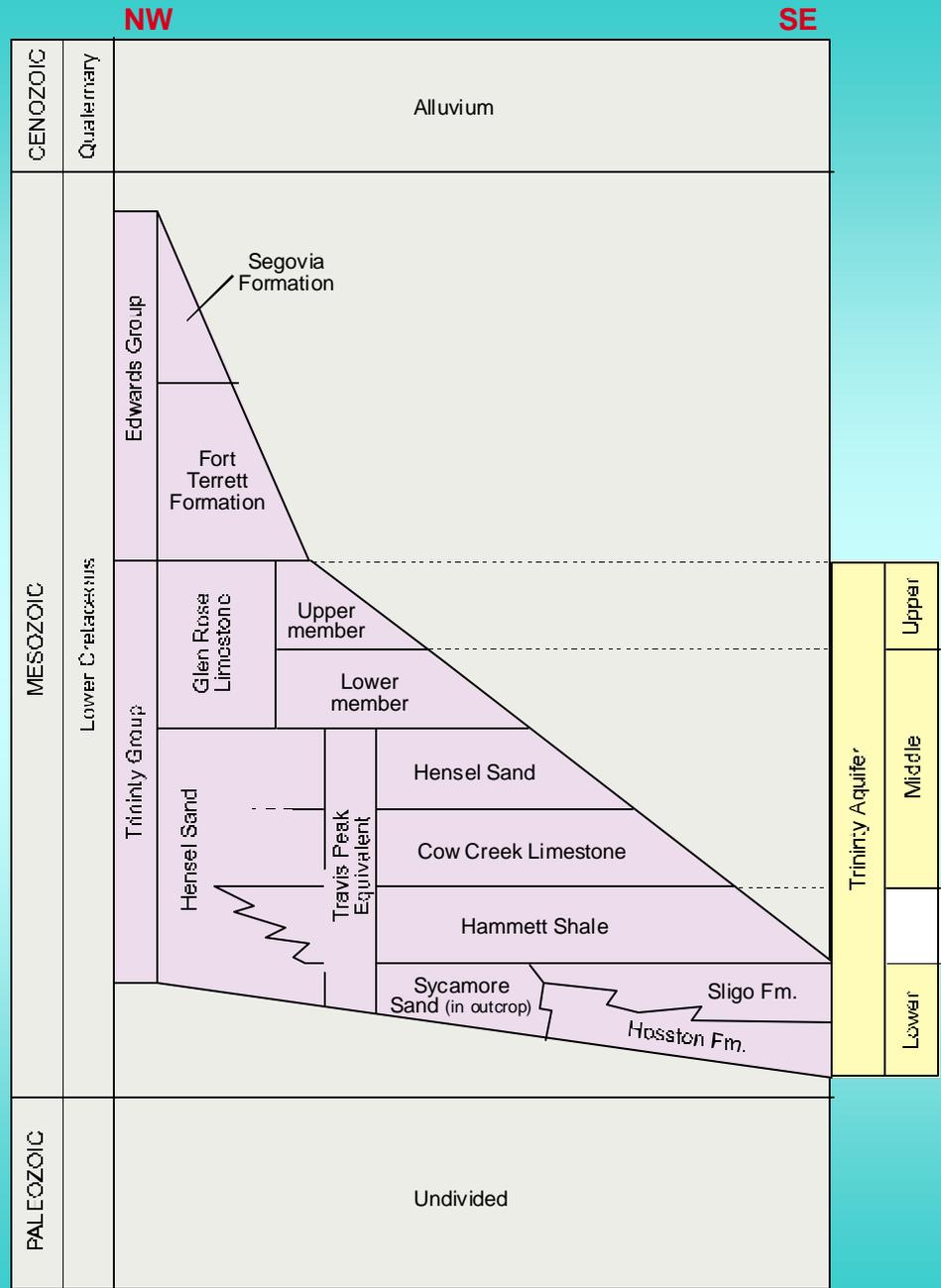
**Texas Water Development Board**



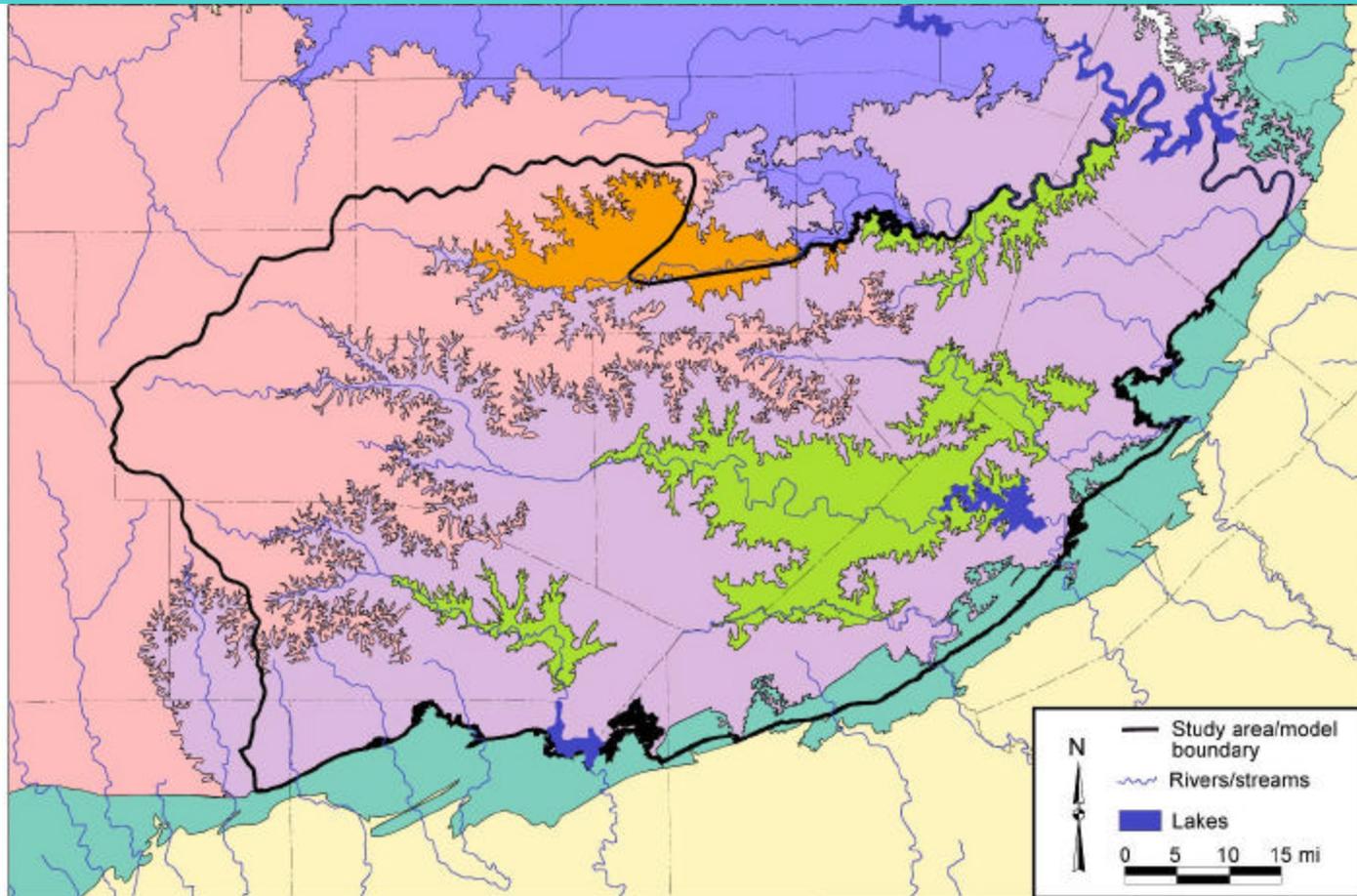
# Trinity Aquifer Study Area



# hydrostratigraphy



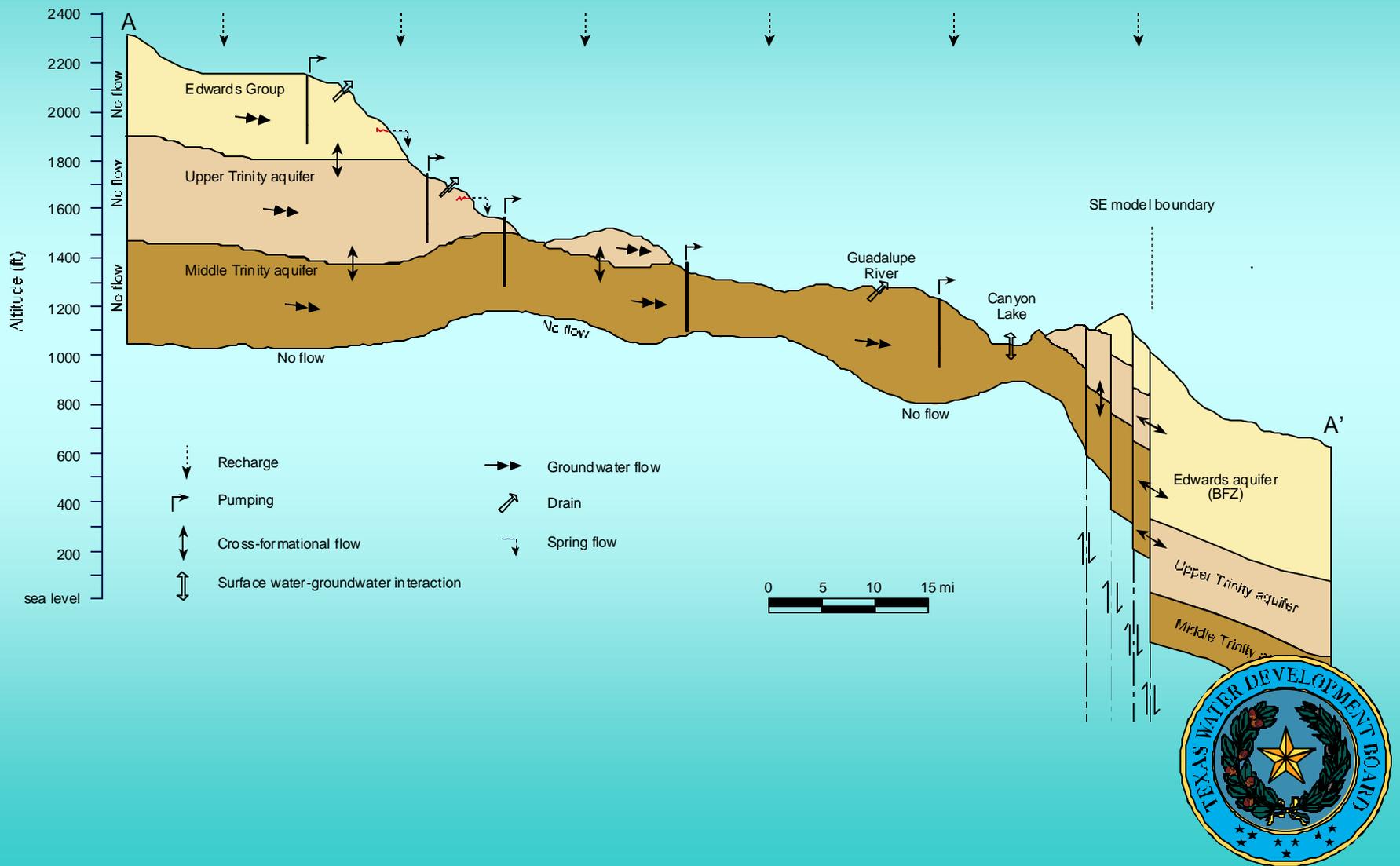
# surface geology



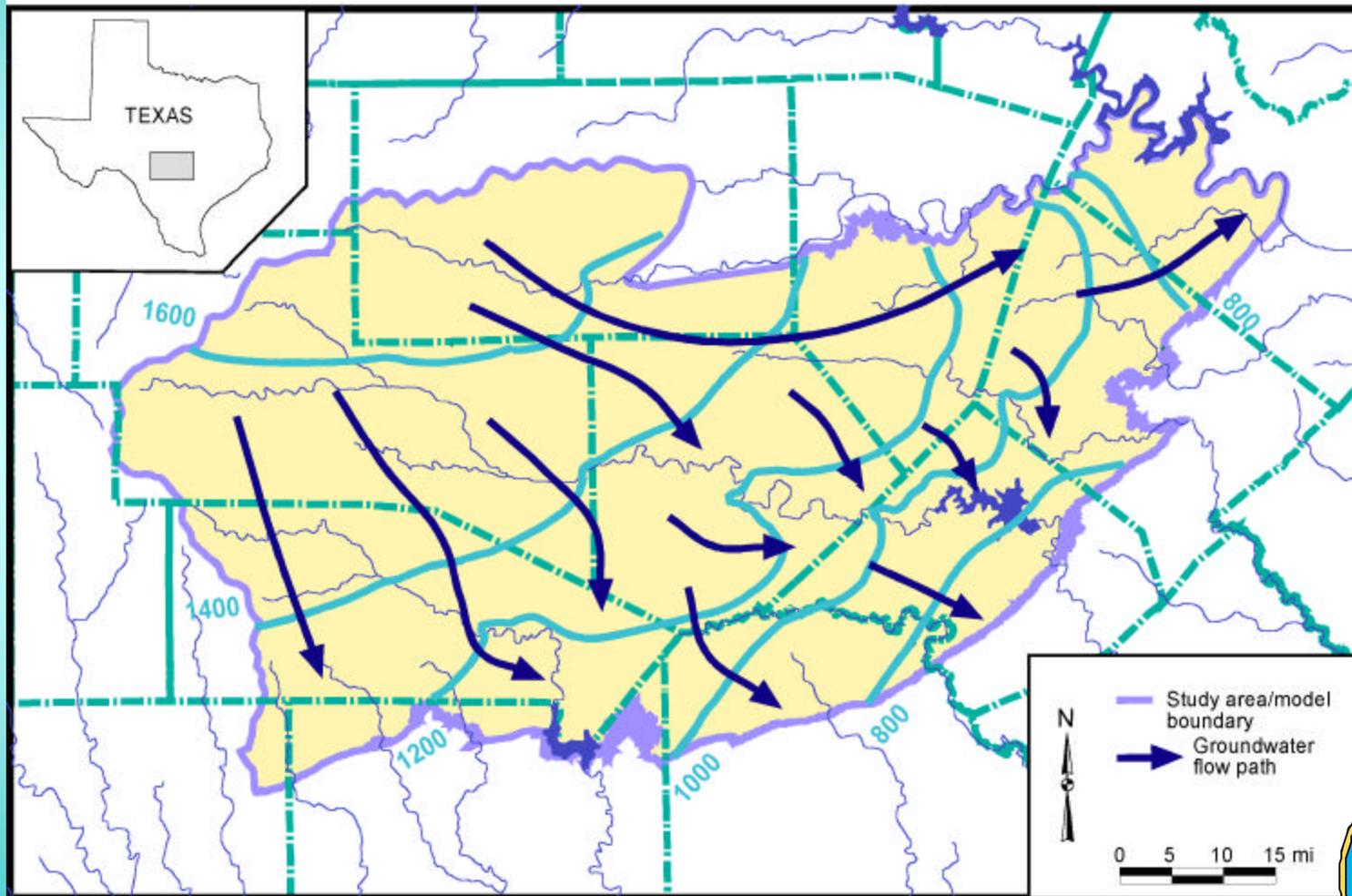
- Sediments younger than Edwards Group
- Edwards Group (BFZ)
- Edwards Group (Plateau)
- Upper member of the Glen Rose Limestone
- Lower member of the Glen Rose Limestone
- Hensel Sand
- Sediments older than the Hensel Sand



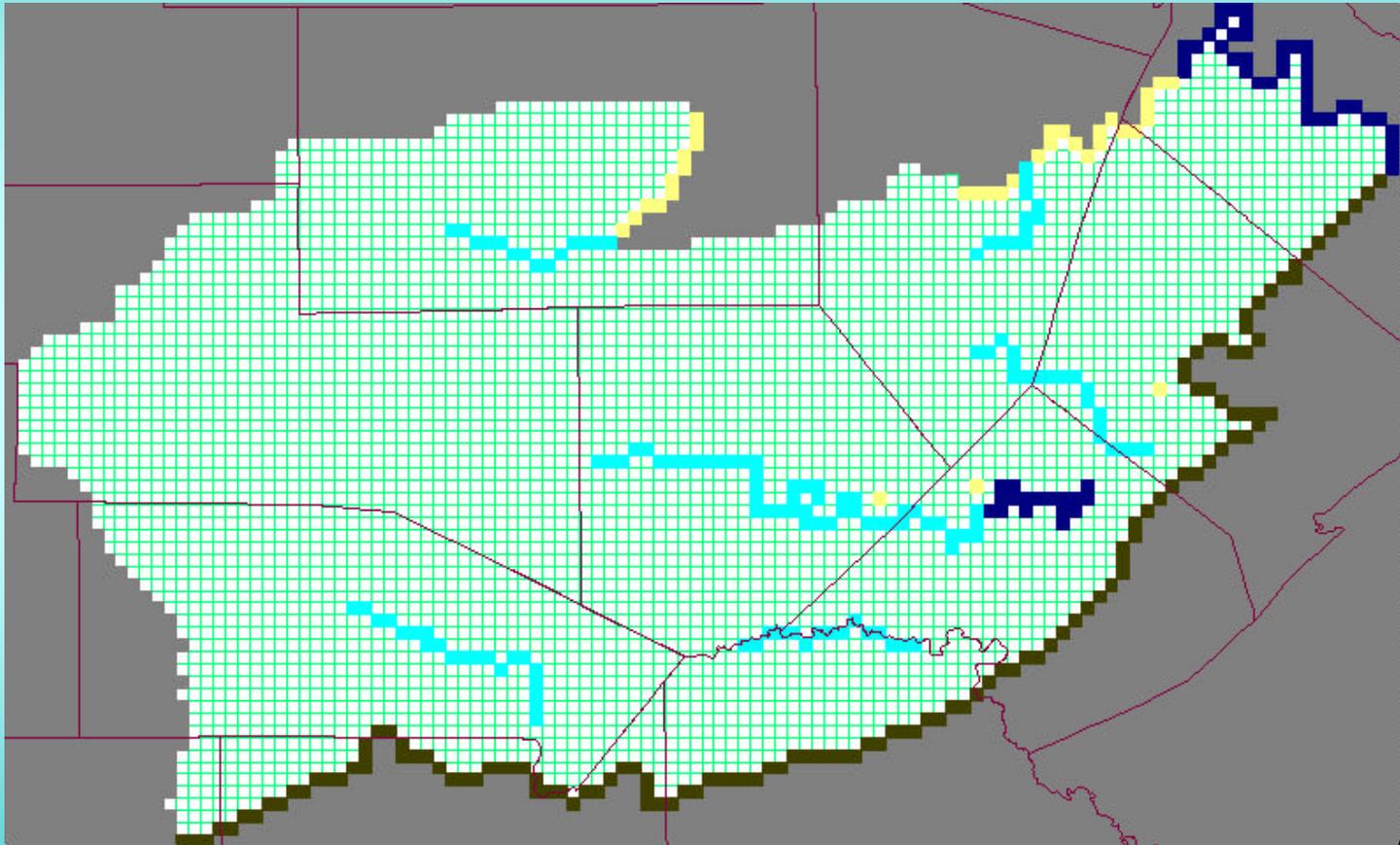
# A West-to-East Cross Section



# Groundwater Flow Paths

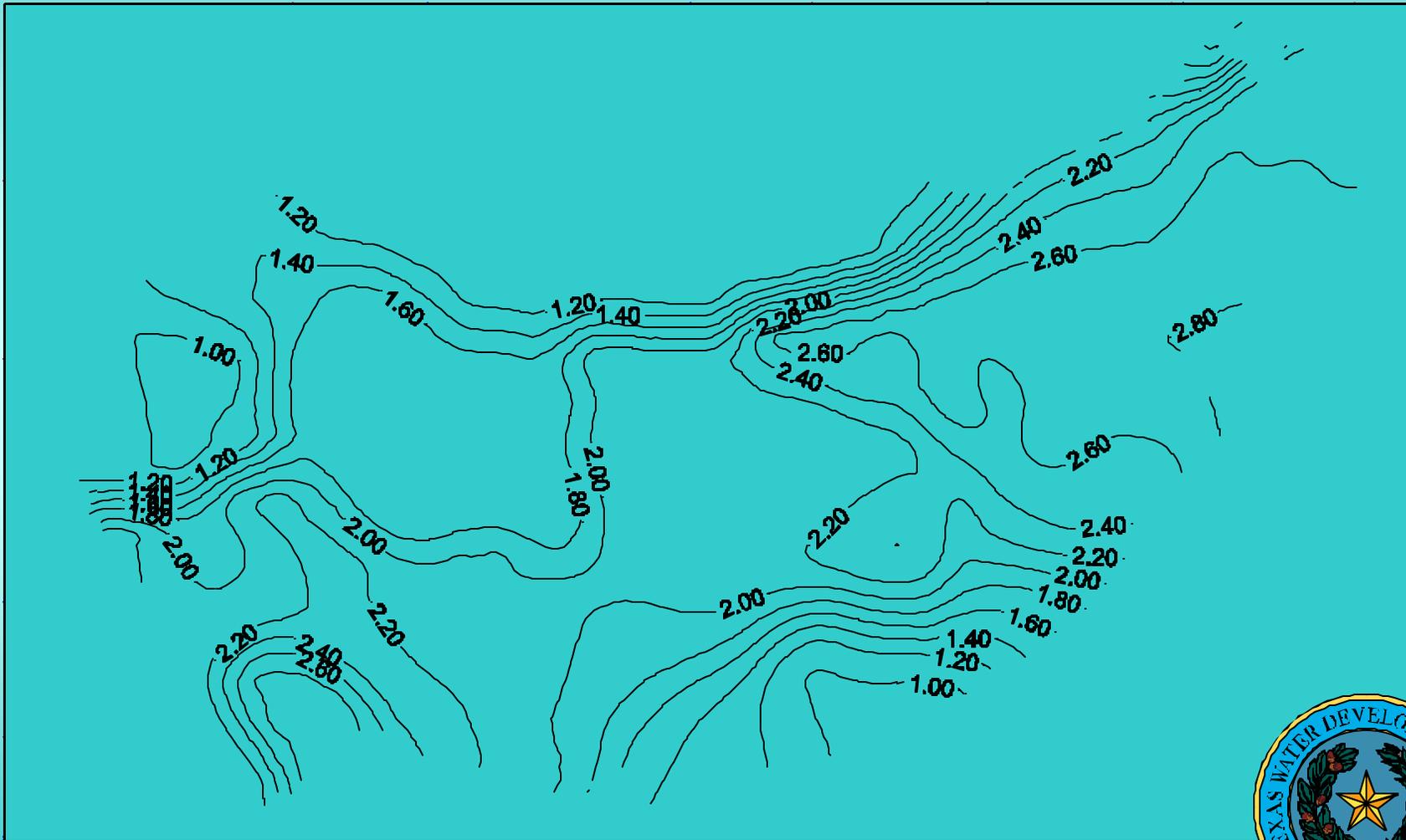


# Model Grid And Boundaries

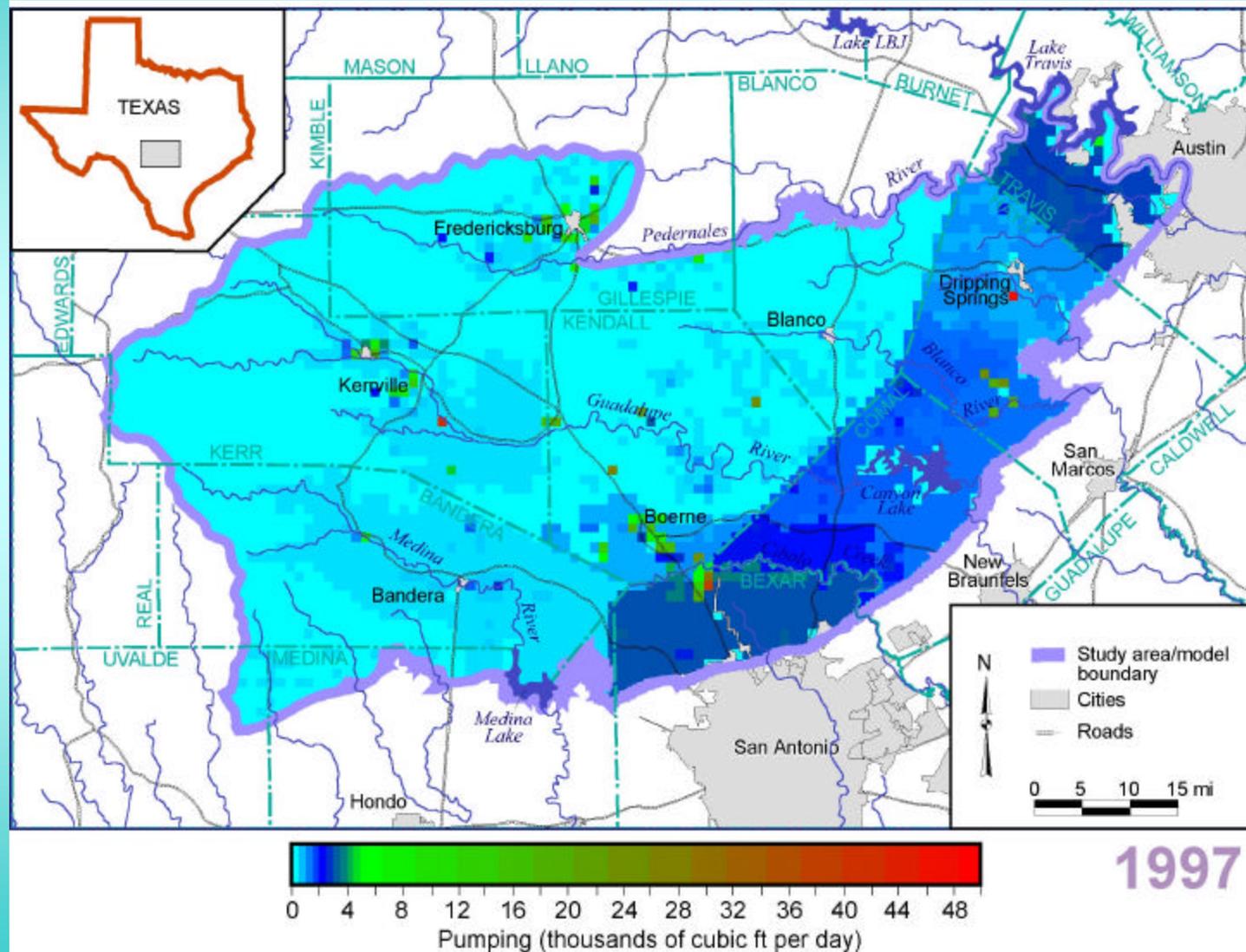


# Spatial Distribution For Recharge

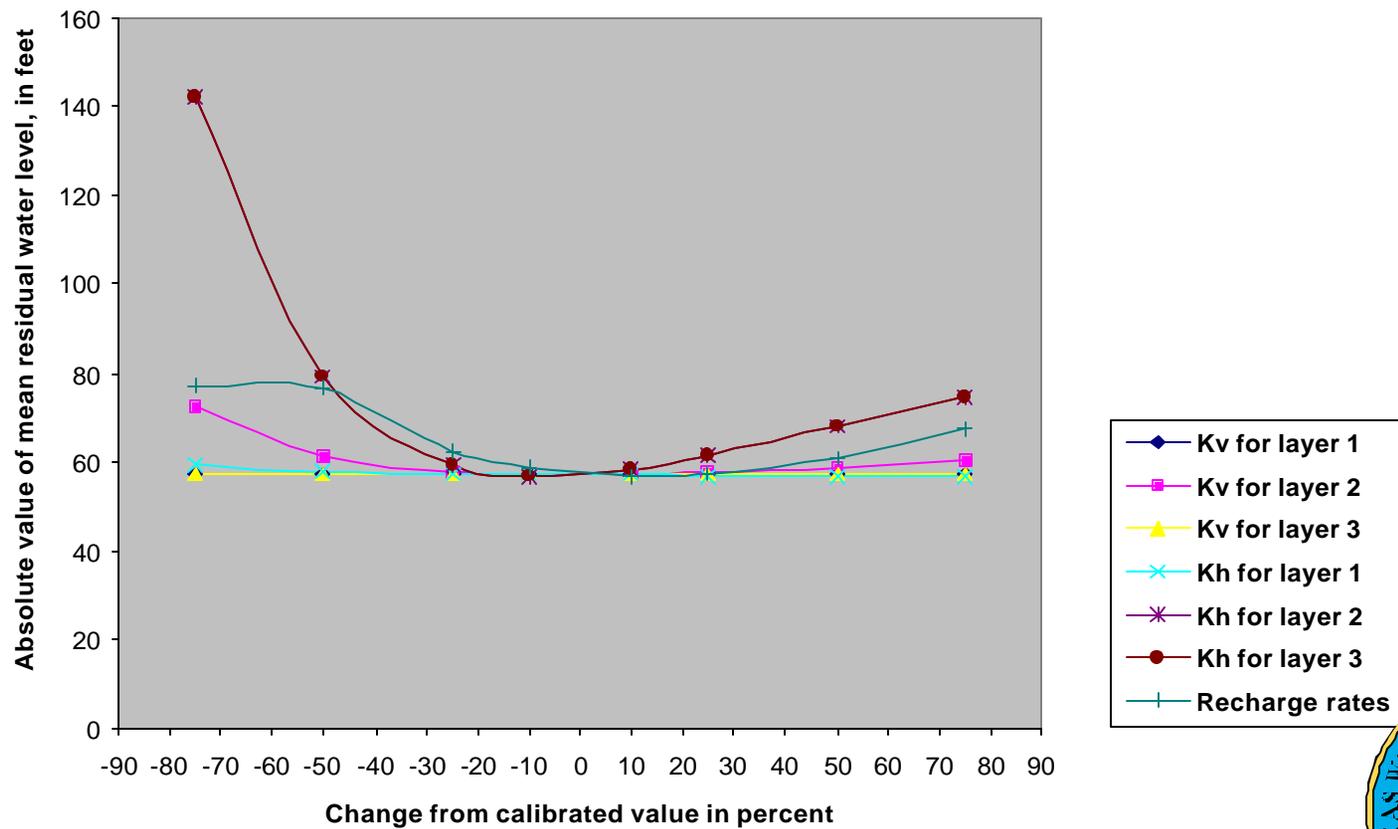
Estimated Recharge for 1975 (in/yr)



# Spatial Distribution For Pumpage

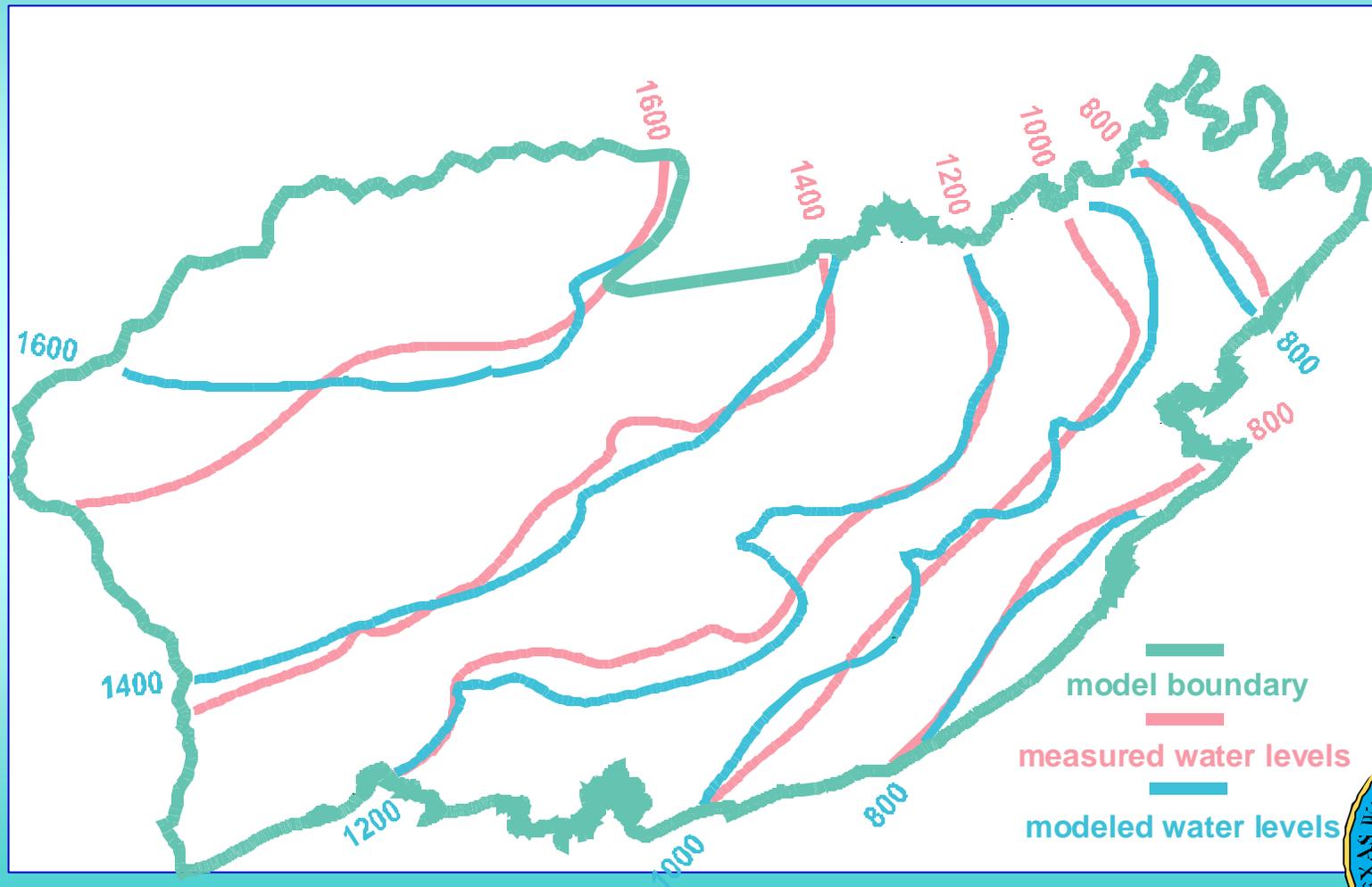


# Sensitivity Analysis

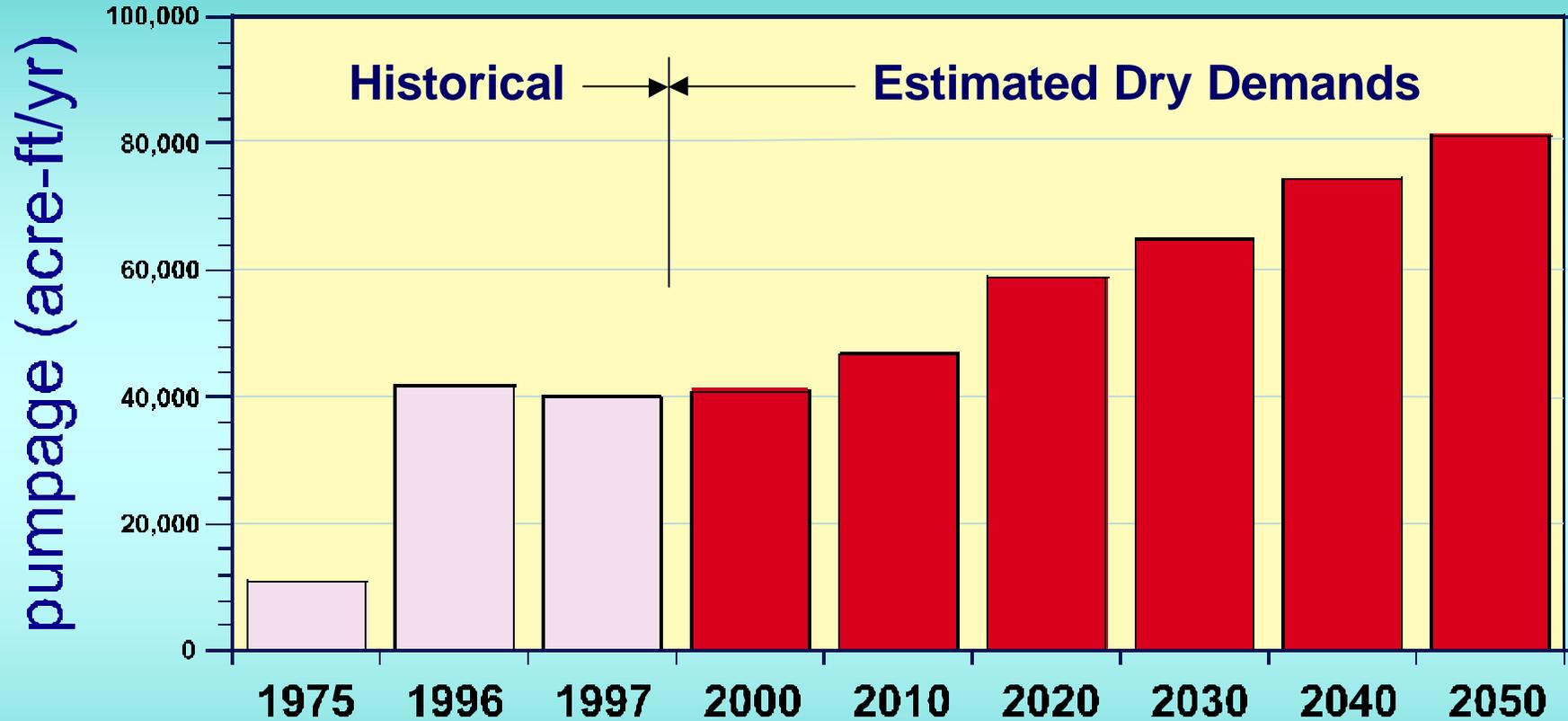




# Modeled vs. Measured Water Levels

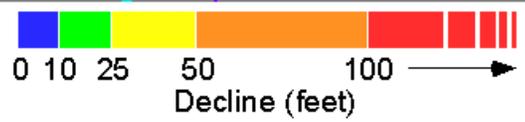
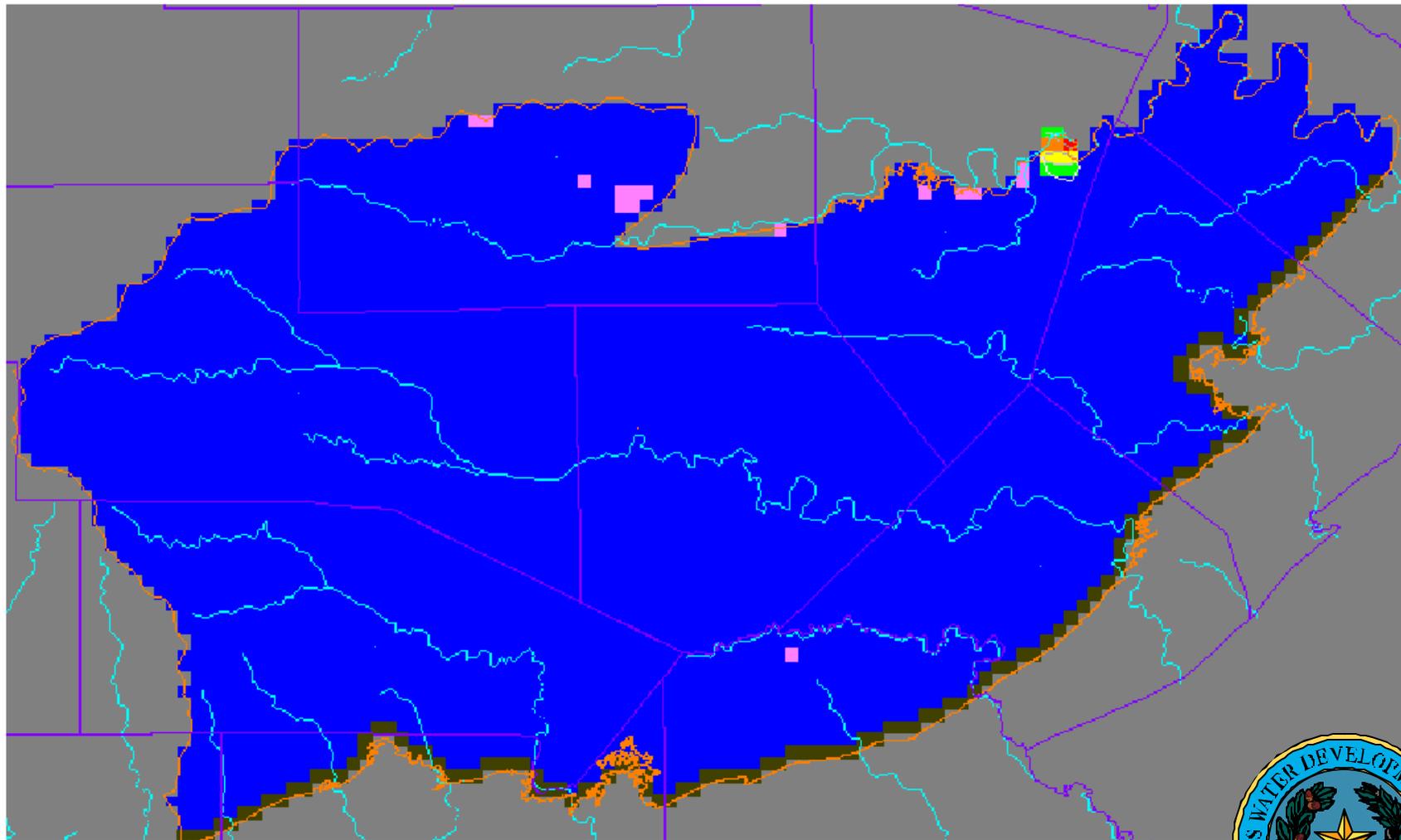


# Temporal Distribution For Pumpage

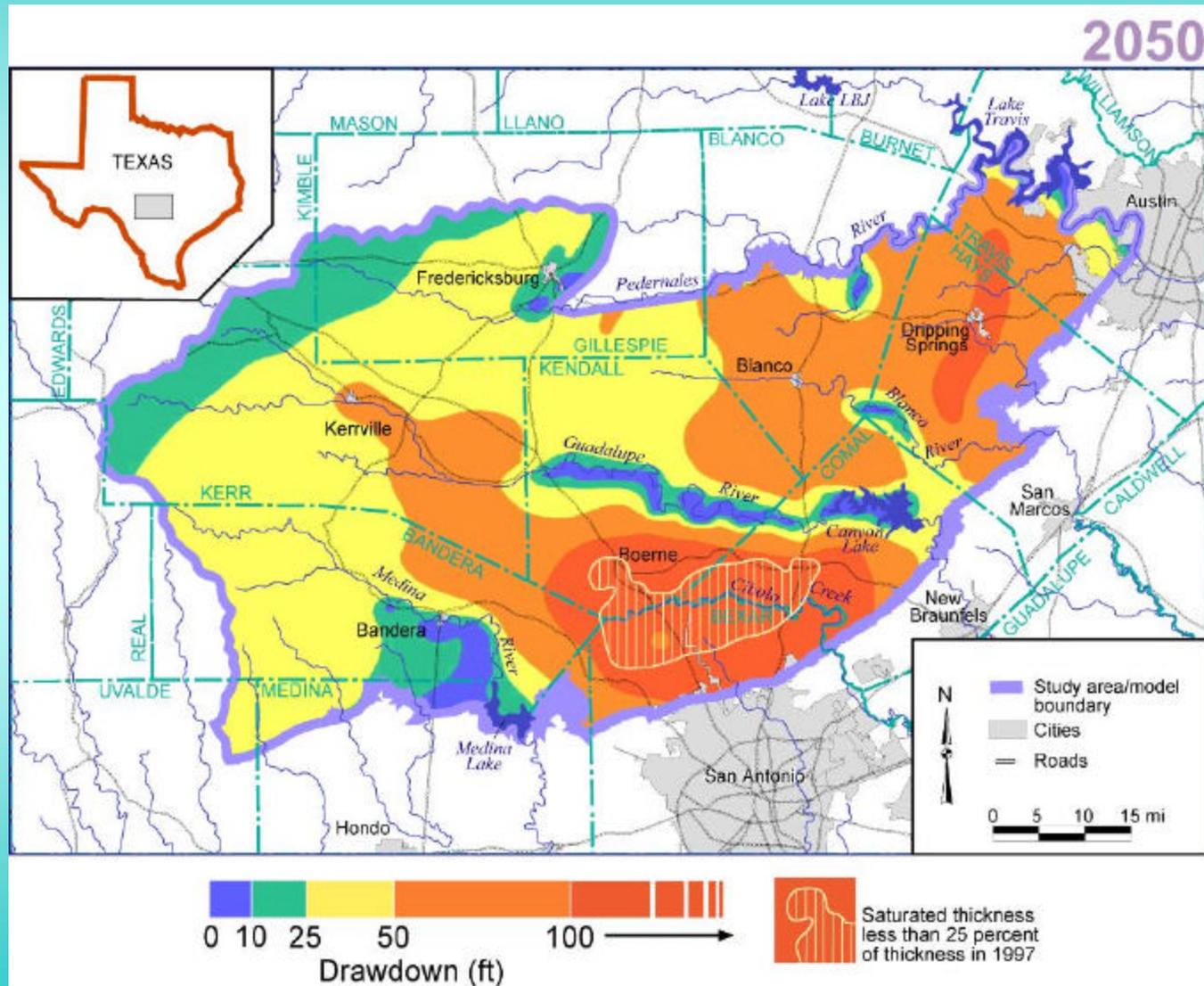


# Predicted Water Level Declines

1997



# Predicted Water Level Declines



# Questions or Comments?

**15 Minute Break!**

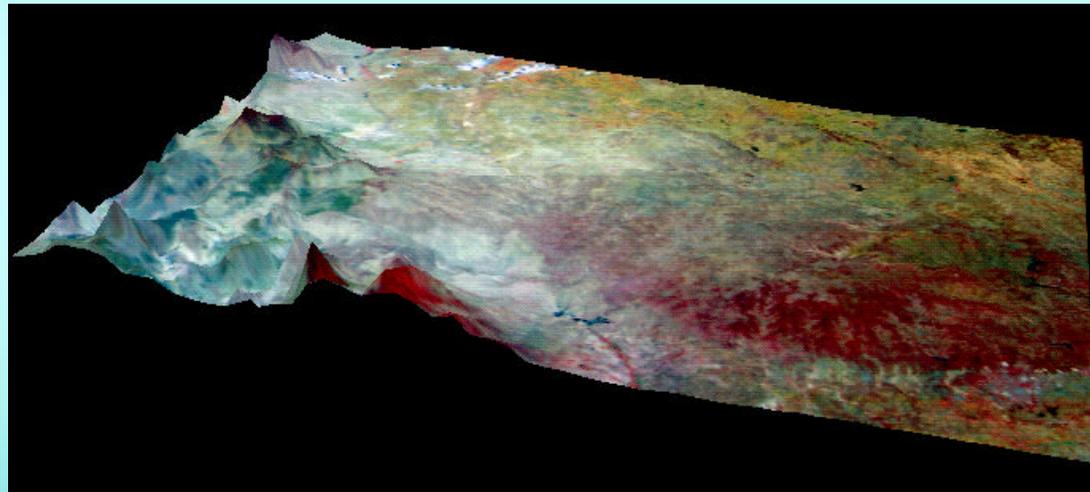
We will reconvene to discuss the  
Edwards-Trinity Aquifer

FOR MORE INFO VISIT...

[www.twdb.state.tx.us/gam](http://www.twdb.state.tx.us/gam)



# A Groundwater Flow Model for the Edwards-Trinity Aquifer of West-Central, Texas



**Roberto Anaya**

**Texas Water Development Board**



# Edwards-Trinity Stakeholders Advisory Forum Objectives

- Provide Public Awareness of GAM
- Update Interested Participants
- Solicit Data and Information
- Encourage Comments and Criticism



# ET GAM Project Goals

- To Develop a “Living” Numerical Groundwater Flow Model for Use as a State-of-the-Art Management Tool
- To Build a Standardized Digital Library of Aquifer Data and Information for Internet Access
- To Provide an Improved Understanding of Groundwater Resources for West-Central, Texas



# ... But A Model Already Exists!

- USGS Model Developed in Early 1990s
- One Layer
- Finite Element
- Steady-State



# Why Do We Need Another Model?

- Finite Difference
- 3-Dimensional Multi-Layer
- Steady-State and Transient
- Widely Supported MODFLOW Code
- More Advanced Digital Technology
- Easy Access to Standardized and Documented Model Data



# How Will The New Model Be Developed ?

- Collect, Process, Organize, and Analyze All Available Hydrogeologic Data
- Conceptualize the Aquifer System
- Calibrate and Verify the Model
- Simulate Future Aquifer Responses to Pumping Demands and Climate Variations

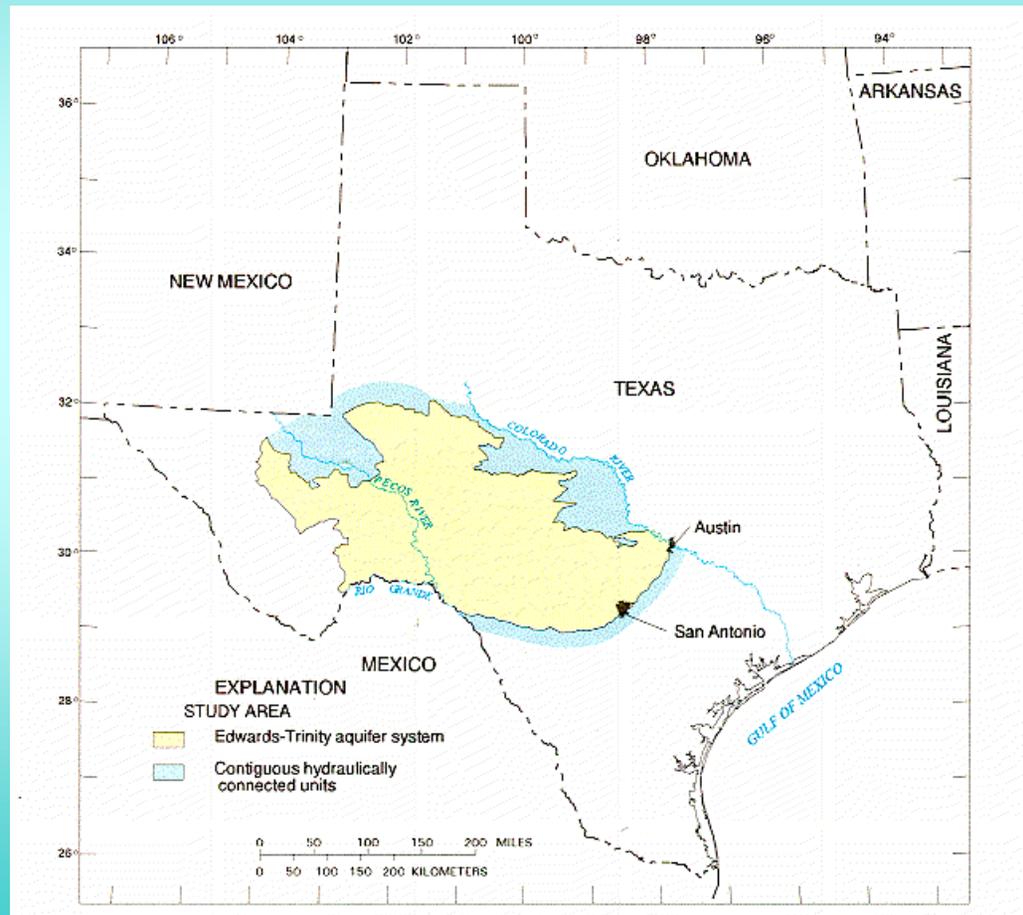


# What Hydrogeologic Data Is Required For The New Model?

- Geology
- Geophysics
- Geomorphology
- Soils
- Land Use/Cover
- Surface Hydrology
- Sub-Surface Hydrology
- Climate
- Political Boundaries
- Cultural Features



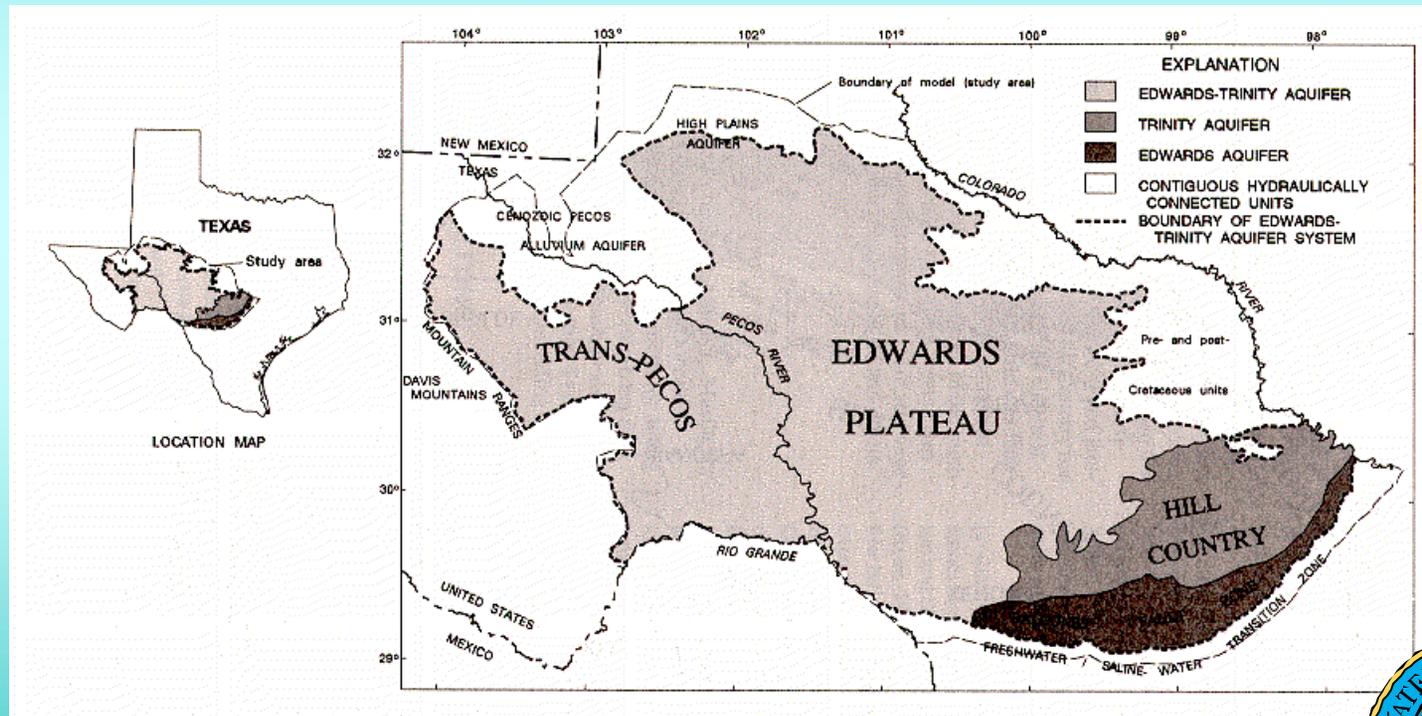
# Edwards-Trinity Aquifer System And Contiguous Hydraulic Units



From Barker and Ardis, 1996



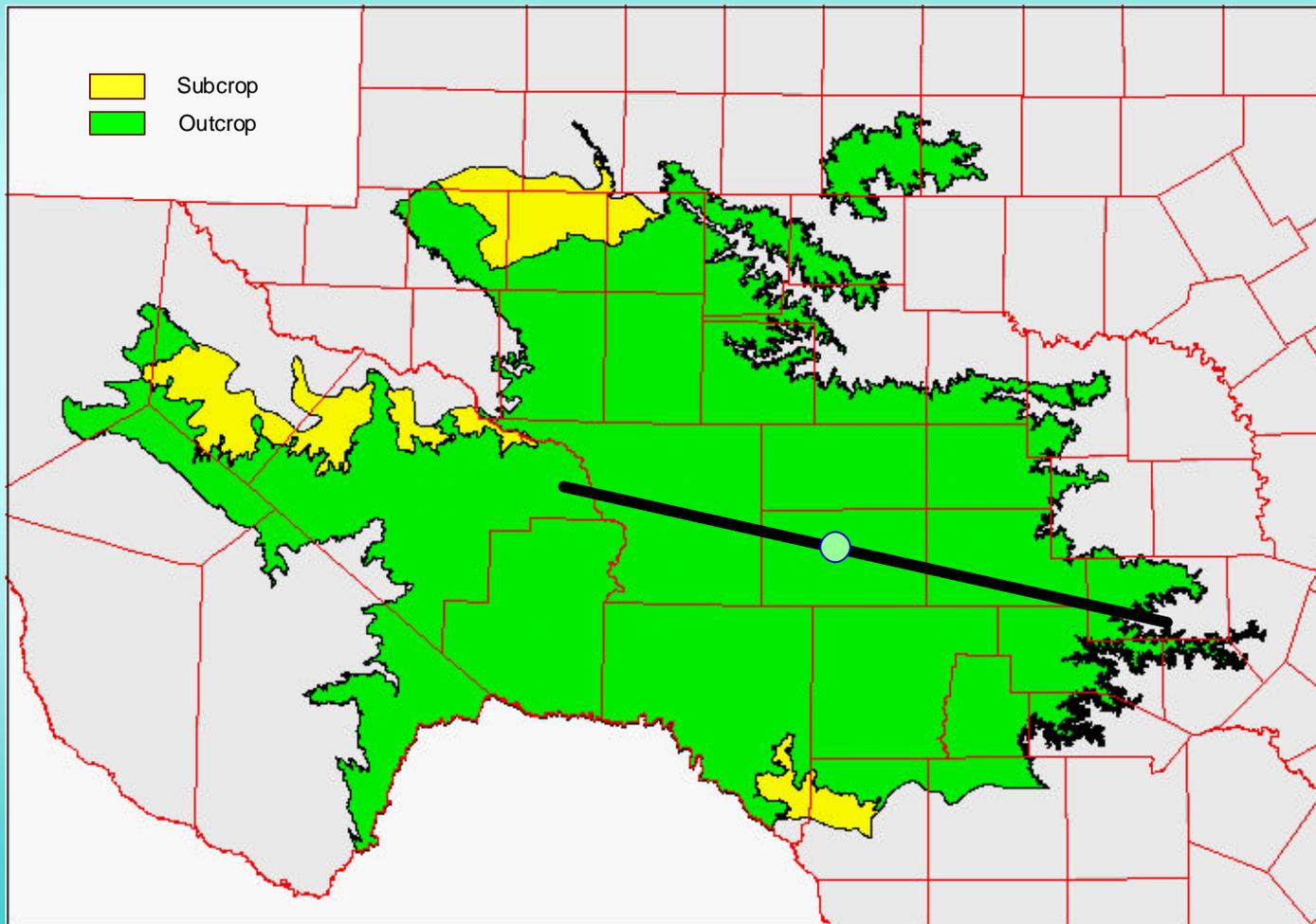
# Geographic Sub-Regions Of The Edwards-Trinity



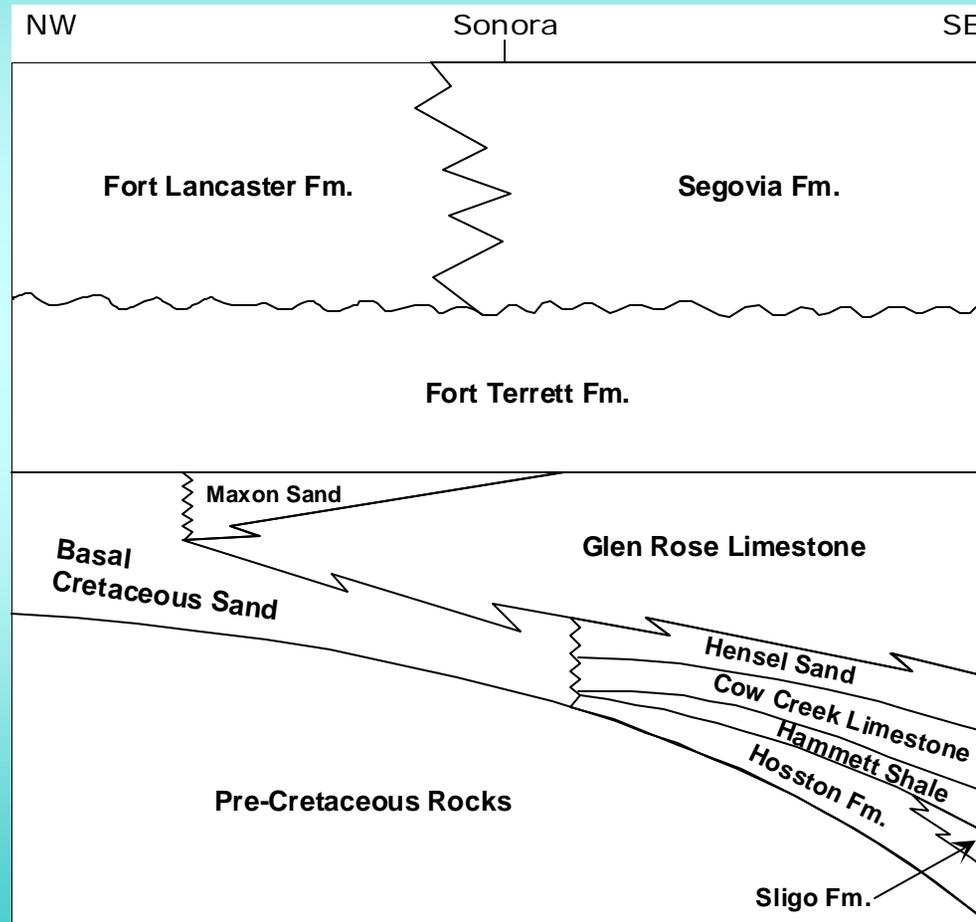
From Kuniansky and Holligan, 1994



# Spatial Extent Of The Edwards-Trinity Sediments



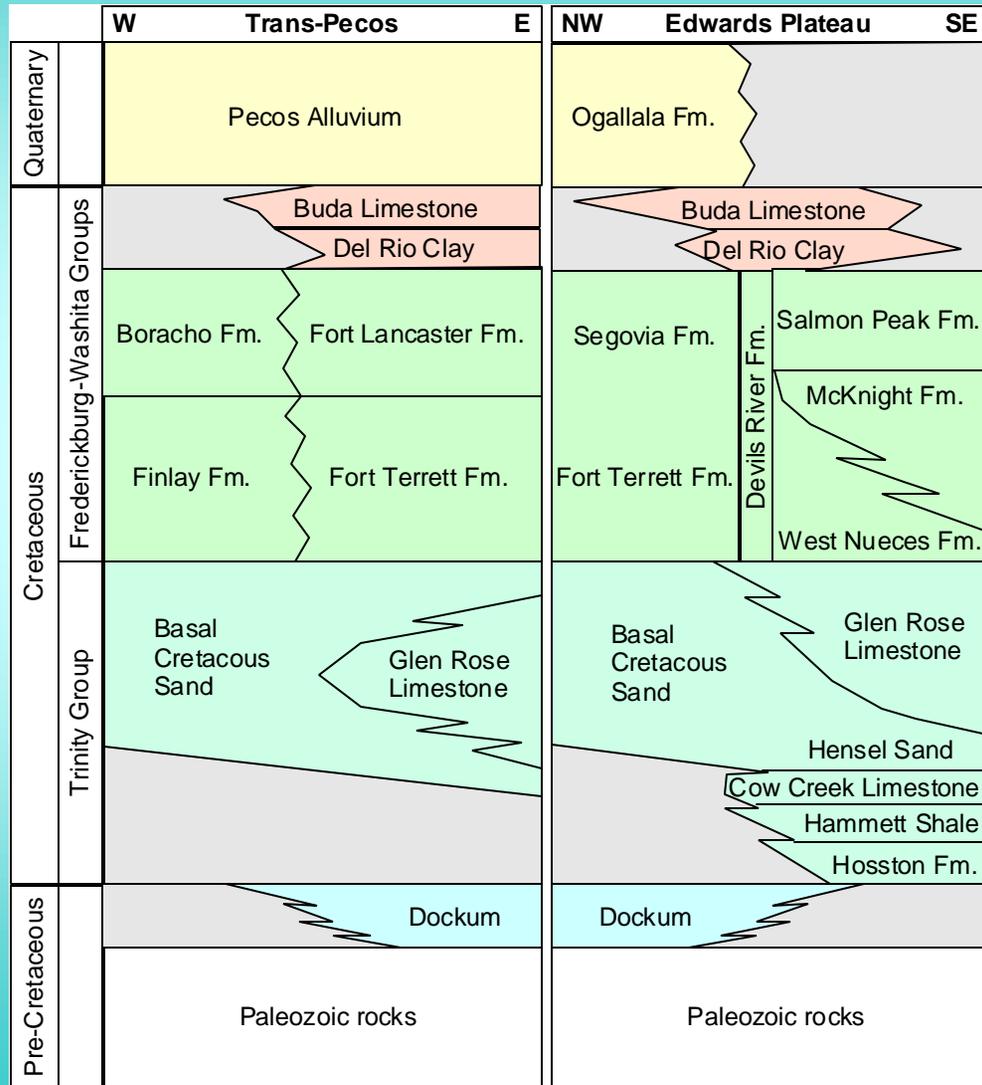
# Vertical Profile Of The Edwards-Trinity Aquifer Sediments



Modified From Barker and Ardis, 1996



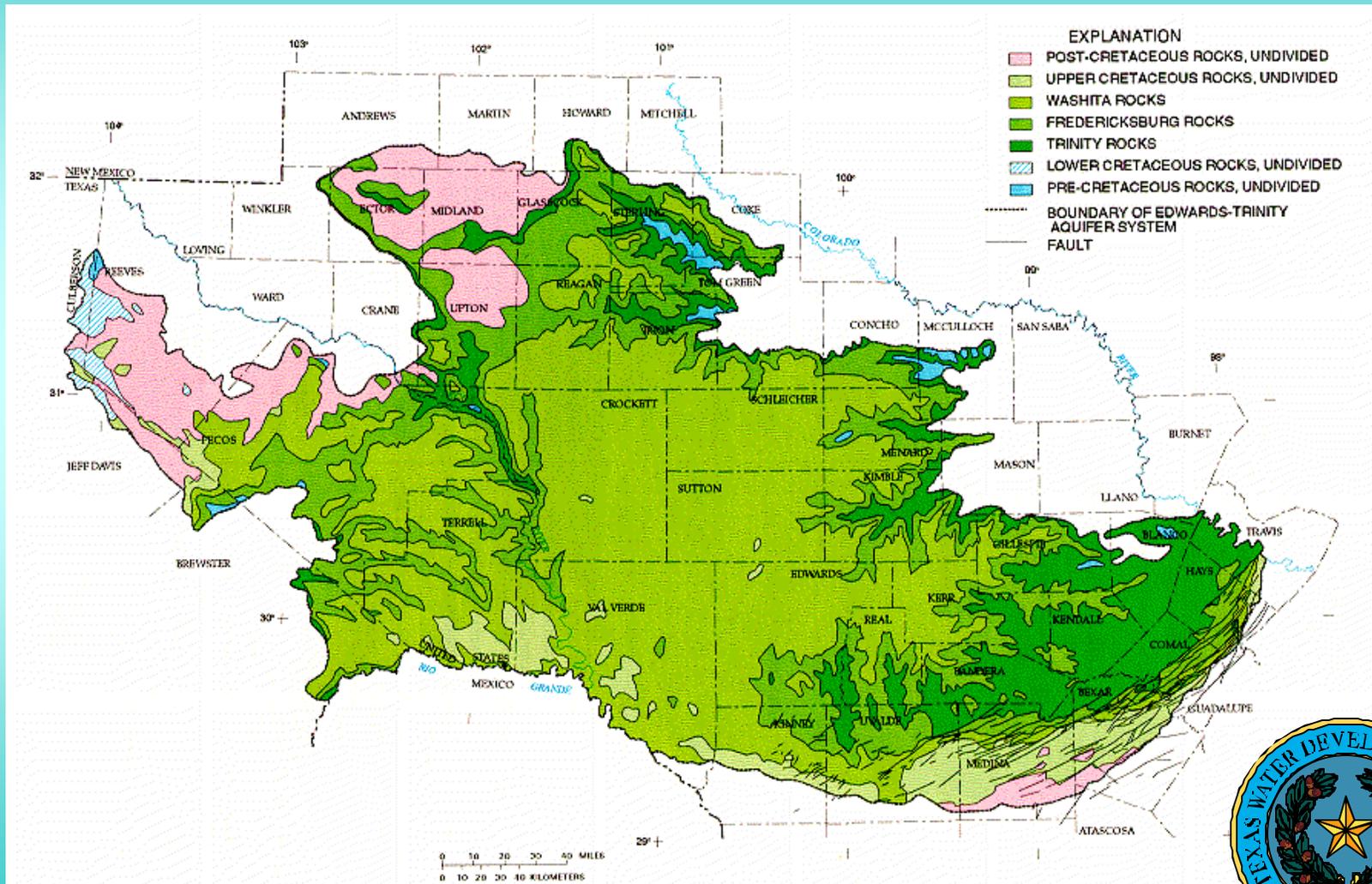
# Stratigraphic Units



Modified From Barker and Ardis, 1996

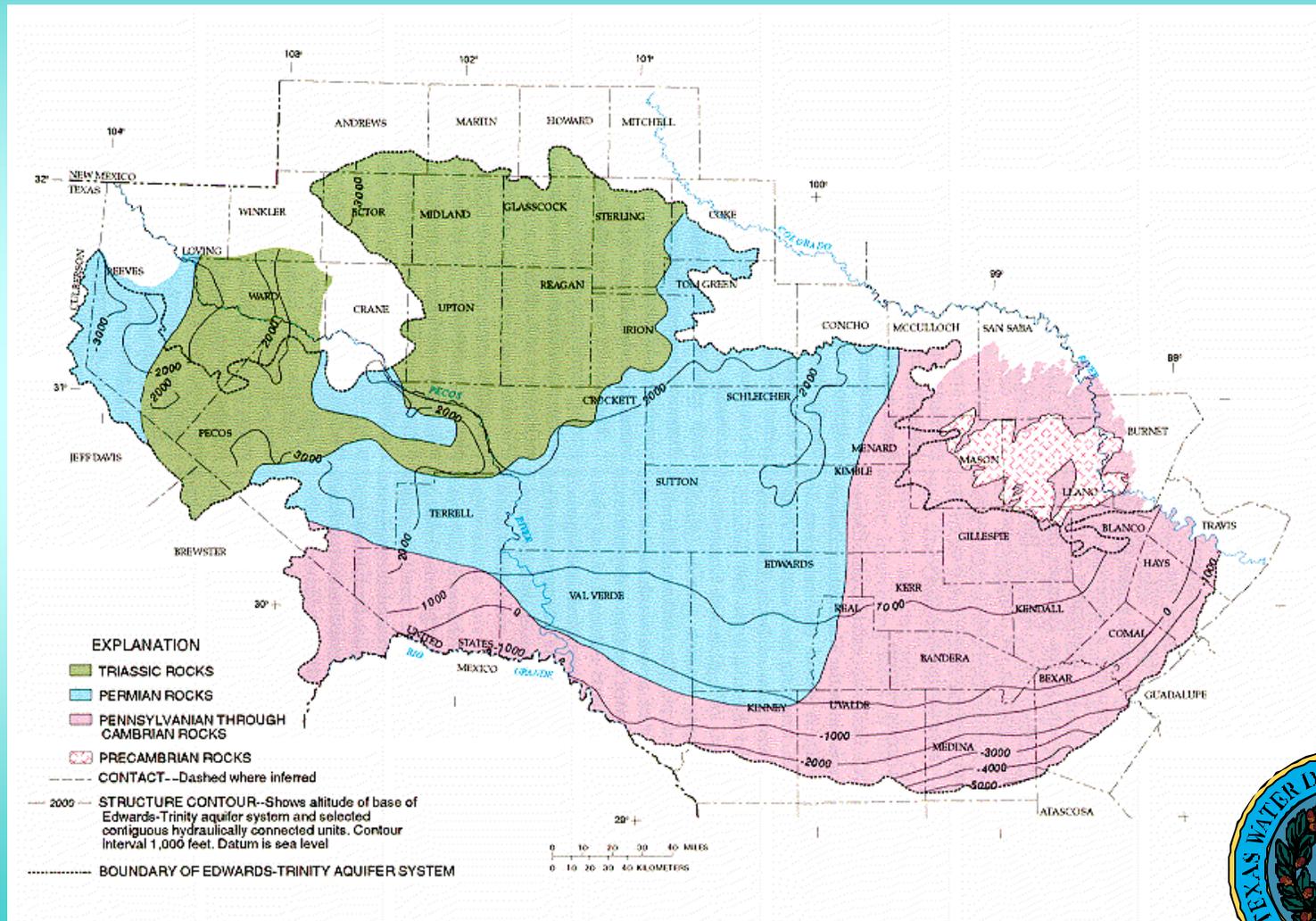


# Surface Geology



From Barker and Ardis, 1996

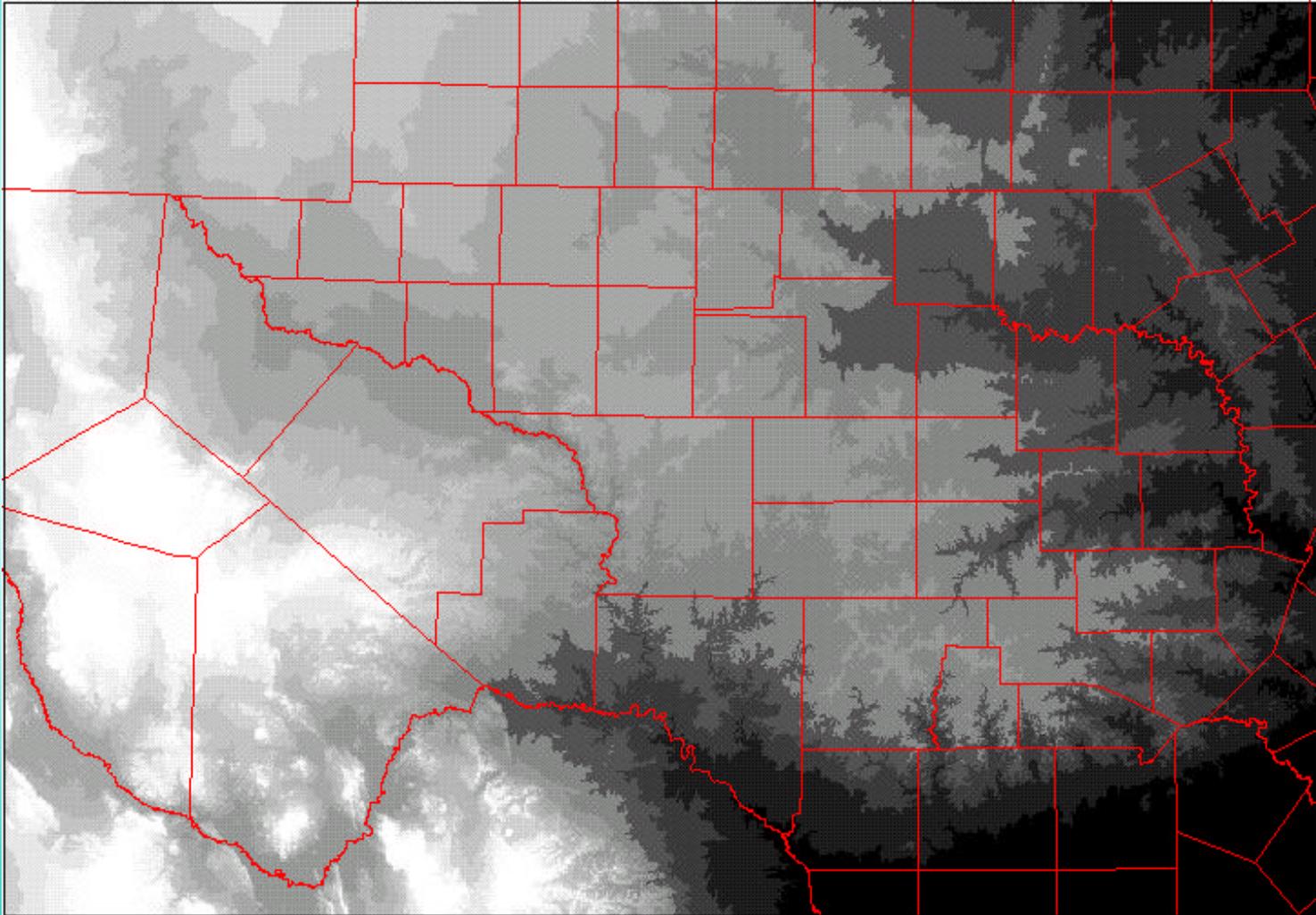
# Structural Base For Trinity Group



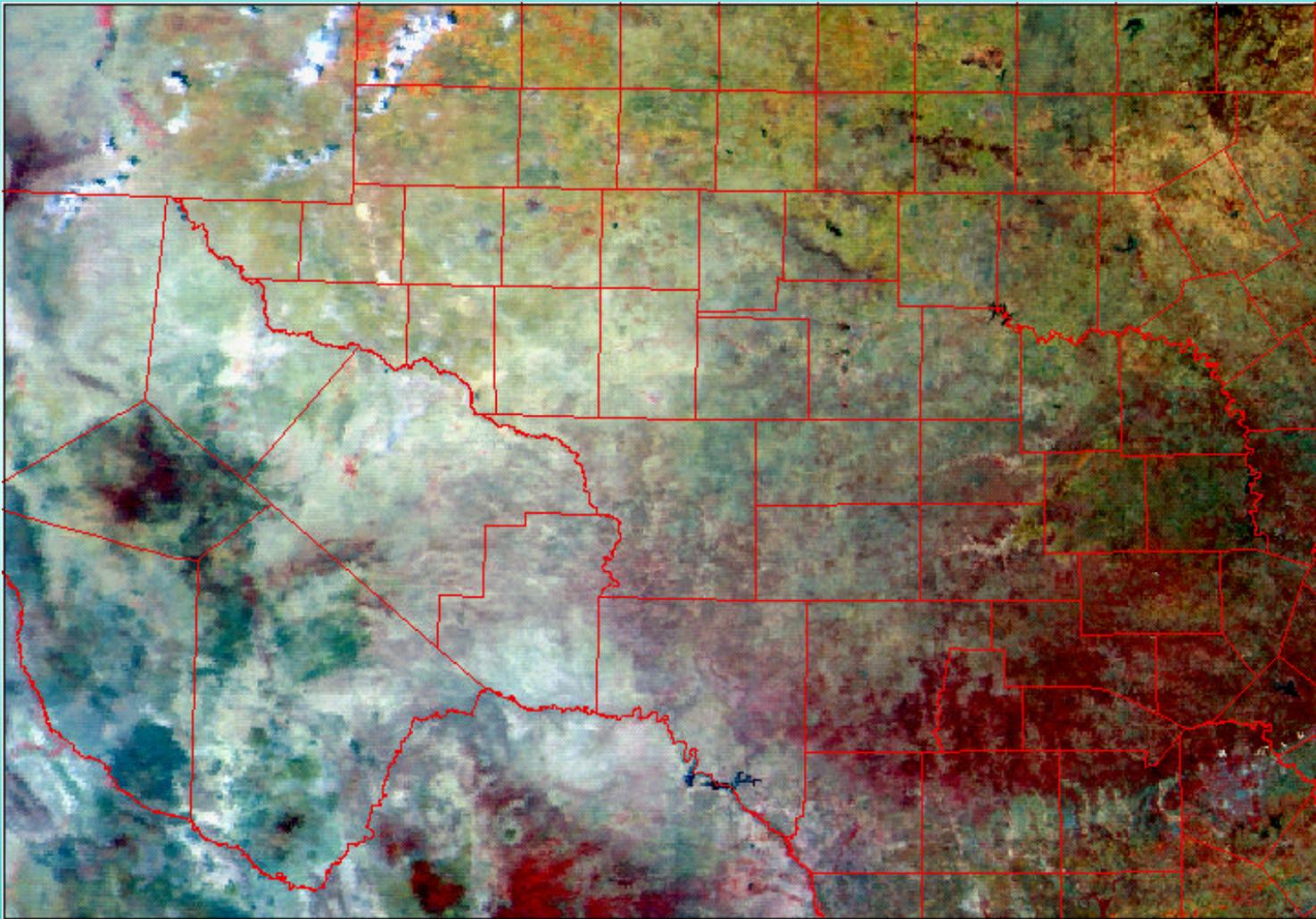
From Barker and Ardis, 1996



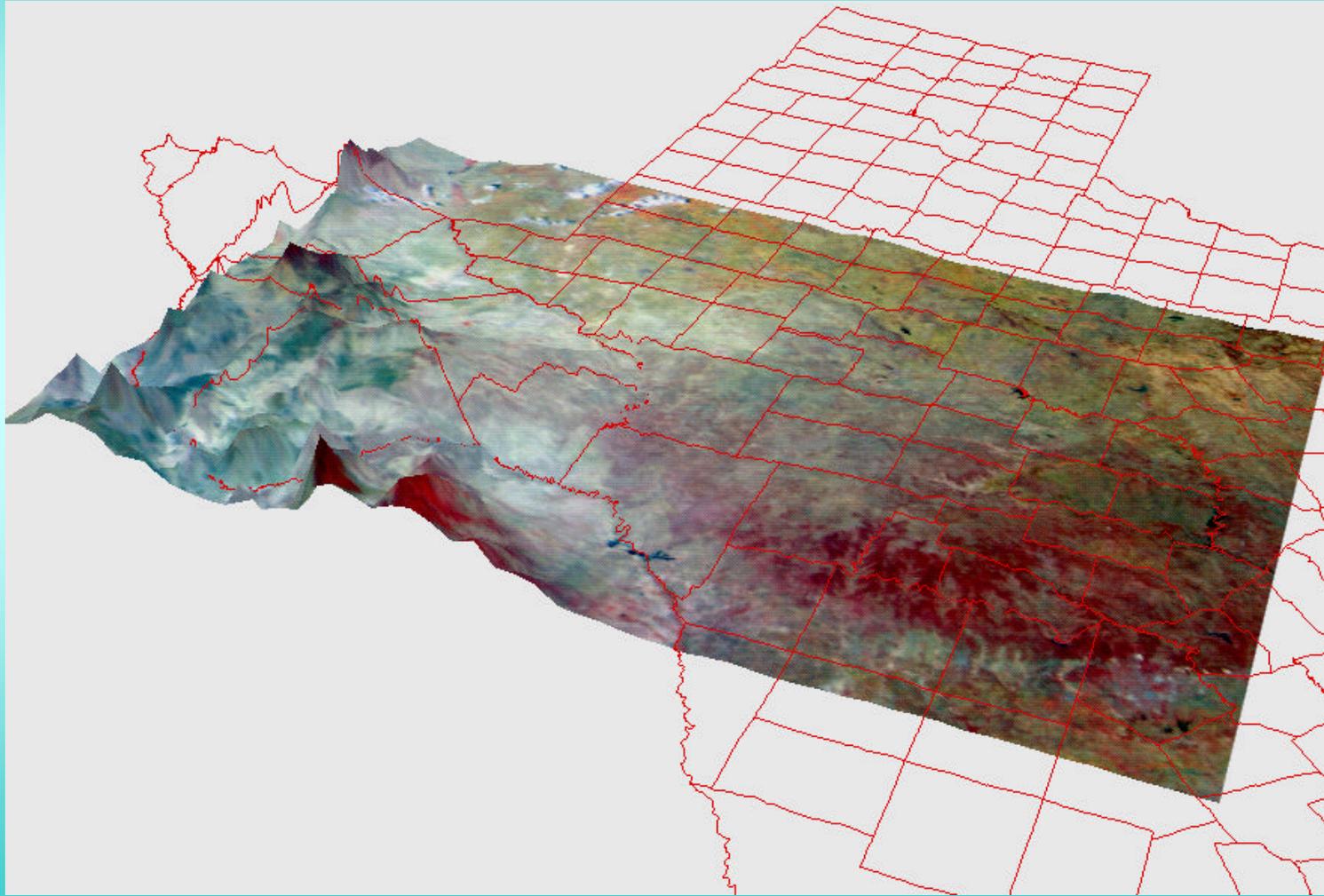
# Digital Elevation Model



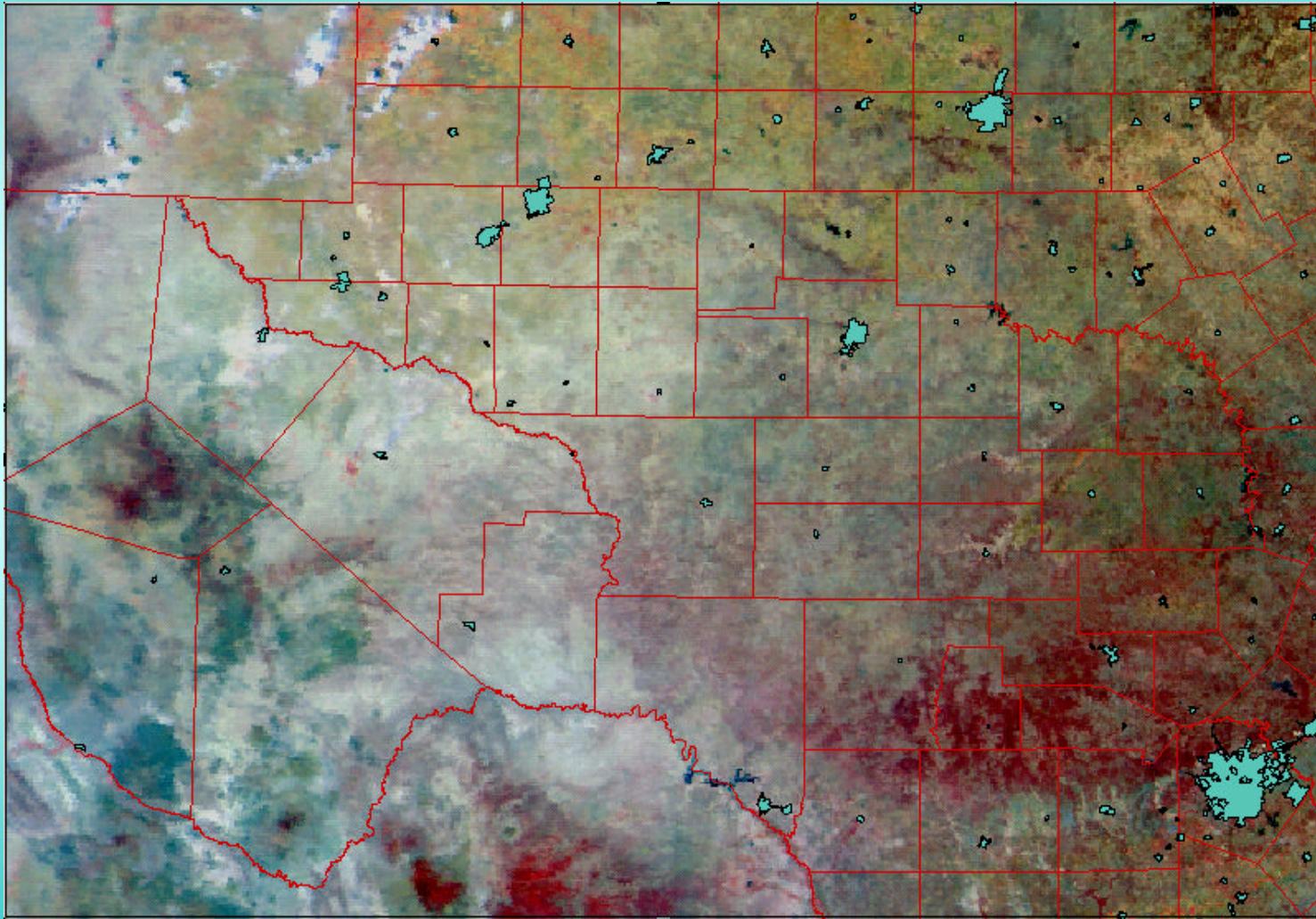
# MODIS Color Infrared Image



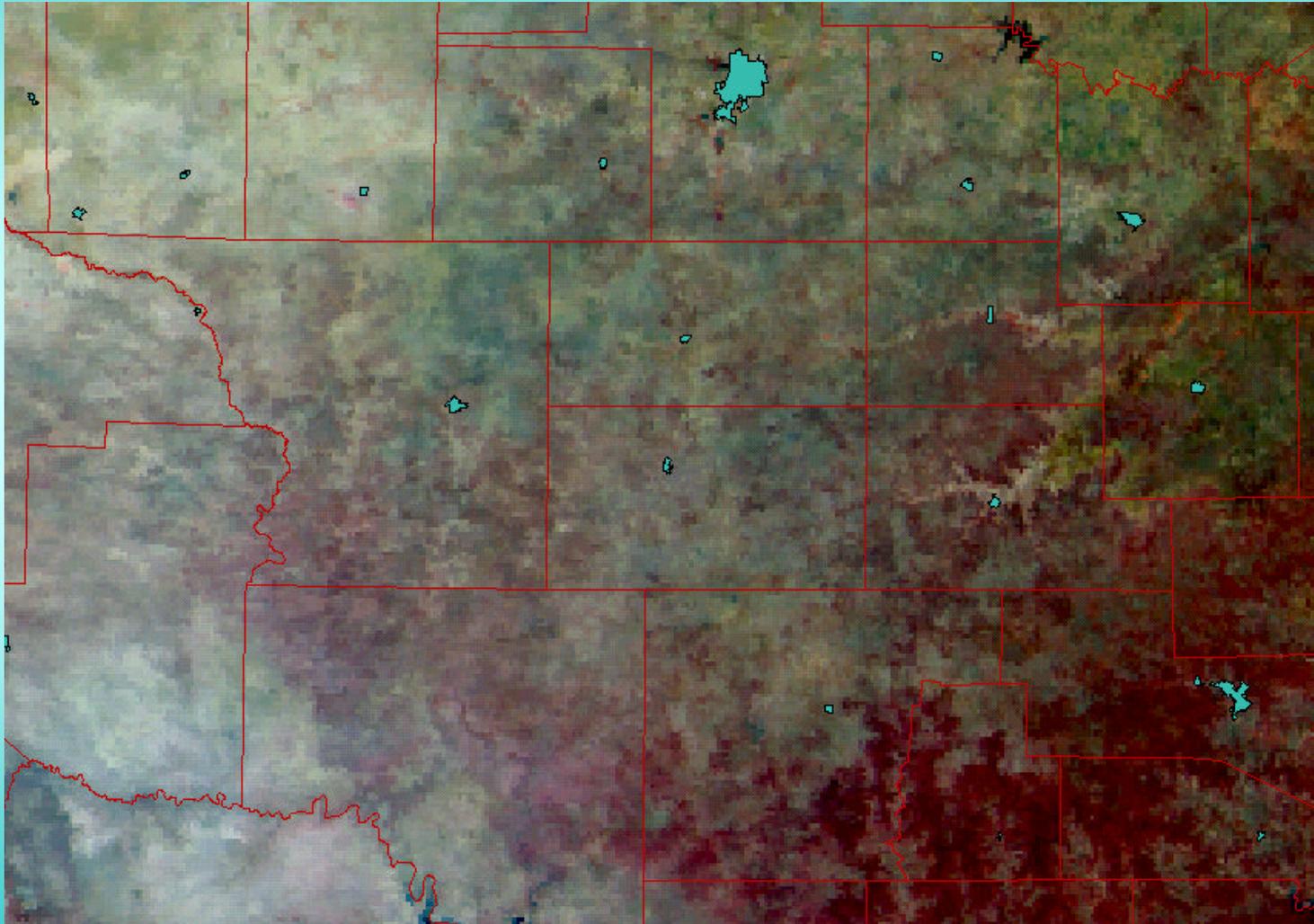
# Digital Terrain Model



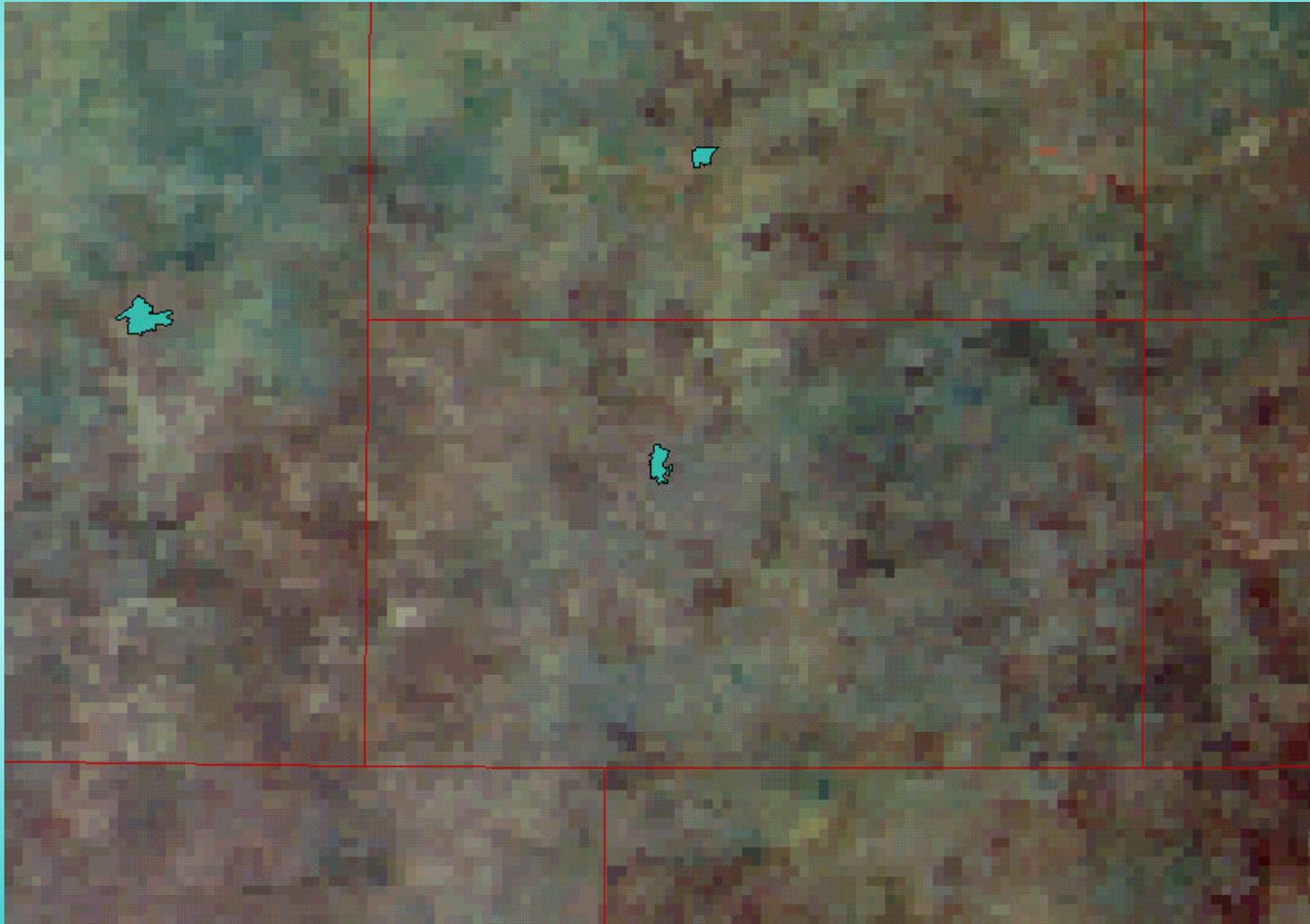
# Example Of Scale And Resolution



# Example Of Scale And Resolution



# Example Of Scale And Resolution



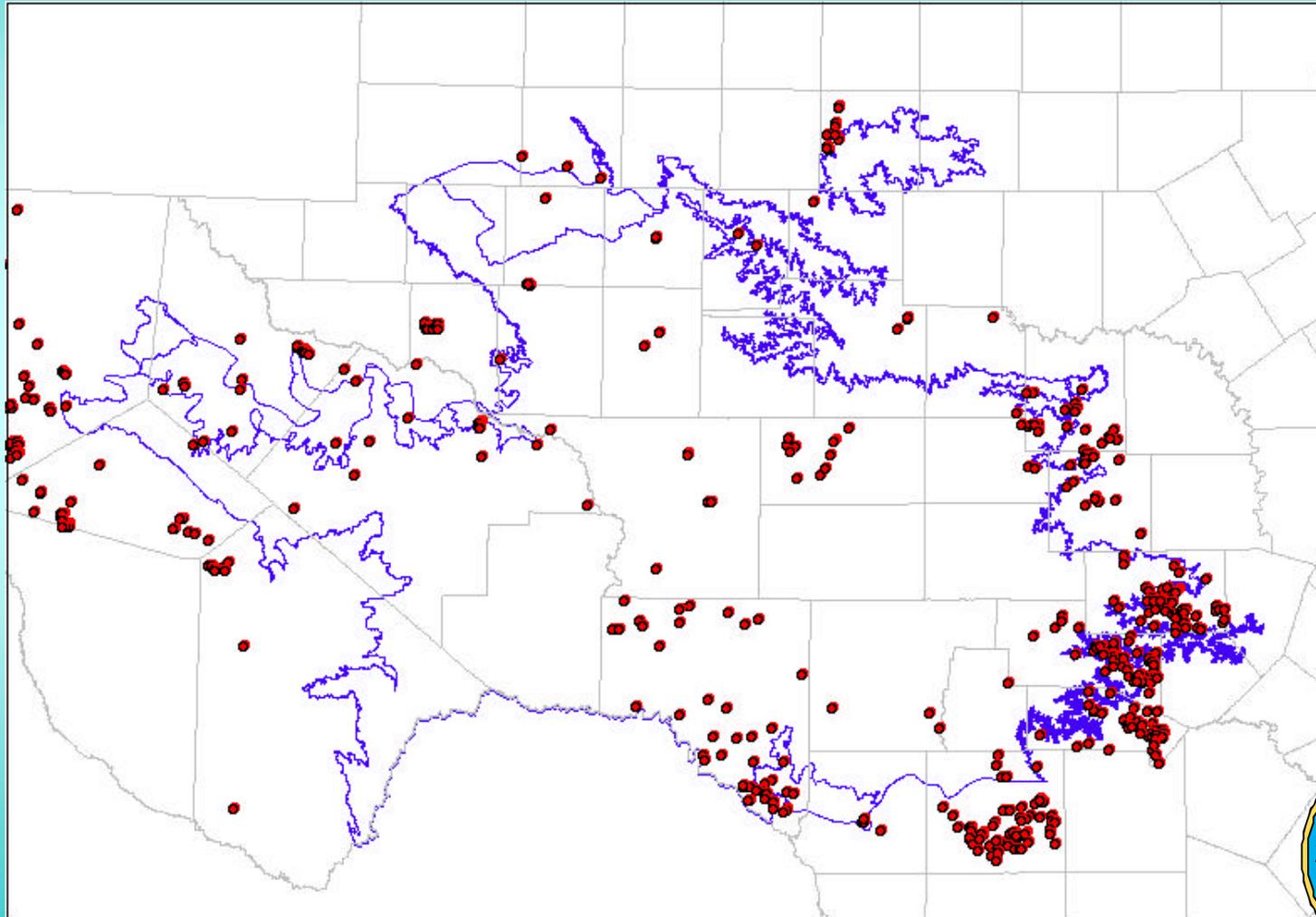
# Example Of Scale And Resolution



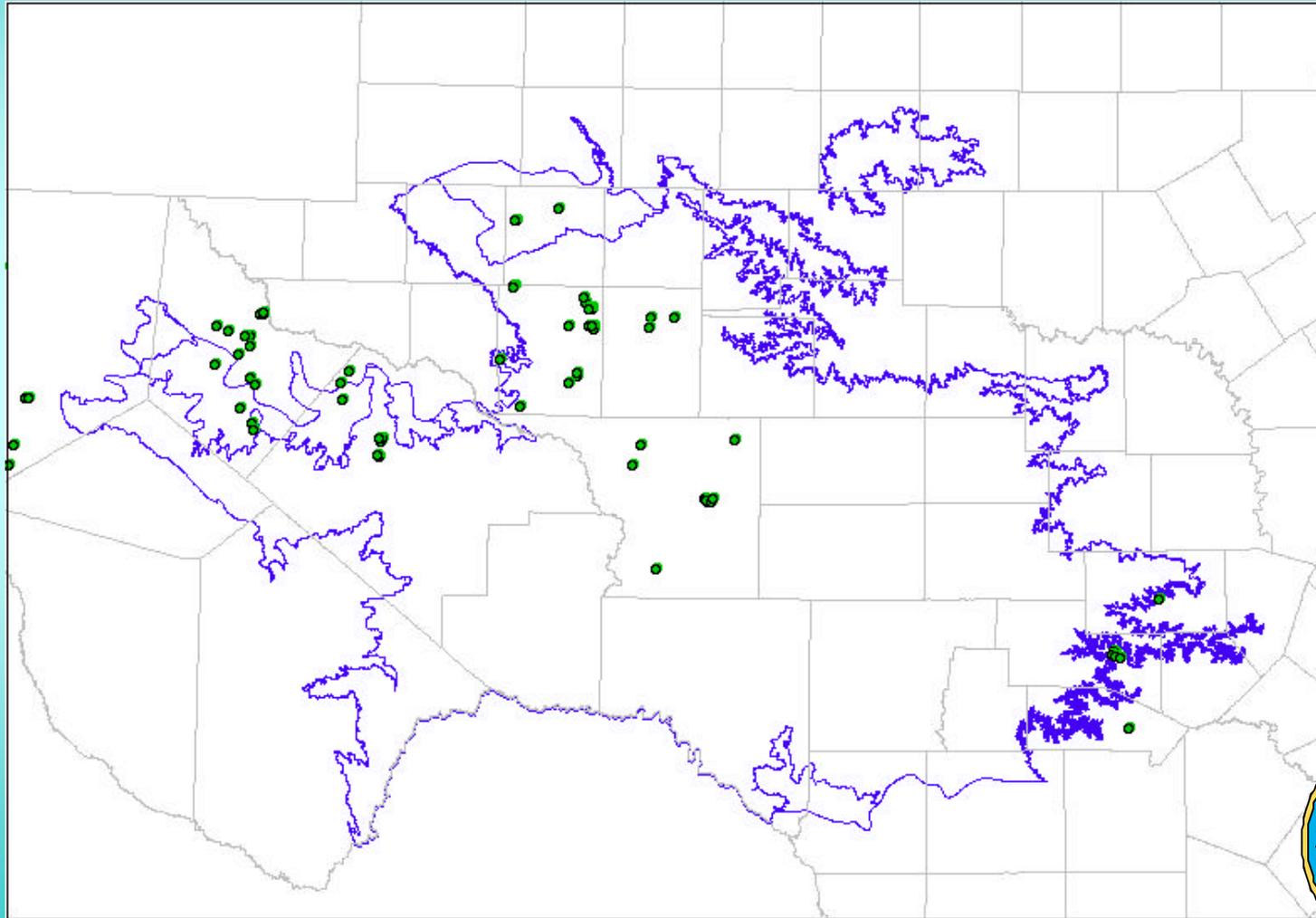
# Example Of Scale And Resolution



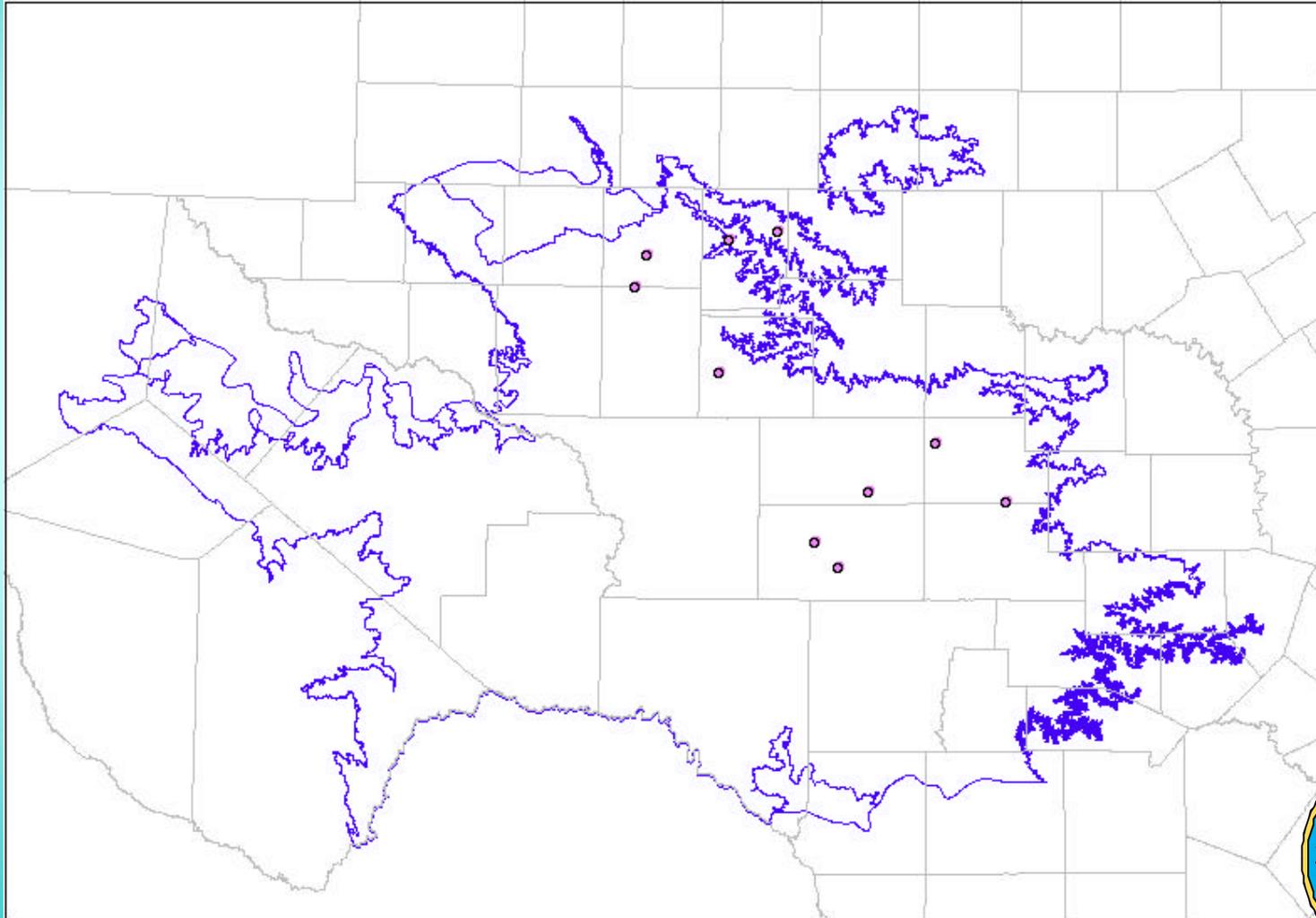
# Specific Capacity Tests



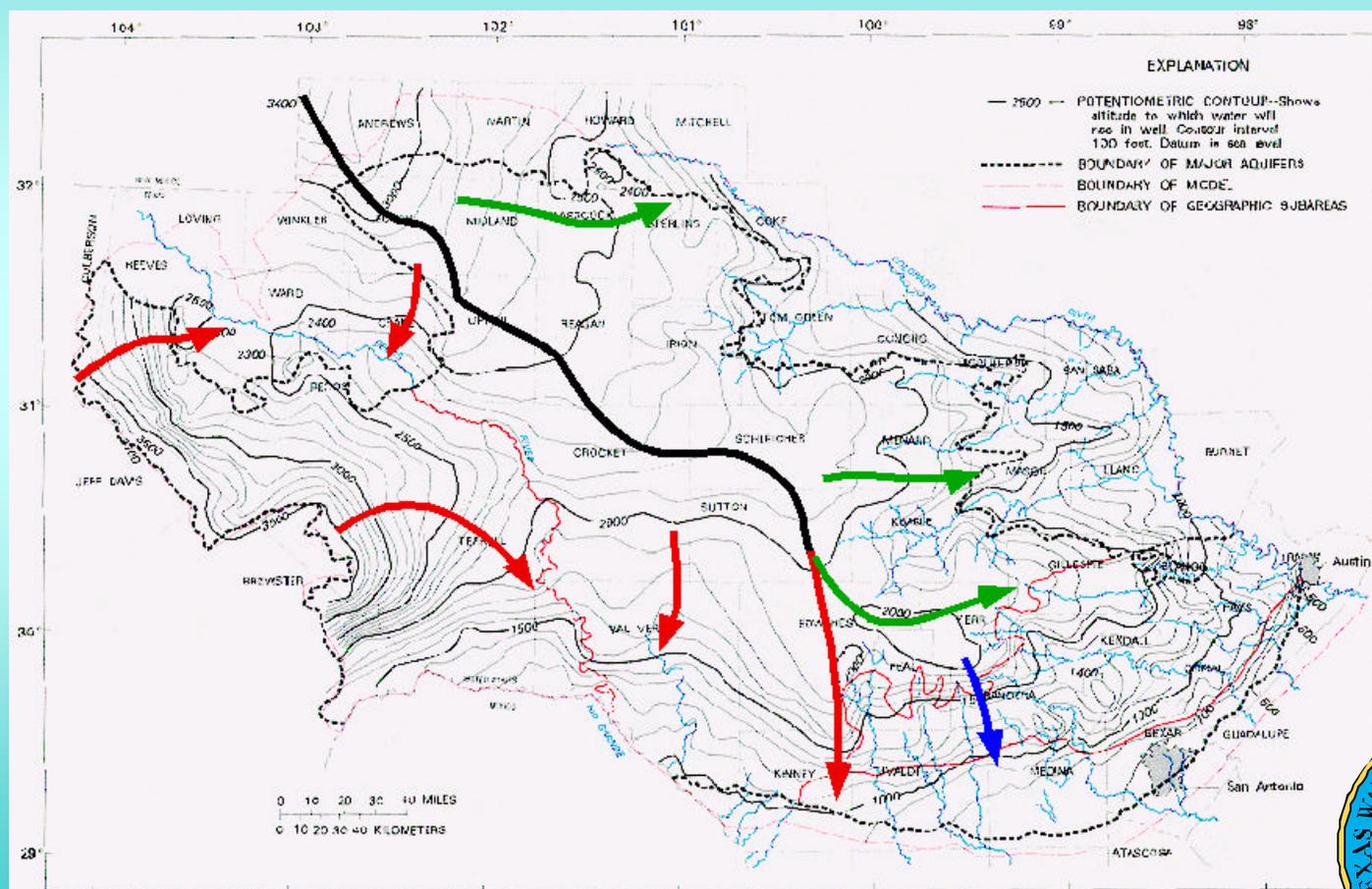
# Existing Pumping Tests



# Recent Pumping Tests



# 1974-75 Potentiometric Surface Of The Edwards-Trinity And Contiguous Units

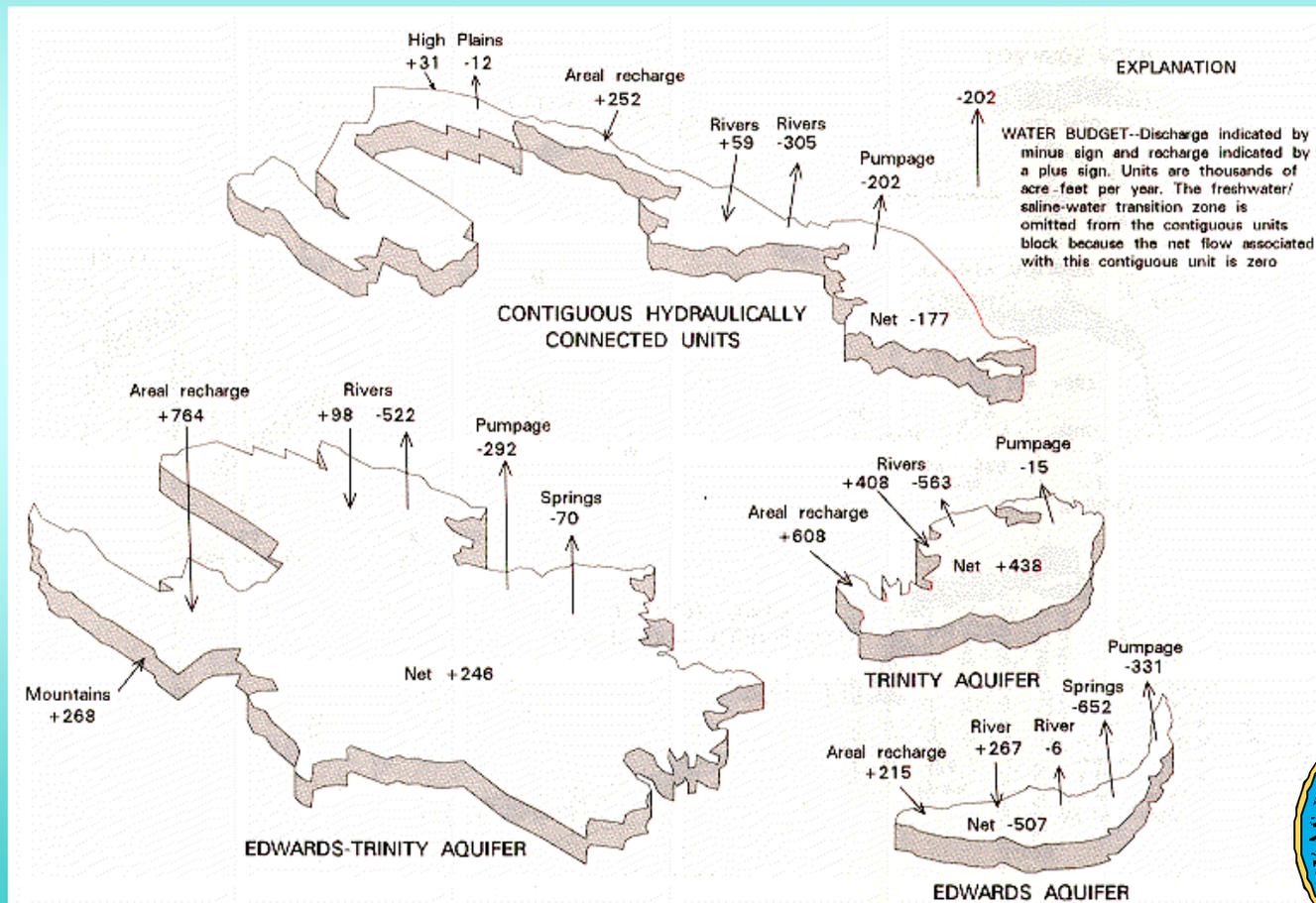


Modified From Kuniansky and Holligan, 1994





# 1974-75 Water Budget For Edwards-Trinity Aquifer System



From Kuniansky and Holligan, 1994



# Primary Literature Sources

- R. A. Barker and A. F. Ardis, *Hydrogeologic Framework of the Edwards-Trinity Aquifer System, West-Central Texas*, USGS Professional Paper 1421-B, 1996.
- L. E. Walker, *Occurrence, Availability, and Chemical Quality of Groundwater In The Edwards Plateau Region of Texas*, Texas Department of Water Resources Report 235, 1979.
- R. Rees and A. W. Buckner, *Occurrence and Quality of Groundwater In The Edwards-Trinity (Plateau) Aquifer in the Trans-Pecos Region of Texas*, Texas Department of Water Resources Report 255, 1980.
- E. L. Kuniansky and K. Q. Holligan, *Simulation of Flow in the Edwards-Trinity Aquifer System and Contiguous Hydraulically Connected Units, West-Central Texas*, USGS Water-Resources Investigation Report 93-4039, 1994.



# Current Project Status

- Continued Literature Review
- Continued Collection of Hydrogeologic Data
- Continued Data Processing and Analysis
- 10 -20 New Pumping Tests



# Anticipated Project Status For Next Quarter

- Complete Literature Review
- Continue New Pumping Tests
- Develop the Geologic Structure
- Begin Water Level Analysis
- Begin Recharge Analysis



# Topics For ET SAF 2

- Update on Hydrogeologic Data Sets
  - for Geologic Structure
  - for Water Levels
  - for Recharge
- Discuss the Conceptual Model Issues for the Edwards-Trinity Aquifer System



# Questions or Comments?

## Lunch Break!

We will reconvene in an hour and a half for  
the Pumping Test Workshop  
by Dr. Robert Mace ...

FOR MORE INFO VISIT...

[www.twdb.state.tx.us/gam](http://www.twdb.state.tx.us/gam)



**Edwards-Trinity GAM Stakeholders Advisory Forum 1**  
**May 16, 2001 – Sonora, Texas**  
**List of Attendees**

<b>Name</b>	<b>Affiliation</b>
Cindy Cawley	Sutton County UWCD / Plateau UWCD
Scott Holland	Sterling County UWCD / Irion County Water Conservation District
Larry Sanders	Phillips Petroleum Company
Winton Milliff	Coke County UWCD
Stan Reinhard	Hickory UWCD NO. 1
Virgil PoloEEK	Sutton County UWCD
Janet Adams	Jeff Davis County UWCD
Marvin Shurley	Private Citizen
George Thorp	Private Citizen
Geary Schindel	Edwards Aquifer Authority
Allan Lange	Lipan-Kickapoo Water Conservation District
Phillip Beckley	Aqueduct Enterprises LLP/Neural Nebula LLC
Caroline Runge	Menard County Underground Water District
Dennis Clark	Emerald UWCD
Clark Abel	CA Drilling
Joe Will Ross	Private Citizen
Joe David Ross	Private Citizen
Rocky Jones	Private Citizen
Grant Snyder	URS Corporation
Robert Mace	Texas Water Development Board
Roberto Anaya	Texas Water Development Board

**Edwards-Trinity GAM Stakeholders Advisory Forum 1**  
**May 16, 2001 – Sonora, Texas**  
**Meeting Summary**

About 20 people were in attendance at the first quarterly Edwards-Trinity Aquifer Groundwater Availability Modeling Stakeholders Advisory Forum, held May 16, 2001 at the 4-H Civic Center in Sonora, Texas. Although most stakeholders were from local groundwater conservation districts, a few consultants, drillers, and private citizens, were present in addition to one petroleum geologist.

The first half of the meeting was conducted by Roberto Anaya, the lead modeler for the Edwards-Trinity aquifer. The recently completed Trinity Aquifer Model was presented as an example GAM product followed by a brief presentation and discussion of the Edwards-Trinity aquifer and the data requirements for the proposed model. The second half of the meeting was led by Robert Mace as a short training workshop for stakeholders interested in conducting and analyzing simple pumping tests on a low budget.

Primary Stakeholder Issues Follow:

- 1) A stakeholder asked if the model would be able to accurately simulate land management practices such as brush control.
- 2) A stakeholder was concerned about the ability to accurately model flow through a karst aquifer.
- 3) A stakeholder was concerned the model would infer the existence of large volumes of groundwater being available based on saturated thickness when in reality the aquifer may not be transmissive enough to pump very much water out for use.
- 4) Stakeholders were concerned about the limited amount of data available for the model and wanted to know how they could help to provide more data for the modeling effort.

The next forum was scheduled for August 8, 2001 at the same location and time. Topics for the next forum include a progress update on the data collection and a discussion on the conceptualization of the Edwards-Trinity aquifer system. The group also asked for another workshop to learn how to analyze and use specific capacity data.

-Roberto Anaya, 05/17/01