

City  
of Tucson  
Water  
Department  
Drought  
Preparedness  
and  
Response  
Plan

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*Approved by City of Tucson  
Mayor and Council  
November 28, 2006*

*Ordinance Approved  
March 20, 2007*



Updated Spring 2012

**CITY OF TUCSON WATER DEPARTMENT**

**DROUGHT PREPAREDNESS  
AND RESPONSE PLAN**

**Plan Approved: November 28, 2006**

**Ordinance Approved: March 20, 2007**

**PLAN UPDATE FEBRUARY 2012**

## ACKNOWLEDGEMENTS

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*Front cover: The impacts of drought, like drought itself, are varied and unpredictable. A sustained drought of many years may have wet periods, perhaps even wet periods with wetter-than-normal conditions. The photo collage here shows healthy vegetation in the background that responded to the wetter than normal summer of 2006. The ancient saguaro in the foreground, already stressed by disease, was unable to survive the additional stress of the previous decade of drier than normal conditions.*

For more information, visit Tucson Water's website at [www.tucsonaz.gov/water](http://www.tucsonaz.gov/water)



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## EXECUTIVE SUMMARY

### Background

The City of Tucson Drought Preparedness and Response Plan (Plan) was adopted by Mayor and Council November 28, 2006, as required by A.R.S. §45-342. An implementation ordinance (No. 10380) was approved March 20, 2007. The Plan recognized that drought impacts do not occur suddenly or without warning, and acknowledged that with proper planning and review it is unlikely the community will find itself in an emergency situation caused solely by drought. The Plan called for annual reporting on local and regional indicators to be monitored as triggers for implementing or rescinding various stages of drought response that may be required to ensure Tucson Water's water resources and system characteristics are not compromised by drought impacts.

The Plan triggers for escalating drought response stages meet the statutory requirement for drought response indicators to be directly tied to a water provider's water resource availability and the ability to deliver those resources. For Tucson Water, water resource availability requires review of both regional (Colorado River) and local conditions that may impact supplies, whereas evaluation of infrastructure reliability primarily requires review of the potable and reclaimed water distribution systems (local system indicators).

The adopted Plan established four drought response stages, outlined an action plan for responding to potential drought-related impacts on Tucson Water's system and water supplies, and addressed the issue of emergency supplies. The Plan also demonstrated the success of the long-term financial investment the community has made in securing and implementing use of renewable water resources, which has provided a considerable ability to withstand the impacts of sustained drought on Tucson Water's supplies.

Tucson Water's regional indicators are severe or sustained drought on the Colorado River watershed, including declared shortages on the Colorado River; or a drought status "above normal" declared by the Arizona Department of Water Resources (ADWR) for the Santa Cruz Watershed, which includes the City of Tucson. Local system drought impact indicators for Tucson Water include measures of aquifer storage, potable and reclaimed water production capacity (i.e.: measures of water supplies and the ability to deliver them where needed), and gallons per capita per day (GPCD) use. While GPCD is not a "drought indicator" per se, monitoring GPCD allows the Utility to better assess whether drought response measures previously implemented are having the desired effect. Tucson Water's declining GPCD in the face of long-term drought indicates both the responsiveness and the general drought awareness of the Utility's customers.

Tucson Water's drought preparedness planning is an ongoing process closely linked with long-range water resource planning. All successful planning requires periodic updates of any written plans to incorporate new data and adjust planning scenarios to reflect real-life conditions. In addition there is a statutory requirement to update the Plan every five years.

This update meets the statutory requirement and also incorporates experience gained from five years of declared Stage 1 Response. However, over the last five years increasing data related to climate change that may impact current definitions of "drought" and the possibility that drought may become the new normal has driven the need to incorporate climate change, or variability, into long range planning efforts. This update begins to integrate Tucson Water's broader climate change planning efforts into the drought preparedness plan. Over the next five years, the goal is to have the drought preparedness and response plan become one component of an *Integrated Drought Preparedness and Response/Climate Change Adaptability Plan (Integrated Plan)* for the Utility.

Much of Tucson Water's current water resource planning efforts mitigate future supply uncertainty. Storing excess CAP water now, mitigates against future Colorado River shortages. Investment in conservation now provides a hedge against drought, similar to storing excess CAP. Developing and securing multiple supply alternatives, such as effluent and recycled water, will give Tucson Water the flexibility to respond to changing supply conditions.

### Drought Response Stages and Response Measures

The Plan continues the drought response stages established in the original Drought Preparedness and Response Plan including the following drought response stages:

- **Stage 1**
  1. *A Stage 1 drought response will be declared by the City Manager, on the advice of the Water Director, based on either one or both regional indicators. The regional indicators include a severe and sustained drought on the Colorado River or a declaration of drought within Tucson's watershed (Santa Cruz Watershed) posted on the Arizona Department of Water Resources website. During Stage 1, local system indicators will primarily be monitored for implementation of specific response actions.*
  2. *The focus of Stage 1 response actions will include:*
    - *Public notification and information on drought issues;*

- *Changes in system operations (such as expedited well maintenance) and/or system modifications (such as well drilling and well maintenance and other system maintenance programs to reduce system losses such as meter replacement and leak detection) deemed necessary by the Water Director; and*
  - *Self-administered water audits by City departments to identify water-saving and water efficiency measures for City buildings, City-maintained landscapes and City-owned water-cooled equipment.*
  - *Possible additional measures may include voluntary self-audit programs for commercial, multi-family and industrial users.*
- **Stage 2**
    1. *A Stage 2 drought response also will be declared by the City Manager, on the advice of the Water Director, primarily based on regional indicators. Specifically, if an initial shortage (i.e., a shortage affecting only excess or lower priority uses, not municipal uses) is declared on the Colorado River, the City will elevate to Stage 2 drought responses. In addition, local system indicators, in conjunction with a declaration of drought in the Santa Cruz Watershed posted on the ADWR website, could trigger elevation to Stage 2 or may trigger additional response actions.*
    2. *The focus of Stage 2 response actions will include:*
      - *Continuation of all Stage 1 actions, with intensified public education and additional system or operational actions;*
      - *Mandatory implementation of water reductions or efficiencies identified during Stage 1 audits for all City uses of potable water;*
      - *All potable water users will be requested to make additional voluntary reductions;*
      - *Mandatory self-audits will be required for multi-family users, and for commercial and industrial users at/or exceeding monthly usage of 325 cubic feet (Ccf); and*
      - *Irrigation restrictions will be required for multi-family, commercial, and industrial customers, with potential exemptions/variances available for sites demonstrating that minimum efficiency criteria are met and maintained.*
- **Stage 3**
    1. *A Stage 3 drought response will be declared by Mayor and Council, upon the recommendation of the City Manager, based on either one or both of the following drought indicators: reductions in CAP deliveries to the City or local*

*system indicators in conjunction with a declared drought in the Santa Cruz Watershed posted on the ADWR website.*

2. *The focus of Stage 3 response actions may include:*

- *Continuation of all previous actions under Stages 1 and 2;*
- *Prohibition on operation of fountains at multi-family, commercial, and industrial sites.*
- *Mandatory water reductions by all potable water users (percentage to be determined by existing conditions); and*
- *Plumbing retrofit on resale for residential, commercial, multi-family, and industrial users.*

• **Stage 4**

1. *A Stage 4 drought response will be declared by Mayor and Council, upon the recommendation of the City Manager, based on one or both of the following drought indicators: additional reductions in CAP deliveries to the City or local system indicators in conjunction with a declared drought in the Santa Cruz Watershed posted on the ADWR website.*

2. *The focus of response actions for Stage 4 may include:*

- *Continuation of Stage 1, 2, and 3 response actions and implementation of appropriate provisions of the City's Emergency Water Conservation Ordinance No. 8461. These provisions include but may not be limited to:*
- *No outdoor irrigation unless the City Manager designates a schedule of appropriate watering days;*
- *No washing of sidewalks, driveways, parking areas, tennis courts, patios, or other impervious surface areas with water from an open hose, or a spray nozzle attached to an open hose, or under regular or system pressure, except when required to eliminate conditions that threaten public health, safety, or welfare;*
- *No outdoor use of any water-based play apparatus connected to a pressurized source;*
- *No operation of large commercial water-cooled space and equipment cooling systems below an operating efficiency level of two cycles of concentration (see Glossary);*
- *No serving water to customers of restaurants and other food service establishments unless water is specifically requested by the customer;*

- *No operation of outdoor misting systems in public areas;*
- *No filling of new swimming pools, fountains, spas or other exterior water features; including no draining and refilling of exterior water features; and*
- *No washing of autos, trucks, trailers, and other types of mobile equipment, except at facilities equipped with wash water recirculation systems, and for vehicles requiring frequent washing to protect public health, safety, and welfare.*
- *In addition, staff will develop additional response actions if warranted. For example, “demand offset programs” may be developed and implemented – meaning that new commercial and residential development may not be permitted unless the projected water demand of that development is “offset” through water demand reductions elsewhere, such as through retrofitting older facilities to reduce water consumption.*

### Emergency Supplies

The Plan also continues short-term reliance on groundwater resources as backup supplies for the potable system, but acknowledges that long-term, non-sustainable reliance on groundwater is not a preferred alternative. Both mandatory demand reductions and the development of alternative renewable water supplies will be strategies utilized by Tucson Water to avoid or minimize long-term reliance on groundwater. In addition, the use of potable water as a backup for the reclaimed water system will be prohibited during drought response stages 2, 3, and 4. The Plan limits existing interconnect agreements with other water utilities to emergency situations only. Requests for backup supplies from other water utilities will continue to be considered on a case-by-case basis and only at a level which will protect public health and safety (i.e., essential uses); backup supplies for non-essential uses in the service areas of other water utilities will not be considered during drought. Complimenting this response strategy is the on-going efforts to reach regional solutions for utilizing renewable water resources to reduce the need for requests from other local water providers for emergency supplies from Tucson Water.

## GLOSSARY

**Aquifer:** A body of rock or sediments sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

**Aquifer Storage Index:** Groundwater levels in the aquifer as measured at selected wells and compared to groundwater levels in a particular (index) year.

**Arizona Department of Water Resources (ADWR):** A department of state government responsible for water management and administration of water-related programs within the State.

**Arizona Drought Monitoring Technical Committee (ADMTC):** This committee was formed by the Governor's Drought Task Force. It monitors data like climate, weather forecasts, and physical drought conditions. The committee determines drought conditions based on these data.

**Arizona Water Banking Authority:** An institution established in 1996 by the legislature to help secure the state's full entitlement of Colorado River water through the Central Arizona Project.

**Assured Water Supply:** An ADWR requirement that all new developments in "active management areas" (geographical regions of the state subject to regulation by ADWR) must demonstrate a 100-year water supply that is of adequate quality, continuously available, consistent with the management plan and management goal of the AMA, and that there is financial capability to construct the water facilities available for the proposed use.

**Central Arizona Project:** A federal water project designed to bring water from the Colorado River to central and southern Arizona. The Central Arizona Project includes 336 miles of canal and pipeline and 14 pump stations.

**Conservation:** Techniques for saving water that reduce demand.

**Climate Change:** Any trend or persistent change in the statistical distribution of climate variables (temperature, humidity, wind speed, etc.).

**Cycles of Concentration:** A principal measure of water use efficiency in a cooling tower, which are commonly used for cooling in large-scale commercial and industrial facilities. Cycles of concentration refers to the ratio of chemical constituents in cooling

tower bleed-off water to constituents on the make-up (fresh) water that is added to the tower to perform its cooling.

**Demand:** The amount of water being used.

**Demand Offset:** A program whereby a water user agrees to reduce water use in one area in order to consume water in another. (Example: A developer agrees to pay to retrofit older housing with water-efficient plumbing fixtures in order to construct new homes.)

**Demand Reductions:** Measures taken by a water utility to reduce the use of potable water in response to drought or supply insufficiency conditions.

**Drought:** A sustained natural reduction in precipitation that results in negative impacts to the environment and human activities.

**Drought Impact:** The effects of a drought.

**Drought Preparedness:** The act of planning to decrease the impacts of drought by implementing measures and or developing other water supplies to reduce water demand as drought conditions worsen.

**Drought Response Stage:** A level of severity of drought response required, as measured by Tucson Water's indicators. There are four stages of drought response in Tucson Water's drought response plan.

**Economic Hardship:** A threat to an individual's or business' primary source of income.

**Effluent:** Treated municipal wastewater.

**Essential Uses:** Water uses related to maintaining the health, welfare, safety, and public sanitation needs of the community.

**Firm or Firming:** The act of securing Colorado River water supplies by recharging and storing available excess supply in underground recharge basins in order to meet anticipated future declared shortages on the Colorado River.

**Fountain:** An ornamental water-using fixture for purely aesthetic purposes.

**Gallons per Capita per Day (GPCD):** As used in the Plan, GPCD is calculated by taking all potable water produced divided by the population the water system serves, and dividing the result by 365.

**Groundwater:** That portion of water beneath the surface of the earth that can be recovered with wells or that flows naturally to the earth's surface via seeps or springs.

**Indicator:** A variable that changes as drought conditions change (example--Colorado River water availability).

**Long-term Drought:** When sustained precipitation deficits over time periods of one to several years affect surface and subsurface water supplies.

**Mitigation:** Actions or programs that reduce drought risk and impacts and enhance recovery.

**Ordinance:** A municipal regulation.

**Potable Water:** Water that meets the U.S. Environmental Protection Agency and/or the State's drinking water (water-quality) standards.

**Potable Water Production Capacity:** The amount of potable water that can be delivered reliably by the potable system for a 30-day (peak) time period.

**Public Notification:** Notice of drought response stage provided to Tucson Water customers and the general public through local media sources as a result of news releases and/or Tucson Water bill inserts.

**Reclaimed Water:** Wastewater treated to a quality suitable for non-potable applications such as landscape irrigation, decorative water features, non-food crops, and certain industrial uses.

**Reclaimed Water Production Capacity:** The sustainable amount of water that can be extracted from the Sweetwater Recharge and Recovery Facility.

**Recharge:** Water that replenishes an aquifer by surface infiltration or by other natural or induced means.

**Recovery or Recover:** The practice of pumping water that has been artificially recharged to an aquifer.

**Secondary effluent:** Wastewater that has been treated to a higher quality.

**Short-term Drought:** Measured by the departure of precipitation or another drought indicator from average conditions on a time-scale from one to several seasons, an example being a dry winter with little rain for a year.

**Supply Insufficiency:** Supply insufficiency occurs when water available in an area is not sufficient to meet immediate unrestricted demand.

**Surface Water:** Water that is on the earth's surface, such as in a stream, river, or lake.

**Total Demand:** The volume of water a water provider is required to produce to meet the needs of all potable and nonpotable customers.

**Tucson Active Management Area (Tucson AMA):** The Tucson AMA is one of five AMAs in the state that were established pursuant to the 1980 Groundwater Management Act. The State's Active Management Areas were established to provide long-term management and conservation of their limited groundwater supplies.

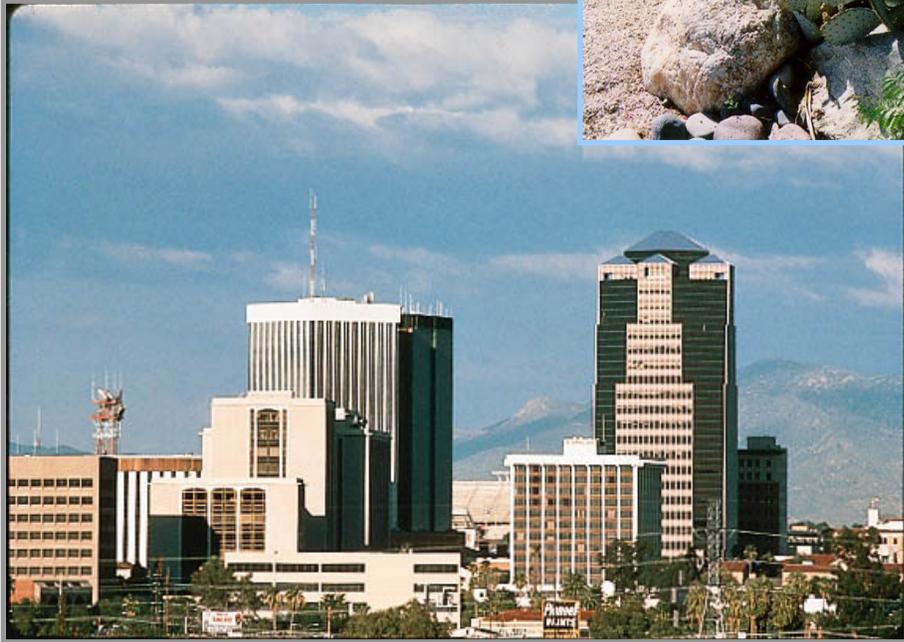
**Triggers:** The value or combined value of one or more indicators that cause a change from one drought response stage to another.

**Vulnerability:** For purposes of this Plan, vulnerability is defined as the probable susceptibility to drought impacts (damage) related to economic, social, and environmental conditions in the community, as mitigated by system characteristics such as reliability and redundancy.

**Water Resources:** A source of water supply or supplies.

**Watershed:** The area drained by a river system.

**Water Year:** A timeframe often used by surface water providers to delineate one year's operation, usually October 1 to September 30, to coincide with the federal budget fiscal year timeframe.



## CHAPTER ONE

### INTRODUCTION

Water providers are responsible for providing reliable and safe drinking water supplies to their customers while maintaining adequate flows to meet pressure requirements in case of fire. During times of water shortage due to drought or climatic conditions, strategic planning to minimize public health and safety impacts on the community is a critical obligation of water providers.

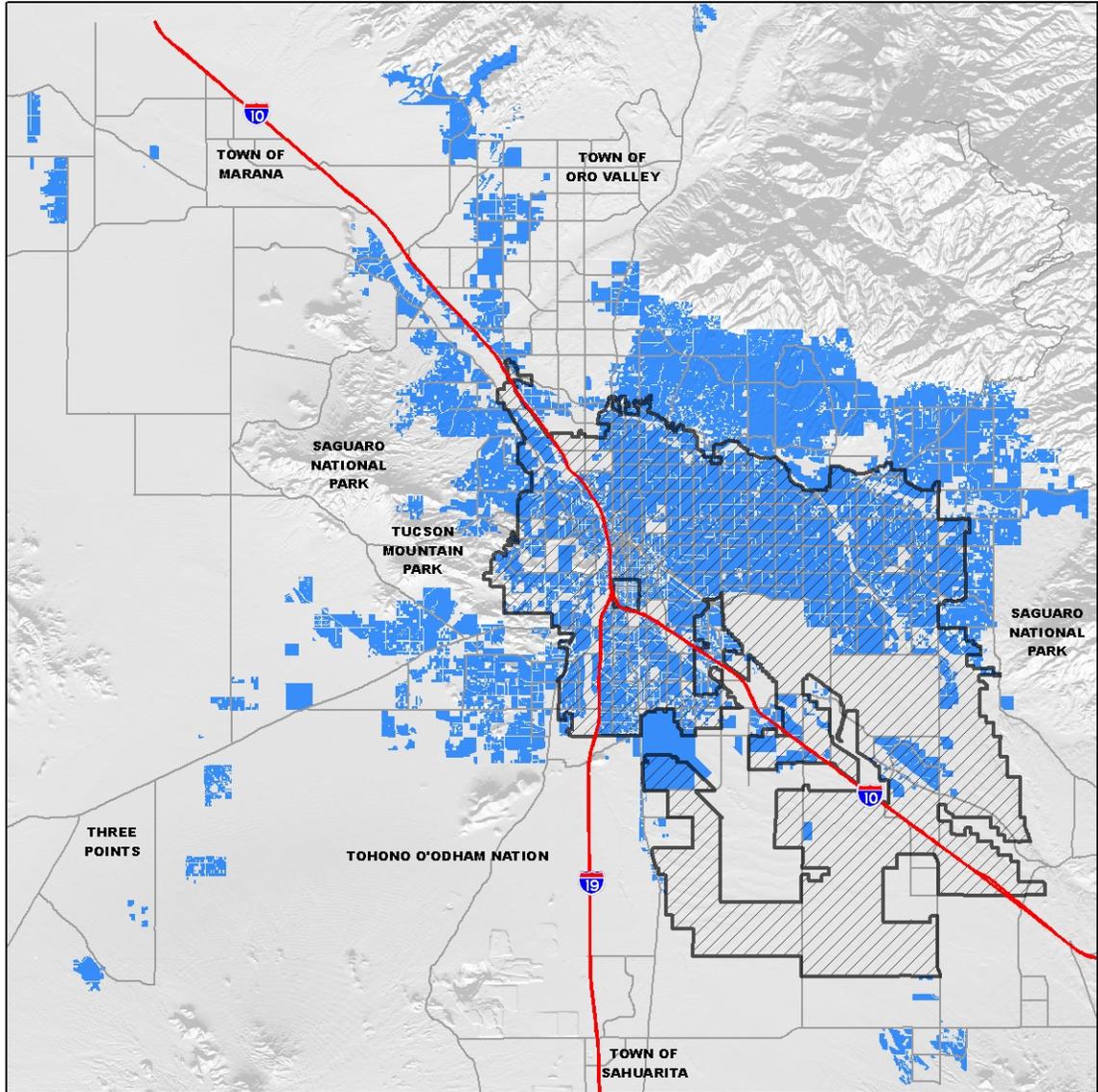
A water provider has a responsibility to prepare for drought and adaptability to climate change by determining the potential impacts of these conditions on its water supply system and the community it serves and by developing plans to minimize those impacts. With this five-year update of the Plan, climate variability – as a planning factor – is a part of the Plan as its own scenario that must be assessed in terms of long range water resource planning and management.

The Plan is intended to help Tucson Water staff implement response and adaptive measures early to avoid the inevitable pitfalls of reactive, crisis-mode decision-making.

#### **Historical Background**

No single definition exists for drought (National Drought Mitigation Center, 2005). However, like the original Drought Preparedness and Response Plan, the Plan will adhere to the *Arizona Drought Preparedness Plan* definition of drought as a *sustained, natural reduction in precipitation that results in negative impacts to the environment and human activities*. As new information becomes available related to long-term drought and climate change the Plan will evaluate it for relevance to the Utility and address or incorporate it in future updates.

Although the entire state continues to experience some degree of drought, not all entities will react to, or be affected by drought conditions the same way. That especially holds true for water providers, each of whom must plan for its unique water supply and demand situation, delivery systems, and customer use patterns. In addition, jurisdictional issues may require consideration in drought and climate change planning. For example, Tucson Water is the largest municipal water provider in southeastern Arizona (estimated 2010 service area population: 705,000) and serves inside and outside the municipal boundaries (Figure 1.1). The Plan is enforceable outside the City limits as a condition of water service.



**Figure 1.1:** Tucson Water Service

The following chapters include the general information on water supplies available to Tucson Water, the water systems designed to deliver those supplies to customers, emergency supplies, and the process for review outlined in the original Drought Preparedness and Response Plan with any relevant updates. However, the "heart" of the Plan, Chapters Two and Four, provides the guidance and a decision-making framework for responsible water-resource management for drought response and adaptability to climate change.

## CHAPTER TWO

### CLIMATE CHANGE PLANNING

The U.S. Global Change Research Program in its 2009 report “Global Climate Change Impacts in the United States” writes that climate variability in the Southwest is among the most rapidly-occurring in the nation, more than the global average in some areas. One anticipated result is less spring snowpack and snowmelt to augment the Colorado River, a critical water resource of the City of Tucson. Analysis of observed and projected hydroclimatic factors suggests that climate change within the Colorado River watershed could include, but may not be limited to:

- an increase in average surface temperature
- spatial changes in annual and seasonal precipitation both in magnitude and intensity
- more frequent earlier melting of spring snow packs
- increased evaporation
- reduced surface water flows in the Colorado River

The Central Arizona Project (CAP) is currently projecting that a shortage on the Colorado River may occur within the next five years. A shortage would mean lower priority CAP water users will be curtailed as needed. CAP also predicts that high-priority CAP allocations (M&I and Indian) may be reduced beginning in the mid-2020s. In subsequent years, the annual probability of an M&I shortage could increase.

Increased regulation of greenhouse gas emissions at fossil-fueled power plants and incentives to develop alternative energy sources are actively being debated by policy makers as a response to climate change. These policies, if implemented, will result in increased energy costs, resulting in higher water rates than they would be otherwise.

In response, Tucson Water established a project team to coordinate with climate scientists, other water providers, and federal, state and local government agencies to articulate the practical resource and supply implications associated with climate change. This project team is comprised of representatives from all pertinent areas of the Utility and includes members from local government and climate science researchers at the University of Arizona.

Tucson Water staff identified a range of potential impacts on Utility-related activities and has already taken a number of steps which will make the Utility more resilient to long-term drought and climate-related shortages on the Colorado River. These and future initiatives will provide the Utility with greater flexibility to respond to climate change and its associated uncertainties.

## **CHAPTER THREE**

### **WATER RESOURCES AND PRODUCTION CAPACITY**

This section describes the water resources (water supplies) used by Tucson Water and the infrastructure used to deliver these water supplies to our customers. It also explains how drought may or may not impact either the water resource or the water system's ability to deliver water. General reliability comments are also included for water resources and system infrastructure.

#### **Available Water Resources**

Currently three water sources are both physically and legally available to Tucson Water for municipal supply:

- Groundwater,
- Colorado River water, and
- Effluent and Recycled Water

Having three sources of water gives the Utility a great deal of flexibility in how it responds to a drought, either on the Colorado River or locally.

#### **Groundwater**

Tucson Water pumps groundwater from a very large aquifer, well over 1,000 feet deep in many locations and hundreds of square miles in area. The estimated volume of groundwater physically available within Tucson Water's service area ranges from about 10 to 20 million acre-feet (City of Tucson Water Department, 2004). Net natural recharge in this area is estimated at 50,000 to 60,000 acre feet per year, or less than one percent of the total volume of groundwater in storage. As a result, most portions of this very large aquifer would respond very gradually to local drought conditions. Because of this, drought impacts to water supply from this aquifer may not become apparent unless local drought is sustained over decades. More shallow aquifers in some parts of this region, however, may be very responsive to a reduction in local precipitation and demonstrate impacts from relatively short-term drought.

Local drought may cause an increase in gallons per capita per day demand (GPCD). Unless additional renewable water supplies, such as Colorado River water, were available to meet that increased demand, or demand was reduced, additional groundwater would

have to be pumped. A *reduction* in the availability of Colorado River water to the City would also have to be made up with groundwater, unless demand was reduced. A combination of local drought *and* drought on the Colorado River could have a significant impact on our groundwater resources if demand was not reduced.

Finally, while the volume of physically available groundwater may be substantial, the City is limited in how much groundwater it can mine, or pump, under the Assured Water Supply (AWS) rules. Increased use of groundwater may be a viable response to drought, but could also have a detrimental impact on the City's ability to maintain its AWS designation in the future through overuse of groundwater. Minimizing the impacts of drought on our physical and legal access to groundwater is a principal focus of the Plan.

### **Colorado River Water**

Tucson Water's current CAP allocation is just over 144,000 acre-feet per year<sup>1</sup>. Like any other surface water resource, the availability of Colorado River water depends on precipitation, especially snow-pack, in the Colorado River Watershed. Colorado River water, the only renewable surface water source available to Tucson, is imported to the Tucson area via the 336-mile long Central Arizona Project (CAP) canal (Figure 3.2).

Tucson Water is no longer the only water provider in the Tucson Active Management Area currently directly utilizing Colorado River water as a source of potable supply. Tucson Water has entered into Intergovernmental Agreements (IGAs) with the Pascua Yaqui Indian Nation and the Town of Oro Valley to take delivery of their CAP allocations (or a portion thereof) at one of the Clearwater Recharge and Recovery facilities and wheel the recovered water through the Tucson Water transmission system thereby increasing utilization of renewable water supplies within the Tucson Active Management Area. The Utility is in discussions with other local water providers for additional wheeling agreements as the region continues to move toward direct utilization of CAP.

As the Utility utilizes its CAP allocation to meet demand close monitoring of drought conditions on the Colorado River Watershed are needed because a severe drought on the Colorado could result in the Secretary of the Interior declaring a shortage on the river.

The Secretary annually (usually in October) determines the condition of the Colorado River for the coming "water year" as surplus, normal, or shortage. A declaration of shortage, meaning the river does not have sufficient capacity to fully meet all of the

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<sup>1</sup> The current CAP allocation is 144,172 acre feet. This will increase by 19 AF once the Flowing Wells transfer is finalized.

allocations to states with contractual rights to the water, could impact delivery of Tucson's CAP water.



**Figure 3.1:** Central Arizona Project Canal

In surplus or normal water years, the Utility has reliable potable water supplies through the City of Tucson's Colorado River water allocation delivered through the Central Arizona Project, and its backup groundwater resources. However, if the Secretary declares a shortage on the Colorado River and CAP deliveries are reduced, Tucson Water's groundwater resources would likely have to be used for drought mitigation.

In anticipation of droughts on the Colorado River, the Arizona Water Banking Authority (AWBA) has been “firming” CAP allocations, or adding water supply reliability, for municipal users by storing (recharging) excess Colorado River water in underground facilities such as Tucson Water's Central Avra Valley Storage and Recovery Project (CAVSARP) and Southern Avra Valley Storage and Recovery Project (SAVSARP). If there were reductions in delivery of the City's CAP allocation due to drought on the Colorado River, this “firmed” water could be made available (pumped) to help meet demand.

## **Effluent and Recycled Water**

Municipal wastewater effluent is a renewable water source that increases as the population increases. Effluent is generated by interior water usage such as toilets, showers, washing machines etc., and the volume generated is largely unaffected by drought, unlike groundwater and Colorado River water. In 2010, 64,500 acre-feet of effluent were produced from the metropolitan wastewater treatment plants in the Tucson area. The City of Tucson has an entitlement to about 31,536 acre-feet of this effluent. About 13,000 acre-feet of the City's current effluent entitlement was recycled in 2010 in the reclaimed water system, primarily providing irrigation water to customers with large turf facilities such as golf courses, parks, and athletic fields. An additional 500 acre feet of the City's secondary effluent was used on the Silver Bell Golf Course directly.

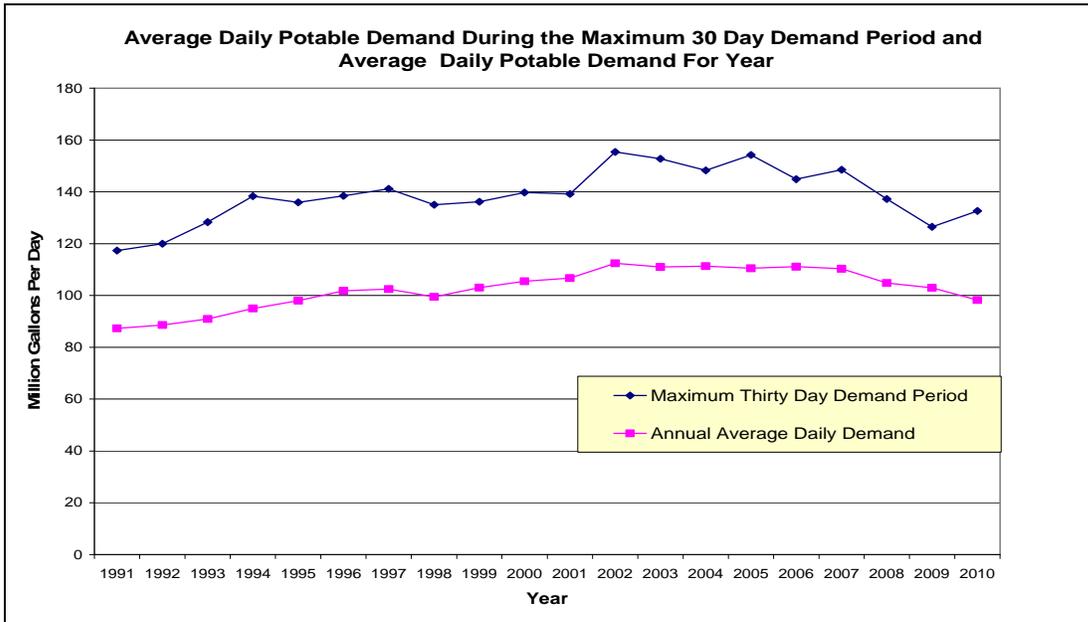
A prolonged drought, both locally and on the Colorado, or climate change could result in the implementation of potable water conservation measures that reduce interior demand and associated effluent volumes. However, given anticipated population growth and the amount of unused effluent, it is extremely unlikely that these conservation measures would result in an insufficient supply of effluent to satisfy the demands of the reclaimed system or other direct users of secondary effluent.

## **SYSTEM DELIVERY CAPACITY**

This section provides an overview of how we produce our two potable water supplies, groundwater and Colorado River water, and how the City's wells are designed and constructed. Because drought affects each of these supplies differently each is discussed separately. Finally, the central distribution system and the isolated systems are discussed as these two are affected differentially by drought.

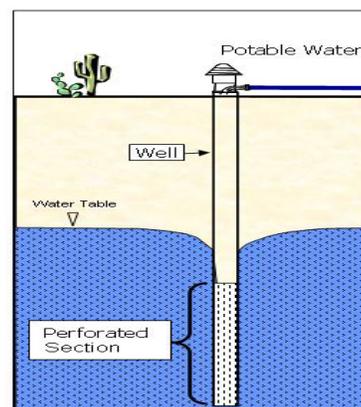
### **Potable Well Fields**

To meet demand, Tucson Water relies on about 200 potable production wells spread over five well fields with a collective pumping capacity of about 200 million gallons per day (MGD). These wells either pump native groundwater or recover a blend of recharged Colorado River water and native groundwater. The combined production capacity of 200 MGD currently far exceeds the average daily demand of the peak 30-day period of about 140 MGD. (Figure 3.3)



**Figure 3.2:** Average Daily Potable Demand and Maximum 30-Day Potable Demand

The Utility’s wells are often drilled to depths which exceed 800 feet below land surface. For many of the City’s wells, the perforated section begins below the water table and the perforated section is quite long. All these characteristics hold for the wells drilled at CAVSARP as well. At CAVSARP, the perforation design and depth was to capture both groundwater and “perched” recharged water to produce a mix of the two sources. In contrast, SAVSARP wells are screened somewhat higher in order to capture primarily recharged CAP water rather than groundwater. As a result, the overall production capacity of the Utility’s well fields will not be immediately impacted if the water table fell (Figure 3.4). For wells producing groundwater, under normal pumping conditions, it could take years of extreme local drought before the water table fell enough to negatively impact these wells. For wells located at recharge facilities it would take both a significant and sustained – six months to a year - reduction in the City’s Colorado River water deliveries for these wells to begin to lose productive capacity. Given the design and deep penetration of Tucson Water's wells into the regional aquifers, they are generally not subject to sudden or dramatic



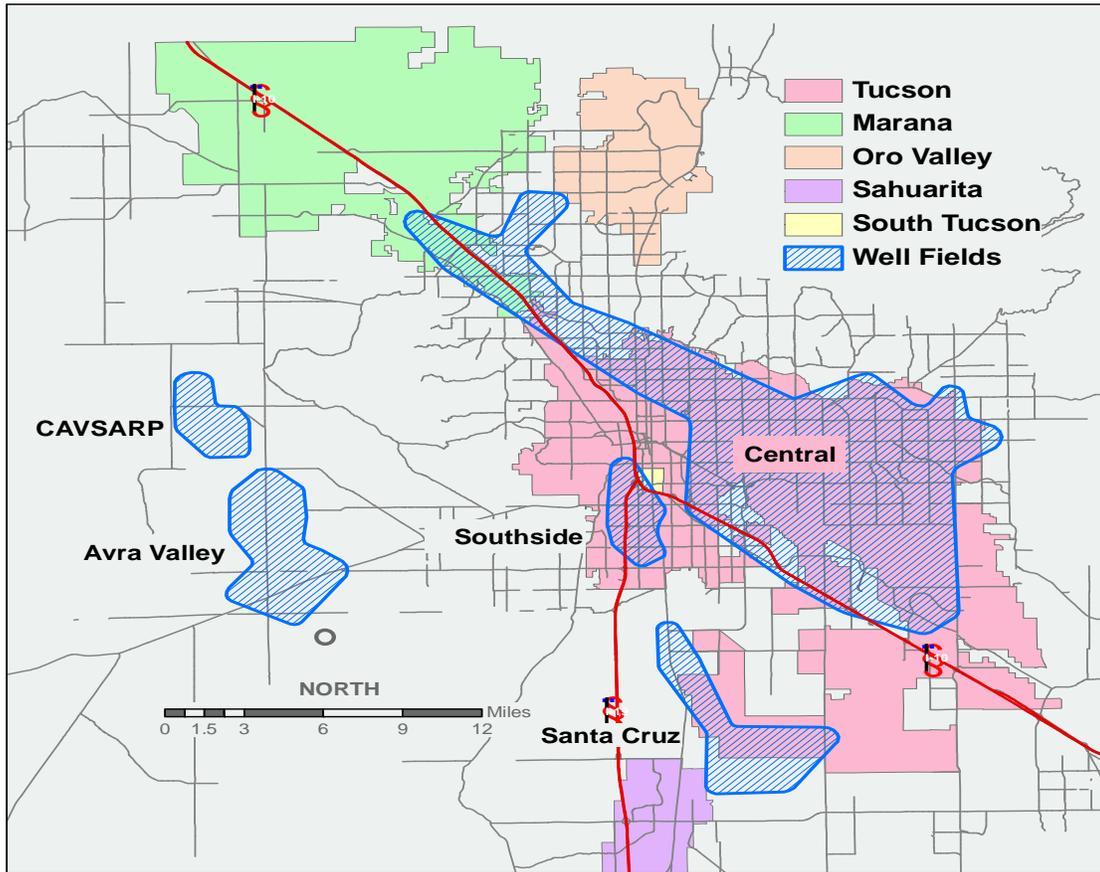
**Figure 3.3:** Well Diagram

declines in production if water tables fall as a result of either local or regional drought. However, aquifer-stewardship goals and subsidence issues preclude Tucson Water from solely relying on groundwater for drought preparedness.

Historically, Tucson Water relied on groundwater to supply potable demands. To that end four major well fields were developed. Since 2001, Tucson Water has been relying less on native groundwater to meet potable demands and more on renewable supply from imported Colorado River water. The Colorado River water is imported via the Central Arizona Project Canal to three recharge and recovery facilities:

- Central Avra Valley Storage and Recovery Project (CAVSARP) which went into operation in 2001;
- Pima Mine Road Recharge Project (PMRRP – jointly owned by the City of Tucson and the Central Arizona Water Conservation District) which went into full-scale operation in 2001;
- Southern Avra Valley Storage and Recovery Project (SAVSARP) which began operation in 2008.

The recharged Colorado River water is then recovered through new or existing well fields and delivered to customers. Two of the four well fields originally designed for producing groundwater are now producing a mixture of groundwater and recharged Colorado River water due to their proximity to the recharge projects. The Avra Valley Well Field which for years was used to pump groundwater, is now recovering Colorado River water recharged at SAVSARP. The Santa Cruz Well Field, located down gradient from PMRRP, now produces a blend of local groundwater and Colorado River water recharged at PMRRP.



**Figure 3.4:** Tucson Water Well Fields

The mixture of groundwater and recharged Colorado River water recovered through the Avra Valley, CAVSARP and Santa Cruz Well Fields accounted for approximately 70% of Tucson Water’s annual potable deliveries in 2010. In 2012, Tucson Water will purchase and recharge its full allocation of Colorado River water for the first time (144,172 acre-feet).

The combination of existing groundwater well fields, well fields which deliver a blend of groundwater and recharged Colorado River water, and the phased construction of the planned recovery well field at SAVSARP will result in production capacity increasing faster than potable demand. This should allow the Utility to comfortably satisfy the average daily demand of the peak 30-day period for at least the next 10 years, under normal climatic conditions within the Colorado River Watershed

The wells at CAVSARP and SAVSARP are designed to allow for continued operations for six months to a year, even in the event *no* Colorado River water was being recharged – for example, if the Central Arizona Project canal were to actually fail. Under drought conditions on the Colorado, it is possible, though very unlikely, that no Colorado River water would be delivered for recharge. The design of the recovery well system would allow these well fields to continue operating for some period of time at full capacity after a cut in CAP delivery was imposed. However, if the water table began to fall the production capacity of this well field could also fall, causing a shift in production back to the Central Well Field.

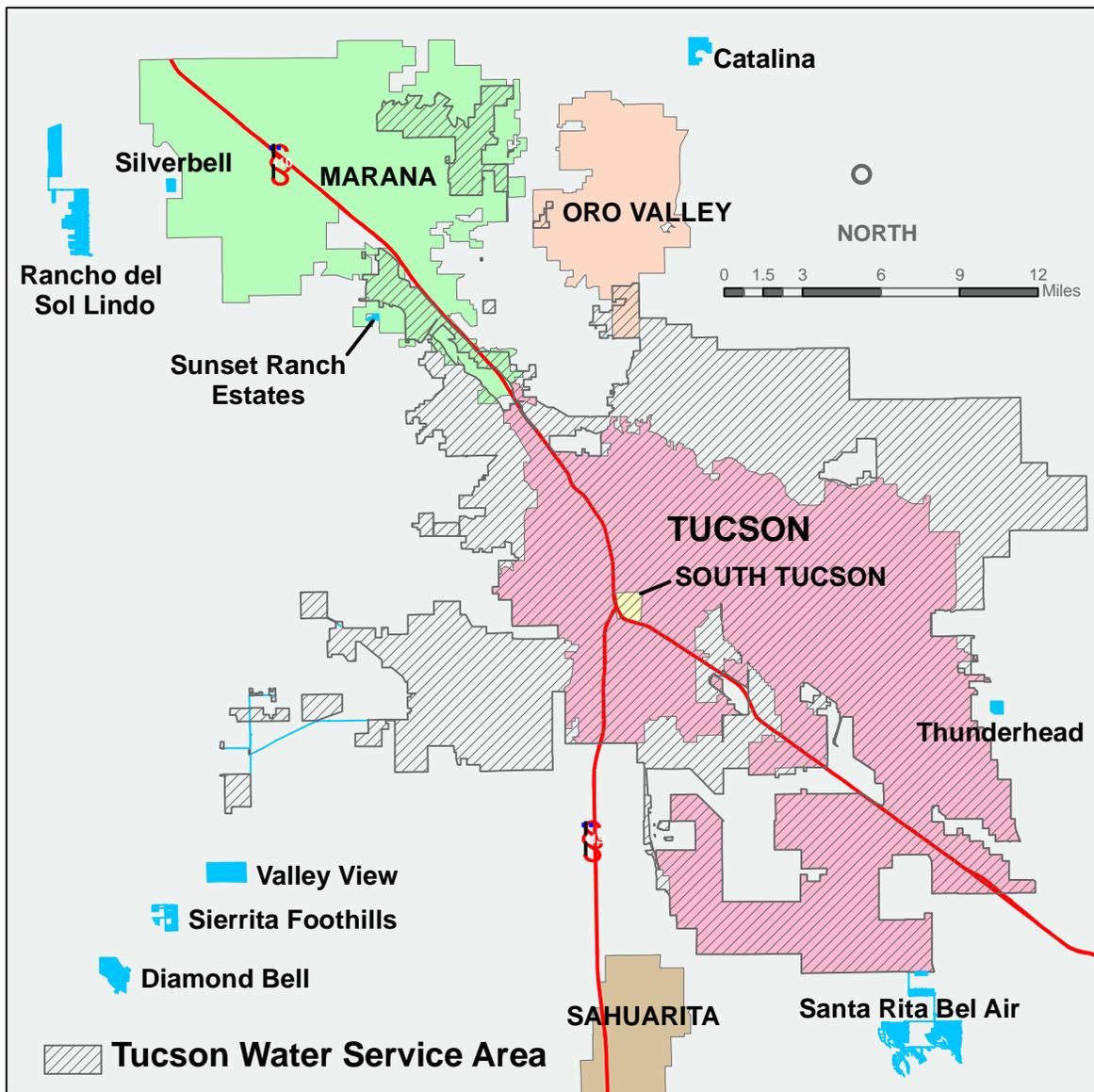
### **Central Distribution System and Isolated Systems**

Tucson Water’s potable systems are designed and operated so that the following operational and regulatory requirements are met:

- Maintain adequate system delivery pressures.
- Meet the daily peak demand.
- Meet potential fire-flow demands.
- Meet or exceed all primary drinking water standards.
- Maintain adequate system disinfection levels.
- Satisfy or exceed customer expectations.

About 99 percent of the water produced by Tucson Water’s production wells enters the large, integrated central distribution system. Generally, the water produced from these wells can be moved anywhere in the central distribution system via pipelines, boosters, and reservoirs and may travel 40 to 50 miles to reach customers. Given the number of production wells and anticipated excess production capacity, the loss of a few wells to falling water tables will generally have little impact on the City’s ability to meet demand.

In addition to the central distribution system, there are nine small, isolated potable systems supplied by dedicated production wells and associated supply infrastructure (Figure 3.6). These isolated systems rely entirely on native groundwater and supply infrastructure located in the immediate area. Isolated systems are more operationally



**Figure 3.5:** Tucson Water Isolated Systems

vulnerable, since they do not benefit from the system reliability available to the central distribution system, making them potentially more vulnerable to *local* drought impacts. Conversely, because such systems are not connected to the central distribution system, they cannot be impacted by drought conditions in the Colorado River Watershed and must be monitored separately.

Chapter Four utilizes the water supply and system information discussed above to identify specific drought indicators for the Utility and determine the factors that will trigger declaration of drought response stages for the Tucson Water service area and the response measures necessary to mitigate potential drought impacts.

### **Reclaimed Water System**

The reclaimed system takes secondary effluent from Pima County's Roger Road Wastewater Treatment Plant and it is either filtered at the Tucson Reclaimed Water Treatment Plant for direct delivery or recharged and recovered for indirect delivery. Demand for reclaimed water is very responsive to increases in temperature and reduction in precipitation. The peak-demand period under drought could be extended, arriving earlier and lasting for a longer period of time. Though the availability of effluent will generally not be affected by drought, the demand from new and existing reclaimed customers could potentially outstrip the reclaimed system's capacity to meet demand. Under normal climatic conditions, the potable system has provided backup supply at critical times. Potable water will not provide backup supply to the reclaimed system during drought response stages 2, 3, and 4.

## **CHAPTER FOUR**

### **DROUGHT RESPONSE STAGE DECLARATION, IMPLEMENTATION, AND RESPONSE MEASURES**

The City of Tucson Water Department Drought Preparedness and Response Plan provides guidelines for determining the current drought response stage, higher or lower drought response stages, termination of all drought response stage declarations, and the response measures suggested for implementation at each stage. The Utility's authority to establish a system of priorities for delivery of potable and reclaimed water during times of shortage is recognized in this Plan. Authority for this plan and its enforcement is derived from Ordinance 10380 (Appendix E).

In general, the Plan provides guidelines, rather than “hard lines,” to provide the Water Director (Director) with sufficient information and flexibility to consider current circumstances pertinent to the declaration of specific drought response stages and implementation of specific drought response measures. Because Tucson Water’s water resources include both local groundwater and Colorado River water, this approach will better serve the community than establishing rigid criteria that may not adequately reflect water supply availability or water distribution system conditions.

Tucson Water’s Plan includes four drought response levels ranging from Stage 1 to Stage 4. A Stage 1 drought response level will be declared based on either one or both of the following: monitoring of local drought conditions and an associated declaration of drought by ADWR in its monthly “Arizona Drought Monitor Report” or a severe and sustained drought on the Colorado River Watershed. These Stage 1 triggers are among the primary hard line or mandatory triggers in Tucson Water’s Plan. Once a Stage 1 level has been declared for Tucson Water’s service area, progression through Stages 2, 3 and 4 will be declared based on threats to Tucson Water’s Colorado River supplies *and/or* local system indicators that indicate negative impacts to the Utility’s groundwater supplies.

#### **DROUGHT DECLARATION**

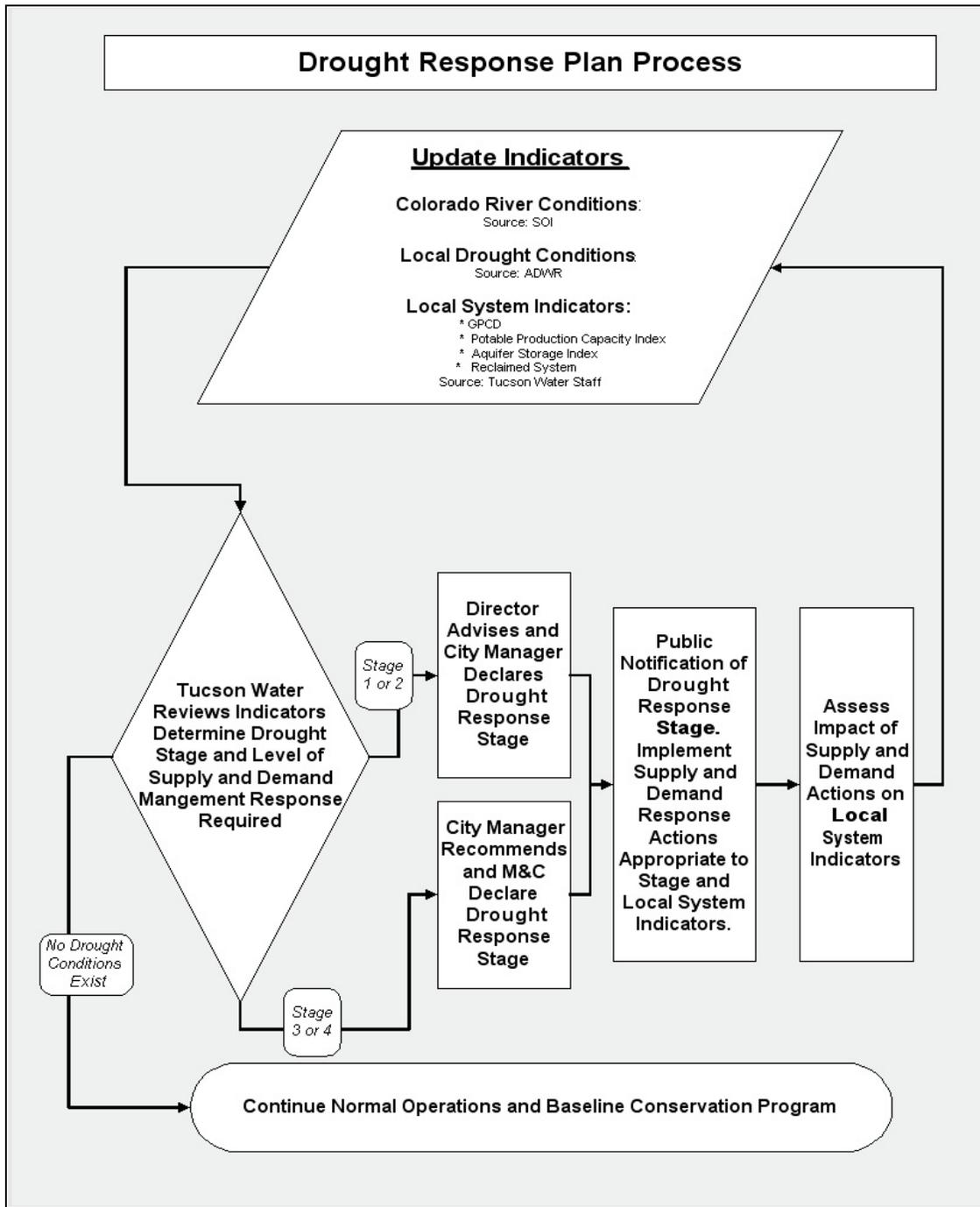
A Stage 1 or 2 drought response in the Tucson Water service area will be declared by the City Manager on the advice of the Director (Figure 4.1). Following the City Manager’s declaration of Stage 1 or 2 drought response level, Tucson Water will implement appropriate response actions, including but not limited to various conservation measures. The Director will continually monitor drought conditions and promptly recommend to the City Manager and Mayor and Council that the level increase to Stages 3 or 4 if conditions worsen. Declaration of a Stage 3 or a Stage 4 drought response level requires approval of the Mayor and Council (Tables 4-1 through 4-4). Water reduction goals will be

developed for each drought stage at the time the stage is triggered. At that time, Tucson Water will have a better understanding of the causes for the trigger, and the response measures needed to relieve drought impacts. Similarly, based on continual monitoring of drought indicators and conditions, the Director will advise the City Manager to rescind Stages 1 or 2, or recommend termination of Stages 3 or 4 to Mayor and Council as warranted by changing conditions.

## **DROUGHT INDICATORS**

Drought indicators are measurable variables that describe drought conditions. For example, the state of Arizona uses its watersheds to describe drought conditions throughout Arizona. Tucson Water's drought indicators (Figure 4.2) include variables for both regional and local drought and are designed to measure potential drought impacts on Tucson Water's available water supplies and/or potential distribution system impacts related to drought.

Staff from the System Planning, Water Resources Management, and Operations sections selected drought indicators based on their specific applicability to Tucson Water's water resources and distribution system. Staff also assigned values or "triggers" to these indicators to assist the Director in determining drought response stages appropriate for the Tucson Water service area.



**Figure 4.2.** Drought Declaration Process Flow Chart

DROUGHT INDICATORS	DROUGHT RESPONSE STAGES and THEIR TRIGGERS			
REGIONAL INDICATORS	Stage 1: Declared by City Manager on advice of Water Director	Stage 2: Declared by City Manager on advice of Water Director	Stage 3: Declared by M&C based on recomm of City Manager (per advice of Water Director)	Stage 4: Declared by M&C based on recomm of City Manager (per advice of Water Director)
<p><b>Colorado River - Shortages and Associated CAP Reductions</b></p> <p><b>Arizona Department of Water Resources Drought Stage above "Normal"</b></p>	<p>Either one or both of the following: Severe and sustained drought in the Colorado River watershed or ADMTC declares drought in Tucson's watershed.</p>	<p>Either one or both of the following: Secretary of Interior declares shortage on Colorado River with CAP deliveries to excess and Ag Users reduced or Local System Indicator Values*</p>	<p>Either one of both of the following: Continuing shortage on Colorado River with CAP deliveries to M&amp;I users reduced; or Local System Indicator Values*</p>	<p>Either one of both of the following: Continued shortage on Colorado River with additional reductions in CAP deliveries to M&amp;I users, or Local System Indicator Values*</p>
LOCAL SYSTEM INDICATORS				
<p><b>Potable Production Capacity Index:</b> a ratio of Production Capacity (how much water can be produced reliably over a 30 day period) divided by Average Demand (the peak 30 day average)</p> <p><b>Aquifer Storage Index:</b> Groundwater levels in the aquifer as measured at selected wells and compared to groundwater levels in a particular (index) year.</p> <p><b>Reclaimed Production Capacity Index:</b> Can operational requirements be met?</p>	<p>Local System Indicators are not a trigger in this stage but may be used for determination of required response actions.</p>	<p>One or more index numbers that are low or trending downward, in conjunction with ADMTC declared drought, could trigger elevation of a drought response stage. **Local system indicators may also be used to determine response actions.</p>	<p>One or more index numbers that are low or trending downward, in conjunction with ADMTC declared drought, could trigger elevation of a drought response stage. **Local system indicators may also be used to determine response actions.</p>	<p>One or more index numbers that are low or trending downward, in conjunction with ADMTC declared drought, could trigger elevation of a drought response stage. **Local system indicators may also be used to determine response actions.</p>
<p><b>Response Monitoring Tool: GPCD</b></p>	<p>Changes in GPCD will be used as a tool for monitoring customer reaction to response actions and may be used in conjunction with other Local System Indicators to determine needed response actions.</p>			
<p><b>Tucson Water Isolated Systems</b></p>	<p>ADMTC Declaration of Drought triggers Stage 1; Shortage on Colorado River has no impact</p>	<p>Local System Indicator values that are low or trending downward</p>	<p>Same triggers are monitored for elevation to Stage 3</p>	<p>Same triggers are monitored for elevation to Stage 4</p>
<p><b>Focus of Responses Actions:</b> *See Drought Response Measures tables for specific menu of actions for each stage</p>	<p>Public Education and Information Focus on Drought, Operational or System Maintenance Actions and City Depts to "lead by example" by conducting water-use self-audits.</p>	<p>All Stage 1 actions plus mandatory city dept water reductions and voluntary customer water reductions</p>	<p>All Stage 1 and 2 actions plus mandatory potable water use reductions/ restrictions</p>	<p>All Stage 1,2, and 3 actions plus implement Ordinance 8461 with mandatory restrictions on all non-essential water uses</p>

\*Local system indicators act as triggers only in conjunction with an ADMTC declared drought in the Tucson area.

**Figure 4.2:** Indicators and Triggers

**Footnote for Figure 4.2:**

Mandatory or hard-line triggers primarily relate to potential impacts from drought on Colorado River water availability. Sustained drought on the Colorado River will trigger Stage 1. A declaration of shortage on the River by the Secretary of the Interior will trigger Stage 2. A reduction in CAP deliveries to municipal users (including Tucson Water) will trigger Stage 3; and further reductions in deliveries will trigger Stage 4.

The Arizona Drought Monitoring Technical Committee's (ADMTC), declaration of drought in the Tucson region, as posted on ADWR's website and based on local climatic indicators, is a mandatory trigger as well and will trigger a Stage 1 regardless of conditions on the River. However, increased severity of drought status posted by ADWR will not be mandatory triggers for Tucson Water's drought response stages, but will be used to implement specific public information or education related to drought.

Advisory triggers relate to drought impacts on local system indicators. These indicators must be analyzed in conjunction with the ADMTC's declaration of drought in the Tucson region and other water conditions to determine if drought response Stages 2, 3 or 4 should be triggered. Local system indicators will not trigger a Stage 1, but may be used to implement specific response actions.

## **Regional Indicators**

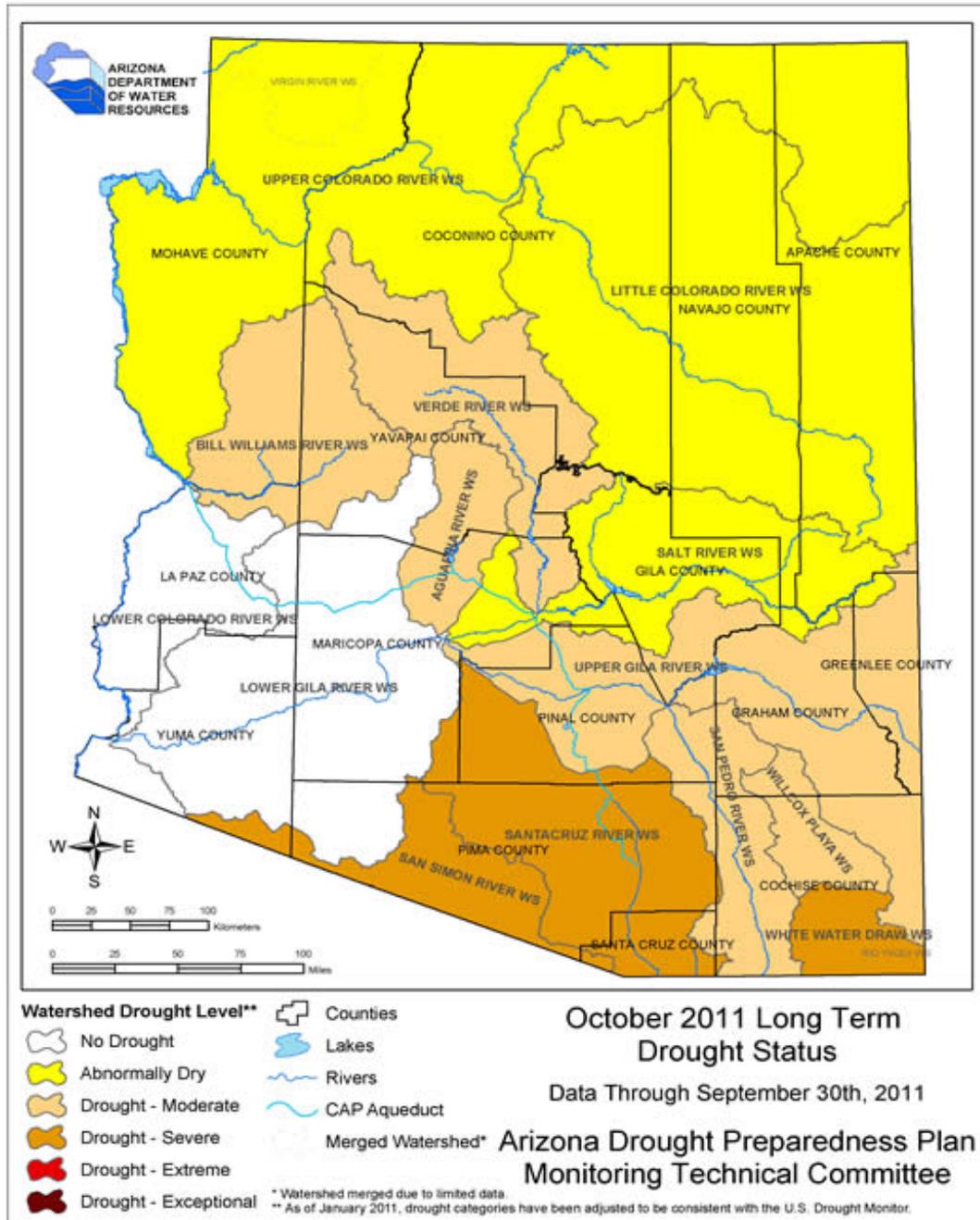
Regional indicators specific to Tucson Water's Plan are either drought and shortages on the Colorado River, or a declaration of drought by the ADMTC for the Tucson region, or both.

### Shortages on the Colorado River

A regional drought on the Colorado River Watershed could lead to a declaration of shortage on the river by the Secretary of the Interior. Section 301 (b) of the Colorado River Basin Project Act of 1968 provides for Arizona to curtail use of its CAP entitlement to assure water availability to satisfying uses in California and water rights in Arizona and Nevada which are prior to the Central Arizona Project if Colorado River water supplies are below normal. This means that a declaration of shortage could potentially reduce CAP deliveries to Tucson Water, eventually impacting the water resources available to meet customer demand depending on the severity and duration of the shortage and the quantity of Arizona Water Banking Authority (AWBA) firming credits available to pump. Because of this potential impact, a severe and sustained drought in the Colorado River Watershed will trigger a Stage 1 drought response within the Tucson Water service area. A severe and sustained drought in the Colorado River Watershed will be determined by climatological data and the reservoir levels of Lake Mead and Lake Powell, as reported by ADMTC, which includes CLIMAS (Climate Assessment for the Southwest Project), a collaboration of researchers who study the effects of climate for organizations who need climate information to make informed decisions. The impact of drought conditions on the City of Tucson's Colorado River supplies will be determined by the Secretary of the Interior's designation of shortage conditions on the River.

### Declaration of Drought by ADWR

ADWR publishes on its web site a monthly Drought Monitor Report (Figure 3.3) that graphically depicts the severity of drought for each of the fourteen surface watersheds in Arizona. Tucson is located in the Santa Cruz Watershed. These reports use climatological and environmental data collected by the ADMTC including precipitation, temperature, stream flows, vegetation status, and reservoir status describing state conditions in each of the watersheds.



**Figure 4.3:** Long-Term Drought Status Graphic from Arizona Department of Water Resources October 2011 Drought Monitor Report

Tucson Water's drought indicators do not include specific climate or environmental variables because the state already monitors these indicators and announces drought conditions throughout the state. Instead, the Utility will rely on the state's declaration of drought (any stage above normal) within the Santa Cruz Watershed to trigger a Stage 1 drought response level within the Tucson Water service area.

### **Local System Indicators**

Local system indicators are measures specific to Tucson Water's customer use patterns and water system that are not only useful in good resource management practices, but also provide a means of forecasting potential system impacts related to drought, and in assessing the implementation of drought response measures. Local system indicators include production capacity indices for both potable and reclaimed water, an aquifer storage index, and GPCD. A discussion on the selection and development of Tucson Water's local system indicators is included in Appendix A.

### **DROUGHT TRIGGER MECHANISMS**

The System Assessment Team assigned guidelines, rather than rigid values, to the regional and local system indicators that can be used to trigger declaration of drought response stages. The triggers assigned to local system indicators will generally function in combination with another trigger, such as the ADMTC's declaration of drought in the Tucson region--these are primarily "advisory" triggers. However, certain triggers will, by themselves, initiate, elevate, or terminate drought response stages--these are "mandatory" or "hard line" triggers. For example, reductions in Colorado River water supply declared by the Secretary of the Interior or reductions in Central Arizona Project water supply declared by the State of Arizona will trigger changes in drought response stages regardless of the values of other drought indicators. The System Assessment Team will regularly monitor drought indicators and advise the Director when any indicator requires closer monitoring or when a trigger point has been reached for a specific drought response stage.

### **DROUGHT RESPONSE STAGES AND RESPONSE MEASURES**

Tables 4.1 through 4.4 describe response actions City departments and Tucson Water customers will be asked or required to do to reduce water demand during drought response Stages 1 through 4. Drought response measures supplement rather than replace ongoing water conservation and education programs. One or more response actions may be implemented when a drought response stage is declared. Additional actions may be implemented if needed based on continual monitoring of local system indicators and other tools such as the GPCD. Specific conservation measures included in Tucson

Water's drought response actions were developed based on the following general principles:

1. Emphasize the need for visible leadership from City-maintained facilities.
2. Reduce or restrict highly visible, non-essential uses of water.
3. Avoid or minimize economic impacts to the community except under extreme conditions.
4. Work with large commercial water users to determine their own operational strategies for reducing water use well in advance of implementing advanced drought response stages.
5. Continue to proactively educate all customers on the importance of using water efficiently regardless of climatic conditions.
6. Ensure that any water restrictions do not impact community health and safety.

## TABLE 4.1

### STAGE 1

**Trigger:** Either one or both of the following: a severe and sustained drought on the Colorado River Watershed or any declaration of drought status above normal by the ADMTC will trigger a Stage 1 drought response.

**Theme:** Continuation of baseline conservation program (all stages--Appendix B). Public notification and education on drought issues for customers and a requirement that City Departments initiate plans to review (audit) a representative sample of water to maintain and/or increase efficiency. Self-administered water audits at all non-residential facilities are voluntary during this stage, with incentives offered during later stages for conducting and implementing conservation measures.

<b>City of Tucson</b>	<ul style="list-style-type: none"><li>• Require City departments to self audit a representative sample of their facility's water use to determine if there is conservation potential beyond existing water-efficient practices.</li><li>• Tucson Water continues or accelerates ongoing operations such as well drilling and well maintenance and other system maintenance programs to reduce system losses (meter replacement, leak detection).</li></ul>
<b>Residential Customers</b>	<ul style="list-style-type: none"><li>• Continue baseline conservation program (Appendix B).</li><li>• Public notification through local and social media and/or water bill inserts.</li><li>• Implement an information program designed to specifically address the drought situation and need for voluntary water reductions (e.g., WaterSmart program).</li></ul>
<b>Multi-Family Customers</b>	<ul style="list-style-type: none"><li>• Implement Stage 1 measures for residential customers and may include:</li><li>• Conduct voluntary self-audits and develop water budgets for possible exemptions from mandatory restrictions in Stage 2. For example, utilizing the WaterSmart business program and informing customers how to implement business specific voluntary measures.</li></ul>

<b>Commercial Customers</b>	<ul style="list-style-type: none"> <li>• Implement Stage 1 measures for multi-family customers and may include:</li> <li>• Encourage customers to implement business-specific voluntary measures (Examples: encourage restaurants to serve water only upon request or ask plant nurseries to promote the sale of low-water-use vegetation).</li> </ul>
<b>Industrial Customers</b>	<ul style="list-style-type: none"> <li>• Implement Stage 1 measures for commercial customers.</li> </ul>
<b>Reclaimed Water Users</b>	<ul style="list-style-type: none"> <li>• Continue customer education on efficient-water-use especially related to drought conditions.</li> <li>• Voluntary self-audits and developing water budgets to potentially gain exemptions from mandatory reductions in advanced drought response stages.</li> <li>• Tucson Water staff prepares a methodology to monitor wastewater treatment plant flows and calculate reclaimed water customer reductions for later drought stages if approved water budgets are not implemented.</li> </ul>

**TABLE 4.2**

**STAGE 2**

**Trigger:** A declaration by the Secretary of the Interior of a shortage on the Colorado River will result in a reduction in Central Arizona Project supply to excess uses, agricultural and other non-municipal users and will trigger a Stage 2 drought response level. If ADWR has declared a drought response stage above normal for the Santa Cruz Watershed, local system indicators may also trigger progression to Stage 2 drought response. In addition, local system indicators will be used to determine the level of initial or continuing response actions needed for this stage.

**Theme:** Continues all Stage 1 measures. Voluntary reductions by Tucson Water residential and multi-family customers. Implementation of water savings/efficiencies identified during Stage 1 for City Departments. Adds a requirement for self-audits and conservation plans for commercial/industrial customers with a volume usage at/or exceeding 325 Ccf monthly.

<p><b>City of Tucson</b></p>	<ul style="list-style-type: none"> <li>• City Departments are required to budget for the implementation of cost effective water saving and efficiency practices identified in Stage 1 audits.</li> <li>• Develop a plan for managing public fountains and other non-essential uses within City operations.</li> <li>• Tucson Water continues system operation, maintenance, and well drilling activities initiated during Stage 1 and expedites if warranted.</li> </ul>
<p><b>Residential Customers</b></p>	<ul style="list-style-type: none"> <li>• Continue baseline conservation program (Appendix B).</li> <li>• Consider implementation of voluntary irrigation schedule based on suggested schedule.</li> </ul> <p>Encourage voluntary reductions of all uses of non-essentials, including decorative fountains.</p>
<p><b>Multi-Family Customers</b></p>	<ul style="list-style-type: none"> <li>• Continue Stage 1 measures, implement Stage 2 measures for residential customers, and may include:</li> <li>• Develop and initiate irrigation restrictions with exemptions for sites that have developed water budgets meeting efficiency standards established by Tucson Water.</li> </ul>

<b>Commercial Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1 measures, implement Stage 2 measures for multi-family customers, and may include:</li> <li>• Require commercial facilities with monthly demand at/or exceeding 325 Ccf to conduct a self-audit and develop a conservation plan.</li> </ul>
<b>Industrial Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1 measures; implement Stage 2 measures for commercial customers.</li> </ul>
<b>Reclaimed Water Users</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1 measures.</li> <li>• Prepare customers for potential reductions if wastewater flow reductions occur and if an approved water budget is not implemented.</li> <li>• Potable water will not provide backup supplies to the reclaimed water distribution system.</li> </ul>

**TABLE 4.3**  
**STAGE 3**

**Trigger:** Continuing shortages on the Colorado River resulting in reductions in CAP deliveries to municipal subcontractors, including the City, will trigger a Stage 3 drought response level. Local system indicators, in combination with an ADWR declared drought in the Santa Cruz Watershed, may also trigger a Stage 3 drought response. Local system indicators will be used to determine the implementation of specific drought response actions during this stage.

**Theme:** Addition of mandatory customer reductions as conditions warrant. Response actions from Stages 1 and 2 will continue. In addition a drought surcharge may be implemented in Stage 3 if determined necessary to recover additional operating costs including increased public education and enforcement efforts due to drought conditions. A drought surcharge will be developed, based on an annual (October) evaluation of need, as part of Tucson Water’s rate process subject to the same review and approvals as other rates and charges. In cases of severe, prolonged drought, the Mayor and Council may consider implementing a temporary moratorium on new water connections or require implementation of an "offset" program that would reduce water use in one area in order for water use to occur in another (see Glossary). Construction water use will be limited and only on approval by the Water Director.

<p><b>City of Tucson</b></p>	<ul style="list-style-type: none"> <li>• Continue Stage 1 and 2 measures.</li> <li>• Restrict washing down of paved areas with exception of public/animal health and safety issues (e.g.,: Reid Park Zoo, Fire and Police, emergency vehicles).</li> </ul>
<p><b>Residential Customers</b></p>	<ul style="list-style-type: none"> <li>• Continue Stage 1 and 2 measures and may include:</li> <li>• Develop restrictions on vehicle washing except at commercial facilities with reuse features.</li> <li>• Intensify water waste monitoring and enforcement. The City Manager may request or direct assistance from other City staff to monitor and cite repeat violators.</li> <li>• Develop watering restrictions and publicize through Tucson Water website, social media and in public information materials.</li> <li>• Implement interior retrofit on resale of property requirements.</li> </ul>

<b>Multi-Family Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1 and 2 measures and Stage 3 residential measures and may also include:</li> <li>• Intensify water waste monitoring and enforcement.</li> <li>• Implement watering restrictions.</li> <li>• Prohibit operation of public fountains.</li> <li>• Prohibit fall overseeding of turf areas unless irrigated with reclaimed water.</li> <li>• Implement interior retrofit on resale of property requirements for pre-1991 construction.</li> <li>• Implement landscape retrofit on resale of property requirements if warranted.</li> </ul>
<b>Commercial Customers</b>	<ul style="list-style-type: none"> <li>• Implement all Stage 1 and 2 measures and Stage 3 multi-family measures and may include implementing conservation plan recommendations developed in Stage 2:</li> <li>• Implement twice a week watering restrictions. (Water use linked to some commercial customer's products, e.g. nurseries, can apply for exemption.)</li> <li>• Implement mandatory retrofit on resale of property requirements for interior and exterior uses.</li> <li>• Prohibit operation of fountains at commercial and industrial sites.</li> <li>• Prohibit fall overseeding of turf unless reclaimed water is used.</li> <li>• Restrict washing of sidewalks, driveways, parking lots or any other paved surface.</li> </ul>
<b>Industrial Customers</b>	<p>Implement all Stage 1 and 2 measures and all measures for commercial customers and may include implementing conservation plan recommendations developed in Stage 2.</p>
<b>Reclaimed Water Users</b>	<ul style="list-style-type: none"> <li>• Implement all Stage 1 and 2 measures and may include:</li> <li>• Require irrigation restrictions, with potential exemptions for sites that have conducted audits, upgraded systems to meet minimum efficiency standards, and irrigate with budget-based irrigation schedules.</li> <li>• Require signage for facilities that implement budgets stating they are in compliance with current drought restrictions.</li> <li>• Potable water will not provide backup supplies to the reclaimed water distribution system.</li> </ul>

**TABLE 4.4**  
**STAGE 4**

**Trigger:** Additional reductions to CAP municipal deliveries, inadequate AWBA firming credits to offset the CAP delivery reductions, deteriorating local system indicators, or a failure to significantly reduce water demand in Stage 3 could trigger a Stage 4 drought response.

**Theme:** Eliminate all non-essential uses. Continuation of drought surcharge if implemented in Stage 3. In cases of severe, prolonged drought, the Mayor and Council may consider implementing a temporary moratorium on new water connections or require implementation of an "offset" program that would reduce water use in one area in order for water use to occur in another (see Glossary). Construction water use will be limited and only on approval by the Water Director.

<p><b>City of Tucson</b></p>	<ul style="list-style-type: none"> <li>• Continue all Stage 1, 2, and 3 measures and implement appropriate provisions from the City’s Emergency Water Conservation Ordinance (No. 8461) including but not limited to:</li> <li>• No operation of large-scale water-cooled systems below 2 cycles of concentration.</li> <li>• No outdoor irrigation (or implementation of further reduced watering schedule at the discretion of City Manager and Mayor and Council)</li> <li>• No washing of paved areas with any pressurized water source except in the case of meeting health and safety issues.</li> <li>• No use of any water-based play apparatus connected to a pressurized water source.</li> <li>• No restaurants and other food service establishments will serve water to their customers unless water is specifically requested by customers.</li> <li>• No operation of outdoor misting systems to cool public areas.</li> <li>• No filling of new swimming pools, fountains, spas, or other exterior water features, including no draining and refilling of existing exterior water features.</li> <li>• No washing of autos, trucks, trailers, and other types of mobile equipment except at facilities equipped with wash water recirculation systems, and for vehicles requiring frequent washing to protect public health, safety, and welfare.</li> </ul>
<p><b>Residential Customers</b></p>	<ul style="list-style-type: none"> <li>• Continue Stage 1, 2, and 3 measures and implement appropriate provisions from the City’s Emergency Water Conservation Ordinance (No. 8461) including but not limited to:</li> </ul>

	<ul style="list-style-type: none"> <li>• No outdoor irrigation, or establish an irrigation schedule (discretion of City Manager and Mayor and Council).</li> <li>• No washing of paved areas with any pressurized water source except in the case of meeting health and safety issues.</li> <li>• No use of water-based play apparatus.</li> <li>• No filling of new swimming pools, fountains, spas, or other exterior water features. Existing pools may be topped off to maintain water level but may not be refilled if drained.</li> <li>• No washing of autos, trucks, types of mobile equipment except at facilities with wash water re-circulating systems.</li> </ul>
<b>Multi-Family Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1, 2, and 3 measures and include Stage 4 measures listed for residential customers.</li> </ul>
<b>Commercial Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1, 2, and 3 measures and include Stage 4 measures for multi-family customers.</li> <li>• No operation of large-scale water-cooled systems below 2 cycles of concentration.</li> <li>• No restaurants and other food service establishments will serve water to their customers unless specifically requested by customers.</li> <li>• No operation of outdoor misting systems to cool public areas.</li> </ul>
<b>Industrial Customers</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1, 2, and 3 measures in addition to appropriate provisions under Stage 4 for Commercial Customers.</li> </ul>
<b>Reclaimed Water Users</b>	<ul style="list-style-type: none"> <li>• Continue Stage 1, 2, and 3 measures.</li> </ul>

## **Customer Notification**

Upon approval by the City Manager and/or Mayor and Council, the Director shall instruct the Utility's Public Information Office to notify customers of the stage of drought response. Declaration of any drought response stage will initiate public education and information programs to advise and educate customers on potential drought impacts in the Tucson Water service area and the need for possible conservation measures. Public notification will be made through various channels including but not limited to media releases and water bill inserts.

## **Enforcement**

Enforcement of Ordinance 10380 will be done by Tucson Water's "Water Cop" staff. Additional Tucson Water staff may be temporarily assigned to enforcement if conditions warrant. The City Manager is authorized to designate additional City employees to assist in the enforcement of the Plan as authorized through the ordinance. Enforcement assistance will be coordinated with the Water Director.

## **Violation**

Violations of Ordinance 10380 will result in a written notice placed on the property where the violation occurred. A duplicate notice will be mailed to the person who is regularly billed for the water service where the violation occurs, and to any person known to the Department who is responsible for the violation or its correction. The notice will describe the violation and order that it be corrected, ceased, or abated immediately or within such specified time as the Department determines is reasonable under the circumstances. The notice of violation will include a description of the possible fees and associated penalties. If the order is not complied with, the Department may disconnect the service where the violation occurs and the then current disconnection charge will be applied to the customer account. Reconnection of any service disconnected for non-compliance will require payment of the then current complete new service connection charge in addition to other fees or charges imposed by this ordinance for disconnection of service.

In addition to being grounds for discontinuation of service, violation of any provision of this article shall be a civil infraction. An individual or corporation convicted of violating provisions of this ordinance will be assessed a civil penalty of not less than \$250 or more than \$1,000 per violation as determined by the Court upon review of the Utility's recommendation based on a description of the violation.

## **Essential Uses**

Essential uses that are exempted from drought restrictions include but may not be limited to:

- Any use to maintain the health, welfare, and safety of Tucson Water customers, City residents, and visitors, including hospitals, other health care facilities, and fire departments;
- Any use to maintain public sanitation, including washing of sanitation trucks, trucks used to carry food or other perishables, and commercial establishments that must wash paved areas for sanitation purposes.

## **Variations**

The Director, or designee, is authorized to review special cases within which strict application of the ordinance would result in serious hardship to a customer. A variance may be granted only for reasons involving health, safety, or economic hardship. Application for variance must be made on a form provided by the Director. The Utility will charge a fee to process a variance request (Appendix F).

## **DROUGHT RESPONSE STAGE TERMINATION**

When the conditions warranting declaration of Drought response Stage 1 or 2 no longer exist, the Director will advise the City Manager that the drought response stage should be terminated or reduced. The Manager will declare the change or termination of Stage 1 and 2. When the conditions warranting declaration of Drought Response Stage 3 or 4 no longer exist, the Director will recommend the change or termination of the drought response stage to the City Manager and the Mayor and Council. Changes in, or termination of, Drought Response Stage 3 and 4 will require the approval of the Mayor and Council. Response actions will be reduced to the appropriate level as drought response stages are terminated or reduced.



A well rig. Groundwater wells can provide backup supplies during severe drought.

## **CHAPTER FIVE**

### **EMERGENCY OR BACKUP SUPPLIES FOR POTABLE WATER**

Guidelines for development of drought preparedness and response plans were provided by ADWR to assist water providers in completing meaningful plans. A discussion of emergency, or backup, potable water supplies is an essential element of the drought preparedness and response plan. This section will address Tucson Water's potable backup supplies for meeting service area demands as well as address agreements with other local water providers for emergency water supplies.

#### **Tucson Water Backup Supplies**

Decades of water supply and system infrastructure planning have resulted in a water system that utilizes both CAP water and groundwater for most of the Tucson Water service area, with the exception of isolated water systems which depend solely on groundwater. The conjunctive use of groundwater and surface water supplies, particularly the operation of the Clearwater recharge and recovery system, provides a great deal of resilience to the Tucson Water supply system during water emergencies as well as during times of local drought.

Tucson Water's resource planning and system design staff acknowledge the similarity in certain operational responses to water emergencies and severe drought conditions while recognizing that drought itself is not an emergency situation. Drought does not occur suddenly and without warning. Rather, careful observation of key drought indicators will allow for implementation of responses to avoid reaching emergency conditions.

However, should a prolonged unforeseen crisis occur with delivery of surface water supplies, such as damage to the CAP canal or a long-term declared shortage on the Colorado River causing a reduction in CAP water deliveries to Tucson, groundwater supplies would serve as emergency backup for the City of Tucson. Although long-term reliance on groundwater is not a preferred alternative, and is not advisable from a Utility policy, regulatory, or environmental standpoint, short-term reliance will provide a reliable emergency supply should Tucson Water customers need it.

#### **Emergency Supply Policy for Other Water Providers**

Other water providers in the greater Tucson region may occasionally experience difficulty in meeting customer demand due to a variety of supply or infrastructure issues. The City of Tucson currently has "interconnect agreements" with some area water providers for such specific needs as fire protection capacity or other emergencies related

to water supply or infrastructure. As stated above, drought is not an emergency and *these agreements do not cover water shortages due to drought.*

However, it is possible the Utility could occasionally be asked to provide water on an emergency basis to other water providers who may have less resource or system reliability than Tucson Water during a severe drought. Such requests for drought-related, short-term emergency supplies will be reviewed on a case by case basis. The Water Director will expedite review of the request and forward a recommendation to the Mayor and Council, or if a quorum is not available the Mayor or Mayor's designee, for approval or denial of the request based on the following guidelines:

1. Short-term drought supply assistance will only be provided to alleviate a public health or safety condition. A public health or safety condition is defined as inadequate water supply to provide for fire flow capacity, essential human uses or to meet the requirements of healthcare establishments.
2. Short-term drought supply assistance will only be provided if the Utility can adequately meet the projected needs of its customers on a continuing basis.
3. Short-term drought supplies will be provided at a price equivalent to three times the Commercial Customer rate. The price is in part determined by the fact that the water supply is being provided during peak demand times and therefore is going to be more expensive for the Utility to provide than water delivered during off-peak times.
4. Recipients of short-term drought supplies are required to implement in their service area drought response measures equal to or more stringent than Tucson Water's Stage 4 drought response measures. Recipients of these short-term supplies also must make provisions for developing their own alternative water supplies.
5. The duration of short-term drought supply shall not exceed 90 days (subject to approval of the Mayor and Council) while alternative supplies are being developed. However, the Utility has the right to discontinue emergency service at any time.

## **CHAPTER SIX**

### **PLAN REVISIONS**

Even with built-in flexibility, the Utility's Plan will require occasional review and revision. Significant community investments in system reliability and use of renewable resources have enabled the Utility to maintain a robust water system that has demonstrated little impact from drought to date. Because of that, the Plan is based on best available information and judgment, rather than on actual drought impact experience.

Over time, if drought conditions persist or become more severe, the Plan will likely require adjustments. Climatological studies indicate there may be long-term changes in store for global weather patterns and there is general consensus in the scientific community that average temperatures are increasing in the Southwest. It is unclear how these changes may impact precipitation patterns over the long term. However, changes in weather patterns will make forecasting more difficult and thorough planning more important. To ensure that the Plan remains an effective management tool, Tucson Water staff will review the Plan annually and recommend any necessary revisions or updates needed to meet the challenges of new or changing conditions.

Based on the relationships between well field and distribution system health, the annual review will also be useful to system planners and operations staff from a maintenance and infrastructure development standpoint.

Minor updates to the Plan will be approved by the Water Director and be appended to the drought plan. However, if significant revisions or updates are recommended the Plan will be formally revised with revisions approved by the Mayor and Council and forwarded to the Arizona Department of Water Resources (ADWR). The plan will be formally revised no less than every five years in accordance with ADWR requirements.

## **APPENDIX A**

### **DEVELOPMENT OF LOCAL SYSTEM INDICATORS**

The indicators used in the Plan were developed to provide guidelines for the Water Director to:

- determine the level of drought response needed in the Tucson Water service area;
- evaluate the potential impacts drought might have on availability of water supplies or the Utility's ability to deliver water to customers; and
- implement the response actions needed to mitigate potential impacts.

To accomplish this, drought indicators must be meaningful and measure something that is:

- critical to Tucson Water's ability to deliver water (including water supply availability and potential system impacts specific to our water system);
- useful for good resource management practices; and
- not already measured by another indicator (i.e. not repetitive or a variable included in another indicator).

Because Tucson Water uses both imported surface water and groundwater for potable supply, the Plan's indicators needed to reflect potential drought impacts to either or both of these supplies. This consideration resulted in development of both regional indicators and local system indicators. Regional indicators, as described in Chapter 3, reflect potential reductions in availability of Colorado River water as well as watershed conditions for our local area monitored and reported by the Arizona Department of Water Resources (ADWR). Local system indicators reflect potential impacts specific to Tucson's water system and groundwater supplies. Tucson Water's Plan includes 3 local system indicators and one additional indicator that will be used primarily as a "response monitoring tool".

Whereas regional indicators are outside the control or influence of Tucson Water, usually reflecting watershed related conditions, the Utility can generally exercise more direct control in responding to local system indicators. Tucson Water staff routinely evaluates a number of variables to examine the performance of the potable and reclaimed systems. However, monitoring and analyzing these variables in terms of their relationship to drought will provide early warning of potential drought related system problems that can signal the need to implement mitigation measures to avoid those problems.

The local system indicators give a general view of the overall "health" of the water systems, with each one reflecting the influence of a number of possible impacts of drought. A downward trend in any of the indicators would be a signal to the Director that

a more in-depth evaluation of system components is needed or that specific response measures should be implemented.

### **Potable Water Production Capacity Index (PPCI)**

The PPCI indicator is a ratio of potable production capacity to potable demand. In this equation, demand is the forecasted total potable water demand for the average day of the peak 30-day period for the upcoming summer. Production capacity in this equation is the expected capability to produce and deliver water to adequately meet the upcoming summer demand over the entire maximum 30-day period – this will be less than the sum of the capacity of all the individual wells. PPCI measures the Utility's overall ability to produce sufficient water to meet peak demand.

Production capacity in the PPCI ratio is largely determined based on well efficiency measures, including such factors as system pressures, static water levels, specific well capacity and so forth. Tucson Water's integrated potable system is generally designed to provide supply in excess of the average day of the peak 30-day period. Tucson Water will monitor this index both for its absolute value and for its trend in each of the potable systems. A high value trending downward or a low value that is not showing signs of improving will likely warrant operational response actions such as expedited system maintenance or well drilling programs.

### **Gallons Per Capita Per Day (GPCD)**

“Gallons per capita per day water use”, or GPCD, has been tracked by the utility for a number of years to ensure compliance with ADWR regulations. GPCD was incorporated into the Plan as a local system indicator that will be used primarily as a “response monitoring tool” when a drought response stage is declared for the Tucson Water service area. Per capita water use is simply total potable demand, including lost and unaccounted for water, divided by the population and by the number of days in the year.

Under normal climatic conditions, GPCD would be expected to remain stable. One of the anticipated effects of local drought is an increase in GPCD because customers traditionally tend to use more water when it is hotter and drier than normal. Monitoring GPCD will help determine if there is a demand response to the drought –increases due to drought conditions or decreases corresponding to water conservation or drought specific programs.

The Potable Production Capacity Index (PPCI) will capture increases in total demand or reductions in capacity during the peak demand periods. Given anticipated expansion of

production capacity, however, a local drought will likely not result in demand exceeding production capacity (as measured by the PPCI) even if GPCD were to increase.

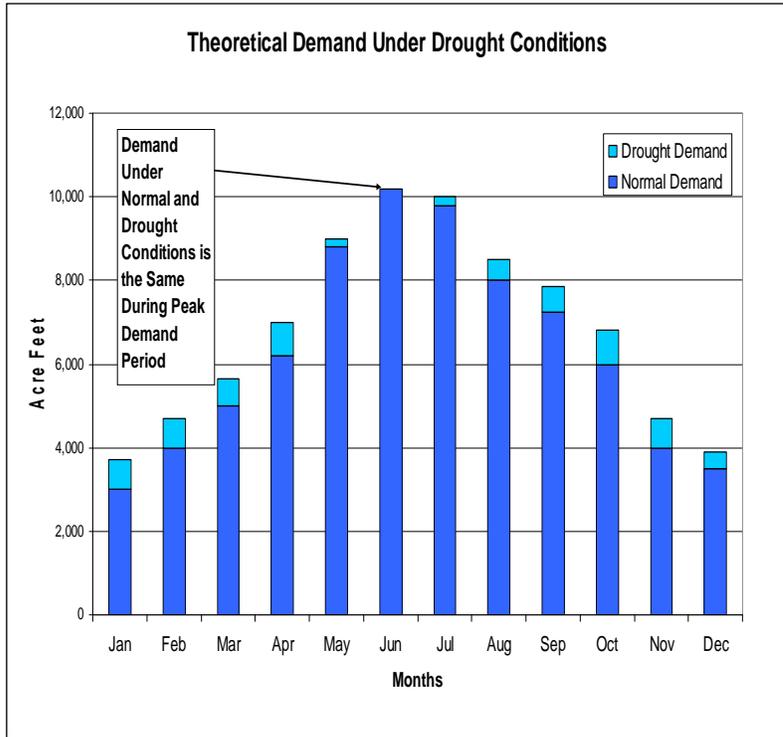


Figure A.1: Theoretical Demand under Drought Conditions

In fact, GPCD could go up as a result of increased demand during the winter and shoulder months (March, April and September, October) rather than during the maximum 30- day (peak) demand period, which can be generally characterized as “drought-like” even under normal climate conditions. Therefore, if the PPCI were the only indicator incorporating demand, the drought plan would fail to address potential drought related impacts of increased GPCD. An example of those potential impacts might

include more groundwater being used than under normal climate conditions, which in turn would result in more rapid use of our Allowable Groundwater Credits and would potentially contribute to a more rapid decline in the water table. (See Figure A.1)

### Aquifer Storage Index (ASI)

The "health" of the aquifers from which Tucson Water pumps groundwater can be measured in a number of ways. Aquifer health, regional water table elevations, and the number and depth of wells can all impact the overall productivity of a well field. In addition, drought conditions on the Colorado River could lead to decreased CAP deliveries to the City’s recharge and recovery projects. While the design of the recharge projects allow for continued pumping with reduced or no recharge for a considerable time, doing so over sustained periods could negatively impact the productive capacity of those well fields.

When considering drought impacts, changes to the regional water table in the most productive well fields are of prime concern. Tucson Water developed the ASI to capture changes in static water level conditions to provide a measure of changes in the aquifer that could influence water supply.

The ASI is an annual measure which indicates a change in groundwater levels by comparing groundwater levels with those in a particular (index) year. The groundwater levels are taken from individual, spatially-distributed wells and summed to produce a total for the year. The water levels are weighted by the volume pumped. The total for the current year is divided by the total for the index year of 2000 to derive the ASI. (The year 2000 was selected because it represents the condition of the aquifer immediately prior to the introduction of CAP water at the CAVSARP facility, following many years of continuous groundwater pumping.) A prolonged local and/or regional drought would be expected to decrease water levels in the aquifer, which in turn could eventually affect the productivity of the well fields.

### **Reclaimed Production Capacity Index (RPCI)**

The RPCI indicator is a ratio of reclaimed production capacity to reclaimed demand, very similar to the PPCI. Tucson Water's reclaimed system is generally designed to be 2.0 times the average day of the peak month. The design standard for the reclaimed system is different than the standard for the potable system because reclaimed demand is primarily related to irrigation needs and is, therefore, more responsive to climatic conditions and has higher "peak demand" requirements.

A probable outcome of local drought is an increase in demand for reclaimed water from existing and new customers that could negatively impact the system's ability to meet that demand unless capacity (infrastructure enhancement) keeps pace. A downward trend in the RPCI will be considered along with other drought indicators to determine appropriate drought response.

**APPENDIX B**  
**TUCSON WATER BASELINE CONSERVATION PROGRAM**

- General public information programs (Beat the Peak, speaker's bureau, presence at community events, distribution of bill inserts).
- Education and training programs (annual teacher internship training, water audit training for landscapers).
- Rebates and other incentive-type programs.
- Direct assistance programs (Zanjeros audit program, Water Smart irrigation workshops for homeowners, Smartscape workshops for landscapers).
- Regulatory measures (landscaping and water waste ordinances, plumbing codes).
- Increasing block water rate structure.
- Participate in or sponsor water conservation-related research projects.

## APPENDIX C

### RELATED CITY PLANS, ORDINANCES, AND POLICIES

#### **Plans:**

City of Tucson Water Department, 2004. *Water Plan: 2000-2050 (Final Draft)*.

City of Tucson Water Department, 2008. *Water Plan 2000-2050, 2008 Update*

City of Tucson Water Department, 1997. *Tucson Water Emergency Response Plan*.

#### **Ordinances:**

City of Tucson, 1995. *Ordinance 8461*, Relating to Water; establishing the City of Tucson Emergency Water Conservation Response Plan; amending the Tucson Code by adding a new article VI, Emergency Conservation Response, and by adding new sections 27-90 through 27-99 to the Tucson Code.

#### **Policies:**

City of Tucson, 1998. *Mayor and Council Water Policies* (Roman Numeral 3, Policies; Section C., Water Supply Management, and Development, Number 2--Contingency Plans).

## APPENDIX D

### REFERENCES

American Water Works Association (AWWA), 2002. *Drought Management Handbook* AWWA Water Shortage Subcommittees, AWWA Water Conservation Committee

Arizona Department of Water Resources, 2006 *System Water Plan Guidance Document* [www.water.az.gov/dwr](http://www.water.az.gov/dwr)

Arizona Department of Water Resources, 2006 *Drought Monitor Report* (various issues), Governor's Task Force Monitoring Technical Committee

Arizona Governor's Drought Task Force, Governor Janet Napolitano, 2004. *Arizona Drought Preparedness Plan, Operational Drought Plan*

Arizona Hydrological Society Symposium, 2006 *Climate Change and Drought Workshop*, Glendale Civic Center, Glendale, Arizona

City of New York, 1998 *Drought Management Plan and Rules* City of New York Department of Environmental Protection

City of Peoria, Arizona, 2003 *Drought Contingency Plan* City of Peoria Utilities Department, Water Resource and Conservation Division

City of Phoenix, Arizona, 2000 *Drought Management Plan* City of Phoenix Water Services Department

City of Scottsdale, Arizona (not dated) *Drought Management Plan* City of Scottsdale Water Department

City of Tucson Water Department, 2004 *Water Plan: 2000-2050 (Final Draft)*

City of Tucson Water Department, 2008 *Water Plan 2000-2050, 2008 Update*

Climate Assessment for the Southwest (CLIMAS) Project; University of Arizona Cooperative Extension 2006 *Southwest Climate Outlook* (various issues)  
CLIMAS web site [www.ispe.arizona.edu/climas](http://www.ispe.arizona.edu/climas)

National Drought Mitigation Center, U.S. Drought Monitor web site:  
[www.drought.unl.edu/dm/monitor.html](http://www.drought.unl.edu/dm/monitor.html)

Pima County, Arizona, 2006 *Pima County Drought Management Plan* (draft)

Southern Nevada Water Authority, 2005 *Drought Plan* (supplement to the Authority's Water Resource Plan.)

## **APPENDIX E**

### **ORDINANCE 10380**

*(Editor's Note: The City of Tucson Mayor and Council unanimously approved the drought response plan November 28, 2006. The implementing ordinance was subsequently adopted March 20, 2007.)*

*See next page.*

ADOPTED BY THE  
MAYOR AND COUNCIL

March 20, 2007

ORDINANCE NO. 10380

RELATING TO WATER; AMENDING THE TUCSON CODE, CHAPTER 27, WATER, BY ADDING A NEW ARTICLE VIII, DROUGHT PREPAREDNESS AND RESPONSE PLAN; AND DECLARING AN EMERGENCY.

BE IT ORDAINED BY THE MAYOR AND COUNCIL OF THE CITY OF TUCSON, ARIZONA, AS FOLLOWS:

SECTION 1. The Tucson Code Chapter 27 is amended to add a new Article VIII, as follows:

**ARTICLE VIII. DROUGHT PREPAREDNESS AND RESPONSE PLAN**

**Sec. 27-110. Purpose.**

This article establishes a city drought preparedness and response plan.

**Sec. 27-111. Declaration of policy.**

It is hereby declared that, because of varying conditions related to water resource supply and distribution system capabilities during drought, it is necessary to establish and to enforce drought response stages and drought response measures to ensure that the water resources available to the city are put to the maximum beneficial use; that unreasonable use, or unreasonable method of use is prevented; and that conservation of water is accomplished in the interests of the customers of the city and for the public health, safety, and welfare.

**Sec. 27-112. Application.**

(a) This article applies to all departments of the city, and to all city water customers who own, occupy, or control water use on any premises as defined in section 27-10.

(b) No person shall make, cause, use, or permit the use of water received from the Department for residential, commercial, industrial, governmental or any other purpose in any manner contrary to any provision in this article.

(c) Mandatory drought response measures shall be implemented based upon the declaration of drought response stages pursuant to section 27-115.

**Sec. 27-113. Declaration of drought response stages, implementation, termination.**

(a) Stage 1 or Stage 2 drought response will be declared by the City Manager, or any designee, on the advice of the Director. A Stage 3 or Stage 4 drought response will be declared by the Mayor and Council, or any designee, upon the recommendation of the City Manager.

(b) The Director shall develop guidelines which set forth general criteria to assist the City Manager or Mayor and Council, or any designee, in determining drought response stages.

(c) Following the declaration of any drought response stage, the Department will implement appropriate response actions, including but not limited to public notification and various drought response measures.

(d) The Director will continually monitor drought conditions and promptly recommend that the drought stage level increase if conditions worsen. Similarly, the Director will advise the City Manager to rescind Stage 1 or 2, or to recommend termination of Stage 3 or 4, if warranted by lessened drought conditions.

**Sec. 27-114. Triggers for each drought response stage.**

Each drought response stage will be triggered by specific conditions related to the availability of Colorado River water and/or local water system indicators, such as well and distribution system operating capacities:

(a) Stage 1 trigger: A severe and sustained drought on the Colorado River watershed and/or any declaration of drought status above normal in the Santa Cruz Watershed by the Arizona Drought Monitoring Technical Committee.

(b) Stage 2 trigger: A declaration by the Secretary of the Interior of a shortage on the Colorado River that results in a reduction in Central Arizona Project (CAP) water deliveries to agricultural, other non-municipal users, or to excess users, OR, a deterioration in local water system

indicators in conjunction with a drought status above normal for the Santa Cruz Watershed.

(c) Stage 3 trigger: Continuing shortages on the Colorado River resulting in reductions in CAP deliveries to municipal subcontractors, including the city, OR, a further deterioration in local water system indicators in conjunction with a drought status above normal for the Santa Cruz Watershed.

(d) Stage 4 trigger: Additional reductions to CAP municipal deliveries, a further deterioration of local system indicators, and/or a failure to significantly reduce water demand in Stage 3.

**Sec. 27-115. Response actions for each drought response stage.**

Upon declaration of a drought response stage the Director shall be authorized to implement and enforce any or all of the drought response measures for a specific drought response stage included in the last-adopted Drought Preparedness and Response Plan on file with the City Clerk's Office.

**Sec. 27-116. Variances.**

The Director, or the Director's designee, is authorized to review special cases within which strict application of this chapter would result in serious hardship to a customer. A variance may be granted only for reasons involving health, safety or economic hardship. Application for variance from requirements of this article must be made on a form provided by the Director. The Department may charge a fee to process a variance request.

**Sec. 27-117. Violation.**

(a) Violations of this article will result in a written notice placed on the property where the violation occurred. A duplicate will be mailed to the person who is regularly billed for the service where the violation occurs and to any person known to the Department who is responsible for the violation or its correction. The notice will describe the violation and order that it be corrected, ceased or abated immediately or within such specified time as the Department determines is reasonable under the circumstances. The notice of violation will contain a description of the possible fees and penalties associated with said violation. If the order is not complied with, the Department may disconnect the service where the violation occurs and the then current disconnection charge will be applied to the customer account. Reconnection of any service disconnected for non-compliance will require payment of the then current complete new service connection charge in addition to other fees or charges imposed by this ordinance for disconnection of service.

(b) In addition to being grounds for discontinuation of service, violation of any provision of this article shall be a civil infraction. An individual or corporation convicted of violating provisions of this section shall be assessed a civil penalty of not less than two hundred fifty dollars (\$250.00) or more than one thousand dollars (\$1,000.00) per violation.

**Sec. 27-118. Enforcement.**

This article will be enforced by the Department. The City Manager, in consultation with the Director, is authorized to designate additional city employees to assist in enforcement, should conditions warrant.

**Sec. 27-119. Definitions.**

*Department* means the City of Tucson Water Department (Tucson Water).

*Director* means the Director of the City of Tucson Water Department.

*Economic hardship* means a threat to a primary source of income for an individual or business.

*Notification to public* means notification through local media, including interviews and issuance of news releases and/or Department bill inserts.

SECTION 2. If any Section, Subsection, Sentence, Clause, Phrase, or Portion of this Ordinance is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 3. The various City officers and employees are authorized and directed to perform all acts necessary or desirable to give effect to this ordinance.

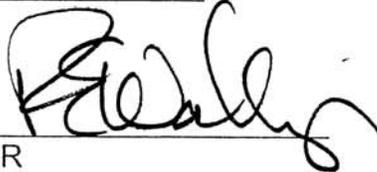
SECTION 4. WHEREAS, it is necessary for the preservation of the peace, health, and safety of the City of Tucson that this Ordinance become

...

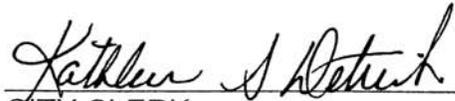
...

immediately effective, an emergency is hereby declared to exist and this ordinance shall be effective immediately upon its passage and adoption.

PASSED, ADOPTED AND APPROVED BY THE MAYOR AND COUNCIL  
OF THE CITY OF TUCSON, ARIZONA, March 20, 2007.

  
MAYOR

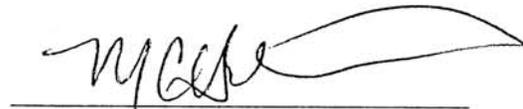
ATTEST:

  
CITY CLERK

APPROVED AS TO FORM:

  
CITY ATTORNEY

REVIEWED BY:

  
CITY MANAGER

  
SA:dc  
03/06/2007 12:55 PM

**APPENDIX F  
VARIANCE APPLICATION  
FROM  
CITY OF TUCSON WATER DEPARTMENT  
DROUGHT PREPAREDNESS PLAN  
ORDINANCE NO. 10380 REQUIREMENTS**

**SECTION I. General Information**

1. Applicant Name: \_\_\_\_\_
2. Customer Name \_\_\_\_\_
3. (if different from  
1.): \_\_\_\_\_
4. Service Address: \_\_\_\_\_
5. Account Number(s) \_\_\_\_\_
6. Daytime Contact:
  - Name: \_\_\_\_\_
  - Address \_\_\_\_\_
  - Affiliation: \_\_\_\_\_
  - Telephone Number(s) \_\_\_\_\_

**SECTION II. Variance Request**

Article VI, Section 27-96 of the Tucson Code states: "The City Manager, or the City Manager's designee, is authorized to review hardship cases and special cases within which strict application of the Chapter would result in serious hardship to a customer. A variance may be granted only for reasons involving health, safety, or economic hardship. Application for variance from requirements of the Chapter must be made on a form provided by the Director."

1. Identify the use of water for which a variance is being applied: \_\_\_\_\_

\_\_\_\_\_

2. Above use is located at a (check one only):  Residence  Commercial  
Establishment

3. Identify the hardship for which a variance is requested.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**VARIANCE APPLICATION  
FROM  
CITY OF TUCSON WATER DEPARTMENT  
DROUGHT PREPAREDNESS PLAN  
ORDINANCE NO. 10380 REQUIREMENTS  
(Continued)**

4. Cite specific health codes or safety regulations that impact your ability to comply with the Drought Preparedness and Response Plan Ordinance.

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Applicant Signature: \_\_\_\_\_

Date: \_\_\_\_\_

OFFICE USE ONLY:

COMMERCIAL OFFICE ONLY:

1. Reviewer \_\_\_\_\_ 1. Reviewer: \_\_\_\_\_  
2. Date: \_\_\_\_\_ 2. Date Received: \_\_\_\_\_  
3. Status: Approve \_\_\_\_\_ Reject \_\_\_\_\_ 3. Date Entered: \_\_\_\_\_

4. Comments: \_\_\_\_\_

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[www.tucsonaz.gov/water](http://www.tucsonaz.gov/water)