PART II
Managing our Groundwater:
The Trinity & Brazos River Alluvium Aquifers
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
The Trinity aquifer provides water for rural areas in the county, as well as the more heavily-populated area around the City of Waco.
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


- Depth Below Land Surface (Ft)

- Hosston Monitoring Well 40-31-802

- Over 300 ft drawdown in about 30 years

- Declining > 10 ft/yr

- 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

- Similar cyclicity and overall decreasing trend
- About 100 ft in 10 years

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:
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
Brazos Alluvium – recharge

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

(Harlan, 1990)
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?

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allotted maximum annual withdrawals, includes exempt uses</td>
<td>20,194 ac-ft (6,580,214,900 gal)</td>
</tr>
<tr>
<td>Currently issued in permits</td>
<td>17,026 ac-ft (5,547,989,000 gal)</td>
</tr>
</tbody>
</table>

- 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

Historical Monthly Precipitation

2000-2010 average

2011

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
Trinity Aquifer update

2012:

- Pumping amounts in the first quarter of 2012:

<table>
<thead>
<tr>
<th>Month</th>
<th>Water pumped (000’s of gallons)</th>
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<tbody>
<tr>
<td>January</td>
<td>321,656</td>
</tr>
<tr>
<td>February</td>
<td>297,251</td>
</tr>
<tr>
<td>March</td>
<td>332,123</td>
</tr>
</tbody>
</table>
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)