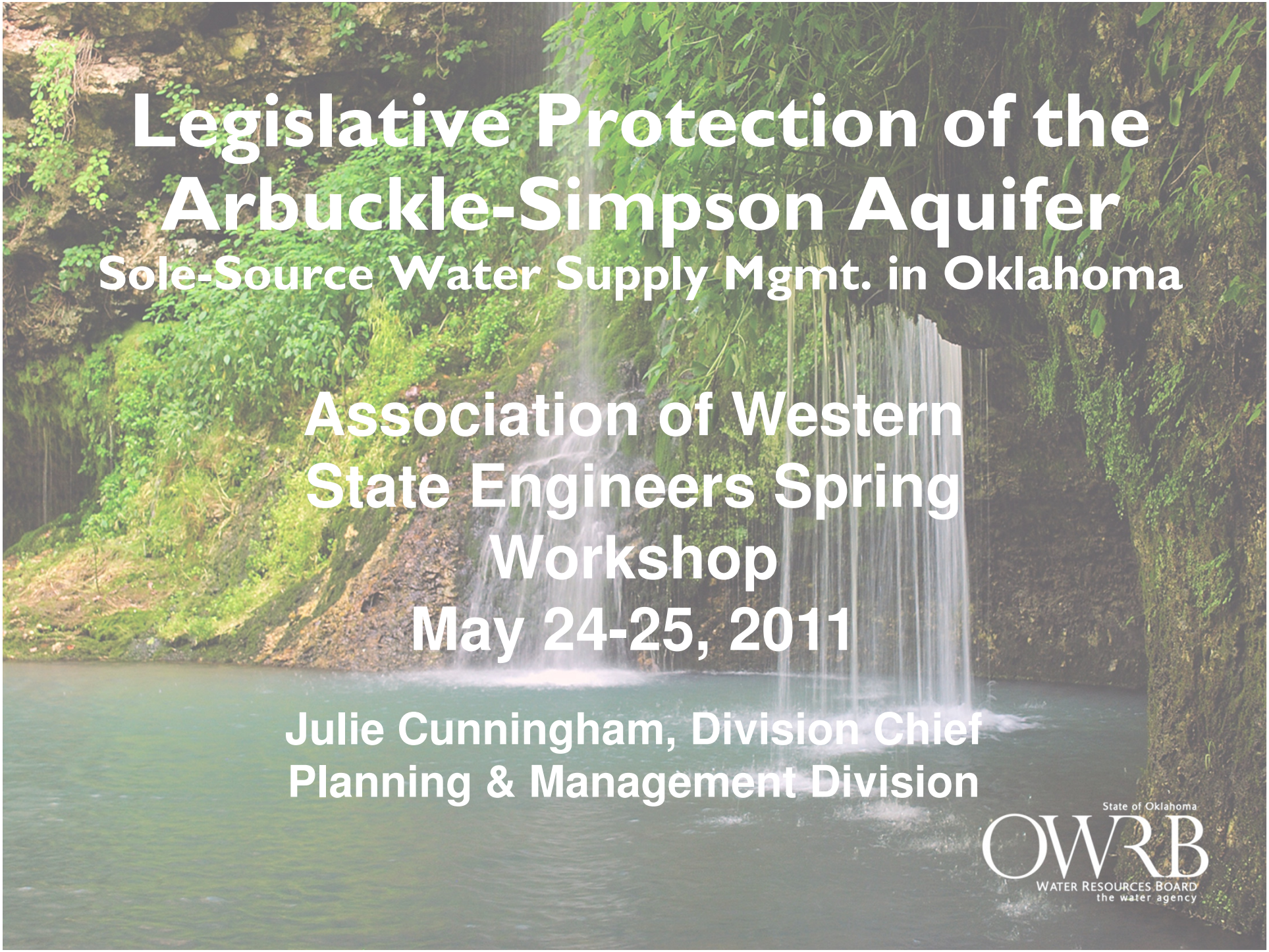

Legislative Protection of the Arbuckle-Simpson Aquifer

Sole-Source Water Supply Mgmt. in Oklahoma

Association of Western State Engineers Spring Workshop
May 24-25, 2011

Julie Cunningham, Division Chief
Planning & Management Division

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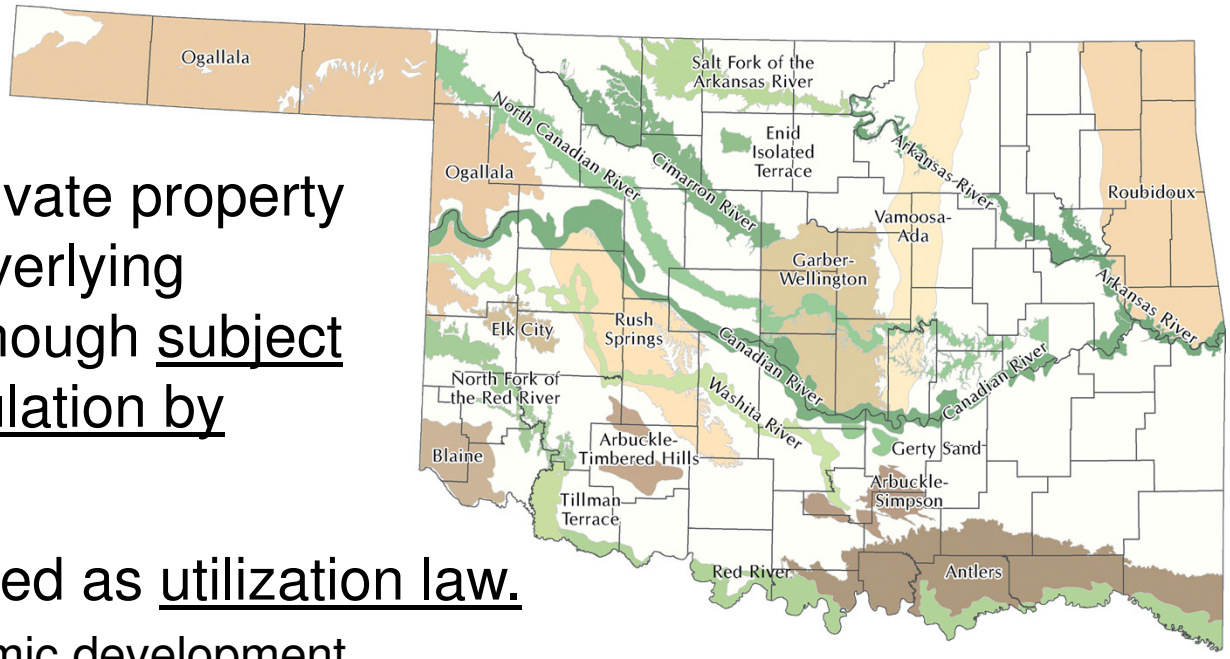
Oklahoma Groundwater Law



GW considered private property belonging to the overlying surface owner, although <u>subject to reasonable regulation by OWRB.</u>

1973 law established as <u>utilization law.</u>

- Created for economic development
- Mining law allows depletion

<u>Current discussion refocusing on conservation of resource!</u>

23 major groundwater aquifers store ~320 million a.f. of water

10,500 groundwater permits allocate ~3.2 million a.f./year

Overview of GW Permitting

If the Board finds that these four points of law have been met, "*…then the Board shall approve the application and issue the appropriate permit.*"

Four Points of Groundwater Law:

1. The applicant owns or leases the land from which the water will be withdrawn
2. The dedicated land overlies a groundwater basin
3. The water will be put to a beneficial use
4. Waste of the water will not occur

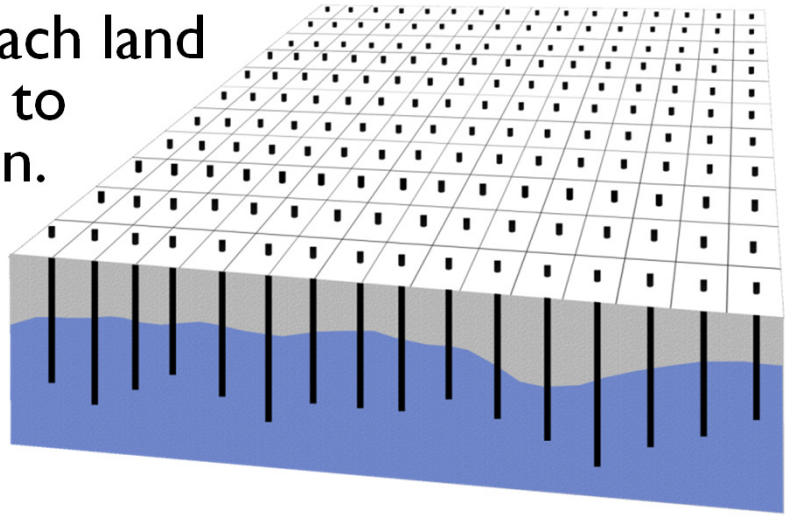
Domestic Uses exempt from permit requirement.

GW Availability Determinations

Question: **How much water is available per acre of land?**

Max. Annual Yield (MAY) is a determination by the Board of the **total amount of fresh gw** that can be produced from a basin or subbasin allowing a **minimum 20-year life.**

"Equal Proportionate Share" applies: Each land owner has right to share of MAY equal to his/her ownership of land over the basin.



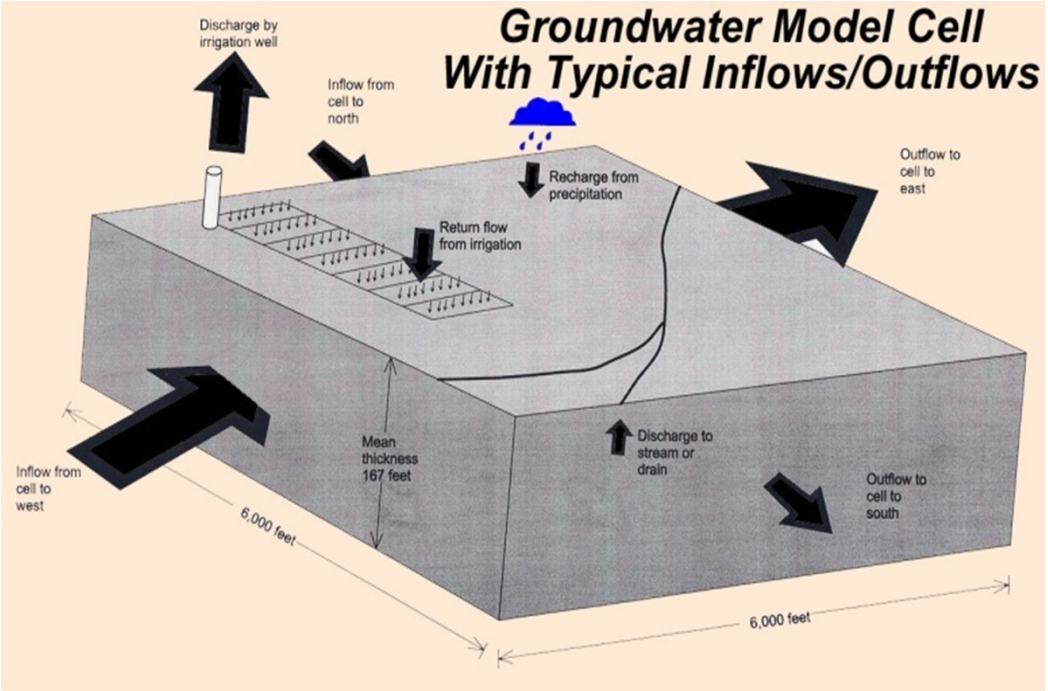
GW Availability Determinations

Amount apportioned based on land owned , (default two acre-feet water per acre of land by statute):

- Slightly more or less in basins where detailed hydrologic surveys have been conducted (0.5 acre-feet/acre- Enid Isolated Terrace up to 2.1 acre-feet/acre- Antlers Sandstone)
- Well spacing requirement only in basins with adopted hydrologic survey (1,320 feet in bedrock and 660 feet in alluvium & terrace aquifers).
- No priority in types of uses (OWRB v. Texas Co. Irrigation & Water Resources Association Inc., 1984 OK 96)
- Metering of wells only required "Upon request of a majority of landowners residing within a basin" (82 O.S. § 1020.19))

Determination of Maximum Annual Yield

- Total land area overlying the basin
- Water in storage
- Recharge rate
- Discharge
- Transmissivity
- Possibility of pollution



- Minimum 20 year life of the basin
- <u>New addl. requirement under SB 288 to protect "Sensitive Sole Source" basins!</u>

Senate Bill 288

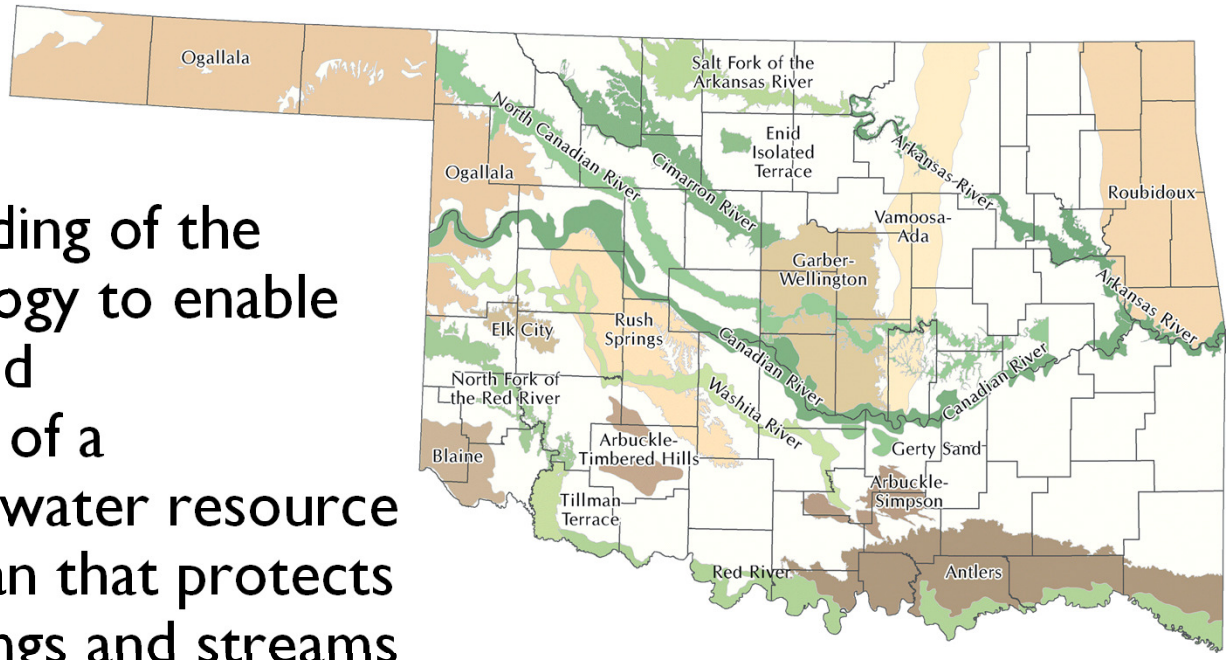
- BROAD focus— Imposes **moratorium** on **"outside-basin" use** of Arbuckle-Simpson water "until such time as the OWRB "approves a **maximum annual yield** that will ensure that any permit for the removal of water" from the basin **will not reduce the natural flow of water from springs or streams** emanating" therefrom.

- NARROW focus— Essentially adds a **fifth point of law** or criteria that conditions the OWRB's issuance of any groundwater permit on findings that the proposed use **is not likely "to degrade or interfere with springs or streams emanating in whole or in part"** therefrom.


Buffalo Spring in Chickasaw

OWRB

Arbuckle-Simpson Aquifer Study



Study Purpose:

- Gain understanding of the aquifer's hydrology to enable development and implementation of a comprehensive water resource management plan that protects the flow of springs and streams in the region.

Study Scope:

- Aquifer-scale assessment for determination of the maximum annual yield

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Arbuckle-Simpson Aquifer Study

Study Objectives:

- Characterize geologic setting, boundaries, hydraulic properties, water levels, gw flow, recharge, discharge, budget
- Characterize surface water hydrology- stream and spring discharge, runoff, base flow, surface/gw relationship
- Construct digital gw/sw flow model to evaluate allocation of water rights and simulate management options
- Determine chemical qualities, potential natural contaminants, and vulnerable areas.
- Construct stream water allocation models of major streams
- Propose water management options that address potential impacts of pumping on base flows, wq, and supply development.

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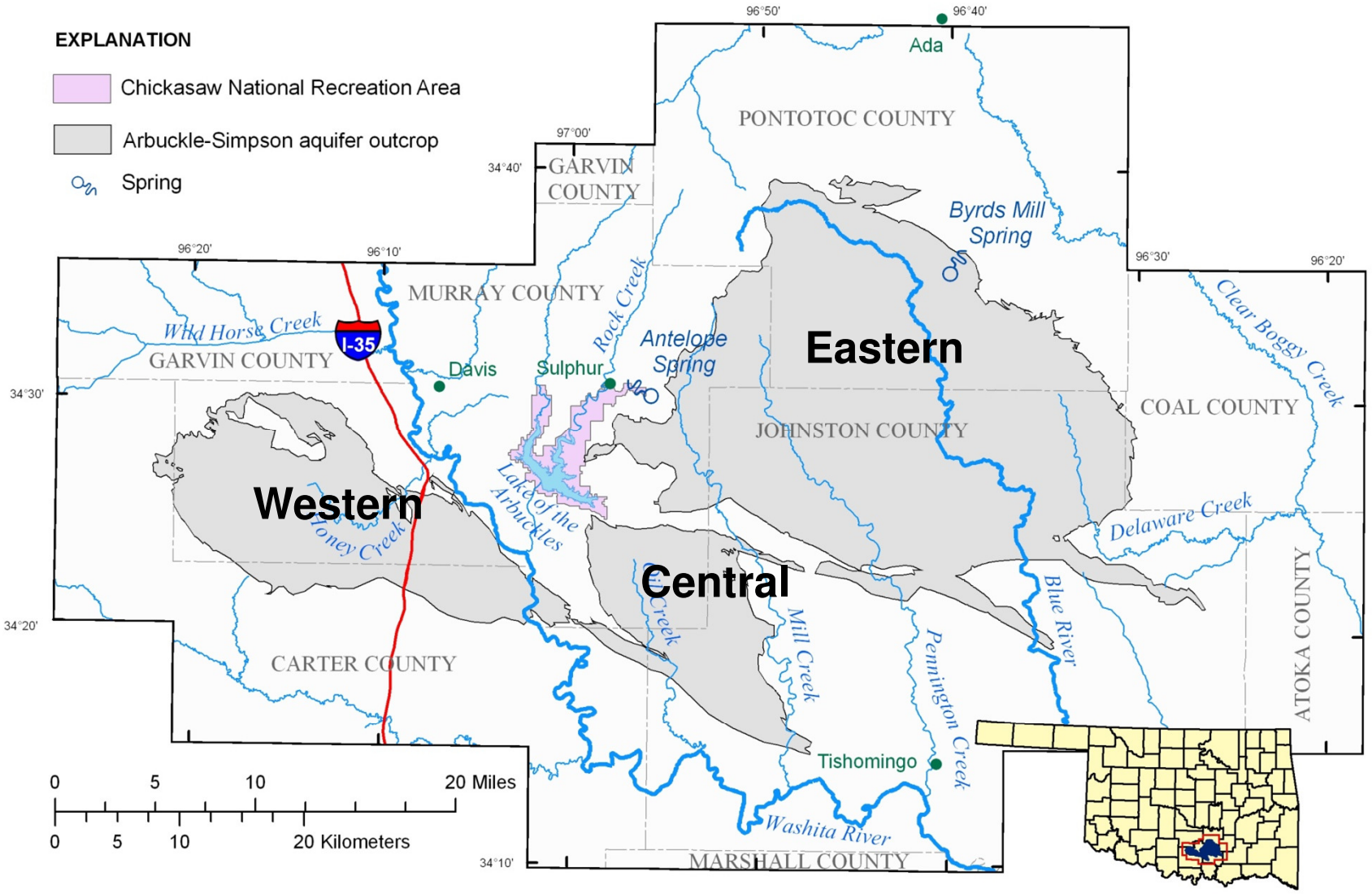
EXPLANATION
Chickasaw National Recreation Area
Arbuckle-Simpson aquifer outcrop
Spring
96°50'
96°40'
Ada
PONTOTOC COUNTY
97°00'
34°40'
GARVIN COUNTY
96°20'
96°10'
96°30'
96°20'
MURRAY COUNTY
Byrds Mill Spring
Clear Boggy Creek
Wild Horse Creek
I-35
GARVIN COUNTY
Davis
Sulphur
Rock Creek
Antelope Spring
Eastern
34°30'
COAL COUNTY
JOHNSTON COUNTY
Western
Lake of the Arbuckles
Delaware Creek
Central
Honey Creek
Mill Creek
Pennington Creek
Blue River
ATOKA COUNTY
34°20'
CARTER COUNTY
Tishomingo
0 5 10 20 Miles
0 5 10 20 Kilometers
Washita River
34°10'
MARSHALL COUNTY

Protection of Springs and Streams

- Approve a maximum annual yield that will not reduce the natural flow of water from springs or streams emanating from the basin.

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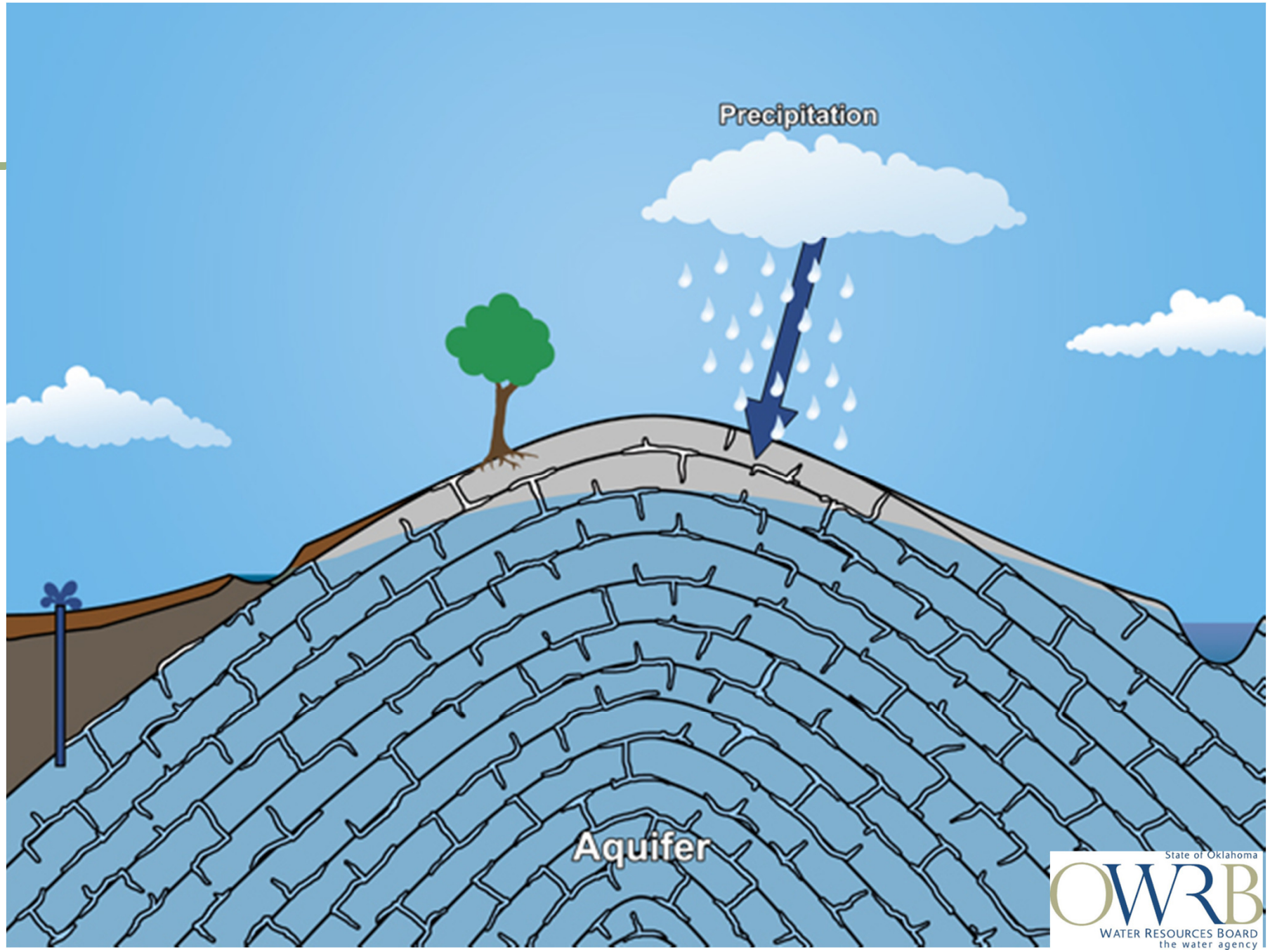
Arbuckle-Simpson Hydrology Study

- Conducted **comprehensive hydrologic investigation**
- Greatly enhanced understanding of the hydrology
- Obtained scientific information necessary to make informed water management decisions

Participants

- U.S. Bureau of Reclamation
- U.S. Geological Survey
- Oklahoma State University
- University of Oklahoma
- Oklahoma Geological Survey
- Climatological Survey
- U.S. Environmental Protection Agency
- The Nature Conservancy
- Chickasaw and Choctaw Nations
- National Park Service
- Hydrosphere Resource Consultants
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Citizens for the Protection of the Arbuckle-Simpson Aquifer
- Municipalities
- Landowners


Precipitation
Aquifer
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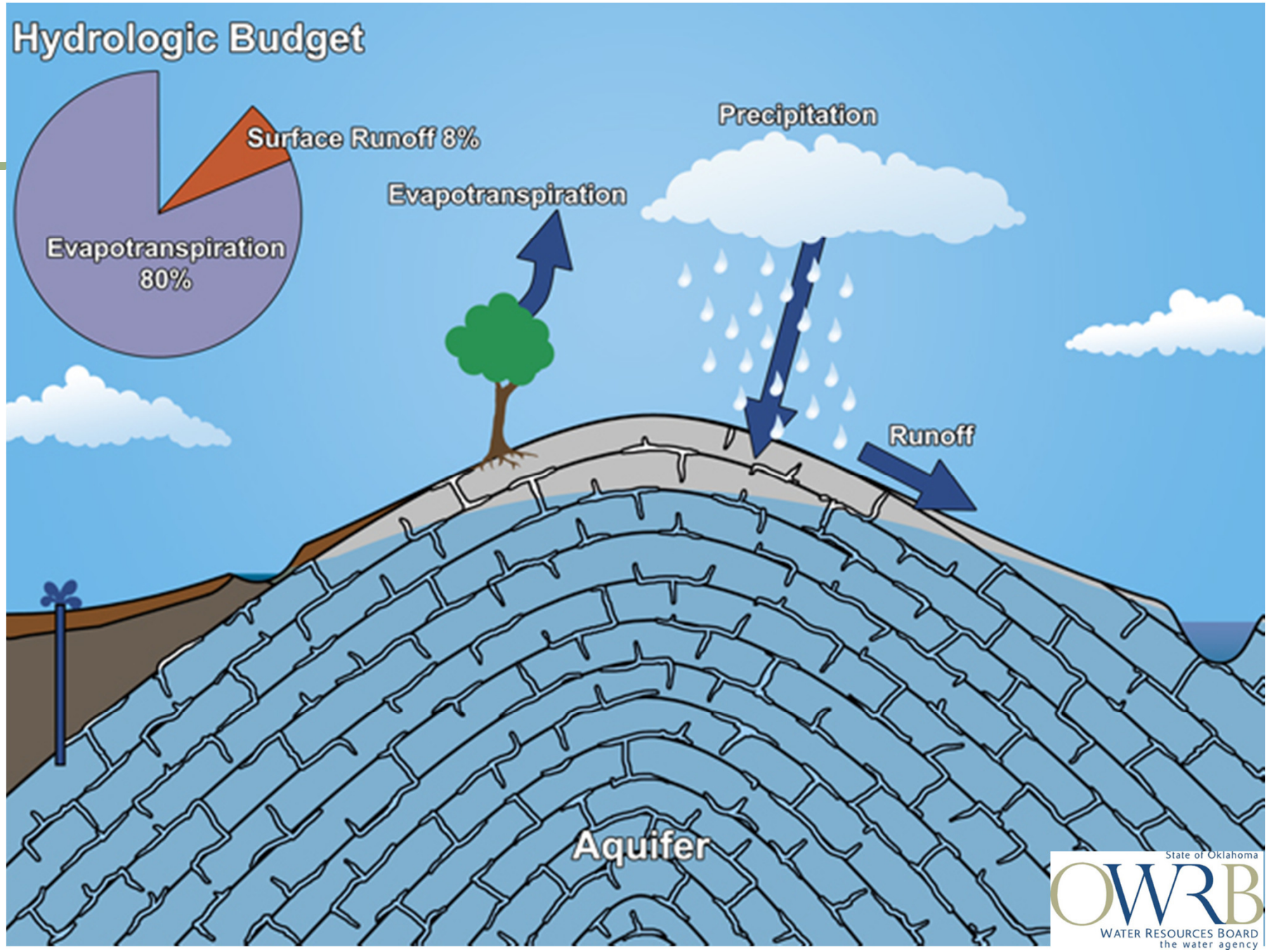
Hydrologic Budget
Surface Runoff 8%
Evapotranspiration 80%
Evapotranspiration
Precipitation
Runoff
Aquifer
State of Oklahoma
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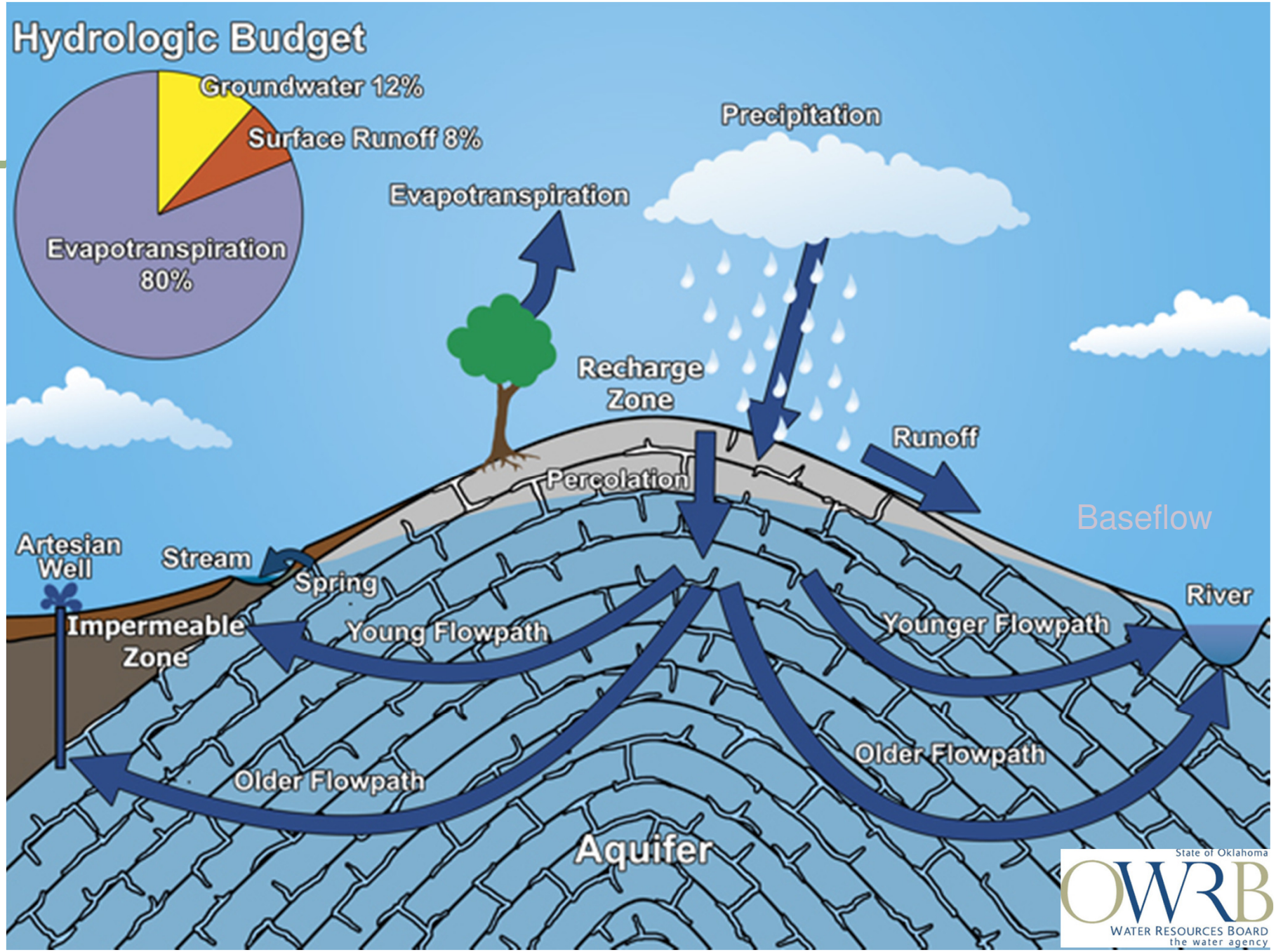
Hydrologic Budget
Groundwater 12%
Surface Runoff 8%
Evapotranspiration 80%
Precipitation
Evapotranspiration
Recharge Zone
Runoff
Percolation
Baseflow
Artesian Well
Stream
Spring
River
Impermeable Zone
Young Flowpath
Younger Flowpath
Older Flowpath
Older Flowpath
Aquifer
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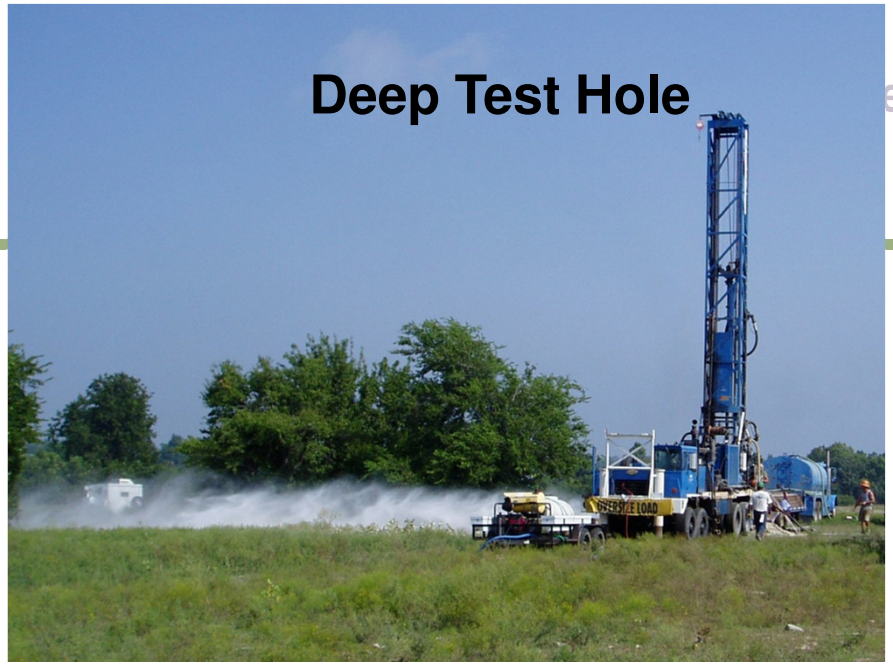

Deep Test Hole


Ground Penetrating Radar


Helicopter Electromagnetic


Gravity

Putting the pieces together

Geology
- Petroleum information
- Fracture properties
- Geophysics
- Deep test well
- 3-D geologic modeling

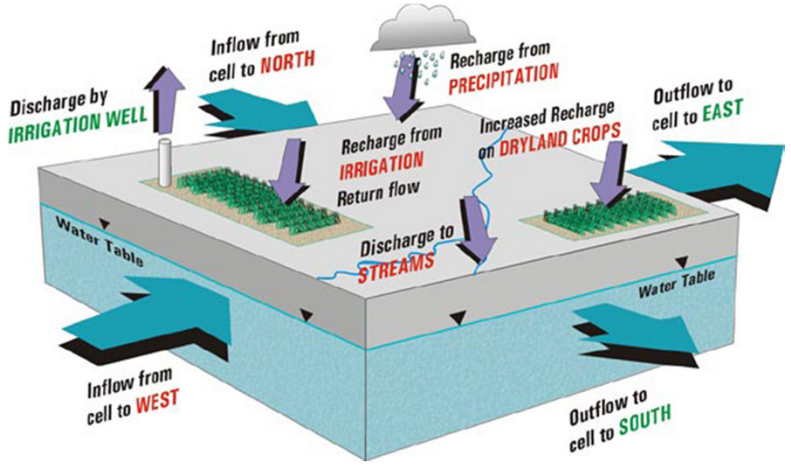
Surface Water:
- 3 USGS gages
- Baseflow monitoring
- Rainfall-runoff modeling
- Instream flow study

Climate
- Fittstown Mesonet station
- Hydrologic budget
- Tree-ring analysis

Ground Water:
- Water-level monitoring
- Water chemistry
- Age-dating
- Aquifer tests
- Water use
- Ground-water modeling

Digital Groundwater Flow Model

- Test our understanding of the aquifer
- Predict the consequences of groundwater withdrawals on streamflow
- Evaluate allocation of water rights
- Simulate management options



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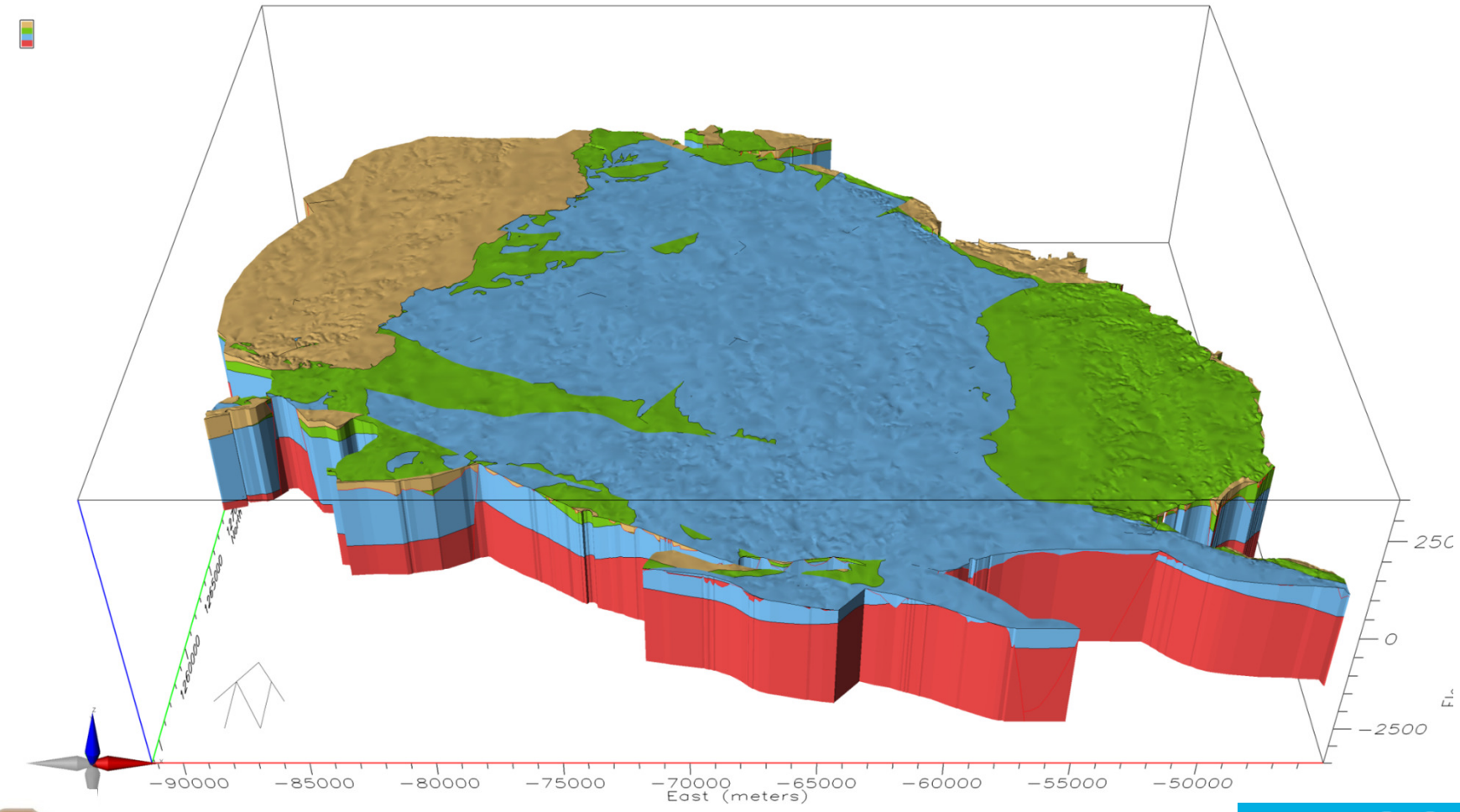
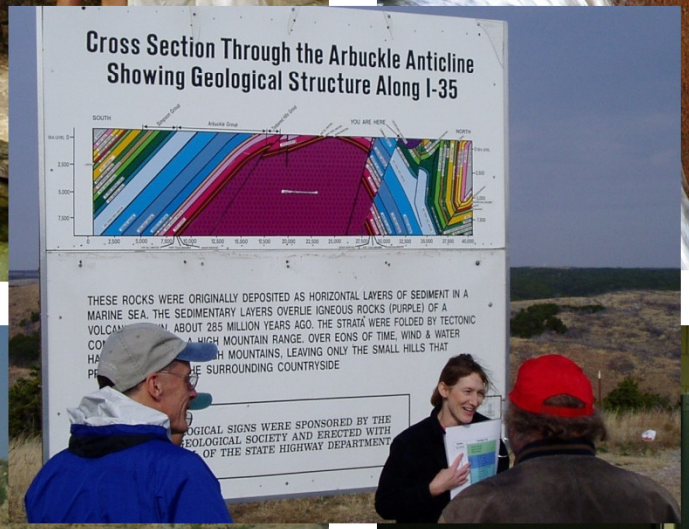
3D Geologic Model

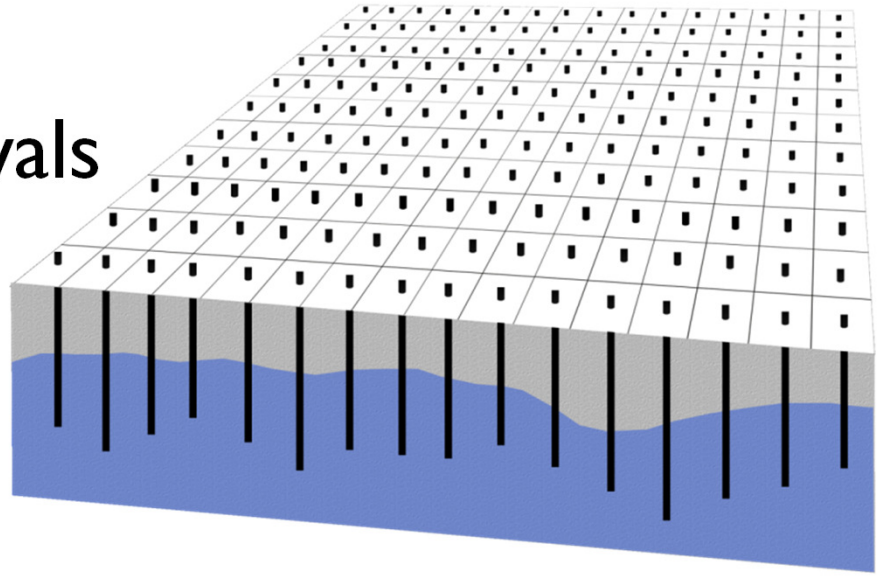



Cross Section Through the Arbuckle Anticline
Showing Geological Structure Along I-35
SOUTH
NORTH
YOU ARE HERE
THESE ROCKS WERE ORIGINALLY DEPOSITED AS HORIZONTAL LAYERS OF SEDIMENT IN A
MARINE SEA. THE SEDIMENTARY LAYERS OVERLIE IGNEOUS ROCKS (PURPLE) OF A
ABOUT 285 MILLION YEARS AGO. THE STRATA WERE FOLDED BY TECTONIC
A HIGH MOUNTAIN RANGE. OVER EONS OF TIME, WIND & WATER
H MOUNTAINS, LEAVING ONLY THE SMALL HILLS THAT
HE SURROUNDING COUNTRYSIDE
OGICAL SIGNS WERE SPONSORED BY THE
EOLOGICAL SOCIETY AND ERECTED WITH
OF THE STATE HIGHWAY DEPARTMENT


Arbuckle-Simpson Regional Geology

Model Results

- Assumes the aquifer is completely developed at some future time
- Distributed withdrawals
- Based on the equal proportionate share concept



USGS science for a changing world

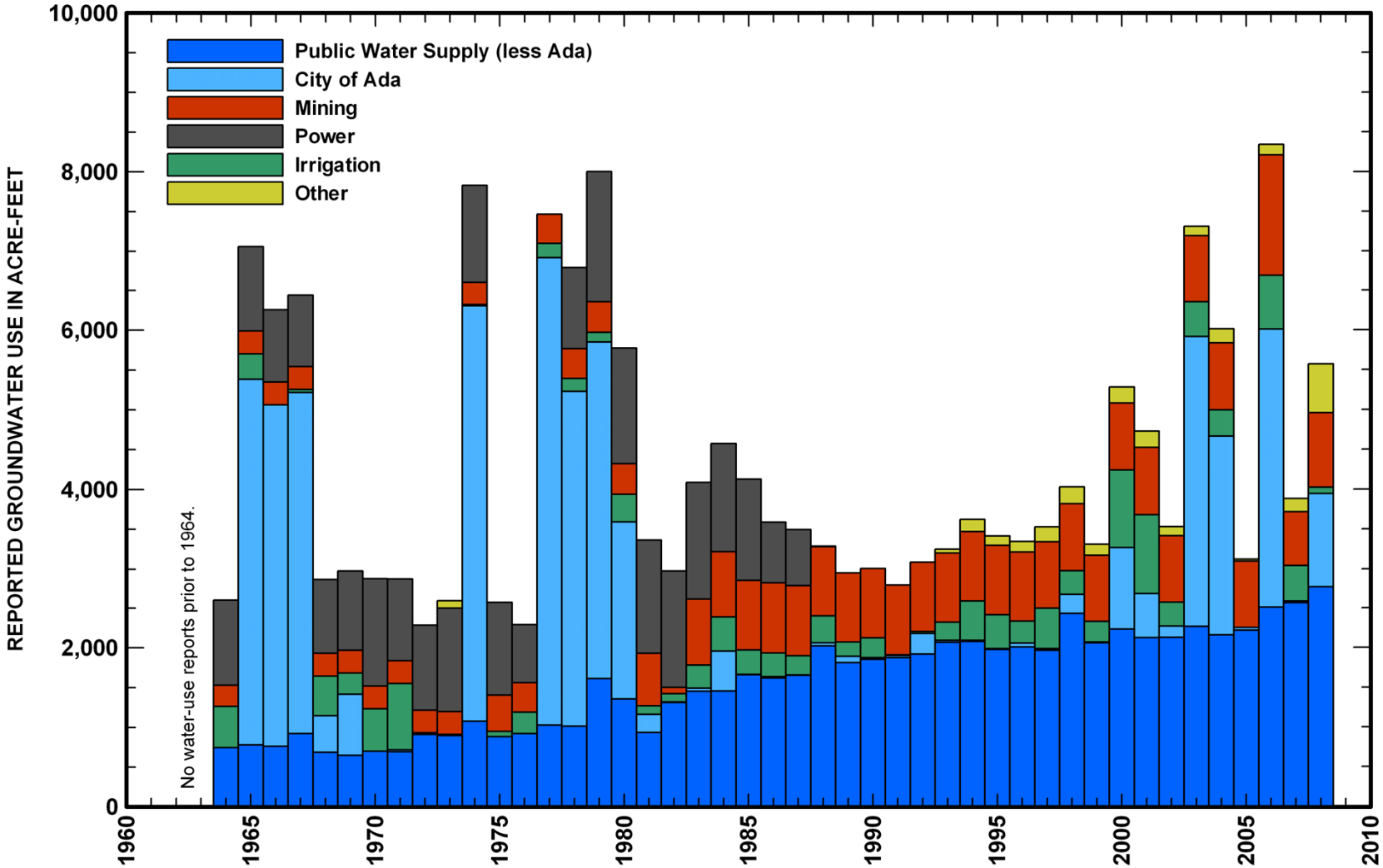
Model Simulations

- What equal proportionate share would result in 25, 33, and 50 % reductions in mean baseflow at Blue R. and Pennington Ck. stream gages?
- What EPS would result in no more than a 25% reduction in habitat based on instream flow model?
- Pumping equally distributed across the aquifer
- 0.125 - 0.250 (acre-feet/acre)/year

Questions

- What would the response be in a dry year?
- Are some areas more sensitive to pumping than others?
- How would localized pumping (rather than the equally distributed simulated pumping) affect steam and spring flow?
- Would a buffer area around springs help protect spring flow?
- What is the duration and recurrence of low flows?

Average Annual Water Withdrawal 1964-2008



Public Input

Cities, towns, rural districts— wants less **reduction in EPS** per acre (less land purchase requirement), reliable **long-term supply**, **phase-in** period for existing water right holders, and **focus on drinking water** use (SB 288 specifically targets "sole source aquifer" protection)

Citizens for the Protection of Arbuckle-Simpson Aquifer (CPASA)— very well organized citizens group that wants **protection** and permit **reductions** if stream levels decrease through time, ongoing **metering/monitoring, no export of water** to other basins

Landowners— want **fairness** in implementation timeframe and b/w gw and surface water owners, ability to **export** water, final MAY with **no future reduction** of permitted amount...

Tribe— **reduced economic burden** associated with lower EPS **without increasing adverse impacts**.

Aggregate Mining Industry, Farm Bureau, USFWS, Nat. Park Service…

Public Input

- ✓ Held, attended numerous meetings with various interests
- ✓ Held informal public meeting with over 300 in attendance
- ✓ Compiled public comments on website
- ✓ USGS Scientific Investigation complete and approved for publication by USGS in January 2011.
- ✓ Upcoming formal MAY process: tentative Board order, public hearing and comment, final order for Board approval
- ✓ New Development in 2011: CPASA group and Oklahoma Farm Bureau proposing to work on legislation to relax the "no impact" to natural flows which could be taken literally as NO use of water allowed.

Possible Management Strategies

- Well spacing requirements
- Restricting pumping rates
- Set-back distances from springs and streams
- Sub-basin allocations
- Term permits
- Conjunctive use of groundwater and surface water to optimize use and to minimize adverse effects
- Credits for conservation practices/artificial recharge/flow mitigation
- Phase in period for existing users
- Metering requirement
- Creation of a local management authority
- Site specific analysis to protect local springs and streams
- Establish minimum instream flows for major streams
  - Cause restrictions to SW & GW users

Questions?

Julie Cunningham, Division Chief

Planning & Management Division
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, Oklahoma 73118

www.owrb.ok.gov
jmcunningham@owrb.ok.gov
Phone: 405-530-8800

Four Points of GW Law

4. Waste of water will not occur.

Two types of waste considered:

1. Waste by pollution-

Board may consider...

- manner and method of…applicant's uses of fresh groundwater;
- …well and water distribution system;
- history and incidents of permitting or causing pollution…or failure to properly plug abandoned…wells…;
- and anything else that tends to prove that the applicant will or will not cause or allow groundwater pollution

If the activity for the use of water is required by ODEQ or ODAFF, Board shall be precluded from making waste by pollution determination

Four Points of GW Law

4. Waste of water will not occur (cont.)

2. Waste by Depletion- Board considers evidence concerning the…
   - manner and method of use proposed
   - efficiency of system proposed
   - history and incidents of past waste and applicant's response thereto; and
   - amount of groundwater needed for proposed purpose in relation to the amount allocated to the land dedicated to the application

To ensure waste…will not occur…Board may impose conditions on the use of the groundwater

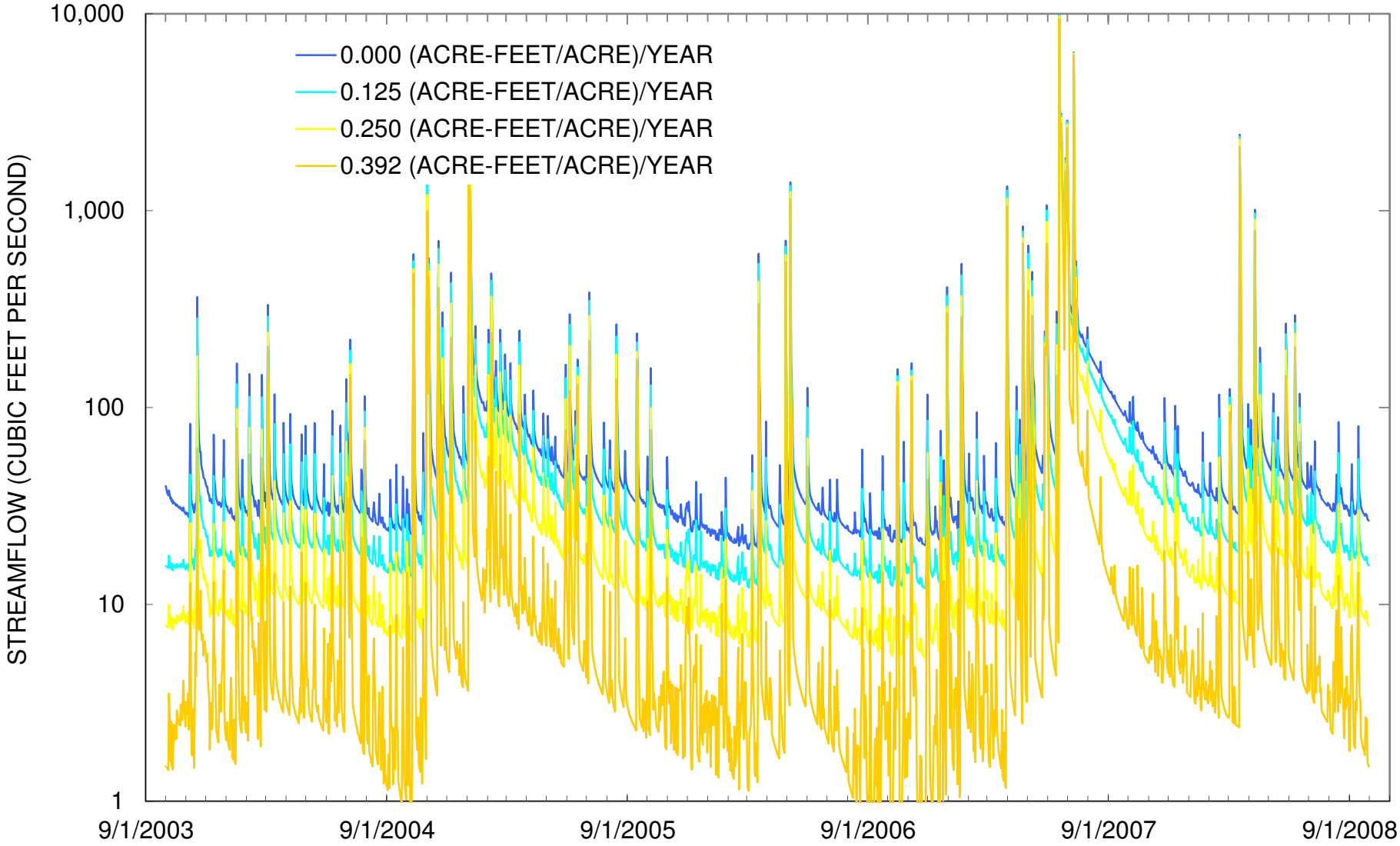


Figure X. Model calculated streamflow for Blue River near Connerville (07332390) for water years 2004-08 based on groundwater withdrawals distributed as an equal proportionate share

Preliminary results, subject to revision

USGS science for a changing world

Water Use Permitting in Oklahoma

- Domestic Use of Water:
  - ...for household purposes, for farm and domestic animals up to the normal grazing capacity of the land whether or not the animals are actually owned by such natural individual or family, and for the irrigation of land not exceeding a total of 3 acres in area for the growing of gardens, orchards and lawns.
  - ...for agriculture purposes;
  - ...for fire protection;
  - ...by non-household entities for drinking water purposes, restroom use, and the watering of lawns
    - not to exceed 5 acre-feet per year