# INTRODUCTION TO GROUNDWATER

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Texas Water Development Board

Groundwater Availability Modeling (GAM)

August 13, 2014

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# DISCLAIMER

The following presentation is based upon professional research and analysis within the scope of the Texas Water Development Board's statutory responsibilities and priorities but, unless specifically noted, does not necessarily reflect official Board positions or decisions.

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**…THE EXISTENCE, ORIGIN, MOVEMENT, AND COURSE OF [GROUNDWATER] … ARE SO SECRET, OCCULT, AND CONCEALED…**

Texas Supreme Court (Houston & Texas Central Railroad Co. vs A. East, 1904) quoted from Ohio Supreme Court (Frazier vs Brown, 1861)

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# Educational Groundwater Video Team

- RPS Espey
- Big Look! Productions
- Watearth
- Aquaveo

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# Video Modules

1. Aquifers in Texas
2. How do Aquifers Work
3. Groundwater Budget and Availability Models
4. Using Groundwater Availability Models in Water Planning

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# MODULE 2: HOW DO AQUIFERS WORK?

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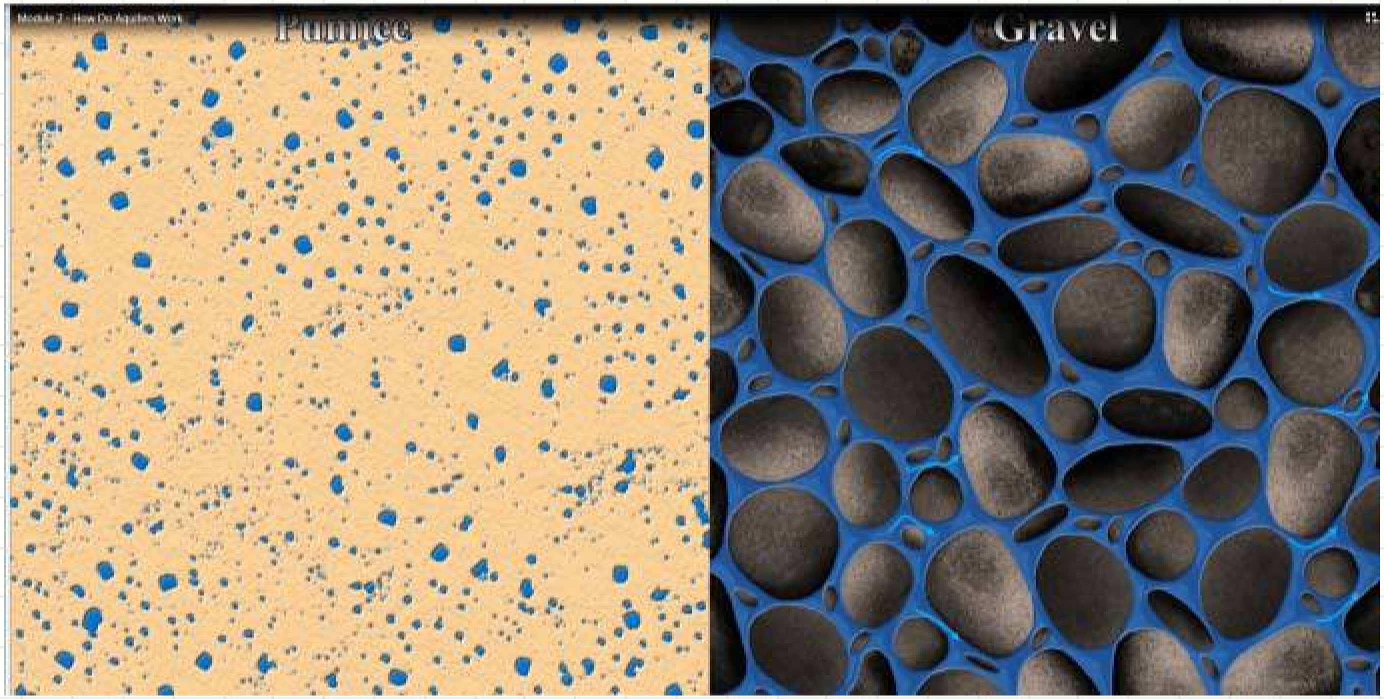
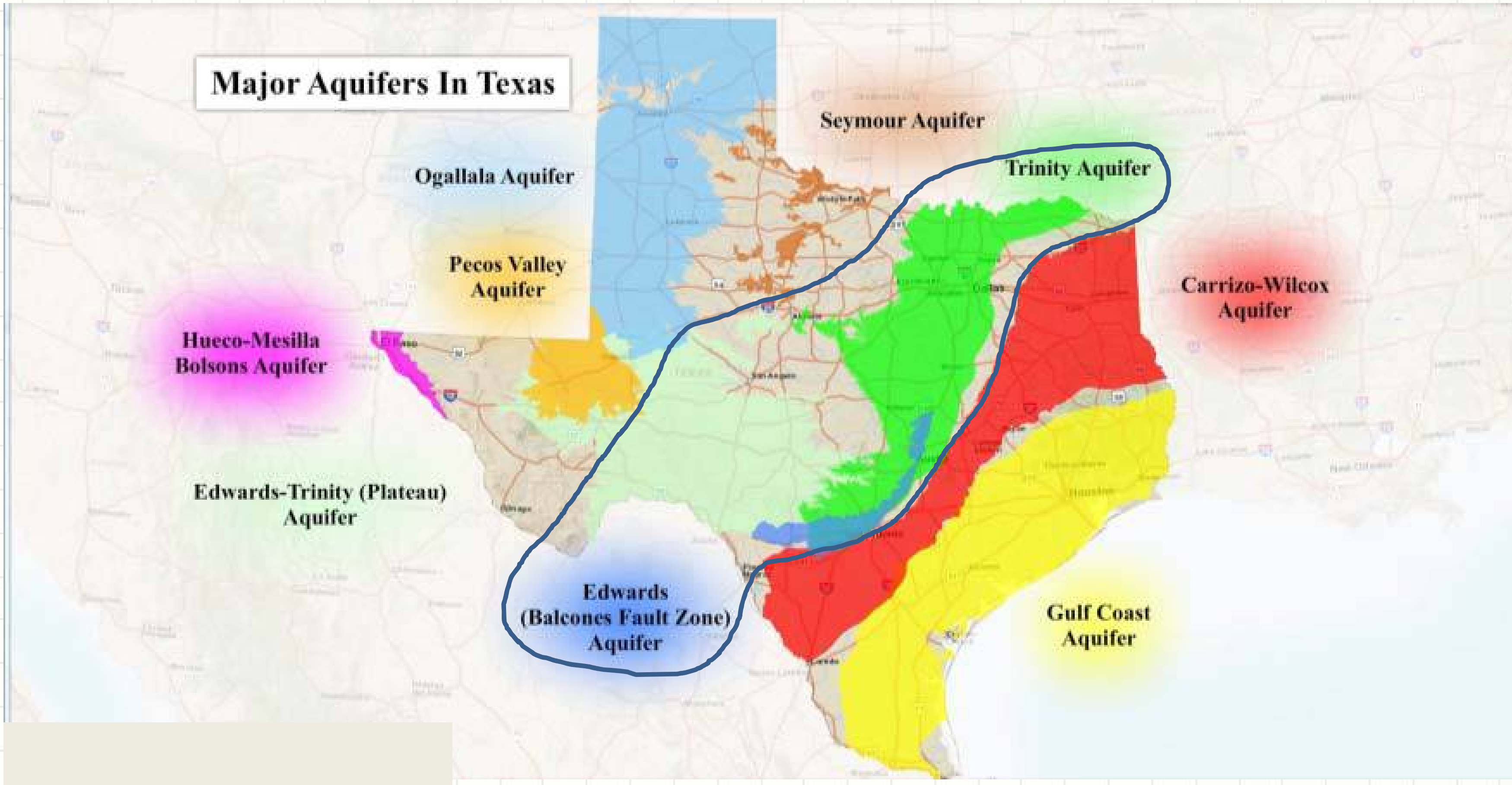



**Porosity:**

- Measure of the volume of empty space—or pore spaces—inside the rock.
- Represents the volume of water a rock formation can hold

**Permeability**

- Measure of how readily water can flow within the rock



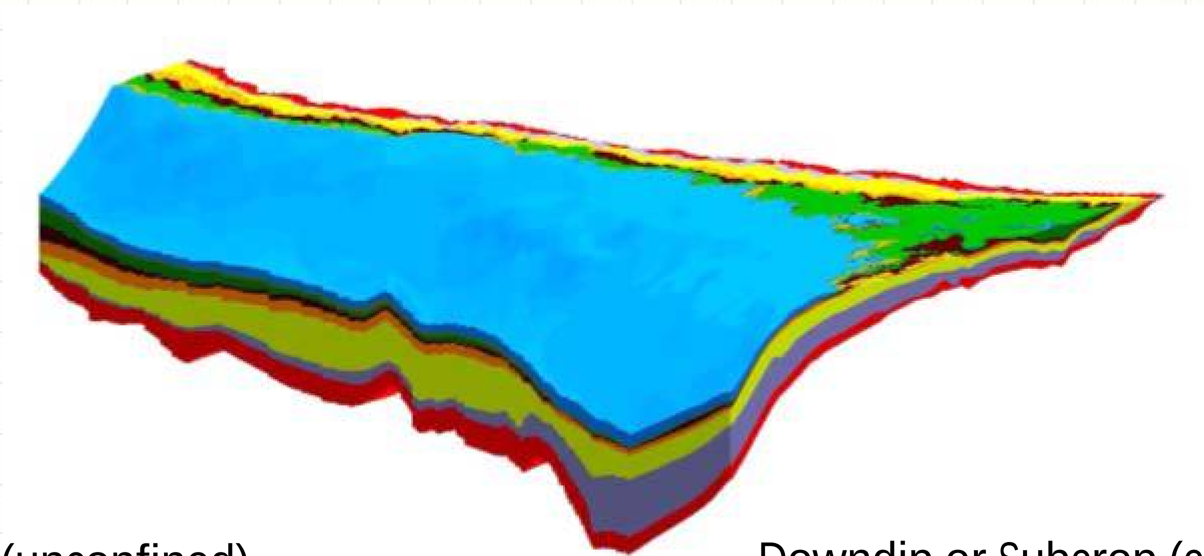

**Aquifers from Sedimentary Rocks:**

- Gulf Coast
- Carrizo-Wilcox
- Seymour
- Ogallala
- Pecos Valley
- Hueco-Mesilla Bolsons

**Aquifers with Limestone (Karst)**

- Edwards (Balcones Fault Zone)
- Trinity
- Edwards-Trinity (Plateau)

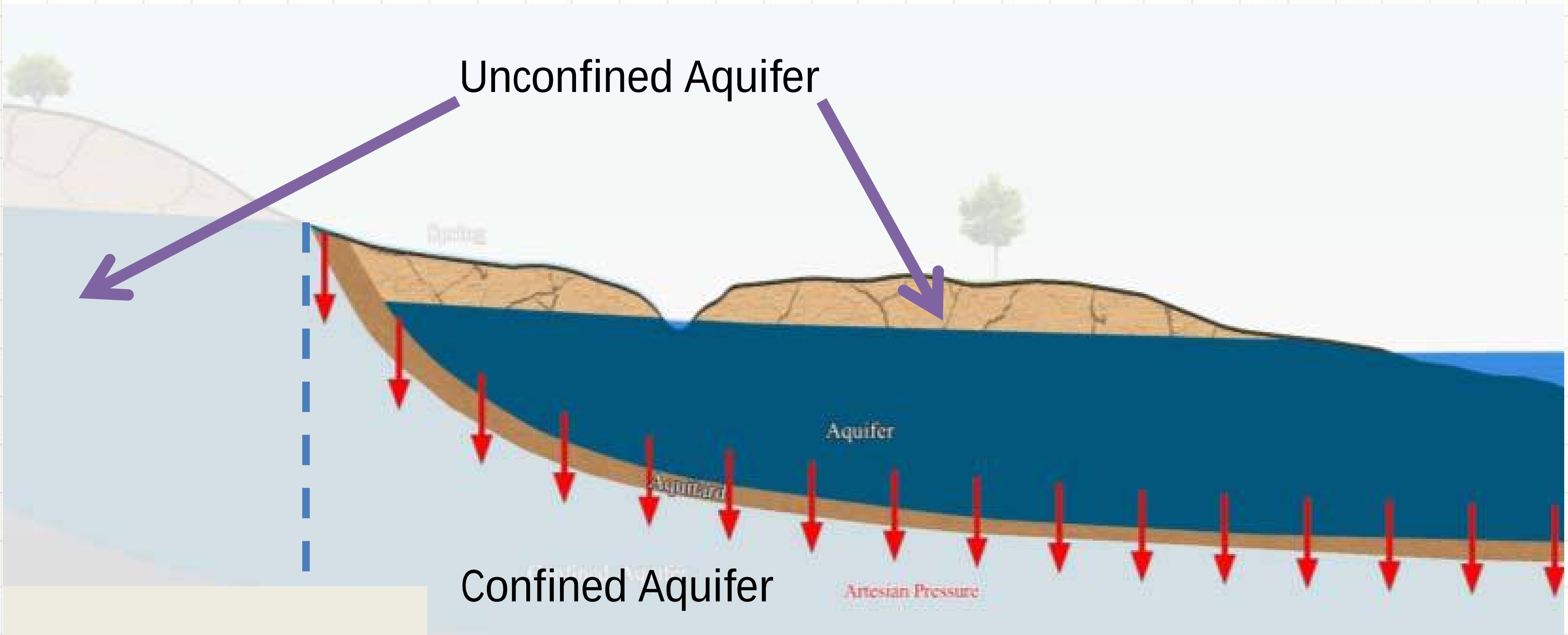
# Parts of an Aquifer…



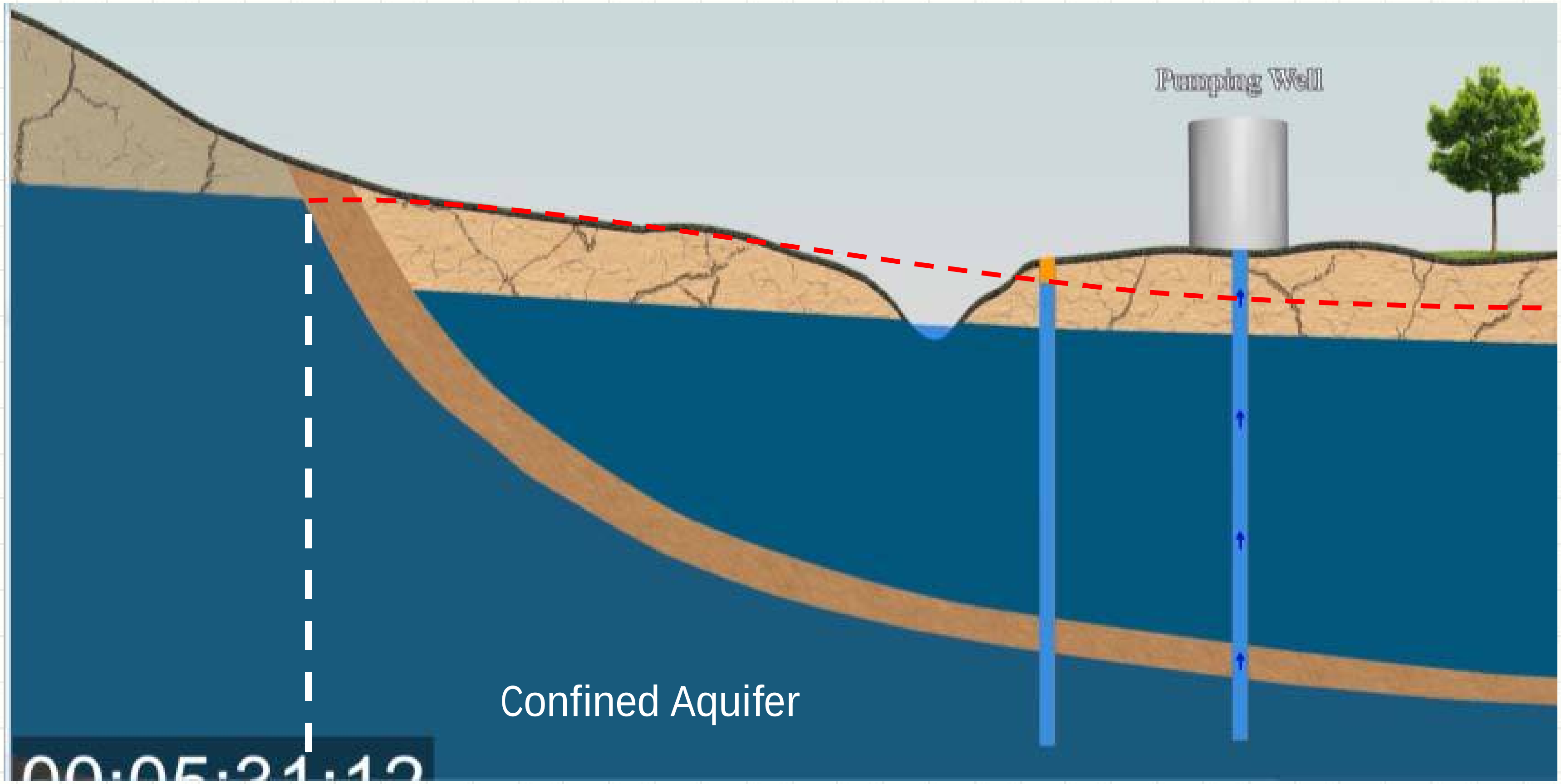
Outcrop (unconfined)


Downdip or Subcrop (confined)

# Confined or Unconfined?

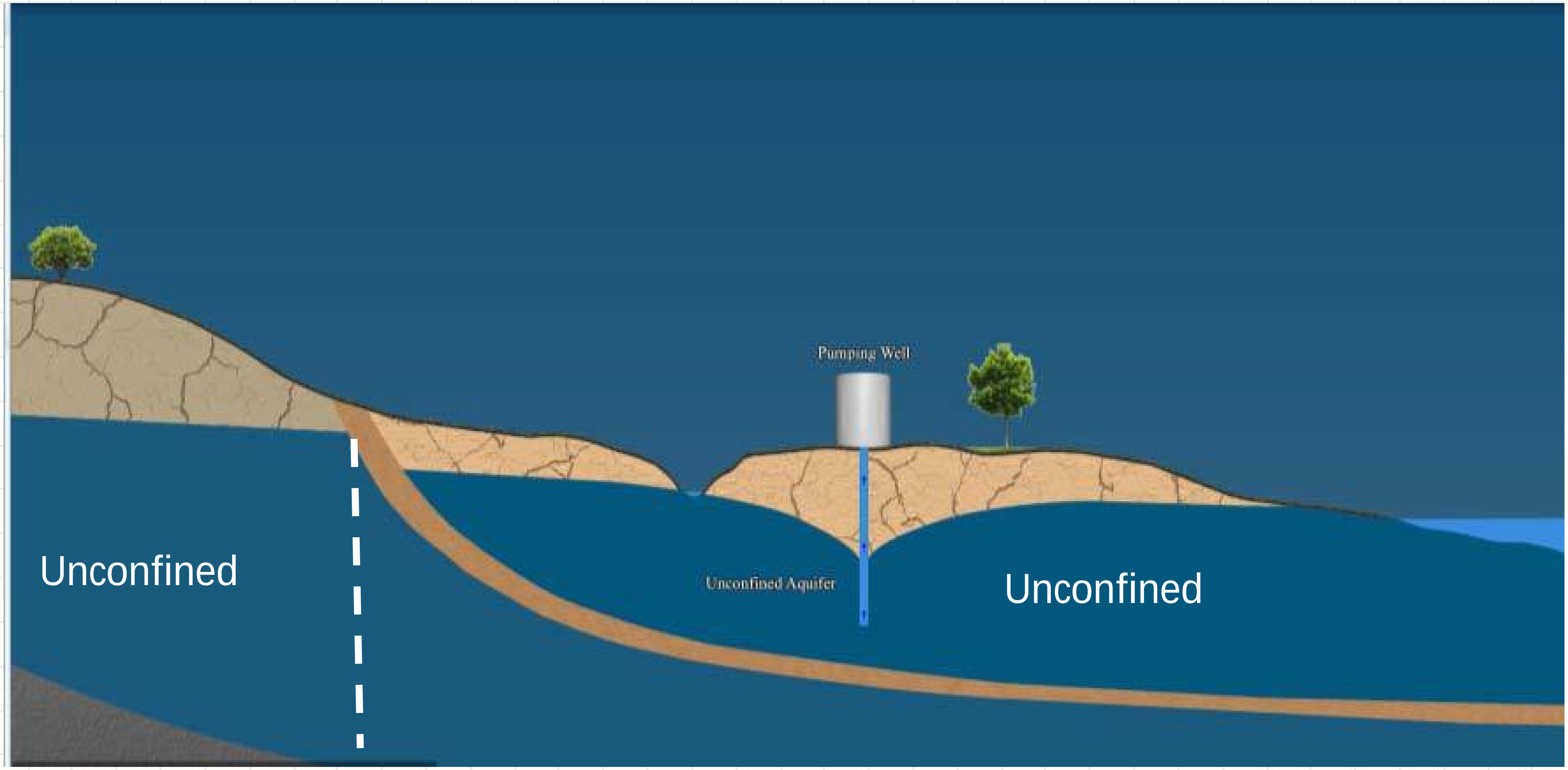


# Confined Aquifer




- Not exposed to atmosphere (surrounded by “aquitards” confining units)
- Water levels are above “aquifer unit”
- Water under pressure
- Usually less energy to pump
- Recharge only through “inflows” – no precipitation recharge or surface water interactions

# Unconfined Aquifer




- Exposed to "atmosphere"
- Allows interaction with surface water, plants, evaporation, and recharge from precipitation
- Usually more energy to pump
- Pumping can lower water levels in aquifer itself

# MODULE 3: GROUNDWATER BUDGET AND AVAILABILITY MODELS

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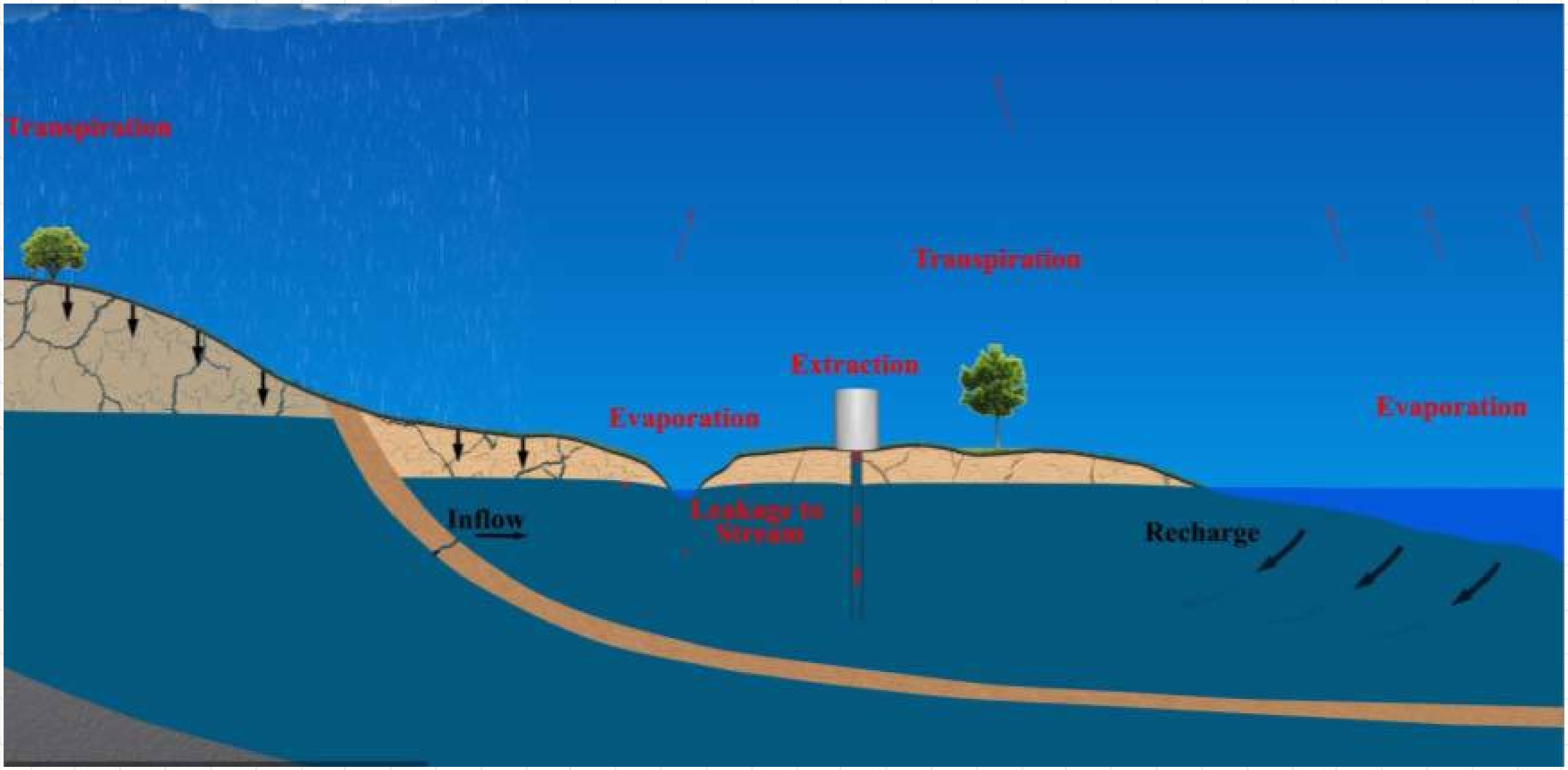
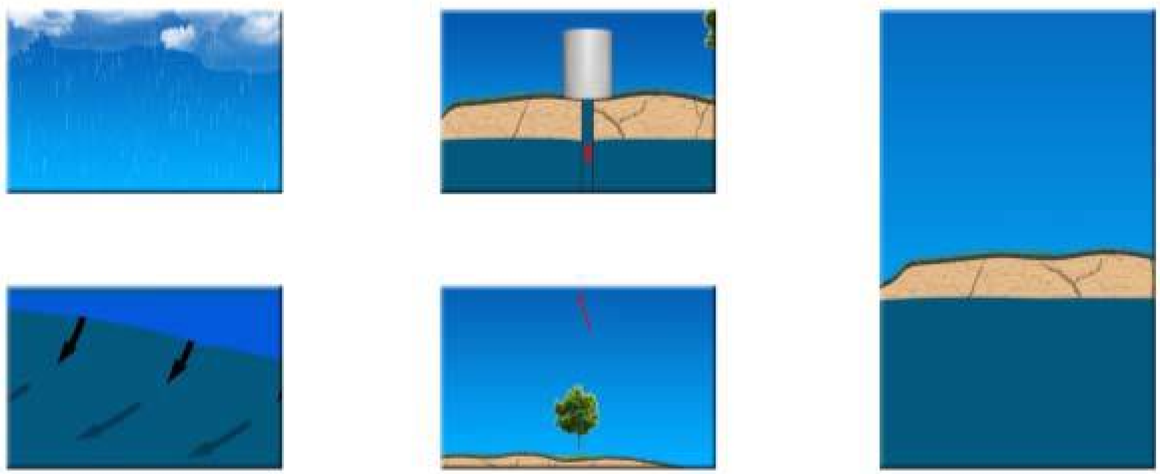
# Water Cycle:




Inflows (black)
Outflows (red)

# Simple water budget


Credits | Debits | Balance



Inflow | Outflow | Storage

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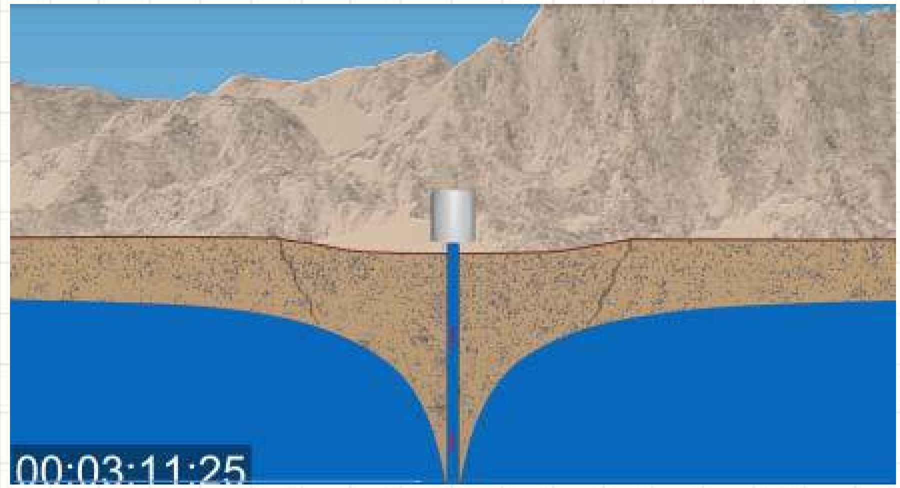
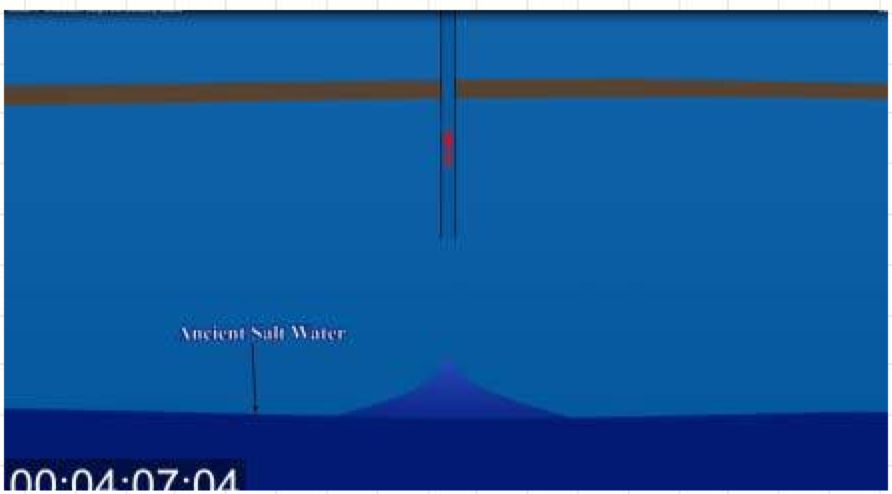
# Some concerns with pumping…

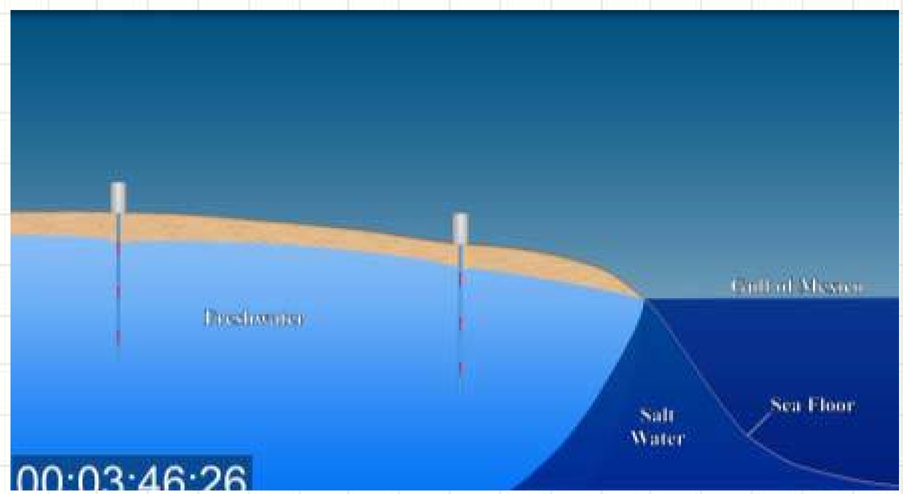
Surface water/groundwater interactions

Subsidence

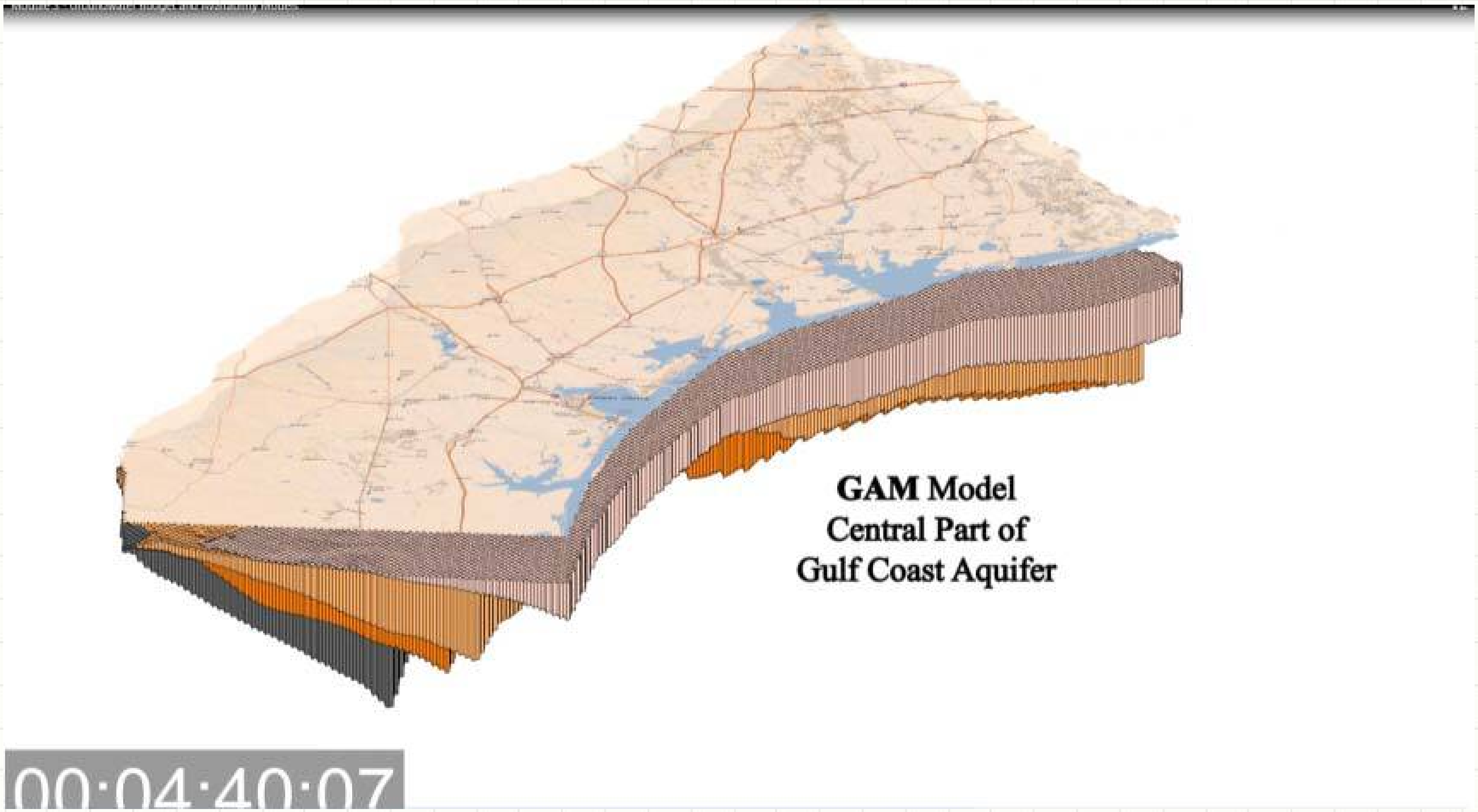



Water quality issues

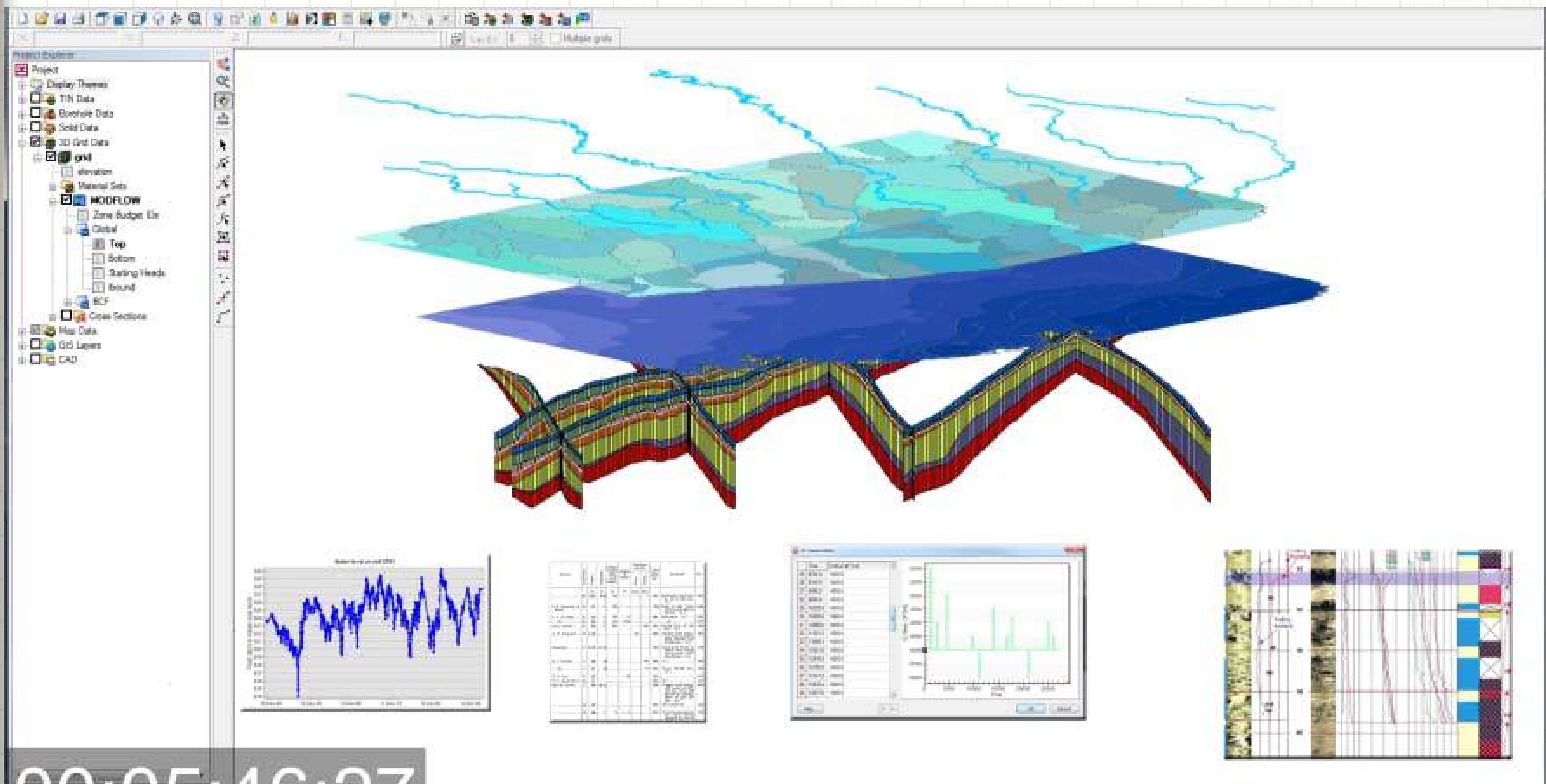


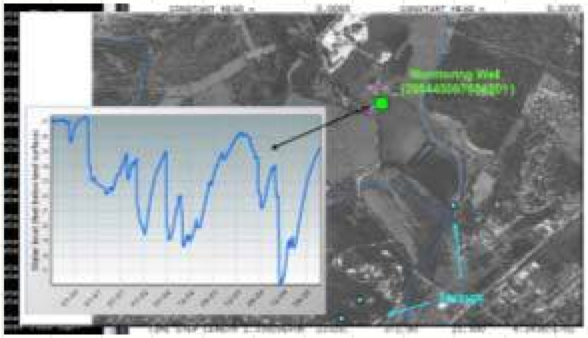
# Groundwater Availability Models (GAM)

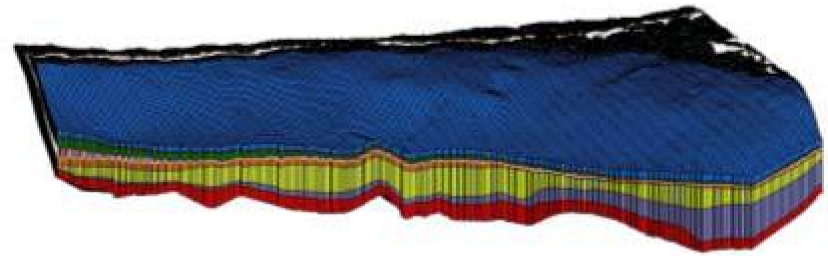


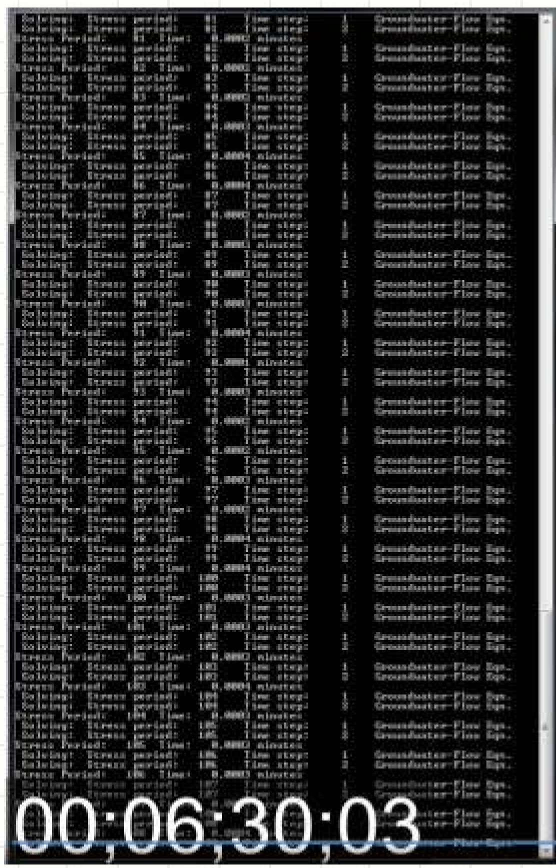
# Review data to develop conceptual model

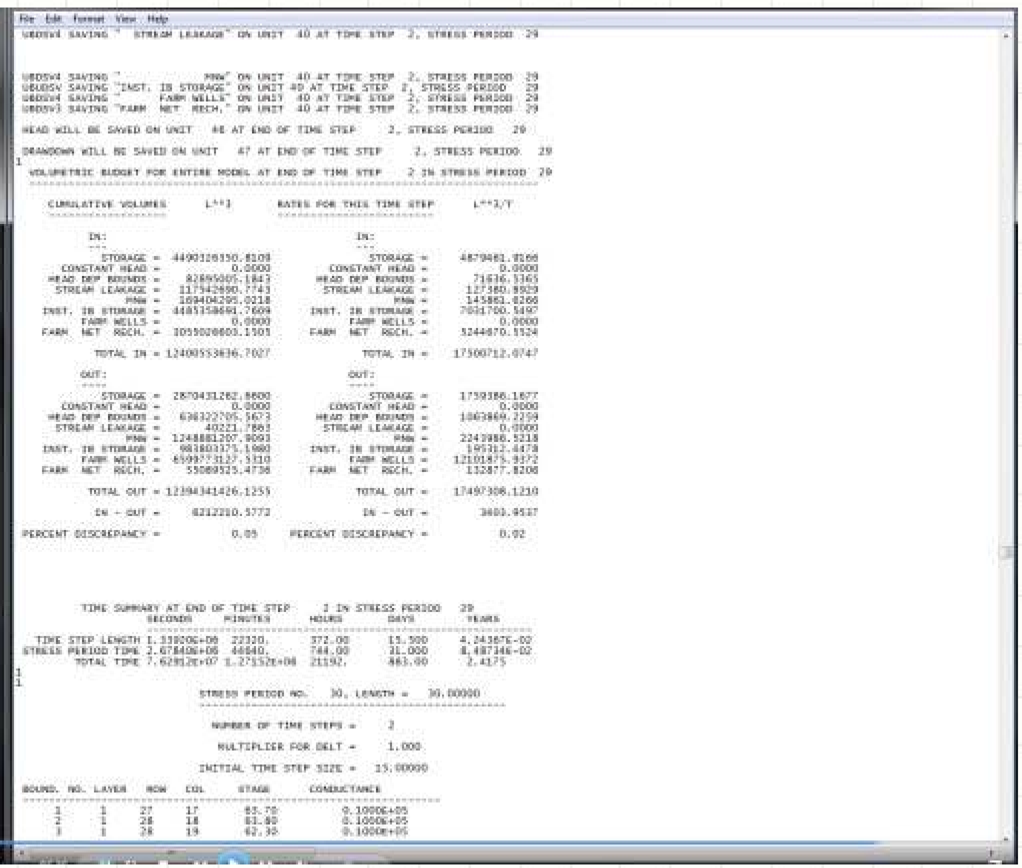


# Model calibrations and simulations…







# Tentative Schedule

- **January to March, 2014**: Review draft videos for pace, images, sound
- **March to August 2014**: Provide draft videos for review and screening
- **September to December 2014**: Finalize with closed captions
- **January 31, 2015**: Provide final draft deliverables to Texas Water Development for review and comment
- **June 30, 2015:** Review final deliverables and close contract

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# Summary

- Aquifers behave differently depending on the aquifer materials
- Aquifers behave differently depending if they are unconfined or confined
- Large pumping (outflows) usually affect the status quo or balance of the aquifer system
- …the existence, origin, movement, and course of [groundwater] may be somewhat concealed but is not always so secret or occult. (groundwater models help!)

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# Contact Information

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# QUESTIONS?

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