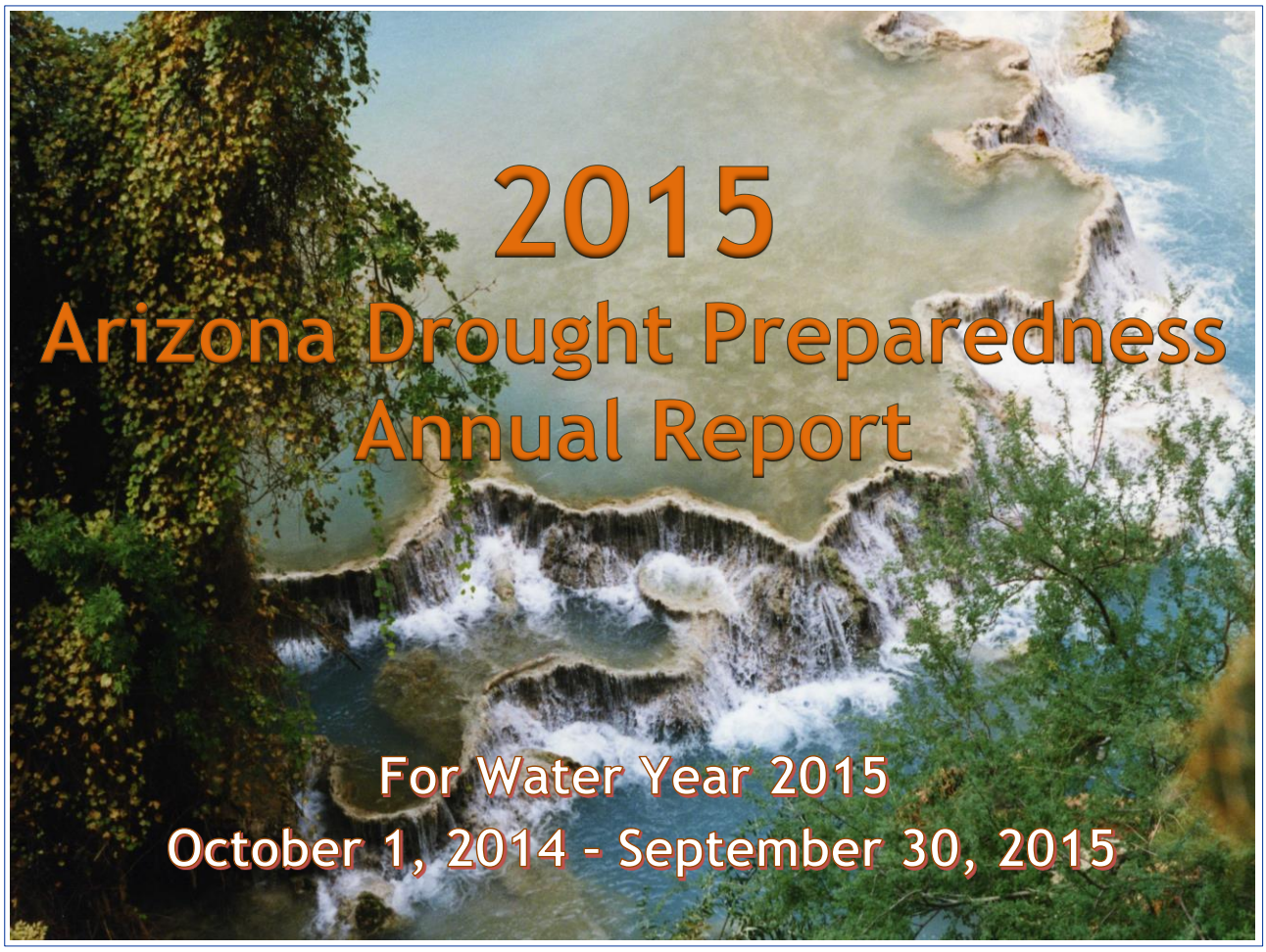

2015
Arizona Drought Preparedness Annual Report

For Water Year 2015
October 1, 2014 - September 30, 2015

ARIZONA DEPARTMENT of WATER RESOURCES
EST. 1980

PROTECTING
ARIZONA'S WATER SUPPLIES
for ITS NEXT CENTURY

2015 Arizona Drought Preparedness Annual Report

Acknowledgements

The ***Arizona Drought Preparedness Plan*** was adopted in 2004 and its continued implementation ordered in 2007 (EO 2007-10). The Arizona Department of Water Resources (ADWR) prepares the report each year based on updates from the Drought Monitoring Technical Committee, Interagency Coordinating Group, Local Drought Impact Groups and others. The 2015 Drought Preparedness Annual Report covers the drought conditions and preparedness activities for the 2015 water year, from October 1, 2014 through September 30, 2015. ADWR acknowledges and thanks all who contributed to this report.

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Appendices

2015 Arizona Drought Preparedness Annual Report

1. Introduction

Arizona has been in a state of long-term drought for approximately 21 years. Although Arizona's long-term drought status has improved significantly compared to last year, more than two thirds of the state is abnormally dry or in moderate drought. Furthermore, major reservoirs are only approximately 50% full, and every county had a United States Department of Agriculture disaster designation due to drought this water year. Enhanced chances for above normal winter precipitation due to El Niño could help alleviate drought conditions even more, however, extended years of normal or above normal precipitation are needed to alleviate the long-term drought and recharge aquifers as their recovery tends to be relatively slow. Arizona's drought preparedness plan activities continue to provide a framework to monitor drought, improve understanding of drought impacts, and determine mechanisms for limiting future vulnerability.

2. Drought Status Summary

A. Winter Precipitation: October 2014 – April 2015

The winter of 2014 (**Fig. 1**) was the 4th consecutive dry winter in Arizona. By comparison, the winter of 2015 was significantly wetter in all areas of the state except extreme northern Mohave County (**Fig. 2**). The Navajo Nation and Cochise County received near- or above-average precipitation, while the rest of the state was slightly drier than normal. Through April, the Upper Colorado River Basin was generally at or below 70% of normal precipitation. Both winters, 2014 and 2015, were neutral years in terms of El Niño/La Niña, but 2015 managed to be significantly wetter than 2014 for Arizona.

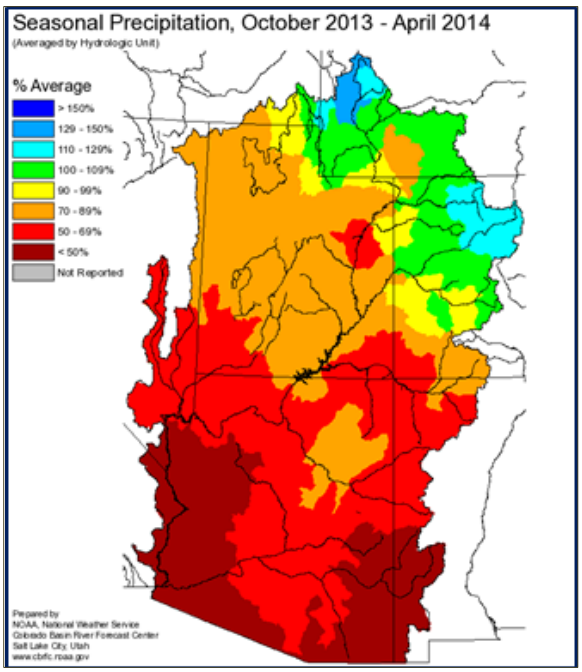

Figure 1. Precipitation Oct. 2013 – Apr. 2014.

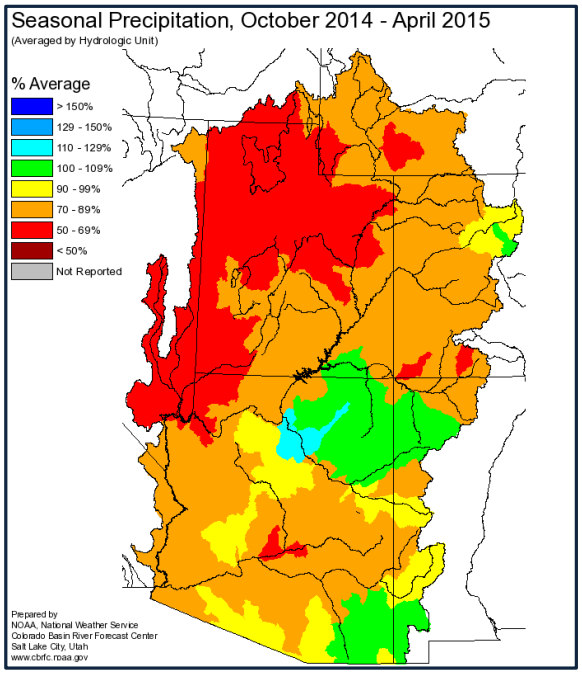

Figure 2. Precipitation Oct. 2014 – Apr. 2015.

Similar to last year, snow accumulation during the winter season was well below normal across the state (**Fig. 3**). An early March storm brought the snowpack up somewhat, however, snow water equivalent levels remained well below the 30-year median.

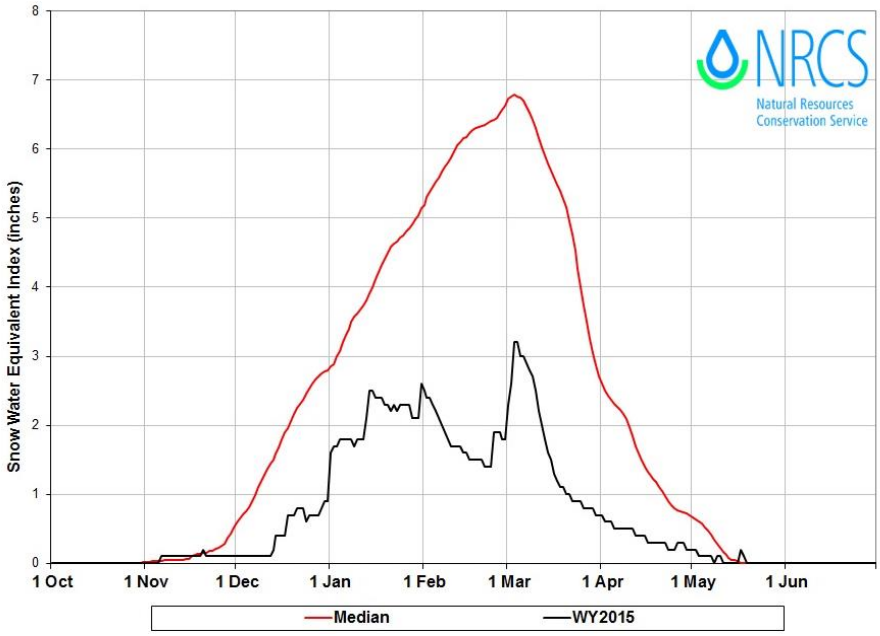

Figure 3. 2015 Arizona statewide snowpack summary as of Sep, 30, 2015, Natural Resources Conservation Service.

B. Monsoon Precipitation: July – September 2015

Both the 2014 and 2015 monsoon seasons were wetter than normal (**Fig. 4 and Fig.5**). The very wet summer of 2014 was due to very warm water off the coast of Mexico that led to a series of tropical storms that brought several record rain events to central and southern Arizona, causing widespread flooding to the Phoenix area as well as to Nogales, Douglas and other southern communities. The hurricanes that developed off of Mexico tended to move north along the coast, and the southeasterly flow brought the moisture into the state. Since the warm water off the Mexican coast continued through the summer of 2015, similar storm patterns were expected. However, the hurricanes and tropical storms that did develop tended to move to the northwest toward Hawaii rather than move up the coast. Therefore, Arizona had a lot less moisture than in 2014, and few record rain events. The 2015 monsoon was much more localized with central Arizona receiving slightly below average monsoon precipitation.

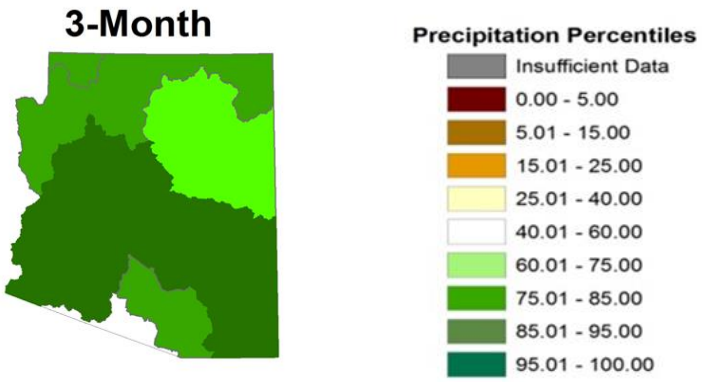

Figure 4. 2014 Monsoon precipitation.

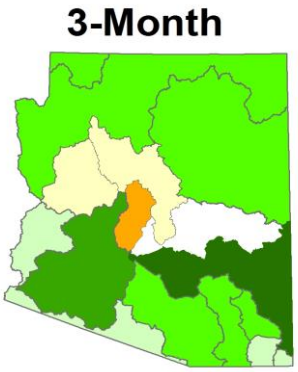

Figure 5. 2015 Monsoon precipitation.

C. Cumulative Precipitation and Streamflow Summary

→ *Precipitation*

Cumulative precipitation for water year 2015 ended up at near normal levels throughout the mountainous areas of Arizona, ranging from 90% to 94% of average in the major river basins. A well below normal winter was followed by a wetter than normal monsoon which resulted in the near normal conditions for the water year (**Table 1**).

Table 1. Water Year 2015 Mountain Precipitation (as of September 30, 2015)	
Major Basin	*Percent of 30-year Average Precipitation*
Salt River Basin	92%
Verde River Basin	94%
San Francisco-Upper Gila River Basin	90%
Little Colorado River Basin	90%

→ *Streamflow*

Overall drought status as indicated by streamflow data shows a slight decrease in drought severity from 2014 to 2015 (**Fig. 6**). Additionally there is less variability in drought conditions during 2015 than in 2014 (most basins in 2015 were defined as showing no drought or abnormally dry). Basins that increased drought status did so by only one drought category; those that decreased drought status did so by one or two categories. Out of the 26 basins; eight remained at the same level, fifteen decreased, and three increased in drought severity.

There was a trend during the fourth quarter of the 2014 water year defined by decreasing drought conditions due to significant streamflow related to monsoon season precipitation. This trend was temporarily suspended due to below average streamflow in November 2014, but during the winter season streamflow was above average and drought conditions for several basins showed no drought. For the rest of the 2015 water year, a number of basins had a slight increase in drought conditions, but overall the magnitude of drought was less than 2014.

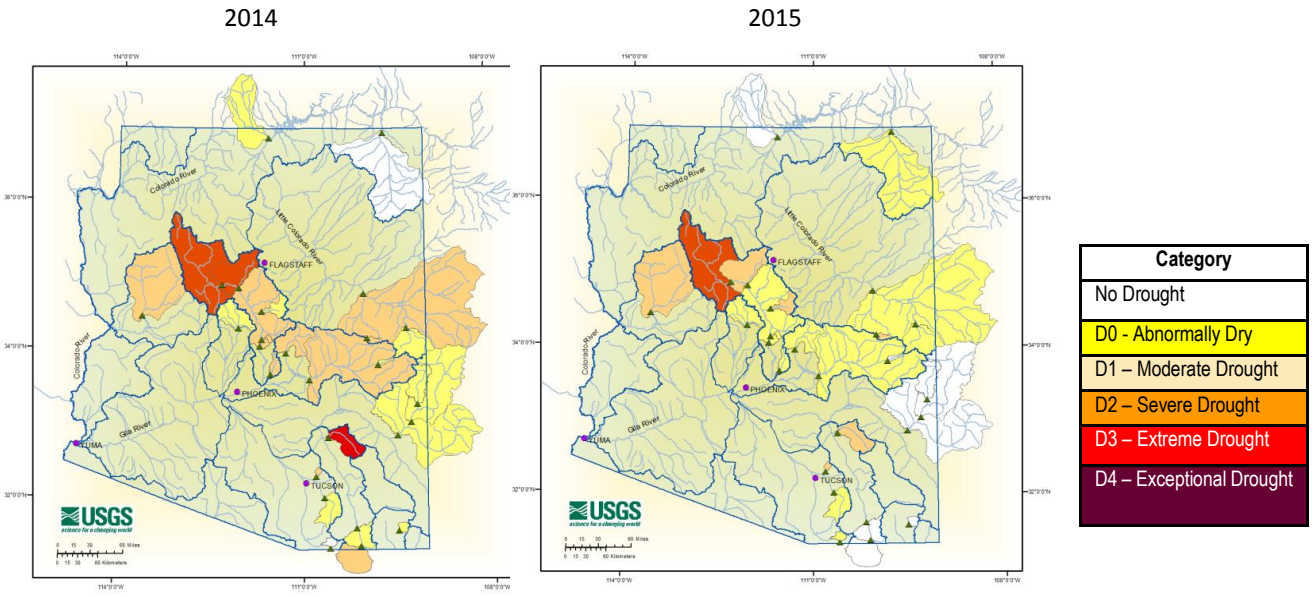

Figure 6. Overall drought condition from 2014 to 2015 improved from moderate drought to abnormally dry, as determined by USGS stream gages.

D. Drought Index Wells

Two ADWR groundwater index wells located in the southeastern part of the state serve as a qualitative supplement to existing drought indicators. The water level monitoring results below are expressed as depth to water below land surface, i.e., DTW.

→ *Lower San Pedro Watershed Groundwater Index Well*

Continuous water level monitoring of this well began in June 2007 with a DTW of 32.21 feet. Since that time, the lowest DTW recorded was 26.23 feet on September 20, 2014. The second lowest DTW was on August 7, 2007 at 29.11 feet. The greatest DTW was also recorded this past year on July 4, 2014 at 33.89 feet, and previously on July 4, 2013 at 33.85 feet.

The 2015 groundwater level trend for this well site (**Fig. 7**) correlates with decreasing drought severity over the past year, showing an overall slight increase in water levels when compared to the previous year. When compared to the water level spike of 26.23 feet DTW on September 20 water levels have decreased to more normalized conditions. The seasonality patterns observed this year are similar to water level variation seen in previous years. Annual fluctuations are observed with increases in water levels typically during summer precipitation events.

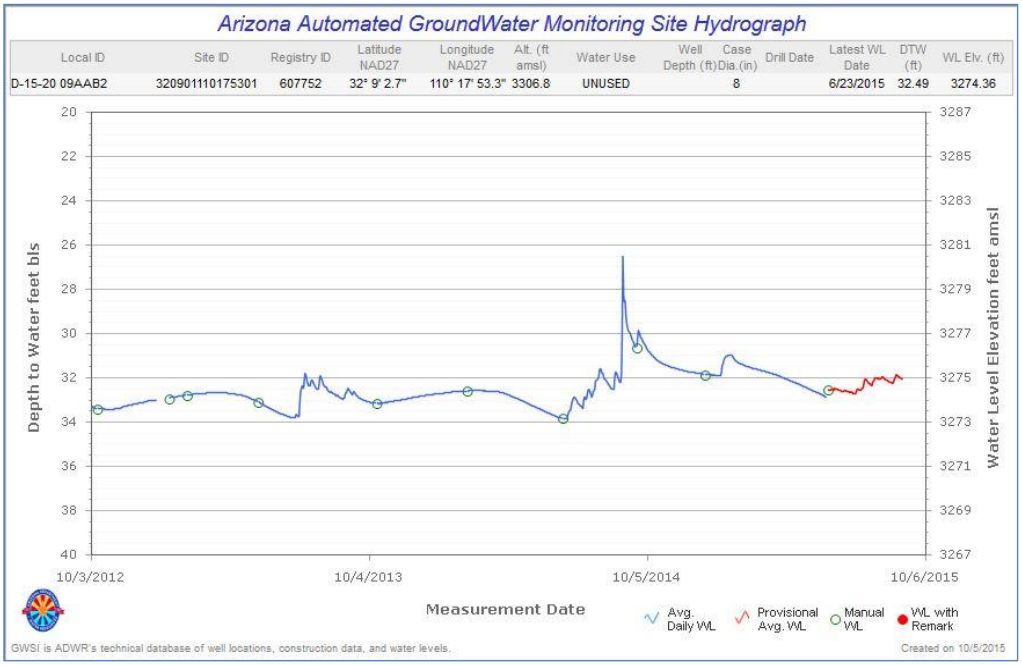

Figure 7. Continuous groundwater levels for drought index well in the Lower San Pedro Watershed (D-15-20 09AAB2).

→ *Whitewater Draw Watershed Groundwater Index Well*

Continuous water level monitoring of this well began in April 2009 with a DTW of 4.76 feet. Since this time, the highest water level recorded was on December 18, 2014 at a DTW of 1.45 feet while the lowest DTW at this site was recorded on September 13, 2012 at 18.35 feet. Groundwater levels at this site increased overall, gradually throughout the year from a DTW of 7.81 feet on July 9, 2014 to an all-time high of 1.45 feet DTW on December 18, 2014. Following the all-time high water level, water levels started to continually decline to the latest DTW measurement of 5.57 feet on October 5, 2015. As indicated by the hydrograph (**Fig. 8**), one significant spike in water level occurred (probably a precipitation event) during the year which did not alter the declining water levels for the time period following December 18, 2014. Overall water levels have increased from the previous year

correlating with improvements in long-term drought conditions from moderate to abnormally dry.

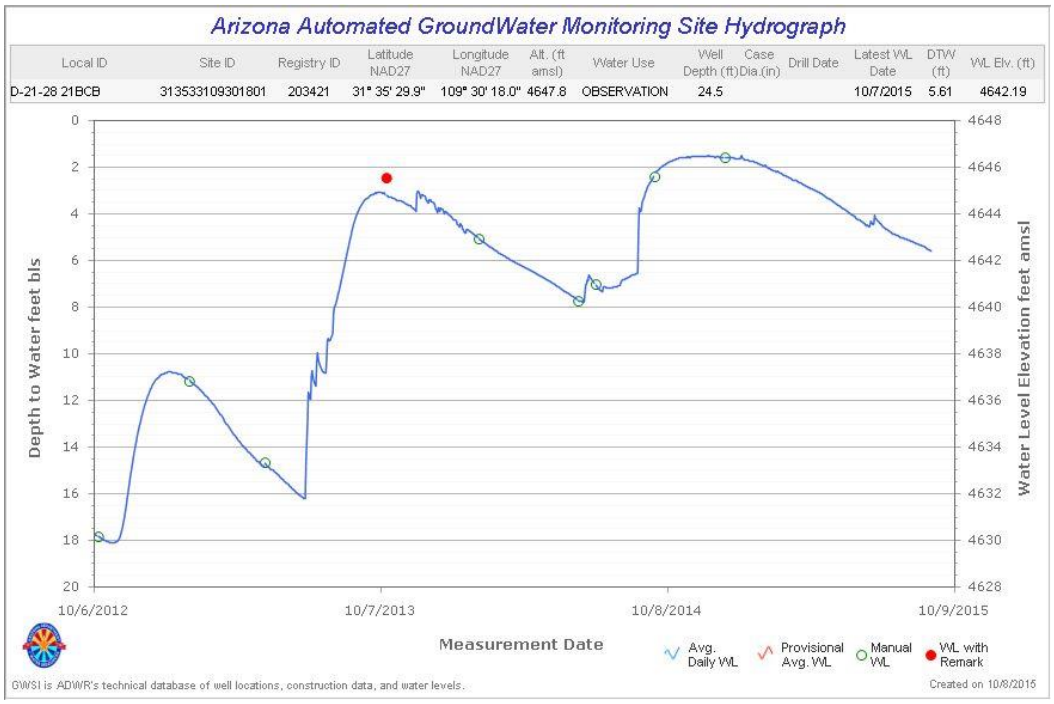

Figure 8. Continuous groundwater levels for drought index well In the Whitewater Draw Watershed (D-21-28 21BCB).

E. Drought Status Changes

Arizona's drought status is continually monitored and updated. The short-term drought status is updated weekly and monthly. The long-term drought status is updated seasonally at the end of each quarter.

→ *Short-term Drought Status*

Due to the moderate winter and wet summer, the current short-term drought (**Fig. 11**) is significantly better than a year ago (**Fig. 9**). The change from October to April (**Fig. 9 to Fig. 10**) shows that the winter did provide some short-term relief, particularly in central Navajo County, northern Coconino County and Pinal County. Yuma and La Paz counties also benefitted from some wet winter storms, improving from moderate drought and abnormally dry to no drought. Further improvement was seen through the monsoon as much of southern Arizona also improved from moderate drought to abnormally dry or no drought. Severe drought has all but disappeared from the state, and no part of the state is in extreme drought.

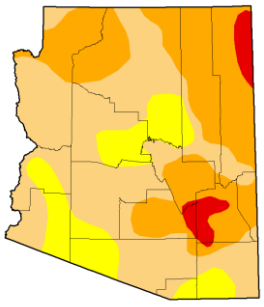

Figure 9. October 28, 2014 short-term drought status.

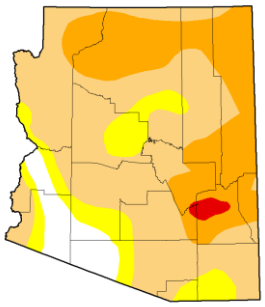

Figure 10. April 28, 2015 short term drought status.

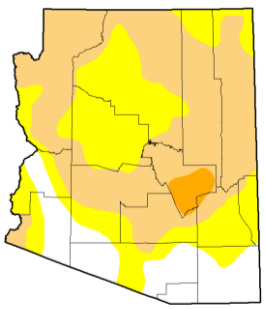

Figure 11. October 27, 2015 short-term drought status.

Level	Description	Percentile	Color
	No Drought	>30	
D0	Abnormally Dry	21-30	
D1	Moderate	11-20	
D2	Severe	6-10	
D3	Extreme	3-5	
D4	Exceptional	0-2	

→ *Long-term Drought Status*

For the long-term, 2015 brought significant improvement to most of the watersheds relative to a year ago (**Fig. 12**). Only the Verde is still at D1, moderate drought. The rest of the state is either abnormally dry or has no drought (**Fig. 13**). While the winter of 2014-15 was relatively dry in much of the state, it was wetter than all of the previous four winters, and was followed by a relatively wet spring and a very wet monsoon. The monsoon was particularly wet in the upper and lower Gila River watersheds as well as the Santa Cruz, San Pedro and Willcox Playa watersheds, areas that had been very dry. The wet spring was very helpful as the rainfall was frequent and tended to soak into the ground rather than run off. Last summer's intense monsoon also provided significant relief as the long-term conditions are based on the previous 24-, 36-, and 48-month intervals, so each successive wet season is replacing a very dry season from two, three and four years ago. The number of watersheds in each drought category over the last three years, as of October, can be seen in **Table 2**.

Arizona has been easing out of drought for the past two years, moving from several watersheds in extreme drought in 2013 to several watersheds in severe drought in 2014 to one watershed in moderate drought this year. However, while the drought appears to be easing, it is not over, since Roosevelt Reservoir is only 50% full, and Lakes Mead and Powell on the Colorado River System are also only near 50% full. Since Arizona relies on both groundwater and these surface water reservoirs, the drought is definitely not over. Also, the rate of groundwater recharge varies around the state, so some aquifers are improving, but their recovery tends to be relatively slow. Though the long-term maps incorporate streamflow, not all watersheds have sufficient streamflow data to be included, so they are depicted based solely on the standardized precipitation index.

Category
No Drought
D0 - Abnormally Dry
D1 – Moderate Drought
D2 – Severe Drought
D3 – Extreme Drought
D4 – Exceptional Drought

Figure 12. Long-term drought status as of Oct. 2014.

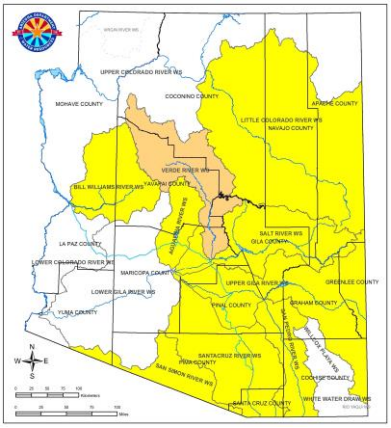

Figure 13. Long-term drought status as of Oct. 2015.

Table 2. Number of Watersheds in Each Drought Category

Category	2013	2014	2015
No Drought	0	1	6
D0 - Abnormally Dry	3	2	8
D1 – Moderate Drought	6	7	1
D2 – Severe Drought	3	5	0
D3 – Extreme Drought	3	0	0
D4 – Exceptional Drought	0	0	0

The Standardized Precipitation Index (SPI) graph (**Fig. 14**) shows the changes in drought over time: Short-term drought conditions (0 – 15 months) are at the bottom, and longer term drought conditions (48 – 60 months) are near the top. The bottom bar graph shows

the monthly anomalies with green being wetter than average and brown being drier than average.

Across the top of the SPI graph there are two wet long-term periods, the first from 1981 through spring of 1988, followed by a short abnormally dry period from spring 1990 through the summer of 1992. The second wet period began in the winter of 1992 and continued through the winter of 1994 when the current long-term drought began. The most intense period of the current drought for Arizona was 2002 through 2004, however, the long-term drought continues in the state.

For more information about how the graph can be used to correlate precipitation and drought impacts, visit the Climate Science Application Program website at http://cals.arizona.edu/climate/misc/spi/spicontour.png.

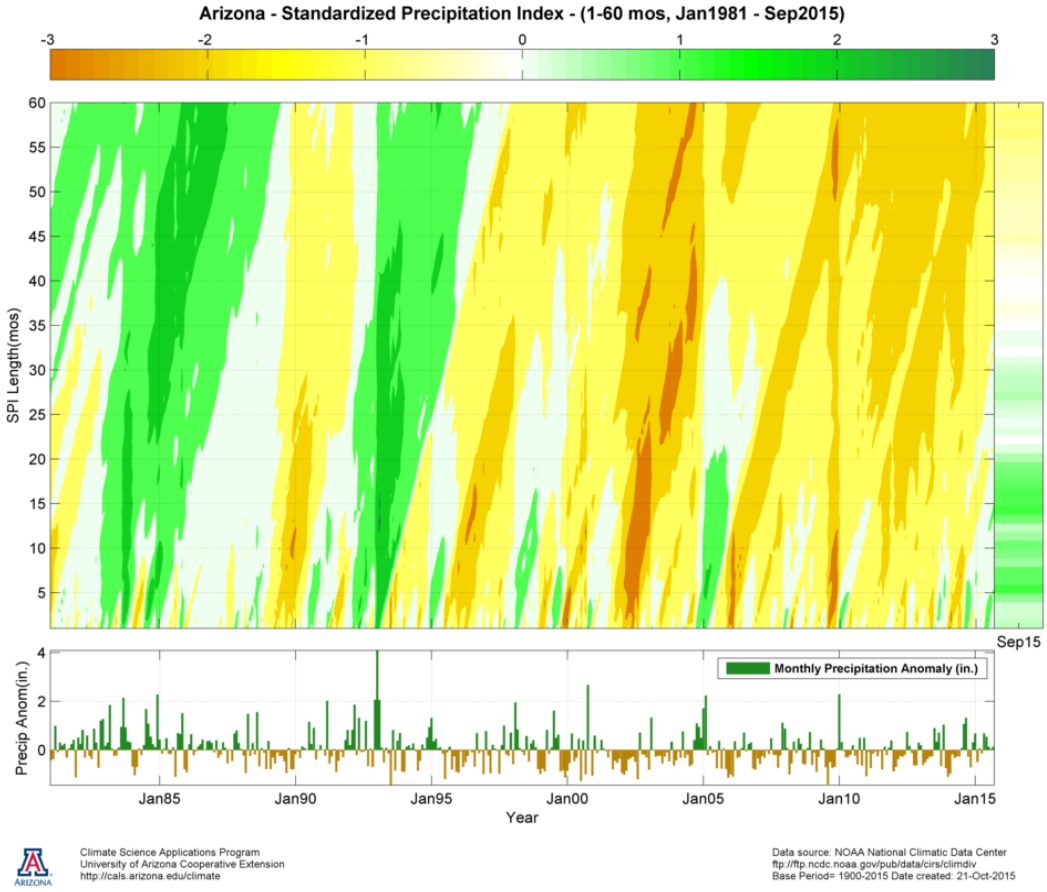

Figure 14. Standardized precipitation index and precipitation anomalies.

F. Outlook for 2014 - 2015

→*Winter 2015-2016*

Sea surface temperatures across the central and eastern equatorial Pacific Ocean (a proxy for El Niño/La Niña) have warmed substantially during the spring and summer months of 2015. We are now in the midst of a strong El Niño episode, and in fact, one of the strongest recorded since 1950**. Figure 15** depicts recent sea surface temperature anomalies, and the classic strong El Niño signature featuring a tongue of very warm water straddling the equator. There is better than a 95% chance that these El Niño conditions will persist through the winter season. Strong El Niño has the most predictable and consistent signal for wet weather in Arizona during the winter months. (**Appendix A**).

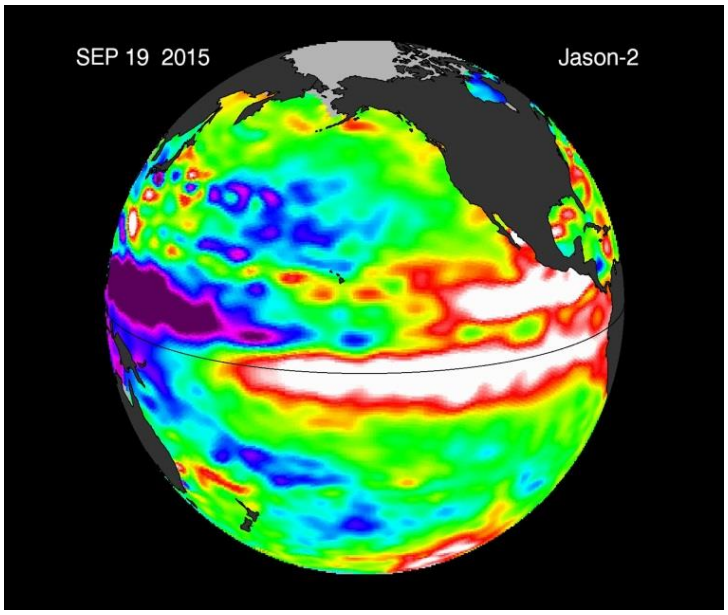

Figure 15. Sea surface temperature anomalies – September 2015.

The official outlook from NOAA's Climate Prediction Center depicts the chances of temperatures and precipitation being in the above normal, near normal, or below normal categories. The outlook for January-March 2016 (**Fig. 16**) shows about equal chances for above, below, or near normal temperatures. The precipitation outlook is consistent with strong El Niño seasonal composites and shows significantly better odds that totals will fall in the above normal category (50-65% chance of above normal versus only 5-15% chance of below normal).

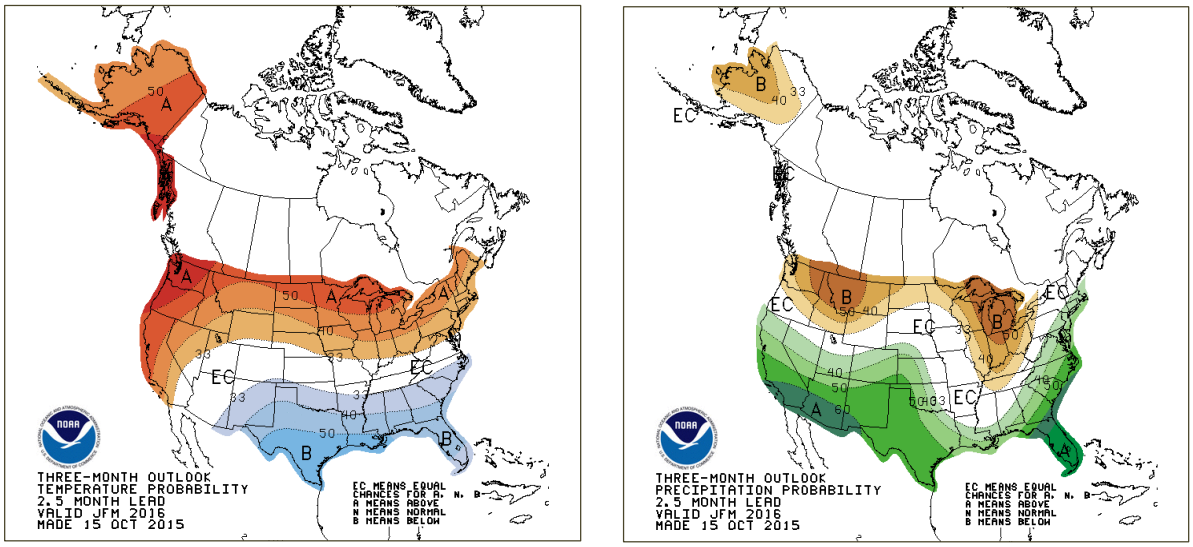

Figure 16.January – March 2016 outlooks for temperature (left) and precipitation (right). Shading indicates the percentage of increased chances for being above or below normal. (Climate Prediction Center)

→ *Summer 2015*

The Climate Prediction Center's outlook for June-August 2016 (**Fig. 17**) shows better chances that the average temperature during these three months will be above normal statewide. This outlook is based primarily in recent trends over the past 10 years (climate change) versus the longer term 30-year average. The precipitation outlook shows no discernible signal during this period. That is, there are equal chances for the 2016 monsoon season to have above, below, or near normal rainfall. This is very typical for our monsoon

season where thunderstorm activity is usually localized, and not influenced by larger scale climate signals (the most likely outcome is for El Nino to weaken and head towards a neutral state during spring-summer 2016).

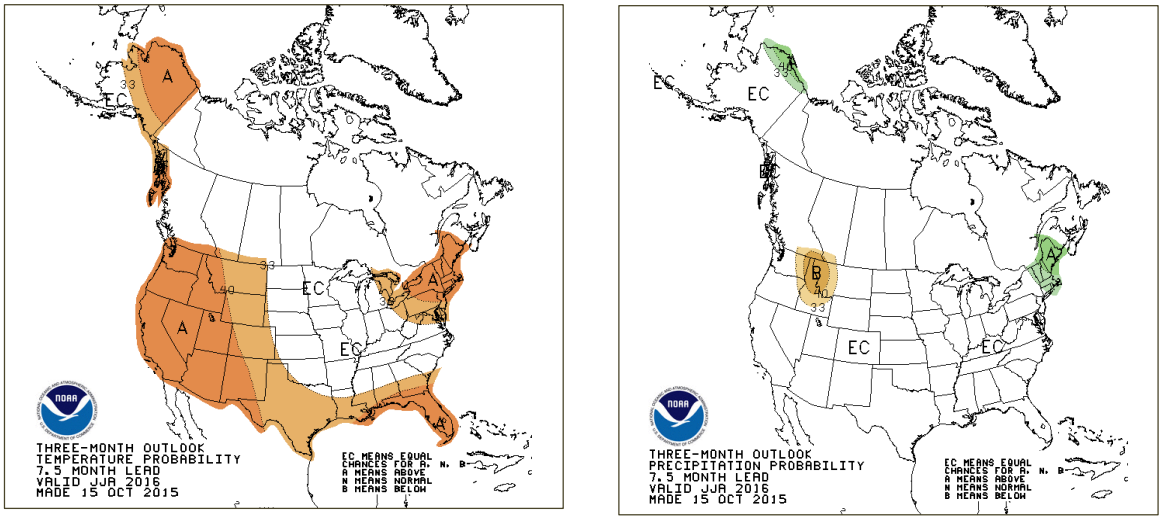

Figure 17. June – August 2016 outlooks for temperature (left) and precipitation (right). Shading indicates percentage increased chances of being above or below normal. (Climate Prediction Center)

3. Drought Declarations

A Drought Emergency Declaration has been in effect in Arizona since 1999. The current declaration, PCA 99006, was issued by the Governor in June 1999 and continued by Executive Order 2007-10. The declaration maintains the state's ability to provide emergency response if needed, and enables farmers and ranchers to obtain funding assistance through the Farm Service Agency if they experience significant production losses due to drought. The Drought Interagency Coordinating Group (ICG) is responsible for providing recommendations to the Governor regarding drought declarations based on presentations and discussions at the spring and fall ICG meetings.

4. Disaster Designations

A disaster designation from the Secretary of the U.S. Department of Agriculture (USDA) is necessary for farm operators in both primary and contiguous disaster areas to be considered for assistance from the Farm Service Agency. The USDA uses the U.S. Drought Monitor to help determine designations. Extreme (D3) or Exceptional (D4) drought conditions qualify as automatic designations, while severe (D2) drought for eight consecutive weeks during the growing season qualifies for nearly automatic designation. This "Fast Track" authority designation process delivers fast and flexible assistance to farmers and ranchers.

The following disaster designations by the U.S. Department of Agriculture occurred this water year:

- February 4, 2015: Five counties (Apache, Cochise, Gila, Graham and Pinal) were designated as primary disaster counties; the seven contiguous disaster counties (Coconino, Greenlee, Maricopa, Navajo, Pima, Santa Cruz and Yavapai) also received disaster designations.

- February 4, 2015: One county (Apache) was named as a contiguous disaster county, which was the result of the designation of Colfax, McKinley, Quay, San Juan and Union counties in New Mexico.
- February 4, 2015: One county (Mohave) was named as a contiguous disaster county, which was the result of the designation of Churchill, Emeralda, Humbolt, Lander, Lyon, Mineral, Nye, Pershing, Washoe and Carson City counties in Nevada.
- February 4, 2015: Two counties (La Paz and Mohave) were named as contiguous disaster counties, which was the result of the designation of 55 counties in California.
- February 25, 2015: Two counties (Coconino and Mohave) were designated as primary disaster counties; the four contiguous disaster counties (Gila, La Paz, Navajo and Yavapai) also received disaster designations.
- March 4, 2015: Four counties (Greenlee, Navajo, Pima and Yavapai) were designated as primary disaster counties; the eleven contiguous disaster counties (Apache, Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pinal and Santa Cruz) also received disaster designations.
- March 4, 2015: Two counties (La Paz and Yuma) were named as contiguous disaster counties, which was the result of the designation of Imperial County in California.
- March 4, 2015: Two counties (Apache and Greenlee) were named as contiguous disaster counties, which was the result of the designation of nine disaster counties in New Mexico.
- April 8, 2015: One county (Maricopa) was designated as a primary disaster county; the six contiguous disaster counties (Gila, La Paz, Pima, Pinal, Yavapai and Yuma) also received disaster designations.
- April 22, 2015: One county (Mohave) was named as a contiguous disaster county, which was the result of the designation of Beaver, Iron, Millard, and Washington counties in Utah.

5. Drought Preparedness Plan Implementation Highlights

A. Water Supply Status

→ *2015 Colorado River Basin and Reservoir Status*[1]

Near average stream flows were observed throughout much of the Colorado River Basin during water year 2015. Unregulated inflow[2] to Lake Powell was 10.17 million acre-feet (MAF), or 94% of the 30-year average[3] (10.83 MAF). Unregulated inflow to Flaming Gorge, Blue Mesa, and Navajo Reservoirs was 106, 105, and 84% of average, respectively.

Precipitation in the Upper Colorado River Basin was below average during the first part of water year 2015 and above average during the second part. On September 30, 2015, the cumulative precipitation received within the Upper Colorado River Basin was 91% of average.

Snowpack conditions trended below average across most of the Colorado River Basin throughout the snow accumulation season. The basin-wide snow water equivalent

[1] The source of the information in this section is taken from the United States Bureau of Reclamation's August 2016 draft "Annual Operating Plan for Colorado River Reservoirs 2016." The information has been updated to the end of the 2015 water year, where appropriate.

[2] Unregulated inflow adjusts for the effects of operations at upstream reservoirs. It is computed by adding the change in storage and the evaporation losses from upstream reservoirs to the observed inflow. Unregulated inflow is used because it provides an inflow time series that is not biased by upstream reservoir operations.

[3] All unregulated inflow, precipitation, and snowpack statistics are based on the 30-year period 1981-2010.

measured 62% of average on April 1, 2015. Total seasonal accumulation peaked at approximately 74% of average on March 9, 2015. On April 1, 2015, the snow water equivalents for the Green River, Upper Colorado River Headwaters, and San Juan River Basins were 74, 81, and 47% of average, respectively.

During the 2015 spring runoff period, inflows to Lake Powell peaked on June 15, 2015 at approximately 53,100 cubic feet per second (CFS). The April through July unregulated inflow volume for Lake Powell was 6.71 MAF, which was 94% of average.

Lower Basin tributary inflows above Lake Mead were below average for water year 2015. Tributary inflow from the Little Colorado River totaled 0.093 MAF, or 64% of the long-term average. Tributary inflow from the Virgin River totaled 0.092 MAF, or 51% of the long-term average.

Tributary inflows in the Lower Colorado River Basin below Hoover Dam were below average during water year 2015. Total tributary inflow from the Bill Williams River was 0.021 MAF, or 22% of the long-term average, and total tributary inflow from the Gila River was 0.004 MAF.

The Colorado River total system storage experienced a net increase of 0.385 MAF in water year 2015. Reservoir storage in Lake Powell increased by 0.302 MAF. Reservoir storage in Lake Mead decreased by 0.272 MAF. At the beginning of the water year (October 1, 2014), Colorado River total system storage was 50% of capacity. As of September 30, 2015, total system storage was 51% of capacity.

At the beginning of calendar year 2015, the probability of Lower Colorado River Basin shortage declaration in 2016 was 21%. Due to the low runoff into Lake Powell during January through March 2015, US Bureau of Reclamation's April projections for a shortage in 2016 increased to 33%. Because of the unusually high precipitation in the Upper Colorado River Basin in May, runoff forecasts for unregulated inflow into Lake Powell increased markedly and Reclamation's projection of a Lower Colorado River Basin shortage decreased to 1%. The official operational forecast for 2016 made by Reclamation in August shows a 0% chance of shortage in 2016 and 18% chance of a shortage declaration in 2017.

→ *2015 Salt – Verde Reservoirs*

This is the fifth consecutive year that the Salt and Verde watersheds experienced below median winter runoff. Even so, the Salt and Verde reservoirs have remained at the same levels as this time last year, approximately 49% full. This is due to the continued use of groundwater to meet demand, a fairly active monsoon season, and a general decrease in demand over historical norms. If projections for very low inflow hold, this consecutive five year period will be the driest five year period on record (1913-2015). Even if this record is set by the end of the year, projections for this winter are much more promising with very strong El Niño conditions present in the tropical Pacific. Arizona typically benefits from increased winter storms during these events. Forecasts call for Arizona to have a greater likelihood of wet weather from now through spring of 2016.

→ *Rural Areas*

While the most populated areas of the state are subject to stringent groundwater management, have mandatory water conservation requirements and have access to diverse water supply portfolios, most of rural Arizona relies exclusively on groundwater as its primary water source, and lacks comprehensive groundwater management regulation. The lack of targeted groundwater management along with the effects of the ongoing drought can result in water supplies being more stressed in some areas of rural Arizona.

Willcox Basin

Since September 2014, ADWR has been working with water users in the Willcox Basin, at their request, to develop water management strategies to ensure that the necessary water supplies are available to meet their current and future water demands. Through this

process the water users in the Willcox Basin have developed a new water management concept to address the unique management issues in the Willcox Basin. The Groundwater Conservation Area (GCA) concept (which is still in draft form and is still in flux) is the result of collective inputs from the various water users in the Willcox Basin. The intent of the GCA is to limit, but not eliminate, the growth in groundwater pumping and minimize negative impacts to groundwater users by maximizing conservation of water use with minimal regulatory footprint. More information regarding this matter is available at: http://www.azwater.gov/azdwr/PublicInformationOfficer/SEArizonaInformation.htm

Currently, there are only two water management tools available that were designed to directly manage groundwater withdrawal and use. These tools are Active Management Areas (AMAs) and Irrigation Non-Expansion Areas (INAs). Groundwater withdrawn from inside of an AMA can be subject to withdrawal fees, metering, annual reporting, conservation requirements, and other provisions, while groundwater withdrawn from inside of an INA can be subject to metering and reporting.

San Simon Valley Sub-basin

In the spring of 2015, ADWR received a petition for the initiation of procedures to designate the San Simon Valley Sub-basin of the Safford Groundwater Basin as an INA. Within an irrigation non-expansion area there is a prohibition on irrigating new acres, as well as metering and reporting requirements for most wells that pump over 35 gallons per minute.

Arizona law provides that the Director of ADWR can designate an area as a subsequent INA if both the following apply: 1) there is insufficient groundwater to provide a reasonably safe supply for irrigation of the cultivated lands at current rates of withdrawal and 2) the establishment of an AMA is not necessary.

After holding a public hearing, reviewing the factual data in ADWR's possession, and considering public comments, the Director made and filed his Decision on August 12, 2015 determining that the San Simon Valley Sub-basin should not be designated as an INA.

On September 25, 2015, a party filed a timely motion for rehearing or review of the Director's Decision. The Director denied the motion on October 9, 2015. The Director's Decision is now a final administrative decision and may be subject to judicial review. For more information, visit: http://www.azwater.gov/azdwr/SanSimonValley.htm

B. Drought Planning for Community Water Systems

Drought planning requirements and water use reporting regulations were recommended in the 2004 Arizona Drought Preparedness Plan and established by the state legislature in 2005 for the purpose of reducing community water systems' vulnerability to drought and providing a means for the state to gather water use data to provide assistance.

All community water systems in the state (approximately 800) are required to submit a Drought Preparedness Plan to ADWR every five years. The Drought Preparedness Plan is part of the required System Water Plan, which also includes a Water Supply and Conservation plans. The drought plan requires water systems to describe their drought stages and triggers, emergency sources of water, customer communication strategies, and other planning actions.

ADWR provides assistance to water providers in meeting these requirements through web-based resources, online reporting tools and phone or in-person consultations. To date, ADWR has received 670 initial and 461 updated System Water Plans. The number of annual water use reports received from systems located outside the state's AMAs can be seen in **Table 3**. (Annual water reports have been required for systems inside the AMAs since the passage of the 1980 Groundwater Act.)

Table 3: Annual Water Use Reports Received from CWS Located Outside Active Management Areas

	2014	2013	2012	2011	2010	2009	2008	2007 (1st yr)
Number of reports received out of total CWS for that year:	383/462	382/468	382/461	394/461	390/469	383/484	396/481	387/463
Percent of population represented by reports received:	97%	96%	93%	97%	96%	95%	96%	97%

C. Local Drought Impact Group Efforts

Local Drought Impact Groups (LDIGs) participate in monitoring, education and local mitigation, mainly through cooperative extension and county emergency management programs. Initial planning efforts included ten LDIGs, and as many as eight LDIGs have been active in the past. Since 2008, LDIG focus has been entirely on drought impact monitoring and reporting in response to local fiscal and staffing limitations. At the present time, only Mohave County and Pima County are active. See **Appendix B** for the Mohave County LDIG report and **Appendix C** for the Pima County LDIG Report.

D. State Drought Monitoring Technical Committee Efforts

The State Monitoring Technical Committee (MTC) is responsible for gathering drought, climate, and weather data, and disseminating that information to land managers, policy-makers and the public. Specifically, the MTC prepares the short- and long-term drought status reports, briefs the ICG on drought conditions, and provides assistance to Local Drought Impact Groups. The two co-chairs are Nancy Selover, State Climatologist, and Mark O'Malley, National Weather Service, Phoenix Office.

→ *Communicating Drought Status*

The MTC and ADWR coordinate to achieve the primary goal of improving the accessibility of drought information to resource managers, state decision-makers and the public. To further communication, information is updated on the ADWR Drought Status webpage on a weekly, monthly and quarterly basis as follows:

Weekly - The MTC confers weekly with the National Weather Service offices that cover Arizona, Flood Control Districts, LDIGs, water and rangeland managers, agricultural extension and others who observe and report drought impacts, to advise the U.S. Drought Monitor authors on the current conditions in Arizona, and makes recommendations about the position of the drought boundaries for Arizona. The U.S. Drought Monitor is the official record of drought for Federal drought relief claims. Information used by the MTC in advising the Drought Monitor authors includes numerous drought indices, precipitation and stream flow data, and impacts data. Every Thursday, the ADWR Drought Status webpage automatically updates with the latest U.S. Drought Monitor map of Arizona.

Monthly - At the end of each month, the MTC produces a web-based, short-term drought status update based on U.S. Drought Monitor's maps for the past four weeks. An email with the latest map and summary is sent to interested parties.

Quarterly - The MTC meets on a quarterly basis and produces a long-term drought status map and summary report. This report incorporates the 24-, 36- and 48-month precipitation and streamflow percentiles for major Arizona watersheds (i.e., 4-digit U.S. Geological Survey Hydrologic Unit Code (HUC)). Vegetation indices, snowpack, temperature, reservoir levels, and county-scale drought impact information are used to verify or modify the result of the calculations. The long-term drought status reports are posted on the ADWR website and disseminated via email seasonally: in May (for January – March), August (for April – June), November (for July – September) and February (for October – December).

The monthly and quarterly reports serve as an information resource for the public and as a planning tool for resource managers developing mitigation and response strategies.

→ *Arizona DroughtView*

DroughtView, a new University of Arizona program that replaced DroughtWatch, is an online tool for collecting drought impact data that incorporates several remote sensing and climate drought monitoring products. For more information, visit the DroughtView website at http://droughtview.arizona.edu

→ *Community Collaborative Rain Hail and Snow (CoCoRaHS) Network*

The CoCoRaHS network of citizen precipitation observers in Arizona continues to expand. A drought impacts reporting tool enables the 1002 observers in Arizona to efficiently add their drought impact observations to their precipitation observations. An online Drought Impacts Reporting Guide explains drought and its impacts as well as how to report various impacts. Drought data is intended to go directly to the Drought Impacts Reporter. The data collected are important in Arizona's drought monitoring as well as flood warning. There is at least one observer in every county.

→ *ADWR Drought Index Wells*

ADWR's Field Services Section collects groundwater levels statewide from approximately 1,800 index wells, including the state's two drought index wells. ADWR also monitors aquifer storage and maintains a statewide network of roughly 120 automated groundwater monitoring sites and an ORACLE database that contains field-verified data including discrete water level measurements, location, and other well specific information.

In 2015, ADWR staff developed a Monitoring Well Network Optimization Plan, which in part will focus on the identification of additional drought monitoring index wells within the state. Water level data from continuous monitoring sites statewide will be reviewed and evaluated with respect to meeting criteria for the USGS Climate Response Network. Drought index wells identified will be integrated with USGS Climate Response Network monitoring sites in Arizona.

→ *Calculating the Standardized Precipitation Index*

The MTC is experimenting with the use of gridded precipitation data to create gridded standardized precipitation index (SPI) maps and a gridded drought status map, using the same calculations for drought status currently used for watershed level mapping. The gridded maps will provide smoother transitions across the state rather than the abrupt watershed boundaries. The results should be more reflective of the Drought Monitor maps and will facilitate internal decision making. Even though drought declarations may be made at the county level, the higher resolution data will provide better information about which parts of individual counties are having the worst drought problems.

→ *Drought Impact Reports from State and Federal Agencies*

Drought impact data is used by the Drought MTC in its efforts to correlate drought conditions with precipitation and streamflow data. Impact information is received from hydrologists, researchers and other field staff from the Bureau of Land Management, United States Geological Survey, U.S.D.A. Natural Resources Conservation Services, Arizona

Forestry Division, Arizona Game and Fish Department, Arizona State Parks, Native American Communities and other state and federal groups.

Arizona State Park Managers have been asked to rate drought conditions from 1 to 10 and provide comments for more than 30 individual state parks. (**Appendix D**). Compared to last year, this year saw improvements in most of the ratings.

The U.S.D.A. Arizona Natural Resources Conservation Service submits a water year report (**Appendix E**) about the impacts of drought on range and farmland. The 2015 survey sent to all NRCS field offices in the state describes drought impacts on dryland farming, irrigation water supply, rangeland water supply, rangeland forage supply, and rangeland precipitation. Losses of crop production, shortages of water supply, and shortages of forage were reported.

→ ***Presentations and Workshops***

Western Governors' Drought Forum, October 2014 and July 2015
Arizona is an active participant in the Western Governors' Drought Forum initiated by Nevada Governor Brian Sandoval in September 2014. The forum fosters a regional dialogue in which states share best practices on drought policy, preparedness and management. The forum hosts meetings that focus on specific sectors and is creating an online resource library with drought resources such as webinars, Science Briefs and drought tools.

Dr. Nancy Selover, Arizona State Climatologist and Drought MTC co-chair, presented at the October 8-9, 2014 meeting in Tempe. Einav Henenson, ADWR conservation specialist, participated in the July 2015 meeting in Seattle, which focused on the roles of drought coordinators and emergency managers in drought preparedness and response.

Climate Prediction Applications Science Workshop (CPASW), March 24-26, 2015
Dr. Michael Crimmins, University of Arizona, presented at the 13th annual CPASW workshop at New Mexico State University, Las Cruces. The workshop theme was "Climate and Drought Information for Food Resilience, Agriculture, and Water Resources". The presentation was titled *Exploring Summer Season Precipitation Monitoring Strategies for Arizona Ranchers and Range Managers*.

Arizona Hydrologic Society Presentation, September 16-18, 2015
Mark O'Malley, State Monitoring and Technical Committee co-chair, provided the keynote luncheon address focusing on how drought is measured and determined in Arizona's arid climate; and potential effects of the upcoming 2015-16 El Nino on water resources. The theme of this year's symposium was "Where Did the Water Go?". Not only was statewide drought a focus, but legal frameworks and water rights between sectors and municipalities were also studied and discussed. The goal of this year's symposium was for sponsors and hydrologists to have a better understanding of water storage and routing, and provide a basis for future discussion and planning of water resources for Arizona.

E. Interagency Coordinating Group Efforts

The Interagency Coordinating Group (ICG) has met biannually since 2006 and advises the Governor on drought status, impacts, and any necessary preparedness and response actions. The meetings include a review of statewide monitoring efforts and drought status, water supply updates, rangeland conditions, forest health, and the impacts of drought on wildlife. At both the November 2014 and May 2015 meetings, the ICG recommended continuation of the Drought Declaration for the State of Arizona (Executive Order 2007-10) and the Drought Emergency Declaration (PCA 99006). The presentations and subsequent decisions are on the ADWR web site. In 2015, ADWR director Thomas Buschatzke replaced Michael Lacey as ICG co-chair and Wendy Smith Reeve, Arizona Department of Emergency Management director, replaced Chuck McHugh as co-chair.

F. ADWR Outreach and Assistance

ADWR promotes and encourages efficient use of water throughout Arizona by developing conservation tools and resources, assisting Arizona communities and water providers, presenting on conservation issues and solutions, collaborating with regional and national partners, and participating in outreach activities. Staff provides materials and answers inquiries from the general public, the press, water professionals, students, researchers, and others about water conservation and drought. Staff also administers the Arizona Water Awareness website, ArizonaWaterAwareness.com, a central source of information for all Arizonans about water, including current conservation events and activities, regional and seasonal tips, and resources about a variety of conservation topics.

→ *Colorado River Shortage Preparedness Workshop, April 22, 2015*

In an effort to provide stakeholders with the most relevant and timely information available related to current Colorado River conditions and possible shortage impacts to Arizona, ADWR and Central Arizona Project co-hosted a Colorado River Shortage Preparedness Workshop. Nearly 300 individuals participated in the event, including US Congressional and Senate staff, the Governor's Office, State legislators, tribal leaders, representatives from California and Nevada, cities, industrial and agricultural water users, on-river water users and members of the media and the public. ADWR created the following webpage dedicated to Arizona's efforts to respond to a potential Colorado River shortage declaration:
http://www.azwater.gov/azdwr/ColoradoRiverShortagePreparedness.htm

→ *Testimony to the U.S. Congress, June 2, 2015*

Thomas Buschatzke, ADWR Director, provided testimony to the U.S. Senate Committee of Energy and Natural Resources in support of additional opportunities for federal support of programs to conserve water that are equitable, consistent with the Law of the River, do not impinge on Arizona's efforts to deal with the drought, and that will benefit the entire Colorado River system rather than any one particular Colorado River water user (**Appendix F**).

→ *Water Awareness Month, April 2015*

ADWR has coordinated Arizona's Water Awareness Month campaign since the Governor's executive order in 2008. In 2015, ADWR conservation personnel participated and exhibited Water Awareness Month and conservation information as well as distributed free educational materials at the SRP Water Conservation Expo on March 7th and the Fix A Leak Week 4 Miler Run on March 21st. For more information, visit http://www.waterawarenessmonth.com/.

6. Resource Needs

A. Develop a strategic plan to identify data gaps and monitoring needs.

Arizona's current network of meteorological and hydrological observations for drought monitoring lacks sufficient spatial resolution to accurately characterize drought status at the local level requested by stakeholders throughout the state. Improving the spatial, temporal and altitudinal resolution of Arizona's drought monitoring network will improve the MTC's ability to serve the needs of Arizona stakeholders, including the LDIGs. In particular, Arizona faces the following conspicuous data gaps:

- Absence of soil moisture monitoring
- Few high elevation meteorological monitoring stations
- Constantly decreasing network of streamflow gages

Although the MTC has identified these data gaps in general terms, it is imperative to conduct a systematic evaluation in order to characterize and prioritize these identified data and observation gaps. A strategic plan, with carefully considered criteria for prioritization, is essential for making state funding requests and for taking advantage of Federal funding opportunities. The MTC recommends funding to develop a strategic plan, conduct data and

observation gap analyses, and document priority locations using geographic information system technology. *Total cost: $9,000*

B. Incorporate groundwater data for drought status determination.

ADWR evaluates groundwater level changes around the state, however, further analysis is needed to determine what role drought plays in these observed changes. Drought index wells serve as a qualitative supplement to existing drought indicators and help establish drought status for watersheds where either precipitation or stream flow data are lacking. The Basic Data Unit of the Field Services Section is exploring the use of groundwater data in a more quantitative manner, perhaps by a modified Palmer index. As the groundwater level signature may include influences other than a climate response, such as pumping or artificial recharge, additional research is needed to determine the suitability of each well site with regards to percentile analysis. The MTC plans on further assessment of statewide groundwater index wells to identify and incorporate data that meet the criteria for drought index wells. Incorporating groundwater level trend data will be critical in determining future drought conditions and impacts on water supply. Funding is needed to implement the Monitoring Well Network Optimization Plan **(Appendix G**) which was developed last year and integrates many of ADWR ORACLE databases, thus allowing for drought monitoring well identification. *Total cost: $138,000 per year.*