
# Water Resources Master Plan

August 2021

City of Tempe
Municipal Utilities Department
Water Utilities Division

Tempe®

# Table of Contents

# Glossary and Abbreviations

| Abbreviation | Term | Definition |
|---|---|---|
| ADWR | Arizona Department of Water Resources | State regulatory agency created to manage water resources. |
| ASR | Aquifer Storage and Recovery well | Technology for storing and recovering water in aquifers. |
| AF | Acre-feet | Measure of quantity of water. One AF is enough water to cover one acre of land with one foot of water, approximately 325,851 gallons. |
| AF/yr | Acre-feet per year | Measure of quantity of water in a year (365 days). |
| AMA | Active Management Area | Geographic areas (five) within which groundwater or other waters are monitored by ADWR. |
| AMWUA | Arizona Municipal Water Users Association | A nonprofit corporation comprised of members from the ten large municipal providers (Peoria, Phoenix, Scottsdale, Mesa, Tempe, Goodyear, Glendale, Gilbert, Chandler, Avondale) in Maricopa County. AMWUA provides a forum for users to collaborate on water issues to ensure water supplies are protected and enhanced to support economic prosperity and water resources sustainability. |
| AWS | Assured Water Supply | A process by which ADWR certifies that a water supply meets five criteria defined by statue that ensure the provider will have sufficient supplies to meet the needs of the water service area for 100 years. Also referred to as the Assured and Adequate Water Supply. |
| | Aquifer | A Geologic formation that contains sufficient saturated materials to be capable of storing water and transmitting water in useable quantities to a well. |
| CAP | Central Arizona Project | The reclamation project and associated works that conveys about 1.5 MAF of Colorado River water per year to Pima, Pinal and Maricopa counties. |
| CAWCD | Central Arizona Water Conservation District | The multi-county water conservation district established as a special taxing district for the purpose of delivery of CAP water and repayment of associated CAP infrastructure costs. |
| DCP | Drought Contingency Plan | Tiered shortages to Colorado River supplies, tied to Lake Mead surface elevations, intended to prevent shortages that would trigger federal actions. |
| | General Adjudication | A legal action by which determination or establishment of the extent and priority of the rights of all persons to use water in a river system or source. |
| | Groundwater Savings Facility | A facility within an AMA or INA which saves groundwater by providing a location for the storage and recovery of water in-lieu of pumping groundwater. |
| GMA | Groundwater Management Act | 1980 legislation that created ADWR, with the goal of managing groundwater. |
| GRUSP | Granite Reef Underground Storage Project | A storage facility operated by SRP, located adjacent to the Salt River above Mesa, which Tempe own a share (2.35 percent), used to store water to create LTSC. |
| JGM | Johnny G Martinez Water Treatment Plant | Tempe water treatment plant capable of producing 50 MGD of potable water from surface water supplied by SRP. Located in north Tempe (College and Curry). |
| KMGC RSF | Ken McDonald Golf Course Recharge and Storage Facility | Tempe aquifer recharge and storage facility. |
| KWRF | Kyrene Water Reclamation Facility | Tempe wastewater treatment facility associated with KMGC RSF. |

| | | |
|---|---|---|
| LTSC | Long Term Storage Credit | An account established to credit water stored using a water storage permit at a water storage facility for future use. |
| MG | million gallons | Measure of quantity of water. |
| MGD | million gallons per day | Measure of quantity of water in a day (24 hours). |
| M&I | Municipal and Industrial (sub-contract) | Contract by which water users can obtain a share of Arizona's allotment of Colorado River via CAP. Primarily for municipal and industrial users, these contacts are the means by which Tempe and other users receive the majority of their CAP allotments. |
| | Master Plan | A comprehensive or far-reaching plan of action. |
| MUD | Municipal Utilities Department | Department within the City of Tempe that includes the Water Utilities Division and is charged with the management, operations and maintenance of Tempe's water utility. |
| | SRP Member Lands | Lands that have surface water rights related to development of SRP reservoir system. |
| | SRP Non-Member Lands | Lands that do not have SRP surface water rights. |
| | Normal Flow | Lands that have surface water rights that pre-date the construction of the SRP reservoir system. |
| NCS | New Conservation Space | Surface water stored behind the additional space created when SRP's Theodore Roosevelt Dam in the mid-1900s. Tempe's portion of the storage capacity is 13,500 AF. This water right is not appurtenant to the land, meaning it can be utilized anywhere within the water service area for beneficial uses. |
| | Recharge (Artificial) | Water recharged to an aquifer through constructed or engineered projects when accomplished through artificial means. |
| | Surface Water | Water from rivers, lakes and reservoirs. Typically from precipitation, snow melt and subsequent runoff, surface water is considered a renewable source of water supply. |
| | Safe-yield | A goal which attempts to achieve and maintain a long-term balance between annual withdrawals and recharge of groundwater within an AMA. |
| SRP | Salt River Project | The reclamation project and associated works that collects and conveys water from the Salt and Verde watersheds to the Phoenix Metropolitan area. |
| SRVWUA | Salt River Valley Water Users Association | The association established for the purpose of developing storage and delivery of water by SRP. |
| STWTP | South Tempe Water Treatment Plant | Tempe water treatment plant capable of producing 50 MGD of potable water from surface water supplied by SRP. Located in south Tempe (Guadalupe and 101). |
| SROG | Sub-Regional Operating Group | A partnership between five cities (Phoenix, Glendale, Mesa, Scottsdale, and Tempe) to collectively own a regional WWTP and associated infrastructure. |
| | Underground Storage Facility | A constructed (non-natural) underground storage facility; also called a managed underground storage facility. |
| | Water Storage Permit | A permit issued by ADWR to store water at a storage facility. |
| | Water Storage Facility | A groundwater savings facility or underground storage facility permitted by ADWR. |
| WTP | Water Treatment Plant | A facility designed to receive non-potable water and produce potable water. |

| | | |
|---|---|---|
| WWTP | Wastewater Treatment Plant | A facility designed to receive wastewater and produce water suitable for discharge to the environment or other uses. |
| NIA | Non-Indian Agriculture (sub-contract) | Contract by which water users can obtain a share of Arizona's allotment of Colorado River water via CAP. Primarily for irrigation districts, these contacts can be acquired by other users through agreements and settlements. |
| INA | Irrigation Non-expansion Area | Geographic areas (two) within which groundwater or other waters are monitored by ADWR. Prohibits expansion of irrigation. |
| WMAT | White Mountain Apache Tribe | Native American tribe in northeastern Arizona that has agreed to lease surface water to Tempe. |
| WUD | Water Utilities Division | Division within MUD that contains the sections responsible for water and wastewater utility functions for Tempe. |

# Executive Summary

The Water Resources Master Plan provides a planning framework that will ensure Tempe maintains sufficient supplies to continually meet the demands of the Water Service Area. The plan contains an overview of Tempe's water portfolio and assets, describes available supplies and demand forecasting, provides strategies and tactics to meet current and future water demands and contains an executive summary of the Water Conservation and Efficiency Program Strategic Plan and Drought Preparedness Plan.

Water Resources Strategies:

- Prioritize utilization of renewable resources and protect Tempe's access to them.
- Provide the highest level of water resiliency at highest possible value.
- Acquire new sources and renewable supplies whenever feasible opportunities exist.
- Manage groundwater rights to maintain safe-yield pumping.
- Develop new infrastructure and maintain current assets to protect Tempe from the impacts of prolonged droughts.
- Maintain a customized water conservation and efficiency program that utilizes targeted outreach, innovative demonstrations and measurable programs whenever possible to continually improve water conservation and efficiency in the residential, commercial and industrial sectors of Tempe's community.
- Continue to establish water resources planning guidelines that consider the water rights status of lands slated for development and redevelopment projects.
- Maintain a detailed and effective Drought Preparedness Plan.

In 2010, Tempe received an Assured Water Supply Designation (AWS) from the Arizona Department of Water Resources (ADWR). This designation certified that Tempe has access to sufficient water resources to meet water system demands for 100 years. Based on an evaluation of current demand forecasting and the supplies outlined in the Tempe AWS Designation, Tempe will have sufficient water resources to meet demands up to and beyond anticipated buildout in 2040. However, maintaining these supplies, and supplementing them when necessary, requires significant effort and planning. This document addresses how Tempe will meet current and future water supply challenges, while continuing to provide affordable water that satisfies the demands of the Water Service Area now and into the future.

# Water Service Area, Water Resources Portfolio and Associated Infrastructure

Within Tempe, the Municipal Utilities Department's (MUD) Water Utilities Division (WUD) provides customers in the Tempe Water Service Area with water to meet both potable and non-potable demands. The Tempe Water Service Area includes all lands incorporated within Tempe, the Town of Guadalupe and several unincorporated county islands. The Water Service Area pictured in Figure 1 covers approximately 40 square miles and is more than 97 percent developed.

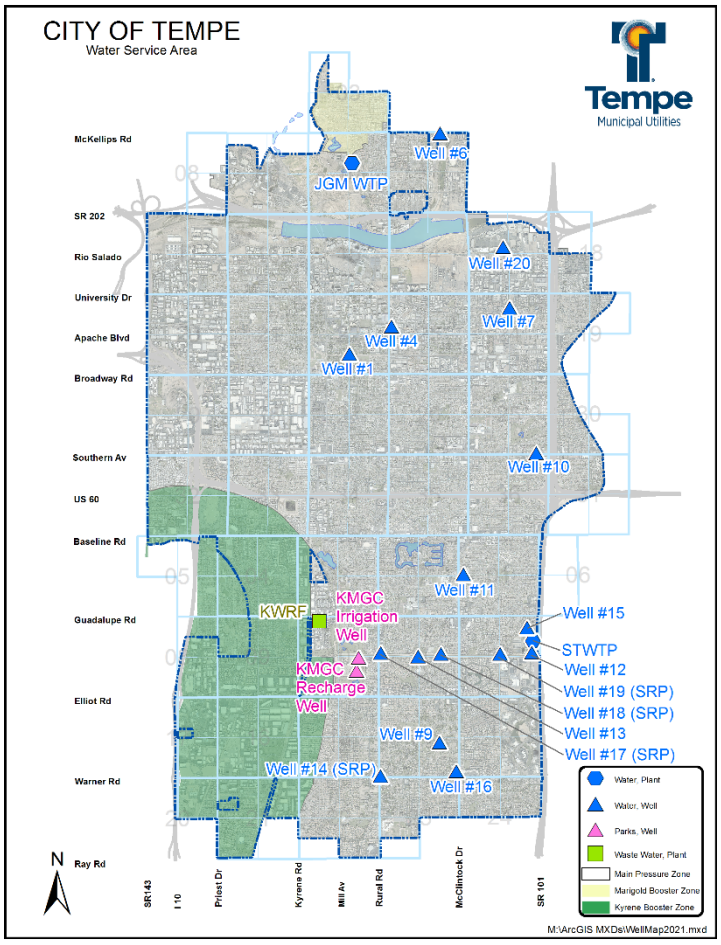



Figure 1 - Tempe Water Service Area

Tempe has been landlocked since 1974 and is bordered by the cities of Chandler to the south, Mesa and Chandler to the east, Scottsdale to the north and the Town of Guadalupe and the city of Phoenix to the west. As such, the external boundaries of Tempe's Water Service Area are not likely to grow in the future. However, significant growth through redevelopment is anticipated within the existing boundaries of the Water Service Area. This growth will be accomplished largely by increases in density, especially in the commercial and multi-family residential sectors.

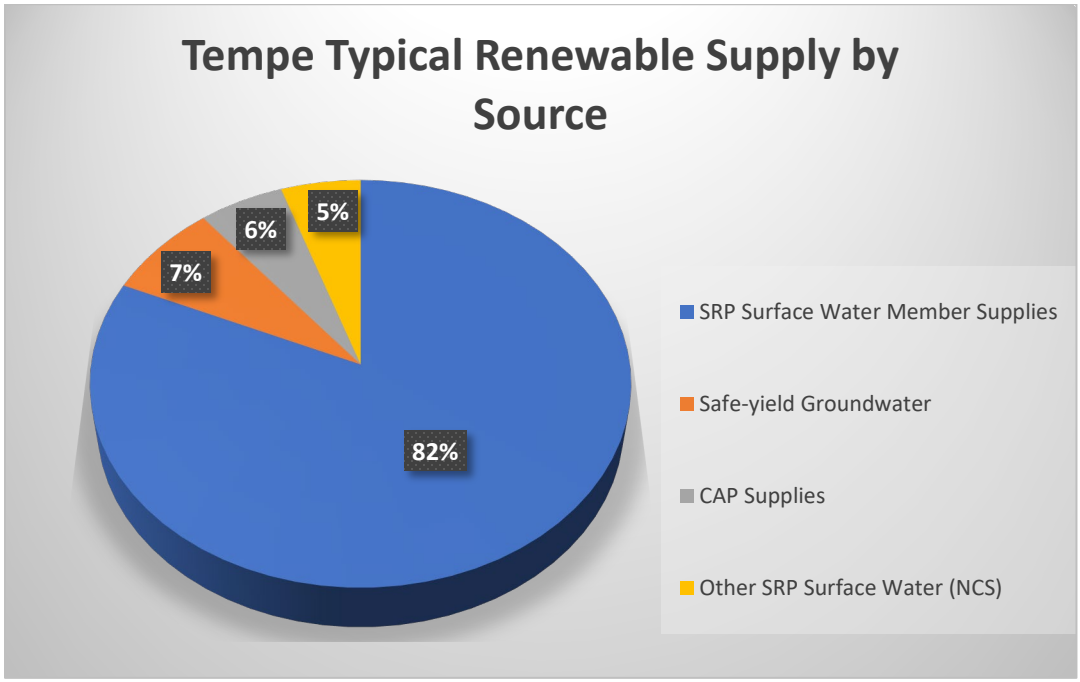
Potable water delivered to customers within Tempe's Water Service Area is produced primarily at two municipally-owned and operated surface water treatment plants: the Johnny G. Martinez Water Treatment Plant (JGMWTP) and the South Tempe Water Treatment Plant (STWTP). Both plants are rated to treat 50 million gallons of water per day (MGD), for a total surface water system treatment capacity of 100 MGD. In addition, 15 groundwater wells can be utilized to produce potable water and supplement surface water treatment. In addition to these assets, Tempe maintains groundwater wells used for irrigation, water recovery and water exchange purposes.

Tempe delivers potable water to about 43,000 customer accounts, which together constitute the majority of the water demand within the Tempe Water Service Area. Water can also be delivered directly to customers through canals and laterals, from irrigation wells, or directly from water reclamation facilities, for non-potable water uses. These uses include residential flood irrigation, irrigation at parks, athletic fields, golf courses, lakes and to meet certain industry-related demands.

## Water Resources Portfolio

The City of Tempe's water resources portfolio consists primarily of renewable resources. These include surface water, safe-yield groundwater and surface water stored in groundwater aquifers. Figure 2 illustrates the typical makeup of Tempe's renewable supplies.

Figure 2 – Average Year Allocation of Tempe Renewable Water Supplies




In some years, renewable surface water can make up almost 90 percent of Tempe's annual water supply. The surface water portion of Tempe's renewable supplies are stored and delivered by two Federal Reclamation Projects: Salt River Project (SRP) and Central Arizona Project (CAP).

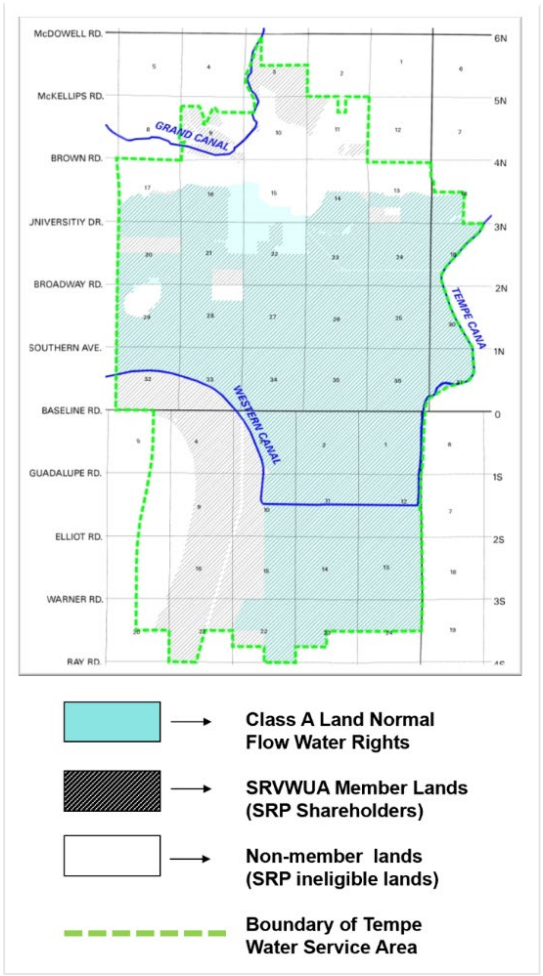
### Salt River Project (SRP)

SRP manages and delivers the majority of Tempe's surface water, and supplies power to more than one million residents in the Phoenix Metropolitan area. SRP is comprised of two primary organizations: Salt River Valley Water Users Association (SRVWUA) and the Agricultural Improvement and Power District.

#### *Salt River Valley Water Users Association (SRVWUA)*

SRVWUA is the private water association of SRP and was formed in 1903 when farmers, ranchers and other landowners in the Salt River Valley became shareholders in SRP. Together, they pledged more than 200,000 acres of their land as collateral to repay the loan for one of the first Federal Reclamation Projects in the western United States. These lands where deemed "shareholder land", also referred to as "SRP Member Lands", and receive deliveries of the water stored and developed by SRP.

Figure 3 – Water Rights within the Tempe Water Service Area




Today, SRP serves water to more than 248,000 acres in the Salt River Valley. Each year, SRP delivers more than 700,000 acre-feet (AF) of water to shareholder lands. Currently, the SRP Water Service Area is about 92 percent urbanized, with just eight percent of lands still used for agriculture.

Most of the water delivered from SRP to valley cities is appurtenant to the land, meaning that it can only be utilized to meet water demands on SRP member lands. Aside from shareholder water, SRP also delivers surface water appurtenant to Class A lands with normal flow rights (Class A lands normal flow). Figure 3 illustrates the water rights of the lands within the Tempe Water Service Area.

Normal flow is defined as the amount of water that would have reached Class A lands in a given month, were it not for the construction of the SRP system. As with shareholder lands, Class A lands have decreed water rights that can only be utilized to meet water demand on those lands. Additionally, Class A lands water rights pre-date construction of the SRP reservoir system and are considered senior water rights to SRP shareholder rights.

SRP's service area consists of lands within the water service areas of the communities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Tempe and Scottsdale. As is the case in Tempe, the majority of shareholder water delivered to these communities is treated at municipally-owned water treatment plants and delivered to SRP shareholder lands to meet their water demands.

### *SRP Agricultural Improvement and Power District (the District)*

The second component of SRP is the SRP Agricultural Improvement and Power District, typically known as "the District". The District oversees the power generation aspects of SRP's operations. The District was established in 1937 and is a political subdivision of the State of Arizona, with authority to issue bonds. This community-based, not-for-profit public utility is the largest provider of electricity in the Phoenix Metropolitan Area.

## Central Arizona Project (CAP)

In 1922, seven Colorado River basin states signed the Colorado River Compact (Compact). The Compact apportioned the use of Colorado River water among the upper and lower basin states. The upper basin states (Colorado, Wyoming, Utah and New Mexico) were allocated 7.5 million AF/year, and the lower basin states (Arizona, California and Nevada) were allocated 7.5 million AF/year. Disputes about Arizona's

share of the lower basin apportionment delayed the adoption of the Compact by the State of Arizona until 1944.

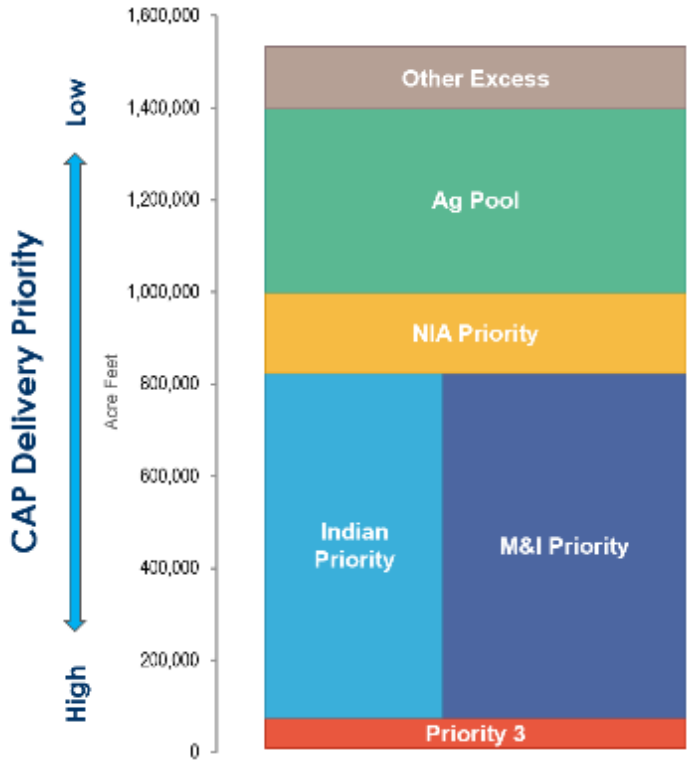
Lower Basin Colorado River Annual Allocations:

- Arizona: 2.8 million AF/year
- California: 4.4 million AF/year
- Nevada: 300,000 AF/year

Mexico is allocated 1.5 million AF/year, pursuant to a 1944 treaty with the United States.

The Colorado River Basin Project Act of 1968 authorized construction of the Central Arizona Project (CAP) system, bringing a portion of Arizona's Colorado River allocation to central Arizona. In 1971, the Central Arizona Water Conservation District (CAWCD) was created to oversee construction, operation and management of the CAP system. CAWCD is a political subdivision of the State of Arizona, with 15 elected Board members. CAP delivers about 1.5 million AF/year of Colorado River water to central Arizona, following a priority-based system. Figure 4 illustrates the CAP priority system and types of allocations.

Figure 4 - CAP Delivery Priority and Allocations




| CAP Abbreviation | Priority Name |
|---|---|
| Ag Pool | Agricultural Pool |
| NIA | Non-Indian Agriculture |
| M&I | Municipal and Industrial |
| Indian | Indian |
| Priority 3 | Priority 3 |

To facilitate deliveries, Colorado River water is pumped 336 miles from Lake Havasu, in western Arizona, to water users in Maricopa, Pinal and Pima counties. CAP supplies Colorado River water to the City of Tempe and other municipalities and industries through agreements known as Municipal and Industrial (M&I) subcontracts. Additionally, CAP supplies agricultural water users and Native American communities in Central and Southeast Arizona.

In Tempe, CAP water is primarily used to meet water demands on lands not entitled to SRP water supplies; about 20 percent of all lands within the Tempe Water Service Area. Tempe's CAP allocation amounts and mix of priorities is illustrated in Figure 5.

Figure 5 - Tempe's CAP Allocations and Delivery Priority

| | | Priority | Full Allocation (af) |
|---|---|---|---|
| | RWCD Assignment Water | NIA | 23 |
| | Current CAP Allocation | M&I | 4,315 |
| | SRPMIC Lease Water | Indian | 60 |
| | Wellton-Mohawk Exchange Water | Priority 3 | 95 |
| | **Current Total** | | **4,493** |
| Future Supplies | White Mountain Apache Lease Water | NIA | 1,800 |
| Future Supplies | White Mountain Apache Lease Water | M&I | 681 |
| | **Future Total** | | **6,974** |

## Groundwater

In 1980, The Arizona State Legislature passed a comprehensive water management bill. The 1980 Groundwater Management Act (GMA) was created primarily to address the use and overdraft of groundwater in the most populous areas of the State. To accomplish this, the GMA created the AWS Designation process, five Active Management Areas (AMAs), two Irrigation Non-expansion Areas (INAs), a comprehensive and progressively aggressive conservation management program and a State department (ADWR) to serve as a regulator. The five AMAs illustrated in Figure 6 are labeled according to their approximate geographic areas: Phoenix, Tucson, Pinal, Prescott and Santa Cruz.

Figure 6 – AMAs and INAs


Groundwater use within the AMAs is regulated by annual limits for users. The primary goal of the Phoenix AMA is to achieve safe-yield groundwater use by 2025. Safe-yield is defined as a condition where groundwater withdrawal is balanced by natural and artificial groundwater recharge to the aquifer.

The groundwater management code created by the GMA allows for water recovered from the aquifer by wells to be accounted for either as groundwater, or from other sources. Based on this rationale and findings of Tempe's AWS designation, Tempe can withdraw a limited amount of groundwater each year, while remaining aligned with the AMA-wide goal of achieving safe-yield. This annual recovery of groundwater is therefore called safe-yield groundwater. Additionally, other sources of water stored in Tempe's aquifers, through underground storage projects, can be recovered and are not considered groundwater.

Tempe's annual use of all sources of water recovered from wells has varied from 11 percent to about 24 percent of total municipal water use over the last decade.

When surface water supplies are reduced by drought, Tempe's use of groundwater may temporarily increase above safe-yield levels until watershed conditions improve. This is known as "drought exemption groundwater pumping" and requires approval from regulators. However, Tempe is committed to recovering only safe-yield groundwater annually, under normal conditions.

## Long Term Storage Credits

Tempe holds water storage permits and underground storage facility permits for several groundwater recharge projects and groundwater savings facilities-related programs.

Groundwater savings facility programs are considered "in lieu" recharge and storage projects. Tempe partners with SRP to reduce groundwater pumping through groundwater savings facilities that recharge surface water, instead of using local groundwater supplies.

Tempe has the ability to generate long-term storage credits (LTSC) by recharging three primary sources of water: CAP supplies, Salt River surface water stored behind the Modified Roosevelt Dam in New Conservation Space (NCS) or reclaimed water supplies. Stored credits generated from these sources can be recovered later through wells and utilized to supplement Tempe's supplies during times of surface water shortages.

Tempe's currently available recharge projects, which can be utilized to generate LTSC, are SRP's Granite Reef Underground Storage Project (GRUSP) and Tempe's Ken McDonald Golf Course Groundwater (KMGC) Recharge Project.

### Granite Reef Underground Storage Project (GRUSP)

GRUSP is a storage facility managed by SRP in which numerous partners in the Salt River Valley own portions of the capacity and share in the management costs. Tempe's share of GRUSP storage is about 2.35 percent of the total, or about 1,100 AF/year, depending on annual total storage at the facility. Short-term monthly storage and recovery can also be accomplished at this facility using SRP surface water supplies, but this type of storage does not generate LTSC.

### Tempe History with Ken McDonald Golf Course (KMGC) Recharge Project

Initially, the short-term recharge pilot project at Tempe's Ken McDonald Golf Course (KMGC) utilized a dry well or "vadose zone recharge well". This technology allowed for recharge of the upper alluvial aquifer using reclaimed water from the Kyrene Water Reclamation Facility (KWRF). Reclaimed water from KWRF was also used to irrigate the golf course. In 2014, upgrades to this system added an aquifer storage and recovery (ASR) injection well. Beginning in the early 2020s, additional upgrades will take place that will triple the capacity of this system and enable it to meet the original design capacity of 3 MGD or about 3,360 AF/year. Currently, Tempe stores CAP and NCS water at the facility to create LTSC. Once KWRF is re-commissioned, it will be utilized to store reclaimed water to generate additional LTSC.

## Tempe Surface Water Treatment Facilities

In the early 1960s, Tempe's Water Utility began to shift from a reliance on groundwater wells for domestic water production to the use of treated surface water to meet system demands. In 1964, Tempe ratified an agreement that allowed the City to receive and

deliver treated SRP surface water to its residents as potable water. Tempe's two treatment plants are both capable of treating 50 MGD of surface water, and together can deliver up to 100 MGD of high-quality potable water to Tempe's residents, businesses and industries.

### Johnny G. Martinez Water Treatment Plant (JGMWTP) Timeline

1965–1966: Planning, siting and survey work

1967: 20 MGD Capacity Papago Park Water Treatment Plant completed

1969: 20 MGD capacity increase for a total capacity of 40 MGD (completed in 1972)

1984: 10 MGD capacity increase for a total capacity of 50 MGD; administration buildings modified

1990s: Modifications to treatment components including the raw water flume, pre-sedimentation basins, solids handling and chemical feeding

2000s: Major upgrades to treatment components including the two-phase upgrades to most components and systems, filter rehabilitation, ultraviolet (UV) disinfection added, a new finished water pump station and of a second 12 MG reservoir

2010s: Water treatment quality upgrades including structural evaluations, repairs and upgrades

### South Tempe Water Treatment Plant (STWTP) Timeline

1974: Site acquisition

1975: 12 MGD reservoir and booster pump

1983: 20 MGD capacity South Tempe Water Treatment Plant construction completed

1984: 20 MGD capacity increase for a total capacity of 40 MGD

1990s: Modifications to facilities including reservoir liner, improvements to the grounds, water quality laboratory expansion and reservoir rehabilitation

2002: 10 MGD capacity increase for a total capacity of 50 MGD

2000s: Major upgrades to treatment components including chemical systems and UV disinfection technology

2010s: Major upgrades to treatment components including replacing the liner and grout in sedimentation basins, structural repairs, drying beds and disinfectant system; new water quality laboratory constructed and water treatment quality upgrades

## Reclaimed Water

The majority of wastewater collected throughout Tempe's Water Service Area is treated regionally at the 91st Avenue Wastewater Treatment Plant (WWTP) in Phoenix. This facility is operated by the City of Phoenix for the benefit of a collection of municipalities known as the Sub-Regional Operating Group (SROG). SROG is comprised of the cities of Phoenix, Glendale, Mesa, Scottsdale and Tempe. These municipalities jointly own the 91st Avenue WWTP and associated transmission infrastructure. Effluent, or reclaimed water, produced at the 91st Avenue WWTP is primarily used as cooling water at Arizona Public Service's (APS's) Palo Verde Nuclear Generating Station, with smaller portions used for irrigation by the Buckeye Irrigation

Company and for a riparian habitat project at the Tres Rios Constructed Wetlands Project.

Reclaimed water produced locally at KWRF can be used for irrigation at KMGC, for industrial water uses and cooling at SRP's Kyrene Electric Generating Station and for groundwater aquifer storage. Operations at the KWRF were temporarily discontinued in 2010 due to a significant reduction in overall City-wide wastewater flow. Forecasts at that time indicated that economic conditions would improve by the mid-2020s, and there would be a greater need for more flexibility in Tempe's water resources portfolio. WUD is currently developing a roadmap to bring the KWRF back on-line as early as 2025.

## SRP Direct Delivery Sites

Numerous sites within Tempe's water service area receive direct delivery of non-potable water from SRP canals and laterals. These sites include KMGC and Tempe's Rolling Hills Golf Course, riparian habitat projects, several ponds and lakes, numerous city parks and athletic fields and SRP's Kyrene Electric Generating Station. SRP also delivers water directly to SRP shareholders for residential irrigation use in Tempe.

## Assured Water Supply (AWS) Designation and Demand

The AWS Designation process was developed as part of the 1980 Groundwater GMA to ensure that water providers within an AMA demonstrate the physical, legal and continuous availability of supplies to meet the demands of their water service area for a minimum of 100 years.

The City of Tempe received a designation of AWS (AWS 97-007, Decision and Order No. 26-002043) from ADWR on December 31, 1997, by demonstrating the availability of sufficient groundwater, SRP surface water, CAP/Colorado River water and reclaimed water to meet the demands of the water service area for 100 years.

To encourage responsible use of groundwater, the GMA requires that AWS designations be re-evaluated every 15 years by a process called modification. Tempe's most recent modification (AWS No. 2010-013, Decision and Order No. 86-2043.0001) was approved on September 29, 2010. Tempe will be required to update supply projections and apply for a modification to its AWS Designation in 2025. Work on this application has commenced, as the modification process is complex and filing for the 2025 designation must be completed no later than December 31, 2023.

In 1997, Tempe demonstrated the availability of 77,222 AF/year for use in the water service area for 100 years. By 2010, Tempe demonstrated 88,518 AF/year. This increase of about 14 percent illustrates Tempe's success in effectively managing its water supply portfolio, while continuing to seek and add additional water resources and infrastructure to meet future demands.

At the time of the AWS Designation in 1997, Tempe had stored 35,200 AF of renewable water supplies in local aquifers as LTSC. As of 2019, Tempe has stored more nearly 81,000 AF of renewable water supplies in local aquifers and is committed to increasing its underground storage program by adding infrastructure to accomplish a higher rate of aquifer storage in the future.

Tempe's 2010, AWS Designation includes the following water supplies:

- SRP (SRP stored water + Class A land normal flow) = 65,000 AF/year
- CAP (CAP M&I subcontract) = 4,315 AF/year

- Other CAP (CAP water through settlements and assignments) = 178 AF/year
- Modified Roosevelt Dam NCS = 4,200 AF/year
- Effluent (reclaimed water from KWRF) = 7,798 AF/year
- Total Groundwater (groundwater allowance + incidental recharge allowance) = 6,071 AF/year
- Existing LTSC = 956 AF/year

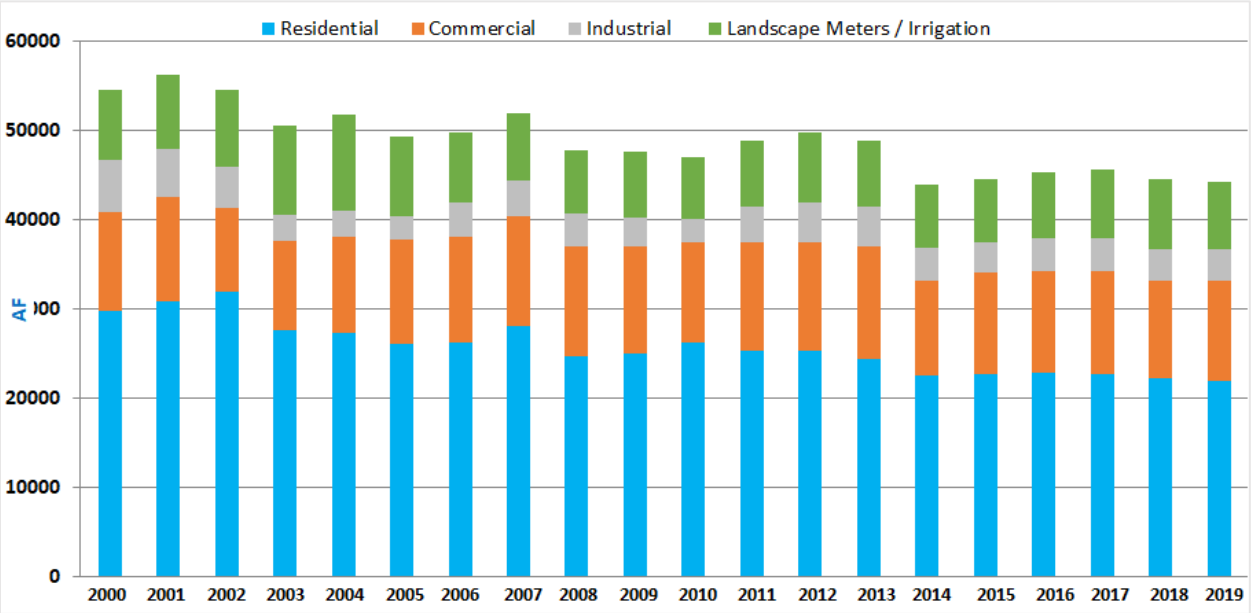
**Total Tempe AWS (all sources) = 88,518 AF/year for 100 years**

Supplies identified in the 2010 AWS Designation are about 49 percent greater than Tempe's water service area water demand in 2019, approximately 45,000 AF. Available water supplies outlined in Tempe's 2010 AWS designation are more than 20 percent greater than the highest projected water demand for 2050.

## Water Demands for the Tempe Water Service Area

Since the early 2000s, water demands for the Tempe Water Service Area have been steadily declining.

Figure 7 – City of Tempe: Metered Water Use by Customer Classification (in AF)




While due to many factors, Tempe's water conservation and efficiency efforts, and the types of development and re-development occurring within the water service area, are largely responsible for the declines observed in water demands. It is likely that water demand will flatten and then increase slightly as Tempe's population continues to grow toward buildout. Demand projections are utilized to ensure that Tempe continues to maintain sufficient supplies to meet water demands now and into the future.

### Water Demand Projections

The central focus of the Water Resources Master Plan is to ensure Tempe's water resources portfolio is diverse and resilient to meet current and future demands of the water service area. Demand forecasting for infrastructure planning was an integral part of Tempe's Water and Sewer Master Plan effort, completed in 2016. The methodology

utilized in that effort analyzed historical water use for each land use category and projected demands into the future based on population and development characteristics found in Tempe's General Plan 2040. Building on work of the Water and Sewer Master Plan, the demand data displayed in Table 1 contains updated information on Non-SRP member land demands, based on average water demands observed between 2014-2019.

Table 1 – Tempe Water Service Area Projected Demands (AF)

| **Projection Based on High Demand[1]** | | | | | |
|---|---|---|---|---|---|
| | **2020** | **2025** | **2030** | **2040** | **2050** |
| SRP[2] Member Demands | 53,409 | 56,276 | 59,143 | 60,582 | 60,649 |
| SRP Non-Member Demands | 5,104 | 5,719 | 6,546 | 6,791 | 6,798 |
| Total Demands High Projection | 58,513 | 61,995 | 65,690 | 67,373 | 67,447 |
| | | | | | |
| **Projection Based on Probable Demand[1]** | | | | | |
| | **2020** | **2025** | **2030** | **2040** | **2050** |
| SRP[2] Member Demands | 43,794 | 45,337 | 46,881 | 47,655 | 47,707 |
| SRP Non-Member Demands | 5,071 | 5,278 | 5,736 | 5,873 | 5,879 |
| Total Demands Probable Projection | 48,865 | 50,615 | 52,617 | 53,528 | 53,587 |
| | | | | | |
| **Projection Based on Low Demand[1]** | | | | | |
| | **2020** | **2025** | **2030** | **2040** | **2050** |
| SRP[2] Member Demands | 41,285 | 42,505 | 43,724 | 44,336 | 44,385 |
| SRP Non-Member Demands | 4,862 | 4,971 | 5,338 | 5,447 | 5,453 |
| Total Demands Low Projection | 46,147 | 47,475 | 49,063 | 49,784 | 49,838 |

(1) Includes direct deliveries of non-potable water
(2) SRP Member Lands includes SRVWUA lands and Class A Normal Flow lands demand

The projection, based on high annual demand in Figure 8 indicates the demand for SRP member lands within the Tempe Water Service Area in 2050 will be 60,649 AF, with an additional 6,798 AF needed for non-member demands.

Figures 8 and 9 illustrate how Tempe plans to meet the water demands of SRP member and non-member lands through 2050.

Figure 8 – Projected Demands of SRP Member Lands and Supplies (AF)

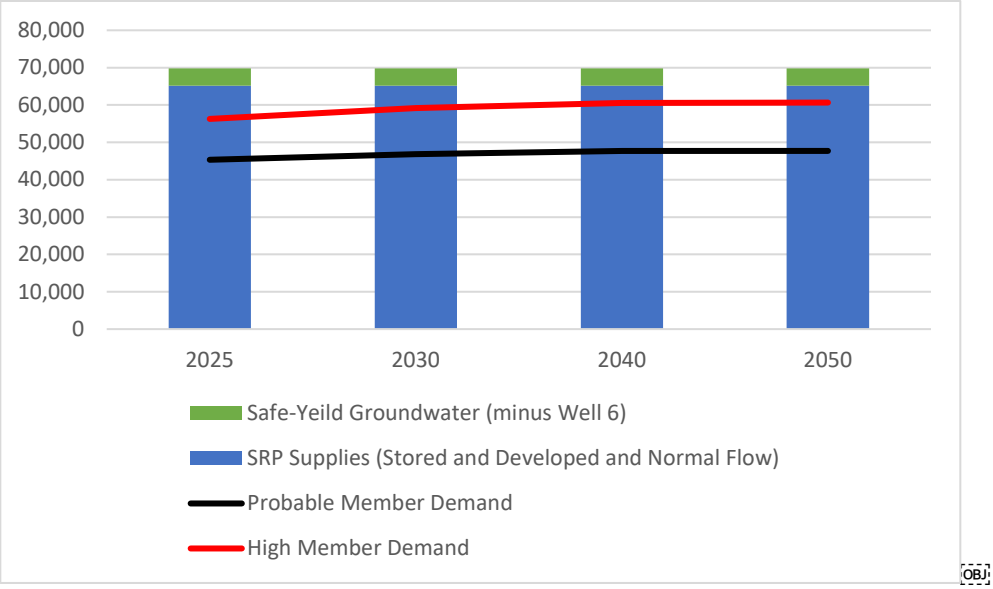
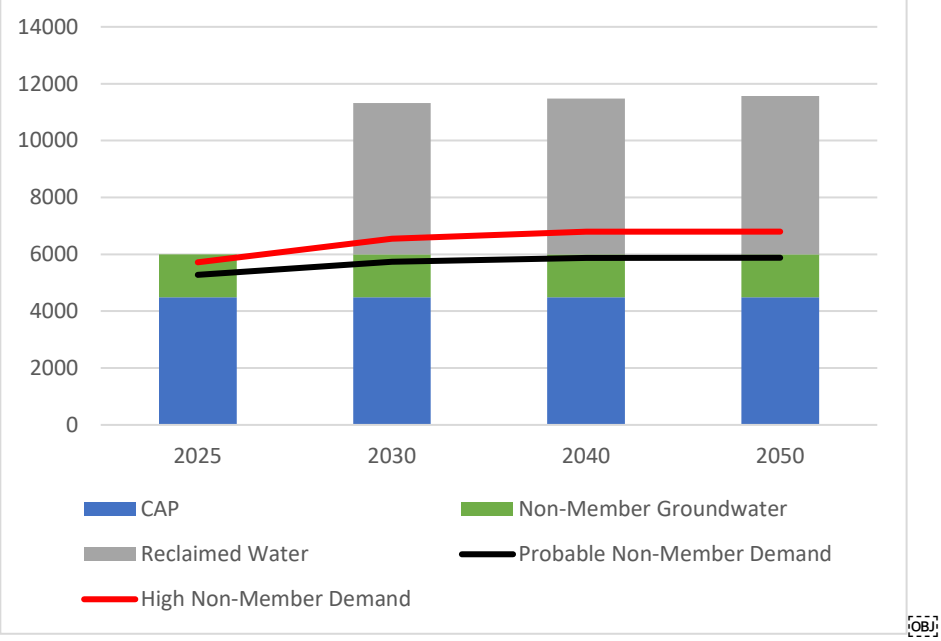



Figure 9 – Projected Demands of SRP Non-member Lands and Supplies (AF)




# Water Resources Planning Strategies and Tactics

The following section provides the strategies and tactics the City will pursue to ensure Tempe maintains a diverse and resilient water supply portfolio to provide high-quality water from reliable sources at the highest possible value to utility customers.

## Strategy: Prioritize utilization of renewal resources as the primary means to meet current and future demands and protect Tempe's access to those supplies

Tempe has a long history of reliance on renewable and sustainable surface water supplies. WUD works cooperatively with water supply agencies such as SRP, CAP, the U.S. Bureau of Reclamation, and Regulators such as ADWR and the Arizona Department of Environmental Quality to protect Tempe's renewable water supplies.

### Tactic: Reliance on renewable surface water supplies and protection of rights

Tempe is committed to protecting existing rights to Salt and Verde River water supplies for all lands in the Tempe Water Service Area. These rights include those pursuant to decreed Class A normal flow lands, SRP shareholder member lands and SRP NCS surface water supplies. Surface water supplies from the Salt and Verde rivers, delivered by SRP, are the largest component of Tempe's AWS. The City continues to work closely with SRP to protect these rights from infringement by other parties with junior rights, or users with no established rights to these surface water supplies. Tempe will continue to be proactive in protecting its water resources through active participation in the Gila River General Stream Adjudication and ongoing water rights settlement negotiations with SRP, CAP, the United States, Indian Communities, cities and other water users. Tempe will continue to fully utilize its annual CAP M&I water subcontract allotment for non-member land demand and groundwater recharge to create LTSC.

- Participate in Colorado River and CAP water users' stakeholder groups to protect Tempe's interests in Colorado River water supplies.
- Remain engaged in the Arizona Gila Stream Adjudication through close collaboration with the Tempe City Attorney's Office and dedicated legal consultant support.
- Protect water resources and maintain critical habitat through participation in the National Environmental Policy Act (NEPA) and following Environmental Impact Statement (EIS) procedures and habitat conservation plans (HCPs) at Roosevelt Lake and the Salt River watershed, Bartlett and Horseshoe lakes, the Verde River watershed and along the lower Colorado River.
- Continue to participate in regional policy and water supply planning efforts through membership in the Arizona Municipal Water Users Association (AMWUA), the East Valley Water Forum, through Arizona's participation in the Colorado River Drought Contingency Plan and other water users' stakeholder groups.

## Strategy: Provide the highest level of water resiliency at the highest possible value

Tempe's water utility is operated such that necessary costs associated with water supply and resiliency are planned for and allocated consistent with efficient financial and business practices, in order to ensure water and wastewater rates remain among the lowest in Arizona.

## Tactic: Properly maintain assets, carefully evaluate system expansions and control expenditures to ensure utility rates, fees and charges remain reasonable for all customers

- Assure proportional cost of service allocation across customer classifications and implement necessary water and wastewater revenue adjustments to minimize impacts to utility customers.
- Develop and implement business models to operate Tempe's water and wastewater treatment facilities and infrastructure in the most efficient and cost-effective means possible.
- Design water and wastewater treatment expansions and technology enhancements at the most cost-effective facilities on a per-unit treatment cost basis.
- Utilize innovative and efficient technology at WUD facilities to reduce operating costs.
- Perform strict enforcement of Tempe's wastewater pretreatment ordinance.
- Continue to offer convenient and efficient payment options for utility customers.

The following structure of rates, fees and charges for water services was adopted by the Tempe City Council, effective January 3, 2021:

Table 2—Tempe Water Rate Schedule

| Monthly Water Volume Charge per Thousand Gallons | |
|---|---|
| Multi-Family | $2.05 |
| Commercial | $2.65 |
| Industrial | $2.77 |
| Landscape | $3.96 |
| Construction | $4.07 |
| | |
| Single Family Residential (tiered rates depending on monthly usage) | |
| Tier 1 (0-6,000 gallons) | $1.84 |
| Tier 2 (6,001-12,000 gallons) | $2.83 |
| Tier 3 (12,001-20,000 gallons) | $3.89 |
| Tier 4 (20,001-40,000 gallons) | $4.93 |
| Tier 5 (40,001+ gallons) | $5.42 |
| | |
| Monthly Service Charge per Meter Size | |
| 5/8" | $13.15 |
| 3/4" | $14.85 |
| 1" | $22.15 |
| 1.5" | $47.00 |
| 2" | $91.60 |
| 3" | $207.25 |
| 4" | $298.70 |
| 6" | $1,148.55 |
| 8" | $2,004.35 |
| 10" | $3,002.80 |

## Strategy: Strategically acquire new water sources and renewable supplies whenever feasible opportunities exist

The City of Tempe has sufficient renewable surface water supplies to meet projected future water demands on SRP member lands. SRP member lands represent about 80 percent of all lands within the water service area. For the 20 percent of the Tempe Water Service Area located on non-member lands, additional renewable water supplies should be developed to secure existing supplies and assure a more dependable annual supply of sustainable water resources for these areas.

Reclaimed water will continue to be an important component of Tempe's long-term renewable water resource portfolio. The objective is to fully utilize this resource when and where it is available for a wide range of non-potable water uses and feasible to do so. The use of reclaimed water conserves the use of surface water and/or groundwater supplies and reclaimed water can be used for water exchange purposes, resulting in greater water use efficiency.

### Tactic: Secure new surface water supplies (CAP, Colorado River, Salt and Verde) for the Tempe Water Service Area through participation in innovative storage project, reallocations of existing sources and/or long-term leases of existing water rights for future non-member land demands

- Tempe has secured a 100-year lease of Colorado River (CAP) water from the White Mountain Apache Tribe (WMAT) through a comprehensive water rights settlement agreement. In as early as 2023, Tempe will lease 2,481 AF/year of CAP water under the terms of this lease agreement.
- Tempe is evaluating participation in two innovative storage modification projects associated with SRP's reservoirs, which have the potential to create additional supplies of renewable surface water.

### Tactic: Maximize Tempe's ability to store CAP, Colorado River, Roosevelt Dam NCS Salt River and reclaimed water for LTSC and future recovery

- Develop additional groundwater recharge and underground storage facility capacity.
- Recommission KWRF and provide reclaimed water for industrial use at the SRP Kyrene Generating Station, for irrigation use at the KMGC or other future reuse sites, in exchange for surface water credits from SRP.
- Work with SROG at the 91st Avenue WWTP to maximize the use of uncommitted reclaimed water from that facility through groundwater recharge projects, water reuse projects or water exchanges.
- Increase annual recharged water quantity to reach current permitted capacity.
- Explore other partnerships for wastewater treatment and reclaimed water reuse.
- Investigate the potential for mutually beneficial water exchanges with other water users.

## Strategy: Manage groundwater rights to maintain safe-yield levels of annual pumping to meet Tempe's demands now and in the future

Challenging source water conditions created by drought and wildfires on the watershed have created an operational reliance on groundwater as a treatment strategy.

### Tactic: Identify and implement improvements to increase surface water treatment capability at Tempe's water treatment plants

Changes to watersheds have led to higher levels of total organic carbon and turbidity in source water. Challenging source water quality, combined with challenges associated with formation of disinfection byproducts in the distribution system, has led to the operational and process control practice of utilizing groundwater blending to ensure high quality potable water reaches all of Tempe's customers. Since 2005, Tempe has periodically installed technology improvements at its two water treatment plants including enhanced coagulation, improved solids handling, UV disinfection, optimized chlorine dosage and reservoir aeration. While these improvements have positioned the water treatment plants to better address challenging raw water quality conditions, the Water Utility is not yet able to fully transition the water system to an on-going operational strategy of utilizing groundwater wells solely as a backup to available surface water supplies. Additional improvements are being planned and implemented, which will prepare Tempe to handle future challenging watershed water quality conditions with less reliance on groundwater wells.

### Tactic: Utilize groundwater capacity and infrastructure strategically

Tempe's early agricultural heritage and decades of water management partnerships and agreements have provided current residents and business owners with a strong and secure portfolio of renewable surface water supplies. Class A land normal flow surface water supplies with senior water rights, SRP surface water supplies in storage for SRP member lands, CAP contract Colorado River water supplies and Roosevelt Dam NCS Salt River water supplies can provide for nearly all of Tempe's potable water supply needs each year. The City's surface water supply portfolio allows Tempe to limit the use of groundwater resources to primarily an operational back-up water supply in meeting water demands, by supplementing one or both of the surface water treatment plants or for supplemental water supply during times of drought.

Under the terms of Tempe's AWS Designation and Arizona's AWS Rules, the City is limited in the annual amount of groundwater it may withdraw to safe-yield pumping, and to a groundwater allowance account for the Tempe Water Service Area. Tempe will limit its annual use of groundwater to the volumes allowed under the AWS Rules and use aquifer storage and recovery of renewable water supplies when available. The objective for groundwater resources is to maintain safe-yield levels of groundwater withdrawals so these supplies are reserved as an emergency back-up water supply and to supplemental water supply during times of drought.

- Shift usage of Tempe's supply for non-member land demands from CAP to safe-yield groundwater pumped from wells located on non-member lands, while adjusting overall groundwater usage to remain within the safe-yield pumping allowance. This will allow for greater flexibility in maximizing Tempe's current non-member land sources, while providing greater demand management during shortage conditions.
- Develop a framework for the minimum quantity of LTSC required to ensure Tempe can continue to meet current and future demands, provide operational flexibility to meet surface water quality challenges and remain prepared for drought conditions that may require additional pumping of groundwater. The current amount of Tempe's LTSC is 72,000 AF. Further details of how this value was derived, and actions that should be taken should Tempe approach this value, can be found in the Drought Preparedness Plan.

- Limit groundwater pumping and LTSC recovery from wells to use for water quality blending, operational back-up, emergency water supply conditions or as a supplemental supply during shortage conditions.
- Monitor the use of groundwater throughout the year and determine when the use of alternative sources of water accounting for water recovered is required. This may include monthly storage and recovery and the use of Tempe's LTSC.
- Develop annual groundwater use plans tied to SRP water allocations and reservoir storage levels, the current amount of NCS water in storage and CAP water contracts. In years with a full 3.3 AF/acre water allocation for SRP member lands, no shortage reductions in the CAP M&I water supply and near normal deliveries of Class A land surface water, there should be no need for groundwater use above safe-yield pumping. When any one or a combination of surface water supplies are reduced because of drought conditions, the annual groundwater use plan may be adjusted to provide a temporary increase in groundwater use within the limits of the drought groundwater exemption set by the ADWR AWS Rules.

## Strategy: Develop new infrastructure and maintain current assets to protect Tempe from the impacts of prolonged drought

Tempe's municipal water system is made more resilient with a greater level of redundancy between surface water treatment plant production and groundwater well production. Increasing Tempe's recovery well production capacity provides additional back-up water supply for use during droughts, emergencies or conditions that limit surface water treatment capacity. Tempe currently maintains nine municipally-owned recovery wells that can produce nearly 20 MGD of potable water, independent of water treatment plant operations. Additional sources of supply from direct connect wells brings the total recovery well production available to more than 30 MGD. In 2018, Tempe added a new production well, which can produce nearly 6 MGD. Capital improvement projects are on-going and include upgrades to water delivery pipelines, siting and development of new production wells (with a priority on non-member lands) and on-going rehabilitation and updates to many of Tempe's existing wells.

### Tactic: Continue implementing groundwater production/recovery well projects outlined in the Water Capital Improvement Program (CIP)

- The current CIP budget includes funding for two new production/recovery wells to be designed over the next five years, one well to be re-drilled and re-equipped and one well to be purchased from a third party and equipped.
- Implement production performance and/or water quality rehabilitation projects at several older municipal production/recovery wells. Tempe has an ongoing CIP project to rehabilitate and upgrade existing wells in the water service area. One to two production/recovery wells will be scheduled for repairs and upgrades each year.
- Implement wellhead treatment for wells with limited production due to current/future regulatory requirements.
- Increase total municipal production/recovery well capacity in the Tempe Water Service Area from the current level of approximately 30 MGD, to 45 MGD by 2040.
- Continue to work with partners at SRP to develop joint use production well projects within the Tempe Water Service Area.
- Examine other partnership opportunities for sharing production/recovery well capacity, to be used for supplemental drought supply and aquifer management.

## Strategy: Increase the resiliency of the Water Utility from the impacts of prolonged drought by developing new groundwater recharge capacity and increase utilization of reclaimed resources

WUD is pursuing new opportunities to increase direct groundwater recharge facility capacity at KMGC Groundwater Recharge Project and continues to pursue securing of additional firm or leased capacity at other groundwater recharge facilities, as opportunities become available.

### Tactic: Fully utilize Tempe's water supplies (CAP, SRP NCS and reclaimed water supplies when available) to recharge Tempe's aquifers

- Continue to participate in partner's direct recharge projects like GRUSP and other facilities being developed or that Tempe does not currently utilize.
- Upgrade KMGC Recharge Project by installing and equipping two additional ASR recharge wells by 2025. These upgrades will allow recharge of the full permitted capacity of the storage facility: 3,363 AF/year.
- Explore and develop opportunities to store water from other providers in Tempe's aquifers.

## Strategy: Utilize targeted water conservation and efficiency outreach, innovative demonstrations and measurable programs whenever possible to continually improve water use efficiency in the residential, commercial and industrial sectors of Tempe's community

Tempe's Water Conservation Program is a regulatory requirement that ensures all water in the service area is used efficiently, through effective water-saving best practices and targeted outreach. The Conservation Program includes tactics that guide how Tempe maintains a robust and resilient water resources portfolio, appropriate to meet the current and future needs of the community.

### Tactics: Maintain a Water Conservation and Efficiency Program that is effective, targeted to Tempe and measurable

- Promote water use efficiency.
- Maintain and advance quality of life.
- Support water utility resiliency.
- Provide customized, targeted and intelligent programs that are tied to water and revenue savings whenever possible.
- Reduce water waste from leaks, overwatering, evaporation and street runoff.
- Inspire water consciousness and appreciation.
- Support and benefit from regional water conservation efforts and collaborations.

For information on Tempe's Conservation Program, see Tempe's Water Conservation Strategic Plan.

## Strategy: Establish water resources planning guidelines that consider the water rights status of lands slated for development and redevelopment projects

WUD will work with other sections, divisions and departments in the City to inform industries and commercial enterprises that are considering locating to Tempe about its top-rated water and wastewater utility services.

### Tactic: Collaborate with Tempe's Economic Development Office and the development community to ensure water usage is considered as part of Tempe's planning process

As development is planned in Tempe's Water Service Area, it is critical to evaluate the water rights status of the land where development is expected to occur. Larger, water-intensive industry for example, should be located primarily on lands holding the most diverse and senior water rights portfolio. In the Tempe Water Service Area, these areas include SRP member lands and lands that have Class A land decreed water rights, which represents about 80 percent of all lands within the city.

An additional planning tool guiding non-residential development involves close coordination between WUD and Tempe's Economic and Community Development teams.

Water Conservation staff identify new and innovative technologies aimed at increasing water use efficiency and water recycling in all sectors. This effort may involve the examination of potential alternative water supplies for use in the non-residential sectors, such as reclaimed water or on-site recovery wells.

Understanding and properly locating industrial water users is a critical part of ensuring Tempe's future water supplies. This need has been heightened since the end of the great recession, when many municipal water providers in the Valley struggled with challenges posed by high-visibility, high water use industrial developments. The City could explore the creation of an ordinance that could be utilized to ensure that potential impacts on Tempe's water resources by proposed development are considered during the existing planning process.

# Water Supply Augmentation

Planning for water supply augmentation is critical to ensuring Tempe maintains sufficient sources of water supplies prior to a prolonged drought that results in shortages. With a comprehensive water portfolio, different surface water supplies can be impacted differently during shortages. Additionally, developing additional water sources for use during a shortage involves recovering groundwater supplies and stored water from aquifers, and providing the necessary water infrastructure to recover, deliver, treat and distribute these supplies.

## Strategy: Development of New Supplies

### Tactic: Develop additional sources of surface water supplies through settlement agreements and infrastructure projects

A key component of Tempe's water resources strategy is to enhance water supplies through comprehensive water rights settlements. These settlements can include many partners like the United States, Indian communities, water agencies (SRP and CAP), other municipalities, irrigation and agricultural improvement districts and other water

users in Arizona. Water rights settlement agreements enable legislation that can avoid costly and protracted legal battles over water supplies, while providing greater certainty for all water users. In the past, Tempe has entered into comprehensive water rights settlement agreements with the Fort McDowell Indian Community, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe and the Gila River Indian Community. Tempe and other Arizona water users are parties to a comprehensive water rights settlement agreement called the Arizona Water Settlement Agreement and Congressional Arizona Water Settlement Act of 2004. This agreement protects rights to water supplies from the SRP and CAP and makes certain CAP Colorado River water supplies are available to facilitate future Indian community water rights settlements.

In 2009, Tempe and several partners entered into a comprehensive water rights settlement agreement with the White Mountain Apache Tribe (WMAT). Included in the settlement agreement (and the Congressional Act of 2009) were provisions to construct a dam on the North Fork of the White River, a water treatment plant and a water delivery system for communities on the WMAT Indian Reservation in eastern Arizona. The WMAT was also provided with 25,000 AF of CAP Colorado River water, which can be leased to other parties as a source of revenue. The WMAT Tribal Council voted to offer its CAP Colorado River water to other parties in the WMAT Settlement Agreement under the terms of a 100-year lease.

Tempe City Council approved the WMAT Settlement Agreement and the terms of the 100-year lease in 2009. With the signing of this agreement, Tempe will have the ability to lease 2,481 AF/year of CAP water from the WMAT for 100 years. The anticipated enforceability date of the WMAT Settlement Agreement is in the mid-2020s, at which time Tempe will make the initial lease payment to the WMAT and begin scheduling delivery of this additional CAP Colorado River water for use in the Tempe Water Service Area.

### Tactic: Increase utilization of reclaimed water to ensure ability to meet projected demands

Current operational practices of utilizing groundwater well capacity to mitigate water quality challenges have led to an ongoing reliance on LTSC.

Figure 10 – Long-term Storage Credits (acre-feet)

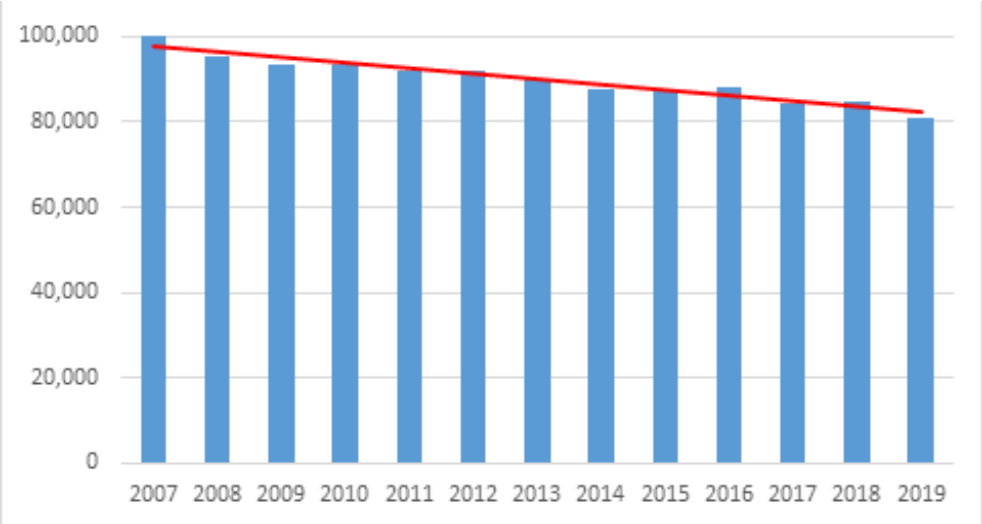
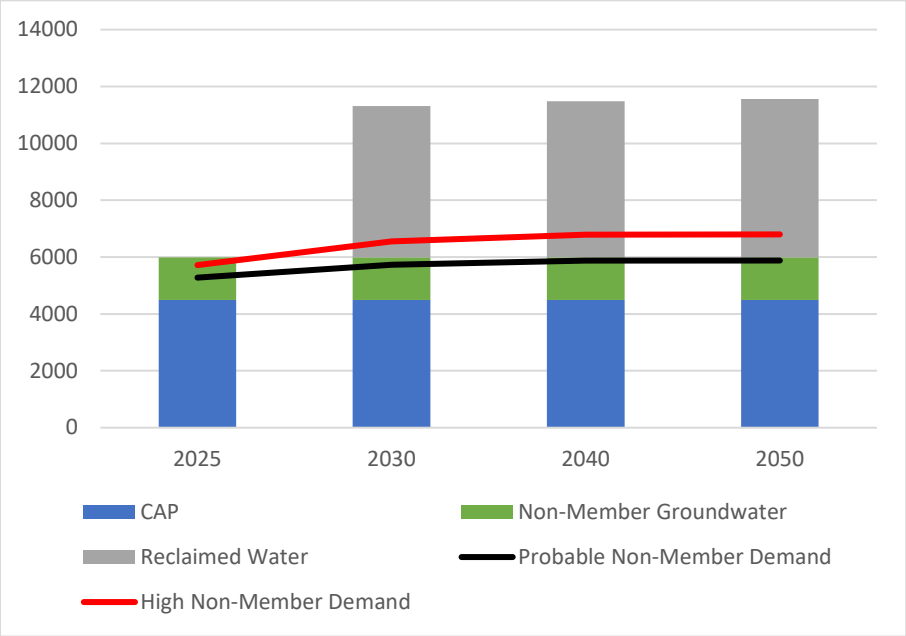


Figure 11 illustrates Tempe's non-member land projected demands, which may exceed existing renewable surface water supplies as early as 2030.

Figure 11 – Non-member Projected Demands and Supplies (AF)




It is also becoming more likely that CAP supplies, including Tempe's lease of WMAT water, will be reduced due to shortages on the Colorado River.

To address, in part, this potential supply shortfall, re-commissioning of the KWRF will provide the opportunity (and resource) to exchange reclaimed water with SRP to meet non-member demand and generate LTSC. Based on demand projections and LTSC utilization, this would preferably occur in 2023.

## Strategy: Increase groundwater and recovery well production capacity for back-up water supply and supplemental drought supply. Increase Tempe's groundwater and recovery well production capacity to 45 MGD by 2040.

### Tactic: Maintain a capital improvement program that accomplishes the following goals:

- Increase groundwater and recovery well production capacity from approximately 30 MGD to 45 MGD to match the equivalent to average daily water demand in the Tempe Water Service Area.
- Continue funding on-going rehabilitation of older municipal wells at a rate of one to two per year to improve production, performance, reliability and water quality.

## Strategy: Utilize all available sources to meet demand when surface water supplies are reduced due to shortages.

### Tactic: Utilize ADWR groundwater exemption when surface water drought is declared.

When SRP stored surface water allocation was reduced in 2003 and 2004, Tempe was eligible for an AWS drought exemption for groundwater from ADWR. This exemption allowed Tempe to pump groundwater above safe-yield levels in both years. Tempe requested approval from ADWR for a drought exemption of 8,622 AF of municipal groundwater use in 2003, and 10,908 AF of municipal groundwater use in 2004. The drought exemption groundwater volumes for those years were not deducted from Tempe's AWS groundwater allowance. This strategy will be utilized again should a shortage that impacts Tempe's renewable surface water supplies be declared.

### Tactic: Maximize storage of CAP or NCS surface water or reclaimed water in aquifers during non-drought conditions for future recovery during surface water shortages conditions.

Tempe has more than 80,000 AF of surface water and reclaimed water (predominantly CAP Colorado River surface water) in storage in groundwater aquifers through direct or in-lieu recharge projects.

### Tactic: Maximize groundwater recharge capacity at KMGC Groundwater Recharge Project by drilling and equipping two new ASR recharge wells.

WUD drilled the first ASR recharge well at KMGC in 2014, and started recharging that same year. Two additional ASR recharge wells are in the planning stages and are expected to be drilled and equipped by 2022.

### Tactic: Increase direct municipal use of available excess CAP Colorado River surface water when available and acquire available CAP or NCS Salt River surface water supplies from other users to partially offset reductions in SRP stored water allocations due to drought.

Tempe will monitor other users' CAP usage and express willingness to partner with other users to store excess CAP, preferably to Tempe's accrual of LTSC, within Tempe's aquifer, whenever an opportunity to do so occurs. Municipalities with excess CAP may consider shifting these allocations to Tempe through "hand in hand agreements" or provide willingness to take delivery of other M&I subcontract allotments for storage in Tempe facilities. These arrangements will benefit Tempe regardless of which entity accrues the LTSC.

### Tactic: Maintain and promote a comprehensive water loss control program.

Tempe continues to be compliant with all regulations governing water loss control. To promote an even greater comprehensive water loss control program, Tempe conducts annual leak surveys of the water distribution system to identify specific areas of concern for repair and replacement. In 2018, for example, a leak survey indicated fire hydrants as the primary source of system leaks. In response, WUD implemented a proactive Fire Hydrant Maintenance Program in 2018. Between January 2018 and June 2019, Tempe serviced all 9,222 fire hydrants within the City using updated strategies and procedures. The City continues to perform maintenance on each hydrant once every two years to assure reliable operation and no water leakage.

Tempe conducts water system audits annually. Guided by the American Water Works Association's Manual M36, and with support from industry experts, Tempe's water system is thoroughly evaluated for leaks and losses. This effort is an important part of Tempe's Water Loss Control Program. Data gathered from audits is combined with leak survey data and allows for additional efforts to ensure all water produced and delivered by the Utility reaches its intended usage. Maintaining a water distribution system with a low rate of leaks and losses sets an example for customers and demonstrates the importance Tempe places on water. It also aids efforts to be as prepared as possible when faced with the challenges posed by prolonged drought.

## Strategy: Ensure the Utility has the tools in place to meet supply challenges created by prolonged drought.

For the purposes of this plan, drought is defined as a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group or environmental purpose. Droughts are the result of many factors that are largely beyond the control of a large municipal water utility. In contrast, shortages caused by droughts can be planned for and potentially mitigated if they are anticipated with significant lead time. Therefore, it is critical to understand how and when droughts have the potential to create shortages.

For surface water supplies, drought leads to less precipitation, less runoff, less surface water supplies and ultimately results in shortages. However, since Tempe's Water Service Area is located outside the geographic boundaries of the watersheds that provide it with surface water supplies, it is possible that Tempe may experience a prolonged drought while the watersheds that provide its water do not, or vice versa.

Regional droughts also occur. While SRP's Salt and Verde River watersheds, and CAP's Colorado River watershed, may be simultaneously impacted by a regional drought, they may each respond quite differently. Recent studies indicate that the Salt and Verde Rivers may be up to four times more resilient to drought than the Colorado River. Due to these factors, it is critical to understand and monitor drought on these watersheds and use this data to predict and plan for potential shortages.

### Tactic: Maintain a detailed and effectively communicated Drought Preparedness Plan

The Drought Preparedness Plan ensures Tempe has strategies in place to predict, prepare and react to shortages in order to meet the demands of the water service area now and into the future.

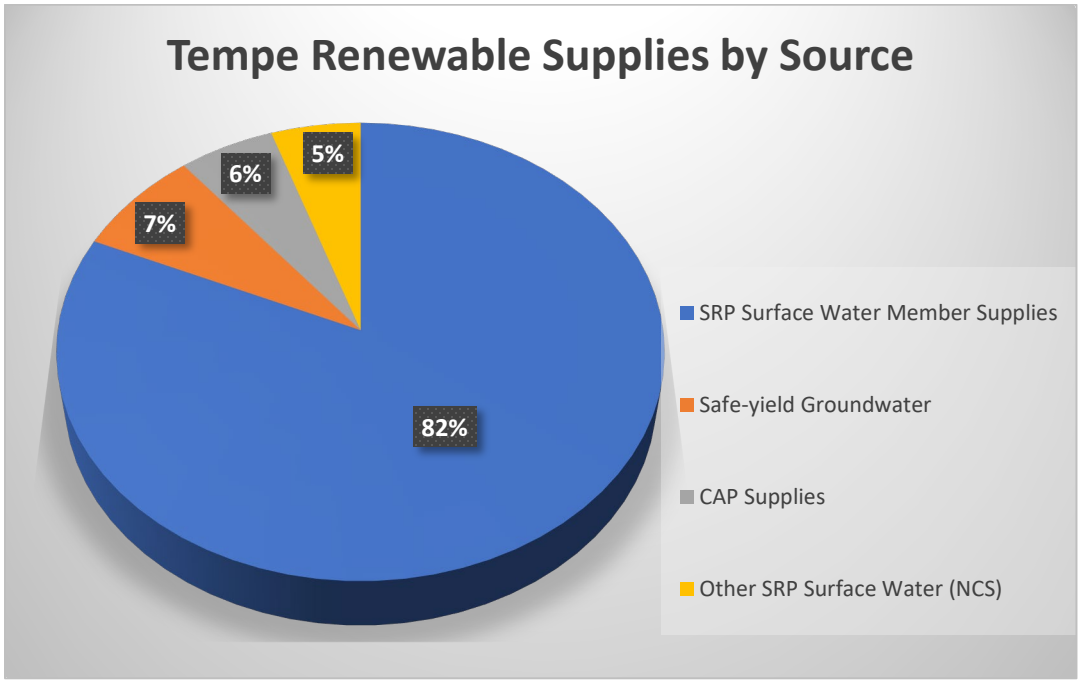
The objectives of the plan are as follows:

- Monitor drought conditions that can result in shortages.
- Understand the impact of shortages on Tempe's supplies.
- Maintain the ability to adjust operations to meet water system demands.

Climate studies illustrate that the Western United States has experienced cyclical periods of drought and above average rainfall for many millennia. These cycles occur at different frequencies and intensity and result from numerous and complex factors. Despite these challenges, many communities in the Central Arizona desert have managed to adapt and thrive. Utilizing renewable resources as a primary means to meet demands is critical to sustaining life in the desert. From the first peoples that settled in the Salt River Valley that built canals, to the farmers near Hayden Ferry in the

late 1890s who used their land as collateral to tame the Salt River, to today's innovative reuse and transportation projects that provide sources of water unimaginable in the past, Tempe has a long history of responsible water use and sound water management practices. Figure 11 illustrates Tempe's typical allocation of renewable water supplies. In most years, 87 percent of demands of the water service area are met by renewable surface water supplies provided by SRP, including SRP Member supplies and NCS water. The remaining demand is met with additional renewable supplies consisting of surface water delivered from the Colorado River by CAP and safe-yield groundwater.

Figure 11 – Tempe's Renewable Supply Allocation in a Typical Year




In addition to providing a framework to meet supply challenges, maintaining a drought management plan is a requirement for all Community Water Systems operating in Arizona that serve more than 1,850 people (Arizona Revised Statutes § 45-341 – 45-343).

In 2002, a prolonged drought on SRP's watersheds resulted in reduced allocation of SRP surface water supplies. In response, Tempe developed and implemented a drought management plan, which was approved by Tempe City Council in 2004. Shortly thereafter, the drought abated and SRP allocations returned to normal. Tempe's drought plan has been periodically reviewed and was incorporated into the 2012 update to the Water Resources Plan.

In 2021, Tempe will complete a major update to the drought management plan, removing it from the Water Resources Plan and expanding the drought plan to include the following new information:

- Updates regarding Tempe's supplies and demands.
- Water shortage indicators and triggers.
- How and when a Water Shortage Response Team will be convened.
- Updated and expanded Shortage Management Stages and Measures.
- Draft language for a Water Shortage Ordinance.

*Shortage Indicators, Triggers and Management Stages*

Identifying and monitoring drought indicators that can lead to shortages is a critical aspect of Tempe's drought resiliency and preparedness efforts. For each of the City's water supplies, there are identified shortage indicators and selected triggers that reflect a point at which drought conditions are anticipated to stress supplies and potentially lead to shortages.

| Shortage Management Stage | SRP Trigger | CAP Trigger | Groundwater Trigger | Long-term Storage Credit (LTSC) Trigger | Impact on Utility Production |
|---|---|---|---|---|---|
| (0) Watch | Drought of concern on SRP/CAP watersheds | DCP Tier 0 | Monitor and trend static groundwater levels from wells | Annual LTSC utilization is greater than recharge | 0 |
| (1) Alert | Allocation reduced by less than 10 percent | DCP Tier 1 | Static groundwater trends indicated downward trend | Less than 72,000 AF LTSC balance | Up to 3.5 MGD |
| (2) Advisory | Allocation reduced by 10-20 percent | DCP Tier 2 | Static groundwater levels drop to within 50 feet of pump intakes at wells | Less than 60,000 AF LTSC balance | Between 4 and 8.2 MGD |
| (3) Emergency | Allocation reduced by 20 percent or greater | DCP Tier 3 | N/A | N/A | 8.3 MGD or greater |

There are many tools available to manage demands when water shortages are predicted or occurring. These range from recommending changes to non-essential water using activities to instituting fines and surcharges for non-compliance with temporary water usage restrictions. The demand management strategies described in the Drought Preparedness Plan can be applied across many customer types to ensure Tempe maintains the ability to provide water for as much demand as possible, regardless of the magnitude of a shortage. For more information, see Tempe's Drought Preparedness Plan.