



ARIZONA DROUGHT PREPAREDNESS

ANNUAL REPORT
2022

FOR WATER YEAR 2022:
OCTOBER 1, 2021 - SEPTEMBER 30, 2022





Acknowledgments

The *Arizona Drought Preparedness Plan* was adopted in 2004 and its continued implementation was ordered in 2007 (Executive Order 2007-10). The Arizona Department of Water Resources (ADWR) prepares an annual report based on drought updates from the Drought Monitoring Technical Committee (MTC), Governor's Drought Interagency Coordinating Group (ICG), Local Drought Impact Groups (LDIGs), and others. The 2022 Arizona Drought Preparedness Annual Report covers the drought conditions and preparedness activities for Water Year 2022, from October 1, 2021, through September 30, 2022.

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1. INTRODUCTION

Arizona has a long history of drought due to its arid and semi-arid climate. The latest drought conditions have been in place across Arizona since approximately 1994. The average annual statewide precipitation per water year¹ is 12.26 inches (based on records of Water Year (WY) 1896 to 2022). In the past 29 water years (since WY1994), more than two-thirds (20 years) have been below average. While there is no overall trend in precipitation across the period of record, the annual statewide precipitation trend since WY1994 shows a decrease in precipitation of 0.02 inches per decade (**figure 1**).

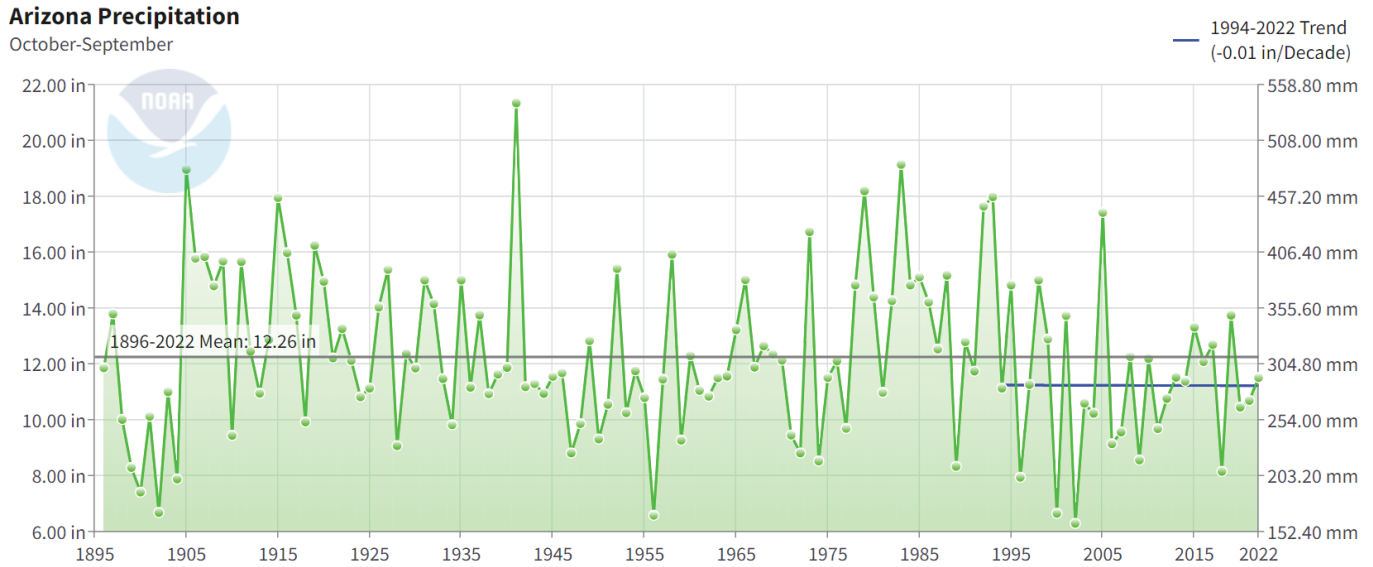


Figure 1. Arizona precipitation from October-September from 1896 to 2022. The average annual statewide precipitation per water year is 12.26 inches.

The annual average statewide temperature per water year is 59.7°F (WY1896-2022). The average statewide temperature for WY2022 was above average at 62.2°F. Since WY1994, only one year (WY1997) has been below average. The annual statewide temperature trend since WY1994 shows an increase in temperature of 0.5°F per decade (**figure 2**).

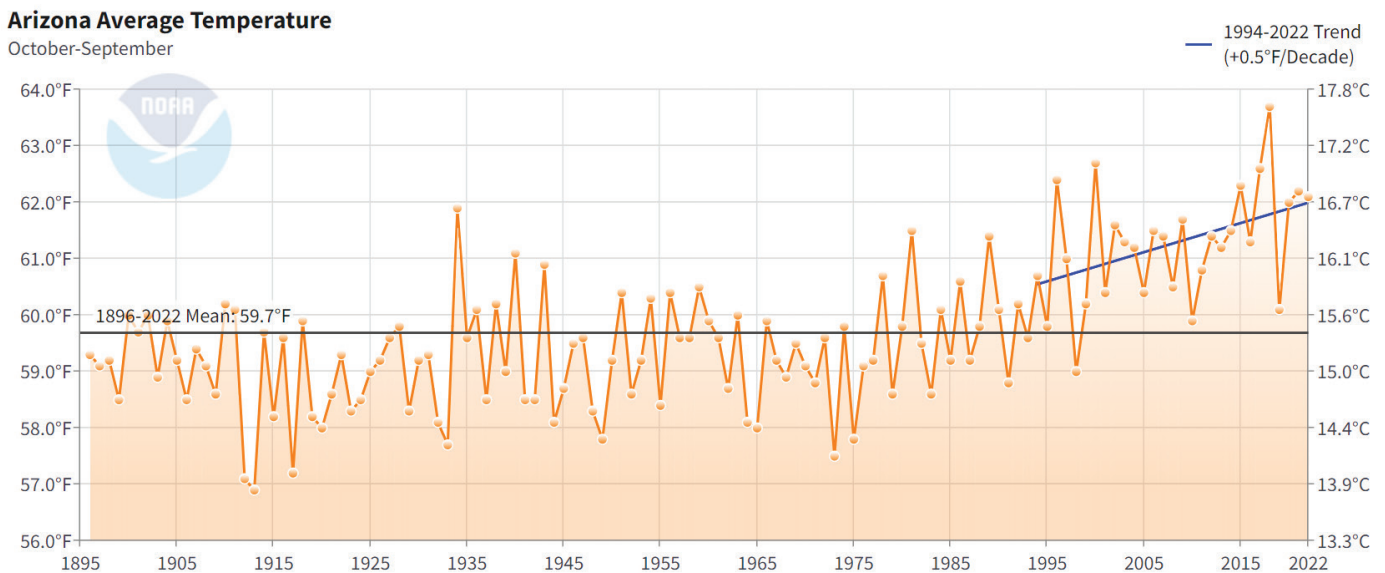


Figure 2. Arizona Average Temperature from 1896 to 2022 for October-September. The average annual statewide temperature per water year is 59.7°F.

¹A water year consists of 12 consecutive months starting October 1 and ending September 30.

Total statewide precipitation for WY2022 was below average at 11.39 inches. Northeastern and southeastern counties received higher amounts of precipitation during WY2022 due to a very wet monsoon season in those locations, with up to 150% of normal water year precipitation (**figure 3**). Western and central counties received roughly 50% of average precipitation during the water year. Some locations, including portions of Mohave, Coconino, Maricopa, and Pima counties received near average precipitation for the water year.

December was the wettest winter month for the water year as several frontal systems crossed the state, bringing Maricopa, Gila, and Yavapai counties up to 150% of average December precipitation. However, April and May were the driest April-May on record, with no measurable precipitation in the state in May. The first monsoon precipitation was received on June 18. Monsoon activity continued with very few breaks into September. June to September was the 9th wettest on record, measuring 140% of the average statewide June to September precipitation.

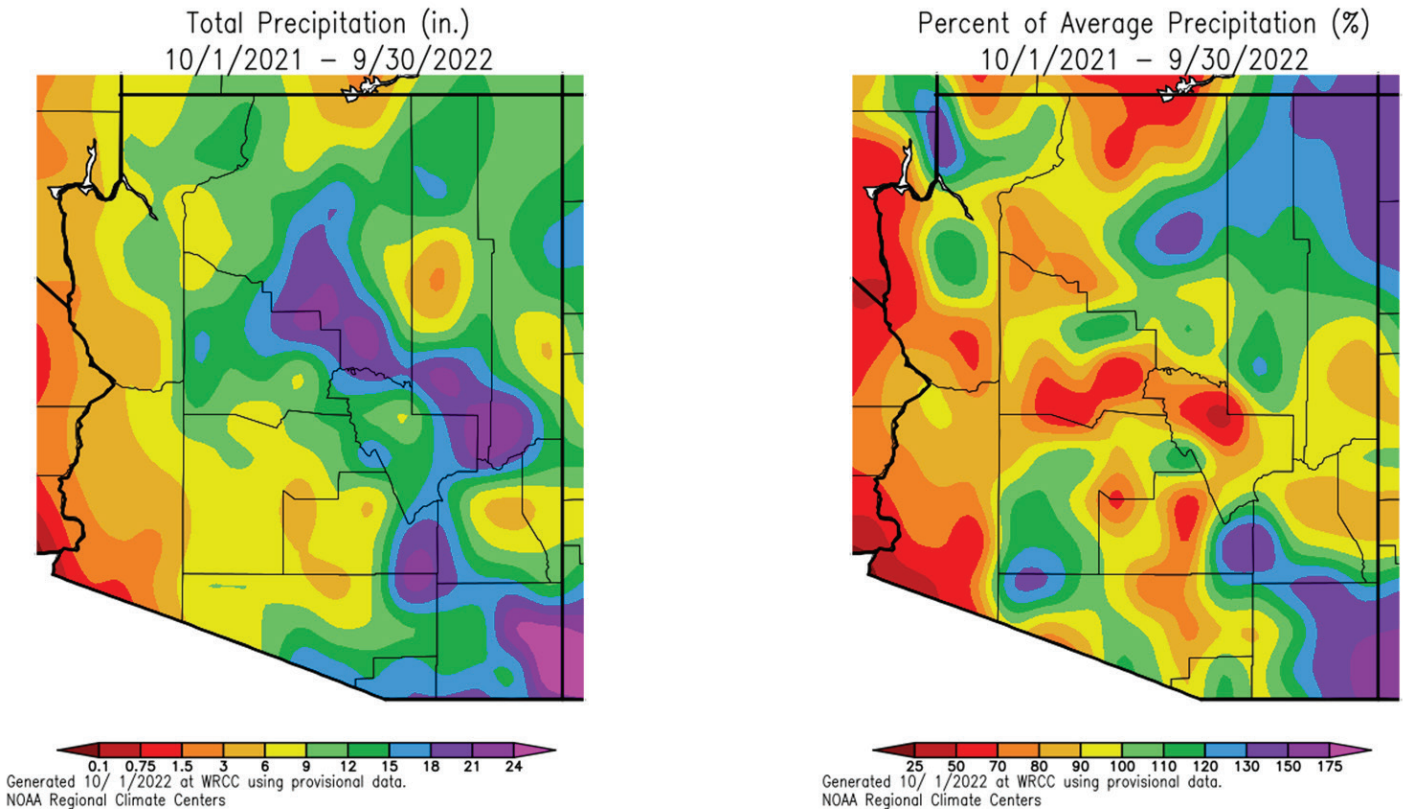


Figure 3. Total precipitation and percent of average precipitation for WY2022.

WY2022 began with most of the state in Moderate (D1) short-term drought and Abnormally Dry (D0) conditions (60% of the state; **figure 4**). Due to a very warm and dry spring, Severe (D2) short-term drought advanced in April and expanded to 51% of the state by June. Extreme (D3) short-term drought increased from May through July in the western, northern, and northeastern areas of the state, as well as in Cochise and Santa Cruz counties (up to 23% of the state). Exceptional (D4) short-term drought returned to western Mohave County from May to July (up to 3% of the state). A wetter monsoon helped mitigate much of the short-term drought, allowing the water year to end with most of the state (81%) in Moderate (D1) short-term drought and Abnormally Dry (D0) conditions.

Arizona Short-Term Drought WY2022

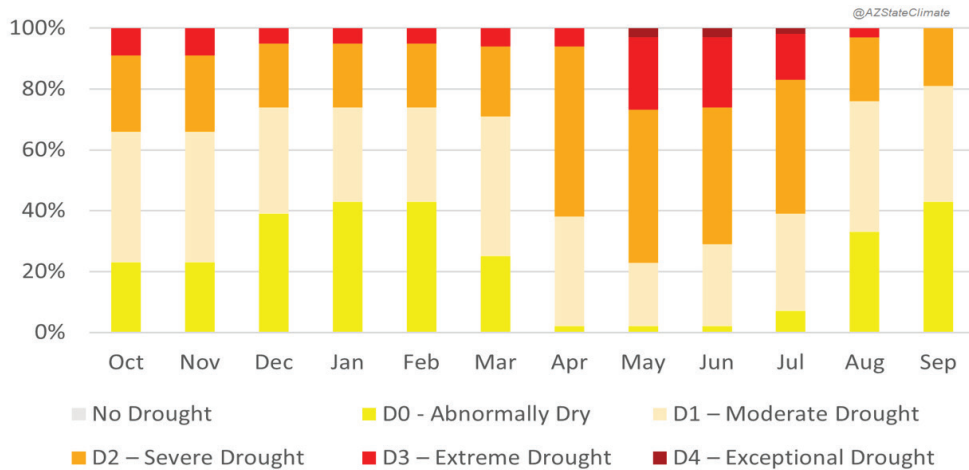


Figure 4. Monthly short-term drought through WY2022.

The Upper and Lower Colorado River Basins (CRBs; **figure 5**) received average to below-average snowpack during winter 2021-22, reducing streamflow in the Colorado River. Water levels in the Lake Mead reservoir decreased by 22.65 feet from WY2021; water levels in the Lake Powell reservoir decreased by 16.03 feet from WY2021.² Water in the Salt and Verde system decreased by 141,366 acre-feet (AF, 9%) from WY2021.³ See **Section 2.D** for more information about the CRB and the Salt and Verde rivers system.

The *Arizona Drought Preparedness Plan* provides the framework to improve drought-resilience across the state and communities of the state by monitoring drought conditions, increasing understanding of drought impacts, and determining mechanisms for limiting future vulnerability.

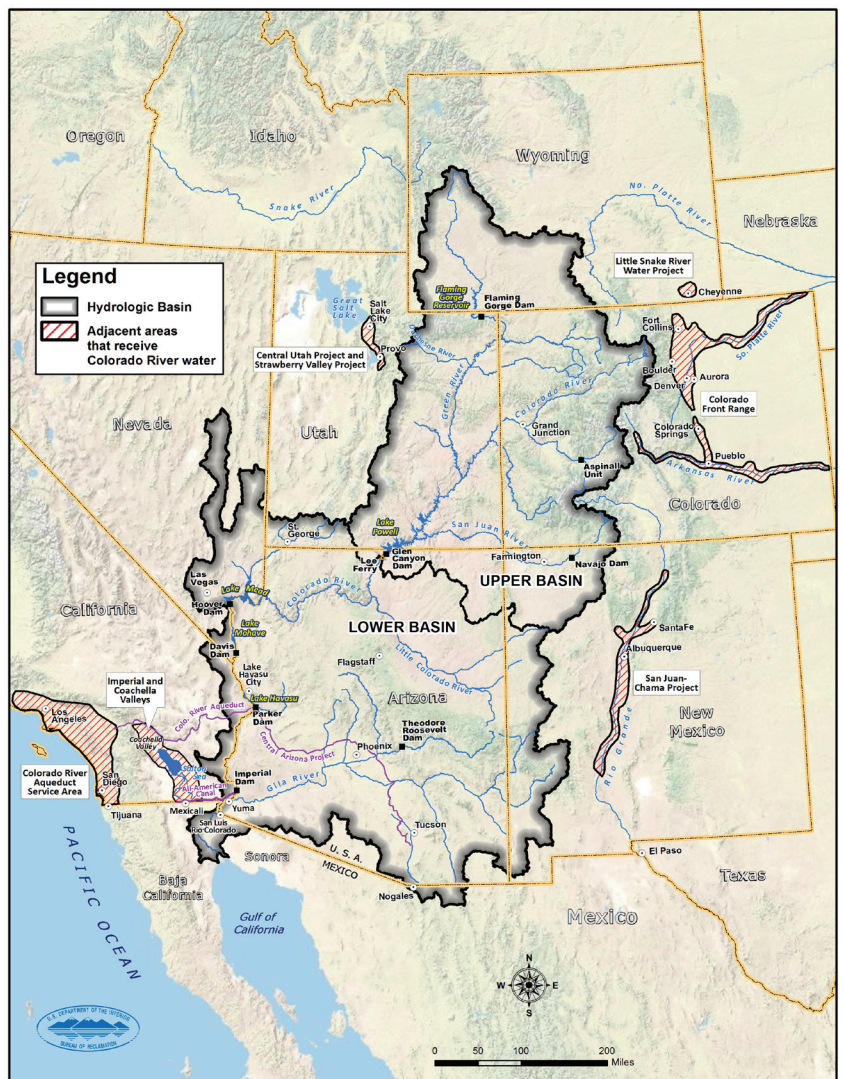


Figure 5. Upper and Lower Colorado River Basins.

² United States Bureau of Reclamation (BOR): Lake Mead Elevation (https://www.usbr.gov/uc/water/hydrodata/reservoir_data/921/dashboard.html#pool_elevation/); Lake Powell Elevation (https://www.usbr.gov/uc/water/hydrodata/reservoir_data/919/dashboard.html#pool_elevation/); Lower Colorado Region Daily Reservoir & River Conditions (https://www.usbr.gov/lc/region/g4000/levels_archive.html).

³ Salt River Project (SRP) Watershed Connection reservoir data: <https://streamflow.watershedconnection.com/DWR?reportDate=2022-9-29>

2. DROUGHT STATUS SUMMARY

2.A. WINTER PRECIPITATION: OCTOBER 2021-APRIL 2022

December was a very wet and cool month in the Upper and Lower CRBs, providing average to above-average snowpack in the Colorado basins (Yampa, Colorado, Gunnison up to 150% of average). Peak snowpack in the Upper basin had ended by the second week in April, followed by melting rates that were above average. Utah CRB precipitation was largely below average (70-90%) to average (90-100%, **figure 6**).

At the end of April, snow water equivalent (SWE) for the Upper CRB was 76% of the 1991-2020 median. Lower basin SWE was 34% of the 1991-2020 median at the end of April (**figure 7**.) Sub-basin SWE at the end of April included 53% of the 1991-2020 median for the Little Colorado basin, and 32% of the 1991-2020 median for the Lower Colorado-Lake Mead basin.⁴

Statewide precipitation for October 2021 to April 2022 was 3.86 inches, ranked as the 19th driest October-April on record (127 years of record). The long-term October-April precipitation average for Arizona is 6.89 inches.

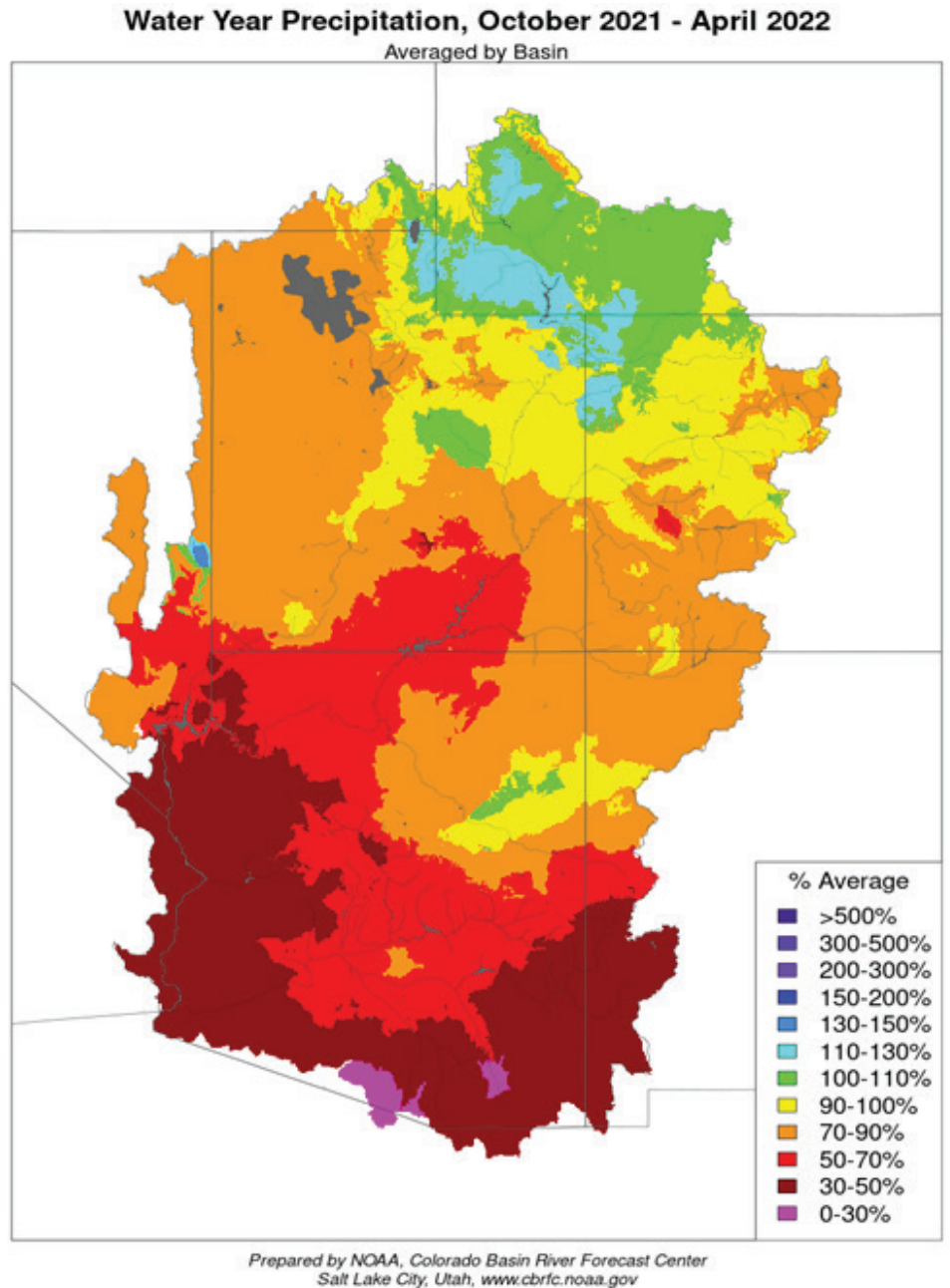


Figure 6. CRB winter precipitation in WY 2022 was a mix of above and below average.

⁴ Natural Resources Conservation Service (NRCS) National Water and Climate Center: <https://www.nrcs.usda.gov/wps/portal/wcc/home/>

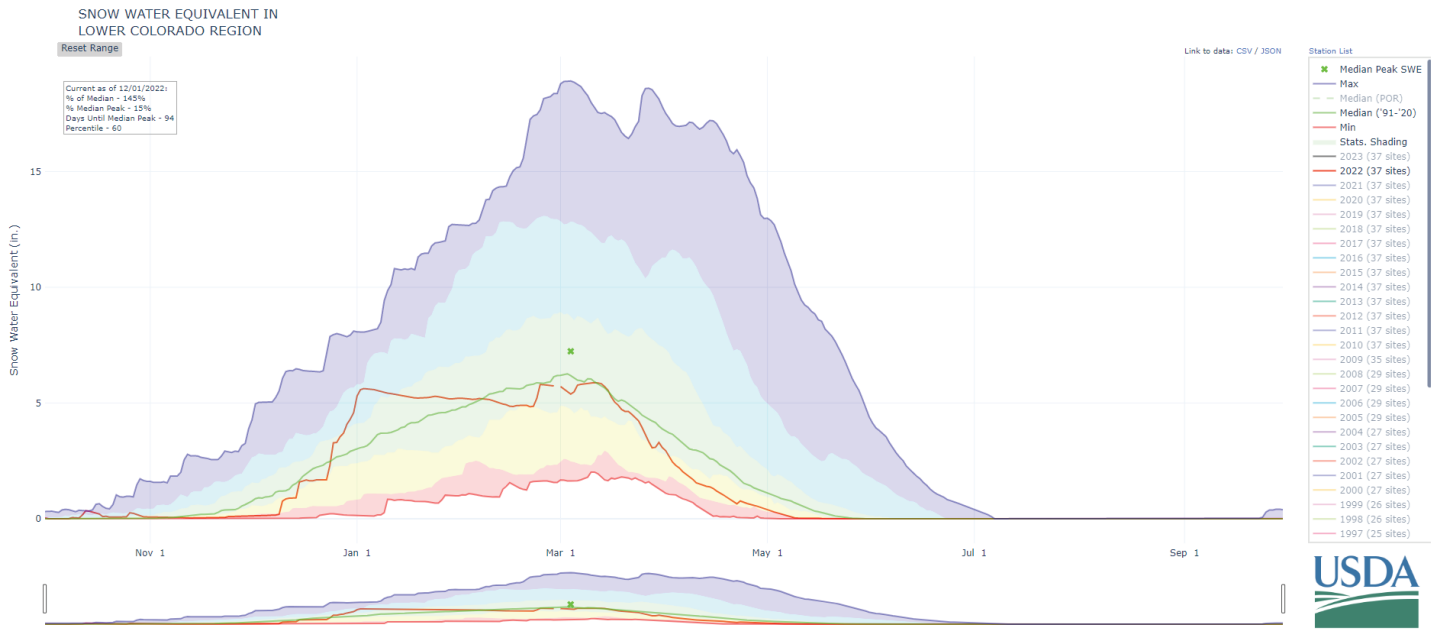
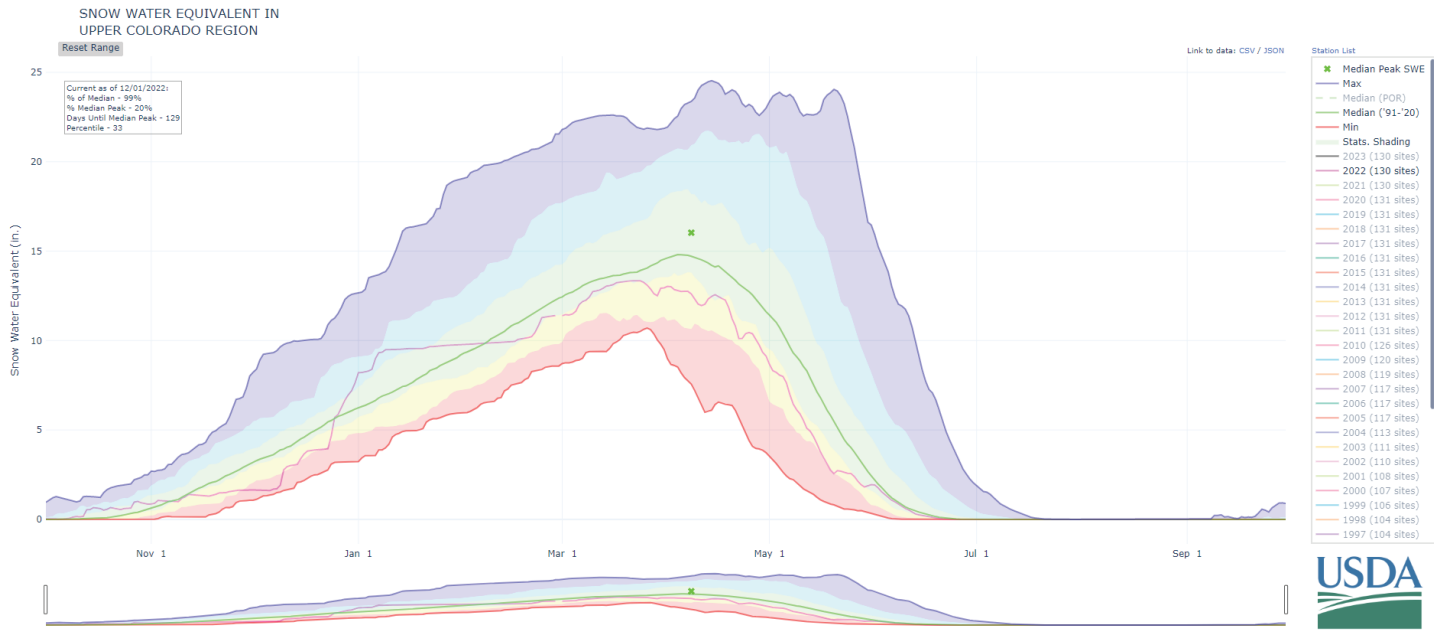


Figure 7. CRB snow water equivalent levels in WY2022 were below median levels.

2.B. MONSOON PRECIPITATION: JUNE-SEPTEMBER 2022

The 2022 monsoon season was productive, with above-average amounts of precipitation across much of the state. The season was dominated by the Monsoon Ridge remaining positioned near the Four Corners region for much of the monsoon. Easterly disturbances fueled activity during July and August, as did several Mesoscale Convective Vortices (MCV) that moved across the state. Remnants of tropical systems in August and September extended thunderstorm activity.

Strong monsoonal activity first advanced into New Mexico in early June, with the first monsoon precipitation in Arizona on June 18. The monsoon structure continued setting up in July, with a persistent flow of atmospheric moisture in August. Brief thunderstorm activity continued through September 30.

Much of the state received at least 150% of average monsoon precipitation. Areas that received less than average amounts of monsoon precipitation included portions of southwestern Yuma, northcentral Pima, northcentral Coconino, and northern Greenlee counties (**figures 8 and 9**).

June 2022 resulted in above-average amounts of precipitation (statewide total of 0.70 inches), becoming the 9th wettest June on record (128 years of record). In July, 2.29 inches of statewide precipitation were measured, which led to the 30th wettest July (0.49 inches above average precipitation). August was the 10th wettest on record (1.18 inches above average precipitation), resulting in 3.28 inches of precipitation. In September, 1.33 inches of statewide precipitation were observed, which led to the 52nd wettest September on record (0.15 inches above average precipitation).

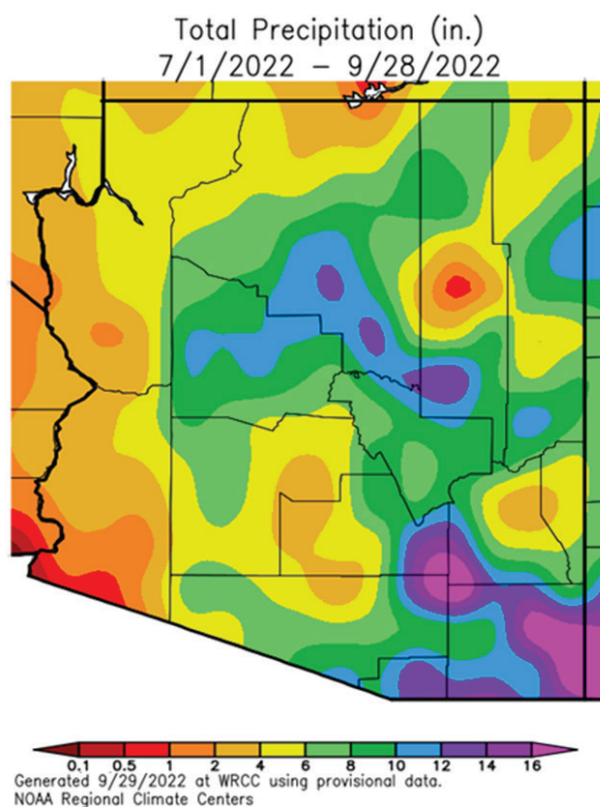


Figure 8. Total precipitation in inches July-September 2022

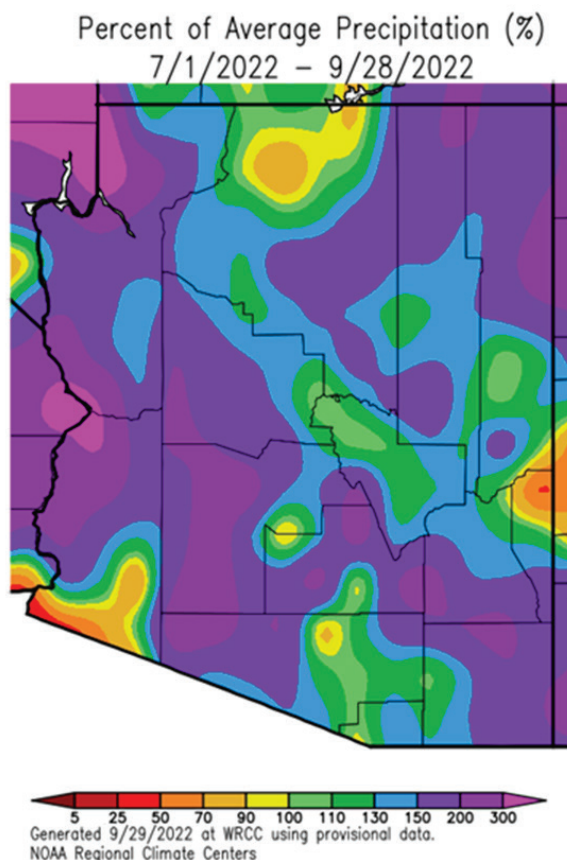


Figure 9. Percent average precipitation July-September 2022

2.C. CUMULATIVE PRECIPITATION AND STREAMFLOW SUMMARY

PRECIPITATION

Cumulative precipitation for WY2022 was at median levels throughout the mountainous areas of Arizona, ranging from 92-100% of median in the major river basins. Despite well below-median precipitation during the winter months, the monsoon season moisture over the summer months helped bring the cumulative precipitation for the year back to median levels (**Table 1**).

Table 1. Water Year 2022 Mountain Precipitation (as of September 30, 2022)

Major Basin	Percent of 30-year Average Precipitation
Salt River Basin	92%
Verde River Basin	100%
San Francisco-Upper Gila River Basin	93%
Little Colorado River Basin	97%



STREAMFLOW

Drought status, as indicated by streamflow data (**figure 10**), shows normal drought conditions throughout Arizona in the beginning of the water year. During fall and winter of WY2022, streamflow was characterized by average flow. Multiple winter precipitation events resulted in increased streamflow. During the spring and early summer of 2022, flows were below normal. This season ordinarily has little precipitation and associated runoff, and similar to the previous year, 2022 had below-normal flow. Monsoon season conditions had elevated flows resulting from significant and widespread storms that saturated basins throughout the state. Several sites had runoff that helped aid in reservoir storage and groundwater levels. Ultimately, the monsoon season resulted in normal to above-normal conditions at the end of the WY2022. In general, 2022 had higher runoff quantities during the monsoon season than 2021 (which was also very active).

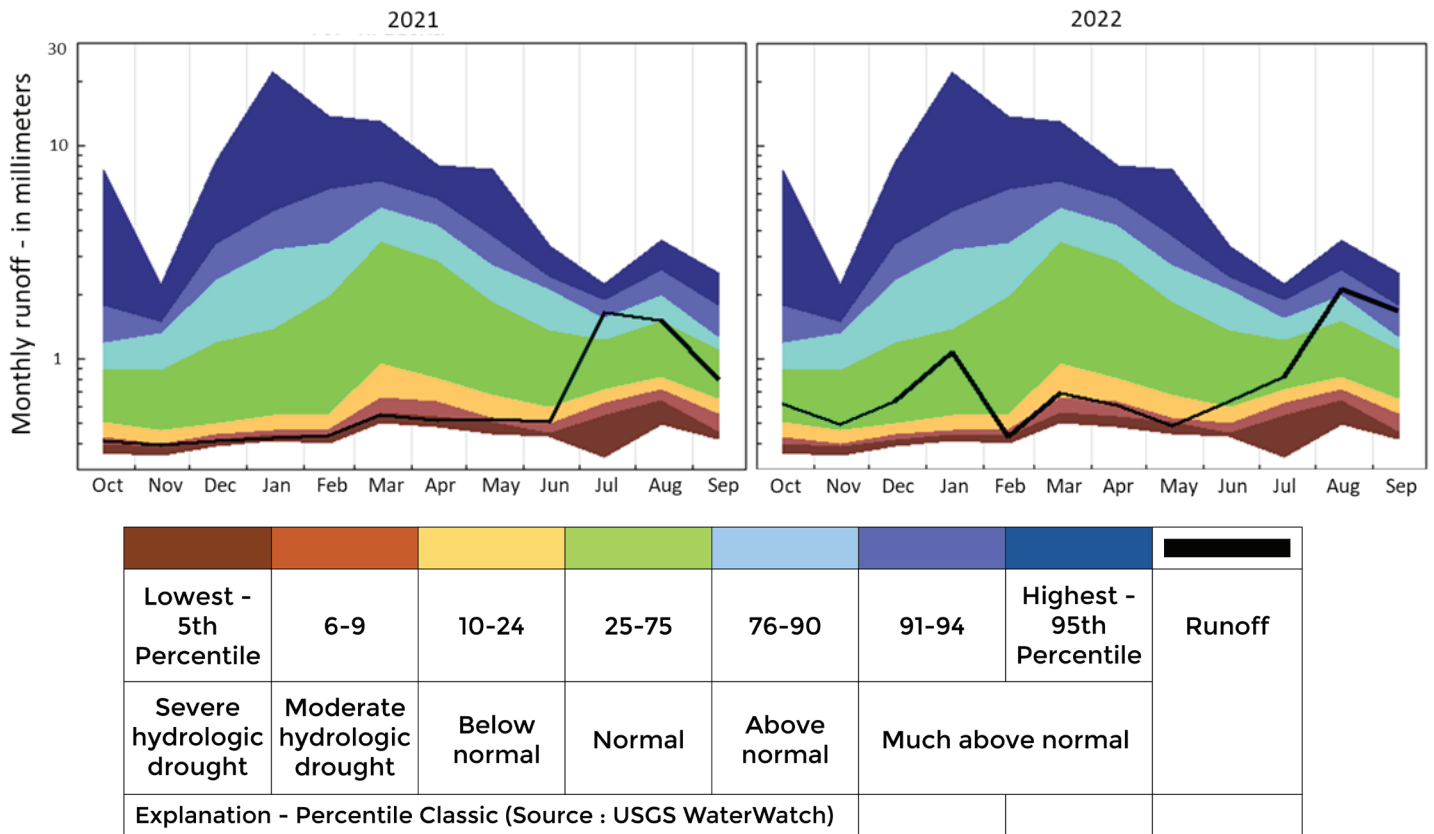


Figure 10. Area-based monthly runoff as determined by United States Geological Survey (USGS) streamflow gages for 2021 and 2022 representing the entire state of Arizona. The hydrograph (black line) represents runoff per unit area and is plotted over the long-term statistics of runoff for each month. The statistics include the maximum runoff during the period of record for each month of the year (top of the dark blue area); the 90th percentile runoff for each month (top of the light blue area); the interquartile range (the green area bounded by the 75th percentile on top and 25th percentile on the bottom); the 10th percentile runoff for each month (the bottom of the orange area); and the minimum discharge for each month (bottom of dark brown area). The plot covers a period of one year with the statistics being identical for each year.

2.D. WATER SUPPLY STATUS

COLORADO RIVER BASIN AND RESERVOIR STATUS⁵

The Colorado River total system storage experienced a net decrease of 3.38 million acre-feet (MAF) in WY2022. Colorado River total system storage was 38% of capacity at the beginning of the water year, and by the end, it was at 33% of capacity. Reservoir storage in Lake Powell decreased by 1.46 MAF, and reservoir storage in Lake Mead decreased by 1.69 MAF.

Precipitation in the Upper CRB was median⁶ during WY2022. On September 30, 2022, the cumulative precipitation received within the Upper CRB for WY2022 was 100% of median. Snowpack conditions trended below average across most of the CRB throughout the snow accumulation season. The basin-wide SWE peaked at 96% of average on March 24, 2022, which is approximately two weeks earlier than the average peak date (April 6) for the total seasonal accumulation period. On April 1, 2021, the SWEs for the Green River, Upper Colorado River Headwaters, and San Juan River Basins were 75%, 89%, and 103% of median, respectively.

Much below-average streamflows⁷ were observed throughout much of the CRB during WY2022. Unregulated⁸ inflow into Lake Powell was 6.08 MAF, or 63% of the 30-year average.⁹ During the Spring 2022 runoff period, inflows to Lake Powell peaked on June 3, 2022, at approximately 28,300 cubic feet per second (cfs). The April through July unregulated inflow volume for Lake Powell was 3.751 MAF (59% of average). Unregulated inflows for WY2022 into Flaming Gorge, Blue Mesa, and Navajo Reservoirs were 64%, 71%, and 63% of average, respectively.

Lower CRB tributary inflows above Lake Mead were near average/median for WY2022. Tributary inflow measured at the Little Colorado River near Cameron gage totaled 0.164 MAF, or 139% of average. Tributary inflow measured at the Virgin River at Littlefield gage totaled 0.115 MAF, or 67% of average. Below Hoover Dam, tributary inflow for WY2022 measured at the Bill Williams River below Alamo Dam gage totaled 0.018 MAF, and tributary inflow measured at the Gila River near Dome gage totaled 0.007 MAF.

SALT & VERDE RESERVOIRS

WY2022 started with wet antecedent watershed conditions following a near record wet 2021 summer monsoon season. In December 2021, the Salt and Verde Watershed observed 4.00 inches (229% of normal) of average precipitation resulting in above-median streamflow totaling 78,000 AF in January 2022 (about half of which occurred in the first five days of the month). As of January 1, the watershed had above-normal snowpack (150% of normal) and wet soil moisture conditions, entering the winter runoff season with only abnormally dry drought conditions. From January 1 through March 31, only a few additional small precipitation events occurred throughout the rest of the winter, and total winter precipitation (December to March) on the Salt and Verde watershed was below normal at 6.08 inches (86% of normal). As a result of the predominantly dry winter in 2022, the watershed observed a total inflow of 216,000 AF into Salt River Project (SRP) reservoirs (48% of median) throughout the entire 2022 winter runoff season (January to May) and moved toward more moderate

⁵ This section and associated footnotes are from the Bureau of Reclamation's October 7, 2022, draft "Annual Operating Plan for Colorado River Reservoirs 2023." The information has been updated to the end of Water Year 2022 where appropriate and data was available.

⁶ Snowpack, snow water equivalent, and precipitation statistics are provided by the Natural Resources Conservation Service and are based on the median for the 30-year period 1991-2020. Hydrologic conditions are described in the following manner: much above average/median (greater than 130%), above average/median (111-130%), near average/median (90-110%), below average/median (70-89%), and much below average/median (less than 70%). Reservoir specific ROD descriptions are used in place of this terminology where applicable.

⁷ Streamflow statistics are provided by the National Water Service's Colorado Basin River Forecast Center and are based on the average/median for the 30-year period 1991-2020. Hydrologic conditions are described in the following manner: much above average/median (greater than 130%), above average/median (111-130%), near average/median (90-110%), below average/median (70-89%), and much below average/median (less than 70%).

⁸ 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.

⁹ All unregulated inflow, precipitation, and snowpack statistics are based on the 30-year period 1991-2020. The average for this 30-year period is 9.60 MAF.

drought conditions. Roosevelt Lake saw a small increase in storage during the winter overall, going from 68% full to 73% full between October 1 and May 1. Horseshoe and Bartlett Reservoirs, on the Verde River, started the water year at a combined 52% full and declined to 33% capacity by May 1.

The 2022 monsoon season experienced above-normal precipitation throughout the watershed and increased Salt and Verde streamflow in late July and August. The month of August observed 3.53 inches of precipitation (150% of normal) and inflows into SRP reservoirs totaled 128,000 AF (391% of median). Of the August total inflow, the majority occurred from the Salt River (102,000 AF, 498% of median) and was the 3rd highest August inflow on record for the Salt River. Overall, the 2022 monsoon season (June 15 to Sept 30) observed 8.90" of total precipitation (141% of normal), and SRP reservoir inflow (Salt River, Tonto Creek, and Verde River) for July through September was approximately 197,000 AF (210% of median). Overall, total inflow for the entire WY2022 was still below normal with 530,000 AF (77% of median) and total water year precipitation was near normal. While a dry winter across the watershed led to moderate drought conditions and decreased reservoir levels through June, the wet monsoon has again improved conditions throughout the parts of the watershed to only abnormally dry conditions by the end of WY2022. Total storage of the Salt and Verde reservoir system is in good condition at 64% (1,469,590 AF) as of September 30, 2022, compared to 70% at the same time last year.



2.E. DROUGHT INDEX WELLS

ADWR maintains groundwater index wells throughout the state (**figure 11**). Using criteria established by the USGS, seven wells in Arizona have been utilized as qualitative supplements to existing drought indicators. Depth-to-water measurements are collected at these sites, multiple times per day, by means of a pressure transducer. Automated, or transducer, measurements are later verified with less frequent discrete measurements taken by ADWR field staff. For additional information regarding the USGS climate response network criteria: <https://waterdata.usgs.gov/networks/CRN/>.

Figures 12 through **18** are hydrographs showing the groundwater level record and the historical daily median. Automated groundwater levels for each well site are plotted in blue, the historical daily median is plotted in green, and provisional data is plotted in red. The gray area on the right-hand side of the graph indicates the extent of WY2022, beginning on October 1st, 2021.

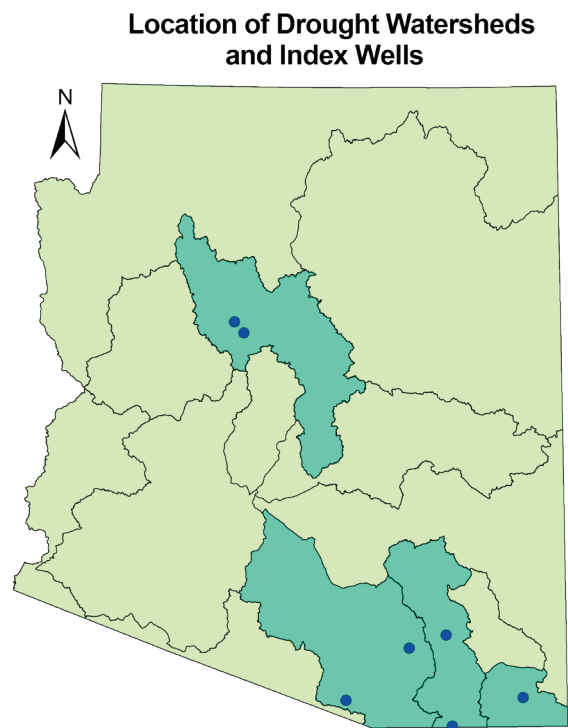


Figure 11. Location map of drought monitoring index wells and Arizona watersheds.

SAN PEDRO RIVER WATERSHED

ADWR MONITORING SITE 'D-15-20 09AAB2'

ADWR Index Well 'D-15-20 09AAB2' is located within the San Pedro River Watershed and in the Lower San Pedro Groundwater Basin. Situated on the bank of the San Pedro River, this well is completed in a shallow alluvial aquifer system and is in the river's floodplain.

Water levels at this monitoring site have consistently remained below the historical daily median throughout most of the water year. A slow and steady rise in water levels is observed from November 2021 to April 2022 followed by a steep decline until the end of June 2022. Water levels quickly recovered during August and September 2022, and as a result, water levels rose above the historical daily median for the first time this water year.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 32° 09' 02.74", W 110° 17' 53.34"	89 feet	3307 feet	34.81 feet	26.10 feet	32.86 feet

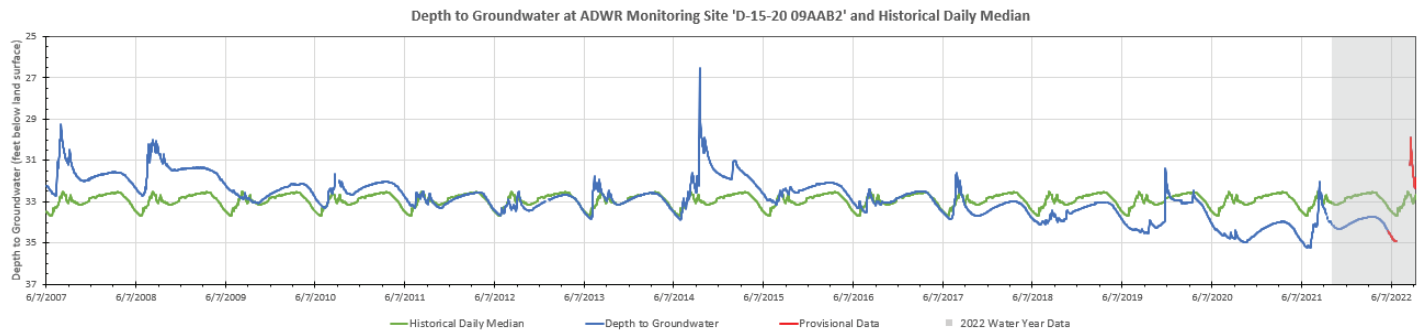


Figure 12. Automated groundwater level data for ADWR drought index well 'D-15-20 09AAB2' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gwsi/Detail.aspx?SiteID=320901110175301>.

USGS MONITORING SITE 'D-24-21 17BCB3'

Monitoring well 'D-24-21 17BCB3' is operated through USGS and is located to the southeast of the Huachuca Mountains in the San Pedro River Watershed.

Seeing minimal winter and monsoon precipitation in 2021, this well has remained below the historical daily median depth-to-water for the entire water year. This large decline in water level brought this site to near record maximum depth-to-water readings. However, a rise in water level of nearly two feet occurred between July and September 2022.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 31° 20' 43.90", W 110° 14' 19.70"	123.6 feet	5100 feet	36.70 feet	30.05 feet	33.37 feet

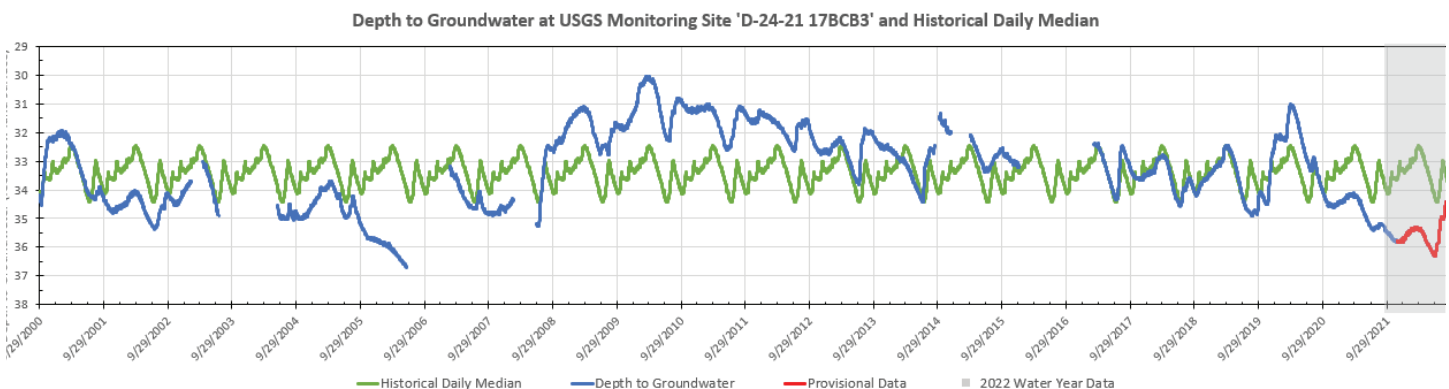


Figure 13. Automated groundwater level data for USGS drought index well 'D-24-21 17BCB3' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through USGS, located here: https://waterdata.usgs.gov/nwis/uv?site_no=312044110141901&legacy=1.

SANTA CRUZ RIVER WATERSHED

ADWR MONITORING SITE 'D-16-16 14CAC'

ADWR Index Well 'D-16-16 14CAC' is located along Pantano Wash within the Santa Cruz River Watershed. This monitor well is completed in a shallow alluvial aquifer system.

Last year, this well saw a significant rise in water level during the summer, which resulted in a new minimum depth-to-water of 18.48 feet observed on September 9th, 2021. This year, water levels have been in decline throughout the water year, except for September. This site has observed higher than normal daily medians most of the year.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 32° 02' 16.17", W 110° 40' 58.77"	105 feet	3179 feet	60.62 feet	18.48 feet	51.07 feet

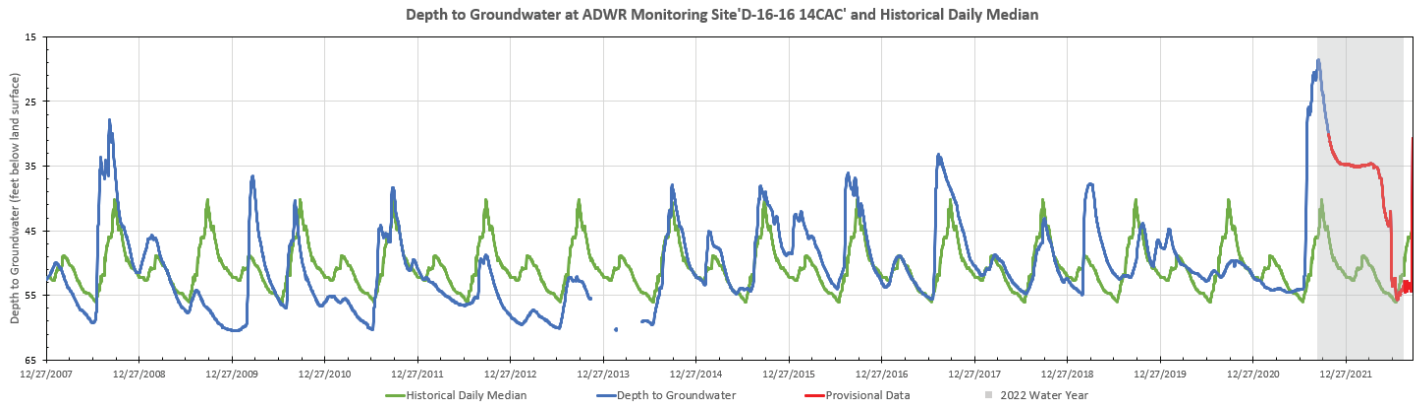


Figure 14. Automated groundwater level data for ADWR drought index well 'D-16-16 14CAC' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gwsi/Detail.aspx?SiteID=320216110405901>.

ADWR MONITORING SITE 'D-21-10 29ADB'

ADWR Index Well 'D-21-10 29ADB' is situated along Arivaca Creek in the Santa Cruz River Watershed. This well is completed in shallow alluvial materials.

Water levels remained below the historical daily median for the entirety of WY2022. This well typically sees a greater recovery in water levels during the winter months as opposed to the summer months. Minimal recharge is observed over the last two winters and has resulted in depth-to-water being below historical averages for the past two years.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 31° 35' 32.74", W 111° 20' 13.63"	38 feet	3609 feet	14.84 feet	5.45 feet	9.78 feet

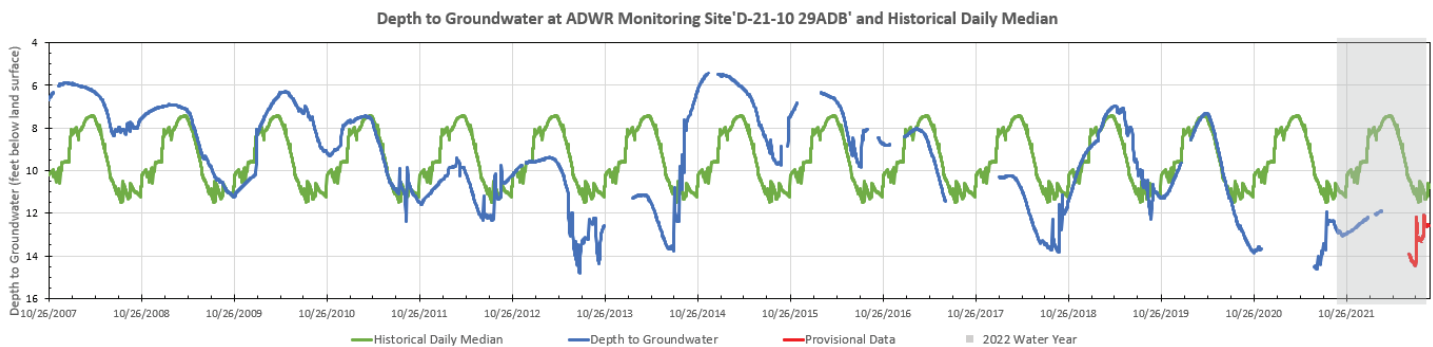


Figure 15. Automated groundwater level data for ADWR drought index well 'D-21-20 29ADB' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gwsi/Detail.aspx?SiteID=31343311201601>.

VERDE RIVER WATERSHED

ADWR MONITORING SITE 'B-18-03 26BDD'

ADWR Index Well 'B-18-03 26BDD' is situated along Big Chino Wash in the Verde River Watershed. This monitoring well is completed in a shallow conglomerate unit.

This well is the most recent addition to the drought monitoring program. A transducer was installed in October 2020. This site shows a significant response to monsoon events; however, a minimal response is observed during the winter months thus far. Water levels steadily declined from October 2021 through July 2022. Precipitation events are observed during July and August 2022.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 34° 55' 02.03", W 112° 32' 55.99"	609 feet	4403 feet	19.24 feet	14.37 feet	18.34 feet

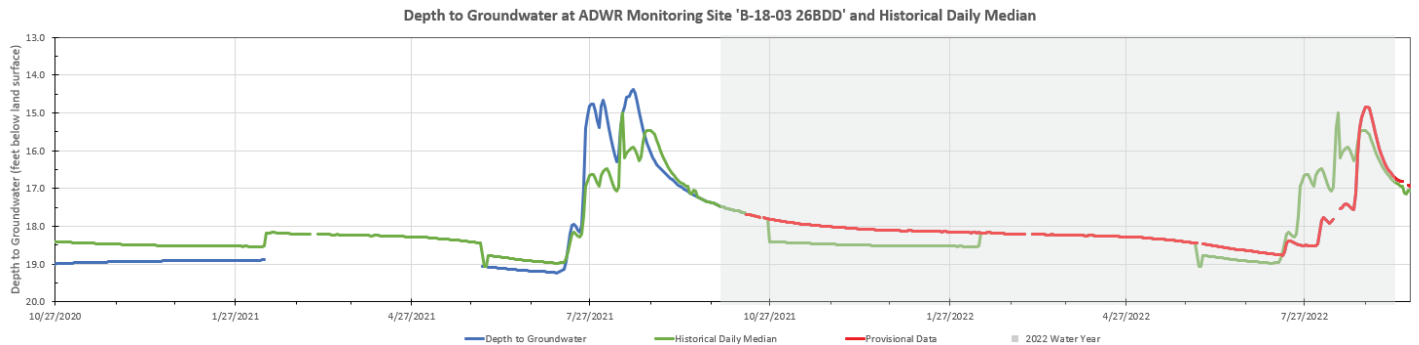


Figure 16. Automated groundwater level data for ADWR drought index well 'B-18-03 26BDD' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gws/Detail.aspx?SiteID=345500112324501>.

ADWR MONITORING SITE 'B-17-02 26CCD3'

ADWR Index Well 'B-17-02 26CCD3' is located at Del Rio Springs in the Verde River Watershed. This monitoring well is completed in a shallow conglomerate unit.

Seasonal fluctuations continue to be observed, showing a consistent yearly rise in water levels from Fall 2021 through Spring 2022 followed by a decrease in late Spring 2022 through Summer 2022. Water levels remained at or below the historical daily median throughout the water year, except for September 2022.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 34° 49' 11.86", W 112° 26' 40.83"	206 feet	4456 feet	15.35 feet	13.05 feet	14.12 feet

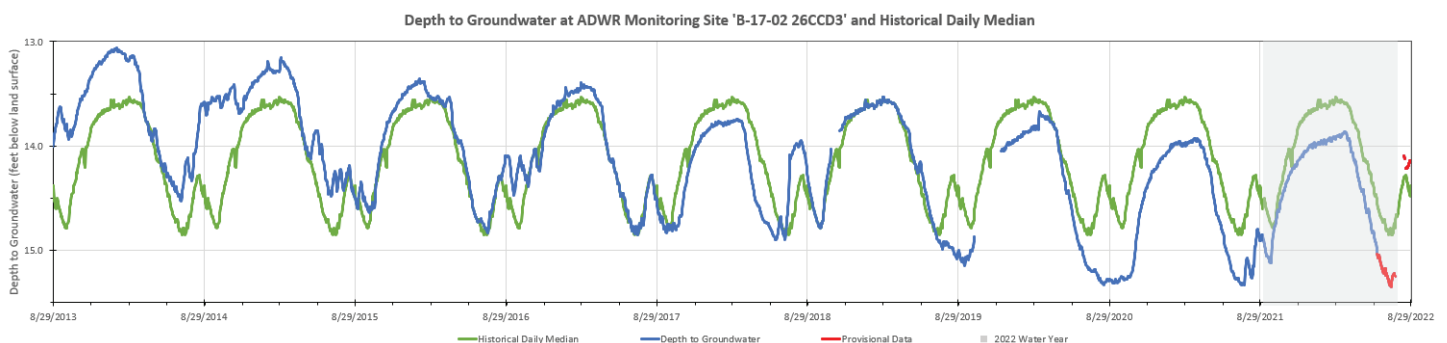


Figure 17. Automated groundwater level data for ADWR drought index well 'B-17-02 26CCD3' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gws/Detail.aspx?SiteID=344912112264101>.

WHITewater DRAW WATERSHED

ADWR MONITORING SITE 'D-21-28 21BCB'

ADWR Index Well 'D-21-28 21BCB' is located within the Whitewater Draw Watershed and in the Willcox Groundwater Basin. Adjacent to the Leslie Creek drainage, this well is completed in shallow alluvial material.

Water levels at this site saw a dramatic rise to close out WY2021 due to heavy monsoon moisture that fell over August and September 2021. Since the beginning of WY2022, water levels have slowly and steadily decreased throughout most of the year except for August and September. Despite this, water levels have remained above historical daily median values for the entire water year.

Location (NAD 27)	Depth of Well	Altitude (above sea level)	Record Maximum Depth to Water	Record Minimum Depth to Water	Median Depth to Water
N 31° 35' 29.87", W 109° 30' 18.00"	25 feet	4648 feet	18.34 feet	1.47 feet	9.19 feet

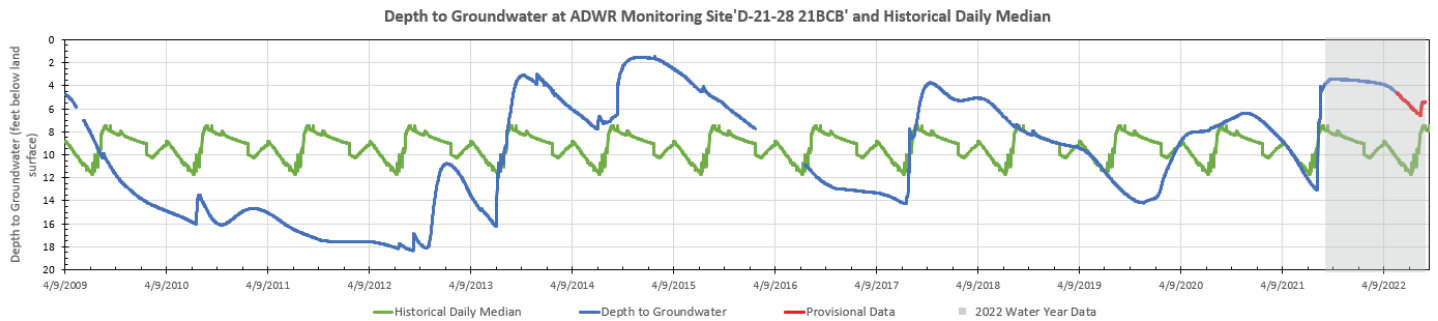


Figure 18. Automated groundwater level data for ADWR drought index well 'D-21-28 21BCB' plotted with historical daily median groundwater levels. Water level data and additional information for this site is available through ADWR's GWSI web application, located here: <https://azwater.gov/gwsi/Detail.aspx?SiteID=313533109301801>.

ADWR DROUGHT INDEX WELLS

ADWR's Field Services Section collects groundwater levels statewide from approximately 1,800 index wells, including the state's seven drought index wells. ADWR also maintains a statewide network of roughly 130 automated groundwater monitoring sites and an ORACLE database that contains field-verified data including discrete water level measurements, location, and other well specific information.

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

ADWR has plans to continue expanding its Drought Monitoring Network in WY2023 with the addition of a few automated groundwater sites. The wells will be added to the network over the next 12 months in order to obtain an improved spatial representation of drought sites throughout the State of Arizona.

2.F. FOREST HEALTH

Aerial and ground detection surveys for dead and dying trees have been conducted in Arizona for more than 50 years. The Arizona Department of Forestry and Fire Management (DFFM) uses these survey data to monitor changes in forest health, as well as emerging insects and disease agents. The data and information are provided to land managers and the public through the DFFM's annual Forest Health Conditions Report.

As precipitation and temperature are two of the biggest environmental factors influencing forest health, it is important to understand the climatic conditions occurring throughout our state. When trees are drought stressed from a lack of precipitation and stressed from increased average temperatures, they become increasingly susceptible to infection and infestation from diseases and insects. Tree tissues produce and collect more ethanol and terpenes when they are stressed; many insects, in particular bark beetles, can detect these chemicals. In addition, prolonged drought stress, which is drought lasting longer than 6 months, can lead to decreased overall tree health and increased likelihood of tree death. According to the U.S. Drought Monitor, Arizona has been experiencing continual drought conditions since 2002, nearly 20 years of continual drought stress. The connection between stress and increased susceptibility to insects and diseases underscores the importance of understanding the type and severity of stress.

During the summer of 2021, forest health professionals mapped 528,108 acres with observed bark beetle mortality. This was a 551% increase in bark beetle caused tree mortality statewide from 2020. By the end of August, La Niña¹⁰ conditions were starting to develop over the Pacific Ocean, indicating drier than normal weather would occur during Winter 2021-2022.

Long-term drought appeared to improve in parts of Arizona by spring of 2022, leading to some forest health improvements. When aerial detection surveys were completed in 2022, there was an overall decrease in observed bark beetles caused tree mortality. However, symptoms of prolonged drought stress were still evident across the entire State of Arizona.

2.G. 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 an emergency response if needed and enables farmers and ranchers to obtain funding assistance through the Farm Service Agency (FSA) if they experience significant production losses due to drought.

The Governor's 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 (see **Section 3.B**).



¹⁰ For more information about La Niña: <https://www.climate.gov/enso>

2.H. 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 FSA.

The USDA uses the U.S. Drought Monitor to determine designations. Extreme (D3) or Exceptional (D4) drought 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 disaster designations by the USDA in **Table 2** occurred during WY2022:

Table 2. Drought Disaster Designations in Water Year 2022

Date of Designations	Primary Disaster Counties			Contiguous Disaster Counties (AZ)		
April 8, 2022	Apache Graham Mohave	Cochise Greenlee Navajo	Coconino La Paz	Gila Pinal Yuma	Maricopa Santa Cruz	Pima Yavapai
April 8, 2022	Alameda Butte Contra Costa Fresno Imperial Kings Los Angeles Mariposa Modoc Napa Placer Sacramento San Diego San Luis Obispo Santa Clara Sierra Sonoma Tehama Tuolumne Yuba	Alpine Calaveras Del Norte Glenn Inyo Lake Madera Mendocino Mono Nevada Plumas San Benito San Francisco San Mateo Santa Cruz Siskiyou Stanislaus Trinity Ventura	Amador Colusa El Dorado Humboldt Kern Lassen Marin Merced Monterey Orange Riverside San Bernardino San Francisco Santa Barbara Shasta Solano Sutter Tulare Yolo	La Paz	Mohave	Yuma
April 8, 2022	Adams Archuleta Boulder Cheyenne Costilla Delta Douglas El Paso Gilpin Hinsdale Jefferson Lake Las Animas Mesa Montezuma Otero Phillips Pueblo Routt San Miguel Teller Yuma	Alamosa Baca Broomfield Clear Creek Crowley Denver Eagle Fremont Grand Huerfano Kiowa La Plata Lincoln Mineral Montrose Ouray Pitkin Rio Blanco Saguache Sedgwick Washington	Arapahoe Bent Chaffee Conejos Custer Dolores Elbert Garfield Gunnison Jackson Kit Carson Larimer Logan Moffat Morgan Park Prowers Rio Grande San Juan Summit Weld	Apache		

Date of Designations	Primary Disaster Counties			Contiguous Disaster Counties (AZ)
April 8, 2022	Bernalillo Cibola De Baca Grant Hidalgo Los Alamos Mora Rio Arriba San Juan Sierra Torrance	Catron Colfax Dona Ana Guadalupe Lea Luna Otero Roosevelt San Miguel Socorro Union	Chaves Curry Eddy Harding Lincoln McKinley Quay Sandoval Santa Fe Taos Valencia	Apache Cochise Greenlee
April 8, 2022	Churchill Esmeralda Lander Mineral White Pine	Clark Eureka Lincoln Nye	Elko Humboldt Lyon Washoe	Mohave
April 22, 2022	Yuma			La Paz Maricopa Gila
April 22, 2022	Beaver Davis Garfield Juab Salt Lake Sevier Washington	Box Elder Duchesne Grand Kane San Juan Tooele Wayne	Carbon Emery Iron Millard Sanpete Uintah Weber	Apache Coconino Mohave Navajo
May 13, 2022	Yavapai			Coconino Gila La Paz Maricopa Mohave
May 23, 2022	Pima Santa Cruz			Cochise Graham Maricopa Pinal Yuma
May 31, 2022	Maricopa			Gila La Paz Pima Pinal Yavapai Yuma
July 11, 2022	Pinal			Gila Graham Maricopa Pima

2.I. DROUGHT STATUS CHANGES

Following directives within the Arizona Drought Preparedness Plan, Arizona’s drought status is continuously evaluated and updated throughout the water year. The short-term drought status is monitored on a weekly basis, and the Arizona Drought Monitoring Technical Committee (MTC) provides weekly recommendations to the U.S. Drought Monitor¹¹ authors. The long-term drought status is monitored monthly and updated quarterly by the MTC.

The U.S. Drought Monitor categorizes drought based on precipitation and environmental impacts. Different aspects of drought (hydrological, meteorological, and agricultural) are encapsulated within the U.S. Drought Monitor categories.

The U.S. Drought Monitor began reporting on short-term drought in January 2000 (figure 19). The largest expansion of Exceptional (D4) short-term drought in Arizona occurred in WY2021.

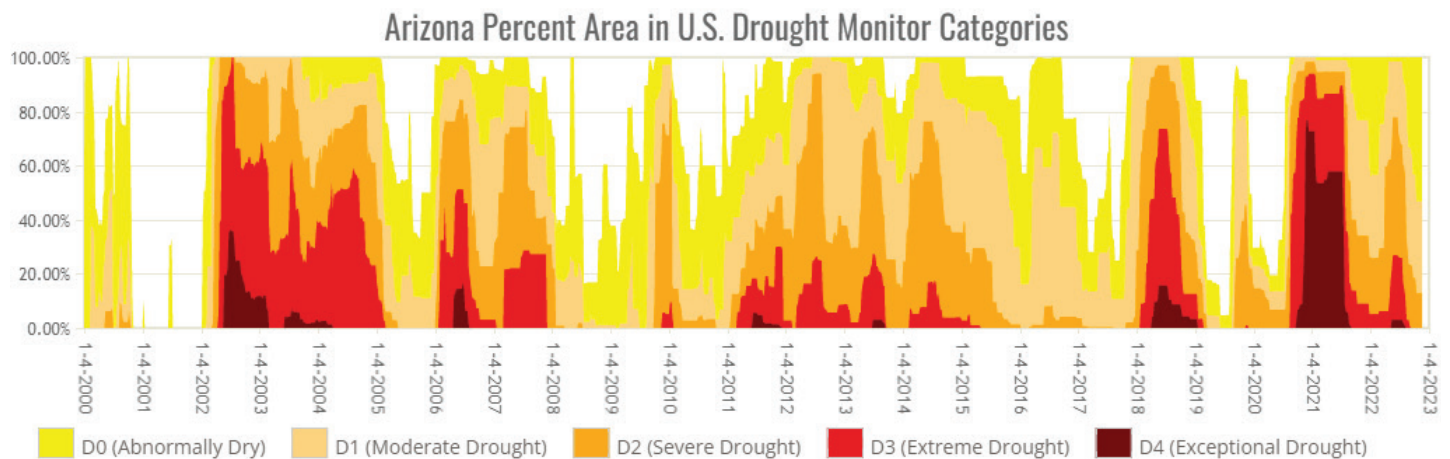


Figure 19. Short-term drought has been shown on the U.S. Drought Monitor since 2000.

Through WY2022, Moderate (D1) and Severe (D2) short-term drought continued across the state. Slight advances of Extreme (D3) short-term drought during summer diminished by the end of the water year. Exceptional (D4) short-term drought was only present from May to August 2022, covering less than 3% of the state. Abnormally Dry (D0) conditions were gained by the end of WY2022, replacing areas of Moderate (D1), Severe (D2), and Extreme (D3) short-term drought (Table 3).

Table 3. Percentage of change in short-term drought WY2021 vs WY2022.

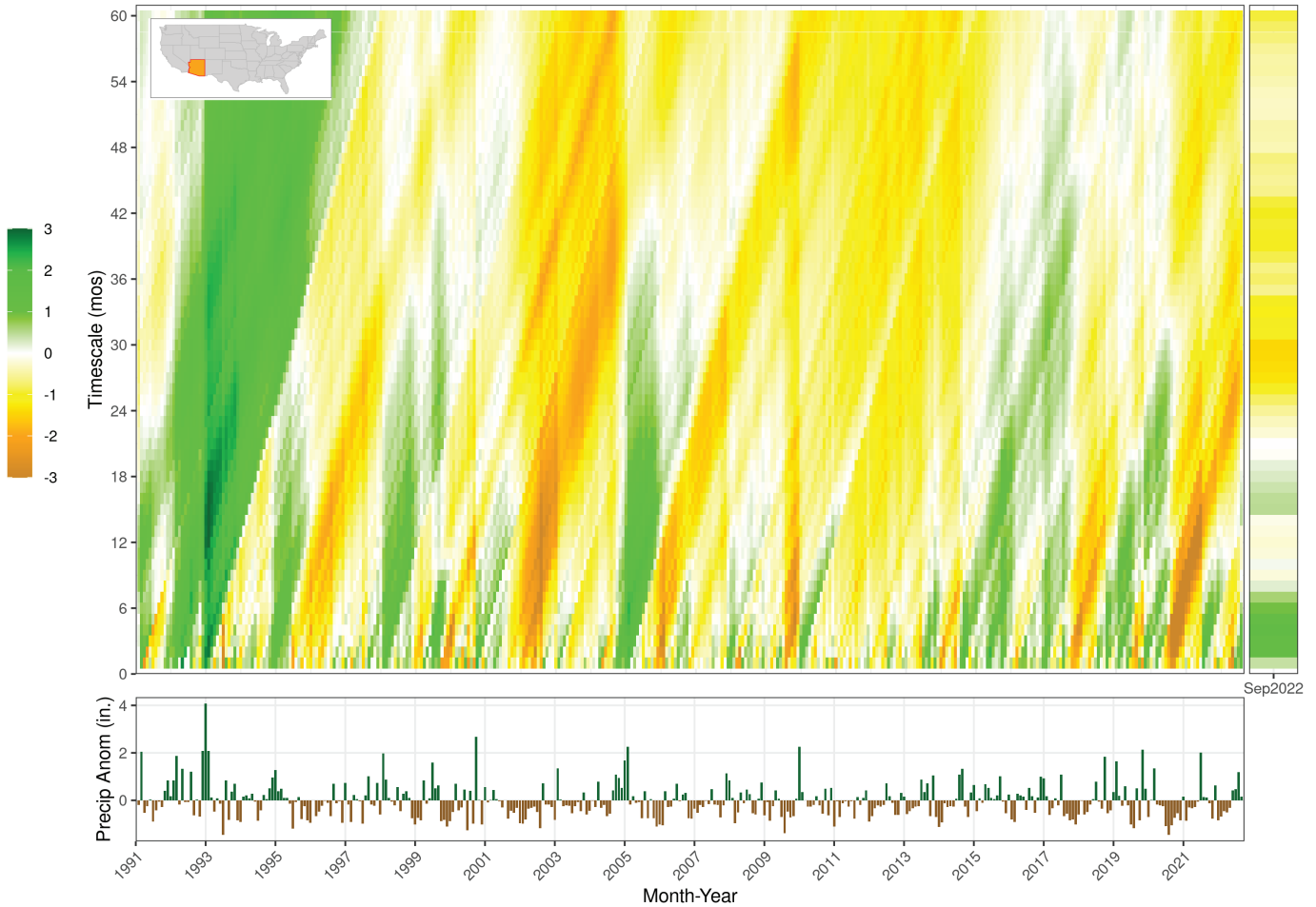
Category	End of WY2021	End of WY2022	Change from last WY
No Drought	0	0	0
D0 - Abnormally Dry	20	43	+23
D1 - Moderate Drought	40	38	-2
D2 - Severe Drought	26	19	-7
D3 - Extreme Drought	14	0	-14
D4 - Exceptional Drought	0	0	0

¹¹The U.S. Drought Monitor is a map released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4): <https://droughtmonitor.unl.edu/>

The Standardized Precipitation Index (SPI) portrays precipitation at different time scales as a means to identify aspects of short- and long-term drought. SPI values are calculated for 1-month through 60-month timescales, per each month starting January 1991 through August 2022. The SPI demonstrated the continuation of long-term dry conditions across the state for much of WY2022 (**figure 20**).

Typically, long-term drought conditions are more likely to improve following a heavy winter precipitation season because snowpack tends to recharge reservoirs and aquifers more adequately than summer rainfall. While the 2022 monsoon season improved short-term meteorological and agricultural drought conditions, long-term hydrological drought remained entrenched. At this publication, La Niña is expected to persist through winter 2022-23 and then transition to El Niño Southern Oscillation (ENSO)-neutral conditions late winter to early spring. Statistically, stronger La Niña winters tend to be drier than normal for Arizona.

Arizona Standardized Precipitation Index (Jan1991 - Sep2022)



Data from NOAA-NCEI
<ftp://ftp.ncdc.noaa.gov/pub/data/cirs/climdiv/>
 Plot created: 10-14-2022
 The University of Arizona
<https://cals.arizona.edu/climate/>



Figure 20. Standardized Precipitation Index (SPI) and precipitation anomalies: https://cals.arizona.edu/climate/misc/spi/spi_contour.html

SHORT-TERM DROUGHT STATUS

The second wettest July on record in 2021 helped mitigate much of the Extreme (D3) and Exceptional (D4) drought from WY2021, allowing WY2022 to begin with the majority of the state in Moderate (D1) and Abnormally Dry (D0) conditions (60% of state). While western Mohave and the northeastern counties still observed Extreme (D3) conditions (15% of state), no portion of the state started WY2022 with Exceptional (D4) drought.

La Niña conditions returned for the second winter in a row, which limited winter storm activity. However, December was a very wet and cool month across the state from several passing low-pressure systems and attendant cold fronts. Subsequently, Abnormally Dry (D0) conditions expanded along the Mogollon Rim to the White Mountains and within the central and southern areas of the state in January.

Following a very warm and dry spring, Severe (D2) drought advanced across the majority of the state (53%) in April, essentially encircling all borders of the state with Severe (D2) drought. Extreme (D3) drought expanded in May in Cochise, Santa Cruz, and Mohave counties, along western La Paz County, and into northern Coconino, Apache, and Navajo counties (24% of state). Exceptional (D4) drought returned to western Mohave County in May (3% of state).

By the end of July, Extreme (D3) and Exceptional (D4) drought diminished as the wet 2022 monsoon season continued, with only 3% of the state remaining in Extreme (D3) drought by August. By September, remnants of Severe (D2) drought remained across much of Mohave County, north and western Coconino County, and small areas of Apache, Navajo, Pima, Santa Cruz, and Cochise counties (19% of state). The water year ended with the majority of the state in Moderate (D1) or Abnormally Dry (D0) conditions (81% of state; **figure 21**).

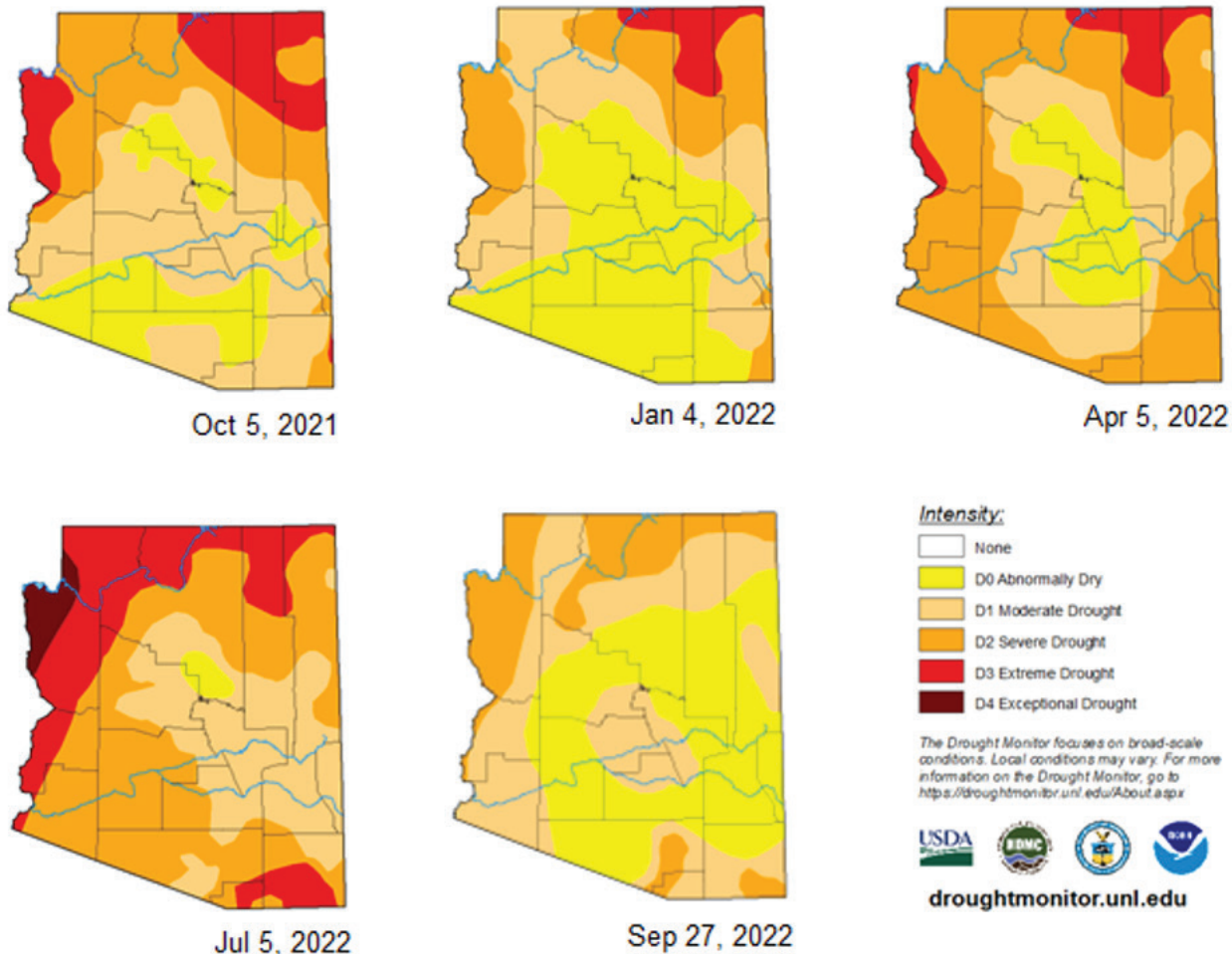


Figure 21. U.S. Drought Monitor maps for WY2022

LONG-TERM DROUGHT STATUS

Long-term drought is evaluated using the Standardized Precipitation Evapotranspiration Index (SPEI). SPEI incorporates precipitation and potential evapotranspiration as a tool for evaluating drought. Evapotranspiration is water lost in vapor form from evaporation and transpiration, and potential evapotranspiration considers temperature and wind conditions that influence aspects of water loss. Long-term drought is analyzed from the previous 24-, 36-, and 48-month periods and updated quarterly (**figure 22**).

The majority of the state ended the water year in Moderate (D1) or Severe (D2) long-term drought, experiencing long-term drought improvement in central, southern, and eastern counties.

At the start of WY2022, Exceptional (D4) long-term drought resided in central Mohave County, eastern Coconino County, western and central Navajo County, and eastern Apache County, while much of the remaining areas of the state experienced either Extreme (D3) or Severe (D2) long-term drought.

Above-average amounts of precipitation received in 2018 and 2019 (48-month data), along with two wetter monsoon seasons (2021 and 2022), alleviated much of the Exceptional (D4) long-term drought across the state by the end of WY2022. Only small areas of north central Coconino, western La Paz, and southern Yuma counties remained in Exceptional (D4) long-term drought. Long-term Extreme (D3) drought continued in La Paz, Yuma, and Mohave counties, large areas of western, northern, and eastern Coconino County, and portions of Maricopa, Navajo, and Apache counties. Locations without any long-term drought at the end of WY2022 included Cochise, Santa Cruz, eastern Pima, and central Yavapai counties, as well as areas along the Mogollon Rim.

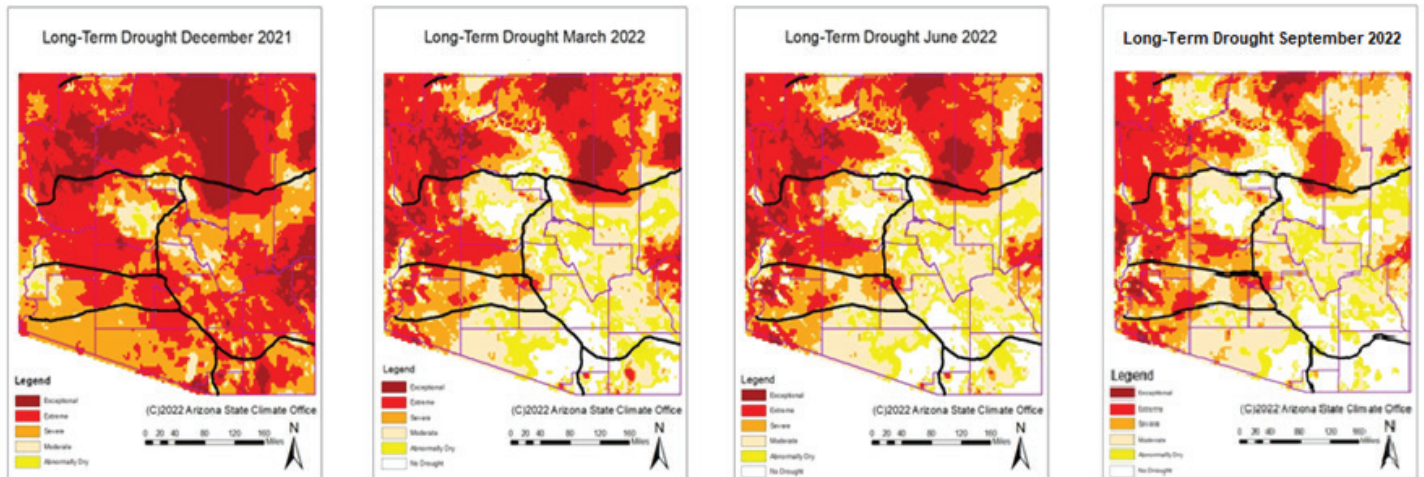


Figure 22. Quarterly SPEI long-term drought map WY2022

2.J. OUTLOOK FOR 2022-2023

WINTER 2022-2023

Weak La Niña conditions have persisted through the Spring and Summer 2022 and will continue through at least the first half of Winter 2022-23 before potentially decaying in Spring 2023. This will mark a 3rd consecutive La Niña winter, which is a rare occurrence. While weather on shorter time scales in the Southwest will occasionally be wet even during a La Niña winter, on a seasonal scale, the majority of La Niña events result in drier than normal winters. In fact, the majority of the driest winters recorded over the past 40 years in Arizona (figure 23) have been observed during a La Niña episode.

Arizona Precipitation

November-April

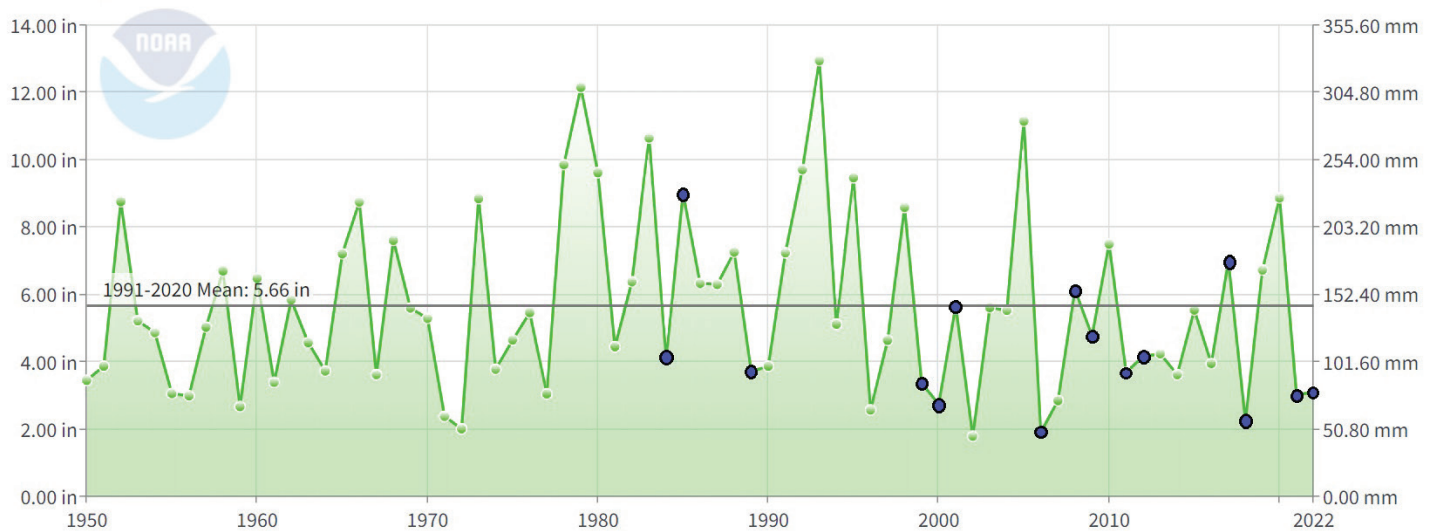


Figure 23. Historical November-April precipitation in Arizona since 1950. Blue dots are La Niña winters since 1980.

While several climate models suggest a warmer than normal Winter 2022-23, the official forecast is primarily based on climate change trends where Arizona winters over the past 20-40 years have been steadily warming (figure 24). This trend of warming has been problematic for the Southwest over the past couple of decades negatively affecting average snow levels over the winter season, as well as soil moisture profiles. In turn, these impacts have resulted in a detrimental effect on spring runoff and reservoir recharge.

Arizona Average Temperature

November-April

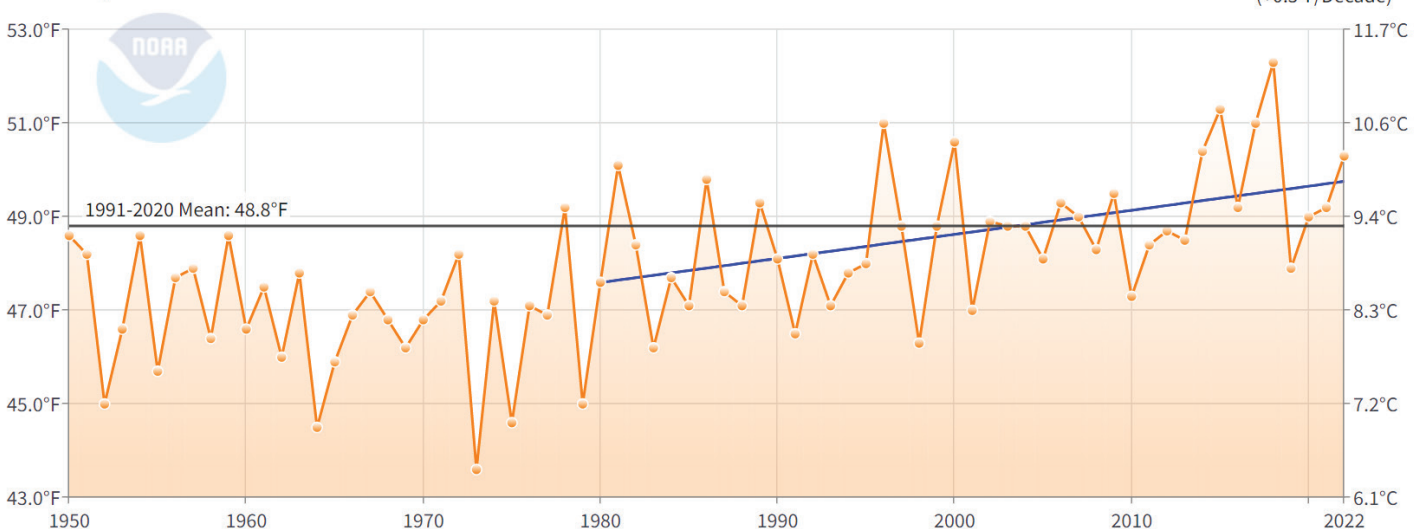


Figure 24. Historical November-April average temperature in Arizona since 1950. Blue line defines the 40-year trend.

The outlook from NOAA's Climate Prediction Center (**figure 25**) for January-March 2023 reveals a better chance that the average temperature during this period will fall in the above-normal category. The precipitation outlook suggests better chances for below-normal precipitation through the middle of the 2022-23 winter. This is based on a consensus of dynamic, seasonal climate models along with historical precedent during La Niña winters.

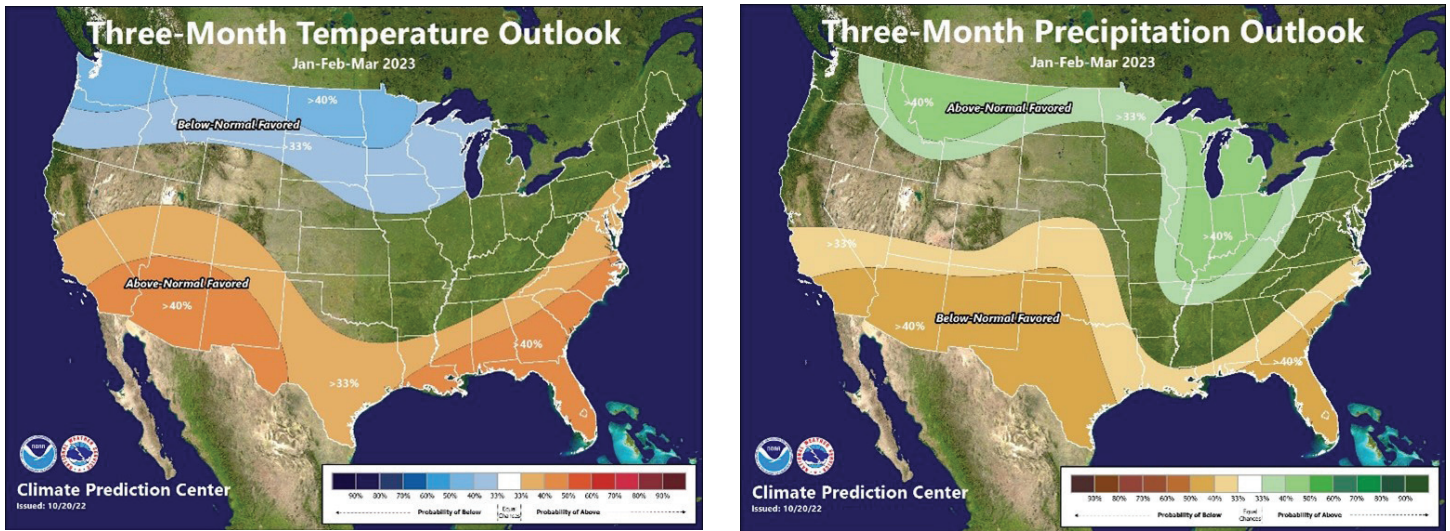


Figure 25. Climate Prediction Center outlook for temperature (left) and precipitation (right) for January-March 2023. Shading indicates a tilt in odds towards being above or below normal. Unshaded areas indicate equal chances of above, below, or near normal temperatures and precipitation.

SUMMER 2023

The Climate Prediction Center's outlook for July-September 2023 (**figure 26**) indicates the average temperature during Summer 2023 has slightly better odds of falling in an above-normal range. This outlook is strongly based on trends of steady regional climate warming over the past several decades when compared to the climatological average. The precipitation outlook shows no trend or signal during this period over Arizona; that is, there are equal chances for the 2023 monsoon season having above, below, or near normal rainfall. This is typical for the monsoon in the Southwest, where thunderstorm activity is generally not influenced by larger-scale climate patterns and rainfall amounts can become extremely varied over the region.

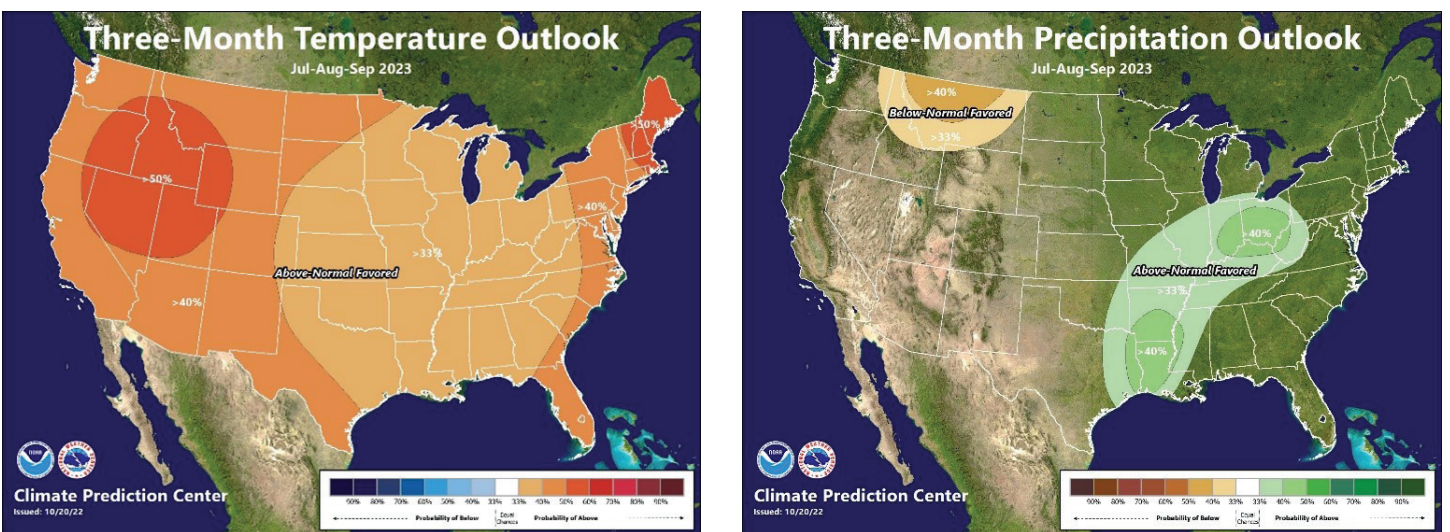


Figure 26. Climate Prediction Center outlook for temperature (left) and precipitation (right) for July-September 2023. Shading indicates a tilt in odds towards being above or below normal. Unshaded areas indicate equal chances of above, below, or near normal temperature and precipitation.

3. DROUGHT PREPAREDNESS PLAN IMPLEMENTATION HIGHLIGHTS

3.A. STATE DROUGHT MONITORING TECHNICAL COMMITTEE (MTC) EFFORTS

The MTC is responsible for gathering drought, climate, and weather data, then disseminating and interpreting that information to water and land managers, policymakers, and the general public. Specifically, the MTC prepares short- and long-term drought status reports, facilitates multi-agency conversations regarding drought impacts, briefs the ICG on drought conditions, and provides assistance to Local Drought Impact Groups (LDIGs). The current two co-chairs of the MTC are State Climatologist Dr. Erinanne Saffell and National Weather Service Lead Forecaster Mark O'Malley.

COMMUNICATING DROUGHT STATUS

In accordance with the [ADWR mission](#) to safeguard the health, safety and economic welfare of the public by protecting, conserving and enhancing Arizona's water supplies, the MTC and ADWR coordinate to improve the accessibility of drought information to resource managers, state decision-makers, and the general public. To enhance communication, information is updated on the ADWR Drought Status webpage (<https://new.azwater.gov/drought>) 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 offices, and others who observe and report drought impacts. This is done to advise the U.S. Drought Monitor⁹ authors on the state's current drought conditions and provide recommendations on drought designation in 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 U.S. Drought Monitor authors includes, but is not limited to, numerous drought indices, precipitation and streamflow data, and impacts data. Every Thursday, ADWR's 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 the U.S. Drought Monitor's maps for the past four weeks, with an explanation of how drought conditions have changed in Arizona over the preceding month. An email with the latest map and summary is sent to stakeholders, partners, and MTC members.

Quarterly - The MTC meets every quarter with numerous federal, state, and local partners to discuss drought conditions and impacts across the state. Objective climate data such as SPI and SPEI are analyzed as an initial proxy for drought conditions. Vegetation indices, snowpack, temperature anomalies, reservoir levels, and county-scale drought impact information are used to verify or modify the initial estimates of the objective data. The long-term drought status reports are posted on the ADWR Drought webpage and disseminated via email quarterly: in April (for January-March); July (for April-June); October (for July-September); and January (for October-December).

SUPPLEMENTAL TOOLS SUPPORTING MTC EFFORTS

ARIZONA DROUGHTVIEW

DroughtView, a University of Arizona program, is an online tool for collecting drought impact data incorporating remote sensing and climate monitoring products. The tool can be used to track high-resolution (~250 meters) changes in remotely sensed 'greenness' using Normalized Differenced Vegetation Index (NDVI) data collected on a bi-weekly basis from the National Aeronautical and Space Administration's (NASA) Moderate Resolution Imaging Spectroradiometer (MODIS) satellite. This index can be particularly useful for tracking changes in rangeland conditions related to livestock forage production and forest drought stress. These measures can indicate long-term drought impacts and wildfire risk. For more information, visit the University of Arizona DroughtView website at <http://droughtview.arizona.edu/>.

COMMUNITY COLLABORATIVE RAIN, HAIL, AND SNOW (COCORAHS) NETWORK

The CoCoRaHS network is a crowd-sourced observing system where citizens report daily precipitation. A drought impact reporting tool called “Condition Monitoring” is part of the CoCoRaHS interface where some of the observers in Arizona add weekly observations of the condition of vegetation, water bodies, and wildlife that reflect drought impacts. Since the observers simply note the conditions they detect, they do not require extensive training to provide useful information. In addition to the drought reports, the CoCoRaHS precipitation reports are incorporated into the products used by the U.S. Drought Monitor authors and by the Parameter Elevation Regression on Independent Slopes Model (PRISM) group who generate gridded SPI and SPEI data. For more information, visit the CoCoRaHS Network website at <https://www.cocorahs.org/>.

DROUGHT DETECTION FOR RANCH-SCALE TOOLS

Drought creates both production and legal risks to ranchers as they typically rely on federal lands for 50-90% of their forage. Policies for these rangelands dictate responses regarding herd reduction, reduced access to forage, and a lengthy approval process to change infrastructure and management. In many cases, patchy spatial distribution of drought in Arizona means that some ranches experience drought while others do not. However, the spatial resolution of most objective drought information is too coarse to represent this difference among ranches.

Dr. Mike Crimmins, University of Arizona faculty and MTC member, and his team developed two online tools to support the deployment of rain gauges for ranchers and federal managers in Arizona to detect drought more precisely at the ranch-scale. These precipitation monitoring tools help reduce production and legal risk by focusing responses only on drought-affected ranches. View a specific example of the tool here: <https://myraingelog.arizona.edu/>.

STANDARDIZED PRECIPITATION INDEX (SPI) EXPLORER

SPI is a widely used drought index that has several strengths including the ability to calculate precipitation anomalies at different timescales and interpret SPI units (standard deviations) in probabilistic terms. This tool was created to explore SPI values at specific locations by using a gridded PRISM climate database to estimate local precipitation time series. Data are accessed through the [Applied Climate Information Web Service](#) and analyzed and plotted using several R-based packages. This version of the tool includes the calculation of the SPEI, as well. For more information, visit the SPI tool website at <https://uaclimateextension.shinyapps.io/SPItool/>.

GRASSLAND PRODUCTIVITY FORECAST

The “Grass-Cast” Grassland Productivity Forecast was released for the Southwest in Spring 2020. Grass-Cast is an optional tool that managers can use to develop well-informed expectations about grassland productivity. The model provides three “what-if” scenarios that show how much grass might grow during the upcoming season depending on whether precipitation is above, near, or below-normal. Grass-Cast can be used in the design of proactive drought management plans, trigger dates, stocking dates, and grazing rotations.

Grass-Cast is the result of a collaboration between the USDA Research Service, USDA’s “Climate Hubs,” and the Natural Resource Conservation Service (NRCS). Visit the Grass-Cast website for more information: <https://grasscast.unl.edu/>.

INTERACTIVE DROUGHT DASHBOARD

ADWR’s Drought Program developed an Interactive Drought Dashboard (**figure 27**) that depicts short-term drought conditions in Arizona from 2000 to the present. This tool utilizes U.S. Drought Monitor maps and allows users to explore drought conditions for the entire period or for specific time frames. Viewers can access drought data on the state as a whole or a selected county. Visit the Interactive Drought Dashboard on the ADWR Drought website for more information: <https://new.azwater.gov/drought/drought-dashboard>.

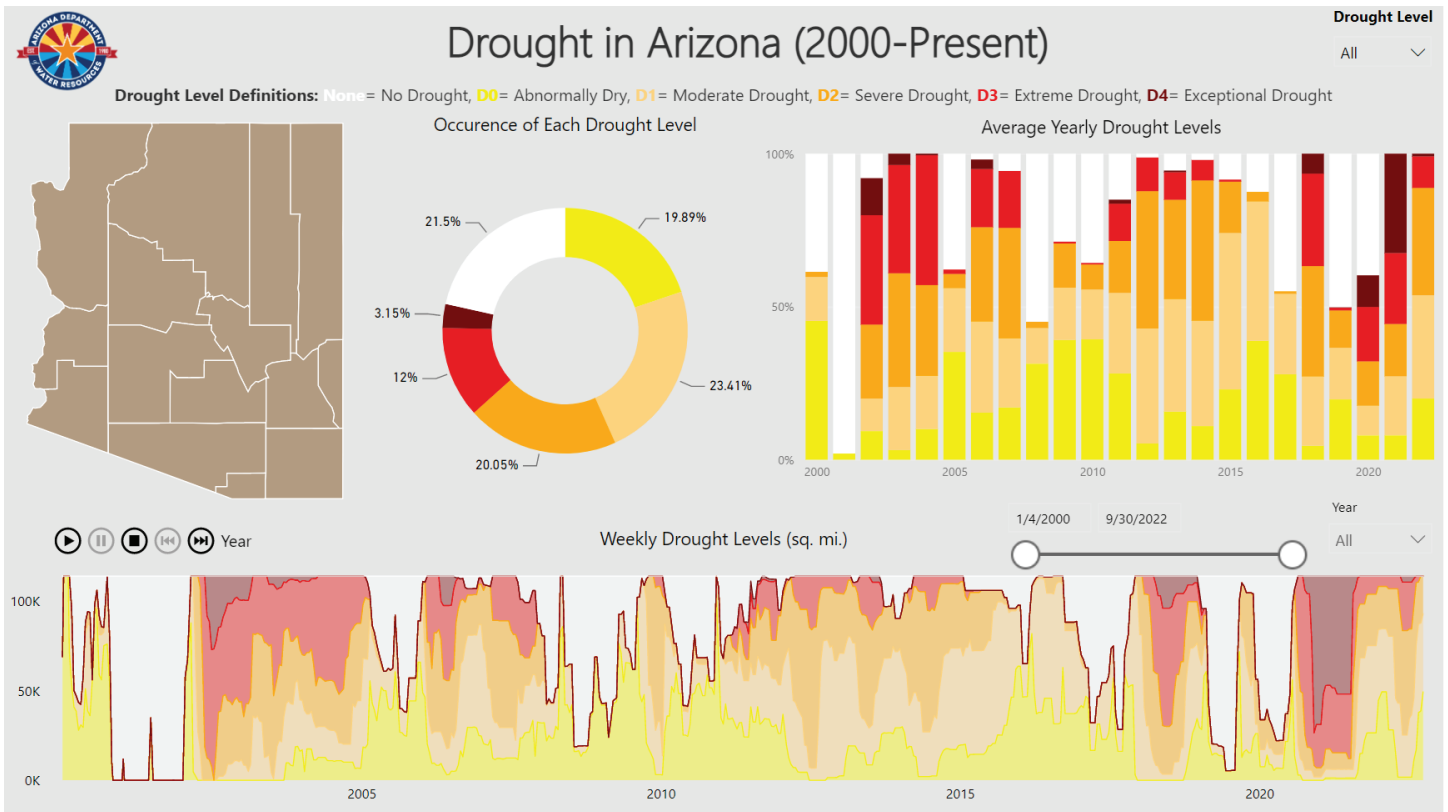


Figure 27. ADWR Drought Interactive Dashboard.

DROUGHT IMPACT REPORTS FROM STATE AND FEDERAL AGENCIES

Drought impact data is used by the MTC in its efforts to correlate on-the-ground drought conditions with precipitation and streamflow data. Impact information is received from hydrologists, researchers, and other field staff from the Bureau of Land Management (BLM), USGS, USDA, NRCS, DFFM, Arizona Game and Fish Department, Arizona State Parks, Native American communities, and other state and federal groups. The NRCS submits a water year report (**Appendix B**), which identifies the impacts of drought on range and farmland.

MTC PRESENTATIONS AND WORKSHOPS

PUBLICATIONS: INTERMOUNTAIN WEST MONTHLY DROUGHT UPDATE, DR. ERINANNE SAFFELL

Drought Early Warning Updates are issued in partnership with NOAA's National Integrated Drought Information System (NIDIS), the National Weather Service (NWS), and the State Climatologist for Arizona. The purpose of the update is to communicate changes in drought conditions within the Intermountain West based on recent conditions and the upcoming forecast.

PRESENTATION: SOUTHWEST DROUGHT LEARNING NETWORK QUARTERLY MEETING, ARIZONA DROUGHT AND CLIMATE UPDATE, DR. ERINANNE SAFFELL, NOVEMBER 23, 2021 & SEPT 14, 2022

"The Drought Learning Network (DLN) is a peer-to-peer knowledge exchange between climate service providers and resource managers. The main goal of the DLN is to gather and share lessons learned from drought events to improve responses to future droughts." Partners include NIDIS and the USDA Southwest Climate Hub.

WORKSHOP: DROUGHT MONITORING AND REPORTING IN ARIZONA: BUILDING A NETWORK FOR DROUGHT RESPONSE, DECEMBER 2, 2021

Planning committee/presenters Dr. Erinanne Saffell and ADWR's Némesis Ortiz-Declet

Objective: "The Arizona Drought MTC seeks to engage community members, researchers, natural resource professionals, metals and mining professionals, recreation and tourism professionals, and agriculture professionals to build a network of stakeholders that will share information about drought impacts in Arizona."

PRESENTATION: CLE INTERNATIONAL LAW OF THE COLORADO RIVER CONFERENCE, MAY 19-20, 2022

ADWR's Colorado River Program Manager Kristen Johnson presented at the CLE International Law of the Colorado River Conference in Santa Fe, New Mexico. Ms. Johnson presented on Arizona's response to the prolonged Colorado River drought condition and actions the state is taking to support Lake Mead elevations.

PRESENTATION: 2022 ANNUAL MEETING DROUGHT LEARNING NETWORK, JUNE 2022

Presentations about drought planning efforts in the State of Arizona: Némesis Ortiz-Declat
State Climatologists Panelist: Dr. Erinanne Saffell

WORKSHOP: WATER UTILITY CLIMATE ALLIANCE CLIMATE RESILIENCE FOR WATER PROVIDERS TRAINING, JULY 2022

ADWR's James Heffner and Rachel von Gnechten attended the virtual Water Utility Climate Alliance (WUCA) Climate Resilience for Water Providers Training. The training featured presentations by experts in the field and activities on the capabilities and limitations of climate science, examples from water planners for long-term management, deep uncertainty, and communicating climate science.

WEBINAR: 2022 U.S. DROUGHT AND HEAT WEBINAR: THE WEST, JULY 21, 2022

Dr. Erinanne Saffell participant. "NOAA's NIDIS and National Integrated Heat Health Information System (NIHHIS) are co-hosting a webinar... that will focus on the Western U.S. (Southwest, California, Pacific Northwest, Missouri River Basin, and Alaska) and will provide the latest information on current drought, heat, and fire conditions and forecasts, as well as the serious impacts to diverse sectors of the economy and communities throughout the West."



3.B. GOVERNOR'S DROUGHT INTERAGENCY COORDINATING GROUP (ICG) EFFORTS

The ICG has met biannually since 2006 and advises the Governor on drought status, impacts, and any necessary preparedness and response actions.

The Fall 2021 meeting included a review of 2021 drought status, Winter 2021-2022 weather outlook, 2021 wildfire season update, impacts of drought on the Gila River Indian Community, and water supplies updates for the Colorado River and Salt River and Verde River watersheds.

The Spring 2022 meeting included a review of 2021-2022 winter precipitation, Summer 2022 weather outlook, impacts of drought on hydropower, the Gila River Indian Community, and on Navajo Nation, as well as water supply updates for the Colorado River and Salt River and Verde River Watersheds.

At both the Fall 2021 and Spring 2022 meetings, the ICG recommended the continuation of the Drought Emergency Declaration ([PCA 99006](#)) and the Drought Declaration ([Executive Order 2007-10](#)) for the State of Arizona. The presentations and subsequent decisions are on the ADWR ICG webpage: <https://new.azwater.gov/drought/interagency-coordinating-group>.



3.C. DROUGHT PLANNING FOR COMMUNITY WATER SYSTEMS

Drought planning requirements and water use reporting regulations for Community Water Systems (CWSs) were recommended in the Arizona Drought Preparedness Plan and established by the State Legislature in 2005 to help CWSs reduce their vulnerability to drought and water shortages. These reports provide a means for the state to gather water-use data and offer assistance to CWSs where needed. ADWR aids water providers in meeting these requirements through web-based resources, online reporting tools, and phone or in-person consultations. For more information, see the ADWR CWS webpage: <https://new.azwater.gov/cws>.

All CWSs in the state 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 (SWP), which includes a Water Supply Plan and a Conservation Plan. The Drought Plan requires water systems to describe their drought stages and triggers, emergency sources of water, customer communication strategies, and other planning actions. As of the end of WY2022, ADWR has received SWPs from 661, or 89%, of active CWSs.

The number of annual water-use reports received from active CWSs located outside the State’s Active Management Areas (AMAs) can be seen in **Table 4**. Annual water reports have been required for systems inside the AMAs since the passage of the [1980 Groundwater Act](#).

Table 4. Annual Water Use Reports Received from Active CWSs Located Outside Active Management Areas by Calendar Year

2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Number (and percent) of reports received out of total active CWSs for that year:										
362/464 (78%)	407/466 (87%)	423/471 (90%)	405/481 (84%)	396/465 (85%)	403/466 (86%)	405/465 (87%)	404/462 (87%)	395/468 (84%)	397/461 (86%)	409/461 (89%)

In June of 2022, ADWR released the CWS Data Dashboard online. The dashboard is designed to improve public access to water planning data as well as to increase the State’s ability to identify communities at high-risk of drought or shortage conditions. Data reported within CWS Drought Preparedness Plans, such as drought stage declarations or emergency water supply plans, are displayed through the dashboard and can be filtered to highlight specific criteria or timeframes, see **figures 28 and 29**. The dynamic nature of the dashboard allows any user to rapidly identify communities that have experienced drought conditions or those that have an increased risk of experiencing a shortage event in the future. For more information, see the CWS Data Dashboard online: <https://new.azwater.gov/cws/community-water-systems-data>.



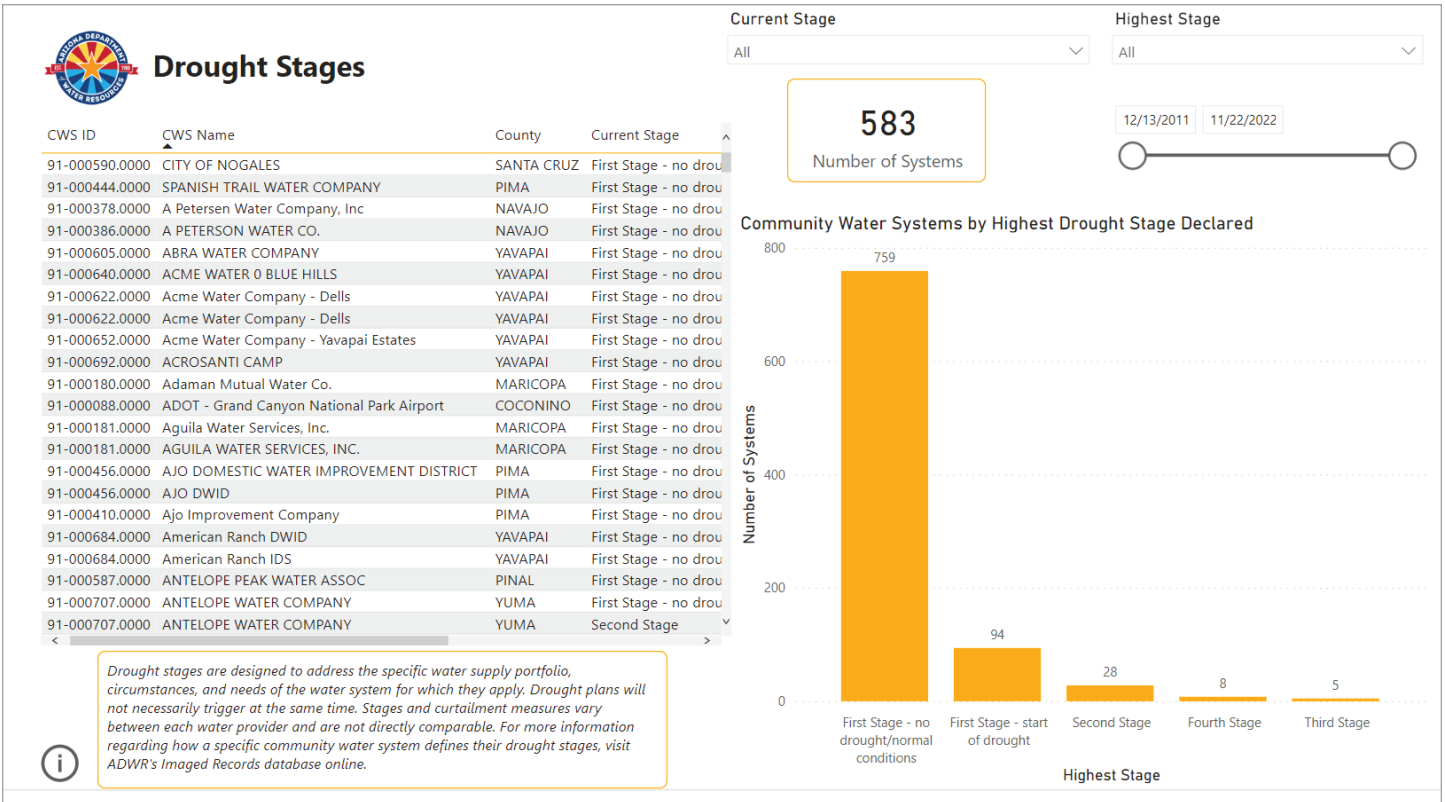


Figure 28. CWS Data Dashboard, Drought Stages.

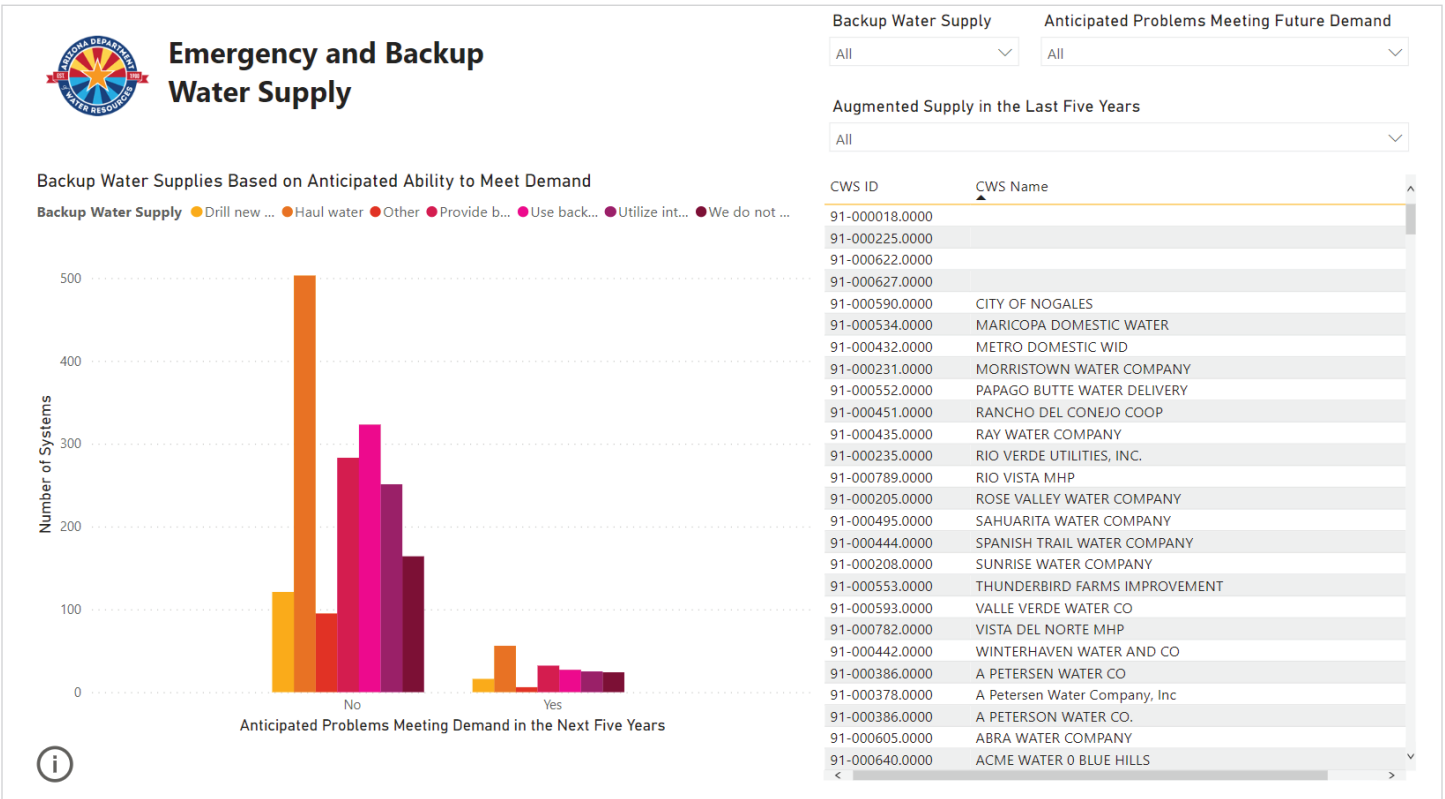


Figure 29. CWS Data Dashboard, Emergency and Backup Water Supply.

3.D. LOCAL DROUGHT IMPACT GROUP (LDIG) EFFORTS

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, in response to local fiscal and staffing limitations, the focus of the LDIGs has been entirely on drought impact monitoring and reporting. Currently, only Pima County has an active LDIG program inclusive of many stakeholders, from water providers to ranch and creek managers. See **Appendix C** for the full Pima County LDIG WY2022 Annual Report.

3.E. COLORADO RIVER DROUGHT RESPONSE EFFORTS¹²

The Colorado River is a highly variable system, subject to dramatic change in runoff from year to year. In general, the average annual natural flow of the Colorado River at Lee's Ferry has averaged around 15 MAF over a 115-year period (WY1906 through 2020) but has ranged from as little as 5.4 MAF to as much as 24.4 MAF in a single year. The entire Colorado River Reservoir System supply has been in decline, and projections indicate that this is likely to continue into the foreseeable future. Lake Mead and Lake Powell are at the lowest reservoir elevations since they began filling. The period from 2000 through 2022 is the lowest 23-year inflow in the historic record and one of the lowest in the past 1,200 years. As a result of the exceptionally low runoff conditions over the past three years (2020, 2021, and 2022), drought response operations have been triggered at Lake Powell and Lake Mead, consistent with the 2007 Interim Guidelines and 2019 DCPs.

2007 INTERIM GUIDELINES

In December 2007, the Secretary of the U.S. Department of the Interior adopted the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead*¹³ (2007 Interim Guidelines). The 2007 Interim Guidelines created a novel approach to Colorado River operations that incentivized conservation and augmentation through the creation of Intentionally Created Surplus (ICS). In addition, the Guidelines defined the criteria for shortages in the Lower CRB based on elevations in Lake Mead, implemented closer coordination of operations of Lake Powell and Lake Mead, and preserved flexibility to deal with further challenges such as climate variability and deepening drought.

PILOT SYSTEM CONSERVATION PROGRAM (PSCP)

More recent drought mitigation planning efforts include the PSCP and the Lower Basin Drought Memorandum of Understanding (MOU) agreements. The PSCP involves water agencies from both the Upper and Lower CRBs that agreed to jointly fund water conservation projects in both the Upper and Lower Basins to benefit the Colorado River system. The purpose of the Lower Basin Drought MOU was to generate additional water to be left in Lake Mead to reduce the risk of reaching critical reservoir elevations. Both programs were voluntary and were initiated in 2014. The Pilot Program in the Lower Basin is expected to create 175,347 AF of system conservation in Lake Mead by 2035 for a cost of approximately \$29.8 million or \$170.14/AF. The Federal/Non-Federal cost share is 47/53%, respectively. By the end of calendar year 2022, 142,496 AF of system conservation is expected to be conserved in Lake Mead. The majority of the conservation was completed by 2019, with the exception of the Bullhead City PSCP continuing through 2022.

¹² The Substantial portions of this section and associated footnotes are from the Bureau of Reclamation's October 7, 2022, draft "Annual Operating Plan for Colorado River Reservoirs 2023."

¹³ Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead: <https://www.usbr.gov/lc/region/programs/strategies/RecordofDecision.pdf>

DROUGHT CONTINGENCY PLAN (DCP)

In 2013, the seven CRB States, the United States, and the Republic of Mexico started drought contingency planning discussions in response to the ongoing historic drought in the CRB.

Arizona's participation in this effort proceeded along two tracks: one was the intra-Arizona pursuit of a plan to implement the DCP within Arizona and to authorize the Director of ADWR to sign the DCP on behalf of the state. That effort became known as Arizona's DCP Implementation Plan. The other track involved the negotiations among the CRB States and the Interior to finalize the DCPs.

The agreements include an Upper CRB DCP and a Lower CRB DCP. They are designed to help reduce the risk of Colorado River reservoirs, particularly Lake Powell and Lake Mead, declining to critical elevations.

The Lower CRB DCP agreement was made and entered on May 20, 2019, by and among the United States, represented by the Secretary of the Interior; the State of Arizona, acting through the Director of the ADWR; the Metropolitan Water District of Southern California (Metropolitan); the Coachella Valley Water District (CVWD); the Palo Verde Irrigation District (PVID); the City of Needles, California; the Colorado River Commission of Nevada (CRCNV); and the Southern Nevada Water Authority (SNWA).

The Lower CRB DCP is designed to protect Lake Mead from declining to critically low elevations by requiring water delivery reductions at higher elevations than specified in the Interim Guidelines and providing enhanced incentives for conservation of water to be stored in Lake Mead by Arizona, California, and Nevada. Adoption of the Lower CRB DCP is important to Arizona, which is at risk of potentially catastrophic reductions in water deliveries if elevations in Lake Mead continue to fall to critically low elevations. To adopt and implement the Lower CRB DCP, Arizona established a Steering Committee, composed of key water leaders, water users, and representatives from various sectors across Arizona in a way that is acceptable to Arizona water users.

UPPER BASIN DROUGHT RESPONSE OPERATIONS AGREEMENT (DROA)

Hydrologic projections in early 2021 indicated that Lake Powell could decline to below the Drought Response Operations Agreement's (DROA) Target Elevation of 3,525 feet, prompting the Bureau of Reclamation (Reclamation) to work with DROA¹⁴ parties to develop the 2022 Plan (i.e., a Framework document and attachments identifying operations).

In July 2021, Reclamation initiated an emergency release of 0.161 MAF from Flaming Gorge, Blue Mesa, and Navajo reservoirs in accordance with the DROA.

After consultation and coordination with the Upper Division States, Reclamation initiated a second DROA action in January 2022. Pursuant to DROA, the first drought response that is considered is the modification of monthly release volumes from Lake Powell while maintaining the annual release volume pursuant to the 2007 Interim Guidelines.

Reclamation modified Lake Powell release volumes by reducing the monthly releases from January through April 2022 by a total volume of 0.350 MAF. This volume was scheduled to be added back into releases scheduled for June through September 2022; however, in May 2022, the Department of the Interior modified the annual release volume from Lake Powell from 7.48 MAF to 7.00 MAF, in accordance with Sections 6 and 7.D of the 2007 Interim Guidelines.

In April of 2022, the DROA parties finalized the 2022 Plan for the duration of May 2022 through April 2023¹⁵. The Secretary of the Interior, through her designee, approved the 2022 Plan on April 29, 2022¹⁶, as summarized and including the following key operational elements:

¹⁴ See: <https://www.usbr.gov/dcp/docs/final/Attachment-A1-Drought-Response%20Operations-Agreement-Final.pdf>

¹⁵ Drought Response Operations Framework and Plan: <https://www.usbr.gov/uc/DocLibrary/Plans/20220420-2022DroughtResponseOperationsPlan-Signed-508-UCRO.pdf>.

¹⁶ Department of Interior Approval Memo: <https://www.usbr.gov/uc/DocLibrary/Plans/20220429-2022DroughtResponseOperationsPlan-ApprovalMemo-508-DOI.pdf>.

1. Drought Response Operations releases approximately 0.500 MAF from Flaming Gorge Dam
2. Possible Drought Response Operations releases from Blue Mesa Reservoir in Fall 2022 and Winter 2023, contingent upon available release volumes
3. Possible Drought Response Operations releases from Navajo Reservoir in Fall 2022 or Winter 2023, contingent upon available release volume
4. Possible operational adjustments at Glen Canyon Dam in Winter 2023
5. No anticipated recovery of DROA release volumes through the term of the 2022 Plan

2022 POWELL RELEASE REDUCTION; OPERATIONAL NEUTRALITY AND PROTECTION OF THE GLEN CANYON DAM FACILITIES AND OPERATIONS

In light of the prolonged drought, low runoff conditions, and depleted storage at Lake Powell, the Department of the Interior implemented an action under Sections 6 and 7.D of the 2007 Interim Guidelines specifically reducing the Glen Canyon Dam annual release from 7.48 MAF to 7.00 MAF in WY2022. This action, issued on May 3, 2022¹⁷, was undertaken in conjunction with 2022 DROA actions resulting in the addition of approximately one million additional acre-feet of storage, or 16.00 feet of pool elevation, by April 2023.

The reduction of releases from Lake Powell from 7.48 MAF to 7.00 MAF in WY2022 will result in a reduced release volume of 0.480 MAF that, consistent with routine operations under the 2007 Interim Guidelines, normally would have been released from Glen Canyon Dam to Lake Mead as part of the 7.48 MAF annual release volume. The reduction of releases from Glen Canyon Dam in WY2022 (resulting in increased storage in Lake Powell) will not affect future operating determinations and will be accounted for “as if” this volume of water had been delivered to Lake Mead. The August 2022 24-Month Study modeled Lake Powell and Lake Mead as if the 0.480 MAF had been delivered to Lake Mead for operating tier/condition purposes both for the U.S. Lower Basin and for Mexico.

The Commissioner of the Bureau of Reclamation announced the Lower Colorado River will operate in a Tier 2a Shortage condition in calendar year 2023 when operating under Operational Neutrality. In Arizona, a Tier 2a Shortage requires total reductions of 592,000 AF when Lake Mead is below elevation 1,050 feet¹⁸.

500+ PLAN MEMORANDUM OF UNDERSTANDING

The August 2021 24-Month Study Minimum Probable inflow scenario projected the elevation at Lake Mead falling below elevation 1,030 feet in July 2023. Consistent with Section V.B.2 of Exhibit 1 to the Lower Basin DCP, this projection triggered consultation among the Secretary and Lower Division States to determine what additional measures will be taken to avoid and protect against the potential for Lake Mead to decline below 1,020 feet.

In December 2021, an MOU was executed, with the aim to conserve 500,000 AF of water in Lake Mead in both 2022 and 2023 in addition to required 2007 Interim Guidelines reductions and 2019 Drought Contingency Plan contributions. The plan outlined in the MOU, known as the “500+ Plan”, includes conservation efforts in both urban and agricultural communities, such as funding crop following on farms to save water or urban conservation to reduce diversions from Lake Mead. Reclamation, ADWR, Central Arizona Water Conservation District, Metropolitan, and SNWA committed to investing up to \$200 million in projects at Lake Mead over the next two years.

As of October 2022,¹⁹ approximately 417,259 AF is projected to be conserved through calendar year 2023 in accordance with the 500+ Plan.

¹⁷ More information about Lake Powell’s operating decision for Water Year 2022 is available online:

<https://www.usbr.gov/uc/DocLibrary/Plans/20220503-2022DROA-GlenCanyonDamOperationsDecisionLetter-508-DOI.pdf>.

¹⁸ The 2007 Interim Guidelines require a reduction of 400 KAF and the DCP requires a contribution of an additional 192 KAF, totaling 592 KAF.

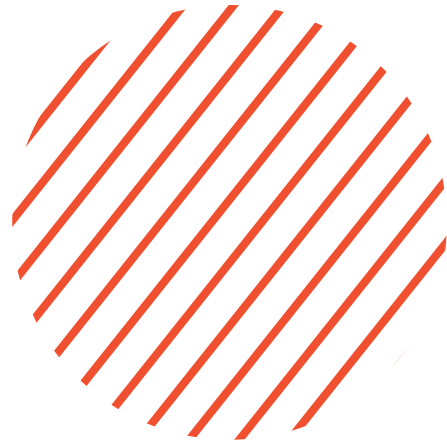
¹⁹ From Bureau of Reclamation’s October 2022 Most Probable 24-Month Study model assumptions.

ARIZONA'S RECONSULTATION

Arizona continues to build on the success of the DCP process by utilizing the same approach at the intrastate level to develop an Arizona consensus on the "reconsultation" of the 2007 Interim Guidelines. On June 25, 2020, Arizona reconvened Arizona's Lower Basin DCP Steering Committee delegates to form the "Arizona Reconsultation Committee" or ARC. In all, the ARC set out four primary goals:

- Establish a process for continued engagement within Arizona throughout the Reconsultation process.
- Provide a venue for developing and sharing stakeholder perspectives and values to guide Arizona's perspectives in the Reconsultation process.
- Identify risks and benefits to inform Arizona's input to the Reconsultation process.
- Continue the transparency that was established during the successful DCP Steering Committee effort.

As Reclamation initiates the formal Reconsultation process with the anticipated publication of a Notice of Intent in 2023, the ARC will continue to provide guidance to the co-chairs as requested.



3.F. DROUGHT AND HEALTH EFFORTS

The Arizona Department of Health Services (ADHS) Office of Environmental Health addresses and monitors the public health effects of drought in Arizona. Drought can negatively impact water quality and quantity and increase incidences of zoonotic disease. Drought can intensify heat waves causing increased risk of health-related illness and cause respiratory distress from wildfire smoke, dust storms, pollen, and airborne particles.

WATER QUALITY

Potable water quality can be threatened during drought which in turn can impact availability of water supplies. Drought affects groundwater table levels, resulting in the fluctuating concentration of metals and minerals. Arizona groundwater is known to contain naturally occurring arsenic, fluoride, and uranium. The Arizona Environmental Public Health Tracking (EPHT) Data Explorer tracks the levels of these contaminants in drinking water from public drinking water systems and private wells throughout Arizona with data available from 2006-2021.²⁰

Droughts produce conditions that can exacerbate wildfires or flooding events that can compromise well water quality. A wildfire can damage well components and mobilize pollutants into aquifers. A flood may pollute wells with contaminated surface water carrying sewage and runoff from farms or waste disposal sites. There are over 120,000 registered private wells in Arizona. These well owners are dependent on groundwater as their primary water source. To protect the health of well owners, ADHS assists well owners to monitor their well water quality by offering free well water testing. Since 2014 ADHS has collected and analyzed over 500 samples of well water.

The ADHS [well water website](#) provides private well owners with guidance on where to get their private well water tests for bacteria, nitrates, arsenic, fluoride, and uranium and how to treat their contaminated well. Additionally, through a partnership with ADWR, ADHS provides well water and health safety materials, including information on testing, treatment, health effects, and a well owner guide that describes drought impacts on well water and health.²¹ Approximately 1,200 new well owners have received this information in 2022. In 2021, ADHS incorporated an online interactive tool called the [Be Well Informed App](#), which allows private well owners to input their water contaminant testing results and provides recommendations for treatment and health safety.

Private well owners are especially vulnerable to drought because they live in rural areas and are solely responsible for their water supplies and monitoring of water quality. ADHS is developing a systematic approach to address public health concern and health inequality. ADHS will educate well owners on water quality and well safety in drought conditions. ADHS is continuing its effort to promote groundwater testing and contamination awareness.

AIR QUALITY

Drought can affect air quality in several ways. For example, drought and heat waves can cause vegetation to dry up, which can then become fuel for wildfires leading to more smoke and an increase in health problems.²² In addition, drought conditions can intensify and increase the number of dust storms, which reduces air quality.

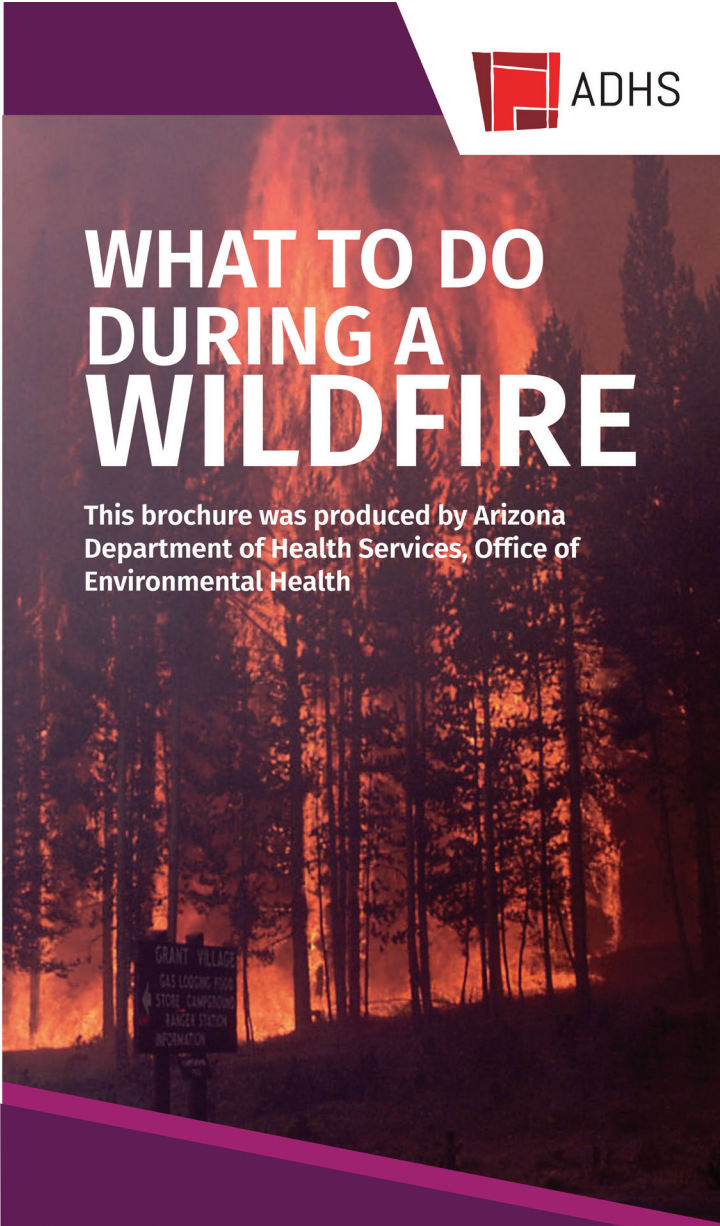
Poor air quality can exacerbate chronic respiratory conditions such as asthma and chronic obstructive pulmonary disease. Several counties in Arizona, notably, Pinal and Maricopa, experienced 6.6% and 3.3% of days of particulate matter (PM) 2.5 levels and 16.9% and 1.1% of days of PM 10 levels above the National Ambient Air Quality Standards (NAAQS) in 2020, respectively. In 2020, the state age-adjusted rates for emergency care visits for asthma and chronic obstructive pulmonary disease were 22.7 and 23.7 per 10,000 population, respectively.¹⁸ In response to these challenges, ADHS's Office of Environmental Health has published bilingual brochures on what to do [during](#) ([español](#)) and [after](#) ([español](#)) (**figure 30**) a wildfire as well as launched health safety pages on [dust storms](#) and [air quality](#).

²⁰ Arizona EPHT Explorer: <https://gis.azdhs.gov/ephtexplorer/>

²¹ Arizona Well Owner's Guide to Water Supply 2nd Edition: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/environmental-toxicology/well-water/arizona-well-owners-guide.pdf>

²² CDC Health Implications of Drought: <https://www.cdc.gov/nceh/drought/implications.htm>

Visibility in Miles	PM _{2.5} or PM ₁₀ µg/m ³ , 1 to 3hr avg.	Health Category (AQI)	Cautionary Statements
10+	0-38	Good (0-50)	None
5-10	39-88	Moderate (51-100)	Unusually sensitive people should consider reducing prolonged or heavy exertion.
3-5	89-138	Unhealthy for Sensitive Groups (101-150)	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
1.5-3	139-350	Unhealthy (151-200)	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
1-1.5	351-526	Very Unhealthy (201-300)	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
1 or less	526+	Hazardous (≥300)	Everyone should avoid all physical activity outdoors; people with heart or lung disease, older adults, and children should remain indoors and keep activity levels low.



WHAT TO DO DURING A WILDFIRE

This brochure was produced by Arizona Department of Health Services, Office of Environmental Health

Natural disasters like forest fires can be stressful and chaotic times, having a checklist or plan in place can greatly relieve some of the pressures and allow you to focus on protecting the health and safety of you and your household. This brochure provides information that maybe helpful in organizing your family's plan.

Remember that you are not alone when disaster strikes. Your neighbors, your community, local fire departments, your county and the agencies of the State of Arizona are available to give you aid and comfort to the best of their abilities.

Figure 30. Arizona Department of Health Services, Office of Environmental Health (2021) What To Do During a Wildfire Brochure ([Spanish](#))

EXTREME HEAT

Drought and extreme heat are intertwined. Unusually high temperatures and dry spells can contribute to drought severity. In addition, drought can intensify extreme heat health effects, such as heat exhaustion or heat stroke. In 2021, there were 2,873 heat-related illness emergency department visits and 552 heat-related deaths recorded in Arizona, occurring in predominantly Maricopa, Mohave, Pima, Pinal, and Yuma counties²³. Over the last four years, heat-related deaths have increased, exceeding 250 deaths annually.

To address the impacts of extreme heat ADHS collaborates with universities to update heat vulnerability assessments for Arizona. These assessments identify the impacts of extreme heat among vulnerable populations, such as Native Americans (5%) and the Hispanic population (32%) in Arizona, based on the 2019 U.S. Census American Community Survey. To protect vulnerable populations (e.g., children, older adults, low-income/unemployed, unsheltered populations, and residents without access to air conditioning) from extreme heat, ADHS collaborates with county and university partners to evaluate cooling centers and conduct a spatial analysis to identify the optimal locations for cooling centers to assist planning efforts.

Additional resources are available through the [Extreme Heat Network](#), of which ADHS is a partner. This network is a community of research and practice regarding the causes, impacts, and strategies to increase resilience to extreme heat. For example, partners work to inform urban design through heat mapping efforts to see where air and surface temperatures are highest. The impacts of the urban heat island (UHI) are well documented, including increases in heat-related public health issues, stresses on urban ecology, and energy usage to mitigate the higher temperatures. UHI is of particular concern to cities in the Southwest, since it counteracts the cooling that otherwise normally occurs at night during heat waves. While UHI mapping and modeling has become more sophisticated in recent years, there is still an information gap between the heat maps, urban planning strategies to decrease heat, and the use of that information in policy decision-making. Increased drought severity, coupled with increased heat, increases evapotranspiration and thus increases water needs for cooling shade trees in urban areas.

ZOO NOTIC DISEASES

Drought conditions can create an environment ripe for transmission of zoonotic diseases, including Valley fever and West Nile virus (WNV).²⁴ Dust that is blown by dust storms throughout the year can carry the fungal spores, *Coccidioides*, which are the source of infection for coccidioidomycosis, also known as Valley fever. It is a fungus that is commonly found in the southwestern United States. People can acquire Valley fever by breathing in the microscopic fungal spores from the air, although most people who breathe in the spores don't get sick.²⁵ Symptoms are similar to the flu and include fatigue, cough, fever, shortness of breath, headache, night sweats, muscle aches, and rash.

From 2014 to 2020, Valley fever incidence ranged from 84.4 to 158.0 per 100,000 population in Arizona.²⁶ Drought increases the opportunity for WNV transmission by reducing the size of water bodies, causing them to become stagnant; this provides additional breeding grounds for certain types of mosquitoes.²⁷ WNV disease symptoms include acute febrile illness with headache, myalgia or arthralgia, and gastrointestinal issues. WNV disease is reported mostly in Maricopa, Pima and Pinal counties, where the majority of WNV cases occurred in 2022 to date.²⁸

²³ADHS Extreme Weather & Public Health: <https://azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/index.php#news-publications>

²⁴Projections of Climate Impacts on Vector-Borne Diseases and Valley Fever in Arizona: <http://azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/pubs/projections-climate-impacts-vector-borne.pdf>

²⁵CDC Symptoms of Valley Fever (Coccidioidomycosis): <https://www.cdc.gov/fungal/diseases/coccidioidomycosis/symptoms.html>

²⁶ADHS Epidemiology & Disease Control: <https://www.azdhs.gov/preparedness/epidemiology-disease-control/index.php#data-stats-past-years>

²⁷Drought and immunity determine the intensity of West Nile virus epidemics and climate change impacts: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5310598/>

²⁸Arizona 2022 West Nile Virus Statistics: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/mosquito-borne/west-nile/data/west-nile-virus-stats-2022.pdf?v=20220914>

AZ ENVIRONMENTAL PUBLIC HEALTH TRACKING (EPHT)

The ADHS EPHT program monitors population health status during moderate to extreme drought conditions. Public health partners are able to access and track environmental and health indicators in one location at different spatial scales, such as county, sub-county, and public water system levels (**figure 31**). Drought-related environmental topics tracked include drought indices, extreme precipitation, flood vulnerability, temperature, heat vulnerability, wildfires, hazard losses, water quality, and air quality. Drought-related health topics tracked include asthma, heat-related illness, chronic obstructive pulmonary disease (COPD) hospitalizations, heat-related deaths, WNV, and social vulnerability factors. Data is visualized in an online interactive Data Explorer in maps, tables, graphs, and charts and can be viewed at <https://gis.azdhs.gov/ephtexplorer/>.

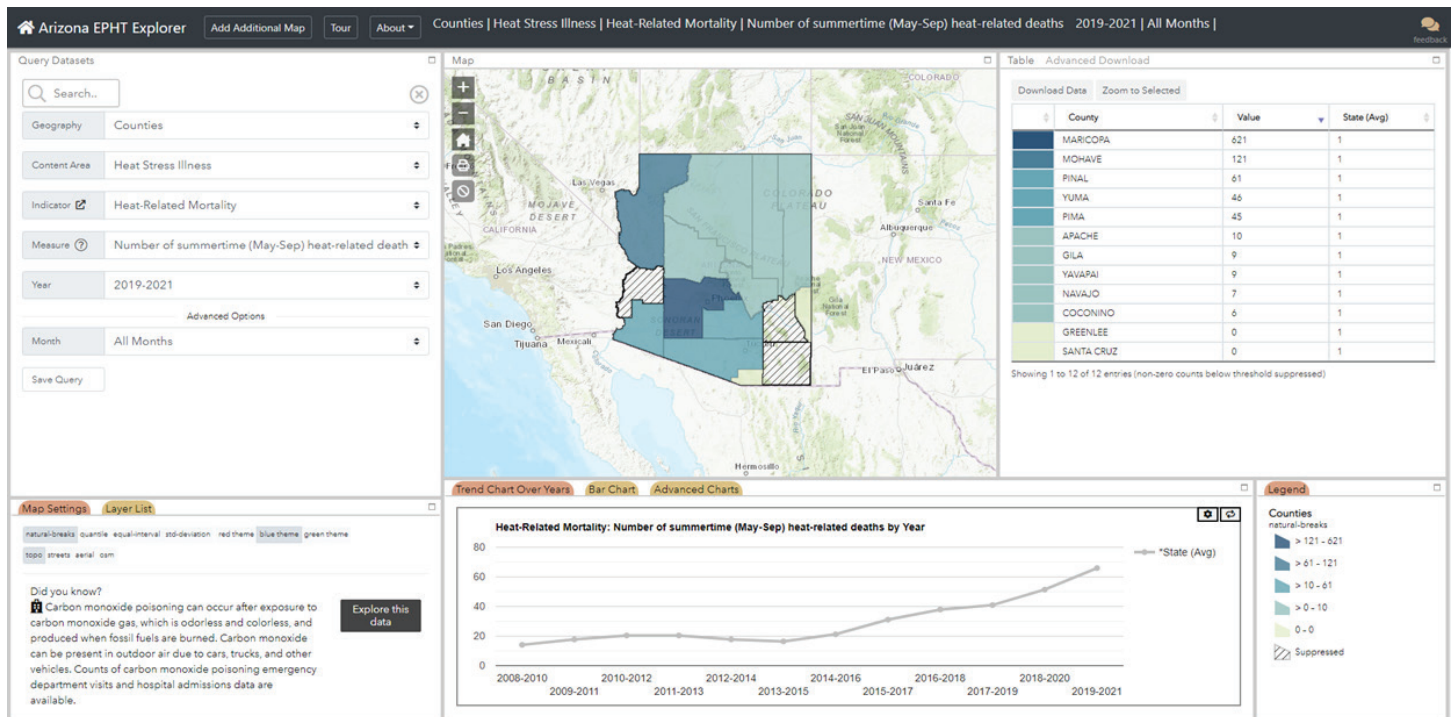


Figure 31. ADHS EPHT Data Explorer displaying the number of summertime (May-September) heat-related deaths by county 2019-2021.

The ADHS EPHT program also partnered with the ADHS Syndromic Surveillance Program to monitor health impacts and trends in near-real-time during wildfire and extreme heat events in the last year. ADHS EPHT monitored respiratory illnesses, like asthma or COPD, air quality indicators, like PM 2.5, and wildfire-related emergency department visits in wildfire-prone areas of the state to support public health decision-makers and respond to public health emergencies.

CLIMATE AND HEALTH

ADHS incorporates the CDC's Building Resilience against Climate Effects (BRACE) Framework (**figure 32**) and partners with organizations to implement public health interventions aimed at protecting Arizonans against climate-sensitive hazards including drought.

ADHS partnered with Arizona State University and the University of Arizona to produce reports such as a Profile on Extreme Weather, Climate and Health; Climate and Health Adaptation Plan; and an Assessment of Climate and Health Impacts on Vector-Borne Diseases and Valley Fever in Arizona.²⁰ The ADHS Extreme Weather and Public Health Program has also worked with Public Health Emergency Preparedness to develop and update public health emergency response plans for extreme and wildfires.

Most recently, ADHS continues its collaborative efforts to update the BRACE

reports with a greater focus on health equity and new climate data. This will eventually lead to informing a new State Climate and Health Adaptation Plan expected to be completed in 2023. ADHS also works with county health departments and universities to develop local climate and health strategic plans addressing topics such as drought, wildfires, heat, dust storms, air quality, and vector-borne diseases related to climate-sensitive hazards.

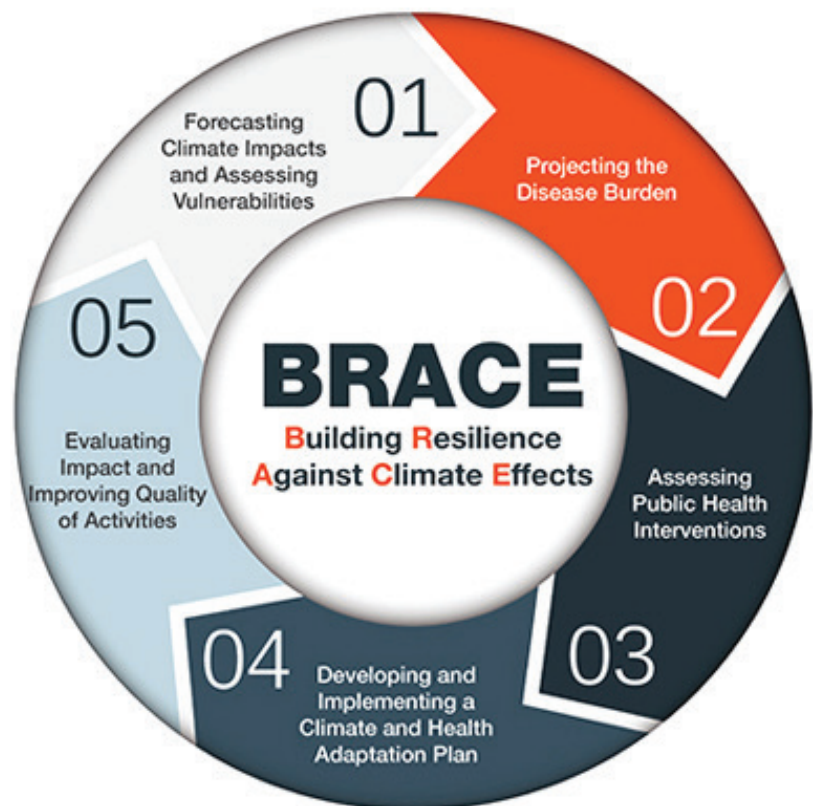


Figure 32. CDC BRACE Framework.

3.G. ADWR OUTREACH & ASSISTANCE

ADWR LEADERSHIP DROUGHT ACTIVITIES

During WY2022, ADWR Director Tom Buschatzke and ADWR Deputy Director Clint Chandler actively promoted drought preparedness efforts and activities around the State of Arizona, not only by leading many of these efforts, but also by discussing and presenting on these activities to a wide array of stakeholders, groups, and organizations, as those listed below. Their discussions included topics such as Arizona's Reconsultation Committee; Governor Ducey's Water Augmentation, Innovation, and Conservation Council (GWAICC; **Appendix A**); Arizona's water resource challenges; and the first-ever Tier 2a Shortage declared for Colorado River operations in 2023. ADWR is committed to transparency and is passionate about providing water information to interested parties.

- Greater Phoenix Chamber: Agriculture Environment & Water Committee, January 19, 2022
- Arizona House of Representatives: Committee on Natural Resources, Energy & Water, February 13, 2022
- Arizona State Senate: Natural Resources, Energy & Water Committee, February 16, 2022
- Arizona State Senate: Natural Resources, Energy & Water Committee, March 2, 2022
- Arizona Forward: Water Strategies Committee, March 10, 2022
- Arizona House of Representatives: Committee on Natural Resources, Energy & Water, March 15, 2022
- National Council of Real Estate Investment Fiduciaries: Winter Conference, March 16, 2022
- County Supervisors Association of Arizona: Board of Directors Meeting, March 17, 2022
- Phoenix East Valley Partnership: Critical Infrastructure and Transportation Committee Meeting, April 12, 2022
- Noble Law Office: Water Law Class, April 25, 2022

- Greater Phoenix Chamber: Agriculture Environment & Water Committee, January 19, 2022
- Arizona House of Representatives: Committee on Natural Resources, Energy & Water, February 13, 2022
- Arizona State Senate: Natural Resources, Energy & Water Committee, February 16, 2022
- Arizona State Senate: Natural Resources, Energy & Water Committee, March 2, 2022
- Arizona Forward: Water Strategies Committee, March 10, 2022
- Arizona House of Representatives: Committee on Natural Resources, Energy & Water, March 15, 2022
- National Council of Real Estate Investment Fiduciaries: Winter Conference, March 16, 2022
- County Supervisors Association of Arizona: Board of Directors Meeting, March 17, 2022
- Phoenix East Valley Partnership: Critical Infrastructure and Transportation Committee Meeting, April 12, 2022
- Noble Law Office: Water Law Class, April 25, 2022
- ADWR & CAP Joint Colorado River Shortage Preparedness Briefing, May 6, 2022
- Coldwell Banker Realty Agents - Tuesday Sales Meeting, May 2, 2022
- Yuma Fresh Vegetable Association State of the Industry, May 12, 2022
- Tucson Regional Water Coalition, May 17, 2022
- SALC Virtual presentation, May 11, 2022
- Salt River Project All Hands Meeting, May 26, 2022
- Grand Canyon Electric Cooperative Association Annual Meeting, July 20, 2022
- Arizona Water Reuse Symposium 2022, July 25, 2022
- 30th Annual Arizona Water Law Conference, August 12, 2022
- 2022 Arizona Hydrological Society Symposium, September 15, 2022
- Greater Phoenix Chamber - AZ in Focus, September 14, 2022
- Realty One Group-Agent Collective Presentation, September 23, 2022
- Zion Bancorporation Ag Summit, September 27, 2022
- Southern Arizona Water Users Association Annual Forum, September 29, 2022
- AG 100, October 7, 2022
- Arizona Business Alliance, October 12, 2022
- 2022 Colorado River Forum, October 18, 2022
- Arizona Mexico Commission, October 18, 2022
- Realty One-Group Agent Collective Presentation, October 19, 2022
- Greater Phoenix Economic Council Ambassador Event: Arizona's Water Position, October 26, 2022
- American Society of Civil Engineers Phoenix Chapter, October 27, 2022
- Arizona Municipal Water Users Association Board of Directors Meeting, October 27, 2022
- Valley Partnership Valley Morning Breakfast Critical Water Shortage: Planning for a Drier Future, October 28, 2022

ADWR COMMUNICATION ACTIVITIES

ADWR promotes and encourages efficient use of water throughout Arizona by developing conservation tools and resources, assisting Arizona communities and water providers, presenting on drought and conservation issues and solutions, collaborating with regional and national partners, and participating in outreach activities. Staff provide materials and respond to inquiries from the public, businesses, press, water professionals, students, researchers, and others about water conservation and drought. Below are a few highlighted efforts and activities by ADWR staff during WY2023 that promoted water conservation and awareness:

DROUGHT STATUS AND PREPAREDNESS PRESENTATIONS

The ADWR Drought Program Coordinator, N  mesis Ortiz-Decl  t, prepared and delivered presentations about Arizona drought status and preparedness activities, as well as weather projections in the state. During WY2022, presentations were delivered to multiple groups, committees, and agencies, including the Phoenix Herpetological Sanctuary Summer Camp (May 25, 2022) and the Pima Association of Governments' Environmental Planning Advisory Committee (EPAC; October 7, 2022).

ARIZONA WATER NEWS

ADWR’s Arizona Water News (**figure 33**), a weekly newsletter featuring articles on Arizona and Colorado River water-related issues, was launched in March 2016. The newsletter articles help stakeholders stay up to date on the latest developments regarding Arizona water. Since its launch, Arizona Water News articles have received over 81,496 views. Visit the Arizona Water News website to read past news articles: <https://new.azwater.gov/news>.

Below are a few drought-related WY2022 Arizona Water News articles:

- [ADWR Director And CAP General Manager Give Grim Assessment Of Colorado River Conditions](#), September 16, 2022
- [Arizona Water Leaders Vow To Work On A System-Wide Agreement To Protect The Colorado River](#), August 30, 2022
- [With Third-Straight “La Niña” Likely, Drought Panel Recommends Continuing Drought Status](#), June 2, 2022
- [The Drought Monitoring Technical Committee: Tracking Drought Is A Year-Round Project](#), January 27, 2022
- [Real “No Brainer”: Drought Interagency Coordinating Group Recommends Continued Declaration](#), December 7, 2021
- [ADWR Director Testifies Before U.S. House Panel On Colorado River Conditions](#), October 22, 2021
- [ADWR Director Testifies Before Senate Panel: Taking Steps To Protect Vital River System](#), October 7, 2021



Figure 33. ADWR Arizona Water News.

WATER AWARENESS MONTH

ADWR has coordinated Arizona’s Water Awareness Month (WAM) campaign since the Governor’s executive order in 2008. During the April 2022 WAM celebration (**figure 34**) ADWR’s WAM virtual campaign included free educational materials through social media, Arizonawaterfacts.com and other platforms. Additionally, ADWR hosted seven [water education webinars](#) during “WAM Tech Tuesdays” and “WAM Water Wednesdays”:

- [Hydrologic Science to Support Arizona’s Water Management Decisions: Emerging Approaches from the USGS Arizona Water Science Center](#)
- [Saving Water in your Home, Yard, or Business with Environmental Protection Agency \(EPA\) WaterSense](#)
- [We Water People with Grand Canyon National Park Service \(NPS\)](#)
- [Colorado Basin River Forecast Center & the Science of Forecasting Streamflow](#)
- [History of Salt River Project \(SRP\)](#)
- [H2OMG! Summer Is Here at Arizona State Parks!](#)
- [Arizona Tourism & Water-Based Recreation](#)

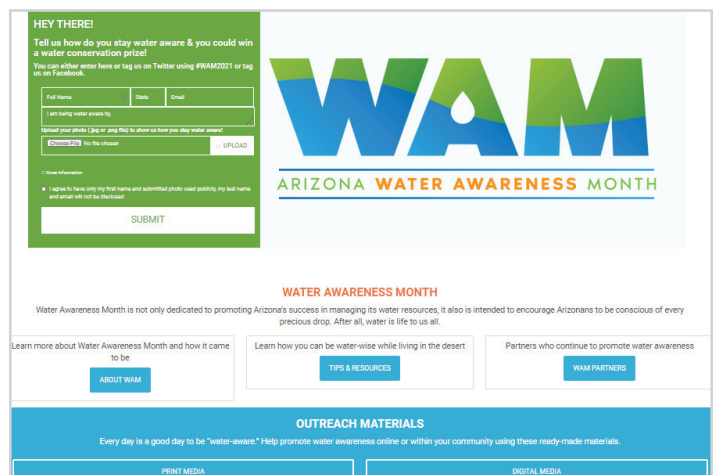


Figure 34. April 2021 Water Awareness Month water conservation education campaign.

ADWR DROUGHT WEBSITE

ADWR's Drought website features the weekly, monthly, and quarterly drought statuses for Arizona as well as updates regarding MTC, ICG, and LDIG activities (see **Section 3**). The website also provides a historical background on drought planning in Arizona, and an archive for past drought preparedness annual reports that are easily accessible to the public. Visit ADWR's Drought website here: <https://new.azwater.gov/drought>

ARIZONA WATER FACTS WEBSITE

On June 1, 2016, ADWR launched Arizonawaterfacts.com (**figure 35**). This website is dedicated to promoting Arizona's success in managing its water resources, presenting current water resource challenges, and planning for the future. Arizona Water Facts is intended to build confidence in our water resources – a necessity for fostering a thriving economy and communities.

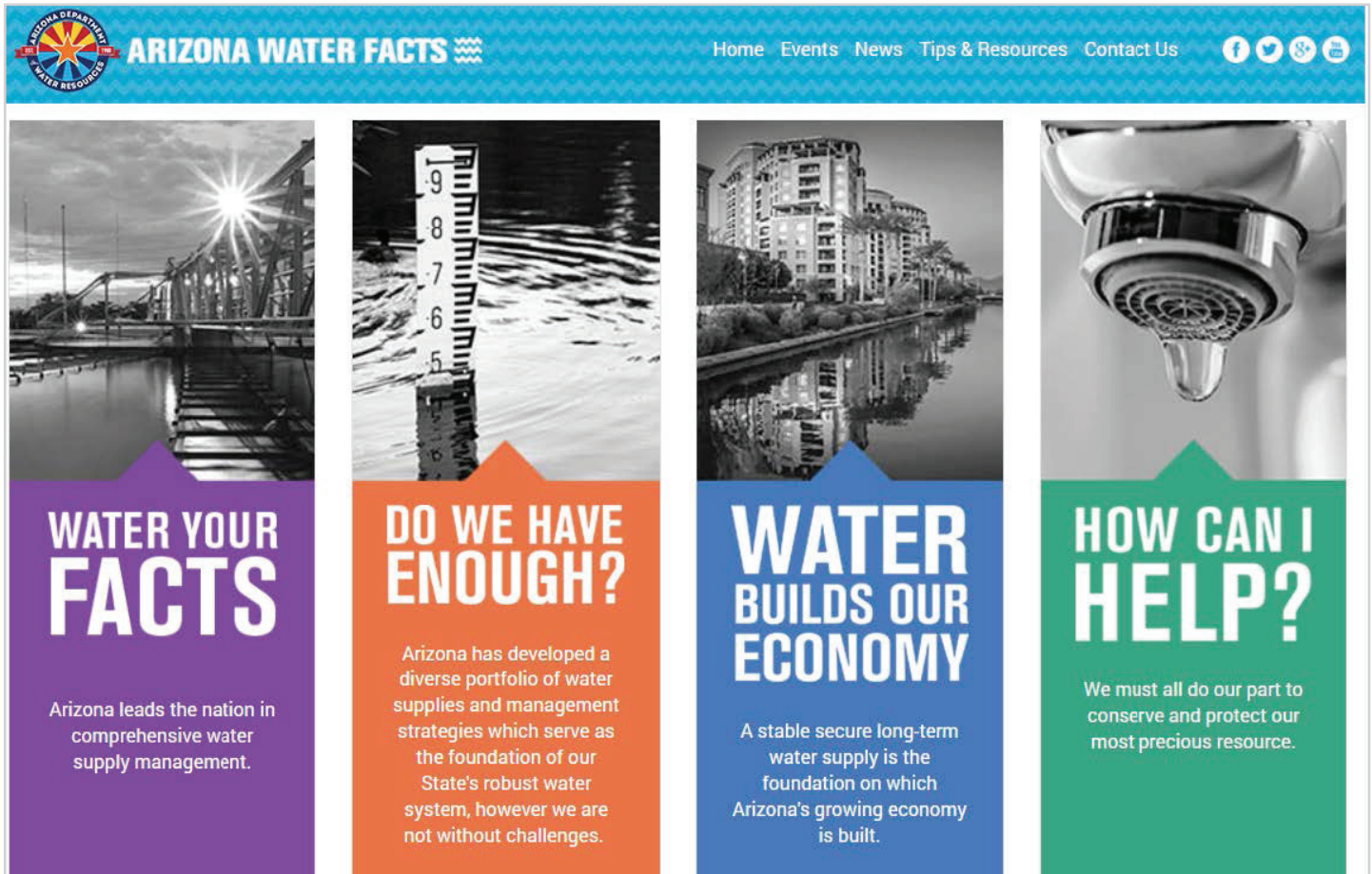


Figure 35. Arizona Water Facts webpage.

APPENDIX A. ARIZONA WATER INITIATIVE ACTIVITIES



ARIZONA WATER INITIATIVE ACTIVITIES

The Arizona Water Initiative was originally formed by Governor Ducey in October 2015 to implement the Arizona Strategic Vision for Water Supply Sustainability. The Water Initiative was expanded through the creation of a new Governor's Water Augmentation, Innovation, and Conservation Council (GWAICC; Council) in January 2019, per Executive Order 2019-02. The creation of the new Council was concurrent with the historic signing of the legislation ratifying the DCP and legislation implementing the DCP in Arizona.

COUNCIL OVERVIEW

The Council is charged with identifying and recommending opportunities for water augmentation, innovation, and conservation. The Council is also tasked with providing guidance on issues to the Director of ADWR, upon the Director's request. The Council brings together stakeholders from across the state to raise, analyze, discuss, and vet what are often difficult, complex issues in an effort to ensure a sustainable water future.

The Council currently comprises 38 individuals appointed by the Governor and four legislators, including the Speaker of the House, President of the Senate, House Minority Leader, and Senate Minority Leader. The Council is chaired by the Director of ADWR. Council members come from diverse organizations and backgrounds, including local and state government, Tribal communities, non-profits, business associations, academia, public and private water providers, and Arizona agriculture, mining, and homebuilding.

The Council may form working groups or committees to identify and discuss issues, as well as develop, evaluate, and prioritize recommendations for the Council to consider. The Council has formed four committees: the Desalination Committee, Long-Term Water Augmentation Committee, Non-AMA Groundwater Committee and Post-2025 AMAs Committee.

COUNCIL ACTIVITIES

Over the course of WY2022, the Council met twice and was briefed on significant water issues. The Council continued to receive updates on the activities and findings of the four committees.

The Post-2025 Active Management Areas (AMAs) Committee of the Governor's Water Augmentation, Innovation, and Conservation Council (Council) was the focus of much of the Council's work in Fiscal Year (FY) 2021-22, working rapidly the first half of the year to finish exploring challenges identified the year prior and develop recommendations. A set of near-term recommendations, described later, were provided to the Council at the November meeting. One of the committee's recommendations—accelerating rules for direct potable reuse—was addressed in legislation introduced in 2022 (HB2129).

The Desalination Committee, formed initially under the original Governor's Water Augmentation Council in 2016, completed its work and made its final recommendations to Council at the September meeting. The committee concluded that no policy changes were required to enable the use of brackish, or poor quality, groundwater, and that it should continue to be regulated as it currently is, as groundwater. The Desalination Committee will be on hiatus until recalled by the Council.

The Non-AMA Groundwater Committee discussed the potential for augmentation of groundwater aquifers through enhanced stormwater recharge, water harvesting and reuse, conservation and efficiency practices, and options for rural groundwater management, including irrigation non-expansion areas and rural management areas, a proposal that was again submitted to the Arizona Legislature in 2022.

The Long-Term Water Augmentation Committee highlighted the need for comprehensive, statewide water augmentation planning. Committee participants researched and discussed financing opportunities and needs for water augmentation and efficiency projects, recommending to the Council that the State commit additional funds to build on the \$200 million funding set aside for the Drought Mitigation Board established in 2021 by SB 1822.

The Council and committees largely paused their work in the second half of FY2022. During this span, Arizona's water community focused on a water-intensive legislative session and Colorado River shortage. At his final State of the State address in January, Governor Ducey announced a proposal to provide \$1 billion in funding for augmentation, innovation, and efficiency projects. Draft legislation to establish an Arizona Water Authority was announced in the weeks that followed. The new Arizona Water Authority would have the ability to fund, borrow money, and issue bonds to fund projects. Council members were asked to provide input into the draft legislation. At the close of FY2022, the impacts of ongoing drought across the southwest are of increasing concern statewide. As Arizona's communities and economy continue to grow, innovative policy, planning, and investment will be crucial.

Senate Bill (SB) 1740 was one of the final acts signed into law by the state legislature in 2022. This new legislation expands the Water Infrastructure Finance Authority (also known as WIFA). WIFA will continue to fund the design and construction of water infrastructure projects but will have new duties to pursue augmentation and conservation projects with a new board structure appointed jointly by the Legislature and the Governor.

SB1740 also includes a provision that requires ADWR to conduct a rolling 5-year supply and demand assessment of each groundwater basin in the state. The provision detailed in [Arizona Revised Statutes \(A.R.S.\) § 45-105\(B\)\(14\)](#) requires ADWR to analyze and prepare a water supply and demand assessment for at least 6 of the groundwater basins every year, with all the basins having a supply and demand assessment completed once every 5 years. This supply and demand assessment will be an important part of the state's efforts in addressing ongoing drought and Colorado River shortages.



APPENDIX B.
2022 NATURAL RESOURCES CONSERVATION SERVICE
DROUGHT REPORT

PREPARED BY EMILIO CARRILLO
STATE RANGELAND MANAGEMENT SPECIALIST
SEPTEMBER 2022



NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

As the USDA's primary private lands conservation agency, we generate, manage, and share the data, technology, and standards that enable partners and policymakers to make decisions informed by objective, reliable science.

Through one-on-one, personalized advice, we work voluntarily with producers and communities to find the best solutions to meet their unique conservation and business goals. By doing so, we help ensure the health of our natural resources and the long-term sustainability of American agriculture.

GENERAL

The annual Drought Survey was sent out to all Field Offices (FO's) in Arizona in late Summer 2022. The purpose of the survey was to gather feedback on drought conditions and effects in FO work areas for the year. Feedback provided was based on observations and field data collected (qualitative & quantitative) during routine work with our clients.

Low response rate of the survey does not allow for an accurate depiction of conditions statewide. However, a general sense of conditions can be interpreted if used appropriately.

This report is a summary of responses provided from 8 of the 19 NRCS offices polled. Survey results are based on individual NRCS staff (i.e., an office could have >1 response) in their work areas.

Survey questions listed below focused on drought related effects. Participants also had the opportunity to provide a narrative response to elaborate on any additional information.

- 1) Drought conditions clients experienced
- 2) Dryland Farming
- 3) Irrigation Water Supply
- 4) Rangeland Water Supply
- 5) Rangeland Conservation Practices (specifically to address drought)
- 6) Rangeland Forage Supply
- 7) Rangeland Precipitation data

Nineteen responses were collected from 8 of the 19 NRCS offices in Arizona (**Figure 1**). Three Offices responded as not experiencing drought (Douglas, Holbrook, and Flagstaff).

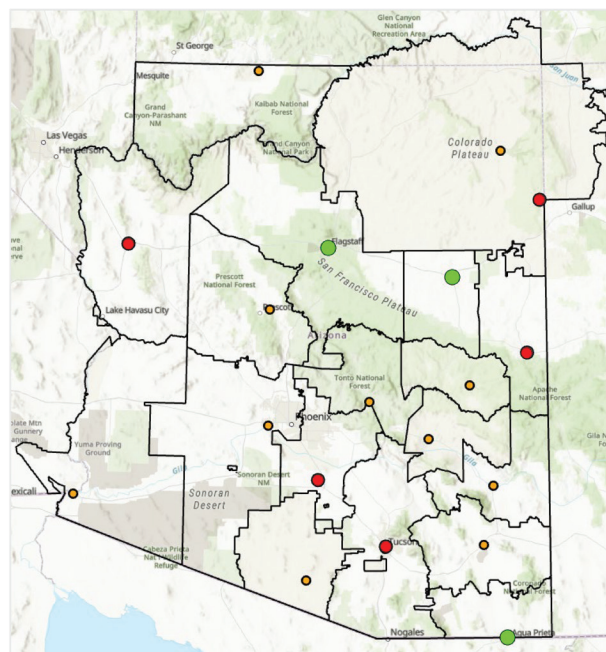
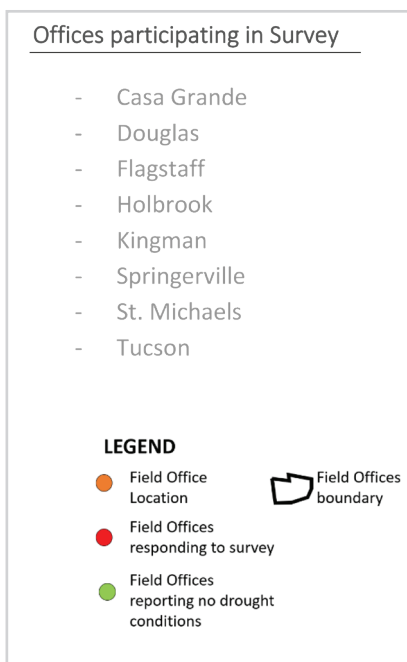


Figure 1. NRCS Office work areas.

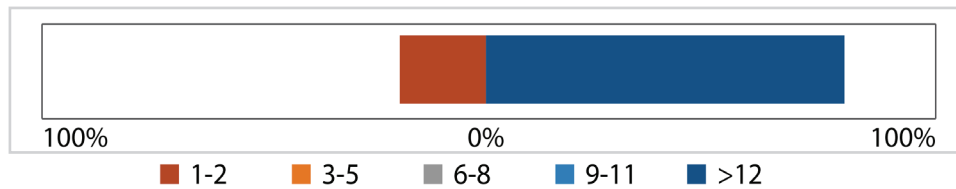
Rainfall across the state was highly variable. Some areas received above-average rainfall, while other parts experienced well below-average rainfall. The rainfall received did little to counteract the effects of the long-term drought. However, it did provide some reprieve.

The following are the results of the survey. The survey was established so that an individual could respond more than once to account for differences in their FO work area. Office work areas cover a large geographic area, comprising various local climate regimes and bio-geographic areas (i.e., plant communities; **Figure 1**). Although 19 participants responded to the survey, not all questions' responses equal nineteen. This is due to additional questions being asked dependent on the response to a prior question. For example, if a respondent answered "yes" to the question asking if dryland farms occurred in their work area, additional questions regarding dryland farms would be posed.

SURVEY RESULTS

DRYLAND FARMS

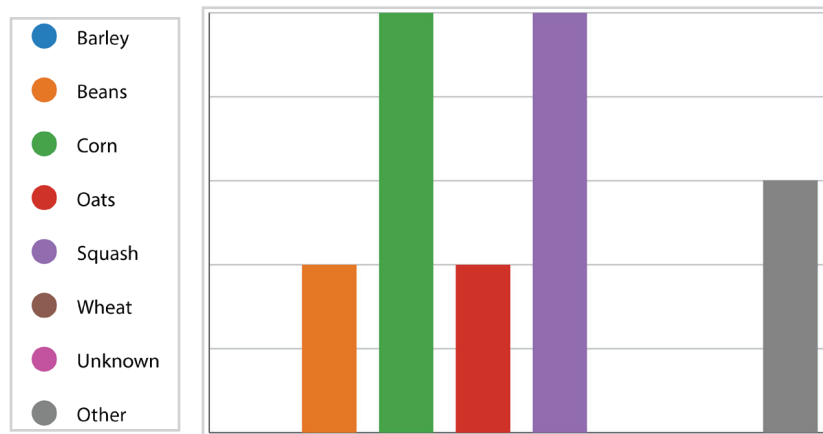
Question 1 - How many clients dryland farm? 6 responses



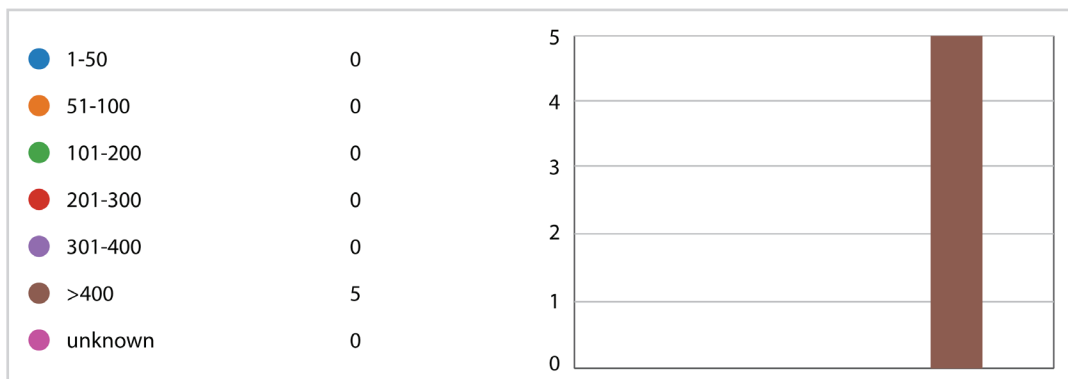
Question 2 - Were clients dryland crops affected by drought?



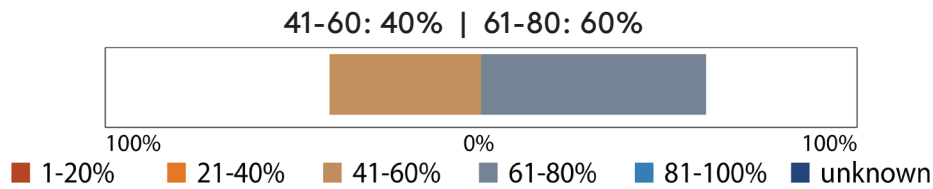
Question 3 - Crops that were affected. 6 responses



Question 4 - Estimate the number of acres of dryland cropland affected? 6 responses



Question 5 - What Percent Loss of crop production occurred or is expected? (Oct. 2021 - Sept. 2022) 6 responses

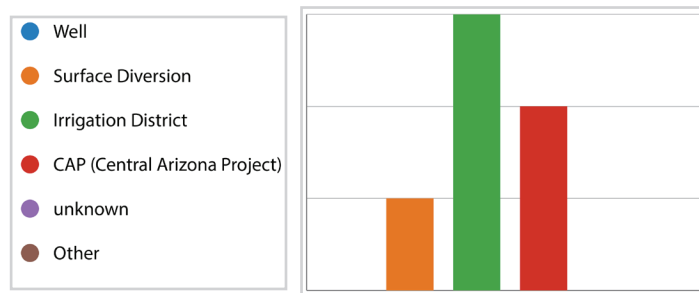


ADDITIONAL INFORMATION FOR DRYLAND FARMING

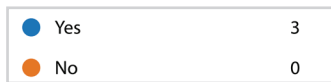
- Limited number of dryland farmers planted due to the dryness of the soil (less than 50% planted). Of the ones that were planted - less than 50% are going to harvest a crop. The farmers planted less than 50% of their fields. After the rains came, about 30% had their crops washed out by floods.
- Although Dryland, there are opportunities for dryland farmers to divert water to irrigate their crops. Some of the farmers faced extreme heat, dryness, and then extreme rainfall events that caused some dryland crops to be washed away in flood events.
- Winter and spring precipitation was low and mid monsoon storms provided the majority of annual precipitation.
- No rain from early spring to early summer affected planting. Many farmers didn't plant or planted fewer acres. Excessive rainfall washed or eroded dryland farmland on the Hopi Reservation.
- Late summer monsoon storms provided the majority of the annual precipitation when fall and spring was mostly drought.

IRRIGATED FARMS

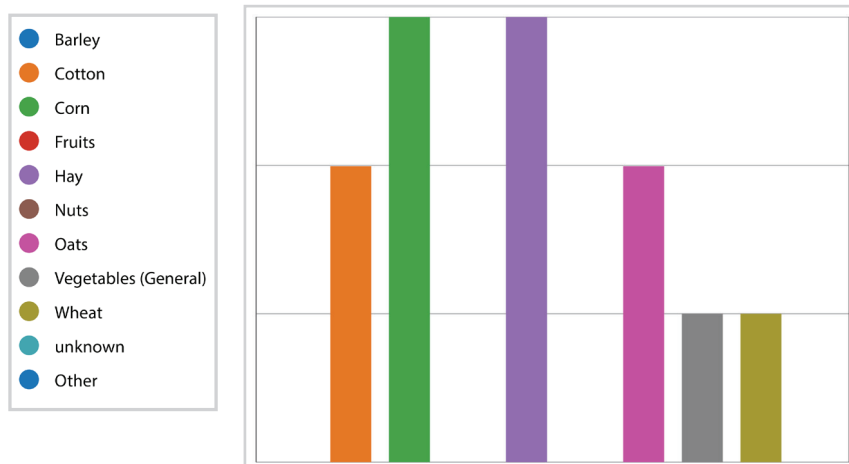
Question 1 - What water sources were affected? 6 responses



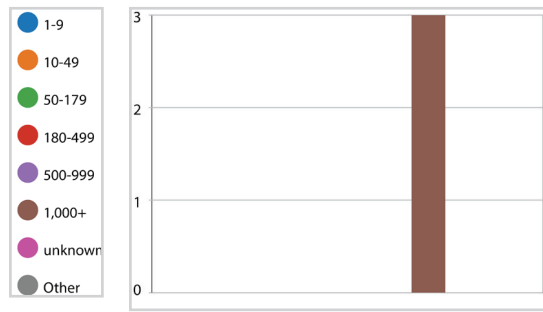
Question 2 - Were any clients irrigated crops affected by drought? 3 responses



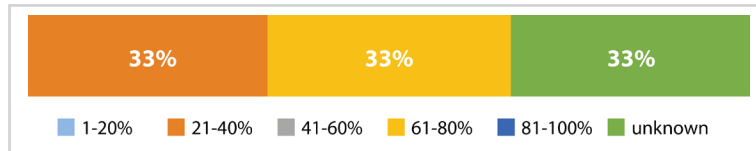
Question 3 - Crops that were affected. 6 responses



Question 4 - Estimate the number of acres of irrigated cropland affected. 3 responses



Question 5 - What Percent Loss of crop production occurred or is expected? (Oct. 2021 - Sept. 2022) 3 responses

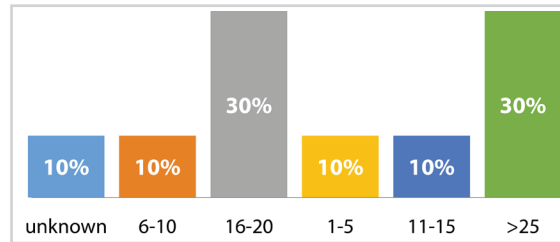


ADDITIONAL INFORMATION FOR IRRIGATED FARMING

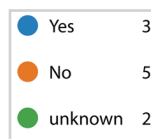
1. No water in Irrigation Ponds created extreme hardship for farmers. Some farmers were not able to access irrigation due to the lack of water to irrigate.
2. CAP cuts result in increased well usage. Money is being spent to get irrigation wells operational.

LIVESTOCK WATER

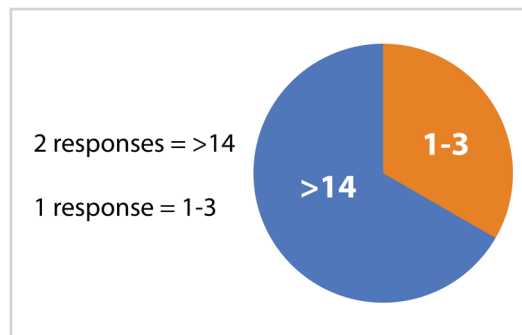
Question 1 - How many of your clients (ranches) experienced a shortage of livestock water? 10 responses



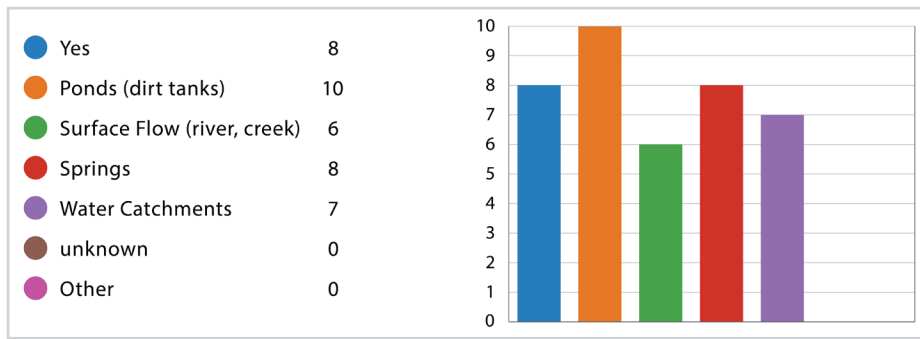
Question 2 - Are any (ranches) completely out of livestock water? 10 responses



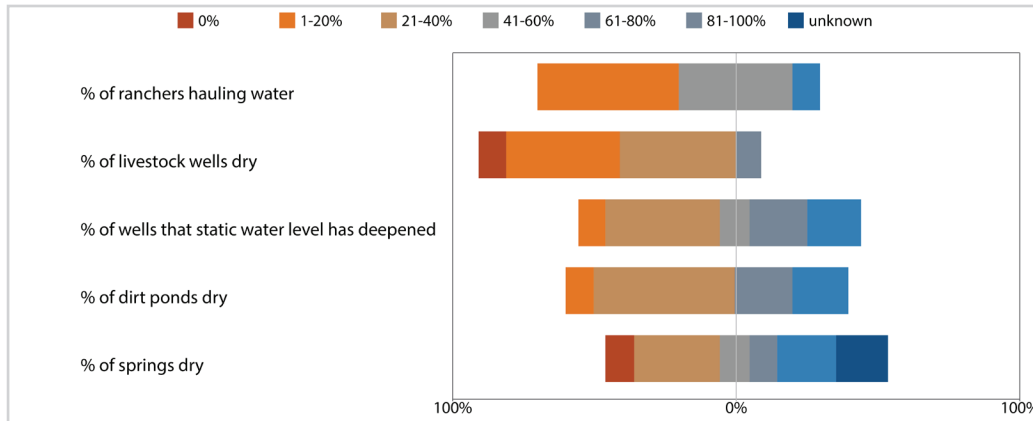
Question 3 - Number of ranches out of livestock water. 3 responses



Question 4 - What water sources were affected? 10 responses

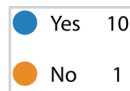


Question 5 - Livestock Water Supply. 10 responses

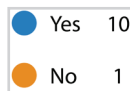


LIVESTOCK FORAGE

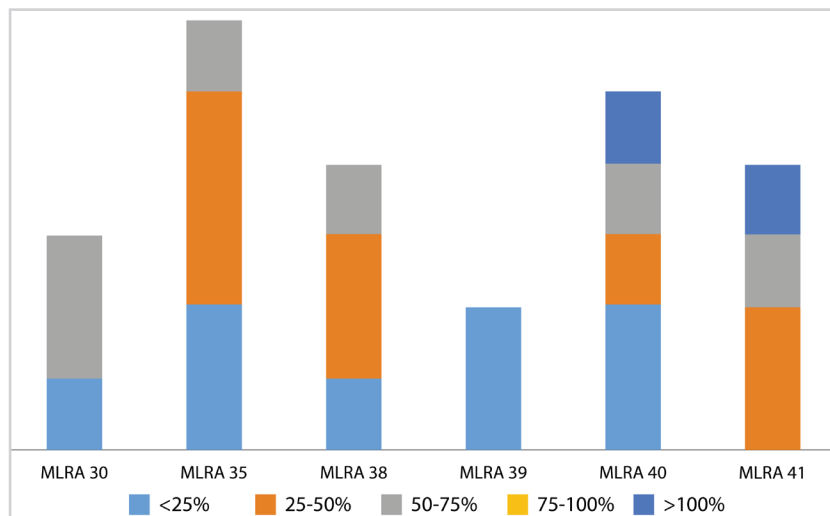
Question 1 - Is there a shortage of spring and/or summer livestock forage in the work area?



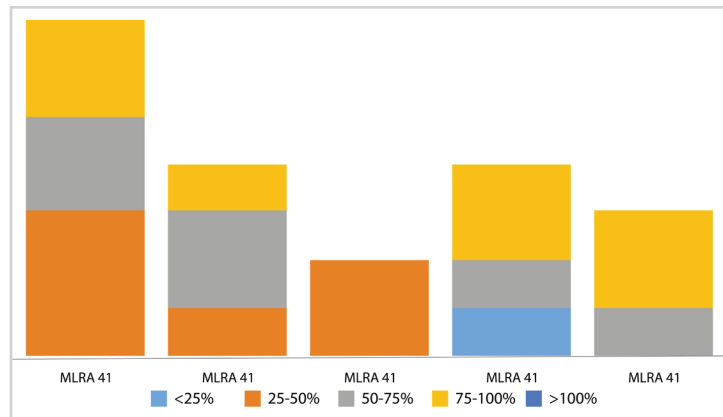
Question 2 - Is there a shortage of spring and/or summer livestock forage in the work area?



Question 3 - What percent of Normal Year Forage production was available this PAST SPRING (2022) for applicable MLRA(s) within the work area? 10 responses



Question 4 - What percent of Normal Year Forage production is expected by the end of this year's GROWING SEASON for applicable Major Land Resource Areas (MLRAs) within the work area? 10 responses



ADDITIONAL INFORMATION FOR LIVESTOCK WATER

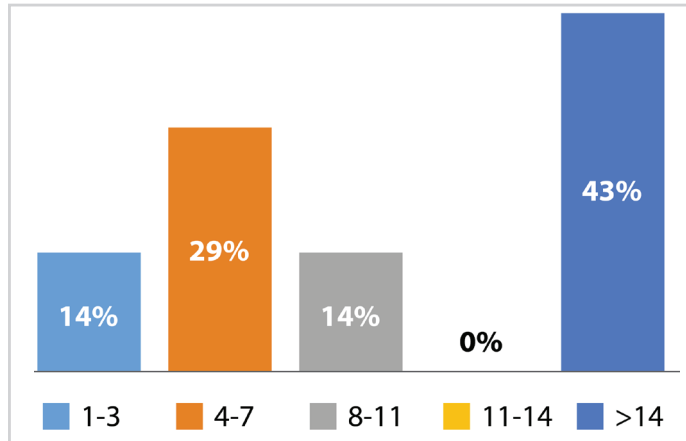
1. Observations from fall and what ranchers have told me. Arriving in fall, forage seemed pretty low. Some ranches I've been to are being overgrazed since shrubs and cacti are being grazed pretty heavily along with grasses.
2. There was a lack of winter moisture. The cool season never really produced. The rains came in late June or mid-July. The warm seasons have grown. A lot of weeds. Some reports of poisonous weeds. A lot of 6 weeks fescue.
3. The summer of 2021 and the winter of 2021-22 were exceptionally dry. Many cool season plants emerged from winter dormancy, only to stop growing soon afterwards as the winter moisture disappeared. This is especially true to the southern portion of the conservation district. The warm season plants stayed dormant due to cooler nights, until late June.
4. Very little growth for Cool Season Grasses in the early spring and early summer. Limited re-growth of shrubs and no forbs.
5. Poor spring rains was a bad start for MLRA40.
6. Ranchers I have met in MLRA 30 are grazing some areas heavily, with shrubs/cacti being grazed too. Ranchers in these areas have also reported that rain is uncommon, and some had to sell off their cattle just to make ends meet. MLRA 35/38 received good rain during the monsoon. Some ranchers have told me the monsoon was a little late this year.
7. Very little MLRA 35 growth for cool seasons. Decent to fair growth of Warm Season plants. More weeds, etc.
8. Cool season plants did not produce adequate early season forage to carry animals to the summer. Many warm season plants did not break dormancy until mid-May, due to low precipitation and cool nights. The early monsoons began late in the middle 1/3 of June. By early/mid-July, the monsoons paused for a couple of weeks and young growth suffered. The monsoons returned in late July, with August being a very spotty, wet month. Some rain shower events have exceeded 1-2 inches, with sudden/strong runoff. Overall rain patterns vary throughout the district as less than average to good to excellent. Some cool season grass species are now producing biomass, but likely will have poor reproductive potential for the year.
9. After the summer started in July 2022, significant growth of warm seasons: alkali sacaton, galleta, spike dropseed, blue grama and black grama. Forbs - 6 weeks fescue and different weeds. Some poisonous plants were reported, but not a huge amount.
10. The monsoon season has provided rains which has helped with plant growth significantly during the growing season. MLRA 30 west of the Black Mountains along the Colorado River has received little of the Monsoons, MLRA 30 east of the black mountains and North of Kingman has been significantly better than near the river.
11. Poor spring rains and lack of monsoon moisture

LIVESTOCK NUMBERS

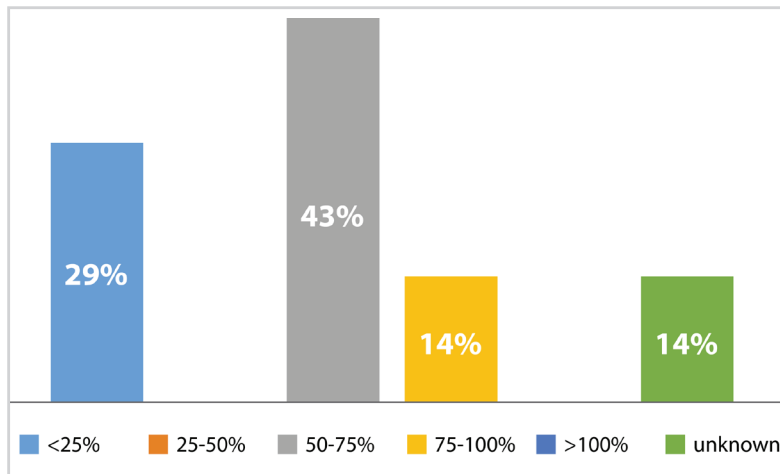
Question 1 - Has livestock numbers been reduced from last year (2021) due to drought? 10 responses



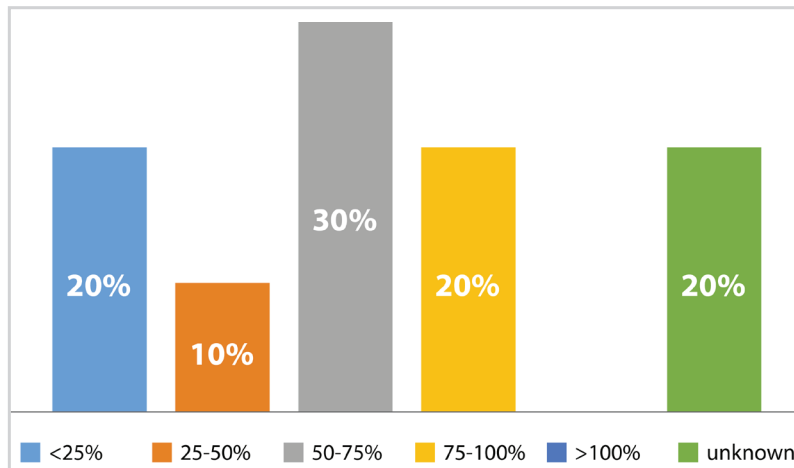
Question 2 - How many clients reduced livestock numbers? 7 responses



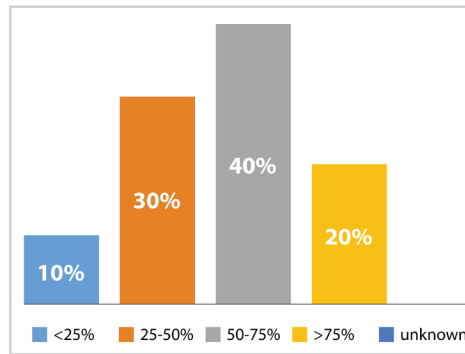
Question 3 - What percent of livestock numbers are currently being grazed (compared to 2021)? 7 responses



Question 4 - What percent of normal livestock numbers (historic or permitted numbers) are currently being grazed (i.e., pre-drought)? 10 responses

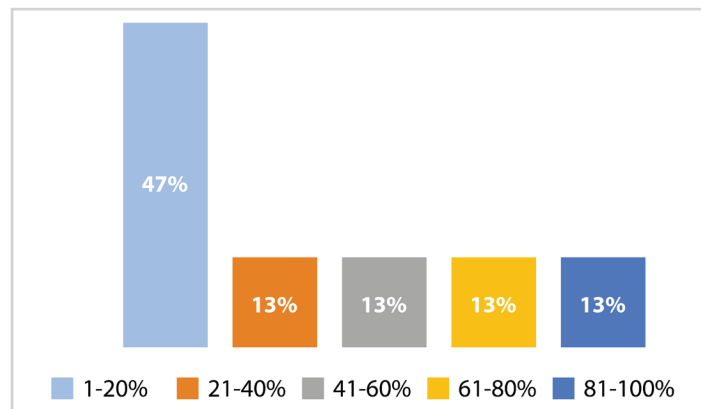


Question 5 - What percent of ranchers are feeding supplemental forage due to lack of forage production? 10 responses



CLIENT PRECIPITATION

Question 1 - What percent of your clients recorded below-average precipitation for the water year (Oct. 2021 to Sept. 2022)? 15 responses



Question 2 - Did precipitation occur during the opportune time and at sufficient amounts for forage production? (i.e., avg. precip. for the growing season) 15 responses



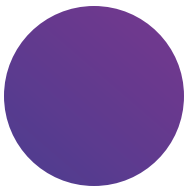
ADDITIONAL INFORMATION FOR CLIENT PRECIPITATION

1. If irrigation was available; the farmers were able to irrigate adequately over the summer. The farmers with capable infrastructure were able to irrigate efficiently (40-60%).
2. Hardly any precipitation during the winter and spring. Very limited Cool Season growth. Rains in late June and mid-July have increased growth during the warm season. Some excessive erosion due to extreme events. 40 year-old dam in Greasewood Chapter was breached.
3. Approx. 60% of my working area received above-average precipitation (from the western half plus). The eastern half received slightly above normal to normal with 5% (the far southeastern portion) receiving slightly below normal.
4. For cool season plants, inadequate precipitation occurred in MLRA's 35 and 39 to produce adequate forage production. Some areas did receive adequate rainfall while other nearby areas did not for the warm season species. Due to the split monsoon pattern, the historically wetter portions of MRLS 35.1 received just below to average rainfall, while the drier areas were overall lower than average. Weed species have benefited the most from the irregular weather patterns and have become more problematic with the coming of the summer rains.
5. Summer monsoon rains provided the majority of annual precipitation, and they were above average
6. Summer monsoon storms were intense and caused flooding in many areas.

7. For most of our service area, precipitation was above average, but some areas were better than others.
8. Although rains were a little late in the growing season with adequate winter moisture and continued good planning the feed will last well into the next years' growing season in managed ranges.

ADDITIONAL GENERAL INFORMATION

1. Some of our contracted projects are being affected because of the drought issues. Producers are not able to complete planned projects on time.
2. I started working in Arizona in September 2021, so I am still learning the area. Based on my interactions with farmers and ranchers, wells are going dry, so they are drilling new ones while others are hauling in water. One ranch I've been on looks like it's going under desertification effects.
3. Smaller High Tunnel structures were built by Non-Government Entities, and they have been installed around people's homes. Water is hauled to those sites.
4. Rainfall occurred at the right time to have a significant and positive effect on crops and rangelands.
5. The Holbrook area received above-average rainfall this season. Some producers have not irrigated their field for an entire month of mid-July through the end of August.
6. The winter and early spring months were exceptionally dry. Snow surveys in Dec. 2021 through March 2022 document the reduced winter precipitation levels in MLRA 39. The summer months were better than the previous 9-14 years, but only amounted to about average at best in some areas and fair/less than average elsewhere. As of 8/29/2022, Lyman Lake is still very low with only approximately 1/4-1/3 of its average capacity (based on observations); while the Little Colorado River is flowing well from run-off, just west of Springerville.
7. Fall and winter precipitation was below average with mild spring and high summer monsoon precipitation.
8. Irrigated farming occurring in Moencopi. Farmers planted, excessive water and rainfall in July in August has caused flooding. Some of the farms expect less harvest.
9. Some tribes are suggesting reduction by 30% in 2021 and 2022. As a result, majority of the ranchers are at less than 50% capacity. Ranchers report good regrowth by warm season grasses.
10. The crop producers in southeastern Arizona received sufficient rainfall this monsoon season. Some areas experienced temporary flooding conditions due to heavy rainfalls in concentrated locations.
11. Parts of central and western Pima County are Abnormally dry or are in Moderate and Severe Drought, receiving ample rainfall in August and early September. Forage has improved for livestock and wildlife. La Niña will occur for the third straight year, drier fall and early winter is predicted.



**APPENDIX C.
PIMA COUNTY LOCAL DROUGHT IMPACT GROUP
2022 WATER YEAR ANNUAL REPORT**



PIMA COUNTY LOCAL DROUGHT IMPACT GROUP - OFFICE OF SUSTAINABILITY AND CONSERVATION 2022 WATER YEAR ANNUAL REPORT

The Pima County Local Drought Impact Group (LDIG) has been an active component of county operations since 2006 when the Board of Supervisors adopted the Drought Response Plan and Water Wasting Ordinance (Chapter 8.70).

LDIG consists of water providers and local, state, and federal agencies interested in the cause and effect of drought conditions in Pima County. LDIG meets bi-monthly to monitor the short-term and long-term drought status, discuss drought impacts, and coordinate drought declarations and responses.

The county's Drought Response Plan and Water Wasting Ordinance established a four-stage trigger category corresponding to the Arizona Drought Monitor Report and their declaration of a watershed drought condition from "Abnormally Dry" to "Exceptional." With each "Stage" declaration the county can consider drought stage response measures established in the ordinance.

LDIG explores drought impacts on various sectors in Pima County, including agricultural water use, ranching, wildfire, hydrology, and flooding. Because many water providers depend on Central Arizona Project (CAP) water, LDIG also monitors the status of the Colorado River, the El Niño Southern Oscillation (ENSO), and other climate weather patterns concerning their effect on drought conditions and climate variability in the Southwest. LDIG also monitors the status of the summer monsoon season and convenes roundtable discussions of drought and water conservation outreach programs. For a list of presentations and agendas, please visit Pima County's [LDIG website](#).

This report is provided for inclusion in the Arizona Drought Preparedness Annual Report and submitted to the Pima County Administrator's Office.

WEATHER (NATIONAL WEATHER SERVICE-TUCSON)

In Pima County, the Water Year (WY) 2022 began after a very wet 2021 monsoon, 3rd wettest on record with 12.79" of precipitation, 7.10" above normal. October 2021 was dry with storm systems bringing cooler temperatures, the average temperature was 1.5°F below normal, but little rain, 0.01". November received only 0.01" of rain but was considerably warmer, 5.5°F above normal. Overall, the fall season was warm and dry. The warm pattern continued in December with well above-normal temperatures, but precipitation was above normal. January 2022 began with winter storms and colder air mass, cooling off average temperatures but delivering below-normal precipitation. Cool temperatures and below-normal rain extended into February. Winter was slightly warmer and drier than normal, consistent with La Niña conditions.

March 2022 is interesting in that, according to National Weather Service (NWS) Tucson - 'Even though this March was warmer than last year by one degree, the average monthly temperature was below normal, thanks to the new set of climate normals which went into effect last May. The 1991-2020 normal for March is 1.8°F warmer than the previous normal period (1981-2010).' That leaves March 2022 ranked as the 24th warmest with below normal precipitation.

April and May 2022 were dry with no rain and warm, 3.7°F and 2.7°F above normal, respectively, with high winds and daily temperatures as high as 108°F in May. Spring was warmer and drier as forecast. The water year precipitation deficit reached -2.84".

June 2022 received normal rainfall amounts and the temperature was 3.0°F above normal with 24 days of highs 100°F or warmer. After 80 consecutive days of no precipitation, 0.05" rain on June 18 was a welcome relief. July was disappointing with over an inch deficit in rain and 1.8°F warmer than normal. Finally, a favorable monsoon pattern developed in August producing 0.84" above-normal precipitation with cooler temperatures. In total, summer was the 3rd warmest on record and 0.29" drier than normal. In September, tropical moisture delivered isolated heavy rainfall but overall, the month was below normal. The monsoon was -0.75" drier than normal.

PRECIPITATION (IN INCHES, RECORDED AT TUCSON INTERNATIONAL AIRPORT)*

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Precipitation	0.01	0.01	1.34	0.28	0.20	0.19	0.00	0.00	0.23	1.08	2.82	0.81
Normal Precip.	0.67	0.56	0.96	0.84	0.84	0.56	0.24	0.20	0.23	2.21	1.98	1.32
Difference +/-	-0.66	-0.55	+0.38	-0.56	-0.64	-0.37	-0.24	-0.20	0.00	-1.13	+0.84	-0.51
Cumulative	-0.66	-1.21	-0.83	-1.39	-2.03	-2.40	-2.64	-2.84	-2.84	-3.97	-3.13	-3.64
Rank	24 th Dry	25 th Dry	33 rd Wet	38 th Dry	30 th Dry	29 th Dry	Driest	Driest	38 th Wet	28 th Dry	34 th Wet	53 rd Dry

MONTHLY AVERAGE TEMPERATURE (IN °F, RECORDED AT TUCSON INTERNATIONAL AIRPORT)*

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Temperature	71.1	67.0	57.2	54.3	54.3	61.7	71.8	79.5	89.1	90.0	85.8	84.7
Normal Temperature	72.6	61.5	53.0	53.6	56.2	61.9	68.1	76.8	86.1	88.2	86.9	82.8
Difference +/-	-1.5	+5.5	+4.2	+0.7	-1.9	-0.2	+3.7	+2.7	+3.0	+1.2	-1.1	+1.9
Rank	42 nd Hot	2 nd Hot	3 rd Hot	17 th Hot	59 th Hot	24 th Hot	4 th Hot	6 th Hot	5 th Hot	7 th Hot	38 th Hot	4 th Hot

SEASON RANKING (NWS-TUCSON)*

WY21-22	Fall	Winter	Spring	Summer	Monsoon
Precip. Rank	13 th Dry	4 th Dry	11 th Dry	52 nd Dry	46 th Dry
Temp Rank	6 th Hot	13 th Hot	5 th Hot	3 rd Hot	5 th Hot

*Period of record is from 1890 for Tucson

PIMA COUNTY DROUGHT STATUS (US DROUGHT MONITOR & STATE MONITORING TECHNICAL COMMITTEE)

Arizona's Short-Term drought status is based on the U.S. Drought Monitor and is updated monthly. Long-Term drought status is derived from the 24-, 36- and 48-month Standard Precipitation and Evapotranspiration Index (SPEI) datasets and is updated quarterly by the Arizona State Climate Office. Both are reviewed by ADWR's Drought Monitoring Technical Committee.

SHORT-TERM

In Pima County WY2022 started with Abnormally Dry conditions in east and west Pima County (59%) and Moderate drought in the central part of the County (41%). Moderate drought remained until improvement in January with the entire county in Abnormally Dry conditions after several storm systems delivered 50-90% of average precipitation in December. Improved conditions held through February.

By March, Abnormally Dry conditions receded to 46% in central Pima County with Moderate drought returning to western and eastern areas. As drier conditions set in and the precipitation deficit for the water year accumulated through April, drought severity increased to 61% in Moderate drought across central and eastern Pima County with 39% in Severe drought in the east. Severe drought increased through May and 95% of the county was in Severe drought by June.

Storm activity began in June, slightly receding Severe drought to 81% in July. July monsoon activity, though below average, contributed to further improvement in western Pima County with 61% of the area reduced to Moderate drought in August. A wet August replaced most of the Severe drought with Moderate drought in the east (38%) and Abnormally Dry conditions in the west (50%) in September. Drought improved incrementally through September.

LONG-TERM

From October to December, western Pima County was in Severe drought worsening to the east with pockets of Extreme drought. From January through March drought improved significantly with Moderate drought and Abnormally Dry conditions in the west and no drought in eastern Pima County. This drought status remained from April through June.

PIMA COUNTY DROUGHT CONDITIONS

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Short Term	D0(59) D1(41)	D0(58) D1(42)	D0(58) D1(42)	D0(100)	D0(100)	D1(54) D0(46)	D1(61) D2(39)	D1(55) D2(45)	D2(95) D1(4)	D2(81) D1(19)	D1(61) D2(39)	D0(50) D1(38)
Long Term	D2 D3			None D0/D1			None D0/D1			Not Available		

D0-Abnormally Dry, D1-Moderate, D2-Severe, D3-Extreme, D4-Exceptional (percentage)

COLORADO RIVER BASIN & CENTRAL ARIZONA PROJECT (CAP)

Nine water providers deliver CAP municipal water to Pima County water users. Tucson Water has the largest CAP annual municipal allocation in the state. Agricultural and industrial users and the Tohono O'odham Nation have access to and use CAP water. The drought status of the Colorado River Basin and probabilities of shortage declarations and impacts to these sectors are monitored by the Pima County LDIG.

LAKE MEAD AND LAKE POWELL

The August 2022 U.S. Bureau of Reclamation (Reclamation) 24-Month Study projected Lake Mead to be below elevation 1,050' above mean sea level on December 31. Concurrent with the 2007 Operating Guidelines and the Drought Contingency Plan, Lake Mead will be operating in a Tier 2a Shortage beginning 2023. This second declared shortage, consecutive and more severe, will impact Arizona's CAP water supplies by reducing 592,000 acre-feet, cutting all Excess water, eliminating Agricultural Pool water and mitigation water for the sector as part of the Drought Contingency Plan. The Non-Indian Agriculture Pool will be mitigated at 75% of normal allocation. Arizona, the Colorado River Basin states, and the federal government continue to work in re-consultation of the 2007 Operating Guidelines and other consultation efforts, such as the 500+ Plan, to reduce the decline of Lake Powell and Lake Mead in light of a hotter and drier climate.

Reclamation's Commissioner testified before the U.S. Senate in June 2022. Despite the 2007 Operating Guidelines, the Drought Contingency Plan, the 500+ Plan and all other conservation efforts, the Commissioner stated significant additional conservation is needed to prevent infrastructure damage and to stabilize the system. Reclamation aims to protect elevations 3,525' at Lake Powell and 1,025' at Lake Mead. This goal will require 2-4 million acre-feet (MAF) of reductions in 2022 and after, distributed across the entire Colorado River Basin and Mexico. The decline in the Colorado River system has accelerated and outpaced collective operational and conservation agreements.

April-July unregulated inflow into Lake Powell was 59% of average. At the end of WY2022 combined storage will be 31% of average. The Operating Guidelines will change operation tiers from a Mid-Elevation Balancing Tier to a Lower Elevation Balancing Tier in 2023. Releases from Lake Powell will be 7.00 MAF in WY2022 and WY2023 (most probable). The August report probability calculations from Reclamation conclude a 57% probability of further Tier 2 shortage in 2024 and a 40-47% probability of a Tier 3 shortage by 2025-26. CAP water supplies would be cut 640,000 and 720,000 acre-feet (AF) in subsequent Tier 2b and 3 shortage declarations.

TIER 2A SHORTAGE

Based on current operational plans, the impact to water customers in Pima County in the near term is minimal. The impact could change depending on any action the U.S. Department of Interior takes to protect the system and system conservation volumes used to meet the goal of conserving 2 to 4 MAF in the next several years. As an example of the impact to Municipal and Industrial (M&I) supplies, Tucson Water's allocation of 144,191 AF will be curtailed by 2 to 4 percent, or 4-6,000 AF. This would increase to 15-20,000 AF in a Tier 2b shortage. The agriculture sector in Pima County uses CAP M&I water in Groundwater Savings Facilities as well as Irrigation

Grandfathered Rights and is unlikely to be affected by the shortage. Pima County also has fewer Non-Indian Agricultural (NIA) water allocations than other Active Management Areas. Shortages can be mitigated by water providers' long-term planning that includes recharge and recovery of unused CAP supplies and other long term storage credits in addition to Arizona Water Banking Authority firming.

With the Tier 2a CAP shortage declaration, water providers receiving CAP water will continue implementing drought responses consistent with their respective drought preparedness plans.

DROUGHT IMPACTS

WILDFIRE

Wildfire activity in Pima County was limited to one large wildfire, the Contreras fire around the Kitt Peak National Observatory on the Tohono O'odham Nation. It was categorized as a Type 4 Incident Command fire and did not damage the telescopes, only several support buildings. Other wildfire incidents were minor, small acreage fires requiring no Incident Command.

Ash and debris flow from the 2020 Bighorn fire scar have affected infiltration rates in the Lower Santa Cruz River, increasing flow extent and decreasing infiltration. This summer there was intensified flooding in the Santa Catalina foothills due to the 2020 Bighorn wildfire.

GROUNDWATER

Pima County Regional Flood Control District (RFCD) monitors groundwater levels within various watersheds to help assess the effects of climate and land-use changes on the overall health of floodplains in Pima County. There are a few shallow groundwater areas along Cienega Creek, Davidson Canyon, and Tanque Verde Creek. Groundwater levels have recovered in many of these areas since 2014 though there is an established long-term downward trend in groundwater levels for most areas.

Groundwater levels increased in all monitored shallow groundwater areas in eastern Pima County in 2021 due to record or near record precipitation and moderate to high flow volumes in stream reaches.

LIVING RIVER REPORT WY2021

This annual report, released in September 2022, documents the benefits of improved water quality released into the Lower Santa Cruz River from Pima County's water reclamation facilities (WRF). Water quality in the river improved following the significant upgrade of the metropolitan treatment facilities in 2013. A [supplemental report](#) compares annual report conditions from 2013 through 2021.

Discharge of high-quality (Class A+) reclaimed water from Pima County's wastewater reclamation facilities into the Santa Cruz River is a drought-proof water source providing many environmental benefits to the river. Over 7,000 AF was released from the Agua Nueva WRF and 32,000 AF from the Tres Rios WRF in 2021, or approximately 6 and 29 million gallons daily on average. This discharge creates a 16 to 23-mile flow extent (depending on infiltration and seasonality) of established riparian habitat and wetland. This multi-benefit project serves as environmental restoration, aquifer replenishment and public recreation. As the report is titled, the river connects wildlife with the water, home to endangered native and non-native fish and invertebrates and used by birds and small and large mammals, providing ecosystem services and a stored renewable water supply.

KINO ENVIRONMENTAL RESTORATION PROJECT

Kino Environmental Restoration Project (KERP) harvests urban storm water and controls flooding in Tucson. KERP covers 121 acres with 28 acres of open water and riparian habitat. The six-acre, 50-foot "Deep Pond" stores stormwater for irrigation within KERP plus the Kino Sports Park Complex. KERP has suffered from reduced availability of stormwater for internal irrigation needs over the past two years, but inflow runoff from monsoon storms July through September 2022 filled the basin.

CIENEGA CREEK AND DAVIDSON CANYON

Located in eastern Pima County, Cienega Creek continues to show the impacts of sustained drought and shifts to seasonal patterns of flow. This year the results demonstrate the impact of climate extremes from the driest year previously to record high base-flows seen in two decades. Pima Association of Governments' (PAG) reporting depicts the localized drought impacts on a shallow groundwater-dependent system and designated Outstanding Arizona Water (OAW), representing drought conditions for local wildlife habitat and human activities dependent on shallow groundwater. It is valuable for drought reporting to represent areas that do not currently benefit from artificial recharge and CAP. PAG's Monitoring Year (MY) mentioned below runs from July 1 to June 30.

PAG and its partners have monitored Pima County's Cienega Creek Natural Preserve since the mid-1980s to provide reliable data and trend analysis for the riparian area including water quality, groundwater, and streamflow. Hot and dry June conditions typically represent the minimum extent of perennial flow within a year. The 2021 monsoon season was the third wettest on record, leading to a drastic recovery in baseflows and breaking perennial baseflow records for most flow from the past two decades of drought. In June 2022, PAG recorded 3.395 miles of flow in the monitored stretch of Cienega Creek, about 5.3 times more flow than was recorded in June 2021. This was the highest perennial baseflow recorded since June 2001, at 37% of the 9.3-miles that flowed perennially and throughout the monitoring area in 1985. In addition, at 7.110 miles, September 2021 baseflows in Cienega Creek were the highest observed by PAG for any quarter since PAG resumed wet/dry mapping in 1999. Following a year with the lowest perennial baseflows on record, these observations demonstrate the impacts of climate extremes on shallow groundwater-dependent streams and the riparian areas that they sustain. This highlights the importance of long-term, consistent seasonal monitoring. As PAG completes annual reports for July through June, this does not reflect the monsoon season of 2022.

In June 2022, there were 2.434 miles of baseflow in the monitored stretches of Davidson Canyon, a major tributary to Cienega Creek that is an OAW as well. Davidson Canyon experienced record high baseflows sustained through all four quarters of Monitoring Year (MY) 2021-22, with baseflows ranging from 2.434 miles to 3.679 miles within the Cienega Creek Natural Preserve and a portion of Pima County's Bar V Ranch. Previously, the highest baseflow observed by PAG within this stretch of Davidson Canyon was 1.5 miles in September 2006, the year monitoring in Davidson began. These numbers do not include the additional baseflow observed by PAG outside of PAG's previously established monitoring area. In MY 2021-22, this furthered flow by 0.04 miles to 0.58 miles in Cienega Creek below the Pantano Dam and by 0.51 miles to 1.44 miles in Davidson Canyon upstream of Andrada Rd. to Empire View Rd. These areas were not monitored by PAG in past years but were presumed to be dry previously.

Although water levels rose, drought's previous impact on erosion, sediment movement, wildlife and vegetation is still apparent. The moisture swing did provide notable improvements. As water levels rose last fiscal year, PAG saw native longfin dace and county-protected lowland leopard frogs that have been absent from Davidson Canyon for a long time, as they depend on more regular surface water supplies to survive. Even more remarkable, in September 2022, PAG observed the federally endangered Gila topminnow in the canyon.

DROUGHT RESPONSE ACTIONS

Pima County continues to adhere to its water resources and drought management policy framework including implementation of goals and recommendations from planning documents and annual reports cataloging progress and resources. These documents are posted on the County's [Drought Management webpage](#):

- Water & Wastewater Infrastructure, Supply and Planning Study, Action Plan and Annual Report Cards.
- Water Resources Asset Management Plan
- Strategic Plan for Use of Reclaimed Water
- Sustainable Action Plan for County Operations
- Drought Response Plan and Water Wasting Ordinance

ENVIRONMENTAL WATER

Through intergovernmental agreements, Pima County and the City of Tucson have established a Conservation Effluent Pool (CEP) reserving up to 10,000 acre-feet of effluent a year generated from metropolitan water reclamation facilities for dedicated use in environmental projects. The 2022 CEP Annual Report to the Board of Supervisors confirms two projects authorized in 2021, the City's Heritage Project and the RFCD Agua Nueva Project.

Tucson Mayor and Council and the Board of Supervisors approved the Heritage Project, allocating up to 110 AF per year for evapotranspiration. In total, 39 AF was used in 2021.

As part of an Endangered Species Act stipulation, the RFCD Agua Nueva Project was approved in 2021 by the City of Tucson and Pima County CEP Administrators; not requiring Council or Board approval. This project will provide a weekly average of 5 MGD of flow from Agua Nueva WRF to maintain the endangered Gila Topminnow in the established riparian habitat downstream of the outfall. Maximum use is limited to 5,600 AF per year; no CEP water was used for this project in 2021.

LOWER SANTA CRUZ RIVER MANAGEMENT PLAN

The Lower Santa Cruz River Management Plan is being developed by Pima County RFCD to manage the effluent-dependent river while balancing flood risk and infrastructure protection with aquifer recharge, riparian habitat preservation, and recreation.

A stakeholder working group assisted in identifying alternative projects for each specific reach of the river through a Multi-Criteria Decision Assessment framework that determined the sequence and funding of the 20 projects selected from 110 possible. The process involved a comprehensive assessment and evaluation of existing conditions, infrastructure, and management in development of the Alternative Selection Report and Implementation Plan. The Plan includes stream restoration, new wetland, and land preservation projects.

LOWER SANTA CRUZ RIVER BASIN STUDY

Pima County is participating with Reclamation in a six-year study of the Lower Santa Cruz River Basin. The in-kind study offers Reclamation's technical expertise in applying climate change models, surface water modeling and groundwater modeling to water supply and demand scenarios, charting the potential range of water imbalance in the region and developing adaptive management strategies to address water imbalance and climate change.

The Study has identified areas of concern and developed adaptation strategies for each area and region wide strategies. Technical memoranda have been completed or are pending and the final report is due in 2022.

PIMA COUNTY WATER WORKING GROUP

Given the historical period of drought and looming water scarcity challenge facing Pima County and the Basin states, the County Administrator has established an in-house Water Working Group (WWG) to ensure the appropriate knowledge base and expertise is maintained and to develop strategic plans for water storage, conveyance, treatment infrastructure and funding. In addition, the County has a Growing Water Smart Team comprised of water and land use policy experts. The WWG will be cooperating with the County's water providers as needed.

RFCD URBAN STORMWATER RESOURCE WORK PLAN

To improve overall regional water resiliency, the Pima County RFCD has developed a work plan to expand the beneficial use of urban stormwater and increase aquifer recharge. The RFCD work plan is a region-wide approach to improve water resiliency by evaluating new large-scale retention projects, expanding existing infrastructure, and decentralizing retention strategies at the neighborhood and lot scale. RFCD is beginning a stakeholder process to modify and improve drainage criteria for new development, maximize retention and reuse stormwater with potential new regional basins. It will also consider opportunities to enhance reclaimed water in channel recharge.

DROUGHT STAGE

Currently, Tucson Water is in Drought Stage 1 and is actively preparing for Stage 2. The Town of Marana is in Drought Stage 2. Metro Water is in Stage 1 and recently updated its drought response plan. The Town of Oro Valley is in Water Conservation Level 1. The remaining water providers are in Drought Stage 1 or its equivalent (voluntary reductions). Pima County remains at Drought Stage 1.

SUMMARY

Pima County had a near record summer monsoon in 2021, followed by a hot and dry fall. Winter and spring precipitation was below average and were followed by the Summer 2022 monsoon season. The monsoon activity overall was modest though August did produce a surplus of rainfall. Both short and long-term drought conditions have improved compared to last year. Pima County did not experience Extreme or Exceptional drought conditions, but the WY2022 precipitation deficit is over three inches.

While conditions have improved, for the third consecutive year, the upcoming fall and winter seasons are expected to enter a La Niña phase and are likely to be drier than average.



