
**OWRB / USACE TULSA DISTRICT**

**WATER FOR 2060 – PHASE 2**

# TECHNICAL MEMORANDUM NO. 1 SCREENING OF HOT SPOT BASINS FOR DETAILED WATER FOR 2060 ANALYSES

**FINAL**
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100 N.E. 5TH STREET • OKLAHOMA CITY, OKLAHOMA 73104 • P. 405.840.7785

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# SCREENING OF HOT SPOT BASINS FOR DETAILED WATER FOR 2060 ANALYSES

## 1.0 PURPOSE

The Governor of Oklahoma signed the Water for 2060 Act into law in 2012. It set an ambitious statewide goal of consuming no more fresh water in 2060 than was consumed in 2012, while continuing to grow the state's population and economy. Toward this goal, the Oklahoma Water Resources Board (OWRB) is promoting water efficiency in partnership with the U.S. Army Corps of Engineers (USACE) through a series of Water for 2060 activities, with an emphasis on potential means of alleviating the water shortages projected in the 2012 Update of the Oklahoma Comprehensive Water Plan (2012 OCWP). Work conducted by Carollo Engineers under Phase 1 of the Water for 2060 program includes facilitation of the legislatively-directed Water for 2060 Advisory Council work. The Advisory Council is charged with recommending incentives and programs to the Governor and Legislature in 2015, toward greater water use efficiency across Oklahoma. Detailed information is available at www.owrb.ok.gov/2060.

Phase 2 of the Water for 2060 partnership focuses on mitigating the surface water supply gaps or groundwater depletions in the "hot spot" basins, defined in the 2012 OCWP as those basins with the greatest future water supply challenges (Figure 1.1). Phase 2 activities will demonstrate how water conservation, marginal quality water supplies, and public water supply system regionalization strategies can address the needs of hot spot basins on a local implementation level, as examples for water users statewide. One hot basin will be analyzed for conservation, one hot spot basin will be analyzed for marginal quality water use, and one hot spot will be analyzed for regionalization.

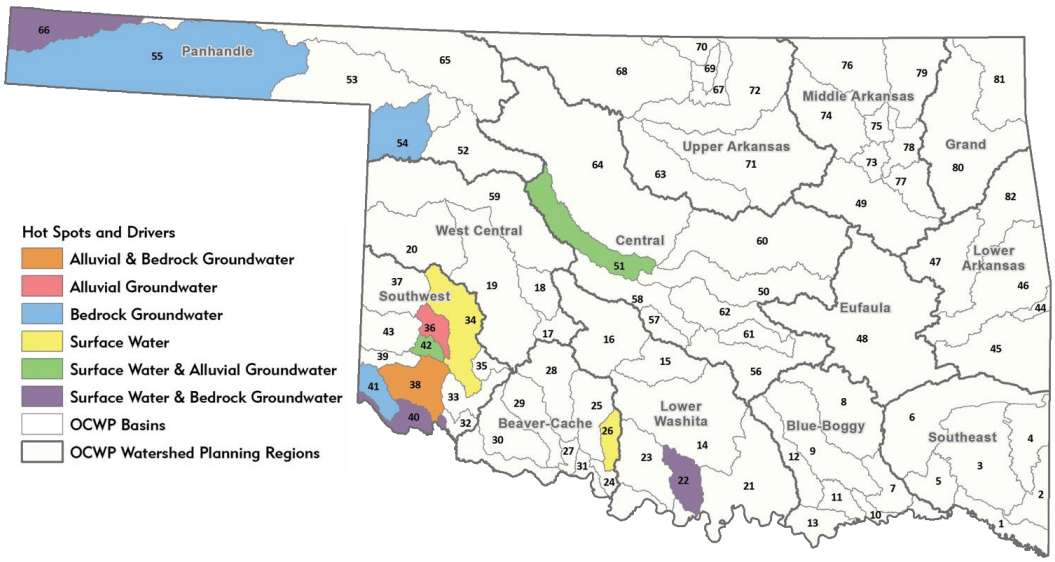


***Figure 1.1 Hot Spot Basins***

This Technical Memorandum describes the methods and recommendations for selecting basins to be analyzed at a detailed local level for each of the three strategies. The Memorandum includes the following sections:

- **Desktop Screening Analysis** – A desktop analysis evaluated the potential effectiveness of and benefits of conservation, marginal quality water use, and regionalization in the hot spot basins, which in turn was used to develop a short-list of potential hot spot basins for detailed analysis.
- **Hot Spot Basin Public Meetings** – A series of four public meetings was held in the hot spot basin areas to share information and obtain feedback on water conservation, marginal quality water, and regionalization strategies.
- **Recommendations** – Three hot spot basins are recommended for detailed analysis based on the results of the desktop analysis and feedback received from the public meetings.

## 2.0 DESKTOP SCREENING ANALYSIS

The potential roles and effectiveness of conservation, marginal quality water use, and regionalization strategies in the hot spot basins were evaluated using the following data from the 2012 OCWP and supplemented with more recent data where available:

- Demand;
- Potential water savings from future conservation activities;
- Availability of surface water and groundwater supplies;
- Projected size and frequency of water shortages;
- Legal availability (permitting) for new supplies;
- Public water supply provider information; and
- Availability of, and ability to beneficially use, marginal quality supplies.

Table 1.1 provides general information regarding water use for each of the 12 hot spot basins. The light blue bars visually indicate the relative demands compared to other basins in the same row. For example, among the 12 hot spot basins, Basin 55 has the largest demands and largest bar, while Basin 26 has the smallest demands and bar. The table also shows that the largest demands in the Southwest and Panhandle Regions' hot spot basins are associated with crop irrigation, while the largest demands in the Lower Washita, Beaver-Cache, and Central Regions' hot spot basins are from the municipal and industrial (M&I, or public water supply) sector. This information provides a background for relative comparison between the hot spot basins.

OWRB and Carollo staff developed criteria to screen the hot spot basins for potential subsequent detailed analyses. The list of criteria used for screening was unique to each of the strategies considered. Appendix 1A details the criteria and detailed screening of the hot spot basins. It includes one table summarizing criteria and results for each of the three strategies (conservation, marginal quality water, and regionalization).

## Table 1.1 Summary of Hot Spot Basin Demands

| DEMAND FACTS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | LW | B-C | SOUTHWEST | | | | | | CENT | PANHANDLE | | |
| Hot Spot Basin | 22 | 26 | 34 | 36 | 38 | 40 | 41 | 42 | 51 | 54 | 55 | 66 |
| 2060 Total Demand (AFY) | 8,746 | 3,331 | 19,014 | 6,600 | 83,563 | 19,186 | 33,064 | 7,062 | 27,740 | 30,400 | 312,929 | 22,483 |
| Growth in Demand (2012 - 2060) (AFY) | 2,675 | 650 | 6,347 | 2,829 | 9,913 | 2,123 | 3,836 | 4,219 | 5,633 | 11,393 | 47,812 | 5,782 |
| Largest Demand Sector | M&I | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation |
| Largest Demand Sector (Percent of Total Basin Demand in 2060) | 41% | 74% | 52% | 92% | 96% | 95% | 97% | 88% | 45% | 88% | 88% | 95% |

## Table 1.2 Hot Spot Basin Water Supply Strategy Summary

| SUMMARY OF RELATIVE PERFORMANCE FOR ALL CRITERIA<br>*Darker colors indicate basins that better meet the criteria* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | LW | B-C | SOUTHWEST | | | | | | CENT | PANHANDLE | | |
| Hot Spot Basin | 22 | 26 | 34 | 36 | 38 | 40 | 41 | 42 | 51 | 54 | 55 | 66 |
| Water Conservation Criteria | | | | | | | | | | | | |
| Marginal Quality Water Criteria | | | | | | | | | | | | |
| Overall MQW source/ demand compatibility | ✗ | ✗ | ! | ! | ! | ! | ! | ! | ! | ✗ | ! | ✗ |
| Regionalization Criteria | | | | | | | | | | | | |
| Geographic proximity of providers | ! | ✓ | ✓ | ! | ✓ | ✗ | ! | ✗ | ✓ | ! | ✗ | ✗ |

Table 1.2 summarizes the results of the detailed desktop screening analyses, showing the overall relative potential effectiveness of conservation, marginal quality water use, and regionalization in each hot spot basin. Dark orange coloration indicates a high potential for the noted strategy to be effective in the indicated basin. Light blue entries indicate a low potential effectiveness based on quantitative metrics, like size and frequency of gap and potential reduction in gaps or depletions. Qualitative metrics were considered to account for concepts like demand compatibility with marginal quality water source and geographic proximity of public water supply systems for regionalization. The qualitative evaluation is summarized using a green check to indicate the highest potential for implementing a water supply strategy; an orange exclamation point for moderate potential; and a red "X" indicating the lowest potential relative to the other basins.

## 2.1 Water Conservation

Basins 26 (Beaver-Cache Region), 38 (Southwest Region), 51 (Central Region), and 55 (Panhandle Region) best met the screening criteria for water conservation, relative to the other hot spot basins. From the 2012 OCWP, these basins generally showed the highest potential for reduction in the frequency or magnitude of shortages through implementation of moderate additional conservation (termed "Scenario I" conservation in the OCWP) strategies for public water suppliers or crop irrigation. Each of these basins self-reported relatively high water loss in public water supply systems, which could potentially be reduced through implementation of certain conservation strategies. Moreover, by 2060, surface water is projected to be fully (or nearly fully) allocated for permits in these basins, further restricting access to local water sources.

## 2.2 Marginal Quality Water

Basins 38 (Southwest Region), 42 (Southwest Region), 51 (Central Region) and 55 (Panhandle Region) best met the screening criteria for marginal quality water supply use, relative to the other hot spot basins. Marginal quality water sources include treated wastewater (also called reclaimed water), stormwater, oil and gas flowback or produced water, brackish water, and waters with elevated levels of key constituents. Basin 38 shows potential for using brackish water while Basins 42 and 55 show potential for using reclaimed water.

Basin 51 shows a high potential for use of marginal quality water to address its future water needs. The 2012 OCWP evaluation of marginal quality water supply did not consider groundwater quality in detail due to a lack of data throughout the state. However, limited groundwater data were available in some hot spot basins, and these data were considered in the current desktop analysis. The Marginal Quality Water Legislative Workgroup (convened as part of the 2012 OCWP development) considered waters with elevated levels of key constituents (like nitrate and total dissolved solids [TDS]) to be marginal quality water supplies because they require advanced treatment in order to meet drinking water standards.

Nitrate and TDS data in major aquifers have been compiled by the Oklahoma Department of Environmental Quality from source sampling of public water supply providers[1] and are also documented in the recently-published USGS 2013 study titled, “Hydrogeology, Distribution, and Volume of Saline Groundwater in the Southern Midcontinent and Adjacent Areas of the United States.” Nitrate levels in some areas of the North Canadian River alluvium aquifer in Basin 51 are above the 10 mg/L drinking water standard and are therefore considered to a potential source of marginal quality water. Basin 51 was considered to have potential for overall MQW source/demand compatibility. Review of groundwater quality data in other basins did not result in changes to their ratings.

## 2.3 Regionalization

Basins 26 (Beaver-Cache Region), 34 (Southwest Region), 38 (Southwest Region), and 51 (Central Region) best met the criteria for regionalization of water supplies relative to the other hot spot basins, based on the desktop screening analysis. Public water supply systems in these basins and adjoining basins are in relatively close proximity to each other, which may help control costs associated with interconnecting the systems to improve reliability.

## 2.4 Desktop Screening Results

Figure 1.2 illustrates the basins shortlisted for potential detailed analysis of each water supply strategy. The desktop analysis was limited by the basin-wide scale of the information available in the 2012 OCWP. Accordingly, there may be localized opportunities for use of each of these strategies that are not reflected in these results.

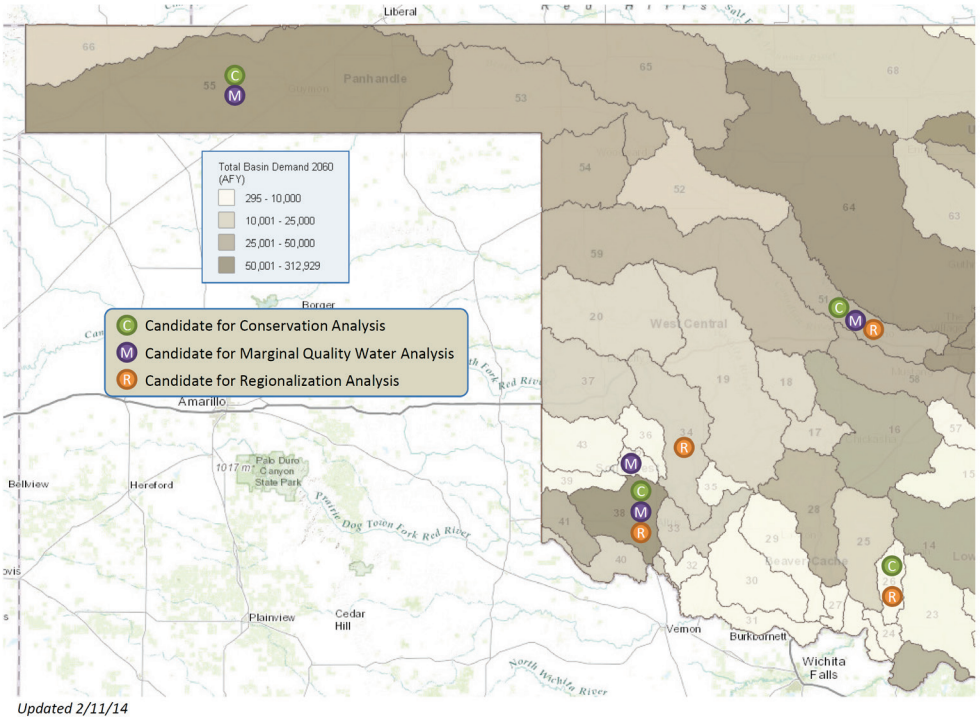


***Figure 1.2 Candidate Hot Spot Basins for Detailed Analysis***

[1] Available at http://www.deq.state.ok.us/wqdnew/groundwater/aquifer_maps.html

## 3.0 HOT SPOT BASIN PUBLIC MEETINGS

OWRB conducted a series of hot spot basin public meetings to share information and solicit local interest in participating in the detailed analysis of conservation, marginal quality water, and regionalization water supply strategies. Four public meetings were held to provide an opportunity for local participation in or near each of the 12 hot spot basins:

- March 11, 2014 in Goodwell (Panhandle Region);
- March 12, 2014 in Quartz Mountain (Southwest Region);
- March 13, 2014 in Duncan (Beaver-Cache and Lower-Washita Regions); and
- April 16, 2014 in Yukon (Central Region).

OWRB sent letters to local water supply providers and other stakeholders, posted meeting information on its website, and issued press releases to advertise the meetings and encourage local participation in the meetings and engagement in the process.[2]

Each meeting began with a presentation providing a framework for the water supply discussion. The presentation discussed the background of the Water for 2060 Act, provided state, regional, and basin-level information from the 2012 OCWP and desktop analyses, and described the planned Water for 2060 work to evaluate the conservation, marginal quality water, and regionalization supply strategies. The region and basin-level data were specific to the location of the meeting, providing attendees with the information most relevant to them. Following the technical presentation at each meeting, OWRB staff led a public discussion period.

Appendix 1B contains a summary of public comments collected during the hot spot basin meetings and a copy of the presentation used in the meetings. Public comments common to many of the meetings include incentivizing water efficiency, expanding use of marginal quality water supplies (including brackish groundwater and treated wastewater), additional research (such as better brine disposal, irrigation technologies, and groundwater quality and quantity), and use of a combination of water supply strategies

## 4.0 RECOMMENDATIONS

Using the desktop screening analysis and input gathered in the hot spot basin public meetings, the project team evaluated where to conduct the more detailed analysis for each of the water supply strategies. The recommendations are based on the applicability and anticipated effectiveness of the water supply strategy for reducing the projected water supply shortages in the basin, the availability of data necessary to conduct a more detailed analysis, the willingness of local water providers and users to actively participate in the study, and the anticipated applicability of the results from the analysis to water providers and users across the state. The recommendations are:

[2] Press release posted at http://www.owrb.ok.gov/news/news2/pressrelease2014.php#022414

- **Water Conservation in Basin 26 (Beaver-Cache Region)** – Water supply issues have become increasingly evident in Basin 26 with the ongoing extended drought. Water users and the public have responded well by implementing drought management measures including water use restrictions. However, there is also an ongoing role for increased water conservation to reduce pressure on local supplies, even in normal precipitation years. In fact, reducing demands each year can help preserve the ability of reservoir storage and other supplies to provide adequate supplies through times of drought.

  In addition to scoring well against the desktop screening criteria, feedback from the public meeting in Duncan also showed significant support for analyzing conservation potential in the area. In particular, officials from the City of Duncan expressed interest in participating and a willingness to share data with the project team, both of which are necessary for a successful analysis. The proposed demonstration will primarily focus on municipal and industrial (M&I) conservation, since that is the predominant demand sector in the basin. The analysis is expected to include other public water suppliers (e.g., Comanche, Stephens County Rural Water District #3), and its results will serve as examples of the potential role of conservation for others in the region and state.

- **Marginal Quality Water use in Basin 51 (Central Region)** – Water supply options are very limited in Basin 51. For example, surface water permits are already fully allocated in the basin, leaving groundwater as the only remaining locally available fresh water supply. However, water quality in the aquifers underlying the basins is known to have significant issues. Communities in the southern (downstream) portion of Basin 51 are evaluating use of brackish groundwater for potable use through efforts underway by the Central Oklahoma Water Resources Authority (COWRA). Advanced treatment will be required to reduce total dissolved solids (TDS) to acceptable levels for drinking water. In other parts of the basin, aquifer data and users' experience indicates widespread nitrate levels near or above drinking water standards (e.g., in portions of the North Canadian alluvial aquifer). Water reuse opportunities may exist in the basin's communities through available effluent from water reclamation facilities and increasing water demands.

  The analysis in Basin 51 initially will screen all sources of marginal quality water (treated wastewater, stormwater, oil and gas flowback and produced water, brackish water, and waters with elevated levels of key constituents) to determine which have a high potential to offset fresh water use. A detailed analysis of those marginal quality water supplies with the highest potential will be performed. It is anticipated that the detailed analysis will focus on water reuse and brackish groundwater supplies, with recognition of the efforts already underway in the basin. The results of the local demonstration study will be applicable to many other areas the state, as there are several areas that may be able to effectively implement water reuse and many areas that also are constrained in their ability to use groundwater due to water quality of locally-available groundwater supplies.

- **Regionalization in Basin 38 (Southwest Region)** – Reliably meeting water needs is challenging, particularly under extended drought conditions. Emergency outages and other supply constraints can also affect deliveries to customers. Having access to a diverse set of groundwater and surface water supplies can help increase overall system reliability, and providing interconnections between systems is one way of realizing that goal. The City of Altus, nearby rural water districts (including those with service areas extending beyond the boundaries of Basin 38), and others already have the ability to share water supplies through system interconnections on an emergency and/or ongoing basis. However, determining how to expand these interconnections and strategically adding new interconnections will improve water supply robustness.

  The demonstration study will focus on providing reliability to water providers through the use of multiple supply sources, and may examine opportunities to add new groundwater supplies to interconnected systems to bolster the area's predominant use of surface water supplies. New groundwater supplies and interconnected systems may offer opportunities and reliability benefits associated with a centralized treatment facility serving multiple providers. Opportunities may also be identified for centralizing other existing or new supply sources that could be delivered through interconnected systems. Local participants have expressed a willingness to share distribution system mapping and groundwater well production data, which will be necessary to a successful regionalization analysis.

The recommendations cover three of the four general areas of the state with identified hot spots. The fourth area, the Panhandle Region, through its own work has already implemented significant water conservation (both in terms of public water supply and crop irrigation water use) and is studying water reuse opportunities. The Oklahoma Panhandle Agriculture and Irrigation (OPAI) and the Panhandle Regional Economic Development Coalition, Inc. (PREDCI) developed the Panhandle Regional Water Plan (PRWP) in December 2012. The PRWP provides region-specific actions that support the 2012 OCWP priority recommendation including water conservation, efficiency, and reuse. The City of Guymon currently is pursuing opportunities to reuse its treated wastewater effluent. The region's demonstration of commitment to water efficiency puts it ahead of the detailed analyses that will be conducted as part of this project, and can serve as a model for other basins much as the Hot Spot analyses will provide.

# APPENDIX 1A – DETAILED SCREENING ANALYSES

Table A1: Conservation Criteria for Prioritizing Basins for Further Analysis
Water for 2060: Water Conservation, Efficiency, Recycling & Reuse, Regionalization
Oklahoma Water Resources Board / US Army Corps of Engineers

Updated 5/16/14

| | | Hot Spot Basin & Region | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metric | Basis for Using Metric | 22 | 26 | 34 | 36 | 38 | 40 | 41 | 42 | 51 | 54 | 55 | 66 |
| | | LW | B-C | SOUTHWEST | | | | | | CENT | PANHANDLE | | |
| REFERENCE DATA | | | | | | | | | | | | | |
| 2060 Total Demand (AFY) | Higher demand basins may have higher potential for savings | 8,746 | 3,331 | 19,014 | 6,600 | 83,563 | 19,186 | 33,064 | 7,062 | 27,740 | 30,400 | 312,929 | 22,483 |
| Growth in Demand (2012 - 2060) (AFY) | Higher growth basins may have higher potential for shortages and savings | 2,675 | 650 | 6,347 | 2,829 | 9,913 | 2,123 | 3,836 | 4,219 | 5,633 | 11,393 | 47,812 | 5,782 |
| Largest Demand Sector | | M&I | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation |
| Largest Demand Sector (Percent of Total Basin Demand in 2060) | May indicate sector with biggest opportunity for saving water | 41% | 74% | 52% | 92% | 96% | 95% | 97% | 88% | 45% | 88% | 88% | 95% |
| Decrease in SW permit availability 2012-2060 | Indicator of growth in shortages and limited options for supply | 20% | 20% | Fully Allocated | Fully Allocated | 8% | Fully Allocated | Fully Allocated | 9% | Fully Allocated | Fully Allocated | Fully Allocated | Fully Allocated |
| Percent of providers in basin with 2013 water use restrictions | Need for conservation | 0% | 25% | 0% | 0% | 13% | 0% | 0% | 0% | 27% | 0% | 9% | 0% |
| Year SW + AGW Gaps Start | Provides timeframe for implementation | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| Year BGW Depletions Start | Provides timeframe for implementation | 2020 | 2020 | NA | NA | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| CRITERIA | | | | | | | | | | | | | |
| Reduction in Gap Magnitude with PWS Scenario 1 Conservation (AFY) | Suggests opportunity for achievable (Scen. I) conservation successes | 450 | 120 | 490 | 30 | 130 | 70 | 110 | 50 | 2,950 | 60 | 1,410 | 0 |
| Reduction in Gap Magnitude with PWS Scenario 1 Conservation (% of Gap) | Suggests opportunity for achievable (Scen. I) conservation successes | 24% | 30% | 16% | 1% | 2% | 4% | 3% | 1% | 66% | 1% | 3% | 0% |
| Reduction in Gap Frequency of SW and AGW Shortages with PWS Scenario 1 Conservation (AFY) | Suggests opportunity for achievable (Scen. I) conservation successes | 0% | 88% | 0% | 0% | 2% | 0% | 5% | 0% | 0% | 0% | 1% | 0% |
| Reduction in Gap Magnitude with Crop Irr. Scenario 1 Conservation (AFY) | Suggests opportunity for achievable (Scen. I) conservation successes | 130 | 30 | 650 | 360 | 7,740 | 1,740 | 3,270 | 300 | 420 | 1,400 | 14,320 | 1,130 |
| Reduction in Gap Magnitude with Crop Irr. Scenario 1 Conservation (% of Gap) | Suggests opportunity for achievable (Scen. I) conservation successes | 7% | 8% | 22% | 14% | 100% | 90% | 98% | 9% | 9% | 14% | 30% | 20% |
| Reduction in Frequency of SW and AGW Shortages with Crop Irr. Scenario 1 Conservation (AFY) | Suggests opportunity for achievable (Scen. I) conservation successes | 0% | 0% | 5% | 0% | 53% | 12% | 13% | 0% | 0% | 4% | 3% | 0% |
| Growth 2012-2060 in SW + AGW Shortage Magnitude (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | -430 | 90 | 2,730 | 2,060 | 4,810 | 900 | 750 | 2,490 | 3,300 | 480 | 610 | 360 |
| Growth 2012-2060 in SW + AGW Gap Frequency (%) | Potential change in ability to handle shortages – small existing shortage may be ok | 0% | 28% | 15% | 1% | 37% | 19% | 18% | 31% | 5% | 62% | 45% | 6% |
| Growth 2012-2060 in BGW Depletion (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | 660 | 230 | 0 | 0 | 1,800 | 700 | 1,910 | 360 | -490 | 7,550 | 39,580 | 4,180 |
| Percent of SW permitted in 2060 | Indicator of existing shortages and limited options for supply | 80% | 80% | 100% | 100% | 92% | 100% | 100% | 91% | 100% | 100% | 100% | 100% |
| Water loss reported in 2008 OCWP survey for five largest PWS (percent) | Large water-loss basins may have more opportunities to improve. | 30 | 27 | 9 | 3 | 22 | 17 | 3 | 4 | 22 | 18 | 16 | NA |

Table A2: Marginal Quality Water Criteria for Prioritizing Basins for Further Analysis
Water for 2060: Water Conservation, Efficiency, Recycling & Reuse, Regionalization
Oklahoma Water Resources Board / US Army Corps of Engineers

Updated 5/16/14

| | | Hot Spot Basin & Region | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metric | Basis for Using Metric | 22 | 26 | 34 | 36 | 38 | 40 | 41 | 42 | 51 | 54 | 55 | 66 |
| | | **LW** | **B-C** | **SOUTHWEST** | | | | | | **CENT** | **PANHANDLE** | | |
| REFERENCE DATA | | | | | | | | | | | | | |
| 2060 Total Demand (AFY) | Higher demand basins may have higher potential for savings | 8,746 | 3,331 | 19,014 | 6,600 | 83,563 | 19,186 | 33,064 | 7,062 | 27,740 | 30,400 | 312,929 | 22,483 |
| Growth in Demand (2012 - 2060) (AFY) | Higher growth basins may have higher potential for shortages and savings | 2,675 | 650 | 6,347 | 2,829 | 9,913 | 2,123 | 3,836 | 4,219 | 5,633 | 11,393 | 47,812 | 5,782 |
| Largest Demand Sector | | M&I | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation |
| Largest Demand Sector (Percent of Total Basin Demand in 2060) | May indicate sector with biggest opportunity for saving water | 41% | 74% | 52% | 92% | 96% | 95% | 97% | 88% | 45% | 88% | 88% | 95% |
| Decrease in SW permit availability 2012-2060 | Indicator of growth in shortages and limited options for supply | 20% | 20% | Fully Allocated | Fully Allocated | 8% | Fully Allocated | Fully Allocated | 9% | Fully Allocated | Fully Allocated | Fully Allocated | Fully Allocated |
| Percent of providers in basin with 2013 water use restrictions | Need for conservation | 0% | 25% | 0% | 0% | 13% | 0% | 0% | 0% | 27% | 0% | 9% | 0% |
| Year SW + AGW Gaps Start | Provides timeframe for implementation | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| Year BGW Depletions Start | Provides timeframe for implementation | 2020 | 2020 | NA | NA | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| CRITERIA | | | | | | | | | | | | | |
| Magnitude of 2060 SW + AGW Gap (AFY) | Large gap directly indicates need for demand mgt. or alternate supply | 950 | 110 | 2,970 | 2,560 | 5,480 | 1,060 | 910 | 2,920 | 4,390 | 540 | 700 | 420 |
| Magnitude of 2060 SW + AGW Gap (Percent of Total Demand) (%) | Large gap directly indicates need for demand mgt. or alternate supply | 24% | 4% | 22% | 39% | 9% | 11% | 10% | 46% | 17% | 32% | 17% | 21% |
| Growth 2012-2060 in SW + AGW Shortage Magnitude (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | -430 | 90 | 2,730 | 2,060 | 4,810 | 900 | 750 | 2,490 | 3,300 | 480 | 610 | 360 |
| Frequency of 2060 SW + AGW Gaps (%) | Frequent gap directly indicates need for demand mgt. or alternate supply | 98% | 88% | 64% | 100% | 53% | 97% | 94% | 78% | 81% | 73% | 94% | 98% |
| Growth 2012-2060 in SW + AGW Gap Frequency (%) | Potential change in ability to handle shortages – small existing shortage may be ok | 0% | 28% | 15% | 1% | 37% | 19% | 18% | 31% | 5% | 62% | 45% | 6% |
| Magnitude of 2060 BGW Depletion (AFY) | Large gap directly indicates need for demand mgt. or alternate supply | 920 | 290 | 0 | 0 | 2,260 | 870 | 2,420 | 440 | 110 | 9,260 | 47,090 | 5,230 |
| Magnitude of 2060 BGW Depletion (Percent of Total Demand) (%) | Large gap directly indicates need for demand mgt. or alternate supply | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Growth 2012-2060 in BGW Depletion (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | 660 | 230 | 0 | 0 | 1,800 | 700 | 1,910 | 360 | -490 | 7,550 | 39,580 | 4,180 |
| Percent of SW permitted in 2060 | Indicator of existing shortages and limited options for supply | 80% | 80% | 100% | 100% | 92% | 100% | 100% | 91% | 100% | 100% | 100% | 100% |
| MARGINAL QUALITY WATER SUPPLY/DEMAND COMPATIBILITY | | | | | | | | | | | | | |
| Treated Wastewater for Potable and Nonpotable Uses | MQW supply is not useful without a viable use in the basin | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ | ✓ | ! | ✗ | ! | ✗ |
| Stormwater | MQW supply is not useful without a viable use in the basin | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Oil and Gas Flowback / Produced Water | MQW supply is not useful without a viable use in the basin | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Brackish Water | MQW supply is not useful without a viable use in the basin | ✗ | ✗ | ! | ✗ | ! | ! | ! | ✗ | ! | ✗ | ✗ | ✗ |
| Waters with Elevated Levels of Key Constituents | MQW supply is not useful without a viable use in the basin | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ! | ✗ | ✗ | ✗ |

Table A3: Regionalization Criteria for Prioritizing Basins for Further Analysis
Water for 2060: Water Conservation, Efficiency, Recycling & Reuse, Regionalization
Oklahoma Water Resources Board / US Army Corps of Engineers

Updated 5/16/14

| | | Hot Spot Basin & Region | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metric | Basis for Using Metric | 22 | 26 | 34 | 36 | 38 | 40 | 41 | 42 | 51 | 54 | 55 | 66 |
| | | LW | B-C | SOUTHWEST | | | | | | CENT | PANHANDLE | | |
| REFERENCE DATA | | | | | | | | | | | | | |
| 2060 Total Demand (AFY) | Higher demand basins may have higher potential for savings | 8,746 | 3,331 | 19,014 | 6,600 | 83,563 | 19,186 | 33,064 | 7,062 | 27,740 | 30,400 | 312,929 | 22,483 |
| Growth in Demand (2012 - 2060) (AFY) | Higher growth basins may have higher potential for shortages and savings | 2,675 | 650 | 6,347 | 2,829 | 9,913 | 2,123 | 3,836 | 4,219 | 5,633 | 11,393 | 47,812 | 5,782 |
| Largest Demand Sector | | M&I | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | Crop Irrigation | M&I | Crop Irrigation | Crop Irrigation | Crop Irrigation |
| Largest Demand Sector (Percent of Total Basin Demand in 2060) | May indicate sector with biggest opportunity for saving water | 41% | 74% | 52% | 92% | 96% | 95% | 97% | 88% | 45% | 88% | 88% | 95% |
| Decrease in SW permit availability 2012-2060 | Indicator of growth in shortages and limited options for supply | 20% | 20% | Fully Allocated | Fully Allocated | 8% | Fully Allocated | Fully Allocated | 9% | Fully Allocated | Fully Allocated | Fully Allocated | Fully Allocated |
| Percent of providers in basin with 2013 water use restrictions | Need for conservation | 0% | 25% | 0% | 0% | 13% | 0% | 0% | 0% | 27% | 0% | 9% | 0% |
| Year SW + AGW Gaps Start | Provides timeframe for implementation | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| Year BGW Depletions Start | Provides timeframe for implementation | 2020 | 2020 | NA | NA | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 |
| CRITERIA | | | | | | | | | | | | | |
| Magnitude of 2060 SW + AGW Gap (AFY) | Large gap directly indicates need for demand mgt. or alternate supply | 950 | 110 | 2,970 | 2,560 | 5,480 | 1,060 | 910 | 2,920 | 4,390 | 540 | 700 | 420 |
| Magnitude of 2060 SW + AGW Gap (Percent of Total Demand) (%) | Large gap directly indicates need for demand mgt. or alternate supply | 24% | 4% | 22% | 39% | 9% | 11% | 10% | 46% | 17% | 32% | 17% | 21% |
| Growth 2012-2060 in SW + AGW Shortage Magnitude (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | -430 | 90 | 2,730 | 2,060 | 4,810 | 900 | 750 | 2,490 | 3,300 | 480 | 610 | 360 |
| Frequency of 2060 SW + AGW Gaps (%) | Frequent gap directly indicates need for demand mgt. or alternate supply | 98% | 88% | 64% | 100% | 53% | 97% | 94% | 78% | 81% | 73% | 94% | 98% |
| Growth 2012-2060 in SW + AGW Gap Frequency (%) | Potential change in ability to handle shortages – small existing shortage may be ok | 0% | 28% | 15% | 1% | 37% | 19% | 18% | 31% | 5% | 62% | 45% | 6% |
| Magnitude of 2060 BGW Depletion (AFY) | Large gap directly indicates need for demand mgt. or alternate supply | 920 | 290 | 0 | 0 | 2,260 | 870 | 2,420 | 440 | 110 | 9,260 | 47,090 | 5,230 |
| Magnitude of 2060 BGW Depletion (Percent of Total Demand) (%) | Large gap directly indicates need for demand mgt. or alternate supply | 19% | 35% | 0% | 0% | 11% | 9% | 10% | 59% | 5% | 32% | 15% | 25% |
| Growth 2012-2060 in BGW Depletion (AFY) | Potential change in ability to handle shortages – small existing shortage may be ok | 660 | 230 | 0 | 0 | 1,800 | 700 | 1,910 | 360 | -490 | 7,550 | 39,580 | 4,180 |
| Percent of SW permitted in 2060 | Indicator of existing shortages and limited options for supply | 80% | 80% | 100% | 100% | 92% | 100% | 100% | 91% | 100% | 100% | 100% | 100% |
| GEOGRAPHIC PROXIMITY | | | | | | | | | | | | | |
| Proximity of PWS Systems to one another (ref: PWS maps in Regional Reports) | Close proximity reduce costs to make imterconnections. | ! | ✓ | ✓ | ! | ✓ | ✗ | ! | ✗ | ✓ | ! | ✗ | ✗ |

# APPENDIX 1B – PUBLIC MEETING SUMMARIES AND PRESENTATION

# INPUT FROM OWRB WATER FOR 2060

# HOT SPOT BASIN MEETINGS

The Oklahoma Water Resources Board, working in partnership with the US Army Corps of Engineers under their Planning Assistance to States program, held a series of public meetings to share information and obtain feedback on water conservation strategies that could mitigate projected water shortages in Oklahoma's most compromised areas. Agriculture producers, water providers, and interested citizens residing in and around twelve "Hot Spot" planning basins—those determined to have the most significant water supply challenges within the next 50 years—were offered an opportunity to shape actions that could collectively satisfy future water demands and thus avoid substantial water shortages projected in those areas.

Presentation materials discussed at the meetings are posted to the OWRB Water for 2060 webpage at http://www.owrb.ok.gov/2060. Information presented below summarizes the feedback received at each meeting, but is not indicative of meeting attendees' consensus, nor does it represent any form of endorsement by OWRB or its partner agencies.

**PANHANDLE WATERSHED PLANNING REGION:**
**OKLAHOMA PANHANDLE STATE UNIVERSITY – Goodwell, March 11, 2014**

- Additional incentives for water reuse
- Additional Oklahoma State University (OSU) research for efficient crop irrigation technologies and practices
- Consider potential implications from Arbuckle-Simpson legislation and potential future maximum annual yield implications for groundwater in the Panhandle
- Identify financial resources for public water supply system regionalization
- Salt Cedar eradication
- Additional research and development for drought-tolerant crops
- Water credits (like California's energy conservation incentives program) to allow efficient use credits to be bought/sold
- Consider modifying "use it or lose it" water rights rules; this serves as a disincentive to conservation
- Revise crop insurance rules to not require irrigating a crop that is certain not to produce
- Investigate reservoir feasibility – Forgan/Englewood sites
- Recycled water for industrial uses (e.g. biodiesel) and municipal uses/fire suppression
- Brackish groundwater – consider use for salt tolerant crops/livestock

**SOUTHWEST WATERSHED PLANNING REGION:**
**QUARTZ MOUNTAIN LODGE – Lone Wolf, March 12, 2014**

- Monitor/meter crop irrigation – same rules should apply for all users to protect/preserve supplies
- Find uses for brackish groundwater – significant supplies but very high hardness/TDS

- Dual-piped system to deliver recycled water to irrigation or other non-potable uses (especially in newer developments)
- Look at desalination technologies and ability to recover resources
- Maintain/repair infrastructure to reduce losses – leak detection
- Augment potable supplies with recycled water
- Complete aquifer studies in unstudied aquifers as a conservation tool (scheduled to be completed by OWRB by 2022)
- Better data on groundwater depth/amount in storage
- Interconnect systems between basins to diversify supplies; use excess in full reservoirs to supply lakes with low levels
- On-demand/circulating hot water systems in homes
- Capture stormwater runoff in cisterns
- Conservation pricing for public water supply customers
- New reservoir on North Fork of Red River
- Use a combination of approaches – e.g., reservoirs and conservation
- Extend canals to better capture runoff in existing reservoirs
- Trade Southeast Oklahoma water to Texas in return for water from Texas Panhandle to Oklahoma
- Regulatory solutions and technology to dispose brine from advanced treatment – recent DEQ/Corporation Commission agreement allows for combined use of oil and gas deep injection wells for water treatment residual disposal
- Dredge lakes in drought when levels are low
- School educational programs
- Lay water pipes in same trench as oil/gas pipelines to reduce costs
- Need regulations/enforcement to make sure leaks are fixed
- Incentives to remove irrigated turf and increase wastewater reuse
- Fund rehabilitation of Blaine Gypsum recharge wells
- Cloud seeding

**BEAVER-CACHE AND LOWER WASHITA WATERSHED PLANNING REGIONS:**
**SIMMONS CENTER – Duncan, March 13, 2014**

- Capture floodwater
- Protect groundwater from oil/gas activity
- Rainwater capture at households
- Find a way to capture more floodwater in Waurika
- Reallocate flood control pool in federal reservoirs
- Divert Cache Creek to Waurika Lake
- State financial incentives for residential efficiency (similar to trash systems)
- Less water use for swimming pools
- Make sure you plan time and dollars for permitting – identify opportunities to streamline regulatory processes and timelines
- Use multi-pronged approach – no silver bullets

- Incentives to plant more trees to increase humidity/supply
- Eradicate invasive species – e.g., red/salt cedar – and incentives to prevent planting/spreading
- Support wind power – does not use water to generate power
- Newer technology allows for cost-effective treatment of brackish groundwater and disposal of brine
- Use treated wastewater to augment potable supplies
- Find largest users and conduct water use audits
- Prevent runoff from excess irrigation
- More local Mesonet stations
- Challenge with regionalization is that existing water lines are not sized for higher flow; also need more inter-local agreements
- Use a standby fee for emergency interconnects between public water supply systems

**CENTRAL WATERSHED PLANNING REGION:**
**DALE ROBERTSON CENTER – Yukon, April 16, 2014**

- Integrated management of limited supplies for multiple users and uses
- Additional education and outreach on impacts of one user's diversion on other users, considering rate of replenishment
- Significant challenges in trans-basin supply projects, but also many challenges in using local brackish groundwater
- Unfunded federal mandates on water quality are challenging
- Infrastructure improvements to reduce channel losses and address sedimentation in reservoirs
- Limit allocations/permits to match available supply
- Need strategies for gaining public support and acceptance of water reuse
- Public awareness programs to gain understanding of level of wastewater treatment and high water quality
- El Reno is looking for reuse opportunities now that the treatment process has been upgraded to a sequencing batch reactor
- Multi-agency partnerships for outreach and efficiency programs
- Need solutions for disposal or reuse of brine from advanced treatment facilities
- Financial incentives – build on existing financing programs
- Basin 51 is doing (and is capable of doing and funding) projects on efficiency and marginal quality water and regionalization – significant interest in supporting Water for 2060 work. Basin 51 is a key transition area between limited northwest OK supplies and metro area demands, with limited replenishment of local sources.
- Use Water for 2060 to head off local shortages
- Yukon is promoting rain barrels and other programs; methods for outreach are available (Channel 20, website, etc.)

# Water for 2060

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## Hot Spot Basin Public Meeting

Goodwell, Oklahoma
March 11, 2014

Quartz Mountain, Oklahoma
March 12, 2014

Duncan, Oklahoma
March 13, 2014

Yukon, Oklahoma
April 16, 2014

State of Oklahoma
OWRB
WATER RESOURCES BOARD
the water agency

## Agenda

- Welcome
- Presentation
  - Hot Spot Basins
  - Overview of Hot Spot Basins in this Area
  - Current and upcoming Water for 2060 activities
  - How can water providers, agricultural producers, and water users monitor and participate?
- Discussion and Input

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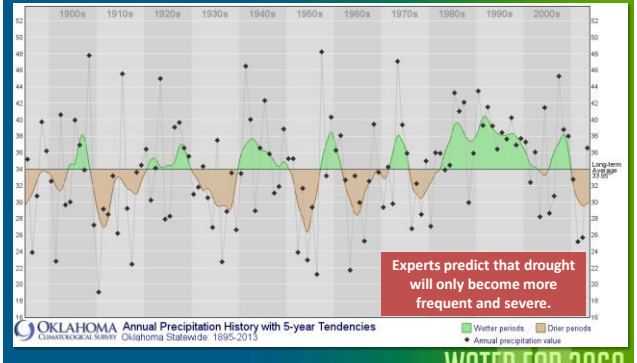
## Oklahoma's Precipitation History (1895-2013)

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## Key Findings from the Oklahoma Comprehensive Water Plan

OCWP
Oklahoma Comprehensive Water Plan

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## Goals of the 2012 Update of the Oklahoma Comprehensive Water Plan

1. Characterize **demands** by water use sector.
2. Identify **reliable supplies** to meet forecasted demands.
3. Perform **technical studies** to evaluate emerging water management issues.
4. Comprehensive **stakeholder engagement** to develop appropriate water policy recommendations.
5. Ensure water resources management programs that **create reliability**.
6. Make **"implementable" recommendations** based upon technical evaluations and stakeholder input.

OCWP
Oklahoma Comprehensive Water Plan

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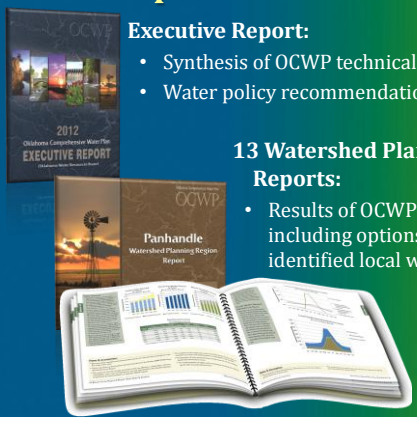
## Most Comprehensive Plan Ever




**Executive Report:**

- Synthesis of OCWP technical studies and results
- Water policy recommendations

**13 Watershed Planning Region Reports:**

- Results of OCWP technical analyses, including options to address identified local water shortages

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## 13 Watershed Planning Regions


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## 82 Basins for Detailed Analysis

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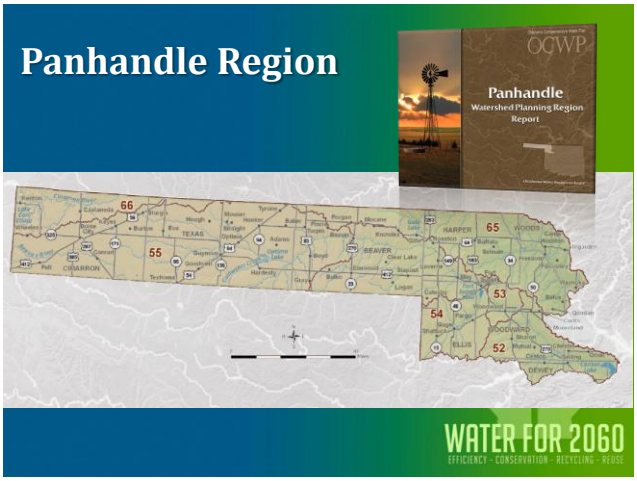
Panhandle Region
OGWP
Panhandle
Watershed Planning Region
Report
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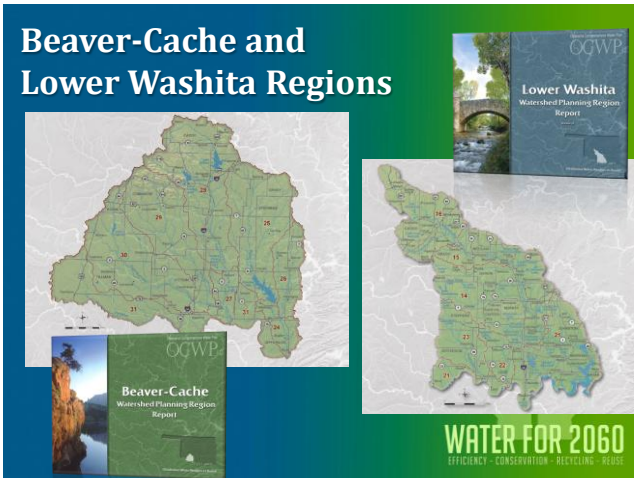
Southwest Region
OGWP
Southwest
Watershed Planning Region
Report
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE


Beaver-Cache and
Lower Washita Regions
OGWP
Lower Washita
Watershed Planning Region
Report
OGWP
Beaver-Cache
Watershed Planning Region
Report
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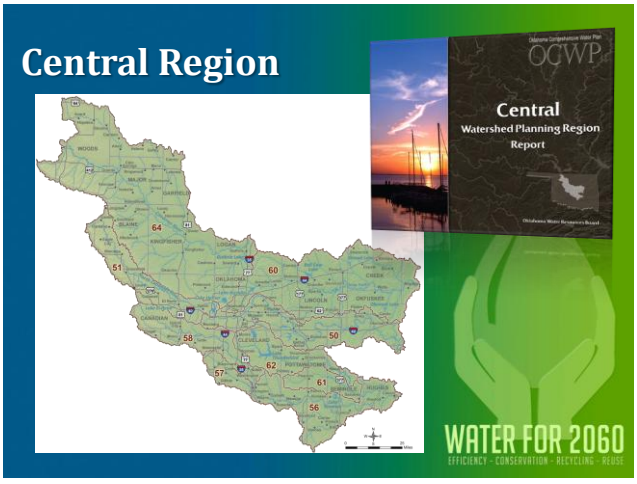
Central Region
OGWP
Central
Watershed Planning Region
Report
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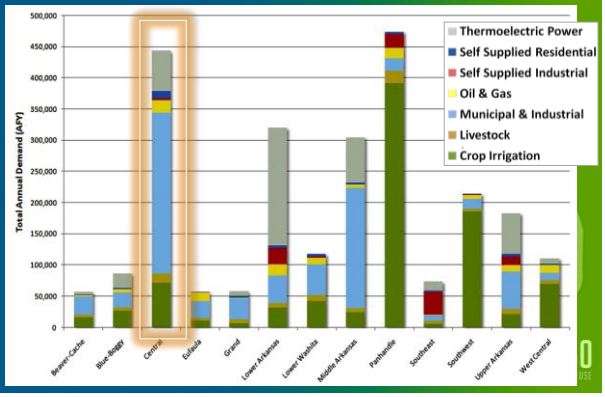
## 2060 Water Demands By Region




## OCWP Public/Stakeholder Participation and Policy Development

- Hundreds of stakeholder and citizen meetings to fine-tune study results as well as develop solutions to Oklahoma's most pressing water issues.

- Local and Regional Input Meetings
- Water Law/Science Seminars
- Stakeholder Meetings
- Planning Workshops
- Legislative Workgroups
- Academy Town Hall
- Feedback/Implementation Meetings

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## "Big 8" Priority Recommendations

- Infrastructure Financing
- Conservation, Reuse, Recycling
- Monitoring
- Supply Reliability
- Instream Flows
- Excess/Surplus
- State/Tribal Resolution
- Regional Planning

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## What is Water for 2060?


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## Water for 2060

- **Water for 2060 Act sets statewide goal of consuming no more fresh water in 2060 than we consume today.**
- Created through passage of HB 3055 in 2012.
- Advisory Council appointed to recommend **incentives and voluntary initiatives** to maintain statewide fresh water use at current levels through 2060.

www.owrb.ok.gov/2060

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## Water for 2060 Advisory Council

Responsibilities

- Recommend incentives for efficient use/reuse
- Recommendations regarding expansion of consumer water-use education programs
- Enhance existing or develop new financial assistance programs
- Submit Final Report to Legislature by November 1, 2015

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## Agenda

- Welcome
- Presentation
  - Hot Spot Basins
  - Overview of Hot Spot Basins in this Area
  - Current and upcoming Water for 2060 activities
  - How can water providers, agricultural producers, and water users monitor and participate?
- Discussion and Input

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## Goals for Tonight's Meeting

- Common understanding of Water for 2060 background and goals
- Consider water efficiency options that could help satisfy future water demands
- Work toward reducing water shortages in Hot Spot basins and Water for 2060 goals
- Get input on local opportunities for conservation, marginal quality water use, and regionalization

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## Hot Spot Basins

12 basins with most significant supply challenges


**Physical Availability**
**Permit Availability**
**Water Quality**

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## Overview of Hot Spot Basins: Panhandle Region

| Metric | Basin 54 | Basin 55 | Basin 66 |
|---|---|---|---|
| 2060 Total Demand (AFY) | 30,400 | 312,929 | 22,483 |
| Source of Supply (% Groundwater / Surface Water) | 99/<1 | 99/<1 | 92/8 |
| 2060 Potential Shortages in Surface Water & Alluvial Groundwater (AFY) | 540 | 700 | 420 |
| | *Shortages will occur most years* | | |
| 2060 Bedrock Groundwater Depletions (AFY) | 9,260 | 47,090 | 5,230 |

***Pumping costs will increase over time***

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## Overview of Hot Spot Basins: Southwest Region

| Metric | Basin 34 | Basin 36 | Basin 38 | Basin 40 | Basin 41 | Basin 42 |
|---|---|---|---|---|---|---|
| 2060 Total Demand (AFY) | 19,014 | 6,600 | 83,563 | 19,186 | 33,064 | 7,062 |
| Source of Supply (% Groundwater / Surface Water) | 52/48 | 99/1 | 38/62 | 92/8 | 99/1 | 81/19 |
| 2060 Potential Shortages in Surface Water & Alluvial Groundwater (AFY) | 2,970 | 2,560 | 5,480 | 1,060 | 910 | 2,920 |
| | *Shortages will occur most years* | | | | | |
| 2060 Bedrock Groundwater Depletions (AFY) | 0 | 0 | 2,260 | 870 | 2,420 | 440 |

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## Overview of Hot Spot Basins: Beaver-Cache/Lower Washita Regions

| Metric | Basin 22 | Basin 26 |
|---|---|---|
| 2060 Total Demand (AFY) | 8,746 | 3,331 |
| Source of Supply (% Groundwater / Surface Water) | 23/77 | 57/43 |
| 2060 Potential Shortages in Surface Water & Alluvial Groundwater (AFY) | 950 | 110 |
| | *Shortages will occur most years* | |
| 2060 Bedrock Groundwater Depletions (AFY) | 920 | 290 |

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## Overview of Hot Spot Basins: Central Region

| Metric | Basin 51 |
|---|---|
| 2060 Total Demand | 27,750 AFY |
| Source of Supply | 32% Surface Water<br>59% Alluvial Groundwater<br>9% Bedrock Groundwater |
| 2060 Potential Shortages: | *Shortages will occur most years* |
| - Surface Water | 1,590 AFY |
| - Alluvial Groundwater | 2,810 AFY |
| | *Up to 20% of demand* |
| 2060 Bedrock Groundwater Depletions | 100 AFY |

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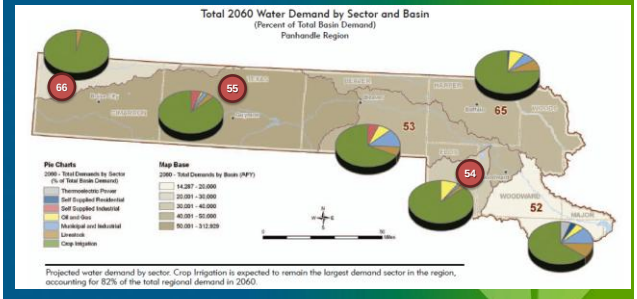
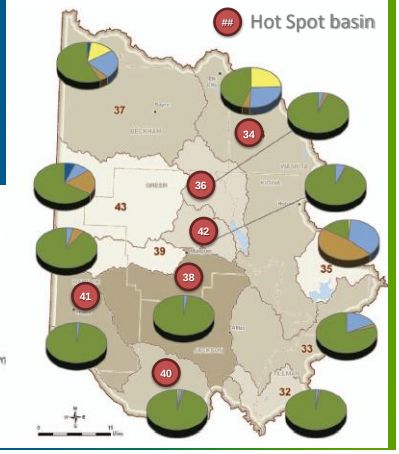
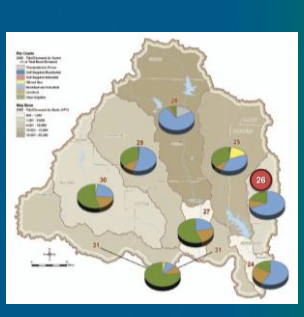
## Projected Water Demands

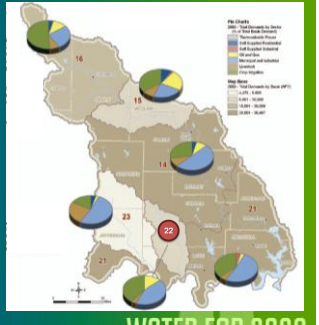



## Projected Water Demands




## Projected Water Demands





## Hot Spot basin

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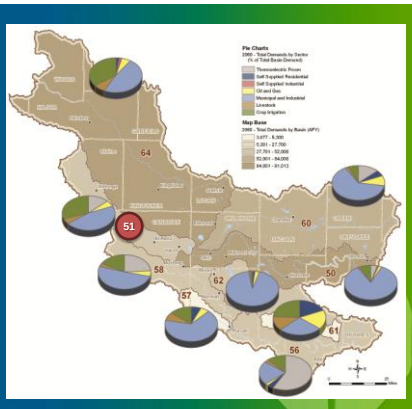
## Projected Water Demands




## Hot Spot basin

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## Feasibility of Supplies and Water Management Strategies

- Analysis of Fundamental Options:
  - Demand Management
  - Out-of-Basin Supplies
  - Reservoir Use
  - Increasing Reliance on SW or GW
- Conservation Analysis
- Aquifer Recharge Study and Workgroup
- Marginal Quality Water Study and Workgroup
- Reservoir Viability Study

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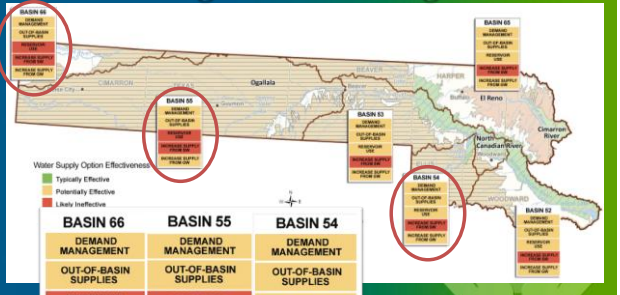
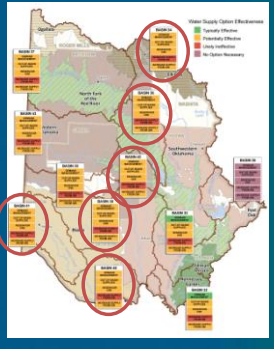
## Feasibility of Supplies and Water Management Strategies




| BASIN 66 | BASIN 55 | BASIN 54 |
|---|---|---|
| DEMAND MANAGEMENT | DEMAND MANAGEMENT | DEMAND MANAGEMENT |
| OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES |
| RESERVOIR USE | RESERVOIR USE | RESERVOIR USE |
| INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW |
| INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW |

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

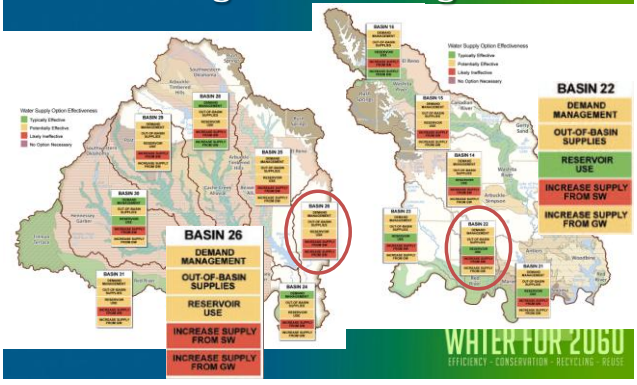
## Feasibility of Supplies and Water Management Strategies



| BASIN 42 | BASIN 36 | BASIN 34 |
|---|---|---|
| DEMAND MANAGEMENT | DEMAND MANAGEMENT | DEMAND MANAGEMENT |
| OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES |
| RESERVOIR USE | RESERVOIR USE | RESERVOIR USE |
| INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW |
| INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW |
| **BASIN 41** | **BASIN 38** | **BASIN 40** |
| DEMAND MANAGEMENT | DEMAND MANAGEMENT | DEMAND MANAGEMENT |
| OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES | OUT-OF-BASIN SUPPLIES |
| RESERVOIR USE | RESERVOIR USE | RESERVOIR USE |
| INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW | INCREASE SUPPLY FROM SW |
| INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW | INCREASE SUPPLY FROM GW |

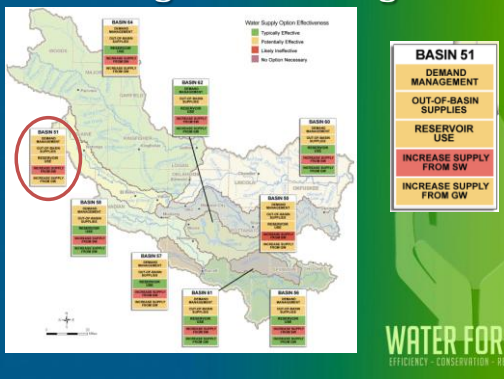
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

## Feasibility of Supplies and Water Management Strategies




WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

## Feasibility of Supplies and Water Management Strategies




WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

## Agenda

- Welcome
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- Discussion and Input

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## Water for 2060
## Hot Spot Pilot Studies

- OWRB and Corps of Engineers
- Analyzing potential roles and effectiveness at a local level
  - Water conservation
  - Marginal quality water use
  - Regionalization of public supply systems
- Three Hot Spot basins
- Models for implementation of water efficiency statewide

**Hot Spots:**
OCWP Planning Basins projected to experience the most significant water supply issues by 2060 (shortages, permit availability, and water quality).

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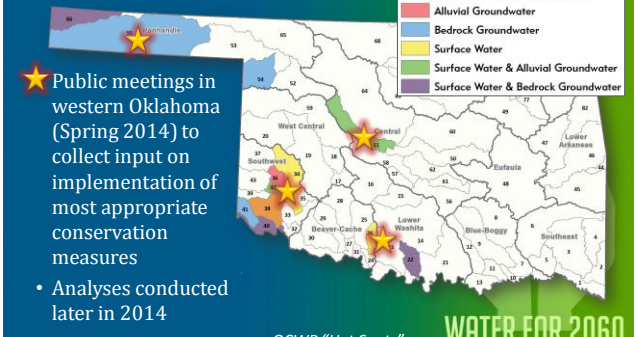
## Water for 2060
## Hot Spot Pilot Studies




- Public meetings in western Oklahoma (Spring 2014) to collect input on implementation of most appropriate conservation measures
- Analyses conducted later in 2014

*OCWP "Hot Spots"*

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## Water for 2060
## Hot Spot Efficiency Studies

Conservation & Efficiency ≠ Drought Management

Every day, every year "Way of life"

Actions we take in response to reduced supplies

Drought drives shortages

Conservation helps us prepare for drought and reduce impacts

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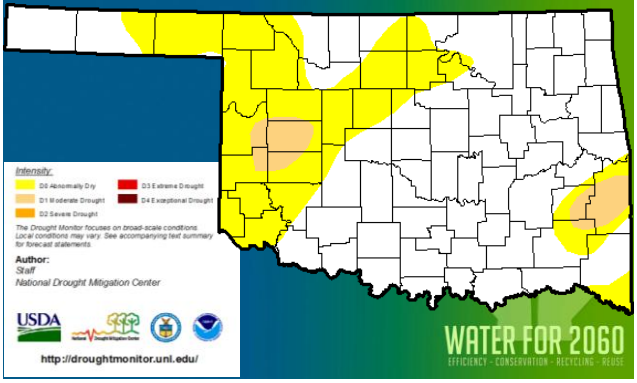
## October 2010
## Onset of the Oklahoma Drought

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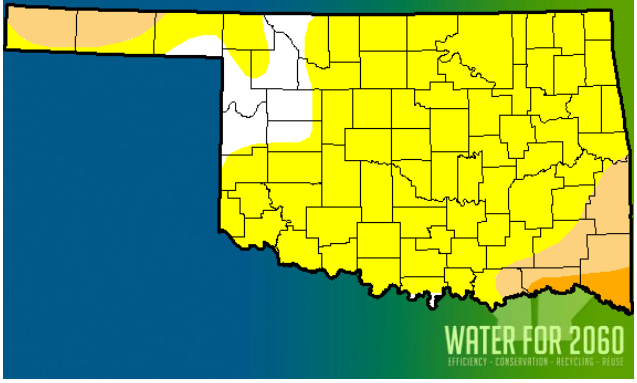
## January 2011



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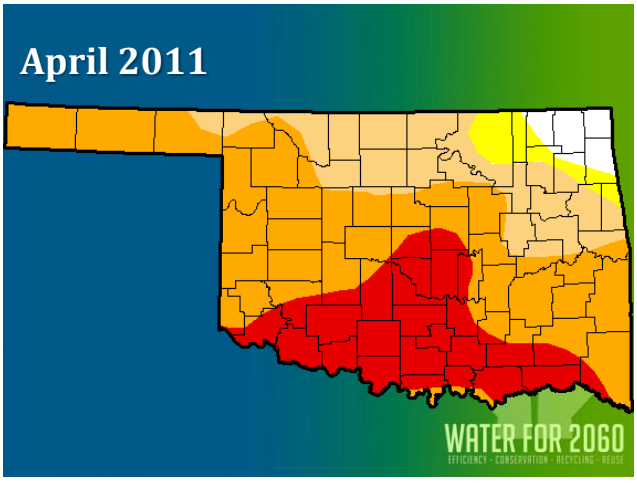
April 2011
WATER FOR 2060
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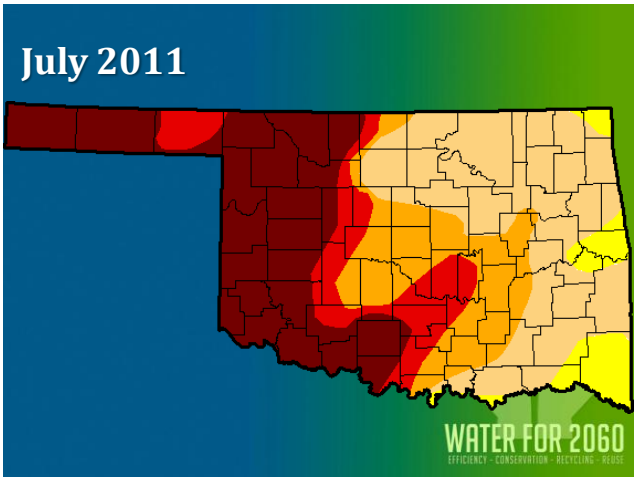
July 2011
WATER FOR 2060
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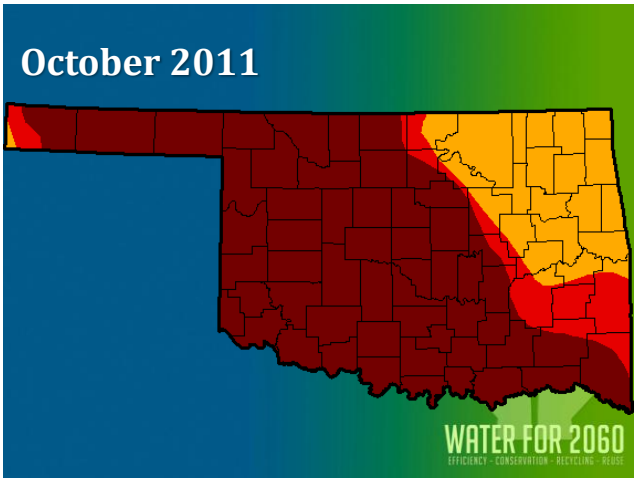
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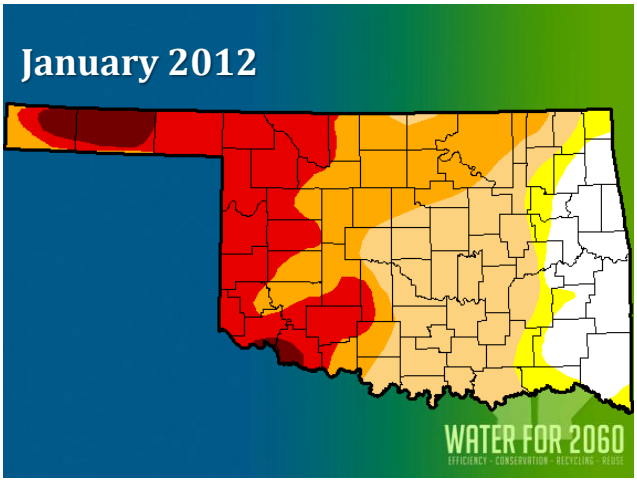
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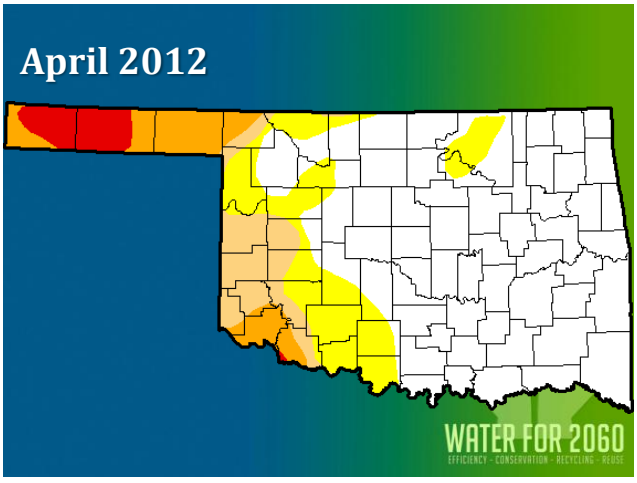
April 2012
WATER FOR 2060
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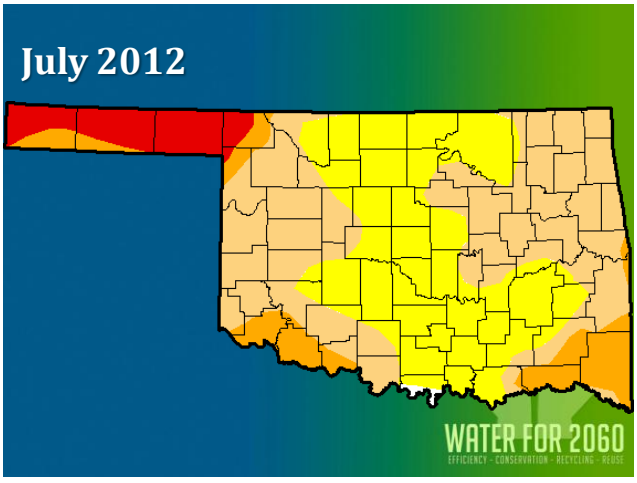
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WATER FOR 2060
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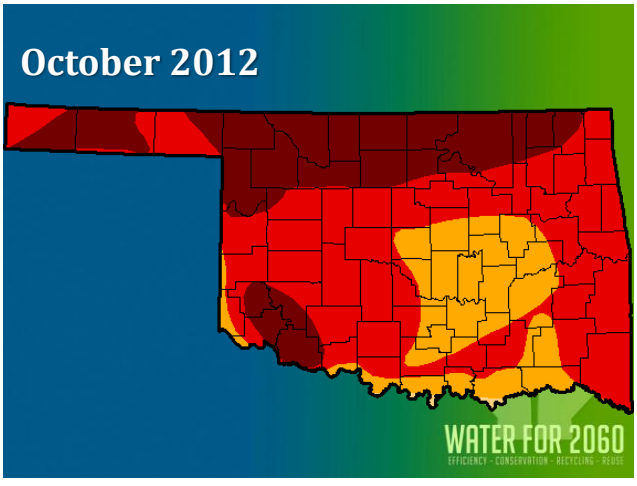
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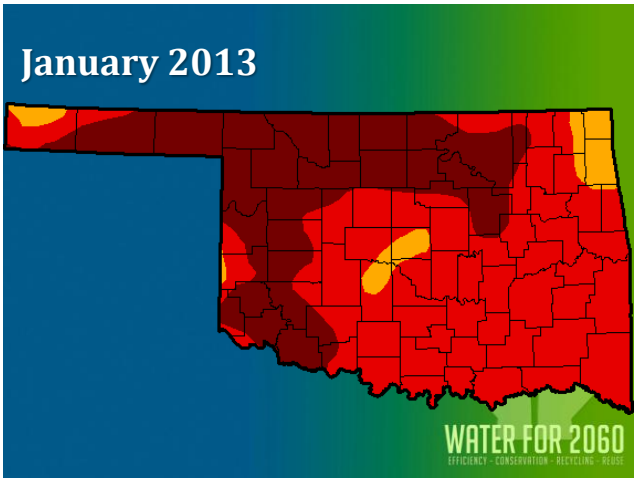
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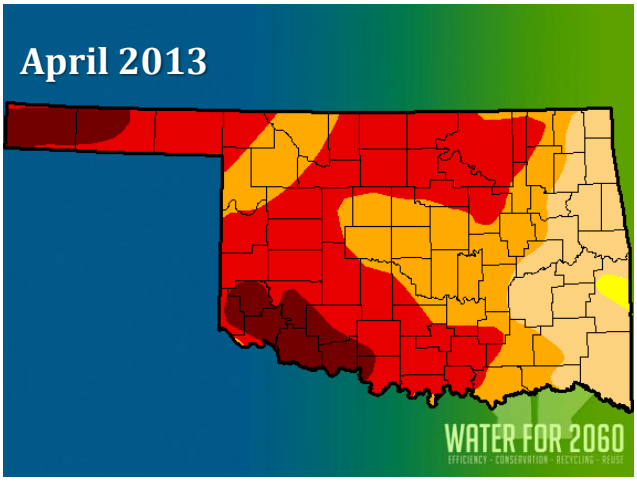
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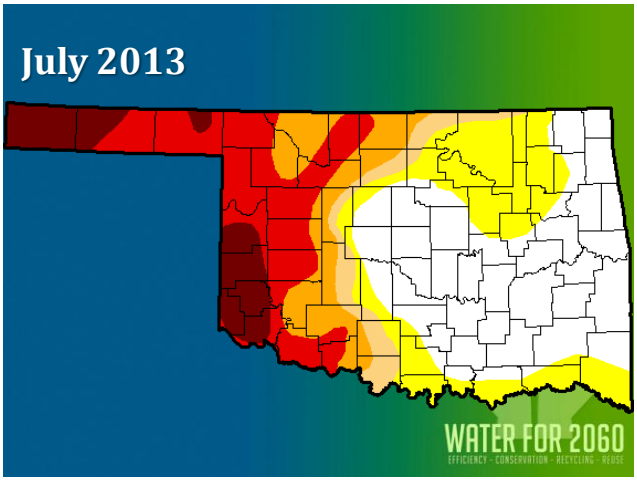
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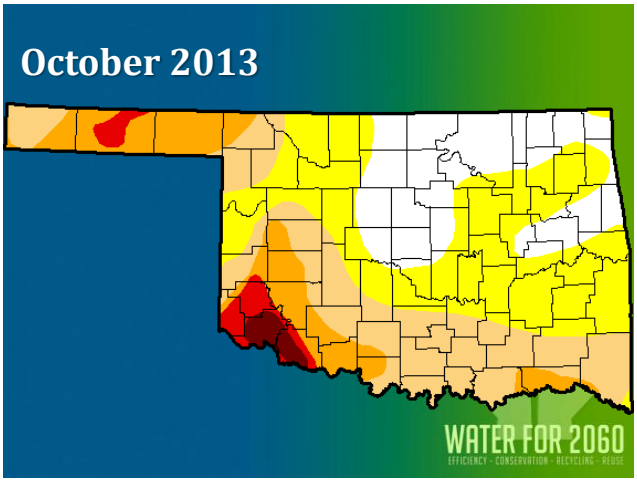
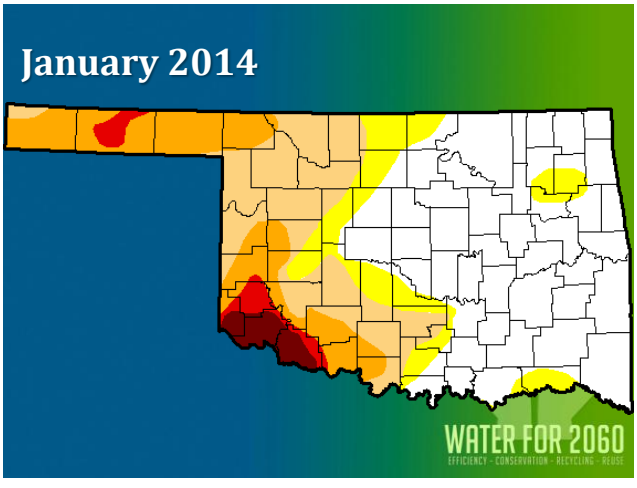

October 2013
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE


January 2014
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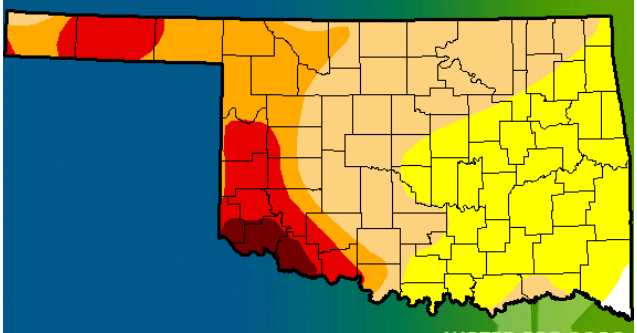
## March 2014



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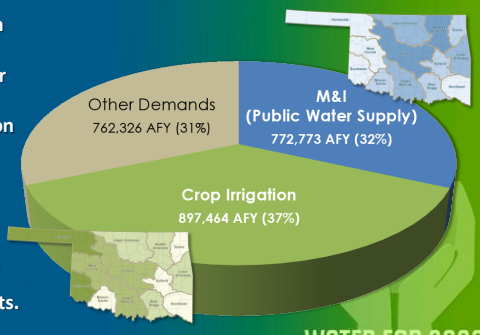
## OCWP Water Conservation Analysis

Conservation in the M&I (Public Water Supply) and Crop Irrigation sectors has significant potential to reduce the severity and frequency of supply deficits.

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## OCWP Water Conservation Analysis

The OCWP analyzed two general levels of conservation for each of the two major demand sectors:

1. Moderately Expanded
2. Substantially Expanded

**"What if" Scenarios - M&I:**

- Passive (Energy Policy Act) vs. high-efficiency plumbing codes/fixtures
- 90% vs. all systems metered
- Reduce system leakage and losses
- Conservation pricing levels
- Standard educational programs vs. school curriculum

**"What if" Scenarios - Irrigation:**

- Increase irrigation system efficiency
- Shift to less water-intensive crops

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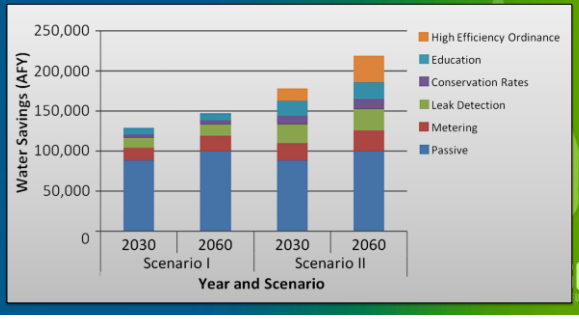
## OCWP Water Conservation Analysis

**Estimated Statewide M&I Water Savings by Program and Conservation Scenario**



## OCWP Water Conservation Analysis
## Potential Water Savings

| | 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 |
| Moderate | N/A | 1,301,816 | 1,332,781 | 1,388,603 | 1,435,807 | **1,496,643** |
| Substantial | N/A | 1,155,397 | 1,170,248 | 1,209,372 | 1,244,123 | **1,295,569** |

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

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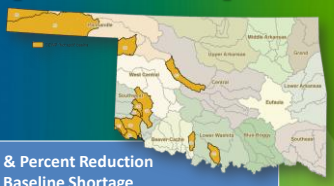
## OCWP Water Conservation Analysis
## What is the Impact on Hot Spots?



| Source | Baseline Shortage | Total & Percent Reduction from Baseline Shortage | | | |
|---|---|---|---|---|---|
| | | Moderate Level | | Substantial Level | |
| SW | 14,590 AFY | 7,440 AFY | 51% | 8,676 AFY | 60% |
| AGW | 12,070 AFY | 6,036 AFY | 50% | 9,036 AFY | 75% |
| BGW | 69,000 AFY | 24,080 AFY | 35% | 61,320 AFY | 89% |

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## Water for 2060
## Promising Conservation Measures

Some Examples:

- Improved irrigation/farming techniques
- Water recycling/reuse systems
- High efficiency plumbing codes
- Smart irrigation
- Education programs that change consumer habits
- Water pricing
- Financial assistance incentives
- Leak detection and prevention

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## Marginal Quality Water Use

| MQW SOURCES | POTENTIAL MQW USES |
|---|---|
| • Treated wastewater | • M&I – potable |
| • Stormwater runoff | • M&I – nonpotable |
| • Oil & gas flowback/ produced water | • Self-supplied residential |
| • Brackish water | • Self-supplied industrial |
| • Other lower-quality sources | • Thermoelectric power |
| | • Oil & gas |
| | • Crop irrigation |
| | • Livestock watering |

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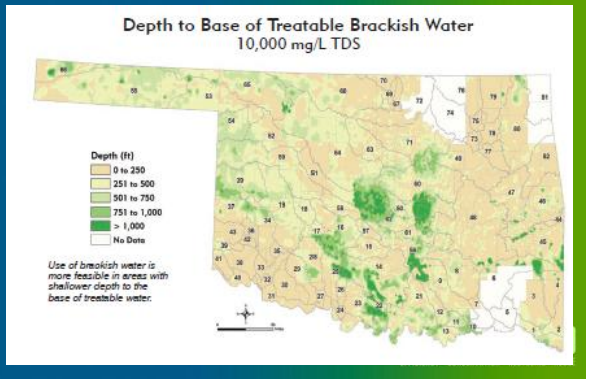
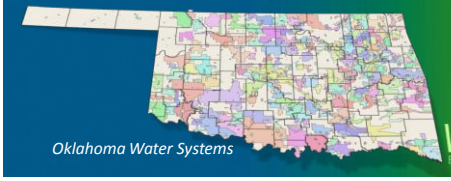
## Example Marginal Quality Source: Brackish Water




## Regionalization

- Oklahoma has ~700 water systems serving less than 1,000 customers.
- Regionalization = interconnected systems sharing supplies
- Systems with multiple sources can be more resistant to drought and can share conservation programs



*Oklahoma Water Systems*

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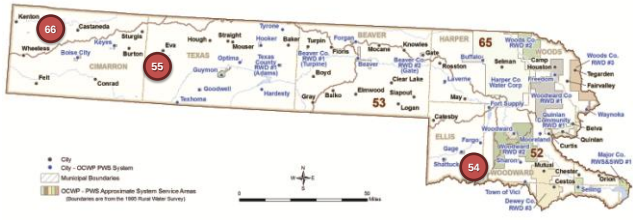
## Public Water Supply Regionalization
### Panhandle Region Municipal & Rural Water Systems




## Hot Spot basin

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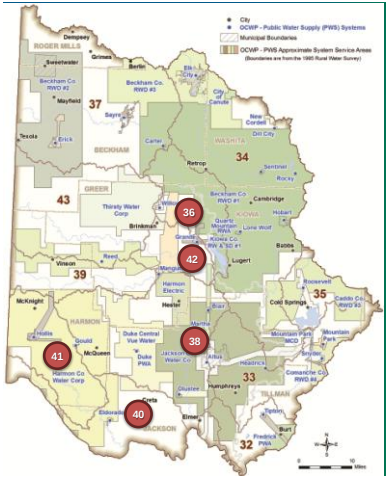


## Public Water Supply Regionalization
### Southwest Region Municipal & Rural Water Systems

## Hot Spot basin

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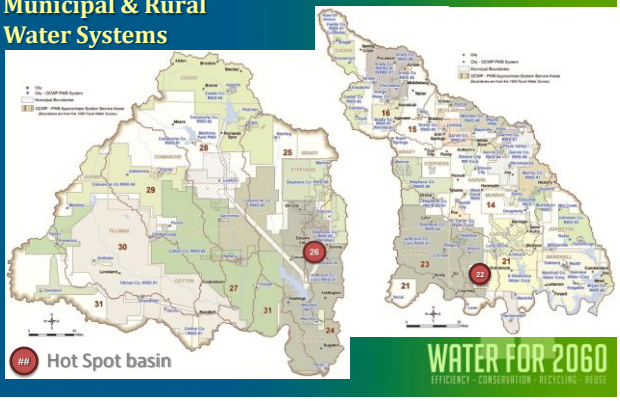
## Public Water Supply Regionalization
### Beaver-Cache & Lower Washita Regions Municipal & Rural Water Systems

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## Public Water Supply Regionalization
### Central Region Municipal & Rural Water Systems


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## Agenda

- Welcome
- Presentation
  - Hot Spot Basins
  - Overview of Hot Spot Basins in this Area
  - Current and upcoming Water for 2060 activities
  - How can water providers, agricultural producers, and water users monitor and participate?
- Discussion and Input

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## Your Involvement

- Monitor which Hot Spot basins are analyzed
- Generate efficiency ideas
- Share reports and data
- Check progress on Water for 2060 website (www.owrb.ok.gov/2060)
- Contact OWRB:
  Terri Sparks 405-530-8800
  terri.sparks@owrb.ok.gov
- Apply results in your area


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## Agenda

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## Discussion and Input

- What opportunities are there for additional conservation, reuse, and water efficiency in our area?
- What marginal quality supplies are available, and how might we use them? Why aren't we already using them?
- Are there examples of regionalized public water supply systems? What has and hasn't worked? Are there other regionalization options we should look at?
- Additional questions and ideas

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