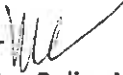




Date: October 18, 2018

To: C.H. Huckelberry, County Administrator

Thru: Carmine DeBonis Jr., Deputy County Administrator for Public Works

From: Linda Mayro, Director 
Kathleen Chavez, Water Policy Manager

RE: Pima County LDIG Annual Drought Report to ADWR

The Pima County Local Drought Impact Group (LDIG) is a component of state drought planning and meets to advise on drought status and review County drought planning in support of the Arizona Drought Preparedness Plan. As part of an annual assessment of drought and associated impacts, Pima County LDIG, in cooperation with various County departments, submits a report to the Arizona Department of Water Resources (ADWR) for inclusion in the Arizona Drought Preparedness Annual Report. Attached is the Annual Report for Water Year 2018 (October 1 - September 30).

In summary, Pima County continues to experience the effects of drought. We had a record warm fall and winter along with a record dry spring. Monsoon activity was not sufficient to overcome a water year precipitation deficit. Severe drought persisted from February through September. While the fire season in Pima County was minimal, creeks and springs continue to be impacted by ongoing drought conditions.

Although drought continues to affect Pima County, we have effective water resource and drought management plans established with new management plans and studies underway to maximize efficient use of available water resources. The County will continue to monitor local, state and regional drought conditions, assess direct and indirect impacts and analyze cascading effects.

Please feel free to let me know if you have any questions.

Copy: Jackson Jenkins, Director Regional Wastewater Reclamation Department

Pima County Local Drought Impact Group (LDIG)

2018 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 that have an interest in the cause and effect of drought conditions in Pima County. LDIG meets bimonthly 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 that corresponds to the Arizona Drought Monitor Report and their declaration of a watershed drought condition from "Abnormally Dry" to "Exceptional." Each "Stage" declaration within the county triggers drought stage reduction measures.

LDIG explores the impacts of drought on various sectors in Pima County including agricultural water use, ranching, wildfire, hydrology, and flooding. Because many water providers depend on Central Arizona Project water, LDIG also monitors the status of the Colorado River, the El Niño Southern Oscillation (ENSO) and other climate weather patterns in relation to 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 2018 Water Year began following a warm and dry period from mid-August through September that would lead into a record warm, dry fall season. October 2017 was warm with temperature extremes and a few scattered showers but no officially recorded rainfall. November was dry and the warmest on record as high pressure systems brought excessive heat. Fall 2017 was the hottest and driest on record. Record heat and dryness would continue through January 2018.

February lurched from average high temperatures of 10.9° above normal and no rain to average highs 6.6° below normal and localized rainfall ranging 2-6" due to Pacific systems moving in sub-tropical moisture. Despite the late month cooling, Winter 2017-2018 ended as the warmest on record. A dry Pacific system lowered temperatures in March but heat returned in April along with record dryness. With similar conditions in May, Spring 2018 ended as the driest on record and 4th warmest.

In mid-June, leftover hurricane moisture ended a dry streak of over 100 days with 0.71" above normal rainfall for the month. Monsoon activity brought normal rainfall with localized amounts as high as 5". August weather delivered the first above normal rainfall for that month in over a decade. Overall, Summer 2018 had an inch above normal rain and was ranked as the 7th warmest.

September high pressure brought a near record streak of triple digit temperatures as well as reduced thunderstorm activity until moisture from Hurricane Rosa poured into the state though in Tucson the month ended with below normal precipitation. Overall, the 2018 Water Year total precipitation was 9.59" with the normal being 11.59" or 2.00" below normal and the year to date total was 9.00" with the normal being 9.20".

Pima County Local Drought Impact Group 2018 Report

Precipitation (in inches, recorded at Tucson Intl Airport)

| WY17-18 | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|------------|------------|-------------|-------------|-------------|-------------|------------|------------|------------|-------------|-------------|-------------|-------------|
| Precip. | 0.00 | 0.09 | 0.50 | 0.02 | 1.96 | 0.00 | 0.00 | 0.00 | 0.91 | 2.26 | 2.71 | 1.14 |
| PrecipNorm | 0.89 | 0.57 | 0.93 | 0.94 | 0.86 | 0.73 | 0.31 | 0.23 | 0.20 | 2.25 | 2.39 | 1.29 |
| D+/- | -0.89 | -0.48 | -0.43 | -0.92 | 1.10 | -0.73 | -0.31 | -0.23 | 0.71 | 0.01 | 0.32 | -0.15 |
| C | -0.89 | -1.37 | -1.80 | -2.72 | -1.62 | -2.35 | -2.66 | -2.89 | -2.18 | -2.17 | -1.85 | -2.00 |
| Rank | 1st Dry | 34th Dry | 54th Dry | 14th Dry | 10th Wet | 1st Dry | 1st Dry | 1st Dry | 11th Wet | 51st Wet | 35th Wet | 58th Wet |

Average Temperature (in °F, recorded at Tucson Intl Airport)

| WY17-18 | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|----------|------------|------------|------------|------------|-------------|-------------|------------|-------------|-------------|------------|-------------|------------|
| AvgTemp | 77.3 | 69.1 | 57.3 | 59.1 | 57.5 | 63.0 | 72.6 | 78.5 | 86.8 | 89.0 | 86.5 | 84.9 |
| TempNorm | 71.0 | 59.8 | 51.9 | 52.6 | 55.3 | 60.1 | 67.0 | 76.0 | 84.8 | 87.0 | 85.3 | 81.6 |
| D+/- | 6.3 | 9.3 | 5.4 | 6.5 | 2.2 | 2.9 | 5.6 | 2.5 | 2.0 | 2.0 | 1.2 | 3.3 |
| Rank | 2nd Hot | 1st Hot | 2nd Hot | 1st Hot | 19th Hot | 15th Hot | 2nd Hot | 11th Hot | 14th Hot | 8th Hot | 15th Hot | 1st Hot |

2017-2018 Season Ranking (NWS-Tucson)

| WY17-18 | Fall | Winter | Spring | Summer | Monsoon |
|------------|------------|-------------|------------|-------------|-------------|
| Precp Rank | 1st Dry | 49th Wet | 1st Dry | 31st Wet | 37th Wet |
| Temp Rank | 1st Hot | 1st Hot | 4th Hot | 7th Hot | 8th Hot |

Pima County Drought Conditions

| WY 17-18 | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Short Term | D1(57) D0(43) | D1(90) D2(10) | D1(90) D2(10) | D1(90) D2(10) | D2(73) D3(27) | D2(73) D3(27) | D2(73) D3(27) | D2(70) D3(30) | D3(80) D2(20) | D3(80) D2(20) | D2(80) D1(20) | D2(80) D1(20) |
| Long Term | D2, D3 | D2, D3 | D2, D3 | D3, D4 | D3, D4 | D3, D4 | D3, D4 | D3, D4 | D3, D4 | D3, D4 | | |

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

Pima County Drought (US Drought Monitor & Monitoring Technical Committee)

Short Term

The 2018 Water Year started with a mix of Moderate drought in western Pima County and an eastern pocket of Abnormally Dry. Through November, Moderate drought expanded across all of Pima County as Severe drought began in the southwest corner. By late January, there was rapid development of Severe drought covering the County with Extreme drought in the southwest corner. In May, Extreme drought expanded from the northwest all across Pima County leaving only a small area of Severe drought in the eastern portion. By August, Extreme drought had receded to the west leaving Moderate and Severe drought in the east. Improvement continued through August and remained steady through September as the County recovered from Extreme drought leaving Severe drought and a small eastern portion of Moderate drought.

Long Term

From October to December, western Pima County was in Extreme and Severe drought radiating to the east with only small portions of Moderate drought in the northeast and southeast corners. By January, Exceptional drought had developed in the western areas. Drought condition continued unchanged through June.

Colorado River Basin & Central Arizona Project (CAP)

Pima County CAP Water (acre feet annually)

| CAP Agriculture Pool | |
|---------------------------------|---------|
| Cortaro Marana Irrigation Dist. | 4,313 |
| Farmers Investment Co. | 2,323 |
| Kai-Avra Farm | 1,575 |
| BKW Farms | 1,226 |
| Kai-Red Rock Farm | 750 |
| <i>Total</i> | 10,187 |
| CAP NIA Water | |
| Freeport | 5,678 |
| Rosemont Copper | 1,124 |
| Town of Marana | 515 |
| <i>Total</i> | 7,317 |
| CAP Tribal Allocations | |
| Tohono O'odham | 74,000 |
| Pascua Yaqui | 500 |
| <i>Total</i> | 74,500 |
| CAP M&I Contracts | |
| City of Tucson | 144,191 |
| Metro DWID | 13,460 |
| Town of Oro Valley | 10,305 |
| Spanish Trail Water Co. | 3,037 |
| Community Water Co-Green Valley | 2,858 |
| Flowing Wells Irrigation Dist. | 2,854 |
| Town of Marana | 2,336 |
| Green Valley DWID | 1,900 |
| Vail Water Co. | 1,857 |
| <i>Total</i> | 182,798 |

Pima County water providers and users are taking delivery of water from the Central Arizona Project. Tucson Water has the largest CAP annual municipal allocation in the state. Metropolitan Domestic Water Improvement District (DWID), the Town of Oro Valley and others have smaller CAP allocations. Agricultural users and the Tohono O'odham Nation also have access to and use CAP water. Consequently, the drought status of the Colorado River and the potential for a shortage declaration is of interest to these sectors.

Pima County CAP Municipal and Industrial (M&I) contracts total 182,798 acre feet a year or 29% of all CAP M&I contracts. With tribal allocations, Non-Indian Agriculture (NIA) water and the Agriculture Pool, Pima County could take delivery of 279,802 acre feet a year of CAP water.

Drought Contingency Plan

Arizona Department of Water Resources (ADWR) and Central Arizona Water Conservation District (CAWCD) committed to a joint stakeholder process to discuss and recommend how to adopt and implement the Lower Basin Drought Contingency Plan (LBDCP or DCP). LBDCP would overlay the 2007 Interim Guidelines for Lakes Mead and Powell operation during Lower Basin shortage. By taking additional cuts to Colorado River deliveries ahead of the existing tiered shortage plan, the Bureau of Reclamation and Lower Basin states hope to avoid a rapid decline in Mead’s supply. These earlier and deeper reductions have been modeled to slow or arrest decline below 1,025’ but not prevent a Tier 1 shortage.

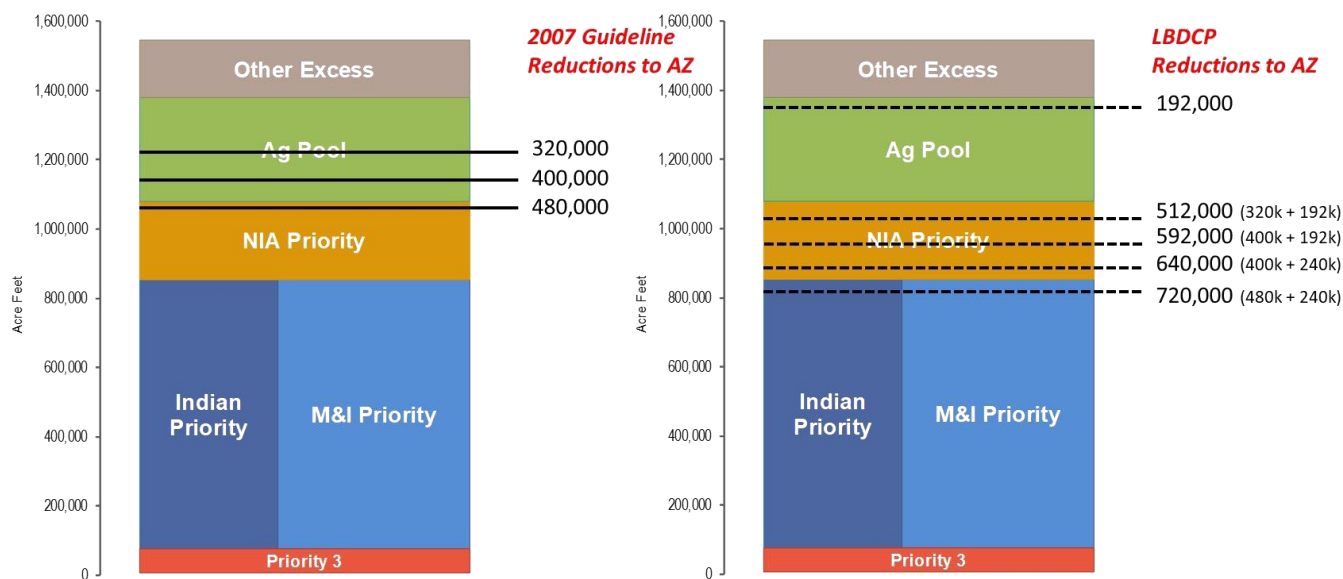
ADWR and CAWCD hosted two public briefings and assembled a LBDCP Steering Committee to reach consensus on the issues needing resolution for successful implementation of the LBDCP. The 38-member committee includes Pima County delegates representing various sectors and will meet through November with the goal of obtaining a joint resolution from the Arizona Legislature that will authorize the implementation of the LBDCP.

The priority issues for the committee are:

- CAP Agriculture Mitigation- Under the LBDCP, the Agricultural Pool supply is eliminated in a Tier 1 shortage. This sector bears most of the burden with limited benefit.
- Tribal ICS- Intentionally Created Surplus (ICS) is a supply management tool that allows for more water to stay in Lake Mead. Giving tribes the ability to create ICS will add to management flexibility.
- CAP Excess Water Plan- This supply has been a major contributor to the conservation water already in Lake Mead and is responsible for keeping the Lower Basin out of shortage. Collaboration is needed to continue realizing the multiple benefits of this supply.
- Arizona Conservation Plan- An intra-state plan must have broader participation in spreading LBDCP reductions across priority pools to gain sufficient support.

| LBDCP Steering Committee – Pima County Regional Delegates | |
|---|--|
| Timothy Thomure | Tucson Water |
| Joseph Olsen | Metropolitan Domestic Water Improvement Dist. |
| Brian Wong | Pima County Agriculture/So. Az. Water Users Assoc. |
| David Godlewski | So. Az. Home Builders Assoc. |
| Ted Maxwell | So. Az. Leadership Council |
| Chairman Edward Manuel | Tohono O’odham Nation |
| Rep. Rosanna Gabaldon | Az. State House, Legislative District #2 |
| Sen. Lisa Otondo | Az. State Senate, Legislative District #4 |

2007 Existing Tier 1-3 Shortages vs LBDP Additional Tier Shortages



Lake Powell and Lake Mead

Inflow into Lake Powell was well below average with observed water year inflow at just 43%. With less than half of normal inflow and Water Year 2019 forecasted to be below average, elevation at Lake Powell will likely decline unless a significant event delivers improved inflow. The forecasted elevation at Lake Mead going into 2020 is 1,070', which would trigger a shortage for that year. The probability of shortage in 2020 does not take into account a Drought Contingency Plan or additional conservation. As Lake Powell declines, it increases the probability that the operating tier will change based on the 2007 Guidelines, resulting in reduced releases from Lake Powell. Analysts believe modeling at this time indicates that if inflows into Lake Powell leading into 2020 are greater than 75% of normal, a reduced release of 7.48 million acre feet would be avoided; any less than 75% of normal would trigger a shortage even if a Drought Contingency Plan were in place.

| Lake Powell Unregulated Inflow | Million acre feet | Percent normal |
|--------------------------------|-------------------|----------------|
| April-July 2018 | 2.602 | 36% |
| August 2018 | 0.011 | 2% |
| September 2018 | 0.001 | <1% |
| WY2018 | 4.612 | 43% |

| Lake Powell Unregulated Inflow | Million acre feet | Percent normal |
|--------------------------------|-------------------|----------------|
| WY2019 Forecast- Most Prob. | 8.1 | 75% |
| _Min Probable | 4.8 | 44% |
| _Max Probable | 15.6 | 144% |

| Elevation Forecast | Lake Powell | Lake Mead | Powell Release |
|--------------------|--------------|--------------|------------------------|
| WY2019_Most Prob. | 3,581' (43%) | 1,070' (35%) | 9.00 Million acre feet |
| _Min Probable | 3,566' (36%) | 1,057' (32%) | 8.23 Million acre feet |
| _Max Probable | 3,648' (70%) | 1,079' (38%) | 9.00 Million acre feet |

Impact in Pima County

Wildfire

Southern Arizona's fire season activity decreased in 2018 in comparison to previous years. Wildfire burned over 75,000 acres in 2017, the Sawmill and Burro fires accounting for most of that total. In 2018 the total acreage was a tenth of that just over 7,500 acres.

Agriculture and Ranching

Agriculture in Pima County is largely irrigated and there are six permitted groundwater savings facilities using CAP water. There were no agricultural drought impacts reported.

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 areas of shallow groundwater in the region along Cienega Creek, Davidson Canyon, and Tanque Verde Creek. Groundwater levels have recovered in many of the areas since 2014 though there is an established long-term downward trend in groundwater levels for most of the areas. RFCD will continue to monitor to ascertain whether the more recent recoveries are just a temporary delay in a downward trend.

Energy

In August, the western energy market was disrupted by heat and wildfire in California causing supply problems as less energy was available to western states. Power companies were not able to prepare for the pricing and availability problems. For several days power companies in southern Arizona asked customers to do everything possible to conserve energy in order to prevent a brownout.

Kino Environmental Restoration Project (KERP)

KERP is an environmental restoration project that harvests urban storm water and controls flooding in Tucson. KERP covers 141 acres with 28 acres of open water and riparian habitat. A central pond banks storm water and stores the water for irrigation within the KERP basin and Kino Park. The six acre "Deep Pond" is 50' deep when full. This year, KERP had no inflow from mid-August through January and the pond receded to two acres, a record dry period that has not occurred since the project was completed in 2002.

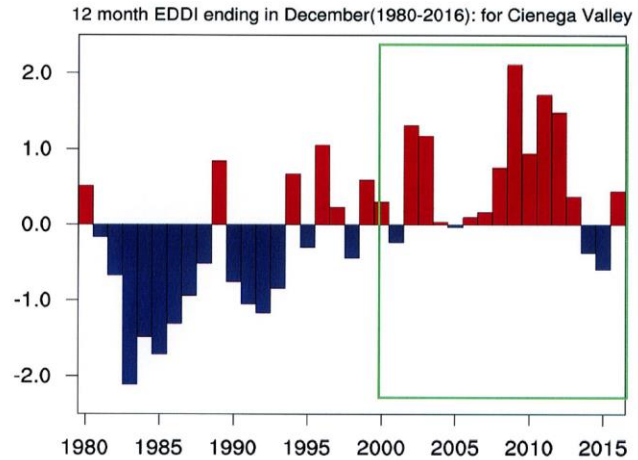
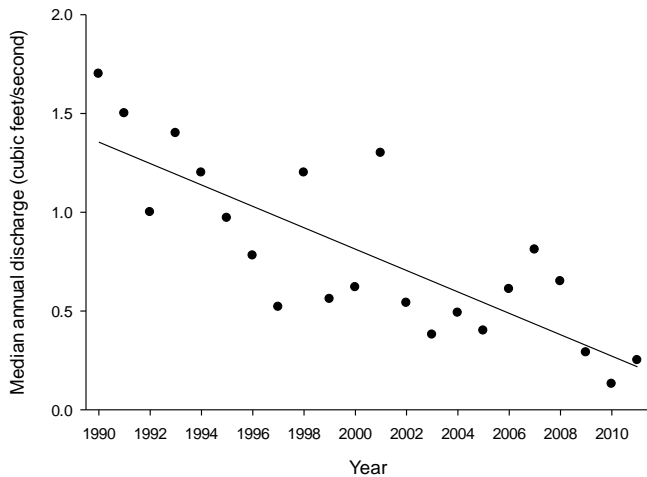
Cienega Creek

Cienega Creek, in eastern Pima County, continues to show the impacts of sustained drought. Pima Association of Governments' (PAG) drought reporting uniquely depicts the localized drought impacts on a shallow groundwater dependent system, important for habitat and rural residents dependent on this water source. With long term support and interest from its member jurisdictions, PAG has consistently monitored the shallow groundwater-dependent riparian area of Cienega Creek Preserve on a monthly and quarterly basis since 1989 and reported the findings to ADWR for compilation into state records.

In the monitoring year 2017-2018, PAG observed a decrease in Cienega Creek and Davidson Canyon's perennial flow extent. Both are Arizona Outstanding Waters. Monitoring during the driest time of year (May/June) maps the segments that contain perennial (year-round) surface water. PAG's long-term consistent inventory of Cienega's hydrologic conditions shows a long-term downward trend. To illustrate, in June 2018, Cienega Creek flows were present in less than 15% of the 9.5-mile monitoring area, which had flowed perennially in 1985. Since 2010, during the wettest season of the year, Cienega Creek's base flow has only reached up to 4 miles of flow. In Davidson Canyon, 2010 to 2016 were peak drought years in which the perennial segment occasionally stopped flowing during the driest part of the year, with flowing

extent ranging from 0.00 to 0.033 miles in June. In June 2017, there was recovery with 0.124 miles of flow but a drop to 0.077 miles in 2018.

The graphs below illustrate the history of decline in annual discharge from Cienega Creek and drought condition. Median annual discharge was measured at the Pantano gage. The Evaporative Demand Drought Index (EDDI) shows drought conditions (in red) and increased occurrence since 2000 (green box). Higher positive values on the Y axis indicate more extreme drought.



Agua Caliente Park

Agua Caliente Park, located northeast of Tucson, has historic and cultural significance. The park's focal point is a natural artesian spring that feeds a creek and produces an abundant variety of oasis vegetation and a habitat for native species. The natural spring originally flowed naturally into two constructed ponds dating to the late 1800s, but in recent years, the spring has stopped flowing. Water is currently being pumped to feed the first pond to maintain the wetland habitat, which also produces a recreational element for neighborhood residents and park visitors. Well pumping, however, only sustains one pond after failure of the spring.

Over the last few years, the well discharge was increased to maintain the main pond at Agua Caliente Park. In order to reduce water loss at a second pond, it was divided into two separate lined ponds. A natural unlined area was retained for seasonal wildlife habitat. The well discharge has maintained the main pond and one lined pond. A proposed plan to renovate and seal the main pond at Agua Caliente Park will help reduce groundwater pumping.

Sabino Canyon

Sabino Canyon is a popular destination and tourist attraction in the Coronado National Forest northeast of Tucson with numerous hiking trails along Sabino Creek. Due to the dry fall and winter, Sabino Creek had no stream flow for 153 days, beginning in mid-September and finally recording measured flow from February's precipitation.

Drought Response Actions

Pima County Regional Wastewater Reclamation Department (RWRD) produces highly treated reclaimed water that is reused in three ways; direct reuse in the reclaimed system, aquifer replenishment through recharge or for environmental projects. A significant portion of reclaimed water is released into the Lower Santa Cruz River. Storm water runoff provided over 15,000 acre feet of water to the river during the water

year, whereas discharge of effluent provided around 40,000 acre feet. Daily discharges of reclaimed water have maintained persistent flows along the channel downstream of the two County water treatment facilities despite the regional drought. Discharges to the river decreased by an average of 11% from a 2013 baseline.

Pima County continues to support Conserve to Enhance (C2E), which urges water conservation that translates into donations to support environmental enhancement. C2E participants have saved 10 million gallons of water since the program inception in 2011, through conservation strategies ranging from behavioral changes to rainwater harvesting installations. C2E has awarded funding to local neighborhood projects totaling approximately \$100,000 in investment. Pima County employees can now donate to C2E through the County's Employees Combined Appeal Program (ECAP).

The Conservation Effluent Pool (CEP) is an effluent allocation set aside pursuant to intergovernmental agreements between the City of Tucson and Pima County for use in riparian restoration projects. No recent formal requests for CEP projects have been submitted. In 2017, the Gila topminnow was detected in the Santa Cruz River and confirmed by subsequent surveys in the effluent stream. CEP water may be useful in maintaining a minimal flow that would safeguard this endangered species.

Pima County continues to adhere to its policy framework regarding water resources and drought management. This framework includes 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

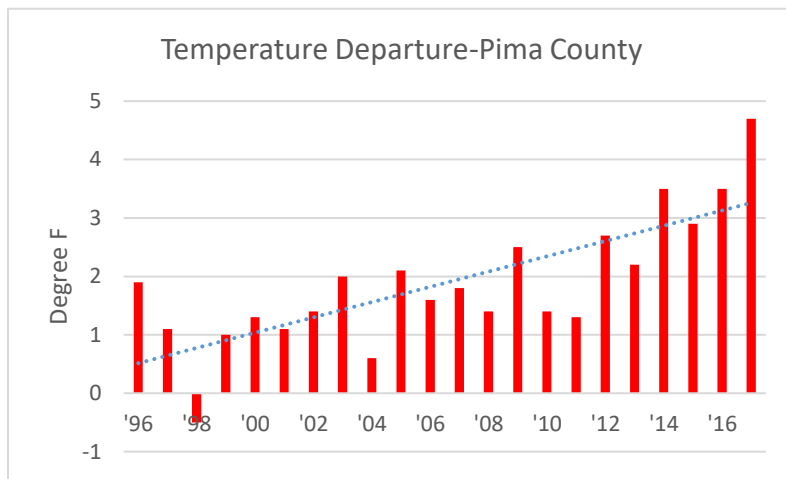
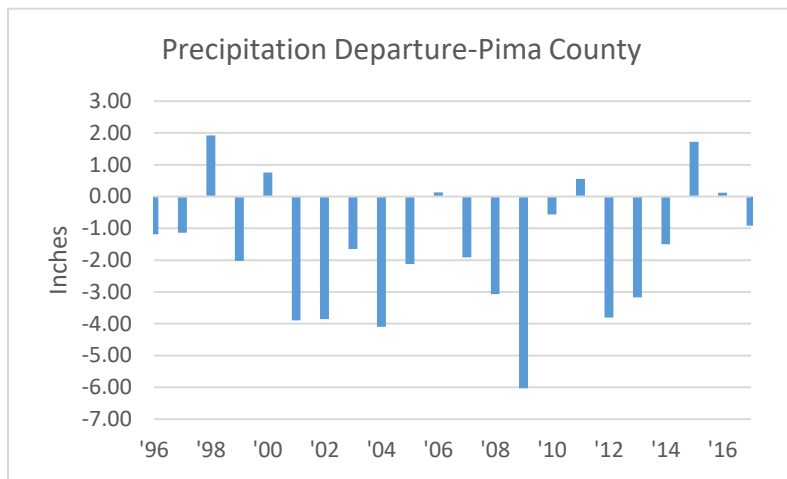
The County is currently updating its Strategic Plan for Use of Reclaimed Water to account for population growth and infrastructure development resulting in changes to effluent volumes in different regions of Pima County. The updated Plan will project future effluent supply and demand and recommend actions to maximize effluent use at both metropolitan and regional water reclamation facilities.

An Underground Storage Facility (USF) application for the Green Valley Water Reclamation Facility was withdrawn to be resubmitted pending data collection for hydrologic modeling.

Pima County Resolutions 2017-39 and 2017-51 reaffirm the County's commitment to address climate change and align County operational efforts and Sustainable Action Plan with the Paris Agreement to reach carbon emissions reduction targets. As part of this effort, the County plans to install green infrastructure on County property and rights of way. The Green Infrastructure and Low Impact Development with Trees (GI-LID+Trees) report was drafted by an inter-departmental working group to identify and recommend appropriate sites for GI and tree installations. The report analyzes return on investment from the financial, social and environmental benefits. Pilot projects have been approved and the project has been expanded.

In order to ensure the County is prepared for water resource impacts resulting from climate change, staff reviewed drought management strategy in relation to current and expected climate change risks to various sectors, producing a [Drought and Climate Change report](#). In the past twenty years, Pima County has experienced a 14 percent decline in precipitation, a deficit of 34.81" of rain. During the same time, annual average temperatures have been increasing, part of the long term trend evident for decades (departure from average annual precipitation and temperature graphs below). The four-year period of 2014-2017

ranks as the warmest on record. As a connection is extrapolated between the probability of increased drought and severity of impacts and higher temperature, County drought management strategy will be informed by accepted climate and drought research and adaptation and mitigation strategies.



- Precipitation and temperature departure from average, Pima County 1996-2017.
Source: NOAA National Centers for Environmental information, 1981-2010 mean.

The Lower Santa Cruz River Management Plan (LSCRMP) is purposed to develop a management strategy to balance flood risk management, drainage infrastructure protection, water recharge, recreation opportunities and riparian habitat preservation for the Santa Cruz River from Grant Road to Trico Road. This multi-benefit project will maximize recharge of effluent within the channel. Stakeholder comments have been received and responsible parties are collaborating on a task list.

Pima County is acting as co-manager with the Bureau of Reclamation in a three-year study of the Lower Santa Cruz River Basin (LSCRB). The in-kind study offers Bureau technical expertise in applying climate change models to water supply and demand scenarios, charting the potential range of water imbalance in the region and developing adaptive management strategies to mitigate imbalance and climate change.

As of now, the region’s water providers and other entities with established drought plans are at Drought Stage 1 or its equivalent (voluntary reductions).

Summary

Pima County had a record warm fall and winter along with a record dry spring. Monsoon activity was not sufficient to overcome a water year precipitation deficit. Severe drought persisted from February through September. While the fire season in Pima County was minimal, creeks and springs are continually impacted by each year of drought.

Pima County has effective water resource and drought management plans established with new management plans and studies underway to maximize efficient use of available water resources. The County will continue to monitor local, state and regional drought conditions, assess direct and indirect impacts and analyze cascading effects.