PIMA COUNTY
REGIONAL WASTEWATER RECLAMATION DEPARTMENT
201 NORTH STONE AVENUE
TUCSON, ARIZONA 85701-1207

JACKSON JENKINS
DIRECTOR

PH: (520) 724-6500
FAX: (520) 724-9635

June 25, 2013

TO: Jackson Jenkins, Director

FROM: Kathleen Chavez, Water Policy Manager

RE: Drought Management Plan Review

As directed in Mr. Huckelberry's November 28, 2013 memorandum, the Water Resources Unit has conducted a review of Pima County's Drought Management Plan and Ordinance. With your approval, I would like to work with the Local Drought Impact Group (LDIG) to update the plan and obtain input on the recommendations outlined in the attached review conducted by Colby Bowser. Specifically, the review recommends:

- Revising drought stage and trigger events to more accurately reflect and communicate current conditions, improve coordination with other jurisdictional declarations, correct "front loading" of response measures, provide more flexibility and buffer against oscillating changes of status

- Review restrictions of each drought stage and consider appropriate levels of duplication with the City of Tucson and other water providers to prevent disparate enforcement

- Increase coordination and consolidate efforts and formalize the decision making process within LDIG to coordinate new declarations with water providers

- Increase public education about the drought and water wasting ordinance. Since enactment, the Health Department has not received any complaints. The public may be unaware of the water wasting measure. Review the Health Department's procedures for receiving and responding to complaints

- Identify steps that other county departments can take to assist impacted groups and vulnerable populations. County departments have expertise and resources that could be employed in mitigation and response strategy in sectors such as:

    - Commerce, recreation and tourism
    - Environmental health, watershed management, livestock and wildlife
    - Irrigated agriculture
    - Municipal and industrial
    - Tribal

Let me know if I have your approval to seek LDIG's input on these recommendations. After LDIG's review and input, a proposed Drought Management Plan and Ordinance would then be submitted to management and for the Board of Supervisors' consideration. Should you have any questions, I am available at your convenience.

Attachment

Copy: Colby Bowser, Water Resources Unit
Karen Wilson, Water Resources Unit

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ICKSON JENKINS
DIRECTOR

PH: (520) 724-6500
FAX: (520) 724-9635

June 24, 2013

TO: Kathy Chavez, Water Policy Manager

FROM: Colby Bowser

SUBJECT: Review of County Drought Ordinance

Drought History

The current drought began affecting Arizona in 1996.[1] With average precipitation below the 30th percentile, Arizona reported its second driest period since 1895; "drought began to develop across the southwestern United States, the southern plains states, and northern Mexico during October 1995 and by May 1996 had severely affected Arizona... The drought in the Southwest was aggravated by above-normal temperatures, very low humidity, and frequently windy conditions. Temperatures averaged more than 2.0°C above normal throughout New Mexico and western Arizona during the period and 1.0°-2.0°C above normal elsewhere in the Southwest."[2] The United States Geological Survey (USGS) precipitation and stream flow data for 1996 recorded significant decline in measurements within multiple watershed basins across the state, indicative of extreme drought.[3] Governor Fyfe Symington signed an emergency declaration (PCA 95006) that May, requesting federal assistance due to the extremely dry conditions- PCA 95006 was subsequently extended through 1998.[4]

The earliest drought mapping by the National Drought Mitigation Center in 1999 rated southern Arizona as Abnormally Dry or in a "standard" stage of drought with impacts to plant life and water supplies.[5] Generalizing the chronology and spatial extent of variable but persistent drought conditions, sections of

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[1] Rotstein, Arthur H. "Panel: Drought May Bring Arizona Problems." Associated Press. N.p., 10 Feb. 2006. Web.
[2] United States. NCEP/NWS/NOAA. Climate Prediction Center. Climate Assessment for 1996. By Michael S. Halpert and Gerald D. Bell. N.p.: n.p., n.d. Web. <http://www.cpc.ncep.noaa.gov/products/assessments/assess_96/swus.html>.
[3] United States. Department of the Interior. US Geological Survey. Precipitation and Streamflow Conditions in Arizona, Winter and Spring, 1996. By Owen R. Baynham and Jeff V. Phillips. FS-223-96 ed. Vol. Nov. N.p.: n.p., 1996. Web. <pubs.usgs.gov/fs/1996/0223/report.pdf>.
[4] http://www.azwater.gov/azdwr/statewideplanning/drought/documents/DeclarationsHistory2012.doc.
[5] http://droughtmonitor.unl.edu/archive/99/drmon520.gif.

Arizona experienced Exceptional Drought in the years 2002-2004, Extreme Drought 2006-2008, Severe Drought in 2009 and Severe or Moderate Drought in 2010.[6] The 2011 ADWR Drought Preparedness Plan Annual Report, while noting considerable winter run-off from the upper Colorado River Basin into Lakes Powell and Mead, chronicled a worsening regional short term drought status, as Exceptional and Extreme Drought radiated from the southeastern corner of the state, transitioning into Severe and Moderate Drought throughout Pima County and most of central and northern Arizona.

Winter precipitation, prominent in replenishing reservoir supplies in 2011, declined across the state, as well as the upper Colorado, resulting in an "extremely dry" seasonal pattern, per ADWR's report for 2012, which predicted a long term drought status for Pima County as Extreme in the San Simon Watershed and Severe in the Santa Cruz, including the Tucson Metro area. Out of 88 monthly drought monitor reports, ADWR has recorded only four months of normal conditions throughout Pima County.[7] Lakes Powell and Mead remain half full with a potential 2016 Colorado River water shortage declaration looming. The narrative of the last 17 years includes aberrations, however, the overall trend has been below or well below average precipitation and above average temperatures - similarly the best estimation of the forecast ahead.

Forecast

University of Arizona researchers report in the "Assessment of Climate Change in the Southwest United States" that 2001-2010 was warmer than any previous decade in the last 110 years leading to declines in soil moisture, late-season snowpack and river flow and resultant reduction of water availability.[8]

Most notably, droughts in parts of the Southwest are expected to become hotter, more severe, and more frequent as warming will continue, with longer and hotter heat waves as precipitation declines in the southern Southwest. As a consequence, water availability and quality will decline, disruptions in agriculture and electric generation are likely and increases in wildfire and outbreak of forest pests and disease will lead to ecosystem change.

While there is a degree of variability in deciphering climate models, it is not unreasonable to prepare for continued and worsening drought conditions given that "recent drought has been unusually severe relative to droughts of the last century, but some droughts in the paleoclimate record were much more severe. The areal extent of drought over the Southwest during 2001–2010 was the second largest observed for any decade from 1901 to 2010. However, the most severe and sustained droughts during

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[6] http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/documents/long-termmapmethods-updated3-2011.pdf

[7] June 2010, May 2010, October 2008, September 2008.

[8] Garfin, G., J. Overpeck, A. Jardine, D. Busch, M. Dettinger, D. Cayan, E. Fleishman, A. Gershunov, G. MacDonald, K. Redmond, W. Travis, and B. Udall. "Assessment of Climate Change in the Southwest United States: Summary for Decision Makers." Southwest Climate Alliance. Southwest Climate Alliance, n.d. Web. 01 May 2013. <http://www.climas.arizona.edu/publications/2587>.

1901–2010 were exceeded in severity and duration by multiple drought events in the preceding 2,000 years."[9]

Impacts

Cumulative drought stress degrades forest viability as prolonged heat and moisture deficit creates abundant and explosive fuel for wildfire. Combined with frontal weather patterns producing sustained winds and peak gusts, the potential for critical "Fire Weather" days (relative humidity below 15%, winds above 19mph, high/extreme fire danger) is expected to increase.[10] The current southwest forecast of Fire Danger Class is High to Extreme. The US Forest Service (USFS) recognizes management adaptation strategies are necessary to mitigate climate conditions as wildfires have become larger, burning twice as much land than in previous decades, and more expensive, consuming 40% of the USFS budget.[11]

Arizona has endured significant wildfire activity over the decade. The 2002 Rodeo/Chediski fire destroyed 468,000 acres- 161,000 additional acres would burn that year. The suppression cost for that fire, $46.5 million, is only part of larger direct, indirect and rehabilitation costs that must be factored in to realize the true scope of a fire's impact- in this case an estimated $308 million.[12] The Bullock and Aspen fires burned 114,000 combined acres and hundreds of structures in Pima County. An unfortunate milestone was passed in 2011 as over 1 million acres were totaled in the aftermath of the Wallow fire, the largest in Arizona history costing $79 million in fire suppression, and smaller fires such as Horseshoe 2 and Monument.

Drought and wildfire predominate the past two decades yet the region is under threat of further loss of habitat and wildlife as wildfire occurrences may increase by 50%-100% per some projections looking forward to 2050. Burned watersheds are prone to erosion and the runoff has a negative impact on water quality. Additionally, research shows some correlation between smoke and decreased rainfall and drought induced monsoon season diminishment, exacerbating drought and wildfire conditions, not to mention air quality.[13]

On that topic, another drought related weather extreme, the haboob, captured attention with several spectacular events. The lack of rain to suppress such had caused concern for Arizona Department of Environmental Quality (ADEQ) air quality managers and pulmonary care physicians given the threat to

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[9] Ibid.
[10] Sosnowski, Alex. "Rough Wildfire Season Ahead for West With Building Drought." AccuWeather. AccuWeather.com, 19 Apr. 2013. Web. 19 June 2013.<http://www.accuweather.com/en/weather-news/rough-wildfire-season-ahead-wi/10344626>
[11] Aleshire, Pete. "Wildfires Double, Drought Redoubles." PaysonRoundup.com. Payson Roundup, 11 June 2013. Web. 19 June 2013. <http://www.paysonroundup.com/news/2013/jun/11/wildfires-double-drought-redoubles/>.
[12] "The True Cost of Wildfire in the Western U.S." Wflcweb.org. Western Forestry Leadership Coalition, Apr. 2010. Web. 20 June 2013
[13] Aleshire, Pete Ibid.

public health.[14] Pima County, having been in compliance since July 2009, recently exceeded air quality standards on three occasions in a month due to blowing dust.[15]

Economic Loss

The economic impact of drought is difficult to quantify, given the magnitude that water serves as an input into economic activity, but accepted figures of average national drought cost have been estimated at $6-$8 billion annually. The Southwest region suffered a $2 billion loss in 2012; the Texas/New Mexico region was impacted more dramatically in 2011, with an estimated $8 billion loss.[16] US farmers will be reimbursed for $17 billion in crop loss last year upon mixed reports of the actual impact to food supply.[17] A $12 billion loss was recorded the previous year[18], contributing to higher food prices of 3% to 5%.[19]

Locally, Pima County farmers will receive $290,482, a fraction of Pinal County's loss reimbursement of $17,967,952. Anecdotally, ranchers, who must haul water in by truck during shortages, have less flexibility in adapting to drought conditions, where dependent on forage - this appears reflected in Arizona crop reports listing a majority of produce condition as fair to good while 79 percent of range is in poor or very poor condition.[20] 2002 forage losses were near total in some areas, decimating two-thirds of the state's cattle at a cost of $400 million.[21] The US cattle herd is at its smallest since 1952[22] and local ranchers face increasing feed and water prices due to drought, forcing them to increase their prices[23]or sell off all or most of their herds. Cattle operations are turning to growth inducing drugs to bolster carcass weights where they once relied on feed alone.[24] Federal budget machinations reduced assistance programs of use to impacted ranchers leaving state agricultural officials with fewer options to respond.[25]

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[14] Reese, Michelle. "Another Haboob-heavy Summer Possible under Drought Conditions." EastValleyTribune.com. East Valley Tribune, 21 Mar. 2012. Web. 19 June 2013. <http://www.eastvalleytribune.com/local/tempe/article_4f9402ce-72e6-11e1-a328-001871e3ce6c.html>.

[15] Davis, Tony. "Pima County Air Quality Rated "unhealthy"" Azstarnet.com. Arizona Daily Star, 04 May 2013. Web. 19 June 2013.

[16] http://www.emdat.be/disaster-list

[17] Doering, Christopher. "Crop Insurance Indemnities Nearly $17 Billion in 2012." Des Moines Register Staff Blogs. Gannett Co., 22 Apr. 2013. Web. 31 May 2013.

[18] Rice, Doyle, and Chuck Raasch. "Drought Could Cost $12 Billion, Most since 1988." USATODAY.COM. Gannett Co., n.d. Web. 31 May 2013

[19] "The Cost and Consequences of the U.S. Drought." CNN Business & Money. Wharton School of the University of Pennsylvania, 26 Oct. 2012. Web. 31 May 2013

[20] http://www.nass.usda.gov/Publications/State_Crop_Progress_and_Condition/index.asp

[21] Arizona. Governor's Drought Task Force. Arizona Drought Preparedness Plan: Background. Appendix VIII. 2004.

[22]Miller, David. "Colorado Cattle Ranchers Face Third Year of Drought." Market to Market. Iowa Public Television, 07 June 2013. Web. 20 June 2013.

[23] "Drought Affecting Local Cattle Ranchers." KVOA.com. KVOA News 4 Tucson, 15 Aug. 2012. Web. 20 June 2013.

[24] "Drought Accelerates Use of Drugs to Beef up Cattle." Trivalleycentral.com. Associated Press, 22 May 2013. Web. 20 June 2013.

[25] Dale, Mariana. "S. AZ Ranchers Face Drought Without Help." Azpm.org. Arizona Public Media, 08 May 2013. Web. 20 June 2013.

Response Efforts

In 1999, Governor Jane Dee Hull signed a declaration of drought emergency (PCA 99006), the state's mechanism for receiving federal assistance, which still remains in effect today. In 2003, Governor Janet Napolitano signed an executive order (EO 2003-12) establishing the Governor's Drought Task Force and directed Arizona Department of Water Resources (ADWR) to coordinate the implementation of the Arizona Drought Preparedness Plan (ADPP), a product of the Task Force to serve as an adaptable framework for state leaders, local governments and water managers to monitor and mitigate drought. At that time, 15 counties were designated as primary natural disaster areas.

The Preparedness Plan structural components are the State Drought Monitoring Technical Committee (MTC), the Drought Interagency Coordinating Group (ICG) and Local Drought Impact Groups (LDIG). The MTC, primary committee of the Preparedness Plan, collects climate and weather data to produce the Arizona Drought Monitor Report and Status Updates (in conjunction with the National Drought Mitigation Center), which details short and long term drought status affecting each watershed- the conditions referenced earlier in this memo. The Drought Interagency Coordinating Group is a multi-jurisdictional advisory body, updating the Governor and recommending emergency declarations. LDIG is the local component of the ADPP, assessing drought conditions and recommending options for adaptation at the county level, compiling this information in an annual report to the Interagency Coordinating Group.

The Preparedness Plan summarized is a "comprehensive statewide support structure" with implementation at the local level; it "encourages local responses to local conditions", recognizing "the strengths inherent in local knowledge". As a framework for drought response, the ADPP determines that the "Local Area Impact Assessment Groups will identify local drought-related impacts, define and assess societal impacts, severity, loss and costs associated with impacts, identify response options, identify unmet needs or needs for response, and identify and facilitate efforts to mitigate impacts focusing on preparedness and reducing drought vulnerabilities." The LDIGs envisioned are to encourage regional coordination, assisting smaller communities lacking resources and working with public land management agencies. In this framework, the MTC would issue alerts of drought stage which would trigger action by the LDIG's.[26]

Continued implementation of the Plan was ordered in 2007, Governor Napolitano signing EO 2007-10 – Drought Declaration for the State of Arizona. EO 2007-10 and PCA 99006 are invoked annually as drought persists and counties lapse back into disaster status. Currently, twelve Arizona counties have received some form of disaster designation from the USDA, including Pima County, a Primary Disaster County.

Guidelines for response and mitigation based on each drought stage are outlined in the ADPP, suggesting appropriate action to be taken by the state, local communities and utilities and individual

[26] Arizona. Governor's Drought Task Force. Arizona Drought Preparedness Plan: Operational Drought Plan. 2004. Print. Pgs 17,18. <http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/ADPPlan.htm>.

households. These guidelines have been incorporated into Pima County's Drought Response Plan and Water Wasting Ordinance - Chapter 8.70.

County Efforts

Citing drought conditions and ADWR's requirement that large water providers put in place drought preparedness plans by January 1, 2007, and desiring to have a coordinated effort with county water providers in drought management should there be staged water curtailments, the County Administrator forwarded to the Board of Supervisors a Drought Management Plan and draft ordinance 2006-43 (Ch. 8.70) on April 18, 2006, subsequently unanimously adopted. This Plan established a task force and a Drought Monitoring Committee to coordinate the development of a response plan and drought monitoring system. The ordinance codified the response plan- "establishing the drought stages, water reduction measures for each stage and prohibitions on water wasting".[27] At final adoption on June 20, 2006, conditions at the time and original drought trigger criteria (based on CLIMAS data) indicated a Stage 3 or Stage 2 declaration as appropriate pending consultation with regional water providers. Emphasis in coordinating implementation was given to the Board- "our declaration of various drought stages should be coordinated with a specific request and recommendation for such from area water providers... the Board's adoption of the Drought Response Plan and Water Wasting Ordinance allows the region's water providers to request of the County, drought emergency and water conservation measures appropriate to actual drought conditions".[28]

Following several county Drought Monitoring Committee meetings, recommendations came forward that drought indicators be streamlined and made consistent with the ADWR Drought Monitor Report and the CLIMAS criteria dropped, the ordinance was therefore revised. In addition, the Drought Monitoring Committee was designated to function as the ADWR Local Drought Impact Group and the County Administrator gave direction for "a review of all County facilities to ensure we are in compliance with our own provisions against water wasting".[29] After revisions and coordination with Tucson Water and other providers, a Stage One Drought was declared on April 24, 2007.

County Ordinance

The current county ordinance establishes 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 "Extreme" (Table 8.70.050). Each "Stage" declaration within the county triggers drought stage reduction measures. To review:

Chapter 8.70 of the Pima County Code, Drought Response Plan and Water Wasting, codifies a drought response plan to declare drought stages to ensure maximum beneficial use, prevent unreasonable use and enable conservation of water. 8.70.030 prohibits water wasting at any time, defined as allowing water to leave one's property, draining onto another parcel or any roadway due to excessive irrigation or an uncorrected leak or failing to fix a leak after being notified. Commercial operations

[27] Pima County-Drought Management and Water Conservation. C.H.Huckelberry Memo to Board. April 18, 2006.
[28] Pima County-Drought Response Plan and Water Wasting Ordinance. C.H.Huckelberry Memo to Board. June 20, 2006.
[29] Pima County-Drought Response and Declaration of Stage One. C.H.Huckelberry Memo to Board. April 24, 2007. (Drought Ordinance Revisions-PC Code 8.70 Memo, June 5, 2007.)

may not wash impervious surface areas by spraying with hose or any other means except for instances necessary for public welfare. 8.70.040 defines drought stages and corresponding required drought conservation measures,

Stage 1 Water Alert initiates a public education and voluntary reduction campaign - the public is notified and asked to conserve water. Stage 1 is triggered by an Abnormally Dry finding related to Pima County by the Arizona Drought Monitor Report.

Stage 2 Water Warning implements limits on irrigation (7pm-7am only) and car washing (no charity car washes except at water recycling wash facilities, personal use of shut-off nozzle and bucket) and prohibits overseeding of turf areas, use of outdoor misters , public fountains or water features. Stage 2 is triggered by a Moderate Drought finding.

Stage 3 Water Emergency includes those limits set in Stage 2 and in addition prohibits filling of new residential pools (or refilling of existing ones) and car washes not using recycled water. Allowances are made to maintain pool levels and keep pool permits active until Stage 3 is downgraded to Stage 2. Stage 3 is triggered by a Severe Drought finding.

Stage 4 Water Crisis includes preceding limits and adds limits on irrigation(no watering of lawn or groundcover - trees and shrubs only) and prohibitions on the filling of any pool (until downgrade to Stage 2) and using water to wash vehicles, parking lots, streets or control dust during construction projects. Stage 4 is triggered by an Extreme finding.

All or part of the county may be declared to be in a particular drought stage by the Board of Supervisors after recommendation by the County Administrator, who is informed by Drought Monitoring Committee (LDIG). Should the Interior Secretary declare a shortage on the Colorado River or a curtailment of CAP water delivery to any local water provider occur, the Board may increase the drought level by one stage.

The Health Director is authorized to review variance requests, those citing a special case in which strict adherence to ordinance causes hardship. The only grounds for issuing variance are for reasons of health, safety or economic hardship. The Health Director shall continually monitor and report on the nature and severity of the drought condition to county administrator.

Enforcement involves a notice of violation phase, where the responsible party is made aware of violation and fines associated, given a chance to correct violation in a certain time period deemed reasonable. After failure to comply, the Health Department will contact water provider who may disconnect service. Violation is a civil infraction, assessment of civil penalty not less than $250 during Stage 2, $400 Stage 3, and $600 Stage 4. Each act of violation and every day upon which violation occurs is a separate infraction. Health Director can also seek injunctive orders.

The Drought Response Plan Ordinance is a situational demand management tool, not necessarily long range planning - its singular purpose is to curtail water usage during shortage. Conservation and efficiency standards, as sketched in the ADPP, are more than adequately addressed in the implementation of multiple county programs and existing ordinances.

The Sustainable Action Plan for County Operations, adopted in 2008, catalogs county resource use, setting goals for improved efficiency and conservation within multiple functions of daily operation and responsibilities, including water conservation and management. The program promotes increased county use of reclaimed water, improved county building water efficiency and landscape standards and creates a baseline study of water use with required reductions through 2025. Success indicators are measured annually, such as a 120% increase in number of parks served by reclaimed water since adoption.

The City/County Water and Wastewater Study and Action Plan for Water Sustainability, adopted in 2010, expands water sustainability and conservation efforts by identifying a comprehensive list of shared regional goals and recommendations under the headings "Comprehensive Integrated Planning," "Respect for the Environment," "Water Supply," and "Demand Management." The City of Tucson and

Pima County are working cooperatively to integrate water, wastewater, stormwater and land use planning in an effort to prioritize renewable water use while minimizing groundwater withdrawals and land use impacts on riparian areas, collaborating on conservation and restoration projects in key areas.

County 2006 and 2007 Water Conservation Code Amendments mandate low use fixtures and use of renewable water for new golf courses, reclaimed-ready and rain sensor irrigation as well as restrictions on fountains, water features and turf. In addition, Pima County Green Building and LEED Certification programs, established in 2008, promote the construction of sustainable homes. The County Water Resource Element of the Comprehensive Plan informs the Board of Supervisors of a development's water use impact and nearby groundwater dependent ecosystems before land use changes are made.

These initiatives enhance drought response efforts and represent substantial and forward looking planning of benefit regardless of drought stage. Continued emphasis on the successful implementation of the Sustainable Action Plan and the Action Plan for Water Sustainability will incorporate drought management measures of merit pertaining to conservation. Within its scope, the ordinance functions as necessary to mitigate the drought effect of reduced water supply but may need modification to ensure response measures are coordinated and appropriate to actual drought conditions.

Possible Ordinance Changes

The county's current drought declaration, Stage 1 Water Alert, correlates to an Abnormally Dry drought condition. The Arizona Drought Monitor Report produces both a short term and long term report and map. Referencing the most recent report, Pima County is experiencing Severe Drought conditions (D2) in its entirety for the short term and a long term combination of Abnormally Dry (D0) in the northwest corner, Extreme Drought (D3) along the border and centrally in the San Simon River Watershed and Severe (D2) throughout its eastern portion including the Tucson Metro region. Corresponding county response would necessitate a Board declaration of Stage 3 Water Emergency for most of the county's population and even a Stage 4 Water Crisis in some areas.

Looking back at last year's findings, an analysis of the short term map shows a predominance of Severe drought with oscillating pockets of Moderate finding from January to July 2012 and then a reversal-Moderate drought with pockets of Severe from August 2012 to March 2013. Again, the most recent finding for May is a Severe drought for the entirety of Pima County. Out of synch, the county has remained in a Stage 1 response position communicating Abnormally Dry conditions since 2007.

Further, comparison of county code with template of response and mitigation guidelines issued by the Governor's Drought Task Force shows some front loading of response measures. A county Stage 2 Water Warning is triggered by a Moderate drought however implements some response measures suggested by ADPP for Severe and Extreme drought and similarly for county Stage 3 Water Emergency at Severe enacting ADPP suggested response for Extreme drought. While local adaptation is encouraged in planning, front loading more stringent restrictions too soon could prove counterproductive.

Comparing the City of Tucson's drought response, their four stage trigger mechanisms are broader and include local system indicators relevant to water utility operation- there is no set stage correlating to

each specific Drought Monitor Report finding. Tucson Water is susceptible to different variables, given its use of CAP water- localized drought conditions impact demand and water use patterns while supply is affected by precipitation in the upper and lower Colorado Basin. Stage 1 remains steady with indication of any drought condition locally or a Severe finding on the Colorado. Upgrading to Stage 2 represents a significant event- a Colorado River shortage declaration and/or reduction in CAP deliveries to non-municipal uses. Stage 3 correlates to municipal CAP shortages impacting the City; Stage 4, a further reduction of same.

Thus, any declaration of Stage 2 or 3 Drought by Tucson Water is unlikely until a potential CAP shortage in 2016 or later. However, Stage 2 continues voluntary customer reductions with some irrigation restrictions for commercial and industrial operation; there are no customer potable water use restrictions comparable to county ordinance until Stage 3. Also of note is declaration authority. Mayor and Council are required to approve more stringent Stage 3 and 4, after recommendation by City Manager though Stage 1 and 2 are declared by the City Manager, informed by the Water Director.

As discussed, it is desirable to coordinate any drought declarations and to ensure measures are appropriate to actual drought conditions in keeping with consistent application and enforcement. Currently, most regional water providers are operating at similar Stage 1 drought declarations. A balance must be found in maintaining flexibility, reporting actual conditions and enacting concrete but compliance friendly measures in a customer oriented manner across jurisdictions. Possible changes to that end include:

- Revising drought stage and trigger events (Table 8.70.050) to more accurately reflect and communicate current conditions, improve coordination with other jurisdictional declarations, correct front loading of response measures, provide more flexibility and buffer against oscillating changes of status.

Indicator	Arizona Drought Monitor Report[1] Based on Findings Related to Pima County
Stage 1 Alert	Abnormally Dry
Stage 2 Warning	Moderate
Stage 3 Emergency	Severe
Stage 4 Crisis	Extreme

Current Table

Indicator	Arizona Drought Monitor Report[1] Based on Findings Related to Pima County
Stage 1 Alert	Moderate-Severe
Stage 2 Warning	Severe-Extreme
Stage 3 Emergency	Extreme-Exceptional
Stage 4 Crisis	Exceptional

Suggested Revised Table

- Reviewing restrictions for each stage and consider appropriate levels of duplication with the City of Tucson and other providers to prevent disparate enforcement. Given burgeoning recovery, restrictions with least economic effect could be implemented first, backload more economically punitive measures for commercial operations.
- Cooperation and consolidation of effort is necessary. LDIG, as a component of the ADPP, is designed to augment the response plan (ordinance) as a repository of assessment information and as a recommendation body. Formalize decision making process within LDIG to coordinate new declarations with water providers.
- Increasing public education about the drought and water wasting ordinance. Since enactment, the Health Department has not received any complaints. The public may be unaware of the water wasting measure. Conduct a review of department procedures for receiving and responding to complaints.

Additional Efforts

Not to be overlooked, steps the county could take to assist impacted groups and vulnerable populations should be part of the discussion. In addition to the ordinance, county departments have expertise and resources that could be employed in mitigation and response strategy. The ADPP investigated such for these sectors:

1. Commerce, recreation and tourism
2. Environmental health, watershed management, livestock and wildlife
3. Irrigated agriculture
4. Municipal and industrial
5. Tribal

Food service and hospitality sector decline is expected in correlation to decreased tourism should wildfire or park closures occur. The county Office of Emergency Management (OEM) released its Wildfire Management Plan in tandem with the Drought Management Plan. As with many aspects of disaster response, the OEM would coordinate within a larger framework of state and federal assistance.

Lack of water will cause increased livestock and wildlife mortality and wildlife interaction. University cooperative extensions have been discussed as a resource for livestock management workshops. The Pima Animal Care Center has worked closely with Arizona Game and Fish in the past in response to resident concerns after wildlife interactions. Wildlife corridors built in developed areas would decrease possibility.

Impacts on the agricultural, municipal, industrial and tribal sectors are best addressed through state and federal agency programs and cooperative aid agreements. The cumulative cost of drought and significant financial and logistical resources needed to recuperate may not be commonly understood because of the inconspicuous character of drought in relation to other natural disasters. Large federal programs such as the Natural Resource Conservation Service and Farm Service Agency are needed to take the lead when crop insurance indemnities hit record level.

County resources such as the One Stop Career Services System could be mobilized to engage those impacted sectors and disseminate information on appropriate existing aid programs at the state and federal level. Drought related job loss across sectors should be cataloged; economic losses for local businesses as well. Regular departmental data sharing on events with a probable drought nexus with LDIG can help in better illustrating the magnitude of impacts locally. The county Drought Management webpage could also be refined to include a "one stop" webpage of information and sector self-reporting data, similar to the National Drought Mitigation Center's Drought Impact Reporter.[30]

For better understanding, what may be needed is an inventory of department assets and capability that could be tasked to monitor and track local drought impacts and analysis to ascertain what appropriate response measure could be applied and identify gaps that could be addressed to improve drought resiliency.

Given the probability of continued warming and an unpredictable forecast for precipitation, annual ENSO weather trends and climate records, the county ordinance and drought management plan should be revisited to facilitate improved implementation and communication to the public and affected groups ahead of worsening drought conditions and associated impacts.

[30] http://droughtreporter.unl.edu/