Oklahoma’s Reservoirs & Water Supply

Oklahoma State Senate
Interim Study 15-51

Julie Cunningham
November 18, 2015
Meeting Oklahoma’s future water supply challenges...

• Economic development
• Climate variability
• Population growth
• Future water needs
• Competing water interests
• Infrastructure needs and costs
• Vulnerability to drought/flooding
• Instream flow needs
Meeting Oklahoma’s future water supply challenges...

Annual rainfall varies from about 15 inches to as much as 57 inches.
Extreme Drought and Flooding
Experts predict that drought/flood dipole events will only become more frequent.
Oklahoma’s Reservoir Storage

- Storage essential during times of drought and flooding!
- Ok. has 4th highest # of dams in U.S.
- 4,773 lakes (public, private, flood control)
- OK’s major reservoirs have the capacity to store 13 million acre-feet of water
Ground Water Resources

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

**Ogallala Aquifer:**
- state’s largest groundwater 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 feet deep)
2012 Update of the Oklahoma Comprehensive Water Plan

- Submitted to Governor and Legislature in 2012
- Most technically sound, extensively vetted Plan
- 13 Watershed Planning Region Reports and numerous technical studies

Overriding goal to provide safe, reliable water supplies to meet needs of all Oklahomans
Ok. Comprehensive Water Plan

- Conservation, Reuse, Recycling
- Infrastructure Financing
- Monitoring
- Supply Reliability
- Fish & Recreation Flows
- Excess/Surplus
- State/Tribal Resolution
- Regional Planning
Total Water Demands (2060)

Other Demands
762,326 AFY (31%)

M&I (Public Water Supply)
772,773 AFY (32%)

Crop Irrigation
897,464 AFY (37%)

Other Demands:
- Thermoelectric Power - 450,227 AF (18%)
- Self-Supplied Industrial - 54,334 AF (2%)
- Oil & Gas - 115,570 AF (5%)
- Self-Supplied Residential - 41,155 AF (2%)
- Livestock - 101,040 AF (4%)
2060 Demands - Sector/Region

Pie Charts
2060 - Total Demands by Sector (% of Total Region Demands)
- Thermoelectric Power
- Self-Supplied Rural Residential
- Self-Supplied Large Industrial
- Oil and Gas
- Municipal and Industrial
- Livestock
- Crop Irrigation

Map Base
2060 - Total Demands by Region (AFY)
- 55,637 - 100,000
- 100,001 - 250,000
- 250,001 - 350,000
- 350,001 - 473,836
Largest Water Demand Sector Growth (2010-2060)
Water Supply Reliability

Physical Availability

Reliable Supply

Infrastructure

Permit Availability – new Permits

Water Quality
Ensuring water availability for future growth through fair and sustainable water allocation.

- stream water allocation models (9 of 42 complete)
- aquifer yield studies - Statutorily mandated (28 of 58)

• 2012 Gross Production Tax set to sunset in 2016
• Work in progress with target 2022 completion, pending funding
Oklahoma Stream Water Law - A Prior Appropriation Law

- Water inside a natural channel, within cut bed and banks, including ponds and lakes
- Stream water publicly-owned and subject to appropriation by the OWRB
- “Domestic uses” have priority and exempt from permitting
- Seniority by water right date and no priority of use type
- OWRB charged with determining water availability prior to permit issuance and addressing interference conflicts after issuance
Reservoir Permit Availability

Two-part process to gain authorization for water:

1. State water rights application, notice, and APA
   - Water is available in the amount requested?
     - *Average annual runoff* minus domestic uses and existing rights, other purposes (reservoir dependable yield, interstate compacts, etc).
     - Use will not interfere with domestic uses or existing uses within the stream system of origin
     - Present or future need for the water exists
     - Proposed use is beneficial

2. Federal storage allocation contract
Authorized Reservoir Purposes and Water Supply Uses

**Authorized Purposes**
- FC = Flood Control
- N = Navigation
- WS = Water Supply
- WQ = Water Quality
- HP = Hydroelectric Power
- R = Recreation

**Water Supply**
- Municipal & Industrial
- Crop Irrigation/Livestock
- Oil & Gas
- Self-Supplied Industrial
- Thermoelectric Power
- Regulatory Flows

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Water Supply
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Reservoir Storage Divisions

- Flood Control Pool
- Conservation Pool
- Inactive Pool

82% of public water supply systems obtain their water from reservoir storage
Major Water Supply Reservoirs
(Federal, State, Municipal, Private)

- Total Pool Storage: 10,761,604 acre-feet
- Water Supply Yield: 1,792,856 acre-feet
- Water Allocated: 1,306,587 acre-feet
- Remaining Supply: 486,269 acre-feet

Acre-feet of water (1 ac-ft = 325,851 gallons)
Kaw Lake

- U.S. Corps of Engineers
- Uses: FC, WS, HP, WQ, R, FW
- 428,600 ac-ft normal storage
- 187,040 ac-ft water supply yield
- 149,403 ac-ft allocated
- 37,637 ac-ft remaining
2060 Surface Water Permit Availability Assessment
Water Supply Reliability

- Physical Availability
- Reliable Supply
- Permit Availability – new Permits
- Water Quality
- Infrastructure
2060 Water Quality Availability Assessment

Watershed mgmt. decreases water supply treatment, dredging, and capacity expansion costs.

- assessed trends in designated beneficial uses for impaired or threaten waters (e.g. turbidity, nitrogen, phosphorus, turbidity, chlorophyll-a (lakes), PPWS, and Ag uses)
All Supply Limitations

Surface Water

Alluvial Groundwater

Bedrock Groundwater
OCWP Priority Recommendation

Water Infrastructure Financing

• Address Oklahoma’s projected $82+ billion water and wastewater infrastructure need by 2060.

• OWRB’s 5 successful (“AAA”) grant & loan programs can only satisfy 4-9% of this need.

• Specifically address the needs of small-to-medium communities.

• SQ 764 (57%Y-43%N): Water Infrastructure Credit Enhancement Reserve Fund
Future Supply Source Opportunities

Generally more statewide in perspective:

1. Reservoir Viability
2. Conservation- Efficiency and Reuse
3. Marginal Quality Water
4. Artificial Recharge
5. Regionalization
Reservoir Viability-New

- Extensive literature search
- Assigned reservoir viability criteria
- Created site information database and mapped most viable sites
- Identify cost drivers
- Screened envt., cultural, endangered species issues
- Updated costs estimates
- Assessment of viability

68 sites identified with sufficient data for additional analysis or considered viable candidates for development
Estimated Cost of New Reservoirs

- Reservoir Viability Study cited 68 detailed studies for Potential new reservoirs
- Costs $9 million to over $1 billion
- Costs Dependable Yield $500 to $22,000 per AF

Five Lowest Estimated Proposals by Total Cost

<table>
<thead>
<tr>
<th>Reservoir Name</th>
<th>Location</th>
<th>Region</th>
<th>Streams</th>
<th>Beneficial Uses</th>
<th>Conservation Surface Area</th>
<th>Dependable Yield</th>
<th>Conservation Pool Storage</th>
<th>Updated Cost Estimate 2010</th>
<th>Cost per AF Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centerpoint Lake</td>
<td>Pottawatomie</td>
<td>Central</td>
<td>South Deer Creek</td>
<td>WS, F&amp;W, R</td>
<td>340</td>
<td>700</td>
<td>3000</td>
<td>$8,943,000</td>
<td>$12,775.71</td>
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<td>Muncrief Dam</td>
<td>McClain</td>
<td>Central</td>
<td>Walnut Creek</td>
<td>WS, FC, R, F&amp;W</td>
<td>6670</td>
<td>20000</td>
<td>112000</td>
<td>$28,757,000</td>
<td>$1,437.85</td>
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<tr>
<td>Wellston Lake</td>
<td>Lincoln</td>
<td>Central</td>
<td>Captain Creek</td>
<td>WS, FC, F&amp;W, R</td>
<td>1555</td>
<td>7700</td>
<td>25000</td>
<td>$54,023,000</td>
<td>$7,015.97</td>
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<td>Verden Reservoir</td>
<td>Caddo</td>
<td>Lower Washita</td>
<td>Spring Creek</td>
<td>WS, F&amp;W, R</td>
<td>2048</td>
<td>5000</td>
<td>34000</td>
<td>$56,222,000</td>
<td>$11,244.40</td>
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<td>Shidler Lake</td>
<td>Osage</td>
<td>Upper Arkansas</td>
<td>Salt Creek</td>
<td>FC, WS, WQ, R, F&amp;W</td>
<td>2450</td>
<td>16803</td>
<td>54920</td>
<td>$58,264,000</td>
<td>$3,467.48</td>
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Five Lowest Estimated Proposals by Cost per A.F. Yield

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<tr>
<td>Caney Mountain Lake</td>
<td>Pushmataha</td>
<td>Southeast</td>
<td>Little River</td>
<td>WS, F&amp;W, R</td>
<td>10440</td>
<td>280055</td>
<td>384720</td>
<td>$131,312,000</td>
<td>$468.88</td>
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<tr>
<td>Durwood Reservoir</td>
<td>Johnston</td>
<td>Lower Washita</td>
<td>Washita River</td>
<td>P, FC, R, F&amp;W</td>
<td>16000</td>
<td>232000</td>
<td>306000</td>
<td>$166,429,000</td>
<td>$717.37</td>
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<td>Asher Lake</td>
<td>Pontotoc</td>
<td>Central</td>
<td>Canadian River</td>
<td>WS, F&amp;W, R</td>
<td>20280</td>
<td>400000</td>
<td>550000</td>
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<td>Bennington Reservoir</td>
<td>Bryan County</td>
<td>Blue Boggy</td>
<td>Blue River</td>
<td>WS, F&amp;W, R</td>
<td>14280</td>
<td>179000</td>
<td>287420</td>
<td>$180,662,000</td>
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<td>Higgins Reservoir</td>
<td>Latimer</td>
<td>Eufaula</td>
<td>Gaines Creek</td>
<td>WS, R, F&amp;W</td>
<td>7400</td>
<td>68000</td>
<td>190500</td>
<td>$84,651,000</td>
<td>$1,244.87</td>
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Sizable Water Conveyances

Kaw to Enid/NW?
Water for 2060 Act sets statewide goal of consuming no more fresh water in 2060 than we consumed in 2010.

Advisory Council recently sent recommendations to Governor and Legislature.

2012 OCWP Priority Recommendation

Conserve/Reuse/Recycle

- Voluntary programs/policies, financial incentives and education
Bold, Yet Attainable Goal

Demand Projections
Conservation Scenarios I & II

Those analyses indicate that it is indeed possible for increased conservation and use of nontraditional sources to offset growth in demand. Statewide adoption of conservation measures somewhere between Scenario I and Scenario II would offset growth in Public Water Supply and Crop Irrigation water demands from 2010 through 2060.
# Case Studies in Conservation

<table>
<thead>
<tr>
<th>City</th>
<th>Problem</th>
<th>Examples of Approach</th>
<th>Goal/Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuquerque, NM</td>
<td>Dry climate and &gt; population growth</td>
<td>Conservation rates, education, high-efficiency plumbing, landscaping &amp; large-use programs</td>
<td>Decreased peak demand by 14%</td>
</tr>
<tr>
<td>Cary, NC</td>
<td>Dry, hot summers and &gt; population growth</td>
<td>Conservation rates, education, landscape &amp; irrigation codes, toilet flapper rebates, residential audits, other</td>
<td>Reduce retail water production by 4.6 mgd by end of 2028 (16% savings)</td>
</tr>
<tr>
<td>Goleta, CA</td>
<td>Dry climate and &gt; population growth</td>
<td>Plumbing retrofits such as high-efficiency toilets &amp; showerheads &amp; increased rates</td>
<td>Decreased use by 30%; delayed WW treatment plant expansion</td>
</tr>
<tr>
<td>Irvine Ranch Water District, CA</td>
<td>Drought and &gt; population growth</td>
<td>New rate structure</td>
<td>Water use declined by 19% after 1st year</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>Dry summers and &gt; population growth</td>
<td>Seasonal rate structure, plumbing codes, leak reduction</td>
<td>Per-capita consumption dropped by 20%</td>
</tr>
</tbody>
</table>

Source: EPA Cases in Water Conservation 2002
More Conservation Examples

- Automated Meter Reading installation (numerous statewide)
- Potable water reuse (e.g., Norman, OK, Aurora, CO, Wichita Falls, TX, Big Spring, TX, Cloudcroft, NM, San Diego, CA)
- Enforcement of water use restrictions- Inspectors and Penalties (statewide)
- Aggressive public education and outreach (statewide)
- New or existing emergency interconnects with neighboring water providers (numerous statewide and west)
- New wells or water supplies to augment existing supplies, or aggressively pursuing alternate supplies (Mountain Park MCD, OK; Altus)
- New or expanded non-potable water reuse (e.g., Guymon, OK, and numerous other examples across the west)
- Emergency water supply plans (Palo Alto, CA, Central Lake County, IL)
Final Report Submitted!

Education & outreach
Online portal to share best practices
Recognition/reward programs
Financial incentives
Marginal Quality Waters—Types

- Treated wastewater effluent
- Stormwater runoff
- Brackish groundwater or surface water
- Flowback/produced water
- Waters with key parameters over identified M&I thresholds ("Constituents of Concern")
Marginal Quality Waters (SB 1627)

Legislative Workgroup

- Senator Paddack
- USGS
- US EPA
- OWRB
- ODEQ
- Okla. Conservation Commission
- Okla. Corporation Commission
- Okla. Farm Bureau
- Okla. Municipal League
- Okla. Rural Water Assoc.
- Chickasaw Nation
- Public Service of Oklahoma
- OIPA & Producers
- Nature Conservancy
- Lugert-Altus Irrigation District

- Characterize quantity and quality: Defining MQ Water, source quality, source quantity, constraints on use
- Assessed potential “good fits” for MQ supply vs. projected demand / gap
Treated Wastewater for M&I Use (2060)
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
- DWSRF can fund 100% principal forgiveness
OCWP Priority Recommendation

Regional Planning

• “Bottom-up” water planning & implementation of OCWP initiatives at the regional level
• Local stakeholders representing unique interests of each region
• Happening organically now
• Developing short, med., long-term strategies
Planning Assistance

• Shifted OCWP Update resources (GPT $) to regional planning
• Guides, models and tools to support efforts
• OWRB Planning Coordinator focused on regional planning
Moving Forward…

• Ensure infrastructure financing programs remain strong and identify potential funding for dam rehabilitation.
• Complete water availability studies for all basins.
• Develop untapped marginal water sources through innovation and removal of legal barriers.
• Elevate Water for 2060 recommendations for long-term conservation, reuse, recycling.
• Promote long-term water planning at the local and regional level.
www.owrb.ok.gov
Questions?

Julie Cunningham
Chief, Planning and Management Division
Julie.Cunningham@owrb.ok.gov
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK  73118
Ph: 405.530.8800 • Fx: 405.530.8900
www.owrb.ok.gov • @OKWaterBoard
Example
Calculating Surplus Water

**Total SW Permit Availability x 10%**
= **26,200 AFY**

**Estimated 2060 SW Rights x 10%**
= **10,500 AFY**

Total In-Basin Reserve = 26,200 + 10,500 = **36,700 AFY**
(subtracted from 2060 remaining permit availability)

Basin 27 Excess & Surplus Water = **120,000 AFY**

*does not include potential federal/Tribal rights or instream flow requirements*