The Oklahoma Comprehensive Water Plan: City of Norman

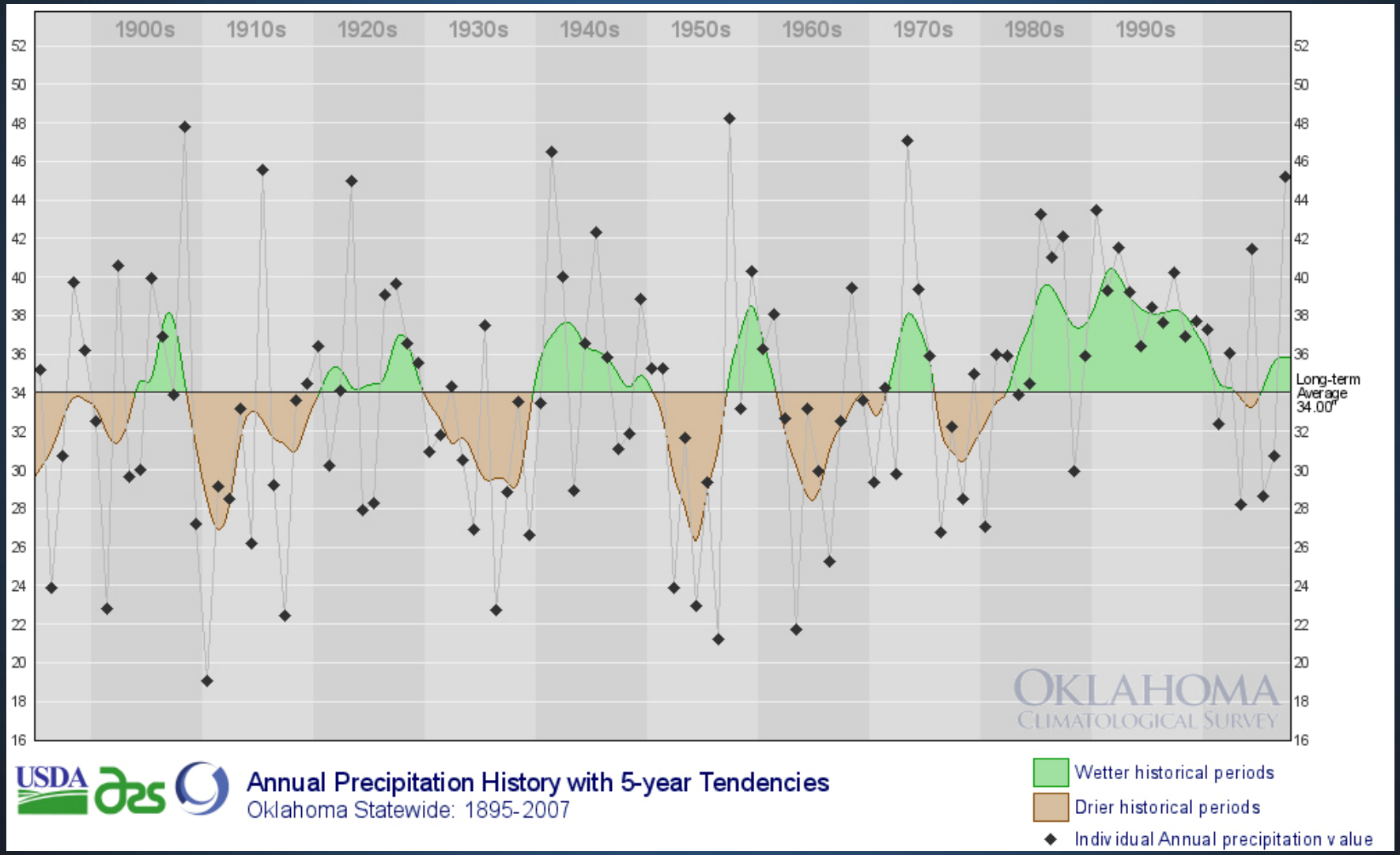
Oklahoma Comprehensive Water Plan

OCWP

Kyle Arthur
Oklahoma Water Resources Board

State of Oklahoma
OWRB
WATER RESOURCES BOARD
the water agency

Oklahoma's Precipitation History

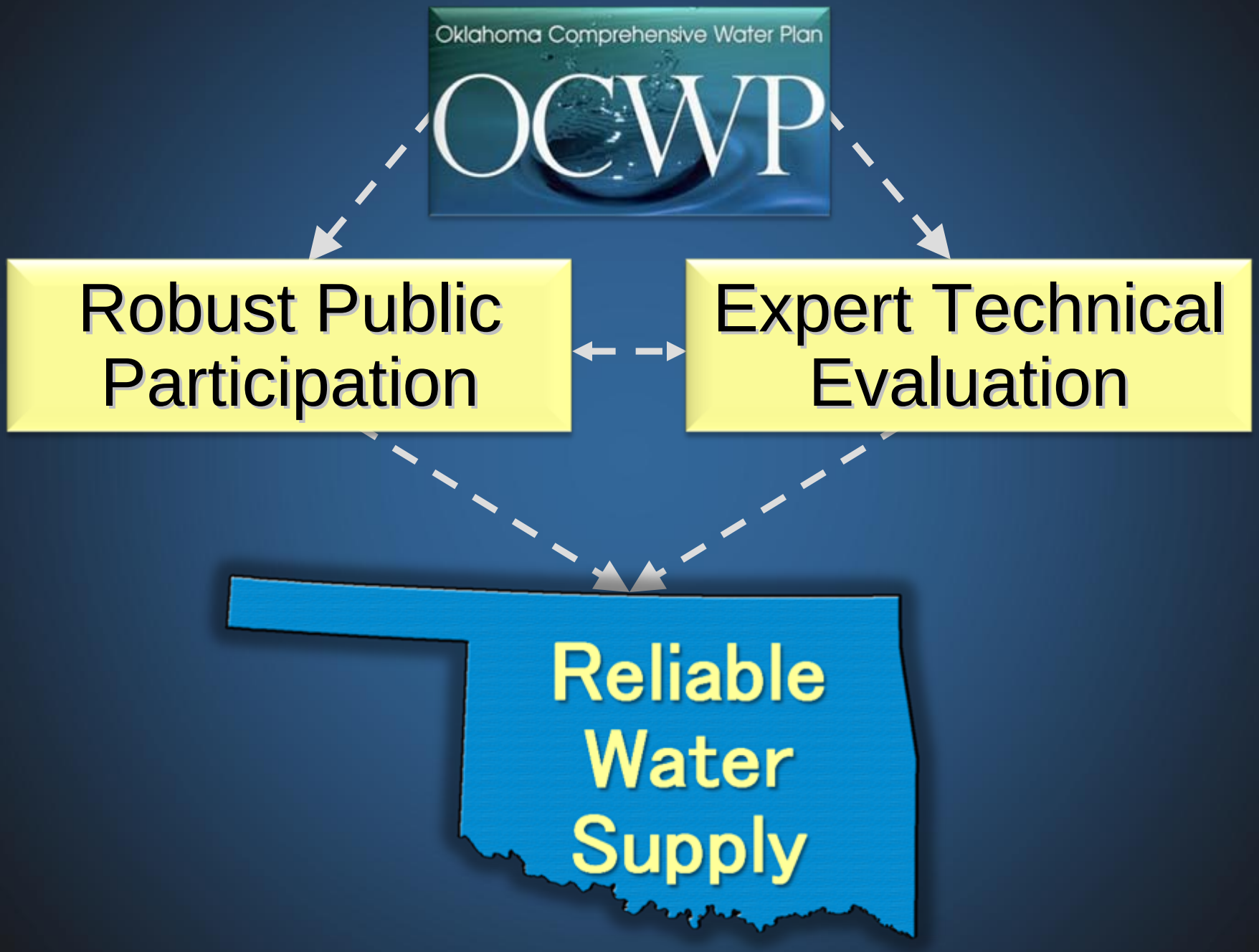


Oklahoma Comprehensive Water Plan

OCWP

"Utilizing public input and expert analysis to establish and implement Oklahoma's priority water initiatives."

- Identify reliable water supplies.
- Forecast tomorrow's water needs.
- Assist water providers in creating 50-year plans.


Oklahoma Comprehensive Water Plan
OCWP
Robust Public Participation
Expert Technical Evaluation
Reliable Water Supply

OCWP Partners

CDM

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USGS
science for a changing world

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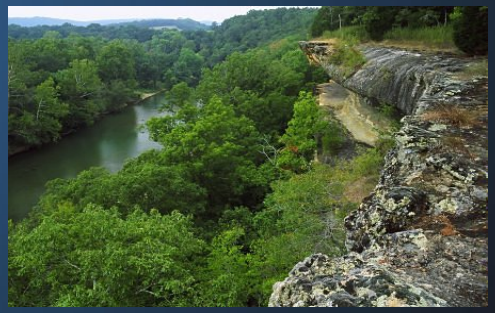
owrri
RESEARCH INSTITUTE

OKLAHOMA
CLIMATOLOGICAL SURVEY

Planning for What, Exactly?



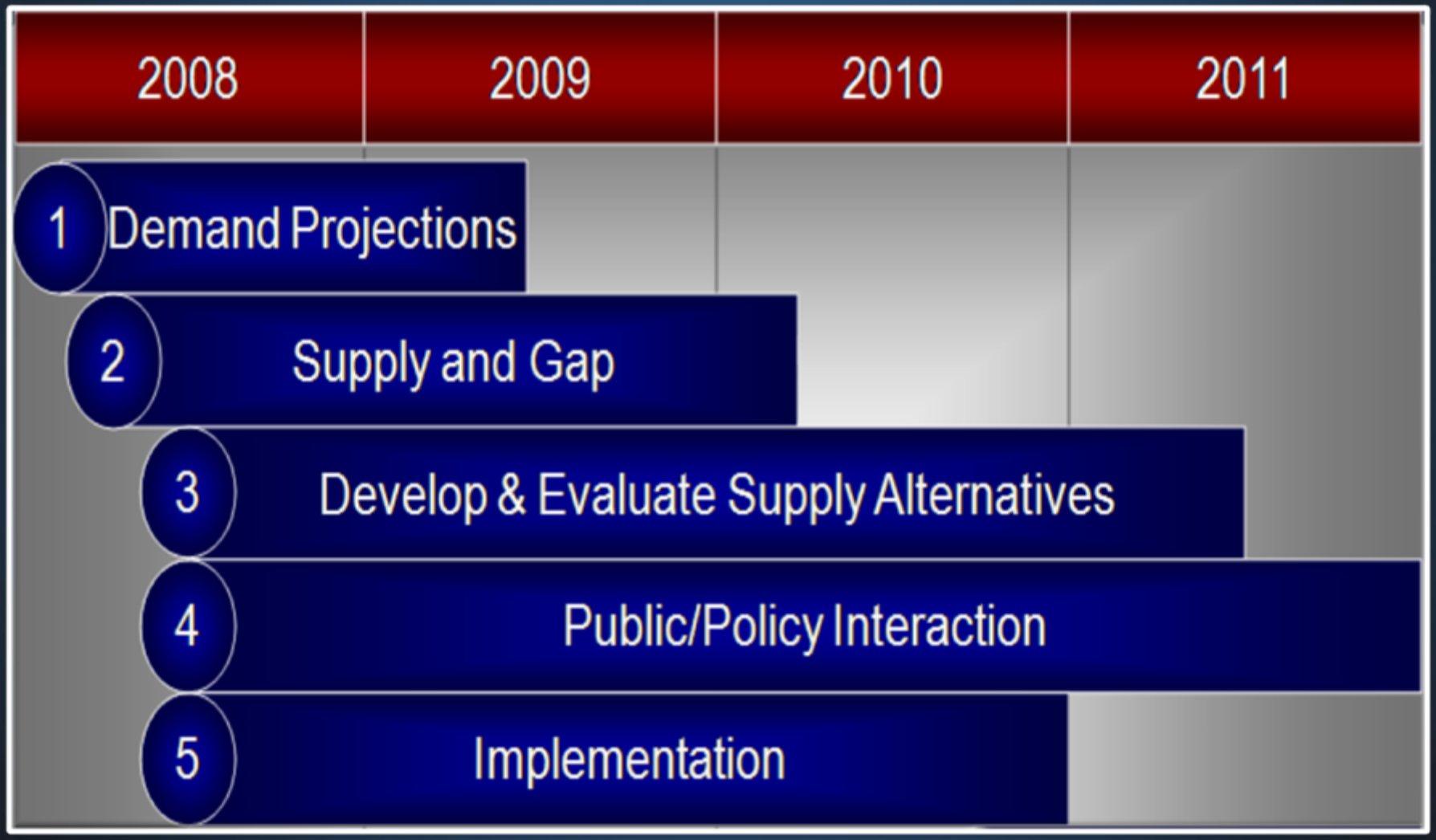
OCWP Policy Development (Public Participation)

- Fair, Inclusive, Transparent
- Ensure development of well-informed and well-supported policy recommendations

OCWP Policy Development (Public Participation)

- Local Input Meetings (2007; 42 meetings):
  - 2,250 attendees; 2,539 comments received
- Regional Input Meetings (2008; 11 meetings):
  - 340 discussants; >1400 recorded comments
- Planning Workshops (2009; 6 sessions):
  - 10 workgroups draft policy recommendations
- Town Hall (2010; 3 days):
  - Refine and finalize recommendations

OCWP Major Technical Work Elements



Expert Technical Evaluation

Oklahoma Water Resources owrri RESEARCH INSTITUTE

OKLAHOMA STATE UNIVERSITY

State of Oklahoma OWRB WATER RESOURCES BOARD the water agency

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Oklahoma Comprehensive Water Plan

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DEQ OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NOAA U.S. DEPARTMENT OF COMMERCE

GUERNSEY

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OKLAHOMA CLIMATOLOGICAL SURVEY

OKLAHOMA CONSERVATION COMMISSION

Oklahoma Department of Mines

OKLAHOMA CORPORATION COMMISSION

THE UNIVERSITY of TULSA

U.S. FISH & WILDLIFE SERVICE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

OKLAHOMA AGRICULTURE · FOOD · FORESTRY

Water Supply Sources

- Streamflow
- Alluvial Groundwater
- Bedrock Groundwater
- Interbasin Transfers

OCWP Surface Water Basins & Planning Regions

Water Demand Sectors

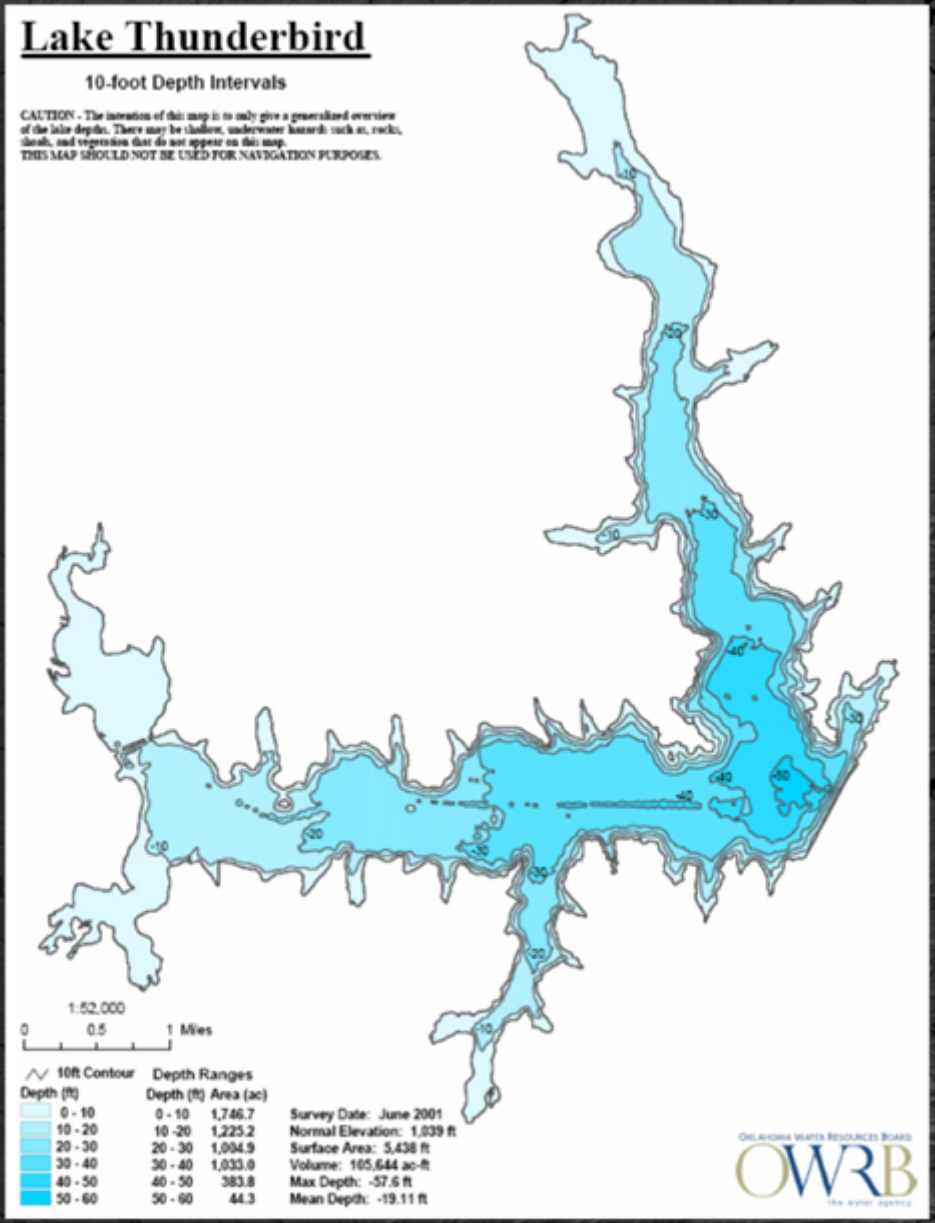
- Municipal and Industrial
- Self-Supply Residential
- Self-Supply Industrial
- Oil and Gas
- Livestock
- Irrigation (Crops)
- Thermoelectric Power

Garber-Wellington (Aquifer) Water Management Study

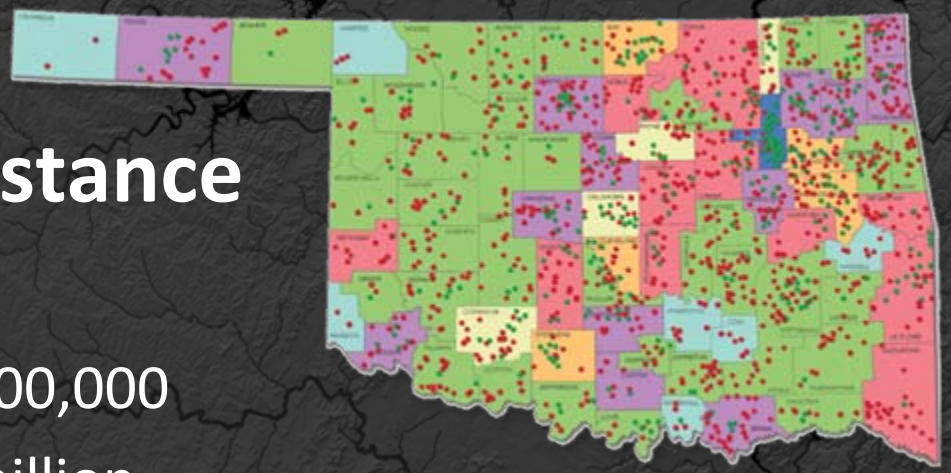
- Initiated in June 2008 to address growing concerns about the future of water availability in central Oklahoma
- USGS, Association of Central Oklahoma Governments, Bureau of Reclamation, Oklahoma Geological Survey, and Tinker Air Force Base:
  - 50/50 cost-share between Bureau of Reclamation and OWRB (OCWP)
- groundwater-flow model will predict the impacts of withdrawals and simulate management strategies
- Determine maximum annual yield

Lake Thunderbird Bathymetric Study

- 2001 bathymetric survey conducted to determine current lake information:
  - sedimentation
  - volume/storage
  - depth
  - surface area



OWRB Financial Assistance Program Funding



Norman Financial Assistance

Conventional FAP Funding:

- 2 Emergency Grants for $200,000
- 4 CWSRF Loans for $19.2 million

ARRA Stimulus Funding:

- 2 CWSRF Loans for $9.1 million (includes COMCD Thunderbird "Green" Project)
- 1 DWSRF Loan for $14 million

Funding Totals by County

- < $1 Million
- $1-10 Million
- $10-20 Million
- $20-50 Million
- $50-100 Million
- $100-200 Million
- $200-600 Million

- Grants
- Loans

Funding Totals by Program

Clean Water Loans	$811 Million
Drinking Water Loans	$595 Million
FAP Bond Loans	$630 Million
REAP Grants	$47 Million
Emergency Grants	$33 Million
TOTAL	$2.12 Billion
TOTAL SAVINGS	$747 Million

OWRB ARRA Stimulus Funding

Federal American Recovery and Reinvestment Act (ARRA) Program (2009):

- expansion of OWRB's conventional CWSRF/DWSRF loan programs
- $62 million in stimulus funding leveraged with $175 million in standard OWRB loans
- 55 water and wastewater projects statewide
- $158 million in interest rate savings to borrowers

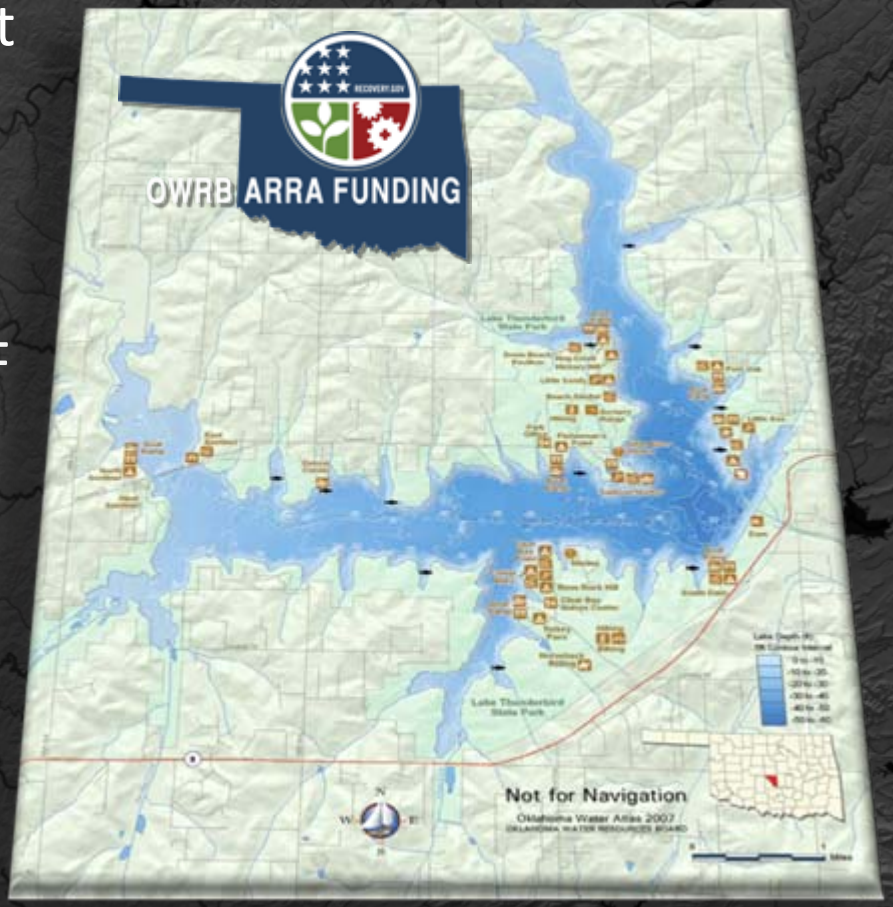
<u>ARRA Funding to Norman/COMCD</u>:

– $23.1 million

OWRB ARRA Stimulus Funding

Lake Thunderbird Project:

- OWRB ARRA "Green" Project
- Funds awarded to Central Oklahoma Master Conservancy District
- $1.5 million in OWRB CWSRF ARRA funds
- implement a oxygenation system to address excessive dissolved oxygen and turbidity levels



Community **Impact Measure Project**

- Quantify the social, economic, and environmental benefits of ARRA investments to communities and the state (beyond regulatory compliance).

Goals:

- **Maximize benefits of investments**
- **Deepen community relationships**
- **Demonstrate the need for projects**

Target Communities:

Norman
Piedmont
Grove
Ardmore

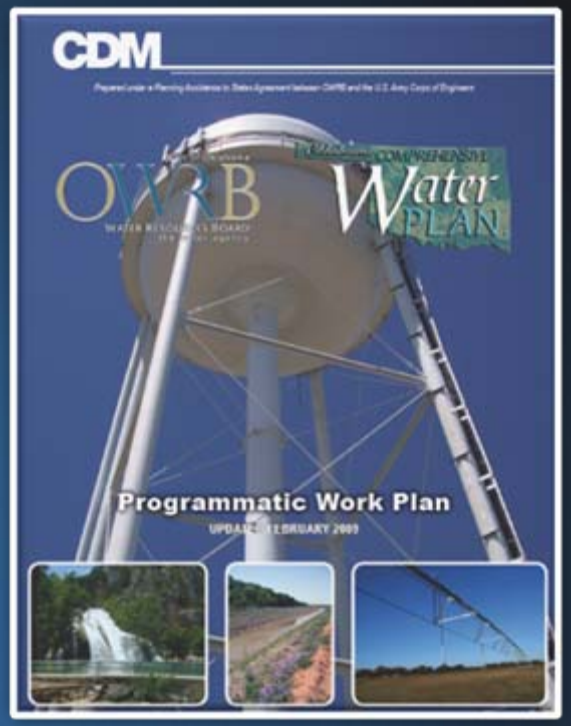
Role of State Water Planning

- How can statewide water planning assist local planning?
  - Provide a wealth of data and information for informed decision-making
  - Identify areas where further investigation needs to occur
  - Establish a model for implementation to benefit local and regional planning and projects
  - Tools for flexible future planning
  - Not to make decisions for local planning

Role of State Planning, cont'd

- Watershed, Basin and provider level:
  - Demands by major water use sectors
  - Supply availability (groundwater, stream water and reservoirs)
  - Potential reservoirs sites
  - Water quality considerations (current and trends)
  - Wholesale transfer information
  - Infrastructure needs assessment (based upon EPA/ODEQ survey)
  - Opportunities for conservation
  - Potential ranges of variability in supply and demand

Programmatic Work Plan



- Living document as a technical work roadmap
- On web: www.owrb.ok.gov
- Technical Work
  - Co-funded by OWRB and U.S. Army Corps of Engineers
  - Focus on defining demands and projecting supply shortfalls
  - identify solutions on a watershed, basin provider-level of detail
  - Additional complementary work to supplement our understanding our Oklahoma's water issues

Sound science is the foundation of good public policy

Oklahoma Comprehensive Water Plan

OCWP

Oklahoma Comprehensive Water Plan

OCWP

OCWP Technical Studies Update

Bryan Mitchell – CDM

City of Norman
Town Hall Meeting
January 21, 2010

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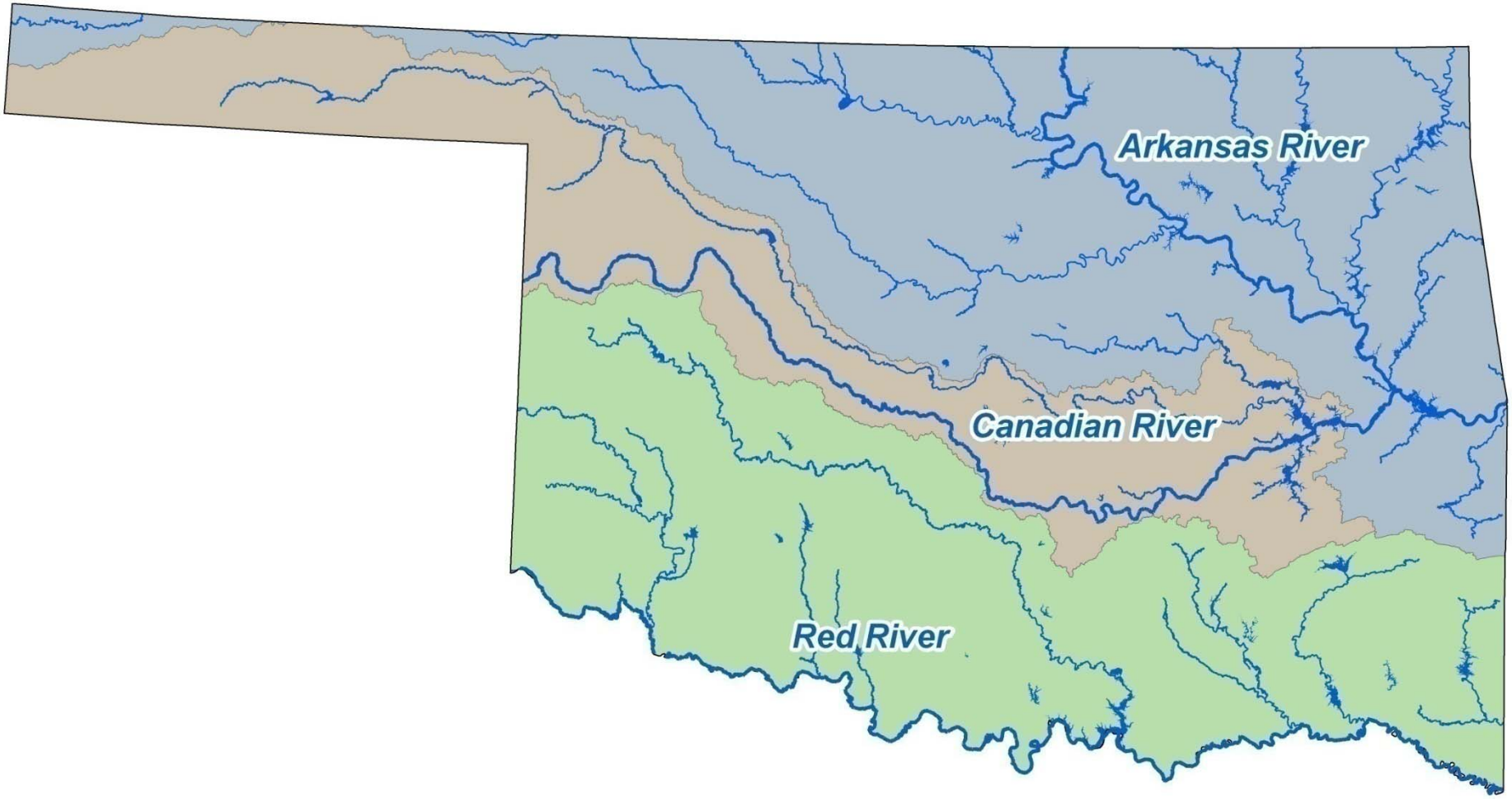
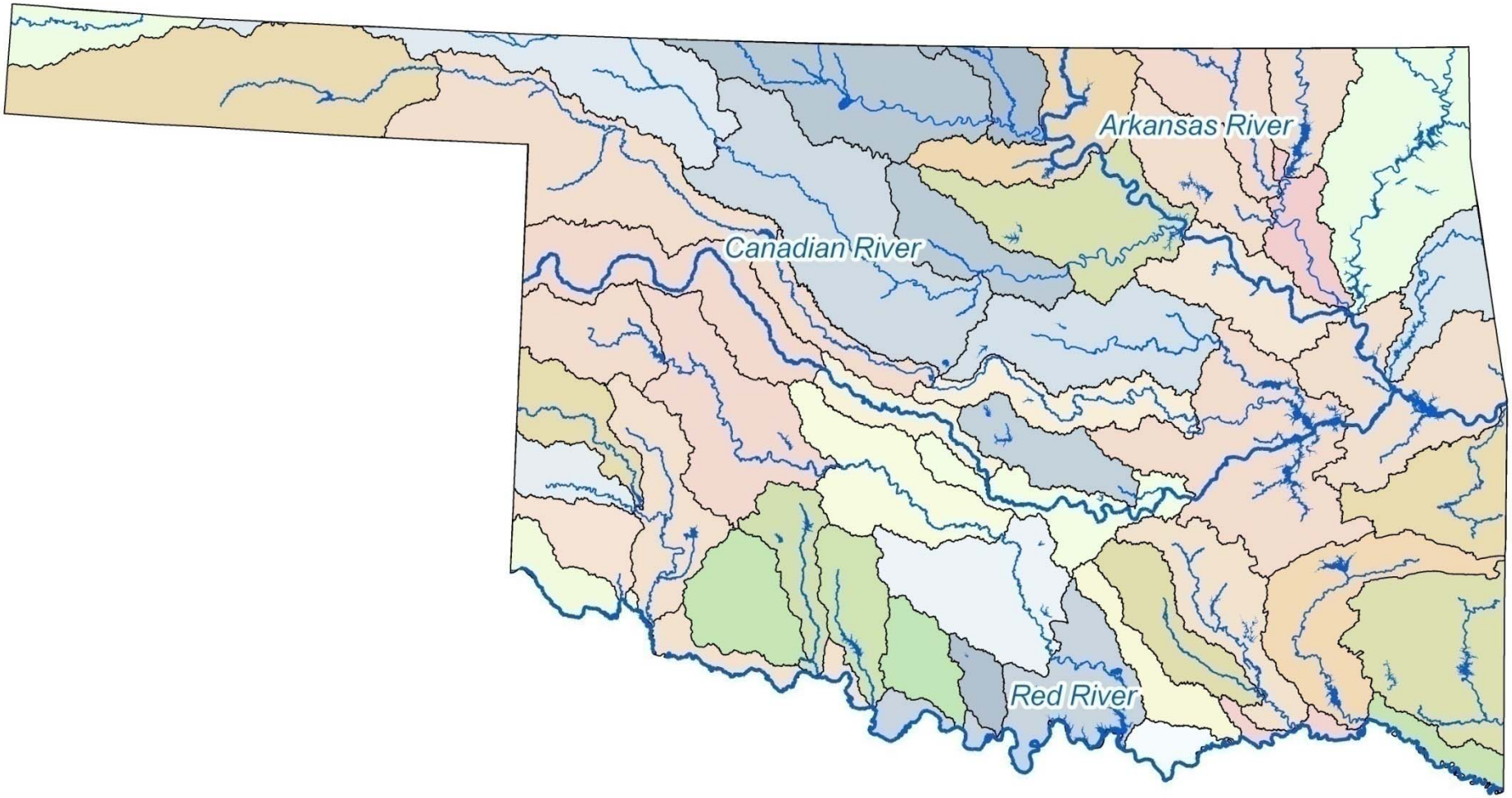
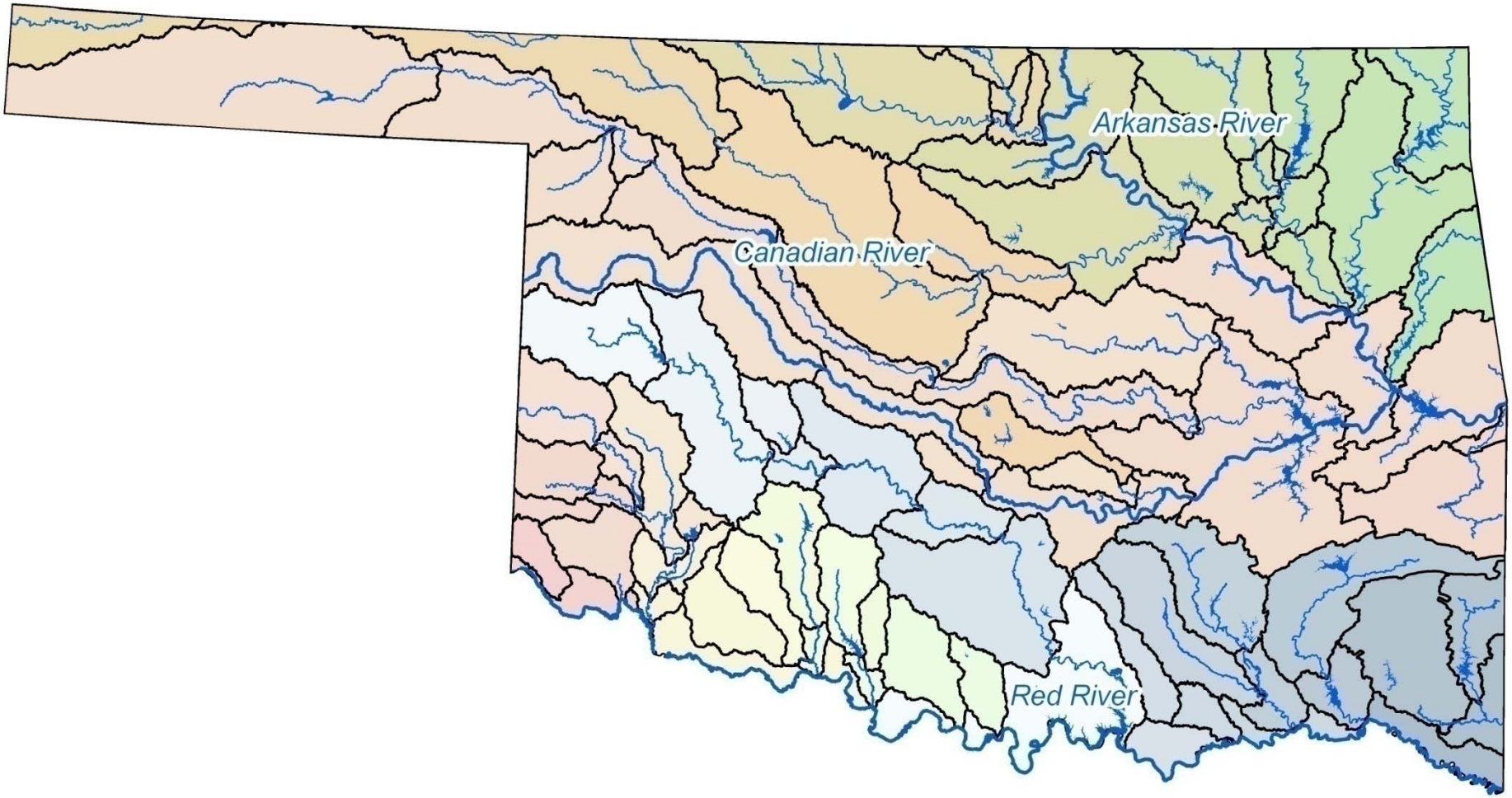
Subdividing the State into Basins & Watersheds



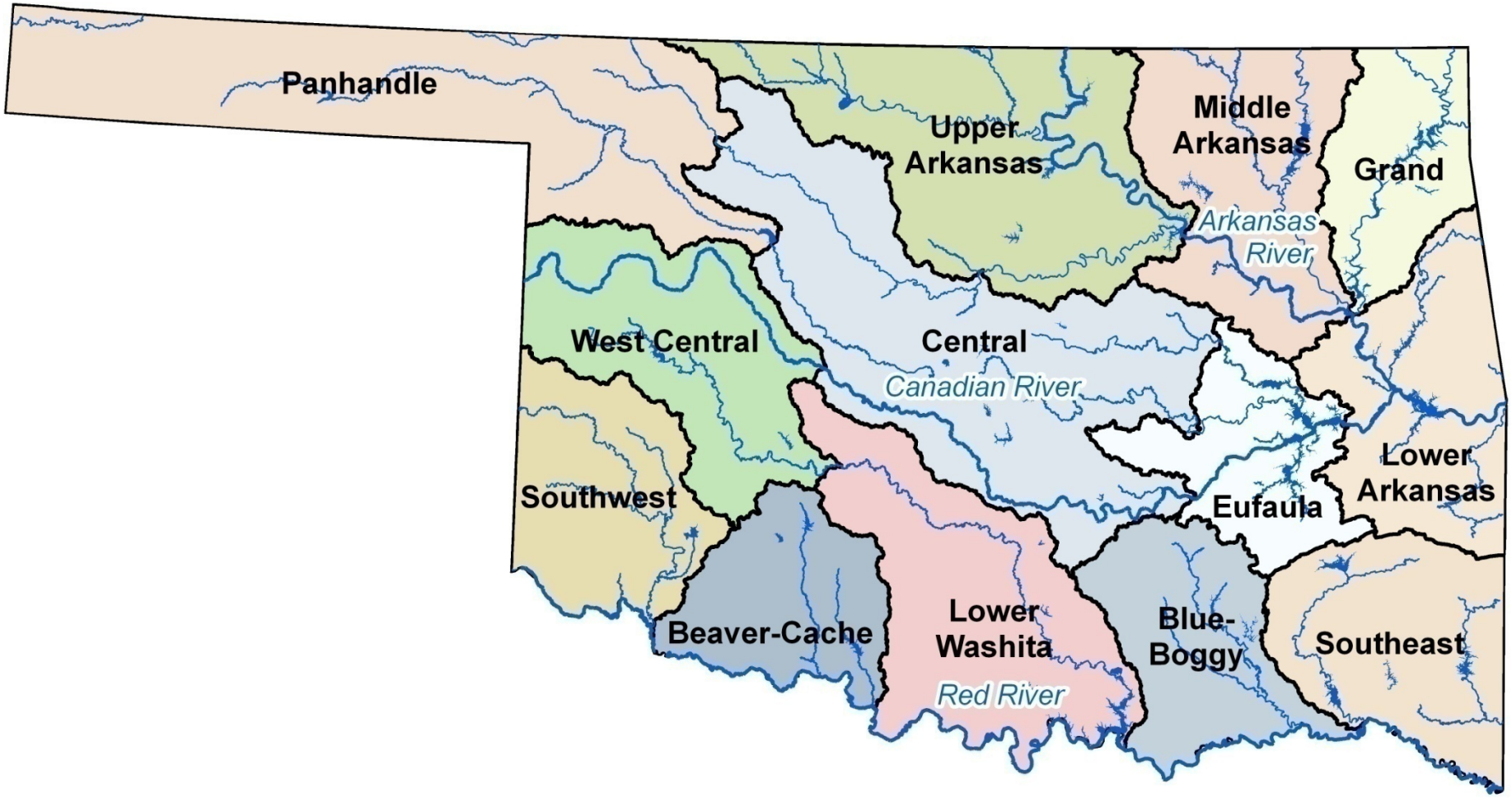
Subdividing the State into Basins & Watersheds



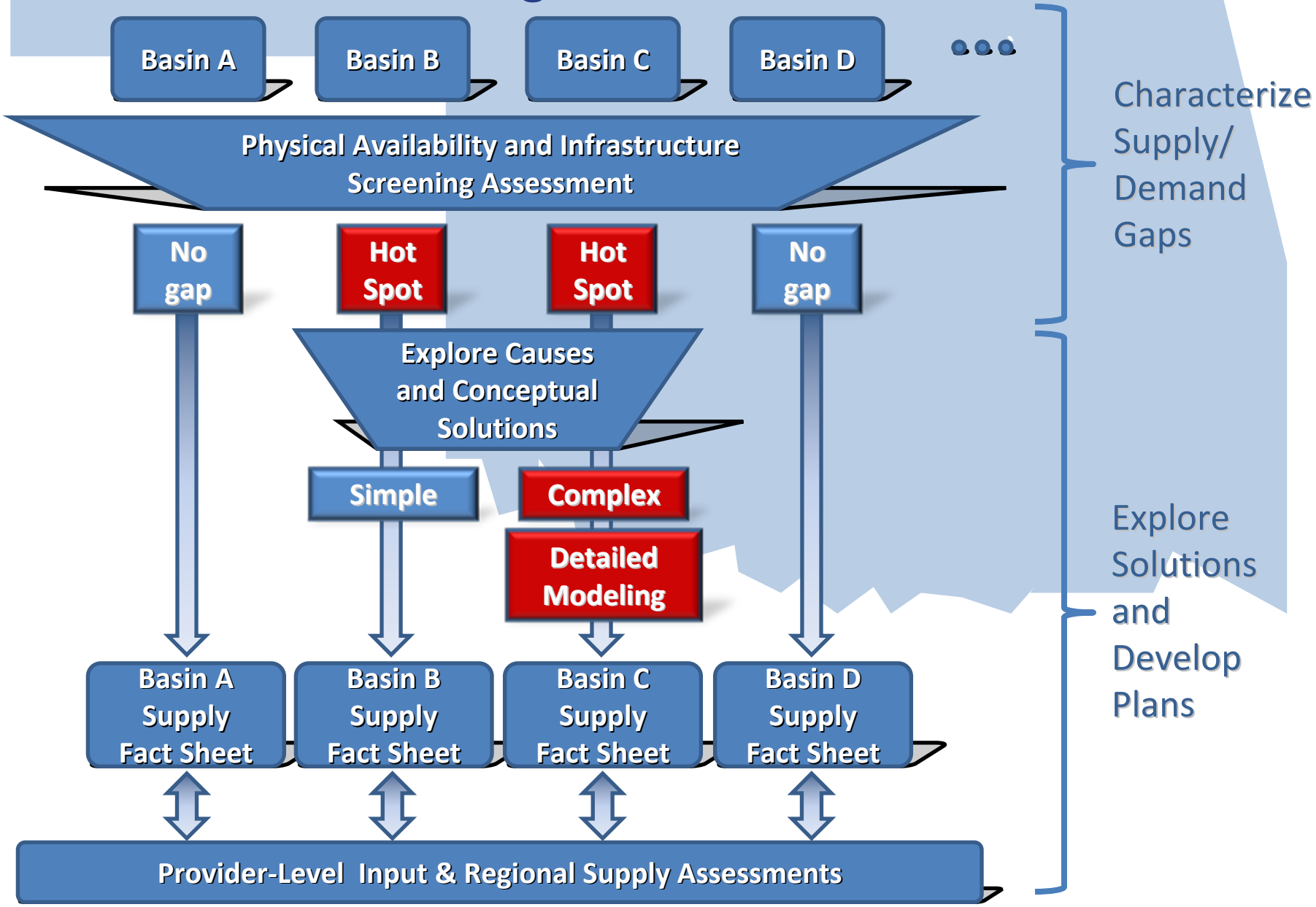
82 Basins for Detailed OCWP Analyses



Aggregated into 13 Watersheds for Regional Supply Assessments

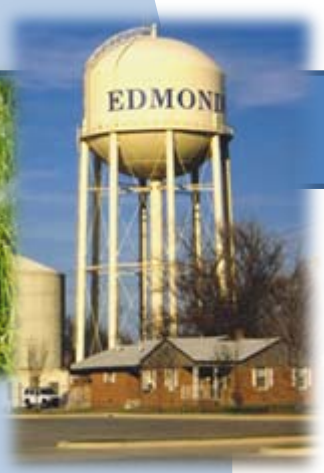


Focused Planning Process for OCWP



OCWP
Task 1 – Demand Projections

Task 1: Demand Projections



Completed through 2009

- Final demands by sector and basin
- Weather/municipal demand correlation
- Assessment of Instream Flow programs in Oklahoma and the West

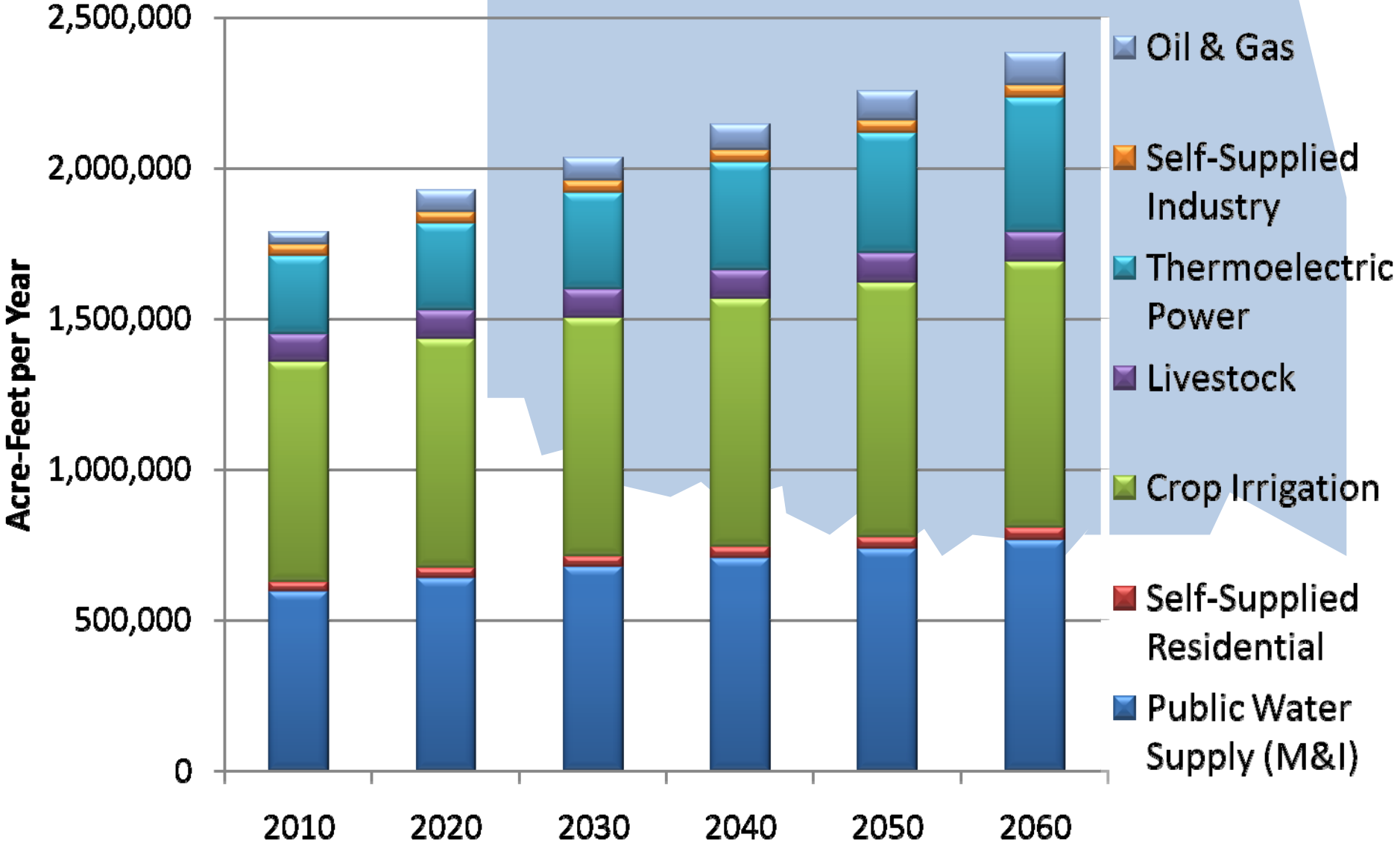
Ongoing and 2010

- Provider-level demands
- Instream Flow work group dialogue
- Assessment of conservation

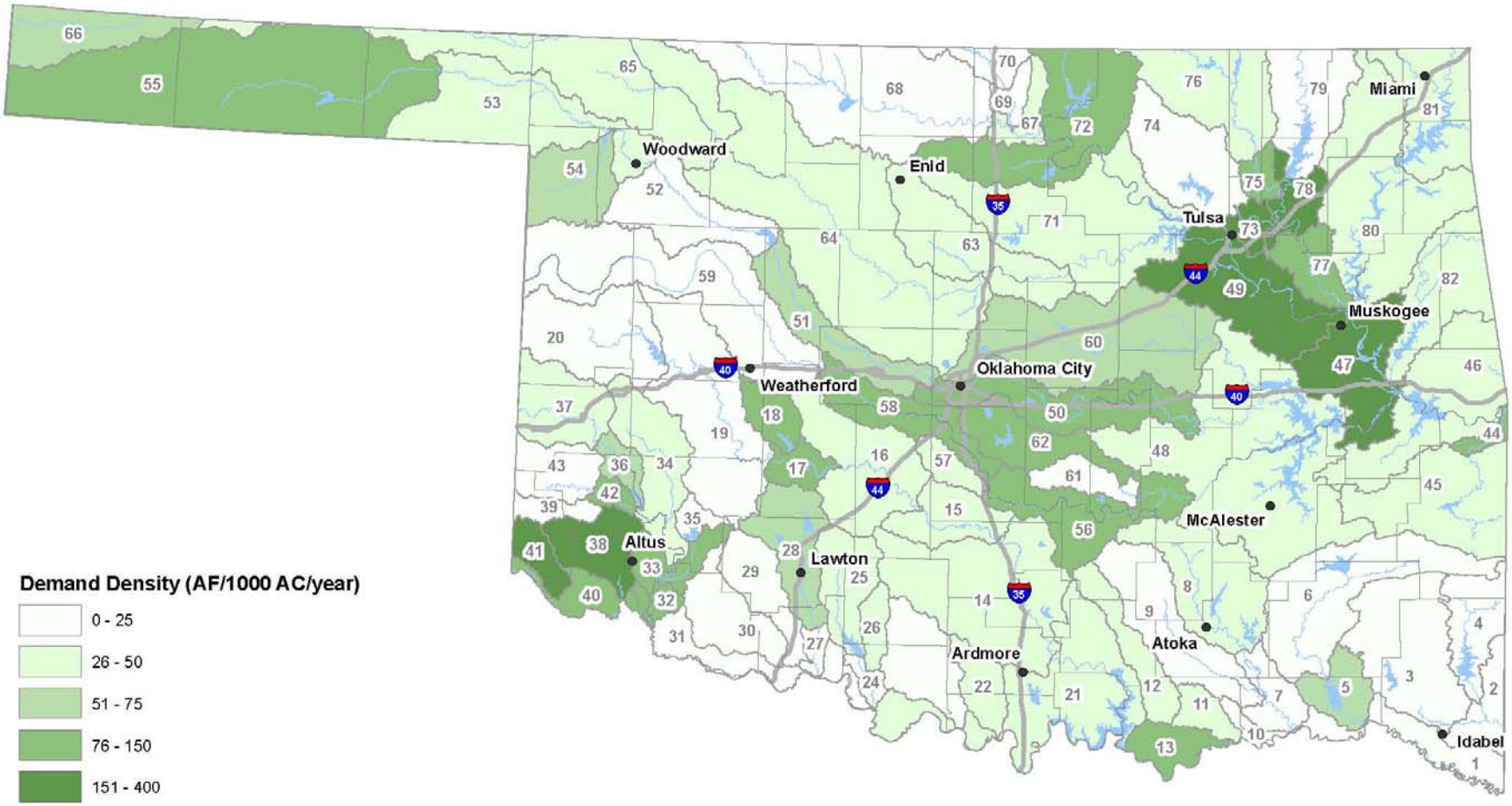
Potential Post-OCWP (Implementation)

- Additional demand refinement

Demand Projections Characterize the Need for Water



Total Demands (2060)



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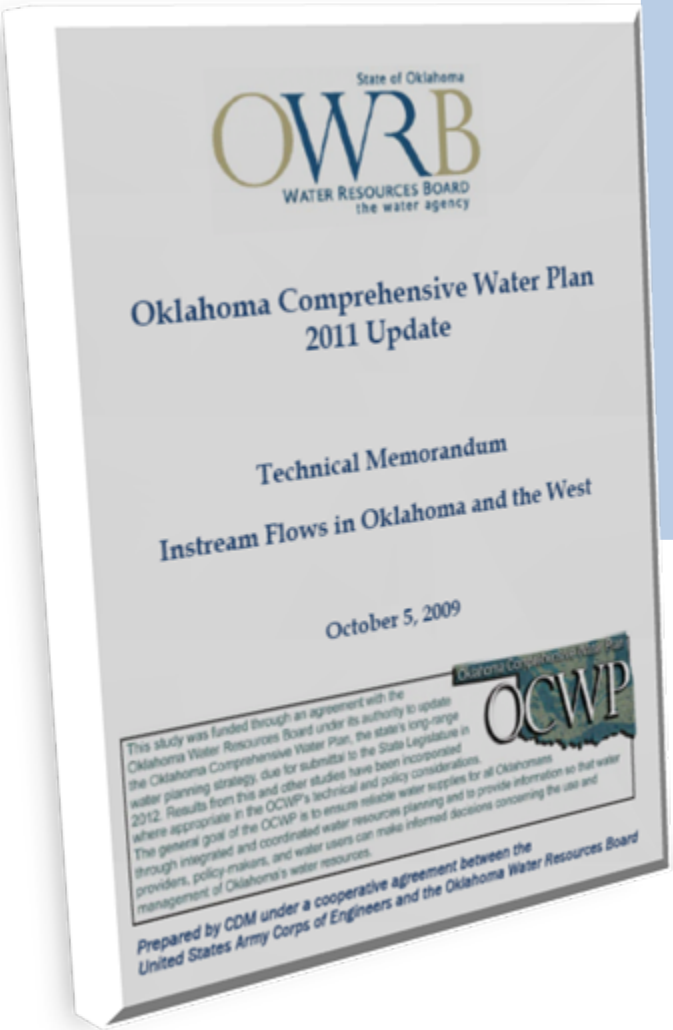
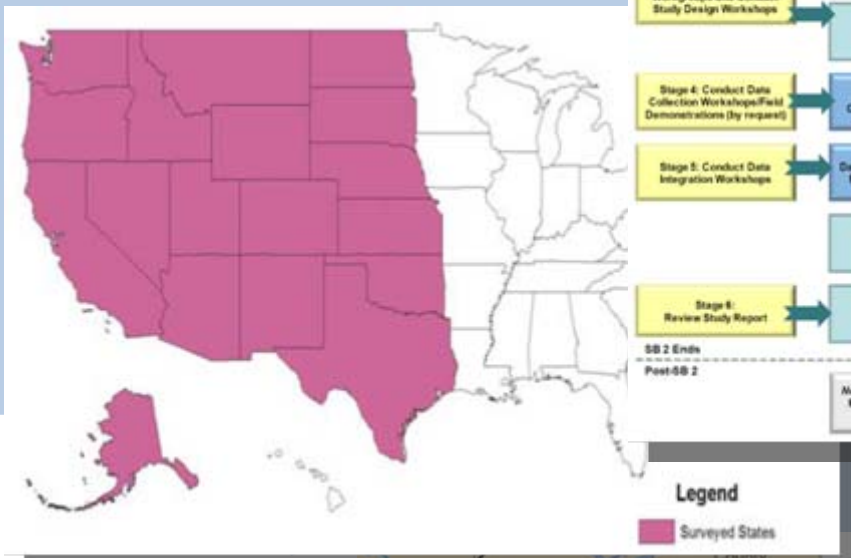
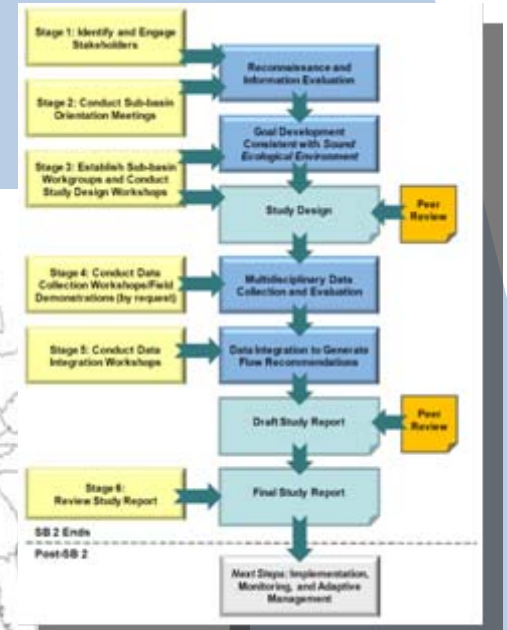
Report: "Instream Flows in Oklahoma and the West"





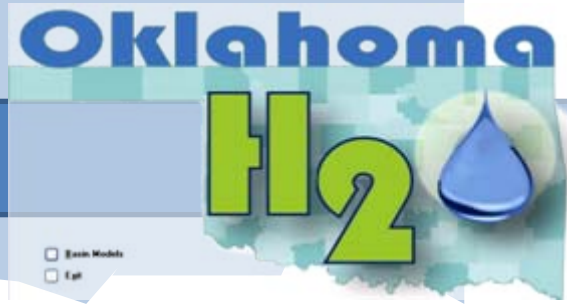


OCWP
Task 2 – Supply and Gap

Task 2: Supply and Gap

Completed through 2009

- Oklahoma H_2O Supply/Demand "Gap Tool"
- Baseline assessment of potential gaps through 2060
- Reservoir yield model
- Permitting/compact "legal availability"
- Public Water Supplier Survey & report
- Water allocation models (Kiamichi & Little River)

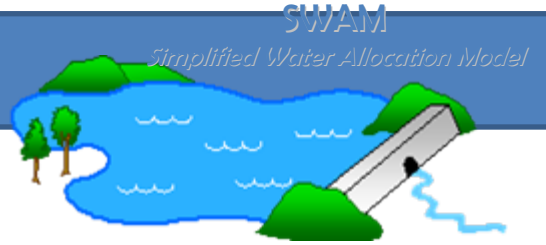


Ongoing and 2010

- Sensitivity analysis – ranges of supply and demand
- Climate change impacts on supply, demand, and gap

Potential Post-OCWP (Implementation)

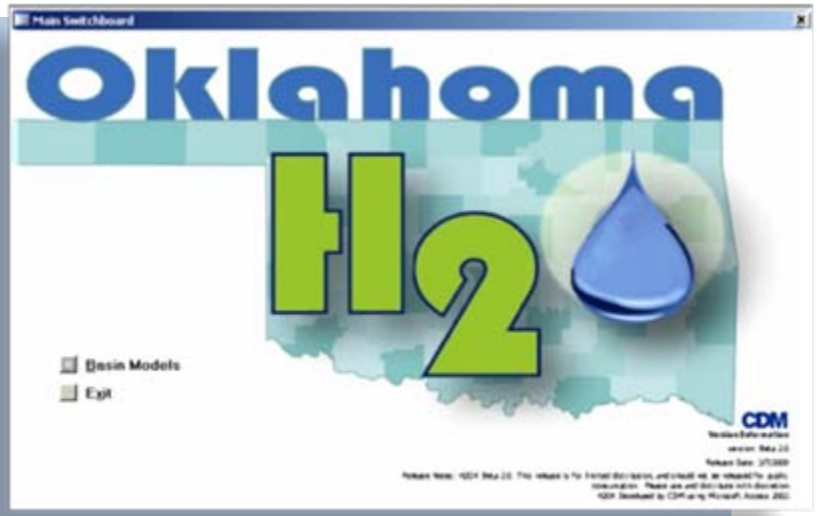
- Additional water allocation model development and application



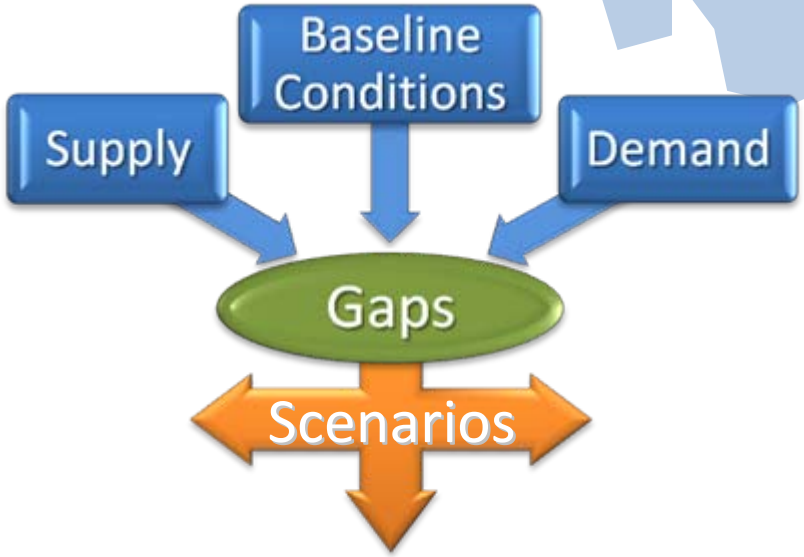
Reservoir Yield Model

OCWP
Task 2 – Supply and Gap Screening Tool

Statewide Supply Availability Screening

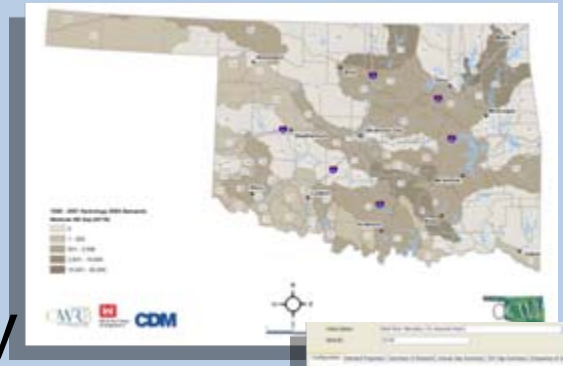


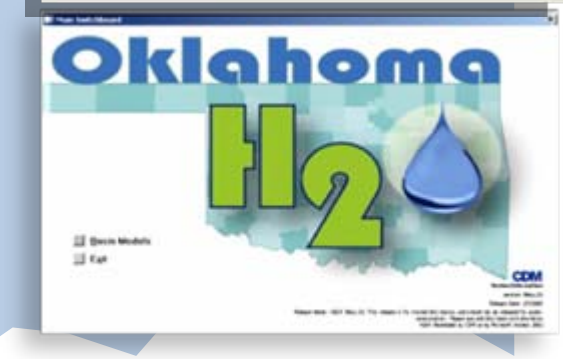
- Physical supply
- Statewide screening tool in *Access* and GIS
- Quickly perform “what-if” analyses to test ranges of conditions



- Planning alternatives and impacts of potential supply & demand variability

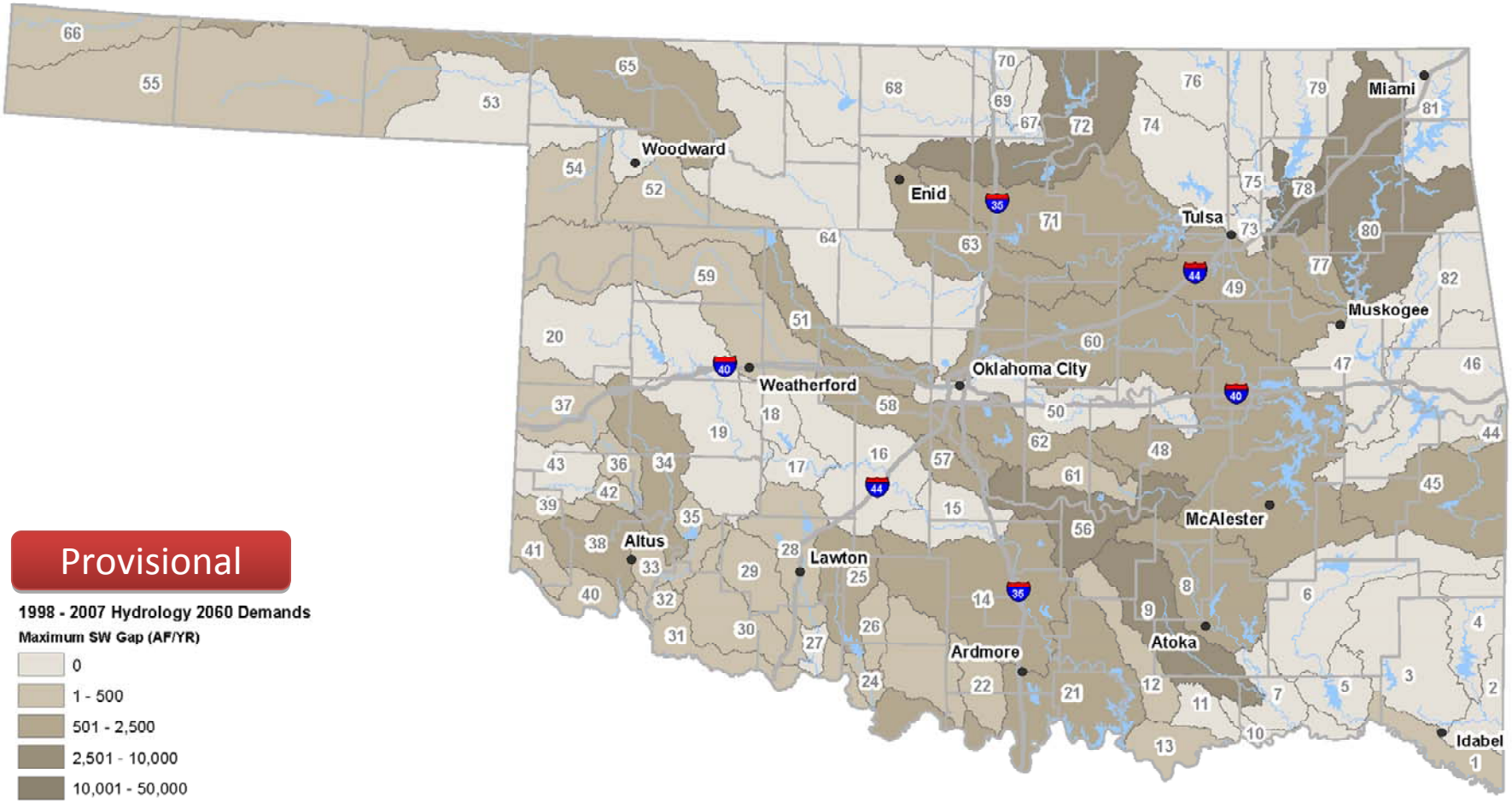
“Gap Tool” Output





- Physical supply availability for each basin
- Supply shortages by decade
  - *2010, 2020, 2030, 2040, 2050, 2060*
- Supply shortages by source
  - *Surface water*
  - *Alluvial groundwater*
  - *Bedrock groundwater*
- Magnitude & frequency of shortages under period-of-record monthly hydrologies

Maximum Surface Water Gaps in 2060



Provisional

1998 - 2007 Hydrology 2060 Demands

Maximum SW Gap (AF/YR)

- 0
- 1 - 500
- 501 - 2,500
- 2,501 - 10,000
- 10,001 - 50,000

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0 25 50 Miles

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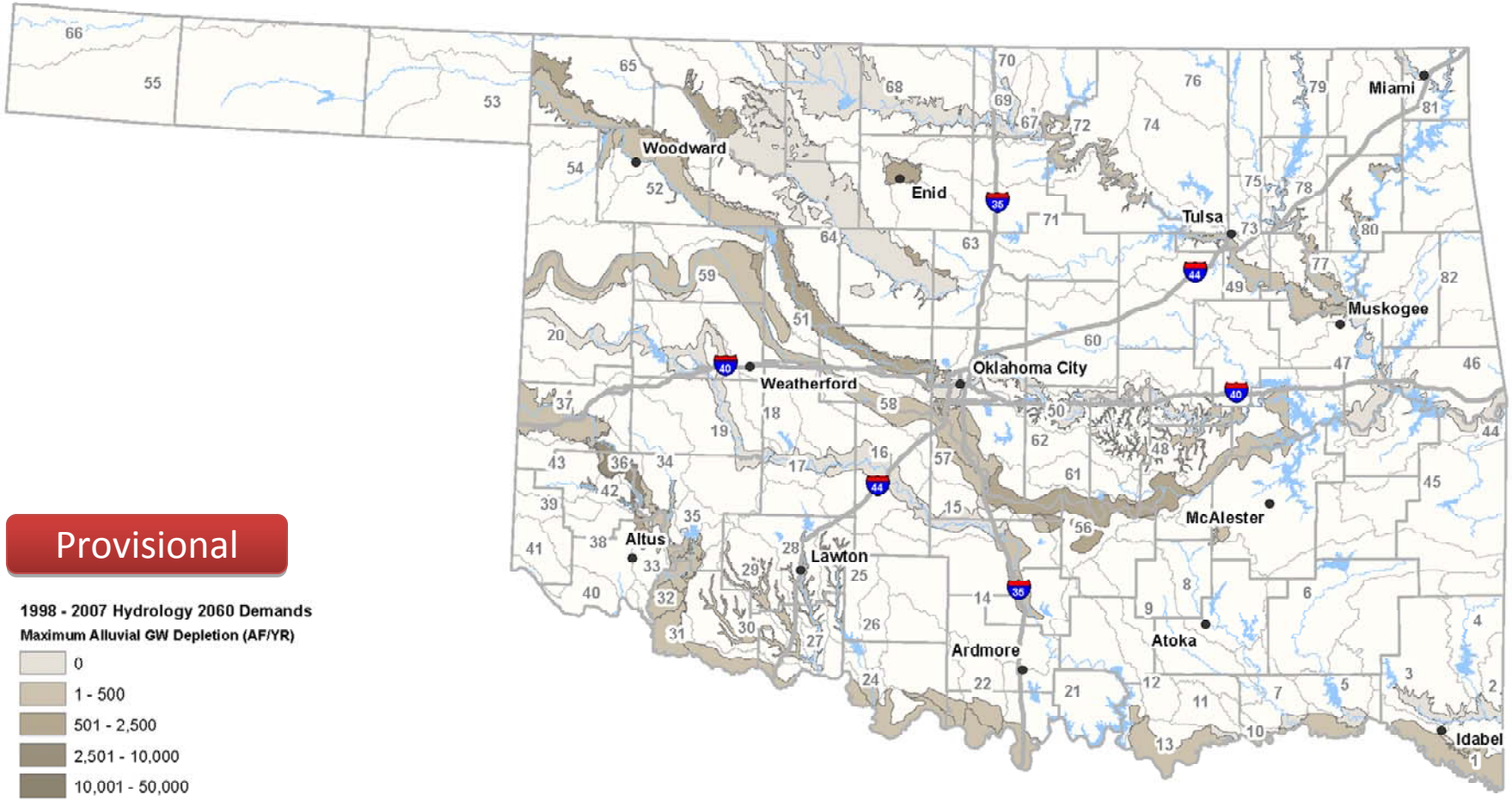
Maximum Alluvial Groundwater Depletions in 2060



Provisional

1998 - 2007 Hydrology 2060 Demands

Maximum Alluvial GW Depletion (AF/YR)

- 0
- 1 - 500
- 501 - 2,500
- 2,501 - 10,000
- 10,001 - 50,000

Note: Areas in tan do not have a delineated alluvial aquifer.

N W E S

0 25 50 Miles

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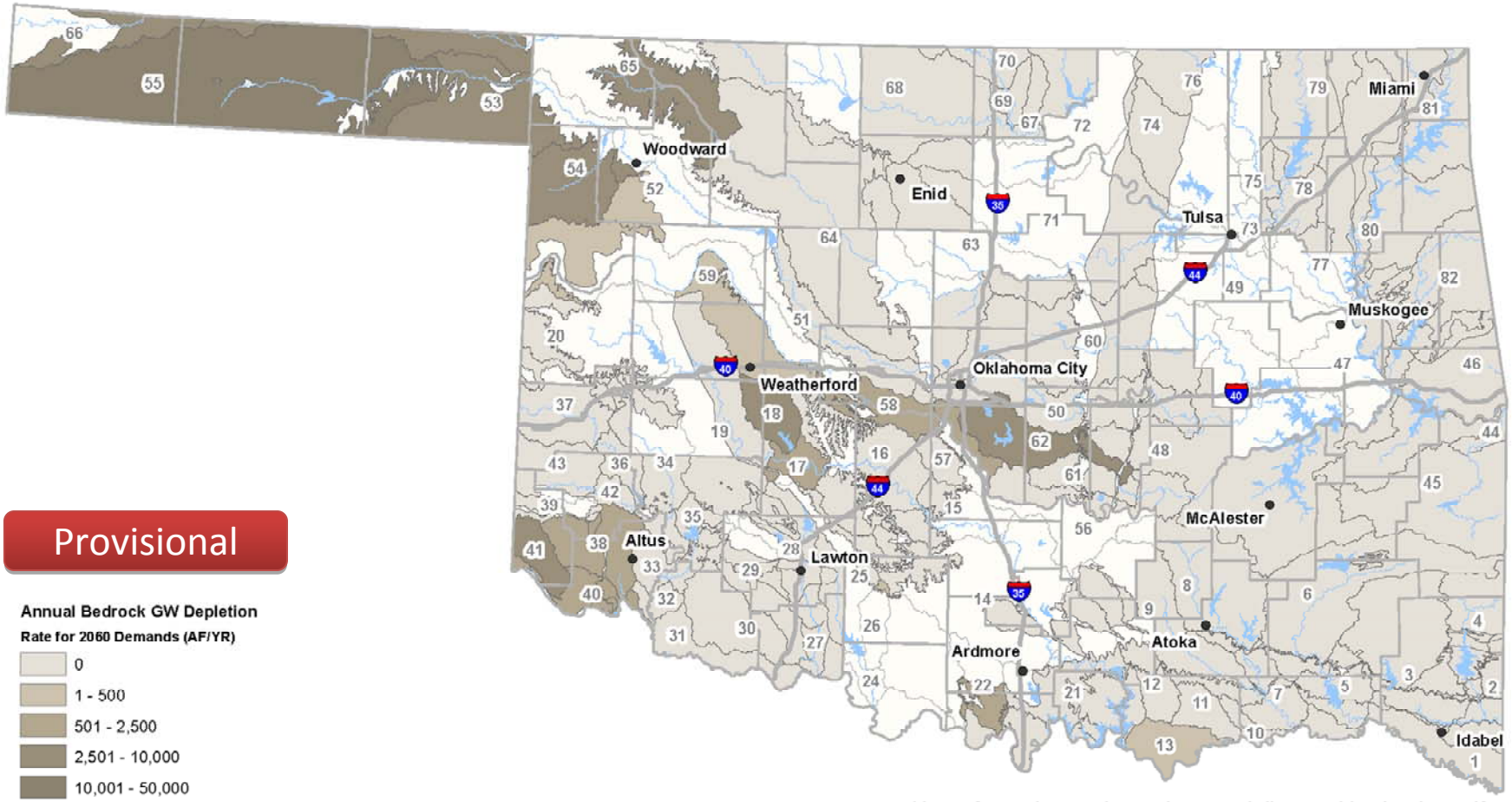
Maximum Bedrock Groundwater Depletions in 2060



Provisional

Annual Bedrock GW Depletion
Rate for 2060 Demands (AF/YR)

- 0
- 1 - 500
- 501 - 2,500
- 2,501 - 10,000
- 10,001 - 50,000

Note: Areas in tan do not have a delineated bedrock aquifer.

N
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0 25 50 Miles

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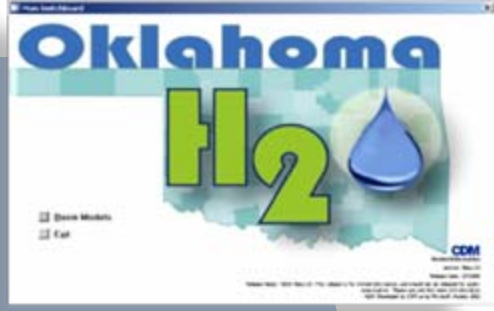
Task 2 – Supply and Gap Screening Tool Examples

Example Scenario 1: Additional 10% Increase in Demands (all Sectors)



Increase Demands by 10%

Sensitivity and Tolerance

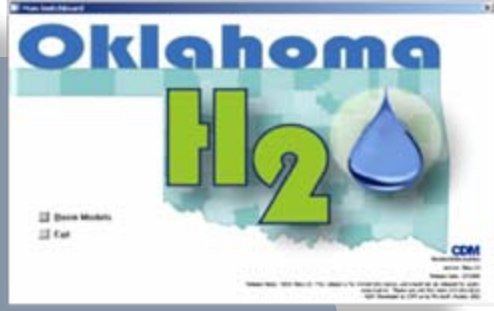
Change of Surface Water Availability (in %)	0%
Acceptable Shortage Tolerance (% of Demand)	0%
Change of Demand (in %)	
Municipal & Industrial	10%
Self Supplied Rural Residential	10%
Self Supplied Industrial	10%
Thermoelectric Power	10%
Crop Irrigation	10%
Livestock	10%
Oil & Gas	10%

Results from Example Scenario 1: Increase in Demands for Example Basin

Demand
10 %

- Maximum Surface Water Gap — 43%
- Maximum Alluvial Groundwater Depletion — 36%
- Bedrock Groundwater Depletion — None (no change)

Example Scenario 2: 10% Decrease in Surface Water Supplies

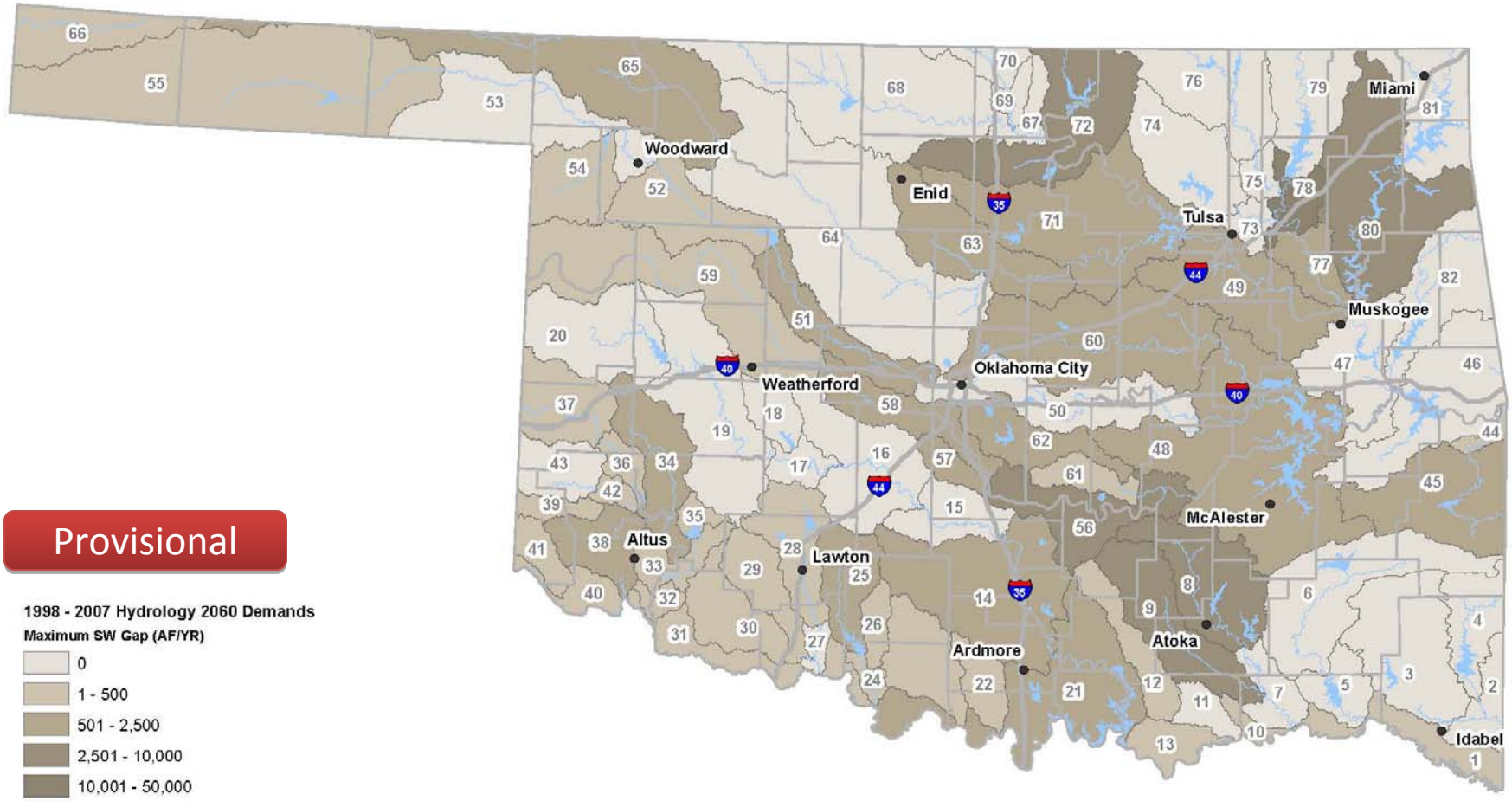


Decrease Surface Water Supplies by 10%

Sensitivity and Tolerance

Change of Surface Water Availability (in %)	-10%
Acceptable Shortage Tolerance (% of Demand)	0%
Change of Demand (in %)	
Municipal & Industrial	0%
Self Supplied Rural Residential	0%
Self Supplied Industrial	0%
Thermoelectric Power	0%
Crop Irrigation	0%
Livestock	0%
Oil & Gas	0%

Results from Example Scenario 2: 10% Decrease in Surface Water Supplies



Provisional

1998 - 2007 Hydrology 2060 Demands

Maximum SW Gap (AF/YR)

- 0
- 1 - 500
- 501 - 2,500
- 2,501 - 10,000
- 10,001 - 50,000

N
W E
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0 25 50 Miles

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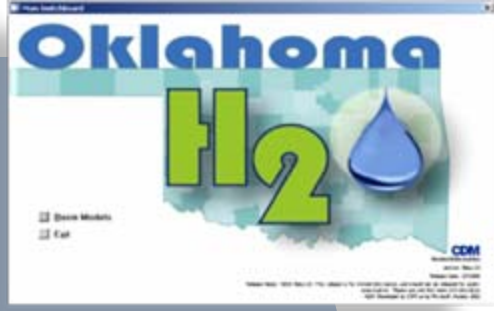
Example Scenario 3: Modifying Supply Proportions



Current Supply Proportions

Demand Percentages

Demand Type	Input Percentages of Demand Met by Surface or GW		If GW Demands Exist, Input the % Met by Type	
	Surface	Ground	Alluvial	Bedrock
Municipal & Industrial	58%	42%	17%	83%
Self Supplied Rural Residential	0%	100%	65%	35%
Self Supplied Industrial	0%	0%	0%	0%
Thermoelectric Power	0%	0%	0%	0%
Crop Irrigation	25%	75%	60%	40%
Livestock	25%	75%	60%	40%
Oil & Gas	0%	0%	0%	0%

Increased Groundwater Use

Demand Percentages

Demand Type	Input Percentages of Demand Met by Surface or GW		If GW Demands Exist, Input the % Met by Type	
	Surface	Ground	Alluvial	Bedrock
Municipal & Industrial	20%	80%	20%	80%
Self Supplied Rural Residential	0%	100%	60%	40%
Self Supplied Industrial	0%	0%	0%	0%
Thermoelectric Power	0%	0%	0%	0%
Crop Irrigation	10%	90%	60%	40%
Livestock	10%	90%	60%	40%
Oil & Gas	0%	0%	0%	0%

Resulting Gaps from Example Scenario 3: Modified Supply Proportions

Current Supply Proportions

Configuration | Demand Projection | Summary of Demand | Annual Gap Summary | SW

Water Year	SW	AGW	BGW	All
1950	0	0	0	0
1951				
1952				
1953				
1954				
1955				
1956	45	86	0	131
1957	0	10	0	10
1958	0	0	0	0
1959	12			
1960	0			
1961	0			
1962	0			
1963	41			
1964	126	145	0	271
1965	0	0	0	0
1966	140	123	0	263
1967	0	0	0	
1968	0	0	0	
1969	0	0	0	
1970	162	175	0	
1971	128	100	0	
1972	0	0	0	0
1973	0	0	0	0
Min	**0**	**0**	**0**	**0**
Max	**254**	**213**	**0**	**467**
Avg	**41**	**44**	**0**	**85**

Modified Supply Proportions

Configuration | Demand Projection | Summary of Demand | Annual Gap Summary | SW

Water	SW	AGW	BGW	All
50	0	0	0	0
	0	0	0	0
	49	146	0	195
	9	38	0	66
	49	162	0	211
	48	54	0	102
5	16	61	0	77
1957	0	0	0	0
1958	0	0	0	0
			0	4
			0	0
			0	0
			0	10
			0	98
1964	40	54	0	174
1965	0	0		0
1966	51	155		206
				0
				0
				271
				162
1972	0	0		0
1973	0	0		0
Min	**0**	**0**	**0**	**0**
Max	**76**	**273**	**0**	**349**
Avg	**11**	**46**	**0**	**57**

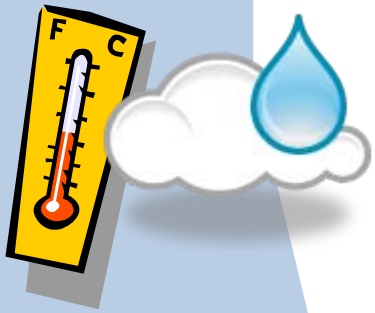
Surface Water Gap
254 AFY → 76 AFY

Alluvial GW Depletions
213 AFY → 273 AFY

Still No Bedrock GW Depletions

OCWP
Task 2 – Supply and Gap
Climate Change Tool

Climate Change Analyses

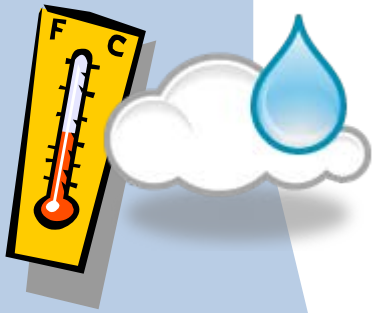


Potential Changes in Water Supply

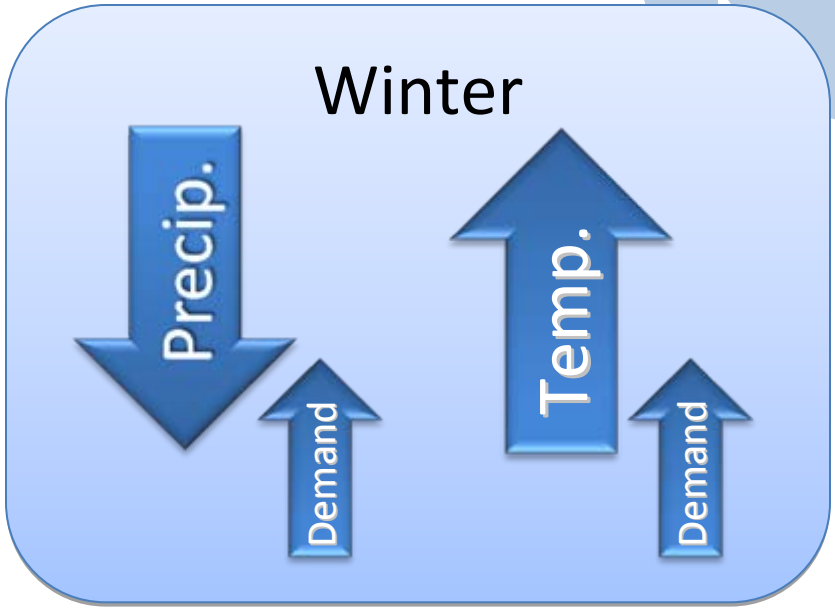
Potential Changes in Water Demand

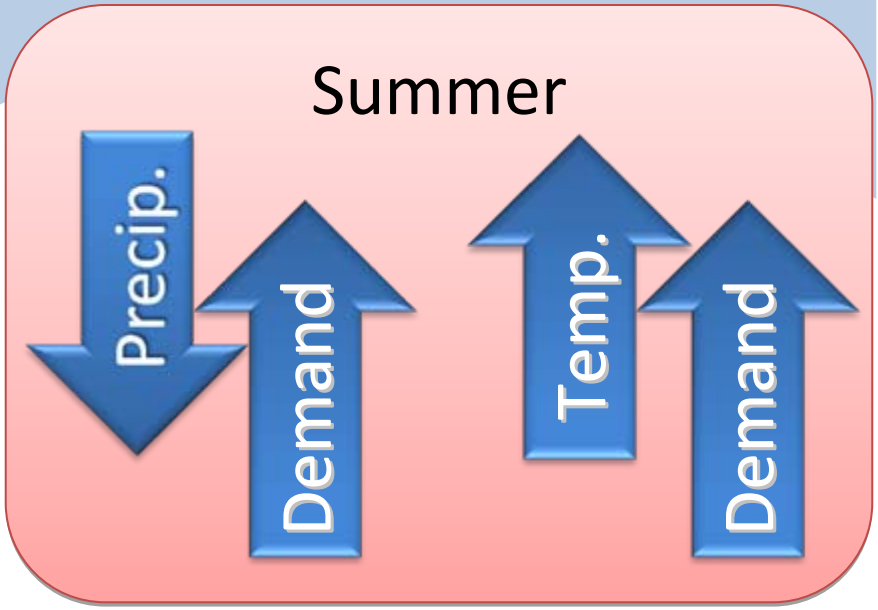
Use Oklahoma H_2O to Assess Impacts on Shortages & Solutions

Climate Demand Model

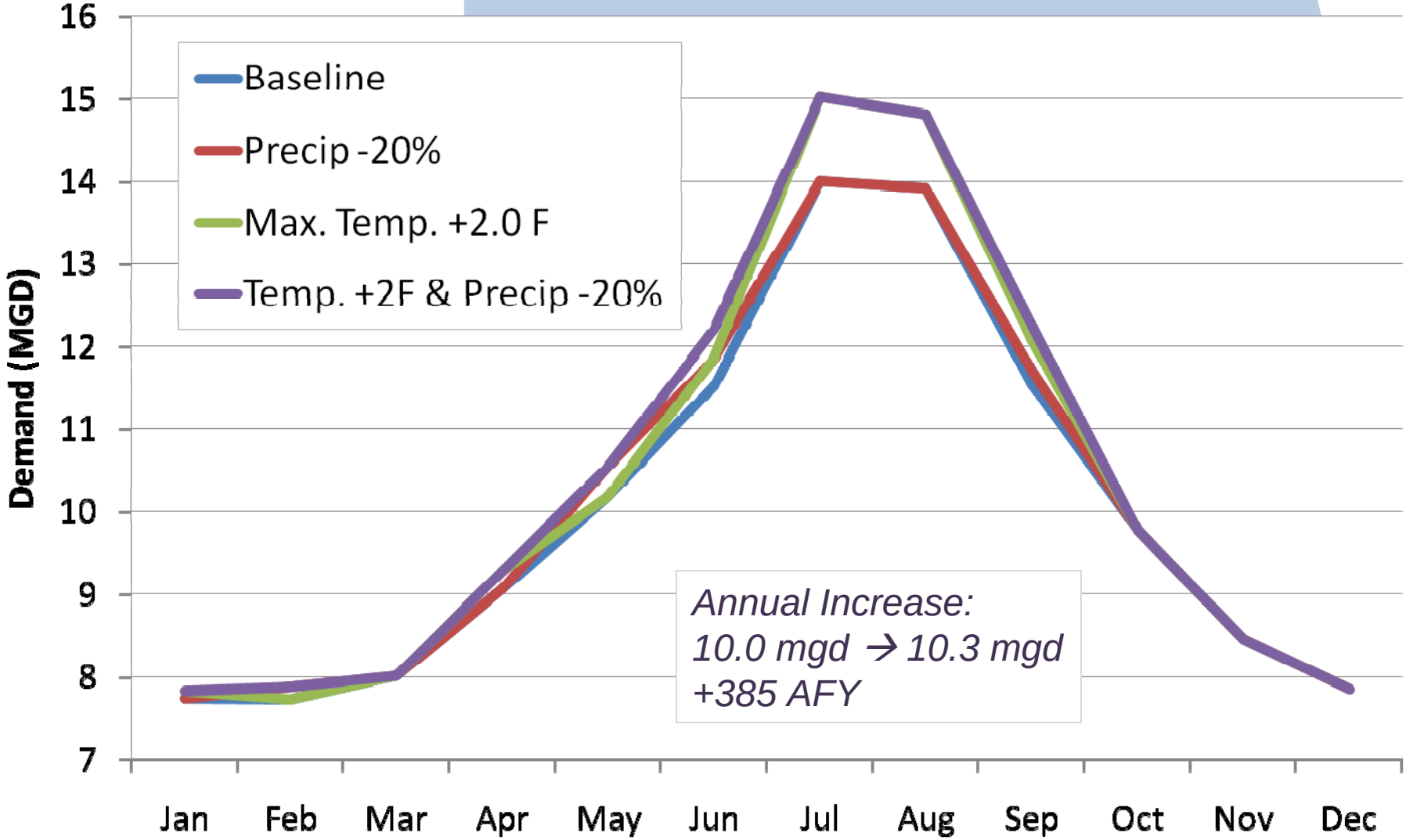


- How do municipal demands react to weather?
- Regression analysis of historical water use and weather data
- Applicable to short or long-term variability



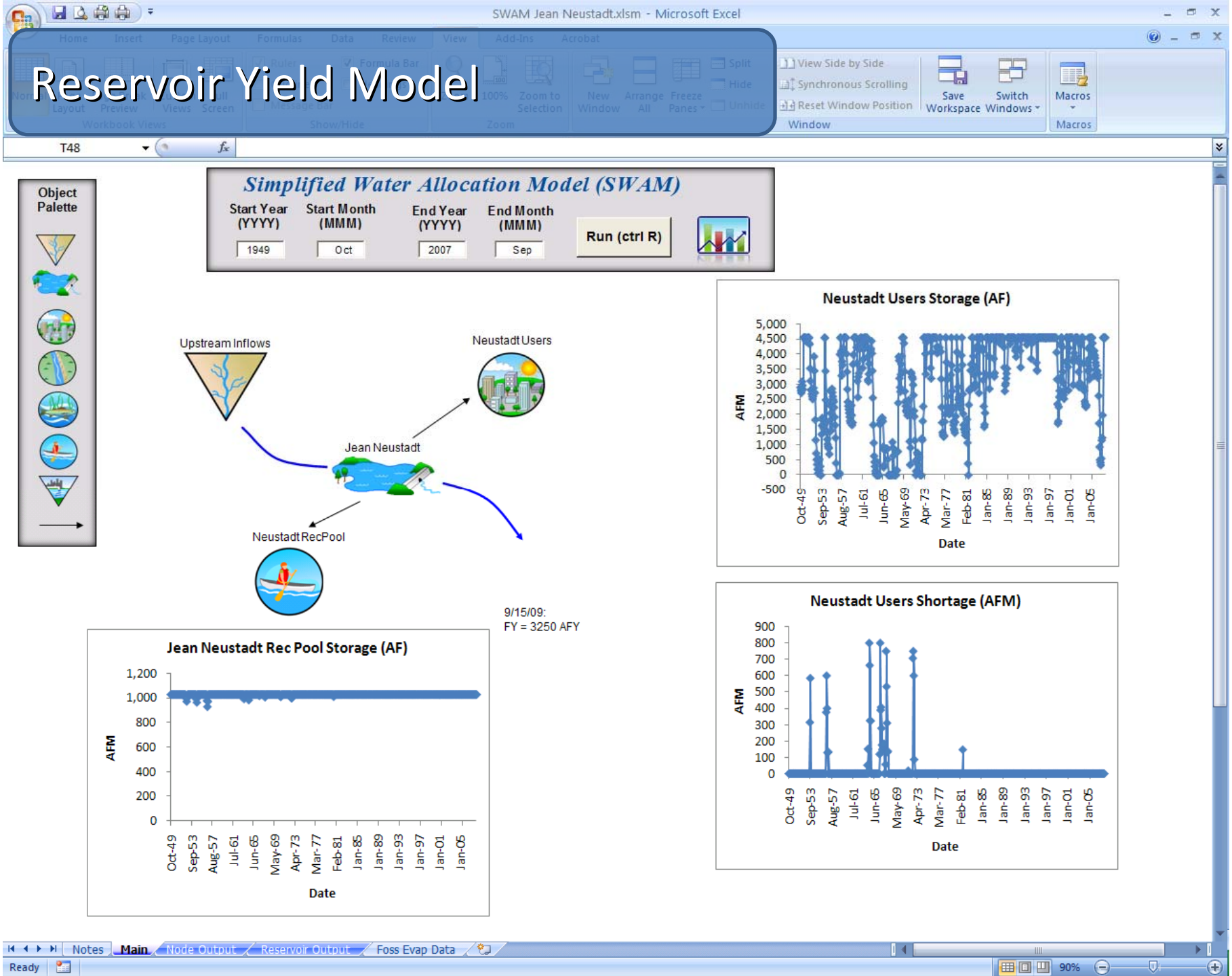


Example Implications

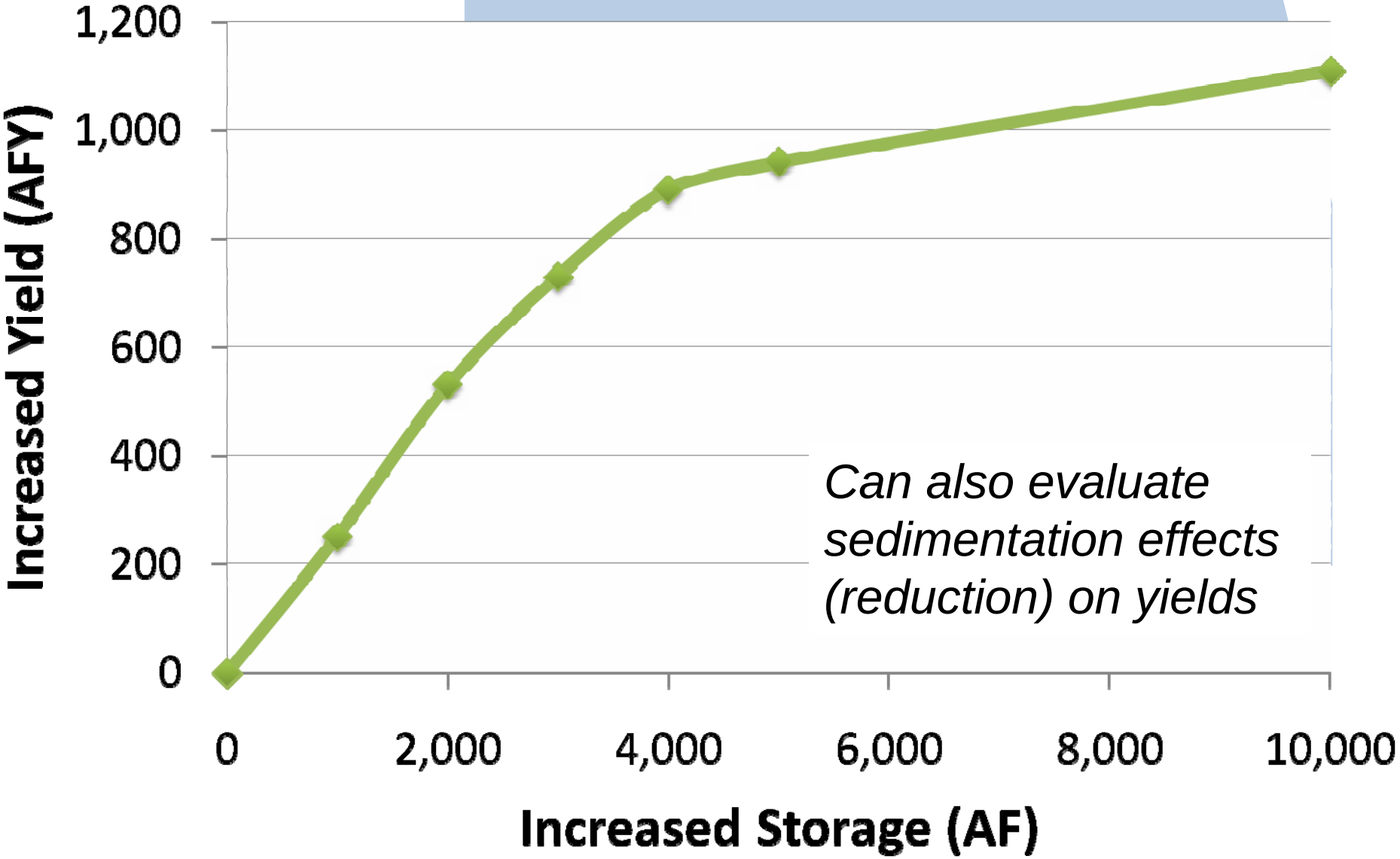


OCWP
Task 2 – Supply and Gap Reservoir Yield Model

Reservoir Yield Model



Effects of Increased Storage on Yield



OCWP

Task 3 – Develop & Evaluate Supply Alternatives

Task 3: Develop & Evaluate Supply Alternatives

Completed through 2009

- Basin Supply Fact Sheets/Watershed Supply Assessment content

Ongoing and 2010

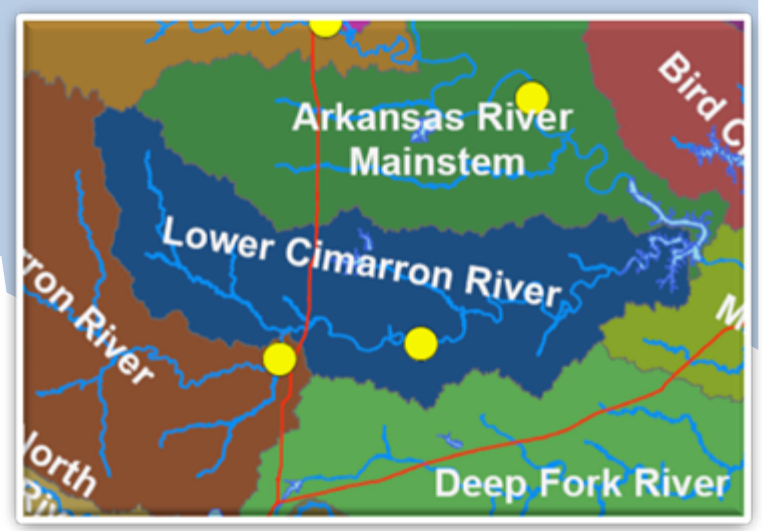
- Basin Supply Fact Sheets for 82 basins
- Watershed Supply Assessments for 13 basins – sources meeting physical availability, legal availability, and water quality
- Watershed Supply Assessment Regional Workshops
- Public Water Supplier Outreach and Supply Information
- Marginal Quality Water & Aquifer Recharge work groups
- Other states' conjunctive management programs; work group
- Tribal water coordination and dialogue
- Reservoir Site inventory and Regional Pipeline Cost update

Potential Post-OCWP (Implementation)

- Implementation of OCWP recommendations

Next Steps: Basin Supply Fact Sheets & Watershed Supply Assessments

- Synthesis of Supply, Demand, and Solutions
  - *Basin water supply resource summary*
  - *Basin water demand summary (by sector and year)*
  - *Major water supply reservoir characteristics*
  - *Existing and planned inter-basin transfers*
  - *Basin-level supply gaps*
  - *Conceptual basin-level supply solutions*



- Public Water Supplier Summary
  - *Listing of suppliers, projected demands, existing sources, infrastructure needs, & key findings from survey*

Built-in Flexibility for What-If Analyses

- Demand and/or supply adjustments
  - *By basin, by sector, by decade*
  - *Or statewide*
- What-if scenarios and sensitivity testing
  - *Surface water / groundwater supply proportions*
  - *Additional surface water storage*
  - *Climate change / climate variability*
  - *Conservation measures*
  - *Variation from demand projections*
  - *Upstream demand variability*
  - *Alternative sources of supply*
  - *Others…*

Legislative Work Group Progress

Marginal Quality Water

- Characterizing quantity and quality
  - *Treated wastewater*
  - *Stormwater runoff*
  - *Brackish water*
  - *Produced water*
  - *Other contaminants*
- Assessing potential "good fits" for MQ supply vs. projected demand / gap

Aquifer Recharge

- Screening sites for demonstration recharge project
- Statewide assessment
- Considering supply and demand
- Recommendations for demonstration phase

Integration into OCWP

OCWP
Task 4 – Public/Policy Interaction

Task 4 – Public/Policy Interaction

Completed through 2009

- Technical expert support to OWRRI Planning Workshops
- Supply and demand handbook for Planning Workshop participants
- Technical evaluation of Planning Workshop strategies

Ongoing and 2010

- Town Hall report
- Town Hall onsite support

Potential Post-OCWP (Implementation)

- Contingent on outcome of Public/Policy process and Town Hall

OCWP
Task 5 – Implementation

Task 5 – Implementation

Completed through 2009

- Pilot-scale mapping of water infrastructure in GIS (Pontotoc County)
- Database migration and modernization

Ongoing and 2010

- Funding/financing needs assessment
- Summarize data gaps
- Water quality management

OCWP

Task 6 & 7 – Documentation & Coordination

Task 6 – Water Plan Documentation

Key Components

- Water Atlas
- Documentation of OCWP components in comprehensive final report

Task 7 – Project Coordination & QA/QC

Key Components

- Technical Review / Peer Review of methods, models, calculations, reports, and deliverables (peer technical staff, OWRB, USACE, BOR, OSU, WRAB, water user stakeholder groups, etc.)
- Biweekly coordination meetings
- Deliverable progress review workshops

Oklahoma Comprehensive Water Plan

OCWP

OCWP Technical Studies Update

Bryan Mitchell – CDM

City of Norman
Town Hall Meeting
January 21, 2010

State of Oklahoma OWRB Water Resources Board the water agency

US Army Corps of Engineers

CDM