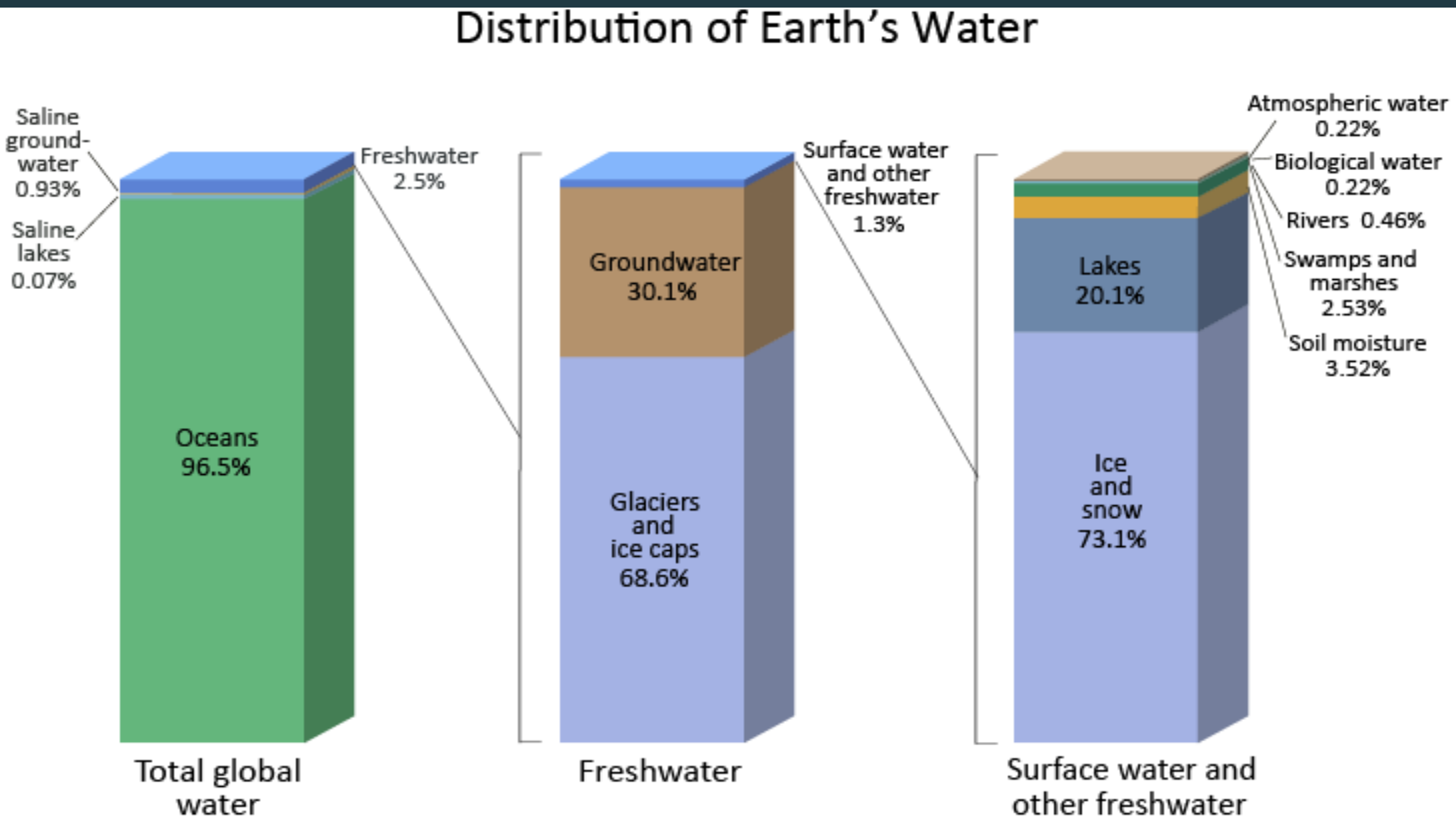
SESSION 2: *Aquifers in Texas*

TWON
TEXAS
Well Owner
NETWORK

Session Outline

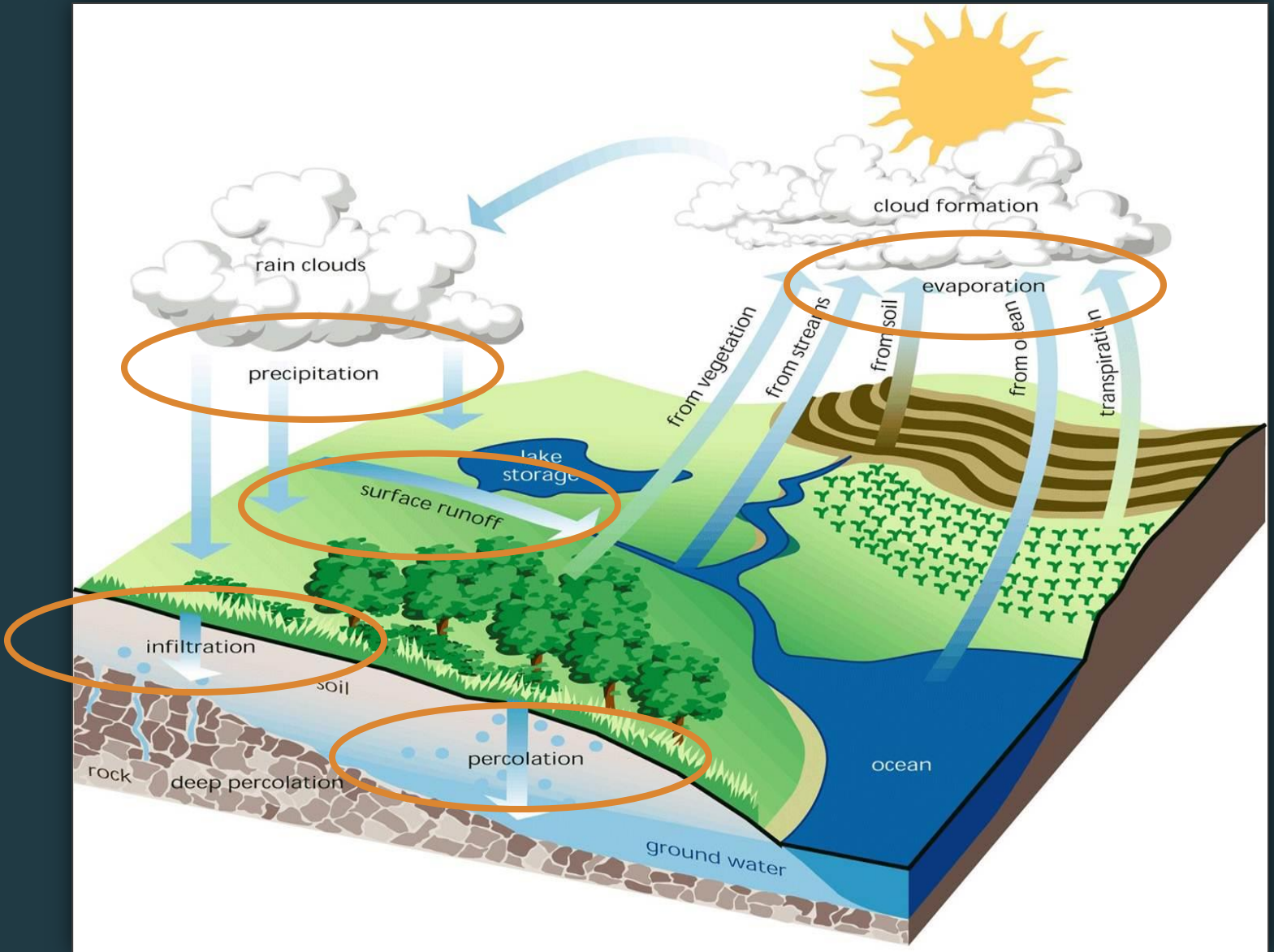
- Water in the World
- Functions of an Aquifer
- Aquifers of Texas
- In which aquifer are you?

Water in the World



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.

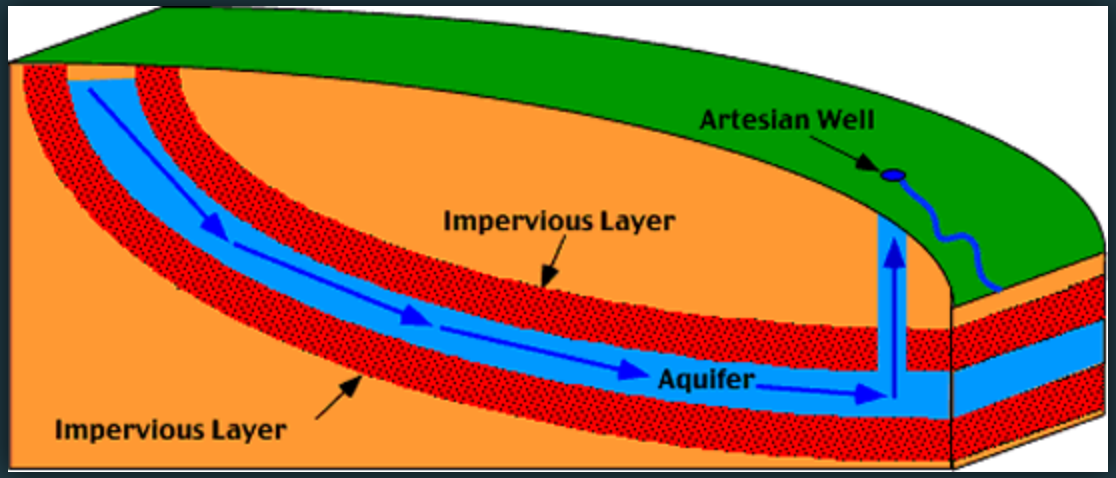
Hydrologic Cycle



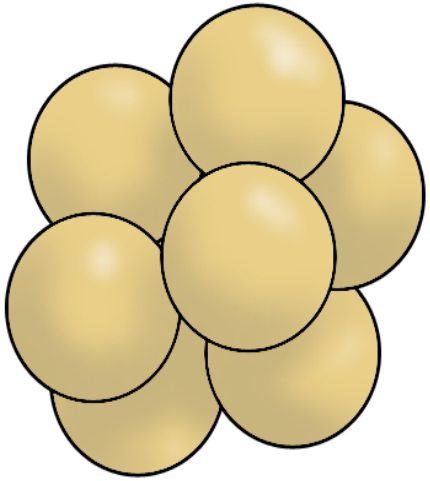
What Is an Aquifer?

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

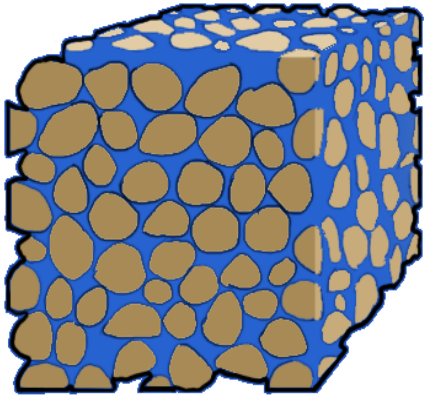
An aquitard is geologic media that can NOT yield economically usable amounts of water.



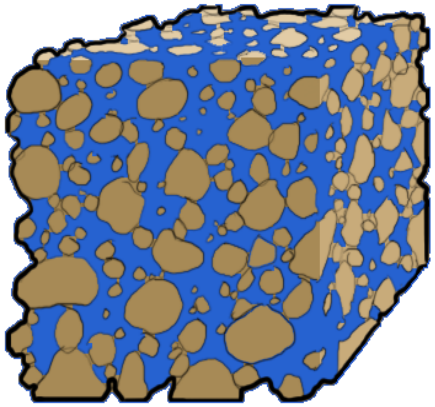
Unconsolidated Aquifer Material



Porous Material

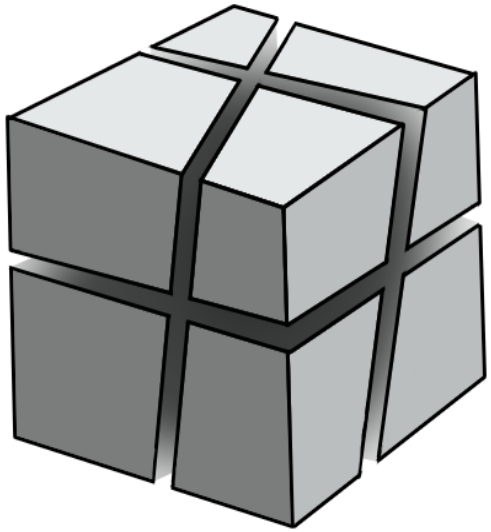


Well-Sorted Sand

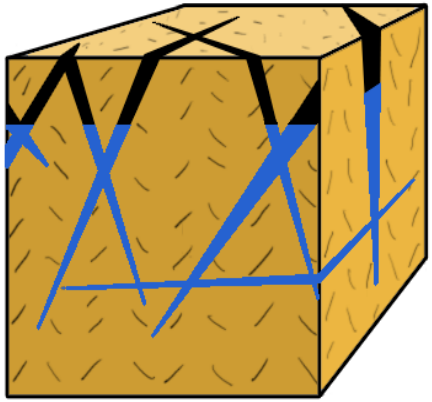


Poorly-Sorted Sand

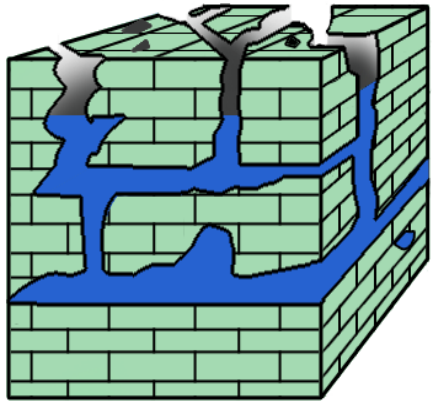
Consolidated Aquifer Material with Secondary Porosity



Fractured Rock

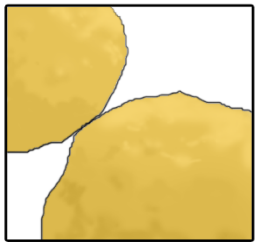


Fractures in Granite



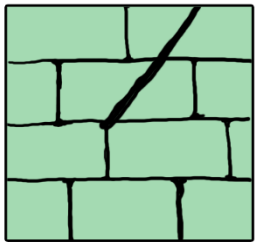
Caverns in Limestone

TYPICAL PERMEABILITY OF AQUIFERS



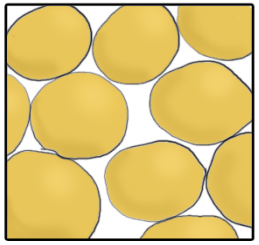
GRAVEL

Highly Permeable - water flows rapidly
300 feet/day to 3000 feet/day



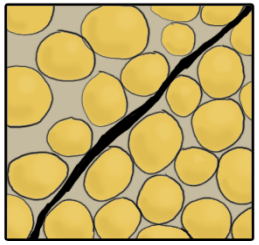
LIMESTONE

Permeable - water flows through fractures and solution cavities
0.1 feet/year to 3 feet/day



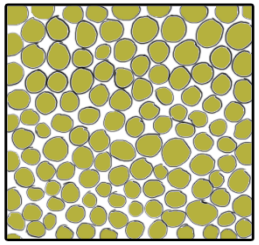
SAND

Permeable - water flow is moderate to rapid
0.03 feet/day to 3000 feet/day



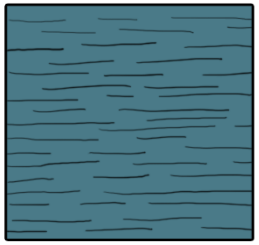
SANDSTONE

Impermeable to Permeable - water flows through fractures and areas where cementing material dissolves
1 foot/100 years to 3 feet/day



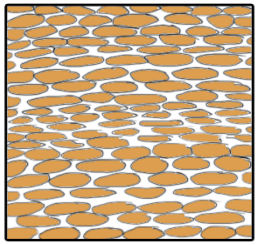
SILT

Slowly Permeable - water flows slowly
0.1 feet/year to 1000 feet/year



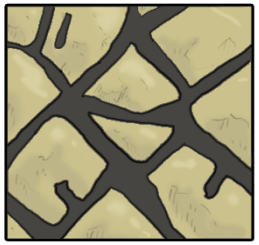
SHALE

Impermeable - water rarely flows through shale unless shale is fractured
1 foot/100,000 years to 0.1 feet/year



CLAY

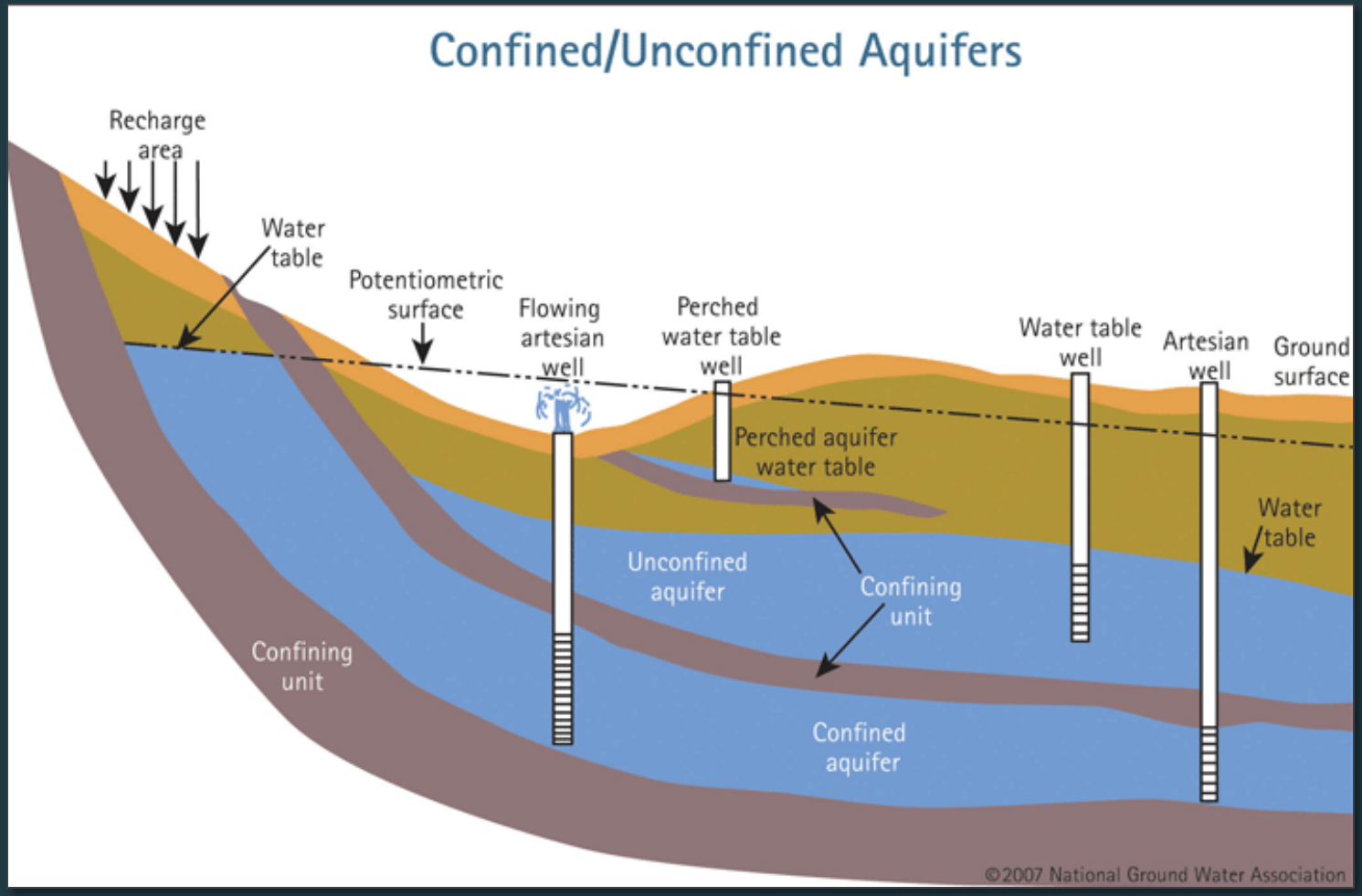
Relatively Permeable - water barely moves
1 foot/10,000 years to 0.1 feet/year



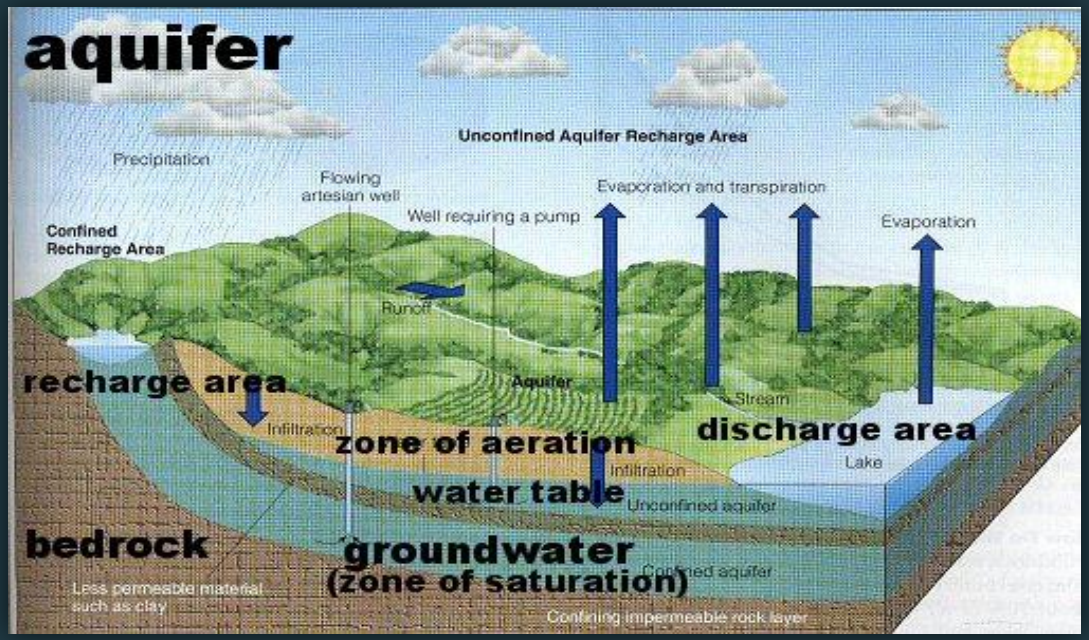
ROCK

Extremely Impermeable to Highly Permeable - rock rendered porous by fracturing, water flows through fractures
1 foot/100,000 years to 300 feet/day

Types of Aquifers

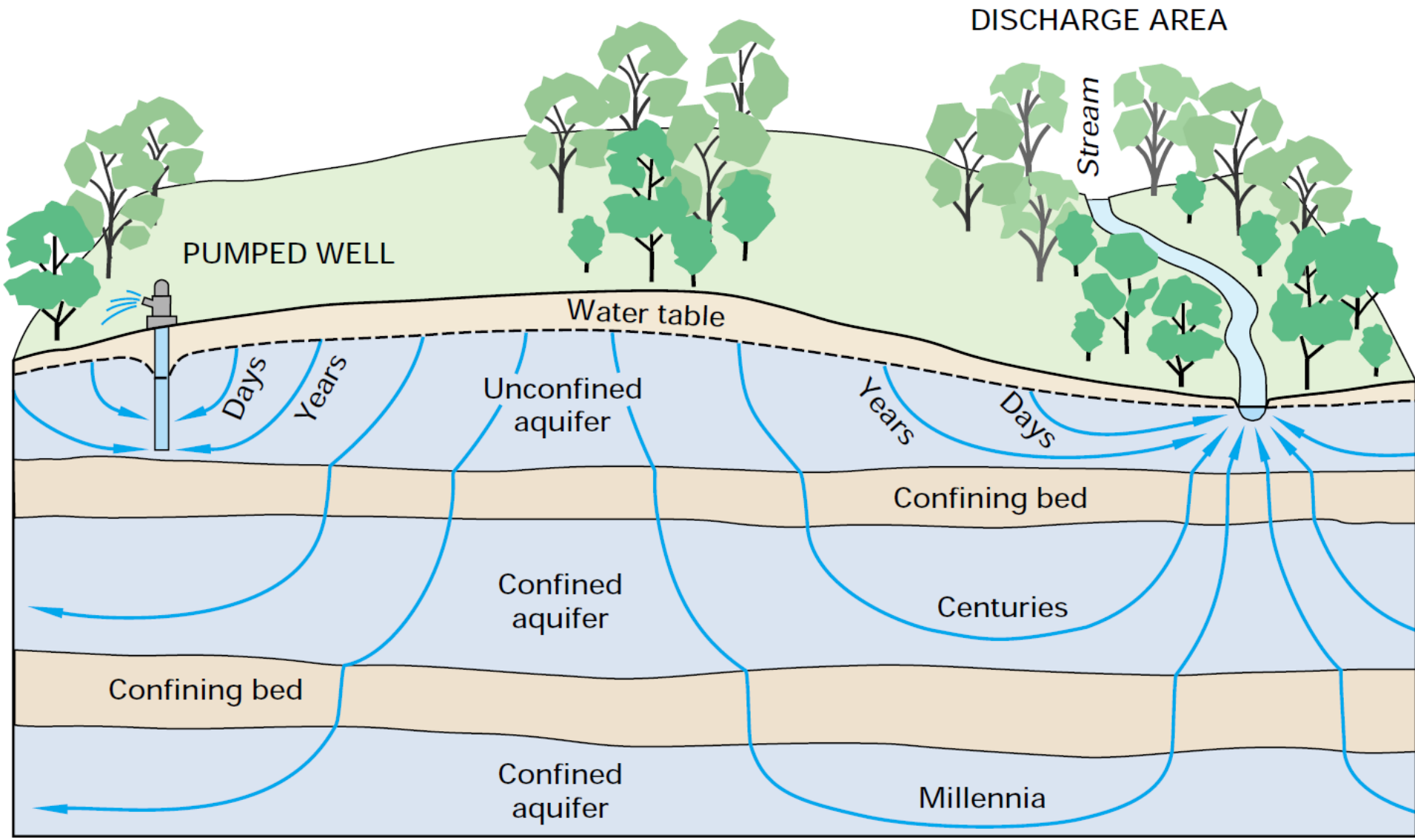


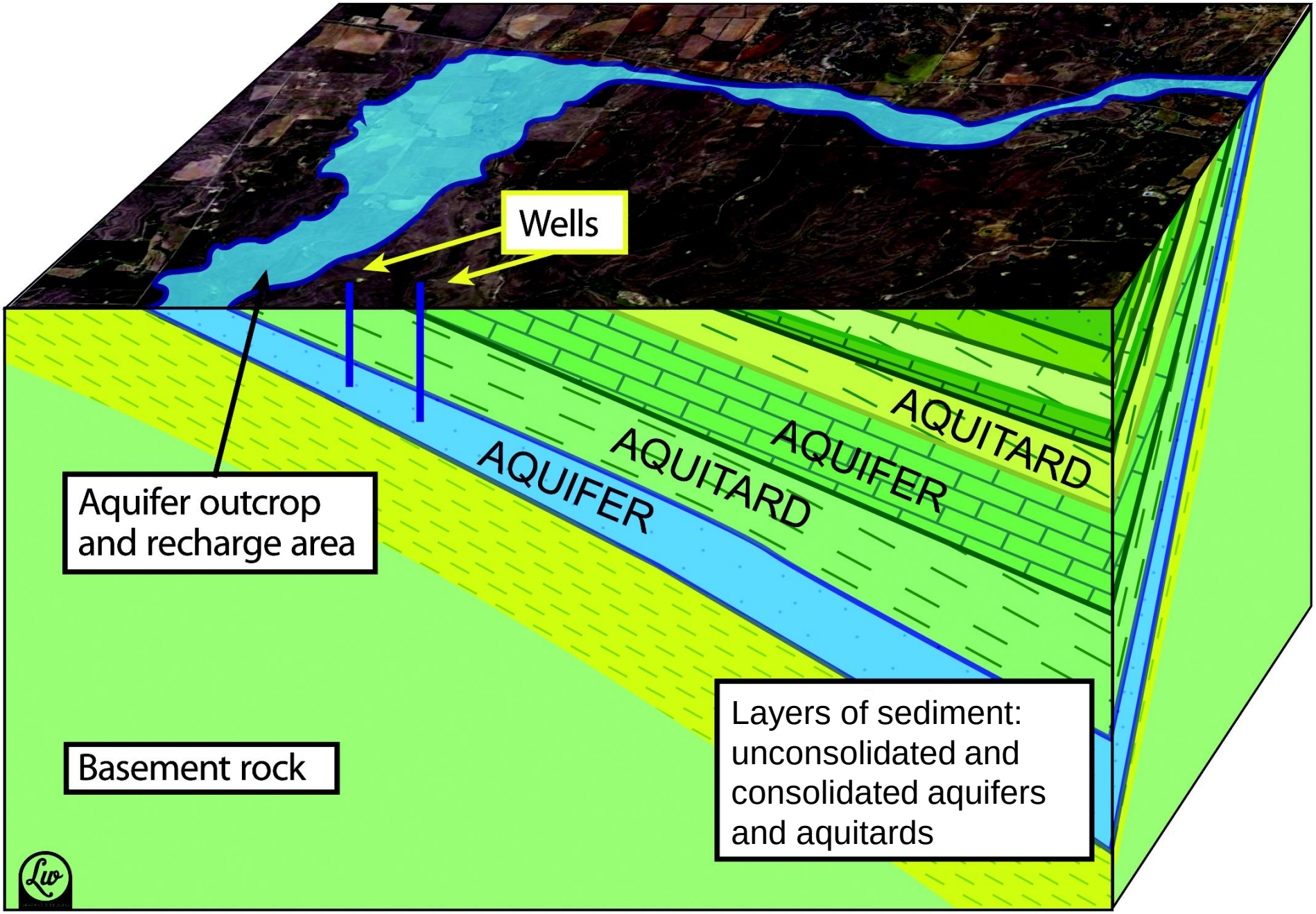
Aquifer Recharge



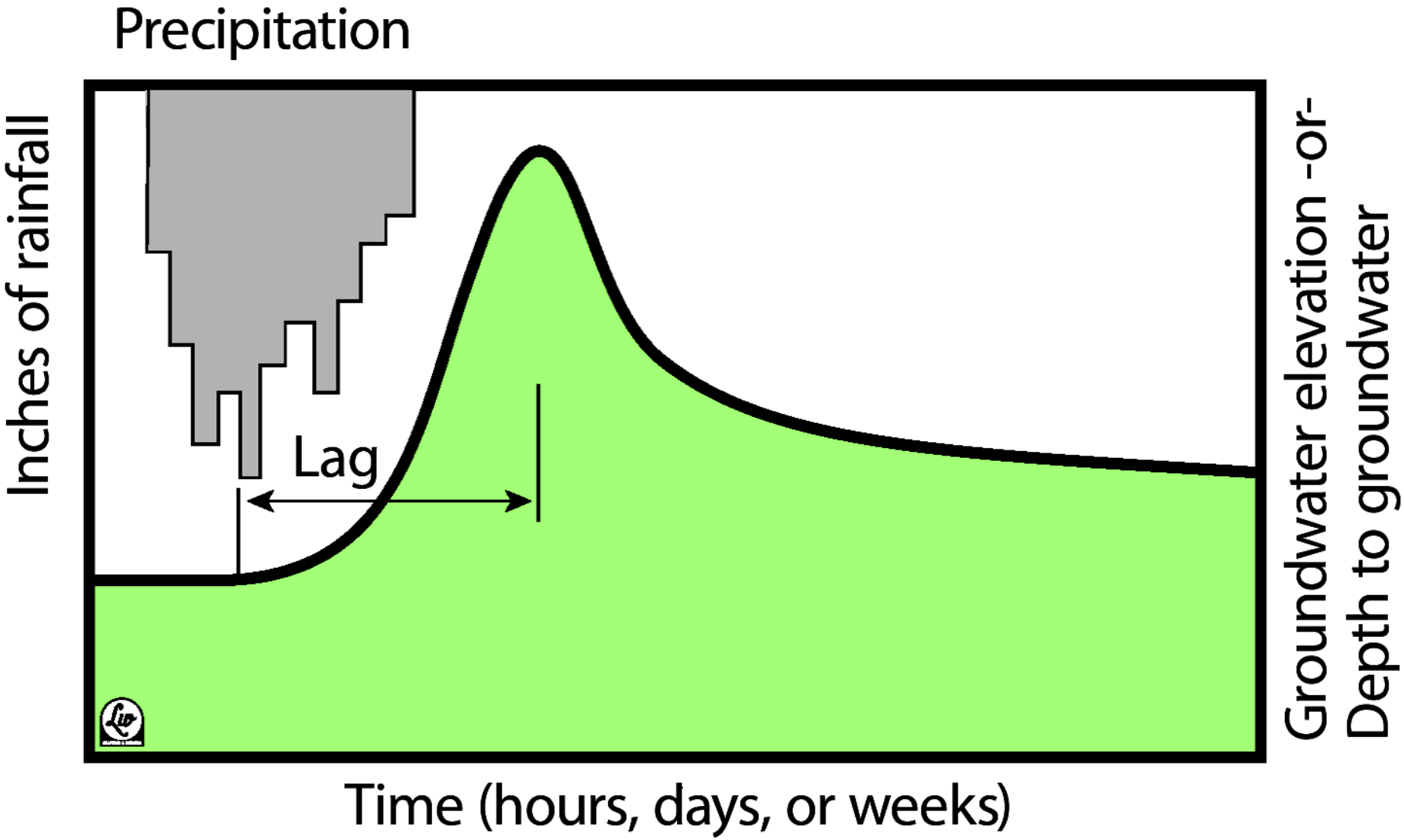
- Aquifer recharge is a key component of the hydrologic cycle
- Recharge can occur locally or miles away

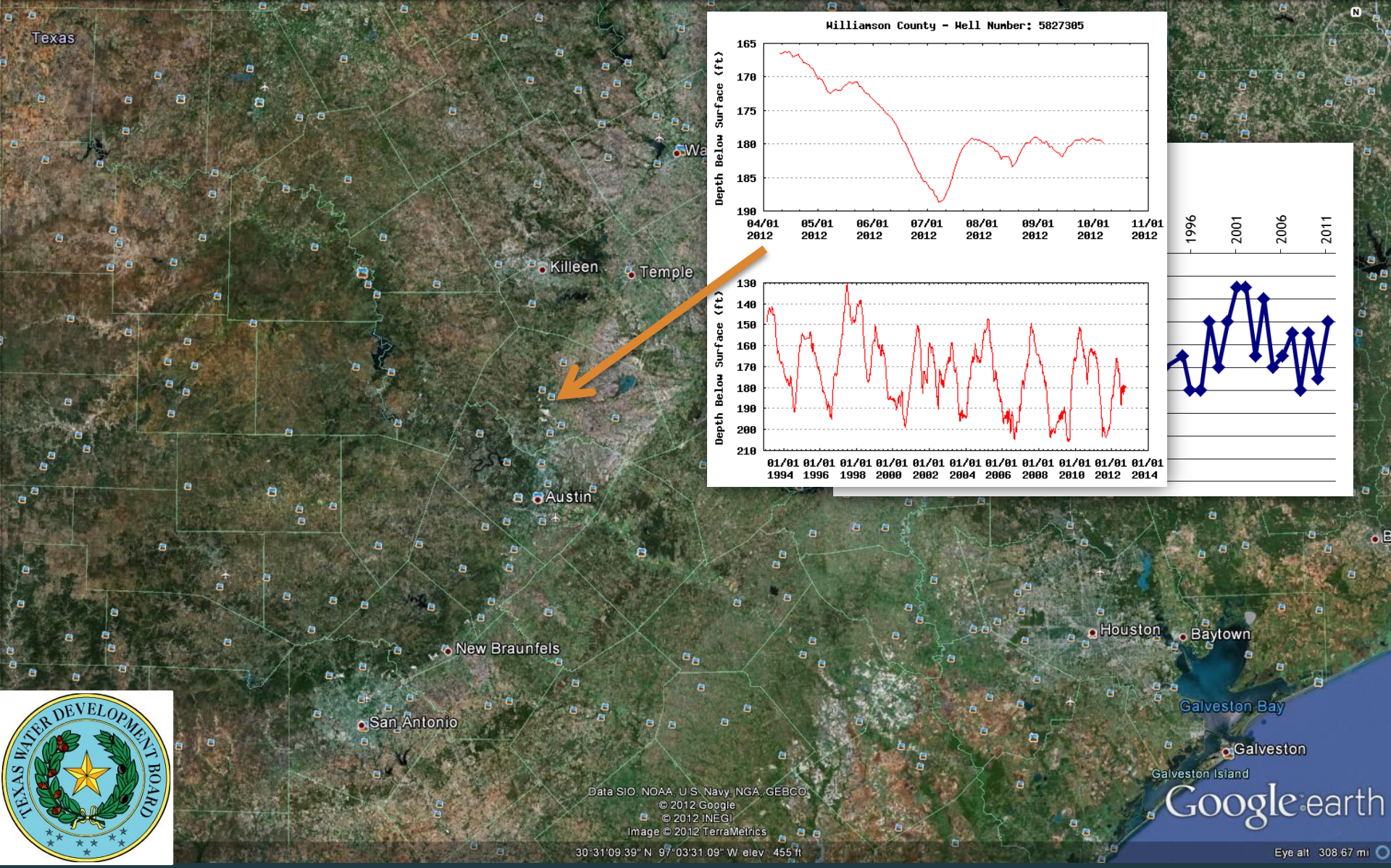
Aquifer Recharge



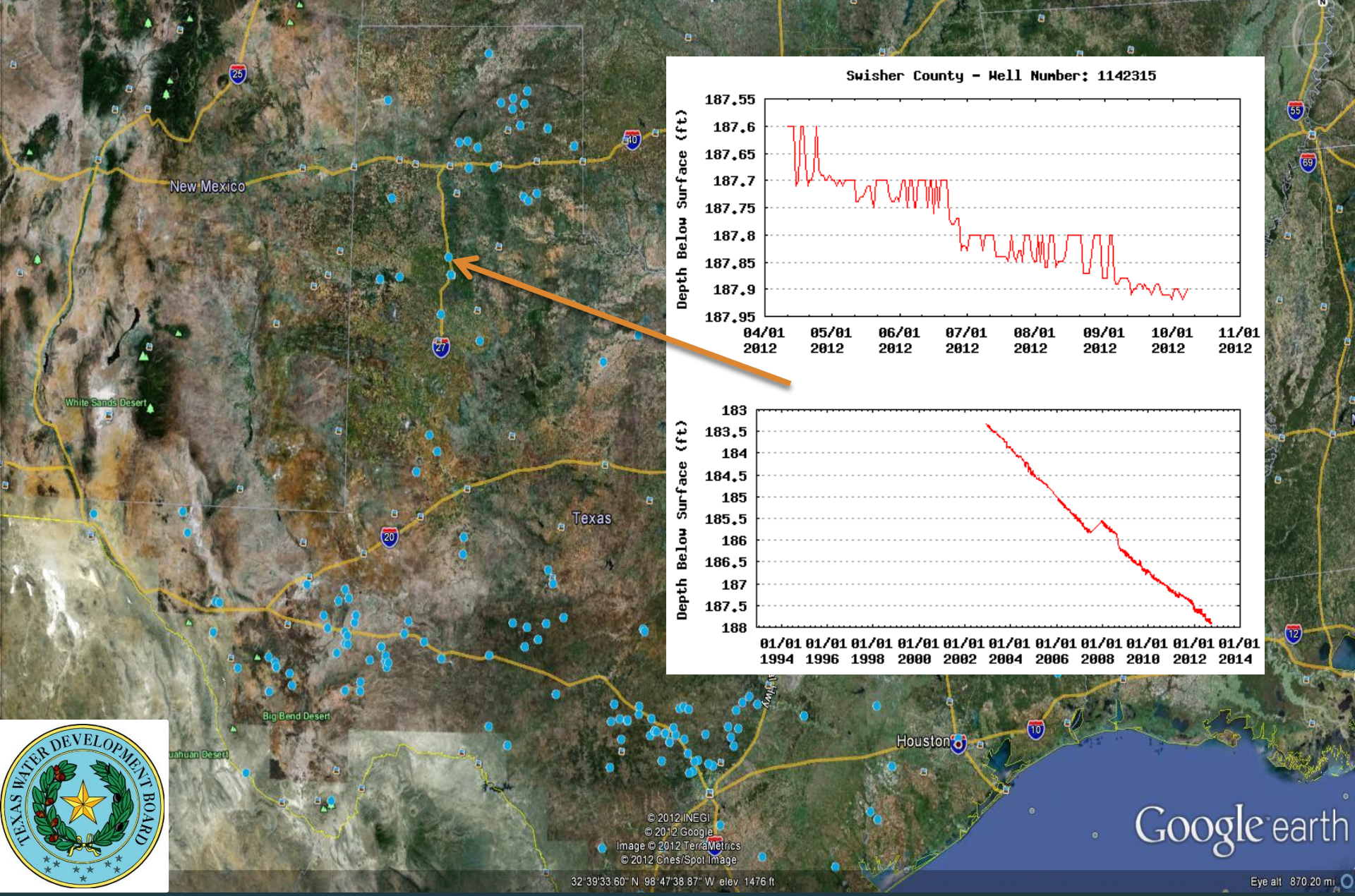

Wells
AQUITARD
AQUIFER
AQUITARD
AQUIFER
Aquifer outcrop and recharge area
Basement rock
Layers of sediment: unconsolidated and consolidated aquifers and aquitards

Well Hydrograph



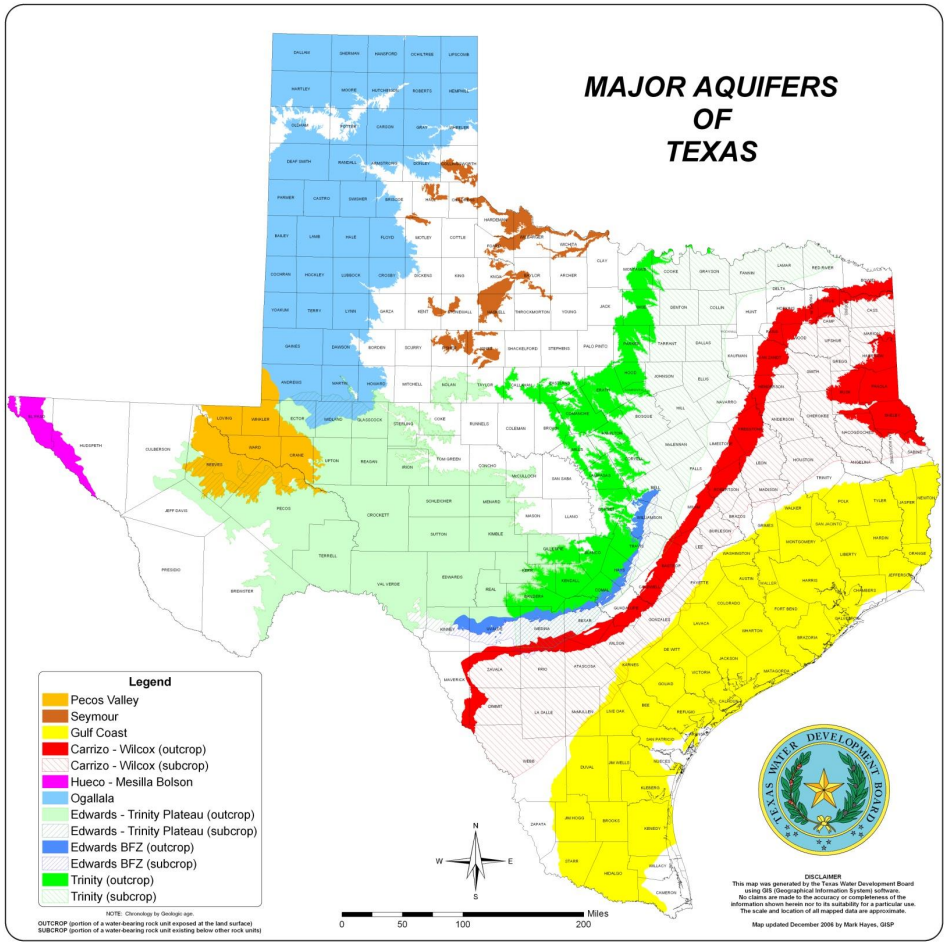


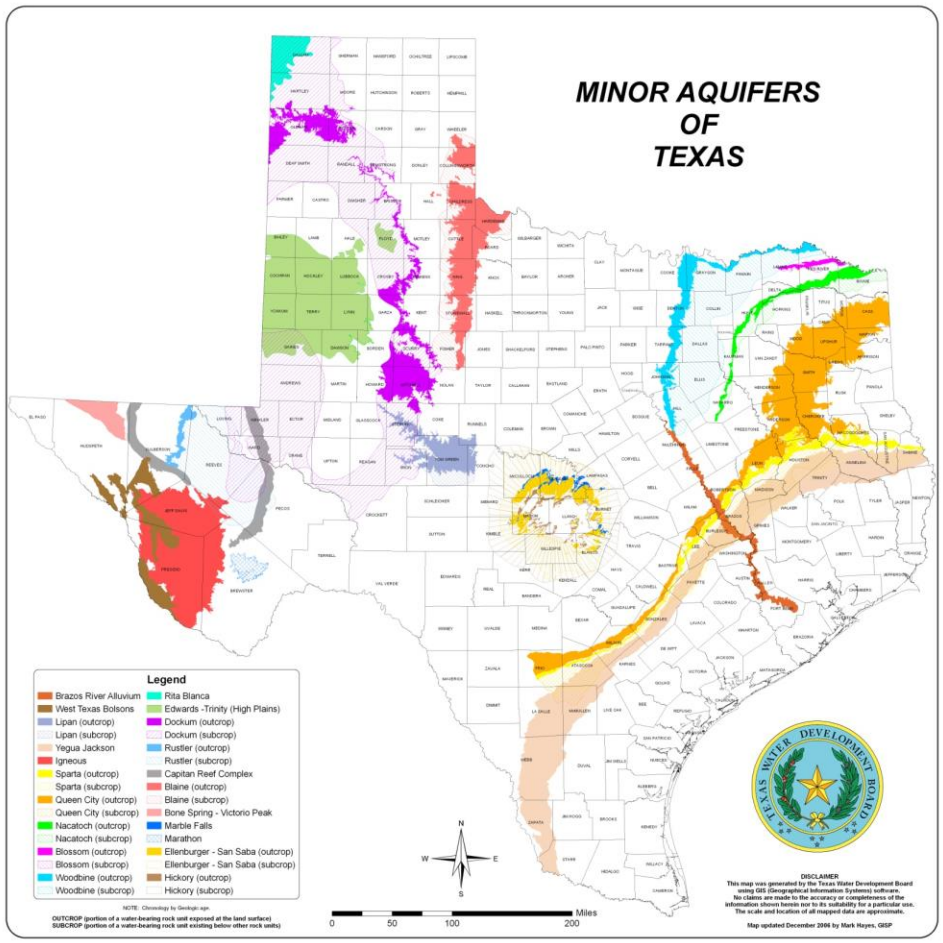
Response to Precipitation



Response to Precipitation

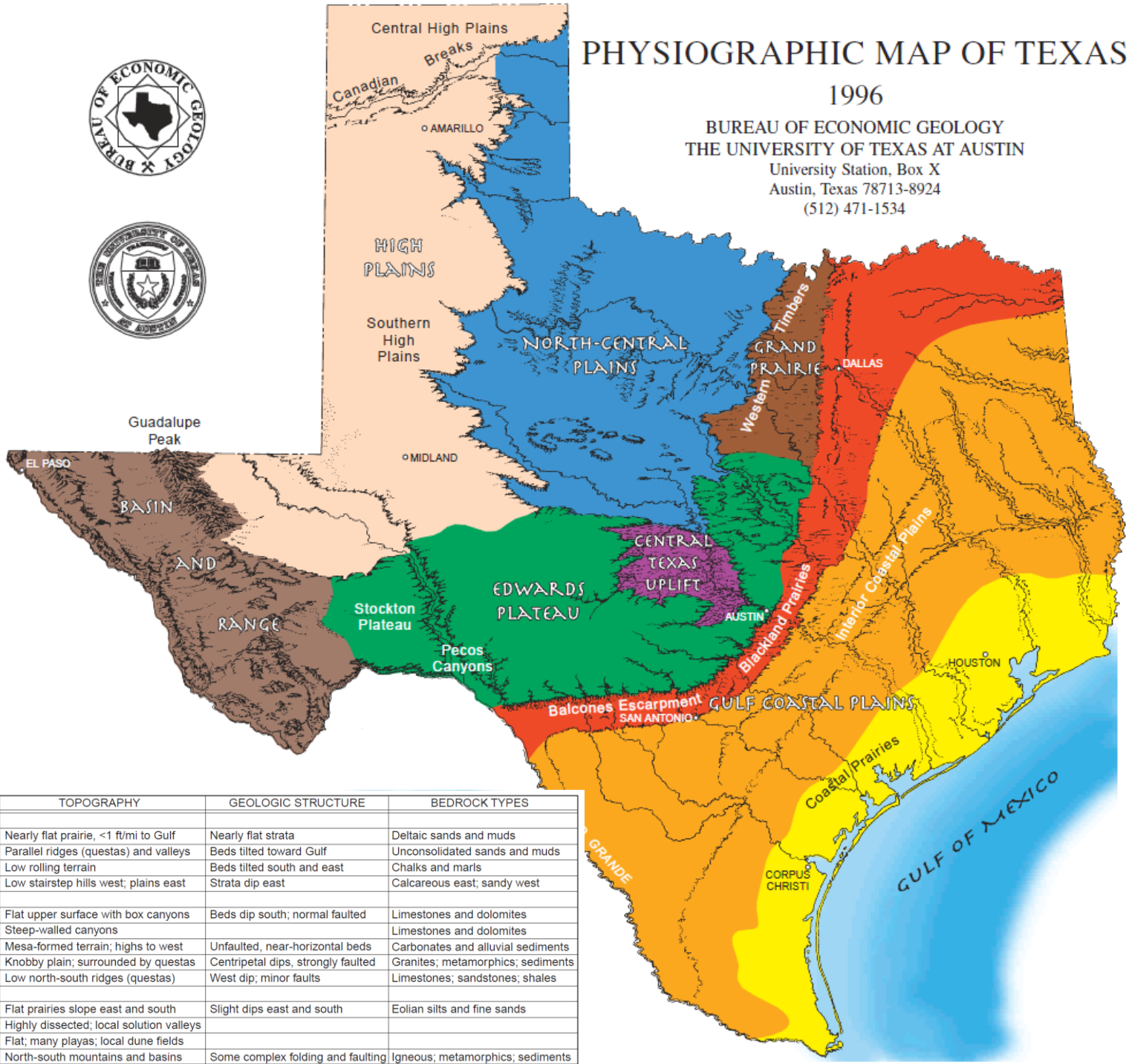
Groundwater In Texas



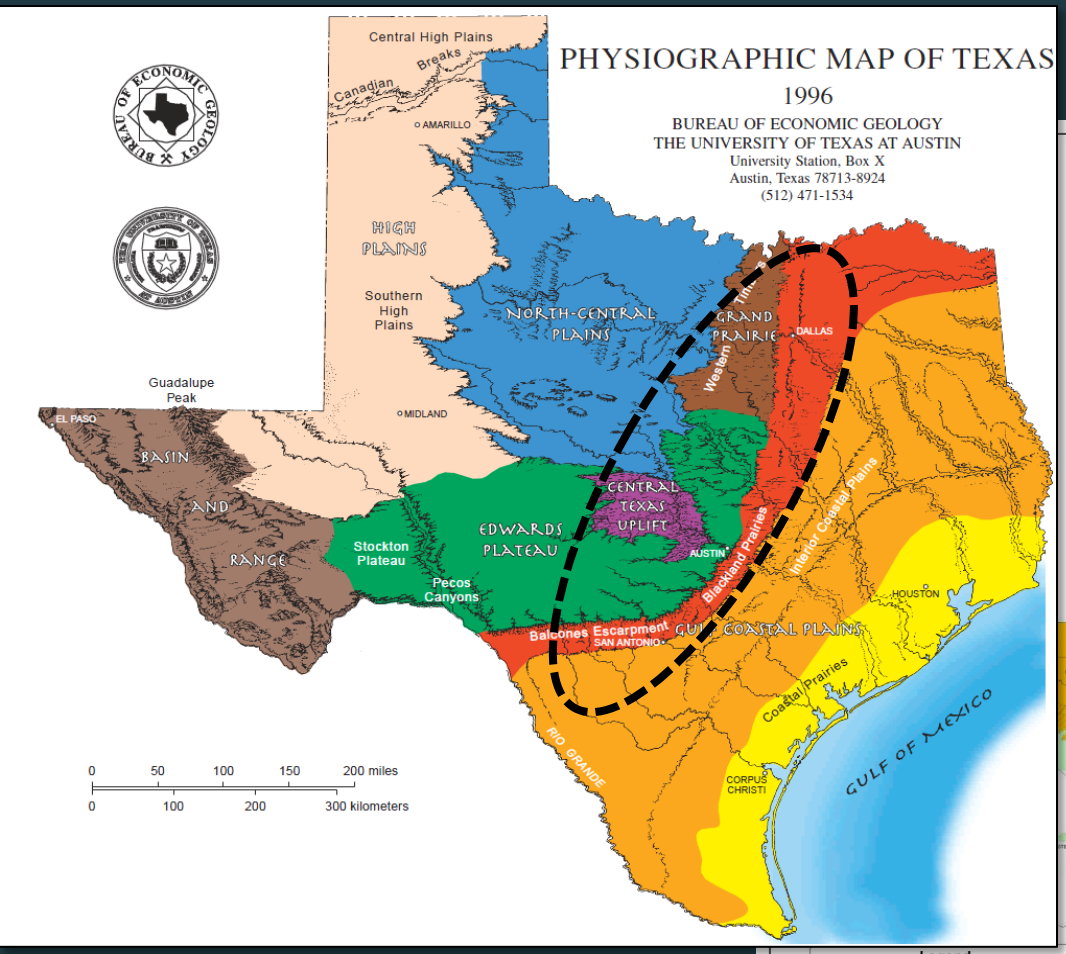


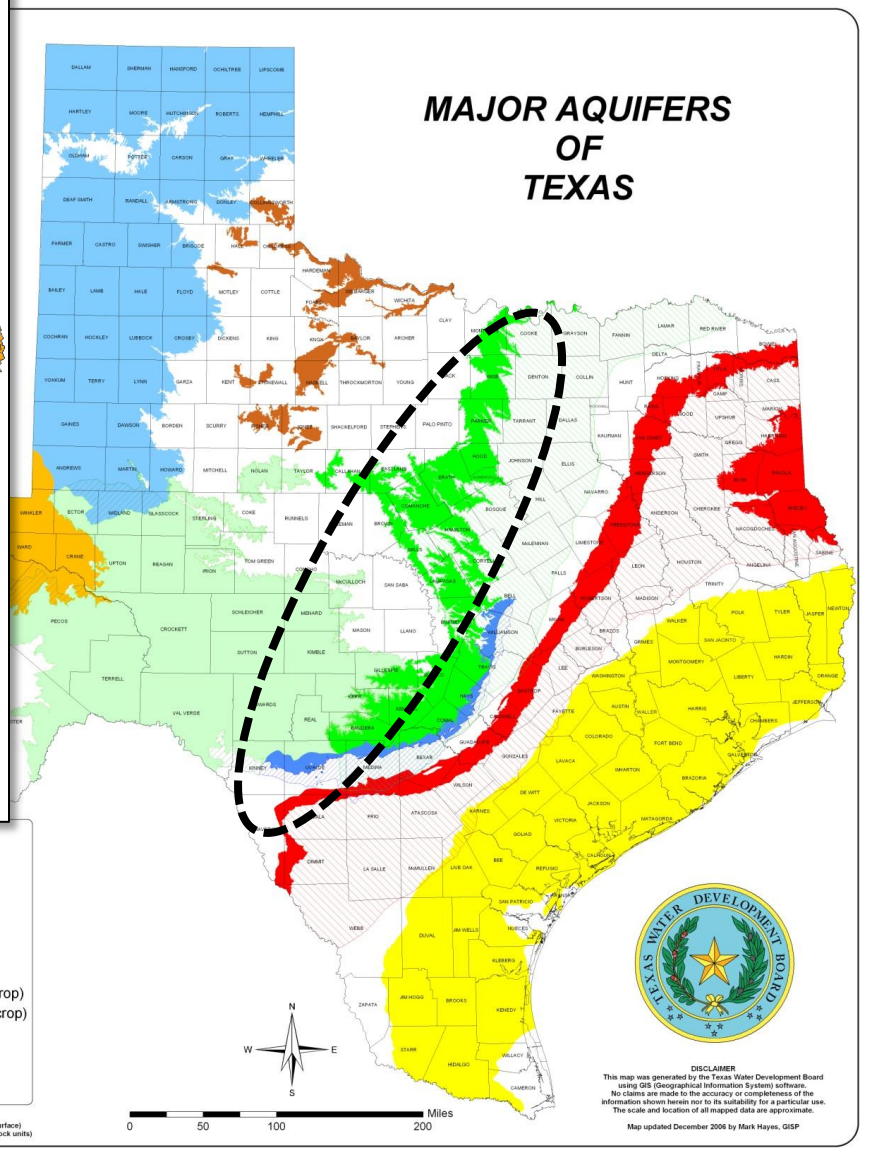
Groundwater In Texas

- Groundwater supplies about 60% of the water used in Texas
- Around 80% of groundwater used is for irrigation
- About 36% of water used by municipalities is from groundwater.



PROVINCE	MAX. ELEV. (ft)	MIN. ELEV. (ft)	TOPOGRAPHY	GEOLOGIC STRUCTURE	BEDROCK TYPES
Gulf Coastal Plains					
Coastal Prairies	300	0	Nearly flat prairie, <1 ft/mi to Gulf	Nearly flat strata	Deltaic sands and muds
Interior Coastal Plains	800	300	Parallel ridges (questas) and valleys	Beds tilted toward Gulf	Unconsolidated sands and muds
Blackland Prairies	1000	450	Low rolling terrain	Beds tilted south and east	Chalks and marls
Grand Prairie	1250	450	Low stairstep hills west; plains east	Strata dip east	Calcareous east; sandy west
Edwards Plateau					
Principal	3000	450	Flat upper surface with box canyons	Beds dip south; normal faulted	Limestones and dolomites
Pecos Canyons	2000	1200	Steep-walled canyons		Limestones and dolomites
Stockton Plateau	4200	1700	Mesa-formed terrain; highs to west	Unfaulted, near-horizontal beds	Carbonates and alluvial sediments
Central Texas Uplift	2000	800	Knobby plain; surrounded by questas	Centripetal dips, strongly faulted	Granites; metamorphics; sediments
North-Central Plains	3000	900	Low north-south ridges (questas)	West dip; minor faults	Limestones; sandstones; shales
High Plains					
Central	4750	2900	Flat prairies slope east and south	Slight dips east and south	Eolian silts and fine sands
Canadian Breaks	3800	2350	Highly dissected; local solution valleys		
Southern	3800	2200	Flat; many playas; local dune fields		
Basin and Range	8750	1700	North-south mountains and basins	Some complex folding and faulting	Igneous; metamorphics; sediments



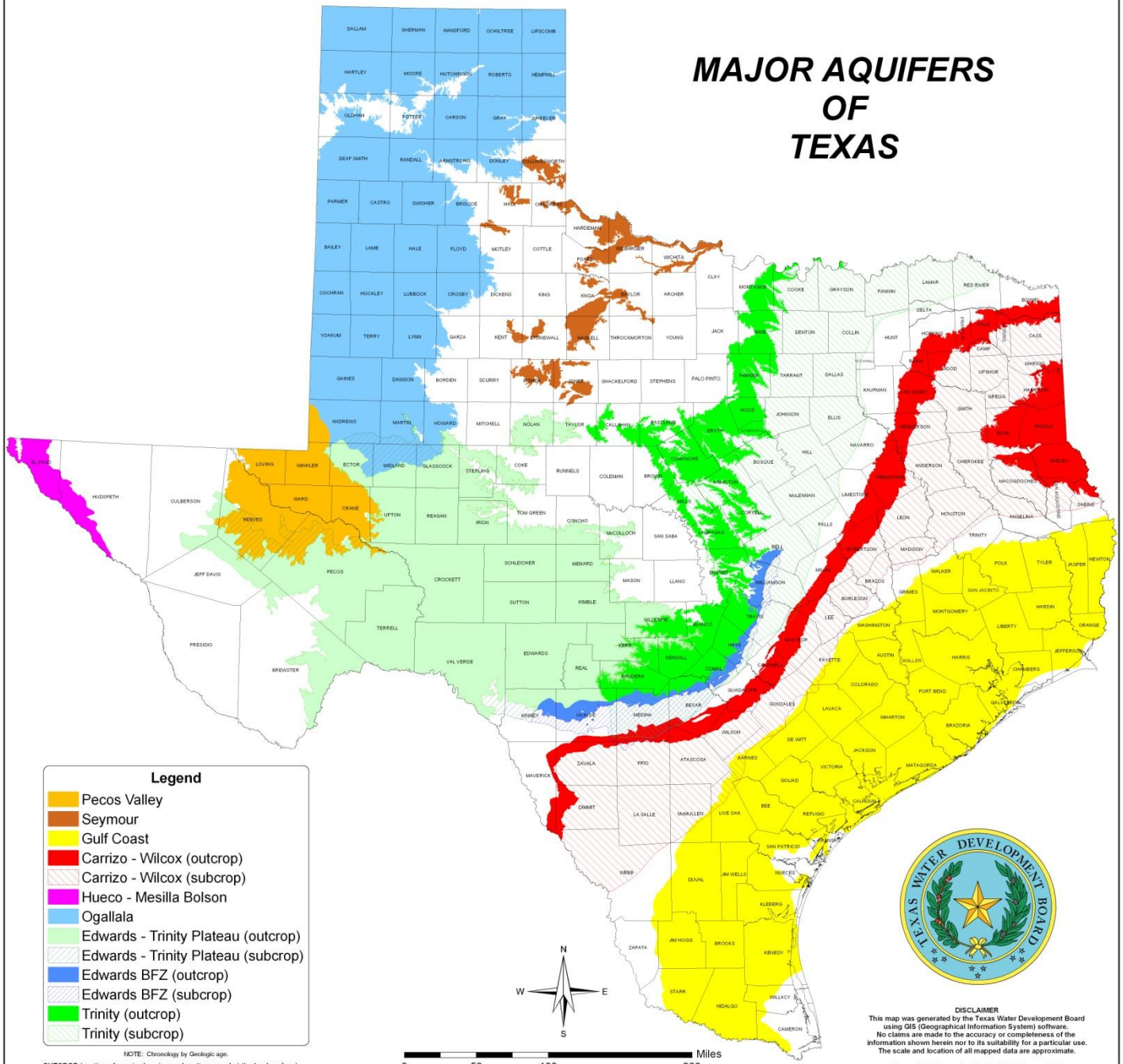


Grand Prairie and Edwards Plateau:

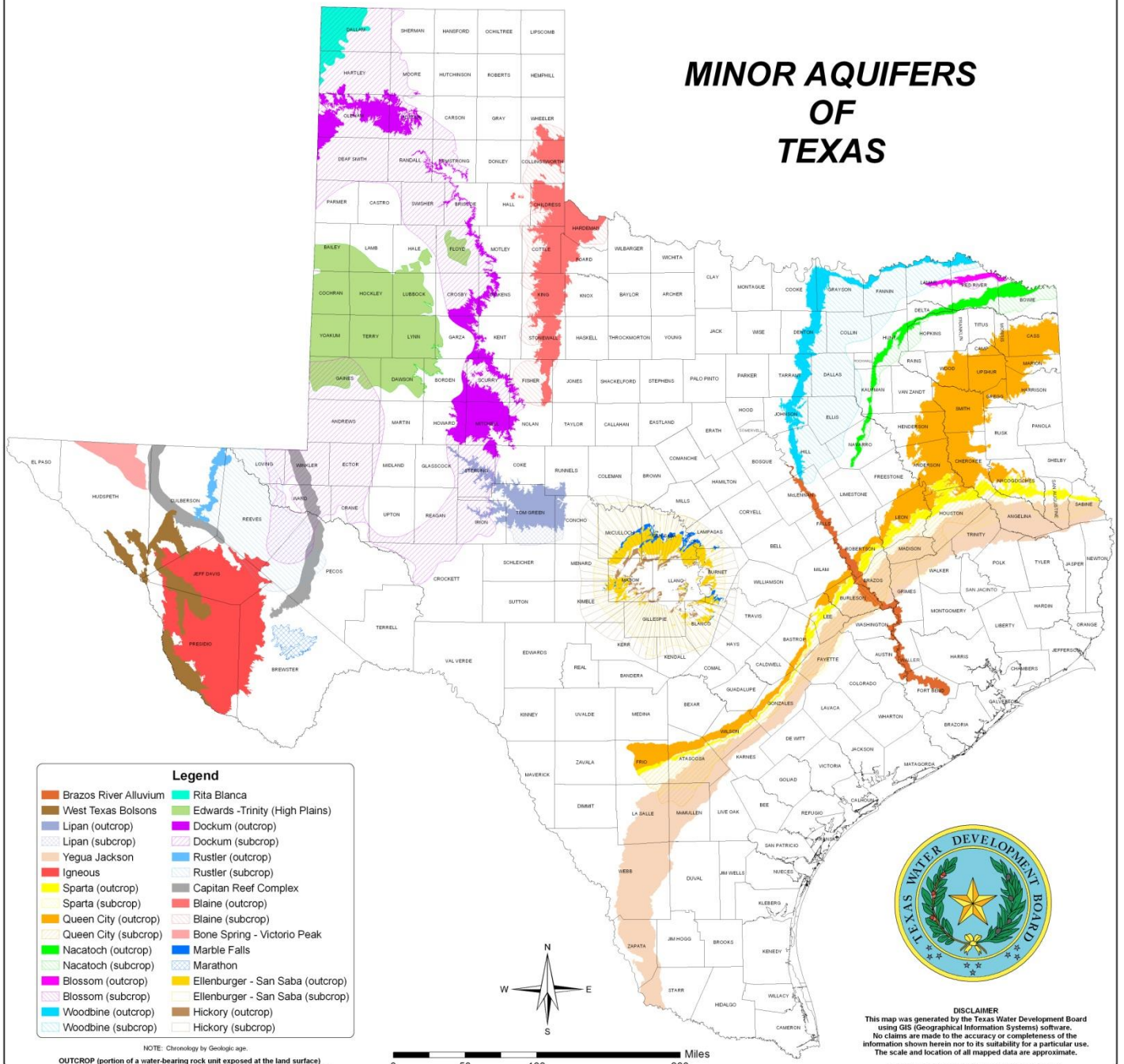
Edwards Aquifer

Trinity Aquifer

MAJOR AQUIFERS OF TEXAS



MINOR AQUIFERS OF TEXAS



NOTE: Chronology by Geologic age.

OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)

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

Map updated December 2006 by Mark Hayes, GISP

TWON

TEXAS Well Owner NETWORK

Questions?