PART II
Managing our Groundwater:

The Trinity & Brazos River Alluvium Aquifers

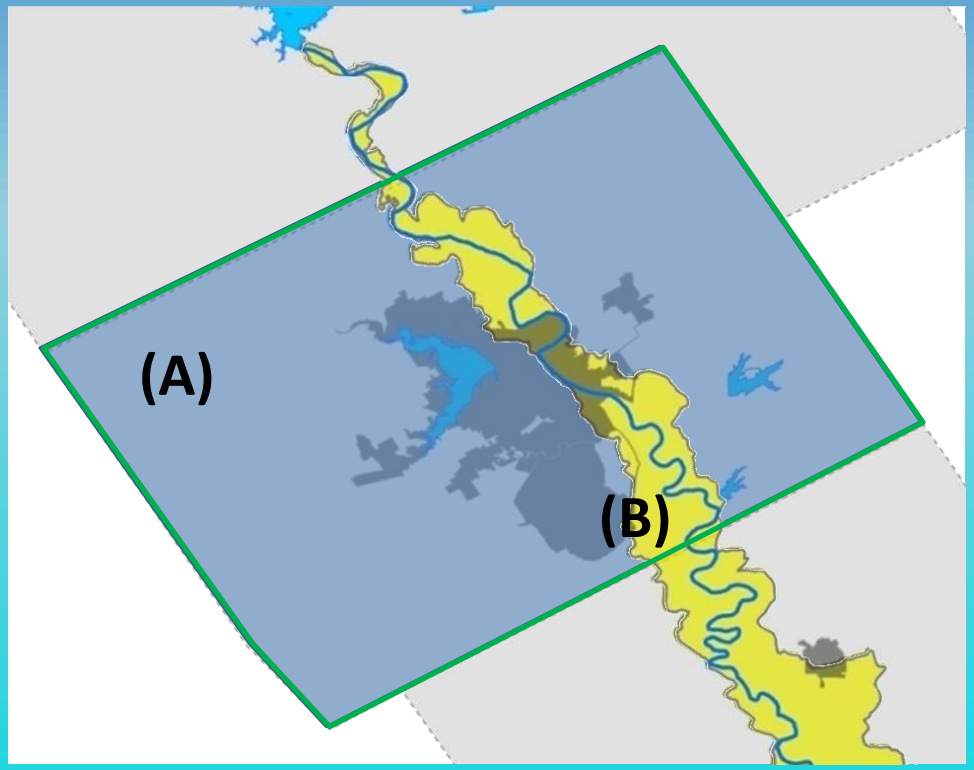
Southern Trinity Groundwater Conservation District

Outline

- **PART I: An Introduction to Groundwater Conservation Districts**
  - History of conservation districts in Texas
  - Southern Trinity Groundwater Conservation District
- **PART II: Managing our Groundwater**
  - Trinity aquifer
  - Brazos River Alluvium aquifer
  - Permitting
  - 2011-2012 update
- **PART III: For water producers**
  - Permits
  - Types of flow meters
  - Reporting & responsibilities

Southern Trinity GCD – Jurisdiction

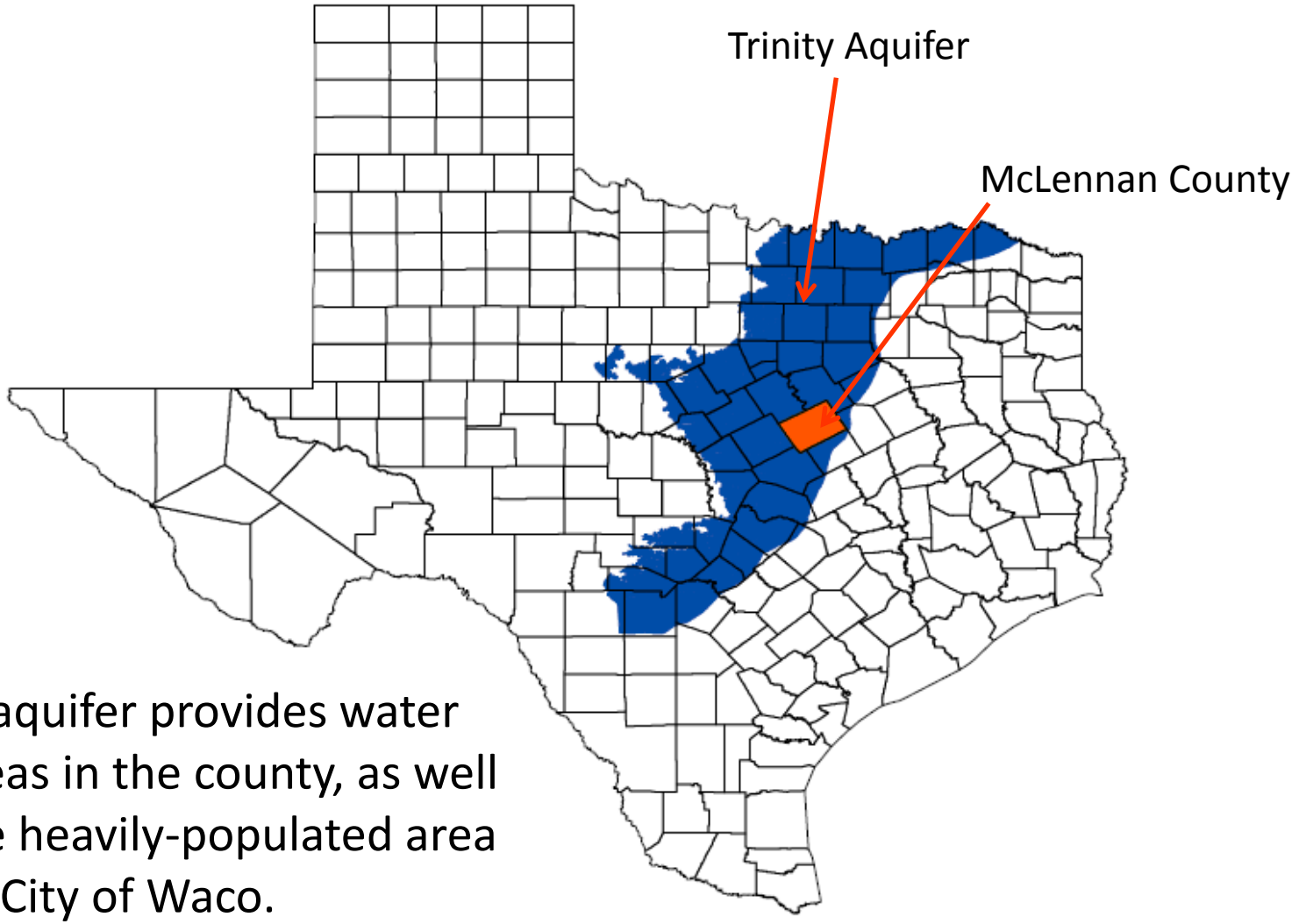
- **A) The Trinity Aquifer:** A deep, confined aquifer that underlies all of McLennan County
- **B) The Brazos River Alluvium Aquifer:** A shallow, unconfined aquifer located along the Brazos River basin
- STGCD also manages groundwater in any undefined aquifers in McLennan County



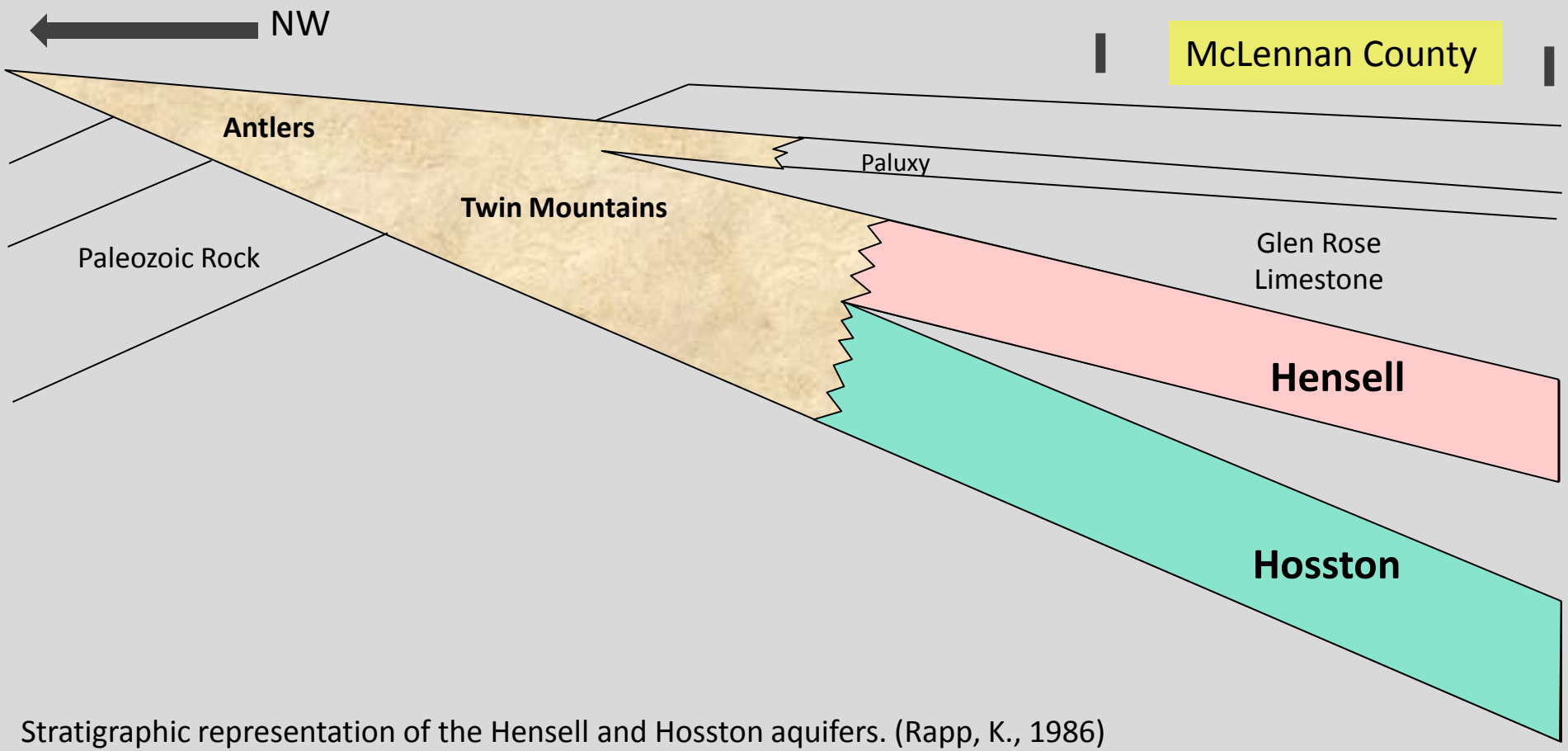
Managing our Groundwater

The Trinity Aquifer

Trinity Aquifer – Extent & geology



The Trinity aquifer provides water for rural areas in the county, as well as the more heavily-populated area around the City of Waco.



Stratigraphic representation of the Hensell and Hosston aquifers. (Rapp, K., 1986)

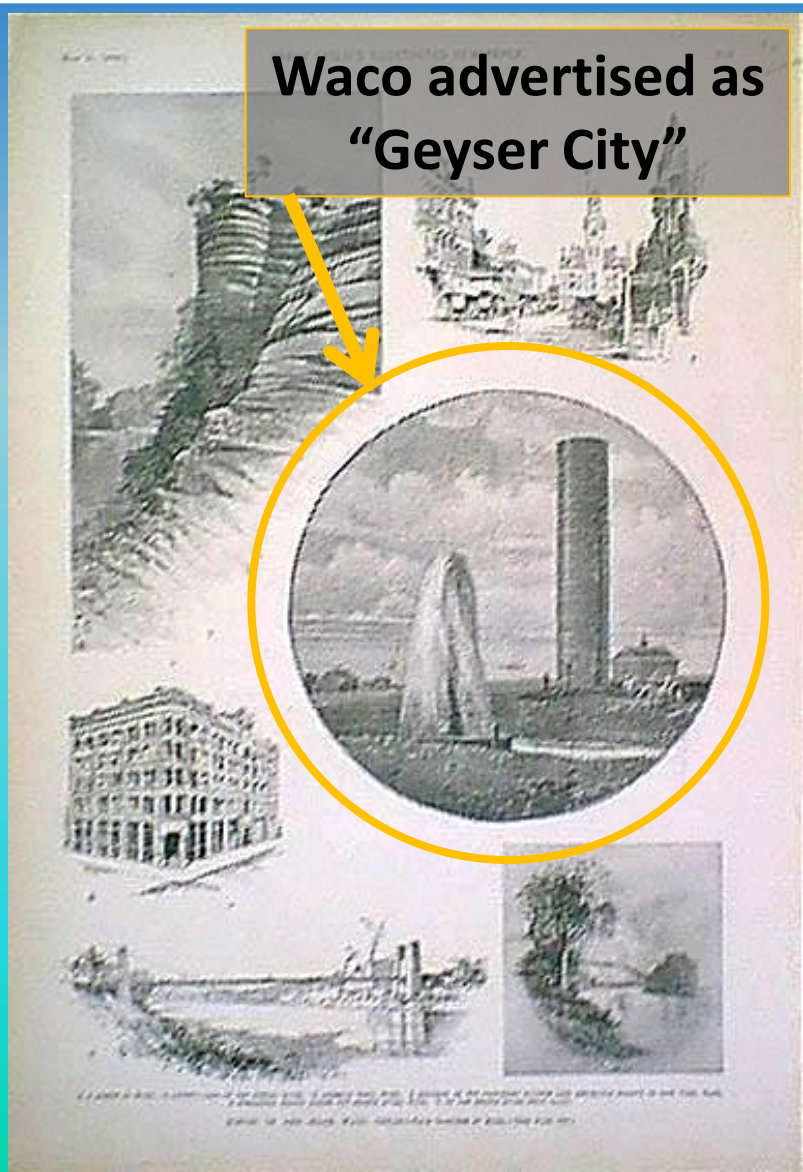
The Trinity aquifer is a deep confined aquifer. It is comprised of several geological units, and has different names depending upon where you are in the state. **In McLennan County, the Trinity is made up of the Hensell and the Hosston units.** The Hosston is a thicker, more productive unit than the Hensell in McLennan County.

Trinity Aquifer - recharge

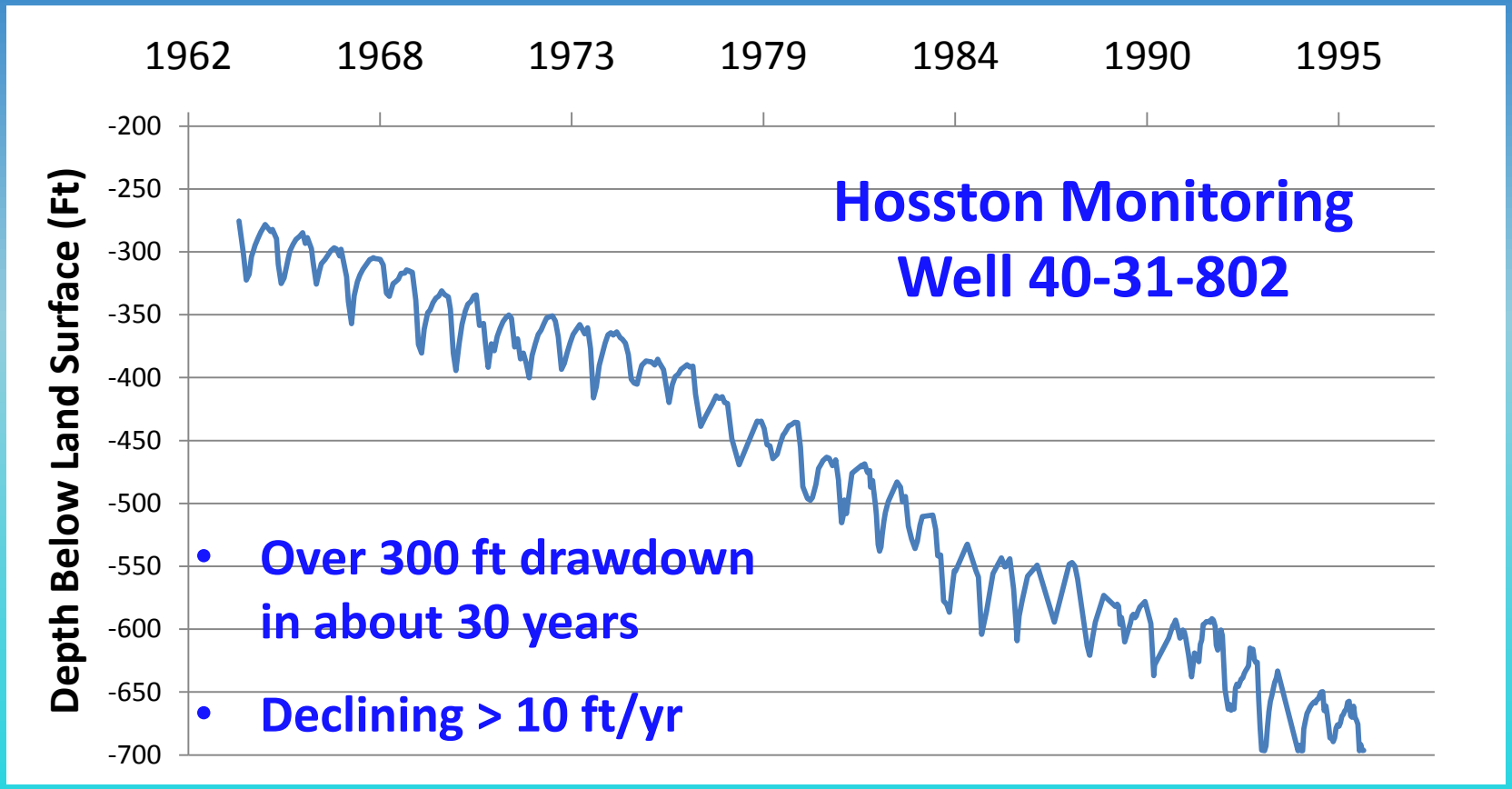
- **Recharge occurs in the outcrop** where aquifer material is exposed on the surface
- Recharge occurs due to rainfall on the **Antlers or Twin Mountains Formations**
- The groundwater then flows into the subsurface (confined aquifer) towards the **east** (into the Hensell and Hosston units)
- It takes **20,000 – 25,000 years** for groundwater to flow from the outcrop to McLennan County

Trinity Aquifer - history

- 1889: First artesian well in Waco
  - 1830 ft deep
  - 103°F
  - ~400 000 gpd
- More wells drilled between ‘89 – ’94
- 1894: Some wells had stopped flowing above the surface
- In recent times, the depth of wells range from **1000 ft** in the west to **3000 ft** in the east

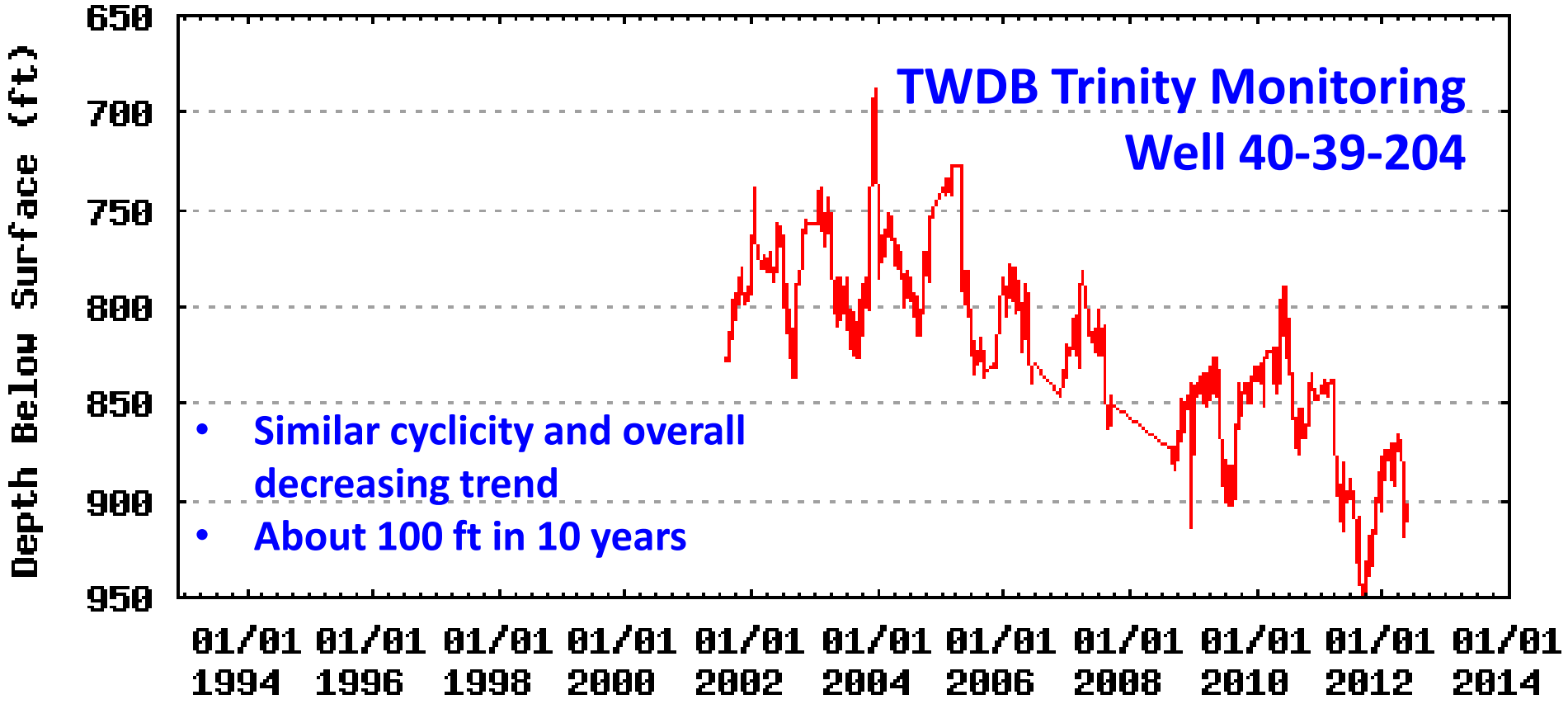


Trinity Aquifer – Historic water level declines



- This hydrograph is of TWDB monitoring well 40-31-802 (this well has since been plugged and no longer exists)
- The cyclicity shown on the graph is **not due to changes in recharge**, but to seasonal changes in demand, or drawdown and recovery.

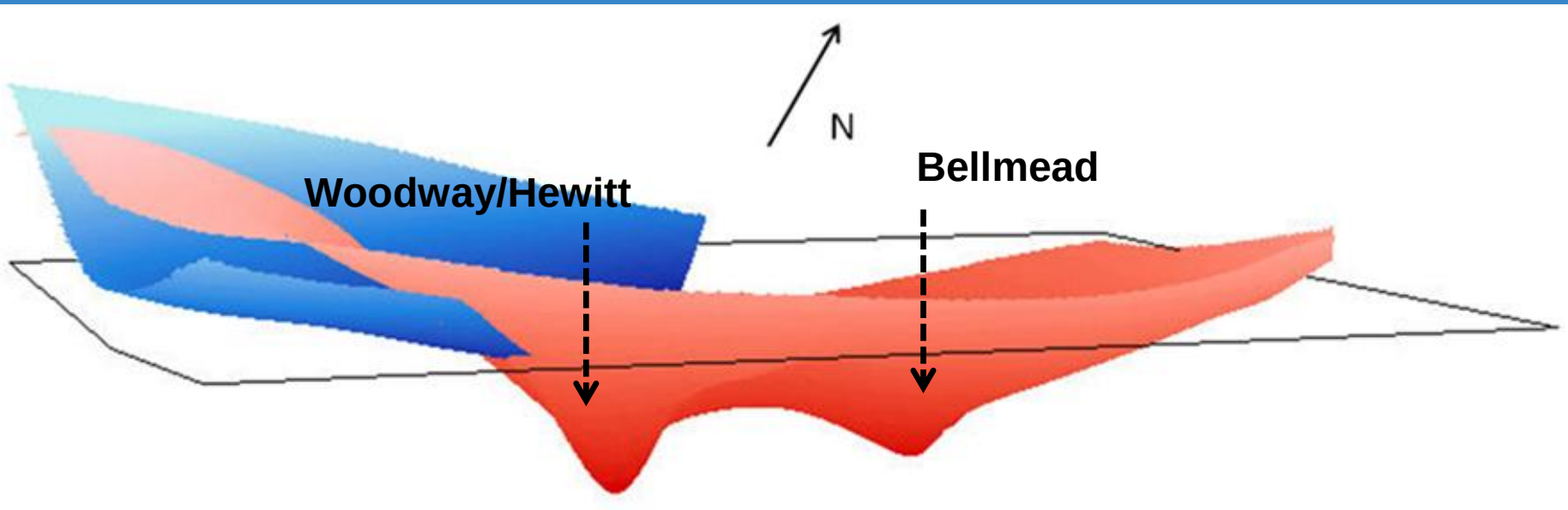
Trinity Aquifer – Modern water level declines



- Last reading: May 21, 2012 – 910.77 ft depth below surface

Trinity Aquifer – Pumping and water levels

- General flow direction in the aquifer:
  - Originally toward southeast
  - Now toward center of the county due to pumping (cones of depression)
- Pumping can affect water levels in nearby wells
  - Thus, non-exempt wells have spacing rules to protect water levels in neighboring wells and minimize water level decline (drawdowns) in all wells



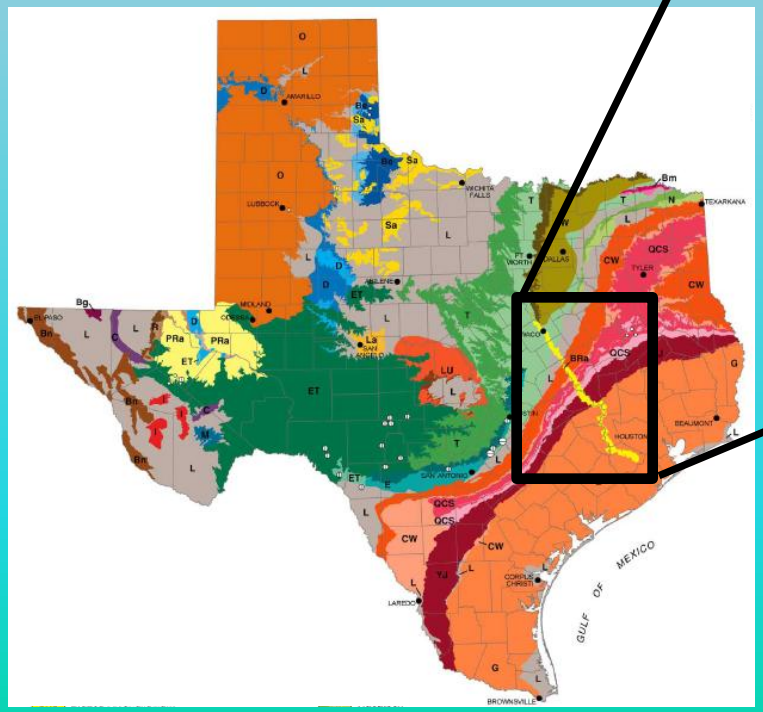
- The flow direction of the Trinity aquifer in McLennan County was originally toward the southeast, but is now toward the center of the county due to a concentration of pumping.

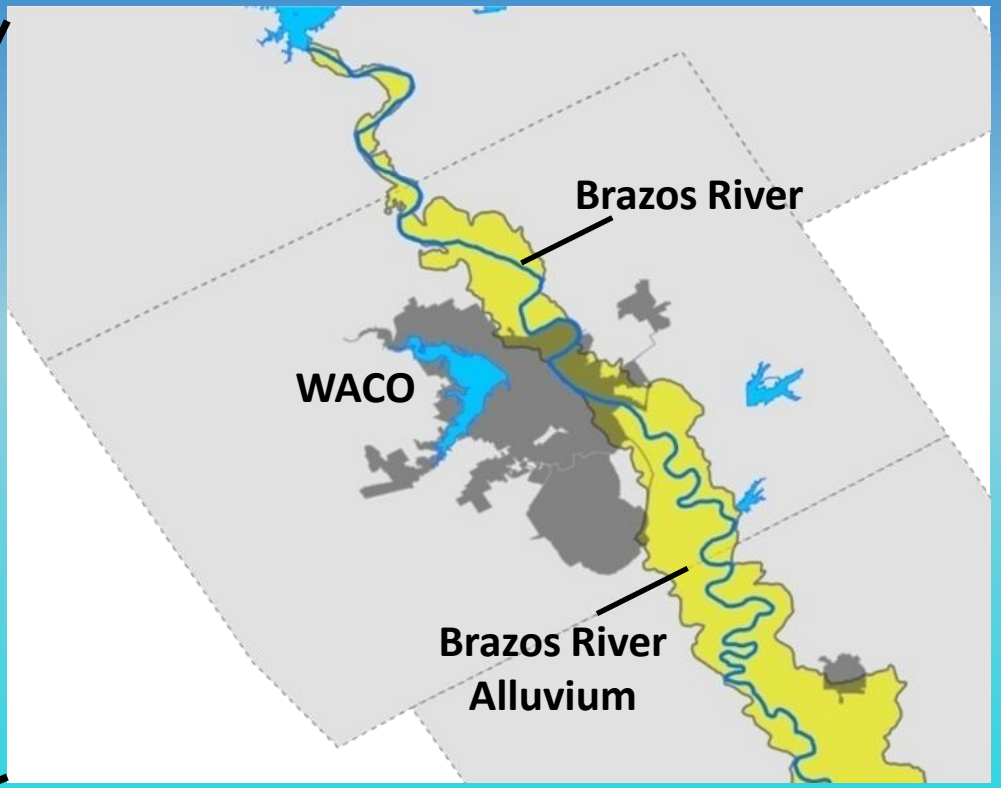
Managing our Groundwater

The Brazos River Alluvium Aquifer

Brazos River Alluvium Aquifer

- 1 of 21 defined minor aquifers in Texas





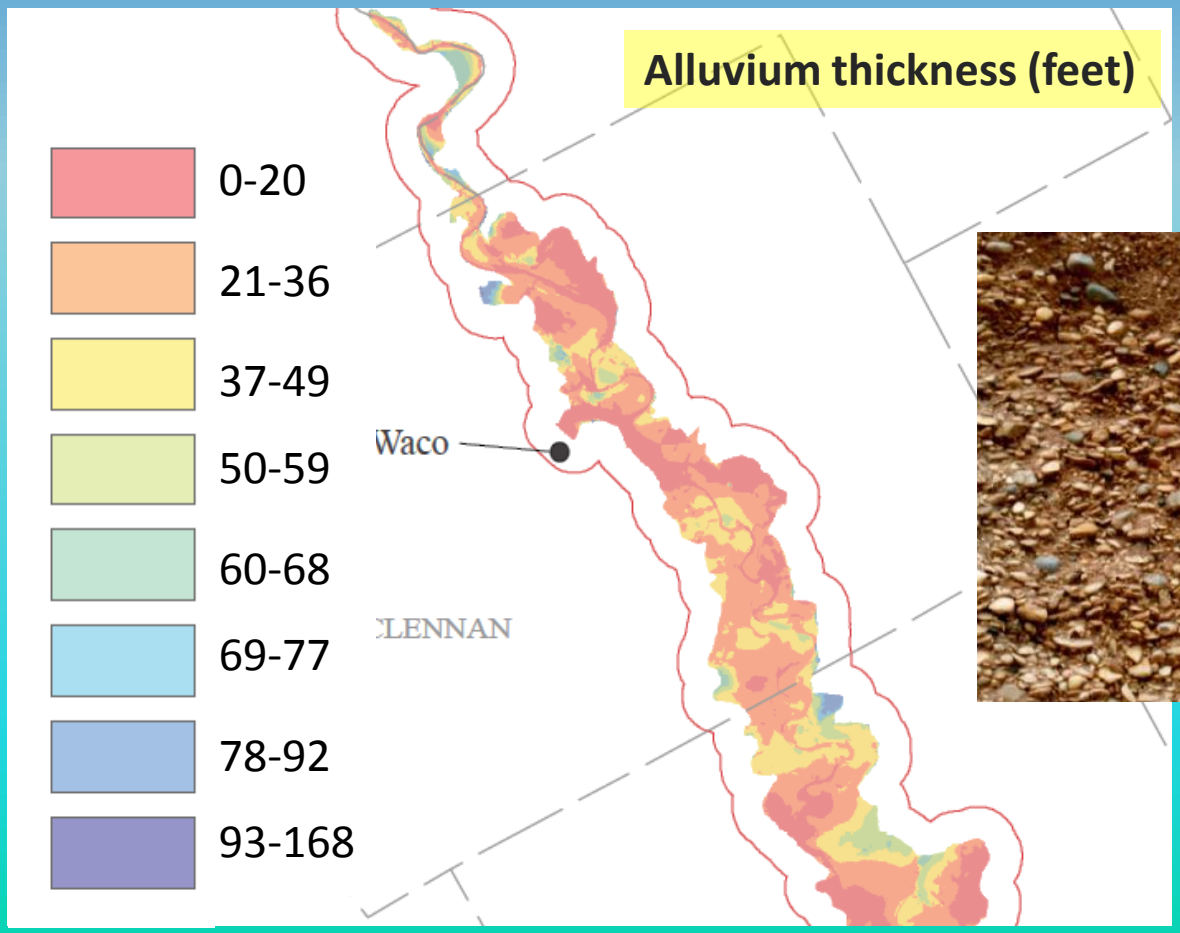
- Officially, the state names this aquifer the “Brazos River Alluvium Aquifer”. It is often referred to as the “Brazos Alluvium” for short.

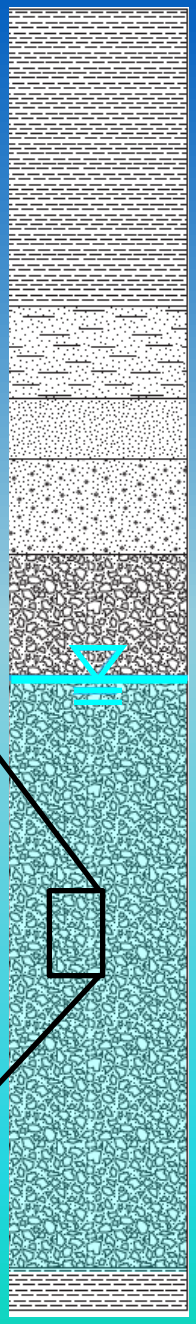
Brazos Alluvium - geology

- Comprised of the floodplain sediments deposited by the Brazos river
- Shallow:
  - Average thickness of the Brazos alluvium in McLennan County is about **20 ft**
- General **fining-upward layering** of sediments, but there is **much variation across the county** (see next slide)
  - Affects possible production from the aquifer

Generally, Brazos alluvium is layered with coarsest sediments at the bottom and finest at the top:

Alluvium thickness is variable across the county:





(after Epps, 1973)

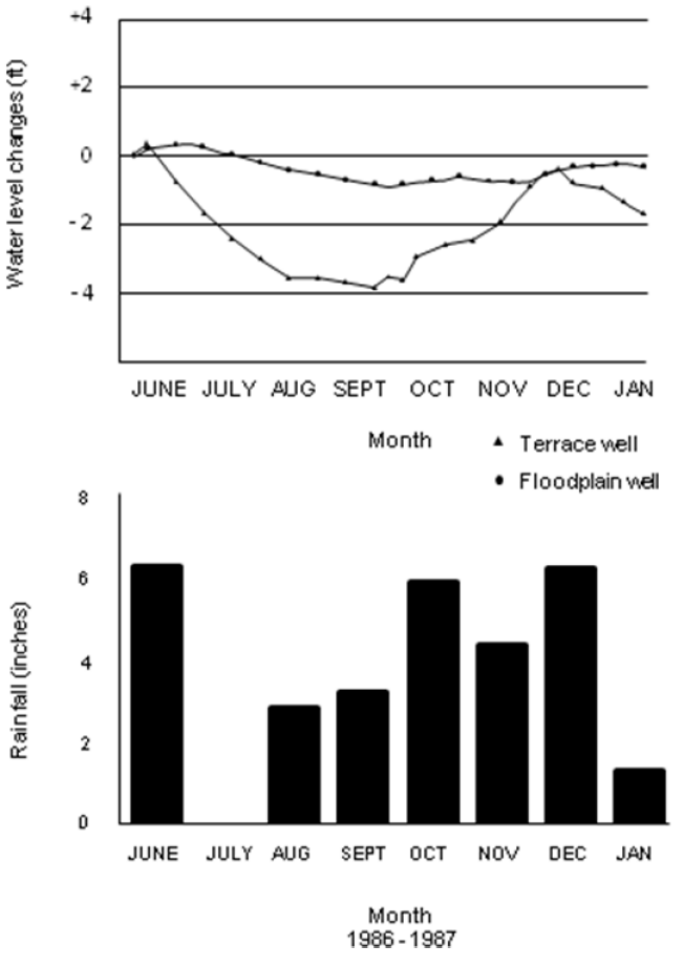
Brazos Alluvium - history

- Historically used for irrigation
- 1964: around 150 Brazos alluvium irrigation wells in the Waco area
- Underutilized as municipal/domestic water source
  - Changing with development

Irrigated field in 1900 (TAMU, 2011)

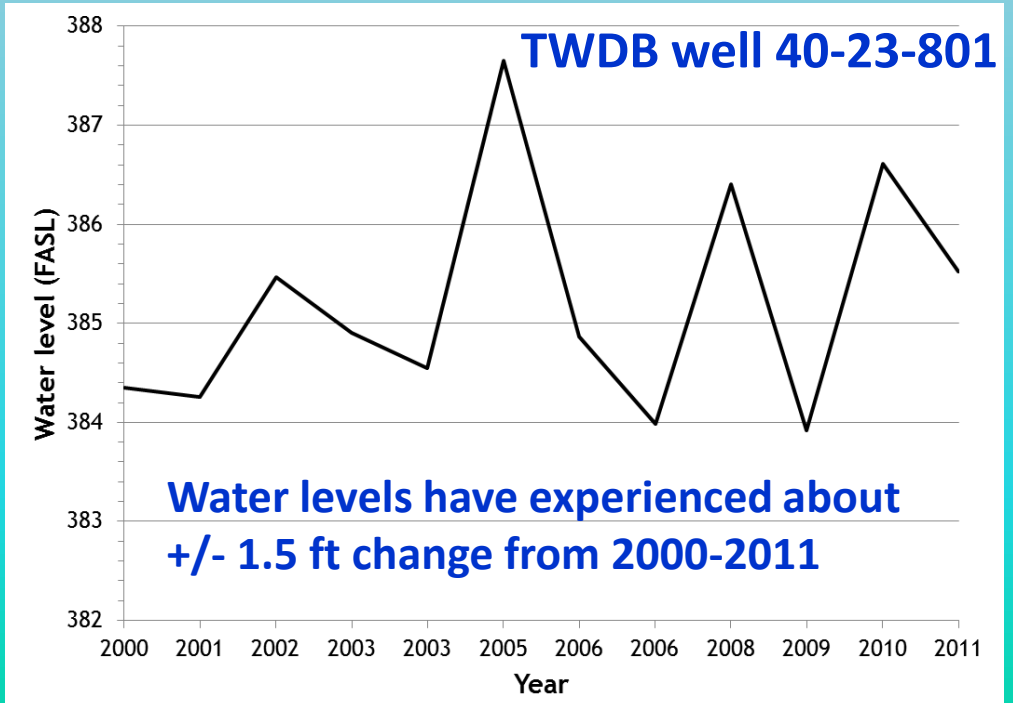
Massive sand in Brazos alluvium (Cronin and Wilson, 1967)

Brazos Alluvium – recharge



(Harlan, 1990)

- The Brazos Alluvium aquifer is recharged seasonally with precipitation
- Aquifer water level is generally stable through time



Brazos Alluvium - production

- Water production in the Brazos Alluvium in McLennan County will **vary** in both **quantity** and **quality**
- Water quantity:
  - **Several gpm** in thin alluvial sections and/or fine sediments
  - **Hundreds of gpm** in thicker alluvial sections with gravel
  - *Keep in mind that production rates **exceeding 17 gpm (2500 gpd)** will require well owner to obtain a permit.*
- Water quality:
  - Because the aquifer is shallow and unconfined, it is quickly recharged.
  - **However,** this aquifer is also more sensitive to **water quality degradation** due to surface activities (eg. Farming, urban run-off)

Managing our Groundwater

Groundwater Permitting

Well Permits

- A permit issued by the district is required to drill or operate a well within the boundaries of the Southern Trinity Conservation District.
- Depending on the status of your well and the intended use of the groundwater produced, there are different permits for which you may apply.
  - Historic Use Production Permit (HUPP)
  - Non-Historic Use Production Permit (NHUPP)
- For more details on well permits, please refer to chapter 5 (subsection C) of the District Rules
- Application forms can be found at:

  http://southerntrinitygcd.org/permits.html

Groundwater Availability Models

- Numerical groundwater flow model (GAM) used to determine **Managed Available Groundwater (MAG)**
- The purpose of a GAM is **to determine groundwater availability for a 50-year period**. Once a **Desired Future Condition (DFC)** has been selected for an aquifer or part of an aquifer, a GAM can be run to determine how much water may be pumped per year from the aquifer or part of the aquifer in accordance with the DFC.
- **Trinity aquifer** GAM completed in 2004; reworked in 2007
- The **Brazos River Alluvium aquifer** currently does not have a GAM

Trinity Aquifer – How much water is available for permitting?

Allotted maximum annual withdrawals, includes exempt uses	**20,194 ac-ft (6,580,214,900 gal)**
Currently issued in permits	**17,026 ac-ft (5,547,989,000 gal)**

- Currently, there are 52 exempt permits total, encompassing 137 producing wells

Brazos Alluvium – MAG and DFC

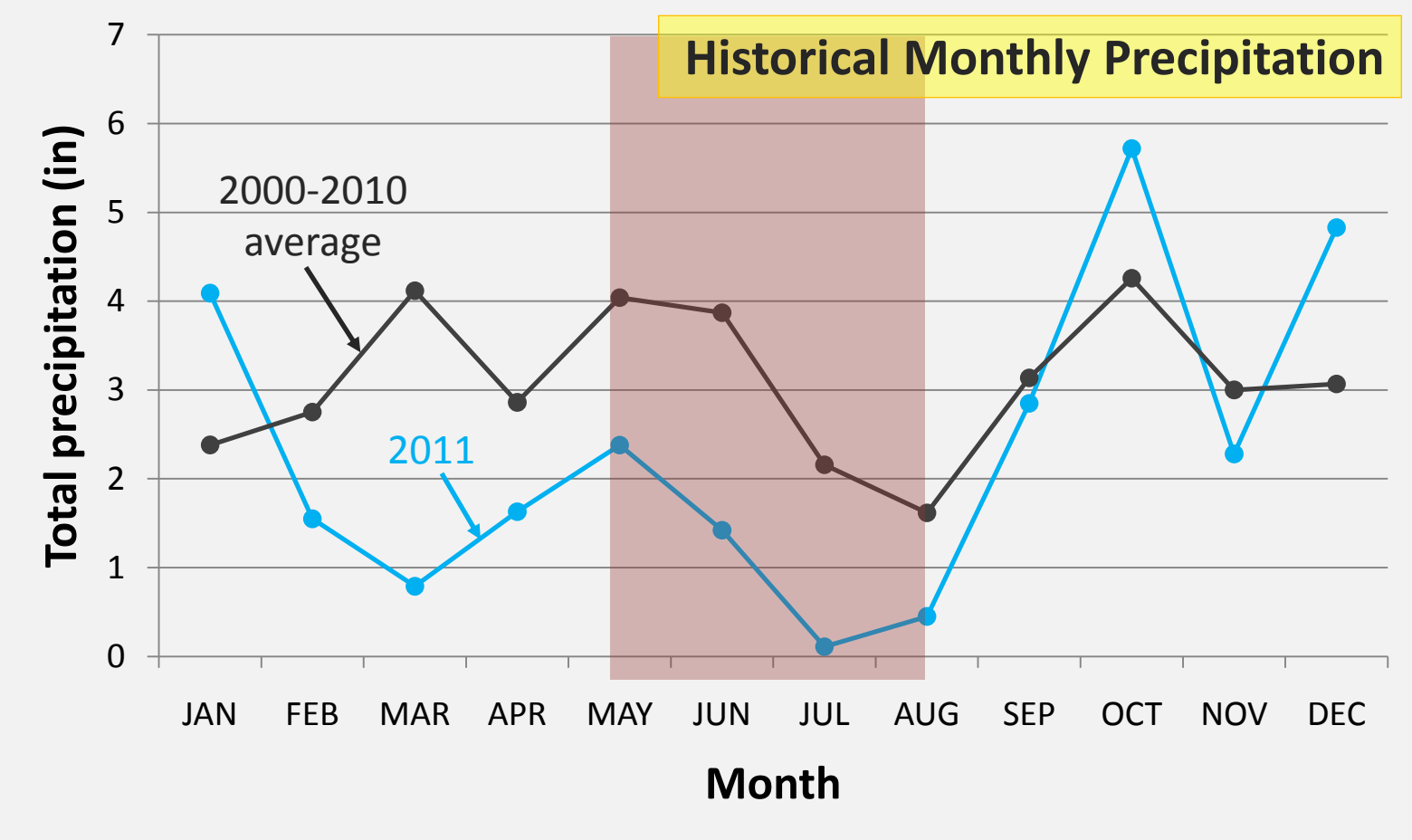
- Managed Available Groundwater = 15,023 ac-ft / year (4,895,266,017 gpy)
- **Desired Future Condition:** *to maintain 82% of estimated saturated thickness after 50 years in McLennan County*
- 2000-2003: TWDB reported that on average **609 ac-ft (198,524,983 gal)** were pumped per year from the Brazos Alluvium for irrigation (no other uses reported)

Managing our Groundwater

2011 – 2012 Update

2011 – Drought conditions

- Drought conditions
- This has put additional stress on our water supplies



http://weather-warehouse.com/WeatherHistory/PastWeatherData_WacoDam_Waco_TX_November.html

Trinity Aquifer update

2011:

- 11 138 ac-ft (3 629 264 000 gal) water pumped between January to August 2011
- Not issuing NHUPPs at this time
  - This will allow us to see how this year affects local water supplies

http://www.harvestdream.org/uploads/Texas%20Drought%202011.jpg

Trinity Aquifer update

2012:

- Pumping amounts in the first quarter of 2012:

Month	Water pumped (000's of gallons)
January	321,656
February	297,251
March	332,123

Brazos Alluvium update

- Because of drought and the existing demands on the Trinity aquifer, interest in drilling Brazos River Alluvium aquifer wells has increased
  - This aquifer is shallow, and therefore wells are cheaper to drill than Trinity wells
  - Water availability: may be sufficient for irrigation and domestic uses
- In response to the increased demand, STGCD has decreased the minimum acreage requirements for an exempt well to be drilled into the Brazos Alluvium:
  - **NOW: Two (2) acres or more**
  - Before: Ten (10) acres or more

Questions?

(End of Part II)

Southern Trinity Groundwater Conservation District