

Water Management in Texas and Management of Groundwater Resources within the Post Oak Savannah GCD



El Camino Real Master Naturalist

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Post Oak Savannah GCD
March 5, 2020

Serving the citizens of Milam and Burleson Counties

Agenda

1. The Basics: The Water Cycle
2. Texas Water Resources and Management
3. GCDs- Powers and purposes
4. Why POSGCD in Burleson and Milam counties
5. Groundwater Resources within POSGCD
6. GMA Joint Planning and State Water Planning
7. Management strategies of POSGCD
8. POSGCD Programs



The Basics: The Water Cycle

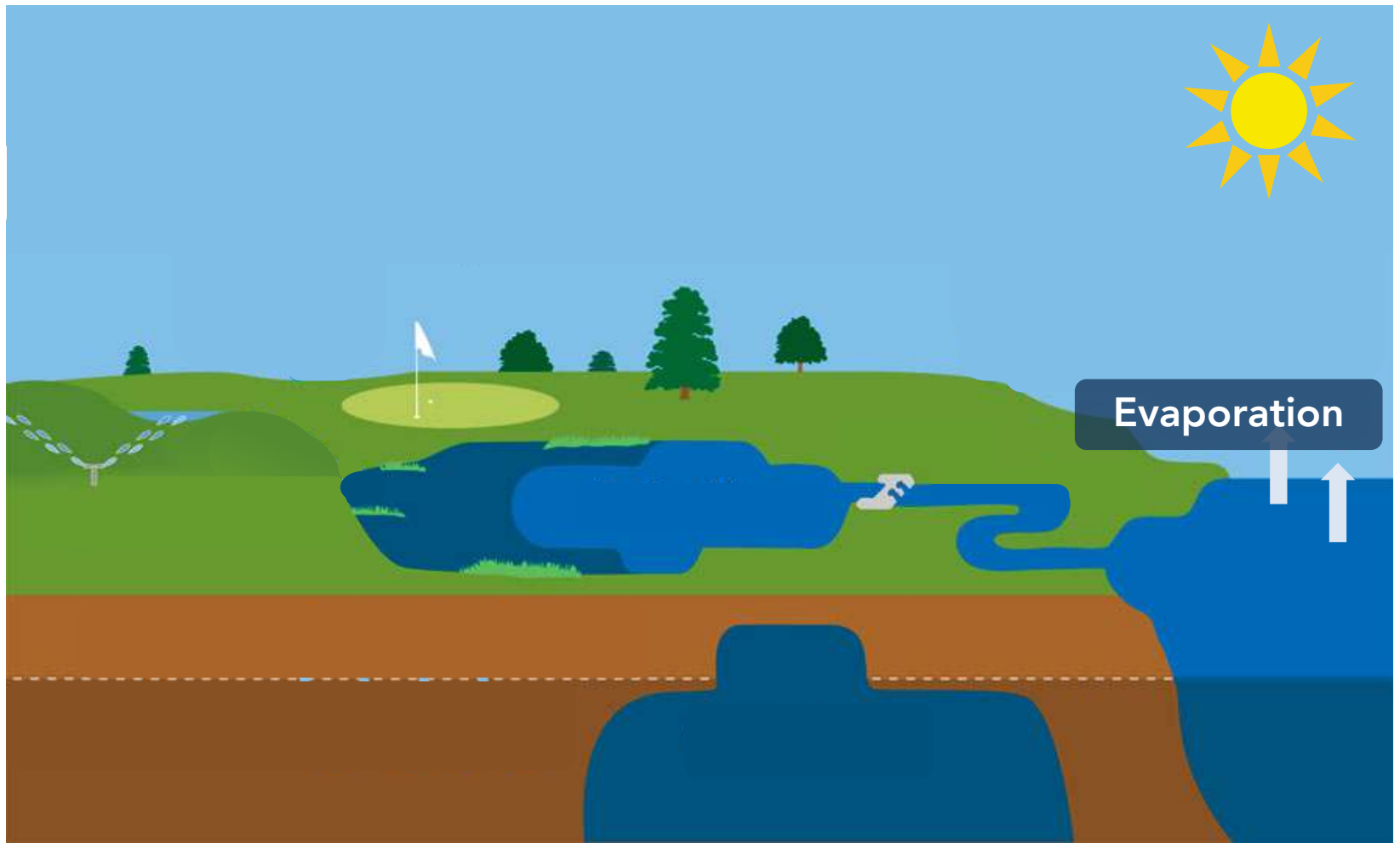


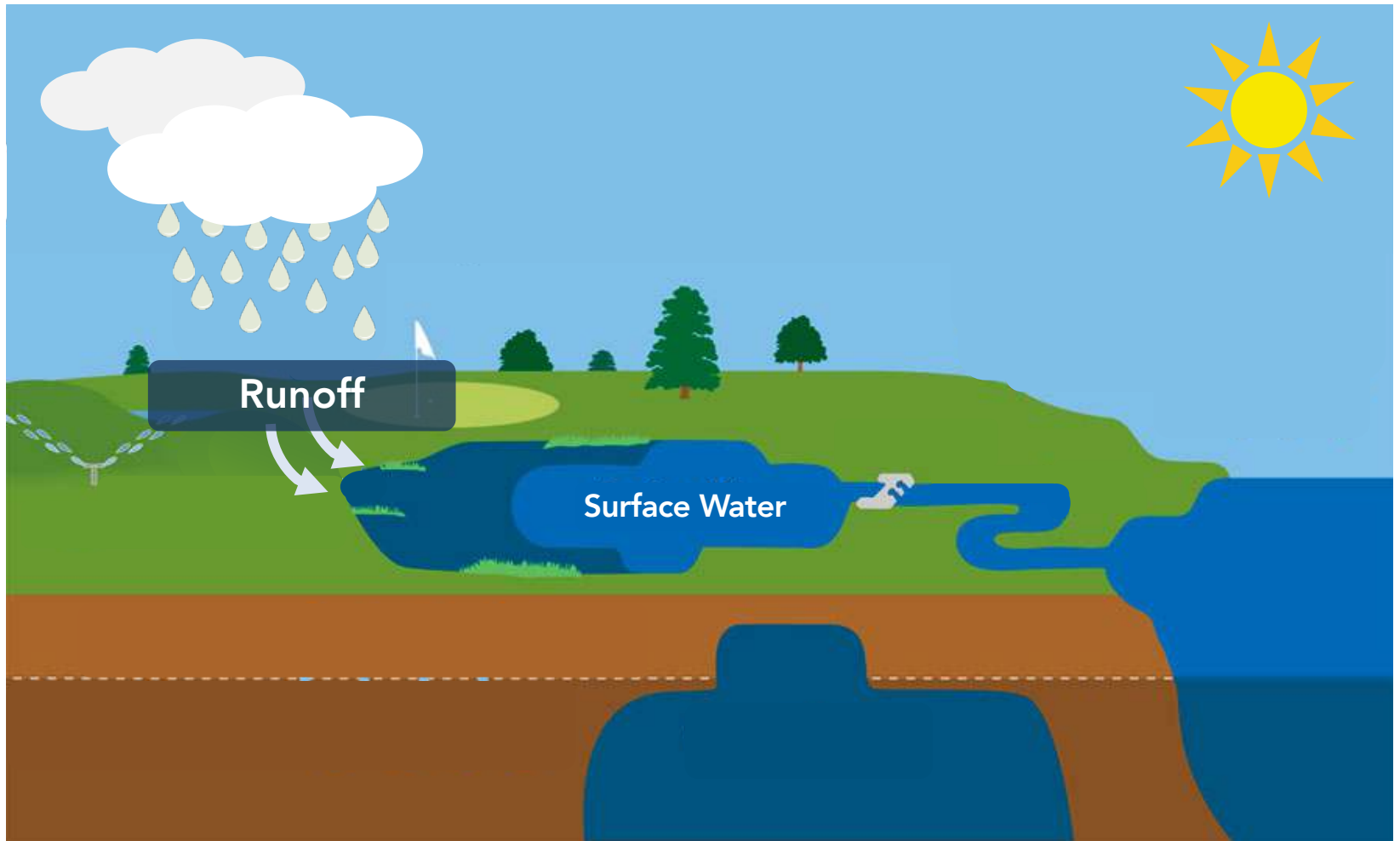
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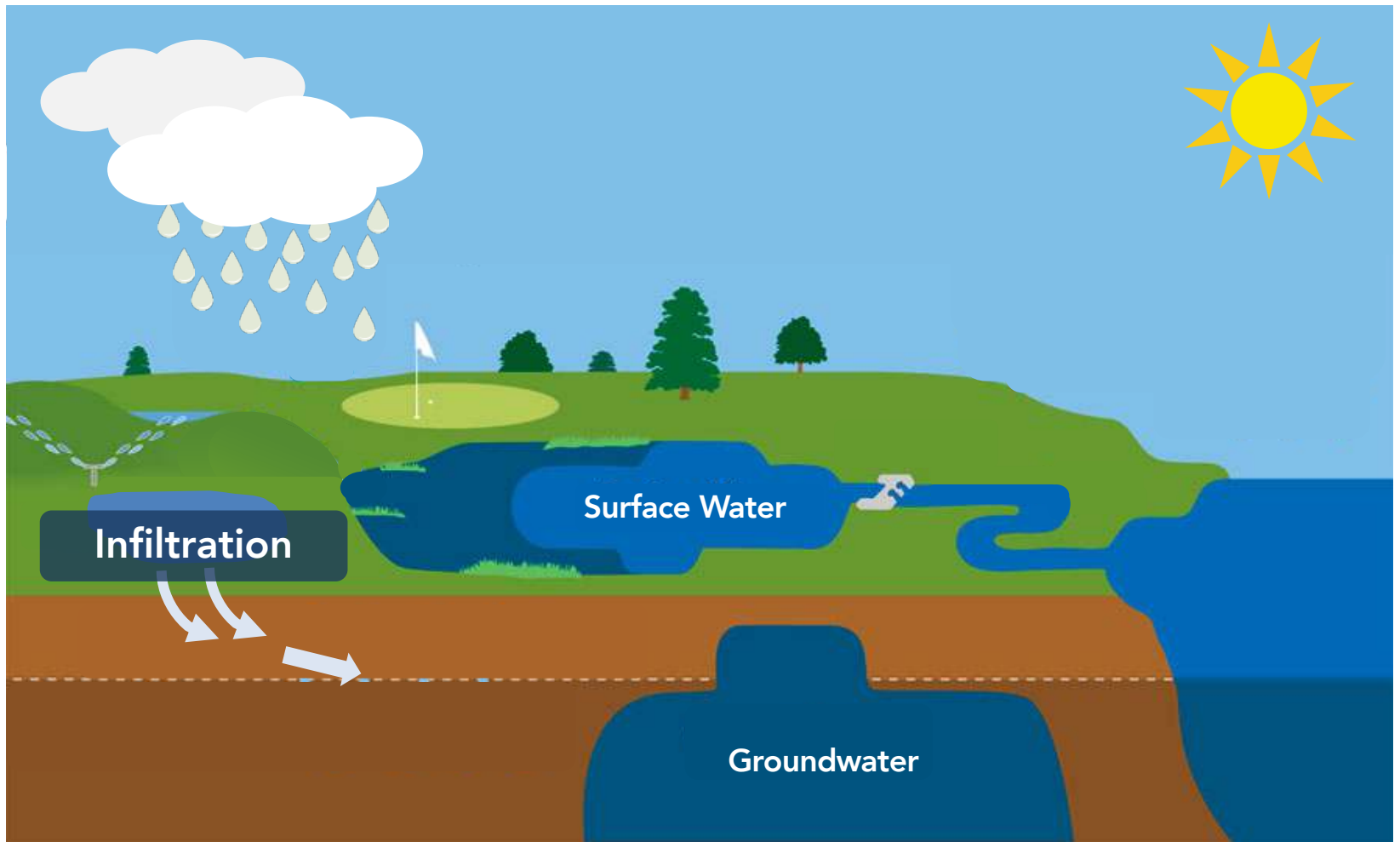
Condensation

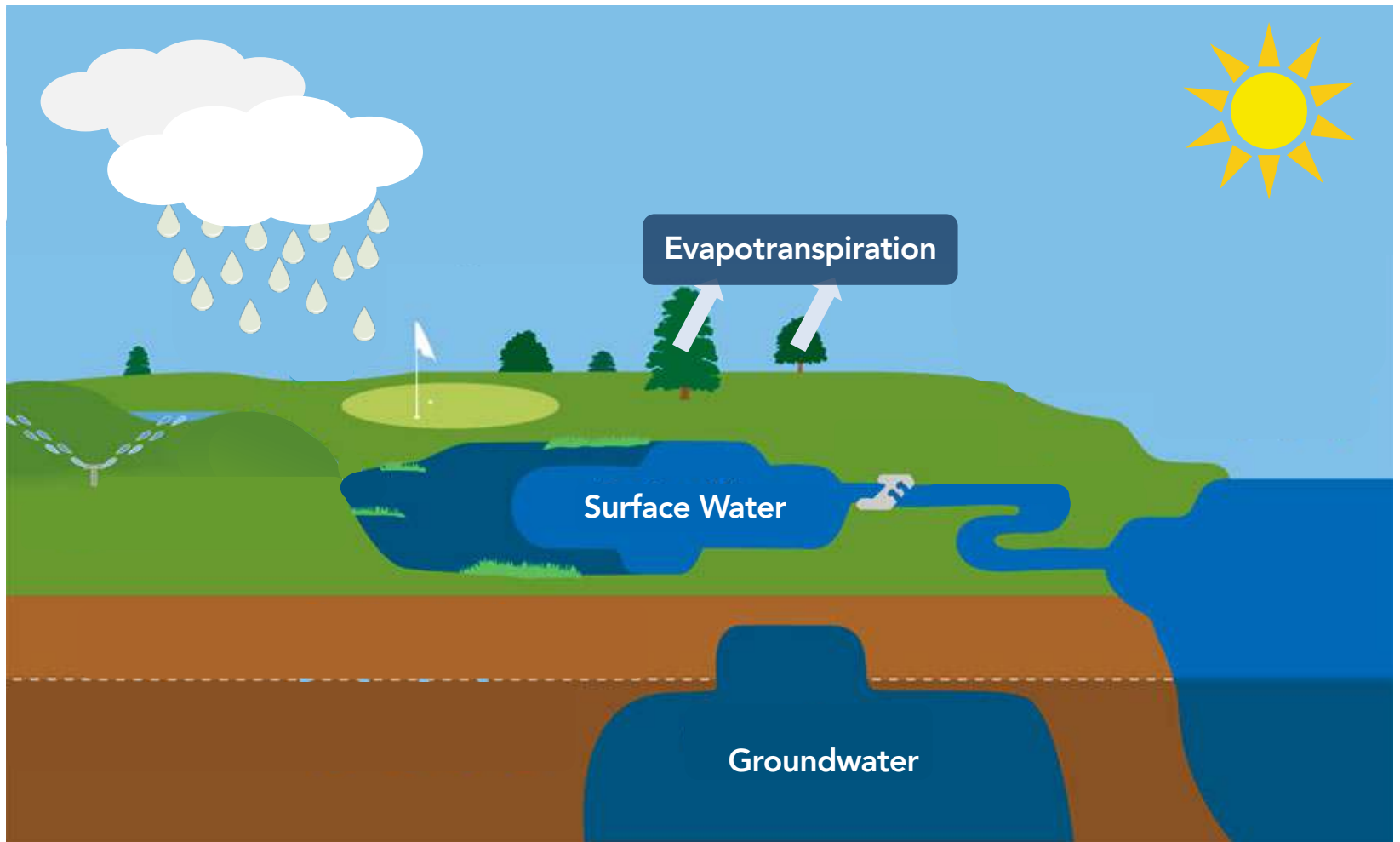


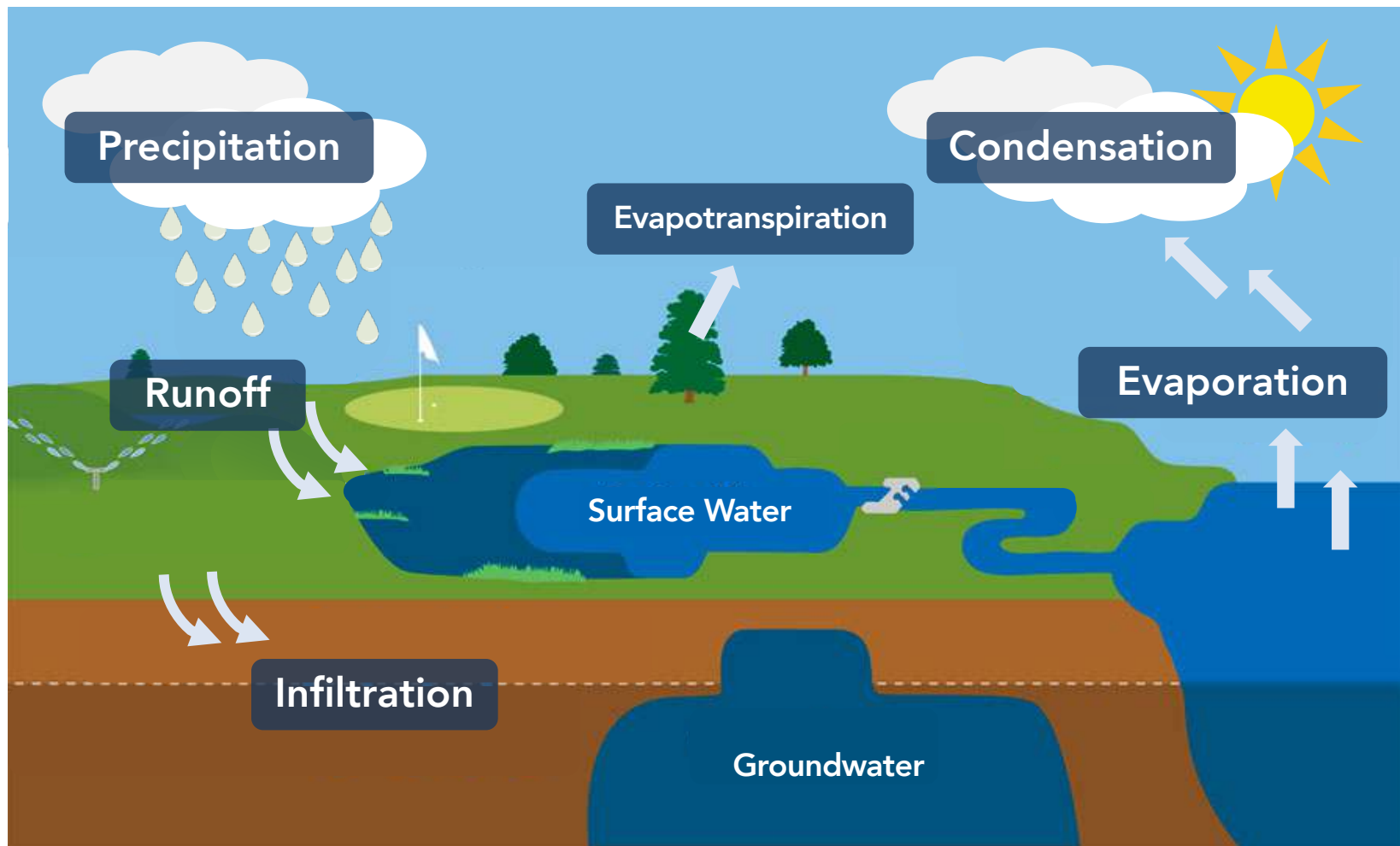










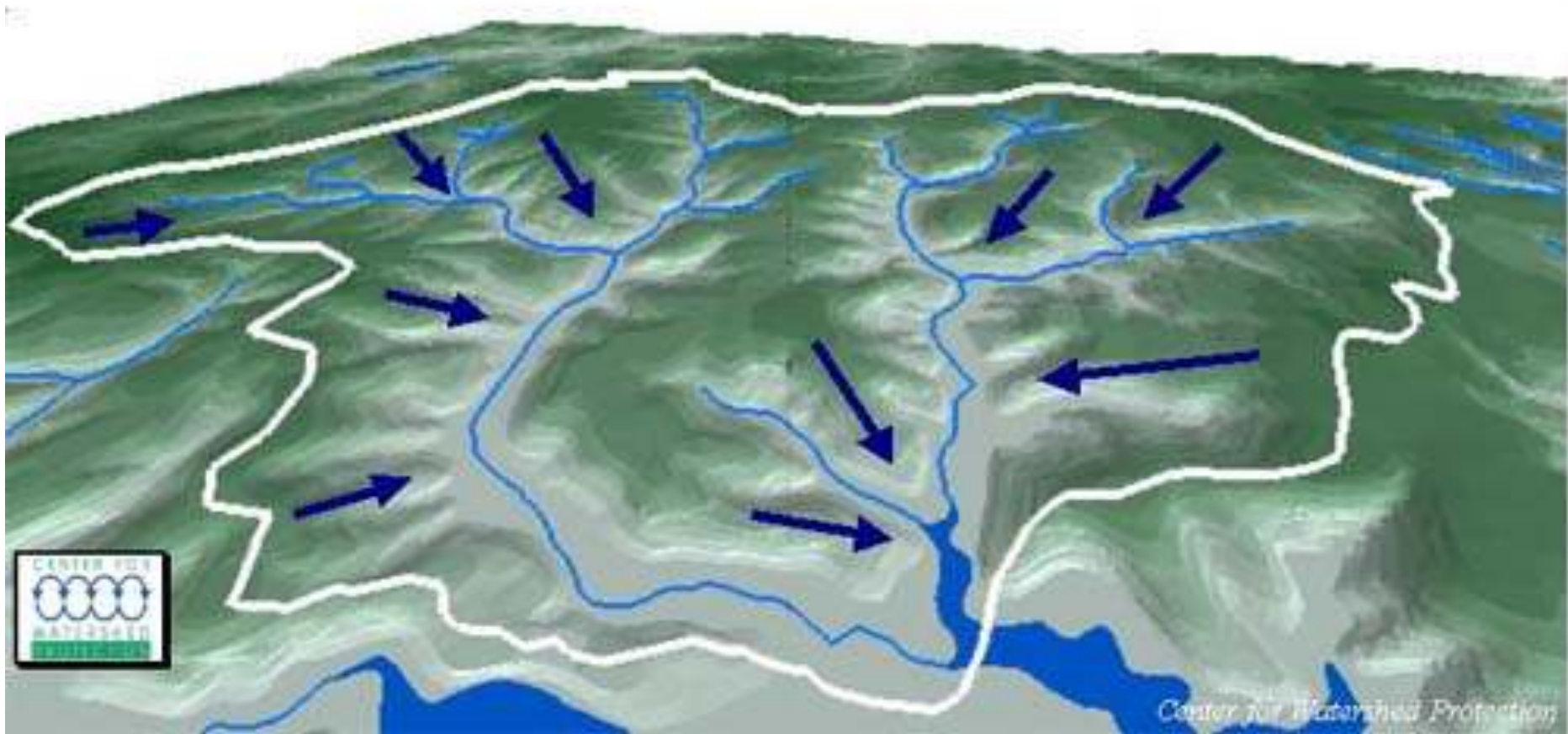




Texas Water Resources and Management

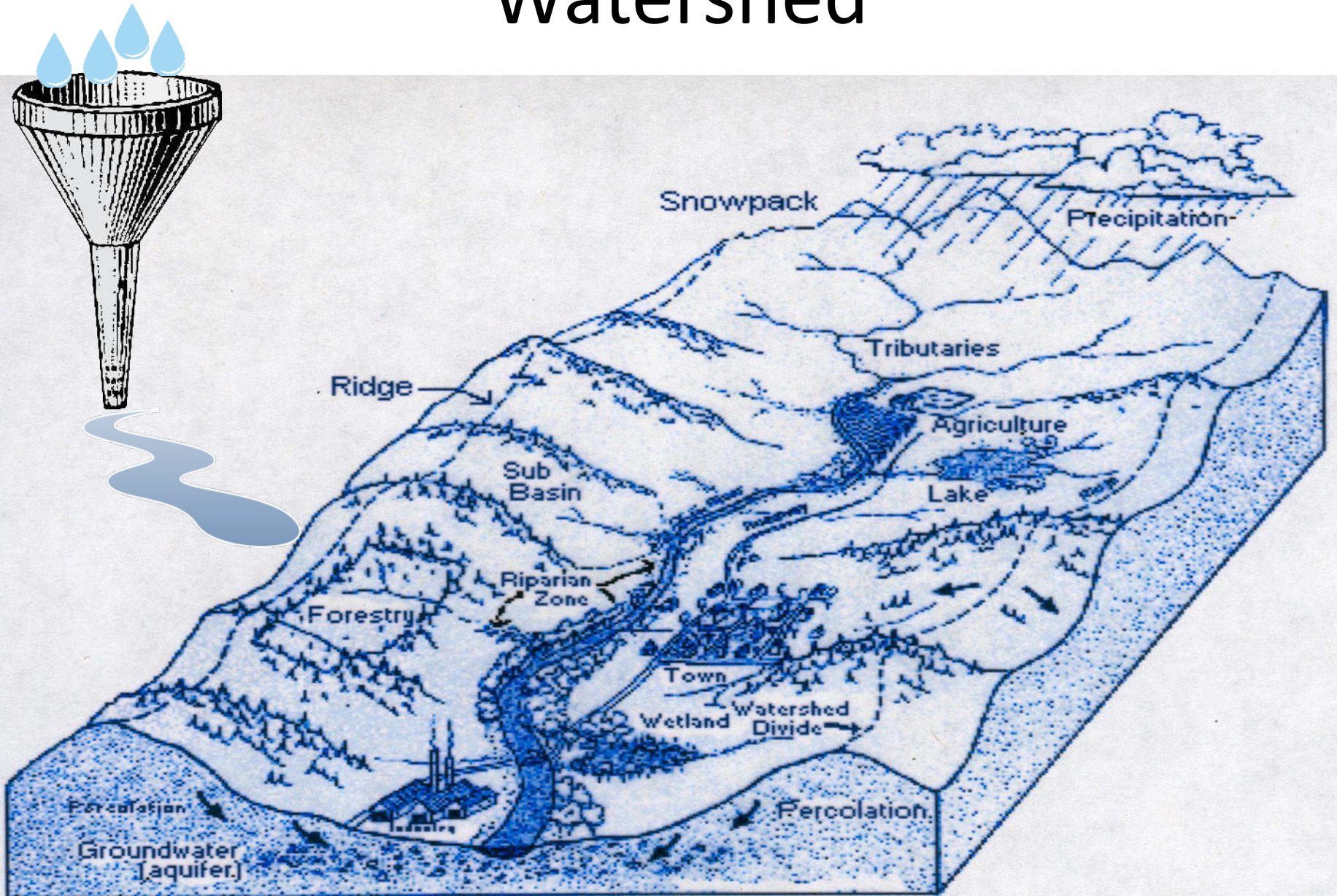
What is a Watershed?

A **watershed** is an area or ridge of land that **separates waters** flowing to different rivers, basins or seas.



Many watersheds make a river basin.

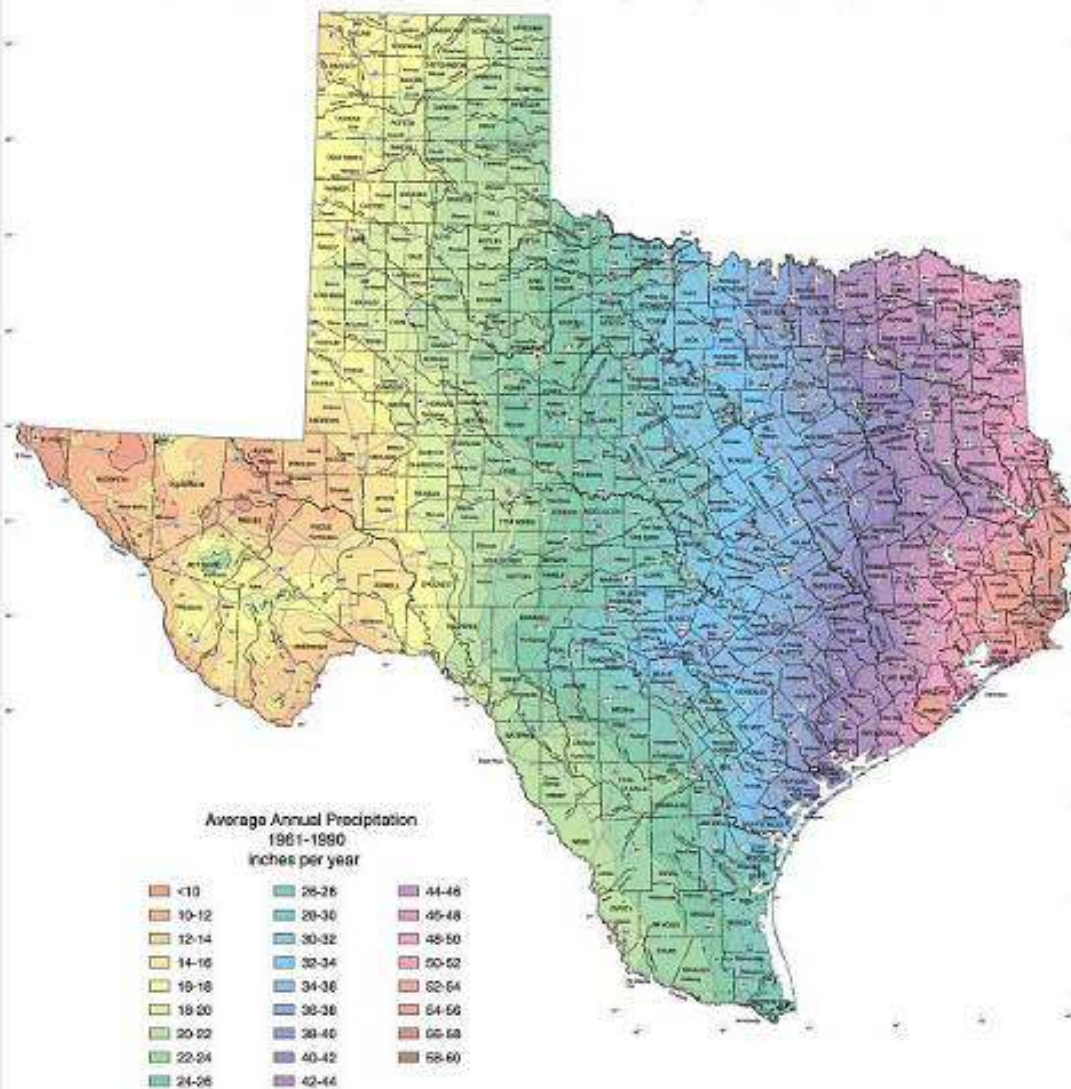
Watershed



Produced by Lane Council of Governments

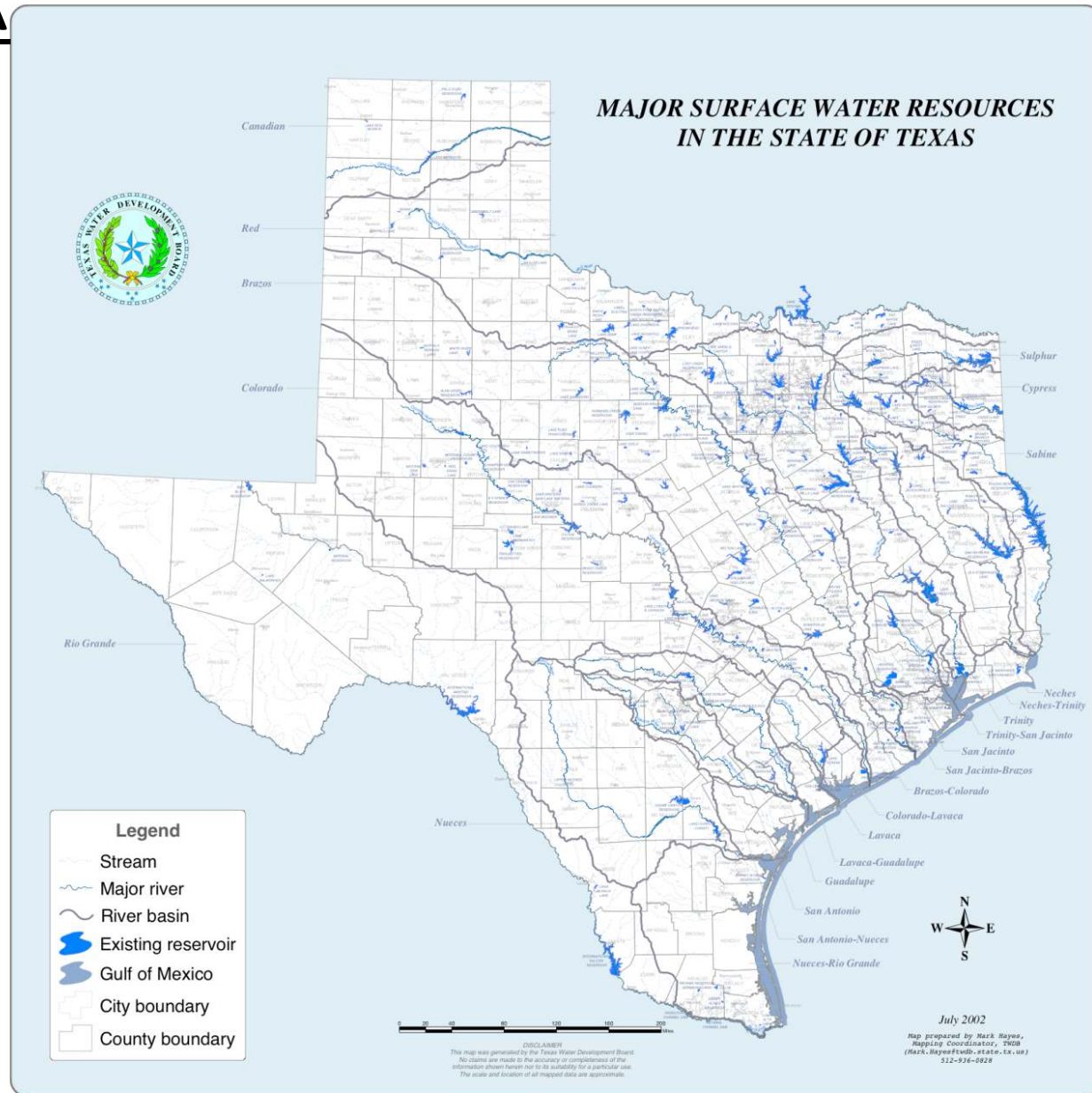
TEXAS

ANNUAL PRECIPITATION



SURFACE WATER

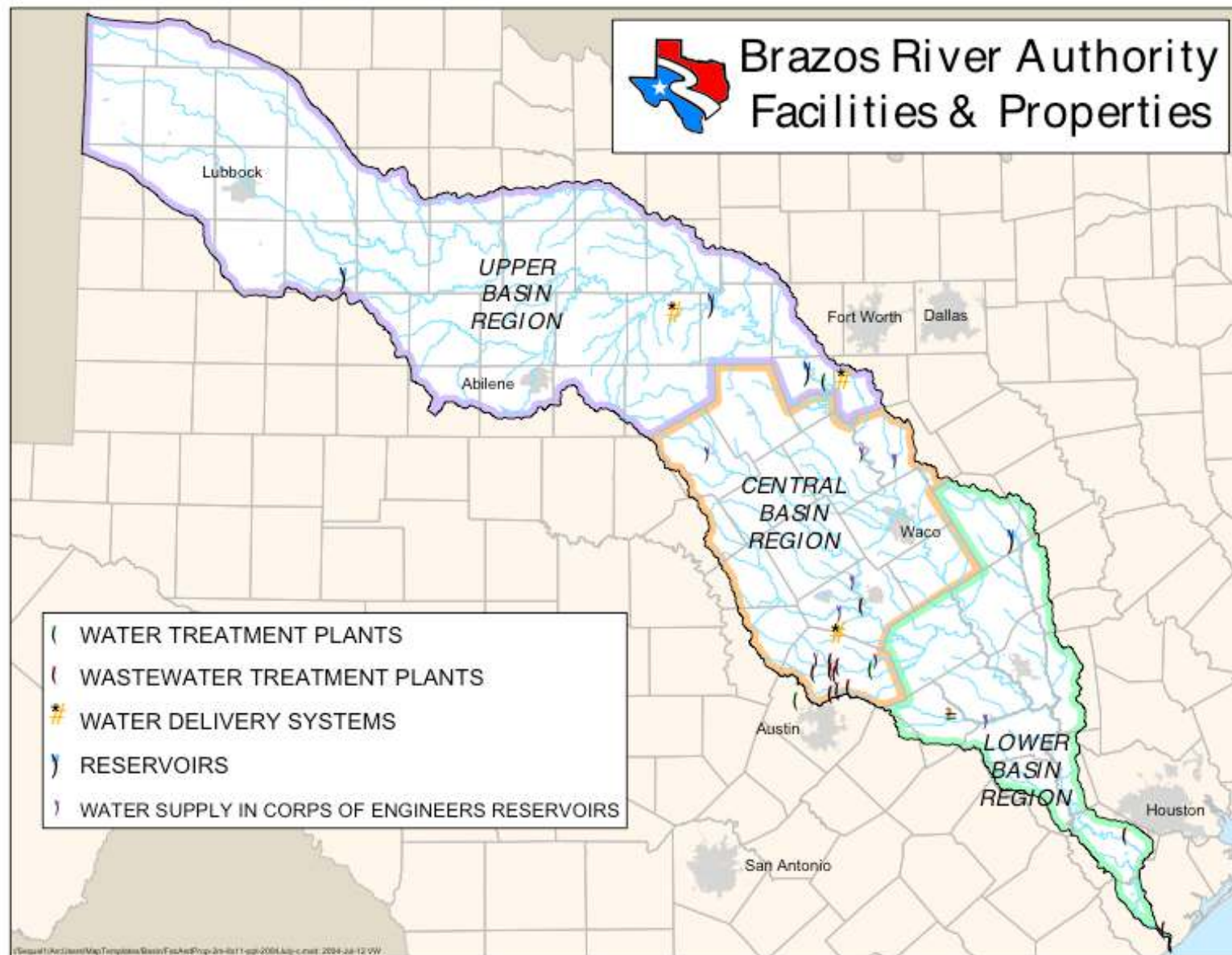
Owned by the
State, Regulated
by Texas
Commission on
Environmental
Quality (TCEQ),
& managed by
River
Authorities



Major River Basins In Texas



Brazos River Authority



Groundwater in Texas aquifers is privately owned & regulated by 100 Groundwater Conservation Districts (GCDs)

Confirmed Groundwater Conservation Districts

1. Anderson County UWCD
2. Bandera County River Authority & Ground Water District
3. Barton Springs/Edwards Aquifer CD
4. Bee GCD
5. Blanco-Pedernales GCD
6. Bluebonnet GCD
7. Brazoria County GCD
8. Brazos Valley GCD
9. Brewster County GCD
10. Brush Country GCD
11. Central Texas GCD
12. Clear Fork GCD
13. Clearwater UWCD
14. Coastal Bend GCD
15. Coastal Plains GCD
16. Coke County UWCD
17. Colorado County GCD
18. Corpus Christi ASRCD
19. Cow Creek GCD
20. Crockett County GCD
21. Cullbertson County GCD
22. Duval County GCD
23. Edwards Aquifer Authority
24. Evergreen UWCD
25. Fayette County GCD
26. Fox Crossing Water District
27. Garza County UWCD
28. Gateway GCD
29. Glasscock GCD
30. Goliad County GCD
31. Gonzales County UWCD
32. Guadalupe County GCD
33. Hays Trinity GCD
34. Headwaters GCD
35. Hemphill County UWCD
36. Hickory County UWCD
37. High Plains UWCD No. 1
38. Hill Country UWCD
39. Hudspeth County UWCD No. 1
40. Irion County WCD
41. Jeff Davis County UWCD
42. Kennedy County GCD
43. Kimble County GCD
44. Kinney County GCD
45. Lipan-Kickapoo WCD

Confirmed Groundwater Conservation Districts (continued)

46. Live Oak UWCD
47. Llano Estacado UWCD
48. Lone Star GCD
49. Lone Wolf GCD
50. Lost Pine GCD
51. Lower Trinity GCD
52. McMullen GCD
53. Medina County GCD
54. Menard County UWCD
55. Mesa UWCD
56. Mesquite GCD
57. Mid-East Texas GCD
58. Middle Pecos GCD
59. Middle Trinity GCD
60. Neches & Trinity Valleys GCD
61. North Plains GCD
62. North Texas GCD
63. Northern Trinity GCD
64. Panhandle GCD
65. Pecos County GCD
66. Pecos Valley GCD
67. Permian Basin UWCD
68. Pineywoods GCD
69. Platano UWCD and Supply District
70. Plum Creek CD
71. Post Oak Savannah GCD
72. Prairielands GCD
73. Presidio County UWCD
74. Real Edwards C and R District
75. Red River GCD
76. Red Sands GCD
77. Refugio GCD
78. Rolling Plains GCD
79. Rusk County GCD
80. San Antonio County GCD
81. Sandy Land UWCD
82. Santa Rita UWCD
83. Saratoga UWCD
84. South Plains UWCD
85. Southeast Texas GCD
86. Southern Trinity GCD
87. Starr County GCD
88. Sterling County UWCD
89. Sutton County UWCD
90. Texoma GCD
91. Trinity Glen Rose GCD
92. Upper Trinity GCD
93. Uvalde County UWCD
94. Victoria County GCD
95. West-Tex GCD
96. Wintergreen GCD

Pending Confirmation Groundwater Conservation Districts

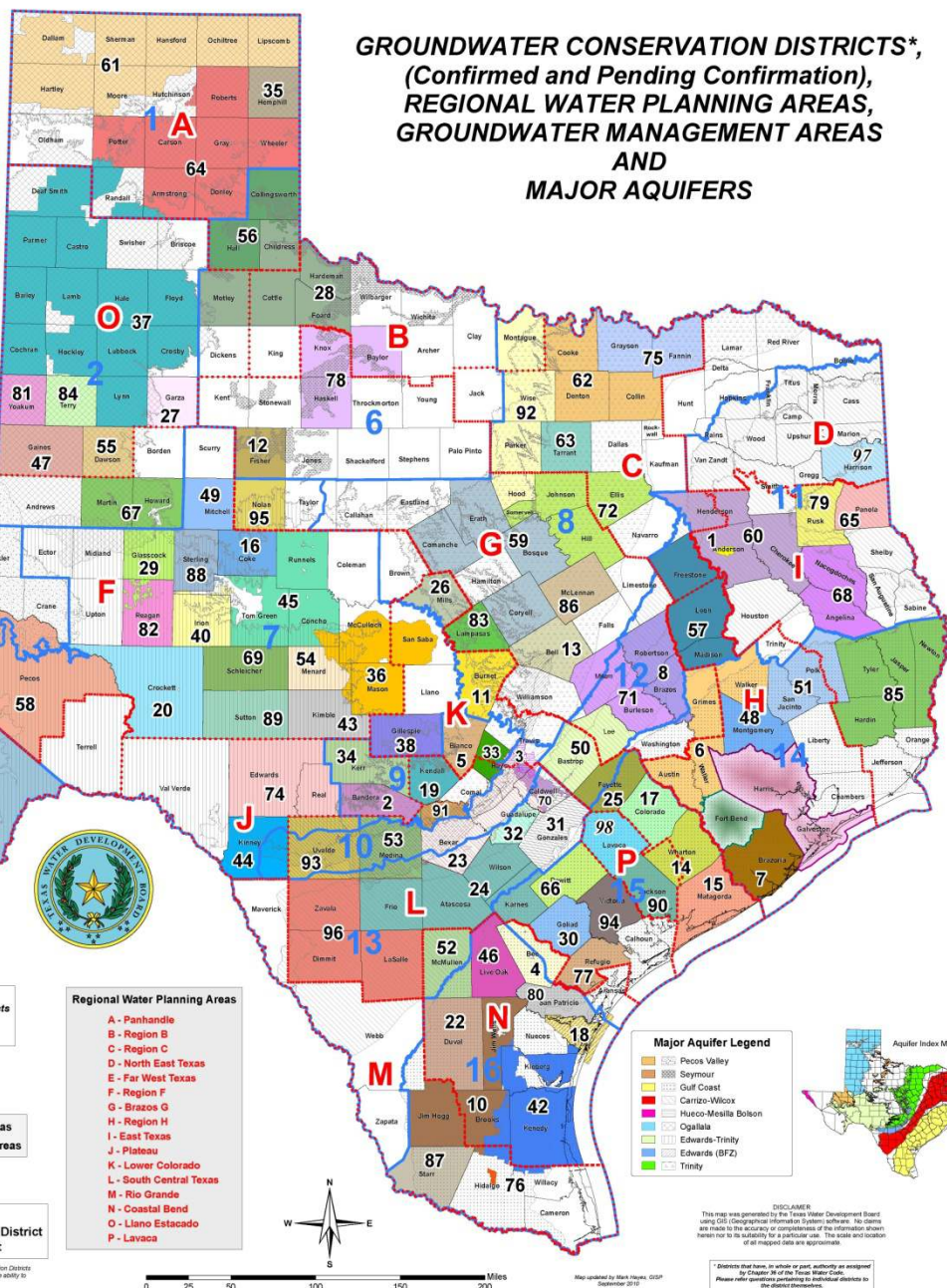
- 97. Harrison County GCD & 98. Leveas County GCD & #
- 99. Pending Election Results
- 100. Created by the 80th Legislature
- 101. Created by the 81st Legislature

Regional Water Planning Areas Groundwater Management Areas

Subsidence Districts

- Harris-Galveston Subsidence District
- Fort Bend Subsidence District

NOTE: These subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater pursuant to individual districts to the district boundaries.

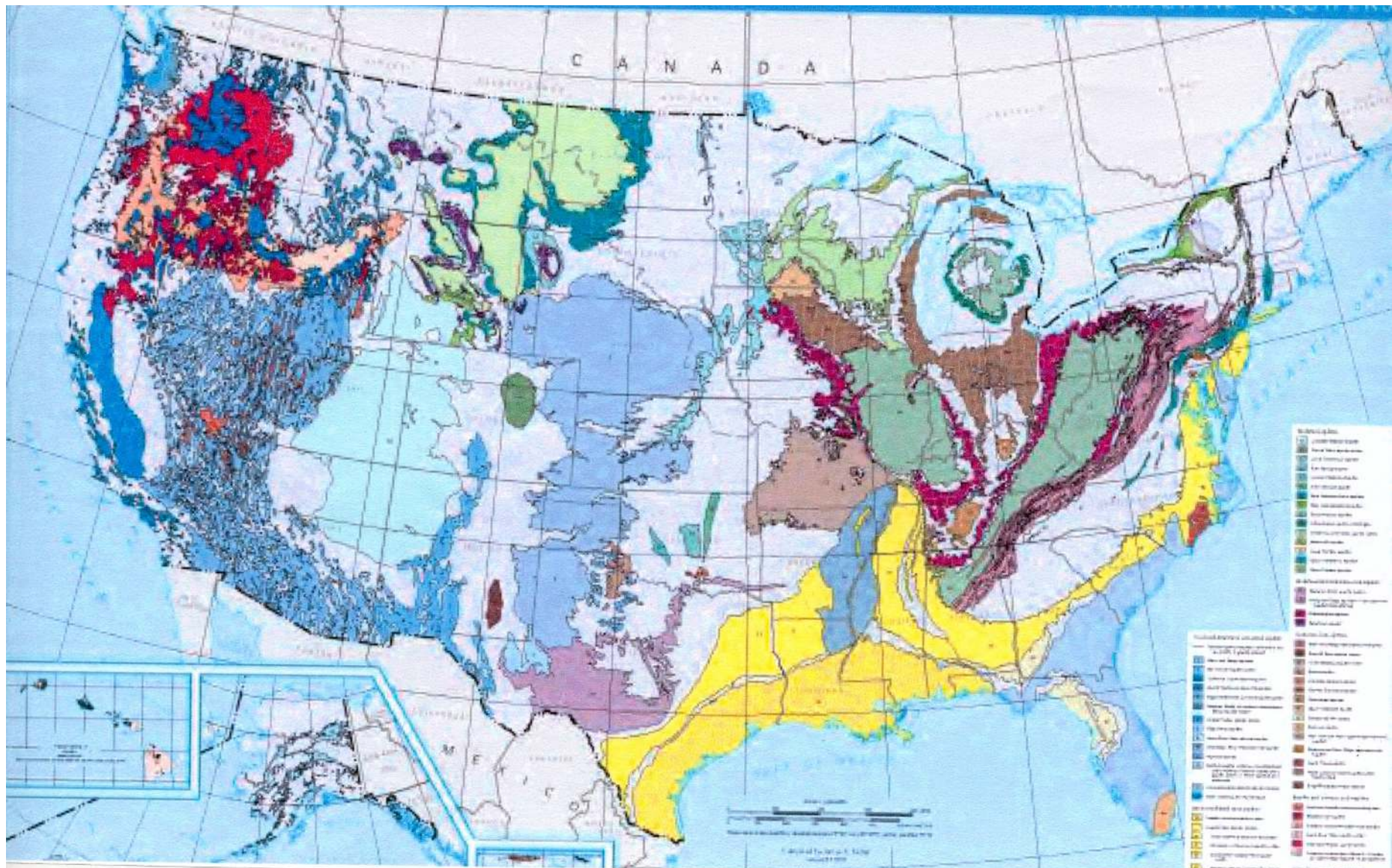


What is an aquifer?

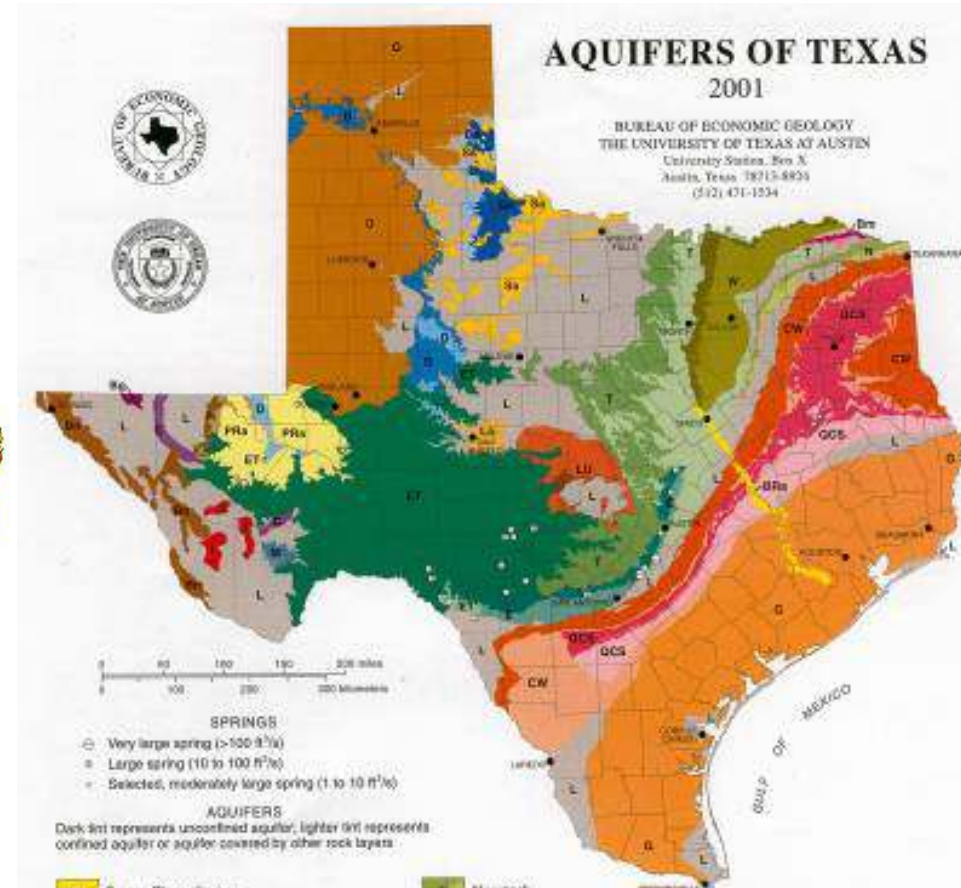
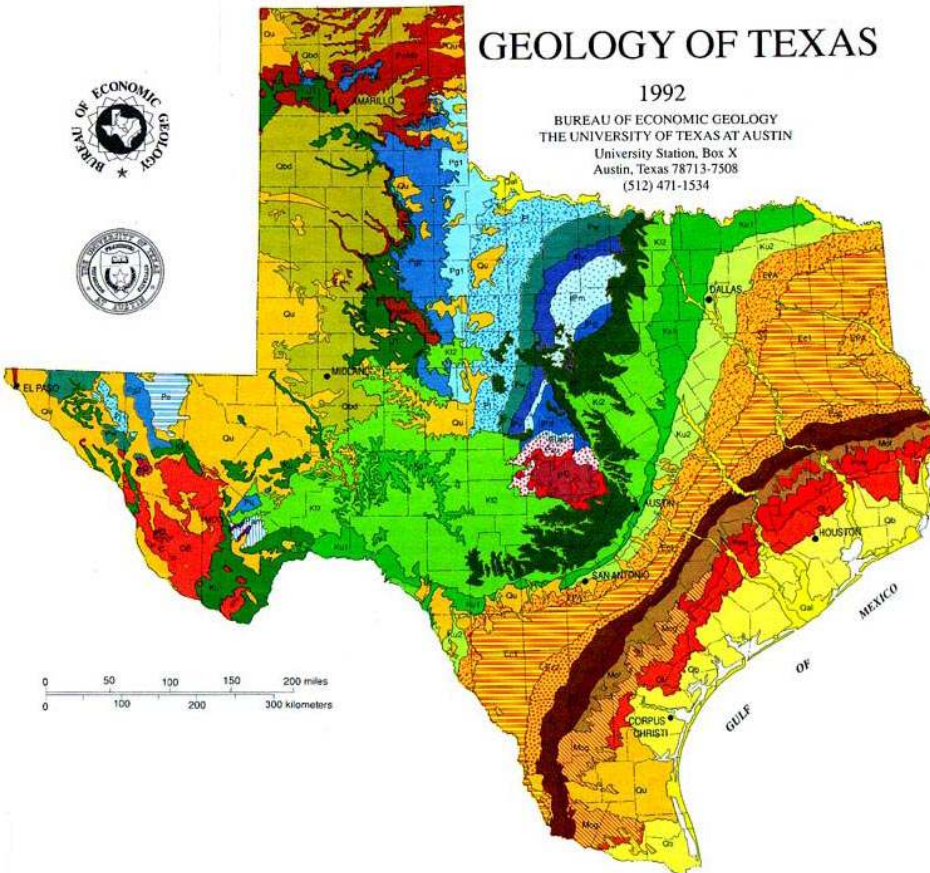
Merriam-Webster: An **aquifer** is a water bearing stratum of permeable rock, sand, or gravel.

From TWDB (Mace and others): An **aquifer** is geologic media (rock, sand, gravel, silts, clays) that can yield economically usable amounts (depends on location and needs) of water.

U.S. Aquifers

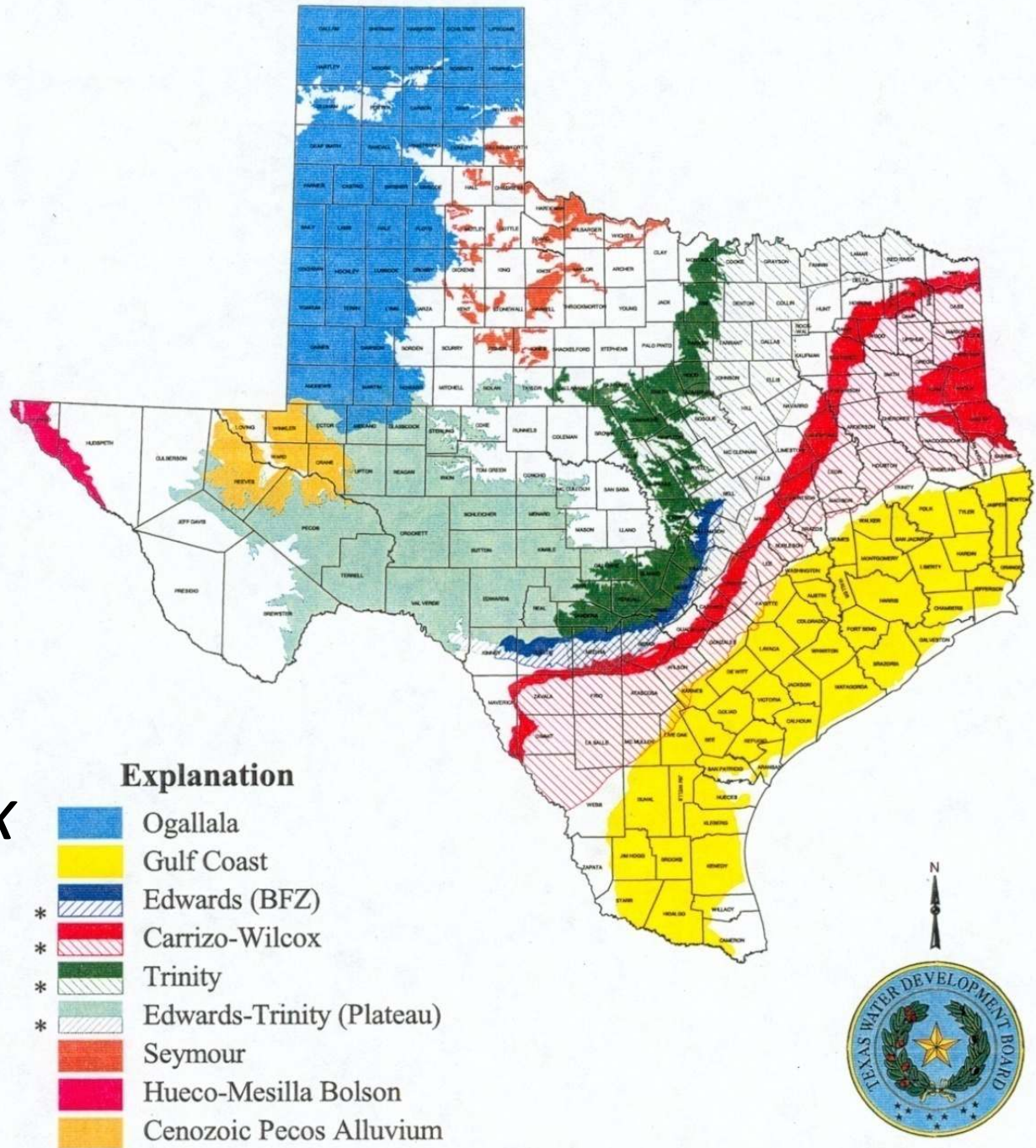


Geology / Aquifers



Major Aquifers of Texas

*POSGCD
Carrizo-Wilcox*



Minor Aquifers of Texas

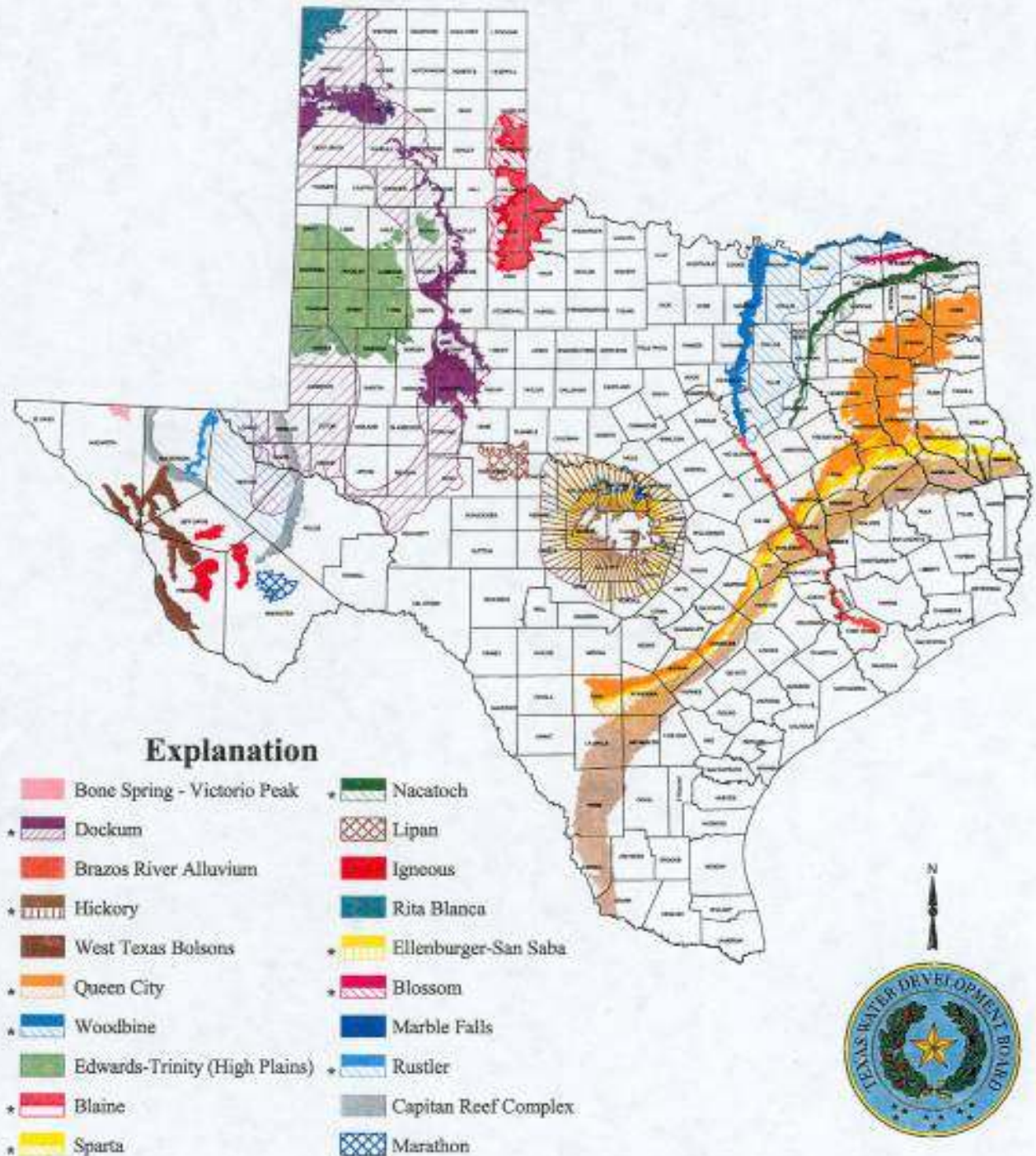
POSGCD

Queen City

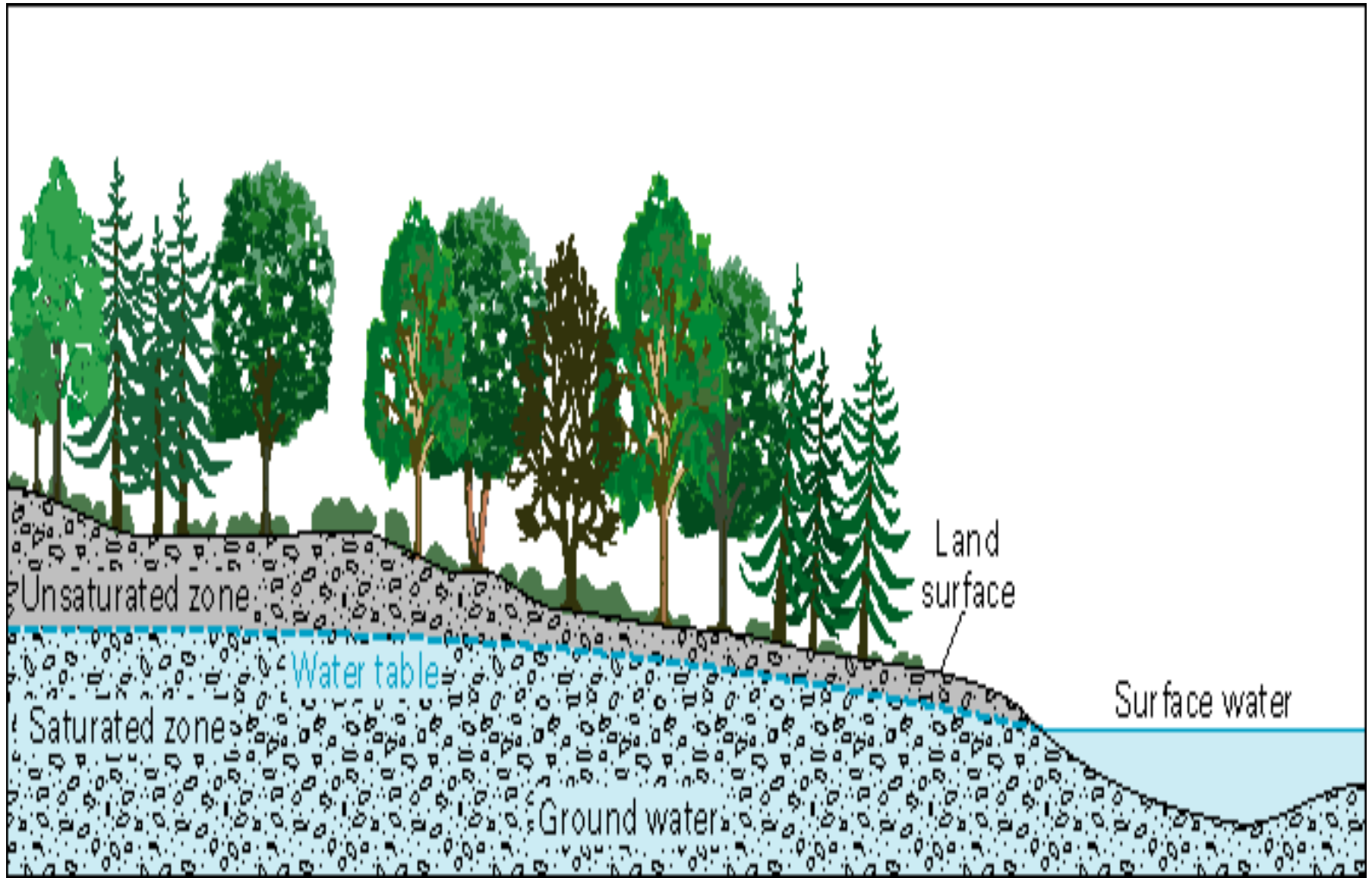
Sparta

Yegua-Jackson

Brazos Alluvium



Groundwater System



More than **half** of all Texans (54.9%)
depend on **groundwater** for their drinking water.
Where does your drinking water come from?

Why Groundwater?

- Comparatively inexpensive - drilling wells costs much less than building water treatment plants required to FILTER, PURIFY, and DISINFECT surface water
- Natural FILTRATION occurs as water percolates through layers of sand & gravel
- Groundwater is generally pure, clear and clean

Planning- Texas Population: 2000 vs. 2060

	<u>2000</u>	<u>2060</u>
<u>Population</u>		
Texas	20 M	45.5 M
Region G	1.6 M	3.3 M
<u>GW Demands (A/F)</u>		
Texas	16.9 M	21.6 M
Municipal	4 M	8.2 M



Groundwater Conservation Districts: Powers and purposes

Common Law/Rule of Capture

- Common Law- Historically developed
- Rule of Capture- Old English Rule
- Under Rule of Capture Landowners have the right to pump unlimited groundwater from the land they own, as long as not malicious or wasteful, without liability to neighbors

History of Groundwater Management in Texas

- 1904 – Rule of Capture
- 1917- Conservation Amendment - Texas Constitution
- 1949 – Legislature- Groundwater Conservation Districts
 - Can alter or modify Rule of Capture
 - Preferred method of groundwater management
- 2001 (SB 2) – Groundwater Management Areas
 - TWDB designates 16 GMAs
 - GCDs within GMA share GWMPs
 - Joint Planning within a GMA available if called for by one of the GCDs
- 2005 (HB1763) Requires GMA Joint Planning
 - GCDs within GMA must set DFCs for aquifers by 2/3 vote by 9-1-10
 - Each GCD gets one vote
 - Must complete process every 5 years, or as needed, annual reviews
 - TWDB evaluates DFCs using GAM to derive MAGs by GCD, RWPG, and River Basin for planning purposes

Political Subdivisions

- GCDs are Political Subdivisions of State
(Specific authority and responsibilities in a defined geographic area)
- "Political subdivision" means a county, municipality, or other body politic or corporate of the state, including a **district or authority** created under Section 52, Article III, or Section 59, Article XVI, Texas Constitution, a state agency, or a nonprofit water supply corporation created under Chapter 67. (*Ch. 36.001*)
- Empowered by Chapter 36, Texas Water Code

PURPOSE

Chapter 36.0015

- **Provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater** (Also must provide for most efficient use of the groundwater resources)
- **Groundwater Conservation Districts are the state's preferred method of groundwater management through rules developed, adopted, and promulgated by a district**

Ownership of Groundwater

TWC 36.002 states: The groundwater ownership and rights described by this section: (1) entitle the landowner,... to drill for and produce the groundwater below the surface of real property, subject to Subsection (d), without causing waste or malicious drainage of other property or negligently causing subsidence, but does not entitle a landowner,... to the right to capture a specific amount of groundwater below the surface of that landowner's land; and (2) do not affect the existence of common law defenses or other defenses to liability under the rule of capture.

Subsection (d), mentioned above, states:

This section does not... prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district,... (or) affect the ability of a district to regulate groundwater production as authorized... under this chapter...

ADMINISTRATION

Section 36.051

The governing body of a district is the board of directors . . .

***may be appointed or elected- please reference enabling legislation.

POSGCD Directors

(appointed by Commissioner's Courts)

Milam County

Interest

Burleson County

Steven Wise

At Large

Becky Goetsch

Dana McClaren

Agriculture

Jay Wilder

Chris Whittaker

Municipal

Tommy Tietjen

Sid Youngblood

Industrial

Lee Alford, III

Bob Wilson

Rural Water

Ed Savage

RULEMAKING POWER

Sec. 36.101

- A district may make and enforce rules, including rules limiting groundwater production **based on tract size or the spacing of wells**, to provide for conserving, preserving, protecting, and recharging of the groundwater or of a groundwater reservoir or its subdivisions in order to control subsidence, prevent degradation of water quality, or prevent waste of groundwater and to carry out the powers and duties provided by this chapter.
- During the rulemaking process the board shall consider **all groundwater uses and needs** and shall develop rules which are fair and impartial.
- After notice and hearing, the board **shall** adopt and enforce rules to implement this chapter....

PROTECTION OF HISTORIC OR EXISTING USE

Sec. 36.116

- In promulgating any rules limiting groundwater production, the district may preserve historic or existing use before the effective date of the rules to the maximum extent practicable consistent with the district's comprehensive management plan under Section 36.1071 and as provided by Section 36.113. **(Historic Use, Resolution of 2003)**

Source of the struggle for Property Rights: Historic or Existing users vs. Future users

Existing Users: “Protect my investment/livelihood”

Future Users: “Protect my property rights”



NOTICE REQUIREMENTS

Section 36.101

- 20 days notice required for **rulemaking** hearings
- Posted at District Office and website, County Clerk's Office, one or more newspapers in counties of District (Office and website only for regular meetings)
- Provide notice by mail, fax, or email to persons requesting notice (lasts one year)
- Make available copy of proposed rules on website and at office location during normal business hours

ENFORCEMENT OF RULES

Section 36.102

- A district may enforce this chapter and its rules by injunction, mandatory injunction, or other appropriate remedy in a court of competent jurisdiction (\$100K settlement)
- The board **by rule may set** reasonable civil penalties for breach of any rule of the district not to exceed \$10,000 per day per violation, and each day of a continuing violation constitutes a separate violation
- If the district prevails in any suit to enforce its rules, the district **may** seek and the court **shall** grant, in the same action, recovery for attorney's fees, costs for expert witnesses, and other costs incurred by the district before the court. Also applies to defense to suit)

RIGHT TO ENTER PROPERTY

Section 36.123

- District employees and agents are entitled to enter any public or private property within the boundaries of the district ... at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state or the compliance with any rule, regulation, permit, or other order of the district
- ... shall observe the establishment's rules and regulations concerning safety ... and notify any occupant or management of their presence and shall exhibit proper credentials

MISCELLANEOUS

- Section 36.107 - A district may carry out any research projects deemed necessary by the board
- Section 36.109 - A district may collect any information the board deems necessary
- Section 36.158 - A district may make or accept **grants**, gratuities, advances, or loans in any form to or from any source approved by the board, including any governmental entity, and may enter into contracts, agreements, and covenants in connection with grants, gratuities, advances, or loans that the board considers appropriate

AUTHORITY TO SET FEES

Section 36.205

- A district may set fees for administrative acts of the district, such as filing applications (Fee schedule)
- A district shall set and collect fees for all services provided outside the boundaries of the district
- A district may assess production fees based on the amount of water authorized by permit
- A district may assess the fees in lieu of, or in conjunction with, any taxes otherwise levied by the district
- A district may use revenues generated by the fees for any lawful purpose in accomplishing its purposes

DRILLERS' LOGS

Section 36.112

A district shall require that accurate drillers' logs be kept of water wells and that copies of drillers' logs and electric logs be filed with the district

RECORDS AND REPORTS

Section 36.111

- A district may require that records be kept and reports be made of the drilling, equipping, and completing of water wells and of the production and use of groundwater
- A district may adopt rules that require an owner or operator of a water well that is required to be registered with or permitted by the district, except for the owner or operator of a well that is exempt from permit requirements under Section 36.117(b)(1), to report groundwater withdrawals using reasonable and appropriate reporting methods and frequency.

EXEMPTIONS

Section 36.117

A district may exempt wells from the requirement of obtaining a drilling permit, an operating permit, or any other permit required by this chapter or the district's rules

A district may not require any permit issued by the district for:

- a well used solely for domestic use or for providing water for livestock or poultry on a tract of land larger than 10 acres that is either drilled, completed, or equipped so that it is incapable of producing more than 25,000 gallons of groundwater a day
- the drilling of a water well used solely to supply water for a **rig** that is actively engaged in drilling or exploration operations for an oil or gas well permitted by the Railroad Commission of Texas provided that the person holding the permit is responsible for drilling and operating the water well and the well is located on the same lease or field associated with the **drilling rig** (Does not include secondary exploration such as frac water)

EXEMPTIONS

Section 36.117

A district may not require any permit issued by the district for:

- the drilling of a water well authorized under a permit issued by the Railroad Commission of Texas under Chapter 134, Natural Resources Code, or for production from such a well to the extent the withdrawals are required for mining activities regardless of any subsequent use of the water
- A water well exempted under (36.117) shall be registered in accordance with rules promulgated by the district

PERMITS FOR WELLS

Section 36.113

A district **shall** require a permit for the drilling, equipping, operating, or completing of wells or for substantially altering the size of wells or well pumps, except as provided by Section 36.117 (Exemptions)

DRILLING OR ALTERING WELL

Section 36.115

No person, firm, or corporation may:

- drill or operate a well without first obtaining a permit from the district
- alter the size of a well or well pump such that it would bring that well under the jurisdiction of the district without first obtaining a permit from the district
- By definition “person” is all inclusive

REGULATION OF SPACING AND PRODUCTION

Section 36.116

A district by rule may:

- Regulate spacing of new wells from existing wells and property lines based on production capacity or other characteristics
- Regulate production of groundwater by setting production limits on wells based on acreage or tract size, acreage assigned to an authorized well site, acre feet per acre, or gallons per minute per well site acre, managed depletion, or any combination of these
- In promulgating any rules limiting groundwater production, the district may preserve historic or existing use... to the maximum extent practicable consistent with the district's comprehensive management plan

MANAGEMENT PLAN

Section 36.1071

- Must be adopted within 3 years of creation or confirmation
- Must be approved by Texas Water Development Board
- Must contain estimates of groundwater resources, availabilities, demands, and uses
- Must contain District management strategies including Desired Future Conditions
- Must be developed by using the District's best available data
- Must be compatible with other GCD Management Plans in same Groundwater Management Area
- The district shall adopt rules necessary to implement the management plan

Other

- GCDs may be Created by:
 - TCEQ- Priority Groundwater Management Area
 - Legislation- Locally filed
- Confirmation Election
 - Temporary Directors prior
 - Permanent Directors after
- Revenues
 - Tax Based
 - Fee Based
 - Both
- Powers and Authorities from 2 sources
 - Chapter 36
 - Enabling or Special Legislation of District- takes precedent over Chapter 36
 - Add or amend powers (fee structure)
 - Remove Powers (eminent domain)



Why Post Oak Savannah Groundwater Conservation District in Burleson and Milam Counties?

POSGCD created by 77th Legislature, HB1784, 2001

POSGCD History

- 2001- Created by 77th Legislature (HB1784)
- 2002- Confirmed by election both counties
- 2003- Resolution for Local Water Utilities
- 2004- Adopt Rules and Management Plan
- 2005- Adopt strategies to protect shallow aquifers
- 2010- Adopt Desired Future Conditions
- 2013- Codified by 83rd Legislature

POSGCD Background and Reasons for creation (2001)

I. Resources + Location + Growth =

>35,000 acres water rights leased by 2000



II. Local Concerns

a. Existing Area Users (100% Burl. Co., 90% Milam Co.- use groundwater)

Municipal, Industrial, Agricultural

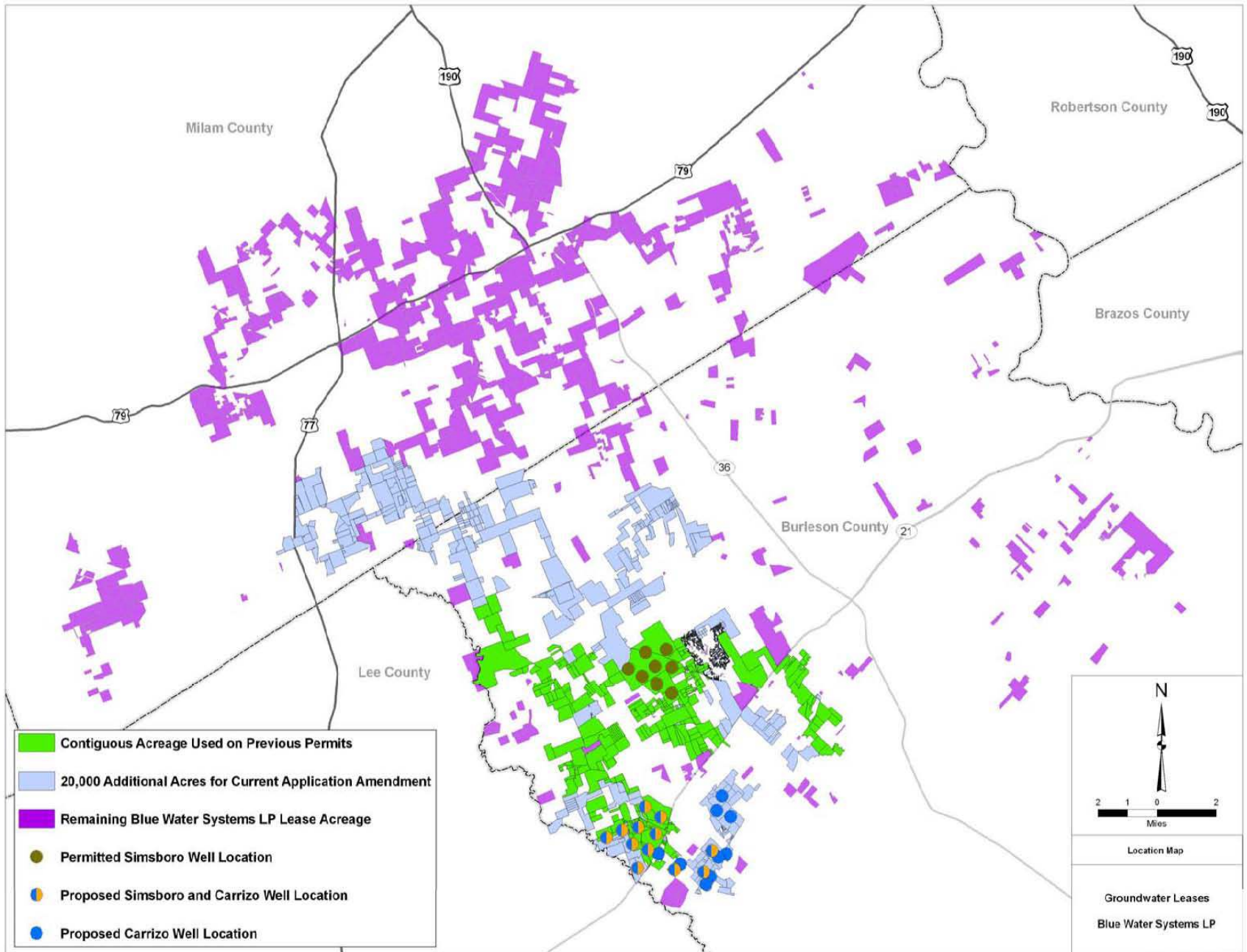
b. Future Growth

c. Reasonableness of Management Strategies

d. Insufficient Science

e. Unknown area future projects (in and out of District)

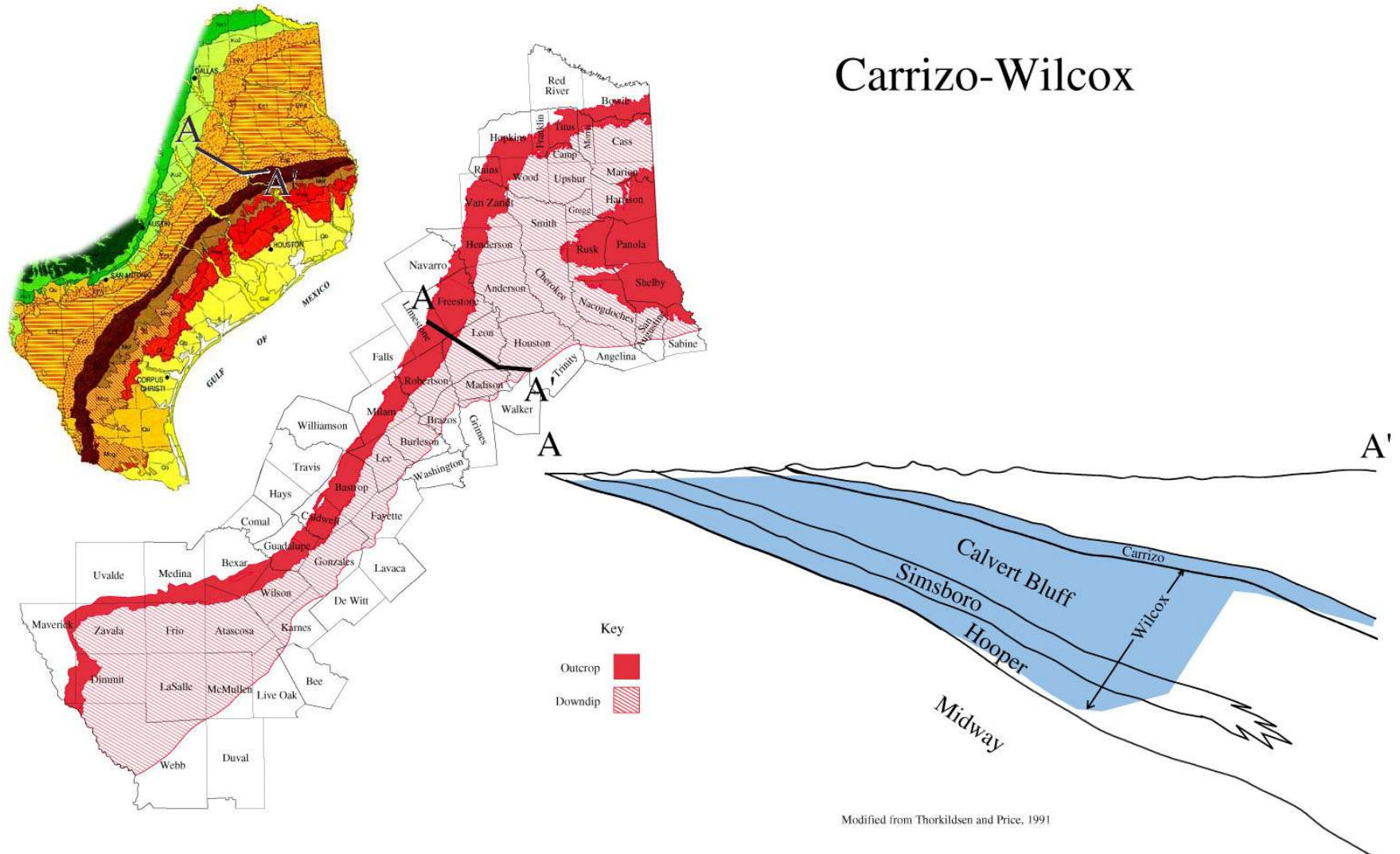
f. Property Rights



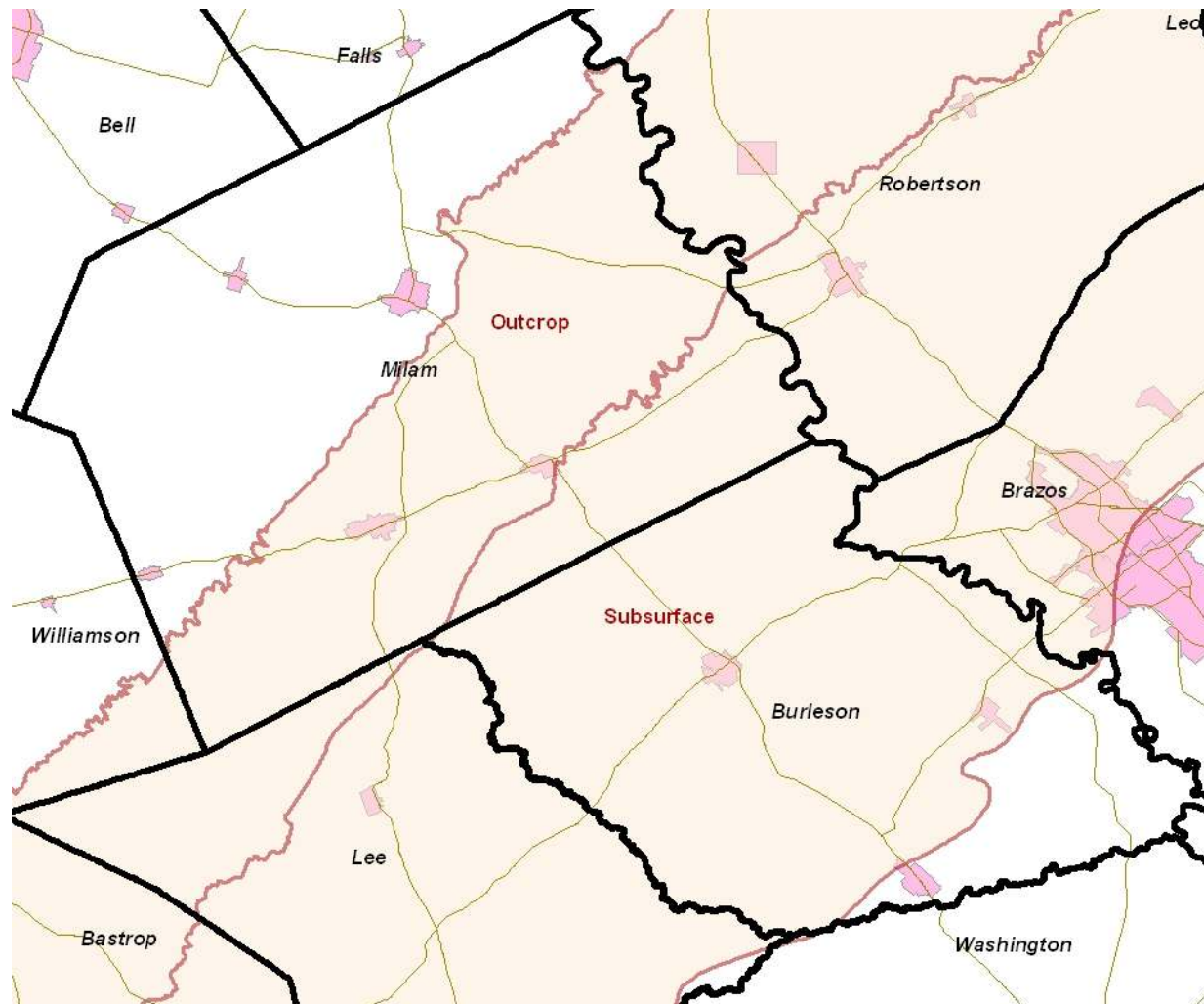


Groundwater resources within POSGCD

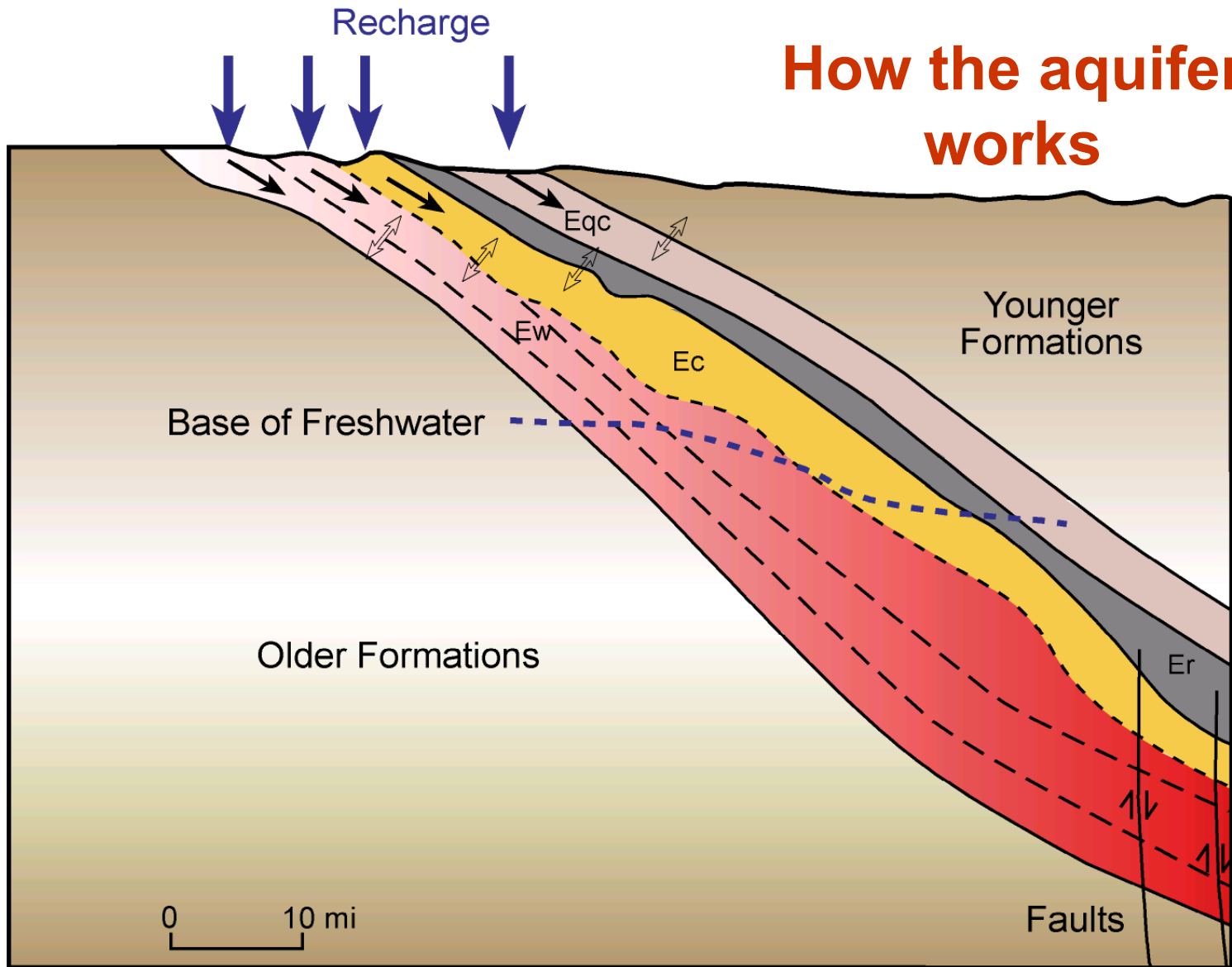
Carrizo-Wilcox Aquifer



Outcrop and Subsurface Extent of Carrizo-Wilcox Aquifer



How the aquifer works

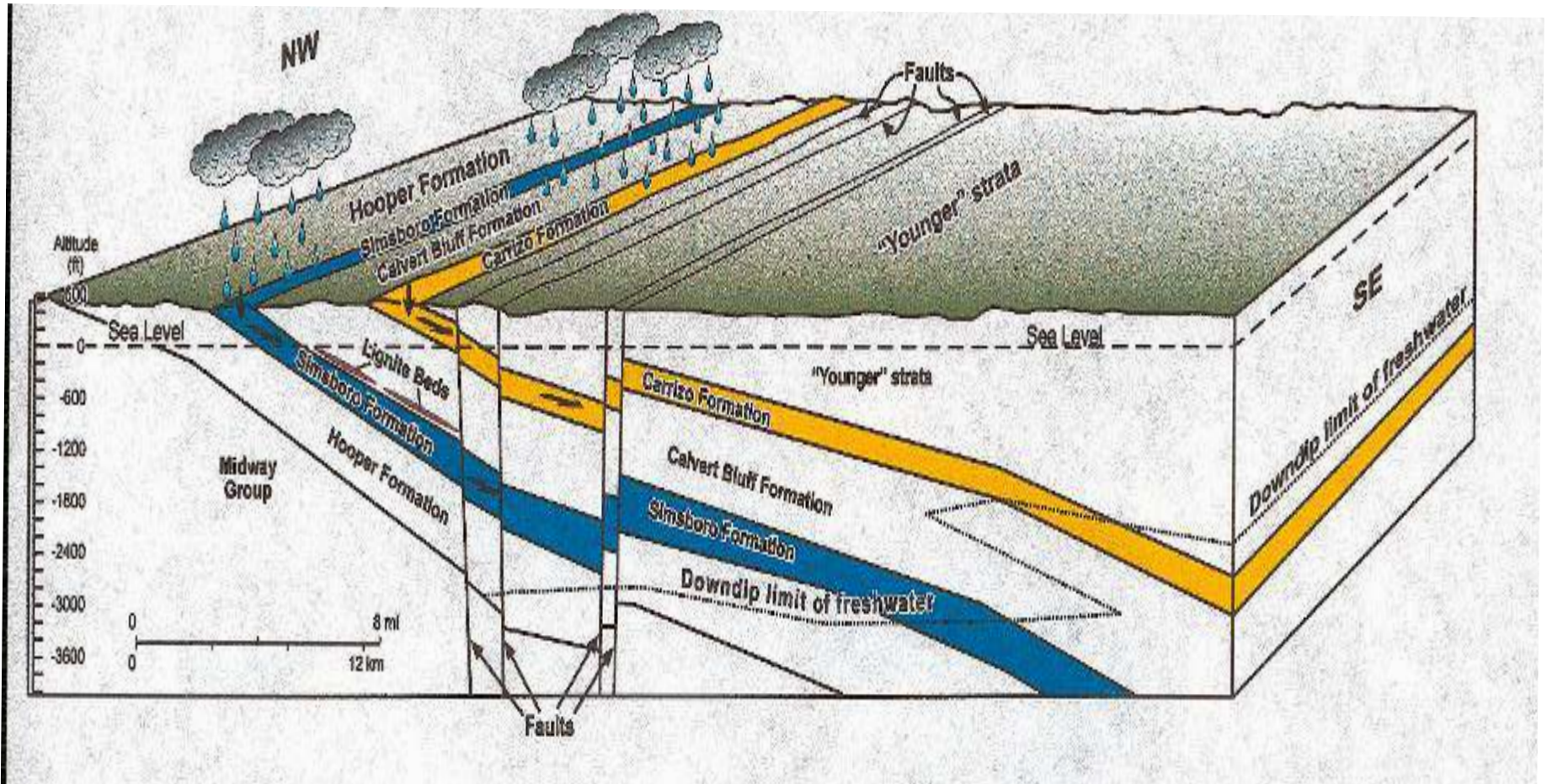


Ew = Wilcox; Ec = Carrizo; Er = Reklaw; Eqc = Queen City

Carrizo-Wilcox Formations (layers)

- **CARRIZO** = primarily sand
- **CALVERT BLUFF** = up to 1000 feet thick, mixture of sand & clays; layer of **lignite**
- **SIMSBORO** = 100 to 700 feet thick, sand
- **HOOPER** = oldest; mud, clay & silt

Geologic Cross Section Carrizo-Wilcox Aquifer Fault Zones





GMA Joint Planning And State Water Planning

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- 1949 – Groundwater Conservation Districts
 - Can alter, modify or discard Rule of Capture
 - Preferred method of groundwater management
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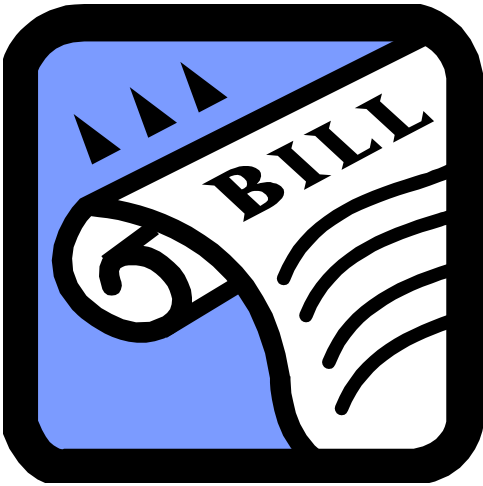
Purpose of the Texas State Water Plan

“To ensure the ongoing vitality of our economy, Texas’ citizens, water experts, and government agencies collaborate in a comprehensive water planning process. We plan so that Texans will have enough water in the future to sustain our cities and rural communities, our farms and ranches, and our homes and businesses while also preserving the agricultural and natural resources that have defined Texas for generations.” - *2017 Texas State Water Plan*

Joint Planning and Acronyms

- Texas Water Development Board (TWDB)
- Groundwater Conservation Districts (GCDs)
- Groundwater Management Areas (GMAs)
- Regional Water Planning Groups (RWPGs)
- Groundwater Availability Models (GAMs)
- Water Availability Models (WAMs)
- Desired Future Conditions (DFCs)
- Modeled Available Groundwater (MAGs)
- GCD Groundwater Management Plan (GWMP)

****GCD Management Plans and Rules within a GMA

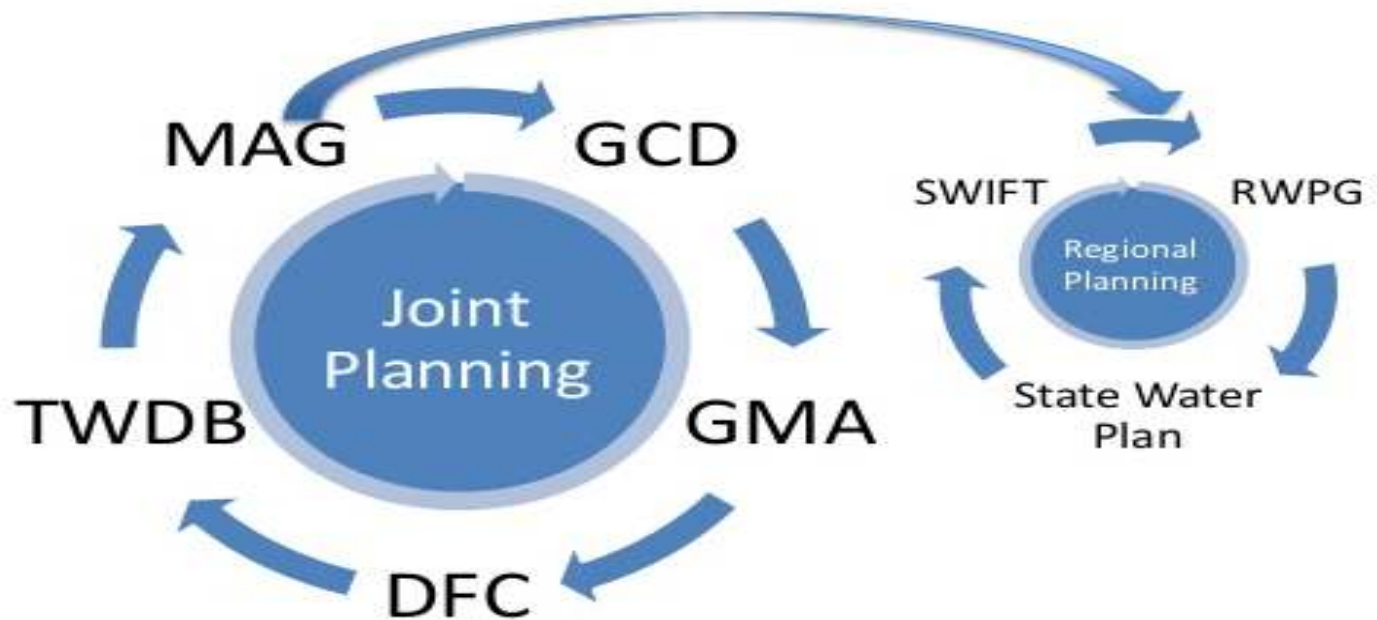


Texas State Water Planning (think balance sheet)

- State Water Planning through 16 RWPGs
- Water demands determined from water users
- Groundwater Supplies (GW) determined by GCDs in 16 GMAs by adopting DFCs
- Surface Water Supplies (SW) determined by State
- RWPGs use available GW and SW Supply numbers for planning and recommended strategies

Two Separate & Very Different Processes- Regulation of GCDs vs. Planning of the State

Regional & Joint Planning



Desired Future Condition

- The desired, quantified condition of groundwater resources
 - water levels, water quality, spring flows, or volumes)
 - at a specified time or times in the future or in perpetuity.
- For “relevant” aquifers (Major and Minor aquifers)
- Broad Policy Goal
 - Drawdown (most)
 - Spring flow (a few)
 - Storage volumes (High Plains, Llano Uplift)
- Updated at least every 5 years (propose by May 1, 2021, final adoption by January 5, 2022)

Science & Policy

MAG

DFC

Groundwater Science

Groundwater Policy



Physical Expression of
Aquifer Capacity

Aquifer Uses or Conditions	State Water Plan	Hydrological Conditions
Private Property Rights	Impacts on Subsidence	Socioeconomic Impacts
Feasibility of achieving DFC	Any other relevant information	Environmental Impacts



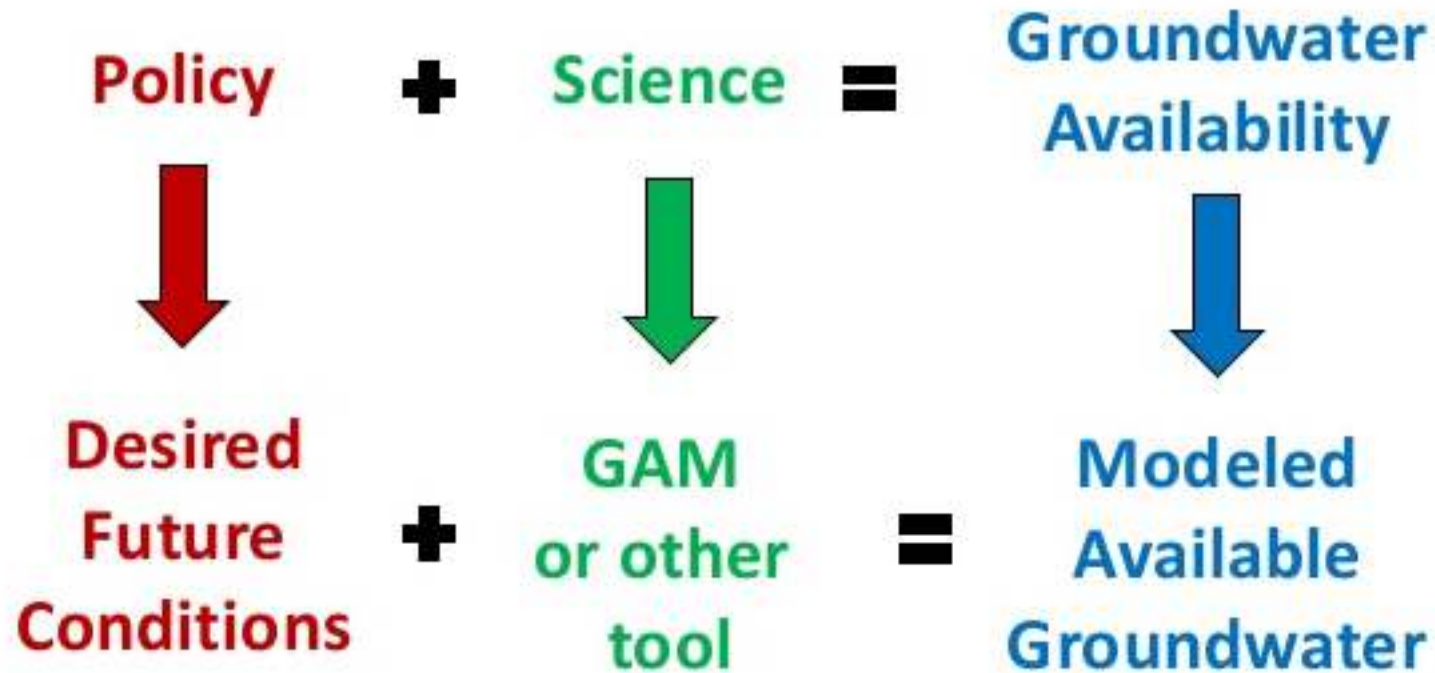
Policy Decision of
Aquifer Conditions



TAGD

TEXAS ALLIANCE OF
GROUNDWATER DISTRICTS

What is Groundwater Availability?



Goal: informed decision-making

A balancing act

- Highest practicable level of groundwater production
- Conservation
- Preservation
- Protection
- Recharging
- Prevention of waste
- Control of subsidence



Modeled Available Groundwater

- **Modeled available groundwater** represents the **total** amount of groundwater, including both **permitted** and **exempt** uses, that can be produced from the aquifer in an average year, that achieves a “**desired future condition.**”
- It is expressed as a rate – generally in acre-feet per year.

Modeled Available Groundwater and Permits (1 of 2)

- The amount of water may be produced on an average annual basis to achieve a desired future condition.
- Districts, to the extent possible, shall issue permits up to the point that the total volume of exempt and permitted groundwater production will achieve an applicable desired future condition.
- But also....not so simple! (next page)

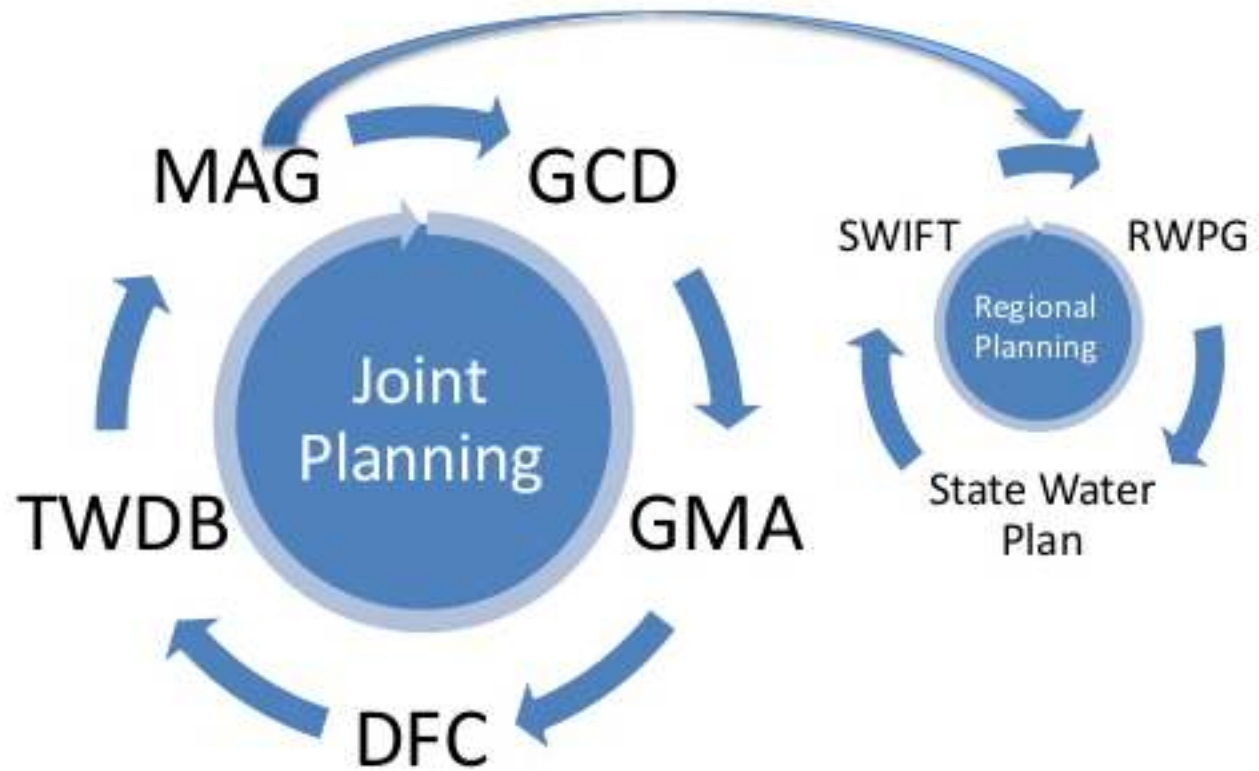
Modeled Available Groundwater and Permits (2 of 2)

- The district shall manage total groundwater production on a long-term basis to achieve an applicable desired future condition and consider:
 - Modeled available groundwater
 - Groundwater produced under exempt uses
 - Amount of groundwater previously permitted
 - Estimate of permitted groundwater that is actually produced
 - Yearly rainfall and groundwater production patterns.

Three points to consider:

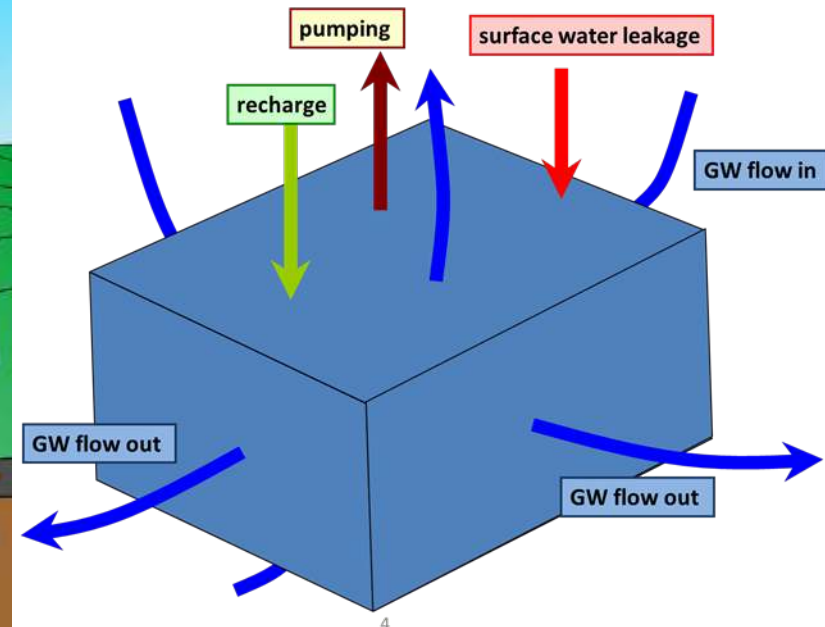
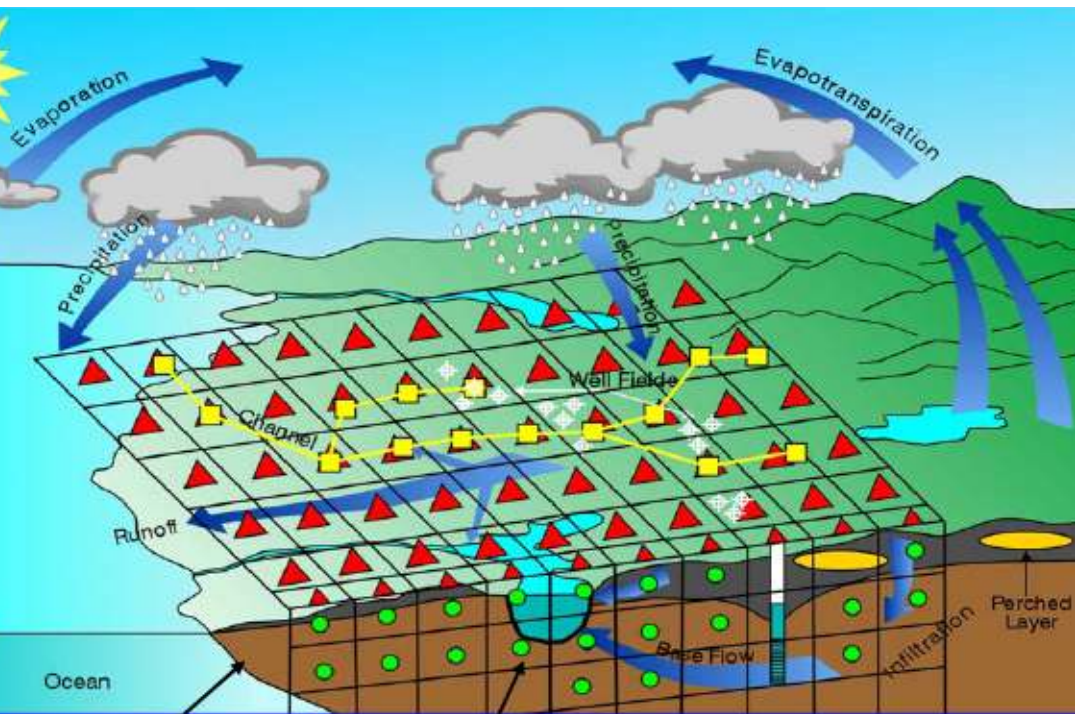
1. Desired future conditions are an expression of local groundwater management.
2. Desired future conditions can be modified by districts to address improvements in data/science/technology and changing groundwater usage.
3. Districts are responsible for managing the groundwater resource to achieve the desired future condition

Regional & Joint Planning



Description of Groundwater Model

- a tool that integrates data and hydrology to predict groundwater flow
- the tool acts like a big Excel spreadsheet where grid cells physically represent “blocks” of aquifer material
- water levels are predicted by solving for a water balance at each block using equations describing groundwater flow



Note: Schematic from MODHMS MODFLOW Manual

The Joint Planning Process of Groundwater Management Areas

Confirmed Groundwater Conservation Districts

1. Anderson County UWCD
2. Bandera County River Authority & Ground Water District
3. Barton Springs/Edwards Aquifer CD
4. Bee GCD
5. Blanco-Pedernales GCD
6. Bluebonnet GCD
7. Brazoria County GCD
8. Brazos Valley GCD
9. Brewster County GCD
10. Brush County GCD
11. Central Texas GCD
12. Clear Fork GCD
13. Clearwater UWCD
14. Coastal Bend GCD
15. Coastal Plains GCD
16. Coke County UWCD
17. Colorado County GCD
18. Corpus Christi ASRCD
19. Cow Creek GCD
20. Crockett County GCD
21. Culberson County GCD
22. Dalway County GCD
23. Edwards Aquifer Authority
24. Evergreen UWCD
25. Fayette County GCD
26. Fox Crossing Water District
27. Garza County UWCD
28. Gateway GCD
29. Glascock GCD
30. Guadalupe County GCD
31. Gonzales County UWCD
32. Guadalupe County GCD
33. Hays Trinity GCD
34. Headquarters GCD
35. Hemphill County UWCD
36. Hickory UWCD No. 1
37. High Plains UWCD No. 1
38. Hill Country UWCD
39. Hudspeth County UWCD No. 1
40. Irion County GCD
41. Jeff Davis County UWCD
42. Jim Hogg County GCD
43. Kinney County GCD
44. Kinney County GCD
45. Lipan-Kickapoo WCD

Confirmed Groundwater Conservation Districts (continued)

46. Live Oak UWCD
47. Llano Estacado UWCD
48. Lone Star GCD
49. Lone Wolf GCD
50. Lost Pines GCD
51. Lower Trinity GCD
52. McMullen GCD
53. Medina County GCD
54. Menard County UWCD
55. Mesa UWCD
56. Mesquite GCD
57. Mid-East Texas GCD
58. Middle Pecos GCD
59. Middle Trinity GCD
60. Neches & Trinity Valleys GCD
61. North Plains GCD
62. North Texas GCD
63. Northern Trinity GCD
64. Panhandle GCD
65. Panola County GCD
66. Pecan Valley GCD
67. Permian Basin UWCD
68. Pineywoods GCD
69. Plateau UWC and Supply District
70. Plum Creek CD
71. Post Oak Savannah GCD
72. Praiselands GCD
73. Presidio County UWCD
74. Real-Edwards C and R District
75. Red River GCD
76. Red Sands GCD
77. Refugio GCD
78. Rolling Plains GCD
79. Rusk County GCD
80. San Antonio County GCD
81. Sandy Land UWCD
82. Santa Rita UWCD
83. Saragosa UWCD
84. South Plains GCD
85. Southeast Texas GCD
86. Southern Trinity GCD
87. Starr County GCD
88. Sterling County UWCD
89. Sutton County UWCD
90. Tarrant County GCD
91. Trinity Glen Rose GCD
92. Upper Trinity GCD
93. Uvalde County UWCD
94. Victoria County GCD
95. Wes-Tex GCD
96. Wintersden GCD

Pending Confirmation Groundwater Conservation Districts

- 97. Harrison County GCD + #
- 98. Lavaca County GCD + #

+ Pending Election Results
Created by the 80th Legislature
& Created by the 81st Legislature

Regional Water Planning Areas

Groundwater Management Areas

Subsidence Districts

- Harris-Galveston Subsidence District
- Fort Bend Subsidence District

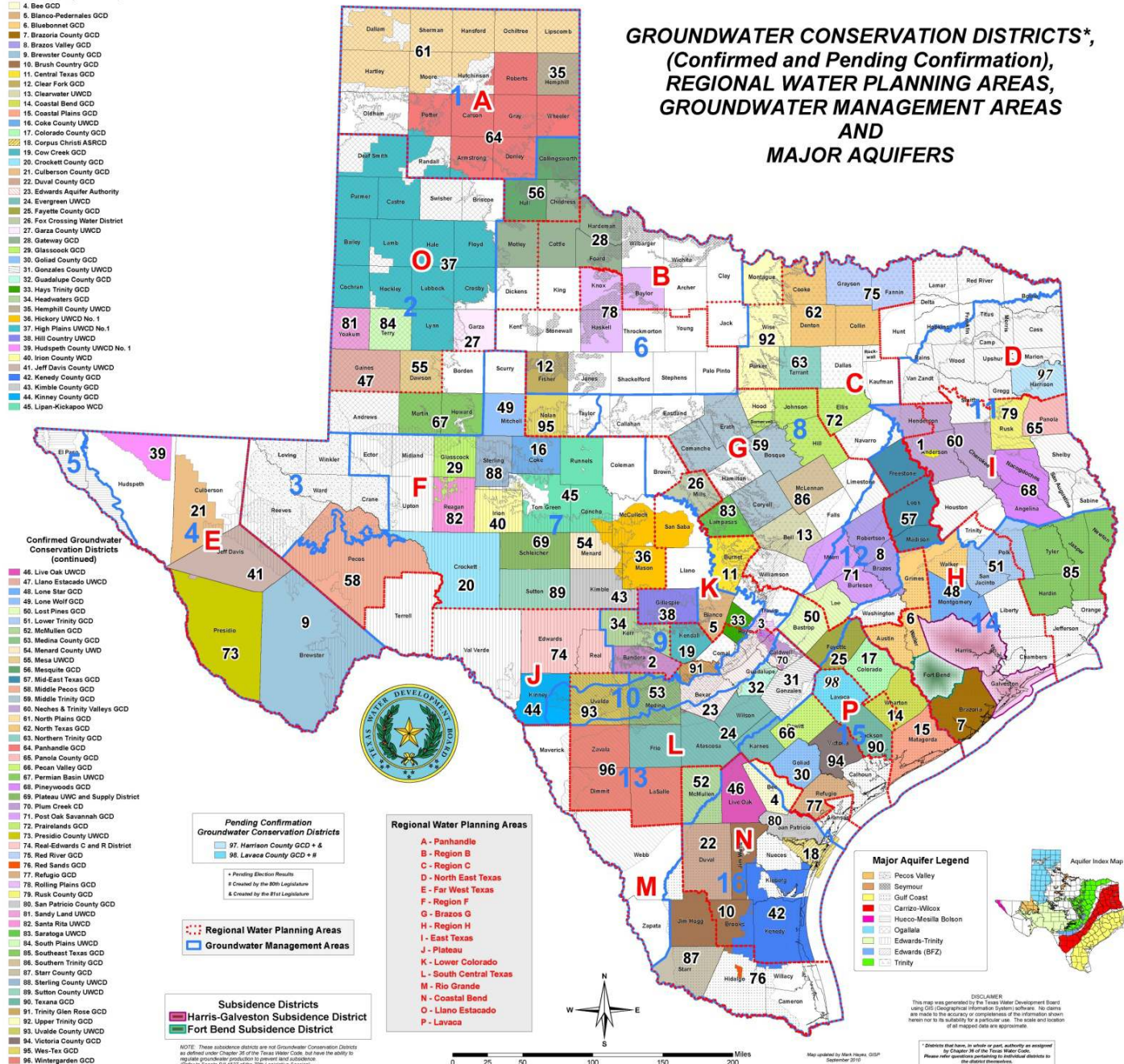
NOTE: These subsidence districts are not delineated by Conservation Districts as defined under Chapter 38 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence. (Refer to Senate Bill 1537 of the 79th Legislative Session)



Regional Water Planning Areas

- A - Panhandle
- B - Region B
- C - Region C
- D - North East Texas
- E - Far West Texas
- F - Region F
- G - Brazos G
- H - Region H
- I - East Texas
- J - Plateau
- K - Lower Colorado
- L - South Central Texas
- M - Rio Grande
- N - Coastal Bend
- O - Llano Estacado
- P - Lavaca

GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation), REGIONAL WATER PLANNING AREAS, GROUNDWATER MANAGEMENT AREAS AND MAJOR AQUIFERS



Major Aquifer Legend

- A - Pecos Valley
- B - Seymour
- C - Gulf Coast
- D - Carrizo-Wilcox
- E - Hueco-Mesilla Bolson
- F - Ogallala
- G - Edwards-Trinity
- H - Edwards (BF2)
- I - Trinity

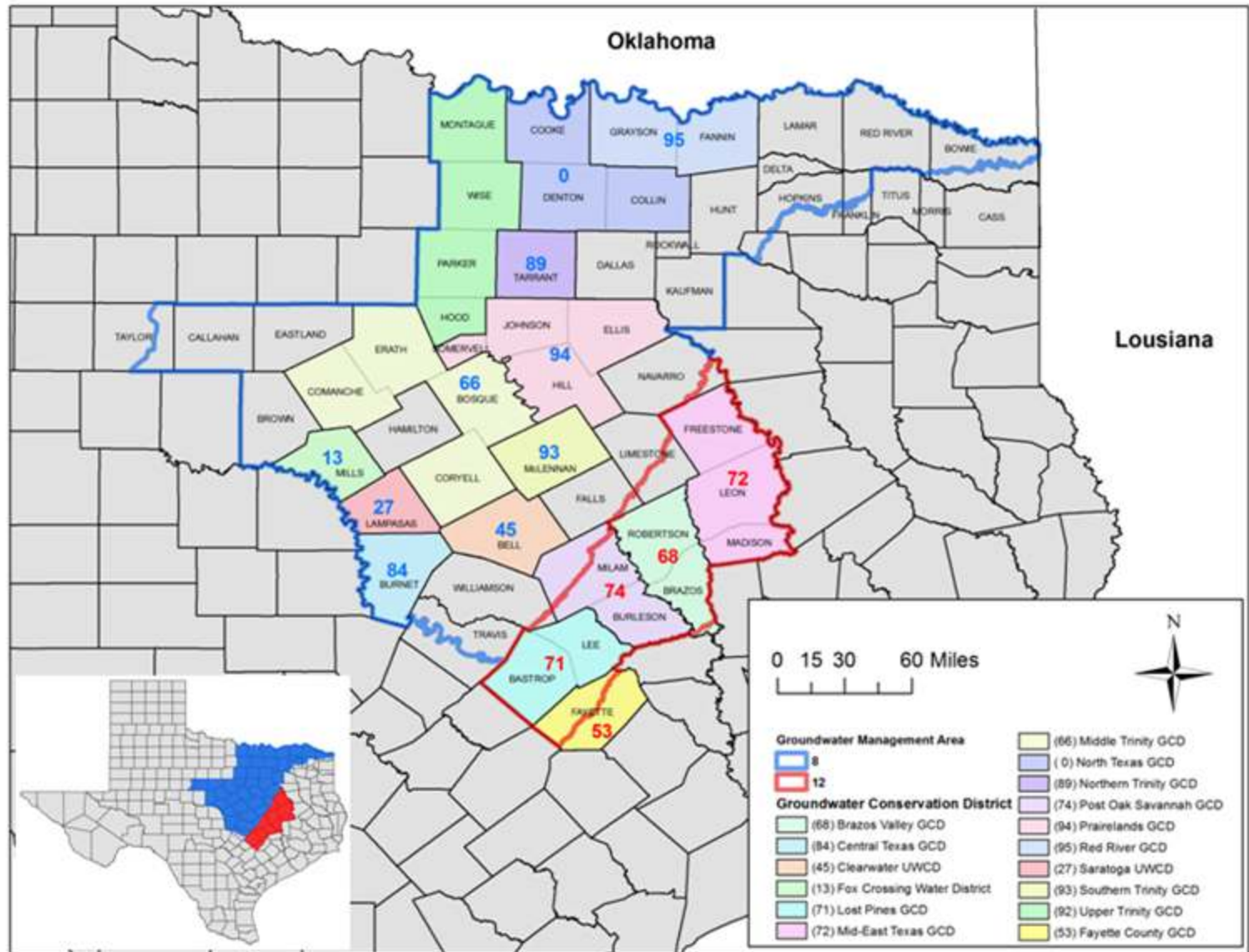
DISCLAIMER
This map was generated by the Texas Water Development Board Using GIS (Geographic Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to the authority for a particular use. The scale and location of all mapped data are approximate.

* Districts that have, in whole or part, authority as assigned by Chapter 38 of the Texas Water Code. Please refer production pertaining to individual districts to the district boundaries.

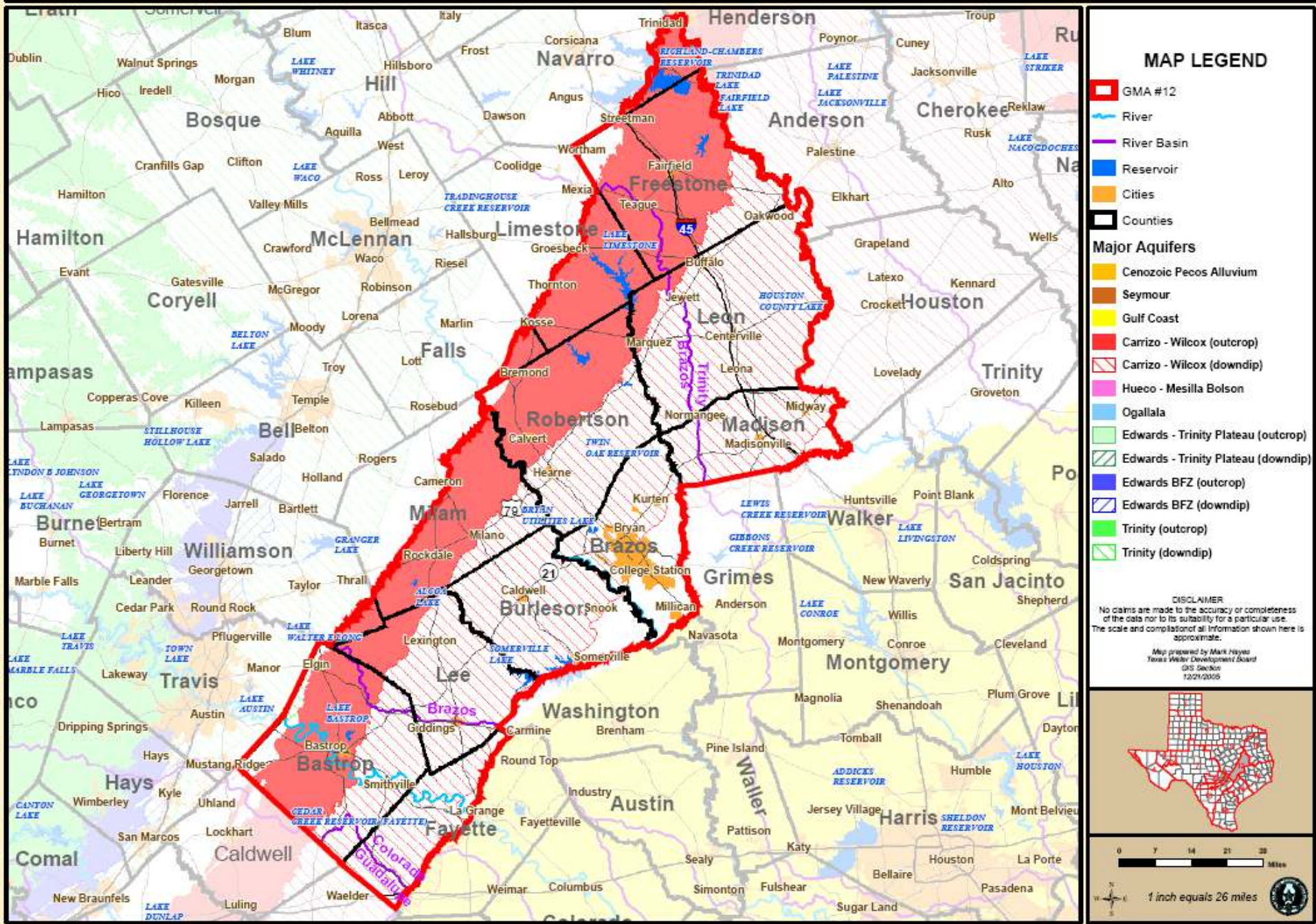


Map updated by Mark Hughes, GISP
September 2010

Groundwater Management Areas 8 and 12



Groundwater Management Area #12



Groundwater Management Areas (GCD Joint Planning)

When considering the adoption of Desired Future Conditions it is important to remember Section 36.108(d-2) of Chapter 36, which states:

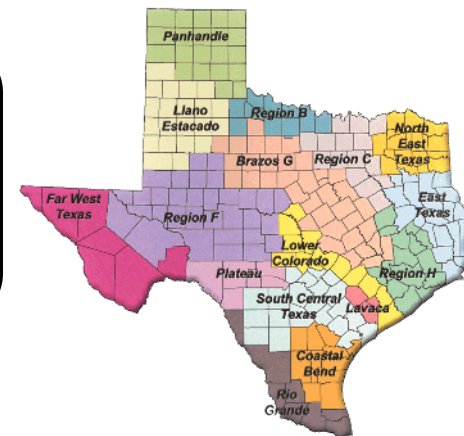
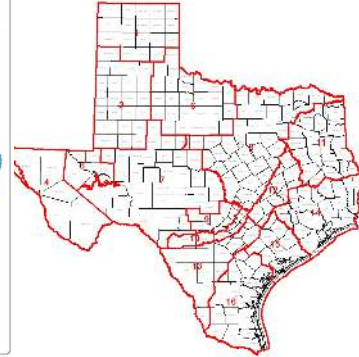
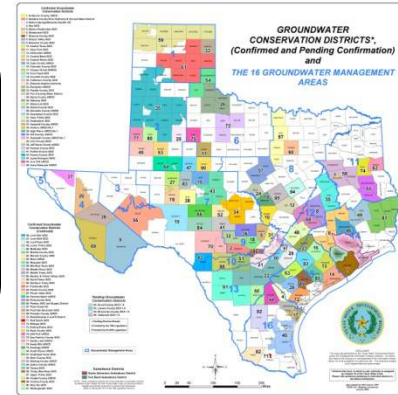
The desired future conditions ... must provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence ...

****GCDs can protect existing wells****

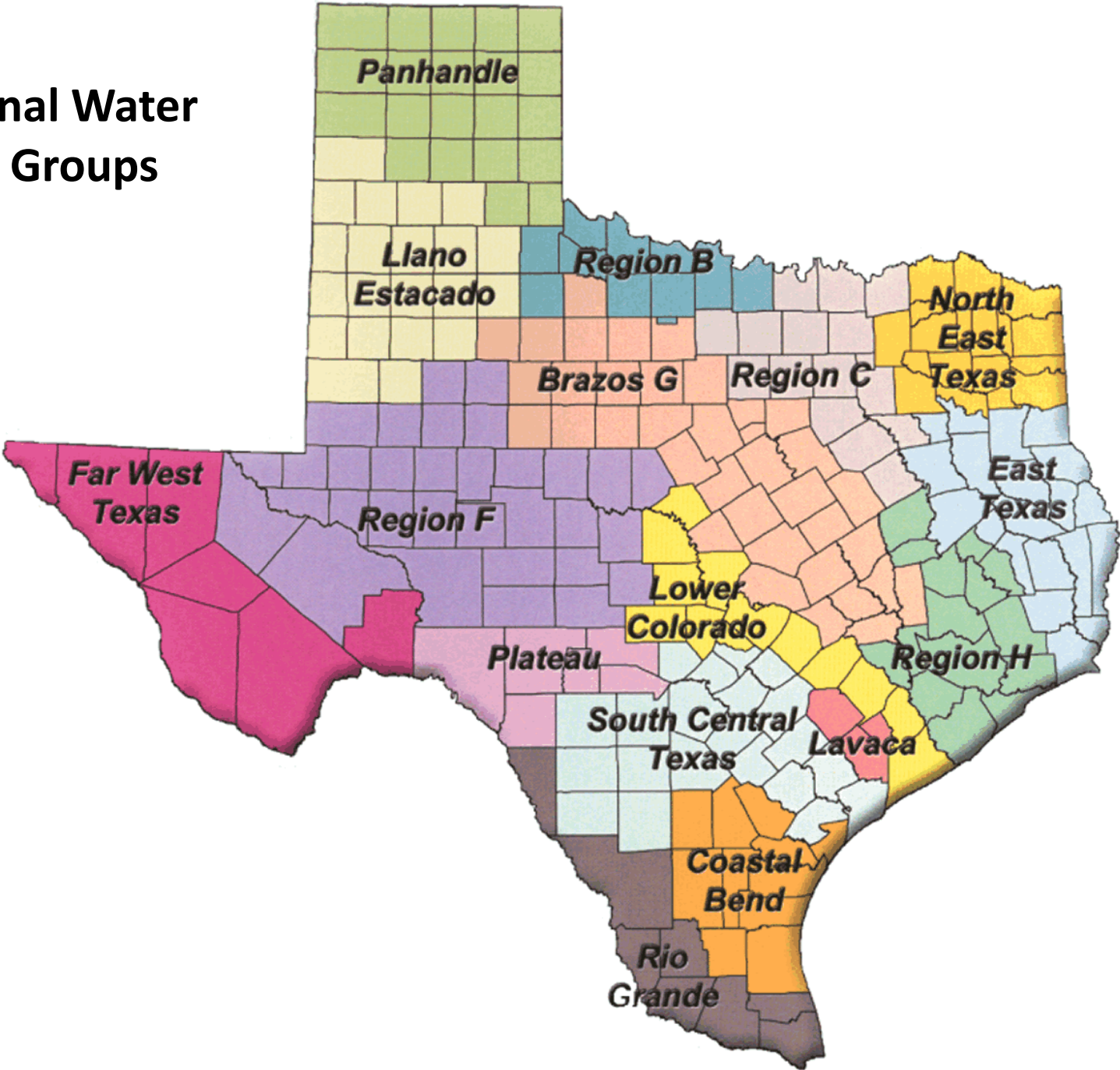
GCDs in GMAs
decide **Desired Future Conditions**
and deliver to TWDB

TWDB provides estimates
of **Modeled Available Groundwater**
to districts and regions

GCDs and RWPGs include
Managed Available Groundwater
in plans



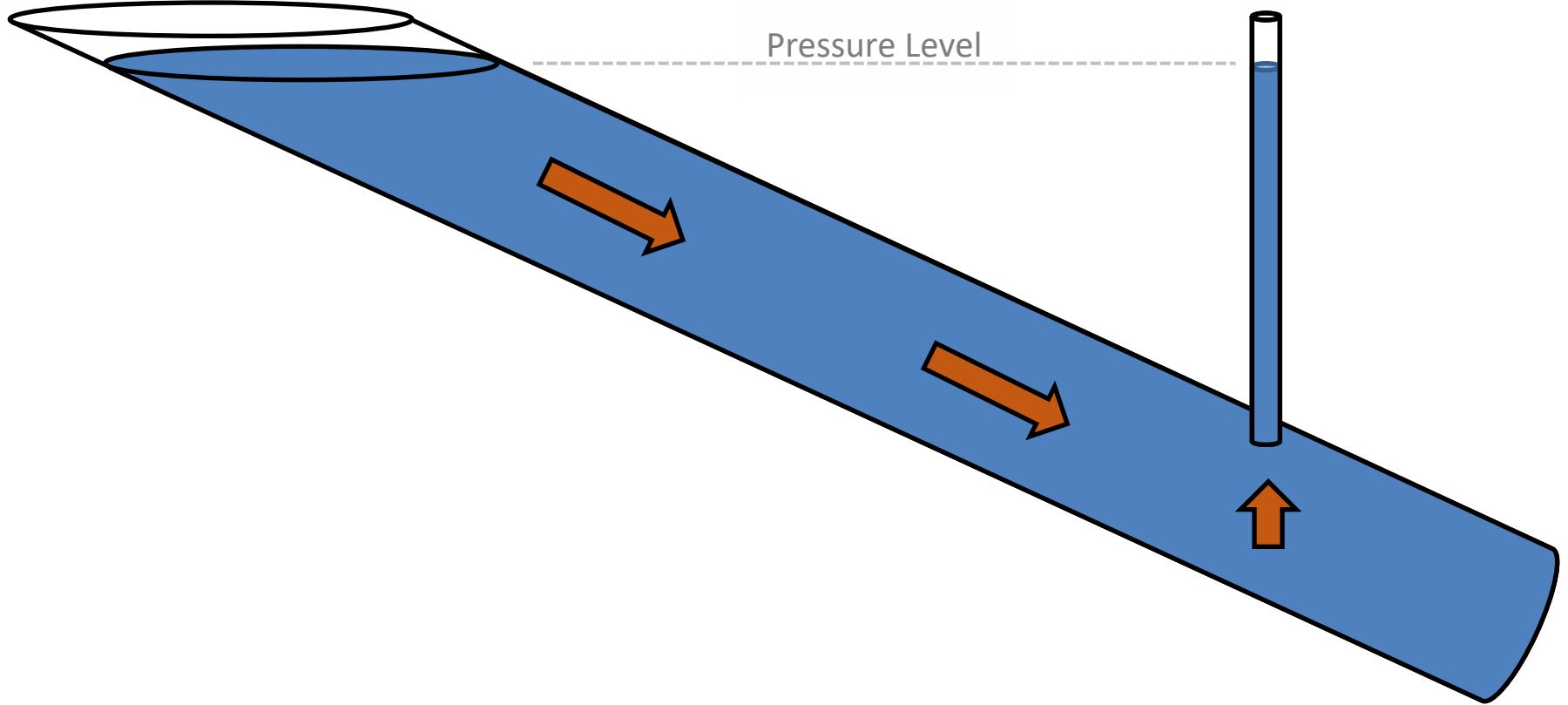
**16 Regional Water
Planning Groups**

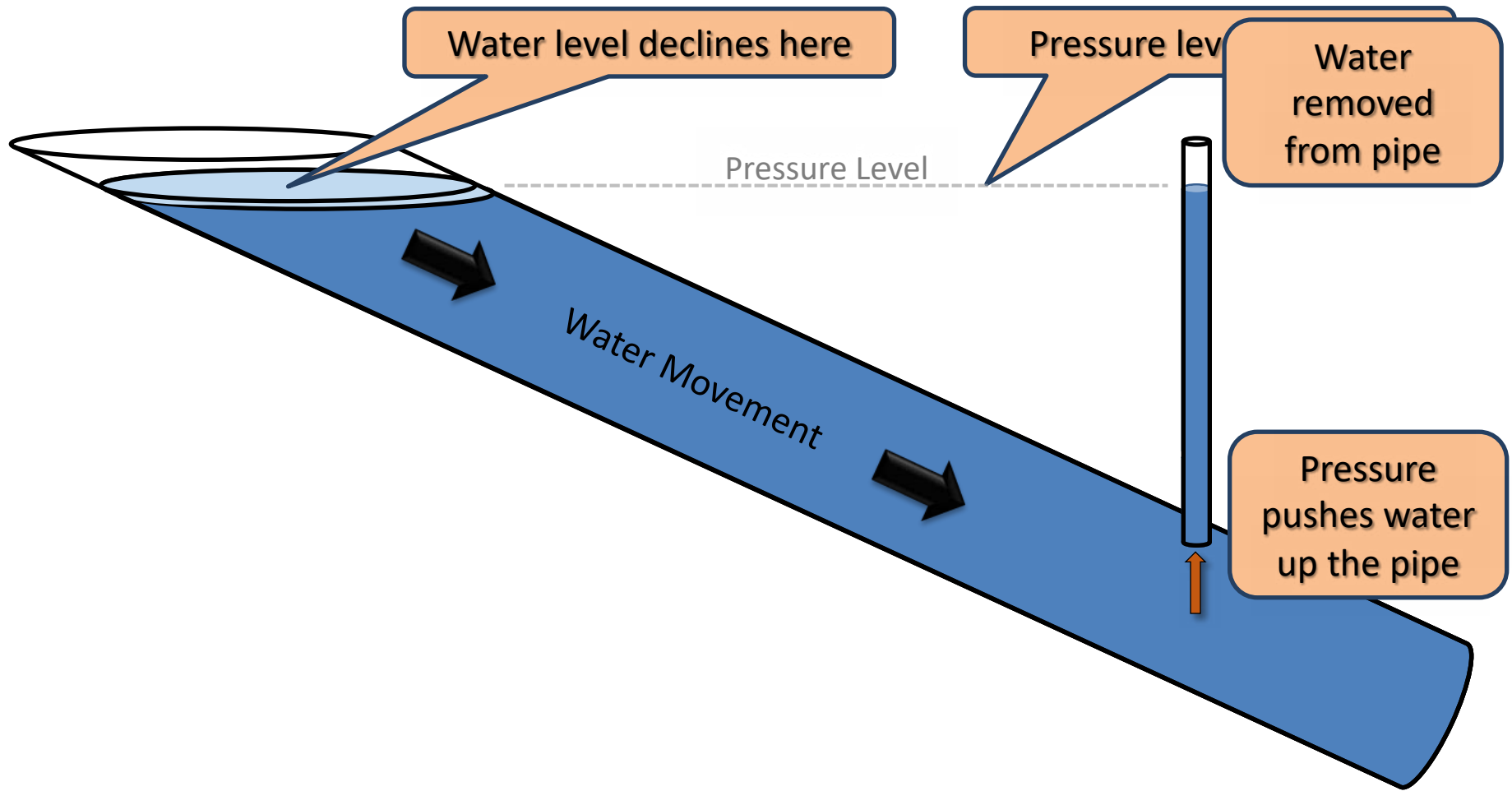




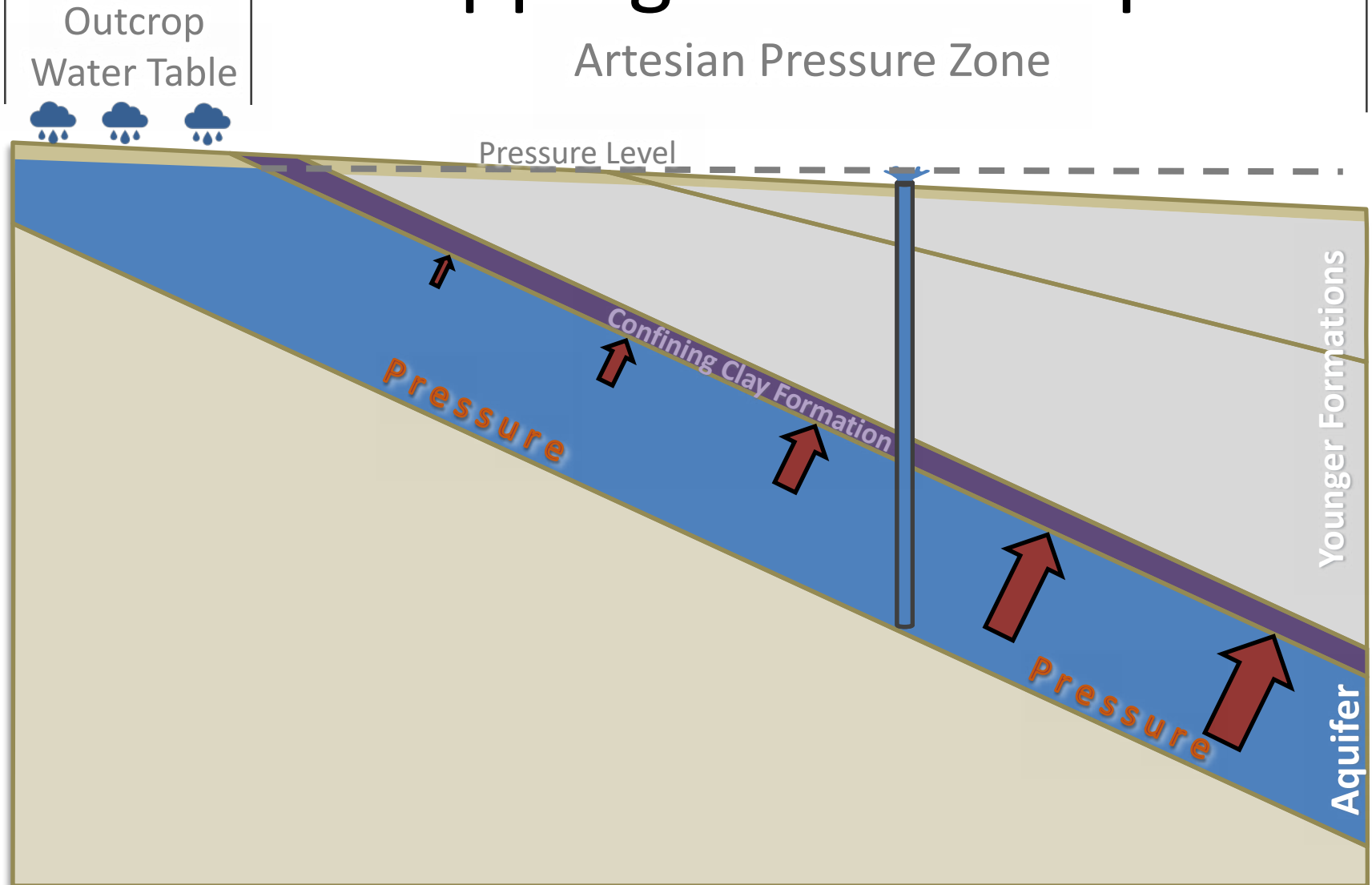
Challenges of balancing
development with protection of
aquifers

Pressure Example

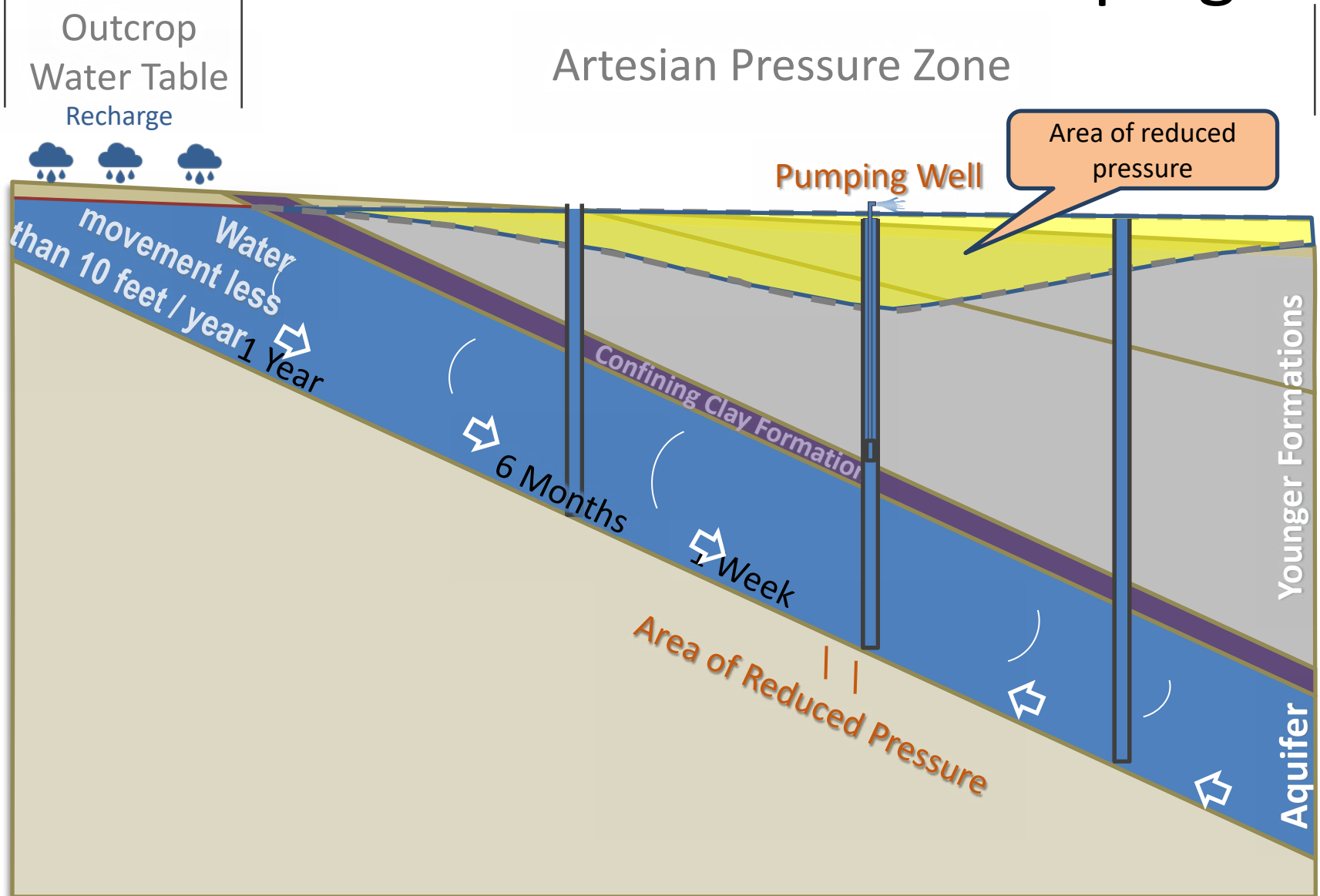




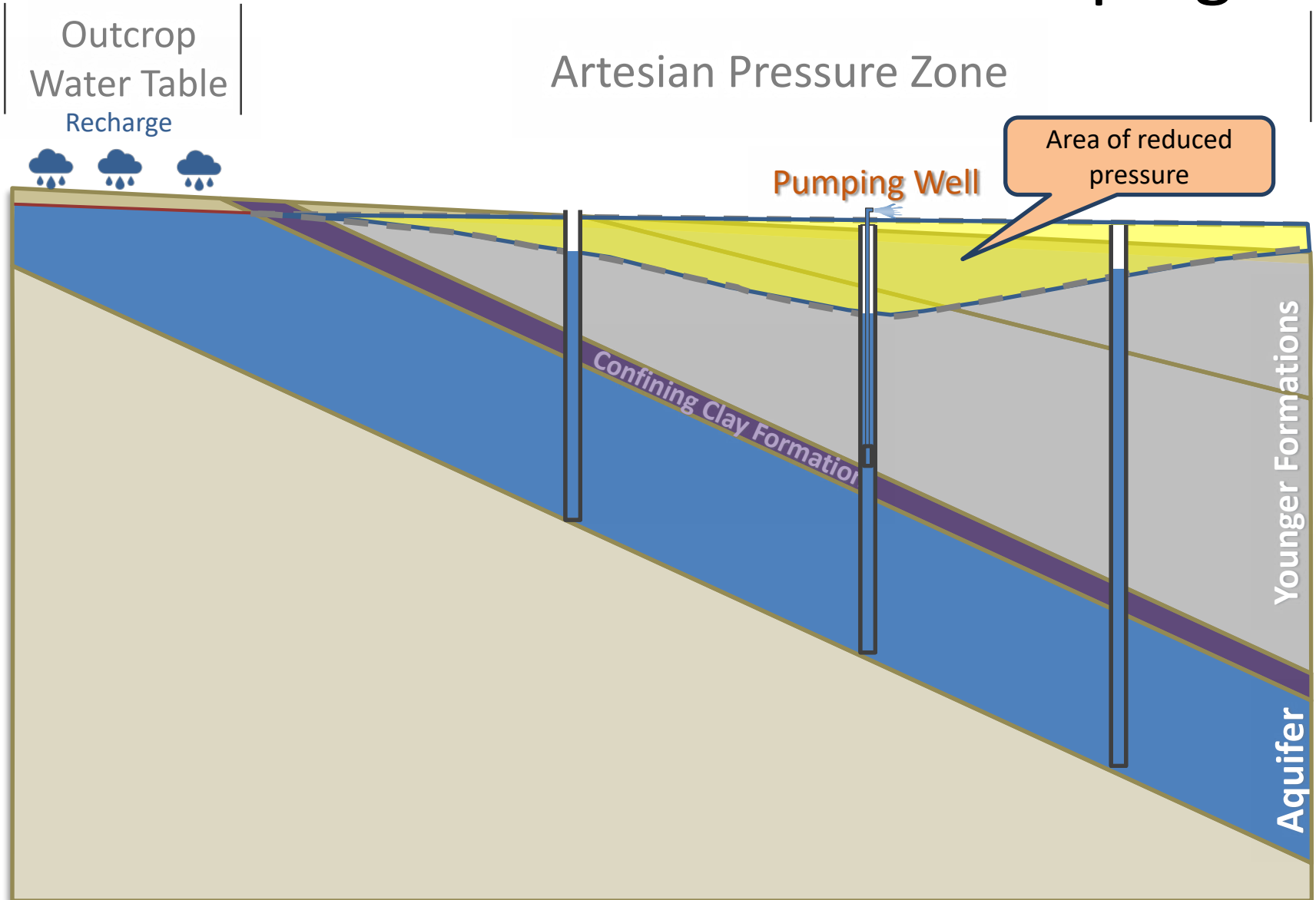
Idealized Dipping Artesian Aquifer



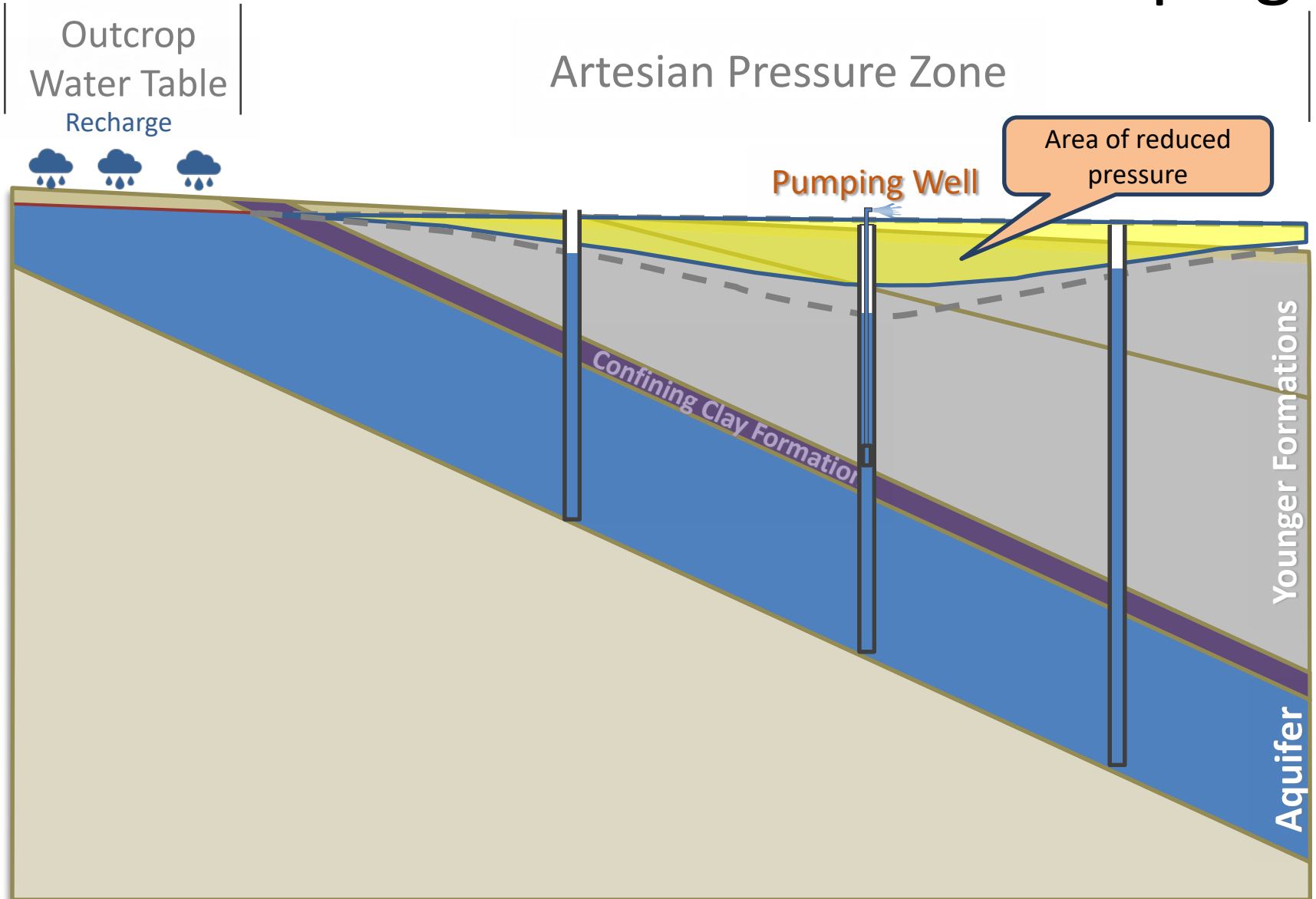
Pressure Reduction due to Pumping



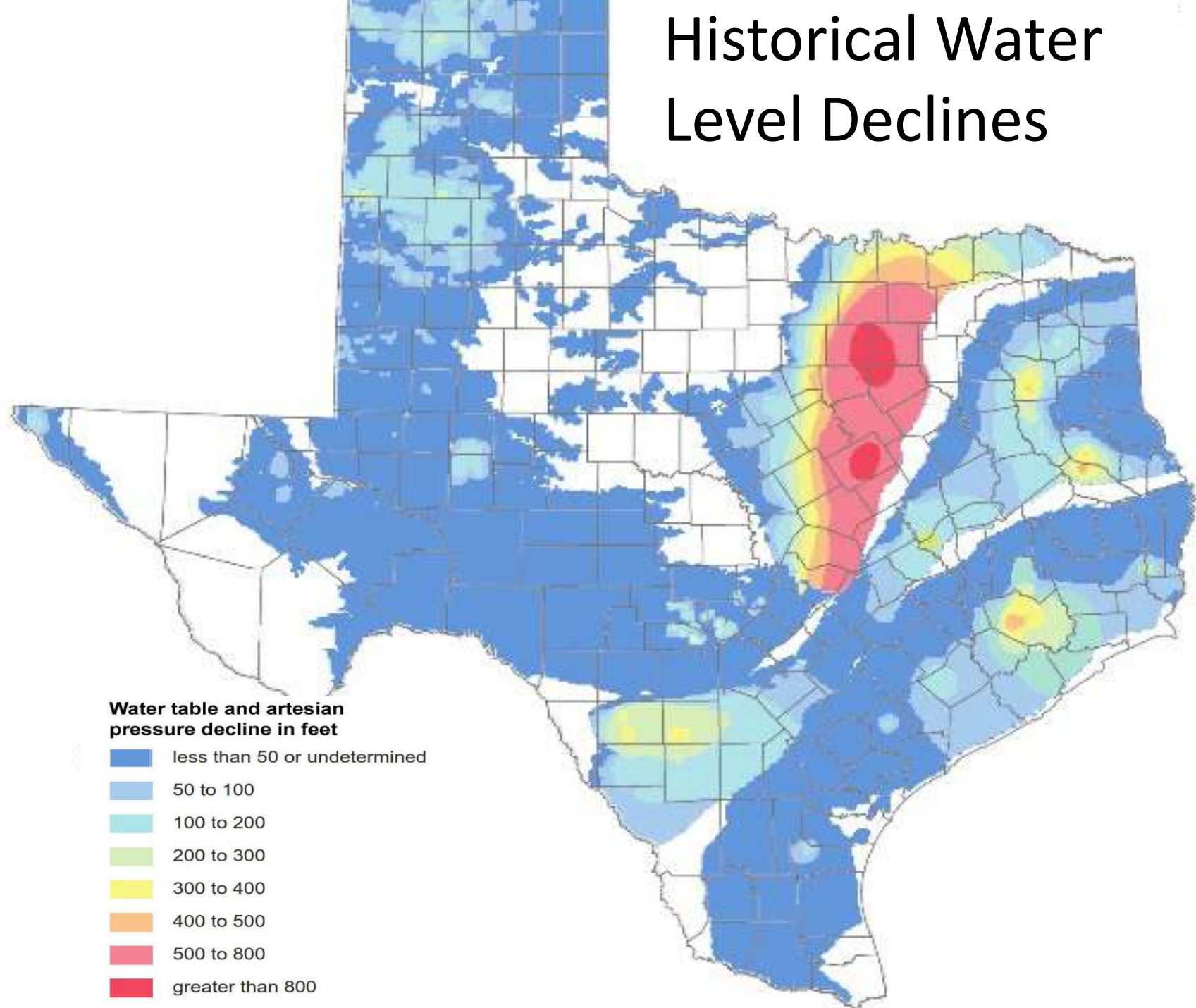
Pressure Reduction due to Pumping



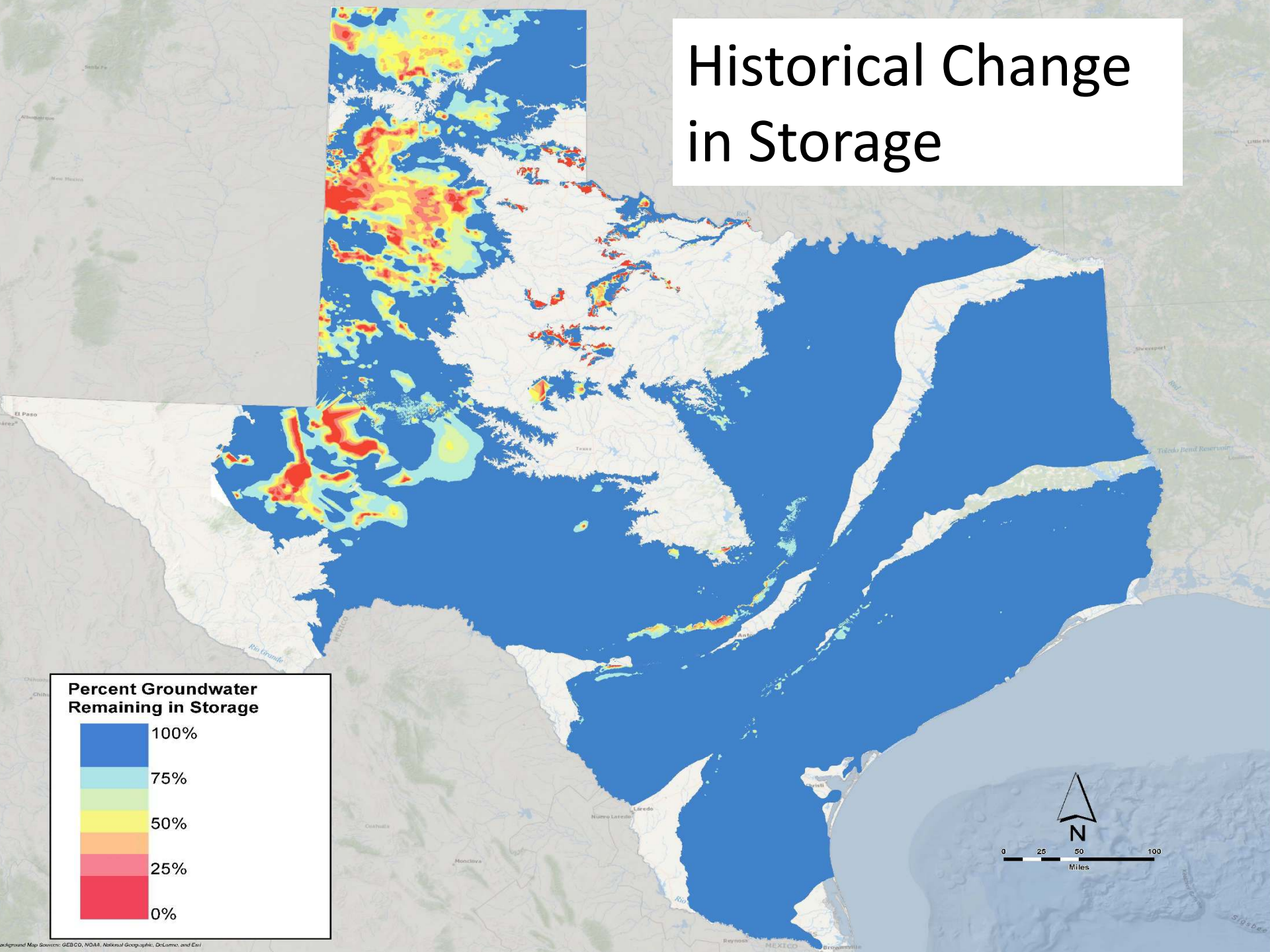
Pressure Rise with Decrease in Pumping



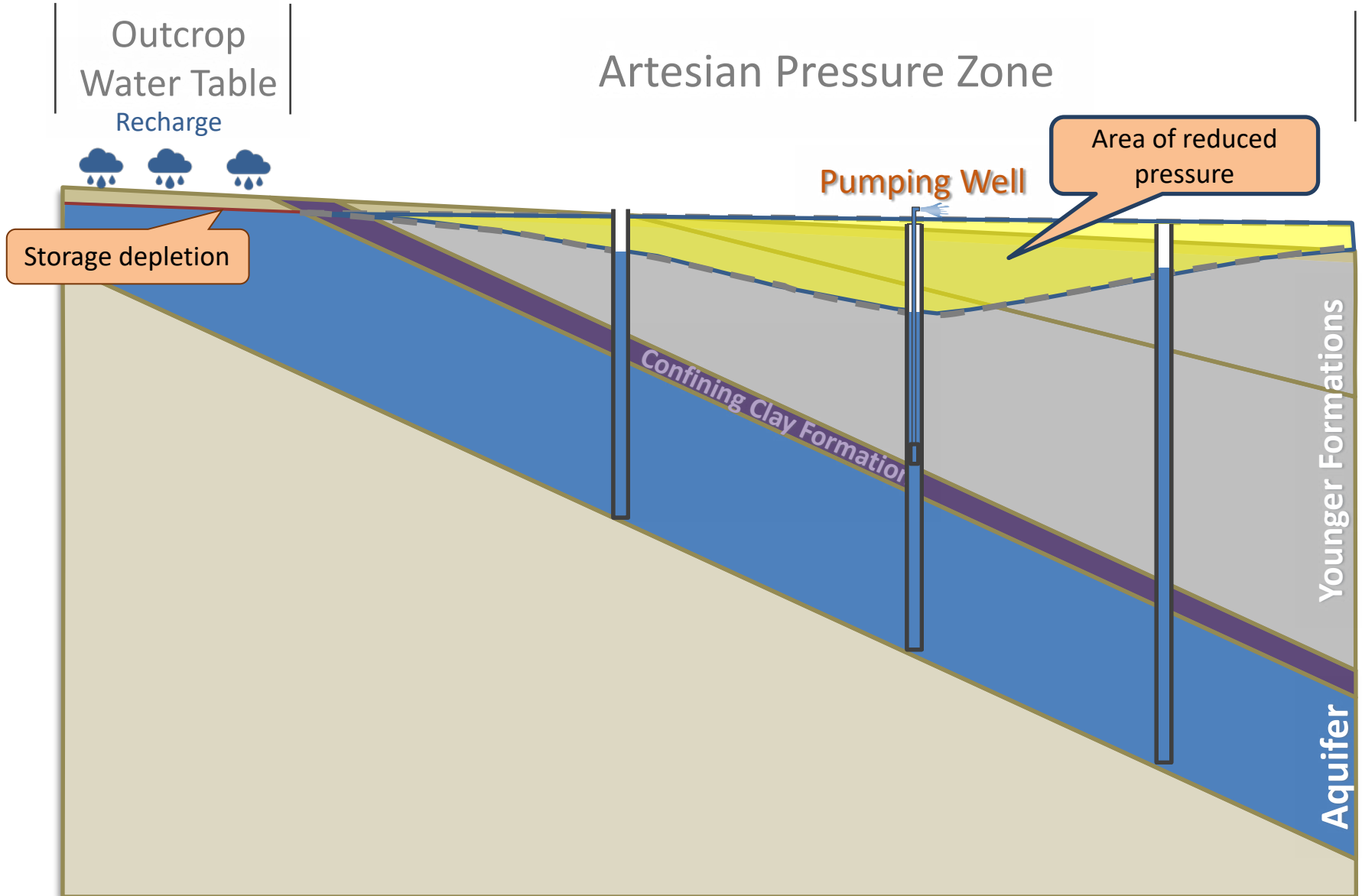
Historical Water Level Declines



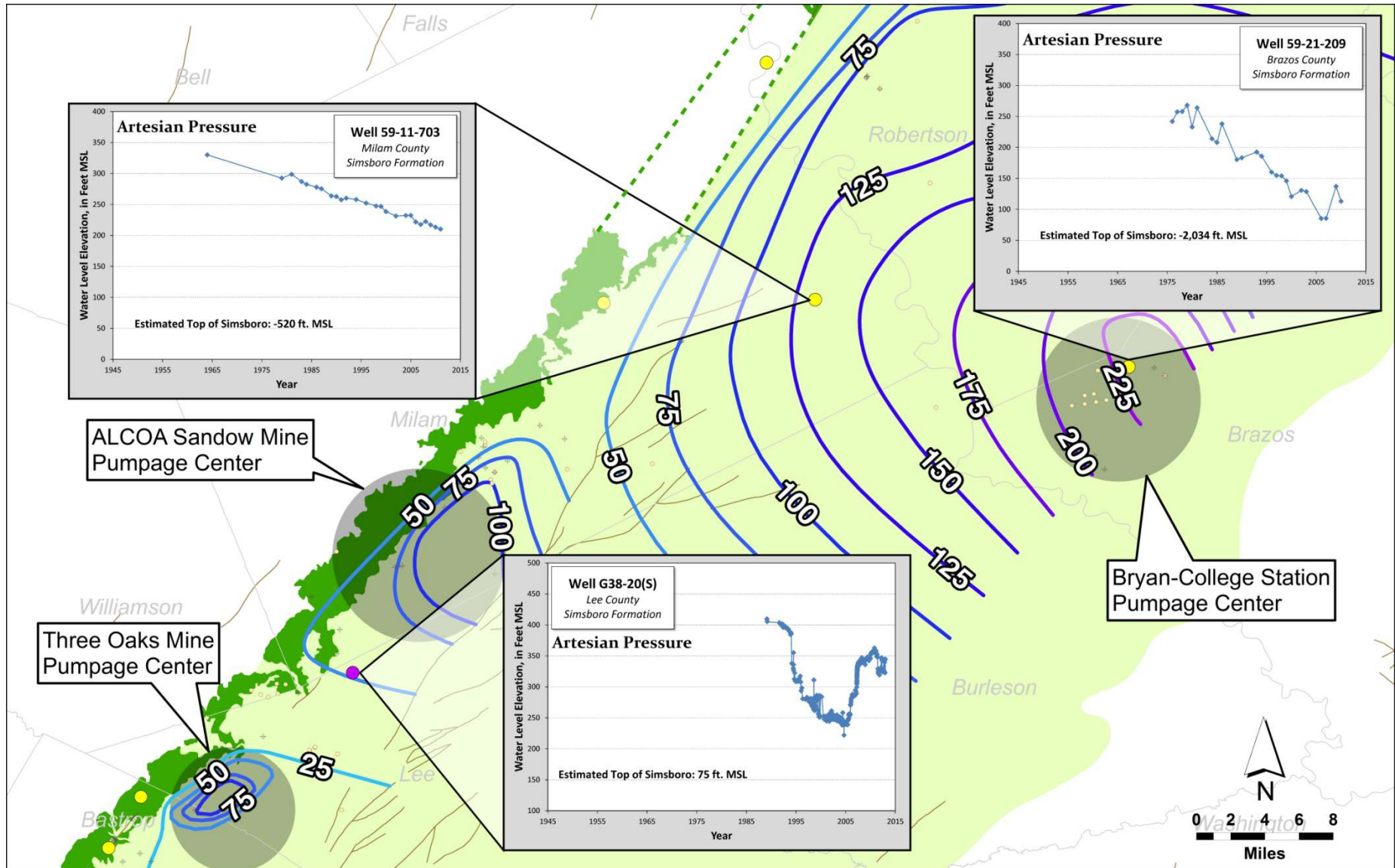
Historical Change in Storage



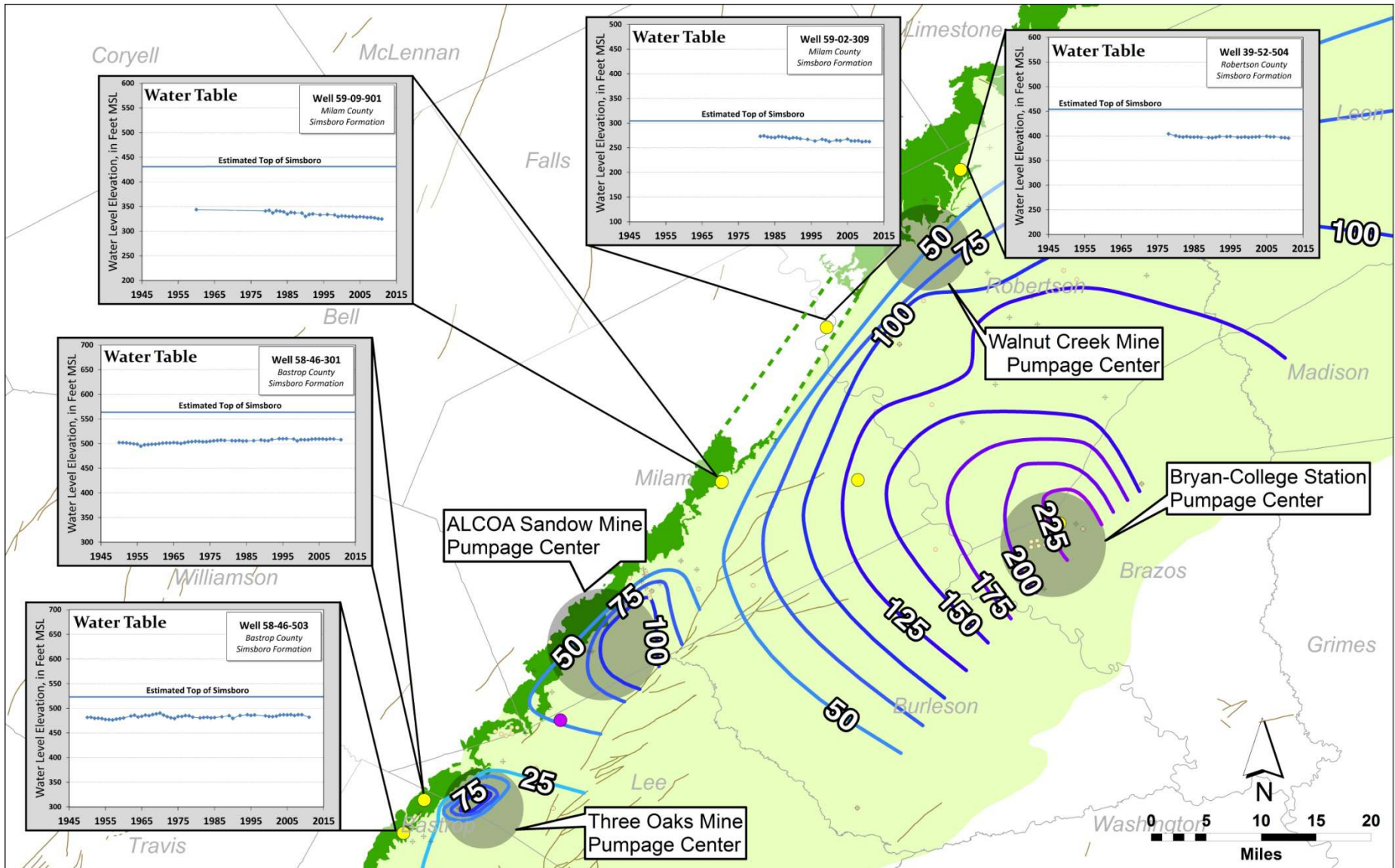
Pressure vs. Storage



Artesian Pressure Drawdown



Water Table Drawdown

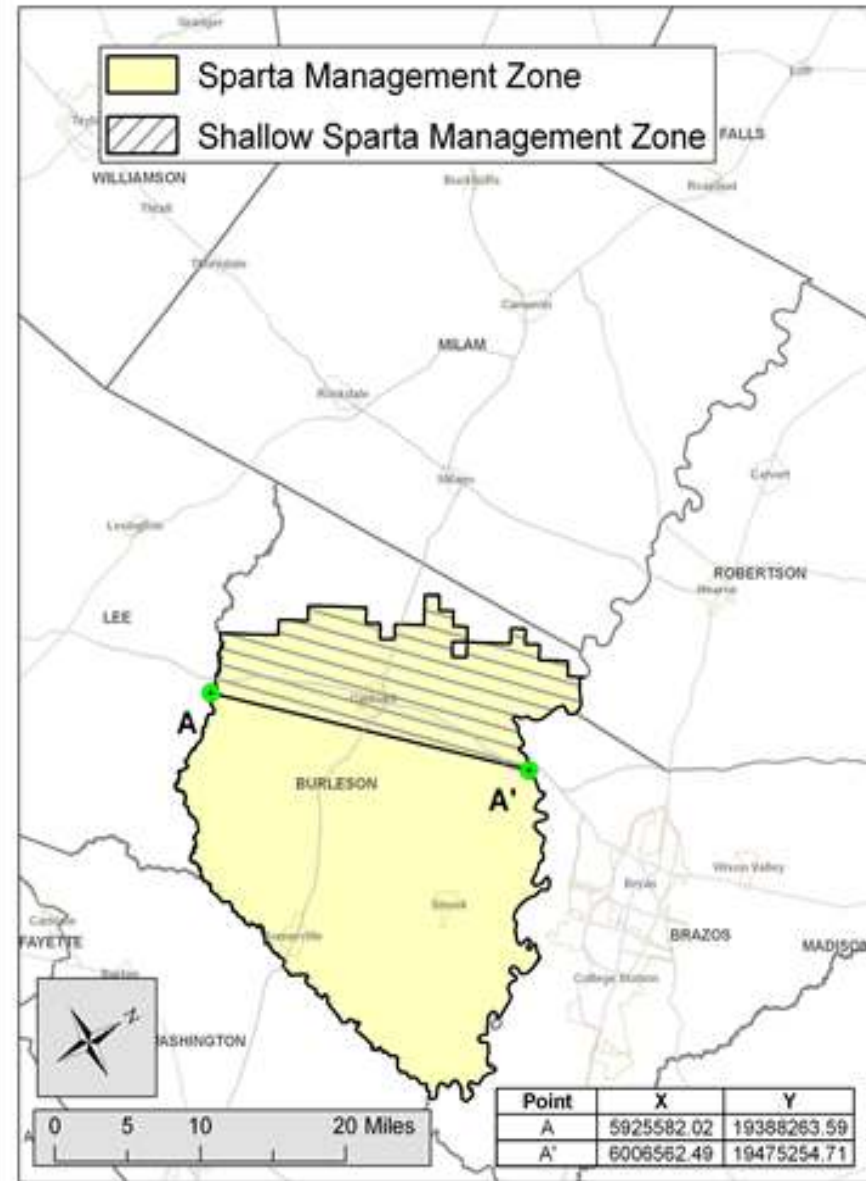


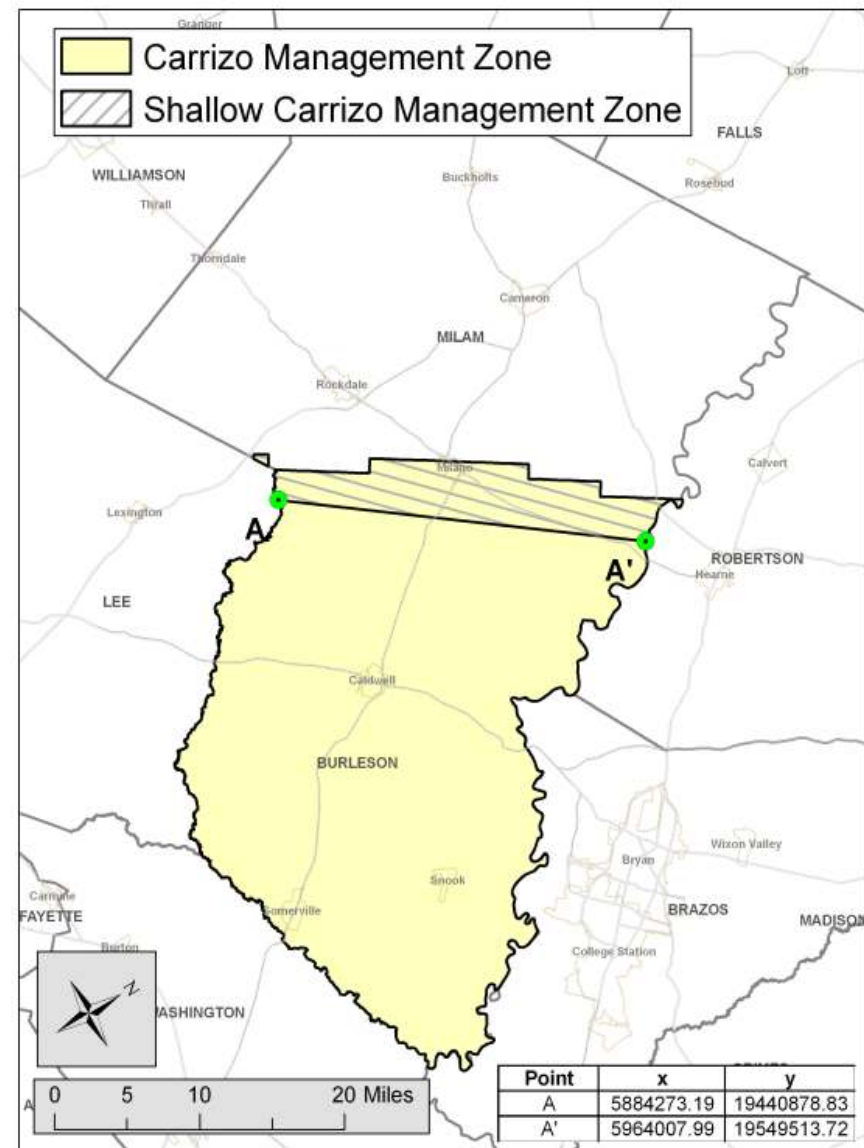
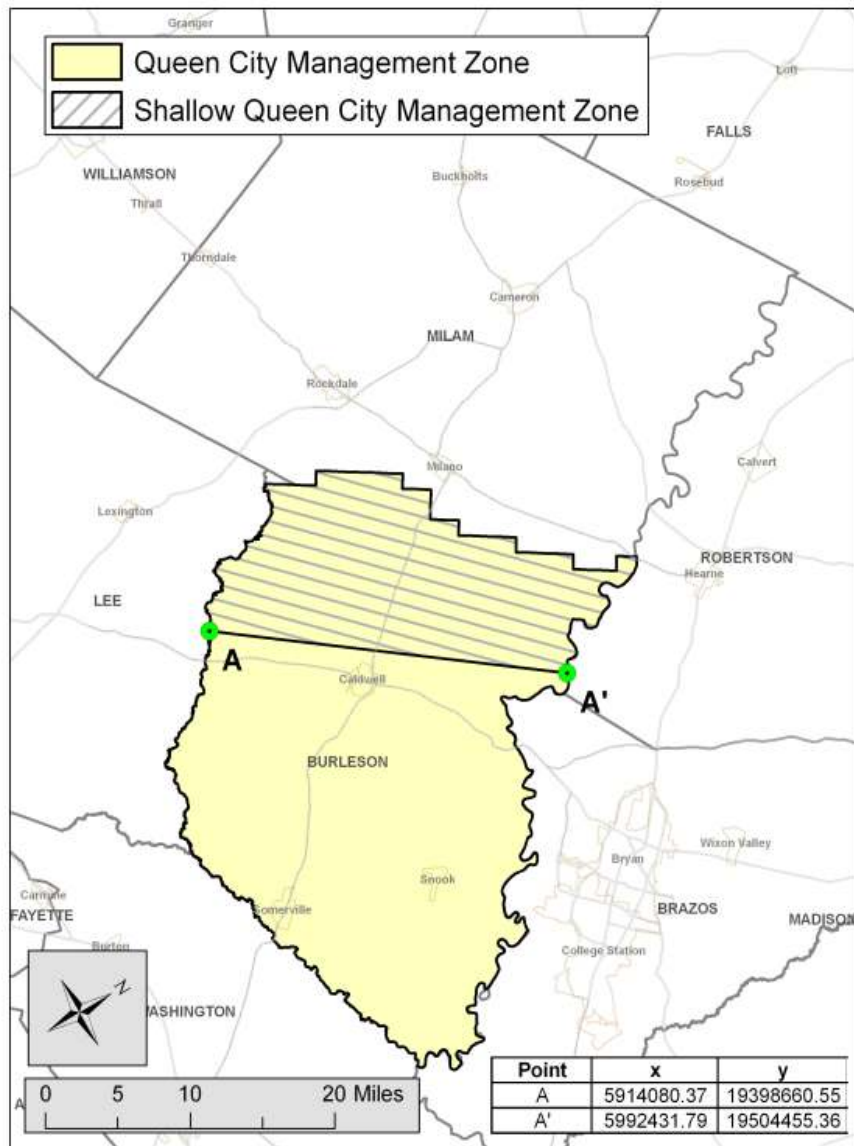


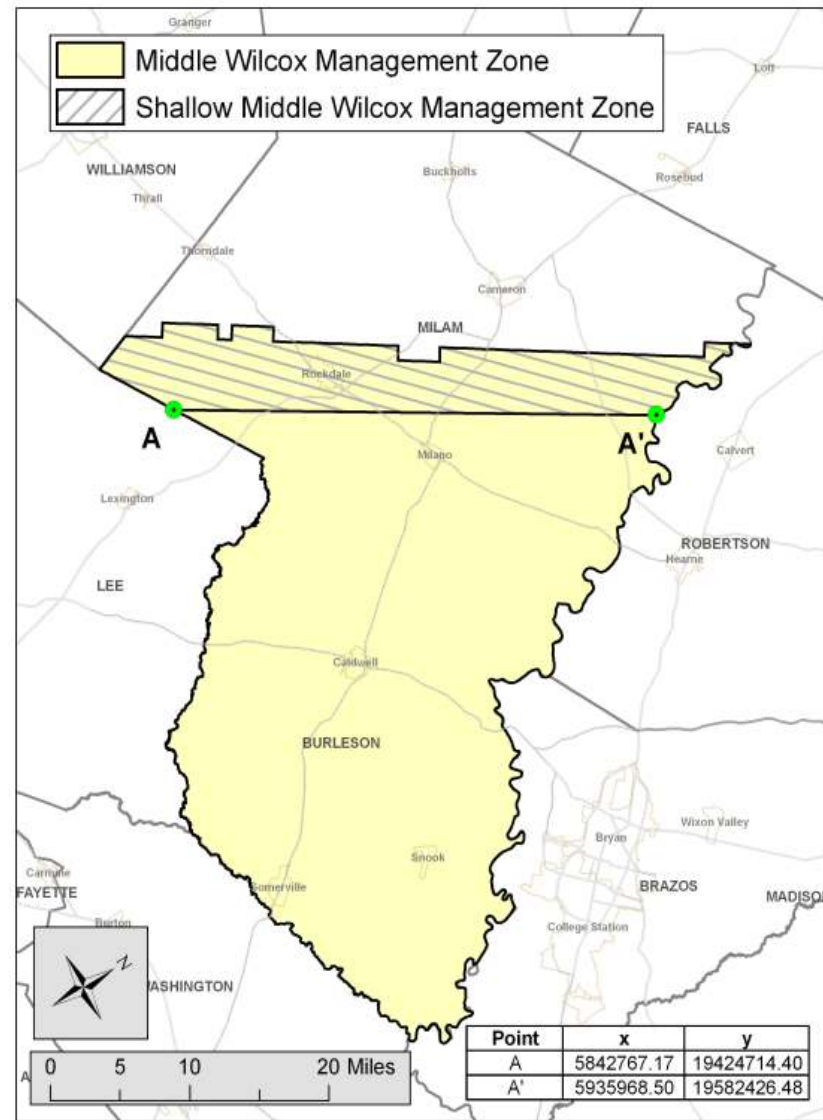
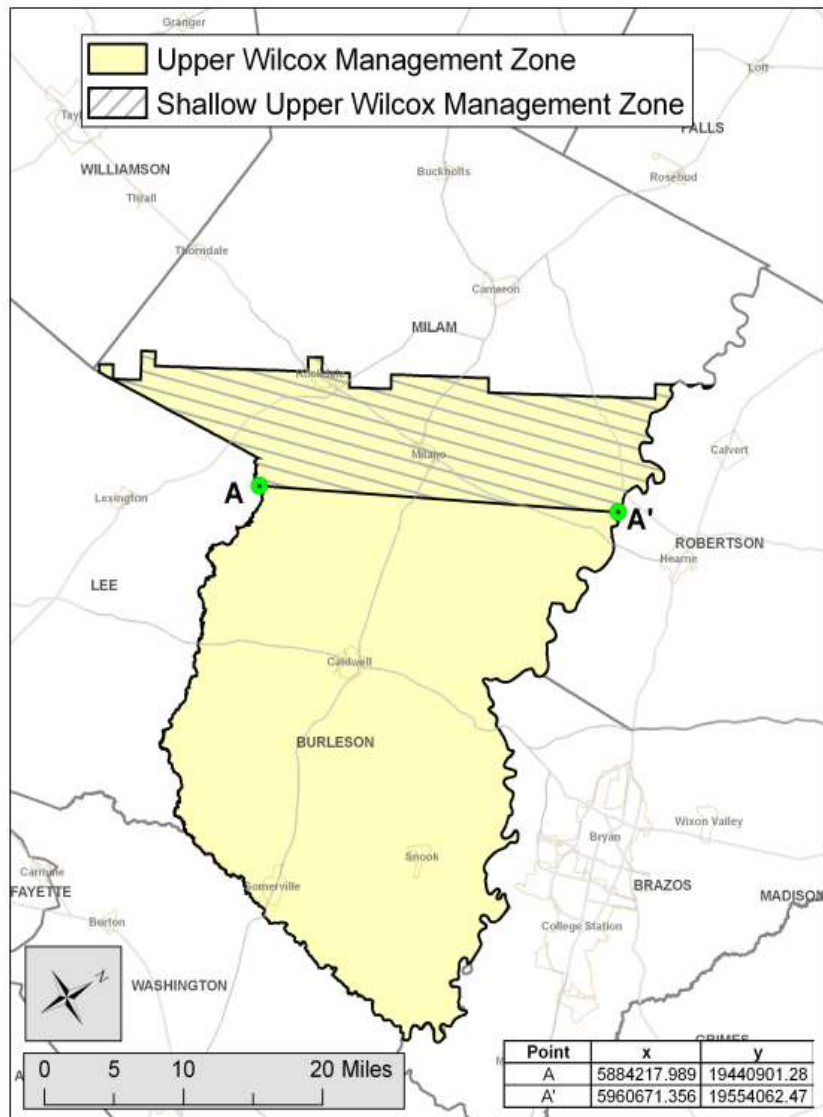
Management Strategies of POSGCD

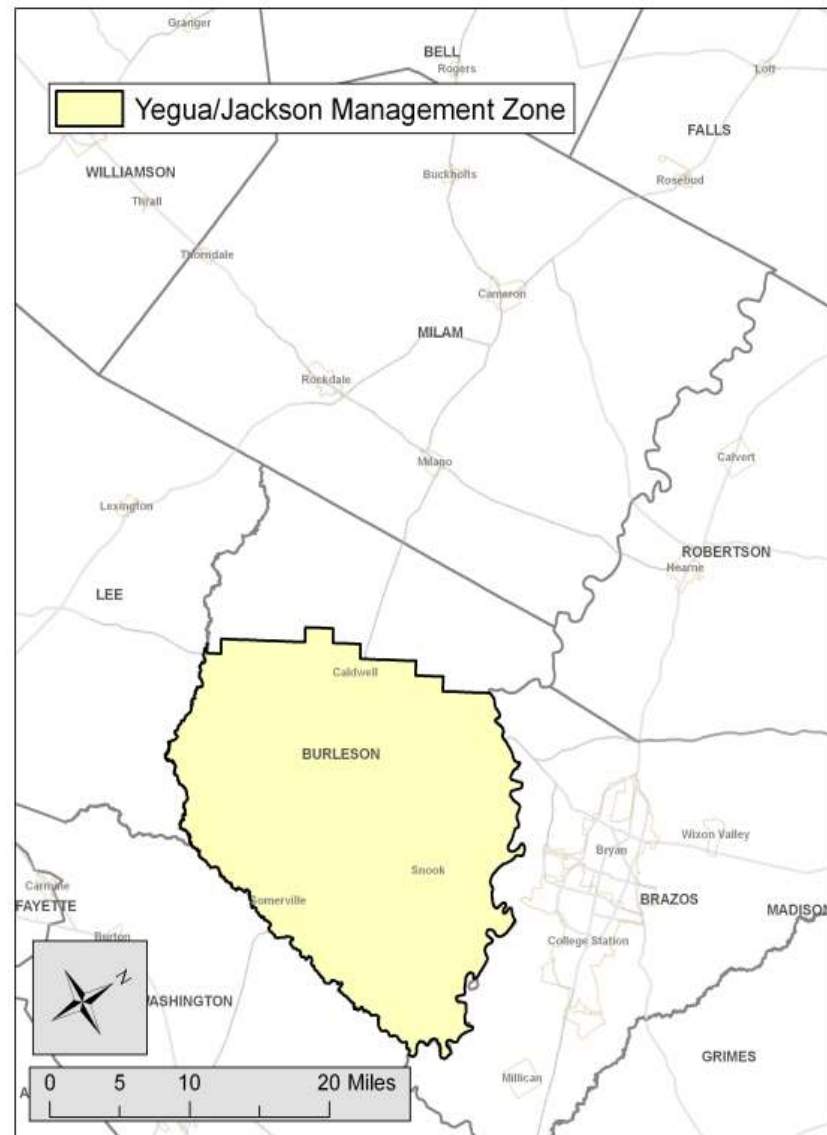
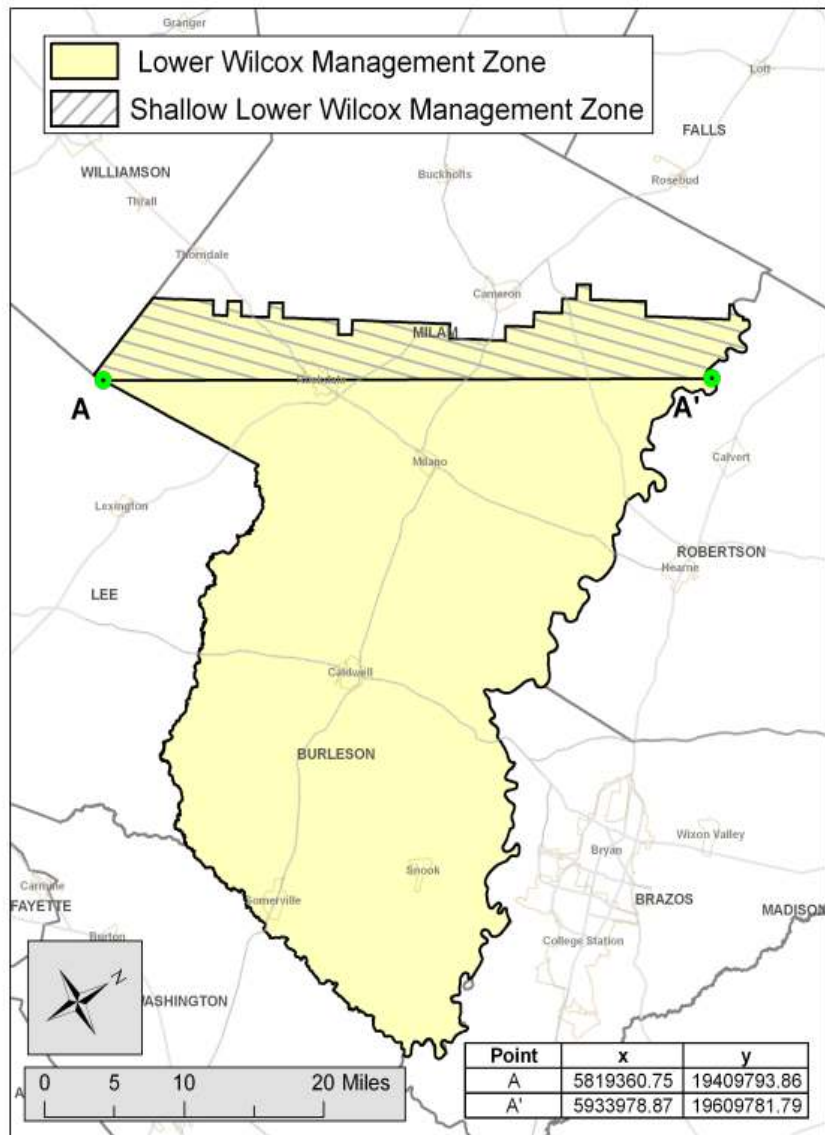
Management Zone Boundaries









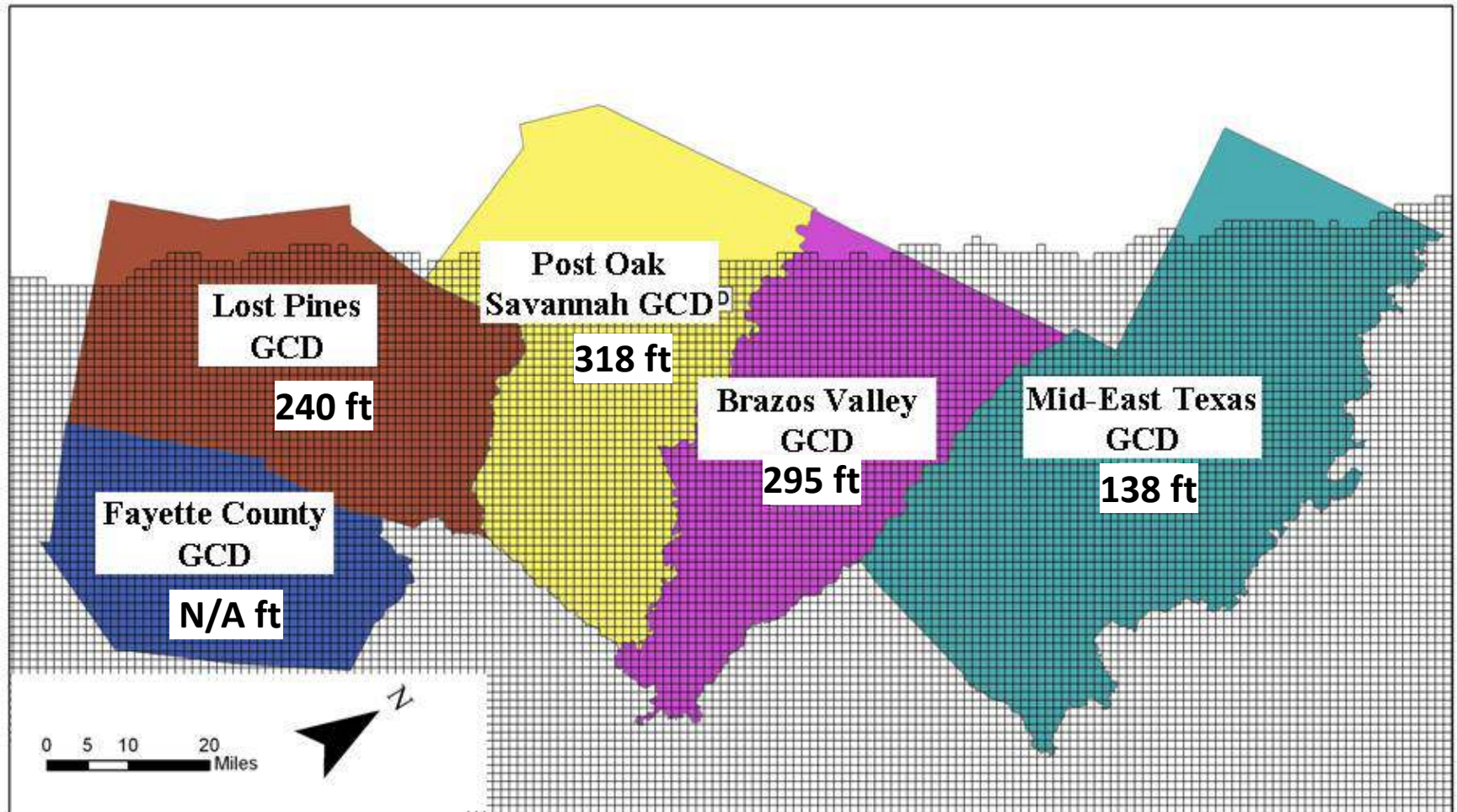


Summary of POSGCD Management Strategies

<u>Aquifer/Formation</u>	<u>Over all DFC</u>	<u>DFC- Unconfined Area</u>
Sparta	28	10
Queen City	30	10
Carrizo	67	20
Calvert Bluff (Upper Wilcox)	149	20
Simsboro (Middle Wilcox)	318	20
Hooper (Lower Wilcox)	205	20
Yegua/Jackson	100	15

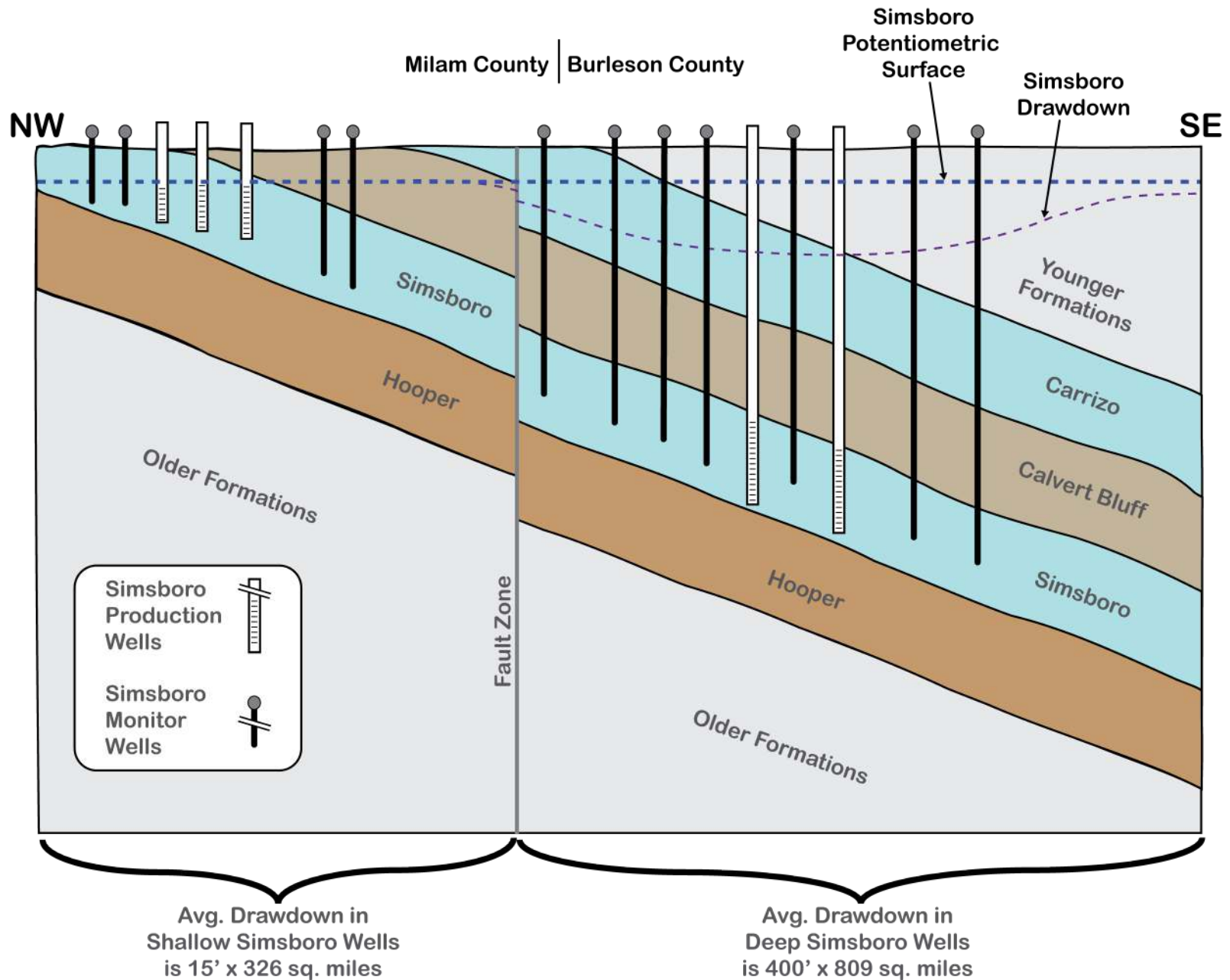
(These DFCs are expressed as average drawdowns for a 60-year period beginning January 2010 and ending December 2069, for the area covered by each aquifer in Milam and Burleson Counties.)

GMA 12 Adopted DFCs: Expressed in Average across District for Simsboro (2010 to 2070)



Schematic Cross Section

Simsboro Drawdown



Rockdale Wells and Water Levels**

Well Name	Screen Depth	Pump Depth	Water Level	Well Buffer	Total Buffer
New Texas	370	273	128	145	242
Airport	443	235	134	101	309
Tracy	346	224	137	87	209
Runway	450	285	154	131	154
Praesel	225	225	N/A	N/A	N/A
Belton (m)	390	N/A	134	N/A	N/A

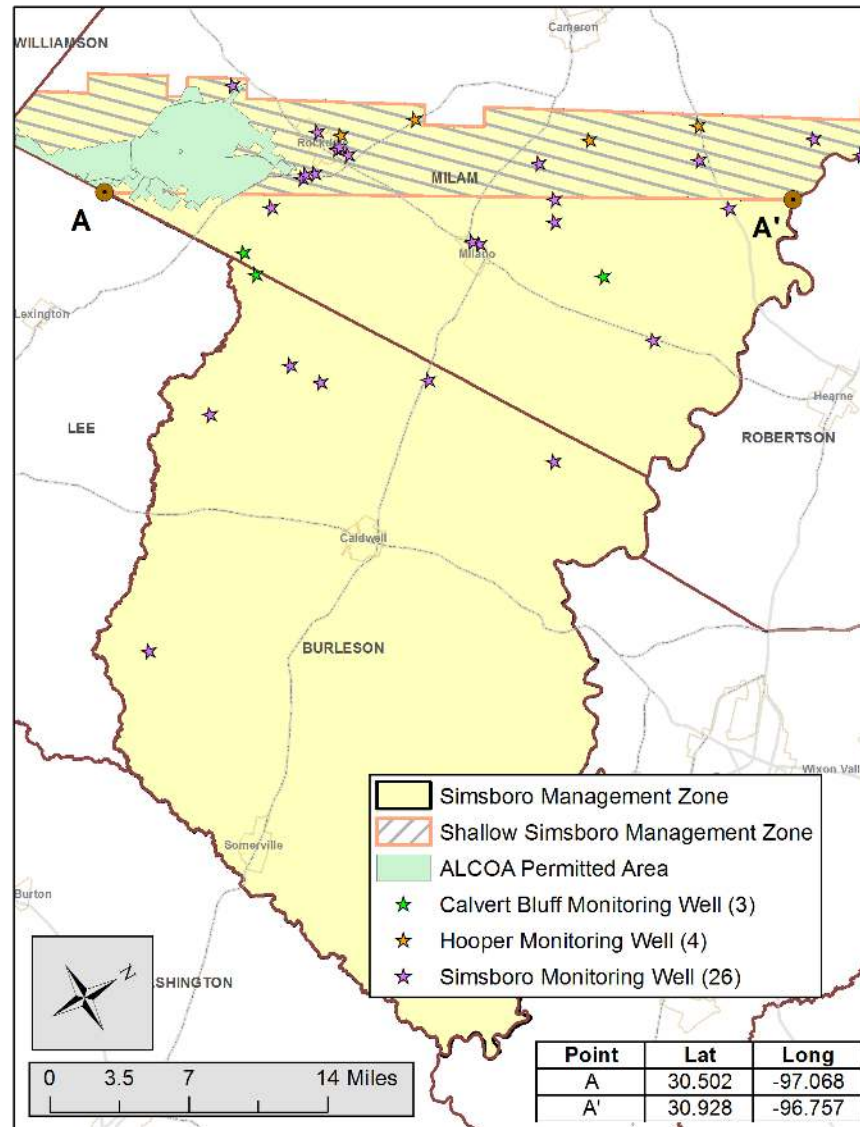
**Rockdale wells are located in the shallow portion of the Carrizo-Wilcox formations

Well Buffer = difference between Water Level and Pump Depth

Total Buffer= difference between Screen Depth and Water Level (if able to drop pumps)

(m) = monitor well only

POSGCD Monitoring Locations for Wilcox Aquifer



Relevant Factors for Consideration in Management of Groundwater Resources

- Chapter 36
- The purpose of the rules of the District;
- The equitable distribution of the resource;
- The economic hardship resulting from grant or denial of a permit, or the terms prescribed by the permit;
- The potential effect the permit may have on the aquifer, sustainability of the recharge on the aquifer as a whole, and groundwater users;
- The Desired Future Conditions and the estimated Modeled Available Groundwater Values; and
- The Management Goals, Objectives, and Performance Standards

Current Info in District Well Database

<u>Formation</u>	<u># wells</u>
• Yegua/Jackson	2091
• Sparta	644
• Queen City	592
• Simsboro	397
• Carrizo	186
• Hooper	422
• Other	>3200
• Total	>7500

Measuring Water Depth



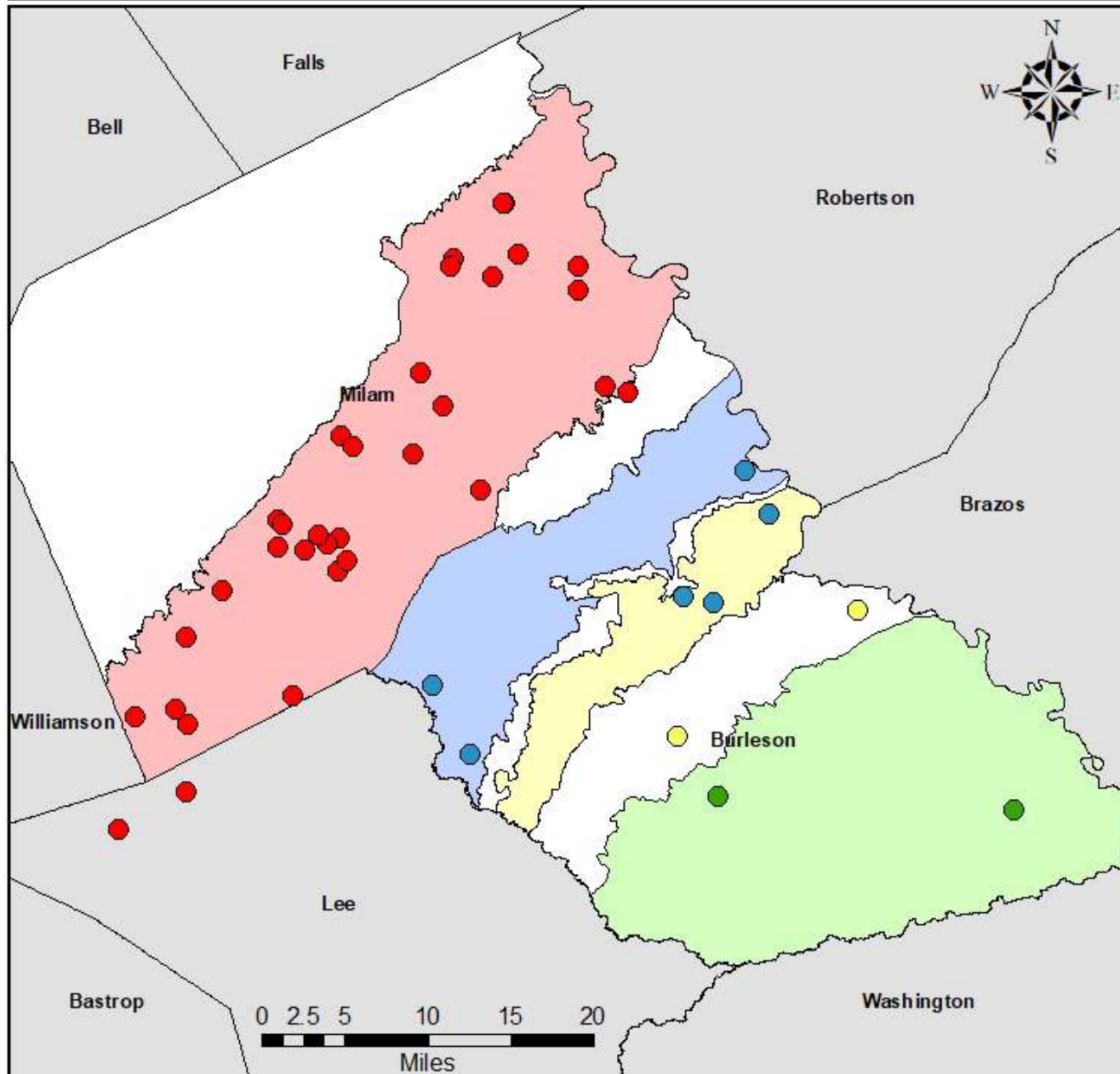




Groundwater Management

- Protection of water levels
 - Overall Desired Future Conditions
 - Shallow zones restrictions
 - District Monitor well network
- Respect for Property Rights
 - To produce
 - When not producing**

District Monitoring Wells - Shallow (<400) Management Zone



This map illustrates the wells in the District's Monitoring Network that are identified to be in the shallow management zone set for 400 feet. The District makes an effort to make management decisions that are supported through best available science. In an effort to improve this science, more wells are needed to increase the quantity and quality of data. While the Carrizo-Wilcox has been prioritized, there is a strong need for some shift towards the minor aquifers in regards to number of shallow monitoring wells. This document is for DRAFT ONLY.

Legend

Monitor Wells <400

- Carrizo-Wilcox
- Queen City
- Sparta
- Yegua - Jackson
- Carrizo-Wilcox Outcrop
- Queen City Outcrop
- Sparta Outcrop
- Yegua-Jackson Outcrop



Monitoring Summary

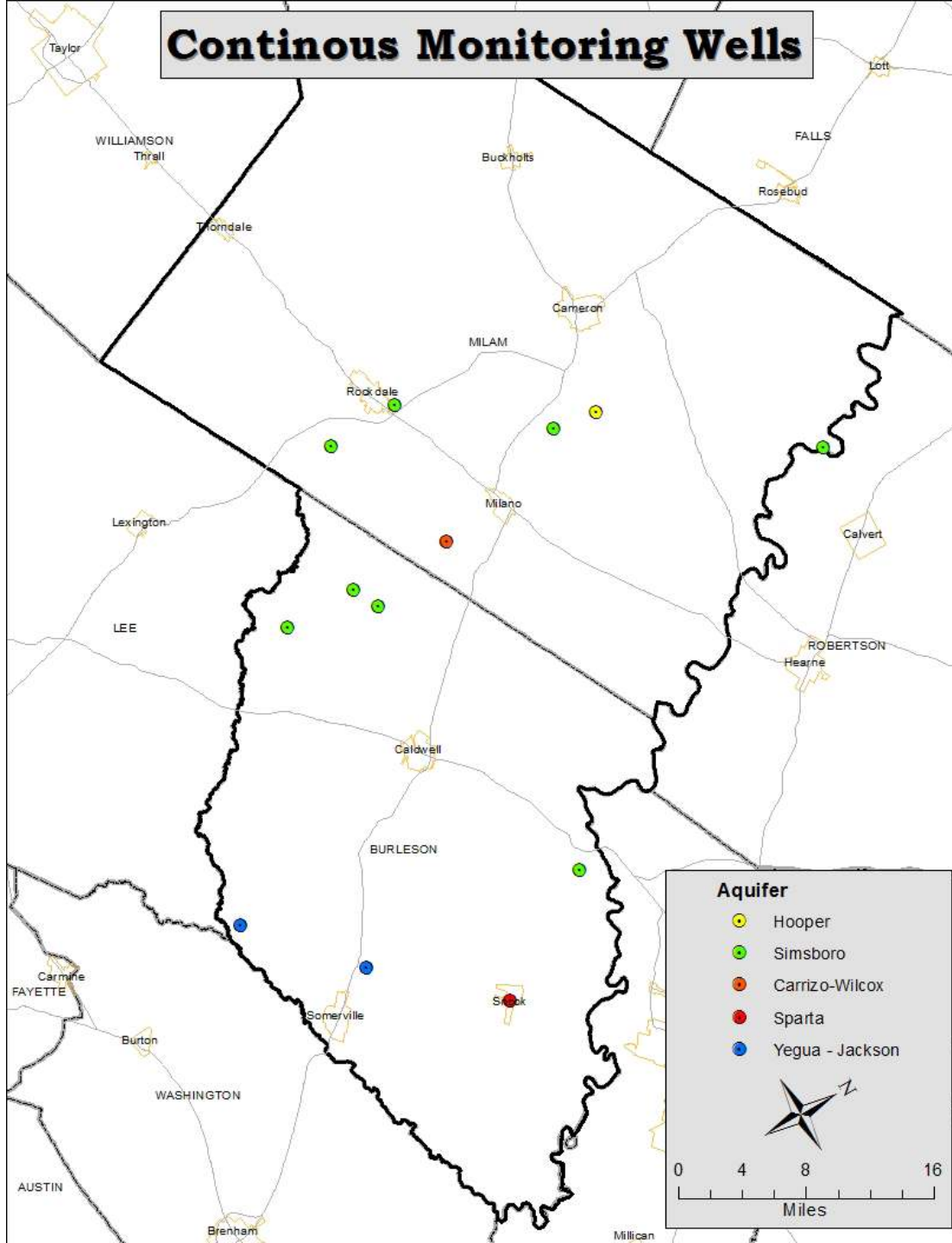
- 201 monitoring wells (adding more)
 - 169 incidental wells (manual measurements)
 - 32 continual wells (hourly measurements)
- Monitoring results available on website
- Continuous evaluations and reports to Board
- Water Level trends are stable
- Changed Shallow Management Zone to be top 400 feet of each formation.

Water Level Monitoring

Aquifer	Management Zone	
	Shallow	Deep
<i>Hooper</i>	6	0
<i>Simsboro</i>	12	16
<i>Calvert Bluff</i>	5	0
<i>Carrizo</i>	4	4
<i>Queen City</i>	5	3
<i>Sparta</i>	0	8
<i>Yegua-Jackson</i>	N/A	3
<i>Brazos River Alluvium</i>	7	N/A

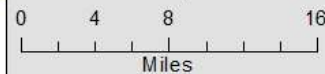


Continous Monitoring Wells



Aquifer

- Hooper
- Simsboro
- Carrizo-Wilcox
- Sparta
- Yegua - Jackson





POSGCD Programs

District Education Program

- Public presentations (Master Gardeners, groups, service clubs, Co. Extension events, Big Spring Clean, etc.)
- Milam and Burleson Counties Groundwater Summit
- Commissioners Court Annual Updates
- Website- *www.posgcd.org*
- Newspapers
- Newsletters
 - Quarterly Paper
 - Monthly Email
- Schools- Public and private
 - Water Wise- 4th and 5th grades
 - In person presentations- 6th & 7th grade science
 - Additional resources- Water IQ for all levels
 - Extension Service

District Groundwater Conservation Grants

>>Local Water Utilities in District

Must be used for conservation of groundwater or recharge of aquifer(s)

History (since 2006)

- Awarded 85 grants
- 23 different Local Water Utilities (All in District)
- Approximately \$12.3 Million
- 2018 Four Recipients totaling \$1,254,150
- 2019 Budgeted amount of \$1 Million

District Groundwater Conservation Grants

(continued)

>> Fire Departments in the District (\$25,000 per year)

Available for water conservation materials and equipment

- Absorbent materials
- Foam
- Foam dispersing nozzles
- ProPaks

>>Well Plugging (\$25,000 per year)

District reimburses 100% of expense up to \$2500

Groundwater Well Assistance Program (GWAP)

Purposes-

- Increase # of monitoring wells***
- Predict and correct issues with water supply***

Aquifer Conservancy Program (ACP)

Conserve water for future generations

Questions?

Contact info:

Gary Westbrook

General Manager

Post Oak Savannah GCD

Phone: 512-455-9900

Fax: 512-455-9909

Email: gwestbrook@posgcd.org

Website: www.posgcd.org



Serving the Citizens of Milam and Burleson Counties