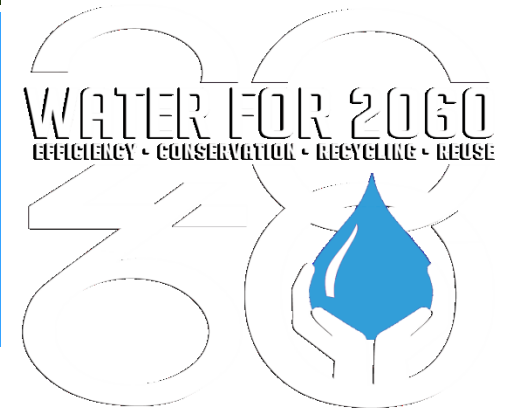
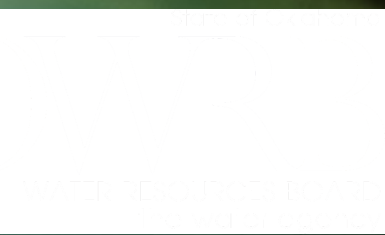


Oklahoma's Water Resources

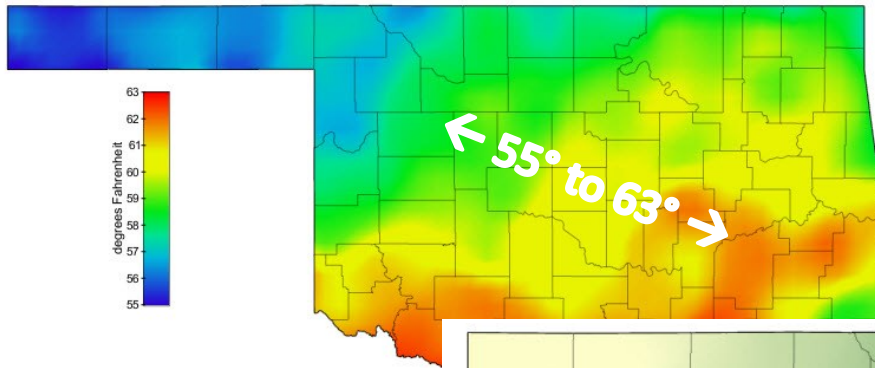


*Western States Water Council
Spring (177th) Meeting
April 17, 2015*

J.D. Strong
OWRB Executive Director



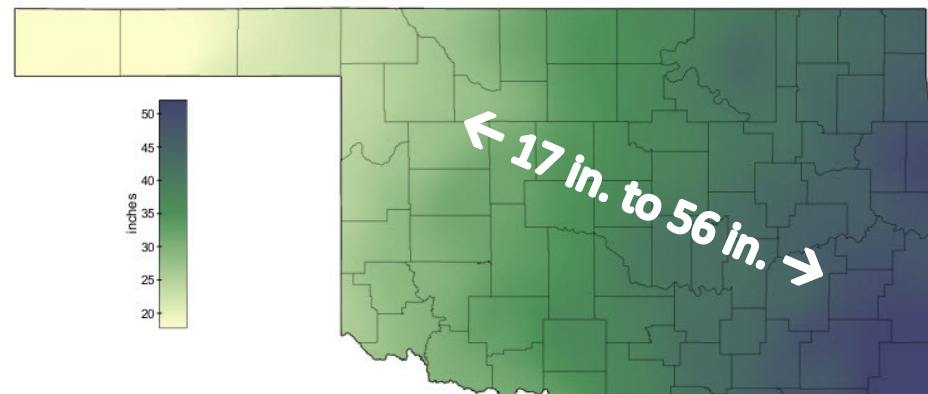
Oklahoma Climate/Terrain



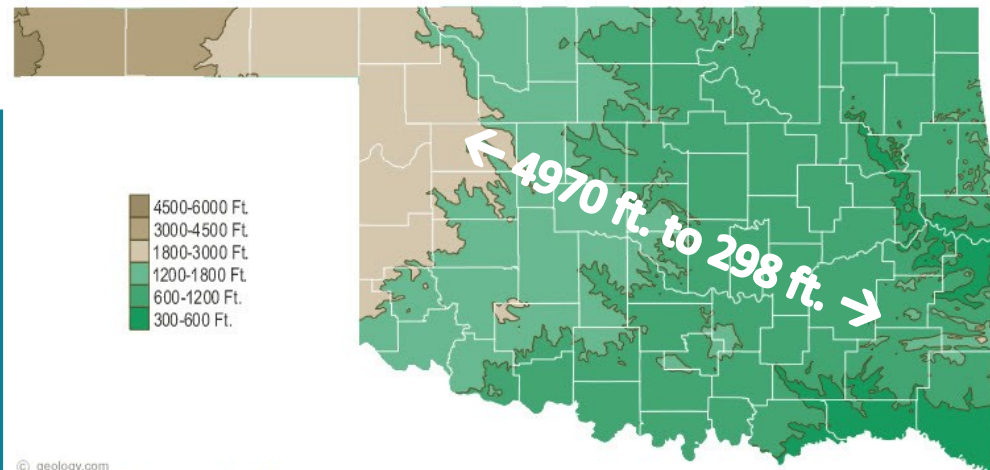
Extremes: -27° to 120°

OKLAHOMA
CLIMATOLOGICAL SURVEY
Normal Annual Temperature

Calculated using no

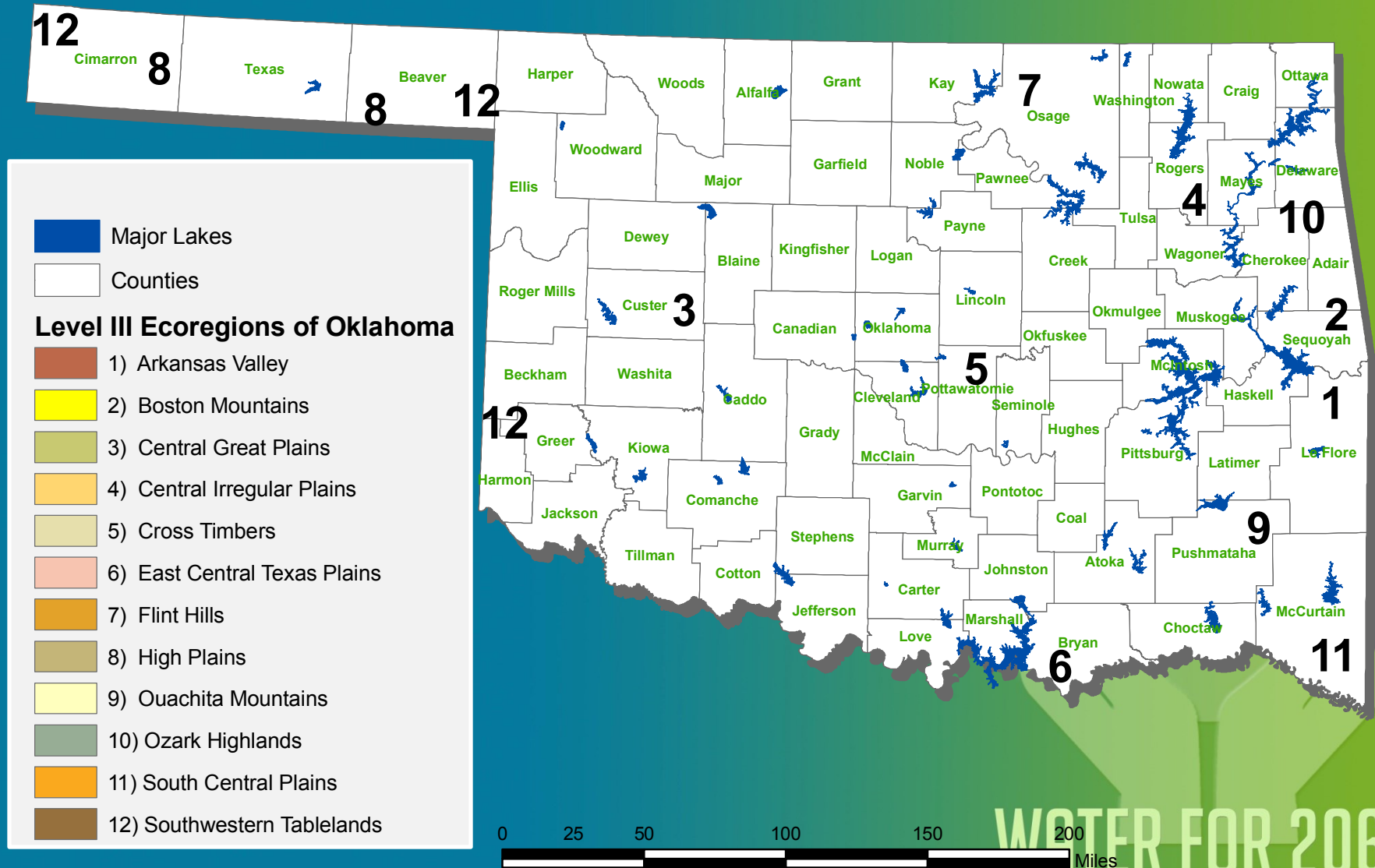


OKLAHOMA
CLIMATOLOGICAL SURVEY
Normal Annual Precipitation

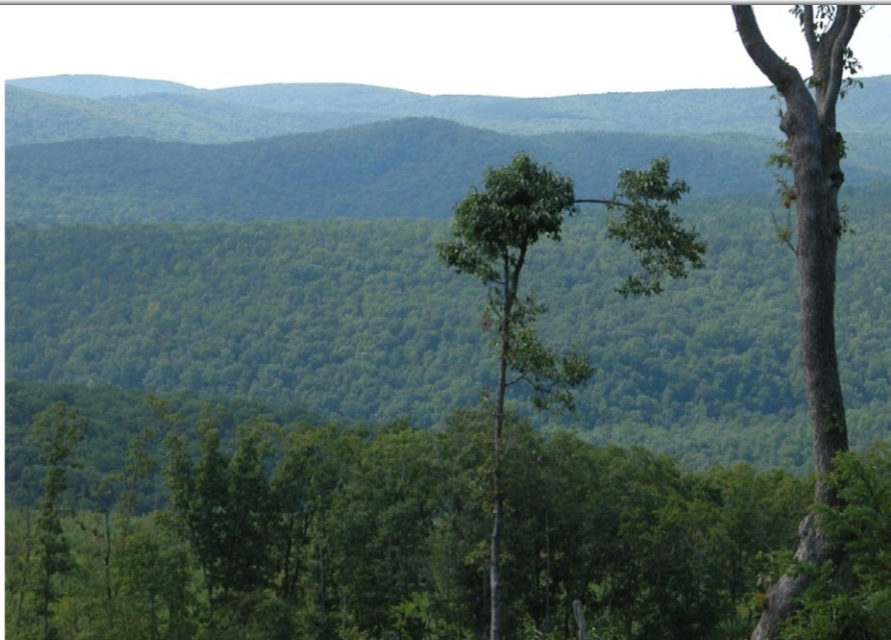


© geology.com
Oklahoma Topographic Map :

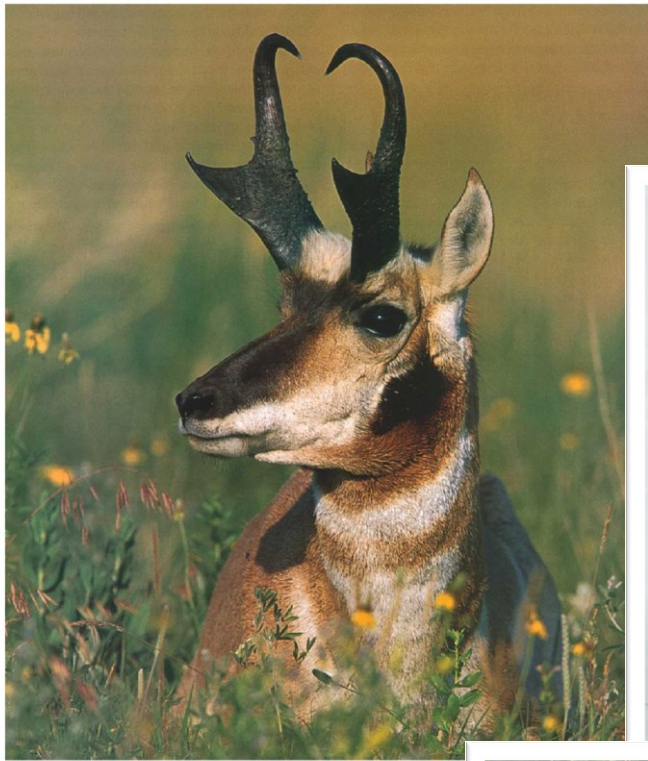
12 Ecoregions of Oklahoma







EFFICIENCY - CONSERVATION - RECYCLING - REUSE

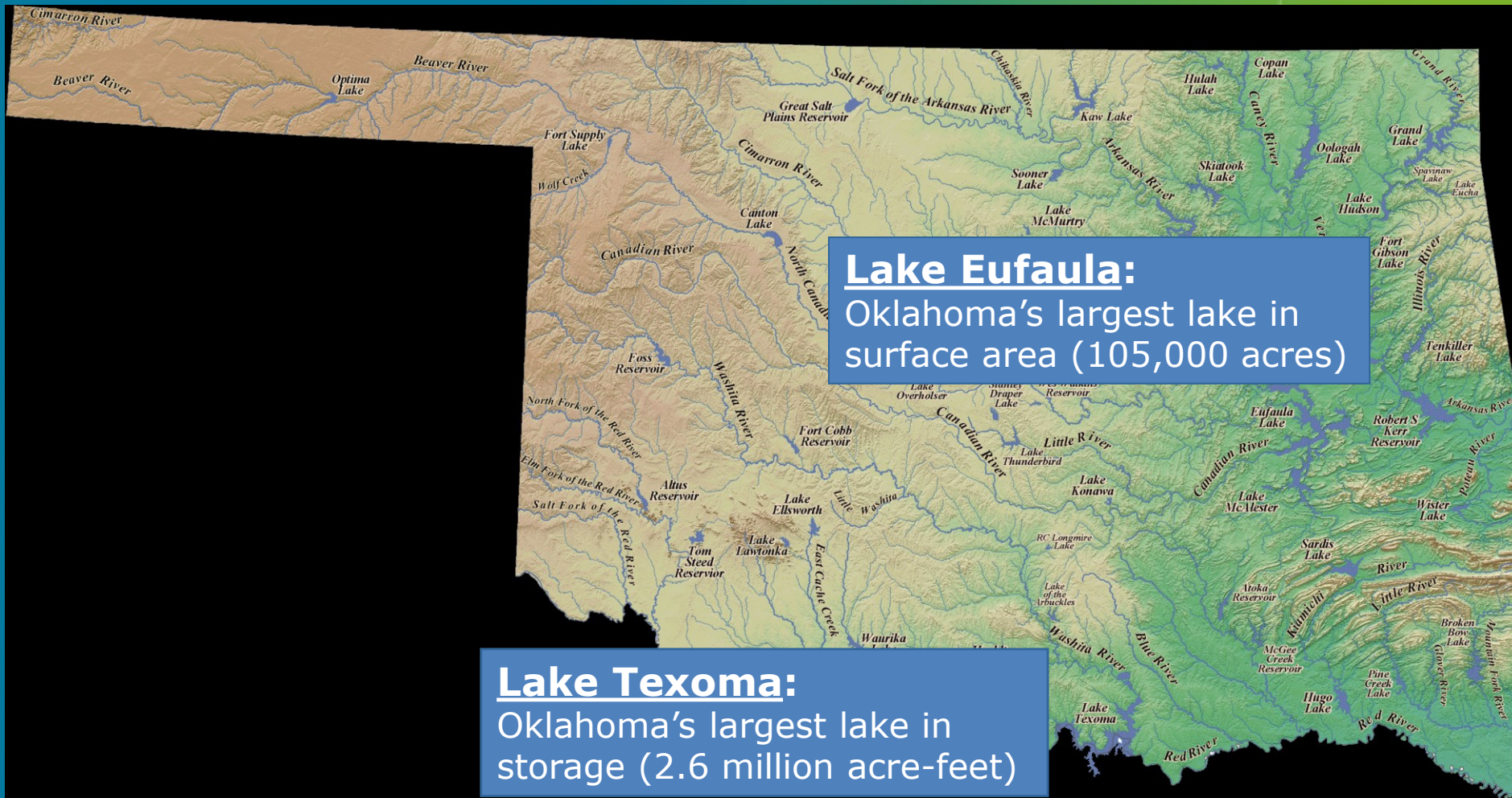


2060

EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Oklahoma's Water Resources

- 34 major reservoirs store 13 million acre-feet of water
- 4,300 public/private & watershed protection lakes

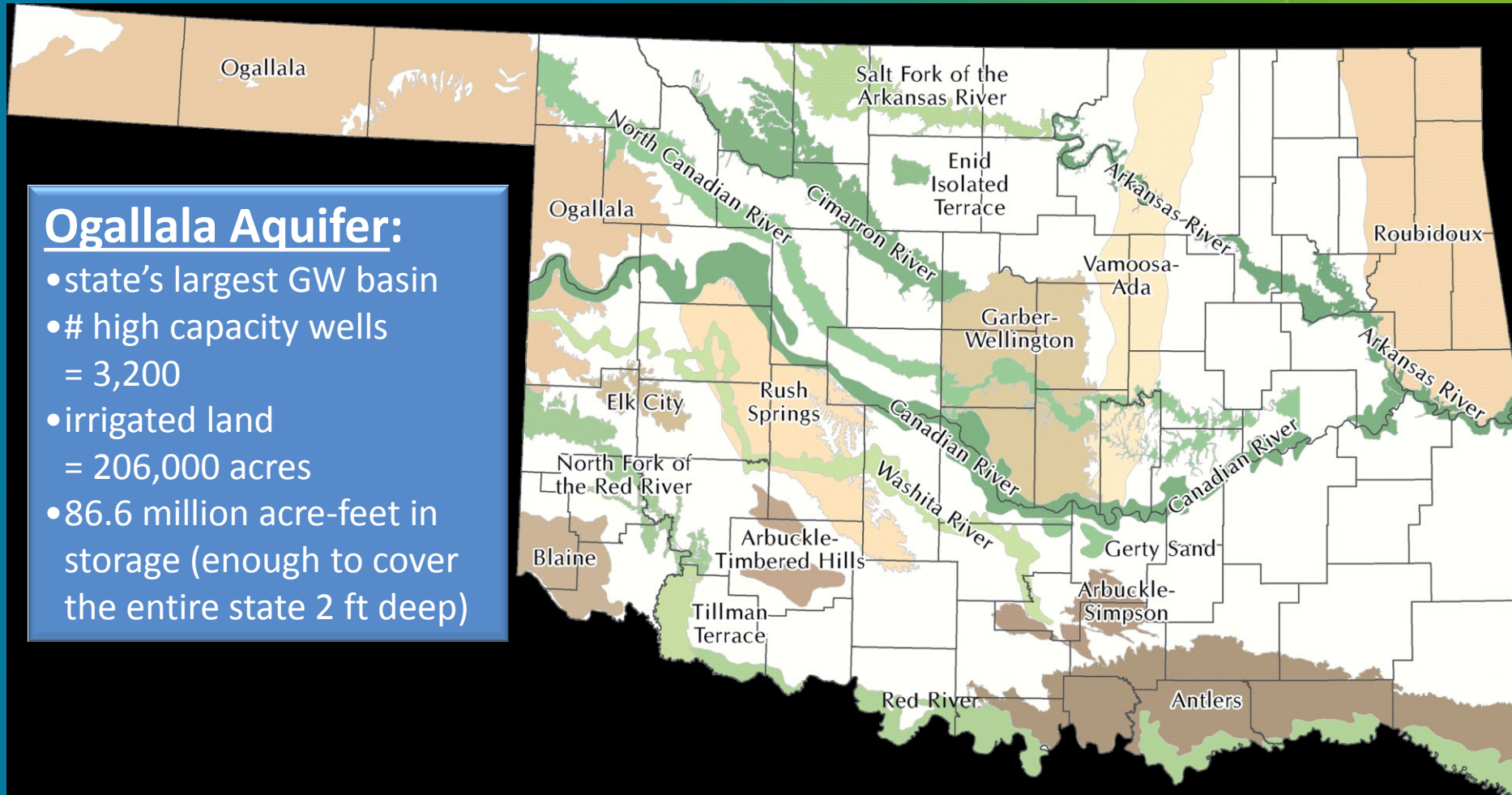


Oklahoma's Water Resources

- 23 major groundwater aquifers store 320 million acre-feet of water

Ogallala Aquifer:

- state's largest GW basin
- # high capacity wells = 3,200
- irrigated land = 206,000 acres
- 86.6 million acre-feet in storage (enough to cover the entire state 2 ft deep)



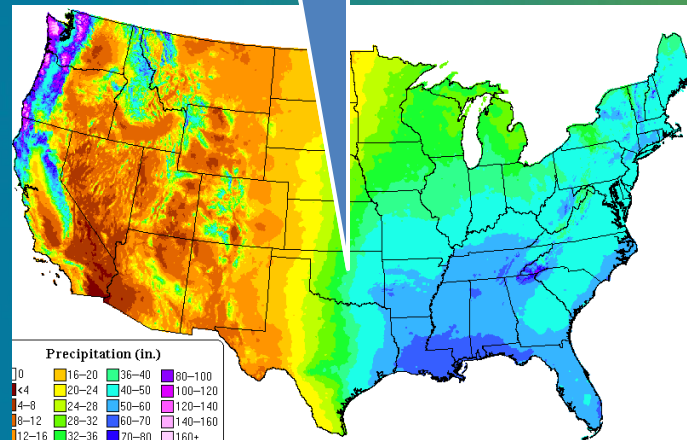
Stream Water Use Doctrines

- **Appropriation (Arid West)**

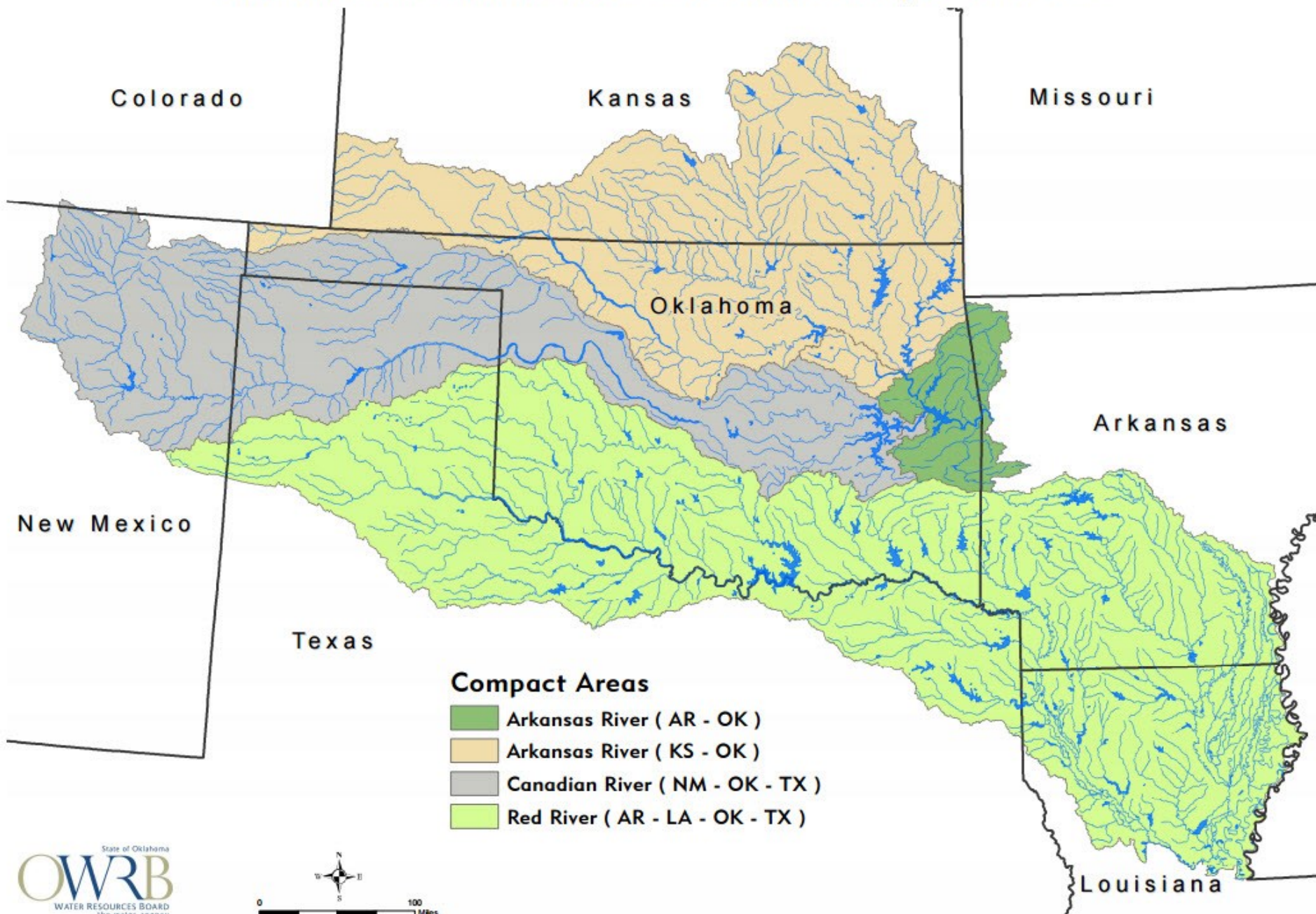
- Water use right like a commodity
- Can be severed from land (critical out west)
- Right transferable
- Beneficial use to vest
- Quantifiable and certain
- Priority by date
- No sharing in drought
- Use-it-or-lose it forfeiture (prevent speculation)
- Water diverted from watercourse

- **Riparian (Humid East)**

- Right tied to land ownership adjacent to water course
- Reasonable use
- Correlative to other users
- Initiate use anytime
- No loss for non-use
- No certain amount
- Less predictable with new/changing user (reasonability test)
- Equitable sharing in drought



Oklahoma's Interstate Stream Compact Areas



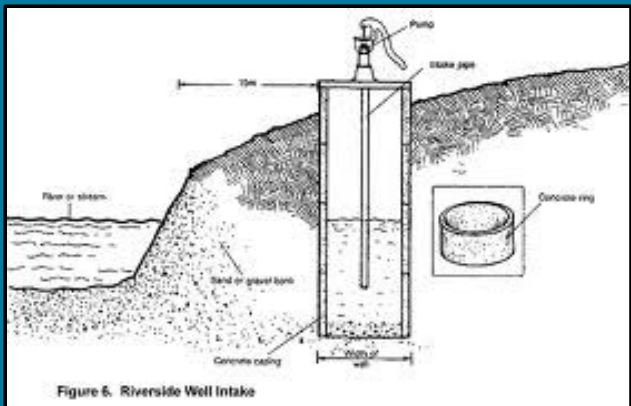
OK Stream Water Law

- Water inside a natural channel, within the cut bed and banks, including ponds and lakes
- Owned by everyone, owned by no one (*res communes* in Roman law)
- Use subject to **appropriation**; can be lost
- Priority by date, not by use
- Domestic/household uses exempt AND “senior”



OK Groundwater Law

- Fresh water under the surface, outside the cut banks of a definite stream
- Ownership tied to overlying land owner (1890 O.T. statute)... yes, it's severable!
- Use subject to reasonable regulation
- Maximum annual yield/equal proportionate share as determined by OWRB
- Domestic/household uses exempt

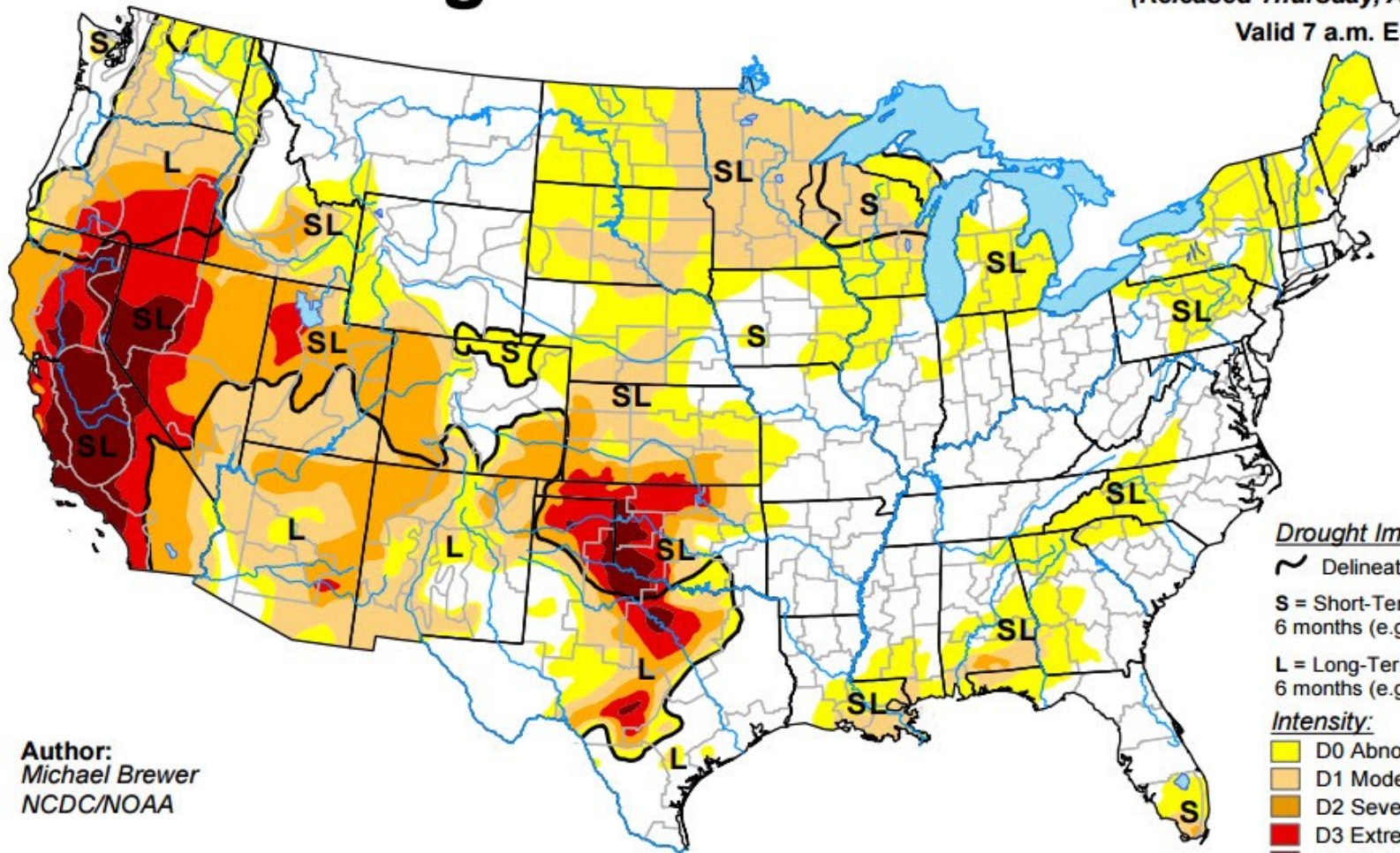


U.S. Drought Monitor

April 7, 2015

(Released Thursday, Apr. 9, 2015)

Valid 7 a.m. EST



Author:
Michael Brewer
NCDC/NOAA

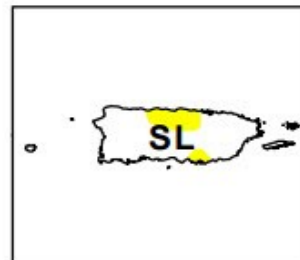
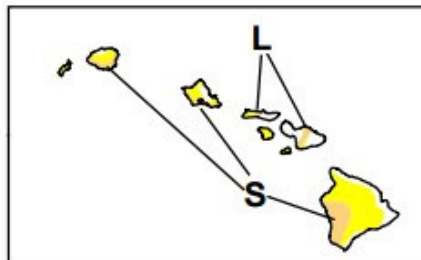
Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- Yellow D0 Abnormally Dry
- Light Orange D1 Moderate Drought
- Dark Orange D2 Severe Drought
- Red D3 Extreme Drought
- Dark Red D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

Top 10 U.S. Disasters*

(damage in billions)

1980-2014

1. Hurricane Katrina (2005) = \$ 151
2. Sandy (2012) = \$ 67
3. Hurricane Andrew (1992) = \$ 45
4. Drought (1988) = \$ 40
5. Midwest Flooding (1993) = \$ 34
6. Hurricane Ike (2008) = \$ 33
7. Drought (2012) = \$ 31
8. Drought (1980) = \$ 29
9. Hurricane Ivan (2004) = \$ 26
10. Hurricane Wilma (2005) = \$ 22

* <http://www.ncdc.noaa.gov/billions/events>; cost adjusted to 2014 CPI



U.S. Drought Monitor

Oklahoma

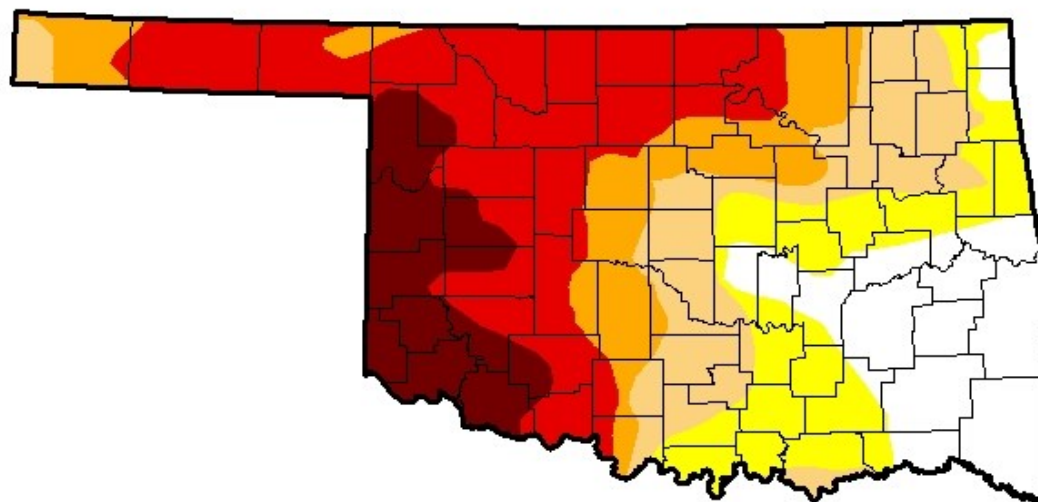
April 7, 2015

(Released Thursday, Apr. 9, 2015)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	16.76	83.24	68.27	52.74	39.72	11.60
Last Week 3/31/2015	14.36	85.64	68.62	50.68	37.38	8.41
3 Months Ago 1/8/2015	29.59	70.41	59.21	42.59	22.35	5.54
Start of Calendar Year 12/30/2014	25.63	74.37	62.03	40.84	21.74	5.70
Start of Water Year 9/30/2014	8.55	91.45	73.31	58.13	20.92	4.64
One Year Ago 4/8/2014	6.34	93.66	76.48	52.63	26.39	13.54



Intensity:



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Michael Brewer

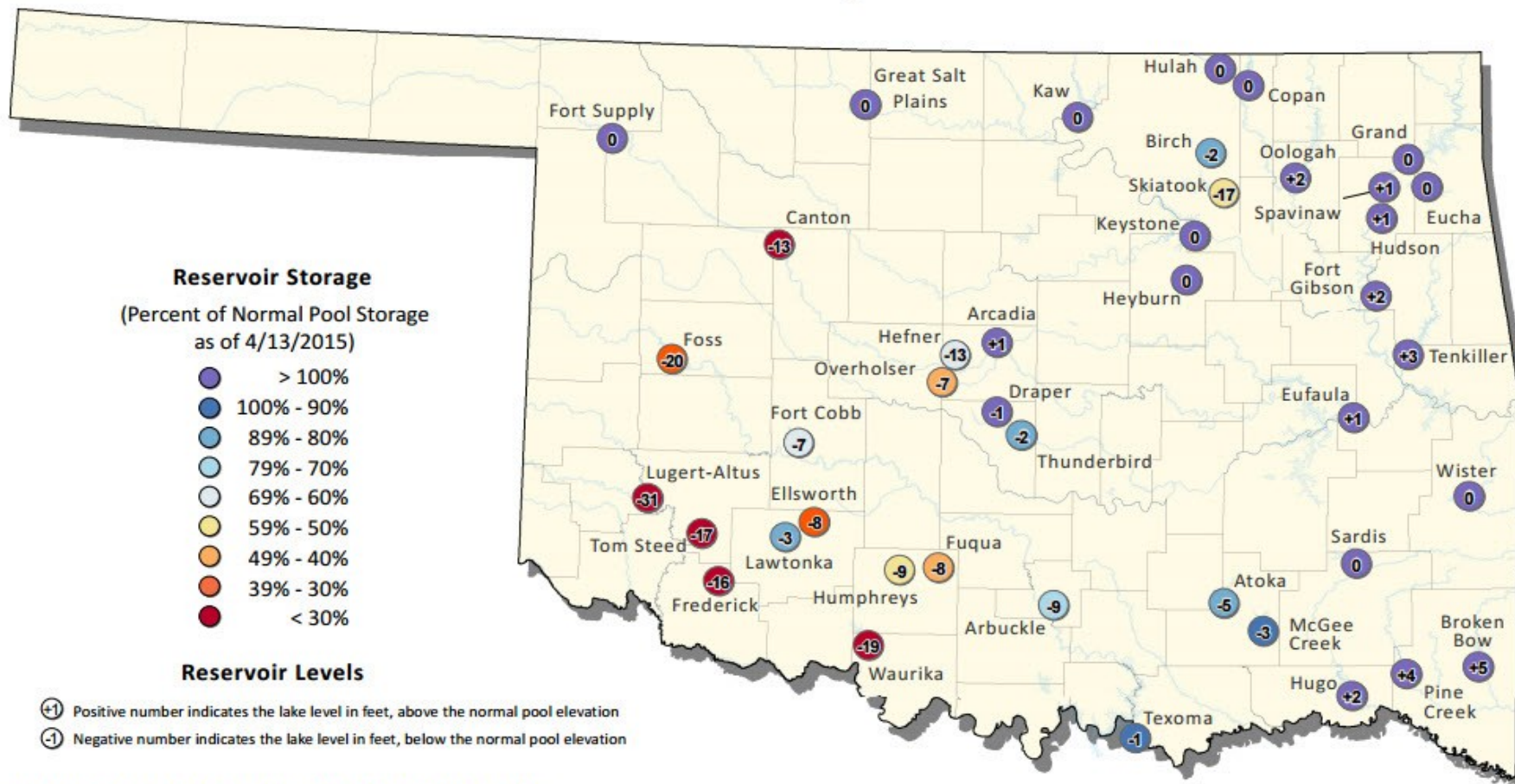
NCDC/NOAA



<http://droughtmonitor.unl.edu/>

Oklahoma Surface Water Resources

Reservoir Levels and Storage as of 4/13/2015



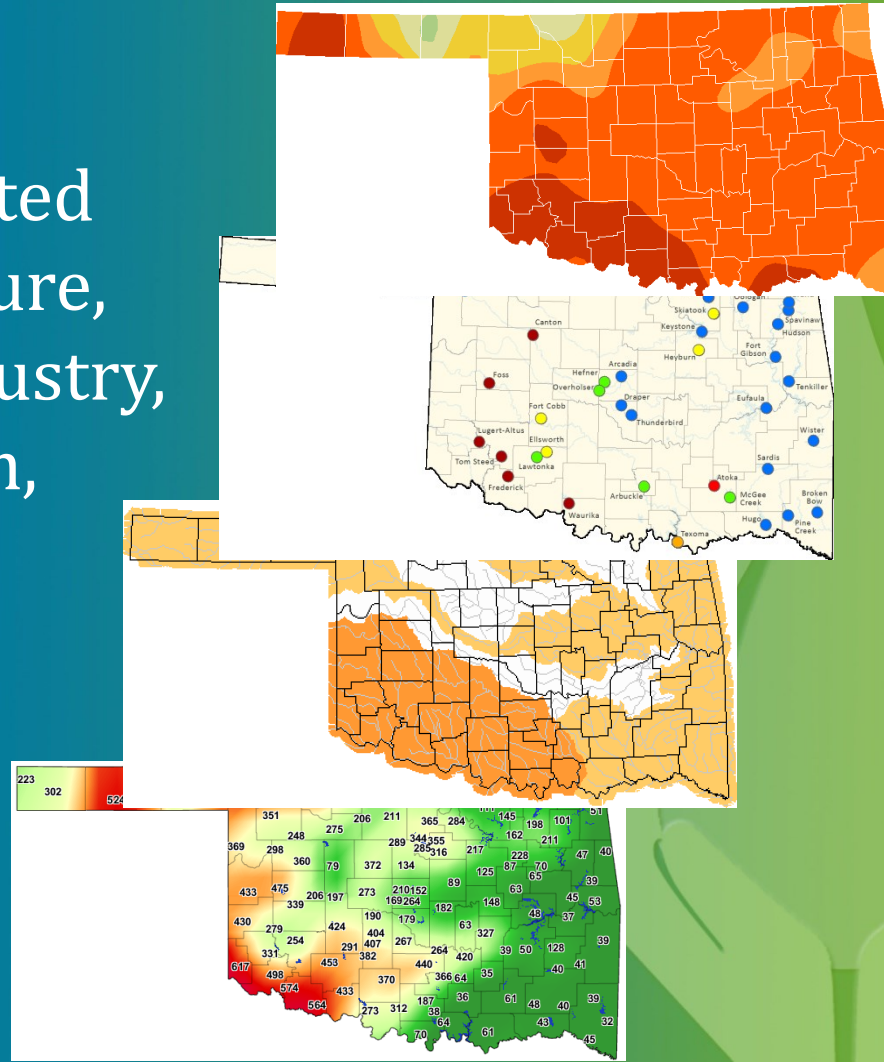
This map shows reservoir storage as a percentage of normal pool storage capacity. The source information was collected from real-time lake gages monitored by the U.S. Army Corps of Engineers (http://www.swt-wc.usace.army.mil/old_resvrep.htm), and the U.S. Geological Survey (http://waterdata.usgs.gov/ok/nwis/current/?type=lake&group_key=basin_cd). For more information please visit the OWRB's website at: (<http://www.owrb.ok.gov>)



Drought Conditions & Impacts in Oklahoma

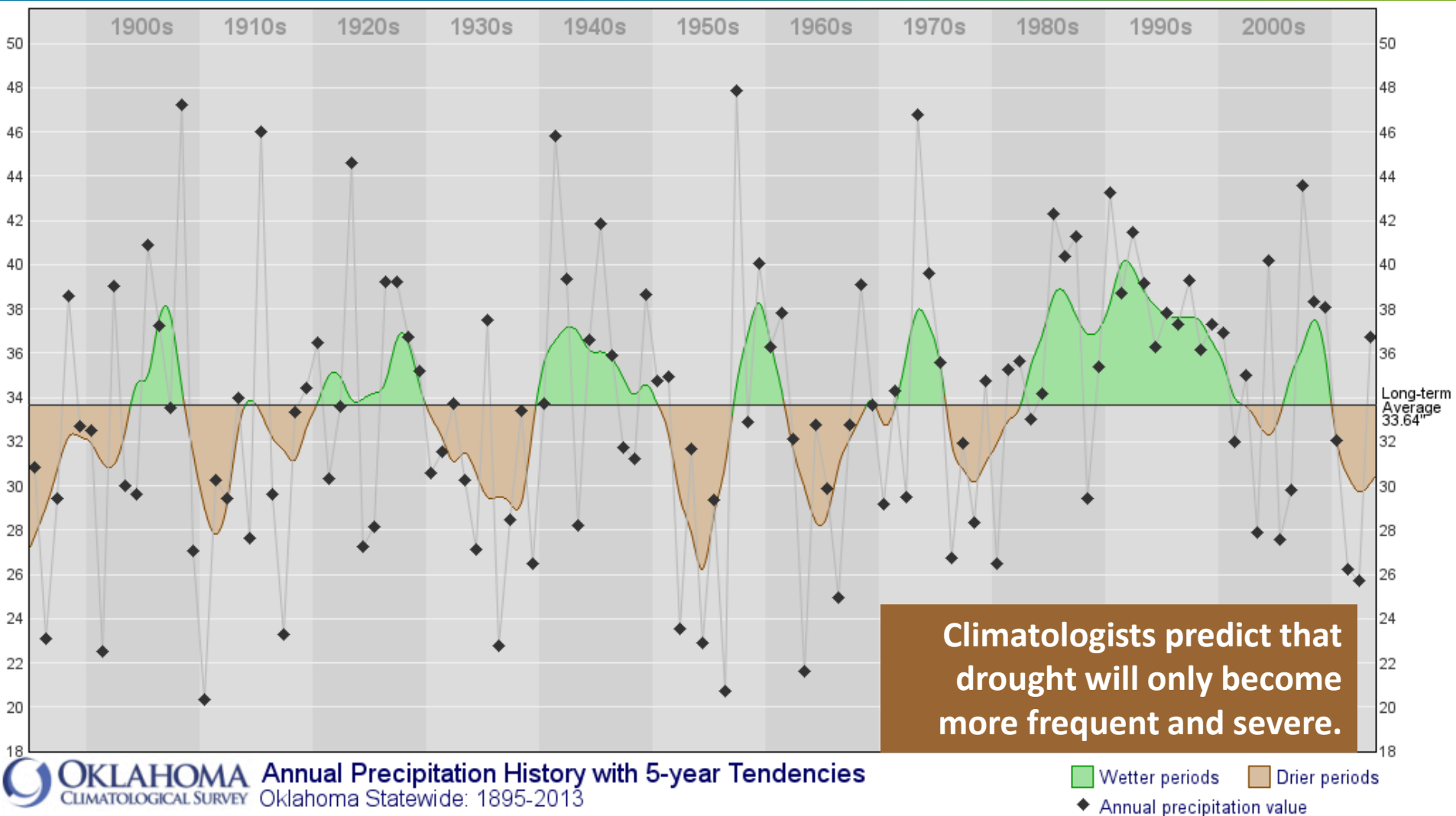
Numerous water-related impacts to Agriculture, Water Systems, Industry, Navigation, Tourism, Recreation, etc.

- **Precipitation**
- **Streamflows**
- **Reservoir Levels**
- **Soil Moisture**
- **Fire Danger**



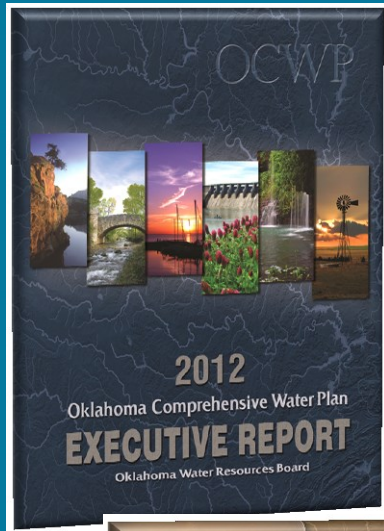
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Oklahoma's Precipitation History

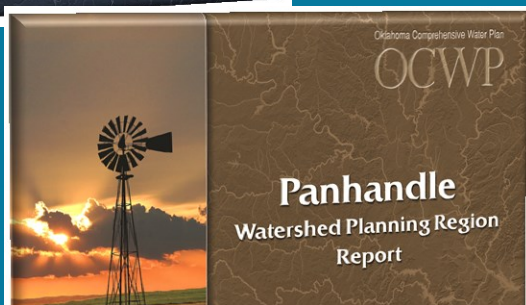


WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

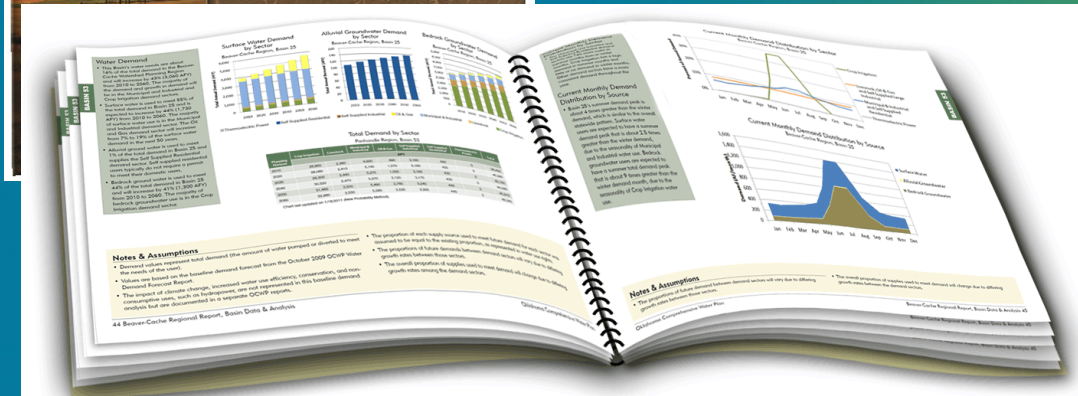
2012 Update of the Oklahoma Comprehensive Water Plan



- Submitted to Governor and Legislature in 2012
- Most technically sound, extensively vetted Plan
- Executive Report & 13 Watershed Planning Region Reports

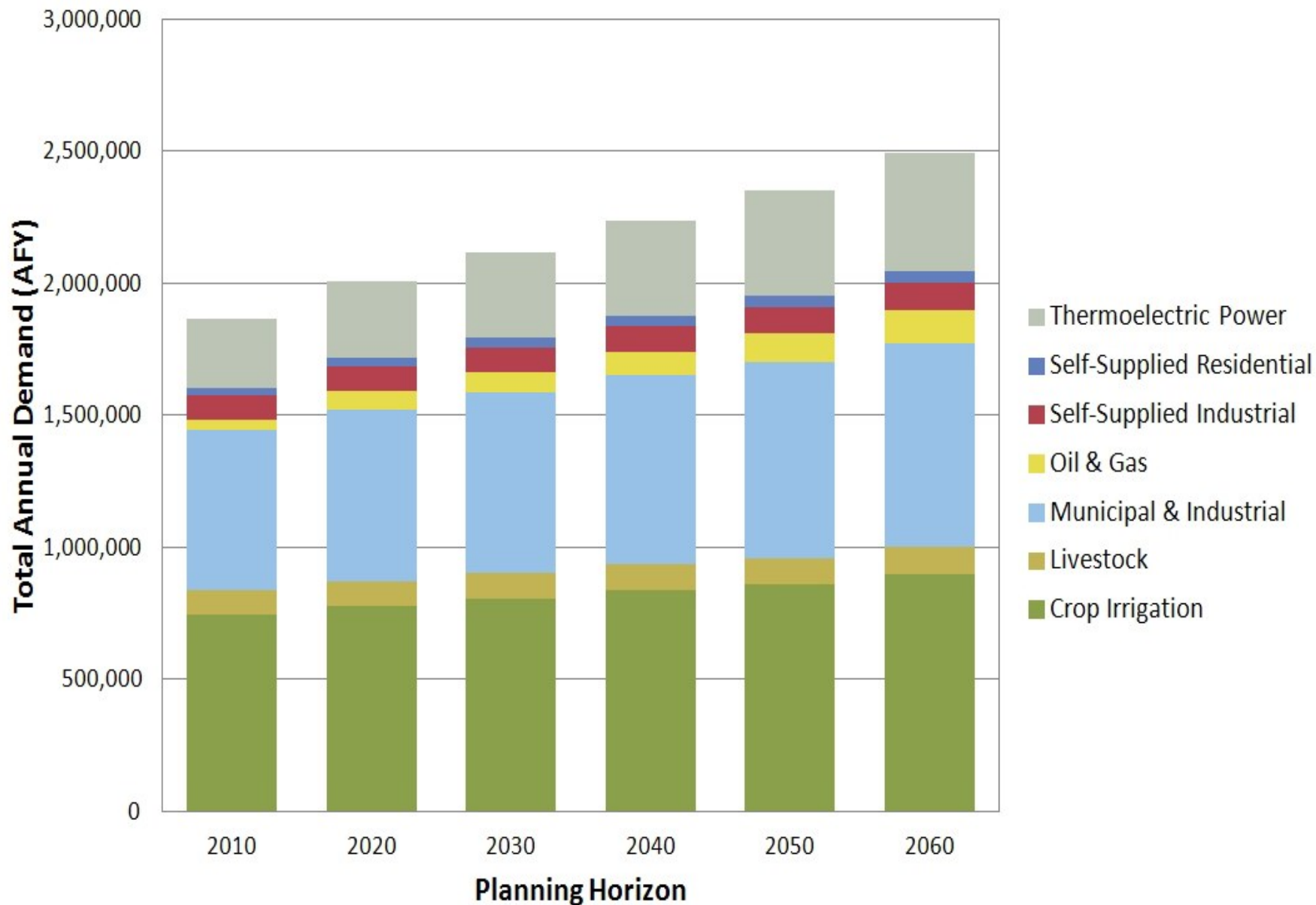


Overriding goal to provide safe, reliable water supplies to meet needs of all Oklahomans.

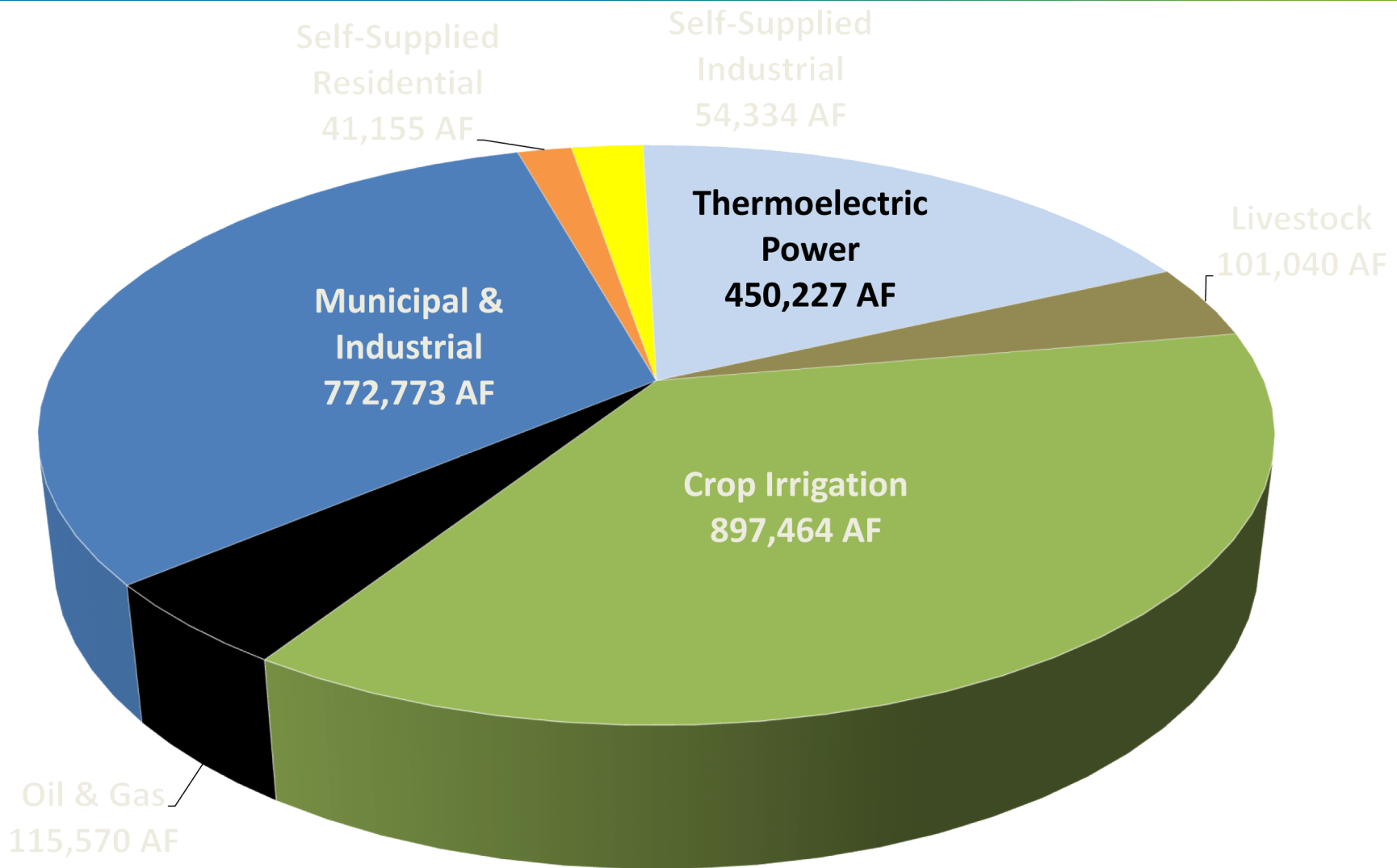


WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

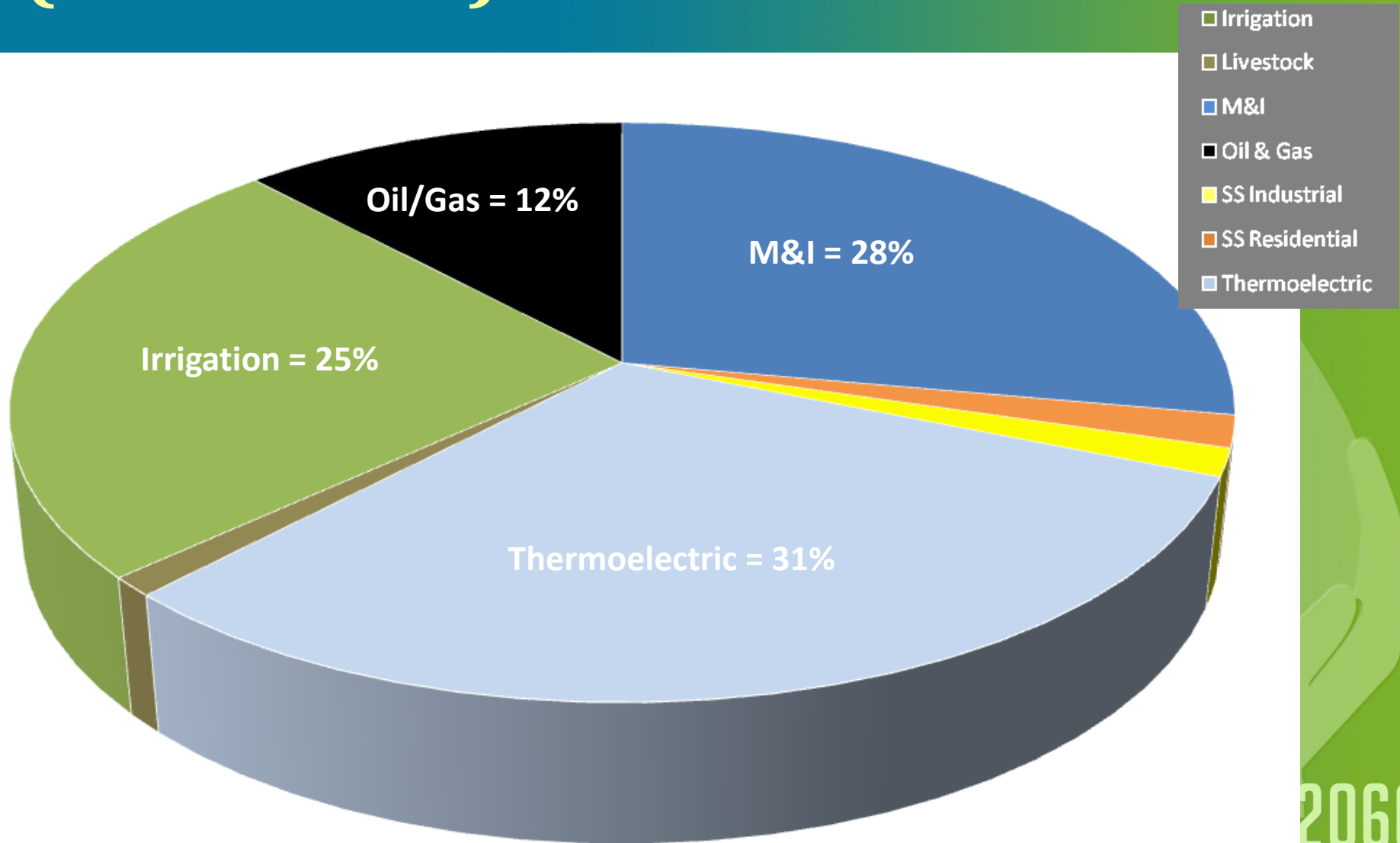
Total Water Demands (2010-2060)



2060 Statewide Water Demand



Growth by Water Use Sector (2010-2060)



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus



State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

OCWP - “Big 8” Priority Recommendations



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State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Water for 2060 Signals a “Sea Change” in Oklahoma Water Management



Conservation
& Efficiency



Drought
Management

Every day
“wa

Actions we take in response
to reduced supplies

Drought drives shortages
Conservation helps us prepare
for drought and reduce impacts

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Can We Do It?

Consuming no more fresh water in 2060 than we consume today... is achievable

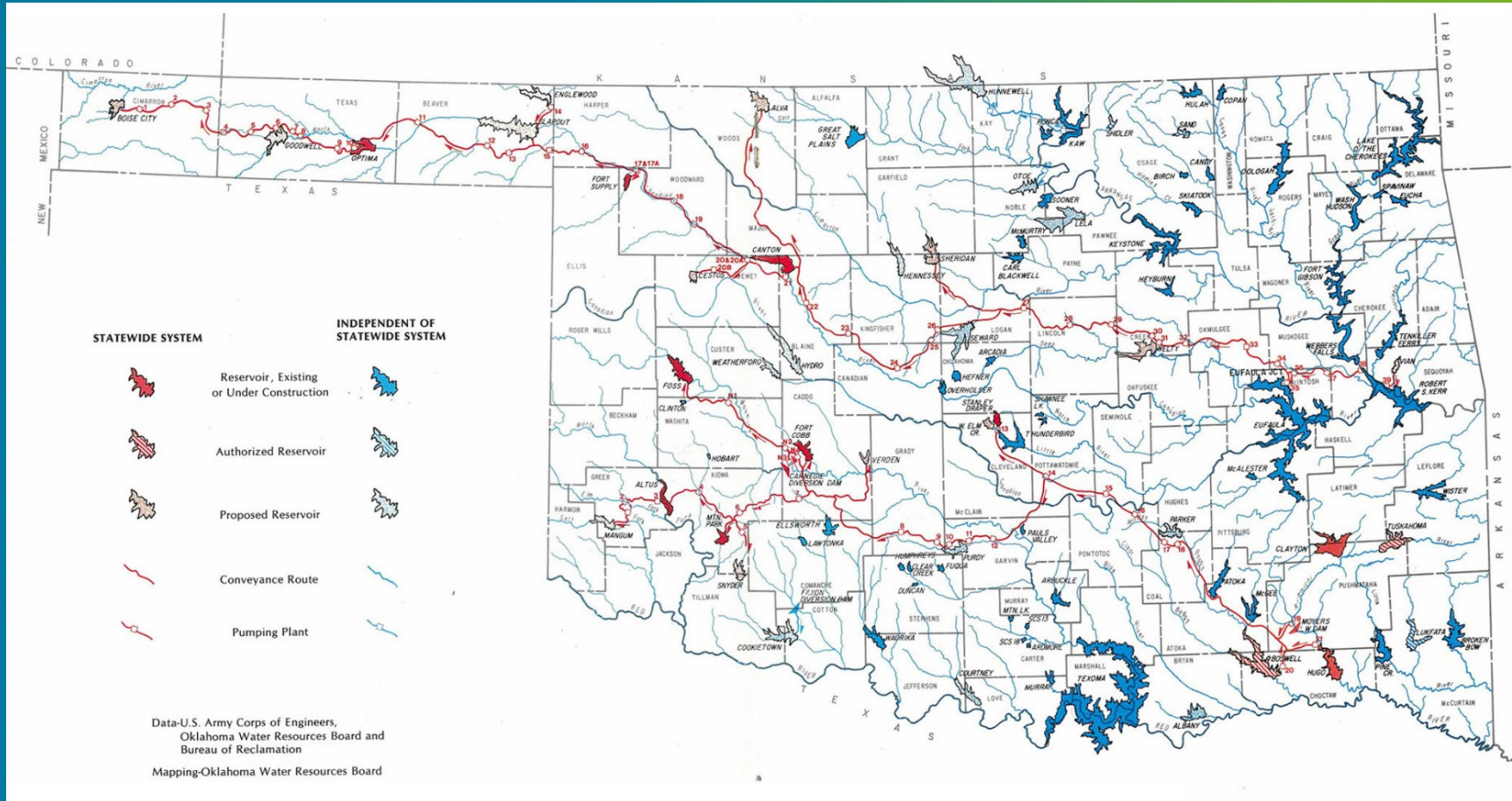


OCWP Conservation Analysis

	M&I and Agriculture Statewide Demand Projections & Water Savings for Conservation Scenarios (AFY)					
	2010	2020	2030	2040	2050	2060
Baseline	1,377,318	1,455,309	1,523,273	1,587,406	1,642,069	1,711,392
Scenario I	N/A	1,301,816	1,332,781	1,388,603	1,435,807	1,496,643
Scenario II	N/A	1,155,397	1,170,248	1,209,372	1,244,123	1,295,569

Innovative Solutions

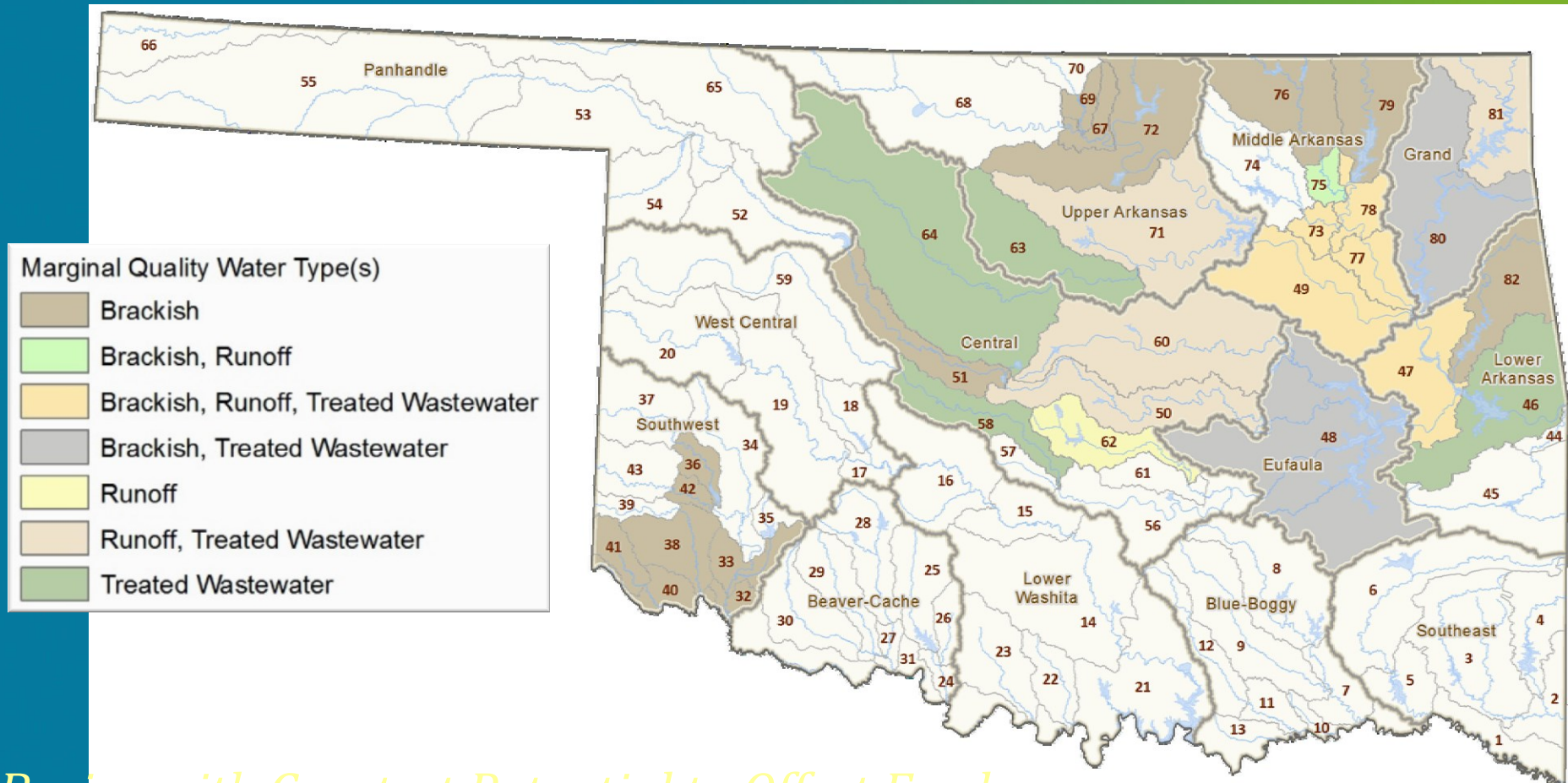
1980 Water Plan



WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Innovative Solutions

Marginal Quality Water



Basins with Greatest Potential to Offset Fresh Water Use with MQ Water

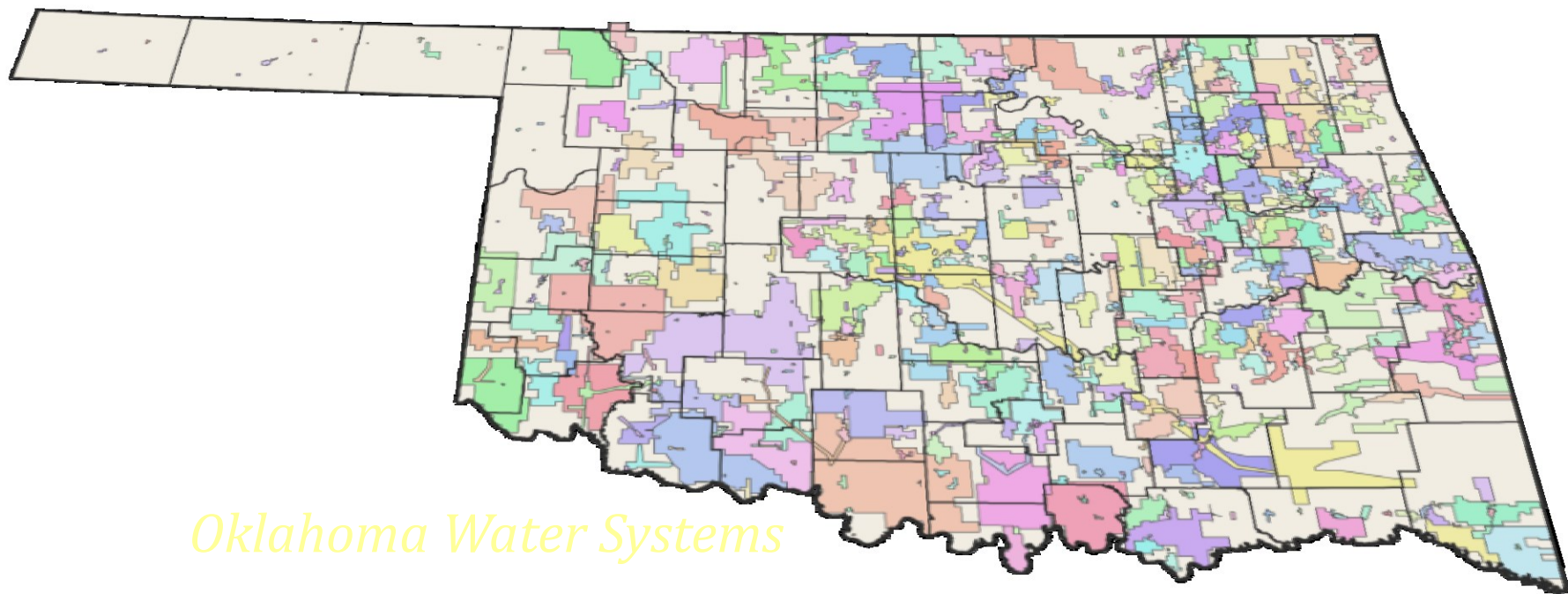
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Innovative Solutions

Regionalization Options



- Oklahoma has ~700 water systems serving less than 1,000 customers
- Economy of scale benefits; systems with multiple sources more resistant to drought



Oklahoma Water Systems



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus



State/Tribal Resolution

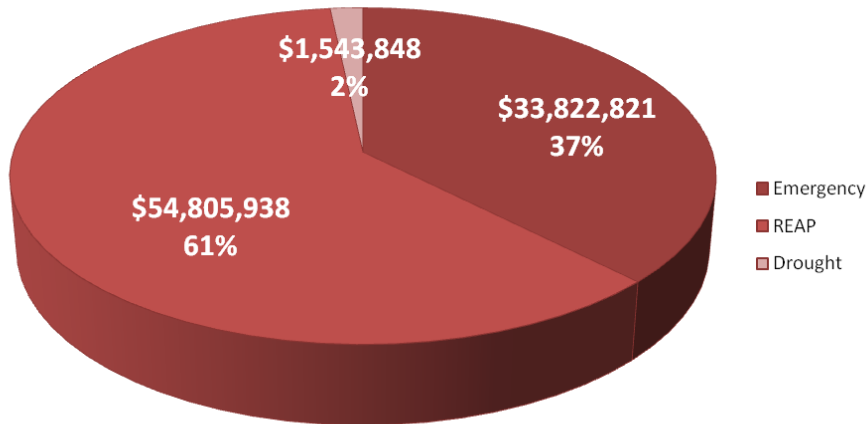
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP

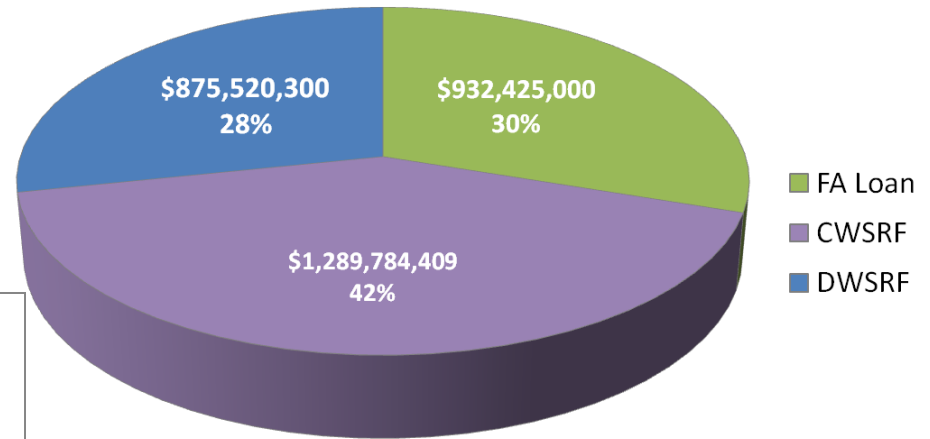
Infrastructure Funding To-Date

Over \$3 billion in loan and grants to date; **savings over \$1 billion**

Grant Programs - Approved Funding



Loan Programs - Approved Funding

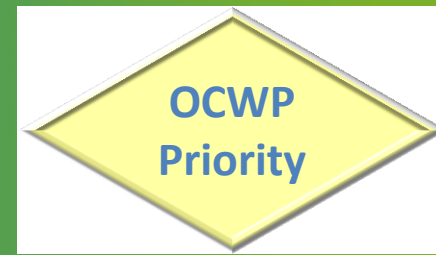


APPROVED FINANCING BY PURPOSE

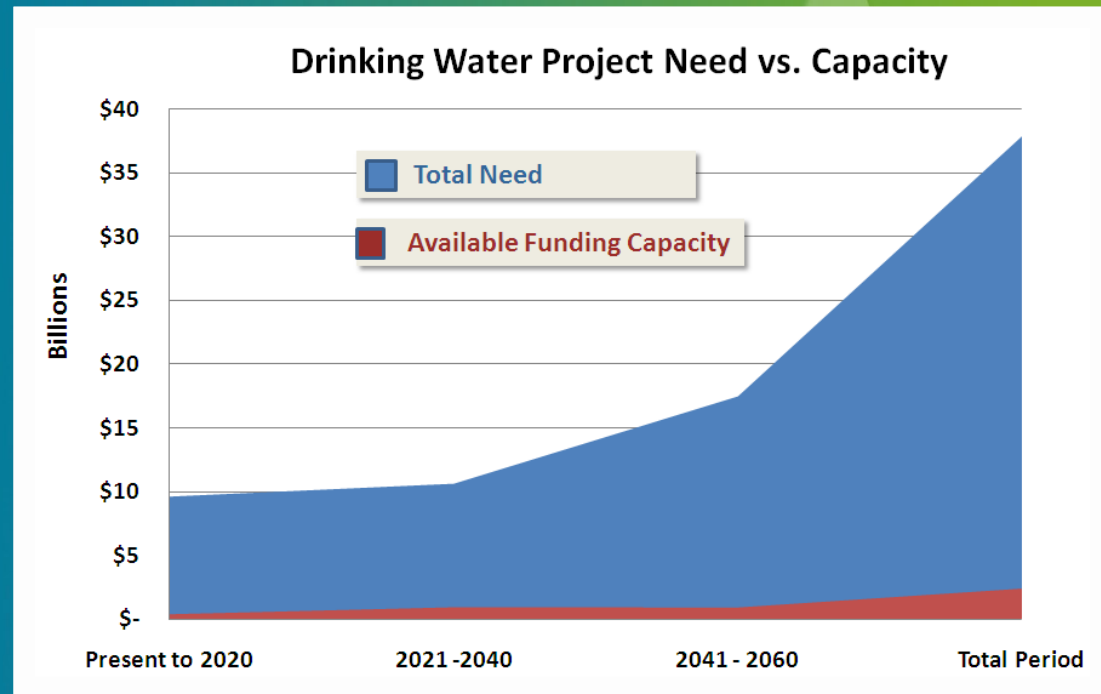
Purpose	Number	Approved Amount
Water	1,269	\$1,552,410,928
Sewer	698	\$1,436,366,086
Other	46	\$199,125,303
TOTAL	2,013	\$3,187,902,316

2012 Update of the OCWP

Infrastructure Funding



- Address Oklahoma's projected \$82+ billion water and wastewater infrastructure need by 2060
- OWRB's successful ("AAA") loan & grant programs can only satisfy 4-9% of this need



2012 Update of the OCWP Infrastructure Funding

OCWP
Priority

STANDARD
& POOR'S
RATINGS SERVICES

RatingsDirect®

SQ 764 (57%Y -43%N)

Water Infrastructure Credit
Enhancement Reserve Fund

Oklahoma Water Resources Board; State Revolving Funds/ Pools

Credit Profile

Oklahoma Wtr Resources Brd
Long Term Rating

AAA/Stable

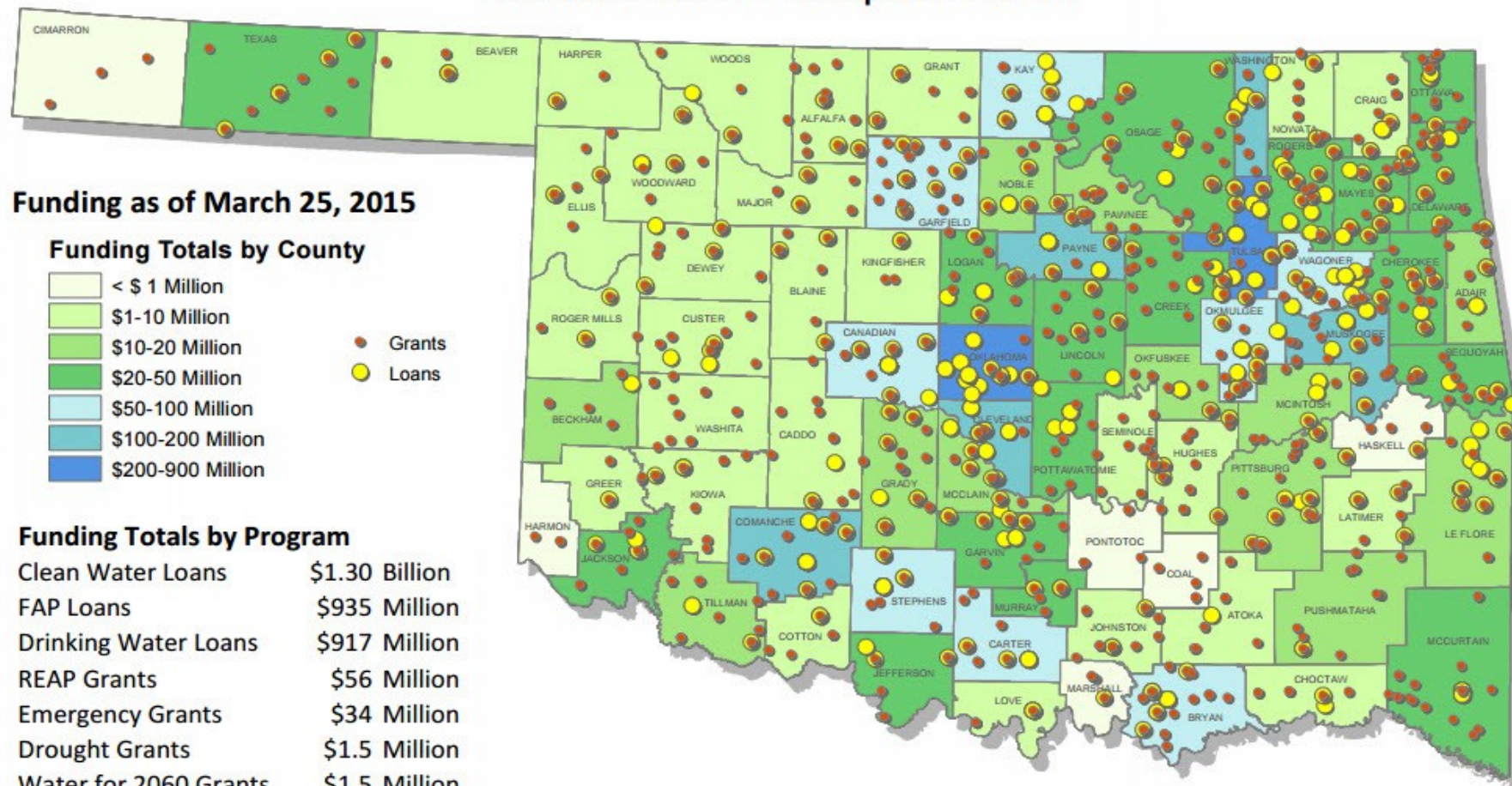
Upgraded

Rationale

Standard & Poor's Ratings Services has raised its rating on Oklahoma Water Resources Board's (OWRB) state loan program revenue bonds to 'AAA' from 'AA+'. The upgrade reflects the board's access to the newly created Water Infrastructure Credit Enhancement Reserve Fund (WICERF). The board now has the ability to issue bonds supported by a state general obligation (GO) pledge in an amount up to \$300 million. This additional support effectively lowers the financial risk score assigned to the state loan program and allows for Standard & Poor's to raise the rating to 'AAA'. The ability to issue state GO bonds is contingent on Oklahoma retaining strong market access. With the high current rating on the state, we do not believe this is a concern; however, should Oklahoma's access to the bond market become less certain, the enhancement provided by access to the WICERF could be diminished.

Financial Assistance Program

Loan and Grant Recipient Status



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus

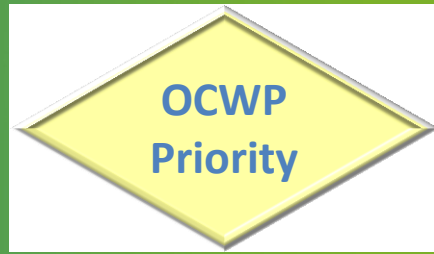


State/Tribal Resolution

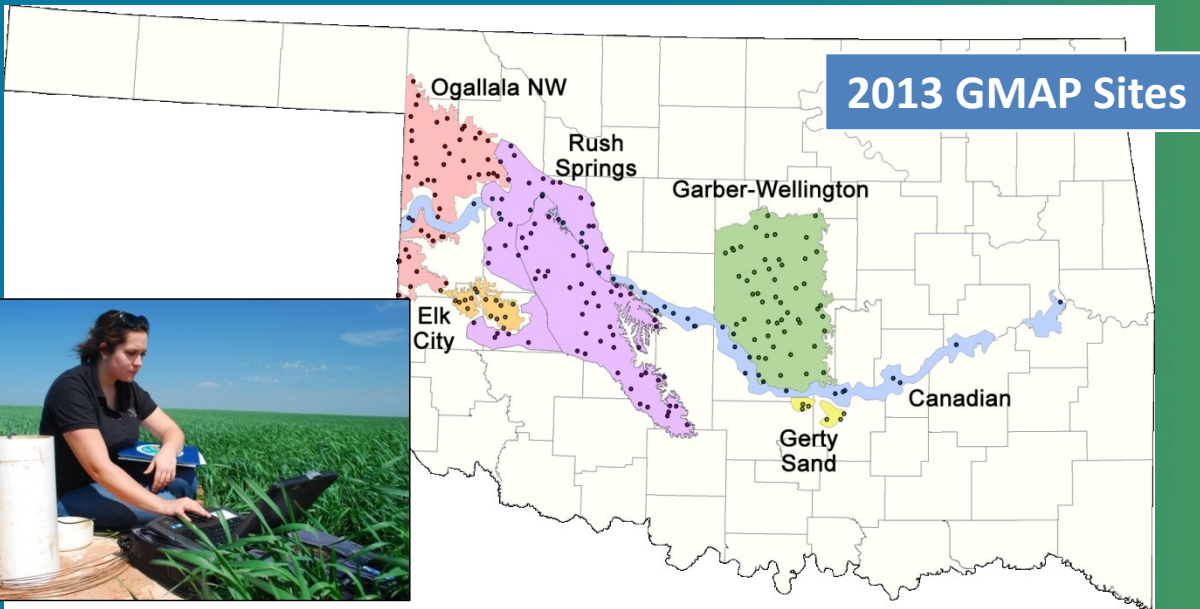
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP

Monitoring



- Better data for improved decision-making
- \$1.5 M/yr for statewide water quality and quantity monitoring program
- Create the first comprehensive groundwater monitoring program (“GMAP”)



WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP Monitoring

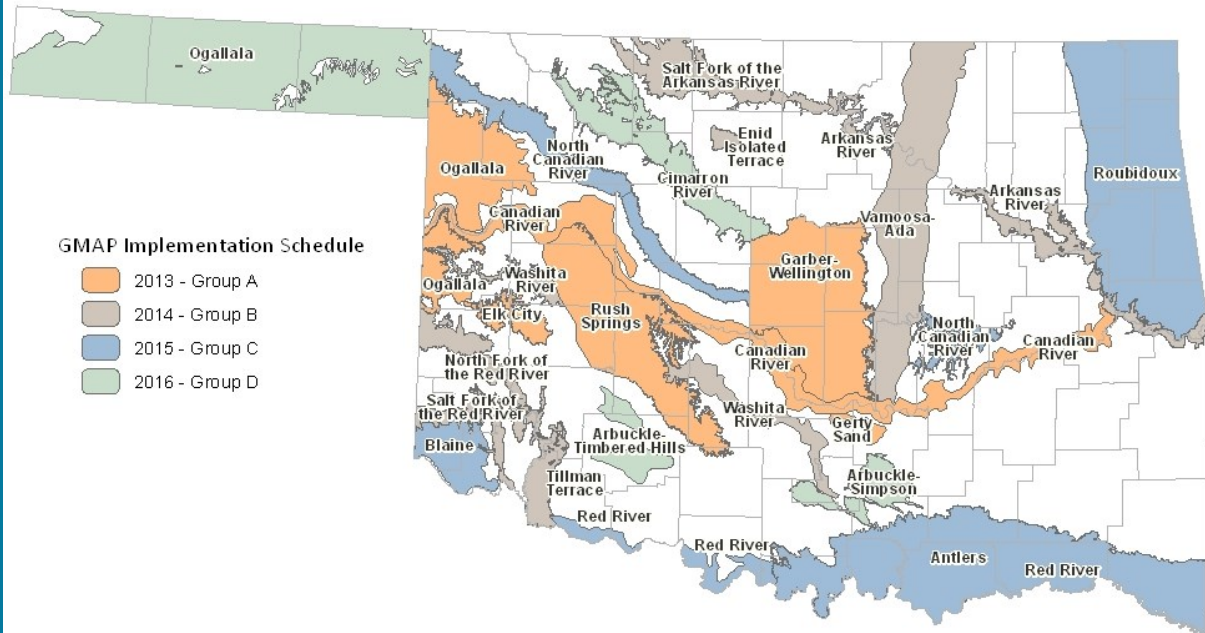
OCWP
Priority

2013 Oklahoma Groundwater Report

Beneficial Use
Monitoring Program

State of Oklahoma
OWRB
OKLAHOMA WATER RESOURCES BOARD
the water agency

Groundwater Monitoring and Assessment Program (GMAP) Implementation Schedule



WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus

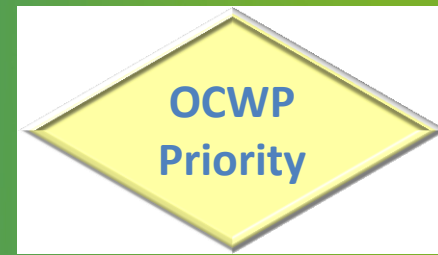


State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

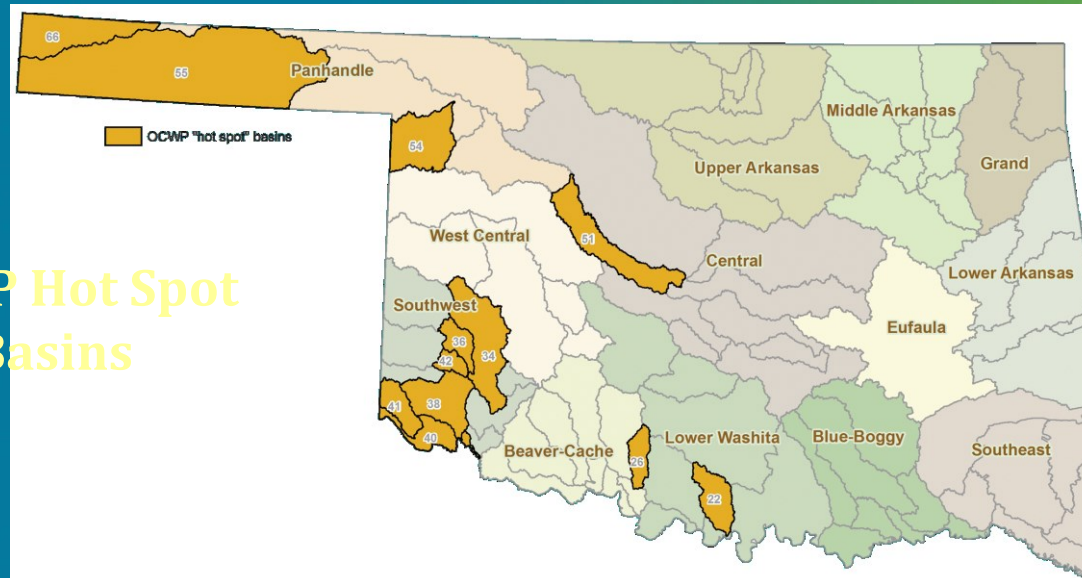
2012 Update of the OCWP

Water Supply Reliability



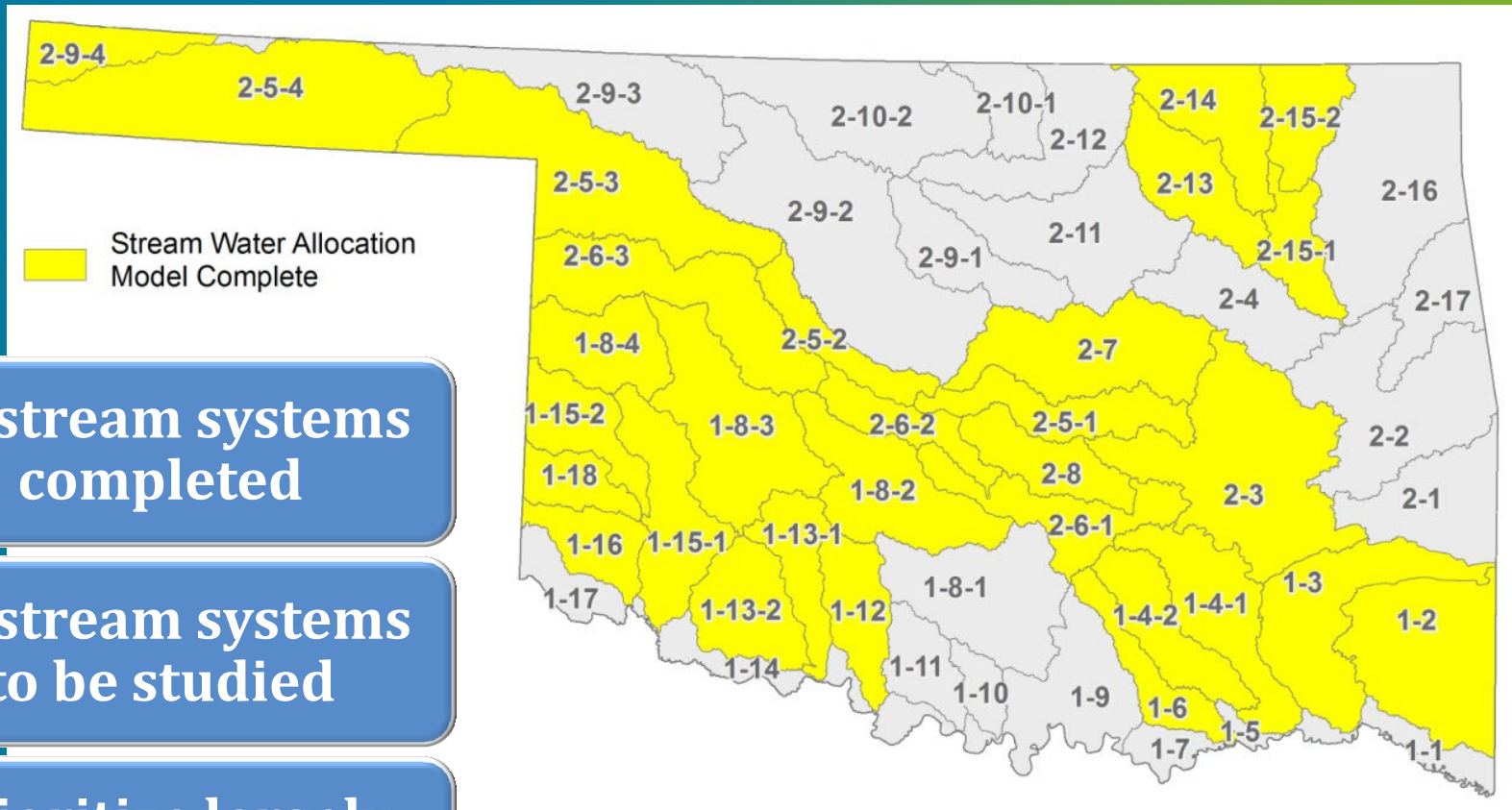
- Ensure water availability for future growth through fair and sustainable water allocation
- Utilization of \$1.3 M/yr Gross Production Tax for groundwater basin/watershed allocation models

OCWP Hot Spot Basins



Stream Water Allocation Models

- Complete all unstudied and overdue GW basins by 2022



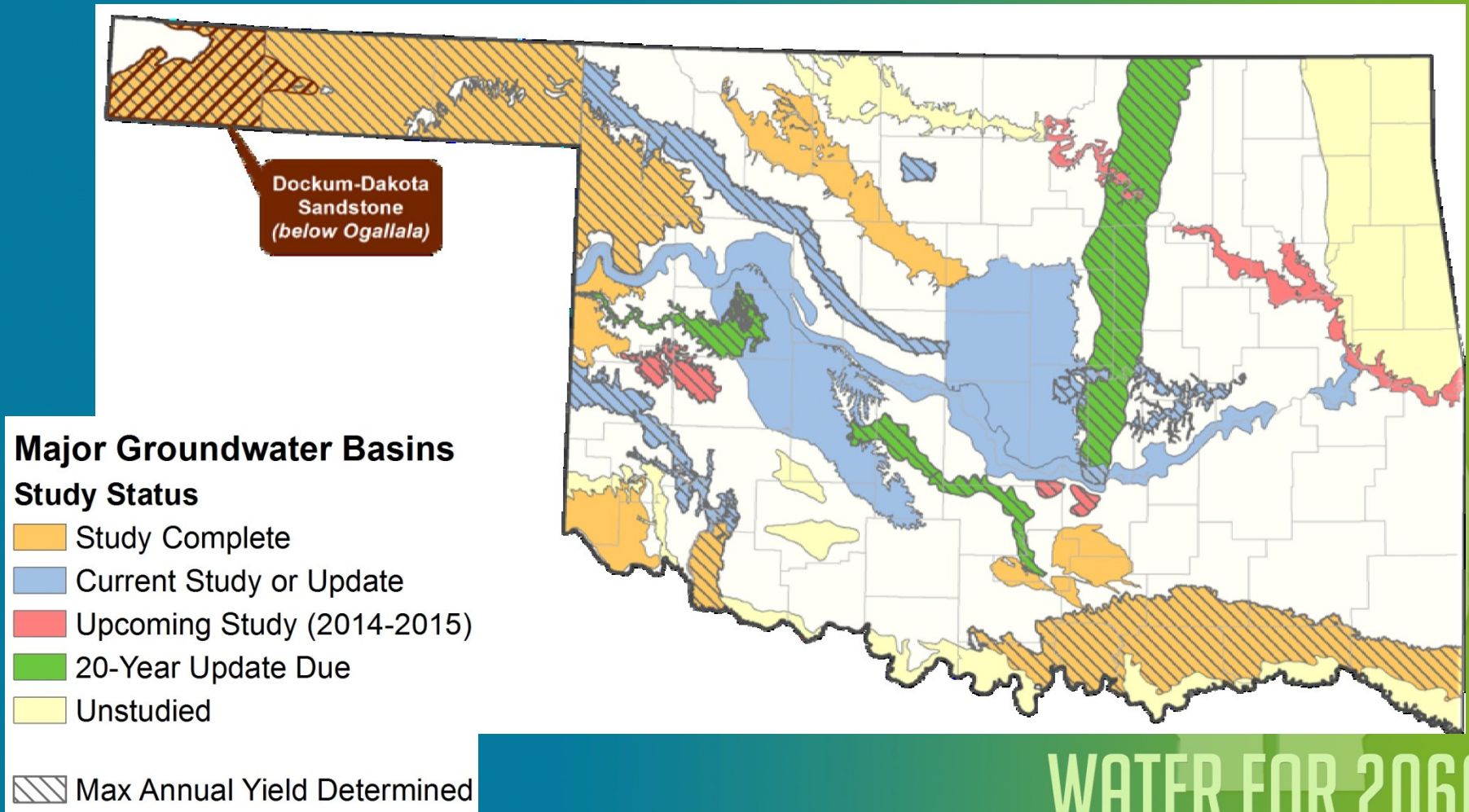
14 stream systems
completed

36 stream systems
to be studied

Prioritize largely
allocated systems

Major Groundwater Basin Studies

- Complete all unstudied and overdue GW basins by 2022



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus

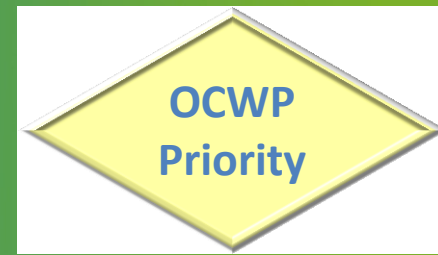


State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP

Fish & Recreation Flows



- Recognize nonconsumptive water needs and **supporting recreational and local economic interests.**
- Assess the suitability and structure of a potential instream flow program for Oklahoma.



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus

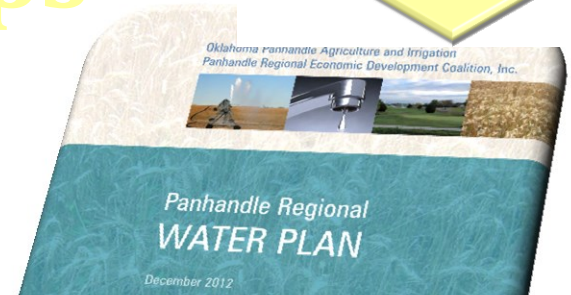
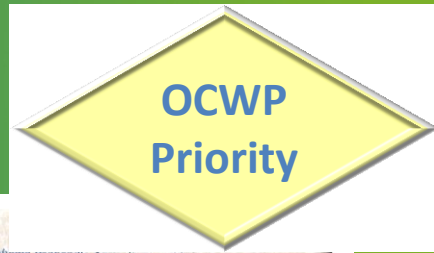


State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP Regional Planning Groups

- Most popular recommendation
- “Bottom-up” water planning
- **Non-regulatory**
- Local stakeholders representing unique interests
- Happening organically now



OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus



State/Tribal Resolution

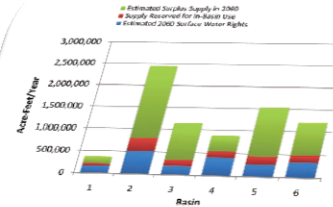
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP Excess & Surplus

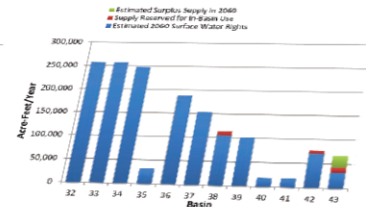
- Protect local water needs while address statewide demands.
- Definition and procedure **required statute.**
- Ensure area of origin will never be made water deficient.

OCWP
Priority

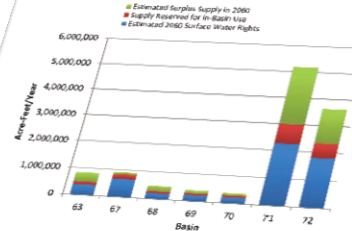
Estimated Surface Water Surplus in 2060
Southeast Region



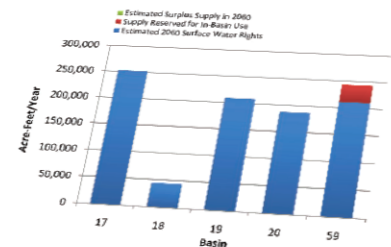
Southwest Region



Estimated Surface Water Surplus in 2060
Upper Arkansas Region



Estimated Surface Water Surplus in 2060
West Central Region



Groundwater Permit Availability

The permit availability of groundwater was determined for each of the 82 OCWP basins, including areas with and without studied groundwater basins. Two major types of groundwater permits are issued by the OWRB—regular and temporary. Regular groundwater permits are issued for aquifers that have been studied, a maximum annual yield (MAY) determined, and an equal proportionate share (EPS) approved. An EPS is the portion of maximum annual yield of groundwater in a given groundwater basin allocated to each acre of overlying land. Current EPS vary from 0.5 to 2.1 AFY per acre. In all areas with no defined EPS, a temporary permit of 2.0 AFY per acre may be issued.

To calculate the maximum amount of groundwater available for permits, the geographical area of any underlying aquifers was determined for each basin. Since the OCWP basins were defined based on surface watersheds, Oklahoma's aquifers typically span multiple OCWP basins. For the groundwater

permit availability analysis, the identified aquifers with EPS determinations had their respective EPS applied and for those basins without an EPS, 2 AFY per surface acre (temporary) was applied. The total permit availability was determined by summing the EPS and temporary withdrawal volumes. Current (2007) permit availability was estimated by subtracting the existing active groundwater rights from the total permit availability. Since forfeiture of existing groundwater rights is rare, all existing active rights were used to conservatively represent the current portion of each basin that is not available for permits.

The quantity of groundwater that would need to be permitted by 2060 was estimated for each OCWP basin by summing the existing active groundwater rights and the increase in projected groundwater demand from 2007 to 2060. Demand increases were calculated using current (2007) surface water and groundwater supply proportions in each OCWP basin. A groundwater permit gap was estimated for the present (2010)

40 Executive Report

Oklahoma Comprehensive Water Plan

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

OCWP - “Big 8” Priority Recommendations



Conservation, Reuse, Recycling



Infrastructure Financing



Monitoring



Supply Reliability



Fish & Recreation Flows



Regional Planning



Excess/Surplus



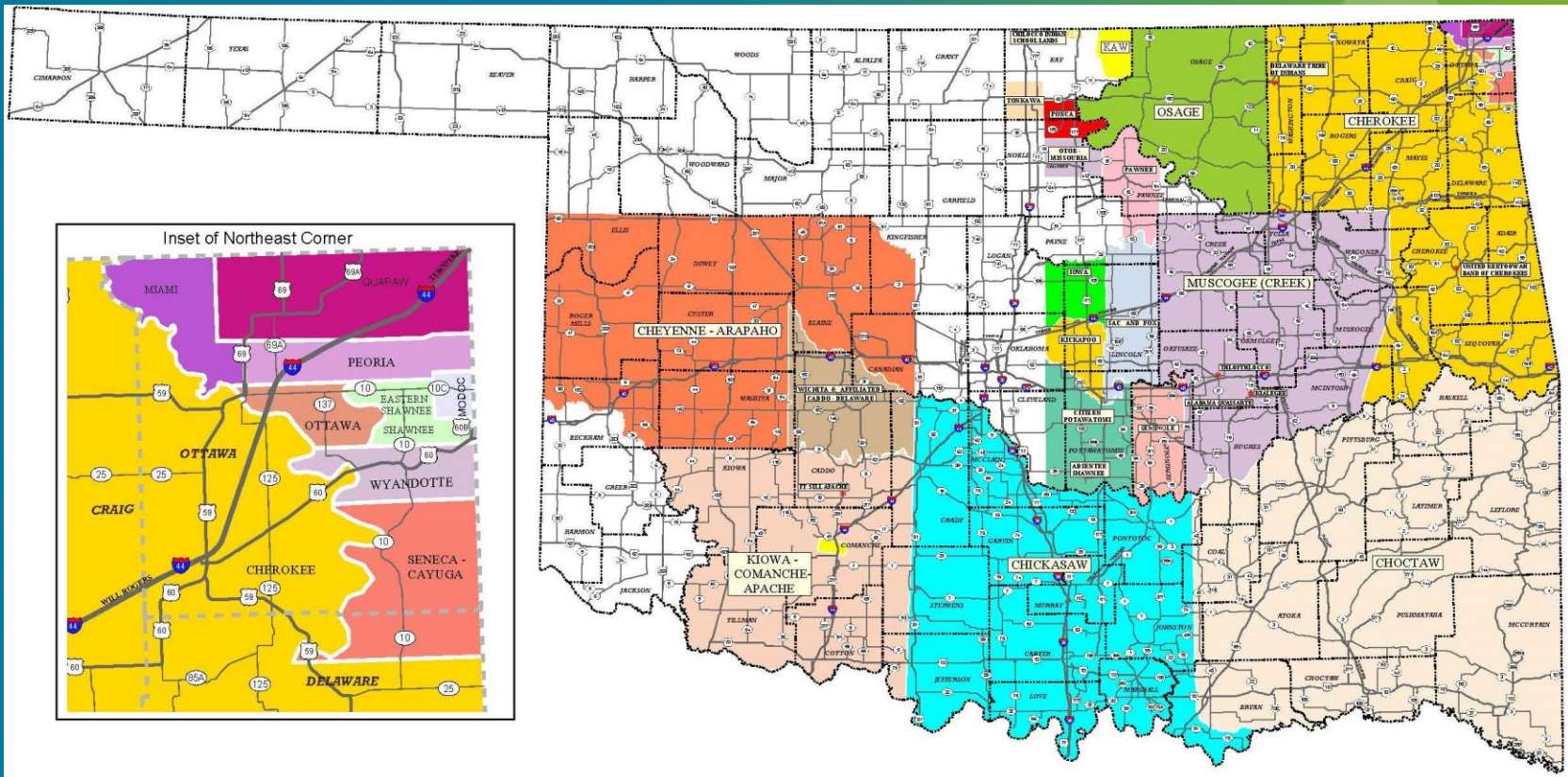
State/Tribal Resolution

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

2012 Update of the OCWP State/Tribal Consultation

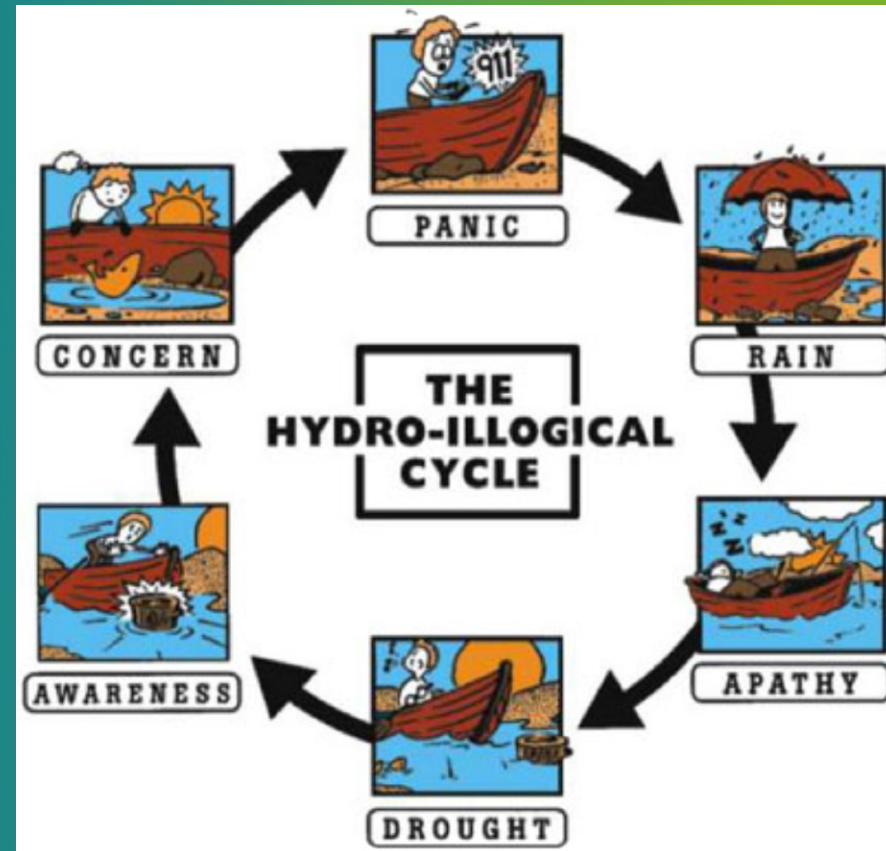
OCWP
Priority

- Build cooperation to **avoid future conflict**.
- Governor, Legislature & Tribes should **make formal consultation a high priority**.



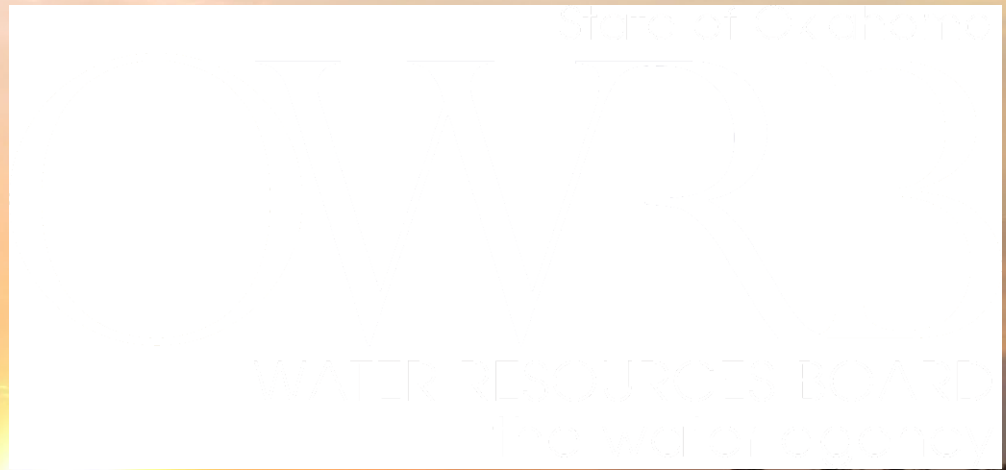
Hydro-LOGICAL Cycle

- **Plan** ahead, and plan for the worst
- **Conserve** as if we're always in drought
- **Reuse/recycle** as much as possible
- **Innovate** – look for alternatives to freshwater for meeting every need
- **Minimize cost**, both fiscal and political



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WATER FOR 2060
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