Groundwater and Surface Water in Texas

Robert E. Mace, Ph.D., P.G.
Meadows Center for Water and the Environment
Texas State University

presented to
Texas Waters Webinar!

yapping from beautiful
San Marcos, Texas; May 29, 2018
There is no life without water. Because without water, there is no coffee. And without coffee, I'll kill you all.
outline:

- Water in Texas!
- Capturing Water in Texas!
- Water Management in Texas!
- Resources!
Outline:

- Water in Texas!
- Capturing Water in Texas!
- Water Management in Texas!
- Resources!
Question 1
Atmosphere:

- Precipitation (Precip): 379,000,000 acre-feet per year
- Evapotranspiration (Evap): 7,200,000 acre-feet per year
- Evapotranspiration (Evap): 320,000,000 acre-feet per year

Surface Water:

- 86% of rain goes back to the sky
- 47,200,000 acre-feet into lakes and rivers from runoff
- 4,700,000 acre-feet into lakes and rivers from rainfall

Groundwater:

- Groundwater recharge: 5,100,000 acre-feet per year
- Baseflow: 1,300,000 acre-feet per year

Texas:

- Texas coast: 35,000,000 acre-feet
- Other states: 9,300,000 acre-feet

All numbers in acre-feet per year for Texas

Data from Ward and Valdes (1995)
atmosphere

precip 379,000,000
evap 7,200,000

evapotranspiration 320,000,000

surface water

47,200,000 into lakes and rivers from runoff
4,700,000 into lakes and rivers from rainfall

groundwater

recharge 5,100,000
baseflow 1,300,000

Texas coast: 35,000,000
Other states: 9,300,000
data from Ward and Valdes (1995)

All numbers in acre-feet per year for Texas

86% of rain goes back to the sky

85% flows out of the state
atmosphere

- evapotranspiration: 320,000,000
- precip: 379,000,000
- evap: 7,200,000

surface water

- recharge: 5,100,000
- baseflow: 1,300,000

groundwater

- Texas coast: 35,000,000
- Other states: 9,300,000

86% of rain goes back to the sky

85% of water flows out of the state

1.3% of rain recharges aquifers

Data from Ward and Valdes (1995)
Average annual precipitation (1981 to 2010)

from 2012 State Water Plan
P = Precipitation in inches
T = Temperature in degrees Fahrenheit

from 2012 State Water Plan
Average annual evaporation (1981 to 2010)

from 2012 State Water Plan
River basins
How a watershed works
Minor aquifers

- Rita Blanca
- Dockum
- Edwards-Trinity (High Plains)
- Capitan Reef Complex
- Bone Spring-Victorio Peak
- Rustler
- West Texas Bolsons
- Igneous
- Ellenburger-San Saba
- Blaine
- Woodbine
- Blossom
- Nacatoc
- Queen City
- Sparta
- Marble Falls
- Hickory
- Marathon
- Yegua-Jackson
- Brazos River Alluvium
Hickory Aquifer, sandstone
Edwards-Trinity (Plateau) Aquifer, limestone
How an aquifer works
Question 2
surface water/groundwater interaction
Outline:

• Water in Texas!
• Capturing Water in Texas!
• Water Management in Texas!
• Resources!
Surface-water features in Texas

image from TWDB
San Felipe Spring - 3rd Largest In Texas - Del Rio, Texas
McDonald Irrigation Well, 1200 Gallons per Minute, Hereford, Texas.
pumping a well
pumping a well: confined
relative groundwater use by county
outline:

- Water in Texas!
- Capturing Water in Texas!
- Water Management in Texas!
- Resources!
Question 3
You own the rain!
and the overland flow!
Surface water is owned by the state. Groundwater is owned by the landowner.

Both are subject to regulation.*

* Some argue that groundwater is now exempt from regulation.**
** But they’re wrong.***
*** Probably…
Discussing Water Rights, A Western Pastime
Land surveys in Austin’s Colony along the Navidad and Brazos rivers
Surface Water

• Owned by the state
• Exempt uses:
  • Domestic and livestock
  • 200 acre-feet stock tanks
  • Wildlife management
  • Emergency use
  • Some others...
Surface Water

- Rights (in time)
  - Perpetual rights
  - Limited-term rights
    - Term permits
    - Temporary permits

- Rights (in place)
  - Impoundment right
  - Diversion (run-of-river) right
    - Diversion point

- Superior Rights
  - Limited riparian rights
Surface Water

• Having a right doesn’t mean you always have water!
• First in time = First in right
• TCEQ for permits
• Usufructable (you can sell your right!)

TCEQ = Texas Commission on Environmental Quality
Rule of Capture 1904

...so secret, occult and concealed...
Question 4
Groundwater conservation districts 1949
Powers of a groundwater conservation district

In general, districts may:

- register wells
- regulate well spacing
- regulate pumping

To know the powers:

- Chapter 36, Texas Water Code
- enabling legislation
- amendments to enabling legislation
- rules
outline:

• Water in Texas!
• Capturing Water in Texas!
• Water Management in Texas!
• Resources!
Wells and springs in database

~130,000 wells and springs

http://www.twdb.texas.gov/mapping/
outline:

• Water in Texas!
• Capturing Water in Texas!
• Water Management in Texas!
• Resources!
Groundwater and Surface Water in Texas

Robert E. Mace, Ph.D., P.G.
Meadows Center for Water and the Environment
Texas State University
(512) 245-6021
rem142@txstate.edu
@MaceatMeadows