Kerr County Water Talk

Managing our groundwater resources

Natalie Ballew, P.G.
Groundwater Division Director, TWDB
November 6, 2023

Texas Water Development Board

Texas Water Development Board

DATA & SCIENCE

PLANNING

FINANCE

What we'll talk about

Groundwater: The Basics

Kerr County Aquifers

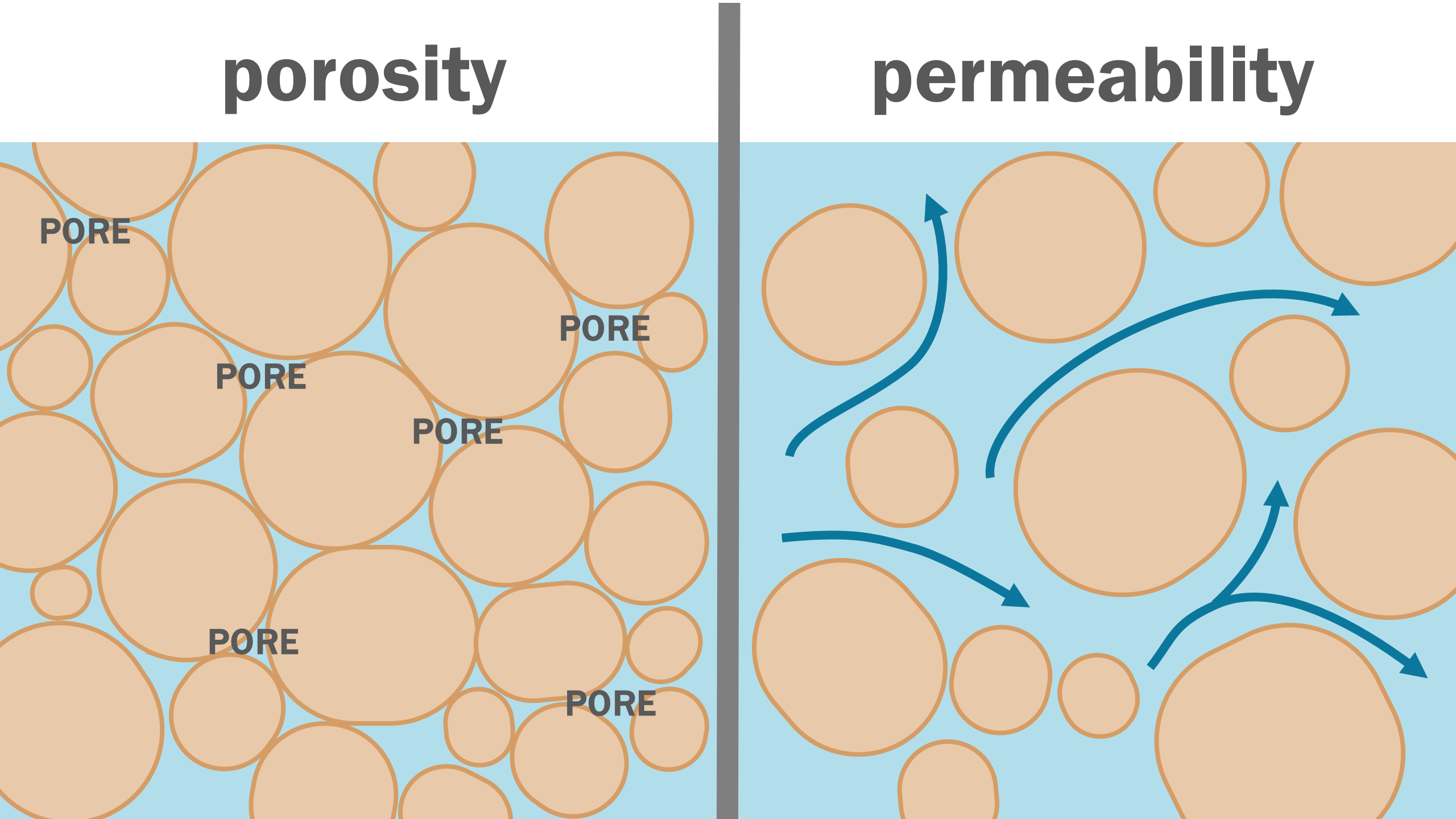
Joint Groundwater Planning

Groundwater Management: Who does what?

Groundwater: The Basics

DIRT & ROCKS

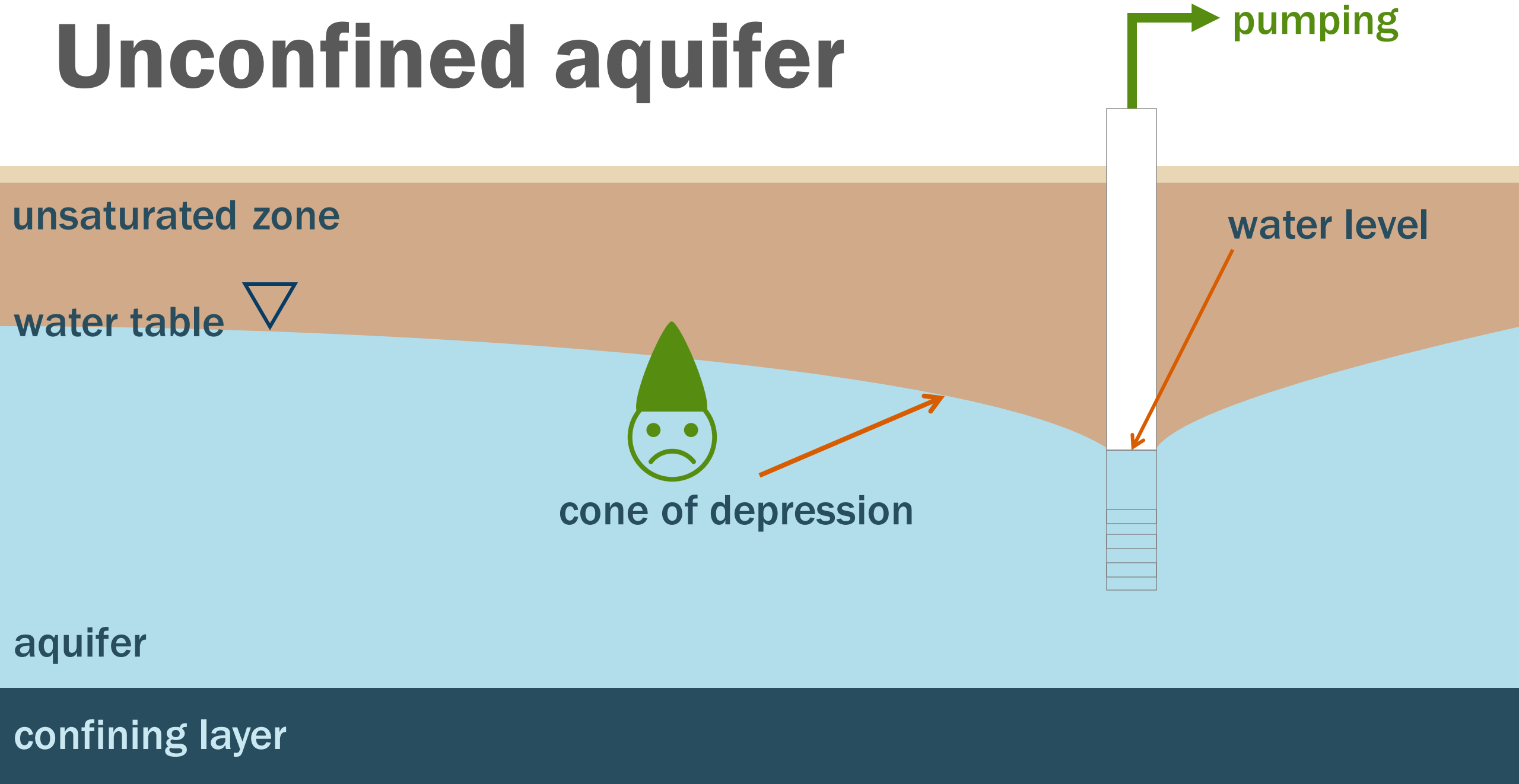
An aquifer is a **geologic media** that can yield **economically usable** amounts of water


porosity
permeability
PORE
PORE
PORE
PORE
PORE
PORE

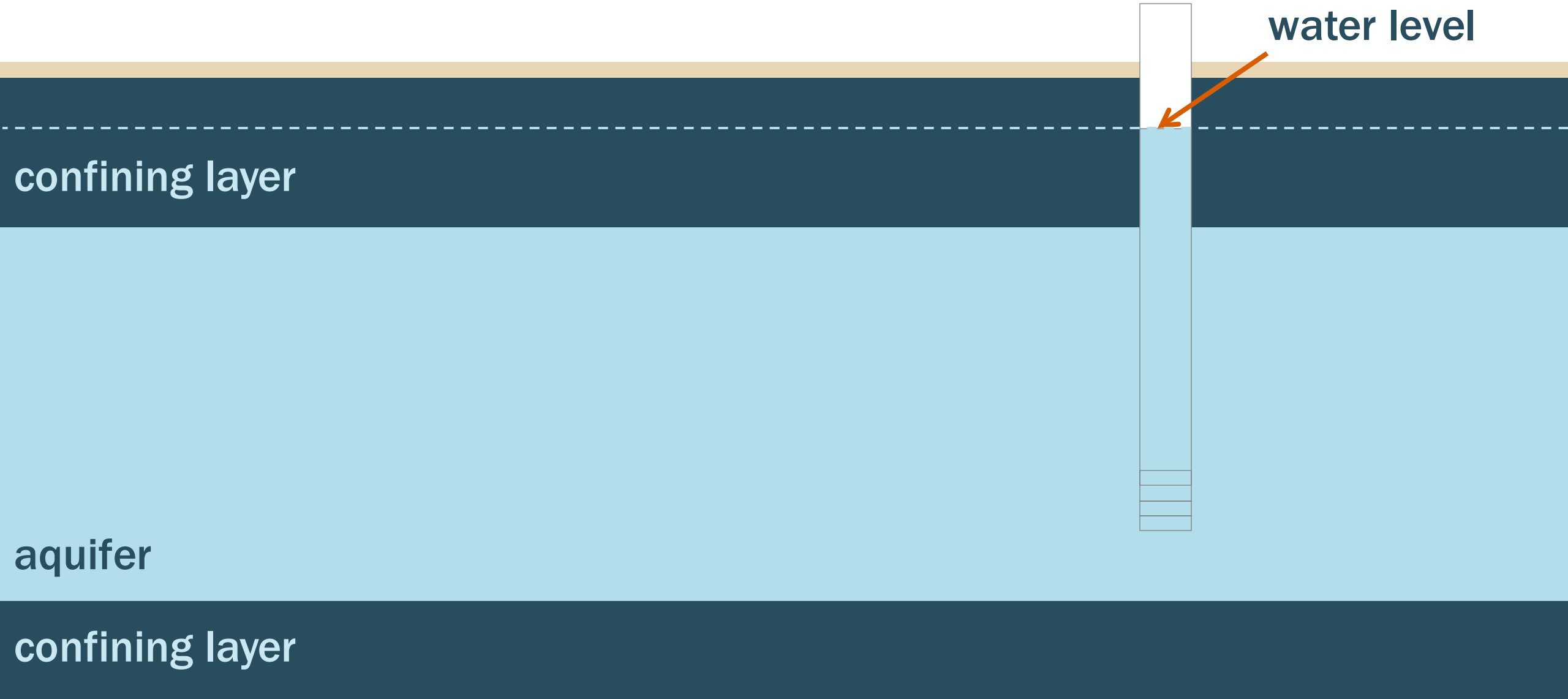
Two general types of aquifers

Unconfined aquifer

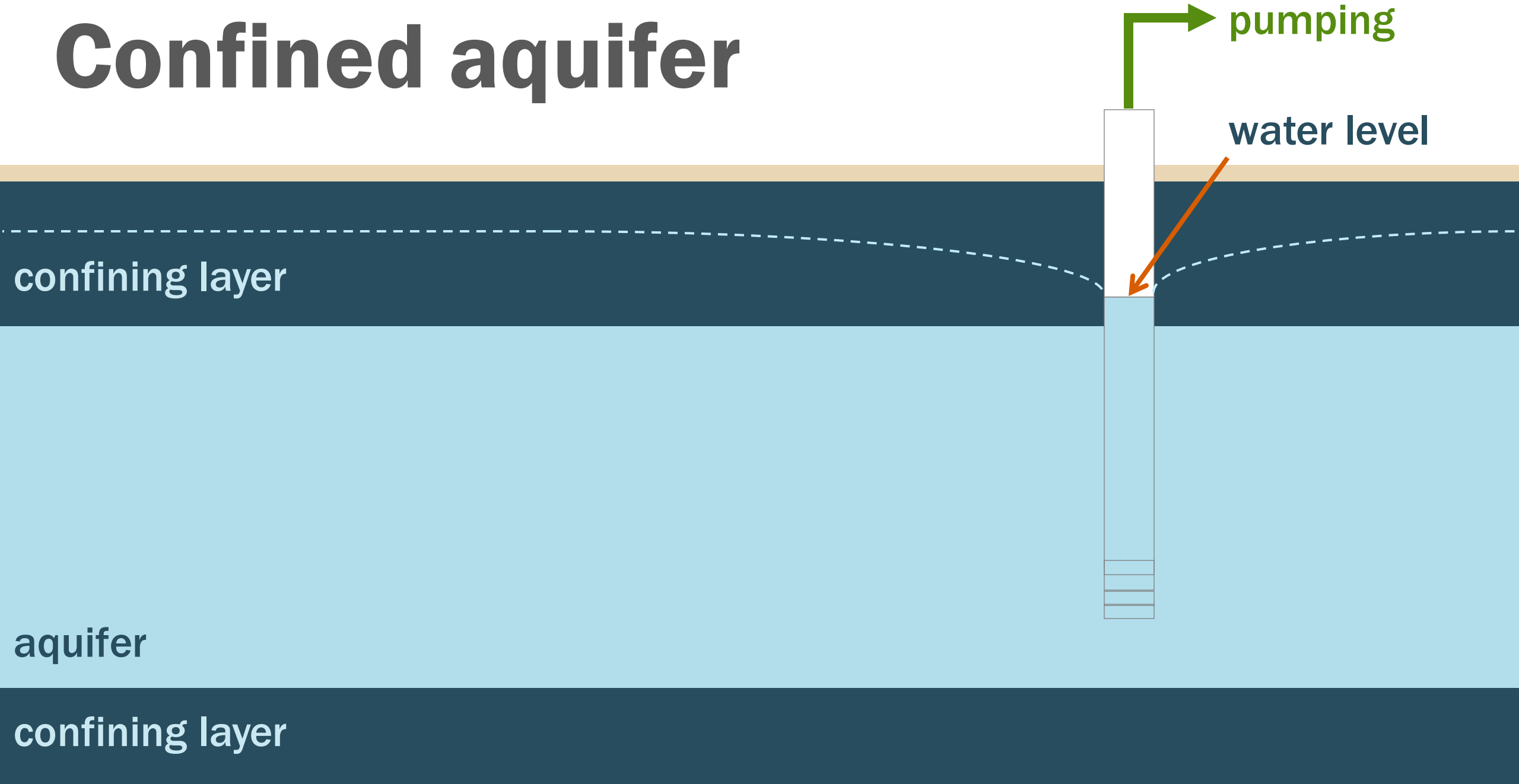
Unconfined aquifer



Confined aquifer



Confined aquifer



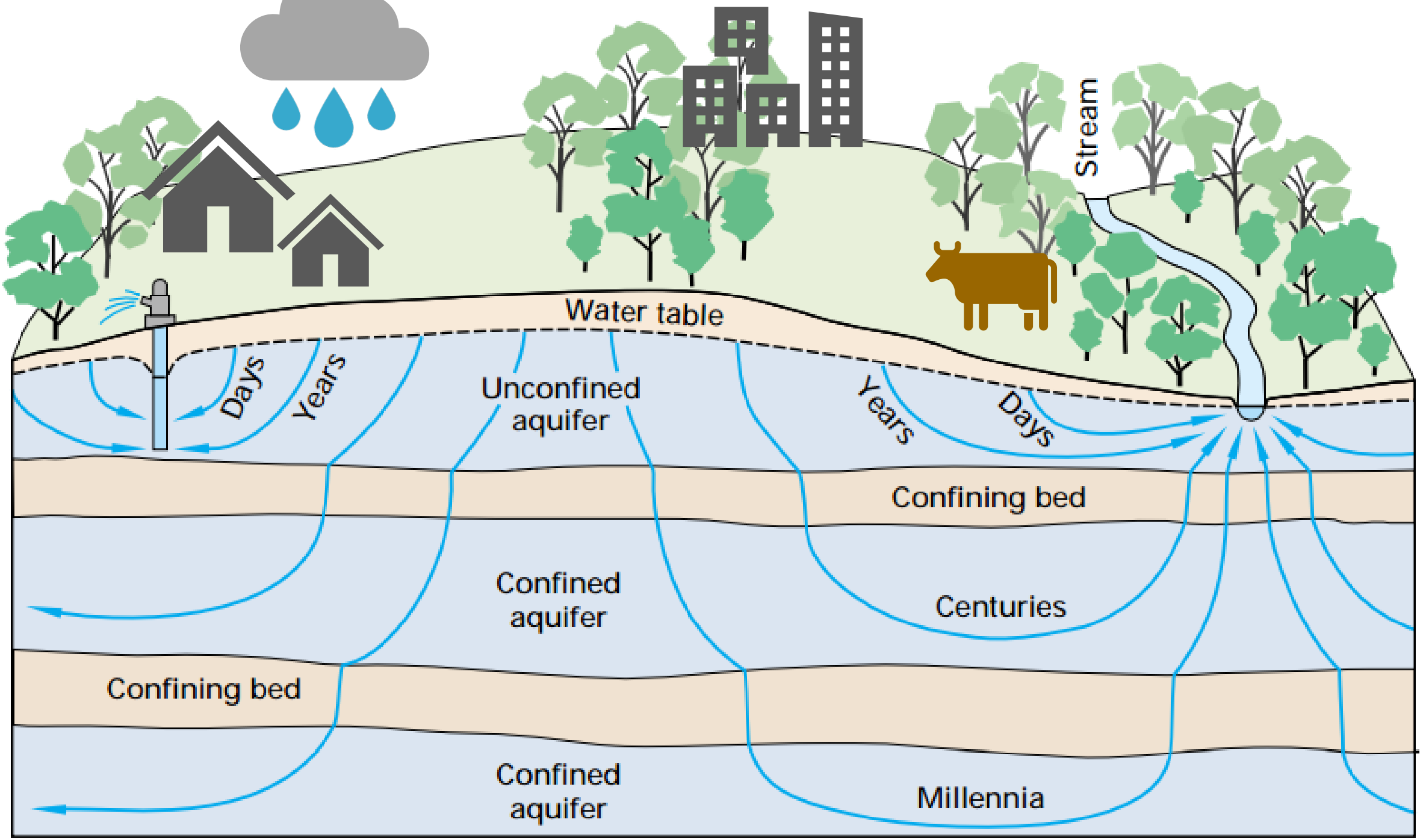


Diagram from pubs.usgs.gov/circ/circ1139/htdocs/natural_processes_of_ground.htm

Water budgets

Inflows

like income

Aquifer storage

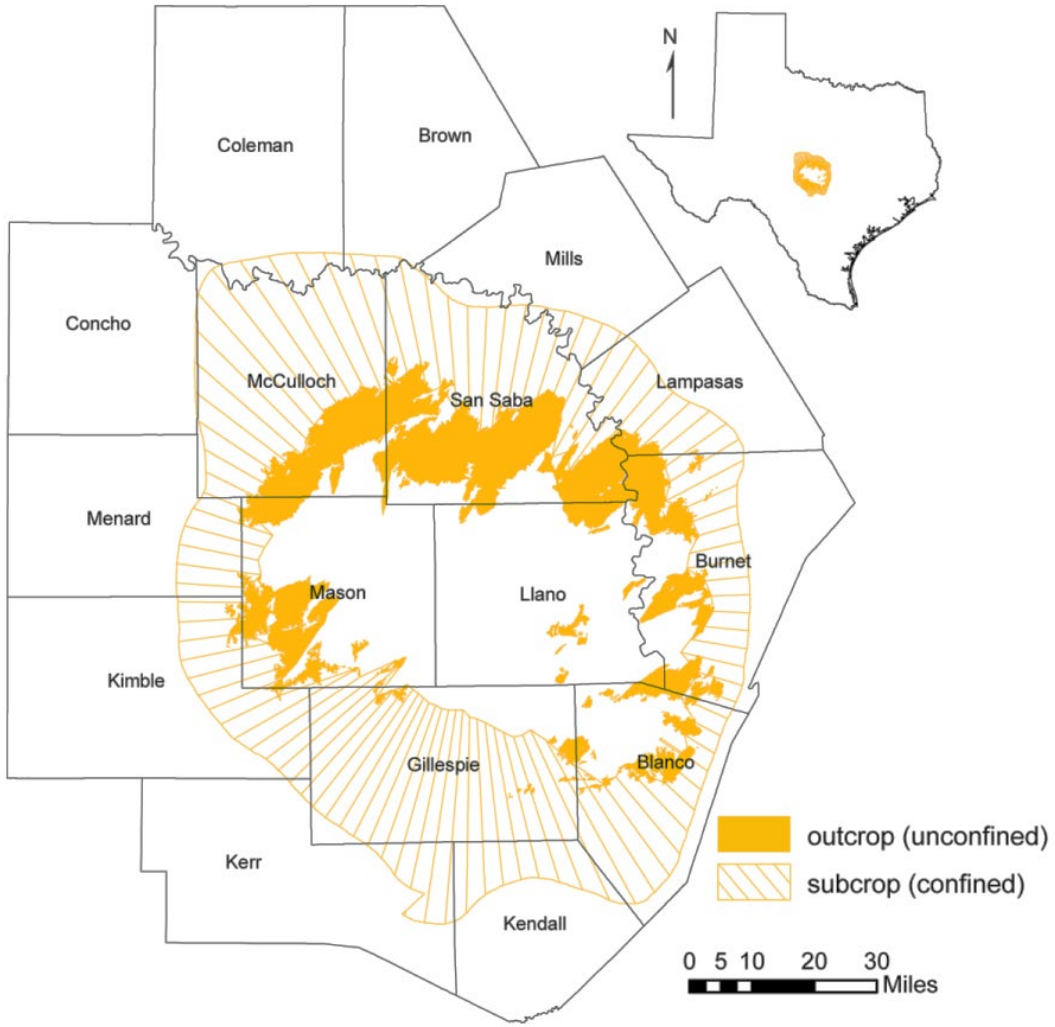
like a bank account

Outflows

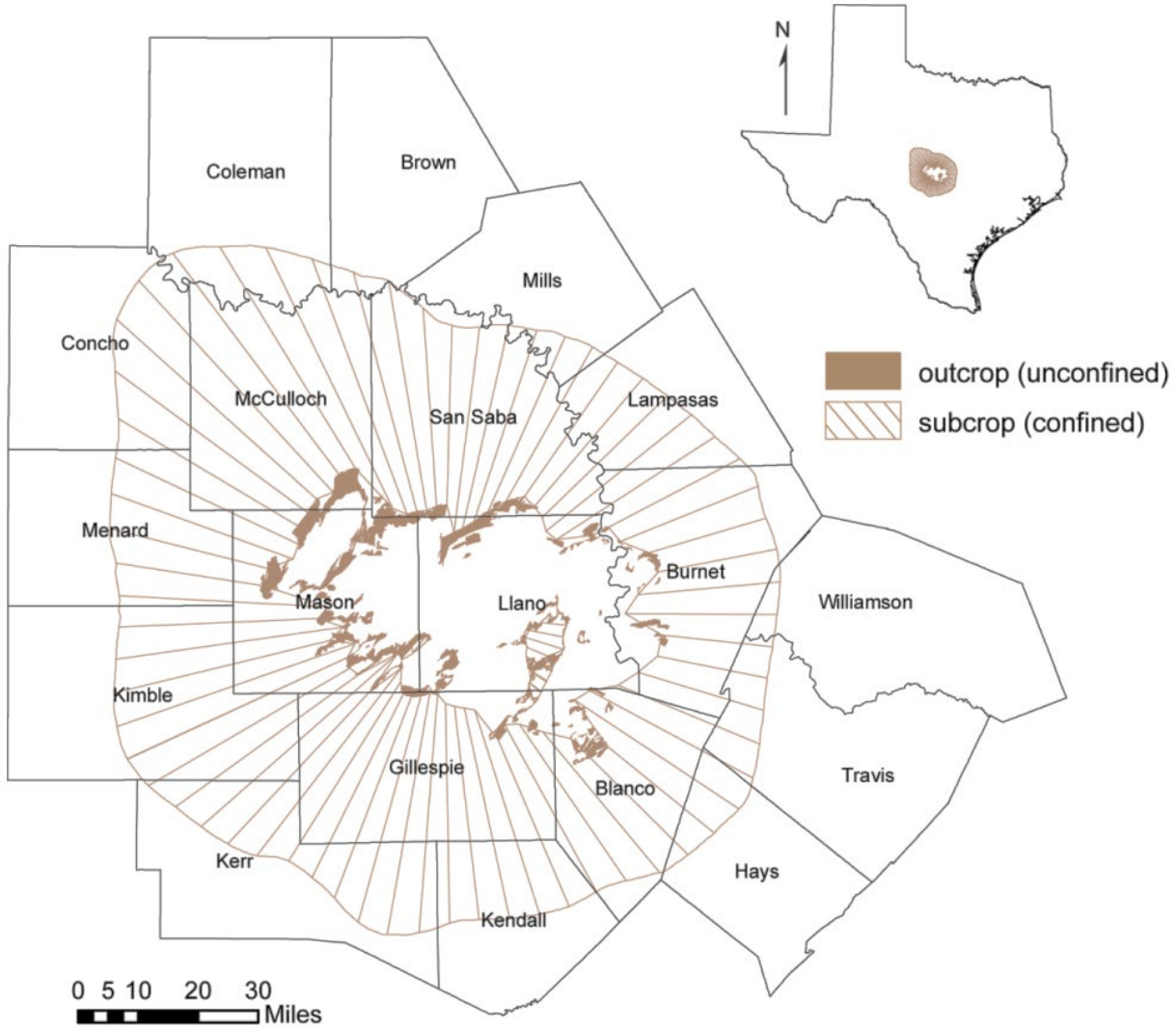
like spending

Kerr County Aquifers

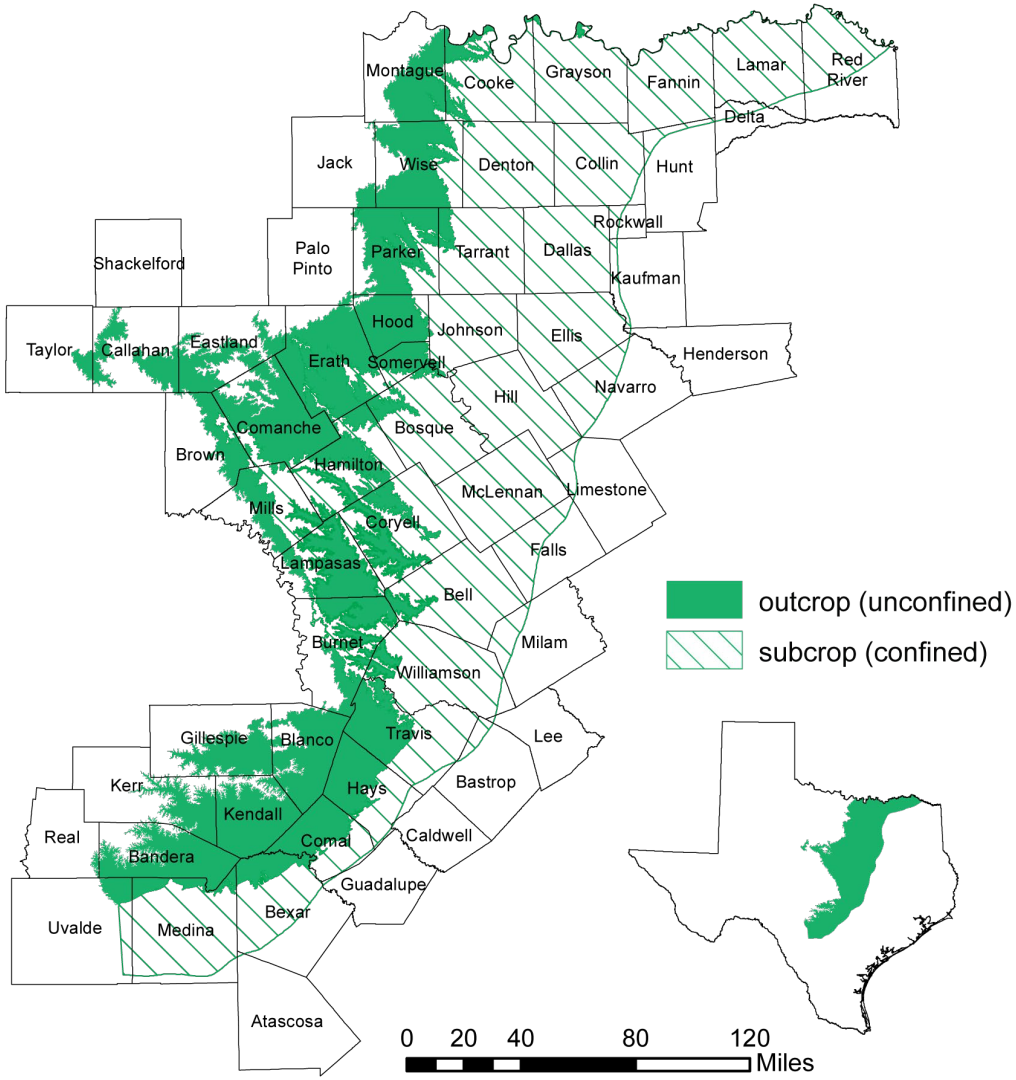
Ellenburger-San Saba Aquifer



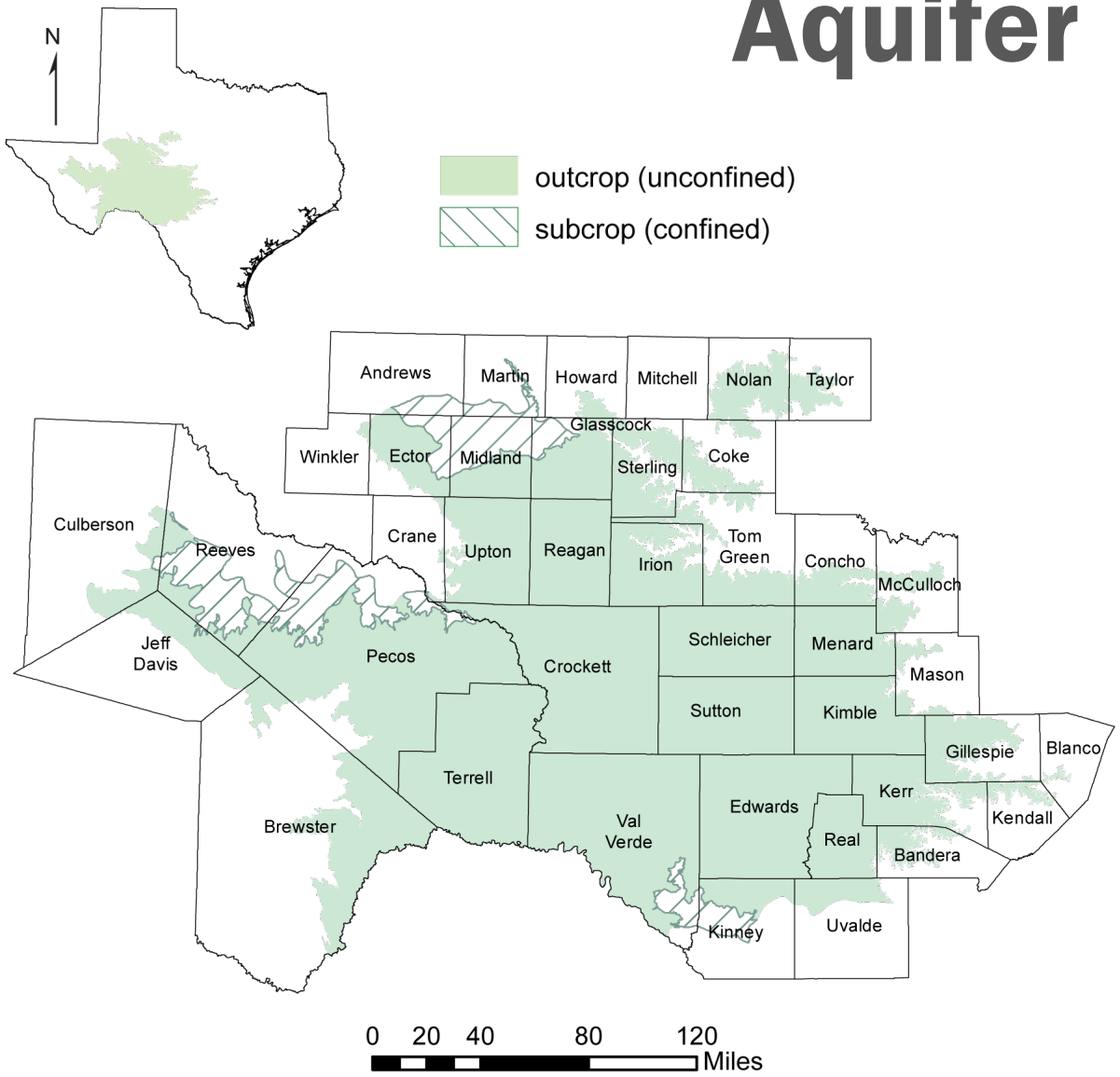
Hickory Aquifer



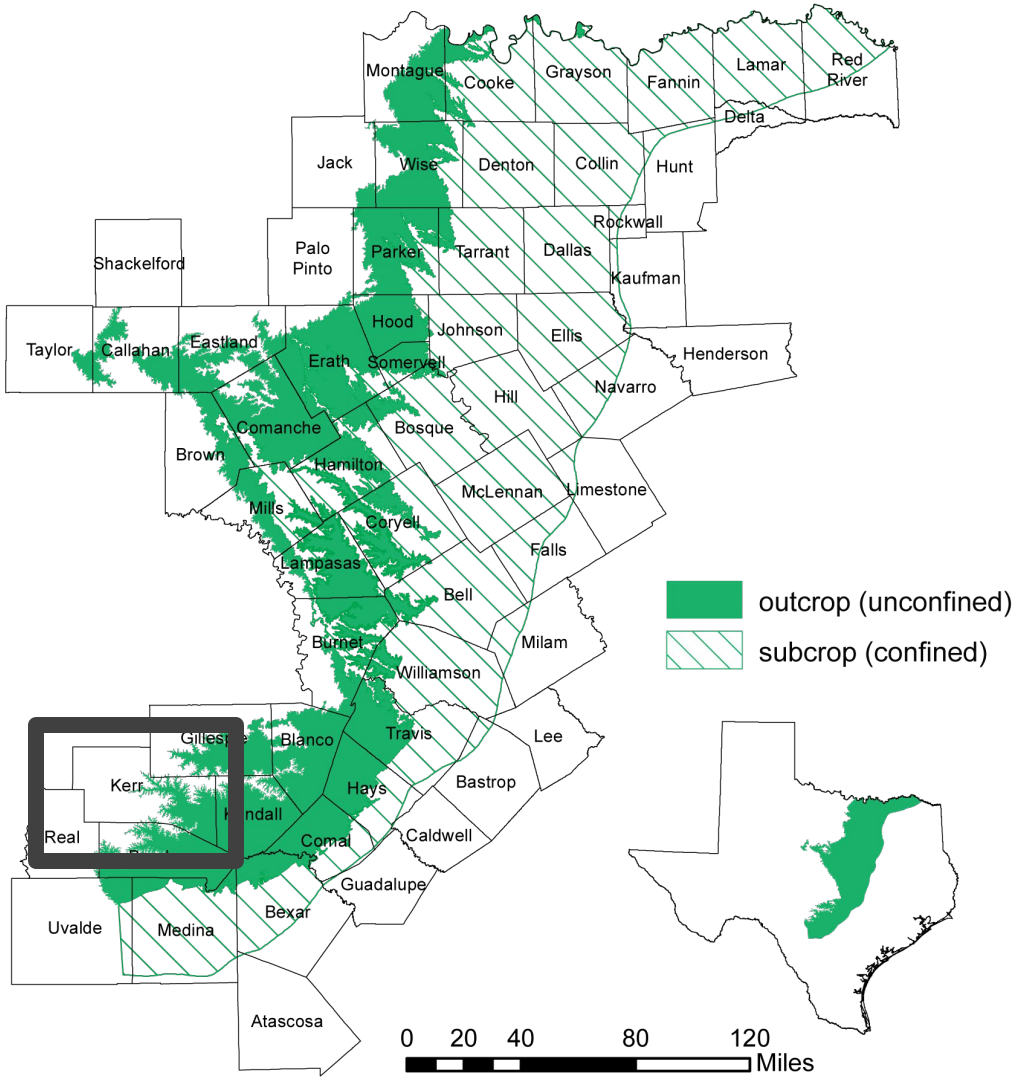
Trinity Aquifer



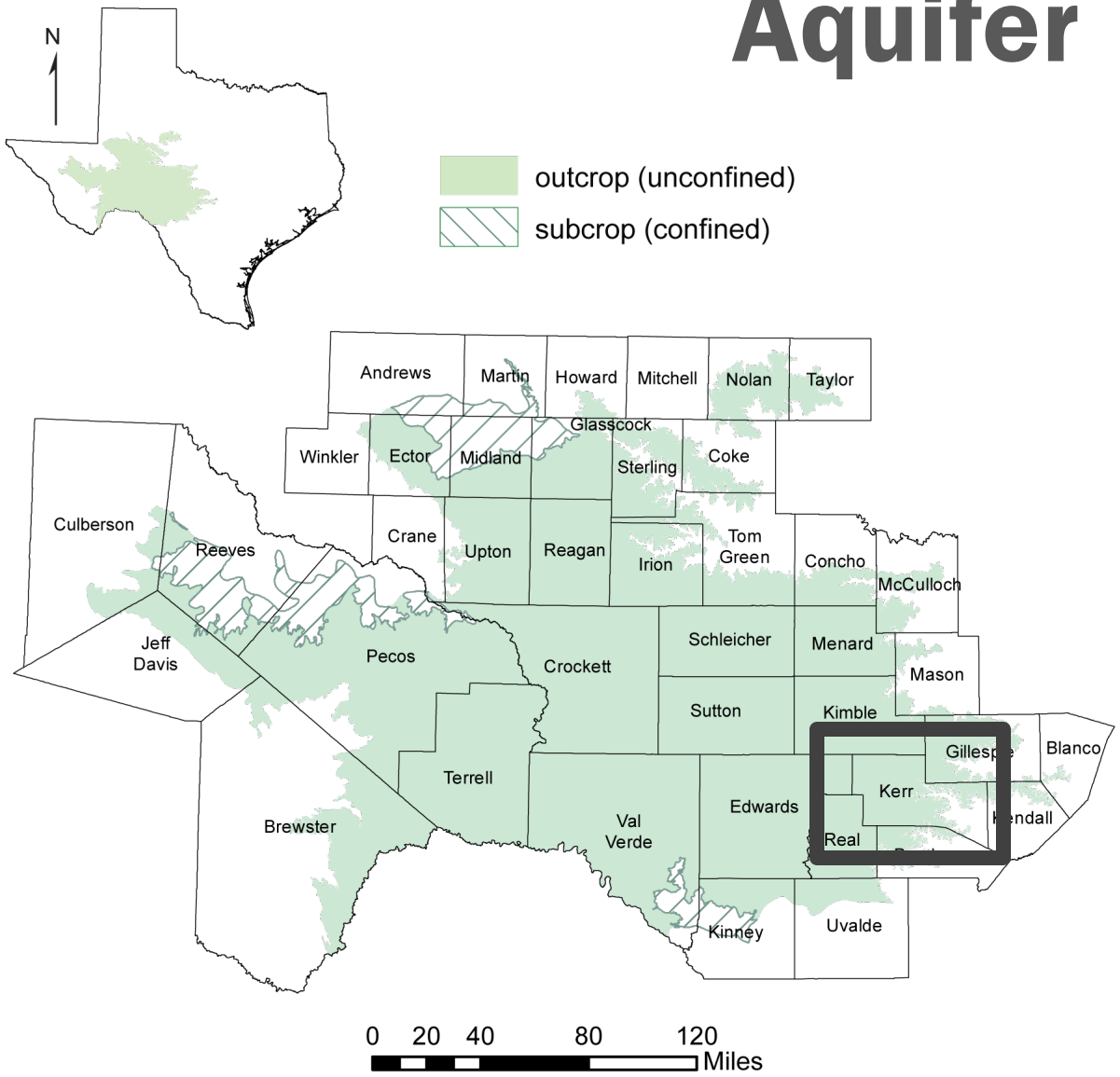
Edwards-Trinity (Plateau) Aquifer

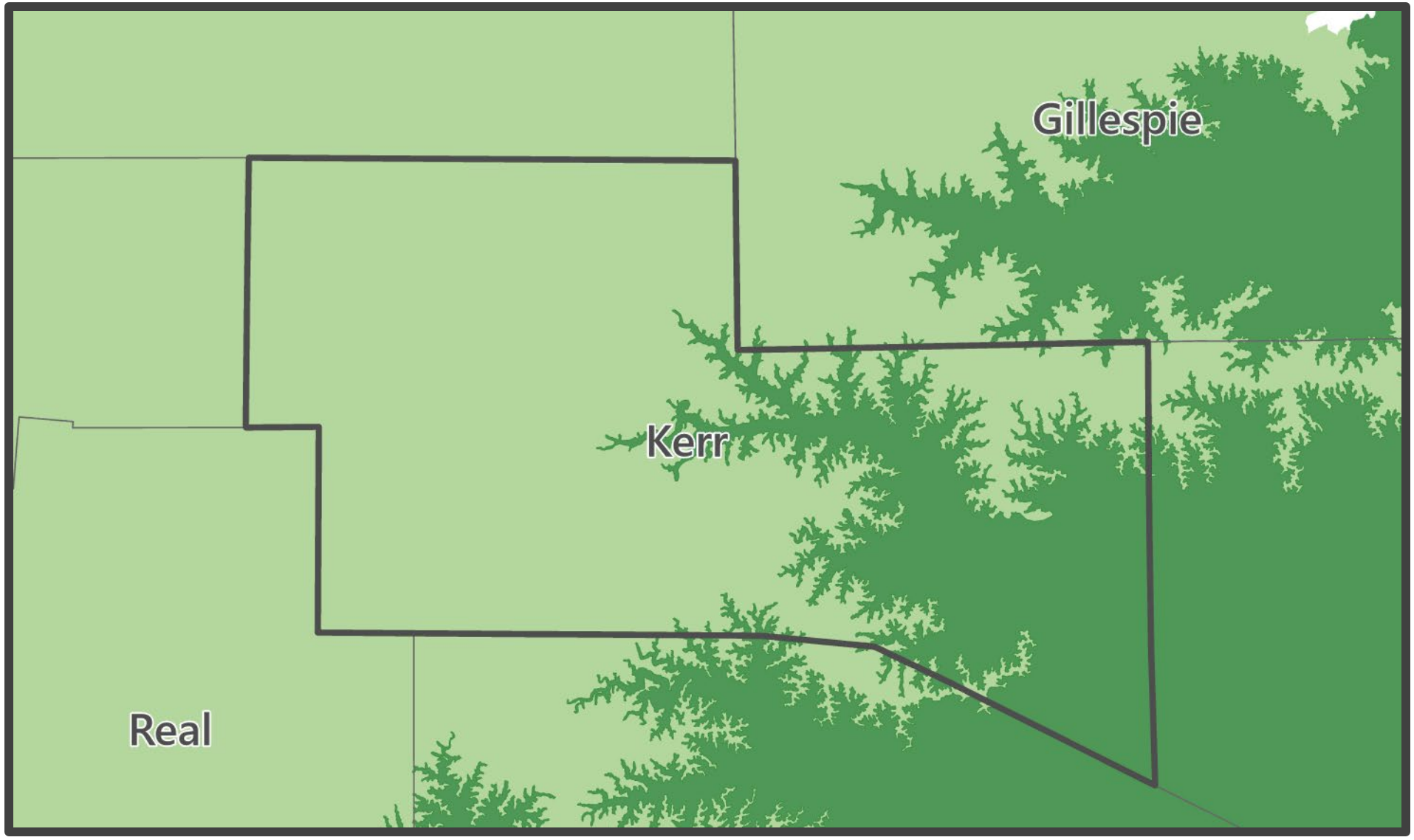


Trinity Aquifer



Edwards-Trinity (Plateau) Aquifer




Gillespie
Kerr
Real
Edwards-Trinity (Plateau)
Aquifer (outcrop/unconfined)
Trinity Aquifer
(outcrop/unconfined)

younger

older

ERA	SYSTEM	GROUP	STRATIGRAPHIC UNIT	HYDROLOGIC UNIT
Cenozoic	Quaternary		Alluvium	Alluvium
Mesozoic	Cretaceous	Edwards	Segovia Formation	Edwards Group
			Fort Terrett Formation	
		Trinity	Glen Rose Limestone: Upper Member	Trinity Aquifer System: Upper Trinity
			Glen Rose Limestone: Lower Member	Middle Trinity
			Hensell Sand/Bexar Shale	
			Cow Creek Limestone	
			Hammett Shale	confining unit
			Sligo Formation	Lower Trinity
			Sycamore Sand/Hosston Formation	
Paleozoic			Undifferentiated Pre-Cretaceous rock	

Modified diagram from www.twdb.texas.gov/groundwater/models/gam/trnt_h/TRNT_H_2009_Update_Model_Report.pdf

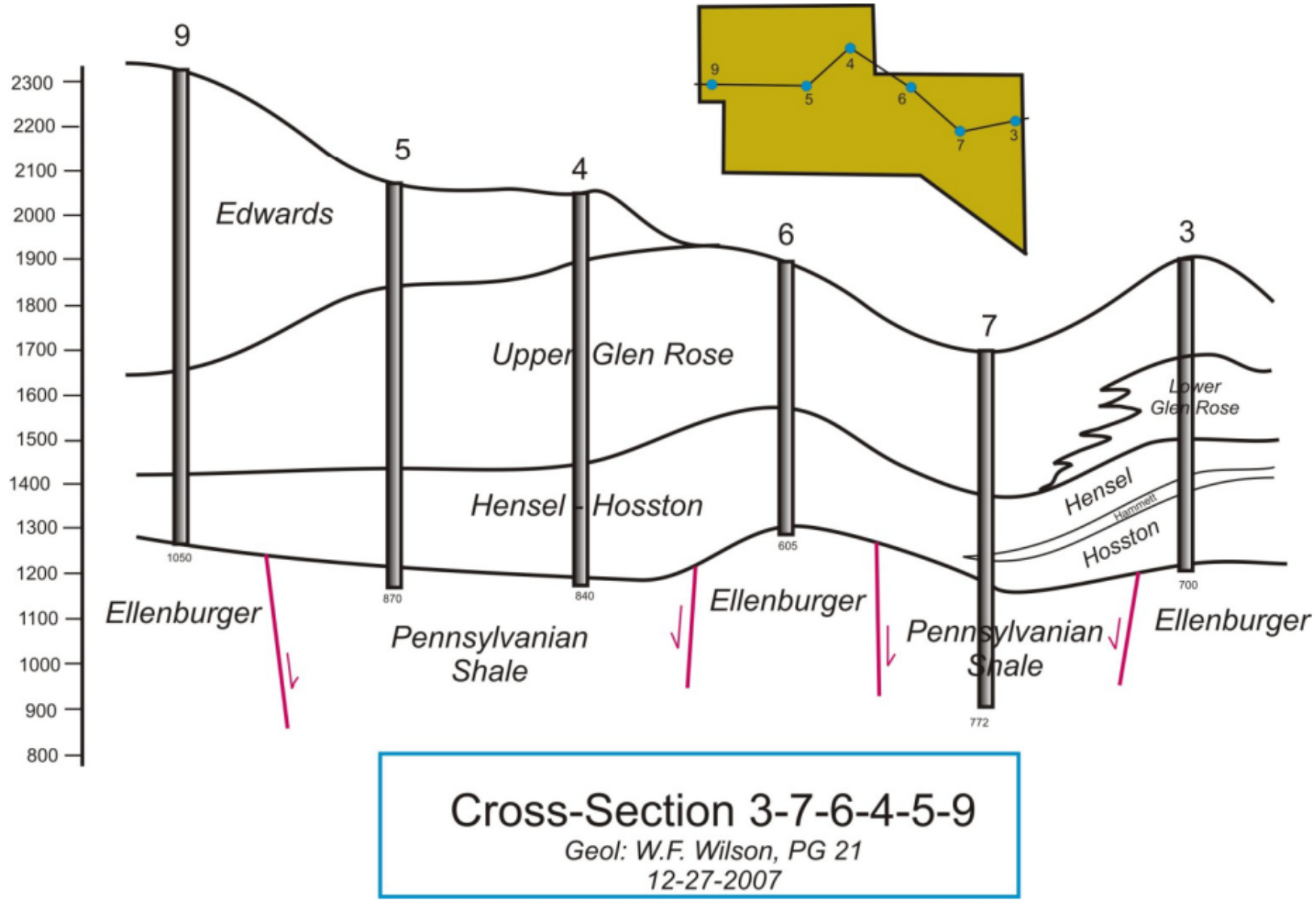
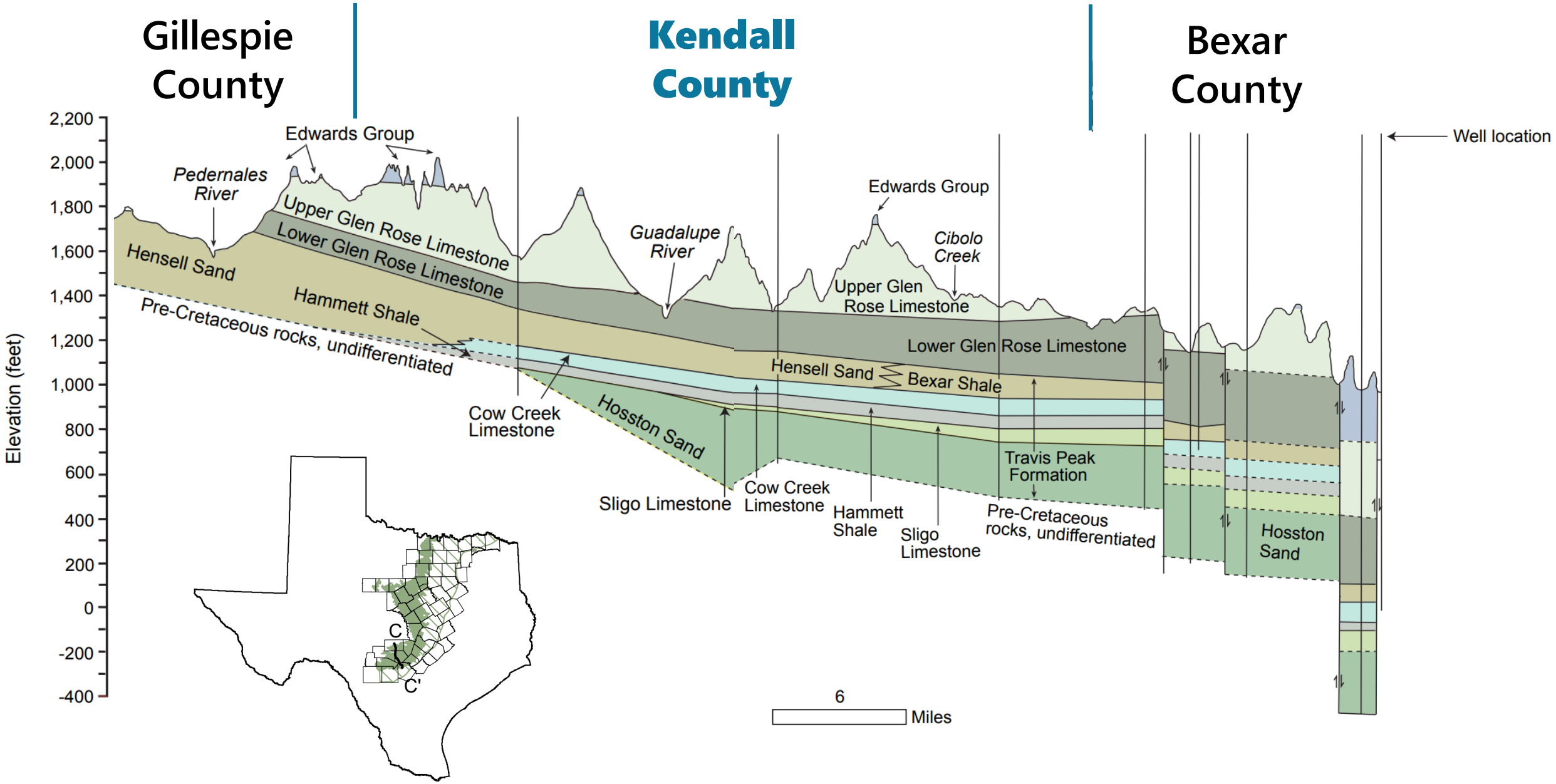


Diagram from https://hgcd.org/wp-content/uploads/2015/07/2008-Kerr-Hydrogeology-Report-.pdf



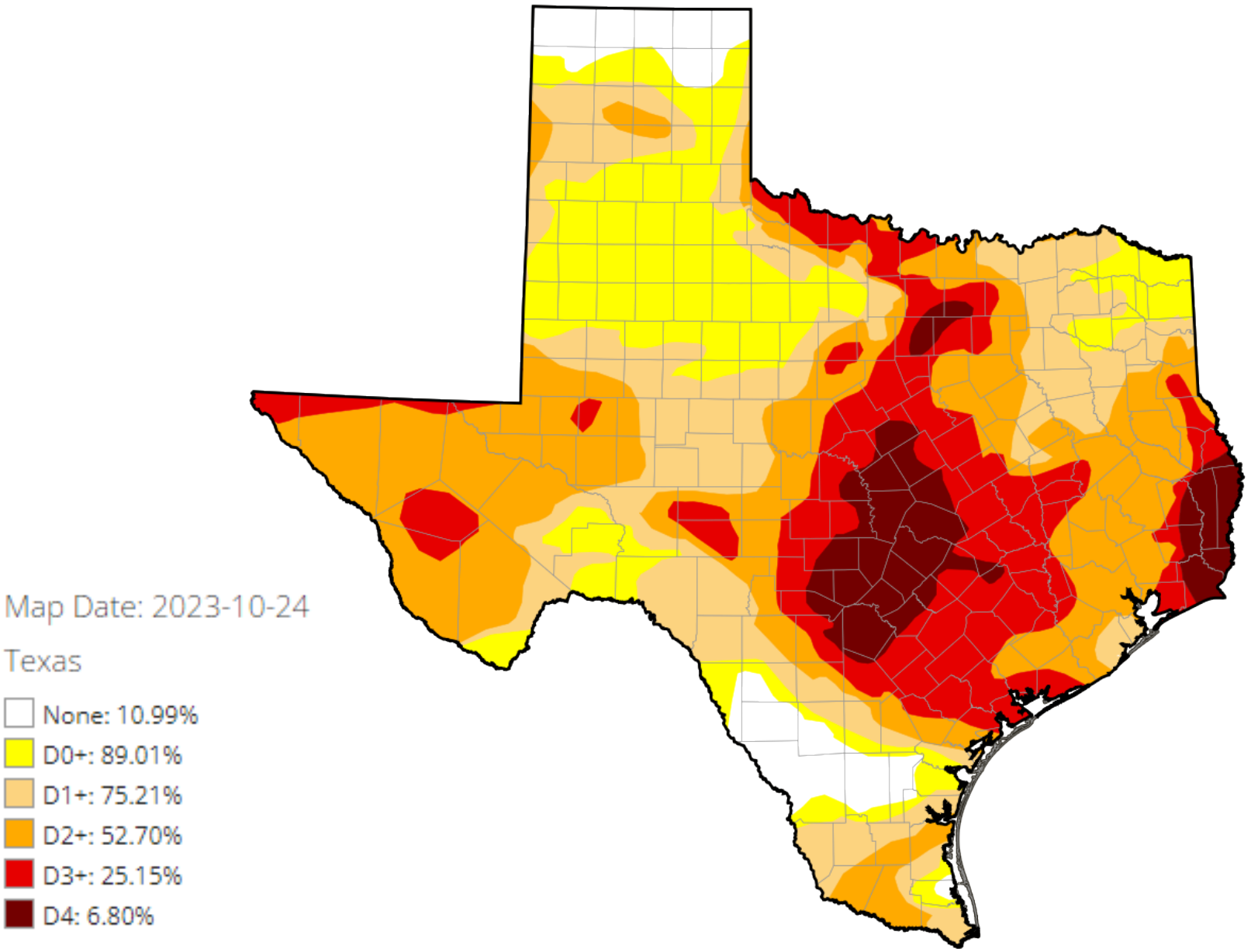
Modified diagram from www.twdb.texas.gov/publications/reports/numbered_reports/doc/R380_AquifersofTexas.pdf


29°33'40" N, 98°54'17" W
14127 FM1283
Mico, Texas
Google Street View
Sep 2023
See more dates
Edwards (BFZ) Aquifer
Edwards Limestone
Google
Image capture: Sep 2023
© 2023 Google
United States
Terms
Privacy
Report a problem


me, Texas
Street View
See more dates
Edwards-Trininty (Plateau) Aquifer
Fort Terrett Formation
Google
Image capture: Apr 2023 © 2023 Google United States Terms Privacy Report


5204 Farm To Market Rd 2722
Upper Trinity aquifer
Upper Glen Rose
Limestone
5204 Farm To Market Rd 2722
Canyon Lake, Texas
Google Street View
Mar 2023
See more dates
Google
Image capture: Mar 2023 © 2023 Google United States Terms Privacy Report a problem


Search Google Maps
FM306
Spring Branch, Texas
Google Street View
May 2023
See more dates
Middle Trinity aquifer
Lower Glen Rose Limestone
WEICHERT REALTORS
Google


Map Date: 2023-10-24
Texas
None: 10.99%
D0+: 89.01%
D1+: 75.21%
D2+: 52.70%
D3+: 25.15%
D4: 6.80%

Groundwater response to drought

Increased pumping → water level declines

Correlate observations with dry condition periods

Differences in aquifer sensitivity

Water levels and spring discharges – changes on variable timescales

Tools to track GW response

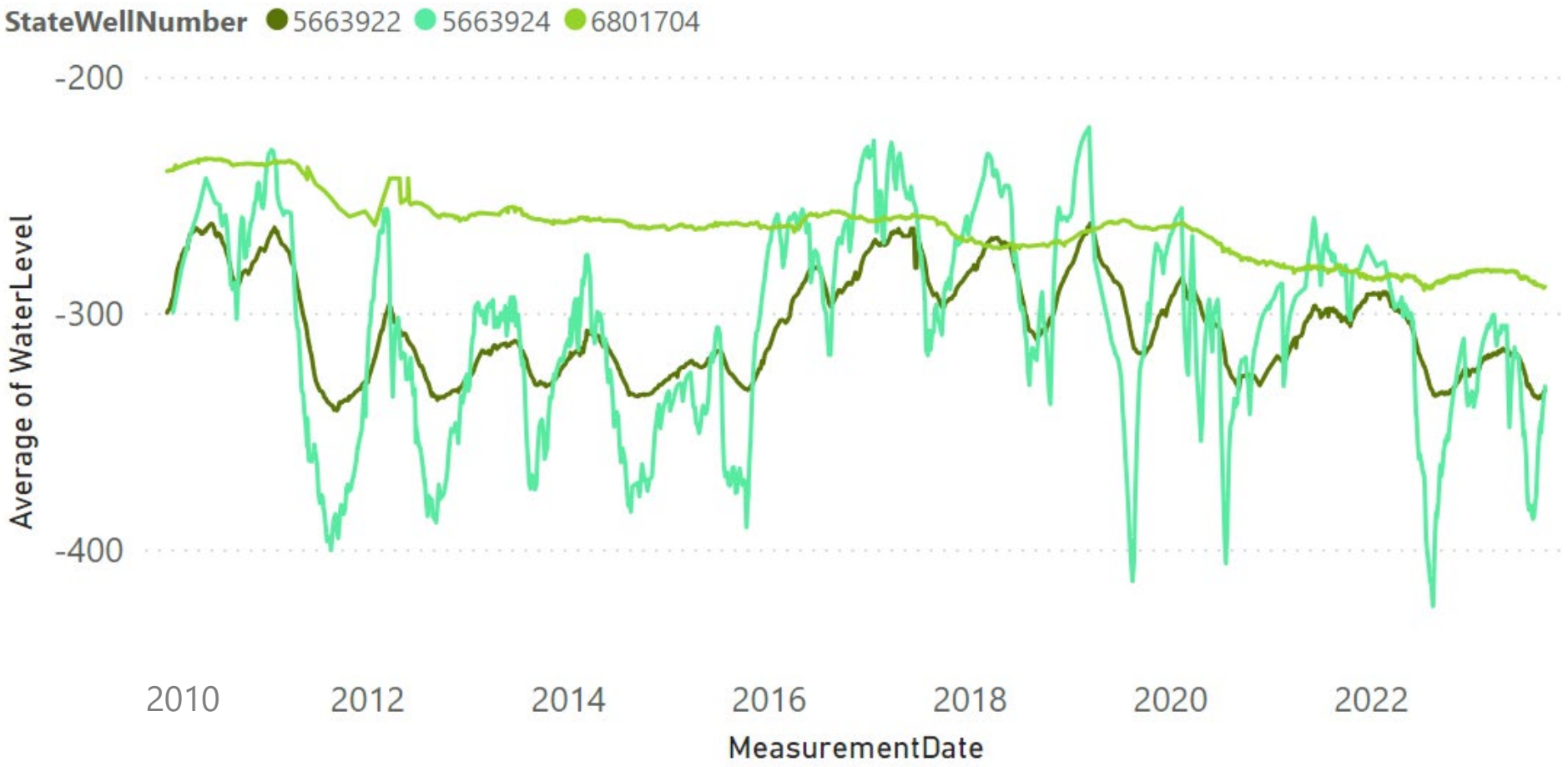
Average water level changes

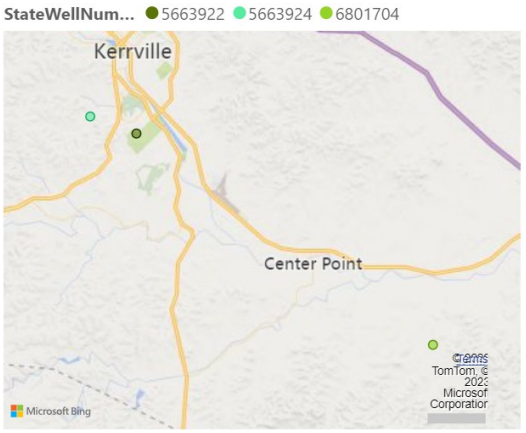
Hydrographs

Drought indicator wells and springs

Trinity Aquifer (Hosston Formation) Wells

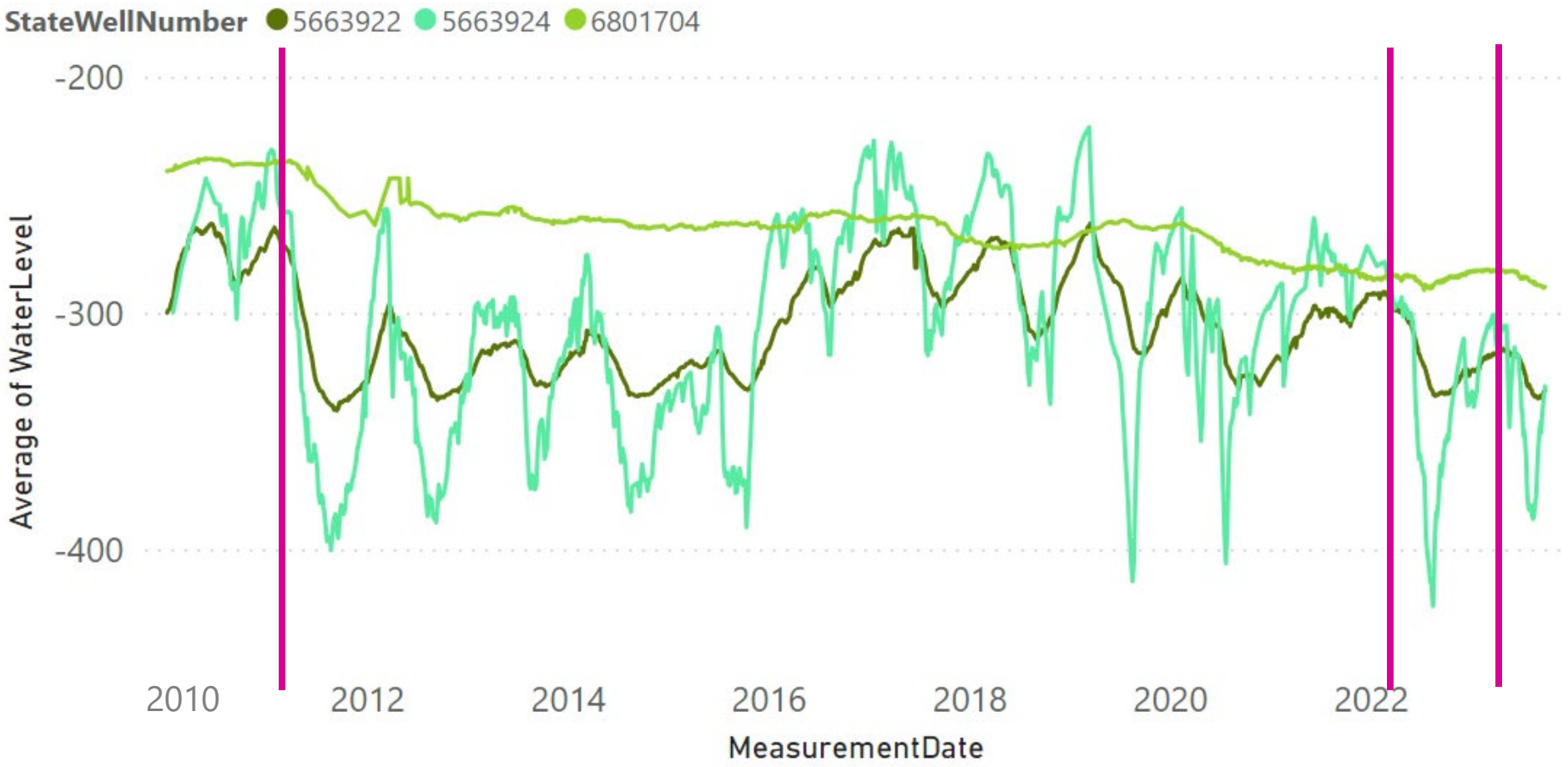
Water level trends since 2010 in Kerr County

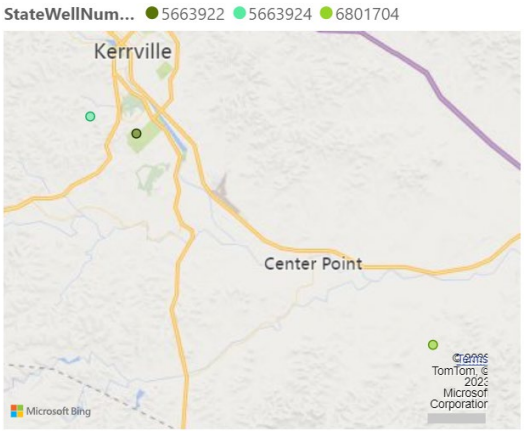




Trinity Aquifer (Hosston Formation) Wells

Water level trends since 2010 in Kerr County





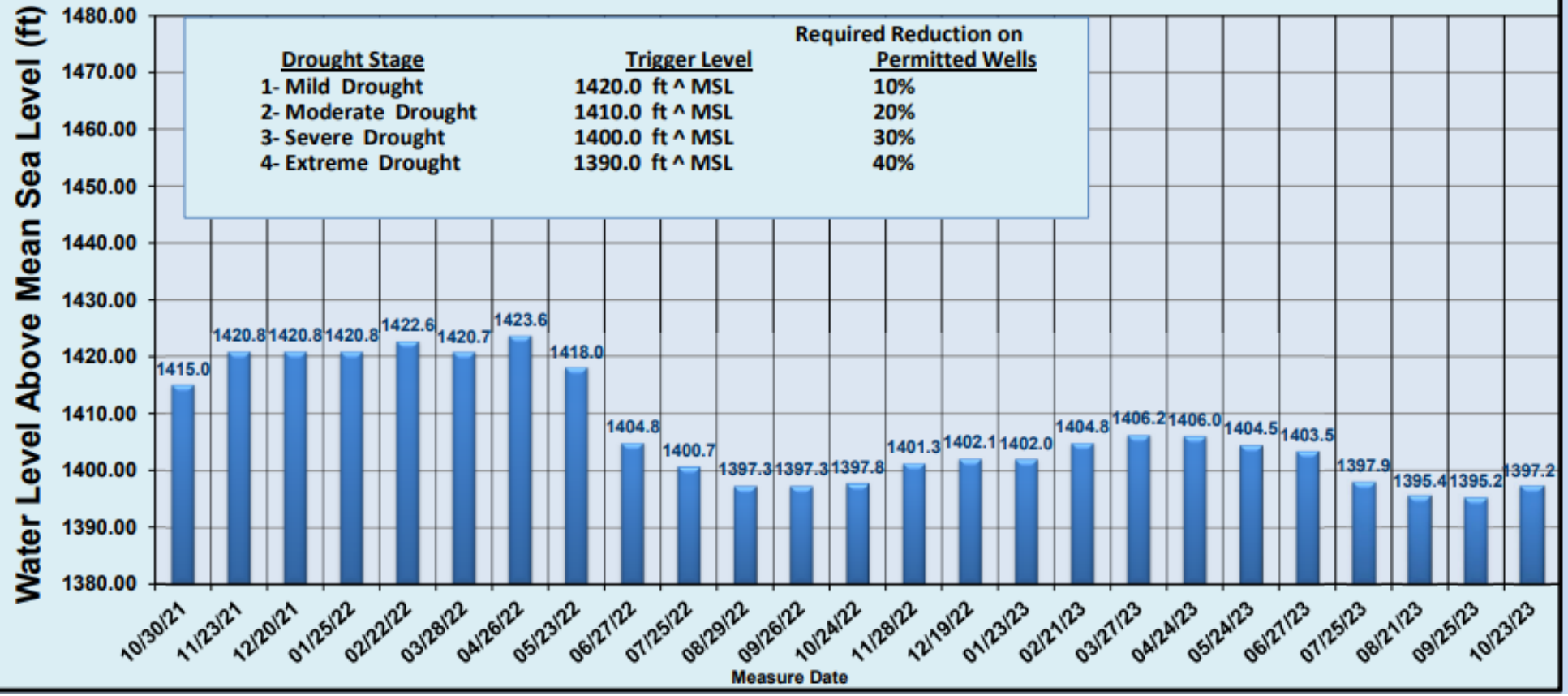
Headwaters Groundwater Conservation District Drought Index

DROUGHT INDEX FOR Oct-23	Drought Index Well Group	Measure Date	Surface Elev.	Current Depth to Water Oct 2023	Static	Previous Depth to Water Sept 2023	Monthly Difference
	HGCD MW#7 MT	10/26/23	1651.00	324.62	1326.38	326.65	2.03
	HGCD MW#11 MT	10/23/23	1703.00	333.97	1369.03	336.69	2.72
	Ag Barn	10/24/23	1590.00	231.10	1358.90	236.38	5.28
	HGCD MW#5 MT	10/25/23	2073.00	538.64	1534.36	538.44	-0.20
	Avg Water Level Above MSL				1397.17		
	Difference from Previous Month				1.96		

https://hgcd.org/wp-content/uploads/2023/10/October-Drought-Index-Water-Levels-2023-New-MW5.pdf

Headwaters Groundwater Conservation District Drought Index

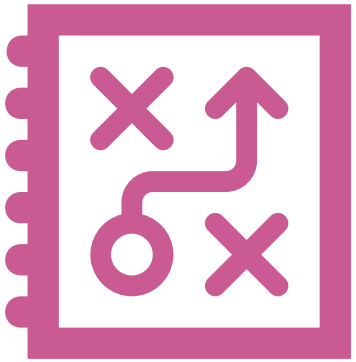
This chart is an average of four wells' water level above mean sea level. The wells consist of Monitor Well 7 Middle Trinity, Monitor Well 11 Middle Trinity, Kerr County Ag Barn, and Monitor Well 5*. Headwaters averages the water levels of these four wells to trigger drought stages. We also take into consideration the Palmer Drought Severity Index and the flow rate of the Guadalupe River in Kerrville.



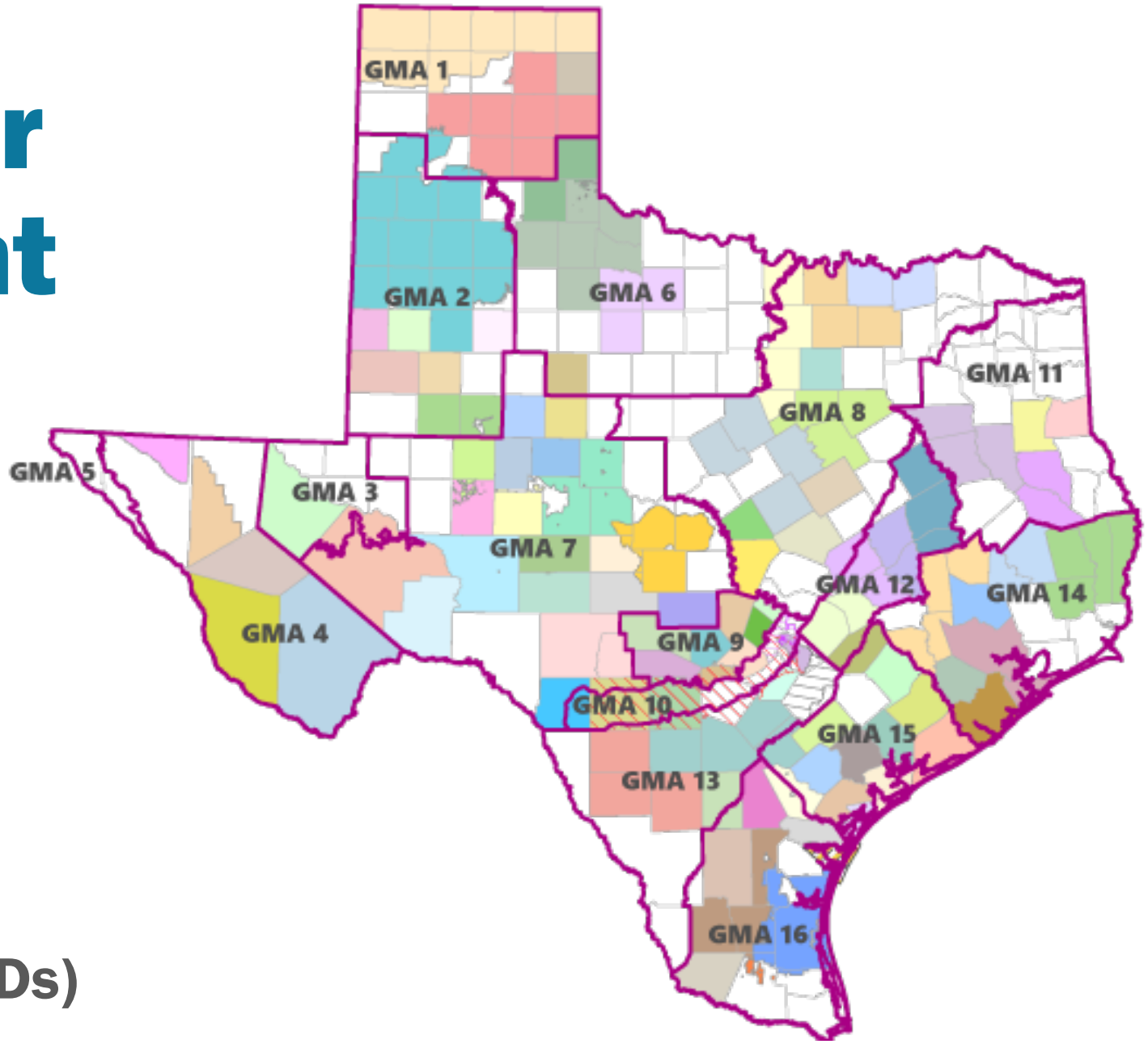
Date	Average Water Level Above MSL
Oct-21	1414.99
Nov-21	1420.78
Dec-21	1420.80
Jan-22	1420.82
Feb-22	1422.65
Mar-22	1420.73
Apr-22	1423.59
May-22	1418.03
Jun-22	1404.82
Jul-22	1400.70
Aug-22	1397.31
Sep-22	1397.29
Oct-22	1397.80
Nov-22	1401.30
Dec-22	1402.08
Jan-23	1402.02
Feb-23	1404.79
Mar-23	1406.20
Apr-23	1406.02
May-23	1404.46
Jun-23	1403.46
Jul-23	1397.87
Aug-23	1395.43
Sep-23	1395.21
Oct-23	1397.17

https://hgcd.org/wp-content/uploads/2023/10/October-Drought-Index-Water-Levels-2023-New-MW5.pdf

Joint Groundwater Planning



Groundwater management areas (GMAs)

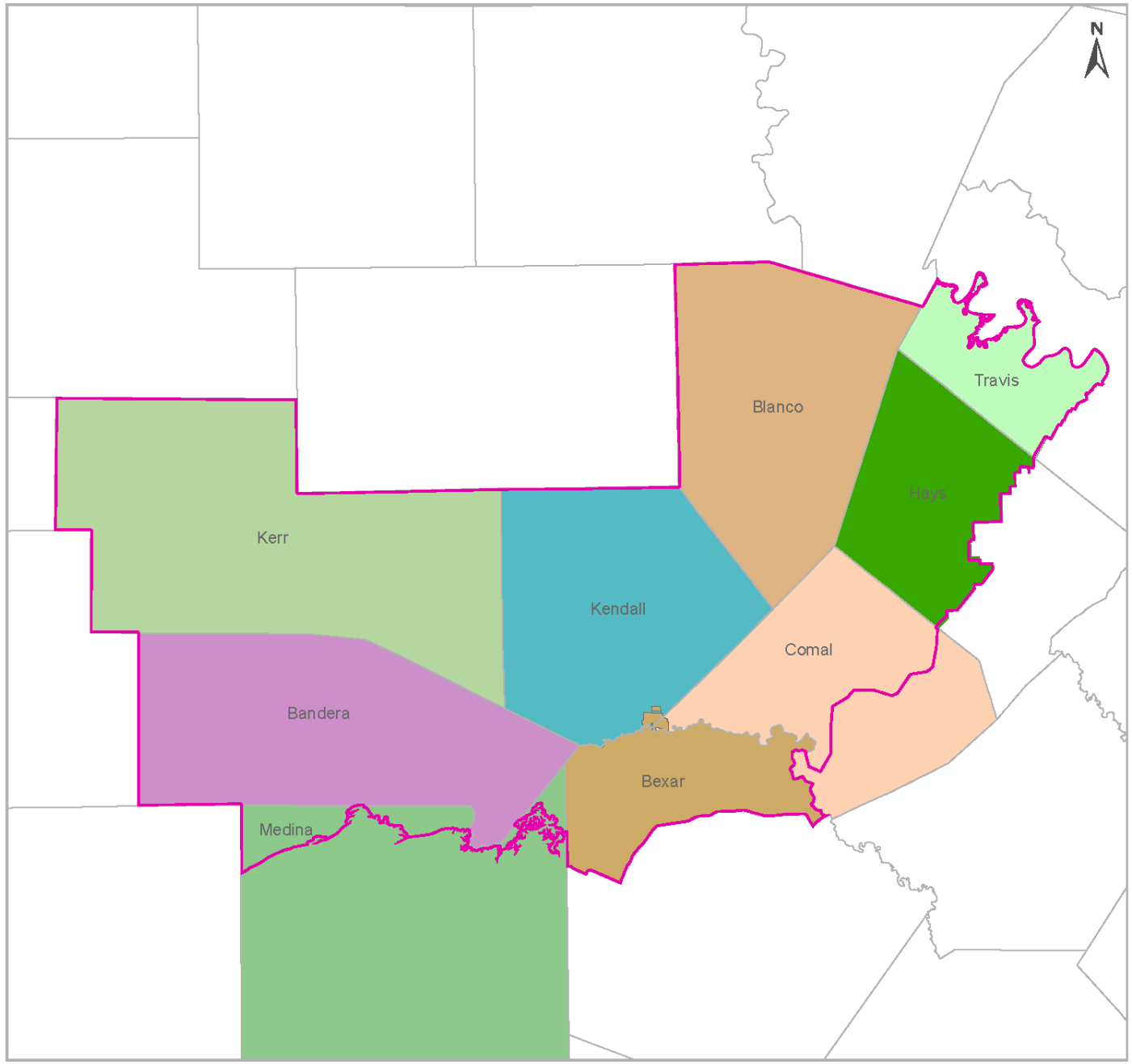


Groups of groundwater conservation district (GCDs)

GMAs, GAMs, MAGs…OMG!

GCD	Groundwater conservation district
GMA	Groundwater management area
DFC	Desired future condition
TWDB	Texas Water Development Board
GAM	Groundwater availability model
MAG	Modeled available groundwater

Groundwater Management Area 9



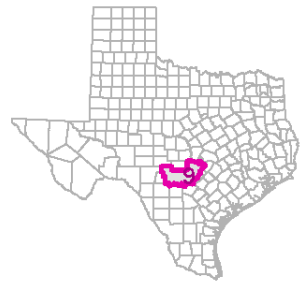
Groundwater Management Areas

Counties

Groundwater Conservation Districts

- Bandera County River Authority & Ground Water District
- Blanco-Pedernales GCD
- Comal Trinity GCD
- Cow Creek GCD
- Hays Trinity GCD
- Headwaters UWCD
- Medina County GCD
- Southwestern Travis County GCD
- Trinity Glen Rose GCD

Updated 5/20/2021

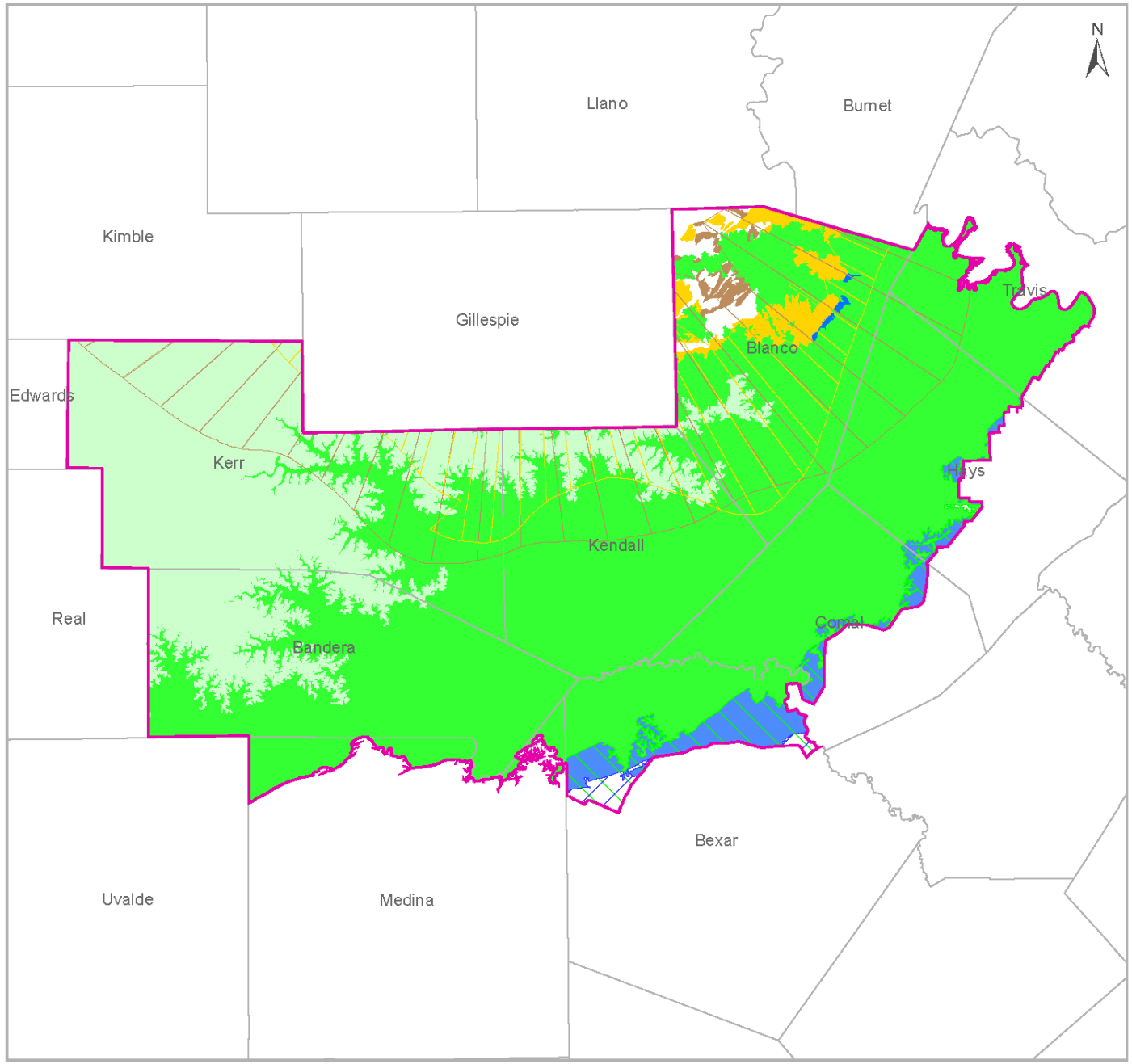


0 105 210 420 630 840

Miles

1 inch = 505 miles

Groundwater Management Area 9



- Groundwater Management Areas
- Counties

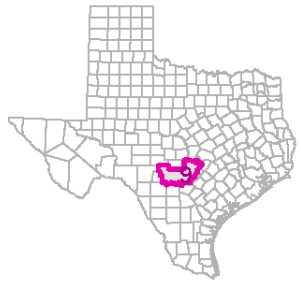
Major Aquifers

- Edwards - Trinity Plateau (outcrop)
- Edwards BFZ (outcrop)
- Edwards BFZ (subcrop)
- Trinity (outcrop)
- Trinity (subcrop)

Minor Aquifers

- Marble Falls
- Ellenburger - San Saba (outcrop)
- Ellenburger - San Saba (subcrop)
- Hickory (outcrop)
- Hickory (subcrop)

Updated 4/11/2022



0 105 210 420 630 840
Miles

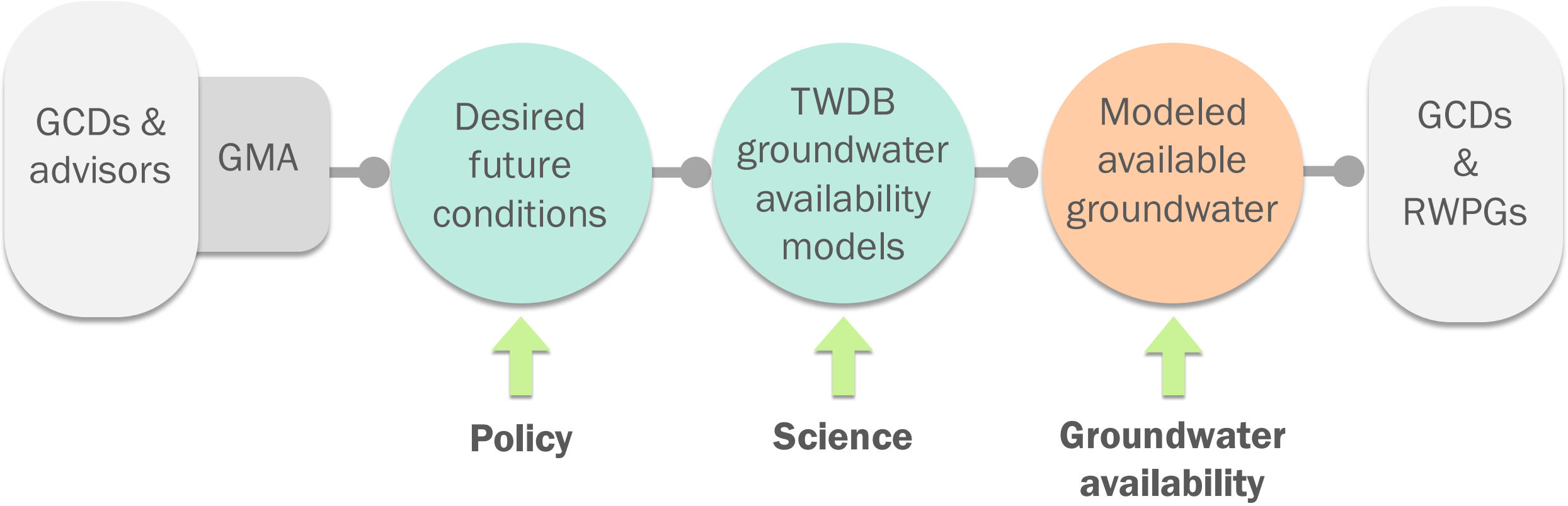
1 inch = 505 miles

What is joint planning?

- District representatives in a GMA meet at least annually to:
  - conduct joint planning
  - propose to adopt new or amended desired future conditions
  - review management plans and GMA accomplishments

Texas Water Code § 36.108

Joint groundwater planning



Desired future conditions

DFCs

Broad policy goal

Quantitative description

Updated at least every 5 years

Used to determine future groundwater availability

Drawdown, springflow, storage volume, etc.

May be established for:

- aquifer
- aquifer subdivision
- geologic strata
- geographic area

GMA 9 DFCs

Aquifer	Desired Future Condition (DFC)	Date DFC Adopted
Edwards Group of the Edwards-Trinity (Plateau)	No net increase in average drawdown in Kendall and Bandera counties through 2080 [no average water level decline in 2080, as compared to 1997 water levels]	11/15/2021
Ellenburger-San Saba	Increase in average drawdown of no more than 7 feet in Kendall County through 2080 [average water level decline of no more than 7 feet in 2080, as compared to 2010 water levels]	11/15/2021
Hickory	Increase in average drawdown of no more than 7 feet in Kendall County through 2080 [average water level decline of no more than 7 feet in 2080, as compared to 2010 water levels]	11/15/2021
Trinity	Increase in average drawdown of approximately 30 feet through 2060 [no more than 30 feet of average water level decline in 2060, as compared to 2008 water levels]	11/15/2021

GMA 9 DFCs

Aquifer	Desired Future Condition (DFC)	Date DFC Adopted
Edwards Group of the Edwards-Trinity (Plateau)	[illegible]	11/15/2021
Ellenburger-San Saba	Increase in average drawdown of no more than 7 feet in Kendall County through 2080 [average water level decline of no more than 7 feet in 2080, as compared to 2010 water levels]	11/15/2021
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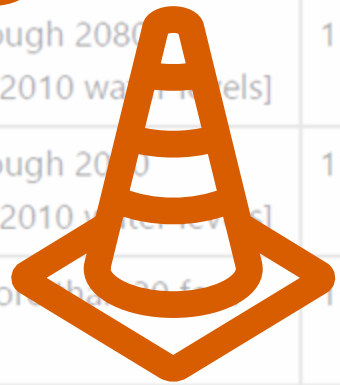
Trinity	Increase in average drawdown of approximately 30 feet through 2060 [no more than 30 feet of average water level decline in 2060, as compared to 2008 water levels]	11/15/2021

New DFCs coming in 2026



Why DFCs matter

Districts must manage production to achieve desired future conditions

A criteria for GCD planning and rule making

Results in modeled available groundwater that can be used to evaluate permit applications

Why DFCs matter

MAGs = water availability components that feed into regional water plans and state water plan

Influence policy and resource management decisions that affect water that Texans use

What is the DFC Process?


GMA proposes to adopt DFCs
by May 1, 2026
90-day public comment period
Each district has a public hearing
GMA adopts DFCs
by January 5, 2027
GMA submits explanatory report to TWDB
with model files

Joint planning meetings leading up to DFC proposal

★ Good time for stakeholder involvement is now, at the beginning of joint planning round, far before any DFC proposals happen

GMA proposes to adopt DFCs
by May 1, 2026

9 factors

Aquifer uses and conditions	Environmental impacts	Property rights
State water plan	Land subsidence	Feasibility
Hydrologic conditions	Socioeconomics	Any other information

GMA proposes to adopt DFCs
by May 1, 2026

A balancing act

Highest practicable level of groundwater production

Conservation, preservation, protection, recharging, prevention of waste of groundwater, and control of subsidence

GMA proposes to adopt DFCs
by May 1, 2026

Assessing DFC scenarios

GMAs often hire consultants to use groundwater availability models to assess various DFC scenarios

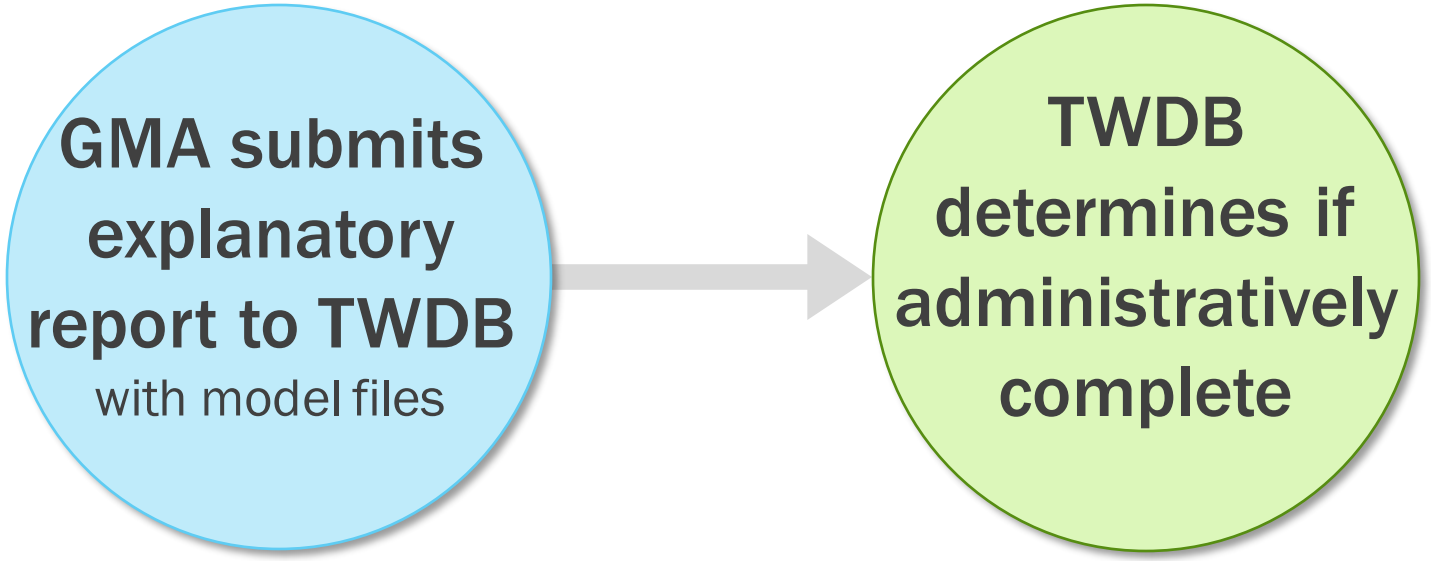
★ Active participation in the process could get a scenario you want to see on the decision table.

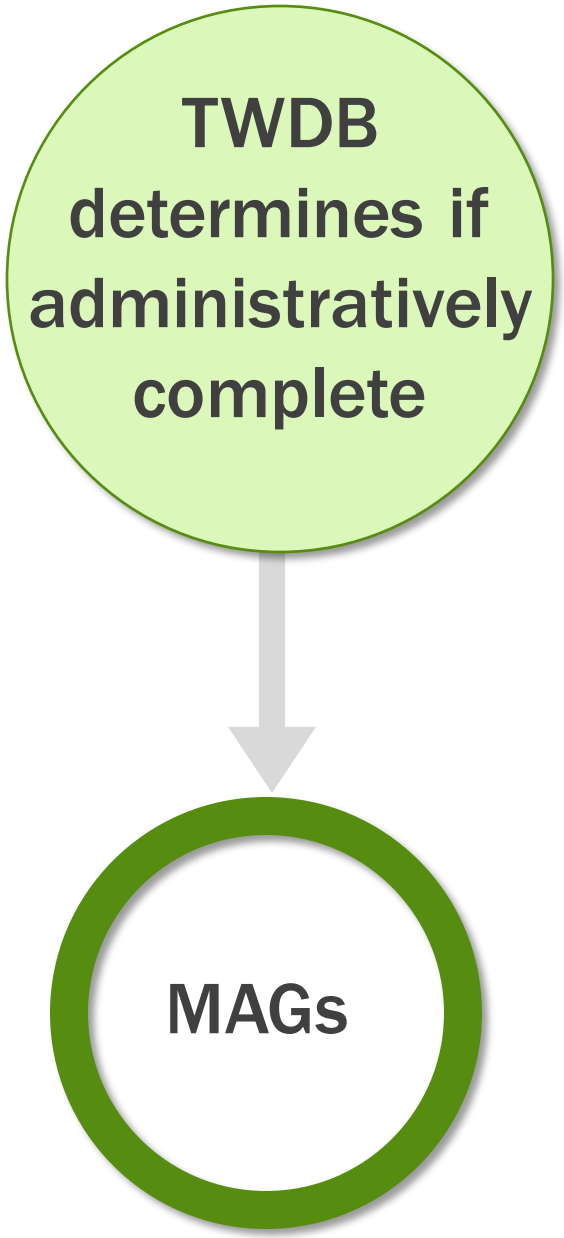
GMA submits explanatory report to TWDB with model files

DFC Explanatory Report

Needs to include

- Each desired future condition
- Policy and technical justification
- Consideration of 9 factors
- Other desired future conditions considered
- Public comments
- Non-relevant aquifer documentation


GMA submits explanatory report to TWDB
with model files
TWDB determines if administratively complete


TWDB determines if administratively complete
MAGs

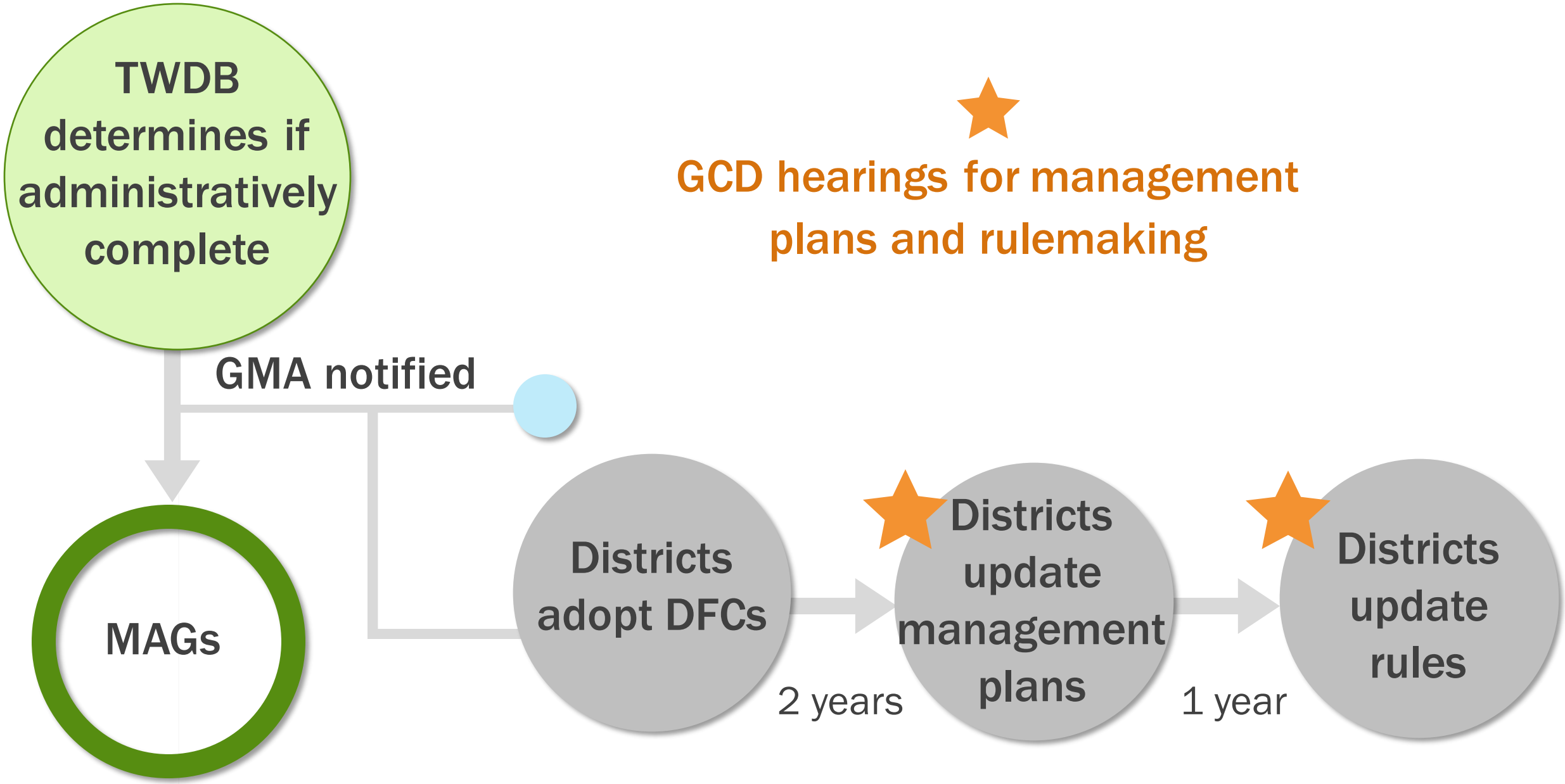
Modeled available groundwater

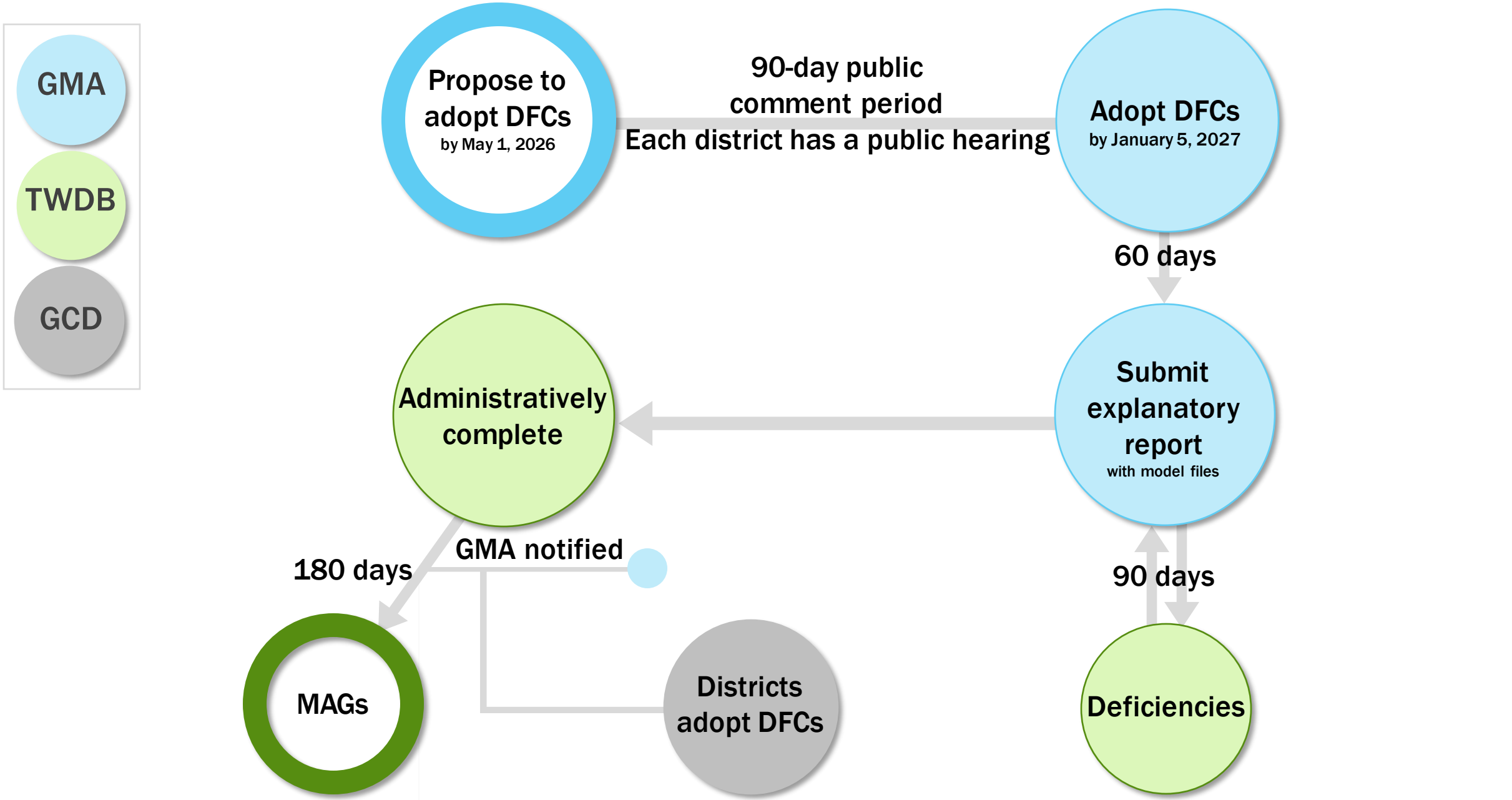
MAG

Amount of water that may be produced on an average annual basis to achieve a desired future condition

Calculated by the TWDB using GAMs

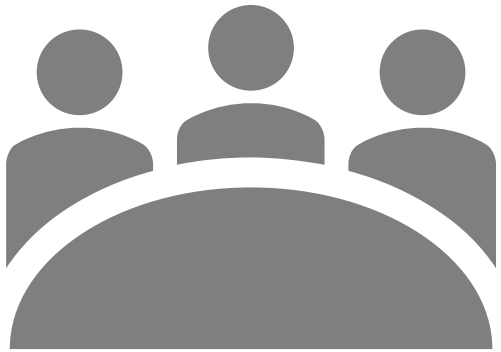
Provided to regional water planning areas as groundwater availability


TWDB determines if administratively complete
GCD hearings for management plans and rulemaking
GMA notified
MAGs
Districts adopt DFCs
2 years
Districts update management plans
1 year
Districts update rules


GMA
TWDB
GCD
Propose to adopt DFCs
by May 1, 2026
90-day public comment period
Each district has a public hearing
Adopt DFCs
by January 5, 2027
60 days
Submit explanatory report
with model files
90 days
Deficiencies
Administratively complete
GMA notified
180 days
MAGs
Districts adopt DFCs

Groundwater Management

Who does what?



hillcountryalliance.org/wp-content/uploads/2023_HCA_ManagingGroundwater_Paper.pdf

Groundwater conservation districts

GCDs

Sec. 36.0015. PURPOSE. (a) In this section, "best available science" means conclusions that are logically and reasonably derived using statistical or quantitative data, techniques, analyses, and studies that are publicly available to reviewing scientists and can be employed to address a specific scientific question.

(b) In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution, groundwater conservation districts may be created as provided by this chapter. Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management in order to protect property rights, balance the conservation and development of groundwater to meet the needs of this state, and use the best available science in the conservation and development of groundwater through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter.

SUBCHAPTER D. POWERS AND DUTIES

Sec. 36.101. RULEMAKING POWER. (a) 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. In adopting a rule under this chapter, a district shall:

(1) consider all groundwater uses and needs;

(2) develop rules that are fair and impartial;

(3) consider the groundwater ownership and rights described by Section 36.002;

(4) consider the public interest in conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and in controlling subsidence caused by withdrawal of groundwater from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution;

(5) consider the goals developed as part of the district's management plan under Section 36.1071; and

(6) not discriminate between land that is irrigated for production and land that was irrigated for production and enrolled or participating in a federal conservation program.

(f) The district shall adopt rules necessary to implement the management plan. Prior to the development of the management plan and its approval under Section 36.1072, the district may not adopt rules other than rules pertaining to the registration and interim permitting of new and existing wells and rules governing spacing and procedure before the district's board; however, the district may not adopt any rules limiting the production of wells, except rules requiring that groundwater produced from a well be put to a nonwasteful, beneficial use. The district may accept applications for permits under Section 36.113, provided the district does not act on any such application until the district's management plan is approved as provided in Section 36.1072.

(g) The district shall adopt amendments to the management plan as necessary. Amendments to the management plan shall be adopted after

Fundamental mandate

Balance protection of property rights, conservation, and development of groundwater using best-available science

HEADWATERS GROUNDWATER CONSERVATION DISTRICT

DISTRICT GROUNDWATER MANAGEMENT PLAN

REVISED DECEMBER 8, 2021

AMENDED September 13, 2023

GCD tools

- Well spacing and pumping limits
- Water use reports
- Drought contingency plans
- Production curtailments to achieve desired future conditions
- Develop science to inform decision making
- Management zones for local conditions
- Education and outreach

From hillcountryalliance.org/wp-content/uploads/2023_HCA_ManagingGroundwater_Paper.pdf

How you can get involved

Get to know your GCD and support the science

Practice groundwater stewardship

- rainwater harvesting, supporting reuse, native plants, etc.

Engage with your elected officials

Share concerns at public meetings

From hillcountryalliance.org/wp-content/uploads/2023_HCA_ManagingGroundwater_Paper.pdf

Resources

Educational groundwater videos

Headwaters GCD

Groundwater Management Area 9

Water Data for Texas and Groundwater Data Viewer

Hill Country Alliance

Texas Alliance of Groundwater Districts GCD Index

Natalie Ballew, P.G.

Groundwater Division Director, TWDB

512-463-2779

natalie.ballew@twdb.texas.gov

Texas Water Development Board

Kerr County Water Talk

Managing our groundwater resources

Texas Water Development Board