OKLAHOMA Water News

1st Quarter 2016

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State Aquifers Slow to Recover Despite Historic Rainfall

According to data provided by the OWRB's Groundwater Monitoring and Assessment Program (GMAP), most major Oklahoma aquifers experienced rising water levels during 2015, but despite a year of record rainfall, numerous wells across the state have not yet recovered to pre-drought (early 2010) water levels.

"Historic rainfall during 2015 helped replenish state reservoir levels and restore streamflows," says J.D. Strong, OWRB Executive Director, "but the state's groundwater supply, especially in western Oklahoma, remains low. It will take some time and a lot more rain to recover to pre-drought levels."

Data collected in January 2016 show that 12 major aquifers have not yet recovered from four-plus years of devastating drought (see page 3).

"While rainfall totals for 2015 were incredibly high across most of Oklahoma, the bulk of that rain fell hard and fast within a short period from May through June," says State Climatologist Gary McManus. "In most cases, these rainfall events resulted in large amounts of runoff and could not provide much recharge to aquifers."

Three of the state's largest aquifers, the Ogallala, Garber-Wellington, and Rush Springs, have not yet recovered half of the amounts lost during those years.

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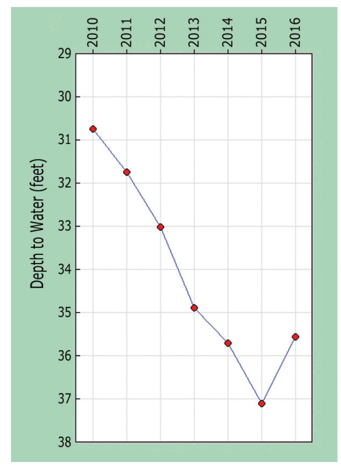

OWRB Geologist Byron Waltman measures water level, temperature, and conductivity in a Rush Springs monitoring well in Washita county. The hydrograph shows a steady decline in water level from 2010 to 2015, losing more than 6 feet during that period. The level increased by more than a foot from 2015-2016, which means that in spite of historic rainfall, the well still has about 5 feet to go before reaching its "pre-drought" level. On average, Rush Springs wells lost 6.54 feet during the drought (2010-2015) and gained 2.37 feet last year. Historic water level graphs and information for all major aquifers can be obtained from the OWRB "Groundwater Level Monitoring Wells in Oklahoma" GIS map viewer at www.owrb.ok.gov/maps.

From the Director

The last five months have proven once again Oklahoma's susceptibility to drought and its disparaging impacts. We've quickly jumped from the end of the wettest year on record to the return of drought conditions across more than one-third of the state, and then back to wet conditions in many places. It is a stark reminder that the devastation of Oklahoma's 2010-2015 drought still haunts us, and that our state's precipitation history is littered with similar swings between extremely wet and dry conditions.

The good news is the OWRB and our partners continue to develop water management practices and tools to allow Oklahoma's water users to break that cycle. In fact, I'm pleased to report that state legislation passed this spring will provide additional drought-proofing ammunition through the establishment of aquifer storage and recovery (ASR) projects in Oklahoma.

(continued on page 2)

J. D. Strong, Executive Director
Oklahoma Water Resources Board

Aquifers Slow to Recover (continued)

Even though the Northwest and Central climate regions experienced their second wettest years on record, OWRB data indicate that Ogallala water levels did not increase last year and are now down by more that 9 feet from pre-drought levels. Garber-Wellington levels went down by about 7.5 feet during the drought and were only able to recoup about 3 feet last year.

The Rush Springs aquifer is primarily located in the West-central and Southwest climate regions, both of which received more than 140% of normal rainfall in 2015. Like the other regions, nearly half of that rain came during a brief period between mid-April and late June. After losing about 6.5 feet to the drought, the aquifer recouped about 2.5 feet on average during 2015.

In addition to timing and intensity of rainfall events, OWRB hydrologists point to a large number of factors that have affected aquifer recharge across the state, including temperature, humidity, farming practices that promote or inhibit infiltration, impervious surfaces from urban development, and types of geologic formations that determine how the water moves and is stored in the aquifer.

(continued on page 3)

From the Director (continued)

SB1219, authored by Senator Eddie Fields and Representative John Pfeiffer, authorizes the OWRB and Oklahoma Department of Environmental Quality (ODEQ) to establish a process for citizens or communities to construct ASR projects.

The 2012 Update of the Oklahoma Comprehensive Water Plan includes a feasibility study of potential ASR sites within Oklahoma. However, it is evident that if we are to join several other western states that already employ ASR projects for drought management, it is imperative to invite all stakeholders to get involved through our rulemaking process. During the recent 5-year drought and with the increased focus Water for 2060 has placed on innovative water management, ASR likely will be an important factor in helping us secure water for decades to come in many places throughout Oklahoma.

Speaking of Water for 2060, I'm also proud to report that this important initiative was highlighted in March at the White House Water Summit as a part of World Water Day. I had the honor of attending the White House ceremony, which highlighted Oklahoma's Water for 2060 initiative as one of several unique drought resiliency measures from across the U.S. Our Water for 2060 work was also recently expanded by Governor Fallin to include a new working group to review opportunities and challenges associated with recycling oil and gas produced water for beneficial reuse.

Finally, I'd like to thank and congratulate all the OWRB employees participating in yet another successful Oklahoma City Memorial Marathon. It is a special time of remembrance at the OWRB each April as we honor our two fallen colleagues, and lift up all those who were tragically impacted. I am always proud and astounded by the number of current and former OWRB staffers that participate in the various races each year.

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Email GO DIGITAL to pubinfo@owrb.ok.gov and include your name & address. Current and past issues of the *Oklahoma Water News* are also available on the OWRB website at www.owrb.ok.gov/waternews.

The OWRB would like to thank our 2016 Water Appreciation Day Exhibitors

- Arkansas Grand Regional Authority
- Chickasaw & Choctaw Nations
- Citizens for the Protection of the Arbuckle Simpson Aquifer
- Conservation Coalition of Oklahoma
- Keep Oklahoma Beautiful
- Oklahoma Climatological Survey/Mesonet
- Oklahoma Conservation Commission
- Oklahoma Corporation Commission
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Mines
- Oklahoma Department of Transportation, Waterways
- Oklahoma Geological Survey
- Oklahoma Ground Water Association
- Oklahoma Municipal League
- Oklahoma Rural Water Association
- Oklahoma Scenic Rivers Commission
- Oklahomans for Responsible Water Policy
- OSU Environmental Science Program
- OSU Water Resources Center/Think Water
- OU School of Engineering & Environmental Science
- Southern Climate Impacts Planning Program
- US Bureau of Reclamation
- USGS Water Science Center
- Water4

Aquifers Slow to Recover (continued)

While total precipitation is clearly linked to the rise and fall of water levels in aquifers, aquifer recharge is a dynamic and multifaceted process involving many environmental and human-induced conditions. Recharge may take hours, days, months, or even years, depending on multiple factors.

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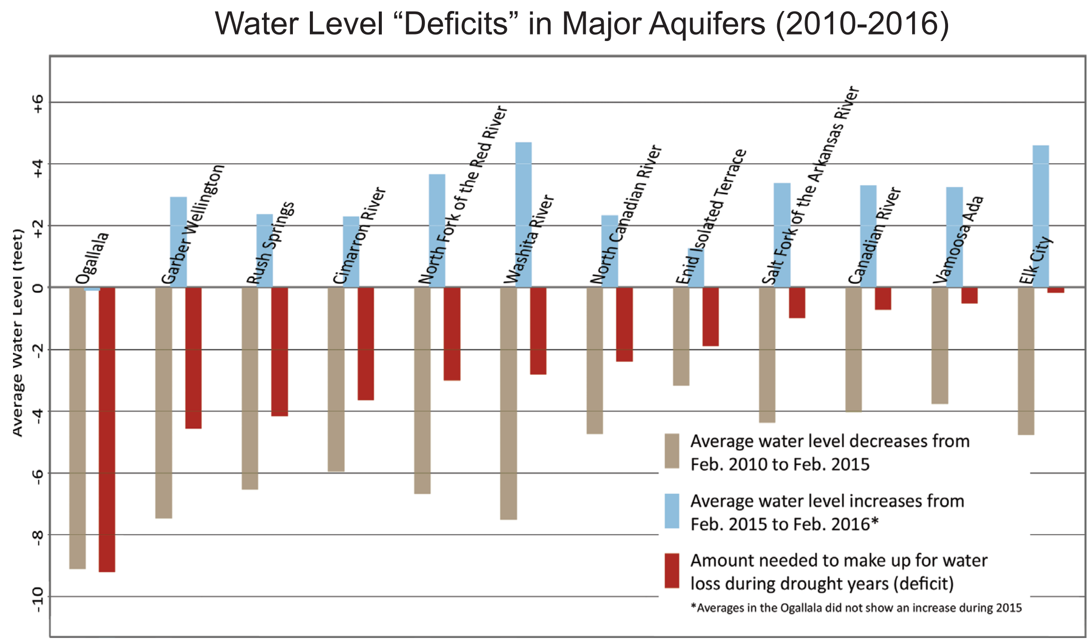

OWRB data indicate that 12 of Oklahoma’s major aquifers, including the state’s most utilized groundwater sources, are still slowly recovering from drought losses.

To gain a better understanding of how each aquifer experiences recharge, it is critical to have water level data for multiple wells over multiple time periods. As the GMAP team works its way across the state, a vast network of approximately 750 wells is being created for both water level and water quality data collection. A sub-set of network wells will be used for trend monitoring and evaluated multiple times per year. Multiple assessments of water level and chemistry will facilitate recognition of seasonal changes, changes due to climate variability, and/or changes due to usage over time.

To further facilitate this effort, 25 GMAP sites have been equipped with continuous groundwater level recorders (pressure transducers) that collect hourly groundwater level measurements and provide insight into water level fluctuations related to daily, localized factors, including groundwater use and precipitation.

According to Mark Belden, OWRB Geologist and GMAP Coordinator, the bulk of the GMAP groundwater level observation sites monitor groundwater level fluctuations

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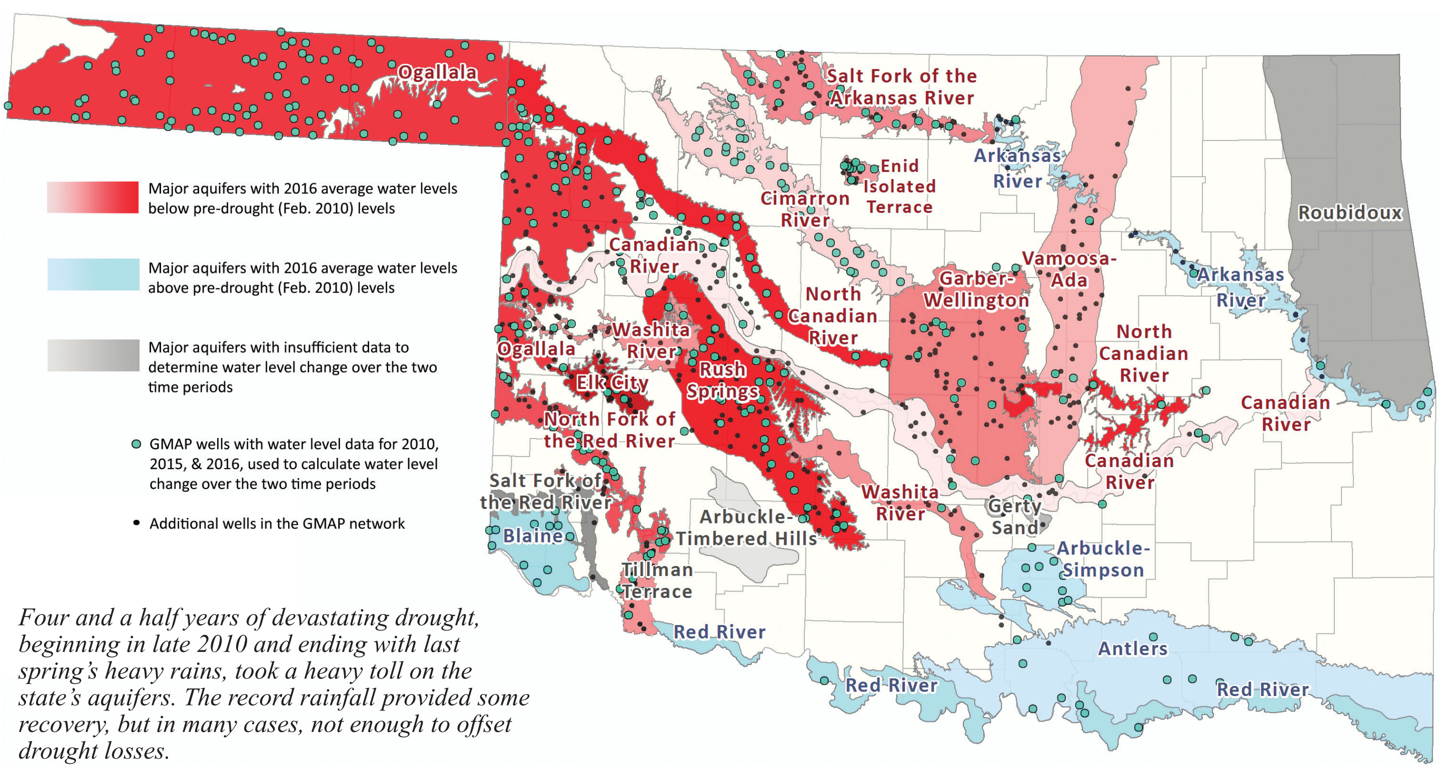

Four and a half years of devastating drought, beginning in late 2010 and ending with last spring’s heavy rains, took a heavy toll on the state’s aquifers. The record rainfall provided some recovery, but in many cases, not enough to offset drought losses.

Aquifers Slow to Recover (continued)

during three periods each year— January-February, May-June, and September-October. "This will allow the GMAP team to examine periods within the groundwater hydrologic cycle roughly approximating a period of quiescence, or onset of groundwater discharge and onset of groundwater recharge, respectively," says Belden.

The valuable data provided by GMAP can be used to estimate aquifer storage and groundwater availability while tracking changes over time. For more information on GMAP, visit **www.owrb.ok.gov/GMAP**.

The OWRB is also currently conducting intensive hydrologic investigations on several state aquifers. During each investigation, upper, lower, and lateral boundaries of the aquifer are determined, followed by a characterization of aquifer properties—such as saturated thickness, hydraulic conductivity, transmissivity, specific yield, and storage coefficient—to understand the storage and yield capacity of the basin. Because water levels constantly fluctuate due to short-term and long-term changes in climate, groundwater withdrawals, and land uses, the amount of water entering the basin (recharge) and the amount of water leaving the basin (discharge) are important factors in the evaluation of groundwater availability. The primary goal of these investigations is to provide data and analysis for the determination of how much water can be withdrawn from individual aquifers (groundwater basins). For more information on hydrologic investigations at the OWRB, visit **www.owrb.ok.gov/gwstudies**.

Aquifer Storage and Recovery (ASR) in Oklahoma, SB 1219

Because of declining water levels in the state's aquifers, water users across Oklahoma are considering new ways to supplement supply. According to the Oklahoma Comprehensive Water Plan (OCWP), aquifer storage and recovery (ASR) could be an effective tool for managing future groundwater demand and meeting the state's Water for 2060 goals.

In early April, the Oklahoma state legislature passed SB 1219, which allows water to be stored in an aquifer for use at a later time without counting against the quantity limits established in a groundwater permit.

The bill gives the OWRB authority to promulgate and implement ASR rules, approve site-specific ASR plans, and issue permits for taking and using stored water. For permitting purposes, ASR will be considered a "beneficial use" of water by the OWRB.

Domestic and permitted groundwater use are protected by limits on permitted withdrawals to the amount of ASR water that is accessible. Well spacing rules to prohibit interference with permitted and domestic use are required as well. Groundwater quality will be protected by ODEQ water quality permitting requirements.

The legislation currently awaits approval by the Governor.

Aquifer	Geologic Framework	Sample Size	Change in Water Level 2010-2015 Mean	2010-2015 Median	2015-2016 Mean	2015-2016 Median
Ogallala	semiconsolidated gravel, sand, silt, clay	116	-9.11	-6.23	-0.09	-0.1
Garber-Wellington	interbedded shale/sandstone	12	-7.48	-7.51	2.92	2.72
Rush Springs	consolidated sandstone & interbedded areas	55	-6.54	-5.86	2.37	1.79
Cimarron River	alluvium and terrace	35	-5.95	-5.77	2.29	2.51
North Fork of the Red River	alluvium and terrace	28	-6.67	-5.95	3.66	3.08
Washita River	alluvium and terrace	3	-7.52	-6.25	4.7	1.16
North Canadian River	alluvium and terrace	24	-4.74	-4.67	2.29	2.51
Enid Isolated Terrace	alluvium and terrace	8	-3.18	-4.07	1.28	1.36
Salt Fork of the Arkansas	alluvium and terrace	17	-4.38	-3.46	3.38	3.77
Canadian River	alluvium and terrace	7	-4.04	-3.19	3.31	3.62
Vamoosa Ada	interbedded sandstone/shale/ conglomerate	4	-3.77	-5.69	3.25	4.09
Elk City	sandstone	6	-4.78	-4.53	4.6	5.02
Antlers	sandstone	8	-1.89	-2.7	2.87	2.82
Red River	alluvium and terrace	4	-2.04	-0.88	4.35	3.99
Arkansas River	alluvium and terrace	6	-0.81	-1.57	4.14	3.94
Arbuckle Simpson	karst, interbedded limestone/ dolomite; sandstone/shale	8	-6.75	-5.61	19.73	21.1
Blaine	karst, interbedded gypsum/ dolomite	13	-6.09	-1.31	29.16	25.43

Major aquifers with water level data for the two time periods. All aquifers had water level declines during the drought (2010-2015), and all but the Ogallala recovered water during 2015-2016. Aquifer recharge can be attributed to a large number of variables, including geologic framework.

According to Chris Neel, OWRB Geologist, karst and alluvial aquifers tend to recover more quickly from drought conditions. "Precipitation can infiltrate into the subsurface with more ease through cracks and fissures in karst aquifers," says Neel. "Although not as responsive, alluvial aquifers can also recover quickly because infiltration rates are fast and the depth to water is typically shallow."

Sandstone aquifers often show the slowest recovery from drought conditions. "In these aquifers, the water table is deeper, the substrate is denser, and infiltration rates are slower," adds Neel.

DID YOU KNOW?

Minor water leaks account for more than

1 trillion gallons

of wasted water each year and are equal to annual household water use in

11 million homes.

HERE'S HOW WE CAN SAVE MORE THAN ONE TRILLION GALLONS OF WATER IN ONE YEAR:

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SHOWERHEADS

If every home in the United States installed WaterSense-labeled showerheads, we could save more than 260 billion gallons of water annually.

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If every home in the United States replaced existing bathroom faucets and aerators with WaterSense-labeled models, we could save 64 billion gallons of water across the country annually.

URINALS

Nationwide, if all older, inefficient urinals were replaced, we could save nearly 36 billion gallons annually.

LANDSCAPE IRRIGATION CONTROLS

If every home in the United States with an automatic sprinkler system installed and properly operated a WaterSense-labeled controller, we could save 120 billion gallons of water across the country annually from not overwatering lawns and landscapes.

PRE-RINSE SPRAY VALVES

If all commercial food service establishments in the U.S. installed and used a WaterSense-labeled pre-rinse spray valve, we could save more than 7 billion gallons across the country annually.

FLUSHOMETER-VALVE TOILETS

If commercial facilities nationwide replaced all of their older, inefficient flushometer-valve toilets with WaterSense-labeled models, it could save an estimated 39 billion gallons of water per year.

Garber Begins Work on DWSRF-funded Regionalization Project

In February, the Garber Municipal Authority began construction on a booster pump station and 11.6 miles of water line to connect the system with the Enid Municipal Authority. The project was funded by a $2.1 million Drinking Water State Revolving Fund (DWSRF) loan last December.

The small Garfield county community was in desperate need either to improve water quality through expensive treatment or find another source of supply. Among other issues, the system's water had carbon tetrachloride and nitrates above maximum contaminant levels.

The DWSRF project priority ranking system granted points to the Garber project both for being under consent order for water quality issues and for being an interconnection project, which helps meet Oklahoma's Water for 2060 goals by improving water quality, supply security, and the ability to make system upgrades for better efficiency.

With 100% principal forgiveness, Garber customers will save an estimated $3,225,000, compared to traditional financing.

The DWSRF loan program is administered jointly by the Oklahoma Department of Environmental Quality (ODEQ) and the OWRB with partial funding from the U.S. Environmental Protection Agency (EPA). To date the DWSRF program has awarded 179 loans to Oklahoma communities totaling $1,014,228,300.

For more information on the DWSRF Loan Program, visit **www.owrb.ok.gov/DWSRF**.

Work crew installing water main along East Willow Road to connect the Garber Municipal Authority to the Enid Municipal Authority

Drinking Water State Revolving Fund (DWSRF) Program

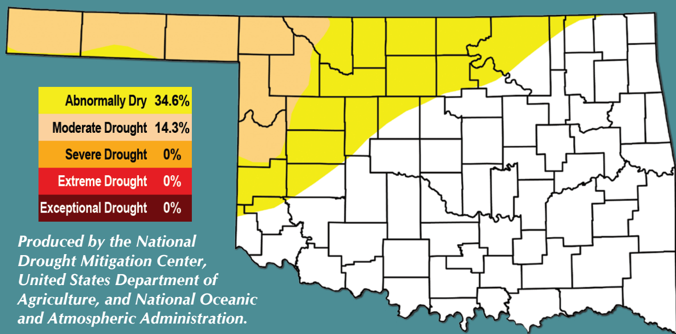
Until 1997, Oklahoma did not have a lower than market rate loan program to assist water systems in complying with the Safe Drinking Water Act (SDWA). The 1996 Amendments to the SWDA allowed the U.S. Environmental Protection Agency (EPA) to make a grant to Oklahoma to fund a Drinking Water State Revolving Fund (DWSRF). The primary purpose of the program is to provide low interest loans and other financial assistance to municipalities and rural water districts for the construction of public water supply projects. The DWSRF is administered cooperatively between the OWRB and Oklahoma Department of Environmental Quality (ODEQ).

Systems eligible for loan money include towns and municipalities with proper legal authority and rural water districts established under Title 82 of the Oklahoma Statutes. Eligible projects include drinking water treatment, new intake/raw water lines, major distribution/storage system rehabilitation, new storage, engineering, and new transmission/distribution systems.

Eligible projects are prioritized using a point ranking system. Points are awarded for the following categories: violations of primary standards (e.g., arsenic, nitrates, or uranium), quantity deficiencies, design deficiencies, vulnerability to pollution, violation of secondary standards (e.g., odor problems or excessive hardness), consolidation, source water protection, compliance orders, affordability of the project, and eligibility for special financing for disadvantaged communities.

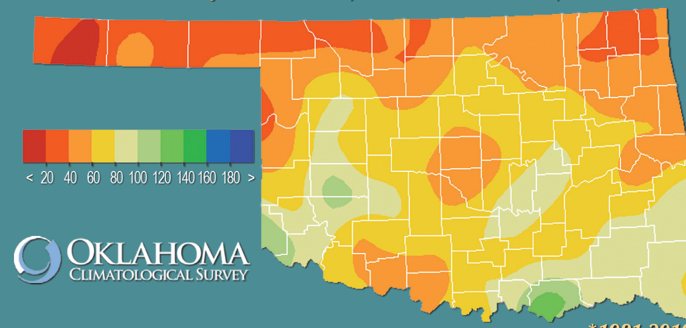
Drought Update

U.S. Drought Monitor
March 22, 2016



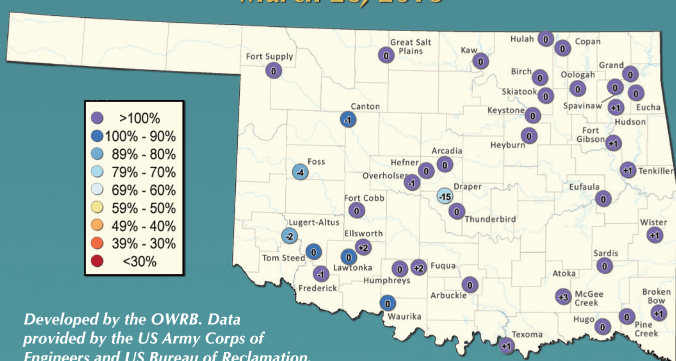
Produced by the National Drought Mitigation Center, United States Department of Agriculture, and National Oceanic and Atmospheric Administration.

Percent of Normal* Precipitation
Last 90 Days (Dec. 30, 2015 - Mar. 28, 2016)



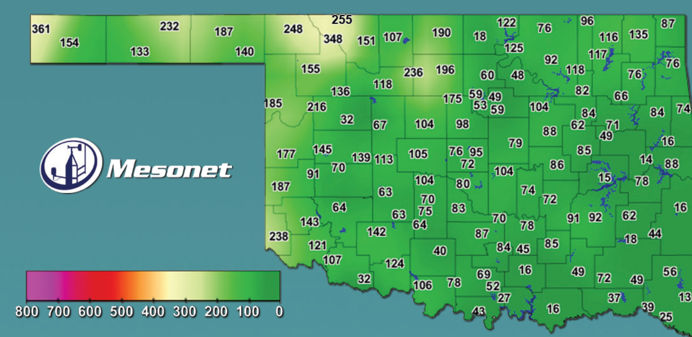
*1981-2010

Reservoir Storage
March 28, 2016

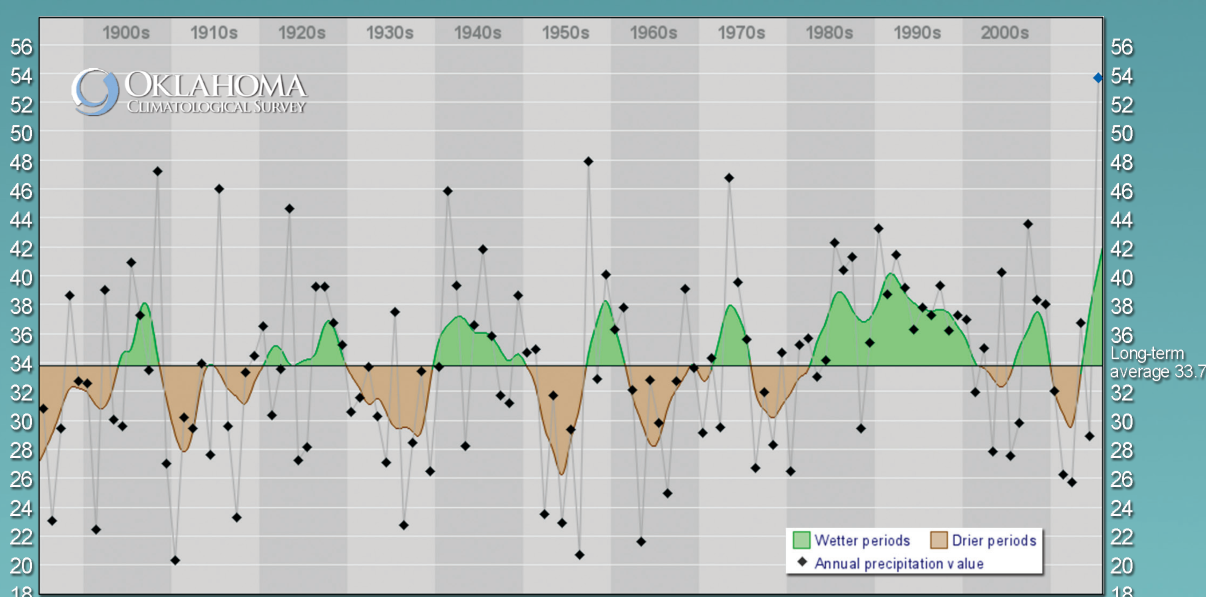


Developed by the OWRB. Data provided by the US Army Corps of Engineers and US Bureau of Reclamation.

Keetch-Byram Drought Index
March 28, 2016



Annual Precipitation History with 5-year Tendencies
Oklahoma Statewide: 1895-2015



Evolution of Oklahoma's precipitation history since the modern record began in 1895. The diamonds represent the average of the measured precipitation for each year. The green-brown trace represents the five-year weighted average of these precipitation values over time. Adding the 2015 record year to the graph (highlighted in blue) brought the long-term average up by 0.1 inch.

For more drought information visit **www.drought.ok.gov**.

Oklahoma Water News
Oklahoma Water Resources Board
3800 N. Classen Blvd.
Oklahoma City, OK 73118

www.owrb.ok.gov

Protecting and enhancing the quality of life for Oklahomans by managing and improving the state's water resources to ensure clean and reliable water supplies, a strong economy, and a safe and healthy environment.

Financial Assistance Program Update

Loans & Grants Approved as of March 31, 2016

FA Loans—368 totaling $958,885,000
The OWRB's Financial Assistance Program (FAP), created by the State Legislature in 1979, provides loans for water and wastewater system improvements in Oklahoma. The tremendous popularity of the bond loan program is due, in part, to extended payoff periods of up to 30 years at very competitive interest rates.

CWSRF Loans—294 totaling $1,338,731,092
The Clean Water State Revolving Fund (CWSRF) loan program was created in 1988 to provide a renewable financing source for communities to use for their wastewater infrastructure needs. The CWSRF program is Oklahoma's largest self-supporting wastewater financing effort, providing low-interest loans to communities in need.

DWSRF Loans—179 totaling $ 1,014,228,300
The Drinking Water State Revolving Fund (DWSRF) loan program is an initiative of the OWRB and ODEQ to assist municipalities and rural water districts in the construction and improvement of drinking water systems. These projects are often mandated for communities to obtain compliance with increasingly stringent federal standards related to the treatment of drinking water.

REAP Grants—652 totaling $57,713,636
The Rural Economic Action Plan (REAP) Program was created by the State Legislature in 1996. REAP grants, used for water/wastewater system improvements, primarily target rural communities with populations of 7,000 or less, but priority is afforded to those with fewer than 1,750 inhabitants.

Emergency Grants—570 totaling $33,918,163
Emergency grants, limited to $100,000, are awarded to correct situations constituting a threat to life, health, or property and are an indispensable component of the agency's financial assistance strategy.

Drought Response Program Grants—10 totaling $1,543,848
Through the OWRB's Drought Response Program, funding is available for communities in most dire need during state drought emergencies declared by the Governor. A maximum of $300,000 is diverted from existing OWRB Emergency Grant proceeds to fund the Program.

Water for 2060 Grants—4 totaling $1,500,000
Through the Water for 2060 Grant Program, funding is available for municipalities, counties, water/sewer districts and other public entities for projects that highlight the responsible use of water.

Total Loans/Grants Approved: 2,077 totaling $3,406,520,040
Estimated Savings: $1,161,269,483
Applicants eligible for water/wastewater project financial assistance vary according to the specific program's purpose and requirements, but include towns and other municipalities with proper legal authority, various districts established under Title 82 of Oklahoma Statutes (rural water, master/water conservancy, rural sewage, and irrigation districts), counties, public works authorities, and/or school districts. Applications for agency financial assistance programs are evaluated individually by agency staff. Those meeting specific program requirements are recommended by staff for approval at monthly meetings of the nine-member Water Board. ***For more information, call (405) 530-8800 or go to www.owrb.ok.gov/financing.***

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1st Quarter, 2016

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