FOURTH MANAGEMENT PLAN

PHOENIX ACTIVE MANAGEMENT AREA

2010-2020

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SUPPLEMENTAL INFORMATION

Supplemental information is available on ADWR's website or by request at
(602) 771-8585 or earp@azwater.gov.

A: SUPPLEMENT I TO THE 4MP FOR PHXAMA
B: LOW WATER USE PLANT LIST
C: SCENARIO BUDGETS AND TEMPLATES

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

The management plans serve as a tool to assist the Arizona Department of Water Resources (ADWR) in achieving the groundwater goals of each of the state's five Active Management Areas (AMA). The statutory management goal of the Phoenix AMA (PhxAMA) is safe-yield by the year 2025 (A.R.S. § 45-562(A)). Safe-yield is defined as "a groundwater management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge in the active management area" (A.R.S. § 45-561(2)). Groundwater withdrawals in excess of natural and artificial recharge lead to groundwater overdraft. The *1980 Groundwater Management Act*, also referred to as the *Groundwater Code* (Code), identifies management strategies to reduce total groundwater withdrawals in the AMAs. These management strategies include conservation programs for all major water using sectors (see Chapters 4, 5, and 6), as well as replacement of groundwater use with renewable water supplies. Management plans also include water-management assistance programs (see Chapter 9), enforcement provisions, and monitoring programs. A description of ADWR's overall water management approach for the PhxAMA is included in this management plan's conclusion in Chapter 12, titled Water Management Strategy.

In November 2010, ADWR published the *Demand and Supply Assessment 1985-2025, Phoenix Active Management Area* (2010 Assessment), a compilation and study of historical water demand and supply characteristics for the PhxAMA for the years 1985-2006 (ADWR, 2010). The 2010 Assessment also calculated eight water supply and demand projection scenarios through the year 2025. ADWR conducted the 2010 Assessment in preparation for promulgation of the *Fourth Management Plan for Phoenix Active Management Area* (4MP) as required by the Code. After publication of the 2010 Assessment, ADWR presented a summary of the document to the Groundwater Users Advisory Council (GUAC) for the PhxAMA. The PhxAMA GUAC is a five-member council appointed by the Governor to represent the groundwater users in the area on matters relating to the development, use, and conservation of water within its borders *(A.R.S. § 45-420(A)).*

The provisions of the conservation programs contained in the PhxAMA 4MP become effective on January 1, 2023 and remain effective until the first effective date of the Fifth Management Plan (5MP).

The statutory management plan promulgation process requires ADWR to conduct formal public hearings after completion of the proposed management plan (A.R.S. § 45-570). In these hearings, ADWR presents information in support of the proposed plan and a summary of any comments provided by the GUAC on the draft management plan. ADWR also takes public comment on the proposed plan. Before the plan is adopted, the Director of ADWR prepares a written summary of matters considered at the hearing and findings on those matters and may adopt the plan as presented or with modifications.

In addition to the management plans, other water management tools exist that limit use of groundwater. The Assured Water Supply (AWS) Program and the Underground Water Storage, Savings & Replenishment (Recharge) Program are focused on use of renewable water supplies and are important vehicles for achievement of the AMA management goals and ADWR's water-management objectives of protecting the general economy and welfare of the State by encouraging the use of non-groundwater supplies, reducing overdraft, storing water underground, augmenting the local water supply, and providing planning and technical support to water users.

1.2 THE ASSURED WATER SUPPLY PROGRAM

The AWS Program was created to preserve groundwater resources and promote long-term water supply planning in the AMAs. AWS statutes and rules limit the use of groundwater by new residential and commercial subdivisions. Every person proposing to subdivide land within an AMA must demonstrate the availability of a 100-year water supply.

In 1995, ADWR adopted the AWS Rules to implement the AWS Program. Under the AWS Rules, developers can demonstrate a 100-year supply by satisfying certain criteria (described below), and by either obtaining a Certificate of Assured Water Supply (CAWS) for a new subdivision from ADWR, or by obtaining a written commitment of service from a water provider for which ADWR has issued a Designation of Assured Water Supply (DAWS) for a municipal water provider's water service area.

An AWS demonstration must include proof of the following criteria: 1) water supplies will be of adequate quality; 2) water supplies will be physically available for 100 years; 3) water supplies will be legally available for 100 years; 4) water supplies will be continuously available for 100 years; 5) any groundwater use will be consistent with the management goal for the AMA; 6) any groundwater use will be consistent with the management plan for the AMA; and, 7) the developer or water provider has the financial capability to construct the necessary water storage, treatment and delivery systems. The Arizona Department of Real Estate will not issue a public report that allows the developer to sell lots within an AMA without an AWS demonstration. For more information on the AWS Program, please visit the ADWR website at: https://new.azwater.gov/aaws.

The AWS Rules require consistency with the management goal of the AMA. To meet this goal some providers join the Central Arizona Groundwater Replenishment District (CAGRD) to replenish groundwater use within their water service areas (See http://www.cagrd.com/). Other providers use renewable supplies, such as Colorado River water delivered through the Central Arizona Project infrastructure (CAP water) and treated effluent, for municipal uses associated with a DAWS and/or a CAWS issued in the AMA. Pursuant to the AWS Rules, however, a certain volume of groundwater is permitted to be used. These groundwater allowances are intended to help municipal providers transition over time from groundwater to renewable supplies.

When a DAWS or CAWS is issued, a groundwater allowance account is established. ADWR credits additional allowable groundwater to these accounts based on several factors. The AWS Rules allow for a limited volume of groundwater to be pumped based on formulas for each AMA. For a new CAWS or a new DAWS in the PhxAMA, the beginning balance of a groundwater allowance is reduced over time, to zero in 2025.

The AWS Rules also allow applicants for a DAWS or CAWS in the PhxAMA to add to their groundwater allowance by using grandfathered groundwater right extinguishment credits. Extinguishment credits are issued by ADWR when a grandfathered groundwater right holder extinguishes either: 1) a type 1 non-irrigation grandfathered right, 2) a type 2 non-irrigation grandfathered right, or 3) an irrigation grandfathered right at a reduced volume through a process described in the AWS Rules. The extinguishment credits are calculated differently for each AMA. An applicant for an AWS determination that acquires extinguishment credits can pledge such credits to demonstrate that all or a portion of the applicant's projected groundwater use is consistent with the AMA's management goal.

Even after the implementation of three management plans, groundwater remains a significant source of supply for municipal, agricultural, industrial, and tribal uses. The total amount of groundwater used in the PhxAMA decreased from 977,000 acre-feet (AF) in 1985 to 716,288 AF in 2017. This represents groundwater decreasing from 45 percent of the AMA's supply in 1985 to 32 percent of overall PhxAMA water supply in 2017. Despite this improvement, the AMA is still in a state of long-term overdraft.

1.3 THE UNDERGROUND WATER STORAGE, SAVINGS AND REPLENISHMENT (RECHARGE) PROGRAM

Prior to the adoption of the Code, more groundwater was pumped from Arizona's aquifers than was naturally recharged back into the aquifers. This imbalance resulted in significant depletion of certain aquifers. Replacing groundwater use with renewable water supplies and recharging renewable water underground reduces this aquifer imbalance. Artificial recharge also is a means of storing available renewable water supplies for future use. Artificial recharge is an increasingly important tool in the management of Arizona's water supplies, particularly in meeting the goals of the Code.

The Arizona Legislature established the Recharge Program in 1986 to allow persons with supplies of renewable water in excess of their demands to store that water underground for recovery at a later time. In 1994, the Legislature enacted the Underground Water Storage, Savings, and Replenishment Act, which further refined the program. Under this program, a person wishing to store, save, replenish, or recover water must secure permits from ADWR. For more information on the Recharge Program, please see Chapter 8 and visit the ADWR website at https://new.azwater.gov/recharge.

In many cases, permitted artificial recharge under the Recharge Program requires a certain percentage of the recharged volume to be made non-recoverable in order to benefit the aquifer and to contribute to meeting the goal of the AMA. These required non-recoverable volumes are called *cuts to the aquifer*. The cuts apply to the storage of water for long-term storage credits, but do not apply to water that is stored and recovered within the same calendar year.

1.4 GOVERNMENTAL AND INSTITUTIONAL SETTING

In the PhxAMA, water management activities are carried out by several entities. City, county, and regional government functions include retail water delivery, flood control, wastewater management, water quality management, and planning and zoning. Several user groups, advisory committees, citizens' groups, and other organizations provide input in developing legislation, policies, guidelines, and educational programs relating to water use and conservation. The GUAC for each AMA advises the ADWR Statewide AMA Director and makes recommendations on groundwater management programs and policies for the AMA and provides comments to ADWR on draft management plans before they are promulgated (A.R.S. § 45-421(1)).

The Arizona Water Protection Fund (AWPF) was established in 1994 to provide grant money for projects that protect or restore the state's rivers, streams, and associated riparian habitats. Funds obtained through AWPF grants may be used to purchase Colorado River water delivered through Central Arizona Project infrastructure (CAP water) or treated effluent for these purposes. The AWPF Commission, with the ADWR director serving as a nonvoting ex-officio member, oversees the fund and grants process. AWPF staff is located within ADWR.

At the state level, the Arizona Department of Environmental Quality (ADEQ) regulates water quality. ADWR and ADEQ jointly participate in specified activities related to protection of groundwater quality and remediation. The Arizona Corporation Commission (ACC) regulates the activities of private water companies, particularly with respect to rate-setting. The Arizona Department of Real Estate (ADRE) works with ADWR to ensure that new subdivisions comply with the AWS requirements.

Federal water management activities in the PhxAMA include the U.S. Bureau of Reclamation's (Reclamation) involvement in regional water supply planning, as well as research into storage and use alternatives for Colorado River water. The Secretary of the Interior also operates as the sole contracting authority for water from the lower Colorado River. As such, any user of Colorado River water in the lower basin must have a water delivery contract with the Bureau of Reclamation. Reclamation also participates in negotiations to provide water resources to tribal communities on behalf of the U.S. Secretary of the Interior. Additional Federal water management activities include the Environmental Protection Agency's Superfund program, and the National Pollutant Discharge Elimination System (NPDES) permit program. The U.S. Geological Survey works independently and in conjunction with ADWR and others in the collection and analysis of hydrologic and subsidence-related data and flood warning information.

The Gila River Indian Community, Salt River Pima-Maricopa Indian Community, and Fort McDowell Indian Community, located within the PhxAMA, also are actively involved with challenges related to the use of groundwater and renewable water supplies. These communities are governed by their respective tribal councils and, like municipalities or counties, have responsibility for water and wastewater management, planning, and zoning.

1.5 PHOENIX AMA WATER-MANAGEMENT CHALLENGES

While the PhxAMA has made improvements in managing its water supply, it will continue to face several water management challenges in the fourth and fifth management periods. These include:

- *Meeting the Safe-Yield Goal*

  During the second and third management periods, significant actions were taken toward reaching safe-yield, including establishment of the Arizona Water Banking Authority (AWBA) and the AWS Program. The PhxAMA 2010 Assessment indicated that the PhxAMA was approaching safe-yield. Updated information indicates that the PhxAMA may have reverted to an overdraft condition since 2010, but there is disagreement on the appropriate time-scales for analyzing long-term overdraft. Further, the current cumulative volume of grandfathered groundwater right allotments far exceeds the amount of groundwater available for pumping under safe-yield conditions. Not all municipal uses are required to replenish or offset groundwater pumping, and the municipal sector can continue to grow, representing potential for increased groundwater demand. Additionally, agricultural and industrial users are not required to replenish or offset groundwater pumping. These factors will be challenges for the PhxAMA to meet and maintain the safe-yield goal.

- *Renewable Supplies*

  Groundwater and non-groundwater sources are managed under different statutes with different approaches. As municipal growth increases the demand for renewable supplies, sound management of all sources of water supply is warranted, including a plan to respond to shortages due to long- or short-term drought conditions. Pending and current water storage projects that bank renewable supplies for future shortages is one effective management tool to mitigate drought impacts. There are significant challenges to management of both renewable and finite water supplies, but it is necessary to ensure the economic stability, health and welfare of the PhxAMA residents.

- *Physical Availability of Groundwater within the Phoenix AMA*

  Physical availability of groundwater within specific geographic sub-areas of the PhxAMA varies, and there are localized areas within the PhxAMA that are experiencing groundwater level declines and land subsidence. Localized infrastructure limitations can constrain access to renewable water supplies, and users in areas experiencing water-level declines and/or subsidence may not have access to those supplies. Other areas within the PhxAMA can exhibit water-logged conditions. While recognizing that the groundwater management goal for the PhxAMA is defined as achieving safe-yield on an AMA-wide basis, localized water management is also desirable to fully achieve the Code's stated policy of "protecting and stabilizing the general economy and welfare of this state and its citizens...." The AWS Rules require applicants to prove the physical availability of groundwater in the area for which the AWS is being applied, and if there is insufficient physical availability of groundwater to meet the current, committed, and projected demand for that area, an applicant would need to demonstrate other sources of water supply that are physically available and meet the other AWS Rules criteria in order for an AWS determination to be issued. Recharge activities conducted by the AWBA, the CAGRD, and others also have the potential to address local water management issues. Addressing these major challenges is an important part of the PhxAMA's groundwater management strategy.

- *Limitations of the Management Plan Authority*

  The 4MP includes conservation requirements for water users within the municipal, industrial and agricultural water-use sectors. Although conservation is an effective means of managing available supplies and can help move the PhxAMA closer to safe-yield, it is insufficient by itself to bring the PhxAMA to safe-yield. Individual water-user choices, city and county ordinances and regional cooperative water management efforts, while outside of ADWR's authority to require or enforce, may result in significant additional progress toward safe-yield.

1.6 PHOENIX AMA 4MP PROGRAMS

The 4MP primarily addresses water conservation, underground storage and recovery, and water management assistance during the fourth management period. A.R.S. §§ 45-567, 567.01 and 567.02 direct that the following components shall, or may, be included in the 4MP:

- Irrigation water duties or intermediate irrigation water duties for agricultural users;
- Historic cropping program for agricultural users;

- Agricultural Best Management Practices Program;
- Non-Per Capita Conservation Program for municipal providers;
- Total Gallons Per Capita per Day (GPCD) Program for municipal providers;
- Monitoring and distribution system requirements for municipal providers;
- Additional conservation requirements for non-irrigation uses;
- Program for additional augmentation of the PhxAMA water supply;
- Groundwater quality assessment for the PhxAMA;
- Conservation assistance program;
- Program for the purchase and retirement of grandfathered rights and
- Recommendations to the AWBA.

While descriptions of the conservation programs and their corresponding requirements are included throughout the 4MP, the legally enforceable provisions for water users and water-distribution systems are printed in italics for easy reference at the ends of Chapters 4, 5, 6 and 8.

1.7 CONCLUSION

The 4MP provides the details of the statutorily mandated conservation requirements, discusses the region's water management needs, and presents ADWR's suggestions for water users to achieve the PhxAMA's water management goals and objectives. Continued commitment from water users in the PhxAMA, ADWR, and the public is necessary to reduce dependence on groundwater and to achieve the statutorily established water management goal of reaching safe-yield by 2025. With the support of the community, ADWR will respond to evolving water challenges and needs while maintaining technical assistance and regulatory programs that ensure a dependable water supply for Arizona's future.

Bibliography

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CHAPTER TWO: HYDROLOGY

2.1 GEOGRAPHY

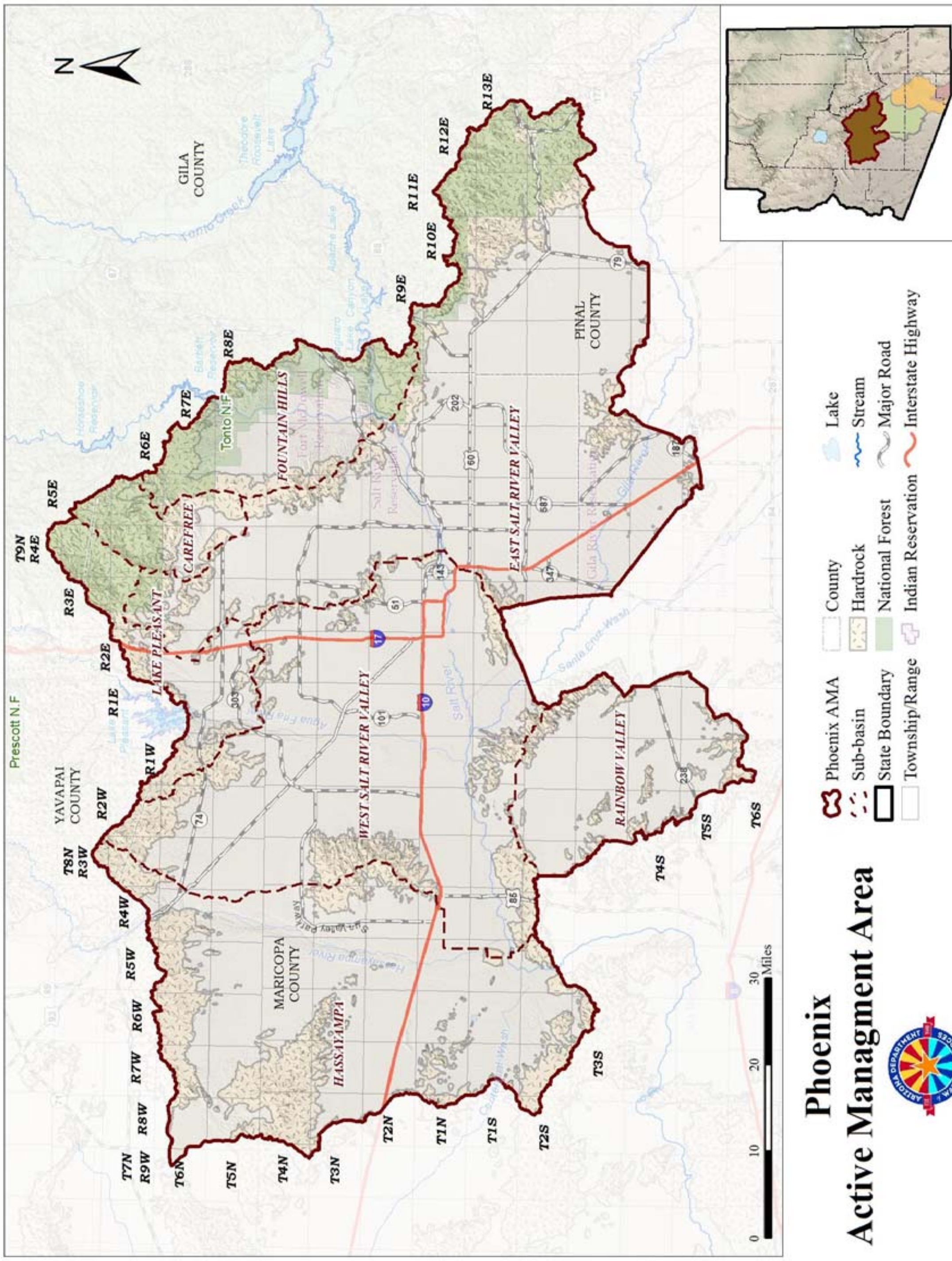
The Phoenix Active Management Area (PhxAMA) is located in the basin and range physiographic province, which is characterized by broad, gently sloping alluvial plains separated by predominately north to northwest trending mountains. The PhxAMA covers 5,646 square miles and consists of seven groundwater sub-basins: the East Salt River Valley (ESRV or East SRV) Sub-basin, the West Salt River Valley (WSRV or West SRV) Sub-basin, the Rainbow Valley Sub-basin, the Hassayampa Sub-basin, Lake Pleasant Sub-basin, Carefree Sub-basin, and the Fountain Hills Sub-basin (See Figure 2-1). Elevations within the PhxAMA range from less than 800 feet above mean sea level at Gillespie Dam to over 6,000 feet above mean sea level in the Superstition Mountains in the eastern portion of the PhxAMA.

Flows of surface water from the Salt, Verde, Agua Fria, and Gila Rivers have long been stored in reservoirs for users downstream. Despite the control over supply afforded by the regulatory storage reservoirs, surface water availability is variable from year to year. Annual surface water flows vary greatly with weather patterns. In years of drought, insufficient surface water is often augmented by pumping additional groundwater. Since 1985, Colorado River water has been delivered to Central Arizona by the Central Arizona Project infrastructure (CAP water). Although use has increased rapidly, high capital costs and lack of existing infrastructure have hindered direct use. Reclaimed water or treated wastewater is an underutilized supply in the AMA. Generally, reclaimed water is used for non-potable uses such as landscape watering. Reclaimed water has the potential to replace potable supply when potable water is not necessary for the use. Currently, however, the PhxAMA’s largest treatment facility is located downstream from most users and a portion of the reclaimed water produced at the facility flows out of the PhxAMA.

The PhxAMA is drained by the Gila River and four principal tributaries: the Salt, Verde, Agua Fria, and Hassayampa Rivers. Other tributaries include Queen Creek, New River, Skunk Creek, Cave Creek, Waterman Wash, and Centennial Wash. Regulatory water storage reservoirs have been constructed on the Salt, Verde, and Gila rivers and for the Agua Fria River, allowing for a relatively high proportion of surface water use in some areas of the PhxAMA. Figure 2-1 shows the major rivers and washes in the AMA. All of the streams and washes within the AMA are ephemeral either naturally or due to upstream diversion. The Gila and Salt rivers have sustained flow in their lower reaches due to return flows from nearby agricultural areas and discharges from wastewater treatment facilities.

Water may be transported within the PhxAMA by canals and pipelines from points of diversion or from withdrawal to principal users. Groundwater withdrawn from adjacent wells; surface water diverted from the Gila, Salt, Verde, and Agua Fria rivers; water from the CAP aqueduct; and, in some cases, reclaimed water are all transported by canals and pipelines. Major canals include the Arizona Canal, Grand Canal, Beardsley Canal, Buckeye Canal, Arlington South Extension, Western Canal, Highline Canal, South Canal, Consolidated Canal, Eastern Canal, and the Roosevelt Water Conservation District Canal. The CAP aqueduct, transporting water from the Colorado River, cuts across the PhxAMA from west to east. Pipeline distribution systems that connect with the canals and the CAP aqueduct have been developed by the larger municipalities and private-water companies of the Phoenix metropolitan area. In certain instances, the water-distribution systems interconnect with each other. Separate, dedicated pipelines to transport untreated CAP water or reclaimed water also have been developed by several water providers in the PhxAMA.

FIGURE 2-1
PHOENIX ACTIVE MANAGEMENT AREA



2.2 CLIMATE

Located primarily in subtropical desert, the climate of the PhxAMA is semi-arid. Long-term average temperature and precipitation are relatively uniform throughout the PhxAMA due to the low topographic relief. Differences in elevation account for most variations.

The PhxAMA has hot summers and mild winters. During July, the hottest month, daytime high temperatures are generally between 100° F and 110° F, with nighttime lows usually between 75° F and 85° F. January, the coolest month, generally has daytime high temperatures between 60° F and 70° F. Nighttime lows are usually between 35° F and 45° F.

Annual precipitation is limited, averaging seven to eight inches across the PhxAMA, although higher elevations receive more rainfall. There are two distinct precipitation periods during the year, both of which are erratic and variable from year to year. In July and August, tropical air from the Gulf of Mexico is carried to the PhxAMA by upper-level winds from the southeast, frequently resulting in thunderstorms. Heavier late summer rains sometimes result from tropical storms moving north along the Sierra Madre of Mexico. During the winter months, precipitation comes from storms originating in the northern Pacific carried southward and eastward by the jet stream across the continent. Winter precipitation is generally less intense but is more widespread and of longer duration than summer precipitation. Spring runoff from melting winter snow along the Mogollon Rim and in the White Mountains north and northeast of the PhxAMA provides most of the surface water collected by the major regulatory storage reservoirs for use in the PhxAMA.

Since records have been kept by the National Weather Service weather station in Phoenix, annual precipitation has ranged from less than 3 inches to nearly 20 inches. Prolonged periods of relatively wet or dry weather are common. Extensive droughts have occurred in the early 1900s, 1930s, and 1950s. Many shorter drought periods have occurred since records have been kept from the 1890s. During years of winter drought, less snowpack in the Salt, Gila, and Verde River watersheds results in less runoff into regulatory water-storage systems on these rivers. This reduces surface water availability in the PhxAMA during those periods, resulting in higher groundwater pumping to make up for the surface water shortage.

Average annual evapotranspiration (vegetative water loss from plant transpiration and soil evaporation) is approximately 79 inches per year (Arizona Meteorological Network, 1998). Despite late summer rains, summer is the period of greatest evaporation potential and peak water demand for irrigation of landscapes, crops, and golf courses.

2.3 SURFACE WATER RESOURCES

The PhxAMA is drained by the Gila River and four principal tributaries: the Salt, Verde, Agua Fria, and Hassayampa rivers. Other tributaries include Queen Creek, New River, Skunk Creek, Cave Creek, Waterman Wash, and Centennial Wash. In the last 100 years, significant infrastructure has been built on major rivers in the AMA to capture and store as much surface water as possible for users in the AMA and elsewhere. Despite the regulatory control afforded by the dam and reservoir system, annual diversions of surface water for downstream users varies greatly with the amount of water that flows into the reservoirs from the watershed. The amount of water stored for use is especially dependent on the snowpack and resultant snowmelt of each winter storm season on the watershed. This can be highly variable from year to year, with extensive droughts not uncommon in recent history. When surface water supplies are insufficient to meet demand, supplies are often supplemented by groundwater pumping to make up the shortfall. In years of excessive snowmelt, water may need to be spilled from storage reservoirs. Although some spill water may augment supplies in the AMA through aquifer recharge and direct use, some of it flows through the AMA without being used. Environmental concerns, cost, and a shortage of suitable sites make it highly unlikely that any additional large-scale regulatory projects will be created to further develop surface water storage capacity in the AMA.

Other than Colorado River water delivered to the AMA through the CAP aqueduct (discussed separately in section 2.5), the Salt and Verde rivers are the principal sources of surface water in the AMA. Most of the surface water from the Salt and Verde rivers is appropriated by downstream users in irrigation districts and is limited for use to lands within the Salt River Project, the Roosevelt Water Conservation District, and the Buckeye Water Conservation and Drainage District. The Gila and Agua Fria rivers also provide surface water. Water from the Gila River is used mainly for agricultural uses in the San Carlos Irrigation District on the Gila River Indian Community (partially within the AMA) and in the Buckeye Water Conservation and Drainage District. Water from the Agua Fria River is used by Maricopa Water District in the West SRV Sub-basin. Small, localized surface water appropriations have been made to users from Cave Creek, Queen Creek, and Centennial Wash. Many municipal, industrial, and agricultural users are outside of the aforementioned district boundaries and are ineligible to receive surface water supplies.

Surface water flow recharges the PhxAMA aquifer by infiltrating through stream channel sediments into the aquifer. Stream channel recharge is a component of net natural recharge and is incorporated into water budget estimates of PhxAMA water supply (see Chapter 3).

2.3.1 Salt and Verde Rivers

The Salt River originates in eastern Arizona and drains approximately 6,000 square miles of the Mogollon Rim area in the east-central part of the state. The Salt River channel enters the AMA north of the Goldfield Mountains; crosses toward the southwest through the East SRV and West SRV Sub-basins and the cities of Mesa, Tempe, and Phoenix. The channel finally joins the Gila River near Laveen. Downstream from the Granite Reef Diversion Dam, the Salt River is ephemeral, flowing in response to flooding or reservoir releases. The Salt River is perennial further downstream due to reclaimed water discharges from the 23rd Avenue and 91st Avenue wastewater treatment plants.

The Verde River originates in the Chino Valley north of Prescott. It is a perennial river that drains approximately 7,000 square miles of central Arizona. The Verde River channel enters the AMA in the north Fountain Hills Sub-basin and moves southward where it joins the Salt River between Stewart Mountain Dam and Granite Reef Diversion Dam. The Verde River is regulated by Horseshoe Dam outside the AMA and Bartlett Dam within the AMA, both of which are part of the Salt River Project.

The Salt River flowed perennially before the late 1800s (Lee, 1905). The diversion dams, canals, and laterals constructed in the late 1880s along the Salt River were inadequate to regulate the effects of drought and flood and to produce a reliable and safe water supply for agricultural irrigation uses in the Salt River Valley. In response, the Salt River Valley Water Users Association was formed in 1903 for the purpose of furnishing water, power, and drainage for participating landowners in the Valley. A series of four regulatory storage reservoirs and five dams were constructed on the Salt River to accomplish this goal. On the Verde River, the United States Bureau of Reclamation (USBR) constructed Bartlett Dam in the 1930s and the Phelps-Dodge Corporation constructed Horseshoe Dam in the 1940s. Collectively, these projects make up the Salt River Project. Table 2-1 shows the dams and reservoir capacity of the Salt River Project. Total water storage capacity of the Salt River Project is nearly 3.6 million acre-feet (AF), although a large portion of this space is usually left vacant for flood storage. At Granite Reef Diversion Dam, which is southwest of the confluence of the Salt and Verde Rivers and within the AMA, water is diverted to users through the Arizona Canal and the South Canal.

TABLE 2-1
SALT AND VERDE RIVERS - WATER STORAGE AND DIVERSION PROJECTS
PHOENIX ACTIVE MANAGEMENT AREA

River	Dam	Reservoir	Storage Capacity (AF)
Salt	Theodore Roosevelt	Roosevelt	1,653,000
	Horse Mesa	Apache	245,100
	Mormon Flat	Canyon	57,900
	Stewart Mountain	Saguaro	69,800
	Granite Reef	(N/A - diversion dam)	N/A
Verde	Bartlett	Bartlett	178,200
	Horseshoe	Horseshoe	109,200
East Clear Creek	C.C. Cragin	C.C. Cragin	15,000

Because of concern over detrimental environmental impacts, two additional dams to increase storage capacity on the Salt and Verde rivers (Orme Dam on the Salt River and Cliff Dam on the Verde River) were never built. An alternative to the construction of Orme Dam (known as Plan 6) raised Roosevelt Dam 77 feet in 1996 and made important flood-handling modifications to Stewart Mountain Dam. Raising Roosevelt Dam increased capacity to over 1.5 million AF, which includes a large amount of space for flood storage. From 1913 to 1997, diversions have ranged from 506,000 to 1,360,000 AF per year. The median diversion has been approximately 808,000 AF. Most Salt and Verde River water is appropriated to shareholders of the Salt River Valley Water Users Association (Salt River Project) for use on lands within the Project. The Salt River Project (SRP) encompasses portions of the East SRV and West SRV Sub-basins in the AMA, including portions of Avondale, Glendale, Peoria, Phoenix, Scottsdale, Tempe, Chandler, Gilbert, and Mesa. (See Figure 4-2 in Chapter 4.) Although SRP still provides water for agricultural use, much of the lands within the project boundaries are highly urbanized, including mature development in central Phoenix, south Scottsdale, Tempe, and Mesa. Most new urban development of the Phoenix urban area is occurring outside the Project's boundaries and is not eligible to directly receive water from the Project. Salt River Project water may be delivered outside of the Project's boundaries only if it is exchanged for another source. Some Salt and Verde River system water has also been adjudicated to or agreed to be delivered to several other irrigation districts with surface water rights, including the Buckeye Water Conservation and Drainage District, Roosevelt Water Conservation District, St. Johns Irrigation District, and Peninsula Ditch Water Company. Salt and Verde River water partially meets water demand within these district boundaries but must be supplemented with other sources, including groundwater. Water-rights settlements have allocated Salt and Verde waters to the Fort McDowell Indian Community and Salt River Pima-Maricopa Indian Community, which will be used to meet urban and agricultural demand within these communities. In 1946, the City of Phoenix increased the capacity of Horseshoe Dam by constructing spillway gates; as compensation, it is eligible to receive a portion of Verde River water. A portion of the water stored behind additional storage capacity on Roosevelt Dam created by Plan 6 is divided by the cities of Phoenix, Mesa, Chandler, Scottsdale, Tempe, and Glendale. Plan 6 water is not restricted for use within Salt River boundaries.

2.3.2 Gila River

The Gila River channel enters the AMA between the San Tan and Sacaton Mountains near Sacaton. It crosses northwest and west near the Sierra Estrella Mountains and Buckeye Hills and exits the AMA at Gillespie Dam. Prior to 1890, the river flowed perennially through the AMA (Lee, 1904). The river is currently regulated by the Ashurst-Hayden Dam east of Florence outside the AMA. Most natural surface water flows are diverted to the San Carlos Irrigation District at the Ashurst-Hayden Dam. The district encompasses a portion of the Gila River Indian Community in the AMA and the community uses the water for agricultural purposes. The river flows downstream from the dam when floods exceed the dam's diversion capacity and is perennial for a couple miles above the confluence with the Salt River. Below the confluence with the Salt River, the Gila River is perennial due to reclaimed water discharge in the Salt River from the City of Phoenix's 23rd Avenue and 91st Avenue wastewater treatment plants. Much of this water is diverted for agricultural irrigation by the Buckeye Water Conservation and Drainage District and the Arlington Canal Company.

2.3.3 Agua Fria River

The Agua Fria River is an intermittent to ephemeral stream that begins northeast of Prescott and drains part of central Arizona between Prescott and Phoenix. The Agua Fria River enters the AMA approximately 20 miles north of Peoria, flows south along the western edge of the Phoenix metropolitan area and joins the Gila River south of Avondale. The drainage area of the Agua Fria River and its tributaries is approximately 2,000 square miles.

The Agua Fria River is regulated at the northern boundary of the AMA by New Waddell Dam, which forms Lake Pleasant. At Lake Pleasant, which functions as regulatory storage for both Colorado River water brought into the AMA by the CAP (CAP water) and the Agua Fria River, water is diverted by the Maricopa Water District to the Beardsley Canal, a 30-mile long canal that cuts southward across the West SRV Sub-basin east of the White Tank Mountains. Maricopa Water District delivers a combination of Agua Fria River water, groundwater, and CAP water to users in the district. Downstream from the dam, the Agua Fria River is ephemeral.

2.3.4 Other Tributaries

Other tributaries exist in the AMA that are not significant sources of surface water supply, including the Hassayampa River, Cave Creek, Queen Creek, New River, Skunk Creek, Waterman Wash, and Centennial Wash. All of these tributaries are ephemeral with the exception of the Hassayampa River, which is intermittent to ephemeral.

2.4 HYDROGEOLOGIC UNITS AND AQUIFER CHARACTERISTICS

There are seven groundwater sub-basins in the AMA: the East Salt River Valley Sub-basin, West Salt River Valley Sub-basin, Hassayampa Sub-basin, Rainbow Valley Sub-basin, Fountain Hills Sub-basin, Lake Pleasant Sub-basin, and Carefree Sub-basin. Each sub-basin has its own unique hydrogeologic characteristics, and a number of factors influence groundwater conditions in each. These include groundwater inflow and outflow, depth to groundwater, withdrawals and recharge, surface water conditions, subsidence potential, and quality of groundwater in different

locations. The use of renewable water supplies is one of the most important factors in counteracting groundwater declines in the AMA.
The primary sources of groundwater in the PhxAMA are basin-fill sediments. While the basin-fill sediments that underlie much of the AMA are extremely heterogenous, three distinct water-bearing units are identified for most of the sub-basins of the AMA: an upper alluvial unit, a middle fine-grained unit, and a lower conglomerate unit. These units are illustrated in Figure 2-2, which shows a hydrogeologic cross-section with exaggerated vertical scale running west to east across the East SRV and West SRV sub-basins. Although conditions and circumstances vary across the AMA, most groundwater is pumped from the middle alluvial unit. At ideal locations, large capacity wells in the basin-fill sediments can yield up to a few thousand gallons of water per minute. Bedrock, consisting of various metamorphic and igneous rock, underlies the basin-fill sediments. The bedrock has little groundwater storage or production capacity and is not considered to be an aquifer.

Groundwater conditions change over time due to natural and human-induced fluctuations in the amount of water being added or removed. Because groundwater flows very slowly underground, the effects of pumping and recharge can alter the shape of the water table – the “surface” of the layer of groundwater –for long periods of time. Water that is naturally or artificially recharged can create a mound underground, while pumping can create a cone of depression in the water table. Major changes in water level elevations occurred after the development of more effective well technology in the 1940s. The new well pumps allowed a much greater volume of groundwater to be pumped than had been possible earlier. Groundwater conditions are described according to each sub-basin in the following sections. Figures 2-3 through 2-6 are among several types of maps used to illustrate groundwater conditions in the PhxAMA. These are based on the location of the water table relative to either land surface, sea level, or the water table at different points in time. When this information is known for a number of wells in an area, contour lines can be drawn around areas with similar conditions. Depth-to-water maps indicate the distance from the land surface to the top of the water table at different locations in the AMA. Water level elevation maps are used to show the level of the water table relative to a fixed reference point: mean sea level. The slope of the water table and the direction of groundwater flow can be determined using a water level elevation map. Water level change maps show areas where the water table has fallen or risen during a given time period.

FIGURE 2-2
HYDROGEOLOGIC CROSS-SECTION
PHOENIX AMA

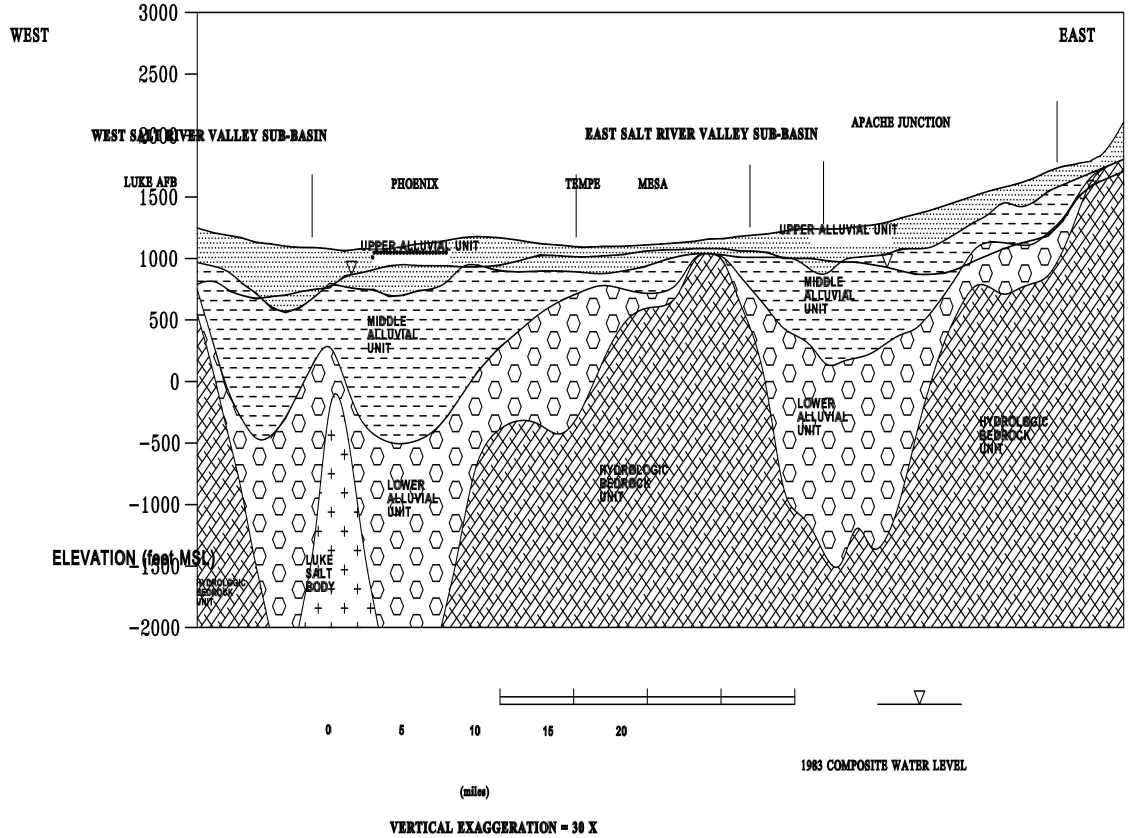


Figure 2-3 shows 1900 water level elevations above mean sea level, changes in water level elevations from 1900 to 1998 are shown on Figure 2-4, and 1998 water level elevations and depth to water below land surface are shown on Figures 2-5 and 2-6, respectively.

FIGURE 2-3
WATER LEVEL ELEVATIONS, 1900
PHOENIX ACTIVE MANAGEMENT AREA

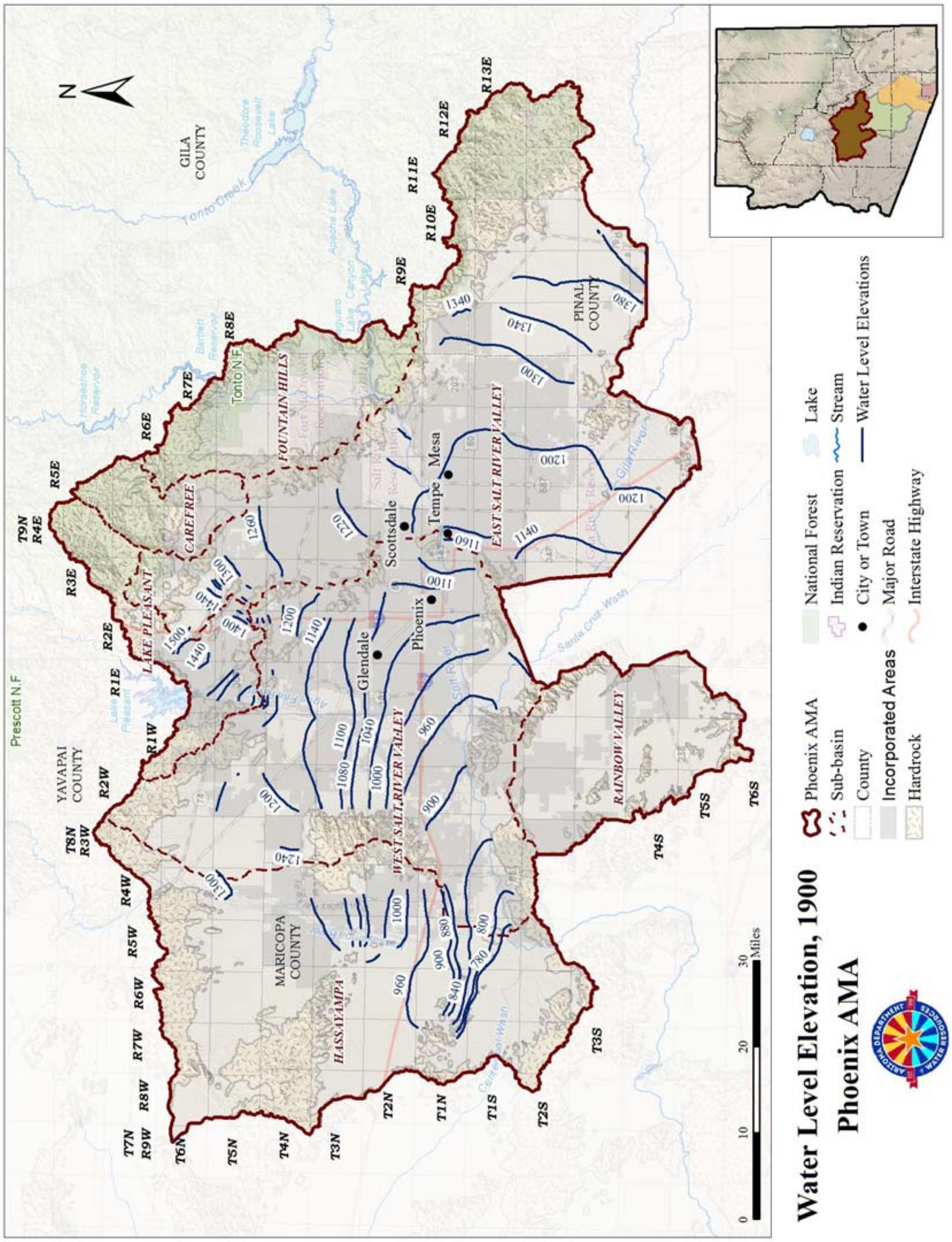


FIGURE 2-4
CHANGE IN WATER LEVEL ELEVATION, 2000 - 2014
PHOENIX ACTIVE MANAGEMENT AREA

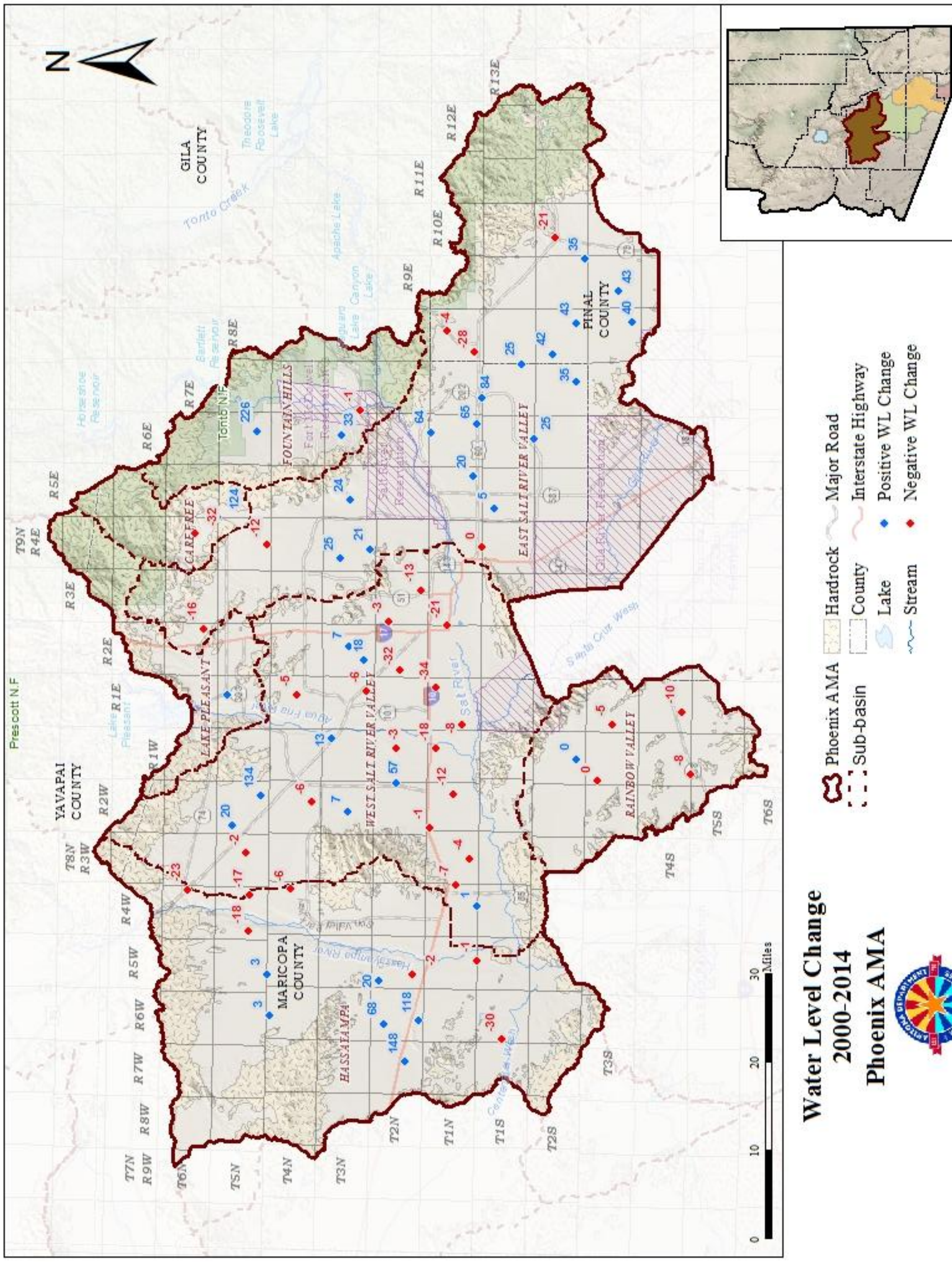


FIGURE 2-5
WATER LEVEL ELEVATIONS, 2015
PHOENIX ACTIVE MANAGEMENT AREA

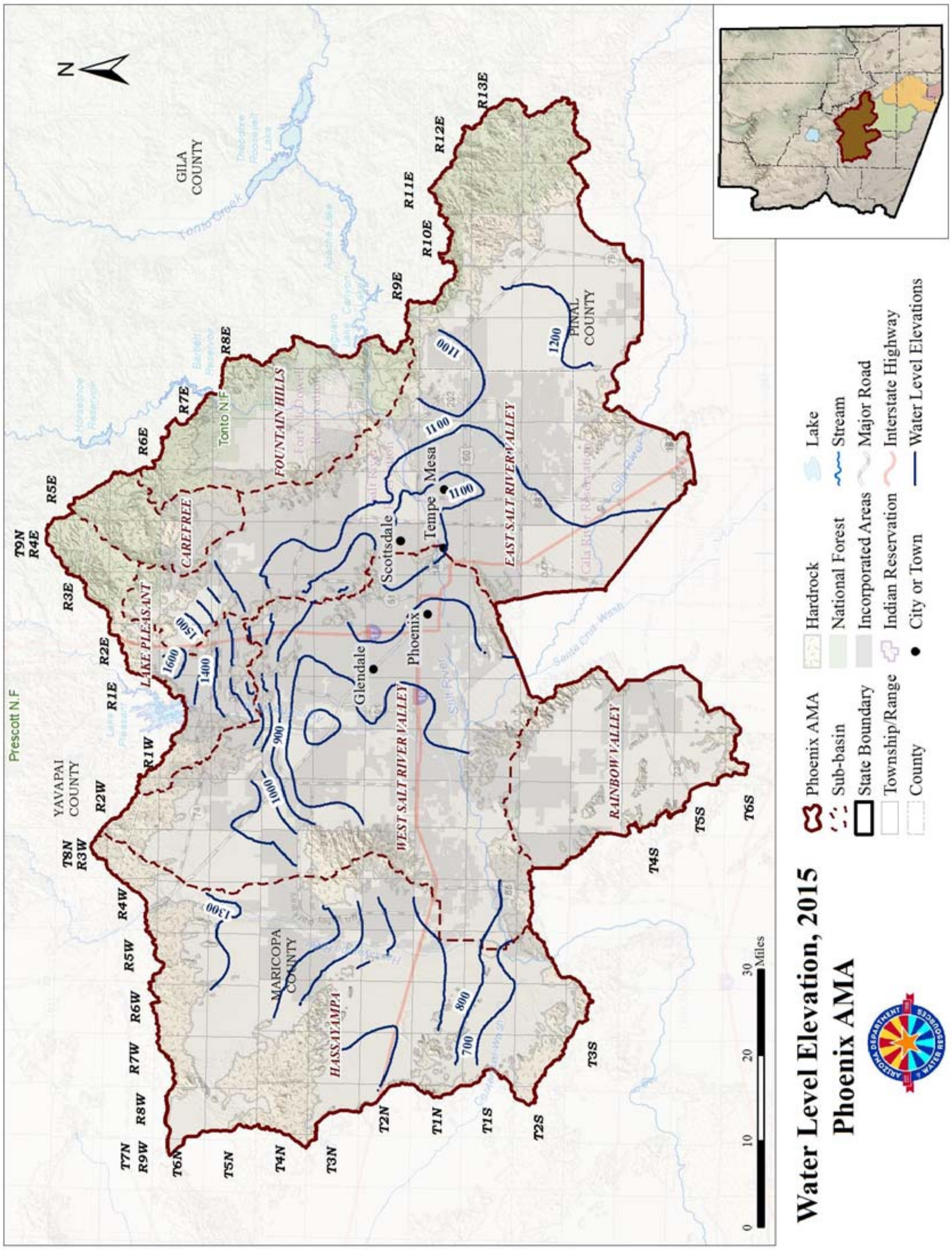
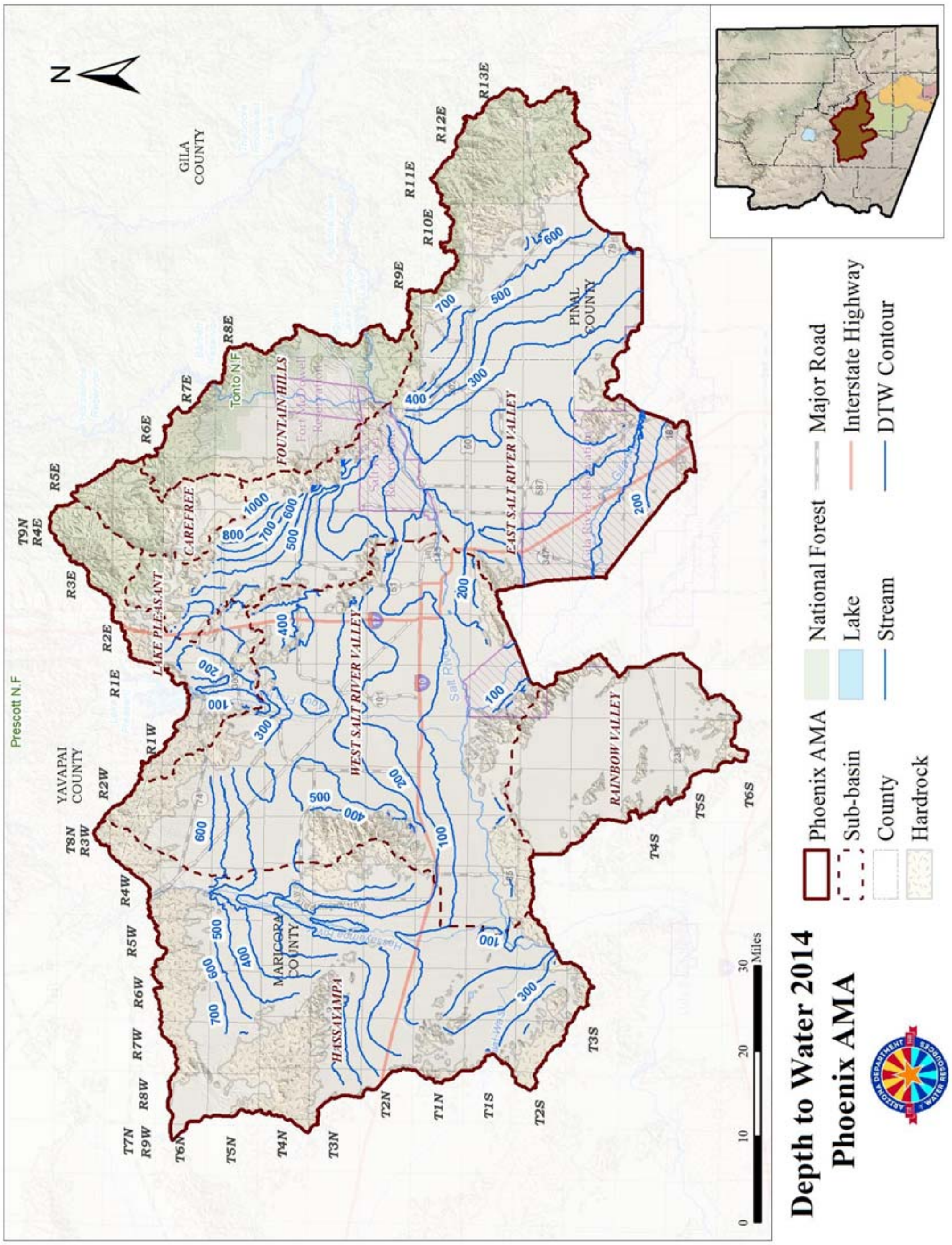


FIGURE 2-6
DEPTH TO WATER, 2014
PHOENIX ACTIVE MANAGEMENT AREA



2.4.1 East Salt River Valley (SRV) Sub-basin

The East SRV Sub-basin is one of the larger sub-basins in the AMA, covering approximately 1,710 square miles. Located in the eastern half of the AMA, it is a broad, gently sloping alluvial plain bounded on the north and east by the New River, McDowell, Usery, Goldfield, and Superstition Mountains; on the south by the San Tan and Sacaton Mountains; and on the west by the South Mountains, the Papago Buttes, the Phoenix Mountains, Union Hills, and the Deem Hills.

The Salt River channel crosses the central portion of the basin from east to west. The ephemeral Indian Bend Wash, much of which is a channelized greenbelt in the City of Scottsdale, flows south and drains the central portion of the sub-basin until its confluence with the Salt River. Queen Creek, also ephemeral, drains the eastern portion of the sub-basin until its confluence with the Gila River, which crosses the far southern portion of the sub-basin and flows from east to west. Cave Creek, also ephemeral, drains the northern portion of the sub-basin southwestward into the West SRV Sub-basin.

Three hydrogeologic units are recognized within the basin-fill sediments in the East SRV Sub-basin: an upper sand and gravel unit, a middle silt and clay unit, and a lower conglomerate unit (Laney and Hahn, 1986). The upper unit mainly consists of sand and gravel with some interbedded silt and clay. The upper unit ranges in thickness from less than 100 feet near the basin margins to over 350 feet in some parts of the basin. The middle unit consists mainly of silt and clay with some interbedded sand and gravel. Near the basin margins, the unit is coarser and typically cannot be distinguished from the upper and lower units. The middle unit ranges in thickness from less than 100 feet near the basin margins to over 1,800 feet southeast of Gilbert. The lower unit consists mainly of conglomerate near the basin margins. The unit ranges in thickness from less than 100 feet near the basin margins to over 9,000 feet southeast of Gilbert.

Prior to extensive development, groundwater underflow entered the East SRV Sub-basin from the north, south, and southeast. Groundwater flowed generally east to west within the sub-basin toward and along the Salt and Gila rivers. Minor underflow exited the sub-basin into the West SRV Sub-basin between the Papago Buttes and South Mountain. Water levels had ranged from greater than 1,500 feet above mean sea level near the east and north basin margins to 1,150 feet above mean sea level near Tempe Butte and south of South Mountain (Figure 2-3).

Since 1940 when extensive groundwater pumping to meet growing agricultural and municipal water demand began, water levels have declined significantly. Three large cones of depression in the Scottsdale, Mesa, and San Tan Mountain areas have been created by agricultural pumping (Figure 2-4). In addition, water levels in the Scottsdale area declined 300 feet from 1900 to 1998 due to municipal use. Water levels declined by more than 400 feet near the San Tan Mountains and 350 feet east of Mesa (Laney, Ross, and Litten, 1978).

In 1998 water-level elevations ranged from approximately 900 feet above mean sea level in the Scottsdale cone of depression to 1,500 feet above mean sea level in the northern part of the sub-basin (Figure 2-5). Depth to groundwater in 1998 ranged from less than 100 feet below land surface near the Salt and Gila rivers to over 850 feet below land surface north of Paradise Valley and 550 feet below land surface near the Superstition Mountains (Figure 2-6). Today, most groundwater flows toward the three large cones of depression.

Although significant quantities of surface water are available to users in this sub-basin (see section 2.4), groundwater pumping is still extensive in the Paradise Valley and the Sun Lakes areas by municipal and industrial users and in the Queen Creek vicinity by agricultural users.

2.4.2 West Salt River Valley Sub-basin

Like the East SRV Sub-basin, the West SRV Sub-basin is one of the larger sub-basins in the AMA (1,330 square miles) and is a broad, gently sloping alluvial plain. It is bounded on the north by the Hieroglyphic Mountains and Hedgpeth Hills; on the east by Union Hills, Phoenix Mountains, and Papago Buttes; on the south by the South Mountains, the Estrella Mountains, and Buckeye Hills; and on the west by the White Tank Mountains (Figure 2-1).

The Salt River channel meets the Gila River in the southern portion of the sub-basin. When flowing, much of the sub-basin drains from north to south into the Gila River via Skunk Creek, New River, the Agua Fria River, and Cave Creek. Skunk Creek drains into New River just east of Sun City, which subsequently flows into the Agua Fria River just south of Glendale Municipal Airport. The Agua Fria River joins the Gila River west of its confluence with the Salt River. Cave Creek flows from the East SRV Sub-basin until it reaches the Arizona Canal Diversion Channel, which drains into Skunk Creek. The West SRV Sub-basin is hydrologically similar to the East SRV Sub-basin. It also has three hydrogeologic units recognized within the basin-fill sequence, consisting of similar fill deposits. The upper unit ranges in thickness from less than 100 feet near the basin margins to over 500 feet in the Luke Air Force Base area. The middle unit ranges in thickness from less than 100 feet near the basin margins to over 1,300 feet southwest of Glendale. The lower unit ranges in thickness from less than 100 feet near the basin margins to over 10,000 feet southwest of Glendale. A large salt body, known as the Luke salt body, lies in the West SRV southeast of the Luke Air Force Base and occurs at a depth of 880 feet to over 6,000 feet. Geohydrologic data indicate that the upper part of the salt body has a local effect on groundwater salinity.

Historically, groundwater entered the West SRV Sub-basin as underflow from the north, northwest, and southeast between the Sierra Estrellas and South Mountain. In addition, minor groundwater underflow entered the sub-basin from the East SRV Sub-basin between the Papago Buttes and South Mountain. Within the sub-basin, groundwater flowed toward and along the Salt and Gila rivers and finally exited the sub-basin into the southern part of the Hassayampa Sub-basin. Historic groundwater levels in the West SRV Sub-basin ranged from 800 feet above mean sea level along the western reaches of the Gila River to nearly 1,300 feet above mean sea level in the north (Figure 2-3). Shallow groundwater conditions occurred in the Buckeye area.

Groundwater pumping for agriculture in the West SRV Sub-basin began in the late 1800s from shallow irrigation wells along the Salt and Gila rivers (Lee, 1905). Increases in well-pumping capacity, expanding agriculture, and later, urban development, have caused increased groundwater pumping volumes. Groundwater levels have declined significantly, with two large cones of depression created by groundwater pumping near Luke Air Force Base and in Deer Valley near the Hedgpeth Hills. From 1923 to 1977, water levels declined by more than 300 feet in these areas (Ross, 1978).

In 1998, water levels ranged from 700 feet above mean sea level in the Luke area cone of depression to 1,350 feet above mean sea level in the northern area of the sub-basin (Figure 2-5). Depth to groundwater during 1998 ranged from less than 50 feet below land surface near the Salt and Gila rivers to over 550 feet below land surface near the Union Hills (Figure 2-6). Along the Gila River west of Goodyear, depth to groundwater may range from as shallow as 4 feet to as much as 20 feet below land surface. In the Buckeye area, shallow groundwater conditions have caused waterlogging problems with detrimental effects on crops (Montgomery & Associates, 1988). In spite of extensive groundwater pumping in the area, waterlogging problems persist because of the high volume of treated reclaimed water discharged into the Salt River by the City of Phoenix's 91st Avenue Wastewater Treatment Plant (WWTP) and because of high volumes of water applied for agricultural irrigation to manage elevated salt levels. Although some groundwater still flows westward from the West SRV Sub-basin into the southern part of the Hassayampa Sub-basin, much of the groundwater flows toward the two large cones of depression.

The West SRV Sub-basin currently contains many water users who do not have access to many renewable supplies and rely heavily on groundwater, including municipal water providers such as Liberty Utilities, EPCOR - Sun City, EPCOR - Sun City West, EPCOR - Agua Fria, the City of El Mirage and Luke Air Force Base; agricultural users served by the Roosevelt Irrigation District; and numerous golf courses in the Sun City and Sun City West area that have their own grandfathered rights to pump groundwater.

2.4.2.1 Waterlogged Areas

In the West SRV, the area in the vicinity of the Buckeye Water Conservation and Drainage District, the St. Johns Irrigation District, and the Arlington Canal Company has an extremely shallow depth to groundwater. There are several possible causes for waterlogging in the area, including the natural drainage of the East SRV and West SRV toward the confluence of the Gila and Salt rivers, crop irrigation and canal seepage, and treated wastewater discharged to the Salt River from the City of Phoenix's 23rd Avenue and 91st Avenue wastewater treatment plants. The combined wastewater discharges continue today at approximately 148,000 AF per year.

In some areas, the current depth to water is less than 10 feet. For certain crops to be grown, the surrounding land must be drained and dewatered. In the aforementioned irrigation districts, systems of drainage channels are operated. These channels divert and discharge groundwater and surface runoff from the area to the Salt and Gila rivers.

High salinity present in the waterlogged area has worsened over time as the salts delivered in irrigation water have accumulated. Deep percolation of water in an effort to leach salts from the root zone has further pushed salts into the groundwater, although this has been somewhat mitigated by the influx of treated wastewater from the plants in certain parts of the waterlogged area.

2.4.3 Hassayampa Sub-basin

In the far western portion of the AMA, the Hassayampa Sub-basin covers 1,200 square miles and is a gently sloping alluvial plain bounded on the north by the Vulture Mountains and the Wickenburg Mountains; on the east by the White Tank Mountains; on the south by the Buckeye Hills and the Gila Bend Mountains; and on the west by the Big Horn Mountains, the Belmont Mountains, and the Palo Verde Hills (Figure 2-1). The area is drained by the Hassayampa River, which enters the sub-basin in the northeast and joins the Gila River east of Arlington. The Gila River, which flows perennially with reclaimed water from the west Phoenix metropolitan area, crosses the southeastern tip of the sub-basin. Tributaries to the Hassayampa and Gila rivers include Jackrabbit Wash and Centennial Wash, respectively. The sequence of basin-fill sediments in the lower Hassayampa Sub-basin consists of three hydrogeologic units designated as the upper, middle, and lower alluvium (Fugro, Inc., 1980). The upper unit is 30 to 60 feet thick and consists of sand and gravel. The middle unit, 230 to 300 feet thick, consists of clay and silt. The lower unit, from 100 to more than 1,000 feet thick, consists of unconsolidated sand and moderately to well consolidated alluvial fan deposits.

Historically, groundwater entered the Hassayampa Plain from the northeast, most of which flowed south into the lower Hassayampa area. Groundwater also enters the southeastern part of the lower Hassayampa area as underflow from the southern part of the West SRV Sub-basin.

Groundwater levels historically ranged from 800 feet above mean sea level in the southern area of the sub-basin to more than 1,300 feet above mean sea level in the extreme northern reaches of the sub-basin (Figure 2-3). In the lower Hassayampa area, extensive groundwater pumping for agricultural development began in the early 1950s. Approximately 24,000 acres of land were under cultivation by 1960 and 22,500 acres were under cultivation in 1982 (Stulik, 1974). As a result of groundwater pumping, water levels have declined significantly in the agricultural areas of the sub-basin. From the mid-1950s through 1998, water levels declined by as much as 70 feet in the Tonopah Desert and 90 feet in the Centennial Wash area, resulting in the creation of two large cones of depression in those areas. Data from 1998 shows groundwater levels ranging from 700 feet above mean sea level in the southern area of the sub-basin to 1,350 feet above mean sea level in the northern section (Figure 2-5). Depth to groundwater in the Hassayampa Sub-basin in 1998 ranged from less than 20 feet below land surface near the Gila River in Arlington Valley to over 700 feet below land surface near the Vulture Mountains.

After passing a bedrock constriction between the Belmont Mountains and the White Tank Mountains, groundwater currently flows from the northeast to southwest toward two cones of depression in the Tonopah Desert and Centennial Wash areas. Groundwater entering the southeastern part of the lower Hassayampa area from the southern part of the West SRV Sub-basin is largely captured by the cone of depression in the Centennial Wash area.

2.4.4 Rainbow Valley Sub-basin

The Rainbow Valley Sub-basin is a gently sloping alluvial plain of approximately 420 square miles bounded on the north by the Buckeye Hills and the northern part of the Sierra Estrella, on the east by the Sierra Estrellas and the Palo Verde Mountains, on the south by the Haley Hills and the Booth Hills and the southern part of the Maricopa Mountains, and on the west by the Maricopa Mountains (Figure 2-1) (White, 1963). The area is drained by Waterman Wash, which joins the Gila River near Buckeye.

The basin-fill sequence which comprises the regional aquifer of the Rainbow Valley Sub-basin consists of poorly sorted gravel, sand, silt, and clay (White, 1963). Due to a lack of geologic data, the regional aquifer is not well-defined. Wells are concentrated in the northern part of the sub-basin; there are very few wells in other parts of the sub-basin. Depth to bedrock in the Rainbow Valley Sub-basin ranges from a few feet near the basin margins to a maximum verified depth of over 1,200 feet in the north-central part of the basin (White, 1963). More recent data suggest that the depth may exceed 9,600 feet in the central part of the basin (Oppenheimer, 1980).

Historically, groundwater may have entered the Rainbow Valley Sub-basin from the Pinal AMA between the Palo Verde Mountains and the Haley Hills (White, 1963). Groundwater from the southern part of the Rainbow Valley Sub-basin generally flowed toward the northwest. Water levels in the Rainbow Valley Sub-basin were approximately 900 feet above mean sea level (Figure 2-3). Water levels began declining in the early 1950s with the commencement of intensive agricultural development in the northern part of the sub-basin. By 1982, water levels had declined by as much as 200 feet in the north and by about 12 feet further south near Mobile. Pumping in the north has created an extensive cone of depression there. Water levels in the sub-basin in 1998 ranged from 750 feet above mean sea level in the northwestern area to 950 feet above mean sea level in the southeast area. Depth to groundwater in the Rainbow Valley Sub-basin in 1998 ranged from 120 feet below land surface near the Buckeye Hills to over 400 feet near the cone of depression and further south in the Mobile Valley. Available information suggests that the regional aquifer in the Rainbow Valley Sub-basin is not currently connected to adjacent sub-basins. Groundwater no longer flows into the sub-basin from the Pinal AMA because of groundwater pumping in that AMA. Similarly, groundwater that historically flowed from the Rainbow Valley Sub-basin into the West SRV Sub-basin prior to development no longer does so because of groundwater pumping for agricultural irrigation in the northern part of the sub-basin. In that area, groundwater flows toward the cone of depression.

2.4.5 Fountain Hills Sub-basin

In the northeastern part of the AMA, the Fountain Hills Sub-basin, covering approximately 360 square miles, is an extensively dissected alluvial plain bounded on the north and east by the Mazatzal Mountains and Stewart Mountain, on the south by the Usery Mountains and Sawik Mountain, and on the west by the McDowell Mountains (Figure 2-1). The sub-basin is drained by the lower part of the Verde River, a perennial river regulated by Bartlett Dam near the northeastern boundary of the sub-basin. The Verde River flows south along the axis of the basin, joining a regulated reach of the Salt River between Stewart Mountain Dam and Granite Reef Dam in the southern part of the sub-basin. Tributaries to the Verde River include Camp Creek and Sycamore Creek.

Depth to bedrock in the Fountain Hills Sub-basin ranges from a few feet near the basin margins to over 1,200 feet near the center of the basin (Ross, 1978); more recent data indicates the depth may exceed 4,800 feet (Oppenheimer, 1980). The regional aquifer consists of two distinct hydrogeologic units: an older basin-fill sequence and unconsolidated alluvium deposited by the Verde River. The unconsolidated alluvium underlies the modern floodplain of the Verde River.

The general direction of groundwater flow is from north to south, parallel to the axis of the sub-basin and has likely remained unchanged since development has occurred in this sub-basin. Available information suggests that the regional aquifer in the Fountain Hills Sub-basin is not connected to adjacent sub-basins. To date, groundwater pumping in the Fountain Hills Sub-basin has been relatively minimal. In the 1920s, the City of Phoenix began diverting groundwater from the Verde River alluvium for municipal water supply. Currently, groundwater is pumped by Chaparral City Water Company, Fountain Hills Golf Course, the development of Rio Verde, and a number of domestic wells. Almost all groundwater pumping occurs in the southern part of the sub-basin.

Long-term water level records are limited for the Fountain Hills Sub-basin; however, available information suggests that water levels have not been significantly affected by groundwater pumping in the sub-basin. Depth to groundwater in 1998 ranged from 19 feet below land surface in the Verde River floodplain south of Bartlett Dam to over 500 feet below land surface near the McDowell Mountains.

2.4.6 Lake Pleasant Sub-basin

In the northern part of the AMA, the Lake Pleasant Sub-basin is a relatively small, gently sloping alluvial plain of 240 square miles bounded on the north by an unnamed ridge southeast of the Agua Fria River; on the east by the New River Mountains and an unnamed group of hills to the south; on the south by the Union, Deem and Hedgpeth Hills; and on the west by the Hieroglyphic Mountains (Figure 2-1). The sub-basin is drained by the lower part of the Agua Fria River, an ephemeral stream regulated by New Waddell Dam at the northern boundary of the sub-basin; by New River, which heads in the New River Mountains to the northeast; and by Skunk Creek.

The basin-fill sediments comprising the regional aquifer of the Lake Pleasant Sub-basin consist of unconsolidated to semi-consolidated silt, sand, and gravel, and locally may include interbedded basalt (Litten, 1979). Depth to bedrock in the Lake Pleasant Sub-basin ranges from a few feet near the basin margins to over 800 feet near the center of the basin.

The general direction of groundwater flow, from north to south, has likely remained unchanged since little development has occurred in this sub-basin. Groundwater flow directions suggest that the Lake Pleasant Sub-basin is hydraulically connected with the West SRV and East SRV Sub-basins. Groundwater enters the sub-basin from the northeast and flows south along New River and into the West SRV Sub-basin, both at the Agua Fria River east of the Hieroglyphic Mountains and at Skunk Creek between the Deem Hills and the Union Hills. Groundwater flows into the East SRV south of the town of New River and north of the Union Hills.

To date, the quantity of groundwater pumping in the Lake Pleasant Sub-basin has been relatively small. Currently, groundwater is pumped by numerous domestic wells mainly near the town of New River, a few small, private water companies, and an outlet mall. Water levels for 1998 ranged from 1,550 feet above mean sea level in the northern area of the sub-basin to 1,300 feet above mean sea level in the southern portion of the sub-basin.

Long-term water level records are limited for the Lake Pleasant Sub-basin; however, available information suggests that water levels have been significantly affected by groundwater pumping. Near the Town of New River, areas underlain by volcanic rock have experienced severe declines and many domestic wells have gone dry. Depth to groundwater in 1998 ranged from 11 feet below land surface in a local aquifer near the Town of New River to nearly 300 feet below land surface in the regional aquifer south of New River (Figure 2-6).

2.4.7 Carefree Sub-basin

The Carefree Sub-basin covers approximately 140 square miles. It is bordered on the east by the northernmost McDowell Mountains, on the north by a mountainous area southwest of New River Mesa, and to the south and west by a group of low-lying hills including Black Mountain (Figure 2-1). The groundwater-bearing portion of the sub-basin is a small dissected alluvial plain located in the far northern portion of the AMA.

Compared to other sub-basins in the AMA, the Carefree Sub-basin is relatively shallow (approximately 2,000 feet) and is filled with older, partially consolidated to consolidated sedimentary rocks (Pewe and Dorn, 1989). The primary aquifer in the basin is the Carefree Formation, which consists of alluvial fan and playa deposits (1989). The Carefree Formation consists of five members, of which only the Grapevine member is a significant source of groundwater. The Carefree Formation is underlain by volcanic rocks.

Groundwater in the Carefree Sub-basin generally moves west-southwest. The general direction of groundwater flow probably has not changed since groundwater pumping has commenced in the sub-basin. Mountain-front recharge occurs along the northeast and eastern portions of the sub-basin, and groundwater flow is generally from east to west in that area. Streambed recharge also occurs along the channel of Cave Creek in the northwestern portion of the sub-basin. Other ephemeral washes draining upland areas also contribute to groundwater recharge. Groundwater leaves the basin and flows into the East SRV Sub-basin.

Detailed water level data prior to development are unavailable for the Carefree Sub-basin. However, groundwater pumping in the Carefree Sub-basin has had a serious impact on groundwater levels. Water levels began declining in the early 1960s with the onset of pumping. In the center of the basin near the Carefree Airport, a cone of depression has formed as a result of heavy pumping associated with golf courses. Water-level declines in this area have exceeded 10 feet per year (Figure 2-4) (Bernier, 1992). However, since the early 1990s, many of the golf courses in the area have ceased pumping groundwater and have converted to Colorado River and commingled water because of concerns raised regarding the impacts on the aquifer and the supply for other users. Water elevations in 1998 range from 2,000 feet above mean sea level in the northwestern area of the sub-basin to 2,450 feet above mean sea level in the northeastern area of the sub-basin. Depth to groundwater in the Carefree Sub-basin in 1998 ranged from less than 30 feet below land surface near Cave Creek to over 390 feet below land surface in the eastern part of the basin.

The Carefree Sub-basin aquifers are relatively shallow and unproductive. Under the Assured Water Supply (AWS) Rules, current and committed demand for groundwater in storage to a depth of 1,000 feet has already been completely accounted for in the northern part of the sub-basin.

2.5 GROUNDWATER RESOURCES

2.5.1 Groundwater Recharge and Discharge

Groundwater recharge components in the PhxAMA include 1) mountain-front, 2) stream recharge, 3) underflow, 4) incidental recharge, and 5) artificial recharge. For purposes of this report, incidental recharge is defined as water that recharges the PhxAMA's regional aquifer during the course of its use for agricultural, industrial, or municipal purposes. This includes water that is recharged as a result of irrigation activities, reclaimed water that is released to the PhxAMA's rivers and their tributaries or used for irrigation, and water infiltrating from canals. Artificial recharge is defined as water that is recharged at constructed or managed recharge projects permitted by ADWR.[1] Historically, the largest source of recharge to the PhxAMA regional aquifer has been agricultural incidental recharge.

[1] A "managed underground storage facility means a facility . . . that is designed and managed to utilize the natural channel of a stream to store water underground pursuant to permits issued under this chapter through artificial and controlled release of water other than surface water naturally present in the stream" A.R.S. § 45-802.01(12). A "constructed underground storage facility means a facility that . . . is designed and constructed to store water underground pursuant to permits issued under this chapter." A.R.S. § 5-802.01(4).

TABLE 2-2
RATES OF ANNUAL NET NATURAL RECHARGE (AF/YEAR)

Year	Natural Recharge			Incidental Recharge		Total Natural and Incidental Recharge	Natural Discharge		Total Natural Discharge	Net Natural and Incidental Recharge
	Mountain front[1]	Stream Channel	Groundwater inflow	Canal Seepage	Ag Recharge - Lagged		Riparian transpiration (GW)[1]	Groundwater underflow		
1985	24,216	140,800	20,177	192,433	585,461	963,087	22,453	24,509	46,962	916,125
1986	24,216	128,007	20,177	192,433	577,372	942,205	22,485	24,509	46,994	895,211
1987	24,216	126,038	20,177	192,433	569,202	932,066	22,529	24,509	47,037	885,029
1988	24,216	133,888	20,177	186,183	522,300	886,765	22,595	24,509	47,104	839,661
1989	24,216	201,787	20,177	186,183	514,523	946,887	22,624	24,509	47,133	899,755
1990	24,216	310,031	20,177	186,183	508,263	1,048,871	22,588	24,509	47,097	1,001,774
1991	24,216	130,628	20,177	186,183	505,378	866,583	22,474	24,509	46,982	819,600
1992	24,216	95,839	20,177	186,183	500,339	826,755	22,453	24,509	46,961	779,793
1993	24,216	126,837	20,177	191,794	534,248	897,273	22,417	24,509	46,925	850,348
1994	24,216	91,412	20,177	191,794	573,311	900,910	22,393	24,509	46,902	854,008
1995	24,216	97,736	20,177	191,794	599,601	933,524	22,431	24,509	46,940	886,583
1996	24,216	198,746	20,177	191,794	516,002	950,936	22,565	24,509	47,074	903,862
1997	24,216	200,486	20,177	191,794	508,271	944,944	22,509	24,509	47,018	897,926
1998	24,216	96,341	20,177	246,247	630,723	1,017,705	22,444	24,509	46,953	970,752
1999	24,216	89,675	20,177	246,247	648,425	1,028,740	22,531	24,509	47,040	981,701
2000	24,216	92,785	20,177	246,247	673,933	1,057,358	22,468	24,509	46,977	1,010,382
2001	24,216	128,796	20,177	73,909	493,828	740,927	22,538	24,509	47,047	693,880
2002	24,216	208,426	20,177	76,280	524,563	853,663	22,589	24,509	47,098	806,566
2003	24,216	169,682	20,177	84,662	513,449	812,186	22,602	24,509	47,111	765,075
2004	24,216	93,178	20,177	80,646	534,478	752,696	22,709	24,509	47,218	705,478
2005	24,216	104,619	20,177	76,440	475,936	701,389	22,734	24,509	47,243	654,146
2006	24,216	92,673	20,177	78,236	604,398	819,701	22,742	24,509	47,250	772,450
2007	24,216	104,042	20,177	78,236	635,527	862,198	22,779	24,509	47,288	814,910
2008	24,216	108,488	20,177	78,236	548,157	779,274	22,730	24,509	47,239	732,035
2009	24,216	102,906	20,177	78,236	625,529	851,065	22,735	24,509	47,244	803,821
2010	24,216	113,858	20,177	78,236	600,816	837,303	23,334	24,509	47,843	789,461
2011	24,216	101,342	20,177	78,236	531,208	755,180	23,222	24,509	47,731	707,449
2012	24,216	101,146	20,177	78,236	482,143	705,918	22,924	24,509	47,432	658,486
2013	24,216	142,115	20,177	78,236	450,466	715,210	22,866	24,509	47,375	667,836
2014	24,216	144,818	20,177	78,236	466,491	733,939	22,769	24,509	47,277	686,662
2015	24,216	101,644	20,177	78,236	469,184	693,458	22,749	24,509	47,257	646,201
2016	24,216	104,055	20,177	78,236	467,628	694,313	22,749	24,509	47,258	647,055
2017	24,216	109,829	20,177	78,236	458,254	690,713	22,680	24,509	47,189	643,524

Groundwater is discharged from the PhxAMA's regional aquifer through pumpage, underflow out of the AMA, and evapotranspiration (ET). Groundwater pumping represents the largest source of outflow in the PhxAMA. Underflow out of the AMA occurs to the east of the Sierra Estrella Mountains and along the Gila River, north of the Buckeye Hills. ET losses occur primarily along the Salt and Gila Rivers riparian corridors.

2.6 GROUNDWATER CONDITIONS

Groundwater conditions in an aquifer can be monitored by collection of water level measurements from the aquifer. The water level in an aquifer reflects the cumulative inflow and outflow stresses that have been applied to the aquifer. Groundwater level measurements also provide important information on long and short-term water level trends and on aquifer storage changes.
The ADWR Hydrology Division's Field Services Unit collects water level data using both conventional field methods (electric sounders or steel tapes) and pressure transducers at automated sites. A selected group of wells, called index wells, are measured annually to monitor ongoing groundwater conditions. In addition to the annual index-well data, ADWR also does AMA-wide water-level sweeps where water levels are measured in as many wells as possible. Recent PhxAMA-wide water level sweeps were completed in 2008 and 2017. ADWR utilizes water level data collected by other entities in the PhxAMA that is submitted to ADWR and water-level data entered into ADWR's Groundwater Site Inventory (GWSI) database that is collected by the ADWR Field Services Unit.

Water level data is used by ADWR to produce water elevation and depth-to-water maps. The 2015 water level elevation map for the PhxAMA is shown in Figure 2-5. The water level elevation map shows the elevation of the water table above mean sea level. The general direction of groundwater flow in an aquifer can be determined by the orientation of the water table contours. The general rule of thumb is that water flows at right angles to the water level elevation contours, and from areas of high elevation to lower elevation.

The depth-to-water in 2015 is shown in Figure 2-6. The depth-to-water map shows the depth of the water table below land surface. The direction of groundwater flow is not easily determined from a depth-to-water map. Depth-to-water maps are generally used for well location and design, and hydrologic interpretation.

2.6.1 Estimated Groundwater-in-storage

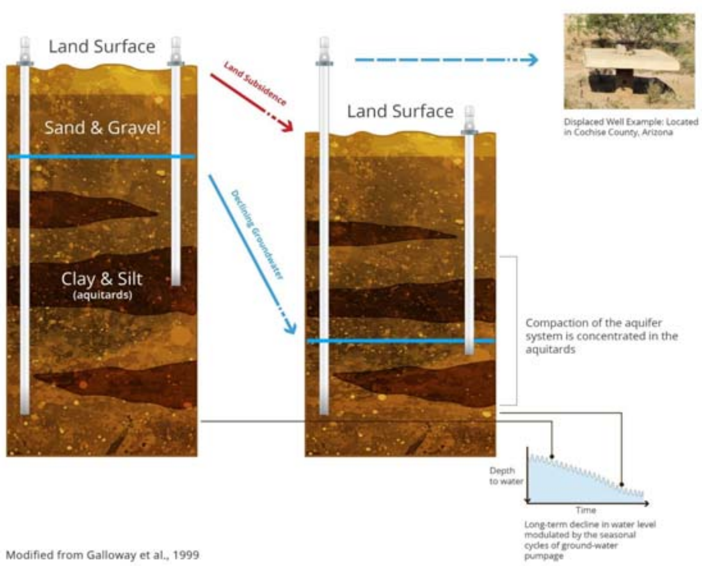
Information on aquifer thickness, depth-to-water, and aquifer storage properties can be used to estimate the volume of water in storage in an aquifer. The estimated groundwater-in-storage to 1,000 feet below land surface for the area covered by the SRV groundwater flow model in 2015 is approximately 84.5 million AF, some portion of this volume may be physically or practically unrecoverable. The groundwater-in-storage for each sub-basin is shown in Table 2-3.

TABLE 2-3
GROUNDWATER FLOW MODEL
GROUNDWATER IN STORAGE ESTIMATE

Sub-basin	AF
East Salt River Valley	33,074,100
West Salt River Valley	30,580,300
Hassayampa	18,714,000
Rainbow Valley	NA
Fountain Hills	NA
Lake Pleasant	2,161,600
Carefree	NA
TOTAL	**84,530,00**

NA – Sub-basin located outside the SRV modeled area.

2.7 LAND SUBSIDENCE



Land Subsidence Diagram

Land subsidence has been occurring across Arizona since the 1940s (Robinson and Peterson, 1962). Some areas in Maricopa and Pinal counties have subsided more than 18 feet since 1940. Land subsidence in the basins of Arizona is generally due to compaction of the alluvium caused by lowering of the water table. As the water table declines, pores in the alluvium once held open by water pressure are no longer supported and collapse (Diagram). Collapse and subsequent lowering in elevation of the land surface is defined as land subsidence. There are two types of land subsidence: elastic land subsidence, which is reversable; and inelastic land subsidence, which is irreversible. Elastic land subsidence occurs from seasonal groundwater declines and recoveries and recharge related to seasonal groundwater pumping and recharge from artificial and natural events, resulting in both seasonal land subsidence and uplift. Inelastic land subsidence occurs when groundwater levels continue to decline over time causing the pore pressure to decrease and a subsequent increase of stress in the subsurface. This results in the rearrangement and permanent compaction of the mineral grains in the subsurface, causing the overlying material to collapse. The permanent compaction from land subsidence also results in a loss of aquifer storage, decreasing the amount of groundwater that could be stored in the subsurface. If this subsidence occurs over areas of bedrock, differential subsidence can occur.

Differential subsidence is when adjacent areas subside at different rates. Bedrock will not compress like the surrounding alluvium, creating a subsurface platform. Differential subsidence occurs where shallow bedrock and deep bedrock are adjacent to each other, creating a zone of differential change in surface elevation. Because of these different amounts of subsidence, tension can build in the alluvium layer at this differential subsidence zone, forming an earth fissure.

Earth fissures are cracks at or near the earth's surface that are the result of differential land subsidence. Earth fissures start out as small cracks and may not be visible on the surface. The earth fissures grow and widen from surface water flowing in the crack, eroding material from the sides. Earth fissures have caused millions of dollars in property and infrastructure damage, damaging pipelines, roads, canals, flood retention structures, bridges, building, and private property.

Several areas of land subsidence and earth fissures exist in the Phoenix AMA (Figure 2-7). In the West Salt River Valley Sub-basin, land subsidence of up to 19 feet and the development of earth fissures have occurred in an area of approximately 214 square miles near Luke Air Force Base. The greatest hazard to the area as a result of the land subsidence has been flooding; in 1992, extensive flooding caused approximately $3 million in damages. It became necessary to re-level the Dysart Drain at a cost of approximately $16 million and to re-level fields and repair irrigation ditches in this area due to land subsidence (Schumann and O'Day, 1995 and Gelt, 1992). The total cost to repair and improve land subsidence-related problems has been in excess of $22 million at Luke Air Force Base.

In the East Salt River Valley Sub-basin, land subsidence and the development of earth fissures has also occurred in the Queen Creek, east Mesa, Apache Junction, Northeast Phoenix and Scottsdale areas (Schumann and Genualdi, 1986). As much as five feet of land subsidence occurred in the Paradise Valley area between 1965 and 1982. In 1980, an earth fissure opened in Paradise Valley at a residential construction site. It was the first known occurrence of an earth fissure in a densely populated area (Pewe, 1990). The earth fissure cost approximately $500,000 in planning and repair expenses (Pewe and Larson, 1986). At least 0.5 feet of land subsidence has been documented in the central Scottsdale area where water levels have declined by 200 to 300 feet since development has occurred (Schumann, 1974). Problems caused by land subsidence in these areas resulted in a need to repair sewer lines that had undergone a change in gradient and caused an interruption in flow (Gelt, 1992).

In the Queen Creek area, an area of approximately 230 square miles north of the San Tan Mountains had subsided more than 3 feet by 1977. In the vicinity of Apache Junction, over 5 feet of land subsidence has been documented by the 1980s, and earth fissuring represents an ever-present concern (Carpenter, 1980). Both the Central Arizona Project canal and several

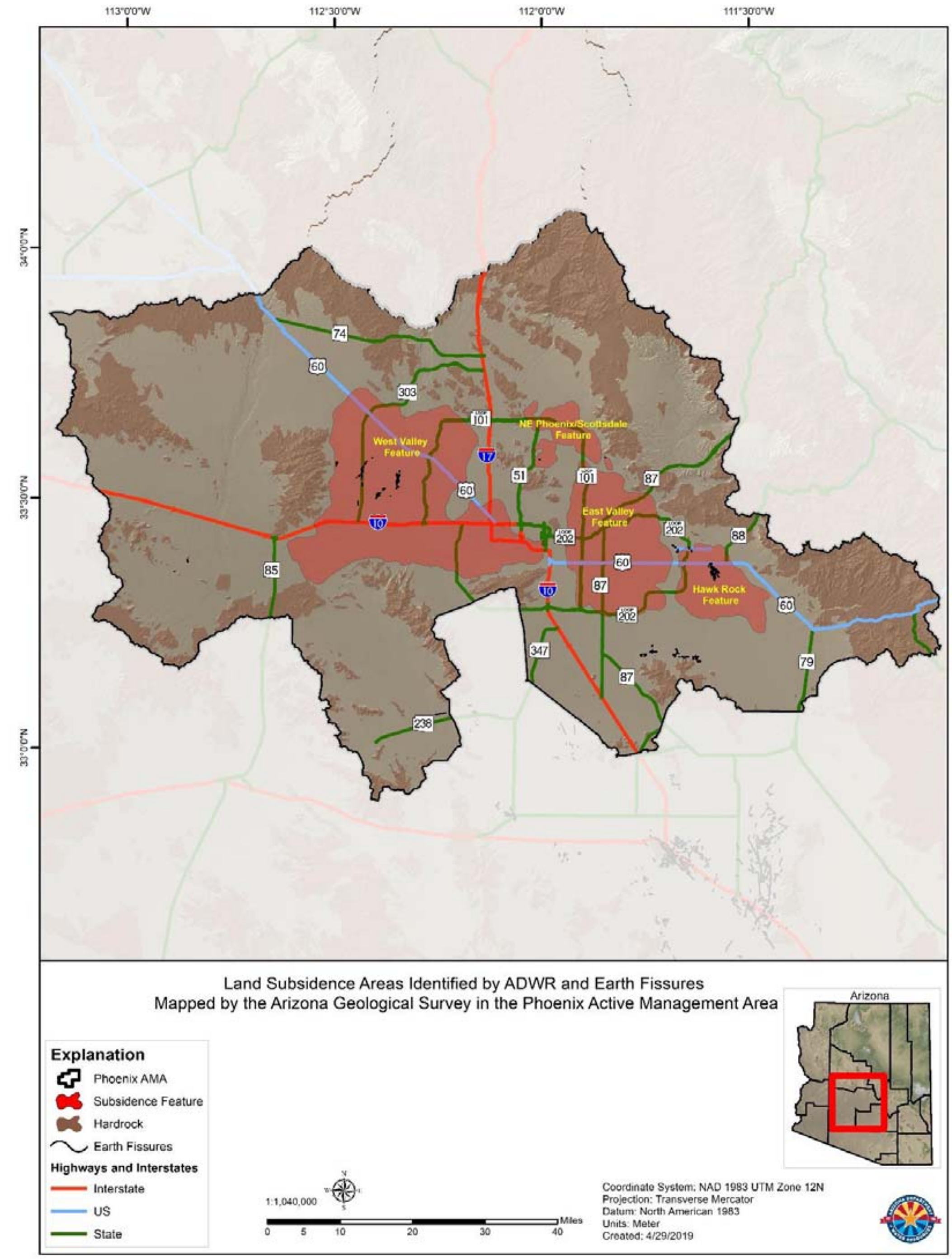
Flood Control District of Maricopa County (FCDMC) flood control structures run directly through the land subsidence feature and earth fissure zone.

The FCDMC McMicken and White Tanks #3 flood control structures (FRS), located along the eastern edge of the White Tanks Mountains, have been weakened by land subsidence and earth fissures and have been determined a "significant safety hazard" by the Dam Safety Section of ADWR. These structures also have been altered and weakened by land subsidence and earth fissures and have required mitigation. So far, the FCDMC has spent $6 million dollars to repair and monitor the Powerline FRS.

ADWR land subsidence monitoring and land subsidence maps published annually on ADWR's Hydrology eLibrary website provide further evidence of continued land subsidence in the Phoenix AMA, particularly in four areas (Figure 2-7). The first feature, referred to as the West Valley feature is located between the White Tanks Mountains, Luke Air Force Base, the Loop 101, the Loop 303, Sun City, Peoria, Glendale, Phoenix, and I-10. The second feature, referred to as the Northeast Phoenix/Scottsdale feature is located in central Scottsdale and Northeast Phoenix between the Paradise Valley Mall area and the McDowell Mountains. The third feature, referred to as the Hawk Rock feature is located in East Mesa and Apache Junction. The fourth feature, referred to as the East Valley feature is located in central Mesa and northern Chandler and Gilbert.

The Arizona Geological Survey (AZGS) is responsible for monitoring and mapping earth fissures throughout Arizona. As of 2019, the AZGS has mapped more than 18 miles of earth fissures in the Phoenix AMA (Figure 2-7).

FIGURE 2-7
LAND SUBSIDENCE FEATURES IDENTIFIED BY ADWR AND MAPPED EARTH FISSURES BY THE ARIZONA GEOLOGICAL SURVEY IN THE PHOENIX AMA



2.8 AVAILABILITY AND UTILIZATION OF RENEWABLE SUPPLIES

To achieve safe-yield in the PhxAMA by 2025 groundwater reliance must be reduced and renewable water supply use increased. Treated reclaimed water, Colorado River water delivered through the CAP (CAP water), and surface water are currently available renewable supplies in the PhxAMA. The continued ability to effectively utilize these renewable supplies throughout the PhxAMA will significantly affect the PhxAMA's ability to reach safe-yield. The historical direct use of renewable supplies is described in detail in Chapter 3.

2.8.1 Reclaimed Water

ADWR estimates that more than 350,000 AF of reclaimed water was produced at wastewater treatment plants in the PhxAMA in 2015. The majority of this reclaimed water was treated at the 91st Avenue Wastewater Treatment Plant. Smaller amounts of reclaimed water were treated at a number of smaller capacity sub-regional plants. More than half of the wastewater generated is reused by the four water using sectors in the PhxAMA. The industrial sector currently uses most of the reclaimed water that is directly reused. This is primarily used by the Palo Verde Nuclear Generating Station for cooling purposes. The Tres Rios wetland area uses another 70,000 to 100,000 AF. Approximately 30,000 AF of reclaimed water is stored for annual recovery or long-term storage credits at constructed or managed underground storage facilities each year. The remainder of the reclaimed water is discharged.

2.8.2 In-State Surface Water

Surface water other than Colorado River water is the most abundant renewable water supply in the PhxAMA. From 1985 to 2015, an average of nearly 869,000 AF of surface water was used each year among the four water use sectors in the PhxAMA. Surface water is supplied by multiple irrigation districts in the PhxAMA, but the largest supplier of surface water is the Salt River Project, which operates several dams containing surface water from the Salt and Verde Rivers.

2.8.3 Colorado River Water

Colorado River Water delivered through the CAP infrastructure (CAP Water) is the second most abundant renewable supply in the PhxAMA. From 2002 to 2017, an average of more than 440,000 AF of Colorado River water was used each year, either directly or through storage and recovery, in the PhxAMA among all four water use sectors. See Chapter 8 of this plan for more information on the storage and recovery of Colorado River and other types of water.

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CHAPTER THREE: WATER DEMAND AND SUPPLY

3.1 INTRODUCTION

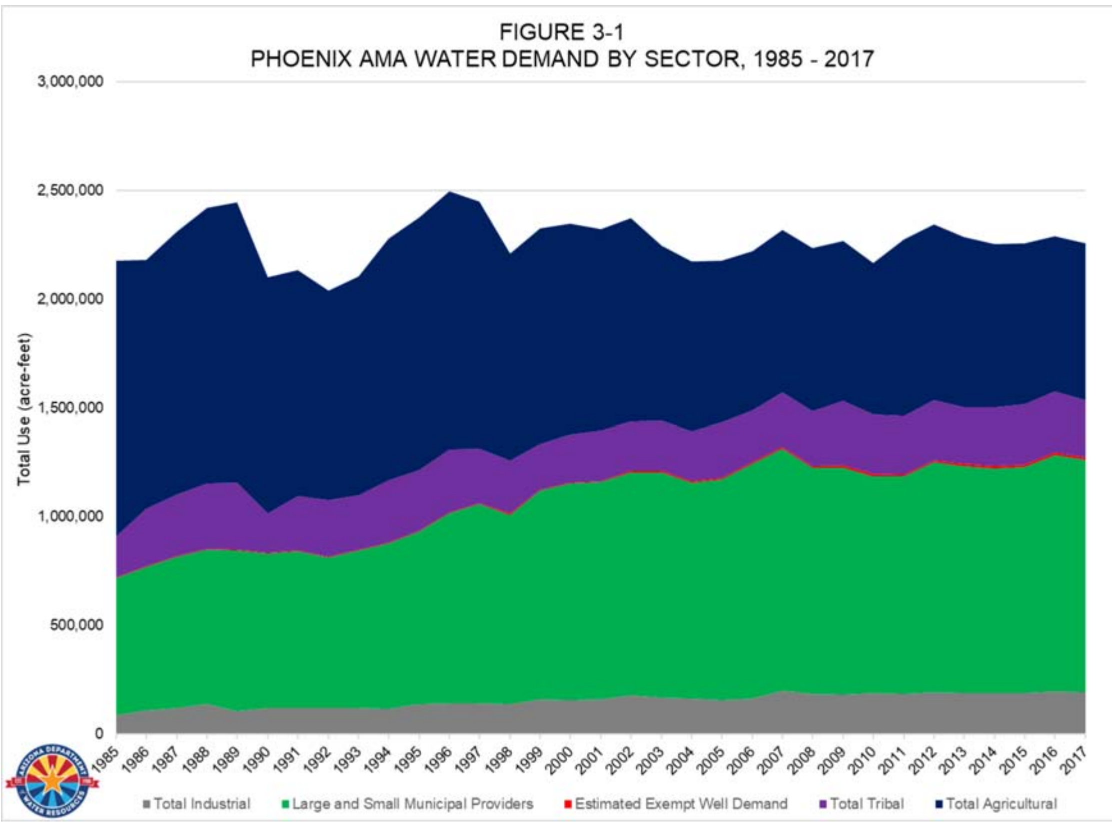
The Arizona Department of Water Resources (ADWR) conducted the *Water Demand and Supply Assessment 1985-2025, Phoenix Active Management Area* (Assessment) in 2010 (See: http://www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm) (ADWR, 2010), as preparation for this *Fourth Management Plan for Phoenix Active Management Area* (4MP). Chapter 3 of the 4MP updates the data included in the Assessment and analyses and identifies the implications of that data.

Historically, water users in the Phoenix Active Management Area (PhxAMA) have benefited from having multiple sources of water supply including groundwater, surface water, treated effluent and Colorado River water delivered through Central Arizona Project (CAP) infrastructure. The direct delivery and storage of treated effluent began in the mid-1990s and has increased over time, along with Colorado River water, somewhat reducing the reliance on groundwater supplies. Each of the four water-use sectors (municipal, industrial, agricultural, and tribal) in the PhxAMA use four water types; groundwater, surface water, treated effluent, and Colorado River water. For a detailed overview of the geography, hydrology, climate, and environmental conditions in the PhxAMA, refer to the *Arizona Water Atlas, Volume 8, Active Management Area Planning Area* (ADWR, 2010). (See: http://www.azwater.gov/azdwr/StatewidePlanning/WaterAtlas/ActiveManagementAreas/default.htm).

Water demand among the sectors has shifted between 1985 and 2017. Figure 3-1 illustrates the shift in demand from the agricultural sector to the municipal sector. The municipal sector is comprised of large and small municipal water providers. Municipal demand increased from 29 percent of the total PhxAMA demand in 1985 to 48 percent in 2017. Industrial sector demand increased from about four percent in 1985 to eight percent in 2017. Agricultural sector demand declined from 58 percent in 1985 to approximately 32 percent in 2017. Tribal demand, which is composed of municipal, industrial and agricultural demand on tribal reservations, increased from about nine percent in 1985 to 12 percent by 2017, primarily due to increased agriculture. Exempt wells accounted for less than one percent of the total PhxAMA water demand in 2017.

Colorado River water was first used in the PhxAMA in 1986. Its use has increased over time, and the proportion of the PhxAMA demand met with groundwater has reduced over time. However, the overall water demand in the PhxAMA has remained stable over the historical period. Treated effluent use has increased four-fold since 1985. Treated effluent is used in all four water-use sectors but is used primarily in the industrial and municipal sectors.

Tables 3-1A and 3-1B show how much groundwater, surface water, Colorado River water, and treated effluent was used by municipal, industrial, agricultural, and tribal sectors within the PhxAMA from 1985 through 2017, as well as estimated water use from private, domestic wells for the same period. In Table 3-1A, municipal water use includes water delivered for non-irrigation uses by a city, town, private- water company or irrigation district. Municipal demand is composed of the large municipal provider and small municipal provider subsectors, along with large untreated providers who deliver untreated water for landscape irrigation. Turf-related facilities, which have their own conservation requirements under the management plan, are included in the large and small municipal provider demand category if they receive water from a municipal provider. Note that for purposes of categorizing water demand in the Assessment, ADWR included estimated water demand associated with domestic exempt wells in the municipal demand category. However, for the 4MP, ADWR is showing estimated exempt well demand as a separate category of use. An exempt well is a well with a pump capacity of 35 gallons per minute or less; ADWR has no regulatory authority over water withdrawn from exempt wells. In general, industrial users withdraw groundwater from their own wells that are associated with Type 1 and Type 2 non-irrigation grandfathered groundwater rights, General Industrial Use (GIU) groundwater withdrawal permits or other withdrawal permits. In the PhxAMA, industrial demand is composed of the following subsectors: turf, sand and gravel, electric power, dairy, feedlot, de-watering, and other. Agricultural use is composed of the use of water by Irrigation Grandfathered Groundwater Rights (IGFRs) for agricultural uses not on tribal land, as well as the lost and unaccounted for water associated with the delivery of agricultural water. Agricultural use is defined as use of water to irrigate two or more acres of land to produce crops or feed. Tribal demand is composed of municipal, industrial and agricultural demand on tribal land. Tribal water use is exempt from state regulation; however, an estimate of this use is included in ADWR water budgets because of the physical impacts on the aquifer.



Municipal demand has been increasing in the PhxAMA since 1985, peaking in 2007. The reduction in municipal demand in subsequent years may be due, at least in part, to the economic downturn. However, data from the Central Arizona Groundwater Replenishment District (CAGRD) and Annual Water Withdrawal & Use Reports for large municipal providers with service areas comprised mostly of post-2000 housing stock indicate that the water demand of new homes is much less water than older homes, and less than the Third Management Plan (3MP) models for new residential development. Increased efficiency of use has been observed in all water-use sectors in the PhxAMA over time.

TABLE 3-1(A)
PHOENIX AMA WATER DEMAND, 1985 – 2017 (AF)
MUNICIPAL, EXEMPT WELLS, & INDUSTRIAL

Year	Municipal					Exempt Wells	Industrial				
	Ground-water	In-Lieu Ground-water	Surface Water	Colorado River Water	Treated Effluent	Ground-water	Ground-water	In-Lieu Ground-water	Surface Water	Colorado River Water	Treated Effluent
1985	221,746	0	408,407	0	0	3,349	69,229	0	5,810	0	13,628
1986	288,694	0	357,323	13,036	1,713	3,414	71,644	0	5,810	0	30,029
1987	263,124	0	373,038	59,518	1,513	3,481	74,777	0	4,917	894	38,029
1988	234,126	0	401,648	74,557	1,321	3,549	71,330	0	4,692	853	60,886
1989	226,792	0	408,876	105,013	1,682	3,618	72,779	0	4,975	905	24,966
1990	270,172	0	286,728	150,827	2,800	3,688	63,250	0	4,607	838	51,232
1991	216,070	0	428,719	74,187	3,202	3,760	62,863	0	4,538	825	51,188
1992	177,395	0	419,196	92,223	3,951	3,833	64,322	0	3,954	719	50,816
1993	202,617	0	408,290	111,471	3,628	3,908	65,682	0	4,734	861	49,069
1994	253,116	0	364,681	138,529	4,264	3,984	65,012	0	4,803	873	46,274
1995	232,989	0	403,744	157,800	1,068	4,062	79,069	0	5,504	828	52,606
1996	233,383	20,262	441,433	173,919	26,668	4,141	75,751	0	6,183	1,574	56,526
1997	261,604	46,455	423,235	208,387	24,884	4,222	74,920	0	4,549	2,367	59,152
1998	201,576	13,079	468,793	178,531	21,977	4,304	72,793	822	4,887	2,098	58,339
1999	261,312	25,465	460,165	194,655	46,424	4,388	83,136	1,272	7,503	2,346	64,099
2000	253,386	18,426	435,346	263,021	46,784	4,473	81,703	1,546	6,658	2,717	62,828
2001	235,630	24,256	437,618	283,261	46,275	5,016	85,663	2,117	5,842	1,960	62,199
2002	261,011	18,802	406,978	304,912	58,697	5,558	95,509	1,444	7,664	1,324	71,735
2003	350,102	19,628	329,552	335,741	25,549	6,100	90,104	1,160	8,879	1,603	66,095
2004	351,083	26,943	257,573	355,074	34,825	6,643	82,933	0	7,314	7,146	66,676
2005	213,005	0	461,866	317,064	30,207	7,185	84,900	0	9,788	1,041	61,141
2006	228,228	6,066	475,007	332,446	53,875	7,727	88,298	0	8,513	1,698	62,872
2007	211,083	18,651	477,136	367,453	64,582	8,270	106,637	0	10,301	2,525	80,306
2008	203,269	0	428,546	363,187	53,125	8,812	97,796	0	6,769	2,048	79,554
2009	190,218	0	429,005	365,059	67,333	9,354	90,728	0	10,830	1,071	80,022
2010	167,335	5,544	422,755	353,076	56,775	9,947	98,124	141	7,789	768	81,724
2011	164,049	8,834	421,971	358,288	54,265	10,004	94,747	197	4,487	2,255	82,635
2012	196,300	7,281	416,726	366,943	79,527	10,061	94,660	0	1,511	10,073	84,761
2013	190,281	36,677	389,372	381,027	84,892	10,118	89,114	243	4,633	10,942	82,920
2014	198,606	49,078	367,719	379,041	88,440	10,174	84,257	0	6,303	10,412	87,148
2015	221,332	54,787	358,121	375,597	81,454	10,231	89,841	0	7,020	7,096	85,590
2016	229,810	57,107	374,747	380,453	95,220	10,288	92,818	0	7,723	8,143	87,388
2017	187,553	33,624	367,218	395,693	87,019	10,345	93,057	0	10,367	2,001	86,056

NOTE: The columns above for Groundwater includes Remediated Groundwater.

Although municipal demand has increased with time, the proportion of the demand met with groundwater has decreased as Colorado River water use and treated effluent use have increased. The largest use of treated effluent in the PhxAMA industrial sector is in the power subsector. In this subsector, treated effluent is used at the Palo Verde Nuclear Generating Station (PVNGS). In-state surface water (surface water) also has been a significant water supply in the PhxAMA, particularly in the agricultural and municipal sectors. The Salt River Project Irrigation District is the largest supplier of surface water in the PhxAMA. For more discussion of the sources of surface water supply in the PhxAMA, refer to the *Draft Arizona Water Atlas, Volume 8, Active Management Area Planning Area* (ADWR, 2010).

TABLE 3-1(B)
PHOENIX AMA WATER DEMAND, 1985 - 2017 (AF)
AGRICULTURAL & TRIBAL

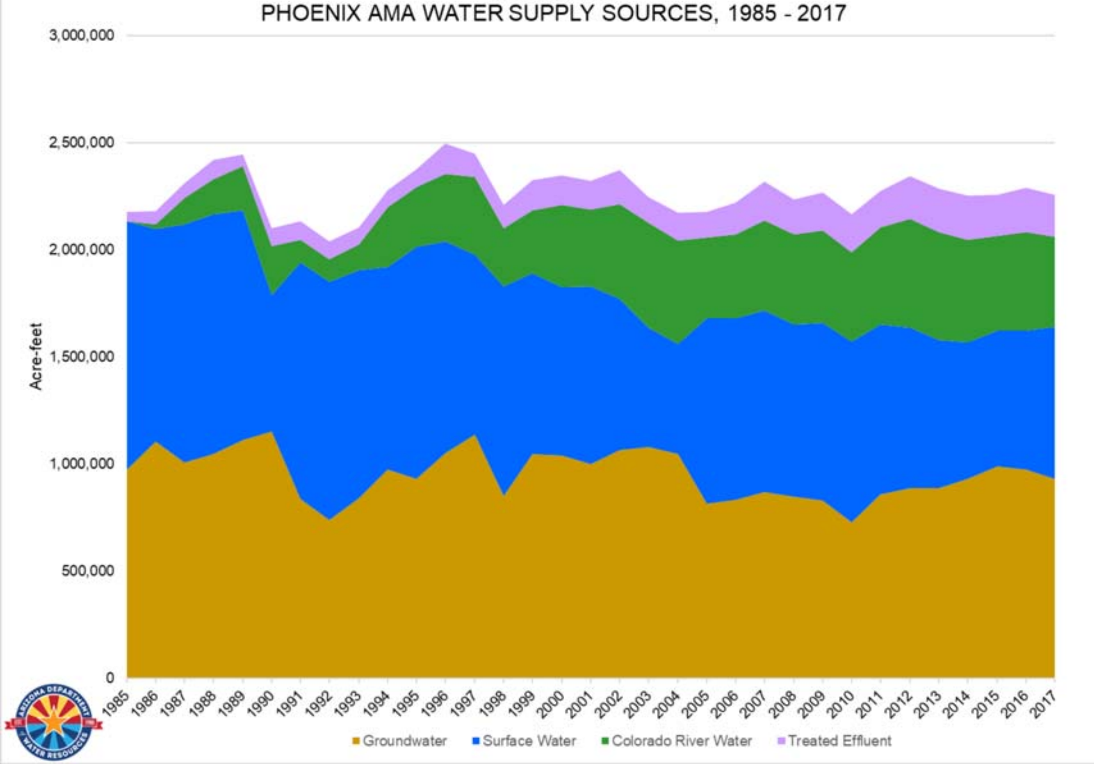
Year	Agricultural						Tribal			
	Groundwater	In-Lieu Ground-water	Surface Water	Colorado River Water	Treated Effluent	Agricultural Allotment	Ground-water	Surface Water	Colorado River Water	Treated Effluent
1985	647,719	0	587,776	0	30,138	1,877,572	34,818	152,880	0	0
1986	645,950	0	455,953	8,574	30,015	1,839,274	97,093	169,512	0	0
1987	572,866	0	543,965	60,597	30,003	1,784,763	94,658	189,208	0	0
1988	632,303	0	520,886	85,856	30,009	1,764,040	106,635	192,558	0	0
1989	703,133	0	456,356	100,228	30,000	1,730,060	106,868	200,652	0	0
1990	700,103	0	275,671	77,574	30,000	1,732,407	115,066	68,065	0	0
1991	465,080	0	507,931	33,083	30,019	1,719,634	91,135	159,220	0	0
1992	329,965	84,981	507,257	9,968	30,001	1,778,340	78,001	181,951	0	0
1993	358,902	129,948	483,247	5,151	30,001	1,753,496	79,431	168,999	0	0
1994	557,581	16,619	369,873	138,660	30,000	1,734,436	81,085	204,280	0	0
1995	474,033	65,690	470,366	119,829	30,000	1,472,183	77,595	200,712	0	0
1996	549,978	137,414	327,116	119,666	28,234	1,457,664	75,157	216,216	0	0
1997	464,040	238,449	264,906	150,118	28,200	1,419,081	83,501	168,006	0	0
1998	382,067	115,476	333,719	93,767	28,200	1,384,560	76,563	167,405	0	0
1999	418,649	198,303	247,021	97,088	28,200	1,357,879	81,832	127,470	0	0
2000	420,485	199,827	203,588	118,635	28,200	1,174,650	78,727	140,732	0	0
2001	380,779	212,033	233,120	73,758	28,200	1,119,874	79,242	151,279	0	0
2002	440,124	183,691	200,580	84,412	28,200	1,094,691	82,335	90,430	52,080	0
2003	373,167	183,136	114,048	105,953	28,200	1,016,176	81,020	102,797	46,200	0
2004	321,899	217,150	134,618	78,821	28,200	936,607	75,326	112,415	41,160	0
2005	256,595	166,862	232,843	58,511	28,200	908,215	93,982	159,925	0	1,011
2006	271,498	147,149	224,523	56,305	30,550	858,037	74,748	146,697	14,280	6,783
2007	323,918	135,422	201,582	47,718	35,403	824,305	68,522	161,376	20,398	5,315
2008	307,582	131,163	231,019	49,561	30,870	788,401	78,542	135,334	36,799	4,863
2009	294,161	133,056	225,504	51,105	31,260	787,330	79,967	157,697	42,090	0
2010	266,152	122,378	227,080	51,760	30,595	774,119	68,447	181,803	10,705	10,399
2011	365,275	148,170	214,363	53,581	32,078	738,775	74,344	150,612	39,382	4,157
2012	382,963	128,221	202,504	61,802	32,262	707,113	75,475	128,348	67,782	4,219
2013	339,571	159,033	198,318	53,915	31,316	692,509	99,716	96,041	61,494	2,363
2014	344,059	177,231	140,551	55,302	22,183	662,004	94,624	103,302	63,959	6,945
2015	356,929	207,756	119,939	19,016	38,047	644,717	98,520	130,217	44,341	3,338
2016	332,173	207,248	132,925	6,937	36,256	627,743	95,598	116,834	63,846	3,563
2017	340,074	182,135	176,823	5,665	20,392	617,432	85,259	151,905	19,526	3,241

Agricultural water use in Table 3-1B includes water deliveries by the active irrigation districts within the PhxAMA as well as groundwater withdrawals pursuant to individual IGFR holders. In-lieu groundwater consists of renewable supplies of water, such as Colorado River water, surface water, or effluent, delivered to Groundwater Savings Facilities (GSFs). This water is referred to as in-lieu groundwater because the farmers use the renewable supplies of water in-lieu of pumping groundwater, which results in a groundwater savings. This savings is accounted for as a stored water credit (long-term or annual) for the entity who supplied the Colorado River water to the farmer. In-lieu groundwater counts as groundwater in the farmer's flexibility account, which determines compliance with the IGFR annual groundwater allotment. In-lieu groundwater also is counted as groundwater in the calculation of overdraft. GSFs are discussed further in Chapter 8, titled Underground Water Storage, Savings & Replenishment.

Tribal water use includes municipal, industrial, and agricultural uses. Beginning in 2002, Colorado River water has been used for tribal agricultural demand.

Figure 3-2 shows the sources of supply used to meet demand by all the sectors in the PhxAMA during the historical period from 1985 – 2017. Municipal groundwater demand has remained relatively consistent over the historical period as renewable supplies such as Colorado River water and treated effluent were used to meet the demand associated with growth. The industrial sector groundwater demand has fluctuated, but generally increased from about 69,000 AF in 1985 to about 93,000 AF in 2017. Industrial treated effluent has increased more than six times over the volume used in 1985. Some Colorado River in-lieu groundwater use has occurred in the industrial sector during the historical period. Surface water use in the industrial sector also has varied over time, with peaks in 2007 and 2009. PhxAMA agricultural groundwater demand has decreased to about 60 percent of the volume used in 1985. Agricultural in-lieu groundwater and direct Colorado River water use, after an initial ramp-up, have been stable for many years. Tribal groundwater demand increased through 1990 but has remained steady since that time. Colorado River water use started in the tribal sector in 2002. Tribal water demand is primarily for agricultural purposes in the PhxAMA.

FIGURE 3-2
PHOENIX AMA WATER SUPPLY SOURCES, 1985 - 2017



3.2 OVERVIEW OF DEMAND AND SUPPLY BY WATER-USE SECTOR

3.2.1 Municipal Sector

The PhxAMA includes portions of Maricopa, Pinal, and Yavapai Counties. There are 24 incorporated cities and towns in the PhxAMA. The 2010 Census populations for these incorporated areas are shown in Table 3-2 below, as well as which of the PhxAMA's seven sub-basins the incorporated areas cover. Note that some incorporated areas extend into the Pinal Active Management Area (PAMA), or even extend outside the PhxAMA into non-AMA areas (OUTSIDE). Nearly 98 percent of the region's population resides within the East (ESRV) and West Salt River Valley (WSRV) sub-basins. The remaining population is distributed among the five remaining sub-basins; Hassayampa (HASS), Carefree (CFRE), Fountain Hills (FTHL), Lake Pleasant (LKPL), and Rainbow Valley (RBVL). The least populated sub-basin is the RBLV Sub-basin.

TABLE 3-2
2010 CENSUS POPULATION FOR INCORPORATED AREAS, PHOENIX AMA

Geographic area	2010 Census Population	2000 Census Population	Sub-basin(s) Incorporated Area is Located Within
Apache Junction	35,840	31,814	ESRV
Avondale	76,238	35,883	WSRV, RBVL
Buckeye	50,876	6,537	WSRV, HASS, RBVL, OUTSIDE
Carefree	3,363	2,927	ESRV, CFRE
Cave Creek	5,015	3,728	ESRV, CFRE
Chandler	236,123	176,581	ESRV
El Mirage	31,797	7,609	WSRV
Fountain Hills	22,489	20,235	ESRV, FTHL
Gilbert	208,453	109,697	ESRV
Glendale	226,721	218,812	WSRV
Goodyear	65,275	18,911	WSRV, RBVL, PAMA
Guadalupe	5,523	5,228	ESRV
Litchfield Park	5,476	3,810	WSRV
Mesa	439,041	396,375	ESRV
Paradise Valley	12,820	13,664	ESRV
Peoria	154,065	108,364	WSRV, LKPL, OUTSIDE
Phoenix	1,445,632	1,321,045	ESRV, WSRV, LKPL, PAMA, OUTSIDE
Queen Creek	26,361	4,316	ESRV
Scottsdale	217,385	202,705	ESRV, WSRV, CFRE, FTHL
Superior	2,837	3,254	ESRV
Surprise	117,517	30,848	WSRV, HASS
Tempe	161,719	158,625	ESRV
Tolleson	6,545	4,974	WSRV
Youngtown	6,156	3,010	WSRV
TOTAL	**3,563,267**	**2,888,952**	

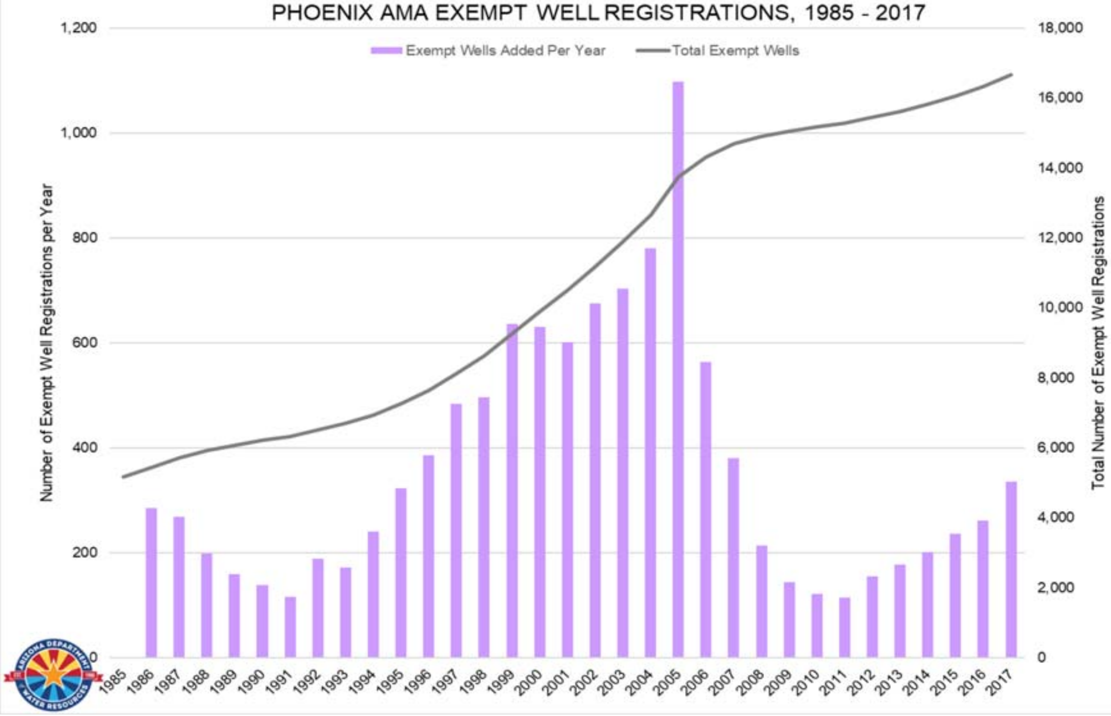
It is important to note that the incorporated area population and the population of the water service area do not precisely correspond. Some municipalities serve outside their municipal boundary, and some municipalities are served by one or more private-water companies rather than solely by a municipal entity. The PhxAMA 2010 Census population within unincorporated areas of the three counties totaled approximately 394,450 people. 37 percent of the population in the PhxAMA in 2010 was served by the City of Phoenix. Part of the Gila River Indian Reservation (GRIC), and the Fort McDowell and Salt River Reservations are located within the AMA boundary. However, these tribal lands are not under the jurisdiction of ADWR. The population of the GRIC within the PhxAMA boundary was approximately 8,076 people in 2010. The 2010 Census populations within the Fort McDowell and Salt River communities were approximately 971 and 10,246 people, respectively.

Large provider population in the PhxAMA was 3,854,671 people in 2010. Small providers were comprised of 12,847 people in 2010. ADWR estimates that in 2010 there were 71,810 people relying on exempt wells (or hauled water) within the PhxAMA who were not served by a municipal water provider. (Population residing on tribal lands is estimated to have been 19,293 people in 2010.)

3.2.2 Exempt Wells

Since 1985, the number of exempt well registrations in the PhxAMA increased more than 220 percent, from 5,168 exempt well registrations in 1985 to 16,658 in 2017. The number of exempt well registrations added each year was higher from 1999 through 2005 than in years prior or since *(See Figure 3-3)*. There were more Notice of Intent (NOI) applications filed to drill exempt wells in 2005 than in any other year. Of the 1,098 NOIs submitted in that year 189 were within the exterior boundaries of a municipal provider holding a Designation of Assured Water Supply (DAWS). In 2005, the Arizona State Legislature passed Senate Bill 1190, which modified A.R.S. § 45-454.C prohibiting exempt wells within 100 feet of the operating distribution system of a DAWS provider, unless exempted based on the specific requirements of the law.

FIGURE 3-3
PHOENIX AMA EXEMPT WELL REGISTRATIONS, 1985 - 2017

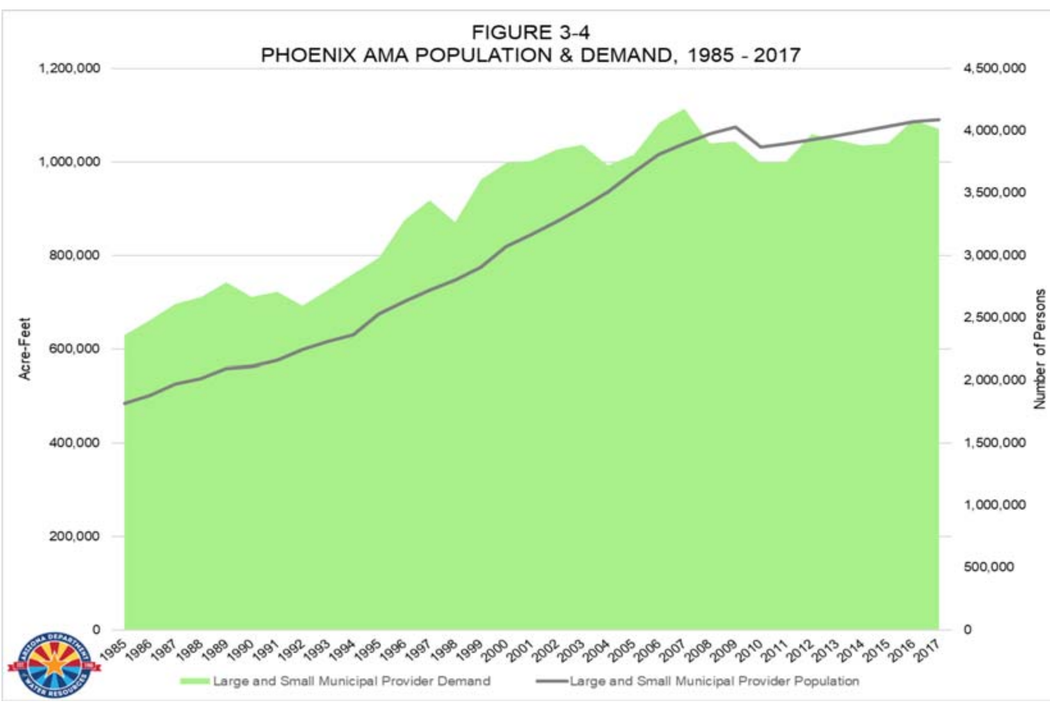


3.2.3 Estimated PhxAMA Population and the 2010 Census

Figure 3-4 compares the large and small provider population with the large and small provider demand from 1985 through 2015. Slight dips or increases in the total population seem to occur as the over-or under-estimation of the population estimate is corrected by the actual Census data. Each decennial U.S. Census is used to calibrate the inter-Census population estimates to the actual population count from the Census.

Between the 2000 Census and the 2010 Censuses, the exempt well population appears to have increased by an estimated 39,517 people. ADWR conducted a detailed analysis of 2010 Census data and the historical estimate of exempt well population figures included in the Assessment. Due to a change in the methodology used to compile large provider Census population between the 2000 and 2010 censuses, ADWR believes that the disaggregation of 2000 U.S. Census data to large municipal provider service areas included people who may have been served water via exempt wells.

Table 3-3 shows population figures based on the 2010 U.S. Census. Overestimation of population in between Censuses results in a downward bias in Gallons per Capita per Day (GPCD) figures. Census years represent an actual count of persons residing within water provider service areas in AMAs. Looking just at the Census years, the large municipal provider GPCD rate in the PhxAMA was 242 GPCD in 1990, it was 246 GPCD in 2000, and it was 205 GPCD in 2010. Water-conservation activities, the use of new, low water using fixtures, and newer homes with low water using landscapes, result in reductions in GPCD over time. Other factors that affect GPCD are weather conditions and water cost. The low GPCD figure in 2010 may be due to loss of income associated with the economic downturn and subsequent cut back in outdoor watering, as well as possible weather conditions (2010 experienced higher than average precipitation).



Multiple factors affect the GPCD rate, sometimes making it an unreliable measure of actual water conservation efforts. However, GPCD can be used as a basic indicator of consumption rates in the absence of more detailed data, such as end-use metering or data-logging, which cost more to collect. Taking into consideration these factors, the data indicate that the overall average GPCD rate for PhxAMA large providers has reduced by about 1.2 percent per year since 2000. GPCD rates for some individual large water providers decreased more than that rate, while some large providers in the PhxAMA experienced increased GPCD rates.

TABLE 3-3
PHOENIX AMA POPULATION BY WATER PROVIDER TYPE, 1985 - 2017

Year	Total AMA Population	Large Provider Population	Small Provider Population	Exempt Well Population	Number of Exempt Wells	Tribal Population
1985	1,852,364	1,808,342	9,542	24,175	5,168	10,305
1986	1,927,223	1,882,169	9,728	24,646	5,454	10,679
1987	2,006,360	1,960,262	9,918	25,127	5,723	11,053
1988	2,054,557	2,007,402	10,111	25,616	5,922	11,428
1989	2,133,654	2,085,429	10,308	26,116	6,081	11,802
1990	2,148,814	2,099,505	10,509	26,625	6,219	12,176
1991	2,198,182	2,147,775	10,714	27,144	6,335	12,550
1992	2,286,857	2,235,338	10,922	27,673	6,524	12,924
1993	2,349,407	2,296,761	11,135	28,212	6,696	13,299
1994	2,403,754	2,349,967	11,352	28,762	6,937	13,673
1995	2,571,485	2,516,542	11,573	29,322	7,260	14,047
1996	2,675,628	2,619,514	11,799	29,894	7,646	14,421
1997	2,768,574	2,711,273	12,029	30,476	8,130	14,795
1998	2,847,802	2,789,299	12,263	31,070	8,626	15,170
1999	2,949,504	2,889,782	12,502	31,676	9,262	15,544
2000	3,118,049	3,057,092	12,746	32,293	9,893	15,918
2001	3,221,753	3,156,534	12,756	36,208	10,495	16,256
2002	3,330,256	3,260,773	12,766	40,123	11,171	16,593
2003	3,445,659	3,371,914	12,776	44,038	11,874	16,931
2004	3,574,499	3,496,491	12,786	47,953	12,654	17,268
2005	3,732,081	3,649,811	12,797	51,868	13,752	17,606
2006	3,883,329	3,796,796	12,807	55,783	14,315	17,943
2007	3,976,172	3,885,377	12,817	59,698	14,695	18,281
2008	4,058,946	3,963,888	12,827	63,613	14,909	18,618
2009	4,116,492	4,017,171	12,837	67,528	15,053	18,956
2010	3,958,621	3,854,671	12,847	71,810	15,175	19,293
2011	3,985,187	3,881,633	11,937	72,221	15,290	19,396
2012	4,017,226	3,913,277	11,820	72,630	15,445	19,498
2013	4,051,763	3,947,338	11,784	73,040	15,622	19,601
2014	4,090,683	3,985,722	11,808	73,449	15,824	19,704
2015	4,127,621	4,022,054	11,902	73,859	16,064	19,806
2016	4,164,707	4,058,534	11,996	74,268	16,323	19,909
2017	4,181,286	4,074,488	12,109	74,678	16,658	20,012

3.2.4 Large Untreated Providers

In addition to large and small municipal water providers, several entities are regulated as large untreated providers in the PhxAMA. These include both cities, towns, private-water companies and irrigation districts. A large untreated provider serves 100 or more AF per year or 500 or more people with untreated water for non-irrigation purposes, usually for residential or commercial flood irrigation of turf. Since 1985 water demand by large untreated providers has been flat, and averages approximately 132,000 AF per year.

3.2.5 Industrial Sector

The *1980 Groundwater Code* (Code) defines industrial use as a non-irrigation use of water, not supplied by a city, town or private-water company, including animal industry use such as dairies and feedlots, and expansions of those uses. In general, industrial users withdraw water from their own wells that are associated with grandfathered groundwater rights (Type 1 and Type 2 rights) or withdrawal permits. Although industrial users are primarily dependent on groundwater, some use renewable supplies such as Colorado River water, surface water, or treated effluent. Historically, industrial uses in the PhxAMA have included turf-related facilities, electric-power generation, dairies, feedlots, and sand and gravel operations (See Table 3-4).

Industrial use is largely dependent on population growth and the economy. In some cases, the difference between the actual water use and the total annual allotment at an individual industrial facility is substantial and is generally a remnant of the allocation process used to establish Type 2 rights. This process assigned users allotments based on the highest annual groundwater withdrawal between 1975 and 1980. In 2017, about 85 percent of the PhxAMA's industrial groundwater rights and permit volumes were used.

About six percent of the Type 1, Type 2 and Withdrawal Permit allotments in the PhxAMA belong to the City of Phoenix, with a total allotment of 18,490 AF. Another ten percent belong to Buckeye Water Conservation District. Arizona Public Service holds just over five percent of industrial allotments. No other Type 1, Type 2 or Withdrawal Permit holders in the PhxAMA account for more than five percent of the total of all industrial allotments.

Water use in the industrial sector in the PhxAMA has increased more than 110 percent since 1985. Total industrial demand peaked in 2007, at 199,769 AF. In that year, electric power and other, non-specific uses were higher than in prior years. The electric power and turf subsectors have remained the dominant subsectors over time, comprising about 80 percent of total industrial demand. The remaining demand was divided among sand and gravel operations, dairies, and other uses such as cooling and manufacturing. By 1993, feedlot use had declined to less than one percent of total industrial demand.

TABLE 3-4
PHOENIX AMA HISTORICAL INDUSTRIAL DEMAND BY INDUSTRIAL SUB-SECTOR
1985 – 2017 (AF)

Year	Turf-Related Facilities	Feedlot	Sand and Gravel Operations	Dairies	Other	Large-Scale Power Plants	Metal Mining	Total
1985	44,697	2,887	9,895	5,858	9,763	15,568	-	88,667
1986	44,697	1,104	10,582	6,197	13,614	31,290	-	107,483
1987	44,697	784	11,063	6,256	17,570	38,246	-	118,616
1988	42,653	612	11,511	6,595	15,450	60,940	-	137,761
1989	45,231	739	11,564	6,018	13,359	26,715	-	103,625
1990	41,881	855	7,701	6,262	11,799	51,428	-	119,927
1991	41,255	601	7,587	6,786	11,695	51,489	-	119,414
1992	35,942	876	13,392	7,230	10,798	51,572	-	119,810
1993	43,040	572	8,177	7,331	11,858	49,368	-	120,346
1994	43,668	552	7,193	7,349	11,305	46,896	-	116,963
1995	50,534	584	11,792	7,990	14,376	52,731	-	138,007
1996	54,757	454	8,141	8,119	11,990	56,572	-	140,034
1997	55,457	450	8,359	9,363	9,632	57,728	-	140,989
1998	56,057	262	9,093	9,277	9,361	54,890	-	138,939
1999	63,338	433	10,302	10,012	12,341	61,930	-	158,356
2000	60,613	142	6,707	10,352	15,049	62,589	-	155,452
2001	65,121	118	5,498	11,721	15,758	59,565	-	157,782
2002	68,028	169	8,730	12,569	22,355	65,824	-	177,676
2003	62,469	229	9,075	12,144	19,760	64,165	-	167,841
2004	63,757	112	10,418	11,643	9,207	68,932	-	164,069
2005	55,110	32	12,495	10,568	9,393	69,272	-	156,870
2006	60,632	58	10,401	10,080	10,624	69,584	-	161,380
2007	65,741	882	9,209	9,646	29,399	84,892	-	199,769
2008	58,805	41	11,571	9,625	24,446	81,679	-	186,167
2009	58,103	40	5,563	8,402	19,870	90,673	-	182,651
2010	54,533	53	8,010	10,320	25,644	89,985	-	188,545
2011	51,907	47	7,656	12,345	21,658	90,708	-	184,321
2012	57,669	59	8,181	12,218	22,063	90,814	-	191,004
2013	57,930	76	11,479	11,004	15,699	91,665	-	187,852
2014	64,765	104	7,466	9,947	12,137	93,701	-	188,120
2015	61,024	96	9,112	11,931	14,201	93,184	-	189,547
2016	66,507	84	11,468	11,919	12,430	93,562	101	196,071
2017	65,892	41	10,601	12,206	9,469	93,205	68	191,483

Much of the treated effluent used in the industrial sector is used by the Palo Verde Nuclear Generating Station (PVNGS) in the electric power subsector, the largest subsector of industrial use. The remainder of the industrial sector treated effluent demand is used by the turf subsector which is the second largest industrial subsector. Many turf-related facilities are served treated effluent or are supplied by municipal water providers, but some use GFRs to withdraw groundwater. There is potential for increased groundwater demand associated with turf-related facilities, however, many facilities in the PhxAMA also use Colorado River water. To date, a significant portion of the Colorado River water use at turf-related facilities has been untreated Colorado River water associated with excess supply. As Colorado River water becomes fully utilized, it is unclear whether turf-related facilities will continue to use Colorado River water or will turn to a different supply. The remaining subsectors rely almost exclusively on groundwater.

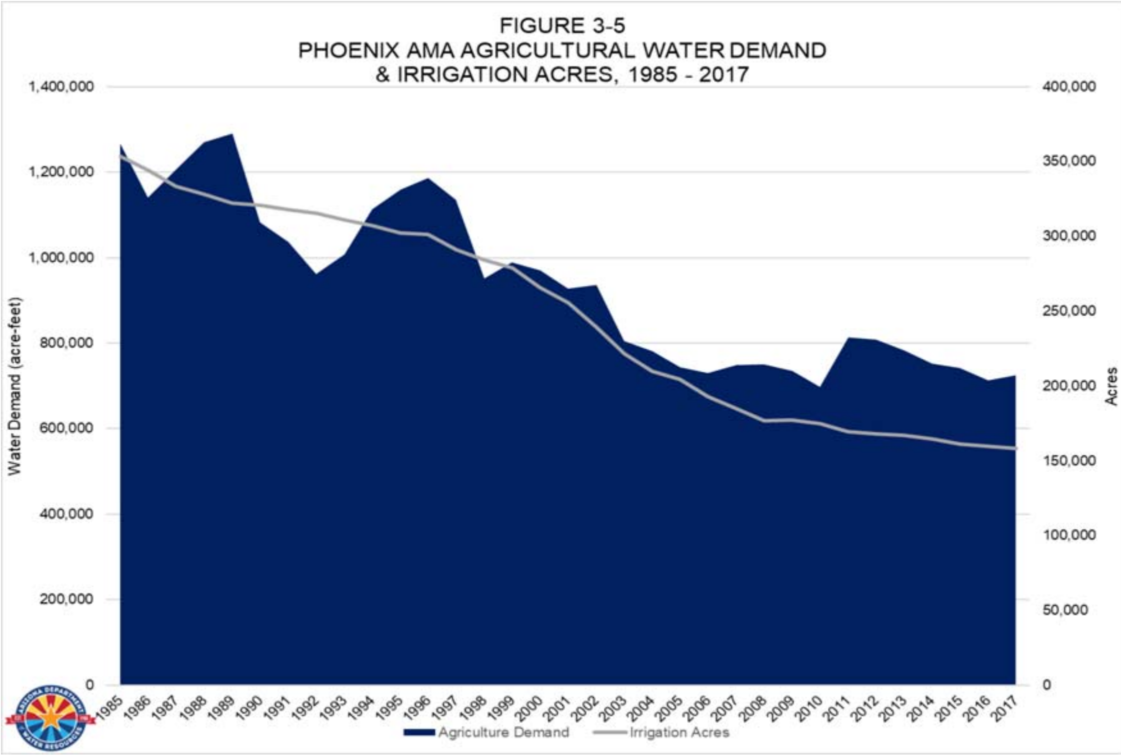
3.2.6 Agricultural Sector

The agricultural sector in the PhxAMA is comprised of farm acreage of two acres in size or larger actively irrigated with groundwater from 1975 to 1980. Agricultural lands that used groundwater to irrigate crops during this time period were issued an IGFR by ADWR. Water use pursuant to these rights must be reported to ADWR if the right is larger than 10 acres.

Agricultural demand has decreased over time in the PhxAMA although it was the primary demand sector until 1999 when the municipal sector matched the agricultural sector in terms of proportion of total PhxAMA use. Since that time, the municipal sector has been the dominant water-use sector in the PhxAMA. In 2017, agricultural demand was more than 725,000 AF, comprising 32 percent of the total PhxAMA demand. Much of the decrease in water use can be attributed to urbanization of agricultural lands. Since 1985, there have been almost 200,000 irrigation acres associated with IGFRs that have been retired. Figure 3-5 shows historical agricultural water use from 1985 through 2017 and the total acres eligible to be irrigated. Table 3-6 compares the total irrigation acres by district as published in the First Management Plan (1MP) with 2017.

Since 1995 there have been nearly 500 IGFRs that were partially or fully extinguished in the PhxAMA pursuant to the AWS Rules. This accounts for about 34,000 acres that can no longer be used for agricultural production. Extinguishment of these rights generated more than 1 million AF of extinguishment credits, of which about 46 percent have been pledged to help meet the consistency with goal criterion of proving a 100-year AWS. Additional IGFR acres were either urbanized or converted to a Type 1 Non-Irrigation GFR and were not extinguished.

The PhxAMA contains 32 active irrigation districts serving approximately 1,800 IGFRs with more than 125,000 irrigation acres in 2017. The total allotment for these acres in 2017 was about 588,000 AF. Nine of the 32 districts accounted for about 80 percent of the agricultural demand in 2017. Table 3-5 summarizes sources of supply used by the largest districts in the PhxAMA in 2017, and the total supplies by non-district farms.



Buckeye Water Conservation and Drainage District (BWCDD)
In 2017, BWCDD delivered water to 209 IGFRs, which used 125,231 AF of water. Irrigation acres associated with these farms totaled 16,929 acres. The primary sources of water supply were surface water, groundwater, and treated effluent.

Roosevelt Irrigation District (RID)
There were 334 IGFRs in RID, which used 130,666 AF of water in 2017, of which 101,875 AF was groundwater. Farms in RID also used GSF treated effluent. In 2017, there were 66 IGFRs in the Best Management Practices (BMP) Program, constituting approximately 7,000 irrigation acres, or 26 percent of the total irrigation acres in the district.

Salt River Project (SRP)
IGFRs within SRP used 77,982 AF on 21,592 IGFR irrigation acres associated with 618 IGFRs. Primary supplies included surface water, spill water, and GSF Colorado River water. Two IGFRs were enrolled in the BMP Program within SRP in 2017.

New Magma Irrigation and Drainage District (NMIDD)
NMMIDD delivered 78,399 AF to 140 IGFRs associated with 20,845 irrigation acres in 2017. The primary sources of supply water were GSF Colorado River water and direct use Colorado River water. Twenty-three IGFRs with more than 9,250 irrigation acres were enrolled in the BMP Program in NMIDD in 2017.

Roosevelt Water Conservation District (RWCD)
The 145 IGFRs in RWCD that received water from the district in 2017 used 34,403 AF of water on IGFRs with 6,707 irrigation acres. Of the total acres, approximately 2,755 were associated with 29

IGFRs enrolled in the BMP Program. Most of the water supply was GSF Colorado River water, followed by groundwater and treated effluent.

Maricopa Water District (MWD)
In 2017, IGFRs within MWD received 35,415 AF of water from the district, used by 112 IGFRs that have rights to irrigate 12,030 acres. GSF Colorado River water, surface water and groundwater were the primary supply sources used. Nine IGFRs in MWD were enrolled in the BMP Program in 2017.

Queen Creek Irrigation District (QCID)
QCID provided 21,362 AF of water to 112 IGFRS with 8,119 irrigation acres in 2017. GSF Colorado River water and direct Colorado River water were used.

Arlington Canal Company (ACC)
Twenty-seven IGFRS with 4,281 irrigation acres used 26,131 AF of water provided by ACC in 2017. This water was primarily surface water and groundwater.

Tonopah Irrigation District (TID)
TID provided 14,514 AF to 22 IGFRS with 3,288 irrigation acres in 2017. This water was mostly GSF Colorado River water. Direct Colorado River water also was used. All IGFRs in TID are enrolled in the BMP Program.

TABLE 3-5
PHOENIX AMA AGRICULTURAL DEMAND & IRRIGATION ACRES BY DISTRICT FOR 2017

District	TOTAL	Ground-water	Surface Water[1]	Colorado River Water	GSF Colorado River Water (in-lieu groundwater)	Treated Effluent	GSF Treated Effluent (in-lieu)	Irrigation Acres
ACC	26,131	19,266	6,865	-	-	-	-	4,281
BWCDD	122,888	30,770	72,118	-	-	20,000	-	16,929
MWD	35,387	2,147	12,308	-	20,932	-	-	12,030
NMIDD	77,093	1,614	-	-	75,479	-	-	20,845
QCID	20,929	-	-	3,365	17,564	-	-	8,119
RID	140,199	111,317	-	-	-	28,882	-	26,896
RWCD	16,366	4,330	32	-	11,617	387	-	6,707
SRP	90,236	2,914	49,174	-	38,148	-	-	21,592
TID	14,638	-	-	2,300	12,338	-	-	3,288
All Other Districts	25,920	15,168	9,214	243	1,295	-	-	4,631
Outside Districts	123,215	121,369	1,985	-	230	5	-	32,866
TOTAL	693,002	308,894	151,696	5,908	177,603	49,275	-	158,164

[1] Surface water includes decreed/appropriative, normal flow, tailwater, and other water not included in any other column.

TABLE 3-6
PHOENIX AMA COMPARISON OF IRRIGATION ACRES BY DISTRICT

District	1MP Acres	2017 Acres	2017 Demand	Change in Acres	Percent Change in Acres
ACC	5,170	4,281	26,131	-889	-17%
BWCDD	18,720	16,929	122,888	-1,791	-10%
MWD	27,970	12,030	35,387	-15,940	-57%
NMIDD	25,240	20,845	77,093	-4,395	-17%
QCID	20,280	8,119	20,929	-12,161	-60%
RID	39,640	26,896	140,199	-12,717	-32%
RWCD	30,050	6,707	16,366	-23,343	-78%
SRP	98,700	21,592	90,236	-77,155	-78%
TID	8,510	3,288	14,638	-5,222	-61%
All other districts	29,540	4,631	25,920	-24,909	-84%
Non-district	49,289	32,866	123,215	-16,423	-33%
TOTAL	353,109	158,164	569,787	-194,945	-55%

3.2.7 Tribal Sector

The Salt River Pima-Maricopa Indian Community (SRPMIC), the Fort McDowell Yavapai Nation (FMYN), and the northern portion of the Gila River Indian Community (GRIC), which also extends into the PAMA, are located within the boundaries of the PhxAMA. Tribal water use is exempt from regulation by the state but may be subject to certain limitations under the terms of specific tribal water settlements. The demand characteristics of these communities are included here as estimates because they have a hydrologic impact on the safe-yield goal. In Table 3-1B tribal demand includes primarily agricultural demand with a small portion of municipal demand.

The *Salt River Pima-Maricopa Indian Community* uses groundwater and surface water for agricultural irrigation. Since 1985, ADWR estimates the SRPMIC used an average of 85,000 AF per year for irrigation of crops.

The *Fort McDowell Yavapai Nation* also uses primarily surface water for agricultural irrigation.

The *Gila River Indian Community* is situated along the Gila River and straddles the PhxAMA and the PAMA, however, most of the GRIC farming operations are within the PhxAMA. In 2017, ADWR estimates that about 180,000 AF of groundwater, surface water, Colorado River water and treated effluent were used for agricultural irrigation in GRIC land within the PhxAMA. Table 3-7 shows water use by water type for tribal uses.

The population on tribal land in the PhxAMA has increased slightly. ADWR used an estimate of 12,000 people for the tribal land population in the PhxAMA in the 3MP. In 2000, the U.S. Census accounted for 15,000 people living on tribal land within the PhxAMA. The 2010 census counted 19,293 persons residing on tribal land in the PhxAMA. The supply for tribal land municipal demand is assumed to be groundwater.

TABLE 3-7
PHOENIX AMA HISTORICAL TRIBAL DEMAND BY WATER TYPE, 1985 - 2017

Year	Groundwater	Surface Water	Colorado River Water	Treated Effluent
1985	34,818	152,880	0	0
1986	97,093	169,512	0	0
1987	94,658	189,208	0	0
1988	106,635	192,558	0	0
1989	106,868	200,652	0	0
1990	115,066	68,065	0	0
1991	91,135	159,220	0	0
1992	78,001	181,951	0	0
1993	79,431	168,999	0	0
1994	81,085	204,280	0	0
1995	77,595	200,712	0	0
1996	75,157	216,216	0	0
1997	83,501	168,006	0	0
1998	76,563	167,405	0	0
1999	81,832	127,470	0	0
2000	78,727	140,732	0	0
2001	79,242	151,279	0	0
2002	82,335	90,430	52,080	0
2003	81,020	102,797	46,200	0
2004	75,326	112,415	41,160	0
2005	93,982	159,925	0	1,011
2006	74,748	146,697	14,280	6,783
2007	68,522	161,376	20,398	5,315
2008	78,542	135,334	36,799	4,863
2009	79,967	157,697	42,090	0
2010	68,447	181,803	10,705	10,399
2011	74,344	150,612	39,382	4,157
2012	75,475	128,348	67,782	4,219
2013	99,716	96,041	61,494	2,363
2014	94,624	103,302	63,959	6,945
2015	98,520	130,217	44,341	3,338
2016	95,598	116,834	63,846	3,563
2017	85,259	151,905	19,526	3,241

NOTE: Tribal groundwater is for municipal/domestic purposes and is estimated assuming 57 GPCD and the growth rate between the 2000 and 2010 census population. Tribal agricultural demand equals the reported delivery of Colorado River water to tribal land as reported by CAWCD and CAP, surface water and groundwater reported as being delivered to tribal land by the San Carlos Irrigation District, along with ADWR estimates of groundwater use within tribal lands in the PhxAMA.

3.3 CURRENT WATER BUDGET

The management goal of the PhxAMA is to achieve a long-term balance between the annual amount of groundwater pumping and the annual amount of natural and artificial recharge in the PhxAMA by 2025; this goal is known as “safe-yield.” Net natural recharge and the other components in the calculation of safe-yield are described in the Assessment (ADWR, 2010) in Part 3, “The Basic Budget Components.” Overdraft, depicted in Figure 3-6, is equal to the sum of the groundwater use for all three sectors (estimated for exempt well demand), minus the sum of the incidental recharge, plus the additional offsets to overdraft (including net natural recharge and canal seepage. Red bars indicate overdraft, while blue bars indicate that supplies stored in the aquifer exceeded the volume of water withdrawn and leaving the aquifer through groundwater outflow in that year. Net natural recharge in the early 1990s was much higher than the long-term average, and, combined with a reduction in groundwater pumping, moved the PhxAMA into a surplus condition which persisted for a time. In 2011, the PhxAMA returned to an annual overdraft condition, which has begun to reduce the surplus.

For purposes of the 4MP, “overdraft” includes use of the AWS groundwater allowance. Despite these volumes of groundwater use being considered consistent with the management goal under the AWS Rules, they are included in the overdraft calculation to allow analysis of the groundwater allowance withdrawal’s physical impact on the aquifer.

Rather than using a long-term average for stream-channel recharge as was done in the Assessment, the actual estimated stream-channel recharge has been incorporated into the budget template in order to show the impact of flood flow on the aquifer, as seen in Figure 3-6 for the years 1991-1993. ADWR now has a greater understanding of the susceptibility of the PhxAMA aquifers to drought and natural recharge during wetter periods. Those updated figures, reflecting actual conditions from 1985 through 2017, are depicted in Figure 3-6. This period of record indicates that the PhxAMA experienced a large surplus in 1993, likely due to particularly heavy precipitation in that year, but returned to overdraft afterwards. PhxAMA also was in surplus from 2006 through 2010 but has been in overdraft since 2010. Values for Figure 3-6 are shown in Table 3-8. The net natural recharge in Chapter 2, Table 2-2 and offsets to groundwater pumping in Table 3-8 do not match; this is because Table 3-8 includes incidental recharge from human activities, cuts to the aquifer, canal seepage, and CAGRD replenishment, while Table 2-2 in Chapter 2 does not.

FIGURE 3-6
PHOENIX AMA ANNUAL OVERDRAFT, 1985 - 2017 (AF)

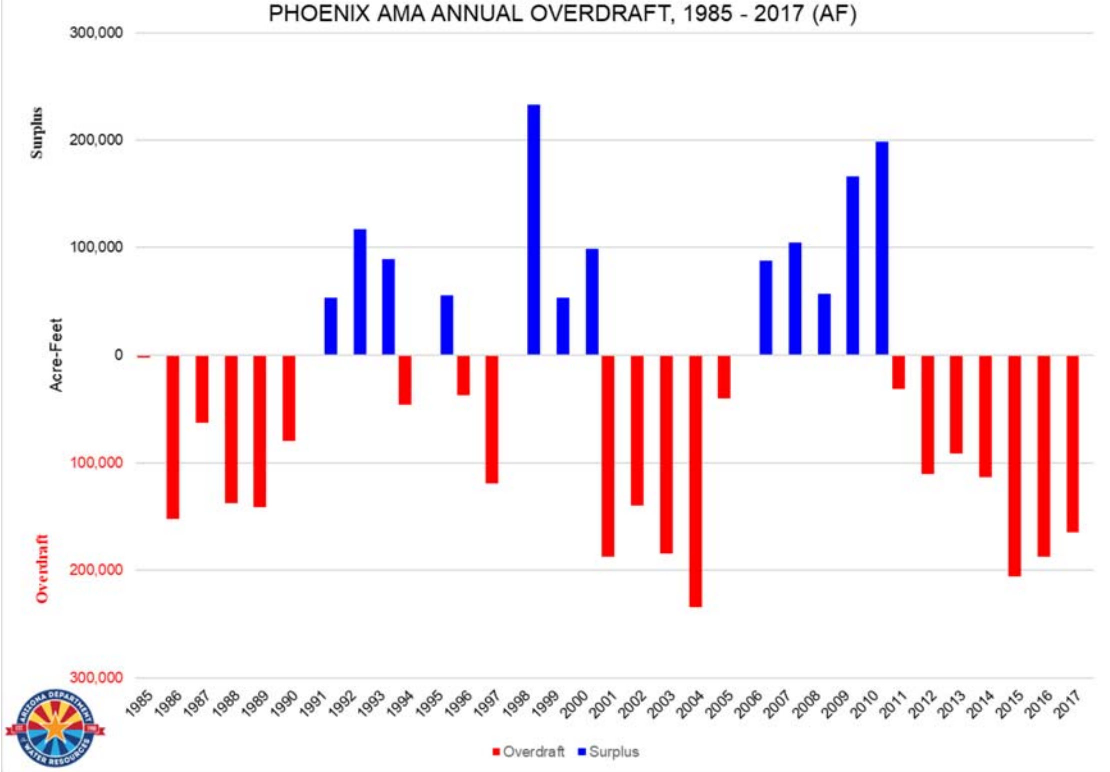


TABLE 3-8
PHOENIX AMA WATER DEMAND BY SECTOR, 1985 - 2017

Year	Municipal Provider Demand	Exempt Well Demand	Industrial Demand	Agricultural Demand	Indian Demand	*TOTAL AMA DEMAND*	Renewable Supplies to Meet Demand[1]	Ground-water to Meet Demand	Offsets to GW Pumping[2]	*OVERDRAFT*
1985	630,153	3,349	88,667	1,265,633	187,698	2,175,500	1,198,639	**976,861**	974,051	(2,810)
1986	660,766	3,414	107,483	1,140,492	266,605	2,178,760	1,071,965	**1,106,795**	954,753	(152,042)
1987	697,192	3,481	118,616	1,207,431	283,866	2,310,586	1,301,680	**1,008,906**	946,474	(62,432)
1988	711,651	3,549	137,761	1,269,055	299,193	2,421,208	1,373,265	**1,047,943**	910,736	(137,207)
1989	742,363	3,618	103,625	1,289,718	307,520	2,446,844	1,333,654	**1,113,190**	972,429	(140,761)
1990	710,527	3,688	119,927	1,083,348	183,131	2,100,621	948,341	**1,152,280**	1,072,765	(79,515)
1991	722,178	3,760	119,414	1,036,178	250,355	2,131,885	1,292,913	**838,972**	891,898	52,926
1992	692,765	3,833	119,810	962,171	259,952	2,038,532	1,300,035	**738,496**	855,522	117,026
1993	726,007	3,908	120,346	1,007,248	248,430	2,105,940	1,265,451	**840,488**	930,001	89,513
1994	760,590	3,984	116,963	1,112,732	285,365	2,279,634	1,302,237	**977,397**	931,740	(45,657)
1995	795,601	4,062	138,007	1,159,919	278,307	2,375,896	1,442,458	**933,438**	989,045	55,607
1996	875,404	4,141	140,034	1,186,816	291,373	2,497,768	1,446,833	**1,050,935**	1,014,280	(36,655)
1997	918,111	4,222	140,989	1,135,806	251,507	2,450,635	1,312,154	**1,138,481**	1,019,569	(118,912)
1998	870,878	4,304	138,939	952,103	243,968	2,210,192	1,358,051	**852,141**	1,084,767	232,626
1999	962,556	4,388	158,356	989,261	209,302	2,323,863	1,274,971	**1,048,892**	1,102,141	53,249
2000	998,119	4,473	155,452	970,735	219,459	2,348,239	1,308,508	**1,039,731**	1,138,189	98,458
2001	1,002,269	5,016	157,782	927,890	230,521	2,323,478	1,323,512	**999,966**	812,436	(187,530)
2002	1,027,343	5,558	177,676	937,007	224,845	2,372,429	1,307,011	**1,065,418**	925,757	(139,661)
2003	1,036,375	6,100	167,841	804,504	230,017	2,244,836	1,164,617	**1,080,220**	896,163	(184,057)
2004	992,399	6,643	164,069	780,687	228,902	2,172,700	1,123,822	**1,048,878**	814,685	(234,193)
2005	1,015,208	7,185	156,870	743,012	254,919	2,177,193	1,361,597	**815,596**	775,504	(40,093)
2006	1,083,226	7,727	161,380	730,331	236,643	2,219,307	1,386,738	**832,569**	907,889	75,320
2007	1,113,579	8,270	199,769	749,169	249,035	2,319,822	1,450,819	**869,003**	959,567	90,564
2008	1,040,142	8,812	186,167	750,194	248,382	2,233,697	1,383,513	**850,184**	876,047	25,862
2009	1,044,282	9,354	182,651	735,086	295,589	2,266,962	1,438,001	**828,961**	959,768	130,807
2010	998,119	9,947	188,545	697,965	271,355	2,165,931	1,435,139	**730,792**	929,319	198,527
2011	1,000,305	10,004	184,321	813,467	268,495	2,276,592	1,418,075	**858,517**	827,573	(30,944)
2012	1,059,064	10,061	191,004	807,753	275,824	2,343,707	1,456,350	**887,358**	777,263	(110,095)
2013	1,046,001	10,118	187,852	782,154	259,613	2,285,738	1,396,870	**888,868**	797,547	(91,321)
2014	1,035,588	10,174	188,120	751,554	268,831	2,254,267	1,322,935	**931,332**	817,824	(113,508)
2015	1,039,629	10,231	189,547	741,687	276,416	2,257,510	1,266,043	**991,467**	786,145	(205,322)
2016	1,089,614	10,288	196,072	712,772	279,842	2,288,588	1,314,035	**974,553**	786,968	(187,586)
2017	1,071,106	10,345	191,482	725,088	259,932	2,257,954	1,325,907	**932,047**	767,986	(164,061)

[1] Includes Colorado River Water and Treated Effluent Water
[2] Includes Incidental Recharge, Net Natural Recharge, Cuts to the Aquifer, CAGRD Replenishment, Riparian Use, and Canal Seepage

3.4 CONCLUSION

Water users in the PhxAMA have increased use of renewable supplies such as treated effluent and Colorado River water over the historical period of 1985 through 2017. However, there are locations within the PhxAMA which may lack the infrastructure to access renewable water sources. It is important for the PhxAMA to continue to move toward a regional water management approach that aims at using renewable supplies (treated effluent and Colorado River water) to reduce reliance upon groundwater evenly and continuously throughout the PhxAMA.

As a part of the 4MP, ADWR will periodically publish an analysis of each AMA's progress toward its goal as a part of the Conservation Report required pursuant to A.R.S. § 45-563.01. This report was previously focused on the municipal conservation programs but will expand in scope to include this analysis of progress toward the goals as well as expanding to analyze the conservation programs of all three sectors. This publication is intended to serve as a communication tool regarding the effectiveness of the conservation programs in working toward safe-yield and also will serve to improve the transparency of the data and methodology that ADWR uses to assess safe-yield. Summary AMA data is compiled yearly and is available at https://new.azwater.gov/ama/ama-data.

The 4MP programs that follow were developed within current statutory guidelines. It is possible, as described in Chapter 11, for the PhxAMA to achieve safe-yield by 2025 with an increased commitment to use of renewable supplies. However, whether safe-yield is achieved and maintained will depend on individual choices of water-right holders and the continued availability of renewable supplies, and it is well recognized that conservation alone may not be sufficient for the PhxAMA to reach safe-yield. The commitment of the PhxAMA community to developing and implementing a water management strategy that recognizes the need for additional water augmentation activities will help ensure the continued economic viability of the PhxAMA into the future and the achievement of the safe-yield goal. This situation is further discussed in Chapter 1.

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CHAPTER FOUR: AGRICULTURAL

4.1 INTRODUCTION

The Agricultural Conservation Program for the *Fourth Management Plan for the Phoenix Active Management Area* (4MP) is designed to contribute to the achievement of the safe-yield goal for the Phoenix Active Management Area (PhxAMA). It is nearly identical to the program included in the *Third Management Plan for the Phoenix Active Management Area* (3MP), with the only change being an adjustment to the irrigation distribution system requirements for irrigation districts. The Groundwater Code's (Code) prohibition on new agricultural land being brought into production inside the PhxAMA has contributed to the PhxAMA approaching its safe-yield goal. Additionally, improved on-farm water management practices, replacement of groundwater supplies with renewable supplies, and reduction of irrigated acreage due to retirement and/or urban development of farmland also have contributed to movement towards achieving the PhxAMA's safe-yield goal.

4.1.1 What is an Agricultural water user?

Pursuant to A.R.S. § 45-465, only land associated with a Certificate of Irrigation Grandfathered Right (IGFR) can be legally irrigated with groundwater within an Active Management Area (AMA). IGFRs were issued by the Arizona Department of Water Resources (ADWR) based on irrigated acreage from 1975 to 1980, and water duties and allotments were calculated for each IGFR base on crop type grown during the same period. To irrigate means to grow crops for sale, human consumption or livestock or poultry feed by applying water on two or more acres (A.R.S. § 45-402(18)). A key component of the Code prohibits the establishment of new IGFRs – prohibiting new acres from being put into agricultural production. Land not associated with an IGFR may not be irrigated with groundwater unless one of the exceptions stated in the Code applies (A.R.S. § 45-452).

4.1.2 Agricultural Conservation Programs – History and Background

ADWR is required by statute to develop and administer an Agricultural Conservation Program in all five AMAs and for all five management periods. The original allotment-based program, known as the Base Program, provides flexibility for farmers to use more than their allotment in some years, and less in other years, provided they do not exceed a maximum debit in their flexibility account. The Base Program has been modified several times since the Code was adopted to assist farmers who had difficulty staying in compliance with the original program. Changes to the conservation programs included: allowing a farmer to market some of his flexibility account credits to other farms; the treatment of treated effluent in the compliance calculation; the exemption of IGFRs of 10 or fewer acres from compliance and reporting requirements; and limitations on the maximum on-farm efficiency ADWR may use when calculating irrigation water duties. The Base Program in the 4MP is identical to the program included in the 3MP.

In addition to the Base Program, the 4MP includes two alternative conservation programs for IGFR owners, as required by A.R.S. § 45-567.02(A) and (G): 1) Historic Cropping Program and 2) Best Management Practices (BMP) Program. The owner of an IGFR may opt to enroll in one of the alternative conservation programs, if certain requirements are met. More information on the Agricultural Conservation Programs can be found in section 4.5 of this chapter.

4.2 AGRICULTURAL SECTOR CHARACTERISTICS AND ROLES IN PhxAMA WATER MANAGEMENT GOAL ACHIEVEMENT

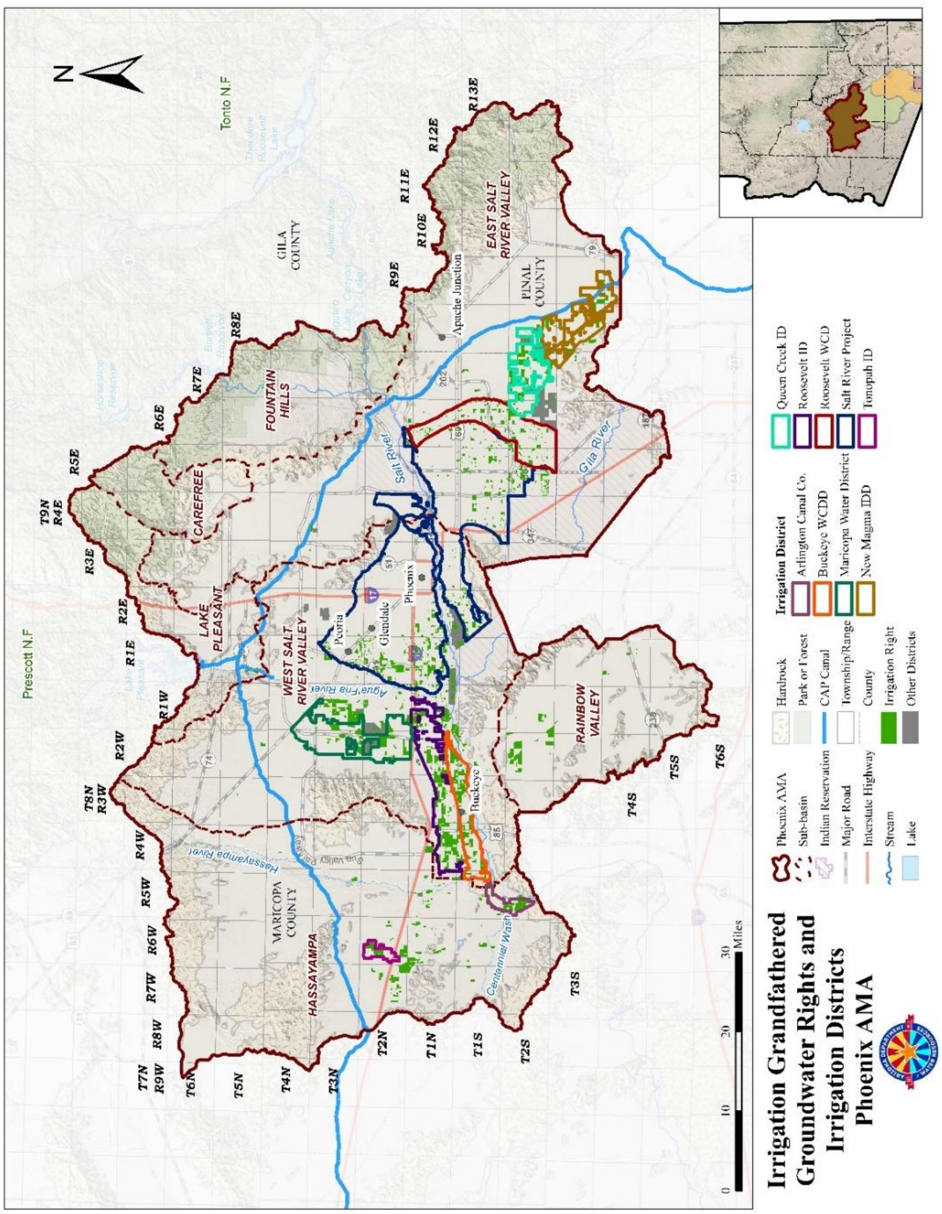
4.2.1 PhxAMA Agricultural Sector Description

Most of the agricultural right holders are located within the boundaries of one of 32 irrigation districts located in the PhxAMA, with more than 80 percent of the total use located in the nine largest irrigation districts: Arlington Canal Company, Buckeye Water Conservation and Drainage

District, Maricopa Water District, New Magma Irrigation and Drainage District, Queen Creek Irrigation District, Roosevelt Irrigation District, Roosevelt Water Conservation District, Salt River Project, and Tonopah Irrigation District (See Figure 4-1).

In 2017, the agricultural sector comprised one-third of the total water demand in the PhxAMA. In that year, groundwater and in-lieu groundwater were the primary sources of supply. Additional supplies include in-state surface water (surface water), Colorado River water delivered through the Central Arizona Project infrastructure (CAP water), and treated effluent. Figure 4-2 and Table 4-1 illustrate the shifting supplies used to meet agricultural demand from 1985 through 2017.

FIGURE 4-1
AGRICULTURAL IRRIGATION ACRES IN THE PhxAMA



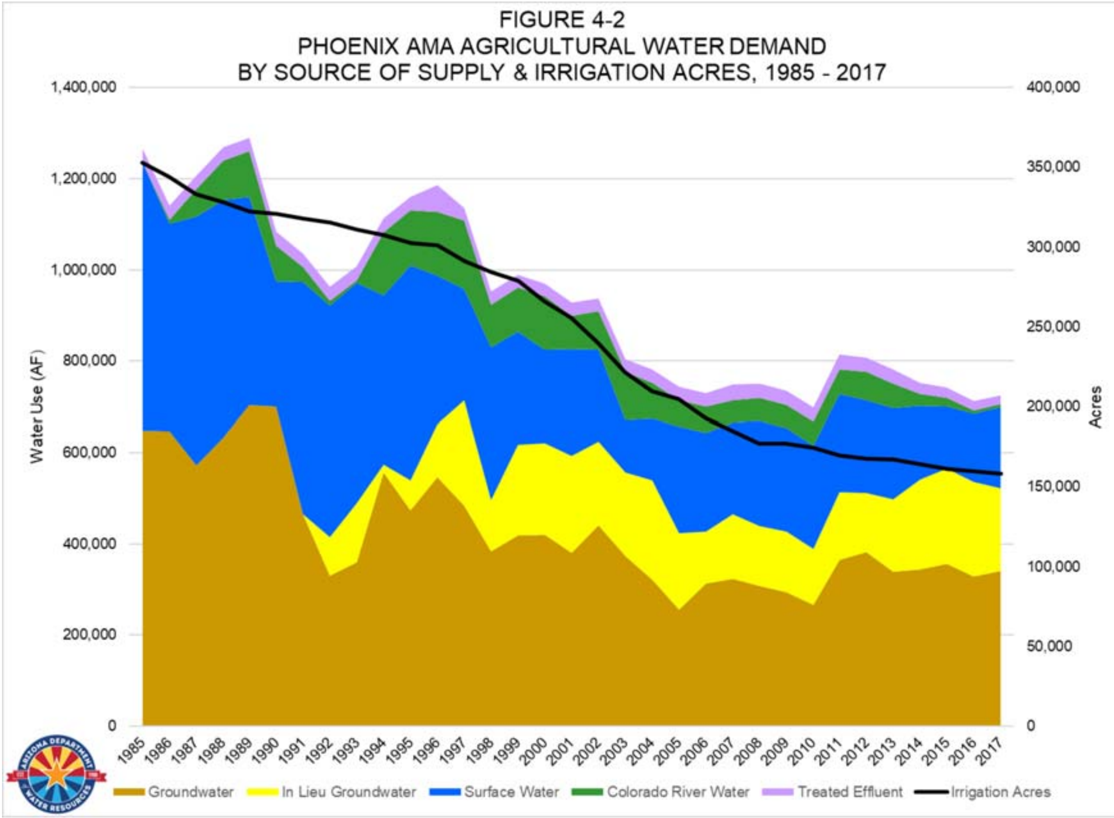


FIGURE 4-2
PHOENIX AMA AGRICULTURAL WATER DEMAND
BY SOURCE OF SUPPLY & IRRIGATION ACRES, 1985 - 2017
Water Use (AF)
Acres
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Groundwater
In Lieu Groundwater
Surface Water
Colorado River Water
Treated Effluent
Irrigation Acres

TABLE 4-1
PHOENIX AMA AGRICULTURAL WATER SUPPLY & DEMAND
1985 -2017, (AF)

Year	Agricultural Demand	Groundwater	In-lieu Groundwater	Colorado River Water	Treated effluent	Surface Water	Allotment
1985	1,265,633	647,719	-	-	30,138	587,776	1,877,572
1986	1,140,492	645,950	-	8,574	30,015	455,953	1,839,274
1987	1,207,431	572,866	-	60,597	30,003	543,965	1,784,763
1988	1,269,055	632,303	-	85,856	30,009	520,886	1,764,040
1989	1,289,718	703,133	-	100,228	30,000	456,356	1,730,060
1990	1,083,348	700,103	-	77,574	30,000	275,671	1,732,407
1991	1,036,114	465,080	-	33,083	30,019	507,931	1,719,634
1992	962,171	329,965	84,981	9,968	30,001	507,257	1,778,340
1993	1,007,248	358,902	129,948	5,151	30,001	483,247	1,753,496
1994	1,112,732	557,581	16,619	138,660	30,000	369,873	1,734,436
1995	1,159,919	474,033	65,690	119,829	30,000	470,366	1,472,183
1996	1,162,408	549,978	137,414	119,666	28,234	327,116	1,457,664
1997	1,145,712	464,040	238,449	150,118	28,200	264,906	1,419,081
1998	953,229	382,067	115,476	93,767	28,200	333,719	1,384,560
1999	989,261	418,649	198,303	97,088	28,200	247,021	1,357,879
2000	970,735	420,485	199,827	118,635	28,200	203,588	1,174,650
2001	927,890	380,779	212,033	73,758	28,200	233,120	1,119,874
2002	937,007	440,124	183,691	84,412	28,200	200,580	1,094,691
2003	804,504	373,167	183,136	105,953	28,200	114,048	1,016,176
2004	780,687	321,899	217,150	78,821	28,200	134,618	936,607
2005	743,012	256,595	166,862	58,511	28,200	232,843	908,215
2006	730,025	271,498	147,149	56,305	30,550	224,523	858,037
2007	744,043	323,918	135,422	47,718	35,403	201,582	824,305
2008	750,194	307,582	131,163	49,561	30,870	231,019	788,401
2009	735,086	294,161	133,056	51,105	31,260	225,504	787,330
2010	697,965	266,152	122,378	51,760	30,595	227,080	774,119
2011	813,467	365,275	148,170	53,581	32,078	214,363	738,775
2012	807,753	382,963	128,221	61,802	32,262	202,504	707,113
2013	782,154	339,571	159,033	53,915	31,316	198,318	692,509
2014	751,544	344,059	197,419	25,609	24,260	160,210	662,004
2015	741,687	356,929	207,756	19,016	38,047	119,939	644,717
2016	712,772	329,406	207,248	6,937	36,256	132,925	627,743
2017	725,088	340,074	182,135	5,665	20,392	176,823	617,432

The agricultural sector demand has decreased over time in the PhxAMA, although it was the primary demand sector through 1999 when demand was almost 990,000 AF. In 2000, the municipal sector demand exceeded one million acre-feet for the first time and replaced agriculture as the primary demand sector. By 2017, agricultural demand was about 725,000 AF. Most of the decrease in water use can be attributed to urbanization of agricultural lands rather than increases in irrigation efficiencies. Other factors affecting agricultural water use included economic and climate conditions (Needham & Wilson, 2005).

The total CAP Agricultural Settlement pool (Agricultural pool) water, which is the source of direct use for CAP water for many agricultural users, was reduced by 25 percent in 2017 and will be by an additional 25 percent in 2024, reducing to zero after 2030. Direct use of Agricultural pool water in the PhxAMA has fluctuated annually. Under the agreements associated with the Lower

Basin Drought Contingency Plan (DCP), some changes were made to how the Agricultural pool is impacted in years of shortage on the Colorado River. Additional details regarding the DCP can be found in Chapter 11.

Agricultural demand in the PhxAMA has experienced annual fluctuations over the historical period of 1985 – 2017, but overall has been declining. 1989 was the highest demand year for agriculture during the historical period, when nearly 1.3 million AF were used. Agricultural demand also exceeded one million AF in years prior to 1992, and from 1993 through 1997. The use of surface water has declined over time, while treated effluent use has remained steady. The agricultural sector began using Groundwater Savings Facilities (GSFs) in 1992 (See Chapter 8 for additional Groundwater Savings Facility information). CAP water and treated effluent may be delivered to GSFs to earn long-term storage credits (LTSCs) for a storing entity. This water is described as in-lieu groundwater in the *Demand and Supply Assessment 1985 – 2025, Phoenix Active Management Area* (2010 Assessment) (ADWR, 2010) and in the PhxAMA 4MP. In-lieu groundwater remains a significant supply used to meet agricultural demand in the PhxAMA (See Figure 4-2).

4.2.2 Harvesting Profile

Cropping patterns have changed significantly over the past decade. From 1985 until 1995, the crop mix remained relatively unchanged from the historical mix. The primary crops grown in the PhxAMA are, in order of acres planted: alfalfa; cotton; wheat; barley; corn; and vegetables. From 1995 through 2015, the acres of alfalfa have increased, and the acres of cotton have decreased. Based on the United States Department of Agriculture data, in 2015 the predominant crop was alfalfa followed by durum wheat and upland cotton. Other commonly grown crops, but not as dominant as alfalfa, cotton, wheat, barley or corn, include vegetables, sorghum, lettuce, sweet corn, kale, tangerines, tomatoes and peaches, along with other crops with fewer acres. With the rise of the dairy industry, alfalfa and other hay production has greatly increased; corn and grain sorghum have also become important feed crops in the area.

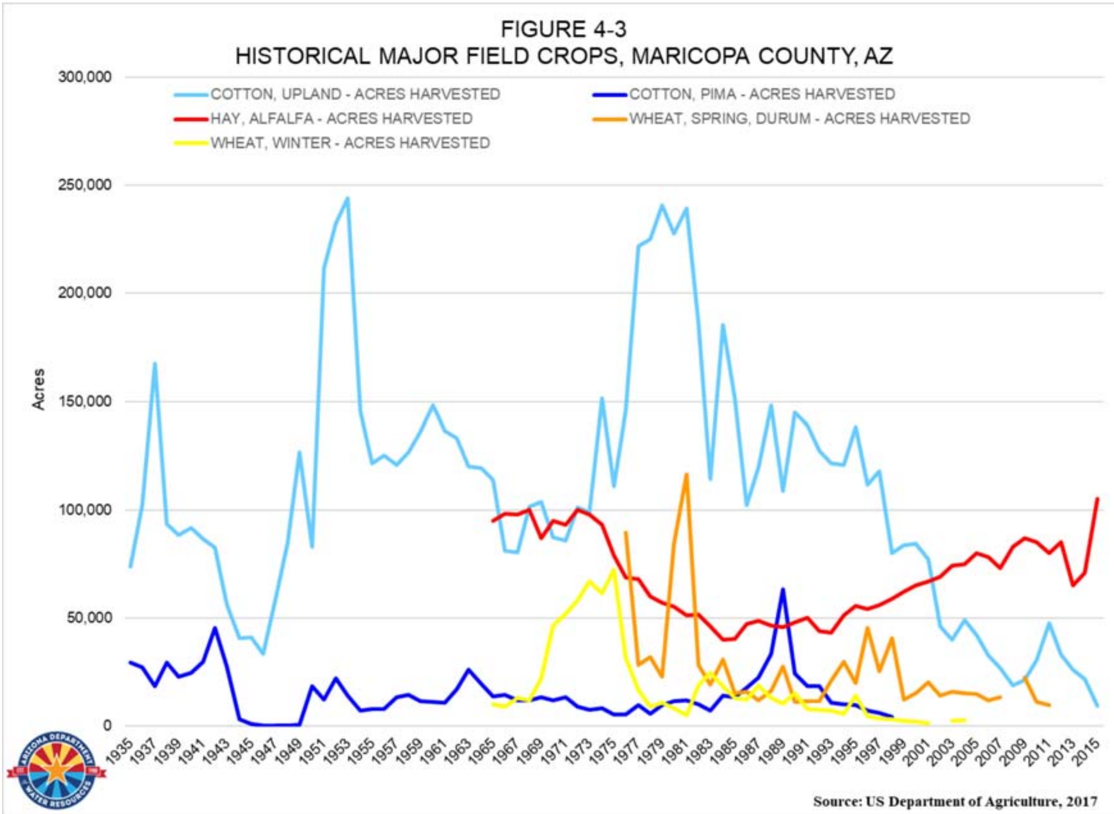


FIGURE 4-3
HISTORICAL MAJOR FIELD CROPS, MARICOPA COUNTY, AZ

4.2.3 Buckeye Waterlogged Area

The Buckeye Water Logged Area (BWLA) was established in 1988 by A.R.S. § 45-411.01. This statute exempts the Buckeye Water Conservation and Drainage District (BWCDD), the St. Johns Irrigation District (SJID), and the Arlington Canal Company (ACC) from the conservation requirements for the distribution of groundwater. In addition, the statute exempts persons using groundwater pursuant to an IGFR on certain waterlogged farm areas located in or near BWCDD, SJID and the ACC from irrigation water duties and the payment of withdrawal fees. These exemptions became effective on January 1, 1989 and continue until January 1, 2020.

In November 2015, ADWR published its *Final Buckeye Waterlogged Area Analysis, Procedures and Recommendation*, wherein ADWR reviewed its findings regarding the hydrologic conditions influencing the designated waterlogged areas, consulted with representatives of BWCDD, SJID, ACC, and the City of Buckeye, and made a recommendation to the Governor and legislative leadership that the BWLA exemptions be extended until the end of the fifth management period, December 31, 2024. ADWR also recommended that legislation extending the exemptions include a provision requiring ADWR to review the hydrologic conditions within the BWLA and submit a recommendation to the governor, the President of the Senate and the Speaker of the House no later than December 15, 2019 regarding extending the exemptions past 2024. ADWR also recommended that the legislation extending the exemptions include a requirement that ADWR consult with the BWCDD, SJID, ACC and all cities and towns within the BWLA on the scope of the hydrologic review before beginning the review and on the status of the review periodically during the course of the review.

4.3 AGRICULTURAL CONSERVATION PROGRAM DESCRIPTION

The following section describes the Agricultural Conservation Program components for the PhxAMA 4MP. This program, which exists in all AMAs, consists of three conservation program options for IGFRs: (1) the Base Program, (2) the Historic Cropping Program, and (3) the Best Management Practices (BMP) Program. The Agricultural Conservation Program also contains irrigation distribution system conservation requirements for irrigation districts and private water companies distributing groundwater for irrigation use. Each of these elements is described below.

4.3.1 Base Program

Pursuant to A.R.S. § 45-567(A)(1), each IGFR owner and any person entitled to use groundwater pursuant to the right will be regulated under the Base Program unless an application for regulation under an alternative conservation program is approved by ADWR during the fourth management period or if the IGFR owner was regulated under the BMP Program in the 3MP. This statute requires ADWR to calculate the water duty according to the calculations in section 4.8 of this Chapter.

A.R.S. § 45-567(A)(1) authorizes ADWR to reduce the highest 25 percent of the water duties within an area of similar farming conditions by up to 10 percent, subject to certain limitations. An ADWR analysis found that implementing this provision would result in 219 water duties being adjusted in the PhxAMA. This would result in the sum of allotments in the PhxAMA being reduced by approximately 6,200 AF or about one percent. This provision represents a small but concrete tool in reducing groundwater withdrawals and is implemented in the PhxAMA 4MP.

In accordance with the statutory provisions of A.R.S. § 45-567(A)(1), for the fourth management period, ADWR will calculate a maximum annual groundwater allotment for each IGFR in the PhxAMA. Section 4.7 of this Chapter describes the allotment calculation.

The Code allows participants in the Base Program to borrow or bank groundwater from year to year to allow for varying climatic and market conditions. To meet this provision, ADWR maintains an operating flexibility account for each IGFR. In the Base Program, the potential to accrue flexibility account credits is not limited. However, a negative balance that exceeds 50 percent of the annual allotment constitutes a violation of the conservation requirement. Flexibility account credits can be used at any time in future years on the same farm unit and may be used to offset debits. Under certain conditions, IGFR owners regulated under the Base Program may transfer, convey, or acquire flexibility credits (A.R.S. § 45-467(O)).

4.3.2 Historic Cropping Program

The Historic Cropping Program was developed by ADWR pursuant to A.R.S. § 45-567.02. As required by this statute, ADWR will calculate the water duty according to calculations in section 4.7. As further required by A.R.S. § 45-567.02, the use of flex account provisions will be limited. Currently, there are no farms in the PhxAMA enrolled in the Historic Cropping Program.

In the Historic Cropping Program, accrued flexibility account credits are limited to 75 percent of the farm's annual allotment. A negative flexibility account balance that exceeds 25 percent of the annual allotment constitutes a violation of the conservation requirement. Flexibility account credits can be used at any time in future years and may be used to offset debits. Participants in the Historic Cropping Program are not allowed to convey, sell or acquire flexibility account credits (A.R.S. § 45-567.02(E)).

The Historic Cropping Program requires a high level of farm management. Participants in the Historic Cropping Program will be required to comply with certain reporting requirements.

Participants must provide information regarding irrigation water management practices, irrigation system type, and the acreage and type of crops grown to assist ADWR in determining program effectiveness.

IGFR owners interested in enrolling in the Historic Cropping Program must satisfy the following requirements:

- File an application with ADWR.
- Reduce any debit balance in the existing flexibility account to an amount which does not exceed 25 percent of the existing maximum annual groundwater allotment.
- Reduce any flexibility account credits in the existing flexibility account balance to an amount which does not exceed 75 percent of the existing maximum annual groundwater allotment.
- Provide documentation showing that an actual irrigation efficiency of at least 70 percent has been, or will be, achieved on the farm unit on a seasonal basis, or agree to enroll in an irrigation management services program.

Once an IGFR owner has enrolled in the Historic Cropping Program, the owner must remain in the program until the effective date of the conservation requirements established in the subsequent management plan or there is a change in ownership of the IGFR.

As of 2018, there were no participants in the Historic Cropping Program.

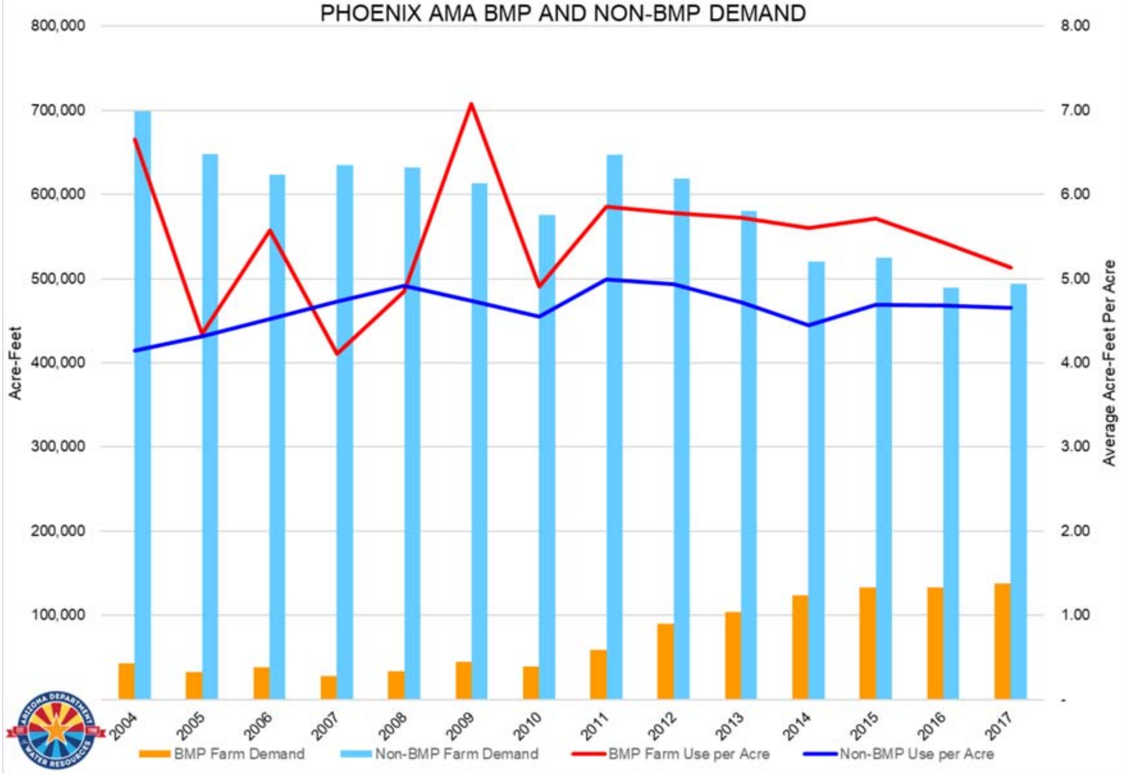
4.3.3 Best Management Practices (BMP) Program

As required by A.R.S. § 45-567.02(G), the Director has included a BMP Program in the 4MP. The BMP Program is characterized by an IGFR owner's commitment to implement certain agricultural conservation practices. The purpose of this program is to provide an alternative conservation program that is designed to be at least as effective in achieving water conservation as the Base Program but provide greater flexibility to program participants and relief from the administrative burden for both participants and ADWR. Program participants are not restricted to maximum annual groundwater allotments based on the crops historically grown. Instead, they are required to implement specific agricultural conservation methods that involve on-farm irrigation system improvements and improved farm water management. This combination of applied operational methods and management improvements is designed to assist farmers in achieving a high level of on-farm seasonal irrigation efficiency.

As of 2017, there were 172 IGFRs enrolled in the BMP in the PhxAMA, including approximately 27,000 irrigation acres. BMP farms in the PhxAMA generally apply about 18 percent more water per irrigation acre than non-BMP farms (See Figure 4-4). This may be due to any number of factors, which may include changes in crop type, double-cropping, or bringing more fallow land into production.

BMPs are approved practices that can be used by farmers to increase the overall water use efficiency of the farm. In order to meet the changing demands of agricultural production, irrigation system improvements and a high level of farm management are essential. ADWR, with the assistance of the agricultural community, has developed a menu of approved BMPs to ensure that individual farmers can select methods that provide the greatest opportunity for increased water savings and efficient operation of their farms.

FIGURE 4-4
PHOENIX AMA BMP AND NON-BMP DEMAND



The BMP utilizes a point-based system based on water conservation potentials and is separated into four distinct categories: 1) Water Conveyance System Improvements; 2) Farm Irrigation Systems; 3) Irrigation Water Management Practices; and 4) Agronomic Management. Each of these categories contains specific approved practices and can be found in Appendix 4B. Certain stipulations for earning points under the BMP program include the following:

- A person must score at least 12 points overall.
- To ensure a balance between categories, a person regulated under the BMP Program may only score a maximum of four points within each category.
- A person must score a minimum of two points in the Farm Irrigation Systems category and a minimum of one point in each of the other three categories
- A BMP may be selected from Category 1 or 2 only if the BMP has already been installed and is in use on the farm.
- A BMP may be selected from Category 3 or 4 only if the BMP will be implemented annually during the time the farm is regulated under the BMP Program.
- In order to receive points for agricultural conservation practices in Category 3 or 4 that are not approved BMPs described in Appendix 4B, the person regulated under the BMP Program must demonstrate to ADWR that such practices will likely result in water savings that are at least equivalent to that of the approved BMPs.

While enrolled in the program, the participant must implement all BMPs selected in the application approved by ADWR, except that the owner or lessee of the farm unit may replace a selected BMP in Category 3 or 4 with a different BMP under certain conditions. A BMP selected in Category 3 or 4 may be replaced with an approved BMP in the same category without prior approval of ADWR. However, the owner or lessee of the farm unit must give ADWR written notice of the replacement within 30 days following replacement.

A BMP selected in Category 3 or 4 may also be replaced with a substitute practice (*i.e*., a practice that is not an approved BMP) in the same category if the owner or lessee of the farm unit applies to ADWR and the application is approved. ADWR will approve an application for replacement of a selected BMP with a substitute practice if it is determined that implementation of the substitute practice will likely result in water savings on the farm at least equivalent to the water savings that would result from implementation of the originally approved BMP.

Under the BMP Program, it is possible to include multiple IGFRs under a single BMP enrollment as long as the IGFRs are either contiguous or in close proximity to each other and part of a single farm unit. Once enrolled in the BMP Program, the IGFR owner and any person using groundwater pursuant to the right (*e.g*. farm operator or lessee) will be regulated under the BMP Program until the Fifth Management Plan (5MP) requirements become effective, unless there is a change in ownership of the farm unit. New owners of IGFRs may file a written request to withdraw from the BMP Program within 30 days after the conveyance of the IGFR has been completed. The Director will grant the request unless the Director determines that the transfer of ownership was made solely for the purpose of withdrawing from the BMP Program. If the request is granted, the new owner will be regulated under the Base Program, unless an application is submitted and is accepted for regulation under the Historic Cropping Program.

In order to enroll in the BMP Program, an individual must apply to the Director on a form provided by ADWR. If all eligibility requirements are met, the Director will approve the application. The applicant must also submit the following:

- A current farm map showing all existing improvements to the farm unit respective to water conveyance and farm irrigation systems; and
- If the applicant is leasing the land, a signed affidavit from the owner of each IGFR for which the application is filed stating that the owner agrees to regulation under the BMP Program until the conservation requirements in the 5MP become effective. ADWR will develop a policy that allows the owner and ADWR to agree to specific terms of compliance at the time the application is filed so that the owner will know at that time the extent of the owner's liability for any violations of the BMP Program while the land is leased.

An IGFR owner enrolled in the BMP Program may, under certain conditions, be allowed to withdraw from the program if the owner demonstrates to the Director that the owner has been unable to find a person willing to lease the IGFR and be regulated under the BMP Program. If a person regulated under the BMP Program acquires or leases land with an IGFR that is not enrolled in the BMP Program, the person may apply to have the IGFR enrolled in the BMP Program, subject to the owner's consent, if applicable.

A person regulated under the BMP Program in the 3MP shall remain in the BMP Program in the 4MP without re-applying but will be required to submit a new BMP Worksheet by July 1, 2022. If a BMP Worksheet is not submitted in a timely manner, that person will be converted to regulation under the Base Program and may re-apply for the BMP Program in subsequent reporting years. More information about the BMP program, including a link to the BMP Worksheet is on ADWR's website at https://new.azwater.gov/ama/ama-conservation.

4.3.3.1 BMP Technical Standards Assistance

In 2013, ADWR established a new partnership with the U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) to assist with the technical standards of the BMPs included in the Agricultural BMP program. The NRCS is available to provide technical and financial assistance to farmers in implementing the BMPs. The NRCS has established specific technical standards for each BMP including yield increase and water savings. In addition, the NRCS is providing matching funds which will result in additional technical personnel available to assist farms in implementing the program requirements at local agricultural conservation assistance offices.

4.4 IRRIGATION DISTRIBUTION SYSTEM REQUIREMENTS

For the fourth management period, the Director may establish "additional economically reasonable conservation requirements for the distribution of groundwater by cities, towns, private water companies and irrigation districts within their service areas" (A.R.S. § 45-567(A)(4)). Establishment of these conservation requirements was required by the 3MP (A.R.S. § 45-566(A)(5)).

The irrigation distribution system requirements, as well as the monitoring and reporting requirements for irrigation districts and private water companies, have been modified in the 4MP to apply to irrigation districts and private water companies distributing any amount of water for irrigation use. This is a change from the 3MP which applied the irrigation distribution system, monitoring and reporting requirements to only those irrigation districts and private water companies distributing 20 percent or more of their total water deliveries for irrigation use. These irrigation districts and private water companies are required to reduce their irrigation distribution system lost and unaccounted-for water by lining all their canals or by operating their delivery systems so that the total quantity of lost and unaccounted-for water is 10 percent or less of the total quantity of water withdrawn, diverted, or received during a year. These requirements are effective upon the commencement of operation, or by the first compliance date of the 4MP, whichever is later.

If a private water company or irrigation district has economic circumstances which prevent timely compliance with the irrigation distribution system conservation requirements, a variance of up to five years may be requested as provided by A.R.S. § 45-574. Information submitted in support of the variance request must include a complete water loss reduction plan prepared by a registered civil engineer that contains:

- A complete construction design document showing specifications for repairing or modifying the irrigation distribution system. The document must include material specifications, proposed design specifications, installation and construction specifications and any other engineering information or specifications necessary to complete the proposed rehabilitation of the distribution system.
- A detailed list of engineering costs and the proposed financing options to complete the system improvements.
- The final completion date for the rehabilitation.
- If applicable, a system operating guide to minimize lost and unaccounted-for water. This guide may be modified as the rehabilitation progresses.

The procedures for obtaining a variance are described in Chapter 10.

4.5 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REDEMIAL GROUNDWATER

Legislation enacted in 1997 and amended in 1999 significantly revised the Water Quality Assurance Revolving Fund (WQARF) Program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater. This legislation provides that ADWR shall account for most uses of groundwater withdrawn pursuant to an approved remedial action project as surface water when determining compliance with management plan conservation requirements (1997 Ariz. Sess. Laws, Chapter 287, § 51(B), as amended by 1999 Ariz. Sess. Laws, Chapter 295, § 49). The criteria that must be met to qualify for this accounting are set forth in the legally enforceable provisions in section 4-807 of this chapter, entitled: *Remedial Groundwater Accounting for Conservation Requirements*. Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes Chapter 2. More information on ADWR's involvement in the WQARF Program is provided in Chapter 7.

The State of Arizona and ADWR have developed incentives to increase the use of non-groundwater supplies. To incentivize treated effluent use, A.R.S. § 45-467 excludes it from consideration in determining the amount of any debit to be registered to a farm's flexibility account. Therefore, a person using groundwater on a farm pursuant to an IGFR may use an unlimited amount of treated effluent on the farm without any of the treated effluent being debited against the farm's flexibility account.

During the fourth management period, ADWR will continue to support the increased use of treated effluent in all sectors, including the agricultural sector. In the past, direct treated effluent utilization for agricultural irrigation has been limited due to a lack of infrastructure. Other requirements, such as the wastewater reuse rules adopted by the Arizona Department of Environmental Quality, have limited the types of crops that can be irrigated solely by treated effluent (A.A.C. R18-11-301 thru 309). As water treatment techniques improve and treated effluent becomes more accessible to the agricultural sector, ADWR expects that treated effluent use for agricultural purposes will increase. The agricultural sector also may use treated effluent that is stored underground and later recovered within the area of impact of storage or, subject to certain restrictions, recovered outside the area of impact of storage. Treated effluent stored underground is further treated as it infiltrates the aquifer. Treated effluent stored underground and later recovered is treated in the same manner as direct-use treated effluent in the calculation of the farm's flexibility account.

Chapter 3 contains additional details on historical use of treated effluent by each water use sector.

4.6 NON-REGULATORY EFFORTS

In addition to the Agricultural Conservation Programs described in section 4.3, other water resource management strategies have been developed to help achieve the water management goal for the PhxAMA. The Water Management Assistance Program is designed to provide funds to enhance groundwater conservation activities within all use sectors, including the agricultural sector, and is described more fully in Chapter 9 of this plan.

4.7 AGRICULTURAL CONSERVATION PROGRAM CALCULATIONS AND FORMULA COMPONENTS

This section describes the calculations used for determinations under the Agricultural Conservation Program and a description of their formula components.

4.7.1 Irrigation Water Duties and Maximum Annual Groundwater Allotments

The irrigation water duty is the primary component of both the Base Program and the Historic Cropping Program and is used to determine the maximum annual groundwater allotment for each IGFR regulated under these programs. This section describes how ADWR determines water duties and maximum annual groundwater allotments. This section and the described water duties do not apply to the BMP Program.

4.7.2 Calculation of Maximum Annual Groundwater Allotments

The maximum annual groundwater allotment for each IGFR is determined by multiplying the irrigation water duty by the water-duty acres. These calculations are governed by A.R.S. § 45-465.

4.7.3 Calculation of Irrigation Water Duties

The irrigation water duty is the quantity of water reasonably required per acre to annually irrigate the crops historically grown on a farm unit from 1975 to 1980. The crops historically grown in each farm unit were verified and established during the first management period. ADWR calculates the irrigation water duty for each IGFR using the following formula:

$$\textit{Irrigation Water Duty} = \frac{\textit{Total Irrigation Requirements per Acre}}{\textit{Assigned Irrigation Efficiency}}$$

In this formula, the irrigation water duty is calculated by dividing the total water requirements to produce the crops historically grown by the assigned irrigation efficiency. Each component of the formula is discussed below.

Assigned Irrigation Efficiencies

In the Base Program, the assigned irrigation efficiency for most farm units is 80 percent as prescribed by A.R.S. § 45-566(A)(1) (See also, A.R.S. § 45-567(A)(1)). For those farm units with limiting soils or excessive slopes, the assigned irrigation efficiency has been determined by the Director to be 75 percent in the PhxAMA. Although few farm units in the PhxAMA have lands with excessive slopes, many farm units do have lands with limiting soils or lands with both limiting and non-limiting soils. In such cases, irrigation efficiency between 75 and 80 percent will be assigned based upon the total number of acres in each category of soil. For farm units where orchard crops were historically grown and continue to be grown, the assigned irrigation efficiency is 75 percent for pecans and 65 percent for citrus.

For the Historic Cropping Program, the assigned irrigation efficiency for farm units with non-limiting soils is 75 percent as prescribed by A.R.S. § 45-567.02. In areas having limiting soils, the Director may use an assigned irrigation efficiency of 70 percent for calculating a farm unit's water duty.

Total Irrigation Requirement

The total irrigation requirement for each farm unit equals the amount of water needed annually to satisfy the sum of the irrigation requirements for any crops grown between 1975 and 1980. For each crop, the irrigation requirement (IR) consists of the amount of water needed to meet the consumptive use (CU) requirement of the crop, plus any other needs (ON) that the crop may have, plus any needed leaching allowance (LA), less any effective precipitation (EP). The irrigation requirement is calculated by the following equation:

$$IR = CU + ON + LA - EP$$

The components of the irrigation requirement equation are discussed below.

Consumptive Use (CU)

The consumptive use requirement of a crop is the amount of water used in transpiration and building of plant tissue, together with the amount of water evaporated from adjacent soil during the growing season. Crop consumptive-use values are unchanged from the information provided in the 3MP and commonly used values for the PhxAMA. Appendix 4A lists the consumptive-use requirement for each crop historically grown in the region.

Other Needs (ON)
Water required by certain crops for purposes other than consumptive use is referred to as “other needs” water. Examples of “other needs” include additional water for certain vegetable crops for germination, cooling and quality control. ADWR makes adjustments for those crops that have “other needs.” Appendix 4A lists the “other needs” requirements for crops historically grown in the PhxAMA.

Leaching Allowance
In some situations, a crop may require additional water for leaching or deep percolation. A leaching allowance may be necessary to prevent salts from accumulating in the crop root zone when high levels of total dissolved solids (TDS) are present in the irrigation water. If the accumulated salts in the soil profile are not leached below the root zone, soil salinity will increase and eventually inhibit plant growth and yields.

The procedure ADWR uses to calculate the leaching allowance for a crop is shown by the following equation:

$$LA = \frac{AE}{0.85}\left[CU \left[\frac{1}{1 - \frac{EC_w}{5\,EC_e - EC_w}} - 1 \right] \right]$$

Where, LA = leaching allowance for the crop; AE = assigned irrigation efficiency for the farm unit; CU = consumptive use requirement of the crop; EC_w = electrical conductivity of the irrigation water (expressed in millimhos per centimeter); and EC_e = tolerance of the crop to soil salinity as indicated by the electrical conductivity of the soil saturation extract (expressed in millimhos per centimeter).

Most irrigation water in the PhxAMA is of adequate quality for irrigation purposes. Consequently, ADWR does not include leaching allowances in the calculation of irrigation requirements for crops grown in the PhxAMA. If, however, an IGFR had an irrigation water supply with an EC_w value greater than 1.5 millimhos per centimeter (a concentration of approximately 1,000 milligrams per liter of TDS), the owner of the IGFR may apply to ADWR for an administrative review to seek a leaching allowance as discussed in Chapter 10 of this plan.

Effective Precipitation (EP)
Effective precipitation is defined as the amount of precipitation occurring before and during the growing season that is available for plant growth. Because precipitation is minimal and varies considerably by year and location in the PhxAMA, effective precipitation is difficult to quantify and is not subtracted from the total irrigation requirements for the crops historically grown. However, managing the use of precipitation to offset the use of other water supplies could be an important irrigation water management tool. Emerging technologies such as soil-moisture sensors may help implement this tool.

Adjustment of Highest Water Duties

Under A.R.S. § 45--567(A)(1), the highest 25 percent of water duties within an "area of similar farming conditions" (ASFC) may be reduced by up to 10 percent, so long as the adjusted amount is no less than:

a) the highest water duty within the lowest 75 percent of water duties for that ASFC, and
b) the water duty calculated for that farm unit using an irrigation efficiency of 80 percent.

4.8 *AGRICULTURAL CONSERVATION, MONITORING AND REPORTING REQUIREMENTS*

4-801. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, the following words and phrases used in sections 4-801 through 4-808 of this chapter shall have the meanings set forth below, unless the context otherwise requires:

1. *"3MP" means the Third Management Plan for the Phoenix Active Management Area.*

2. *"4MP" means the Fourth Management Plan for the Phoenix Active Management Area.*

3. *"5MP" means the Fifth Management Plan for the Phoenix Active Management Area.*

4. *"ADWR" means the Arizona Department of Water Resources.*

5. *"Assigned Irrigation Efficiency" means the irrigation efficiency used to compute an irrigation water duty for the fourth management period pursuant to A.R.S. §§ 45-567 and 45-567.02.*

6. *"BMP Program" means the Best Management Practices Program as described in A.R.S. § 45-567.02(G) and section 4-704 of this chapter.*

7. *"Canal" means a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.*

8. *"Farm" has the same definition as prescribed in A.R.S. § 45-402.(See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00402.htm)*

9. *"Farm Unit" has the same definition as prescribed in A.R.S. § 45-402.(See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00402.htm)*

10. *"Flexibility Account" is an account maintained under A.R.S. § 45-467.(See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00467.htm)*

11. *"IGFR" means an Irrigation Grandfathered Right as prescribed in A.R.S. § 45-402. (See:*

https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00402.htm

12. *"Irrigation Acre" has the same definition as prescribed in A.R.S. § 45-402. (See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00402.htm)*

13. *"Irrigation Distribution System" means a system of canals, flumes, pipes, or other works that are owned or operated by an irrigation district or private water company and used to deliver water for irrigation use.*

14. *"Irrigation Water Duty" has the same definition as prescribed in A.R.S. § 45-567 (See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00567.htm) which, for the 4MP, is the total irrigation requirement to produce the crops historically grown divided by the assigned irrigation efficiency, with reductions made in certain cases as prescribed in A.R.S. § 45-567(A)(1).*

15. *"Lost Water" means water from any source, including treated effluent, which enters an irrigation distribution system and is lost from the system during transportation or distribution due to seepage, evaporation, leaks, breaks, phreatophyte use, or other causes.*

16. *"Maximum Annual Groundwater Allotment" means the maximum amount of groundwater that may be used per year for the irrigation of each irrigation acre in the farm that is calculated pursuant to A.R.S. § 45-465.*

17. *"On-farm Seasonal Irrigation Efficiency" means the total water requirements to produce a crop divided by the total quantity of water actually applied to that crop during one growing season.*

18. *"Treated effluent" has the same definition as "effluent" in A.R.S. § 45-101 (See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00101.htm.*

19. *"Remedial Groundwater" means groundwater withdrawn pursuant to an approved remedial action project but does not include groundwater withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03.*

20. *"Total Quantity of Lost and Unaccounted-for Water" means the total quantity of water from any source, including treated effluent, that enters an irrigation district's or private water company's irrigation distribution system during a calendar year less the total deliveries of water made by the irrigation district or private water company through its irrigation distribution system during the calendar year that are measured or estimated based on a generally accepted method of estimating water use.*

21. *"Water Duty Acres" has the same definition as prescribed in A.R.S. § 45-461 (See: https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/45/00461.htm).*

4-802. Base Agricultural Conservation Program Requirements

A. Unless the owner of a Certificate of Irrigation Grandfathered Right ("IGFR") is regulated under the Historic Cropping Program described in section 4-803 or the Best Management Practices Program described in section 4-804, the IGFR owner and any person who is entitled to use groundwater pursuant to that IGFR shall comply with this section.

B. *The IGFR owner and any person entitled to use groundwater pursuant to that IGFR shall comply with the irrigation water duty and maximum annual groundwater allotment assigned for the IGFR beginning January 1, 2023, and during each calendar year thereafter until the first compliance date for any substitute conservation requirement established in the 5MP. The irrigation acres, water duty acres, assigned irrigation efficiency, irrigation water duty, and maximum annual groundwater allotment for each IGFR in the PhxAMA are set forth in the document entitled "Supplement I to the 4MP for the PhxAMA," which is incorporated herein by reference and which is available for inspection and copying at ADWR.*

C. The IGFR owner and any person entitled to use groundwater pursuant to that IGFR may use the maximum annual groundwater allotment assigned for the right in Supplement I to irrigate only the irrigation acres to which the right is appurtenant.

D. The IGFR owner and any person entitled to use groundwater pursuant to that IGFR shall not use water for irrigation purposes during a calendar year in an amount which exceeds the maximum annual groundwater allotment assigned for the right in Supplement I, except as provided by the flexibility account provisions of A.R.S. § 45-467 and any rules adopted by the Director.

E. Pursuant to A.A.C. R12-15-1013, the IGFR owner and any person using groundwater pursuant that IGFR shall keep and maintain, for at least three calendar years following the filing of an annual report required by A.R.S. § 45-632, all records which may be necessary to verify the information and data contained in the annual report.

4-803. Historic Cropping Program

A. Application for Regulation under the Historic Cropping Program

Only an owner of an IGFR may apply to be regulated under the Historic Cropping Program. An application may be filed by an IGFR owner at any time prior to the first compliance date for the agricultural conservation requirements established in the 5MP. An application for regulation under the Historic Cropping Program shall be on a form prescribed and furnished by the director and shall include the following information:

1. The name, address, and phone number of the IGFR owner.

2. The number of the Certificate of IGFR.

3. The name, address, and phone number of any person entitled to use groundwater under the IGFR.

4. *For each of the three previous years, the number of acres and types of crops planted and the amount of water used to irrigate the planted acres.*

5. *For each of the three previous years, the type of irrigation system which has been used, including percent of slope, length of runs, and method of field application.*

6. *For each of the three previous years, a description of all water conservation practices used on the farm, including the name of any conservation program or irrigation water management service used on the farm.*

B. *Criteria for Approval of Application*

The Director shall approve an application for regulation under the historic cropping program if all of the following requirements are satisfied:

1. *The application is found to be complete and correct.*

2. *Any negative flexibility account balance in the farm's flexibility account does not exceed 25 percent of the maximum annual groundwater allotment in effect at the time that the application is made.*

3. *Any positive flexibility account balance in the farm's flexibility account does not exceed 75 percent of the maximum annual groundwater allotment in effect at the time that the application is made. In order to satisfy this requirement, the IGFR owner may sell or convey any excess credits as provided by A.R.S. § 45-467 or the IGFR owner may relinquish any excess credits.*

4. *The IGFR owner demonstrates that the average on-farm seasonal irrigation efficiency achieved on the farm's irrigation acres during the previous three years was 75 percent or greater. If the IGFR owner cannot demonstrate that an average on-farm seasonal irrigation efficiency of at least 75 percent has been achieved during the previous three years, the IGFR owner shall agree in writing to develop and implement at least one of the following:*

   a. *Enroll in an ADWR-sponsored or private irrigation management services program at all times while regulated under the Historic Cropping Program or until the IGFR owner can demonstrate to the Director's satisfaction that an average on-farm seasonal irrigation efficiency of at least 75 percent has been achieved during the previous three years.*

   b. *Implement water conveyance system or farm irrigation system improvements, approved by the Director, designed to enable the IGFR owner to achieve an on-farm seasonal irrigation efficiency of at least 75 percent.*

C. *Historic Cropping Program Requirements*

An IGFR owner whose application has been approved for regulation under the Historic Cropping Program and any person using groundwater pursuant to that IGFR shall comply with all of the following:

1. *The irrigation water duty and maximum annual groundwater allotment established by the Director under this section, beginning with the calendar year in which the IGFR owner is accepted into the Historic Cropping Program, and continuing thereafter until the first compliance date for any substitute conservation requirement established in the 5MP. The Director shall establish the irrigation water duty and maximum annual groundwater allotment in the same manner that the Director established the irrigation water duty and maximum annual groundwater allotment assigned for the IGFR in the Base Agricultural Conservation Program described in section 4-802, except that the Director shall use an assigned irrigation efficiency of 75 percent.*

2. *The IGFR owner may use the maximum annual groundwater allotment assigned for the IGFR to irrigate only the irrigation acres to which the IGFR is appurtenant.*

3. *The IGFR owner may not use water for irrigation purposes during a calendar year in an amount which exceeds the maximum annual groundwater allotment assigned to the right, except as provided in the flexibility account provisions of A.R.S. § 45-467, as modified in subsection D of this section, and any rules adopted by the director.*

D. *Flexibility Account Provisions*

Under the Historic Cropping Program, the flexibility account provisions of A.R.S. § 45-467 shall apply to the IGFR owner and any person entitled to use groundwater under that IGFR with the following modifications:

1. *If the amount of water used to irrigate the farm in any year is less than the maximum annual groundwater allotment established for the farm pursuant to subsection C, paragraph 1 of this section, the amount of any credit registered to the farm's flexibility account pursuant to A.R.S. § 45-467 shall not exceed the difference between the existing balance in the account and a positive account balance of 75 percent of the maximum annual groundwater allotment. The Director shall not register a credit to the farm's flexibility account in any year in which the account has an existing positive account balance equal to 75 percent of the maximum annual groundwater allotment.*

2. *The IGFR owner, and any person entitled to use groundwater under that IGFR, regulated under the Historic Cropping Program shall not:*

   a. *Purchase flexibility account credits from, or convey or sell flexibility account credits to, another IGFR owner, or any other person entitled to use groundwater under another IGFR, regardless of whether they are regulated under the Historic Cropping Program.*

   b. *Transfer credits from the flexibility account of one farm to another farm, even if the farms are owned by the same IGFR owner.*

3. *The maximum excess amount of groundwater that may be used pursuant to A.R.S. § 45--467 shall not exceed 25 percent of the maximum annual groundwater allotment established for the farm pursuant to subsection C,*

paragraph 1 of this section. The IGFR owner, and any person entitled to use groundwater under that IGFR, violates this section if the flexibility account maintained for the IGFR is in arrears at any time in excess of this amount.

E. Reporting Requirements

1. *In addition to the information required to be submitted in the annual report required by A.R.S. § 45-632, the IGFR owner, or any person entitled to use groundwater pursuant to that IGFR, shall submit the following information on a form prescribed by the Director, regardless of whether an irrigation district files the annual report on behalf of the IGFR owner:*

   a. *The name, address, and phone number of any person entitled to use groundwater under the IGFR.*

   b. *The number of acres and types of crops planted and the amount of water used to irrigate the planted acres.*

   c. *The type of irrigation system which has been used, including percent of slope, length of runs and method of field application.*

   d. *A description of all water conservation practices used on the farm, including the name of any conservation program or irrigation water management service used on the farm.*

2. *Pursuant to A.A.C. R12-15-1013, the IGFR owner, and any person using groundwater pursuant the IGFR, shall keep and maintain, for a minimum of three calendar years following the filing of the form, all records which may be necessary to verify the information and data contained therein.*

F. Duration of Regulation under Historic Cropping Program

1. *Except as provided in paragraph 2 of this subsection, after the Director approves an application for regulation under the Historic Cropping Program, the IGFR owner and any person entitled to use groundwater pursuant to that right shall be regulated under the Historic Cropping Program until the first compliance date for any substitute agricultural conservation requirement established in the 5MP.*

2. *After the Director approves an application for regulation under the Historic Cropping Program, a subsequent owner of the IGFR may file with the Director a written request to withdraw from the Historic Cropping Program within 90 days after acquiring an ownership interest in the IGFR. The Director shall grant the request unless the Director determines that the transfer of ownership was made solely for the purpose of circumventing the provisions of paragraph 1 of this subsection, in which case the request will be denied.*

4-804. Best Management Practices Program

A. Application for Regulation under the Best Management Practices Program

Except as provided in subsection C of this section, an owner of an IGFR, or any person using groundwater pursuant to that IGFR, may apply to be regulated under the BMP Program at any time prior to the first compliance date for the agricultural *conservation requirements established in the 5MP. One application may be filed for multiple IGFRs if the IGFRs are contiguous or in close proximity to each other and are within the same farm unit. An application for regulation under the BMP Program shall be on a form prescribed and furnished by the Director and shall include the following information:*

1. *The name, address, and phone number of the applicant.*

2. *The certificate number(s) of IGFR(s) for which the application is filed.*

3. *The name of the farm or farm unit (if applicable).*

4. *The current balance in the flexibility account for the farm.*

5. *If the applicant is not the owner of an IGFR for which the application is filed, a signed affidavit from the owner of that IGFR stating that the owner agrees to regulation under the BMP Program until the effective date of any substitute conservation requirements established in the 5MP, except as provided in subsection I, paragraph 2 of this section.*

6. *A current farm plan map showing all existing improvements to the farm unit's water conveyance system and farm irrigation systems.*

7. *An identification of those BMPs described in Appendix 4B that the applicant selects to implement on the farm while regulated under the BMP Program. In selecting BMPs:*

   a. *The applicant shall select at least one BMP in each of the four BMP Categories described in Appendix 4B: Category 1 (water conveyance system improvements), Category 2, (farm irrigation systems), Category 3 (irrigation water management practices), and Category 4 (agronomic management practices). The total number of points for all BMPs selected by the applicant shall be at least twelve points, using the point values assigned to each BMP in Appendix 4B, subject to the following:*

      i. *The maximum number of points allowed in any category is four points.*

      ii. *The applicant shall select a BMP or BMPs in BMP Category 2 that have a total of at least two points.*

   b. *A BMP may be selected in BMP Category 1 or BMP Category 2 only if the BMP has already been installed and is being used on the farm at the time the application is filed. A BMP may be selected in BMP Category 3 or BMP Category 4 only if the BMP will be implemented on the farm annually while water use on the farm is regulated under the BMP Program.*

   c. *If the applicant selects a substitute practice in BMP Category 3 or BMP Category 4 as described in Appendix 4B, the applicant shall describe the substitute practice in detail and demonstrate that the practice will likely achieve water savings on the farm at least equivalent to the water savings that would result from implementation of an approved BMP in that category.*

B. *Criteria for Approval of Application*

The Director shall approve an application for regulation under the BMP program if all of the following requirements are satisfied:

1. *The application is found to be complete and correct, and the BMPs selected by the applicant under subsection A, paragraph 7 of this section meet the requirements of that paragraph.*

2. *The applicant is not currently out of compliance with any agricultural conservation requirement in this chapter. This paragraph does not apply to a violation of a conservation requirement if the violation has been resolved by ADWR through a stipulation and consent order or other mechanism and the applicant is not in violation of that stipulation and consent order or other mechanism.*

3. *If the BMPs selected by the applicant under subsection A, paragraph 7 of this section include a substitute practice in BMP Category 3 or BMP Category 4 as described in Appendix 4B, the applicant has demonstrated to the satisfaction of the Director that the substitute practice will likely achieve water savings on the farm at least equivalent to the water savings that would result from implementation of an approved BMP in that category.*

C. *Continuing Regulation in the BMP Program from the 3MP*

1. *An IGFR owner who was regulated under the BMP Program in the 3MP or any person using groundwater pursuant to the IGFR, may be regulated under the BMP Program for the 4MP without the need to re-apply under subsection A of this section, unless the IGFR owner provides written notification of intent to withdraw from the BMP Program pursuant to paragraph 2 of this subsection.*

2. *An IGFR owner or any person using groundwater pursuant to the IGFR who was regulated under the BMP Program in the 3MP shall submit an updated BMP Worksheet by July 1, 2022 demonstrating compliance with the BMP Program under the 4MP. If a BMP Worksheet demonstrating compliance with the 4MP is not submitted in a timely manner, the IGFR owner and any person entitled to use groundwater pursuant to that right shall be regulated under the Base Program beginning January 1, 2023. The beginning balance of the farm's flexibility account shall be the balance in the account at the time the farm was enrolled in the BMP Program in the 3MP.*

3. *An IGFR owner who was regulated under the BMP Program in the 3MP may elect to be regulated under the Base Program in the 4MP by providing written notice of the election to the Director within 60 days after receiving notice of the 4MP agricultural conservation requirements. If an IGFR owner makes an election under this paragraph, the IGFR owner, and any person using groundwater pursuant to the IGFR, shall be regulated under the Base Program beginning January 1, 2023. The beginning balance of the farm's flexibility account shall be the balance in the account at the time the farm was enrolled in the BMP Program in the 3MP.*

D. *Commencement of Regulation Under BMP Program*

1. If the Director approves an application for regulation under the BMP Program pursuant to subsection B of this section, the IGFR owner and any person using groundwater pursuant to the IGFR shall be regulated under the BMP Program beginning January 1 of the first calendar year following the year in which the application is approved, unless the Director approves an earlier date.

2. An IGFR owner who was regulated under the BMP Program in the 3MP and any person using groundwater pursuant to the IGFR, may be regulated under the BMP Program beginning January 1, 2023, unless the IGFR owner provides written notification of intent to withdraw from the BMP Program pursuant to subsection (C)(3) of this section or fails to submit the required BMP Worksheet pursuant to subsection (C)(2) of this section.

3. A person who acquires an IGFR that is appurtenant to land enrolled in the BMP Program, and any person using groundwater pursuant to the IGFR, shall be regulated under the BMP Program beginning on the date the IGFR is acquired.

E. Exemption from Maximum Annual Groundwater Allotment Conservation Requirement

A person regulated under the BMP Program is exempt from the maximum annual groundwater allotment conservation requirements set forth in section 4-802.

F. BMP Program Requirements

A person regulated under the BMP Program shall comply with all of the following:

1. The person shall implement all selected BMPs in the application approved by the Director under this section, or all selected BMPs in the BMP Worksheet submitted pursuant to subsection (C)(2) of this section, whichever applies, beginning on the first date of regulation under the BMP Program, and, except as provided in subsection I, paragraph 2 of this section, continuing thereafter until the first compliance date for any substitute conservation requirement established in the 5MP. If a BMP has been replaced with a new BMP pursuant to subsection G of this section, the IGFR owner and any person entitled to use groundwater pursuant to that IGFR shall implement the new BMP in lieu of the replaced BMP.

2. The person may use groundwater to irrigate only the irrigation acres to which the IGFR is appurtenant.

G. Replacement of an Existing BMP with a New BMP after Acceptance into BMP Program

A person regulated under the BMP Program may:

1. Replace a BMP required to be implemented in BMP Category 3 or BMP Category 4 with an approved BMP in the same category, as described in Appendix 4B, if the person notifies the Director in writing of the replacement within 30 days after the replacement occurs.

2. Apply to the Director to replace a BMP required to be implemented in BMP Category 3 or BMP Category 4 with a substitute practice in the same category as described in Appendix 4B. The Director shall approve the application if the

Director determines that implementation of the substitute practice will likely result in water savings on the farm at least equivalent to the water savings that would result from implementation of the BMP sought to be replaced.

H. Requirement of New Lessee to Apply for Participation in BMP Program

1. Any person who acquires a leasehold interest in the land enrolled in the BMP Program shall file with the Director an application to participate in the BMP Program prior to using water on the land. The application shall be on a form prescribed and furnished by the Director and shall contain the following information:

a. The applicant's name, address and telephone number.

b. The certificate number(s) of IGFR(s) for which the application is filed.

c. A certification that the applicant agrees to be regulated under the BMP Program while leasing the land, and an identification of all BMPs the applicant agrees to implement while leasing the land. The BMPs shall meet the requirements set forth in subsection A, paragraph 7 of this section.

d. Any other information required by the Director.

2. The Director shall approve an application to participate in the BMP Program filed under paragraph 1 of this subsection if the application meets all of the requirements set forth in subsection B of this section. If the Director denies the application and the Director's decision denying the application becomes final after exhaustion of all appeals, the applicant shall file a new application to participate in the BMP Program within 30 days after the Director's decision becomes final. In the new application, the applicant shall make a good faith effort to correct the deficiencies that the Director identifies with the first application. If the Director denies the new application, both the owner of the IGFR and the applicant shall be regulated under the Base Agricultural Conservation Program in section 4-802.

I. Flexibility Account Provisions

Under the BMP Program, the flexibility account provisions of A.R.S. § 45-467 shall not apply to a person regulated under the BMP Program. Upon acceptance into the BMP Program, the balance in the farm's flexibility account at the time of acceptance into the BMP Program shall remain unchanged until water use on the farm is no longer regulated under the BMP program.

J. Reporting Requirements

In addition to the information required to be submitted in the annual report required by A.R.S. § 45-632, a person regulated under the BMP Program shall submit the following information on a form prescribed by the Director by the date the annual report is due, regardless of whether an irrigation district files the annual report on behalf of the IGFR owner:

1. The name, address, and phone number of any person entitled to use groundwater on the farm unit.

2. *Certification that all required BMPs have been implemented during the previous calendar year. Pursuant to A.A.C. R12-15-1013, the person submitting the form shall keep and maintain, for at least three calendar years following the filing of the form, current and accurate records verifying that the BMPs were implemented.*

K. Duration of Regulation under BMP Program

1. *Except as provided in paragraph 2 of this subsection, a person regulated under the BMP Program shall be regulated under the program until the first compliance date for any substitute agricultural conservation requirement established in the 5MP.*

2. *An IGFR owner may file with the Director a written request to withdraw from the BMP Program. The Director shall grant the request if the IGFR owner demonstrates to the satisfaction of the Director that either of the following apply:*

    a. *The IGFR owner desires to lease the land to which the IGFR is appurtenant to a lessee for a term of at least one year but has been unable to find a lessee willing to be regulated under the BMP Program, after making a good faith effort to find such a lessee.*

    b. *The IGFR owner has found a person that will lease the land for a term of at least one year if the owner is allowed to withdraw from the BMP Program, and that person did not previously lease the land while the owner was regulated under the BMP Program.*

3. *A person who acquires an IGFR appurtenant to land enrolled in the BMP Program may file with the Director a written request to withdraw from the BMP Program within 90 days after acquiring an ownership interest in the IGFR. The Director shall grant the request unless the Director determines that the transfer of ownership was made solely for the purpose of circumventing the provisions of paragraph 1 of this subsection, in which case the request shall be denied.*

4-805. Conservation Requirements for Irrigation Distribution Systems

A. Applicability

The irrigation distribution system conservation requirements set forth in subsection B below apply to irrigation districts and private water companies that distribute water for irrigation use.

B. Conservation Requirements

By January 1, 2023 or upon commencement of operation, whichever is later and continuing thereafter until the first compliance date of any substitute requirement in the 5MP, each irrigation district and private water company owning or operating an irrigation distribution system shall either:

1. *Line all canals used to deliver water for irrigation use with a material that allows no more lost water than a well-maintained concrete lining, or*

2. Operate and maintain its distribution system so that the total quantity of lost and unaccounted-for water is 10 percent or less of the total quantity of water from any source, including treated effluent, that enters its irrigation distribution system, calculated on either a calendar year basis or a three-year average basis based on that calendar year and the two preceding calendar years.

4-806. Monitoring and Reporting Requirements for Irrigation Districts and Private Water Companies

A. Applicability

The monitoring and reporting requirements set forth in subsection B below apply to irrigation districts and private water companies that distribute water for irrigation use.

B. Monitoring and Reporting Requirements

Beginning with calendar year 2023 or the calendar year in which the irrigation district or private water company commences service, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the 5MP, each irrigation district and private water company owning or operating an irrigation distribution system shall submit in its annual report required by A.R.S. § 45-632, the following information as it applies to the irrigation district or private water company:

1. A map showing the irrigation distribution system, including those portions which have lined canals and those portions which have unlined canals, unless a current map is on file with ADWR.

2. The number of miles of lined canals and the number of miles of unlined canals in the irrigation distribution system.

3. The total quantity of water from any source, including treated effluent, that entered the irrigation district's or private water company's irrigation distribution system during the calendar year.

4. The total quantity of water from any source, including treated effluent, delivered by the irrigation district or private water company through its irrigation distribution system to all water users during the calendar year.

5. An estimate of the irrigation district's or private water company's total quantity of lost and unaccounted-for water for the calendar year. This quantity shall be determined by a generally accepted engineering method.

6. The total quantity of water ordered by a municipal provider from the irrigation district and released by the irrigation district from a storage or distribution facility but not accepted by the municipal provider or delivered to any other person.

4-807. Remediated Groundwater Accounting for Conservation Requirements

A. Accounting

Remedial Groundwater used by a person subject to a conservation requirement established under this chapter shall be accounted for consistent with the accounting *for surface water for purposes of determining the person's compliance with the conservation requirement, subject to the provisions of subsections B through D of this section.*

B. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remedial groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the United States Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ). The annual authorized volume for a project approved prior to June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to Jan. 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The Director may modify the annual authorized volume for a remedial action project as follows:

1. *For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The Director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the Director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw groundwater in excess of the annual authorized volume to further the purpose of the project. The Director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the Director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

3. *The Director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the Director written notice of the change within 30 days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

C. Notification

To qualify for the remediated groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the Director in writing of the anticipated withdrawal of Remedial Groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to *the withdrawal. At the time the notice is given, the person desiring the accounting must be using Remedial Groundwater pursuant to the approved remedial action project, or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:*

1. *A copy of the document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of remedial Groundwater that will be pumped annually pursuant to the project, the time period to which the document applies and the annual authorized volume of groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the Remedial Groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the Director.*

D. Monitoring and Reporting Requirements

To qualify for the remedial groundwater accounting for conservation requirements as provided in subsection A of this section, Remedial Groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remedial groundwater accounting for conservation requirements shall indicate in its annual report, under A.R.S. § 45-632, the volume of water withdrawn and used during the previous calendar year that qualifies for the accounting.

4-808. Audits of Conservation Requirements

A. ADWR may elect to conduct audits of reports, records, and/or practices pursuant to the conservation requirements contained in sections 4-801 through 4-807 of this chapter. A Report of Audit must be sent to the audited person or entity pursuant to A.R.S. §§45-633(D), 880.01(D), 1061(D), and/or A.A.C. R12-15-1102(E).

APPENDIX 4A
CONSUMPTIVE USE AND OTHER NEEDS REQUIREMENTS BY CROP
PHOENIX ACTIVE MANAGEMENT AREA

Crop	Consumptive Use (AF per acre)	Other Needs (AF per acre)	IRRIGATION REQUIREMENT (AF per acre)
Grain Crops			
Barley	2.08	0.00	2.08
Maize (Sorghum)	2.12	0.00	2.12
Millet	2.58	0.00	2.58
Oats	1.83	0.00	1.83
Rye	1.83	0.00	1.83
Sorghum Grain (Single Crop)	2.12	0.00	2.12
Sorghum Grain (Double Crop)	4.28	0.00	4.28
Wheat	2.15	0.00	2.15
Corn, Grains	2.12	0.00	2.12
Forage Crops			
Alfalfa	4.69	0.00	4.69
Alfalfa High Yield[2]	6.19	0.00	6.19
Bermuda Grass	3.63	0.00	3.63
Blue Panic Grass	4.36	0.00	4.36
Clover[3]	4.33	0.00	4.33
Ensilage (All Single Crop)	2.08	0.00	2.08
Ensilage, Sorghum (Double Crop)	4.52	0.00	4.52
Permanent Pasture Mix	5.67	0.00	5.67
Sudan Sudex Grass	2.58	0.00	2.58
Field Crops			
Castor Beans	3.70	0.00	3.70
Cotton	3.43	0.00	3.43
Cotton (Dry Plant)[4]	3.43	0.33	3.76
Flax	2.60	0.00	2.60
Pinto Beans	1.25	0.00	1.25
Safflower	3.78	0.00	3.78
Soybeans	1.85	0.00	1.85
Sugar Beets	3.56	0.00	3.56
Plantago	1.25	0.00	1.25
Guar (for seed production)	1.93	0.00	1.93
Vegetable Crops			
Beets, Table	2.00	0.50	2.50
Broccoli	1.64	1.00	2.64
Cabbage, Early	1.43	1.00	2.43
Cabbage, Late	2.04	1.25	3.29
Carrots	1.38	0.75	2.13

Crop	Consumptive Use (AF per acre)	Other Needs (AF per acre)	IRRIGATION REQUIREMENT (AF per acre)
Cauliflower	1.55	1.00	2.55
Chili Peppers	2.50	0.50	3.00
Corn, Sweet	1.63	0.87	2.50
Cucumbers, All	1.50	0.50	2.00
Lettuce	0.71	2.44	3.15
Okra	2.50	0.50	3.00
Onions, Dry	1.94	0.75	2.69
Onions, Green	1.46	0.75	2.21
Parsnips	2.00	0.50	2.50
Potatoes	2.03	0.75	2.78
Radishes	0.75	0.50	1.25
Rappini	2.75	0.50	3.25
Turnips and Rutabagas	1.50	0.50	2.00
Tomatoes, All	2.00	0.50	2.50
Miscellaneous Vegetables	2.00	0.50	2.50
Mixed Vegetables	2.00	0.50	2.50
Summer Squash and Zucchini	1.75	0.50	2.25
Green Manure Crops			
Guar	1.93	0.00	1.93
Papago Peas	1.63	0.00	1.63
Sesbania	1.09	0.00	1.09
Small Grain for Green Manure	1.00	0.00	1.00
Vine Crops			
Cantaloupe, Early	1.71	0.50	2.21
Cantaloupe, Late	1.40	0.50	1.90
Honeydew Melons	2.00	0.50	2.50
Watermelons	1.75	0.50	2.25
Citrus			
Grapefruit	3.99	0.00	3.99
Lemons/Limes	3.99	0.00	3.99
Oranges, All	3.26	0.00	3.26
Tangerines	3.26	0.00	3.26
Fruits			
Dates	4.92	0.00	4.92
Grapes	3.00	0.50	3.50
Apricots	4.17	0.00	4.17
Nectarines	4.17	0.00	4.17
Peaches	4.17	0.00	4.17
Plums	4.17	0.00	4.17

Crop	Consumptive Use (AF per acre)	Other Needs (AF per acre)	IRRIGATION REQUIREMENT (AF per acre)
Olives	2.58	0.00	2.58
Nuts			
Pecans with Ground Cover	5.83	0.00	5.83
Pecans Without Ground Cover	4.50	0.00	4.50
Pistachios	4.33	0.00	4.33
Miscellaneous Crops			
Aloe Vera	1.50	0.00	1.50
Guayule	3.00	0.00	3.00
Jojoba	3.00	0.00	3.00
Christmas Trees	2.50	0.00	2.50
Flowers, Cut	3.33	0.00	3.33
Double Cropped Vegetables	3.33	0.00	3.33
Roses	2.50	0.00	2.50
Nursery Stock	3.00	0.00	3.00
Salt Bush	1.50	0.00	1.50
Cactus (In Nursery)	1.25	0.00	1.25

1 Based on crops that were reported from 1975 to 1980 history. 2 ADWR assigned an irrigation requirement of 6.19 AF per acre to farms with demonstrated historic yields above the average. 3 Data are not available for the consumptive use of clover. Until FAO calculations can be made, ADWR has estimated that value at 4.33 AF per acre. 4 ADWR assigned an irrigation requirement of 3.76 AF per acre for Areas of Similar Farming Conditions #3 (Roosevelt Irrigation District) and #4 (Buckeye) due to historic dry plant practices.

Sources: Consumptive Use of Water by Major Crops in the Southwestern United States, Conservation Research Report #29, United States Department of Agriculture, Agricultural Research Service. (Provides consumptive use values for major crops in southwestern United States.)

FAO Irrigation and Drainage Paper #24, Food and Agriculture Organization of the United Nations (revised 1977). (Describes Blaney-Criddle method for computing consumptive use values.)

HIGH CONSUMPTIVE USE CROPS

Crops with a CU value of 4.50 AF per acre or more are assigned a CU value of 5.00 AF per acre.

Alfalfa	Pecans (with and without groundcover)
Dates	Permanent Pasture Mix

MEDIUM CONSUMPTIVE USE CROPS

Crops with a CU value of 3.00 to 4.49 AF per acre are assigned a CU value of 3.50 AF per acre.

Apricots	Grapefruit	Oranges, all
Bermuda Grass	Grapes	Peaches
Blue Panic Grass	Guayule	Plums
Castor Beans	Jojoba	Safflower
Cotton	Lemons/Limes	Sorghum,
Double Crop Vegetables	Nectarines	Double Cropped
Flowers, Cut	Nursery Stock	Sugar Beets

LOW CONSUMPTIVE USE CROPS

Crops with a CU value less than 2.99 AF per acre are assigned a CU value of 2.50 AF per acre.

Aloe Vera	Guar (for Seed Production)	Rappini
Barley	Honeydew Melons	Roses
Beet, Table	Lettuce	Rye
Broccoli	Maize (Sorghum)	Salt Bush
Cabbage, all	Millet	Sesbania
Cactus (Nursery)	Misc. Vegetables	Small Grain for Green Manure
Cantaloupe, all	Oats	Sorghum, Grain, Single and
Carrots	Okra	Double Cropped
Cauliflower	Onions, all	Soybeans
Chili Peppers	Papago Peas	Sudan/Sudex Grass
Christmas Trees	Parsnips	Summer Squash and Zucchini
Corn, Sweet	Pinto Beans	Tomatoes, all
Cucumbers	Planatago	Turnips and Rutabagas
Ensilage, (all Single Crop)	Potatoes	Watermelons
Flax	Radishes	Wheat

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BMP CATEGORY 1. WATER CONVEYANCE SYSTEM IMPROVEMENTS

Description: A farm's water conveyance system allows water to be conveyed from an irrigation district delivery point or a well head for irrigation of each field. This category includes water conveyance system improvements that qualify as approved BMPs.

Approved Water Conveyance Improvements

BMP 1.1 Concrete-lined ditch

A means of transporting water to farm fields via a concrete-lined ditch in order to minimize transmission losses through seepage.

BMP 1.2 Pipelines

Any type of low or high-pressure pipeline used to convey water to a farm field in order to reduce or eliminate water loss prior to the act of irrigation. Pipelines may be constructed of PVC, ABS, concrete, aluminum, and or steel.

BMP 1.3 Drainback system

Level irrigation system technology utilizing headland channel conveyance which is designed and maintained to "drain" excess water applications from one irrigated field to the next down gradient field.

Point Value Determination for BMP Category 1

An applicant for the BMP Program must select one or more of the water conveyance system improvement BMPs described above in the application for the BMP Program. A BMP may be selected only if it is being implemented on the farm at the time the application is filed. The total points for the BMP or BMPs selected in this category shall be calculated by estimating the percentage of the farm's irrigated acreage served by the selected BMP or BMPs, and then determining the point value for that percentage in the table below. For purposes of this determination, "irrigated acreage" means those acres within the farm that will be irrigated while the applicant is regulated under the BMP Program. If the applicant selects more than one BMP in this category, an acre shall not be counted twice in determining the total percentage of the farm's irrigated acreage served by the BMPs. In this category, the maximum number of points allowed is four and the minimum number is one.

Category 1: Water Conveyance System – Point Table

Percentage of the farm's total irrigated acreage served by the approved BMPs	Point Value
60-64	1.0
65-69	1.3
70-74	1.8
75-79	2.3
80-84	2.8
85-89	3.3
90-94	3.8
95-100	4.0

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BMP CATEGORY 2. FARM IRRIGATION SYSTEMS
Description: Farm irrigation systems are the methods by which a farm field is irrigated. Farm irrigation systems include slope, modified slope, level or near level, sprinkler, trickle or drip, or any combination thereof. This category includes farm irrigation systems that qualify as approved BMPs.
Approved Farm Irrigation Systems
BMP 2.1 Slope systems without uniform grades with tailwater reuse - (0.5 Point) Definition: Sloped fields without uniform grades with a constructed recovery system that allows for the reuse of water that runs off the end of the field after an irrigation event.
BMP 2.2 Uniform slope systems without tailwater reuse - (0.5 Point) Definition: Sloped fields that have been engineered to uniform grades with no means of reusing the water that runs off the end of the field after an irrigation event.
BMP 2.3 Uniform slope systems with tailwater reuse - (1.5 Points) Definition: Sloped fields that have been engineered to uniform grades with a constructed recovery system that allows for the reuse of water that runs off the end of the field after an irrigation event.
BMP 2.4 Uniform slope within an irrigation district that captures and redistributes return flows - (1.5 Points) Definition: Sloped fields that have been engineered to uniform grades enabling an irrigation district to collect the water that leaves a farm field after an irrigation event for distribution to another farm field.
BMP 2.5 Modified slope systems - (2 Points) Definition: Sloped fields that have been engineered to uniform grades in the upper portion of the field, with the bottom portion generally having a field slope of 0.0 to 0.2 feet of total fall in the direction of irrigation. All irrigation water is retained on the field.
BMP 2.6 High pressure sprinkler systems - (2 Points) Definition: Side-roll, linear, center-pivot, and solid set designs that operate at mainline water pressures of 10 pounds per square inch (psi) or more.
BMP 2.7 Near level systems - (2.5 Points) Definition: Sloped fields that have been engineered to uniform grades between 0.2 to 0.5 feet of total fall in the direction of irrigation over the entire length of the field. All irrigation water is retained on the field.
BMP 2.8 Level systems - (3 Points) Definition: Level border or level furrow system where the field slope may vary from 0.0 to 0.2 feet of total fall in the direction of irrigation over the entire length of the field. Either all irrigation water is retained on the field or a level drainback system is used.
BMP 2.9 Low pressure sprinkler systems - (4 Points) Definition: Linear and center-pivot sprinkler designs that operate at water pressures measured at the high end of the mainline of no greater than 10 psi.
BMP 2.10 Trickle irrigation systems - (4 Points) Definition: Pressurized drip or subsurface irrigation capable of applying precise amounts of water to the crop root zone (also referred to as drip irrigation).

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Point Value Determination for BMP Category 2
An applicant for the BMP Program must select one or more of the farm irrigation systems BMPs described above in the application for the BMP Program. A BMP may be selected only if it is being implemented on the farm at the time the application is filed. The points for a BMP selected in this category shall be calculated by multiplying the points assigned to the BMP as shown above by the percentage of the farm's irrigated acreage served by the irrigation system described in the BMP. For purposes of this determination, "irrigated acreage" means those acres within the farm that will be irrigated while the applicant is regulated under the BMP Program. If the applicant selects more than one BMP in this category, an acre shall not be counted twice in determining the total percentage of the farm's irrigated acreage served by the BMPs. In this category, the maximum number of points allowed is four and the minimum number is two.

BMP CATEGORY 3. IRRIGATION WATER MANAGEMENT
Description: Irrigation water management practices include management practices that, when implemented properly, will increase a farm's overall efficiency of water application in a growing season. This category includes irrigation water management practices that qualify as approved BMPs.
Approved Irrigation Water Management Practices
BMP 3.1 Laser touch-up - (1 Point) Definition: Annual re-establishment of precision laser grades to ensure good advancement of applied irrigation water. Must be applied to a minimum of 20 percent of the near level and level basin acreage irrigated the prior year.
BMP 3.2 Alternate row irrigation - (1 Point) Definition: The practice of irrigating every other cultivated row during either single or multiple irrigation events to minimize the surface area of applied water. Annually, must be used on at least 20 percent of the acreage irrigated in row crops for at least one irrigation.
BMP 3.3 Furrow checks - (1 Point) Definition: Manually applied or installed devices placed in rows to raise the water level in the row reducing the velocity to prevent erosion and enhance infiltration rates. Annually, must be used on at least 20 percent of irrigated acreage for at least one irrigation.
BMP 3.4 Angled rows/contour farming - (1 Point) Definition: Annual practice of reducing row fall through row angling and/or contouring to enhance water advancement and infiltration rates. This practice may also minimize or eliminate tailwater runoff. Annually, must be used on at least 20 percent of irrigated acreage.
BMP 3.5 Surge irrigation - (1 Point) Definition: The practice of applying irrigation water to a field by intermittent surges or pulses of water rather than by a continuous flow rate. The irrigation water advances down the field (or furrow), in stages, allowing uniform water penetration and avoiding tailwater runoff. A gradual sealing and soil conditioning occurs with each progressive surge allowing a more efficient water application. Annually, must be used on at least 20 percent of irrigated acreage.

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Approved Irrigation Water Management Practices (BMP Category 3 cont.)
BMP 3.6 Temporary sprinklers - (1 Point) Definition: Utilization of portable, roller and/or solid set sprinkler system for meeting pre-irrigation needs, seedling germination to establish a crop, and/or pre-harvest irrigation for maintaining crop quality. This practice reduces water use when compared to conventional flood irrigation techniques that require excessive water applications for seedling germination and/or crop quality. Annually, must be used on at least 20 percent of irrigated acreage.
BMP 3.7 Participation in an educational irrigation water management program - (1 Point) Definition: Enrollment in a private or Department sponsored educational irrigation water management program that includes irrigation water management topics such as soil water replacement needs, application rates, and irrigation scheduling. Annually, must participate in such a program throughout the entire crop season.
BMP 3.8 Participation in a consultant or irrigation district sponsored irrigation scheduling service - (1 Point) Definition: Enrollment in a consultant or Department sponsored irrigation scheduling service that provides recommendations on soil moisture monitoring, soil water replacement needs, irrigation application rates, and irrigation scheduling dates based on soil moisture monitoring or real-time evapotranspiration data. Annually, must participate in such a program throughout the entire crop season.
BMP 3.9 Participation in an irrigation district program to increase the flexibility of water deliveries - (1 Point) Definition: Enrollment in a cooperative program set up by the irrigation district to assist a farmer with timely irrigation deliveries and shut off, constant flow rates, and other water order guidelines developed by the irrigation district. Annually, must participate in such a program throughout the entire crop season.
BMP 3.10 Measure flow rates to determine the amount of water applied - (1 Point) Definition: Measure flow rates to determine the amount of water applied for each irrigation event on each field for the purpose of achieving good application efficiencies.
BMP 3.11 Soil moisture monitoring - (1 Point) Definition: Use of a number of accepted methods to monitor/measure soil moisture for the purpose of determining soil water replacement needs, application rates, and irrigation scheduling on each field (accepted methods may include core sampling, resistance blocks, neutron probe, tensiometers) throughout the entire crop season.
BMP 3.12 Computer based model using meteorological data - (1 Point) Definition: Use of a computer based irrigation scheduling program that incorporates real-time meteorological data (e.g. AZMET) for the purpose of determining irrigation event schedules on each field throughout the entire crop season.
Substitute Irrigation Water Management Practices
Substitute Practice - (1 Point) Definition: A new or existing irrigation water management practice not listed above that the director determines will likely result in water savings on the farm at least equivalent to the water savings that would result from implementation of one of the approved BMPs described in this category.

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Point Value Determination for BMP Category 3
An applicant for the BMP Program must select one or more of the irrigation water management BMPs described above in the application for the BMP Program. A BMP may be selected only if it will be implemented on an annual basis while the applicant is regulated under the BMP Program. In this category, the maximum number of points allowed is four and the minimum number is one.

BMP CATEGORY 4. AGRONOMIC MANAGEMENT
Description: Agronomic management practices include combinations of plant and soil management practices that, if implemented properly, will conserve water over the length of the growing season. This category includes agronomic management practices that qualify as approved BMPs.
Approved Agronomic Management Practices
BMP 4.1 Crop rotation - (1 point) Definition: Periodic rotation of crop types on a given farm field to ensure the non-degradation of soil tilth. Annually, at least 20 percent of the acreage irrigated the prior year needs to be rotated to a different crop.
BMP 4.2 Crop residue management - (1 point) Definition: Crop residue should be left on the soil surface or incorporated to a shallow depth into the soil profile to increase soil nutrients, soil water holding capacities, and increase the available soil moisture to a crop. Annually, must be employed on at least 20 percent of the total irrigated acreage.
BMP 4.3 Soil and water quality testing - (1 point) Definition: Annual soil testing to determine: 1) residual amounts of fertilizer, 2) soil salinity for leaching needs, and 3) water intake rates and water holding capacity. Soil testing is required on at least 50 percent of the irrigated acreage. Water quality testing for needs such as estimating leaching requirements or avoiding potential injury to crops. Testing must include a “blend” analysis of irrigation water used from all sources.
BMP 4.4 Pre-irrigation surface conditioning - (1 point) Definition: Mechanical means (i.e. driving rows, soil torpedoes, etc.) by which rows or borders are prepared prior to an initial irrigation to smooth flow of water to avoid unwanted deep percolation during dry conditions or to enhance water advancement rates. Annually, must be used on at least 20 percent of irrigated acreage.
BMP 4.5 Transplants - (1 point) Definition: Use of established seedlings transplanted into a field. This practice eliminates excessive applications of water to germinate crops in the field from seeds. Annually, must be used on at least 20 percent of irrigated acreage.
BMP 4.6 Mulching - (1 point) Definition: Use of organic matter (apart from or in addition to crop residues) or plastic sheets to cover plant beds (plastic mulch) and/or use of plastic material laid over hoops suspended above the plant beds (floatable row covers) to reduce evaporation losses. Annually, must be used on at least 20 percent of irrigated acreage.
BMP 4.7 Shaping furrow or bed - (1 point) Definition: Use of mechanical means such as a row former to make the bed profile more shallow to minimize time of infiltration and minimize the wetted surface area along the rows. Annually, must be used on at least 20 percent of irrigated acreage.

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Approved Agronomic Management Practices (BMP Category 4 cont.)
BMP 4.8 Planting in bottom of furrow - (1 point) Definition: Practice of planting in the bottom of the furrow as opposed to planting along the top of the row bed to minimize impacts of salt build up and wetting (subbing) requirements for germination. Annually, must be used on at least 20 percent of irrigated acreage.
Substitute Agronomic Management Practices
Substitute Practice - (1 Point) Definition: A new or existing agronomic management practice not listed above that the director determines will likely result in water savings on the farm at least equivalent to the water savings that would result from implementation of one of the approved BMPs described in this category.
Point Value Determination for Category 4
An applicant for the BMP Program must select one or more of the agronomic management BMPs described above in the application for the BMP Program. A BMP may be selected only if it will be implemented on an annual basis while the applicant is regulated under the BMP Program. In this category, the maximum number of points allowed is four and the minimum number is one.

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CHAPTER FIVE: MUNICIPAL

5.1 INTRODUCTION

The Municipal Conservation Program for the *Fourth Management Plan for the Phoenix Active Management Area* (4MP) is designed to assist the Phoenix Active Management Area (PhxAMA) in moving toward its goal of safe-yield by: (1) gradually reducing per capita water consumption; (2) encouraging the use of the best available water conservation practices; and (3) maximizing the efficient use of all water supplies, including the use of treated effluent. In the 4MP, the Arizona Department of Water Resources (ADWR) is continuing its efforts to address water management challenges and minimize obstacles to further progress towards the achievement of the PhxAMA safe-yield goal. The fourth management period Municipal Conservation Program continues to encourage the equitable distribution of water in an economically sound manner through long-range planning, cooperative regional efforts, technical assistance, public education, and regulatory programs. The efficient use of all sources of water and replacement of PhxAMA groundwater uses with alternative supplies will help ensure a sustainable and secure water supply for the future.

Municipal provider conservation programs have been implemented by municipal water providers in response to regulatory requirements from previous management plans. A firm commitment to the continued implementation of conservation measures and of additional measures required in the 4MP for the PhxAMA will result in further reductions in per capita use rates and increased water-use efficiency in the municipal sector. Additional efforts to those required in the PhxAMA 4MP will be necessary to achieve the safe-yield goal by 2025 and to maintain safe-yield thereafter, as well as promote more effective and efficient water management within the PhxAMA. These additional efforts include, but are not limited to, the following: increased water conservation efforts; full utilization of Central Arizona Project (CAP) allocations; and maximized use of treated effluent (which may, in part, be accomplished through artificial recharge).

5.1.1 What is a Municipal Water Provider?

Municipal water providers are cities, towns, private water companies, and irrigation districts that deliver groundwater for non-irrigation uses (such as residential, commercial, governmental, industrial and construction uses). Municipal water providers also can include well co-operatives, mobile-home parks or improvement districts. ADWR regulates those water providers serving more than 250 acre-feet (AF) of water for non-irrigation use annually as large municipal providers. Those providers serving 250 AF or less annually are regulated as small municipal providers. Some municipal water providers deliver water that is untreated for landscape/flood irrigation purposes only. The 4MP regulates as a large untreated provider a municipal provider who delivers 100 AF or more of untreated water annually for landscape/flood irrigation. There are a few small municipal providers who deliver less than 100 AF of untreated water per year and only deliver water for landscape/flood irrigation. These “small untreated” providers are included in the small municipal water provider category in the PhxAMA 4MP.

ADWR does not regulate uses of water by small, private, domestic wells, known as “exempt” wells under the Groundwater Code (Code). Exempt wells are equipped with pumps that have a capacity of 35 gallons per minute or less. Exempt well uses are not subject to reporting and water conservation requirements. Water demand associated with domestic wells is estimated to have been about 10,344 AF in the PhxAMA in 2017. This estimate is based on an estimated population relying on exempt wells and Third Management Plan (3MP) models for interior and exterior demand in new single-family homes.

5.1.2 Municipal Conservation Programs – History and Background

The initial 3MP included the Total Gallons Per Capita per Day (GPCD) Program, the Alternative Conservation Program (ACP), the Institutional Provider Program (IPP), and the Non-Per Capita Conservation Program (NPCCP). The original NPCCP, included in the 3MP, was a Best Management Practices (BMP) program, intended as an alternative to the Total GPCD and ACP programs. Some providers in the PhxAMA applied for and were accepted for regulation under the original NPCCP during the third management period. These providers continued in the original NPCCP even after the Modified NPCCP (MNPCCP) was adopted.

The MNPCCP is a BMP program and was developed because of the desire to consider alternatives to the Total GPCD Program that would better meet the needs and capabilities of the regulated municipal water providers as well as those of ADWR. Between 2006 and 2008, ADWR conducted an evaluation of the 3MP regulatory programs for large municipal water providers. The initial phase of the evaluation included an informal information-gathering effort to identify concerns and to solicit comments and suggestions from large municipal water providers in each of the state's five Active Management Areas (AMAs) as well as from various staff members at ADWR. The public meeting phase of this stakeholder process began with all large municipal water providers within each of the AMAs being invited to further participate in the process through a series of public meetings. In April 2007, legislation was passed to add a new regulatory program to the 3MP for the AMAs - the MNPCCP. On April 1, 2008, the Director issued orders modifying the 3MP for each AMA to include the MNPCCP consistent with A.R.S. § 45-566.01. The modification became effective on May 20, 2008, and the program is described in the Second Modification to Chapter 5 of the 3MP (See https://new.azwater.gov/ama/management-plan/3) The first year of provider program implementation was 2010.

For the 4MP, A.R.S. § 45-567.01 requires only one non-per capita program – the NPCCP. Throughout the remainder of this chapter, references to the NPCCP mean the 4MP NPCCP, which corresponds to the MNPCCP in the 3MP.

All large municipal providers that have a Designation of Assured Water Supply (DAWS), including municipal providers previously regulated under the original NPCCP, will be regulated under the Total GPCD Program for the 4MP, pursuant to A.R.S. § 45-567(A)(2), unless they notify the Director that they elect to be regulated under the NPCCP and the Director approves their entry into the NPCCP. All large municipal providers that have not obtained a DAWS will be regulated under the NPCCP. See section 5.3.1.1 for additional information.

The Total GPCD Program assigns a GPCD target to each large municipal provider based on a statistical analysis of each large municipal provider's GPCD trends. The Total GPCD Program is based on water use characteristics within the water service area and the large municipal provider's water conservation potential.

Large untreated providers are required to meet an acre-feet per-acre application rate limitation. Small municipal providers are required to reduce waste and improve water-use efficiency within their service areas during the fourth management period.

All municipal water providers have maximum allowable lost and unaccounted-for water requirements to minimize system losses. All municipal providers also must comply with monitoring and reporting requirements. Information on water use, growth and system losses must be reported to ADWR annually.

5.2 MUNICIPAL SECTOR CHARACTERISTICS AND ROLES IN PhxAMA WATER MANAGEMENT GOAL ACHIEVEMENT

5.2.1 PhxAMA Municipal Sector Description

There are 43 municipal water providers in the PhxAMA that deliver more than 250 AF of water per year and are therefore classified as large municipal providers. Two of the 43 large providers deliver more than 100 AF of untreated water per year for landscape/flood irrigation and are further classified as large untreated providers. There are 51 small municipal providers that use 250 AF or less water per year. Seven of the 51 small municipal providers are classified as large untreated providers. Of the remaining 44 small providers, five providers deliver only untreated water, but deliver less than 100 AF per year of untreated water for landscape/flood irrigation. There are no specific regulations in the 4MP for small municipal providers that deliver only untreated water and who deliver less than 100 AF per year of untreated water.

The municipal sector in the PhxAMA has grown from about 630,000 AF in 1985 to more than one million AF in 2017. In 1985 the municipal sector accounted for about 29 percent of the total water demand in the AMA. By 2017 the municipal sector in PhxAMA comprised more than 54 percent of the AMA demand. Population in the PhxAMA grew by more than 2.3 million people, an increase of more than 120 percent from 1985. The highest municipal demand in the historical period, which was over 1.1 million AF, occurred in 2007. Groundwater use in the municipal sector in the PhxAMA has fluctuated over time. The historical high occurred in 2003 when 332,000 AF of groundwater was used. The lowest groundwater- use year was 2014, when only 159,000 AF of groundwater was used. Average annual groundwater demand in the municipal sector has been about 232,000 AF. Colorado River water was first introduced in 1986 and its use has increased from 13,000 AF in that year to more than 320,000 AF of direct use (via a water treatment plant) in 2017. Colorado River water that was stored underground and recovered from wells met more than 74,000 AF of municipal demand in 2017. In-state surface water (surface water) use has fluctuated annually. The historical average direct surface water use (via a water treatment plant) in the municipal sector is about 367,345 AF. In 2017, the municipal sector used about 325,000 AF of surface water directly. This volume includes decreed and appropriative, normal flow, other surface water, and spill water. In 2017 the municipal sector used nearly 11,000 AF of surface water that was stored underground and recovered from wells. Treated effluent use in the municipal sector has increased since 1985. Very little treated effluent was used until 1996, when treated effluent use significantly increased. In 2017, direct use of treated effluent for landscape irrigation or other non-potable purposes totaled more than 60,000 AF. Treated effluent that was stored underground and recovered from wells comprised about 17,000 AF of municipal water use in 2017. Pursuant to the 1992 Water Exchange Act (A.R.S. § 45-1002), several municipal water providers give treated effluent in exchange for another source of water, which is often Colorado River water. The physical supply used by the provider is the type of water received. However, for ADWR accounting purposes, the water “counts” as the type of water the provider gave in the exchange. Thus, the exchange water counts as treated effluent. In 2017, municipal providers in the PhxAMA used 6,588 AF of exchange treated effluent.

5.2.2 Municipal Water Use Profile

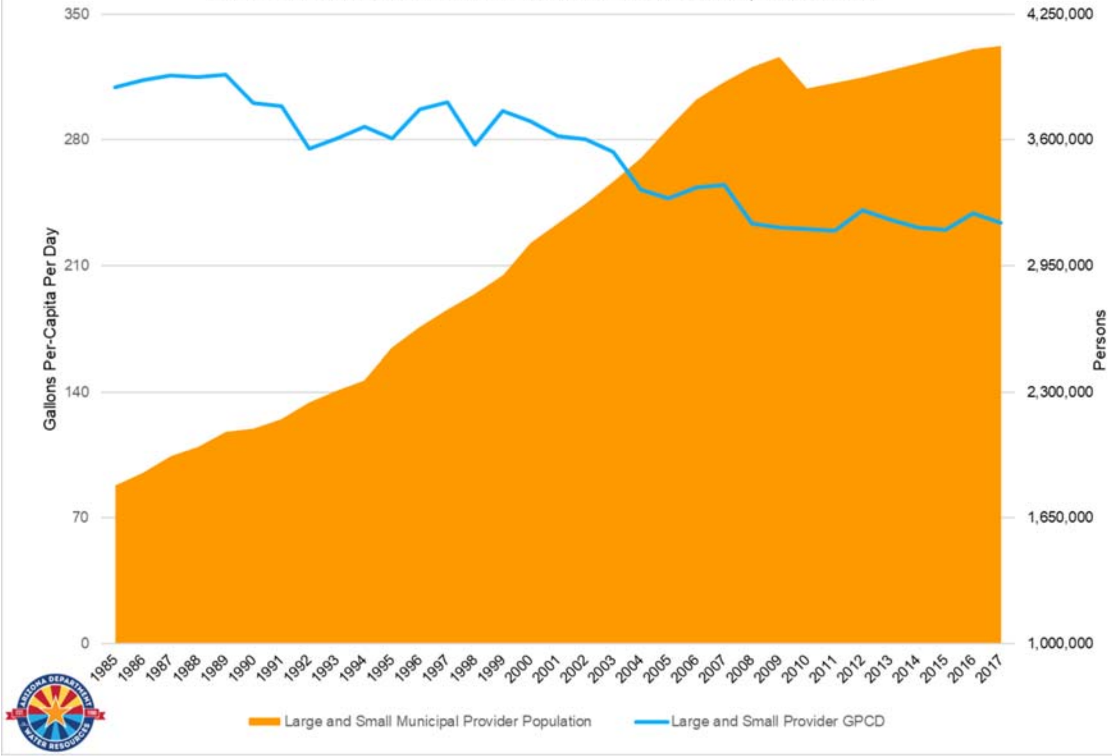
Municipal provider GPCD rates in the PhxAMA have decreased since 1999 (See Figure 5-1), meaning less water is now required to serve the same number of people served in the past. A firm commitment to the continued implementation of conservation measures and implementation of measures in addition to those required in the 4MP will result in further reductions in per capita use rates and increased water use efficiency in the municipal sector. Further efforts in addition to those required in the PhxAMA 4MP will be necessary to achieve safe yield, as well as to promote more effective and efficient water management within the PhxAMA. These additional efforts include, but are not limited to, the following: increased water conservation efforts; full utilization of Colorado River water allocations; and maximized use of treated effluent (which may, in part, be accomplished through artificial recharge).

The majority of municipal groundwater pumping has occurred historically in the East and West Salt River Valley Sub-basins of the PhxAMA, where the majority of the AMA's population resides (See Figure 5-2).

Table 5-1 shows the total demand in the municipal sector from 1985 through 2017 and the sources of supply used to meet the demand. Municipal groundwater demand has fluctuated but has been below the historical average volume since 2005. Surface water, primarily provided by the Salt River Project (SRP), has remained a significant source of water supply in the PhxAMA with overall consistent volumes throughout the historical period, while use of Colorado River water and treated effluent has increased with population growth.

There are many municipal providers in the PhxAMA that treat renewable supplies, such as Colorado River water and surface water, at a water treatment facility and directly deliver the renewable water via their potable distribution systems to their customers. Some municipal providers, however, do not have water treatment facilities. Providers lacking water treatment facilities may still utilize renewable supplies through storage and later recovery via permitted recovery wells. Still other municipal providers remain dependent on groundwater as their sole source of supply. In addition, some municipal providers deliver treated effluent for landscape irrigation or for other purposes such as dust control, while others store and recover treated effluent for use in either their treated effluent water system or their potable delivery system. In-lieu groundwater is renewable supply water delivered to a facility that would otherwise be pumping groundwater. This creates a credit for the entity providing the renewable supply which can be recovered from recovery wells. For more information on water storage and recovery, see Chapter 8 of this plan.

FIGURE 5-1
PHOENIX AMA MUNICIPAL POPULATION & GPCD, 1985 - 2017



5.2.3 Role of the Assured Water Supply Program in the Municipal Conservation Program

Assured Water Supply (AWS) means that sufficient water of adequate quality will be physically, legally and continuously available to meet the water needs of the proposed use for at least 100 years; that the projected use is consistent with the management plan and achievement of the management goal for the PhxAMA and that the financial capability has been demonstrated to construct the water facilities necessary to make the supply of water available for the proposed use (A.R.S. § 45-576(J)).

Municipal providers that hold a DAWS are most prepared to address future needs, long-term drought and future climate variability with an extensive “water portfolio” (*e.g.* the sources of water supply used to demonstrate an AWS). Should a shortage of Colorado River water occur, such providers have demonstrated sufficient volumes of other sources of supply that they can store and recover, or treat and deliver directly, consistent with the safe-yield goal. It should be noted that all municipal providers are required to develop drought plans as a part of their System Water Plan that is filed with ADWR.

TABLE 5-1
PHOENIX AMA MUNICIPAL DEMAND, 1985-2017 (AF)

Year	Demand	Ground-water	Remediated Ground-water	In-Lieu Ground-water	Direct Use Treated Effluent	Exchange Treated Effluent	Recovered Treated Effluent	Direct Use Colorado River Water	Recovered Colorado River Water	Direct Use Surface Water	Recovered Surface Water	Exempt Wells
1985	630,153	221,746	0	0	0	0	0	0	0	408,407	0	3,349
1986	660,766	288,694	0	0	1,713	0	0	13,036	0	357,323	0	3,414
1987	697,192	263,124	0	0	1,513	0	0	59,518	0	373,038	0	3,481
1988	711,651	234,126	0	0	1,321	0	0	74,557	0	401,648	0	3,549
1989	742,363	226,792	0	0	1,682	0	0	105,013	0	408,876	0	3,618
1990	710,527	270,172	0	0	2,800	0	0	150,827	0	286,728	0	3,688
1991	722,178	216,070	0	0	3,202	0	0	74,187	0	428,719	0	3,760
1992	692,765	177,395	0	0	3,951	0	0	92,223	0	419,196	0	3,833
1993	726,007	202,617	0	0	3,628	0	0	111,471	0	408,290	0	3,908
1994	760,590	253,116	0	0	4,264	0	0	138,529	0	364,681	0	3,984
1995	795,601	232,989	0	0	518	0	550	157,798	3	403,744	0	4,062
1996	875,404	213,121	0	20,262	26,142	0	526	173,381	538	441,433	0	4,141
1997	918,111	215,149	0	46,455	24,547	0	337	208,301	86	423,235	0	4,222
1998	870,878	188,497	0	13,079	21,321	0	656	178,531	0	468,793	0	4,304
1999	962,556	235,846	0	25,465	25,701	0	20,723	194,533	122	460,165	0	4,388
2000	998,119	234,543	0	18,426	11,880	27,332	7,571	239,521	23,500	423,232	12,115	4,473
2001	1,002,269	210,860	0	24,256	12,331	26,799	7,145	253,013	30,247	421,402	16,216	5,016
2002	1,027,343	237,955	0	18,802	15,917	28,759	14,021	266,978	37,934	380,885	26,092	5,558
2003	1,036,375	325,905	0	19,628	12,112	1,074	12,363	303,125	32,616	321,557	7,995	6,100
2004	992,399	317,983	0	26,943	19,116	4,267	11,443	323,253	31,822	248,016	9,557	6,643
2005	1,015,208	206,071	0	0	15,020	206	14,980	279,536	37,528	440,492	21,374	7,185
2006	1,083,226	215,832	0	6,066	21,271	23,956	8,647	298,523	33,923	453,249	21,758	7,727
2007	1,113,579	183,040	5,596	18,651	31,803	20,667	12,111	318,679	48,773	442,380	31,878	8,270
2008	1,040,142	189,991	5,667	0	35,240	9,582	8,303	304,949	57,864	407,276	21,270	8,812
2009	1,044,282	174,771	8,264	0	35,824	15,253	16,256	308,853	56,055	408,748	20,258	9,354
2010	998,119	153,086	6,973	5,544	27,852	14,066	14,857	319,646	33,341	410,332	12,423	9,947
2011	1,000,305	149,973	6,973	8,834	24,775	14,668	14,822	311,820	46,468	408,403	13,568	10,004
2012	1,059,064	181,975	6,721	7,281	31,419	27,518	20,590	321,525	45,309	399,544	17,182	10,061
2013	1,046,001	149,340	5,057	36,677	28,167	32,494	24,231	333,409	47,255	372,944	16,428	10,118
2014	1,035,588	148,349	3,375	49,078	30,404	37,844	20,193	320,349	58,278	347,925	19,794	10,174
2015	1,039,629	165,287	8,115	54,787	32,124	36,361	12,969	313,811	58,054	348,984	9,137	10,231
2016	1,089,614	176,083	6,005	57,107	32,443	48,597	14,179	315,721	64,732	361,757	12,990	10,288
2017	1,071,106	187,291	262	33,624	62,790	6,589	17,640	320,809	74,884	356,259	10,958	10,345

For new development, the Code requires persons proposing to offer subdivided lands for sale or lease within an AMA to demonstrate that the proposed subdivision has an AWS (A.R.S. § 45-576). There are two mechanisms for demonstrating that a proposed subdivision has an AWS: the subdivider may apply for and obtain a Certificate of Assured Water Supply (CAWS) from the Director of ADWR; or the subdivider may obtain a written commitment of water service for the subdivision from a city, town or private water company which the Director has designated as having an AWS (A.R.S. § 45-576(A)). If a subdivider fails to demonstrate that a proposed subdivision has an AWS, the plat for the subdivision may not be approved by a city, town or county, and the Arizona Department of Real Estate will not issue a public report authorizing the sale or lease of the subdivided lands (A.R.S. § 45-576(B) and (C)).

Stored water recovered within the area of impact of storage can add to the volume of water that is determined to be physically available to an entity proving an AWS. Additional information on recharge and recovery for AWS purposes can be found in Chapter 8.

5.3 MUNICIPAL CONSERVATION PROGRAM DESCRIPTION

The following section describes the Municipal Conservation Program components for the PhxAMA 4MP. This program consists of two regulatory programs for large municipal providers: the NPCCP; and the Total GPCD Program. The program also includes a conservation program for small municipal providers, and a program for large untreated providers. The Municipal Conservation Program also contains requirements for the distribution of water for non-irrigation use by cities, towns, private water companies and irrigation districts. For a complete list of both large and small municipal providers, including descriptions of those that are large untreated providers, see Appendix 5D.

5.3.1 Non-Per Capita Conservation Program

5.3.1.1 Introduction

The NPCCP is a performance-based program designed to achieve water-use efficiency in the municipal provider's service area, equivalent to the water-use efficiency assumed by the Director in establishing the per capita conservation requirements under the Total GPCD Program. While regulated under the NPCCP, a provider must implement a basic public information program, as well as one or more additional BMPs that are reasonably relevant to the provider's existing service area characteristics or water use patterns.

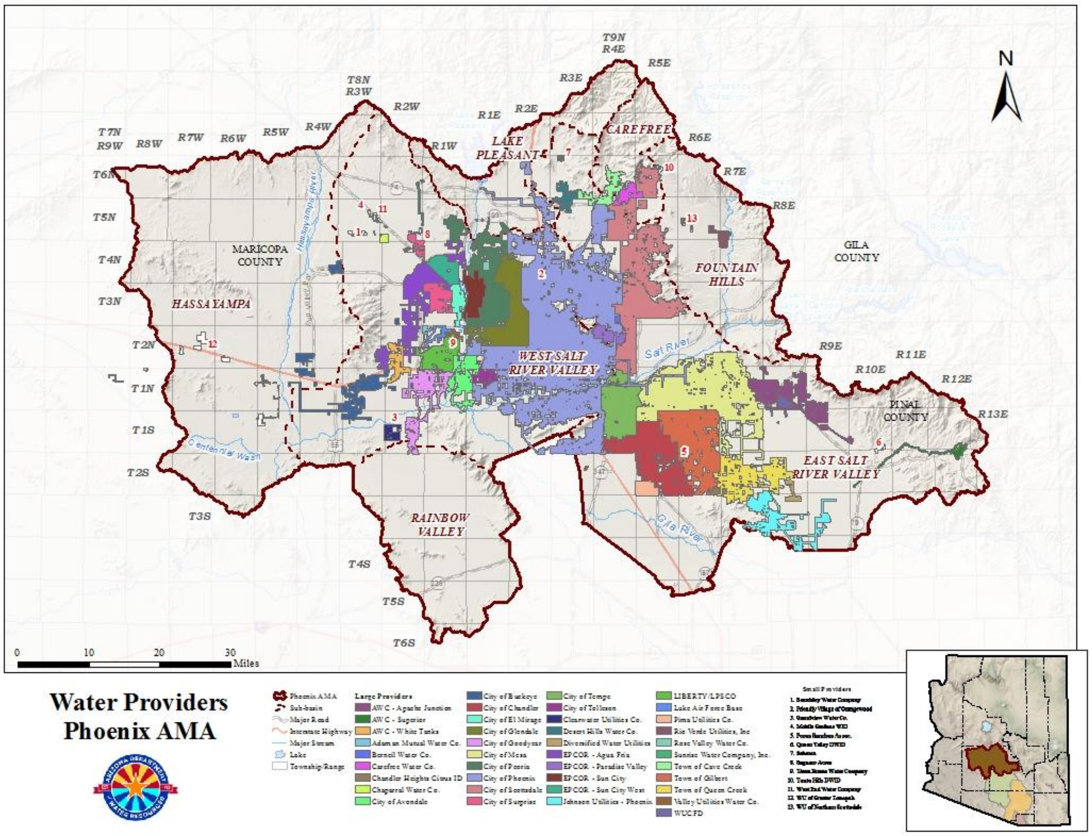
The municipal provider must select the additional BMPs from the list of BMPs approved by the Director in Appendix 5C. The number of additional BMPs that must be implemented depends on the total number of residential and non-residential service connections to the provider's water distribution system. Providers regulated under the NPCCP must submit a Provider Profile containing the information required under A.R.S. § 45-567.01(E) before entering the program and must also submit a Conservation Efforts Report (CER) along with their Annual Water Withdrawal and Use Reports. A municipal BMP Advisory Committee was established in 2009 to assist ADWR in the evaluation of the effectiveness of the program throughout all five AMAs. The Advisory Committee was selected based on stakeholder recommendations to include a mix of policy staff and conservation practitioners and:

- at least one representative from each AMA and each tier (number of service connections tier) of the NPCCP
- several representatives from private water companies
- at least one representative each from a municipality with a DAWS and one without
- a representative from the agricultural use sector
- a representative from the Arizona Corporation Commission.

5.3.1.2 Regulated Parties

Large municipal providers that do not have a DAWS are required to be regulated under the NPCCP (A.R.S. § 56-567(C)). Large municipal providers with a DAWS (including those regulated under programs other than the GPCD during the third management period) will be regulated under the Total GPCD Program for the fourth management period unless they elect to be regulated under the NPCCP.

FIGURE 5-2
MUNICIPAL WATER PROVIDERS IN THE PHXAMA



Large municipal providers with DAWS (including those regulated under the original NPCCP during the third management period) will be regulated under the Total GPCD Program for the fourth management period unless they elect to be regulated under the NPCCP. If they choose to be regulated under the NPCCP for the fourth management period, they will be required to notify the Director in writing that they elect to be regulated under the NPCCP for the fourth management period. They will need to include in that notice a Provider Profile containing the information required by A.R.S. § 45-567.01(E). The provider must begin complying with the NPCCP upon approval of the Provider Profile by the Director.

A new large municipal provider, including a small municipal provider whose deliveries expand to qualify as a large municipal provider during the fourth management period, that does not have a DAWS must submit a Provider Profile within six months after receiving notice of its conservation requirements as a large municipal provider from the Director. The provider must begin complying with the NPCCP upon approval of the Provider Profile by the Director.

Small providers that consolidate to the degree that the consolidated entity now qualifies as a large municipal provider and that does not have a DAWS must submit a Provider Profile to the Director within 60 days after the consolidation becomes effective. The consolidated provider will be regulated under the NPCCP upon approval of the Provider Profile by the Director.

5.3.1.3 General Requirements

Large municipal providers regulated under the NPCCP also must comply with individual user requirements, municipal distribution system requirements and monitoring and reporting requirements. Conservation requirements for individual users in the 4MP are largely unchanged from those in the 3MP. These requirements pertain to existing turf-related facilities, large-scale cooling facilities and landscaping in publicly owned rights-of-way that receive groundwater from a large municipal provider. New turf-related facilities larger than 90 acres are prohibited inside the PhxAMA as of promulgation of this plan.

The distribution system requirement that lost and unaccounted-for water must be 10 percent or less has not changed from the 3MP. Monitoring and reporting requirements for large municipal providers have changed to require providers regulated under the NPCCP to report additional information in their annual CER (See Section 5-611).

Providers in the NPCCP will be placed in tiers based on the provider's combined total of residential and non-residential service connections. For municipal providers with multiple systems, each system having a separate Service Area Right will be treated separately. Only the service connections within that system will be counted to determine the system's tier. In addition to the Basic Public Information Program, which is required for all tiers, the additional number of BMP points that providers must implement is based on which tier they are in:

- Tier 1 – up to 5,000 service area connections: three additional BMP points
- Tier 2 – 5,001 – 30,000 service area connections: eight additional BMP points
- Tier 3 – more than 30,000 service area connections: 15 additional BMP points

5.3.1.4 Provider Profile

A Provider Profile (Profile) is required of all large municipal providers regulated under the NPCCP. The Profile must contain the following information:

1. a description of the provider's existing service area characteristics and water use patterns;
2. the total number of service connections to the provider's water distribution system;
3. a description of the conservation measures the provider is currently implementing;
4. a description of the basic public information program and additional BMPs that the provider intends to implement to comply with the NPCCP; and,
5. an explanation of how the additional BMPs are relevant to the provider's existing service area characteristics or water use patterns.

The Director must either approve or disapprove the Profile and send written notice of the decision to the provider. If the Director does not send written notice approving or disapproving a Profile within 90 days after receiving it, the Profile will be deemed approved (A.R.S. § 45-567.01(F)).

Profiles submitted by providers with a DAWS:

A large municipal provider with a DAWS that elects to be regulated under the NPCCP must include a Profile with the notice it submits to the Director. Regulation under the NPCCP begins on the date that the provider's Profile is approved by the Director. If the Director does not approve a Profile submitted by a provider with a DAWS, the provider has three options: (1) submit a revised Profile, (2) continue to be regulated under the Total GPCD program, or (3) appeal the decision pursuant to Title 41, Chapter 6, Article 10, Arizona Revised Statutes. If the Director disapproves a revised Profile, the provider may appeal the decision.

Profiles submitted by providers without a DAWS:
Large municipal providers that do not have a DAWS and that are serving water when the 4MP is adopted must submit a Profile to the Director by July 1, 2022. Regulation under the NPCCP begins on January 1, 2023 or the date that the provider's Profile is approved by the Director, whichever is later. New large municipal providers that do not have a DAWS, as well as large municipal providers that have a DAWS when the 4MP is adopted but whose DAWS is terminated while they are regulated under the Total GPCD Program, must submit a Profile to the Director within six months after receiving notice of their conservation requirements as a large municipal provider or notice of the termination of their DAWS, whichever applies.

If the Director disapproves a Profile submitted by a provider that does not have a DAWS, the provider has two options: (1) submit a revised Profile within 90 days after receiving written notice of the disapproval or (2) appeal the decision pursuant to Title 41, Chapter 6, Article 10, Arizona Revised Statutes. If the provider appeals the Director's decision and the decision is upheld on appeal, the provider must submit a revised Profile within 90 days after the Director's decision is final. If a revised Profile is not approved, the provider is out of compliance with its conservation requirements beginning on the date the Director's decision disapproving the revised Profile is deemed final, until such time that a resubmitted Profile is approved.

If the total number of service connections to the provider's water distribution system increases to a higher tier while the provider is regulated under the NPCCP, the provider must submit a new Profile. ADWR recommends that providers submit an updated Profile every three years.

5.3.1.5 Basic Education Program

All providers regulated under the NPCCP shall implement a public education program (described in Appendix 5C) that includes the following components:

1. Communicating to customers at least twice a year:
   Providers are required to inform customers about the importance of water conservation and how they can obtain conservation information from the provider. Examples of ways to communicate with customers include messages on water bills or water-bill inserts, conservation messages on the provider's main webpage, post cards, newsletters or other printed materials.

2. Providing free conservation materials to customers:
   Providers are required to provide customers with free written information on water conservation (i.e., pamphlets, brochures), have the materials available in their office, and send information to customers on request. Providers are encouraged to distribute water conservation information at other locations (i.e. libraries, chamber of commerce, town hall, webpages etc.) as well.

5.3.1.6 Best Management Practices (BMPs)

The provider must select water conservation measures from the list in Appendix 5C or any future modifications of the list approved by the Director. All the BMPs selected for implementation must be reasonably relevant to the provider's existing service area characteristics or water use patterns.

The provider must begin implementing all the BMPs described in its Profile upon approval by the Director. A provider may discontinue implementing a BMP identified in its Profile, other than the public education program, and begin implementing a substitute BMP if both of the following criteria are met:

1. The substitute BMP is on the list of approved BMPs described in Appendix 5C, Section II, or any modifications of the list.

2. The provider determines that the substitute BMP is reasonably relevant to its existing service area characteristics or water use patterns.

If a provider begins implementing a substitute BMP, the provider may discontinue implementing that substituted BMP and begin implementing a new substitute BMP under the criteria set forth above. A provider that substitutes a BMP must notify the Director of the substitution in its next CER *(See section 5.3.1.7)*. If the Director determines that the substitute BMP is not reasonably relevant to the provider's existing service area characteristics or water use patterns, the provider will be notified and must resume implementing the discontinued BMP or a substitute BMP that the Director approves. The Director's determination may be appealed.

5.3.1.7 Conservation Efforts Report

A large municipal provider regulated under the NPCCP must include a CER for the previous calendar year with its Annual Water Withdrawal and Use Report (Annual Report) filed by March 31 of each year. The CER must include the following information:

1. A description of the basic public information program and additional BMPs implemented during the year.

2. The results of the activities implemented.

3. An assessment of each BMP implemented that describes what works and what needs modification.

4. The provider's plan for implementation of BMPs during the current year.

5. If the provider substituted a BMP during the year, a description of the BMP that was discontinued, a description of the substitute BMP and an explanation of how the substitute BMP is relevant to the provider's existing service area characteristics or water use patterns.

6. A copy of the provider's current rate structure, unless the rate structure is unchanged since it was last submitted to ADWR.

5.3.1.8 Water Rate Structure

A large municipal provider regulated under the NPCCP must include in its Annual Report, due by March 31 of each year, a copy of its current water rate structure, unless the rate structure is unchanged since it was last submitted to the Director.

5.3.1.9 Records Retention

A large municipal provider regulated under the NPCCP must keep and maintain accurate records verifying that the provider implemented the water conservation measures in addition to recording its water use during the year. The records for a given year must be kept and maintained for at least five years thereafter.

5.3.1.10 Individual User Requirements, Distribution System Requirements and Monitoring and Reporting Requirements

A large municipal provider regulated under the NPCCP must comply with the individual user requirements in Section 5-610, the conservation requirements for municipal distributions systems in Section 5-611, and the monitoring and reporting requirements in Section 5-612.

5.3.1.11 Review of NPCCP

The Director is required to periodically review the program, including the list of approved BMPs, to evaluate its effectiveness. The Director is authorized to establish an advisory committee, and to contract with an independent researcher, to assist the Director in the evaluation. If the Director determines that changes are appropriate to improve the effectiveness of the program, and that those changes are consistent with the existing statutory provisions, the Director must modify the program pursuant to A.R.S. § 45-572. If the changes that the Director determines should be made are not consistent with the existing statutory provisions, the Director must give written notice of the appropriate changes to the Speaker of the House of Representatives, the President of the Senate and the Governor.

5.3.2 Total Gallons Per Capita per Day Conservation Program

For the 4MP, the Code allows the Director to determine if additional conservation requirements are needed beyond those assigned in the 3MP. Pursuant to this statutory requirement, ADWR analyzed information from Annual Reports including water deliveries, monthly water use by sector, water source and number of housing units added to each large municipal provider service area annually. Additional information that was reviewed included: U.S. Census data; Arizona Department of Administration and local associations of governments population projection data; and individual interviews with large municipal providers to assess existing water conservation programs and determine water conservation potential.

In the PhxAMA 4MP, ADWR will calculate a total GPCD requirement for each large municipal provider not regulated under the NPCCP using a methodology different from the methodology used to calculate total GPCD requirements in the 3MP (described in more detail in Appendix 5A). Each large municipal provider will be noticed of its total GPCD requirement for its service area. Municipal providers may apply for a variance from or administrative review of the conservation requirements within 90 days following the notice. Alternatively, a large municipal provider who has a DAWS may elect to be regulated under the NPCCP. A large municipal provider that has a DAWS, and which does not enroll in the NPCCP, will be regulated under the Total GPCD Program.

5.3.2.1 Total GPCD Program Description

A large municipal provider regulated under the Total GPCD Program must limit the annual gallons per capita per-day water usage within its service area to the amount allowed under its total GPCD requirement. For the fourth management period, the component method of calculating the annual total GPCD requirement previously employed by ADWR will not be used. Instead, a large municipal provider regulated under this program will be required to meet its individual total GPCD requirement as shown in Appendix 5A. For each year in which the provider is regulated under the Total GPCD Program, the actual amount of water withdrawn, diverted or received by the provider for non-irrigation use will be compared to the amount allowed by its total GPCD requirement to determine compliance during that year. Compliance is determined pursuant to a flexibility account, which allows providers to use more water than their total GPCD requirement in some years, subject to a maximum negative account balance. Treated effluent used directly from a treatment plant or stored underground and recovered within the area of impact of storage is not counted when determining a provider's compliance with its total GPCD requirement.

5.3.2.2 Total GPCD Program Development

Analysis of Water Conservation Potential

Conservation potential, based on historical water use, is an estimate of the amount of reduction in per capita water use that a municipal provider can achieve from implementing BMPs or water conservation programs. To determine the conservation potential of each large municipal provider in the 4MP, ADWR performed a statistical analysis of the historical per capita trend for each provider. ADWR set the GPCD requirement at the statistical median minus one standard deviation. However, the GPCD target will not be set lower than a computed minimum target and will not be set higher than the provider's final conservation requirement in the year prior to the first effective date of the PhxAMA 4MP GPCD conservation requirement. The computed minimum target is calculated based on updated conservation models for new single family development based on the use of WaterSense products (See https://www.epa.gov/watersense/watersense-products) and updated landscaping assumptions, the provider's 3MP non-residential component and 10 percent lost and unaccounted-for water. This GPCD target was assumed to be the lowest GPCD rate the provider can reasonably achieve.

Total GPCD Compliance

Annual Population Estimates

Each time there is a decennial U.S. Census, ADWR compiles the Census data to determine an updated decennial U.S. Census base population for each provider. ADWR uses the provider's water distribution lines to select Census blocks likely served by the provider. Once ADWR determines the U.S. Census base population for each provider, persons per housing unit and occupancy characteristics are obtained from the U.S. Census American Community Survey at the tract or block group level of geography and are assigned to each provider's service area. Each year after the Census year, the provider's annual service area population is estimated based on the number of housing units the provider reports each year as having been added to its distribution system and multiplying those added housing units by the occupancy and persons per housing unit rates from the American Community Survey data assigned to the provider. The figures are corrected following each decennial Census.

Flexibility Account

To account for variations in weather, the flexibility account ADWR established in the 3MP will continue into the 4MP. The flexibility account allows large municipal providers regulated in the Total GPCD Program to accumulate 60 GPCD of credits or incur debits up to 20 GPCD.

Compliance Calculation

A large municipal provider's annual compliance with its total GPCD requirement will be determined by first calculating the total amount of water that the municipal provider is allocated for municipal use during the year. This allocation is calculated by multiplying the municipal provider's total GPCD requirement for the year by the municipal provider's service area population for the year and then multiplying the product by the number of days in the year.

The amount of water allocated to the municipal provider for municipal use is then compared to the total amount of water, from any source except direct use treated effluent or treated effluent recovered within the area of impact, withdrawn, diverted, and received by the municipal provider for municipal use during the year. If the allocated amount is greater than the amount withdrawn, diverted and received, the difference is credited to the municipal provider's flexibility account, subject to the maximum positive account balance. If the allocated amount is less than the amount withdrawn, diverted and received, the difference is debited to the municipal provider's flexibility account. The large municipal provider is out of compliance for the year if the debit causes the flexibility account to exceed the negative account balance limitation.

5.3.3 Lost and Unaccounted-for Water

Large municipal providers must limit the amount of lost and unaccounted-for water in their distribution systems to no more than 10 percent of the total quantity of water that enters its distribution system, calculated on an annual or three-year average basis (See section 5-611*).*

5.3.4 Conservation Requirements for New Large Municipal Providers

A new large municipal provider is defined as a city, town, private water company or irrigation district that begins serving more than 250 AF of water for non-irrigation use per year after January 1, 2000. All new large providers that are designated as having an Assured Water Supply will initially be assigned to the Total GPCD Program. Their total GPCD requirement will be calculated consistent with the statistical methodology used for existing large municipal providers. ADWR will determine the base year for the municipal provider as the year preceding the year in which the provider began serving greater than 250 AF per year, unless the Director determines that water usage during that year is not representative of historic water use. Additionally, ADWR will collect residential and non-residential water use data during the base year and the total gallons of water withdrawn, diverted, or received by the provider in the service area.

A new large provider regulated under the Total GPCD Program may apply for an administrative review requesting a temporary adjustment to its total GPCD requirement in order to serve a turf-related facility. A temporary adjustment will be allowed if the provider demonstrates that direct-use treated effluent, or treated effluent recovered within the area of impact, is committed to serve the turf-related facility beginning in four years, but a longer period is necessary for sufficient treated effluent to be produced to serve the entire facility. The adjustment will remain in effect until sufficient direct-use treated effluent, or treated effluent recovered within the area of impact, is available to serve the entire facility, but not longer than eight years, and may be adjusted as the volume of treated effluent use increases. The adjustment will be terminated if the infrastructure necessary to deliver the treated effluent is not in place at the beginning of the fourth year following the provider commencing service to the facility. If a new large municipal provider that has a DAWS cannot serve a turf-related facility under its existing per capita requirement, and direct-use treated effluent or treated effluent recovered within the area of impact will not be physically available to serve the facility within a reasonable period of time, the provider may enroll in the NPCCP if it wishes to serve the facility.

A new large municipal provider that does not have a DAWS will be regulated under the NPCCP described in section 5-605. The provider must submit a Provider Profile containing the information described in section 5-605(B)(1) within six months after receiving written notice of its conservation requirements from the Director. The provider must begin complying with the NPCCP upon approval of the Provider Profile pursuant to section 5-605(B)(2) or (B)(3).

5.3.5 Conservation Requirements for Consolidated Municipal Providers and Providers that Acquire or Convey a Portion of a Service Area

If two or more municipal providers consolidate their service areas and the consolidated provider qualifies as a large municipal provider, it will be regulated as follows:

1. If the consolidated provider has a DAWS, it will be assigned to the Total GPCD Program and its GPCD will be calculated by prorating the respective per capita targets,

populations and water use as appropriate. The consolidated provider may elect to be regulated under the NPCCP.

2. If the consolidated provider does not have a DAWS, the provider must submit an updated Provider Profile to the Director as described in section 5-605(B)(1) within 60 days after the consolidation becomes effective. The consolidated provider will be regulated under the NPCCP described in section 5-605 upon approval of the Provider Profile by the Director.

Providers that acquire or convey a portion of a service area continue to be regulated under the conservation program under which they were regulated prior to the acquisition or conveyance. However, if the conveying or acquiring provider does not have a DAWS, it will be regulated under the NPCCP regardless of whether it was regulated under that program prior to the conveyance or acquisition. If the conveying or acquiring provider is regulated under the NPCCP after the conveyance or acquisition, and it was regulated under that program immediately prior to the conveyance or acquisition, the provider must submit a new Provider Profile to the Director if either: (1) the conveyance or acquisition resulted in the total number of service area connections to the provider's water distribution system increasing or decreasing to a new tier level; or (2) the Director determines that the provider's service area characteristics or water use patterns have changed.

5.3.6 Conservation Requirements for Large Untreated Water Providers

A large untreated water provider must limit its deliveries of untreated water during a year to an amount calculated by multiplying the number of gross acres of land to which it serves untreated water by an average application rate of four AF per acre. A gross acre is the entire acre, including associated structures, but not including any acres regulated as a turf-related facility. A large untreated water provider also must meet the individual user requirements, distribution system requirements and the monitoring and reporting requirements.

5.3.7 Conservation Requirements for Small Municipal Providers

During the fourth management period, small providers will continue to be required to minimize waste of all water supplies, maximize efficiency in outdoor watering, encourage reuse of water supplies and improve water-use efficiency as feasible. Small providers also must comply with lost and unaccounted-for standards not to exceed 15 percent, as well as certain other reporting requirements described below.

5.3.8 Regulatory Requirements for All Municipal Providers

The following requirements have been established for all municipal providers: individual user requirements, distribution system requirements and monitoring and reporting requirements. Each is described in this section.

5.3.8.1 Individual User Requirements

An individual user is a person who receives water from a municipal provider for non-irrigation use. For the 4MP, the director is required to establish "additional conservation requirements for non-irrigation uses..." (A.R.S. § 45-567 (A)(2)). ADWR has instituted a prohibition on turf-related facilities larger than 90 acres for the 4MP. All other individual user requirements are not modified and ADWR has not included any additional conservation requirements for individual users from those included in the 3MP.

Either the individual user or the municipal provider serving the individual user is responsible for complying with the individual user requirement. See section 5-610 for determining responsibility for compliance with the individual user requirements.

5.3.8.2 Distribution System Requirements

Lost and unaccounted-for water is defined as the total water from any source, except direct use treated effluent, withdrawn, diverted or received in a year minus the total amount of authorized deliveries made by the municipal provider in that year. Lost and unaccounted-for water includes line leakage, meter under-registration, evaporation or leakage from storage ponds or tanks, system and hydrant leaks or breaks, and illegal connections.

All municipal providers are required to meet an efficient lost and unaccounted-for water standard in their service areas. Lost and unaccounted-for water will be determined for each municipal provider based on the total quantity of metered and unmetered water deliveries and the total water pumped, received, or diverted by the municipal provider for each calendar year, excluding direct-use treated effluent. Small municipal providers must maintain lost and unaccounted-for water at or below 15 percent. Large municipal providers are required to maintain their system not to exceed 10 percent lost and unaccounted-for water. Large untreated water providers are required to either line all canals used to deliver untreated water to the provider’s delivery points with a material that allows no more lost water than a well-maintained concrete lining or operate and maintain its distribution system to limit lost and unaccounted-for water at or below 10 percent.

For the 4MP, ADWR will allow providers to exclude water from the lost and unaccounted-for water calculation that is metered or estimated using approved estimating procedures and used pursuant to other regulatory requirements such as well purging and line flushing. Providers also may exclude estimated water uses such as construction (truck loads for dust control) or fire services, but all other uses of water within a distribution system must be metered. Appendix 5C provides a complete list of uses that are considered in the lost and unaccounted-for water calculation and those uses which can be estimated to determine the volume.

5.3.8.3 Monitoring and Reporting Requirements

All municipal providers, including providers regulated under the NPCCP, are required to annually report to ADWR:

1. information on the total quantity of water withdrawn, diverted or received that enters the groundwater distribution system during the year;
2. total quantity of water used within the service area and the total volume of water delivered for various municipal purposes;
3. total number of housing units by unit type added to the service area from December 31 of the previous calendar year to December 31 of the reporting year;
4. all movements of water made by the provider during the year, including water accepted from another entity (received) that was subsequently sent (delivered) to be stored at a GSF or underground storage facility and stored water that was recovered during the year, whether annual or long-term credit recovery, regardless of the water type;
5. volume of water ordered from an irrigation district that was released by the irrigation district from a storage or distribution facility but not accepted by the municipal provider or delivered to any other person;
6. an updated water-service area and distribution-system map delineating all distribution lines greater than four inches, all treatment works and all well sites;

7. all wells operated by the municipal provider, regardless of the type of water withdrawn from the well.

Large municipal providers are required to separately measure and report the amount of water delivered via the provider's groundwater distribution system each month for: irrigation uses; residential uses, separated by single family and multifamily; and non-residential uses, separated by water-use categories, including turf-related facility use, commercial use, industrial use, government use, construction use, surface water treatment, and other uses. A large municipal provider regulated under the NPCCP must submit a CER, as described in Section 5-605(E) of this chapter and must also report the total number of service connections within the provider's water distribution system as of the end of the reporting year.

5.4 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIATED GROUNDWATER

Since the adoption of the Code, several incentives have been developed in both the management plans and statutes to increase the use of non-groundwater supplies. For instance, the management plans have exempted treated effluent (directly used or stored underground and recovered from within the area of impact) from the per capita use rate for municipal providers under the Total GPCD Program.

Legislation enacted in 1997 and amended in 1999 significantly revised the Water Quality Assurance Revolving Fund (WQARF) Program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater.

Among other provisions, the WQARF legislation provides that when determining compliance with management plan conservation requirements, ADWR shall account for uses of groundwater withdrawn pursuant to approved remedial action projects under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, except for groundwater withdrawn to provide an alternative water supply consistent with A.R.S. § 49-282.03, consistent with its accounting for surface water (See Chapter 7, Section 7.4.4.6.), (1997 Ariz. Sess. Laws, Chapter 287, § 51(B), as amended by 1999 Ariz. Sess. Laws, Chapter 295, § 49). Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes, including all other laws regulating groundwater withdrawal and use, such as: (1) the assessment of withdrawal fees pursuant to A.R.S. § 45-611 *et seq*.; (2) regulation of water exchanges as set forth in A.R.S. § 45-1001 *et seq*.; (3) transportation of groundwater as set forth in A.R.S. § 45-541 *et seq*.; (4) withdrawals of groundwater for transportation to active management areas as set forth in A.R.S. § 45-551 et seq.; and (5) underground water storage, savings, and replenishment as set forth in Title 45, Chapter 3.1, Arizona Revised Statutes.

As of 2018, the Arizona Department of Environmental Quality (ADEQ) identified 19 WQARF projects in Maricopa County, most of which are contained within the PhxAMA *(See https://azdeq.gov/node/337)*

The annual amount of groundwater eligible for the remediated groundwater accounting incentive is generally equal to the maximum annual volume of groundwater that may be withdrawn pursuant to each project, as specified in the consent decree or other documents approved by the U.S. Environmental Protection Agency (EPA) or ADEQ. However, if a project was approved prior to June 15, 1999, and the maximum annual volume of groundwater that may be withdrawn pursuant to the project is not specified in a consent decree or other document approved by the

EPA or ADEQ, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999. The Director may modify the annual amount of groundwater eligible for the accounting incentive if an increase in withdrawals is necessary to further the purpose of the project or if a change is made to the consent decree or other document approved by the EPA or ADEQ.

In order to qualify for the remediated groundwater accounting incentive, a person must notify the Director in writing of the anticipated withdrawal of the groundwater prior to its withdrawal. The notification must include a copy of a document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree. Unless specified in the document, the notification must include the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project. The notification also must include the purpose for which the remediated groundwater will be used and the name and telephone number of a contact person. Additionally, at the time the notice is given, the person must be using remediated groundwater pursuant to the approved remedial action or must have agreed to do so through a consent decree or other document approved by ADEQ or the EPA. Remediated groundwater which qualifies for the accounting must be metered and reported separately from groundwater that does not qualify for the accounting *(See section 5-613 of the Municipal Conservation, Monitoring and Reporting Requirements).*

5.5 NON-REGULATORY EFFORTS

ADWR has a program for water management assistance in the AMAs. Funding for the program comes from an annual withdrawal fee levied and collected from all large groundwater users in the AMAs. Since the Water Management Assistance program began, the PhxAMA has funded several projects that promote prudent water management within the PhxAMA. Additional information is discussed in Chapter 9.

5.6 MUNICIPAL CONSERVATION, MONITORING, AND REPORTING REQUIREMENTS

5-601. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in this chapter shall have the following meanings:

1. *"4MP" means the Fourth Management Plan for the Phoenix Active Management Area.*

2. *"5MP" means the Fifth Management Plan for the Phoenix Active Management Area.*

3. *"ADWR" means the Arizona Department of Water Resources.*

4. *"ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA" means the list of low water / drought tolerant plants found on ADWR's website, https://new.azwater.gov/conservation/landscaping including any modifications to the list.*

5. *"Canal" means a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.*

6. *"CAP water" means Colorado River water delivered through Central Arizona Project infrastructure.*

7. *"CER" means the Conservation Efforts Report required to be filed by a large municipal provider regulated under the Non-Per Capita Conservation Program as provided in Section 5-605(E) of this chapter.*

8. *"Common area" means a recreational or open-space area or areas owned and operated as a single integrated facility and maintained for the benefit of the residents of a housing development.*

9. *"Construction use" means a use of water for construction purposes, including the use of water for dust control, compaction and preparation of building materials on construction sites.*

10. *"Direct use treated effluent" means effluent that is transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use treated effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

11. *"Existing Individual User" means an individual user that was receiving water from a municipal provider as of the date the 4MP was adopted.*

12. *"Existing large municipal provider" means a large municipal provider that was in operation and was serving water on or before the date of adoption of the 4MP.*

13. *"Exterior water use" means non-residential or residential uses of water for landscaping, pools, evaporative cooling systems, decorative fountains and other outdoor uses of water.*

14. *"GPCD" means gallons of water per capita per day.*

15. *"Groundwater distribution system" means a system of pipes, canals or other works within a municipal provider's service area which are owned and operated by the provider to collect, store, treat or deliver groundwater for non-irrigation use, regardless of whether other types of water are also present in the system.*

16. *"Housing unit" means a group of rooms or a single room occupied as separate living quarters. Housing unit includes a single-family home, a patio home, a townhouse, a condominium, an apartment, a permanently set-up mobile home or a unit in a multifamily complex. Housing unit does not include a mobile home in an overnight or limited-stay mobile home park or a unit in a campground, motel, hotel or other temporary lodging facility. A housing unit may be occupied by a family, a family and unrelated persons living together, two or more unrelated persons living together or by one person.*

17. *"Individual User" means a person receiving groundwater from a municipal provider for non-irrigation uses to which specific conservation requirements apply, including turf-related facilities, large-scale cooling facilities and publicly owned rights-of-way.*

18. *"Interior water use" means non-residential or residential indoor uses of water, including toilet flushing, bathing, drinking and washing.*

19. *"Landscapable area" means the entire area of a lot less any areas covered by structures, parking lots, roads and any other area not physically capable of being landscaped.*

20. *"Large municipal provider" means a municipal provider serving more than 250 AF of water for non-irrigation use during a calendar year.*

21. *"Large-scale cooling facility" means a facility which has control over cooling operations with a total combined cooling capacity greater than or equal to 1,000 tons. For the purposes of this definition, the minimum cooling tower size which shall be used to determine total facility cooling capacity is 250 tons. A large-scale cooling facility does not include a large-scale power plant that utilizes cooling towers to dissipate heat.*

22. *"Large untreated water provider" means a municipal provider that as of January 1, 1990 was serving untreated water to at least 500 persons or supplying at least 100 AF of untreated water during the calendar year. In addition, a municipal provider that entered into a written agreement between December 15, 1989 and September 21, 1991 to serve untreated water to a user, and that provided a copy of that agreement to the Director by June 22, 1992 is a large untreated provider upon serving untreated water to at least 500 persons pursuant to the service agreement or upon supplying 100 AF of untreated water during a calendar year pursuant to the agreement.*

23. *"Lost and unaccounted-for water" means the total quantity of water from any source that enters a municipal provider's groundwater distribution system during a calendar year less the total quantity of authorized deliveries of water from the groundwater distribution system during the calendar year that are metered deliveries or deliveries that the municipal provider accounts for by a method of estimating water use approved by the Director.*

24. *"Lost water" means untreated water from any source that enters an untreated water distribution system and is lost from the system during transportation or distribution due to seepage, evaporation, leaks, breaks, phreatophyte use or other similar or dissimilar causes.*

25. *"Multifamily housing unit" means a mobile home in a mobile-home park and any permanent housing unit having one or more common walls with another housing unit located in a multifamily residential structure, and includes a unit in a duplex, triplex, fourplex, condominium development, town-home development, or apartment complex.*

26. *"Municipal distribution system" means a system of pipes, canals or other works within a municipal provider's service area which are owned and operated by the provider to collect, store, treat or deliver water for non-irrigation use.*

27. *"Municipal provider" means a city, town, private water company or irrigation district that supplies water for non-irrigation use.*

28. *"NPCCP" means the Non-Per Capita Conservation Program (formerly the Modified Non-Per Capita Conservation Program).*

29. *"New individual user" means an individual user that begins receiving water from a municipal provider after adoption of the 4MP.*

30. *"New large municipal provider" means a municipal provider that begins serving more than 250 AF of water for non-irrigation use during a calendar year after the date of adoption of the 4MP.*

31. *"Non-residential customer" means a person who is supplied water by a municipal provider for a non-irrigation use other than a residential use.*

32. *"Reclaimed water" has the same definition as effluent prescribed by A.R.S. § 45-101.*

33. *"Reclaimed water recovered within the area of impact" means reclaimed water that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the area of impact of storage. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

34. *"Reclaimed water recovered outside the area of impact" means reclaimed water that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered outside the area of impact of storage. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

35. *"Remedial Groundwater" means groundwater withdrawn pursuant to an approved remedial action project but does not include groundwater withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03.*

36. *"Residential customer" means a person who is supplied water by a municipal provider for a residential use.*

37. *"Residential use" means a non-irrigation use of water related to the activities of a single family or multifamily housing unit or units, including exterior water use.*

38. *"Service area" has the definition prescribed by A.R.S. § 45-402.*

39. *"Service area population" means the number of people residing in housing units connected to distribution lines maintained by the municipal provider within its service area which are being served as of December 31 of the applicable year, as determined pursuant to section 5-603, subsection C.*

40. *"Service connection" means a coupling of a municipal provider's distribution system and its customer's water system.*

41. *"Single family housing unit" means a detached dwelling, including mobile homes not in mobile home parks.*

42. *"Small municipal provider" means a municipal provider that supplies 250 AF or less of water for non-irrigation use during a calendar year.*

43. *"Turf-related facility" means any facility, including a school, park, cemetery, golf course or common area of a housing development, with a water-intensive landscaped area of 10 or more acres.*

44. *"Untreated water" means water that is not treated to improve its quality and that is supplied by a municipal provider through a distribution system other than a potable water distribution system*

45. *"Untreated water municipal distribution system" means a municipal distribution system operated by a large untreated water provider for the purpose of delivering untreated water for non-irrigation use.*

46. *"Water-intensive landscaped area" means, for a calendar year, an area of land which is watered with a permanent water application system and planted primarily with plants not listed in ADWR's Low Water Use Plant List or modifications to the list, and the total surface area of all bodies of water filled or refilled with water from any source, including reclaimed water, that are an integral part of the landscaped area. Bodies of water used primarily for swimming purposes are not an integral part of a landscaped area.*

47. *"Water movement" means, the receipt or delivery of any type of water for direct use by customers, for use within a municipal water service area, or to or from another entity, including underground and groundwater savings facility storage and annual or long-term credit recovery. Water movements also include deliveries and receipts from other entities that are not required to file an annual*

water withdrawal and use report, such as the Central Arizona Water Conservation District, local or regional wastewater treatment plants owned by a county or other entity and Indian reservations.

5-602. Large Municipal Providers - Conservation Programs

A. Except as provided in subsection D of this section, beginning with calendar year 2023 or the calendar year specified in section 5-607(A)(1) and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP, a large municipal provider designated as having an assured water supply shall be regulated under the Total Gallons Per Capita Per Day (GPCD) Program described in section 5-603, unless the provider elects to be regulated under the NPCCP described in section 5-605 as provided in subsection B of this section.

B. A large municipal provider designated as having an assured water supply may elect to be regulated under the NPCCP described in section 5-605 at any time after adoption of the 4MP by giving the Director written notice of the election together with a Provider Profile pursuant to section 5-605(A)(2)(a). If the provider elects to be regulated under the NPCCP, the provider shall continue complying with the conservation requirements in effect for the provider at the time it notifies the Director of the election until the Director approves the provider's Provider Profile pursuant to section 5-605(B)(2) or (B)(3), at which time the provider shall comply with the NPCCP.

C. A large municipal provider that is not designated as having an assured water supply shall submit a Provider Profile to the Director as prescribed in section 5-605(A). The provider shall be regulated under the NPCCP described in section 5-605 beginning on January 1, 2023 or the date the Director approves the provider's Provider Profile pursuant to section 5-605(B)(2) or (3), whichever is later, and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP. Until the provider is regulated under the NPCCP as provided in this subsection, the provider shall continue to be regulated under the conservation program under which it was regulated at the time the 4MP was adopted.

D. If the Director designates a large municipal provider as having an assured water supply while the provider is regulated under the NPCCP described in section 5-605, the provider shall continue to be regulated under the NPCCP unless the provider gives written notice to the Director that it elects to be regulated under the Total GPCD Program described in section 5-603. If the provider elects to be regulated under the Total GPCD Program, the Director shall give written notice to the provider of its total GPCD requirements and the provider shall comply with the total GPCD requirements beginning on the date specified in the notice and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP.

E. All municipal providers shall comply with Individual user requirements, distribution system requirements, and applicable monitoring and reporting requirements as prescribed in sections 5-610, 5-611, and 5-612.

5-603. Large Municipal Provider Total Gallons Per Capita per Day Program

A. Total Gallons Per Capita per Day Requirement

Beginning with the calendar year specified in Section 5-602, subsection A or D, or Section 5-607 (A)(1), whichever applies, and continuing until the first compliance date for any substitute municipal conservation requirement in the 5MP, a large municipal provider regulated under the Total GPCD Program shall withdraw, divert or receive water from any source, except direct use reclaimed water and reclaimed water recovered within the area of impact, for non-irrigation use during a year at or below its total GPCD requirement as calculated by the Director using the methodology set forth in Appendix 5A. The total GPCD requirements calculated by the Director for existing large municipal providers that are designated as having an assured water supply on the date the 4MP is adopted are shown in Appendix 5A.

B. Compliance with Total Gallons Per Capita per Day Requirement

The Director shall determine if a large municipal provider is in compliance with its total GPCD requirement for a calendar year pursuant to the flexibility account provisions in section 5-604, using the provider's service area population for the year as calculated in subsection C of this section.

C. Calculation of Large Municipal Provider's Service Area Population

The Director shall calculate a large municipal provider's service area population for a calendar year as follows, unless the Director has approved an alternative methodology for calculating the provider's service area population prior to the calendar year in question:

1. *Determine the number of single family and multifamily housing units added to the provider's distribution system between December 31 of the previous calendar year and December 31 of the calendar year in question, less any units removed from the system during that period.*

2. *Adjust these totals by the respective average annual vacancy rate for single family housing units and multifamily housing units as calculated from the most recent United States Census Bureau American Community Survey data for the geographic area most closely corresponding to the provider's service area or other source of information approved by the Director.*

3. *Multiply the adjusted number of single-family housing units calculated in 2 above by the average number of persons per occupied single family housing unit as calculated in accordance with the most recent United States Census Bureau American Community Survey data for the geographic area most closely corresponding to the provider's service area or other source of information approved by the Director. The result is the provider's new single-family population for the year in question.*

4. *Multiply the adjusted number of multifamily housing units calculated in 2 above by the average number of persons per occupied multifamily housing unit as calculated in accordance with the most recent United States Census Bureau American Community Survey data for the geographic area most closely corresponding to the provider's service area or other source of information approved by the Director. The result is the provider's new multifamily population for the calendar year in question.*

5. Add the results of 3 and 4 to the provider's new single family population and new multifamily population for each year since the most recent decennial U.S. Census year, and add that sum to the provider's decennial U.S. Census service area population. The sum is the provider's service area population for the calendar year in question.

5-604. Compliance with Total Gallons Per Capita Per Day Requirement - Flexibility Account

A. Total GPCD Program Flexibility Account

The Director shall determine if a large municipal provider regulated under the Total GPCD Program is in compliance with its total GPCD requirement through the maintenance of a flexibility account for the provider which shall operate as follows:

1. Each provider regulated under the Total GPCD Program shall be assigned a flexibility account. The beginning balance in the flexibility account of a provider that was regulated under the Total GPCD Program in the 3MP shall be the ending balance in the flexibility account maintained for the provider under section 5-106 of the 3MP. The beginning balance in the flexibility account of all other large municipal providers shall be zero.

2. Following each calendar year in which the provider withdraws, diverts or receives groundwater for non-irrigation use, beginning with the first calendar year in which the provider is regulated under the Total GPCD Program as provided in section 5-602(A) or (D) or section 5-607(A)(1) the Director shall adjust the provider's flexibility account as follows:

a. Determine the total gallons of water from any source, except direct use reclaimed water and reclaimed water recovered within the area of impact, withdrawn, diverted or received by the provider during the calendar year for non-irrigation use and then subtract that amount from the provider's total GPCD allotment for the year, as calculated in subparagraph d of this paragraph.

b. If the result in subparagraph a above is negative, debit the flexibility account by this volume.

c. If the result in subparagraph a above is positive, credit the flexibility account by this volume.

d. The provider's total GPCD allotment for a calendar year is calculated by multiplying the provider's total GPCD requirement for the calendar year, as assigned to the provider by the Director using the methodology in Appendix 5A, by the provider's service area population as of December 31 of the year, as calculated pursuant to section 5-603(C), and then multiplying the product by the number of days in the calendar year.

3. The account balance existing in a provider's flexibility account after the adjustment provided for in paragraph 2 of this subsection is made shall carry forward subject to the following limitations:

a. The maximum positive account balance allowed in the flexibility account of a provider regulated under the Total GPCD Program shall be calculated by multiplying the provider's service area population as of December 31 of the previous calendar year by a GPCD rate of 60, and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum positive account balance after any credits are registered, the balance carried forward shall equal the maximum positive account balance allowed in the provider's flexibility account for that year.

b. The maximum negative account balance allowed in the flexibility account of a provider regulated under the Total GPCD Program shall be calculated by multiplying the provider's service area population as of December 31 of the previous calendar by a GPCD rate of -20, and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum negative account balance after any debits are registered, the balance carried forward shall equal the maximum negative account balance allowed in the provider's flexibility account for that year.

B. Compliance Status

If the adjustment to a large municipal provider's flexibility account following a calendar year as provided for in subsection A of this section causes the account to have a negative account balance which exceeds the maximum negative account balance allowed in the provider's flexibility account for the year as calculated in 5-604(A)(3)(b) the provider is out of compliance for that calendar year.

5-605. Non-Per Capita Conservation Program

A. Provider Profile – Submittal Date

1. Large municipal providers not designated as having an assured water supply

a. An existing large municipal provider that is not designated as having an assured water supply shall submit a Provider Profile to the Director as described in 5-605(B)(1) of this section no later than July 1, 2022.

b. A new large municipal provider that is not designated as having an assured water supply and that receives written notice of the NPCCP from the Director shall submit a Provider Profile to the Director as described in subsection B, paragraph 1 of this section no later than six months after the date of the notice.

2. Large municipal providers designated as having an assured water supply

a . A large municipal provider that is designated as having an assured water supply and that elects to be regulated under the NPCCP shall submit a Provider Profile to the Director as described in 5-605(B)(1) of this section at the time the provider submits written notice to the Director that the provider elects to be regulated under the NPCCP.

b. A large municipal provider that is designated as having an assured water supply and whose designation of assured water supply is terminated while the provider is regulated under the Total GPCD Program described in section

5-603 shall submit to the Director a Provider Profile as described in 5-605(B)(1) of this section no later than six months after the designation is terminated.

B. Provider Profile – Contents; Review; Approval or Disapproval

1. A Provider Profile required by subsection (A) of this section shall contain the following information:

a. A description of the provider's existing service area characteristics and water use patterns.

b. The total number of service connections to the provider's water distribution system, including residential and non-residential connections.

c. A description of the conservation measures currently being implemented by the provider.

d. A description of the conservation measures that the provider intends to implement to comply with subsection (D)(1) of this section.

e. An explanation of how each of the conservation measures that the provider will implement to comply with subsection (D)(1)(b) of this section is relevant to the provider's existing service area characteristics or water use patterns.

2. Within 90 days after receiving a large municipal provider's Provider Profile, the Director shall approve or disapprove the Provider Profile and send written notice of the decision to the provider. The Director shall approve the Provider Profile if the Director determines that the profile contains information demonstrating that the provider will implement at least the minimum number of best management practices required pursuant to subsection (D)(1) of this section and that the conservation measures to be implemented pursuant to subsection (D)(1)(b) of this section are reasonably relevant to the provider's existing service area characteristics or water use patterns. If the Director disapproves the Provider Profile, the Director shall include with the written notice of the decision the reasons for the disapproval. A decision of the Director disapproving a Provider Profile is an appealable agency action pursuant to Title 41, Chapter 6, Article 10. If the Director fails to send the provider written notice approving or disapproving the Provider Profile within 90 days after receiving the Provider Profile, the Provider Profile shall be deemed approved.

3. If the Director disapproves the Provider Profile submitted by a large municipal provider that is not designated as having an assured water supply, within 90 days after the date of the Director's written notice disapproving the Provider Profile, or within 90 days after the Director's decision is final, if the provider files a timely notice of appeal of the decision pursuant to Title 41, Chapter 6, Article 10, the provider shall revise the Provider Profile to correct the deficiencies identified by the Director in the written notice and submit the revised Provider Profile to the Director. If the Director disapproves the Provider Profile submitted by a large municipal provider that is designated as having an assured water supply, the provider may revise the Provider Profile to correct the deficiencies identified by the Director in the written notice disapproving the Provider Profile and may *submit the revised Provider Profile to the Director. The Director shall approve or disapprove a revised Provider Profile submitted under this paragraph pursuant to paragraph 3 of this subsection. If the Director disapproves the revised Provider Profile:*

a. The decision is an appealable agency action pursuant to Title 41, Chapter 6, Article 10.

b. If the provider is not designated as having an assured water supply, the provider is in violation of A.R.S. § 45-567.01 beginning on the date the Director's decision is final until the provider submits a Provider Profile that is approved by the Director.

C. Commencement of Regulation under Non-Per Capita Conservation Program

1. An existing large municipal provider that is not designated as having an assured water supply shall be regulated under the NPCCP beginning January 1, 2023 or the date the provider's Provider Profile is approved by the Director pursuant to subsection B of this section, whichever is later.

2. A new large municipal provider that is not designated as having an assured water supply shall be regulated under the NPCCP beginning on the date the provider's Provider Profile is approved by the Director pursuant to subsection B of this section.

3. A large municipal provider that is designated as having an assured water supply and that elects to be regulated under the NPCCP shall be regulated under the program beginning on the date the Director approves the provider's Provider Profile pursuant to subsection B of this section.

D. Required Best Management Practices

1. A large municipal provider regulated under the Non-Per Capita Conservation Program shall implement all of the following Best Management Practices while regulated under the program:

a. The Basic Public Information Program described in Appendix 5C.

c. One or more additional Best Management Practices selected from the list of additional Best Management Practices in Appendix 5C or any modification of the list made pursuant to the modification procedure described in Appendix 5C as posted on ADWR's website. The additional Best Management Practices shall be reasonably relevant to the provider's service area characteristics or water use patterns. The exact number of additional Best Management Practices required to be implemented under this sub-paragraph shall be determined based on the total number of service connections to the provider's water distribution system and the following three tier levels:

Total number of service connections (includes both residential and non-residential)	***Required number of additional Best Management Practices***

Tier 1- 5,000 or fewer connections	*3*
Tier 2- 5,001 to 30,000 connections	*8*
Tier 3- Over 30,000 connections	*15*

2. *Except as provided in paragraphs 4 and 5 of this subsection, a large municipal provider regulated under the NPCCP shall implement the Best Management Practices required by paragraph 1 of this subsection as described by the provider in the provider's approved Provider Profile.*

3. *If the total number of service connections to the provider's water distribution system increases to a higher tier level as described in paragraph 1(b) of this subsection after the Director approves the provider's Provider Profile pursuant to subsection (B)(2) or (B)(3) of this section, the provider shall submit a new Provider Profile to the Director within 60 days after the provider becomes aware of the increase and shall include in the profile the information required by subsection (B)(1). The provisions in subsection (B)(2) and (B)(3) shall apply to the new Provider Profile when it is submitted to the Director. Until the new Provider Profile is approved by the Director, the provider shall continue implementing the Best Management Practices described by the provider in its previously approved Provider Profile. Upon approval of the new Provider Profile by the Director, the provider shall implement all of the Best Management Practices described in the newly approved Provider Profile.*

4. *A large municipal provider regulated under the NPCCP may discontinue implementing a Best Management practice identified in the provider's approved Provider Profile, other than the Basic Public Information Program required by paragraph (1)(a) of this subsection, and begin implementing a substitute best management practice if all of the following apply:*

   a. *The substitute conservation measure is a measure described on the list of additional best management practices set forth in Appendix 5C, or any modification of the list made pursuant to the modification procedure described in Appendix 5C as posted on ADWR's website.*

   b. *The provider determines that the substitute best management practice is reasonably relevant to the provider's existing service area characteristics or water-use patterns.*

5. *If a large municipal provider regulated under the NPCCP implements a substitute best management practice pursuant to paragraph 4 of this subsection, the provider may discontinue implementing that substitute best management practice and begin implementing a new substitute best management practice if all of the following apply:*

a. The new substitute conservation measure is a measure described on the list of additional best management practices set forth in Appendix 5C, or any modification of the list made pursuant to the modification procedure described in Appendix 5C as posted on ADWR's website.

b. The provider determines that the new substitute best management practice is reasonably relevant to the provider's existing service area characteristics or water-use patterns.

6. If a provider substitutes a best management practice pursuant to paragraph 4 or 5 of this subsection, both of the following shall apply:

a. The provider shall notify the Director of the substitution in the CER filed by the provider for the year in which the substitution occurred, as provided in subsection (E)(4) of this section.

b. If the Director determines that the substitute best management practice is not reasonably relevant to the provider's existing service area characteristics or water use patterns, the Director shall give written notice of that determination to the provider and the provider shall begin implementing the discontinued best management practice or a substitute best management practice from the list of additional best management practices set forth in Appendix 5C, or any modification of the list made pursuant to the modification procedure described in Appendix 5C as posted on ADWR's website, that the Director determines is reasonably relevant to the provider's existing service area characteristics or water use patterns. The Director's determination is an appealable agency action pursuant to Title 41, Chapter 6, Article 10.

E. Conservation Efforts Report (CER)

In addition to any information required by section 5-612, a large municipal provider regulated under the NPCCP shall include with its annual reports required by A.R.S. § 45-632 a CER containing the following information:

1. A description of each best management practice implemented during the previous year and the results (i.e., what was accomplished).

2. An assessment of each best management practice implemented as to what worked and what needs modification.

3. The provider's plan for implementation of best management practices during the current year.

4. If the provider substituted a best management practice pursuant to subsection (D)(4) or (D)(5) of this section during the reporting year, a description of the best management practice that was discontinued, a description of the substitute and an explanation of how the substitute is relevant to the provider's existing service area characteristics or water use patterns.

F. Water Rate Structure

A large municipal provider regulated under the NPCCP shall include in its annual reports filed pursuant to A.R.S. § 45-632 a copy of the provider's current water rate structure unless no changes have been made to the rate structure since it was last submitted to the Director.

G. Records Retention

For at least five years after a year in which a large municipal provider is regulated under the Non-Per Capita Conservation Program, the provider shall keep and maintain the following records:

1. *Accurate records verifying that the provider implemented the best management practices that it was required to implement during that year.*

2. *Accurate records of the provider's water use during the year.*

5-606. Consolidation of Municipal Provider Service Areas; Acquisition of a Portion of Another Municipal Provider's Service Area

A. Notification

1. *If two or more municipal providers consolidate their service areas into one service area, the consolidated provider shall notify ADWR of the consolidation within 30 days after the consolidation becomes effective.*

2. *If a municipal provider acquires a portion of another municipal provider's existing service area, both the acquiring provider and the conveying provider shall notify ADWR of the acquisition within 30 days after the acquisition becomes effective.*

B. Regulation of Consolidated Provider

1. *Upon consolidation, a consolidated provider that qualifies as a large municipal provider and that is designated as having an assured water supply shall be regulated under the Total GPCD Program described in section 5-603, unless the consolidated provider elects to be regulated under the Non-Per Capita Conservation Program described in section 5-605 as provided in section 5-605(A)(2)(a).*

2. *If the consolidated provider is designated as having an assured water supply and is regulated under the Total GPCD Program, the Director shall establish a total GPCD requirement for the consolidated provider consistent with the methodology used by the Director to establish the consolidating providers' total GPCD requirements as set forth in Appendix 5A. The Director also shall establish and maintain a flexibility account for the consolidated provider in accordance with section 5-604(A) with a beginning balance to be established by the Director based on the ending balances in the flexibility accounts of the consolidating providers.*

3. *If the consolidated provider qualifies as a large municipal provider and is not designated as having an assured water supply, the consolidated provider shall submit to the Director a Provider Profile pursuant to section 5-605(B) within 60*

days after the consolidation becomes effective. The consolidated provider shall be regulated under the NPCCP described in section 5-605 beginning on the date the Director approves the Provider Profile.

C. Regulation of Acquiring Provider

1. *Except as provided in paragraph 2 of this subsection, a large municipal provider that acquires a portion of another provider's existing service area shall continue to be regulated under the conservation program that the acquiring provider was regulated under immediately prior to the acquisition.*

2. *If the acquiring provider is not designated as having an assured water supply after the acquisition, or if the acquiring provider was regulated under the NPCCP immediately prior to the acquisition, both of the following shall apply:*

   a. *The acquiring provider shall be regulated under the NPCCP after the conveyance. If the acquiring provider becomes designated as having an assured water supply after the acquisition, the provider may elect to be regulated under the Total GPCD Program described in section 5-603 by providing the Director with written notice of the election as provided in section 5-602(D).*

   b. *If the acquiring provider was regulated under the NPCCP immediately prior to the acquisition, the following shall apply:*

      1) *If the total number of service connections to the provider's water distribution system increases to a higher tier level as described in section 5-605(D)(1)(b) as a result of the acquisition, the provider shall submit to the Director a new Provider Profile pursuant to section 5-605(B)(1) within 60 days after the acquisition.*

      2) *If the Director determines that the provider's service area characteristics or water use patterns have changed, the Director may require the provider to submit a new Provider Profile pursuant to section 5-605(B)(1).*

      3) *If the provider submits a new Provider Profile, section 5-605(B)(2) and (B)(3) shall apply to the new Provider Profile. The provider shall continue implementing the best management practices described by the provider in its previously approved Provider Profile until the Director approves the new Provider Profile. Upon the Director's approval of the new Provider Profile, the provider shall implement all of the best management practices described in the newly approved Provider Profile.*

3. *If the acquiring provider is regulated under the Total GPCD Program after the acquisition, the Director shall establish a new total GPCD requirement for the acquiring provider consistent with the methodology used to establish the provider's total GPCD requirement in Appendix 5A, taking into account the addition to the provider's service area. The Director may also adjust the balance in the acquiring provider's flexibility account maintained under section 5-604(A) to*

take into account the balance in the conveying provider's flexibility account at the time of the conveyance.

D. Regulation of Conveying Provider

1. Except as provided in paragraph 2 of this subsection, a large municipal provider that conveys a portion of its service area to another provider and that qualifies as a large municipal provider after the conveyance shall continue to be regulated under the conservation program that the provider was regulated under immediately prior to the conveyance.

2. If the conveying provider is not designated as having an assured water supply after the conveyance, or if the conveying provider was regulated under the NPCCP immediately prior to the conveyance, both of the following shall apply:

a. The conveying provider shall be regulated under the NPCCP after the conveyance. If the conveying provider becomes designated as having an assured water supply after the conveyance, the provider may elect to be regulated under the Total GPCD Program described in section 5-603 by providing the Director with written notice of the election as provided in Section 5-602(D).

b. If the conveying provider was regulated under the NPCCP immediately prior to the conveyance, the following shall apply:

1) If the total number of service connections to the provider's water distribution system decreases to a lower tier level as described in section 5-605(D)(1)(b) as a result of the conveyance, the provider shall submit to the Director a new Provider Profile pursuant to section 5-605(B)(1) within 60 days after the conveyance.

2) If the Director determines that the provider's service area characteristics or water use patterns have changed, the Director may require the provider to submit a new Provider Profile pursuant to section 5-605(B)(1).

3) If the provider submits a new Provider Profile, section 5-605(B)(2) and (B)(3) shall apply to the new Provider Profile. The provider shall continue implementing the best management practices described by the provider in its previously approved Provider Profile until the Director approves the new Provider Profile. Upon the Director's approval of the new Provider Profile, the provider shall implement all of the best management practices described in the newly approved Provider Profile.

3. If the conveying provider is regulated under the Total GPCD Program after the conveyance, the Director shall establish a new total GPCD requirement for the provider consistent with the methodology used to establish the total GPCD requirement in Appendix 5A, taking into account the reduction in the provider's service area. The Director may also adjust the balance in the conveying provider's flexibility account maintained under section 5-604 to take into account *the reduction in the provider's service area.*

5-607. Conservation Requirements for New Large Municipal Providers

A. Total GPCD Program

1. *A new large municipal provider that is designated as having an assured water supply shall be assigned to the Total GPCD Program described in section 5-603 and shall comply with its annual total GPCD requirement beginning with the second full calendar year after the provider is given written notice of the requirement by the Director, and for each calendar year thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP.*

2. *A new large municipal provider's total GPCD requirement for a year shall be calculated by the Director using the methodology in Appendix 5A.*

3. *The Director shall determine if a new large municipal provider is in compliance with its total GPCD requirement pursuant to the flexibility account provisions in section 5-604.*

B. Non-Per Capita Conservation Program

1. *A new large municipal provider that is not designated as having an assured water supply shall be regulated under the NPCCP in accordance with section 5-605. If the Director designates the provider as having an assured water supply while the provider is regulated under the NPCCP, the provider may elect to be regulated under the Total GPCD Program as provided in section 5-602(D).*

2. *A new large municipal provider that is designated as having an assured water supply may elect to be regulated under the Non-Per Capita Conservation Program in accordance with section 5-605.*

5-608. Conservation Requirements for Large Untreated Water Providers

A. Rate of Use Requirement

Beginning on January 1, 2023, and continuing thereafter until the first compliance date for any substitute requirement in the 5MP, a large untreated water provider shall not serve an amount of untreated water during a calendar year that exceeds an amount calculated as follows:

1. *Determine the number of gross acres of land to which the provider delivers untreated water during the calendar year. Gross acres do not include those acres regulated as a turf-related facility under section 5-610, subsection A, paragraph 1.*

2. *Multiply the number of gross acres determined in paragraph 1 of this subsection above by an average annual application rate of 4.0 AF of untreated water per gross acre.*

B. Compliance

A large untreated water provider is in compliance with its rate of use requirement as set forth in subsection A of this section for a calendar year if one of the following applies:

1. *The amount of untreated water served by the provider during the calendar year does not exceed the amount of water calculated in subsection A of this section; or*

2. *The aggregate amount of untreated water served by the provider during that calendar year and the preceding two calendar years divided by three does not exceed the sum of the amount of untreated water calculated in subsection A of this section for those three years divided by three.*

5-609. Conservation Requirements for Small Municipal Providers

A. By January 1, 2023, or upon commencement of service of water, whichever is later, and until the first compliance date for any substitute requirements in the 5MP, a small municipal provider shall adopt and implement a program to achieve the following goals:

1. *Minimize waste of all water supplies.*

2. *Maximize efficiency in outdoor watering.*

3. *Encourage reuse of water supplies.*

4. *Increase overall water use efficiency as feasible.*

5-610. Individual User Requirements for Municipal Providers and Individual Users

A. Individual User Requirements

The municipal provider or Individual user responsible for compliance with the Individual user requirements under subsection B of this section shall comply with the following, as applicable:

1. *The municipal provider or individual user shall serve water to, or use water within, a turf-related facility only in accordance with section 6.7 of the Industrial Chapter of the 4MP and shall comply with the monitoring and reporting requirements set forth in sections 6-603 and 6-708 of the Industrial Chapter, as though the individual user were an industrial user. The person responsible for compliance shall also comply with the conservation requirements contained in section 6-602 of the Industrial Chapter, if applicable, as though the individual user were an industrial user.*

2. *The municipal provider or individual user shall serve water to, or use water within, a large-scale cooling facility only if the person using water at the facility complies with all applicable conservation requirements and monitoring and reporting requirements contained in section 6.10 of the Industrial Chapter of the*

4MP as though the person was an industrial user. The person responsible for compliance shall also comply with the applicable monitoring and reporting requirements contained in sections 6-603 and 6-1003 and the conservation requirements contained in section 6-602 of the Industrial Chapter, if applicable, as though the individual user were an industrial user.

3. *The municipal provider or individual user shall serve or use groundwater for the purpose of watering landscaping plants planted on or after January 1, 1987 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb or shoulder which is used for travel in any ordinary mode, including pedestrian travel, only if the plants are listed in ADWR's Low Water Use/Drought Tolerant Plant List for the Phoenix Active Management Area. The Director may waive this requirement upon request from the municipal provider or individual user if the municipal provider or individual user demonstrates to the satisfaction of the Director that plants listed in ADWR's Low Water Use/Drought Tolerant Plant List for the Phoenix Active Management Area, cannot grow in the publicly owned right-of-way because of high elevation or low-light conditions, such as a freeway underpass. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

4. *The municipal provider or individual user shall not serve or use groundwater for the purpose of maintaining a water feature installed after January 1, 2002 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb or shoulder which is used for travel in any ordinary mode, including pedestrian travel. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

B. *Responsibility for Compliance with Individual-User Requirements*

1. *Beginning January 1, 2023 and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP, a municipal provider shall be responsible for complying with an individual user requirement set forth in subsection A of this section that is applicable to an existing individual user unless one of the following applies:*

   a. *The provider identified the existing individual user to the Director on a form provided by ADWR and received by the Director no later than 90 days before the adoption of the 4MP.*

   b. *The Director gave written notice of the individual user requirement to the individual user within 30 days after the adoption of the 4MP.*

   c. *The municipal provider did not identify the existing individual user to the Director on a form provided by ADWR and received by the Director no later than 90 days before the adoption of the 4MP, and the Director gave written notice of the individual user requirement to the individual user more than 30 days after the adoption of the 4MP. If this subparagraph applies, the municipal provider shall comply with the individual user requirement applicable to the existing individual user beginning January 1, 2023 and continuing thereafter until the first date on which the individual user is required to comply with the requirement under paragraph 2 of this subsection.*

2. *An existing individual user that has been given written notice of an individual user*

requirement by the Director within 30 days after the adoption of the 4MP shall be responsible for complying with the individual user requirement beginning January 1, 2023 and continuing thereafter until the first compliance date of any substitute municipal conservation requirement in the 5MP. An existing individual user that is given written notice of an individual user requirement by the Director more than 30 days after adoption of the 4MP shall be responsible for complying with the individual user requirement beginning January 1 of the calendar year following the first full year after the date of the notice and continuing thereafter until the first compliance date of any substitute conservation requirement in the 5MP.

3. *A municipal provider shall be responsible for complying with an individual user requirement set forth in subsection A of this section that is applicable to a new individual user beginning on the date the new individual user first receives water from the provider and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP, unless one of the following applies:*

   a. *The municipal provider identifies the new individual user to the Director in writing on a form provided by the Director. If the provider identifies the new individual user to the Director within 90 days after the provider begins serving water to the new individual user, the municipal provider shall not be responsible for complying with the individual user requirement applicable to the new individual user at any time. If the provider identifies the new individual user to the Director more than 90 days after the provider begins serving water to the new individual user, the provider shall be responsible for complying with the individual user requirement beginning on the date the new individual user first receives water from the provider until the end of the calendar year in which the provider identifies the individual user to the Director.*

   b. *The municipal provider does not identify the new individual user to the Director in writing on a form provided by the Director, within 90 days after the provider begins serving water to the new individual user, and the Director gives written notice of the individual user requirement to the individual user. If this subparagraph applies, the municipal provider shall comply with the individual user requirement for the new individual user beginning on the date the individual user first receives water from the provider and continuing thereafter until the first date on which the individual user is required to comply with the requirement under paragraph 4 of this subsection.*

4. *A new individual user that is given written notice of an individual user requirement by the Director shall be responsible for complying with the individual user requirement beginning on the date specified in the notice.*

C. *Notification of New Individual User by Municipal Provider*

Beginning January 1, 2023, or upon commencement of service of water, whichever is later, and continuing thereafter until the first compliance date for any substitute municipal conservation requirement in the 5MP, a municipal provider shall notify a new individual user in writing of the applicable individual user requirements as set forth in subsection A of this section before commencement of service of water to the individual user.

5-611. Conservation Requirements for Municipal Distribution Systems

A. Beginning with calendar year 2023, or the calendar year in which the provider commences service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute distribution system requirement in the 5MP:

1. A large municipal provider shall not operate a groundwater distribution system in a manner such that lost and unaccounted-for water (see Appendix 5B) exceeds 10 percent of the total quantity of water from any source that enters the provider's groundwater distribution system, as calculated on an annual or three-year average basis.

2. A small municipal provider shall not operate its groundwater distribution system in a manner such that lost and unaccounted-for water (see Appendix 5B) exceeds 15 percent of the total quantity of water from any source that enters the provider's groundwater distribution system, as calculated on an annual or three-year average basis.

3. A large untreated water provider that operates an untreated water municipal distribution system shall either:

a. Line all canals within its service area that are used to deliver untreated water to its delivery points with a material that allows no more lost water than a well-maintained concrete lining, and maintain such lining to minimize its lost and unaccounted-for water; or

b. Operate and maintain its untreated water municipal distribution system in a manner such that lost and unaccounted-for water does not exceed 10 percent of the total quantity of untreated water from any source withdrawn, diverted or received by the provider for non-irrigation uses on an annual or three-year average basis.

5-612. Monitoring and Reporting Requirements for Municipal Providers and Individual Users

A. Beginning with calendar year 2023, or the calendar year in which the municipal provider commences service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring or reporting requirement in the 5MP:

1. A municipal provider, regardless of the conservation program under which the provider is regulated, shall report the following in its annual report required by A.R.S.
§ 45-632:

a. The total quantity of water from any source, including reclaimed water, disaggregated by each source, withdrawn, diverted or received by the provider for non-irrigation use during the reporting year, as separately *measured with a measuring device in accordance with paragraph 5 of this subsection.*

b. *The total quantity of water from any source, including reclaimed water, withdrawn, diverted or received by the provider for irrigation use during the reporting year.*

c. *The total quantity of reclaimed water, disaggregated by direct use reclaimed water, reclaimed water recovered from within the area of impact, and reclaimed water recovered outside the area of impact, served by the provider during the reporting year for non-irrigation use.*

d. *The number of single-family housing units added to the provider's service area from December 31 of the previous calendar year to December 31 of the reporting year.*

e. *The number of multifamily housing units added to the provider's service area from December 31 of the previous calendar year to December 31 of the reporting year.*

f. *The total number of single-family housing units and multifamily housing units served by the provider as of December 31 of the previous year.*

g. *The total quantity of water from any source, including reclaimed water which was delivered to be stored at an underground storage facility or groundwater savings facility, or recovered as annual or long-term storage credits.*

h. *The total quantity of water ordered by the municipal provider from an irrigation district and released by the irrigation district from a storage or distribution facility but not accepted by the municipal provider or delivered to any other person.*

2. *A large municipal provider shall separately measure and report in its annual reports required by A.R.S. §§ 45-468 and 45-632 for the calendar year, the total quantity of water from any source that enters its groundwater distribution system during the reporting year.*

3. *A large municipal provider shall separately measure and report in its annual reports required by A.R.S. §§ 45-468 and 45-632 for the calendar year, the total quantity of water from any source delivered via its groundwater distribution system each month for: a) irrigation uses; b) residential uses by category, including single family and multifamily; and c) non-residential uses by category, including turf-related facility uses, commercial uses, industrial uses, government uses, construction uses and other uses.*

4. *In addition to the information required by paragraphs 1 and 2 of this section, a large municipal provider regulated under the Non-Per Capita Conservation Program described in section 5-605 shall include the following in its annual report required by A.R.S.§ 45-632:*

   a. *A CER as prescribed by section 5-605(E).*

b. The total number of connections to the provider's water distribution system as of the end of the reporting year, including residential and non-residential connections.

5. *A large municipal provider shall meter water deliveries to all service connections on its municipal distribution system, except connections to fire services, dwelling units in individual multifamily units, mobile homes in a mobile-home park with a master meter, and construction users.*

6. *A municipal provider shall make all water use measurements using measuring devices in accordance with ADWR's measuring device rules, R12-15-901, et seq., Arizona Administrative Code.*

7. *An individual user shall comply with the monitoring and reporting requirements prescribed in section 5-610(A).*

5-613. Remedial Groundwater Accounting for Conservation Requirements

A. Accounting

Remedial groundwater used by a person subject to a conservation requirement established under this chapter shall be accounted for consistent with the accounting for surface water for purposes of determining the person's compliance with the conservation requirement, subject to the provisions of subsections B through D of this section.

B. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remedial groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the EPA or ADEQ. The annual authorized volume for a project approved prior to June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to Jan. 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The Director may modify the annual authorized volume for a remedial action project as follows:

1. *For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The Director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the Director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw*

groundwater in excess of the annual authorized volume to further the purpose of the project. The Director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the Director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.

3. *The Director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the Director written notice of the change within 30 days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

C. *Notification*

To qualify for the remedial groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the Director in writing of the anticipated withdrawal of Remedial Groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to the withdrawal. A municipal provider may submit notice on behalf of an individual user. At the time the notice is given, the person desiring the accounting must be using Remedial Groundwater pursuant to the approved remedial action project or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:

1. *A copy of a document approved by the EPA or ADEQ, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of Remedial Groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of Remedial Groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the Remedial Groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the Director.*

D. *Monitoring and Reporting Requirements*

To qualify for the remedial groundwater accounting for conservation requirements as provided in subsection A of this section, Remedial Groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remedial groundwater accounting for conservation requirements shall indicate in its annual report under A.R.S. § 45-632 the volume of groundwater withdrawn and used during the previous calendar year that qualifies for the accounting.

5-614. Audits of Conservation Requirements

A. ADWR may elect to conduct audits of reports, records, and/or practices pursuant to the conservation requirements contained in sections 5-601 through 5-613 of this chapter. A Report of Audit must be sent to the audited person or entity pursuant to A.R.S. §§ 45-633(D), 880.01(D), 1061(D), and/or A.A.C. R12-15-1102(E).

APPENDIX 5A
METHODOLOGY FOR CALCULATING TOTAL GPCD REQUIREMENTS FOR LARGE MUNICIPAL PROVIDERS

The total GPCD requirement for a large municipal provider for the fourth management period shall be the provider's median total GPCD for the period 2000-2009 minus one standard deviation. However, if the median total GPCD minus one standard deviation is less than the provider's minimum total GPCD requirement, the provider's total GPCD requirement shall be the minimum total GPCD requirement. Further, if the median total GPCD minus one standard deviation is greater than the provider's final GPCD requirement in the last effective year of the 3MP, the provider's total GPCD requirement shall be the 3MP final GPCD requirement.

The minimum total GPCD requirement shall be calculated as follows:

1. Divide 132 gallons per housing unit per day by the 2010 U.S. Census persons per household for the provider's service area, and add 40 GPCD to that figure,

2. Add to the result from paragraph 1 above the provider's 3MP non-residential component target. If the provider is a new large municipal provider, the non-residential component target is the lesser of:

   a. The provider's 2010 non-residential GPCD rate or
   b. 18 GPCD.

3. Divide the result from paragraph 2 above by 0.9.

APPENDIX 5A, CONT'D
METHODOLOGY FOR CALCULATING TOTAL GPCD REQUIREMENTS FOR LARGE MUNICIPAL PROVIDERS

Table 5A below shows the total GPCD requirement calculated for each large municipal provider that was designated as having an assured water supply when the 4MP was adopted. A large municipal provider listed in Table 5A must comply with its assigned total GPCD requirement (far right column) beginning January 1, 2023 and continuing until the effective date of any substitute requirement in the 5MP, unless the provider elects to be regulated under the NPCCP.

TABLE 5A
GPCD REQUIREMENT FOR LARGE MUNICIPAL PROVIDERS

Provider	2000-2009 Median Total GPCD	Median Minus One Standard Deviation	Minimum Total GPCD Requirement	2017 Total GPCD Requirement (Maximum)	Assigned Total GPCD Requirement
City of Avondale	172	138	128	129	129
City of Chandler	243	228	166	179	179
Chaparral City Water Company	259	239	232	249	239
City of El Mirage	159	139	128	116	116
Town of Gilbert	250	227	149	158	158
City of Glendale	201	193	148	185	185
City of Goodyear	195	182	223	209	223
City of Mesa	196	186	152	161	161
City of Apache Junction Water Utilities Community Facilities District	108	103	175	145	175
City of Peoria	190	177	144	143	143
City of Phoenix	209	194	164	204	194
City of Scottsdale	366	355	174	255	255
City of Tempe	319	298	216	250	250
City of Surprise	160	130	109	148	130
Johnson Utilities - Phoenix AMA	300	59	108	155	108

APPENDIX 5B
LOST & UNACCOUNTED-FOR WATER AND ALLOWABLE ESTIMATED USES

<u>Lost & Unaccounted-For Water Includes:</u>

- Leaks:
  - Distribution Lines
  - Sewer Lines
  - Storage Tanks
  - Storage Ponds
  - Hydrants
  - Other
- Breaks:
  - Distribution Lines
  - Sewer Lines
  - Mains
  - Hydrants
  - Other
- Measurement Errors:
  - Meter Under-Registration
  - Source Meter Errors
  - Flumes/Weirs Errors
- Evaporation
- Illegal Connections/Water Theft
- Phreatophyte Uses

<u>Water System Uses Include:</u>

Residential Metered Deliveries
Non-Residential Metered Deliveries
Standpipe Uses
(1) Fire Flow
(1) Hydrant Meter Reading
(1) Hydrant Flow Tests
(1) Fire Sprinkler System Flow Tests
(1) Construction
(1) Dust Control
(1) Line Flushing (distribution, sewer, or treatment facility)
(1) Street Cleaning
(1) Storm Drain Flushing
(1) Water Tests & Pressure Tests
(1) Well Purging

(1) Estimates can be provided, using a method approved by the Director. Documentation must be submitted with annual report.

APPENDIX 5C
NON-PER CAPITA CONSERVATION PROGRAM
BEST MANAGEMENT PRACTICES

Introduction

A large municipal water provider regulated under the Non-per Capita Conservation Program (NPCCP) must implement a basic public information program and one or more additional water conservation best management practices. A best management practice (BMP) is a measure that results in reduced water consumption or increased water use efficiency. The number of BMPs that a water provider must implement is based on the provider's size as defined by its total number of water service connections. The provider must select the additional BMPs from Section II below.

At any time while regulated under the NPCCP, a provider may choose to discontinue implementation of a selected BMP (other than the required public information program) and implement a substitute BMP instead. The substitute BMP must be on the list of approved BMPs in Section II of this appendix, and the provider must determine that the substitute BMP is reasonably relevant to its existing service area characteristics or water use patterns. A provider that substitutes a BMP must notify the Director of the substitution in its next Conservation Efforts Report (CER).

The Director may modify the list to include additional BMPs pursuant to the procedure set forth in Section III of this appendix. A copy of the most recent list of additional BMPs shall be posted on the ADWR's website and shall be on file with ADWR.

I. Basic Public Information Program (formerly called "public education program")

All large municipal providers regulated under the NPCCP are required to implement a basic public information program that includes the following components:

1. At least twice a year, the water provider shall communicate to customers the importance of water conservation and notify them of the water conservation materials and programs available from the provider and how they may obtain the materials or more information. Channels through which this information is communicated to customers shall include one or more of the following: water bill inserts messages on water bills, provider website, post cards, newsletters or print pieces.

2. The water provider shall make available to customers free written information on water conservation (e.g. pamphlets, brochures, fact sheets, etc.). The information shall be available in the provider's office, sent to customers on request or provided online for customers who prefer this method. The provider is encouraged to distribute water conservation information at other locations (e.g., libraries, chamber of commerce, town hall, etc.) and on their websites.

II. Additional Best Management Practices (BMPs)

Category 1: Public Awareness/Public Relations

Programs in this category are designed to increase awareness of the need for and importance of water conservation, to inform customers about the availability of conservation resources and services, and to encourage the public to reduce their water consumption.

1.1 Local or Regional Conservation Campaign (1 point)
The water provider actively participates in an advertising or social marketing campaign to raise awareness of the need for water conservation and to encourage the efficient use of water. The campaign must reach local or regional customers using methods such as traditional media (television, radio or print), websites, social media, and promotional materials (e.g., brochures, vehicle wraps, bookmarks, magnets, etc.). To receive credit for this measure, the provider must submit documentation with its CER that describes the campaign and results.

1.2 Special Events/Programs and Community Presentations (1 point)
The water provider provides speakers, conducts tours for the public, or participates in community events to display, provides or presents information about water conservation and informs the public about the programs and resources. To receive credit for this measure, a provider must participate in at least three events per year and record the number of events and a description of each event in its CER.

1.3 Market Surveys to Identify Customer Information Needs or Assess the Success of Conservation Messages (2 points)
The water provider conducts a market survey to be used to improve the water provider's current water conservation activities or to plan future activities. The survey is designed to gather data regarding customers' information needs, program preferences, or responses to conservation messages. The provider must submit documentation with its CER stating the objectives of the survey, data collection methods, analysis of results, and how the results were communicated. Credit for this BMP is limited to once every five years.

1.4 Distribution Plan for Water Conservation Materials (1 point)
The water provider develops and implements a two-year distribution plan to effectively market its water conservation materials and programs. The provider must submit documentation with its CER that describes the following:

- the goals and objectives for the distribution of materials over a two-year period, beginning the year following plan development
- a description of the conservation materials to be distributed
- how the materials will be distributed (libraries, landscape architects, nurseries, realtors, master gardeners, etc.)
- how the materials or programs will be marketed (water bill inserts, on-hold phone messages, e-mail messages, public events, workshops, websites, local publications, etc.
- a timetable for distribution; and
- a mechanism for tracking the distribution of materials.

Credit for this BMP is limited to only one year. In subsequent years, the provider must replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

Category 2: Conservation Education and Training

Programs in this category are designed to provide customers with the knowledge and skills they need to utilize water efficiently and reduce consumption.

2.1 Adult Education or Training Program (1 point)
The water provider implements an education or training program for adults within the provider's service area that includes active personal participation. Examples include regularly scheduled

workshops for homeowners or training programs for landscape professionals or non-residential water users. To receive credit for this measure, a provider must state in its CER the number and type of trainings or education programs and the number of attendees per training or education program.

2.2 Youth Education Program (1 point)
The water provider works with schools in its service area to provide or support programming that increases students' understanding of water resources and promotes water conservation. Examples of youth education programs include teacher trainings, classroom presentations, educational materials, assembly programs, water festivals, and guided field trips. To receive credit for this measure, a provider must state in its CER the number and type of education programs and the number of participants per education program.

2.3 New Homeowner Landscape Information (1 point)
The water provider distributes low-water-use landscape information packets to all owners of newly constructed homes, either through direct distribution (mail or delivery), delivery by the home builder or online distribution if requested by the homeowner. The provider also notifies all new owners of existing homes (resale) that information on low-water-use landscaping is available and must provide such information on request. The number of notifications sent, and packets mailed must be recorded and noted in the provider's CER.

2.4 Xeriscape Demonstration Garden (1 point)
The water provider installs and maintains a low-water-use or water-efficient demonstration garden. The garden must be available to the public and include interpretive signage or literature about low-water-use plants or water-efficient landscape practices.

Category 3: Outreach Services

Programs in this category are designed to provide customers with consultations, audits, or retrofits designed to conserve water or improve water use efficiency.

3.1 Residential Audit Program (1 point)
The water provider offers an audit program to all residential customers within the provider's service area. The audit can be either a self-audit (provider offers self-audit kits) or conducted by the provider or designated representative. The audit may include indoor components (e.g., toilets, faucets, showerheads, etc.), outdoor components (e.g., irrigation system, pool, water feature, etc.), or both. Audits conducted by the provider may include a meter check and written material about how to read the meter and use it to determine if there is a leak. Self-audit kits shall include written instructions on how to conduct an audit and how to read the meter and use it to determine if there is a leak. The number of audits or self-audit kits provided must be recorded and noted in the provider's CER. Additionally, actual water savings one year pre- and post-audit must be recorded in the provider's CER. If unavailable, estimated water savings can be substituted for actual savings, but must be noted as estimated in the provider's CER.

3.2 Landscape Consultations (Residential or Non-Residential) (1 point)
The water provider or a designated representative offers landscape consultation services to residential or non-residential customers located in those portions of the provider's service area with the greatest potential for savings. Examples of services include an evaluation of the irrigation system, controller, plant selection and turf conversion possibilities, as well as providing information about other related services or programs (e.g. rebates, educational materials,

workshops). The consultation may include a meter check and instructions on how to read the meter and use it to determine if there is a leak. The individual providing the consultation shall provide either on-site written or verbal suggestions, and provide a follow-up visit or interview. Landscape consultations must be recorded and noted in the provider's CER. Additionally, actual water savings one year pre- and post-landscape consultation must be recorded in the provider's CER. If unavailable, estimated water savings can be substituted for actual savings, but must be noted as estimated in the provider's CER.

3.3 Water Budgeting Program (1 point)
The water provider offers assistance in developing a monthly or annual water budget to one or more non-residential water-using groups (e.g., homeowner associations, industries, commercial properties, government facilities, parks, schools, etc.) or to apartment complexes. The water budget shall establish target amounts for outdoor use and may include indoor water use that reflect efficient water use/application rates. These rates should meet or exceed water-use efficiencies required for similar uses as described in the Fourth Management Plan. If they are not addressed in the plan, water-use rates should be commensurate with state-of-the-art water efficiency standards found elsewhere in the body of water conservation literature. The number of budgets provided and whether they included indoor, outdoor, or both components must be recorded and noted in the provider's CER.

3.4 Customer High Water Use Inquiry Resolution (1 point)
The water provider designs and implements a program to assist customers who inquire about increases in their water bills or about high-water usage. The program may include a site inspection to discover the cause of a water bill increase and a meter check to inform the customer on how to read the meter and check for leaks. The provider must follow up on every customer inquiry and record the number of customers assisted and the type of assistance provided and report this information in its CER.

3.5 Customer High Water Use Notification (1 point)
The water provider develops a program to identify customers with high water usage and contacts them by telephone, email, door hanger, mail, text, or in-person. The notification must include information on provider services that could benefit the customer, such as audits, educational materials, or rebate programs. The number of notifications sent must be recorded and noted in the provider's CER.

3.6 Water Waste Investigations and Information (1 point)
The water provider designs and implements a program to investigate water waste complaints and assist citizens in preventing water waste. An investigation may include a site inspection and some type of follow-up action, such as customer education to prevent water waste or a letter explaining enforcement (if applicable). The provider must follow-up on every water waste complaint and record the number of complaints and follow-up activities in its CER.

Category 4: Physical System Evaluation and Improvement

These programs ensure that the water system is being well-maintained and is running at optimal efficiency or will become more water efficient as a result of one or more physical water system improvements.

4.1 Distribution System Leak Detection Program (2 points)
The water provider implements a systematic evaluation of its water distribution system to

identify and fix leaks. The provider must implement this program throughout its service area unless the provider can demonstrate that targeting certain portions of its water service area is likely to yield the highest water savings potential. A description of the program and its results must be noted in the provider's CER.

4.2 Meter Repair or Replacement Program (2 points)
The water provider implements a program to systematically assess the meters or submeters in its water service area to identify malfunctioning meters and to repair or replace them. The number of meters repaired or replaced each year must be noted in the provider's CER.

4.3 Approved Comprehensive Water System Audit Program (3 points)
The water provider conducts a systematic water loss or non-revenue water audit following an established methodology and utilizing best loss control techniques. The audit program may include a review of the water provider's water distribution system, systems control equipment, and water records to identify and quantify water losses and shall develop a plan for corrective measures. The audit can be a precursor to a leak detection program or meter repair/replacement program. The provider must submit documentation with its CER that describes the audit, its objectives, methods, and results. Credit for this BMP is limited to only one year unless the provider can provide justification for an ongoing or multi-year program. In subsequent years, the provider must replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

4.4 Installation of Advanced Metering Infrastructure (AMI) (2 points)
The water provider or designated representative (e.g. contractual work overseen by water provider) plans, installs, and monitors advanced metering infrastructure (AMI) throughout its service area. Providers may also retrofit advanced meter reading (AMR) to an AMI system. The number of units installed and/or retrofitted per year must be reported in the provider's CER. The water provider can receive credit for this measure a maximum of 5 years or until the AMI system is fully installed, whichever is less.

Category 5: Ordinances/Conditions of Service/Tariffs

Programs in this category are designed to reduce water use within the service area by limiting or reducing water used for specific purposes. Ordinances apply to cities and towns, and tariffs apply to private water companies regulated by the Arizona Corporation Commission. A water provider that is not part of a municipality can receive credit if it works with local or county jurisdictions to implement a new ordinance.

Note: BMPs that are part of curtailment tariffs for private water utilities do not qualify for the NPCCP because they are only implemented as a response to water shortage or potential water shortage, and do not apply at all times.

5.1 Low-Water-Use Landscaping Requirements (1 point)
Single-family, multi-family, non-residential facilities or common areas are either required to include low-water-use landscapes in all or part of their property or have limitations on water-intensive landscaping or turf.

5.2 Water Tampering/Water Waste Ordinances (1 point)
Water waste or water tampering are prohibited on residential or non-residential properties.

5.3 Plumbing Requirements Stricter than Current Arizona Code (1 point)
Plumbing requirements for new residential or non-residential properties are stricter than those currently in the Arizona code or include restrictions not currently in the Arizona code.

5.4 Limitations on Water Features (fountains, waterfalls, ponds and other artificial water structures) (1 point)
Residential or non–residential properties have limitations on or water conservation requirements for water features.

5.5 Requirement for Water-efficient Landscapes in Model Homes (1 point)
Landscaping at model homes in new residential developments is required to be water-efficient, is limited as to the size of water-intensive landscaped areas or requires water-intensive landscaping to be used for functional areas only.

5.6 Requirements for Graywater or Rainwater Systems (1 point)
Residential or non-residential facilities are required to have on-site plumbing or systems for collecting and utilizing graywater or rainwater.

5.7 Conservation Requirements for Car Washes (1 point)
Commercial car washes are required to recycle water and to implement additional measures to increase water use efficiency and reduce water consumption. Examples of additional measures include using low flow nozzles, repairing leaks, watering landscape with reclaimed water, installing low-water-use landscapes or using automatic shut-off valves on hoses and faucets.

5.8 Landscape Watering Restrictions (1 point)
The watering of landscapes is restricted to certain times of day. (This may be seasonal.)

5.9 Requirements for Water-efficient Hot Water Devices or Systems (1 point)
Water-efficient plumbing design, “on-demand” hot water recirculation devices or other devices or designs for providing hot water efficiently are required in new residential and/or non-residential buildings.

5.10 Retrofit on Resale (1 point)
Owners of single-family homes, multi-family home complexes or non-residential facilities are required to replace or retrofit all indoor plumbing fixtures (e.g., toilets, showerheads, faucets) that do not conform to current water efficiency standards. This could be implemented by the seller prior to sale or by the buyer subsequent to the sale.

5.11 Landscape Water Use Efficiency Standards for Non-residential Customers (1 point)
New or rehabilitated non-residential facility landscaping of a particular size is required to meet specified standards for maximum water allowance, plant selection, irrigation design, grading or other components that result in improved landscape water use efficiency.

5.12 Requiring a Water Use Plan for Non-residential Users (1 point)
All new commercial, industrial, and institutional customers with projected annual water use of 10 acre feet (AF) or more per year are required to submit a water use plan that identifies all anticipated water uses by the customer and the water efficiency measures associated with the uses. The water use plan must include at least five of the following:

1. Statement of water efficiency policy.

2. Water conservation education/training for employees.
3. Identification of on-site recycling and reuse strategies.
4. Total cooling capacity and operating total dissolved solids or conductivity for cooling towers.
5. Identification of best available technologies used for process, cooling, and domestic water uses.
6. Landscape watering system distribution uniformity and landscape water budget.
7. Total annual water budget for the facility.

Category 6: Rebates/Incentives

Programs in this category are designed to provide users with an incentive for implementing a water conservation practice. The program can include rebates or other incentives such as grants, fee reductions, or waivers.

1. Residential

6.1 Customer Assistance Program (1 point)
The water provider offers residential customers in its service area free services or no interest or low-interest loans to repair inefficient equipment or leaks. Repairs include replacing parts, performing maintenance, or installing new fixtures. The number of customers assisted, type of repair (part replacement, maintenance, or replacement), and actual water savings one year pre- and post-repair per type must be reported in the provider's CER.

6.2 Toilet Rebate or Incentive Program (1 point)
The water provider offers residential customers in its service area a financial rebate or other incentive for the purchase and installation of toilets that are more efficient and use 1.6 gallons of water per flush or less. The number of toilets rebated, the total amount rebated, and actual water savings one year pre- and post-rebate must be reported in the provider's CER.

6.3 Smart Irrigation Technology Rebate or Incentive Program (1 point)
The water provider offers residential customers in its service area a financial rebate or other incentive for the purchase and installation of smart irrigation technology (e.g. irrigation controllers, nozzles, flow sensors, etc.). Documentation of the technology's benefits, the number and type of technology rebated, the total amount rebated per type of technology, and actual water savings one year pre- and post-rebate per type of technology must be reported in the provider's CER.

6.3 Rebate for Water-efficient Hot Water Devices or Systems (1 point)
The water provider shall offer a financial rebate or incentive to single-family or multi-family customers for water-efficient plumbing design, "on-demand" hot water recirculation devices, or other devices or designs for providing hot water efficiently. A description of the program and its results must be noted in the provider's CER.

6.4 Water-Efficient Appliance Rebate or Incentive Program (2 points)
The water provider offers residential customers in its service area a financial rebate or other incentive for the purchase and installation of water efficient appliances (e.g. clothes washer). The type and number of appliances rebated, the total amount rebated per type of appliance, and actual water savings one year pre- and post-rebate per appliance must be reported in the provider's CER.

6.5 Graywater Retrofit Rebate or Incentive Program (1 point)
The water provider offers residential customers in its service area a financial rebate or other incentive for the installation of graywater systems, fixtures, or retrofits along with related educational material that includes information on the benefits of using graywater. The type and number of retrofits rebated, total amount rebated, and actual water savings one year pre- and post-rebate must be reported in the provider's CER.

6.6 Rainwater Harvesting Retrofit Rebate or Incentive Program (1 point)
The water provider offers residential customers in its service area a financial rebate or other incentive for the installation of active or passive rainwater harvesting systems (e.g. gutters, downspouts, landscape designs, containers, etc.) along with information about water-harvesting techniques. The type and number of rebates provided, total amount rebated per type, and actual water savings one year pre- and post-rebate must be reported in the provider's CER.

6.7 Landscape Conversion Rebate or Incentive Program (2 points)
The water provider offers residential customers in its service area a financial rebate or other incentive for the conversion of landscape to reduce water usage. Examples include replacing grass with xeriscape or converting a high-water-use landscape to a low-water-use landscape. Educational information about landscape conversions must be provided to customers. The type and number of rebates provided, total amount rebated per type, square feet of grass removed (if applicable), and actual water savings one year pre- and post-rebate per type of rebate must be reported in the provider's CER.

6.8 Installing Xeriscapes in New Landscapes Rebate or Incentive Program (1 point)
The water provider offers residential customers in its service area installing new landscapes a financial rebate or incentive for installing a xeriscape landscape. The type and number of rebates provided and total amount rebated per type must be reported in the provider's CER.

2. Non-residential

6.9 Commercial and Industrial Rebate or Incentive Program (1 point)
The water provider identifies commercial and industrial customers in its service area with the highest conservation potential and implements a water conservation program and/or rebate or incentive program for those customers. The program may include replacements, retrofits, and audits and may focus on outdoor use (irrigation, water features, pools, etc.) or indoor use (machinery, bathrooms, cooling towers, etc.). A description of the program and actual water savings pre- and post-project must be noted in the provider's CER.

6.10 Toilet Rebate or Incentive Program (1 point)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the purchase and installation of toilets that are more efficient and use 1.6 gallons of water per flush or less. The number of toilets rebated, the total amount rebated, and actual water savings one year pre- and post-rebate must be reported in the provider's CER.

6.11 Smart Irrigation Technology Rebate or Incentive Program (1 point)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the purchase and installation of smart irrigation technology (e.g. irrigation controllers, nozzles, flow sensors, etc.). Documentation of the technology's benefits, the number and type of technology rebated, the total amount rebated per type of technology, and actual water savings one year pre- and post-rebate per type of technology must be reported in the

provider's CER.

6.12 Water-Efficient Appliance Rebate or Incentive Program (1 point)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the purchase and installation of water efficient appliances (e.g. clothes washer). The type and number of appliances rebated, the total amount rebated per type of appliance, and actual water savings one year pre- and post-rebate per appliance must be reported in the provider's CER.

6.13 Graywater Retrofit Rebate or Incentive Program (1 point)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the installation of graywater systems, fixtures, or retrofits along with related educational material that includes information on the benefits of using graywater. The type and number of retrofits rebated, total amount rebated, and actual water savings one year pre- and post-rebate must be reported in the provider's CER.

6.14 Rainwater Harvesting Retrofit Rebate or Incentive Program (1 point)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the installation of active or passive rainwater harvesting systems (e.g. gutters, downspouts, landscape designs, containers, etc.) along with information about water-harvesting techniques. The type and number of rebates provided, total amount rebated per type, and actual water savings one year pre- and post-rebate per type of rebate must be reported in the provider's CER.

6.15 Landscape Conversion Rebate or Incentive Program (2 points)
The water provider offers non-residential customers in its service area a financial rebate or other incentive for the conversion of landscape to reduce water usage. Examples include replacing grass with xeriscape or converting a high-water-use landscape to a low-water-use landscape. Educational information about landscape conversions must be provided to customers. The type and number of rebates provided, total amount rebated per type, square feet of grass removed (if applicable), and actual water savings one year pre- and post-rebate per type of rebate must be reported in the provider's CER.

6.16 Installing Xeriscapes in New Landscapes Rebate or Incentive Program (1 point)
The water provider offers nonresidential customers in its service area installing new landscapes a financial rebate or incentive for installing a xeriscape landscape. The type and number of rebates provided and total amount rebated per type must be reported in the provider's CER.

6.17 Large Landscape Conservation Program (1 point)
The water provider implements a program to provide non-residential customers with support and incentives to improve their landscape water use efficiency. A description of the program and its results must be noted in the provider's CER.

6.18 No or Low Interest Loans for Implementing Water Conservation Measures (1 point)
The water provider offers assistance to customers wishing to invest in projects intended to reduce existing water use or bring new uses in at high efficiency rates. A description of the program and its results must be noted in the provider's CER.

Category 7: Research/Innovation Program

Programs in this category are designed to encourage water providers to conduct systematic evaluations of conservation measures already implemented, to implement state-of-the-art water conservation technologies and techniques, or to develop or try new technologies and techniques.

7.1 Participation in Industry or Regional Partnerships for Water Conservation (1 point)
The provider contributes financial support or in-kind services and actively participates in an industry or regional partnership that implements a collaborative program designed to increase water use efficiency or reduce water consumption. The provider must describe the partnership, program objectives, ongoing and future efforts, and submit the information in its CER.

7.2 Research of a New Technology or Technique (1 point)
The provider researches, contributes financial support, or provides in-kind services for the research of a new technology or technique that will enhance their conservation program decision making and development, improve water efficiency or result in water savings. The provider must submit with its CER documentation that describes the research objectives, methods, and results. Additionally, the provider must provide its involvement and methods of support and any other participatory party's involvement and methods of support. This documentation shall be made available for public distribution.

7.3 Pilot Plan Development for New Technology or Technique (1 point)
The provider plans, contributes financial support, or provides in-kind services for the plan development for a pilot of a new technology or technique that will enhance their conservation program decision making and development, improve water efficiency, or result in water savings. The provider must submit with its CER documentation that details the pilot plan, including but not limited to the timeline for implementation, the projected cost of the project, the customers selected (residential, non-residential, the water provider, etc.), the desired outcomes, the proposed methods of analysis, and any anticipated challenges. Additionally, the provider must provide its involvement and methods of support and any other participatory party's involvement and methods of support. This documentation shall be made available for public distribution.

7.4 Piloting a New Technology or Technique (1 point)
The provider pilots, contributes financial support, or provides in-kind services for piloting a new technology or technique that will enhance their conservation program decision making and development, improve water efficiency, or result in water savings. The provider must submit documentation with its CER that includes the pilot program tracking information, including but not limited to the actual timeline of implementation, the actual cost of the pilot, the actual customers selected, the actual method of analysis, and any challenges that occurred and how they were mitigated. Additionally, the provider must provide its involvement and methods of support and any other participatory party's involvement and methods of support. This documentation shall be made available for public distribution.

7.5 Evaluation of New or Emerging Technologies and Practices (1 point)
The provider conducts, contributes financial support, or provides in-kind services for conducting an evaluation of a new technology or technique that will enhance their conservation program decision making and development, improve water efficiency, or result in water savings. The provider must submit documentation with its CER that details the evaluation, including but not limited to the methods used to conduct the evaluation, the results of the evaluation, final

conclusions of the evaluation, and any missing information that may be useful in future analysis. Additionally, the provider must provide its involvement and methods of support and any other participatory party's involvement and methods of support. This documentation shall be made available for public distribution.

7.6 Analyzing a Best Management Practice (BMP) for Actual Water Savings (1 point)
The provider conducts a quantitative analysis of a BMP that yields results regarding actual water savings. The provider must submit documentation with its CER stating the objectives, methods used to conduct the analysis, and the results of the investigation. This documentation shall be made available for public distribution. Credit for this BMP is limited to only one year unless the provider can offer justification for an ongoing or multi-year program. In subsequent years, the provider must analyze a different BMP to receive credit.

7.7 Implementation of Smart Irrigation Technology (1 point)
The provider installs smart irrigation technology and submits documentation with its CER describing the project location, implementation methods and estimates of irrigation efficiency.

III. Procedure for Adding a Best Management Practice to the List of Additional Best Management Practices

1. A large municipal provider may apply to the Director to add a Best Management Practice to the list of additional Best Management Practices set forth in Section II of this Appendix.

2. Upon receipt of an application submitted pursuant to paragraph 1 above, the Director shall review the application and may request additional information from the applicant. The Director may seek information from other sources as deemed necessary to determine if the Best Management Practice should be added to the list.

3. If the Director approves the application, the Director shall add the Best Management Practice to the list of additional Best Management Practices set forth in Section II of this Appendix, post the modified list of additional Best Management Practices on ADWR's web site and file the modified list within ADWR's active management area office.

4. The Director may add a Best Management Practice to the list of additional Best Management Practices set forth in Section II of this Appendix.

APPENDIX 5D
MUNICIPAL WATER PROVIDERS IN THE PHOENIX AMA

Provider Number	Provider Name	Provider Type
56-002150.0000	ADAMAN MUTUAL WATER COMPANY	LARGE
56-002153.0000	ALMA RANCHETTES WELL OWNERS	SMALL
56-002025.0000	APACHE JUNCTION WATER UTILITIES COMMUNITY FACILITIES DISTRICT	LARGE
56-002154.0000	ARCADIA VISTA IMPROVEMENT CO.	LARGE UNTREATED
56-002156.0000	ARCTIC ICE & WATER	SMALL
56-002225.0000	ARIZONA DEPT. OF JUVENILE CORRECTIONS	SMALL
56-002000.0000	ARIZONA WATER COMPANY - APACHE JUNCTION	LARGE
56-002002.0000	ARIZONA WATER COMPANY – SUPERIOR	LARGE
56-002001.0000	ARIZONA WATER COMPANY - WHITE TANKS	LARGE
56-002158.0000	ARLINGTON FARMS WATER COMPANY	SMALL
56-002159.0000	BEARDSLEY WATER COMPANY	SMALL
56-002004.0000	BERNEIL WATER COMPANY	LARGE
56-002160.0000	BROPHY COLLEGE PREPARATORY	SMALL
57-002503.0000	BUCKEYE IRRIGATION DISTRICT	LARGE UNTREATED
56-002227.0000	CANYON STATE ACADEMY	SMALL
56-002007.0000	CAREFREE WATER COMPANY	LARGE
56-002008.0000	CAVE CREEK WATER COMPANY	LARGE
56-002504.0000	CHANDLER HEIGHTS CITRUS IRRIGATION DISTRICT	LARGE
57-002504.0000	CHANDLER HEIGHTS CITRUS IRRIGATION DISTRICT	LARGE UNTREATED
56-002011.0000	CHAPARRAL CITY WATER CO	LARGE
56-002283.0000	CHAPARRAL WATER COMPANY	SMALL
56-002166.0000	CIRCLE CITY WATER CO.	SMALL
56-002345.0000	CITRUS GARDENS IRRIGATION DISTRICT	SMALL
56-002003.0000	CITY OF AVONDALE	LARGE
56-002009.0000	CITY OF CHANDLER	LARGE
56-002016.0000	CITY OF EL MIRAGE	LARGE
56-002018.0000	CITY OF GLENDALE	LARGE
56-002019.0000	CITY OF GOODYEAR	LARGE
56-002023.0000	CITY OF MESA	LARGE
56-002029.0000	CITY OF PEORIA	LARGE
56-002030.0000	CITY OF PHOENIX	LARGE
56-002037.0000	CITY OF SCOTTSDALE	LARGE
56-002344.0000	CITY OF SURPRISE	LARGE
56-002043.0000	CITY OF TEMPE	LARGE
56-002044.0000	CITY OF TOLLESON	LARGE
57-002753.0000	CLEARWATER FARMS	LARGE UNTREATED

Provider Number	Provider Name	Provider Type
56-002165.0000	CLEARWATER UTILITIES CO. INC.	LARGE
56-002282.0000	COLBY MANAGEMENT, INC	SMALL
56-002314.0000	COUNTRY HOME MOBILE VILLAGE PARK	SMALL
56-002169.0000	DESERT HILLS WATER COMPANY	LARGE
56-002258.0000	DIVERSIFIED WATER UTILITIES, INC.	LARGE
56-002012.0000	EPCOR - AGUA FRIA	LARGE
56-002027.0000	EPCOR - PARADISE VALLEY	LARGE
56-002038.0000	EPCOR - SUN CITY	LARGE
56-002039.0000	EPCOR - SUN CITY WEST	LARGE
56-002174.0000	FRIENDLY VILLAGE MOBILE HOME PARK OF ORANGEWOOD	SMALL
56-002297.0000	GILA BUTTES WATER USERS ASSOCIATION	LARGE UNTREATED
56-002175.0000	GRANDVIEW WATER COMPANY	SMALL
56-002241.0000	GREENFIELD RANCHETTES	SMALL
56-002754.0000	HASSAYAMPA WATER CO-OP	SMALL
56-002178.0000	J&M/B&K LAND INVESTMENT CO.	SMALL
56-002346.0000	JOHNSON UTILITIES – PHOENIX	LARGE
56-002248.0000	LIBERTY NATIONAL	SMALL
56-002021.0000	LITCHFIELD PARK SERVICE CO DBA LIBERTY WATER	LARGE
56-002022.0000	LUKE AIR FORCE BASE	LARGE
56-002184.0000	MAR WEST LANDOWNERS ASSOCIATION	SMALL
56-002188.0000	MC CORMICK RANCH PROP OWN ASSOCIATION	LARGE UNTREATED
56-002250.0000	MCDOWELL WATER COMPANY	LARGE UNTREATED
57-002508.0000	MARICOPA WATER DISTRICT	LARGE UNTREATED
56-002216.0000	METRO PHOENIX BANK	SMALL
56-002196.0000	MICHIGAN MOBILE PARK, LLC	SMALL
56-002278.0000	MOBILE GARDENS WATER IMPROVEMENT DISTRICT	SMALL
56-002324.0000	MORRISTOWN WATER COMPANY	SMALL
56-002254.0000	NEW RIVER UTILITY COMPANY	LARGE
56-002194.0000	OLIVE AVENUE HOMEOWNERS ASSOC.	SMALL
57-002758.0000	ORANGEWOOD FARMS	LARGE UNTREATED
56-002028.0000	PARK SHADOWS COUNTRY HOMES	SMALL
56-002199.0000	PECOS RANCHOS ASSOCIATION	SMALL
56-002200.0000	PEEK-A-BOO WATER CO-OP	SMALL
57-002514.0000	PENINSULA DITCH COMPANY	LARGE UNTREATED
56-002031.0000	PIMA UTILITIES COMPANY	LARGE
56-002275.0000	QUAIL RUN IRRIGATION ASSOCIATION	SMALL

Provider Number	Provider Name	Provider Type
56-002204.0000	QUASS FAMILY RANCH	SMALL
56-002221.0000	QUEEN VALLEY DOMESTIC WATER IMPROVEMENT DISTRICT	SMALL
57-002760.0000	RANCHOS JARDINES IRRIGATION DISTRICT	LARGE UNTREATED
56-002035.0000	RIO VERDE UTILITIES, INC.	LARGE
57-002517.0000	ROOSEVELT IRRIGATION DISTRICT	LARGE UNTREATED
57-002518.0000	ROOSEVELT WATER CONSERVATION DISTRICT	LARGE UNTREATED
56-002263.0000	ROSE VALLEY WATER COMPANY	LARGE
56-002026.0000	SADDLE MOUNTAIN R.V. PARK	SMALL
56-002210.0000	SAGUARO ACRES COMMUNITIES FACILITIES DISTRICT	SMALL
57-002520.0000	SALT RIVER PROJECT	LARGE UNTREATED
56-002319.0000	SHANGRI LA WATER WORKS	SMALL
56-002269.0000	SOUTH RAINBOW WATER CO-OP	SMALL
56-002251.0000	STEVE MC ADAMS WATER COMPANY	SMALL
56-002214.0000	SUNBURST FARMS EAST	LARGE UNTREATED
57-002523.0000	SUNBURST FARMS IRRIGATION DISTRICT	LARGE UNTREATED
56-002215.0000	SUNBURST FARMS WEST MUTUAL WATER	LARGE UNTREATED
56-002041.0000	SUNRISE WATER COMPANY	LARGE
56-002284.0000	THUNDERBIRD ADVENTIST ACADEMY	LARGE UNTREATED
56-002339.0000	TIERRA BUENA WATER COMPANY	SMALL
56-002161.0000	TONOPAH FAMILY RESTAURANT	SMALL
56-002271.0001	TONTO HILLS DWID	SMALL
56-002006.0000	CITY OF BUCKEYE	LARGE
56-002017.0000	TOWN OF GILBERT	LARGE
56-002032.0001	TOWN OF QUEEN CREEK	LARGE/LARGE UNTREATED
56-002045.0000	TURNER RANCHES WATER & SANITATION CO.	LARGE UNTREATED
56-002046.0000	VALENCIA WATER COMPANY	LARGE
56-002047.0000	VALLEY UTILITIES WATER COMPANY	LARGE
56-002289.0000	VALLEY VIEW WATER COMPANY	SMALL
56-002288.0000	WATER UTILITY OF GREATER BUCKEYE	SMALL
56-002276.0000	WATER UTILITY OF GREATER TONOPAH, INC	SMALL
56-002347.0000	WATER UTILITY OF NORTHERN SCOTTSDALE	SMALL
56-002048.0000	WEST END WATER COMPANY	SMALL
57-002525.0000	WESTERN MEADOWS IRRIGATION DISTRICT	LARGE

Provider Number	Provider Name	Provider Type
		UNTREATED
56-002224.0000	YINGLING	SMALL

Bibliography

ADWR. (2010). *Demand and Supply Assessment 1985 - 2025, Phoenix Active Management Area.* Phoenix: ADWR.

CHAPTER SIX: INDUSTRIAL

6.1 INTRODUCTION

The Industrial Conservation Program for *the Fourth Management Plan for the Phoenix Active Management Area* (4MP) is the same as in the Third Management Plan (3MP), with the exception of the program for Large-Scale Power Plants, the addition of a conservation program for mines, a turfed acreage maximum for turf-related facilities, and an adjustment to the turf application rate. The objective of the Industrial Conservation Program is to move industrial users within the PhxAMA to the greatest level of water use efficiency economically attainable given the use of the latest available water conservation technology. The 4MP also provides incentives to encourage industrial users to replace groundwater supplies with renewable supplies. Efficient use of groundwater and the replacement of groundwater sources with renewable supplies contribute to the achievement and maintenance of the PhxAMA safe-yield goal.

6.1.1 What is an Industrial Water User?

An industrial user is a person who uses groundwater withdrawn pursuant to a Type 1 or Type 2 non-irrigation grandfathered right (GFR) or a withdrawal permit for an industrial use. For more information on industrial users, refer to the *Demand and Supply Assessment, Phoenix Active Management Area,* (2010 Assessment) (ADWR, 2010). These GFRs and permits (collectively referred to in this chapter as “industrial rights”) have annual volumetric groundwater allotments. The total volume of Type 2 GFRs in the PhxAMA was set immediately following enactment of the *1980 Groundwater Code* (Code). The total volume of water associated with Type 1 GFRs can increase over time as agricultural land with Irrigation Grandfathered Rights (IGFRs) is retired from agricultural production and the IGFRs are converted to Type 1 GFRs. However, total allowable groundwater use is reduced at the time of conversion of the IGFR to a Type 1 GFR. General Industrial Use (GIU) groundwater withdrawal permits are issued by ADWR if water service cannot be secured from a municipal provider and if the use of surface water or treated effluent, or the purchase or lease of a GFR is not economically feasible. GIU Permits expire after a specified period of years.

An industrial user may receive groundwater from an irrigation district. However, an industrial user may not receive groundwater from an irrigation district in excess of the amount it was entitled to receive on June 12, 1980 unless it has obtained a GFR or a GIU permit (A.R.S. § 45-497(B) and 45-515).

There are also groundwater users that, although served by a municipal water provider, are subject to industrial program conservation requirements through the Municipal Conservation Program. These users include turf-related facilities, public rights-of-way and large-scale cooling facilities that are not part of a large-scale power plant. These users are referred to in the Municipal Conservation Program as “individual users.”

6.1.2 Industrial Conservation Programs – History and Background

The Industrial Conservation Programs for the various sub-sectors are based on the requirement in the Code to include a conservation program for all non-irrigation uses of groundwater. Conservation requirements are based on the use of the latest commercially available conservation technology consistent with reasonable economic return. For the 4MP the Code authorizes ADWR to include additional conservation requirements for non-irrigation uses if feasible.

All ADWR management plans have included conservation requirements for industrial users. The First Management Plan (1MP) requirements stressed water use efficiency and contained other general requirements. There were specific conservation programs only for metal mines, turf-related facilities, electric power plants, sand and gravel facilities, and other industrial users. As a result of consultant studies done for the Second Management Plan (2MP), additional conservation requirements were added for dairies and cattle feedlots. In addition, there was a more specific treated effluent incentive provision for turf-related facilities. In the 3MP, separate industrial program categories were created for large-scale cooling facilities, new large landscape users, and new large industrial user subsectors. These three industrial water use groups were included in the "all industrial users" category in the 2MP but were separated out to more clearly present the water use characteristics and specific conservation requirements for the third management period. The 4MP includes the same programs that made up the 3MP Industrial Conservation Program. There are nine industrial program subsectors in the 4MP for the PhxAMA: (1) turf-related facilities, (2) sand and gravel facilities, (3) large-scale power plants, (4) large-scale cooling facilities, (5) dairy operations, (6) cattle feedlot operations, (7) new large landscape users, (8) new large industrial users, and (9) mining facilities. There are also over-arching requirements that apply in general for all industrial users, regardless of the industrial subsector category.

6.1.2.1 All Industrial Users

The PhxAMA 4MP Industrial Conservation Program includes general conservation requirements that apply to all industrial users. For those Industrial Conservation Programs where a water conservation plan was required by the 3MP, an update to that plan is required within 180 days after the industrial user receives written notice from ADWR of its 4MP conservation requirements.

6.1.2.2 Turf-related Facilities

A turf-related facility is any facility, including schools, parks, cemeteries, golf courses, or common areas within a housing subdivision, with ten or more acres of water-intensive landscaped area. Because "irrigation" is defined in the Code as water applied for the purpose of growing crops for sale or consumption, turf-related watering for recreational and aesthetic purposes is considered a non-irrigation water use rather than an irrigation use. Turf-related facilities apply water for growing turfgrass and other landscaping plants and for filling and maintaining water levels in bodies of water. Water application efficiency is determined by the type of water application system that is utilized, maintenance of the system, water application scheduling, site topography, soil type, weather conditions, and water quality.

Turf-related facilities regulated under the Industrial Conservation Program obtain groundwater pursuant to Type 1 or Type 2 non-irrigation grandfathered rights or groundwater withdrawal permits. In addition, some turf-related facilities are served groundwater by municipal water providers and also are subject to the conservation requirements set forth in this section through provisions of the Municipal Conservation Program (See Chapter 5 of this plan). These municipally served facilities are called "individual users." Beginning with 4MP, turf-related facilities are limited to a maximum of 90 acres of water-intensive landscaped area.

A comprehensive list of all permitted turf-related facilities is available upon request from ADWR.

6.1.2.3 Sand and Gravel Facilities

Regulated sand and gravel facilities are facilities that use more than 100 AF of water from any source in a calendar year. Sand and gravel facilities typically mine unconsolidated stream deposits to produce construction materials. The aggregate must be sorted according to grain size and washed to remove fine-grained particles. Aggregate washing accounts for the bulk of water use by sand and gravel producers. In addition to using water for washing, water is used for the following purposes: (1) to produce ready-mix concrete, bricks, blocks, and asphaltic concrete; (2) to control dust; (3) to wash the outside of vehicles; (4) to wash the inside of mixer drums; (5) to wash other equipment; (6) to cool equipment; (7) to cool material; and (8) for domestic purposes.

6.1.2.4 Large-scale Power Plants

ADWR regulates power plants that produce or are designed to produce more than 25 megawatts of electricity. Two types of electric power plants are regulated in the 4MP: steam electrical plants and combustion turbine plants. Steam electrical plants use cooling towers to dissipate excess heat that builds up in the steam electrical generation process. Combustion turbine plants do not use steam to generate electricity. Rather than using steam to drive a turbine, combustion turbines use compressed air. Steam electric power plants use more water than combustion turbine plants. A combined-cycle power plant uses a combination of these two methods to generate electricity. Regardless of whether the plant is a steam electric power plant, a combustion turbine plant, or a combined-cycle plant, the major consumptive use of water at electrical plants is evaporation from cooling towers. Because of the large volume of water used in towers to condense steam, conservation requirements for the electric power plants require facilities to achieve a high level of efficiency in cooling tower operation. Some large-scale power plants such as combustion turbine plants utilize cooling towers for dissipation of heat for auxiliary loads. These are regulated in this subsector, but the conservation requirements are similar to the Large-scale Cooling Facility Program.

6.1.2.5 Large-scale Cooling Facilities

Cooling towers cool water that has absorbed the heat load of a heat-generating process. Cooling towers are present at a variety of commercial, industrial, and institutional facilities. Large-scale cooling facilities are defined as facilities with an aggregate cooling capacity of at least 1,000 tons. The minimum cooling unit that is added to create the aggregate total of 1,000 tons is 250 tons in size. Most large-scale cooling facilities are served by municipal water providers. These facilities are individual users. Water providers are responsible for the individual users' compliance with industrial conservation requirements unless they have notified ADWR of the existence of the individual user as provided in section 5-610 of the Municipal Conservation Requirements (See Chapter 5 of this plan), in which case the individual user is responsible for compliance. Large-scale cooling facilities served by their own wells are regulated directly by ADWR and are responsible for complying with industrial conservation requirements.

6.1.2.6 Dairies

ADWR regulates dairy operations that annually house a monthly average of 100 or more lactating cows per day. The majority of water use at dairy operations occurs for animal drinking needs, udder washing, barn cleanup, and animal cooling.

6.1.2.7 Cattle Feedlots

ADWR regulates cattle feedlot operations that annually house and feed an average of 100 or more beef cattle per day. Water is primarily used for animal drinking and dust control.

6.1.2.8 New Large Landscape Users

New large landscape users are industrial users with substantial water-intensive landscaped areas that were planted after January 1, 1990. The conservation program differentiates between two types of large landscape users: non-residential facilities that are hotels or motels and non-residential facilities that are not hotels or motels. If the facility is not a hotel or motel, conservation requirements apply to landscapable areas in excess of 10,000 square feet. If the facility is a hotel or motel, requirements apply to landscapable areas in excess of 20,000 square feet.

If a facility has 10 or more acres of water-intensive landscaped area, it is defined as a turf-related facility and is subject to specific conservation requirements discussed in 6.7 of this chapter.

6.1.2.9 New Large Industrial Users

New large industrial users in the 4MP are industrial users that use over 100 AF per year and commence use after January 1, 2023. In the 3MP, new large industrial users were defined as industrial users that use over 100 AF of water per year and commenced use after January 1, 1990. As of April 2017, there were 36 large industrial users identified in the PhxAMA that are not industrial users subject to specific conservation requirements discussed elsewhere in this chapter.

6.1.2.10 Mining Facilities

ADWR regulates mining facilities that mine and process ores and use or have the potential to use more than 500 AF of water per year.

6.2 RELATIONSHIP OF THE INDUSTRIAL SECTOR TO ACHIEVEMENT OF THE AMA WATER MANAGEMENT GOAL

6.2.1 PhxAMA Industrial Sector Description

The industrial sector in the PhxAMA has increased more than 100 percent from 1985 to 2017 (See Figure 6-1). Total industrial water use in the PhxAMA in 1985 was 88,667 AF. By 2017, the industrial sector used more than 191,000 AF. Turf-related facilities accounted for approximately half of the industrial groundwater demand in 1985. The remaining demand was divided among large-scale power plants, sand and gravel operations, dairies, feedlots, and other uses such as cooling and manufacturing. By 2017, large-scale power plant use had increased to approximately 49 percent and turf-related facility water use decreased to 34 percent of total industrial sector water use.

In 1985, groundwater was 78 percent of the industrial sector supply in the PhxAMA (See Figure 6-2). In 2017, treated effluent made up 45 percent of industrial supply and groundwater accounted for only 49 percent of industrial supply. The increase in treated effluent use in the industrial sector is primarily due to use of treated effluent at the Palo Verde Nuclear Generating Station (PVNGS) and to a lesser extent, increased use of treated effluent by turf-related facilities.

Large-scale power plants are the predominant industrial use in the PhxAMA, due almost entirely to the demand by PVNGS. Turf-related facilities also comprise a large portion of PhxAMA industrial demand. The remainder of PhxAMA industrial demand includes use by sand and gravel facilities, dairies, and other industrial uses that do not have specific industrial subsector conservation requirements.

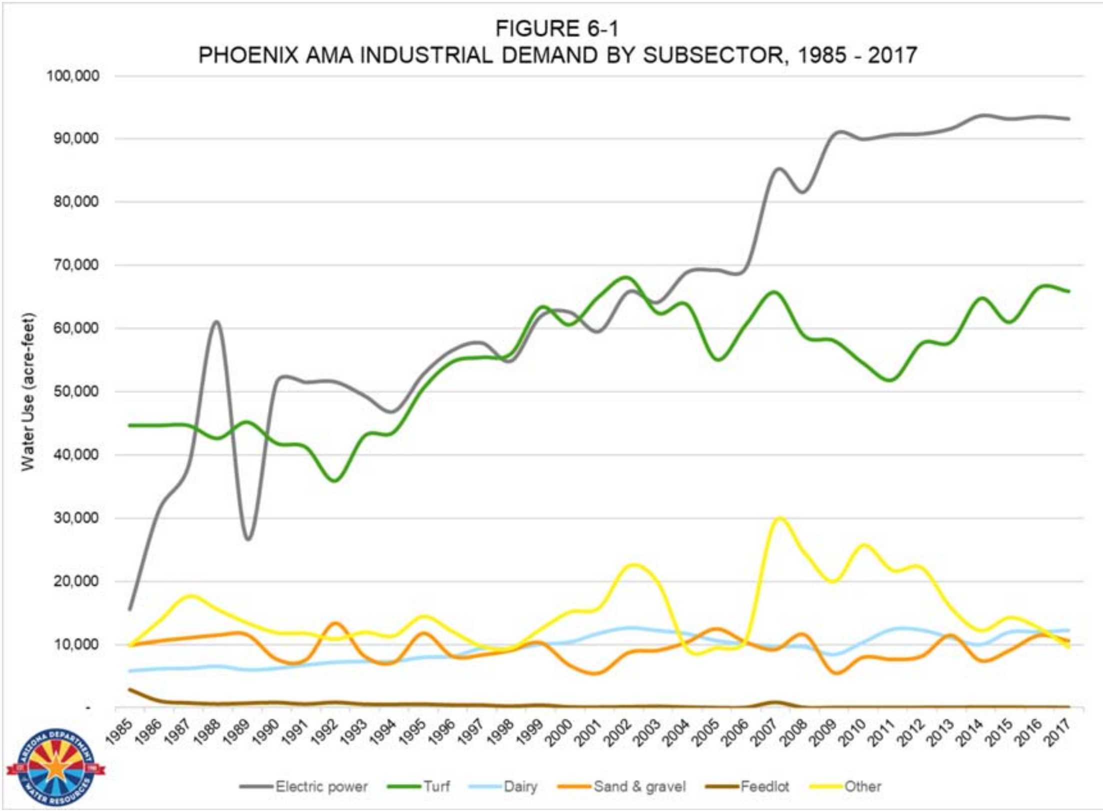
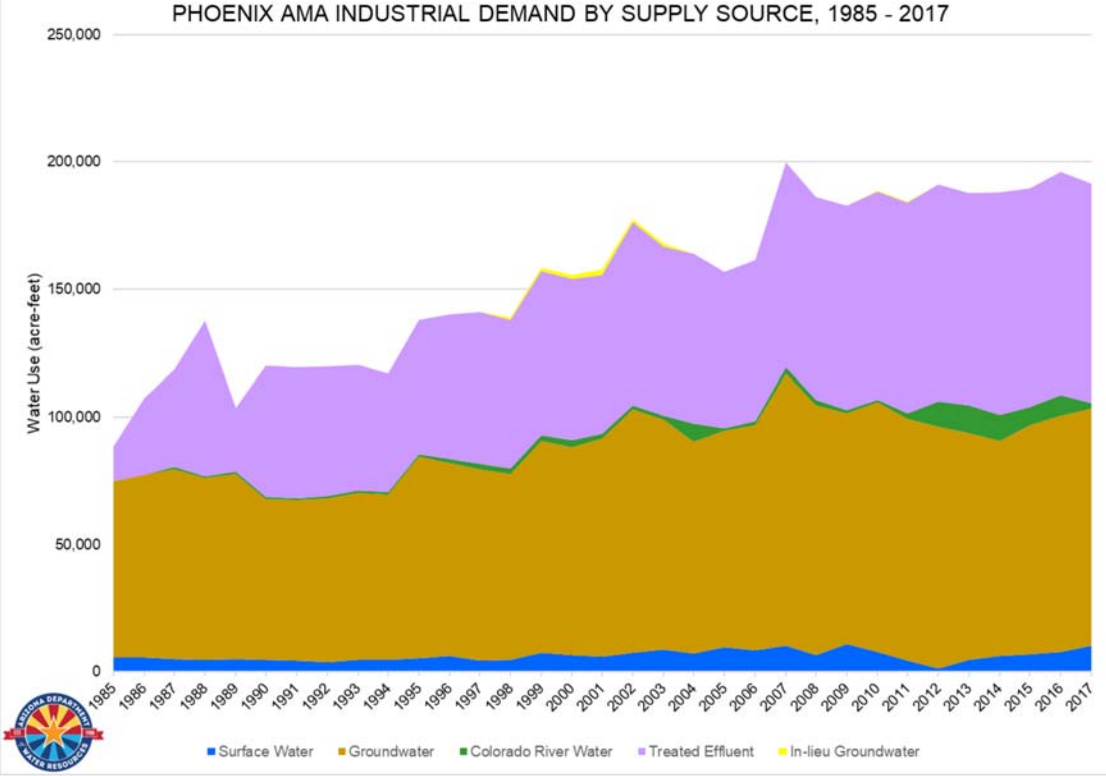


FIGURE 6-1
PHOENIX AMA INDUSTRIAL DEMAND BY SUBSECTOR, 1985 - 2017
Water Use (acre-feet)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Electric power
Turf
Dairy
Sand & gravel
Feedlot
Other

FIGURE 6-2
PHOENIX AMA INDUSTRIAL DEMAND BY SUPPLY SOURCE, 1985 - 2017



6.2.2 Industrial Water Use Profile

Table 6-1 shows the historical industrial demand by source from 1985 to 2017 in the PhxAMA. The sum of the annual water allotments for GFRs and permits also is shown in Table 6-1. Industrial allotments can increase as GFRs are retired to Type 1 GFRs. However, total allowable groundwater use is reduced at the time of conversion of the IGFR to a Type 1 GFR. The sum of the industrial allotments may decrease due to non-irrigation rights becoming inactive and developed, or through extinguishment of GFRs. As of 2017, the annual industrial demand was 84 percent of the total allotment of allowable industrial groundwater use under the Code. It also represents a potential for generation of Assured Water Supply (AWS) extinguishment credits. Under the AWS Rules, GFRs may be extinguished to generate credits that may be used to meet the consistency with goal criterion of the AWS Rules. Extinguishment of a Type 1 GFR is based on the Type 1 acres, while extinguishment of a Type 2 GFR is based on the Type 2 allotment. Extinguishment credits reduce over time based on the year 2025 minus the year the right is extinguished. Mineral extraction Type 2 GFRs and Groundwater Withdrawal Permits do not qualify for extinguishment under ADWR rules. The portion of the 2017 industrial allotment that was metal mining was 1490 AF. Historical water use in each of the industrial subsectors is shown in Table 6-2. Note that the column "Drainage & Dewatering" is not included in the Total column. For more information on drainage and dewatering uses, see the 2010 Assessment. Industrial demand projections in the PhxAMA 2010 Assessment (ADWR, 2010) ranged from 190,000 to 254,000 AF in the year 2025. In all projected scenarios in the 4MP, as in the 2010 Assessment, groundwater remains the primary water supply for the industrial sector.

TABLE 6-1
PHOENIX AMA INDUSTRIAL DEMAND & ALLOTMENT, 1985 -2017 (AF)

Year	Demand	Groundwater	In-lieu Groundwater	Surface Water	Colorado River Water	Treated Effluent	Allotment
1985	88,667	69,229	0	5,810	0	13,628	153,000
1986	107,483	71,644	0	5,810	0	30,029	201,995
1987	118,616	74,777	0	4,917	894	38,029	207,866
1988	137,761	71,330	0	4,692	853	60,886	211,721
1989	103,625	72,779	0	4,975	905	24,966	203,670
1990	119,927	63,250	0	4,607	838	51,232	212,351
1991	119,414	62,863	0	4,538	825	51,188	209,622
1992	119,810	64,322	0	3,954	719	50,816	218,781
1993	120,346	65,682	0	4,734	861	49,069	215,479
1994	116,963	65,012	0	4,803	873	46,274	216,054
1995	138,007	79,069	0	5,504	828	52,606	216,614
1996	140,034	75,751	0	6,183	1,574	56,526	199,939
1997	140,989	74,920	0	4,549	2,367	59,152	198,250
1998	138,939	72,793	822	4,887	2,098	58,339	201,021
1999	158,356	83,136	1,272	7,503	2,346	64,099	207,559
2000	155,452	81,703	1,546	6,658	2,717	62,828	212,459
2001	157,782	85,663	2,117	5,842	1,960	62,199	227,212
2002	177,676	95,509	1,444	7,664	1,324	71,735	236,440
2003	167,841	90,104	1,160	8,879	1,603	66,095	244,094
2004	164,069	82,933	0	7,314	7,146	66,676	249,883
2005	156,870	84,900	0	9,788	1,041	61,141	249,695
2006	161,380	88,298	0	8,513	1,698	62,872	246,539
2007	199,769	106,637	0	10,301	2,525	80,306	244,690
2008	186,167	97,796	0	6,769	2,048	79,554	245,438
2009	182,651	90,728	0	10,830	1,071	80,022	226,068
2010	188,545	98,124	141	7,789	768	81,724	225,034
2011	184,321	94,747	197	4,487	2,255	82,635	227,261
2012	191,004	94,660	0	1,511	10,073	84,761	224,044
2013	187,852	89,114	243	4,633	10,942	82,920	224,468
2014	188,120	84,257	0	6,303	10,412	87,148	223,702
2015	189,547	89,841	0	7,020	7,096	85,590	228,712
2016	196,072	92,818	0	7,723	8,143	87,388	234,132
2017	191,482	93,057	0	10,367	2,001	86,056	228,026

6.2.2.1 Turf-Related Facilities

ADWR has identified 756 turf-related facilities in the PhxAMA, including golf courses, parks, schools, cemeteries, common areas, and other miscellaneous facilities (See Figures 6-3A, 6-3B, 6-3C). Common areas within residential subdivisions are subject to regulation as turf-related facilities if they have 10 or more acres of water-intensive landscaping. During the fourth management period, ADWR will seek to identify any additional turf-related facilities in the PhxAMA.

Total water use by all turf-related facilities in the PhxAMA was approximately 149,000 AF in 2017. There are 496 of these facilities that received all or a portion of their water from municipal providers, some of which were classified as individual users. Their use is included in the water demand for the municipal sector. The remaining 261 turf-related facilities were industrial users that were either in existence before the Code and use Type 2 rights or were developed after the Code on retired agricultural land using Type 1 rights. This industrial subsector has grown from using approximately 44,697 AF of water in 1985 to 65,892 AF of water in 2017.

In 2017, there were 174 active golf courses in the PhxAMA: 94 were industrial users, while the other 80 (some of which were categorized as individual users) were served by municipal water providers. Golf courses in the PhxAMA used about 99,500 AF of water in 2017. Approximately 47 percent of this use was groundwater; the balance of the use was comprised of direct use treated effluent, recovered treated effluent, surface water, Colorado River water and recovered Colorado River water. Turf-related facilities that use any groundwater, regardless of whether they are industrial users or served by a municipal provider, must comply with a maximum annual water allotment based on the size and age of the facility.

6.2.2.2 Sand and Gravel Operations

Sand and gravel facilities in the PhxAMA used 10,601 AF of water in 2017. Sand and gravel demand peaked in 1992 at 13,392 AF. In 2017, there were 43 active sand and gravel operations in the PhxAMA. Water in this subsector is primarily used to wash aggregate before sale; a small amount is used to clean trucks and equipment. Increases in sand and gravel production and associated water use are closely tied to population growth and urbanization. Sand and gravel operations in the PhxAMA have historically relied solely on groundwater.

6.2.2.3 Large-scale Power Plants

There are 10 large-scale power plants located in the PhxAMA. However, three of these plants are neither combustion turbine, steam electric, nor combined-cycle plants, and are not regulated under this subsector. The names and megawatts (MW) of total power generating capacity for the plants ADWR regulates are as follows: Palo Verde – 3,937 MW; Santan – 1,227 MW; Red Hawk – 934 MW; West Phoenix – 932 MW; Agua Fria – 626 MW; Mesquite Block 2 – 595 MW; Mesquite Block 1 – 595 MW; Arlington Valley Energy Facility – 580 MW; Kyrene – 525 MW; Ocotillo – 321 MW. Total water demand for the large-scale power plant subsector in the PhxAMA was 15,568 AF in 1985 and 93,205 AF in 2017. This subsector has grown from approximately 18 percent of the total industrial demand in 1985 to 49 percent in 2017. A large portion of this water (more than 73,000 AF in 2017) is used by the PVNGS, the nation's largest nuclear power plant. The primary consumptive use of water at a thermal power plant is evaporation in the cooling towers. In 2017, 97 percent of the water used by the PVNGS was treated effluent. The Kyrene and San Tan plants utilize Colorado River water in addition to groundwater. Since the year 2003, the large-scale power plant sub-category of industrial users has comprised a greater share of the industrial sector than turf-related facilities.

6.2.2.4 Dairies

Dairies accounted for approximately seven percent of the PhxAMA's total industrial water demand in 1985. In 2017, there were 54 active dairies in the PhxAMA, and water use was 12,206 AF. The highest dairy demand during the historical period was 12,569 AF which occurred in 2002. Some dairies have relocated from the Pinal AMA to the PhxAMA in recent years. Dairies in the PhxAMA have historically relied on groundwater.

6.2.2.5 Feedlots

In 1985, feedlots accounted for approximately three percent of the PhxAMA total industrial water demand. By 2017, the demand had decreased to 41 AF. Feedlots in the PhxAMA have historically relied on groundwater.

6.2.2.6 Other Industrial Users

Other industrial users in the PhxAMA used 9,537 AF of water in 2017, which accounts for approximately five percent of the total groundwater withdrawals by industrial users in the PhxAMA. Many different types of commercial and manufacturing uses are included in this category. The largest volume of water is used in the aerospace, food processing, electronics, hospital, and non-durable goods manufacturing industries. Water uses commonly include cooling; landscaping; and sanitary, kitchen, and industrial processing.

In the Phoenix AMA, 346 water rights and permits are associated with this category. The total annual groundwater allotment of rights and permits associated with this category, excluding dewatering and poor-quality water permits, is nearly 72,000 acre-feet. The right or permit in this category with the largest allotment is owned by Arizona Game and Fish. It is a restricted Type 2 non-irrigation right with an allotment of 3,558 acre-feet. It is used to support wildlife habitat in the Arlington, Mumme Farms and Robbins Butte area, and it cannot be leased, sold or conveyed for another use or to another entity.

FIGURE 6-3(A)
INDUSTRIAL FACILITIES BY SUBSECTOR IN THE PHOENIX AMA

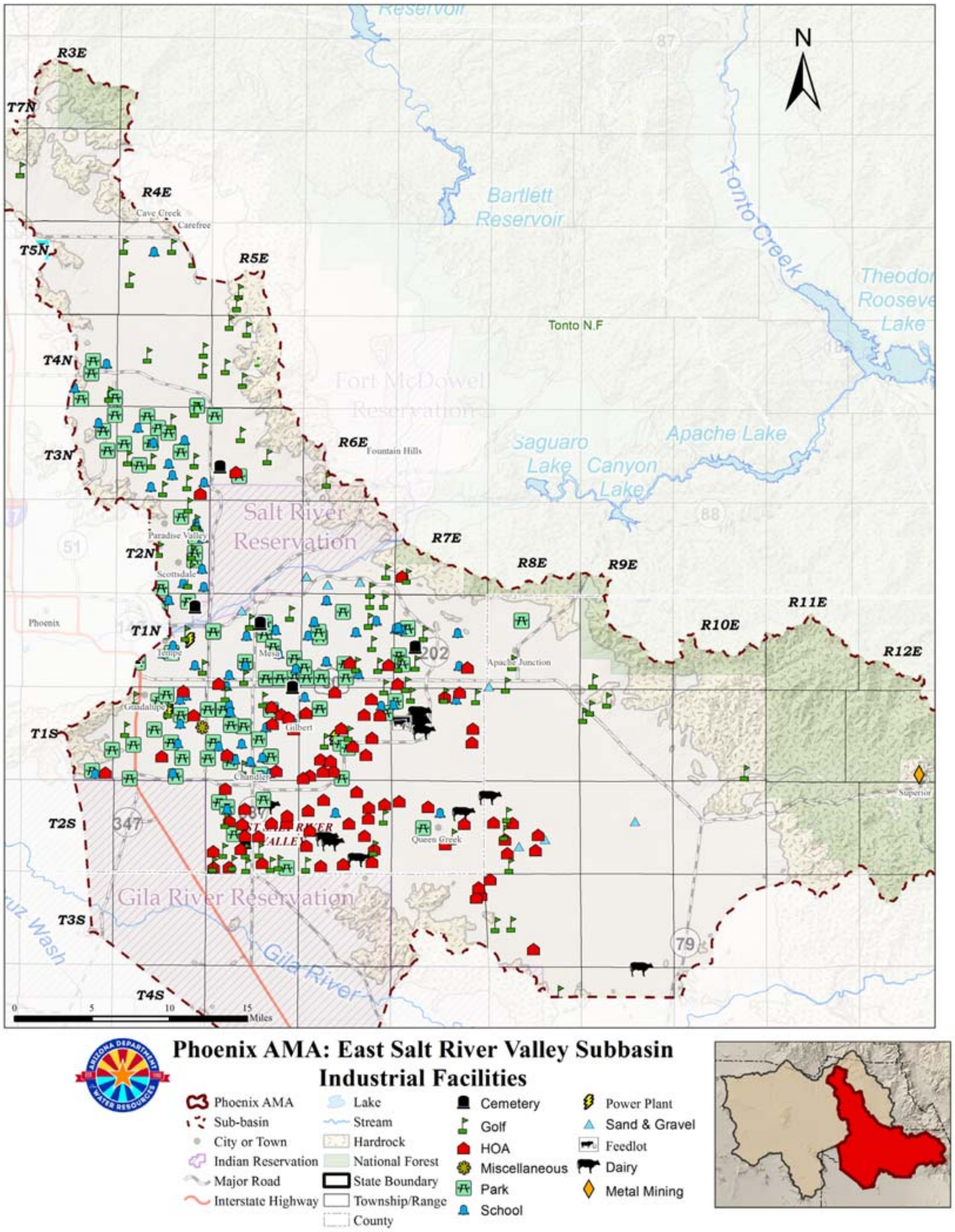


FIGURE 6-3(B)
INDUSTRIAL FACILITIES BY SUBSECTOR IN THE PHOENIX AMA

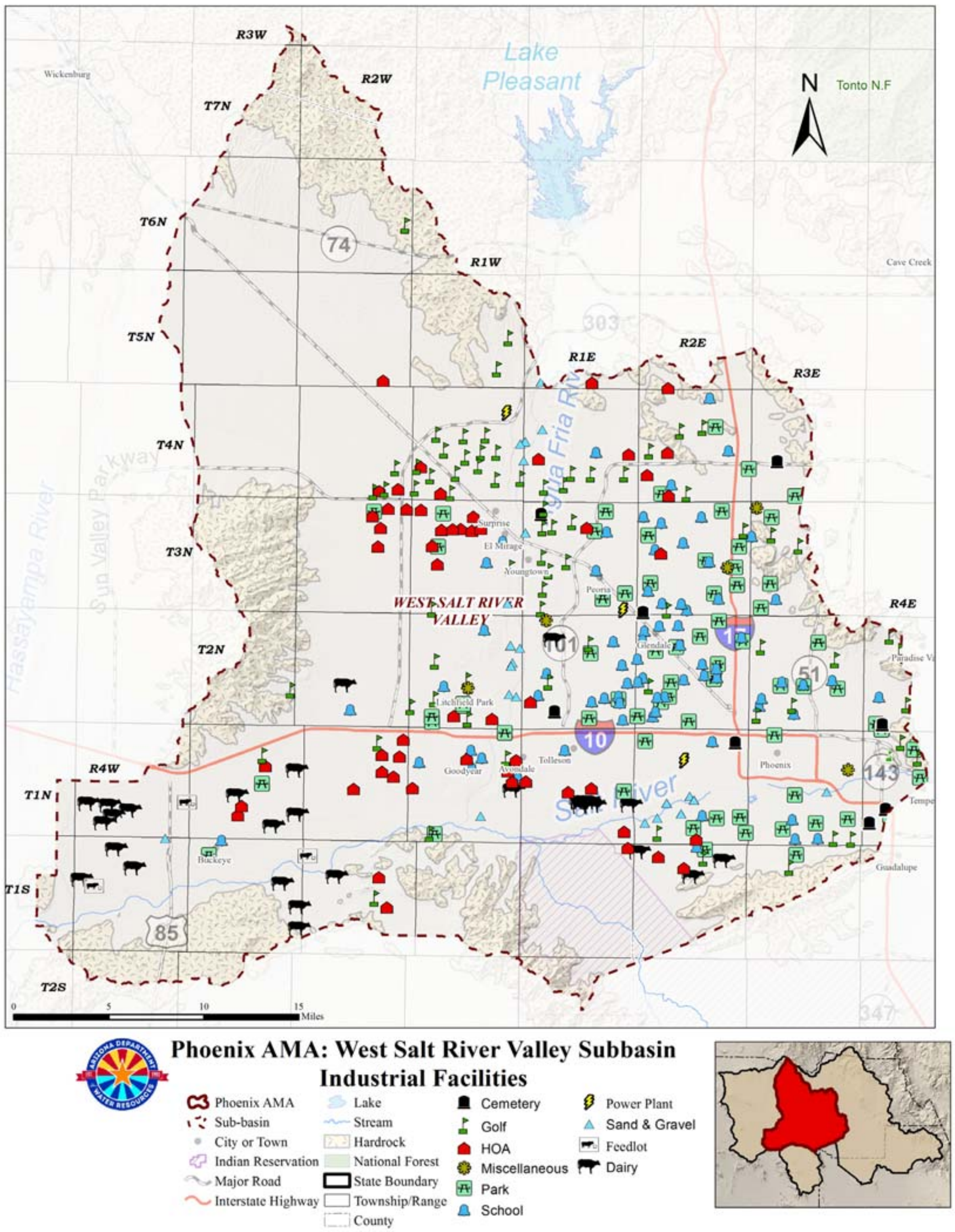


FIGURE 6-3(C)
INDUSTRIAL FACILITIES BY SUBSECTOR IN THE PHOENIX AMA

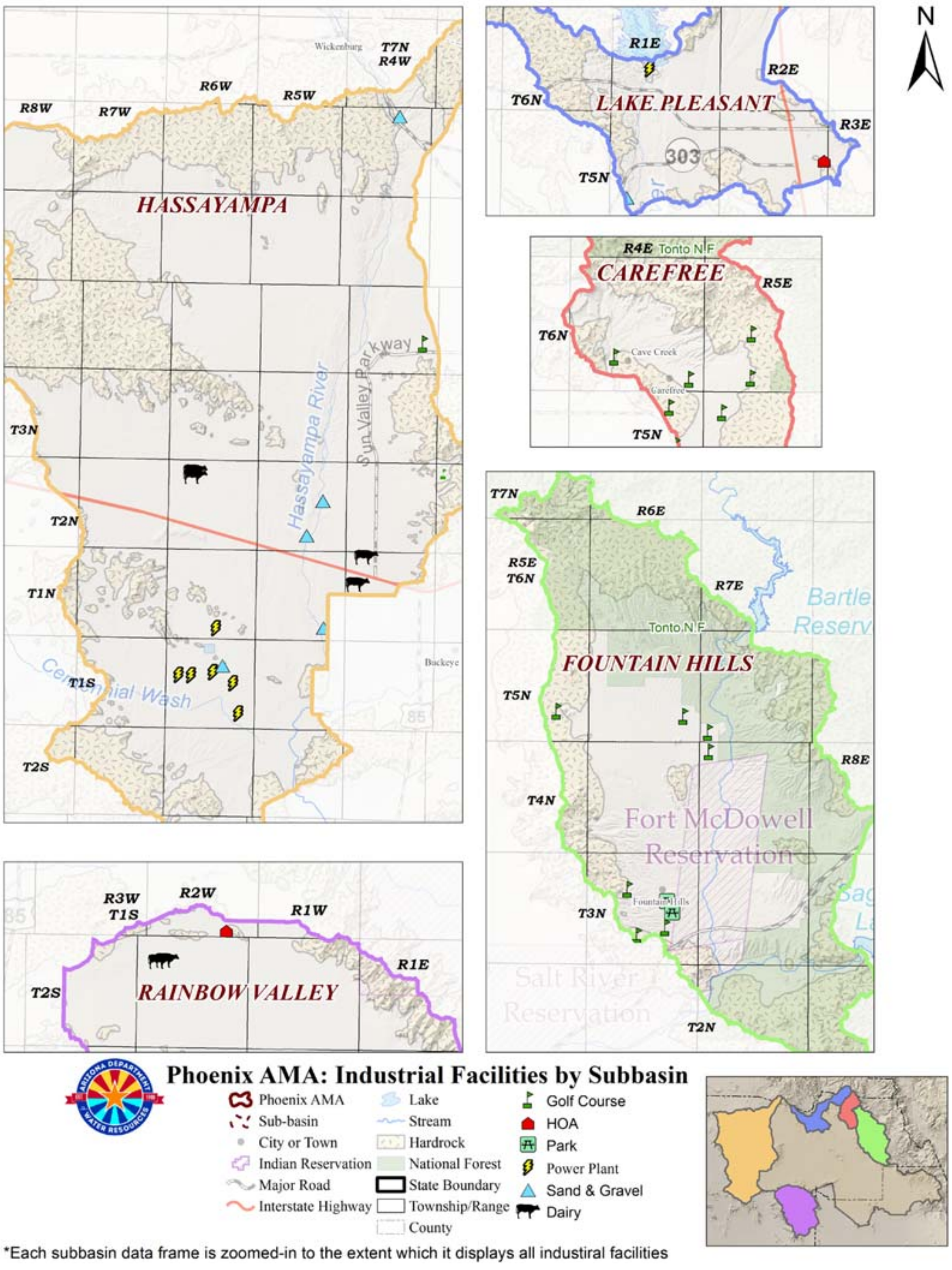


TABLE 6-2
PHOENIX AMA HISTORICAL INDUSTRIAL DEMAND BY SUBSECTOR
1985 – 2017 (AF)

Year	Total	Sand & gravel	Turf	Electric power	Dairy	Feedlot	Other	Drainage & Dewatering
1985	88,667	9,895	44,697	15,568	5,858	2,887	9,763	39,815
1986	107,483	10,582	44,697	31,290	6,197	1,104	13,614	23,940
1987	118,616	11,063	44,697	38,246	6,256	784	17,570	37,753
1988	137,761	11,511	42,653	60,940	6,595	612	15,450	30,757
1989	103,625	11,564	45,231	26,715	6,018	739	13,359	24,146
1990	119,927	7,701	41,881	51,428	6,262	855	11,799	24,492
1991	119,414	7,587	41,255	51,489	6,786	601	11,695	23,056
1992	119,810	13,392	35,942	51,572	7,230	876	10,798	36,875
1993	120,346	8,177	43,040	49,368	7,331	572	11,858	33,500
1994	116,963	7,193	43,668	46,896	7,349	552	11,305	30,591
1995	138,007	11,792	50,534	52,731	7,990	584	14,376	28,205
1996	140,034	8,141	54,757	56,572	8,119	454	11,990	20,966
1997	140,989	8,359	55,457	57,728	9,363	450	9,632	13,652
1998	138,939	9,093	56,057	54,890	9,277	262	9,361	13,994
1999	158,356	10,302	63,338	61,930	10,012	433	12,341	18,893
2000	155,452	6,707	60,613	62,589	10,352	142	15,049	30,536
2001	157,782	5,498	65,121	59,565	11,721	118	15,758	14,325
2002	177,676	8,730	68,028	65,824	12,569	169	22,355	15,929
2003	167,841	9,075	62,469	64,165	12,144	229	19,760	18,836
2004	164,069	10,418	63,757	68,932	11,643	112	9,207	28,210
2005	156,870	12,495	55,110	69,272	10,568	32	9,393	23,095
2006	161,380	10,401	60,632	69,584	10,080	58	10,624	22,072
2007	199,769	9,209	65,741	84,892	9,646	882	29,399	38,610
2008	186,167	11,571	58,805	81,679	9,625	41	24,446	29,261
2009	182,651	5,563	58,103	90,673	8,402	40	19,870	24,969
2010	188,545	8,010	54,533	89,985	10,320	53	25,644	21,534
2011	184,321	7,656	51,907	90,708	12,345	47	21,658	18,716
2012	191,004	8,181	57,669	90,814	12,218	59	22,063	27,408
2013	187,852	11,479	57,930	91,665	11,004	76	15,699	93,824
2014	188,120	7,466	64,765	93,701	9,947	104	12,137	25,272
2015	189,547	9,112	61,024	93,184	11,931	96	14,201	30,839
2016	196,071	11,468	66,507	93,562	11,919	84	12,531	20,258
2017	191,483	10,601	65,892	93,205	12,206	41	9,537	28,611

6.3 INDUSTRIAL CONSERVATION PROGRAMS DESCRIPTION

6.3.1 All Industrial Users Conservation Program Description

The conservation requirements in this section apply to all industrial water users. In addition to these requirements, certain industrial users also are required to comply with conservation requirements specific to their type of water use explained in more detail under other sections of this chapter. For example, a sand and gravel facility is required to comply with the requirement in this section to use plants from the ADWR Low Water Use/Drought Tolerant Plan List for the PhxAMA (See https://new.azwater.gov/conservation/landscaping) for any landscaping at the facility, if applicable; and, in addition, must comply with the conservation requirements specific to sand and gravel facilities detailed in Section 6.8 of this chapter.

The following industrial users are required to comply with the conservation requirements for all industrial users in this section, as well as conservation requirements for their specific type of water use in other sections of this chapter: turf-related facilities, sand and gravel facilities, large-scale power plants, large-scale cooling facilities, dairy operations, cattle feedlot operations, new large landscape users, new large industrial users, and metal mining facilities. All remaining industrial users are referred to in this section as “other industrial users” and are required to comply only with the conservation requirements for all industrial users in this section.

The PhxAMA 4MP conservation program for all industrial users is similar to the 3MP program. All industrial users are required to avoid waste and to make diligent efforts to recycle water. Single-pass cooling or heating is not allowed unless the water is otherwise reused.

Industrial users that are not regulated as turf-related facilities or new large landscape users are required to use plants listed on the ADWR Low Water Use/Drought Tolerant Plant List for the PhxAMA for landscaping where feasible, and water with efficient irrigation systems. Improving irrigation efficiency can be a source of major water savings whether the plants have high or low water needs. ADWR encourages all facilities to irrigate efficiently regardless of the type of vegetation planted. In addition, since Jan. 1, 2002, industrial users have been prohibited from serving groundwater to vegetation planted in a public right-of-way on or after Jan. 1, 2002 unless the plants are on the ADWR Low Water Use/Drought Tolerant Plant List for the PhxAMA. Industrial users have also been prohibited from serving groundwater to a water feature in the right-of-way if installed after Jan. 1, 2002.

6.3.2 Turf-related Facility Program Description

6.3.2.1 Maximum Annual Water Allotment

Base Allotment

The core of the conservation program for turf-related facilities is the maximum annual water allotment. The allotment is calculated differently for different types of facilities, but there is a direct relationship between the number of acres to which water is applied and the volume of the allotment. The total acreage of turf, low water-use landscaped area and water surface area is multiplied by an acre-foot per acre (AF/acre) rate to determine the allotment.

Allotments for turf-related facilities, other than golf courses, are calculated by multiplying acreage by the appropriate application rates shown in Table 6-703-1. The approach used for these facilities allows for the expansion of landscaped area within specific limits.

In developing the water allotment formula for golf courses, ADWR recognized that the latest conservation technology includes course design that concentrates water-intensive landscaping into areas that come into play and water management practices that adjust water application schedules for weather conditions and seasons of highest play. For pre-1985 golf courses, the allotment is based on the highest number of landscaped and water surface areas in existence at the facility between 1980 and 1984. Post-1984 golf course allotments are capped or restricted by limiting the number of landscaped acres and the water surface area for which an allotment is given. The purpose of the cap is to encourage efficient design, construction, water application, and overseeding practices.

In response to advisory committee concerns regarding the need for design flexibility of regulation courses, ADWR developed separate allotment calculation methods for championship length (regulation) and non-championship length (non-regulation) golf courses. The allotment calculations for pre-1985 non-regulation and regulation length courses are shown in Tables 6-704-1 and 6-704-2, respectively, and for post-1984 non-regulation and regulation length courses in Tables 6-705-1 and 6-705-2, respectively. Pre-1985 and post-1984 golf courses may expand or develop any number of water-intensive landscaped acres. However, water use must not exceed the maximum annual water allotment, which assumes acreage restrictions. Although the allotment is calculated on a per-acre basis, the facility manager has discretion on how to use the allotment within the facility.

Allotments for pre-1985 golf courses are calculated based on acres of historic turf, water surface area, and low water use landscaping. The first five acres per golf hole are referred to as “planted acres” and may include low water use landscaped acres if there are less than five acres of turf per hole. The application rate for “planted acres” is calculated using a baseline of 4.75 AF per acre, with the rate increasing on a curve as the acres per hole decreases (see section 6-704). Historic turf and historic low water use landscaping (acres in existence from 1980 through 1984) in excess of planted acres receive lower application rates. Any additions to existing regulation golf courses also are considered to be part of existing golf courses, but will receive still lower application rates. For the allotment in addition to the planted acres, existing championship golf courses may receive a maximum of five AF per hole or the full allotment for only the historic acres, whichever is greater.

Post-1984 golf course allotments are calculated similarly to pre-1985 golf courses, but with several differences. Post-1984 non-regulation length courses do not receive an allotment for turf or low water use landscaped acres in excess of planted acres. Post-1984 regulation golf courses receive an application rate for historic turf acres and historic low water use landscaped area (acres in existence from 1985 through 1989) not included in planted acres. However, the application rate is lower for historic turf than the application rate for historic turf acres within a pre-1985 golf course.

For pre-1985 golf courses, the allotment for water surface area is based on the highest number of water surface acres in existence from 1980 through 1984. The allotment for water surface area within any expanded portion of a pre-1985 golf course is capped at an amount calculated by multiplying the application rate of 6.2 AF per acre by 0.14 acre per hole. For post-1984 golf courses, the allotment for water surface area is based on the highest number of water surface acres in existence within the facility from 1985 to 1989 that were entitled to an allotment under the First Management Plan or an amount calculated by multiplying the application rate of 6.2 AF per acre by 0.14 acre per hole, whichever is greater. Allotments for bodies of water entirely filled and refilled with direct use treated effluent or treated effluent recovered within the area of impact are not included in the 0.14 surface acres per hole cap.

Allotment Additions

Under certain circumstances, a turf-related facility is entitled to an addition to its base allotment. In some cases, the allotment addition is effective only for one year; in other cases, the allotment addition is effective for a longer period. The following sections describe allotment additions allowed in the 4MP.

<u>Allotment Addition for the Establishment of Newly Turfed Area</u>

An allotment addition is given to turf-related facilities for the establishment of newly planted turf. The allotment addition is 1.0 acre-foot per acre of newly turfed area and is limited to the calendar year in which the turf is planted. For golf courses, the allotment addition is limited to an amount calculated by multiplying the number of holes present within the newly turfed area by five AF of water.

Allotment Addition for Revegetation
A revegetation allotment addition is available to facilities that want to establish low-water use or other site-adapted landscaping plants which will need only temporary supplemental water application after construction of a new or renovated facility. This allotment addition of up to 1.5 AF per acre for up to a maximum of three calendar years is quantified and granted on an individual basis through an application process. The quantity and duration of the allotment adjustment is determined through ADWR's evaluation of each application. This adjustment is separate from the low water use landscaping component included in the maximum annual water allotment calculation and is not included in the allotment cap for new landscaped areas within golf courses.

Allotment Addition for Filling Bodies of Water
New turf-related facilities receive a one-time allotment addition to fill bodies of water used within the facility. The allotment addition is equal to the volume used for initial filling of the body of water and is given only for the year in which the body of water is filled. Any facility may also apply for an allotment addition to refill a body of water which has been emptied for maintenance work to eliminate or reduce seepage losses. The allotment addition may be given only for the year in which the body of water is refilled.

Allotment Addition for Leaching
When high levels of total dissolved solids are present in the water supply, a turf-related facility may need an additional amount of water for leaching, or deep percolation, to prevent salts from accumulating in the root zone. If salts accumulate in the soil, salinity may eventually reach levels toxic to turfgrass. If a facility's water supply has a concentration of 1,000 milligrams per liter of total dissolved solids (approximately 1.5 millimhos per centimeter of electrical conductivity) or greater, the turf-related- facility may apply to ADWR for an allotment addition for leaching.

6.3.2.2 Additional Conservation Requirements

All turf-related facilities are required to submit an update to their water-conservation plan by Jan. 1, 2023 or within 180 days after notification of the conservation requirements, whichever is later. The plan update must outline the water-management practices and technologies the facility will utilize to maximize water- use efficiency.

Turf-related facilities that are schools, parks, or common areas are required to design, construct, and maintain grounds in a manner that will minimize water-intensive landscaped areas consistent with reasonable use and enjoyment of the facility. Golf courses have a capped maximum annual allotment which assumes water-efficient design and management.

A turf-related facility that is a cemetery must limit the water-intensive landscaped area within any portion of the cemetery that was neither in operation as of December 31, 1984 nor substantially commenced as of December 31, 1984 so that no more than 75 percent of the total cemetery operating area is landscaped with plants not listed on the ADWR Low Water Use/Drought Tolerant Plan List for the PhxAMA (See https://new.azwater.gov/conservation/landscaping). This restriction does not apply to an expansion of a cemetery onto contiguous land that was under the same ownership as the cemetery as of December 31, 1984.

Beginning with the 4MP, new turf-related facilities that are not cemeteries will be limited to a maximum area of 90 acres or to five acres per hole of water-intensive landscaping. There are four existing turf-related facilities in the PhxAMA over the 90-acre limit. These facilities will not be impacted.

6.3.2.3 Treated Effluent Use Adjustment

In the PhxAMA, treated effluent is the only water supply that is expected to increase in availability throughout the 4MP. Treated effluent's relatively high nutrient content makes it an excellent supply for turf-related watering, as long as the nutrient load is carefully matched to plant needs and over-application of potential groundwater pollutants is avoided. Despite the availability and suitability of treated effluent for turf watering, treated effluent is currently underutilized as a source of water for turf-related facilities.

To encourage the maximum use of treated effluent on turf-related facilities during the fourth management period, ADWR has maintained the treated effluent incentive that was included in the 3MP. While the maximum annual water allotment does not change under this incentive, each acre foot of treated effluent used will be counted as 0.6 AF when compliance with the maximum annual water allotment is determined. This adjustment does not apply to treated effluent stored in a storage facility pursuant to a water-storage permit that is recovered outside the area of impact of the stored water.

6.3.2.4 Flexibility Account

In order to compensate for fluctuating weather conditions, each turf-related facility will have a flexibility account with credit and debit limits. In wetter years or through careful management, facilities will be able to accrue a credit balance up to 20 percent of a facility's annual allotment. When weather conditions or water management decisions cause a facility's water use to exceed its allotment in any year, accrued credits are expended. If all credits are exhausted, a facility may accrue a debit balance up to 20 percent of the allotment. A violation will occur only when all credits have been exhausted and the debit maximum is exceeded. Prudent facility managers will take advantage of wet years and the latest conservation technologies to accumulate as many credits as allowed in order to compensate fluctuations in water demand during hot or dry years.

6.3.2.5 Monitoring and Reporting Requirements

The conservation requirements for the fourth management period include monitoring and reporting requirements for all turf-related facilities. All turf-related facility water use will be assumed to be for landscape watering purposes unless other water uses are metered separately. For example, if water for domestic uses at a park is not metered, it will count against the facility's allotment. This provision encourages facilities to install enough meters to ensure that turf-related watering is accurately reported.

6.3.3 Sand and Gravel Facility Program Description

The provisions in the 4MP for the Sand and Gravel Facility Program have not changed from those contained in the 3MP. The 4MP includes requirements for recycling wash water to improve water use efficiency, which can be applied by all sand and gravel operations. In addition to recycling wash water, sand and gravel facility operators must implement two additional conservation measures, included in the sand and gravel best management practices (BMP) program. There are two general BMP categories; one related to water used for dust control, and the other related to cleanup activities. The facility operator must choose the conservation measure to be implemented in each category from a list of approved measures. The measures chosen must be the most appropriate for the facility for the fourth management period.

As in the 3MP, sand and gravel operators will be required to evaluate specific water-saving methods and submit a conservation plan to ADWR during the fourth management period. The conservation plan must be submitted to the Director within 180 days after notification of the conservation requirements. The requirement to submit a conservation plan is carried over from the 3MP.

Implementation of water conservation practices or technologies can result in reduced costs which can lead to increased profits. Sand and gravel facility operators will analyze conservation methods to identify those that will result in a positive economic return. Operators will be required to perform an economic feasibility analysis of three potential conservation practices: disposal pond surface area reduction, use of clarifiers, and the use of an alternative water supply to groundwater. The following potential costs and savings must be analyzed in the economic feasibility analysis:

- Labor (including planning, construction, operation, maintenance, and management time)
- Equipment (values amortized over the projected life of the equipment)
- Land value (including value of mineral reserves)
- Water costs (including pumping costs, well maintenance, and withdrawal taxes)
- Costs for chemicals and raw materials
- Fuel or energy costs
- Industrial wastewater disposal costs
- Changes in revenue caused by changing production rate, minimizing "down-time," or increasing the size of reserves
- Costs associated with regulatory permitting

6.3.4 Large-scale Power Plant Program Description

6.3.4.1 Steam Electric and Combined-Cycle Power Plants

The 4MP requires steam electric and combined-cycle power plants to achieve an annual average of 15 cycles of concentration in cooling towers. The cycles of concentration requirement applies only when cooling towers are dissipating heat created during the generation of electricity. In addition to achieving 15 cycles of concentration, facilities must divert the maximum possible volume of on-site wastewater (other than blowdown water and sanitary wastewater) to the cooling process so long as this steam does not have a negative impact on the cycles of concentration or any other environmental requirement.

Facilities may be granted adjustments to their full cycles of concentration requirements in cases where, due to the quality of recirculating water, adhering to the 15 cycles of concentration standard is likely to result in equipment damage or blowdown water exceeding environmental discharge standards. Cooling towers at power plants are exempted from cycles of concentration requirements during the first 12 months in which treated effluent constitutes more than 50 percent of tower water supply. After this period, facilities may request an adjustment to full cycles of concentration requirements for treated effluent-served towers based on the water quality of the treated effluent supply.

Facilities may apply to the Director to use alternative conservation technologies in place of achieving 15 cycles of concentration if the use of the proposed alternative technologies will result in equal or greater water savings. Facilities may also request a waiver from conservation requirements on the basis that cooling tower blowdown water is completely reused. Facilities must periodically measure and annually report blowdown water volumes, make-up water volumes, and the chemical concentration of blowdown and make-up water. In addition, facilities must report the amount of electricity generated, periods when they are not generating electricity, and the volume of water used for purposes other than electric power generation.

6.3.4.2 Combustion Turbine Plants

Cooling towers associated with combustion turbine power plants with a capacity of 250 tons or more have the following requirements:

- Fully operational cooling towers with 250 tons or more of cooling capacity must achieve at least one of the following criteria in recirculating water before blowing down:
    - 120 mg/L of silica, or
    - 1,200 mg/L of total hardness, or
    - 2,400 mg/L of total dissolved solids (TDS)
- If needed, a facility may apply for an alternative blowdown standard for any towers using treated effluent. During the initial 12-month period during which 50 percent or more of the water used by a tower is treated effluent, the tower is exempt from blowdown standards;
- If needed, a facility may apply for an alternative blowdown standard for any tower if compliance with blowdown requirements would likely result in damage to cooling towers or associated equipment or exceedance of environmental discharge standards because of the accumulation of limiting constituent other than silica, total hardness, or TDS.
- Facilities must record monthly and report annually the volumes of tower make-up water and blowdown water and the concentrations of silica, total hardness, TDS, or approved alternative constituent, in both make-up water and blowdown water.

6.3.5 Large-scale Cooling Facility Program Description

The purpose of cooling tower operation is to cool water that has absorbed the heat load of a heat-generating process. Cooling towers are present at a variety of commercial, industrial, and institutional facilities. Large-scale cooling facilities are defined as facilities with an aggregate cooling capacity of a minimum of 1,000 tons. The minimum cooling unit that is added to create the aggregate total of 1,000 tons is 250 tons in size. Most large-scale cooling facilities are served by municipal water providers. These facilities are termed individual users. Water providers are responsible for the individual users' compliance with industrial conservation requirements unless they have notified ADWR of the existence of the individual user as provided in section 5-610 of the Municipal Conservation Requirements (See Chapter 5 of this plan) or ADWR has given the individual user notice of the conservation requirements, in which case the individual user is responsible for compliance. Large-scale cooling facilities served by their own wells are regulated directly by ADWR and are responsible for complying with industrial conservation requirements.

6.3.6 Dairy Program Description

6.3.6.1 Allotment-Based Requirements

The amount of water required by a dairy depends upon the number of lactating cows and non-lactating animals housed at the dairy, the breed of cow, the dairy management practices, and the type and effectiveness of the water-use technology employed. Table 6-3 summarizes daily water needs for each dairy process, assuming the use of appropriate water conservation technologies and practices.

TABLE 6-3
PHOENIX AMA WATER NEEDS AT A TYPICAL DAIRY

Operation	Water Use Allocation (gallons per day)	
	Lactating Cow	Non-Lactating Animal
Drinking needs[1]	30	15
Udder washing - based on 72 minutes/day at 8 gallons/minute; 16 cows per milking (two per group). Varies with number of milkings per day.[1]	35	0
Barn cleanup and sanitizing. Varies with number of milkings per day.[1]	20	0
Animal cooling management option, site-specific	10	0
Calf barn cleanup	0	5
Milk cooling tower (if present)	5	0
Miscellaneous	5	0
Total	**105**	**20**

[1] Assumes three milkings per day

The water needs listed are based on two assumptions: (1) milking is done three times per day per lactating animal and (2) cooling is done during the milking cycle for at least a portion of the herd.

The assumptions of Table 6-3 are the basis for the annual water allotments for dairies. When calculating the total annual allotment, lactating cows are allotted 105 gallons per animal per day (GAD) while non-lactating animals are allotted 20 GAD. The allotment is calculated annually and will vary with the monthly average of lactating cows and non-lactating animals per day present at the dairy each year.

Upon application, ADWR may approve an additional allocation of water for a dairy operation above its annual allotment if the dairy operation demonstrates that one or more of the following conditions exist:

- Milking is being done more than three times daily;
- Technologies that are designed to achieve industry health and sanitation objectives, such as the recommended pre-milking sanitation method, are being used;
- Animal cooling technologies designed to increase milk production are being used.

In consideration of weather variability, ADWR has included a three-year averaging provision in the maximum annual water allotments in the fourth management period. The water use of three consecutive years can be averaged to determine if compliance with the 4MP allotment has been achieved.

6.3.6.2 Best Management Practices Requirements

As an alternative to the annual allotment requirement, a dairy may submit an application to the Director to be regulated under the Best Management Practices Program (BMP Program). This program requires implementation of conservation and management practices to maximize efficiency in the following water use categories:

- Delivery of drinking water for dairy animals;

- Udder washing and milk parlor cleaning;
- Corral design and maintenance;
- Cleaning and sanitization milking equipment;
- Dust control, calf housing cleaning, and feed apron flushing;
- Dairy animal cooling; and
- Dairy animal feed preparation.

Implementation of all the standard BMPs listed in Appendix 6A will have a specific measurable result. While most of the standard BMPs are applicable to all dairies, the water-use activities associated with some of the standard BMPs may not exist at all dairies. If a dairy cannot implement a standard BMP, the dairy may apply to implement a substitute BMP with a specific measurable result that demonstrates a water savings equivalent to the water savings associated with the standard BMP. If a substitute BMP is not possible, the dairy may apply for a waiver of the standard BMP. The Director may grant a waiver only for the following standard BMPs: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning, and Feed Apron Flushing); (5) all of the standard BMPs in Water Use Category No. 6 (Dairy Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).

Five years after a dairy is accepted for regulation under the BMP Program, the Director will review the dairy's BMPs to determine if they are still appropriate. If the BMPs are no longer appropriate due to an expansion of the dairy or a change in management practices, the Director will require a modification to the BMPs.

6.3.7 Cattle Feedlot Program Description

For the 4MP, ADWR has not changed the Cattle Feedlot Conservation Program from the program included in the 3MP. The conservation requirements for cattle feedlot operations in the 4MP include a maximum annual water allotment for each facility based on the assumed use of specific conservation technologies.

The formula to determine a feedlot's water allotment is based on the number of gallons of water reasonably required per animal per day. To determine this amount, three components of cattle feedlot water use are considered: (1) cattle drinking water requirements, (2) dust control watering requirements, and (3) other uses. The amount of water required for each component varies with the number of cattle processed by the feedlot. Cattle drinking water requirements include water intake, water spilled while drinking, and evaporation losses from watering tanks. Drinking water requirements are estimated to be 15 GAD. Dust control watering requires approximately 10 GAD. Other uses, including water used for feed mixing, health and environmental controls, system losses, and fire protection total five GAD. Total water requirements for a cattle feedlot operation are 30 GAD. These requirements are continued for the fourth management period.

6.3.8 New Large Landscape User Program Description

In addition to the requirements that apply to all industrial users, new large landscape users must limit the percentage of water-intensive landscaped area above a specified square footage. The facility must limit its water-intensive landscaped area to the greater of the following: 1) 10,000 square feet (20,000 square feet for hotels and motels) plus twenty percent of the area in excess of 10,000 square feet (20,000 square feet for hotels and motels); or 2) the total surface area of all bodies of water within the facility that qualify as water intensive landscaped area and that are allowed under the Lakes Bill, A.R.S. § 45-131, *et seq*.

Water-intensive landscaping includes not only high-water using plants such as turf but also bodies of water such as ponds. However, it does not include any area of land watered exclusively with direct use treated effluent or treated effluent recovered within the area of impact, bodies of water used primarily for swimming, bodies of water filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact and bodies of water allowed under an interim water use permit pursuant to the Lakes Bill (See A.R.S. § 45-131 et. seq) if the body of water will be filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact after the permit expires. If 100 percent wastewater is used to water the landscape, the requirements do not apply. For example, if there is sufficient cooling tower blowdown water and grey water available from the operations of a hotel, this wastewater could be used to water any amount of water-intensive landscaped area up to 10 acres. Once a water-intensive landscaped area equals or exceeds 10 acres in size, it is defined as a turf-related facility and is subject to regulation under that program.

6.3.9 New Large Industrial User Program Description

In addition to the requirements that apply to all industrial users, new large industrial users must prepare and submit a water conservation plan to the Director. However, if the user is required to submit a conservation plan under another section of this chapter, it can combine and submit one plan.

The water conservation plan must show how much water conservation can be achieved at the facility. It must identify how water is used at the facility and what can be done to conserve it in major water use areas. The plan must also detail an employee water conservation education program at the facility and describe when conservation measures will be implemented.

6.3.10 Mining Program Description

While there are currently no facilities within the PhxAMA engaged in open-pit mining, this mining process is still common within the state. If open-pit or underground mining methods are employed during the fourth management period, the legal requirements are included within this subsection. (For more information regarding program description of the traditional mining process, refer to the Tucson AMA's 4MP.)

The 4MP requirements also include the following provisions for in-situ mining:

- Long-range conservation plan
- Minimize water use to the extent practicable
- Comply with monitoring and reporting requirements

In-situ or "in-place" mining requires only a fraction of the water needs as compared to conventional mining techniques. In the fourth management period, mines will be required to evaluate water conservation practices and technologies that may be implemented at their facility and submit these evaluations to ADWR in a long-range conservation plan.

6.4 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIAL GROUNDWATER

The PhxAMA 4MP contains incentives to increase the use of non-groundwater supplies. For example, ADWR has included a treated effluent adjustment for turf-related facilities in the management plans. When determining a turf-related facility's compliance with its maximum annual water allotment within the PhxAMA, ADWR will count each acre foot of direct use treated effluent or treated effluent recovered within the area of impact of storage that is used by the facility as 0.6 acre-foot of water. This adjustment does not apply to treated effluent recovered outside the area of impact of the stored water. In addition to the treated effluent adjustment, facilities using treated effluent may apply to ADWR for an allotment addition to allow for leaching of salts below the root zone.

Legislation was enacted in 1997 (and amended in 1999) that significantly revised the Water Quality Assurance Revolving Fund (WQARF) Program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater. This legislation provides that ADWR shall account for most uses of groundwater withdrawn pursuant to an approved remedial action project as surface water when determining compliance with management plan conservation requirements (1997 Ariz. Sess. Laws, Chapter 287, § 51(B), as amended by 1999 Ariz. Sess. Laws, Chapter 295, § 49). The criteria that must be met to qualify for this accounting are set forth in the legally enforceable provisions in Section 6-604 of this chapter, entitled: *Remedial Groundwater Accounting for Conservation Requirements*. Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes Chapter 2. More information on ADWR's involvement in the WQARF Program is provided in Chapter 7.

6.5 NON-REGULATORY EFFORTS

ADWR has a program for water management assistance in the PhxAMA. Funding for the program comes from a portion of the annual withdrawal fees levied and collected from most persons withdrawing groundwater from non-exempt wells in the PhxAMA. Since the Water Management Assistance Program (WMAP) began, the PhxAMA has funded several projects that promote prudent water management within the PhxAMA (See Chapter 9 of this plan).

6.6 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR ALL INDUSTRIAL USERS

6-601. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in this chapter shall have the following meanings:

1. *"1MP" means First Management Plan for the C.*
2. *"2MP" means Second Management Plan for the PhxAMA.*
3. *"3MP" means Third Management Plan for the PhxAMA.*
4. *"4MP" means Fourth Management Plan for the PhxAMA.*
5. *"5MP" means Fifth Management Plan for the PhxAMA.*
6. *"ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA" means the list of low water use/drought tolerant plants found on ADWR's website, https://new.azwater.gov/conservation/landscaping including any modifications to the list.*
7. *"Industrial process purposes" means water that is used by an industrial user directly in the creation or manufacture of a product.*
8. *"Industrial use" means a non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use.*
9. *"Industrial user" means a person who uses water for industrial uses.*
10. *"PhxAMA" means the Phoenix Active Management Area.*
11. *"Treated effluent" has the same definition as effluent in A.R.S. § 45-101.*
12. *"Remedial groundwater" means groundwater withdrawn pursuant to an approved remedial action project, but does not include groundwater withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03.*
13. *"Single-pass cooling and heating" means the use of water without recirculation to increase or decrease the temperature of equipment, a stored liquid, or a confined air space.*
14. *"Wastewater" means water that is discharged after an industrial or municipal use, excluding treated effluent.*

6-602. Conservation Requirements

Beginning on Jan. 1, 2023 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user shall comply with the following requirements:

1. *Avoid waste; use only the amount of water from any source, including treated effluent, reasonably required for each industrial use; and make diligent efforts to recycle water.*

2. *Do not use water for non-residential single-pass cooling or heating purposes unless the water is reused for other purposes.*

3. *Use low-flow plumbing fixtures as required by Title 45, Chapter 1, Article 12, Arizona Revised Statutes, or any applicable county or city code, whichever is more restrictive.*

4. *Use plants from the ADWR Low Water Use/Drought Tolerant Plant List for the PhxAMA for landscaping to the maximum extent feasible, and water with a water-efficient irrigation system. An industrial user regulated as a turf-related facility under sections 6-701, et seq., or as a new large landscape user under section 6-1301, et seq., is exempt from this requirement.*

5. *Do not serve or use groundwater for the purpose of watering landscaping plants planted on or after Jan. 1, 2002 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb, or shoulder which is used for travel in any ordinary mode, including pedestrian travel, unless the plants are listed on the ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA. The Director may waive this requirement upon request from the industrial user if the industrial user demonstrates to the satisfaction of the Director that plants listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA cannot grow in the publicly owned right-of-way because of high elevation or low-light conditions, such as a freeway underpass. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

6. *Do not serve or use groundwater for the purpose of maintaining water features, including fountains, waterfalls, ponds, water courses, and other artificial water structures, installed after Jan. 1, 2002 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb, or shoulder that is used for travel in any ordinary mode, including pedestrian travel. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

6-603. Monitoring and Reporting Requirements

A. Requirements

For calendar year 2023 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the 5MP, *an industrial user who uses water shall, except as provided for in subsection B below, include the following information in its annual report required by A.R.S. § 45-632:*

1. *The total quantity of water by source, including treated effluent, withdrawn, diverted, or received during the reporting year for industrial process purposes, as measured with a measuring device in accordance with ADWR's measuring device rules. A.A.C. R12-15-901, et seq.*

2. *The total quantity of water by source, including treated effluent, withdrawn, diverted, or received during the calendar year for purposes other than industrial process purposes, as measured with a measuring device in accordance with ADWR's measuring device rules. A.A.C. R12-15-901, et seq.*

3. *An estimate of the quantity of wastewater generated during the calendar year.*

4. *An estimate of the quantity of wastewater recycled during the calendar year.*

5. *A description of the primary purposes for which water from any source, including treated effluent, is used.*

6. *The number of acres of land that were planted with plants listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA during the calendar year as a result of removal of plants not on ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA. An industrial user regulated as a turf-related facility under sections 6-701, et seq., or as a new large landscape user under section 6-1301, et seq., is exempt from this requirement.*

B. Exemption

An industrial user who holds a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit in the amount of 10 or fewer AF per year is exempt from the requirements set forth in subsection A of this section, unless the industrial user holds more than one such right or permit in the aggregate amount of more than 10 AF per year and withdraws more than 10 AF of groundwater during the calendar year pursuant to those rights or permits.

C. Audits of Conservation Requirements

ADWR may elect to conduct audits of reports, records, and/or practices pursuant to the conservation requirements contained in any section or sections of this chapter. A Report of Audit must be sent to the audited person or entity of the audit pursuant to A.R.S. §§45-633(D), 880.01(D), 1061(D), and/or A.A.C. R12-15-1102(E).

6-604. Remedial Groundwater Accounting for Conservation Requirements

A. Accounting

Remedial groundwater used by a person subject to a conservation requirement established under this chapter shall be accounted for consistent with the accounting for surface water for purposes of determining the person's compliance with the *conservation requirement, subject to the provisions of subsections B through D of this section.*

A. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remedial groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the United States Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ). The annual authorized volume for a project approved prior to June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to Jan. 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The Director may modify the annual authorized volume for a remedial action project as follows:

1. *For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The Director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the Director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw groundwater in excess of the annual authorized volume to further the purpose of the project. The Director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the Director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

3. *The Director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the Director written notice of the change within 30 days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

B. Notification

To qualify for the remedial groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the Director in writing of the anticipated withdrawal of remedial groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to the withdrawal. At the time the notice is given, the person desiring the accounting must be *using remedial groundwater pursuant to the approved remedial action project or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:*

1. *A copy of a document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of remedial groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of remedial groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the remedial groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the Director.*

C. *Monitoring and Reporting Requirements*

To qualify for the remedial groundwater accounting for conservation requirements as provided in subsection A of this section, remedial groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remedial groundwater accounting for conservation requirements shall indicate in its annual report under A.R.S. § 45-632 the volume of groundwater withdrawn and used during the previous calendar year that qualifies for the accounting.

6.7 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR TURF-RELATED FACILITIES

6-701. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, and section 6-601 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-701 through 6-706 shall have the following meanings:

1. *"Additional low water use landscaped area" means:*

   a. *For a pre-1985 golf course that is a regulation golf course, low water use landscaped area that was added to the facility after Dec. 31, 1984 and that is not included in the facility's planted acres.*

   b. *For a post-1984 golf course that is a regulation golf course, low water use landscaped area that was added to the facility after Jan. 1, 1990 and that is not included in the facility's planted acres.*

2. *"Additional turf acres" means:*

a. *For a pre-1985 golf course that is a regulation golf course, turf acres that were added to the facility after Dec. 31, 1984 and that are not included in the facility's planted acres.*

b. *For a post-1984 golf course that is a regulation golf course, turf acres that were added to the facility after Jan. 1, 1990 and that are not included in the facility's planted acres.*

3. *"Body of water" means a constructed body of water or interconnected bodies of water, including a lake, pond, lagoon, or swimming pool, that has a surface area greater than 12,320 square feet when full and that is filled or refilled primarily for landscape, scenic or recreational purposes, or regulatory storage.*

4. *"Common area" means an area or areas that is owned and operated as a single integrated facility and that is used for recreational or open space purposes. A common area is maintained for the benefit of the residents of a housing development.*

5. *"Contiguous" means in contact at any point or part of the same master-planned community. Two parcels of land are contiguous even if they are separated by one or more of the following: a road, easement, or right-of-way.*

6. *"Direct use treated effluent" means treated effluent transported from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use treated effluent does not include treated effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

7. *"Golf course" means a turf-related facility used for playing golf with a minimum of nine holes and including any practice areas.*

8. *"Historic low water use landscaped area" means:*

   a. *For a pre-1985 golf course, the highest number of acres of low water use landscaped area in existence within the facility during any one calendar year from 1980 through 1984.*

   b. *For a post-1984 golf course, the highest number of acres of low water use landscaped area in existence within the facility during any one calendar year from 1985 through 1989.*

9. *"Historic total water surface area" means:*

   a. *For a pre-1985 golf course, the highest number of acres of total water surface area, excluding the surface area of any bodies of water entirely filled and refilled with effluent, which were in existence within the facility during any one calendar year from 1980 through 1984, plus the lesser of: (1) the number of acres of total water surface area, excluding the surface area of any bodies of water entirely filled and refilled with effluent, in existence within any portion of the facility that was expanded after Dec. 31, 1984 and (2) an area calculated by* *multiplying the number of holes located within any portion of the facility that was expanded after Dec. 31, 1984 by 0.14 acre per hole.*

b. *For a post-1984 golf course, the highest number of acres of total water surface area, excluding the surface area of any bodies of water entirely filled and refilled with effluent, which were in existence within the facility during any one calendar year from 1985 through 1989 and that were entitled to an allotment of water under the management plan for the first management period.*

10. *"Historic turf acres" means:*

    a. *For a pre-1985 golf course, the highest number of acres of turf acres within the facility during any one calendar year from 1980 through 1984, excluding any acres that have been removed.*

    b. *For a post-1984 golf course, the highest number of acres of turf acres within the facility during any one calendar year from 1985 through 1989, excluding any acres that have been removed.*

11. *"Hole" means a component of a golf course consisting at a minimum of a tee and a green. A practice area or driving range is not a hole.*

12. *"Landscape watering" means the application of water from any source, at a turf-related facility to a water-intensive landscaped area, a low water use landscaped area, and revegetation acres.*

13. *"Low water use landscaped area" means an area of land at least one acre in aggregate, which is located in a turf-related facility, which is watered by a permanent water application system within the landscaped area and planted primarily with plants listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA. Mature vegetation planted in a low water use landscape area must cover at least 50 percent of the area.*

14. *"Newly turfed area" means, for a calendar year, an area of land planted with a warm-season grass species that was not planted with a warm-season grass species during the preceding calendar year.*

15. *"Overseeded area" means an area of land planted during the calendar year in question with a cool-season grass species that grows over dormant warm season grasses during the fall/winter period.*

16. *"Planted acres" means the total turf acres and low water use landscaped area of a golf course, up to a maximum of five acres per hole. In determining a facility's planted acres, turf acres shall be counted first.*

17. *"Post-1984 golf course" means either of the following:*

    a. *A golf course that was neither in operation as of Dec. 31, 1984 nor substantially commenced as of Dec. 31, 1984.*

b. A golf course that was either in operation as of Dec. 31, 1984 or substantially commenced as of Dec. 31, 1984 and that was substantially modified after Dec. 31, 1984.

18. "Pre-1985 golf course" means a golf course that was either in operation as of Dec. 31, 1984 or substantially commenced as of Dec. 31, 1984 and includes any expanded portion of the golf course. If a pre-1985 golf course is substantially modified after Dec. 31, 1984, it becomes a post-1984 golf course.

19. "Treated effluent recovered within the area of impact" means treated effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored treated effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.

20. "Regulation golf course" means a golf course of at least 18 holes that is 6,200 yards or more in length per 18 holes as measured from back of the tee ground furthest from the green down the center line of the hole to the center of the green.

21. "Substantially commenced as of Dec. 31, 1984" means, with regard to the construction of a turf-related facility, that the owner or operator of the facility had obtained all pre-construction permits and approvals required by federal, state, or local governments for the facility by Dec. 31, 1984, or had made a substantial capital investment in the physical on-site construction of the facility by Dec. 31, 1984.

22. "Substantially modified" means that at least 50 percent of the water-intensive landscaped area within the turf-related facility was reconfigured.

23. "Total cemetery area" means an area of land being used for cemetery-related purposes, including any area of land covered by grave markers or by cemetery-related buildings, walks, pathways, and landscaping, but not including roads, parking lots, and any areas of land being held for future expansion of the cemetery.

24. "Total water surface area" means the total surface area of all bodies of water that are an integral part of the water-intensive landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the water-intensive landscaped area of a turf-related facility.

25. "Turf acres" means an area of land within a turf-related facility that is watered with a permanent water application system and planted primarily with plants not listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA.

26. "Turf-related facility" means any facility, including cemeteries, golf courses, parks, schools, or common areas within housing developments, with a water-intensive landscaped area of 10 or more acres.

27. "Water-intensive landscaped area" means, for a calendar year, the turf acres and the water surface acres within a turf-related facility.

6-702. Conservation Requirements for All Turf-Related Facilities

A. Maximum Annual Water Allotment

Beginning with calendar year 2023 or the first full calendar year after commencement of landscape watering, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a turf-related facility shall not withdraw, divert, or receive water for landscape watering purposes at the turf-related facility during a year in an amount that exceeds the turf-related facility's maximum annual water allotment for the year as calculated in sections 6-703 through 6-706.

B. Conservation Plan

No later than Jan. 1, 2023 or 180 days after receiving official notice of conservation requirements, whichever occurs later, an industrial user who uses water at a turf-related facility shall prepare a conservation plan for the facility that contains an accurate and detailed description of the conservation technologies, including management practices, that are applied at the facility when water is used for landscape watering purposes. The industrial user shall maintain the conservation plan until the first compliance date for any substitute requirement in the 5MP.

C. Limiting Water-Intensive Landscaped Area

1. *Beginning on Jan. 1, 2023 or upon commencement of landscape watering, whichever occurs later, and continuing until the first compliance date for any substitute requirement in the 5MP, an industrial user who uses water at a turf-related facility that is not a cemetery shall design, construct, and maintain the grounds of the facility in a manner that minimizes the water-intensive landscaped area of the facility consistent with the use of the facility. All of the facility's water-intensive landscaping shall be planted in those areas directly associated with the turf-related facility's primary purposes, and the total water-intensive landscaped area shall be limited to 90 acres, or to five acres per hole for post-1984 golf courses. Turf-related facilities with greater than 90 acres of water intensive landscape prior to January 1, 2023 are exempt from the limitation on water-intensive landscaped area but are encouraged to reduce water-intensive landscaped area.*

2. *Beginning on Jan. 1, 2023 or upon commencement of landscape watering, whichever occurs later, and continuing until the first compliance date for any substitute requirement in the 5MP, an industrial user who uses water at a turf-related facility that is a cemetery shall limit the water-intensive landscaped area within any portion of the cemetery that was neither in operation as of Dec. 31, 1984 nor substantially commenced as of Dec. 31, 1984 so that no more than 75 percent of the total cemetery area within that portion of the cemetery is planted with plants not listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA. This requirement shall not apply to any expanded portion of a cemetery in operation as of Dec. 31, 1984 or substantially commenced as of Dec. 31, 1984 if the expanded portion of the cemetery was under the same ownership as the cemetery as of Dec. 31, 1984.*

6-703. Calculation of Maximum Annual Water Allotment for Turf-Related Facilities that are not Golf Courses

For each calendar year, the maximum annual water allotment for a turf-related facility that is not a golf course shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-703-1 by the applicable application rate for each category listed in Table 6-703-1 and then adding together the products plus any allotment additions allowed under section 6-706.

TABLE 6-703-1
APPLICATION RATES FOR
TURF-RELATED FACILITIES THAT ARE NOT GOLF COURSES
From 2023 until the first compliance date for any substitute requirement in the 5MP

Type of Landscaping:	*Application rate: (acre-feet per acre per calendar year)*
1.Turf acres	*4.75*
2.Total water surface area	*6.2*
3.Low water use landscaped area	*1.5*

6-704.Calculation of Planted Acres Application Rate for Golf Courses

For all golf courses, the application rate for the planted acres shall be calculated as follows:

$$\frac{\left(\frac{23.75\ AF\ per\ Hole}{5^{x}\ Acres\ Per\ Hole}\right) * Actual\ Planted\ Acres\ Per\ Hole^{x}}{Actual\ Planted\ Acres\ Per\ Hole}$$

Where:

"Planted acres" = the total turf acres and low water use landscaped area of a golf course, up to a maximum of five acres per hole. In determining a facility's planted acres, turf acres shall be counted first.

23.75 = Maximum acre-feet per hole for planted acres, set by assuming 4.75 acre-feet per acre at 5 acres per hole

x = A rate which determines the increased return on application rate as the number of planted acres per hole decreases. For the Phoenix AMA Fourth Management Plan, x = 0.75.

6-705. Calculation of Maximum Annual Water Allotment for Pre-1985 Golf Courses

A. Pre-1985 Golf Courses that are not Regulation Golf Courses

For each calendar year, the maximum annual water allotment for a pre-1985 golf course that is not a regulation golf course shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-705-1 by the applicable application rate for each category listed in Table 6-705-1, subject to the limitations set forth in footnote 1 in that table, and then adding together the products plus any allotment additions allowed under section 6-707.

TABLE 6-705-1
APPLICATION RATES FOR PRE-1985 GOLF COURSES
THAT ARE NOT REGULATION GOLF COURSES
From 2023 until the first compliance date for any substitute requirement in the 5MP

Type of Landscaping:	*Application rate: (acre-feet per acre per calendar year)*
1. Planted acres	*See section 6-704 for calculation*
2. Historic turf acres not included in planted acres	*4.0*
3. Historic low water use landscaped area not included in planted acres	*1.5*
4. Total water surface area[1]	*6.2*

[1] In determining the number of acres of total water surface area in existence within the facility, the total surface area of all bodies of water not filled and refilled entirely with direct use effluent or effluent recovered within the area of impact shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole, or the facility's historic total water surface area, whichever is greater. For purposes of this paragraph, a body of water allowed under an interim water use permit issued pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact after the permit expires.

B. Pre-1985 Golf Courses that are Regulation Golf Courses

For each calendar year, the maximum annual water allotment for a pre-1985 golf course that is a regulation golf course shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-705-2 by the applicable application rate for each category listed in Table 6-705-2, subject to the limitations set forth in footnotes 1, 2, and 3 in that table, and then adding together the products plus any allotment additions allowed under section 6-707.

TABLE 6-705-2
APPLICATION RATES FOR PRE-1985 GOLF COURSES
THAT ARE REGULATION GOLF COURSES
From 2023 until the first compliance date for any substitute requirement in the 5MP

Type of Landscaping	***Application rate: (acre-feet per acre per calendar year)***
1. Planted acres	*See section 6-704 for calculation*
2. Historic turf acres not included in planted acres	*4.0*
3. Additional turf acres[1,2]	*3.0*
4. Historic low water use landscaped area not included in planted acres	*1.5*
5. Additional low water use landscaped area[1,2]	*1.5*
6. Total water surface area[3]	*6.2*

[1] If the sum of the allotments for the facility's historic turf acres not included in planted acres (line 2) and historic low water use landscaped area not included in planted acres (line 4) exceeds an amount calculated by multiplying the number of holes present within the facility during the year by 5 acre-feet of water per hole, the application rates for the facility's additional turf acres (line 3) and additional low water use landscaped area (line 5) shall be zero.

[2] If the sum of the allotments for the facility's historic turf acres not included in planted acres (line 2) and historic low water use landscaped area not included in planted acres (line 4) is less than an amount calculated by multiplying the number of holes present within the facility during the year by 5 acre-feet of water per hole, the total allotment for the facility's historic turf acres not included in planted acres (line 2), historic low water use landscaped area not included in planted acres (line 4), additional turf acres (line 3) and additional low water use landscaped area (line 5) shall not exceed an amount calculated by multiplying the number of holes present within the facility during the year by 5 acre-feet of water per hole.

[3] In determining the number of acres of total water surface area in existence within the facility, the total surface area of all bodies of water not filled and refilled entirely with direct use effluent or effluent recovered within the area of impact shall be limited to either an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole, or the facility's historic total water surface area, whichever is greater. For purposes of this paragraph, a body of water allowed under an interim water use permit issued pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact after the permit expires.

6-706. Calculation of Maximum Annual Water Allotment for Post-1984 Golf Courses

A. Post-1984 Golf Courses that are not Regulation Golf Courses

For each calendar year, the maximum annual water allotment for a post-1984 golf course that is not a regulation golf course shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-705-1 by the applicable application rate for each category listed in Table 6-705-1, subject to the limitations set forth in footnote 1 in that table, and then adding together the products plus any allotment additions as allowed under section 6-706.

TABLE 6-706-1
APPLICATION RATES FOR POST-1984 GOLF COURSES
THAT ARE NOT REGULATION GOLF COURSES
From 2023 until the first compliance date for any substitute requirement in the 5MP

Type of Landscaping:	***Application rate: (acre-feet per acre per calendar year)***
1. Planted acres	*See section 6-704 for calculation*
2. Historic turf acres not included in planted acres	*0.0*
3. Historic low water use landscaped area not included in planted acres	*0.0*
4. Total water surface area[1]	*6.2*

[1] In determining the number of acres of total water surface area in existence within the facility, the total surface area of all bodies of water not filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole, or the facility's historic total water surface area, whichever is greater. For purposes of this paragraph, a body of water allowed under an interim water use permit issued pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact after the permit expires.

B. Post-1984 Golf Courses that are Regulation Golf Courses

For each calendar year, the maximum annual water allotment for a post-1984 golf course that is a regulation golf course shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-706-2 by the applicable application rate for each category listed in Table 6-706-2, subject to the limitations set forth in footnotes 1 and 2 in that table, and then adding together the products plus any allotment additions allowed under section 6-707.

TABLE 6-706-2
APPLICATION RATES FOR POST-1984 GOLF COURSES THAT ARE REGULATION GOLF COURSES
From 2023 until the first compliance date for any substitute requirement in the 5MP

Type of Landscaping	*Application rate: (acre-feet per acre per calendar year)*
Planted acres	*See section 6-704 for calculation*
Historic turf acres not included in planted acres	*3.0*
Additional turf acres[1]	*3.0*
Historic low water use landscaped area not included in planted acres	*1.5*
Additional low water use landscaped area[1]	*1.5*
Total water surface area[2]	*6.2*

[1] If the sum of the allotments for the facility's historic turf acres not included in planted acres (line 2) and historic low water use landscaped area not included in planted acres (line 4) is less than an amount calculated by multiplying the number of holes present within the facility during the year by 5 acre-feet of water per hole, the total allotment for the facility's historic turf acres not included in planted acres (line 2), historic low water use landscaped area not included in planted acres (line 4), additional turf acres (line 3) and additional low water use landscaped area (line 5) shall not exceed an amount calculated by multiplying the number of holes present within the facility during the year by 5 acre-feet of water per hole.

[2] In determining the number of acres of total water surface area in existence within the facility, the total surface area of all bodies of water not filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole, or the facility's historic total water surface area, whichever is greater. For purposes of this paragraph, a body of water allowed under an interim water use permit issued pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct-use effluent or effluent recovered within the area of impact after the permit expires.

6-707. Allotment Additions

A. Newly Turfed Area Establishment Addition

For any year in which a warm-season turfgrass species is planted at a turf-related facility, the facility shall receive an allotment addition of 1.0 acre foot of water per acre of newly turfed area. For golf courses, the newly turfed area establishment addition shall not exceed an amount calculated by multiplying the number of holes present within the newly turfed area by five acre-feet of water.

B. Revegetation Addition

The owner or operator of a turf-related facility may apply to the Director for an allotment addition to revegetate areas within or around the facility after initial construction or renovation. The Director may allow up to an additional 1.5 acre-feet of water per acre for up to three years if the following conditions apply to the acres for which the revegetation addition is sought:

1. The plants that are planted are listed in ADWR's Low Water Use/Drought Tolerant Plant List for the PhxAMA, or were adapted to the site prior to construction;
2. The aggregate area to be watered exceeds one acre and has at least 50 percent vegetative cover at maturity;

3. An allotment is not provided for the revegetation area under sections 6-703, 6-705, or 6-706; and

4. All of the water applied is measured and reported as part of the total water use of the facility.

C. Body of Water Fill and Refill Addition

1. A turf-related facility shall receive a one-time body of water fill allotment addition equal to the volume of water used for the initial filling of any new body of water added after Jan. 1, 2023 within the facility. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.

2. If a body of water at a turf-related facility is drained or partially drained to allow for repairs to reduce water losses, the owner or operator of the facility may apply to the Director for an addition to the facility's maximum annual water allotment in the amount of water necessary to refill the body of water. The Director shall grant the allotment addition if the Director determines that drainage of the body of water was necessary to allow for repairs to reduce water losses. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.

D. Leaching Allotment Addition

The owner or operator of a turf-related facility may apply to the Director for an allotment addition for leaching purposes. The Director shall approve the application if the water supply used for landscape watering at the facility contains at least 1,000 milligrams per liter of total dissolved solids. If the Director approves an allotment addition for leaching purposes, the Director shall calculate the additional allotment as follows:

$$\left(\frac{1}{1 - \left(\frac{EC_w}{5EC_e - EC_w}\right)} - 1\right) \times \frac{CU}{0.85}$$

Where:

Ec_w	=	*Electrical conductivity of water used*
Ec_e	=	*Tolerance of the turfgrass species grown to the soil salinity in electrical conductivity of the soil saturation extract*
CU	=	*Consumptive use requirement for the turfgrass species*

Any allotment addition granted under this subsection shall remain in effect until the water supply used for landscape watering at the facility contains less than 1,000 milligrams per liter of total dissolved solids or until the first compliance date for the *facility's conservation requirements in the Fifth Management Plan, whichever occurs first.*

E. *Combined Allotments for Contiguous Facilities*

The maximum annual water allotments for contiguous turf-related facilities under one ownership or operation may be combined. All or a portion of the combined maximum water allotment may be applied to any part of the contiguous facilities.

F. *Nothing in this section shall be construed as authorizing use of more groundwater or surface water than may be used pursuant to any groundwater or appropriable water rights or permits associated with the use. Nor shall this section be construed as authorizing use groundwater or surface water in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-708. Compliance with Maximum Annual Water Allotment

A. *Effluent Use Adjustment*

For purposes of determining compliance with the maximum annual water allotment requirement, the Director shall count each acre foot of direct-use effluent or effluent recovered within the area of impact used at the facility for landscape watering purposes during the calendar year as 0.6 acre-foot of water.

B. *Flexibility Account*

The Director shall determine if a turf-related facility is in compliance with its maximum annual water allotment through the maintenance of a flexibility account for the facility according to the following:

1. *Beginning with calendar year 2023 or the first full calendar year after commencement of landscape watering, whichever is later, a flexibility account shall be established for a turf-related facility with a beginning balance of zero acre-feet.*

2. *Following each calendar year in which groundwater is withdrawn, diverted, or received for landscape watering purposes at the facility, the Director shall adjust the turf-related facility's flexibility account as follows:*

    a. *Subtract the total volume of water from any source, including effluent as adjusted under subsection A of this section used by the facility for landscape watering purposes during that calendar year, from the facility's maximum annual water allotment for that year.*

    b. *If the result in subparagraph a of this paragraph is positive, credit the flexibility account by this volume.*

    c. *If the result in subparagraph a of this paragraph is negative, debit the flexibility account by this volume.*

3. The account balance existing in a turf-related facility's flexibility account, after the adjustment provided for in paragraph 2 of this subsection is made, shall carry forward, subject to the following limitations:

a. The maximum positive account balance allowed in the flexibility account of a turf-related facility after any credits are registered pursuant to paragraph 2, subparagraph b of this subsection, shall be calculated by multiplying the facility's maximum annual water allotment for the calendar year for which the credits are registered by 0.2. If the account balance exceeds the maximum positive account balance after the credits are registered, the balance carried forward shall be equal to the maximum positive account balance.

b. The maximum negative account balance allowed in the flexibility account of a turf-related facility after any debits are registered pursuant to paragraph 2, subparagraph c of this subsection shall be calculated by multiplying the facility's maximum annual water allotment for which the debits are registered by -0.2. If the account balance exceeds the maximum negative account balance after the debits are registered, the balance carried forward shall be equal to the maximum negative account balance.

C. Compliance Status

If the adjustment to a turf-related facility's flexibility account at the end of a calendar year as provided for in subsection B, paragraph 2 of this section causes the account to have a negative account balance which exceeds the maximum negative account balance allowed in the flexibility account for the calendar year as calculated in subsection B, paragraph 3 of this section, the industrial users who use water at the facility are in violation of the facility's maximum annual water allotment for that calendar year in an amount equal to the difference between the facility's flexibility account balance and the maximum negative balance allowed in the facility's account for that year.

6-709. Monitoring and Reporting Requirements for Turf-Related Facilities

A. An industrial user who uses water at a turf-related facility that commences landscape watering within any new turfed acres, low water use landscaped area or water surface acres after Jan. 1, 2023 shall submit to the Director documentation of the new acres no later than 90 days after commencing of landscape watering to the new acres or receiving notice of these conservation requirements, whichever is later. The scale of the submitted documents, extent of turf acres, water surface acres, and low water use landscaped area must clearly be shown. Documentation may consist of one or more of the following:

1. As-built plans certified by a registered professional such as a civil engineer, golf course designer, or landscape architect.

2. Aerial photography at a scale no smaller than 1"=200'.

3. A survey of the facility certified by a registered professional such as a civil engineer or land surveyor.

4. Any other documentation upon approval by the Director.

B. For calendar year 2023 or the calendar year in which landscape watering commences, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the 5MP, an industrial user who uses water at a turf-related facility shall include in the annual report required by A.R.S. § 45--632 the following information:

1. The total quantity of water by source, disaggregated by source, including treated effluent, withdrawn, diverted, or received during the calendar year for landscape watering purposes at the facility, as measured with a measuring device in accordance with the Department's measuring device rules. A.A.C. R12-15-901, et seq.

2. The total amount of effluent, disaggregated by direct use treated effluent, treated effluent recovered within the area of impact and effluent recovered outside the area of impact that was withdrawn or received during the calendar year for landscape watering purposes as measured with a measuring device in accordance with ADWR's measuring device rules, A.A.C. R12-15-901, et seq.

3. The number of acres of total water surface area within the facility during the calendar year.

4. The number of acres of low water use landscaped area within the facility during the calendar year.

5. The number of acres of turf acres within the facility during the calendar year, not including newly turf area.

6. The number of acres of newly turfed area within the facility during the calendar year.

7. The number of turf acres removed within the facility during the calendar year.

8. The number of acres of total water surface area added or removed within the facility during the calendar year.

9. The number of acres of low water use landscaped area added or removed within the facility during the calendar year.

10. If the facility is a golf course, the number of planted acres within the facility during the calendar year.

11. If the facility is a golf course, the number of acres of historic turf acres not included in planted acres within the facility.

12. If the facility is a golf course, the number of acres of historic low water use landscaped area not included in planted acres within the facility.

13. If the facility is a golf course, the number of acres of historic total water surface area within the facility.

14. If the facility is a golf course, the length of the course as measured from the back of each tee ground furthest from the associated green then down the center line of the hole to the center of the green.

15. If the facility is a regulation golf course, the number of acres of any additional low water use landscaped area within the facility during the calendar year.

16. If the facility is a regulation course, the number of acres of any additional turf acres, including newly turf acres, within the facility during the calendar year.

17. The number of acres approved by the Director for a revegetation addition pursuant to section 6-707, subsection B, within the facility during the calendar year.

18. The quantity of water used to fill or refill a body of water within the facility during the calendar year for which an allotment addition is sought pursuant to section 6-703, subsection B.

19. The number of acres of overseeded area within the facility during the calendar year.

20. If the facility is a golf course, the number of holes within the facility during the calendar year.

21. If the facility is a golf course, the number of holes added within newly turf area during the calendar year.

22. An estimate of the quantity of water from any source, including treated effluent, used for each purpose other than landscape watering purposes at the facility during the calendar year. Any water used at the facility that is not measured separately from the water used for landscape watering shall be counted by the Director as water used by the facility for landscape watering for purposes of calculating the compliance with the maximum annual water allotment.

C. A single annual report may be filed for contiguous turf-related facilities that are under the same ownership or operation if the allotments for the facilities are combined pursuant to section 6-707, subsection E. The annual report shall report water use and landscaped areas of the contiguous facilities as required in subsection B in this section.

6.8 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR SAND AND GRAVEL FACILITIES

6-801. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-601 of this chapter, unless the context otherwise *requires, the following words and phrases used in sections 6-802 through 6-804 shall have the following meanings:*

1. *"Alternative water supply" means a water source other than groundwater of drinking water quality.*

2. *"Sand and gravel facility" means a facility that produces sand and gravel and that uses more than 100 AF of water from any source per calendar year. For purposes of this definition, the annual water use shall include all water used by the facility regardless of the nature of the use.*

3. *"Rock out method" means agitating rock inside concrete truck mixer drums for the purpose of cleaning excess concrete from the drums.*

4. *"Wash water" means water used for washing or sorting sand, gravel, or other aggregates.*

6-802. Conservation Requirements

A. Standard Conservation Requirements

Beginning on Jan. 1, 2023 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirements in the 5MP, an industrial user who uses water at a sand and gravel facility shall comply with the following conservation requirements:

1. *If sufficient land area for construction and operation of disposal ponds is available at a reasonable price, the industrial user shall construct disposal ponds at the sand and gravel facility. All wash water, all water used for wet scrubbers at asphalt plants, all runoff from cleanup operations and all drainage from sand and gravel piles shall be discharged or diverted into the disposal ponds unless prohibited by state or federal environmental regulations. The disposal ponds shall contain a barge pump or sump pump of sufficient capacity, together with any necessary additional equipment, to assure the maximum reclamation of the water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

2. *If sufficient land area for the construction and operation of disposal ponds is not available at a reasonable price, clarifiers shall be used at the sand and gravel facility for reclaiming wash water, all water used for wet scrubbers at asphalt plants, runoff from cleanup operations and all drainage from sand and gravel piles. The clarifiers shall be designed and operated to assure the maximum reclamation of water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

3. *At least one of the following techniques or technologies designed to reduce water use for dust control shall be implemented at the sand and gravel facility:*

    a. *The placement of binding agents on all haul roads;*

b. The paving of all haul roads;

c. The placement of recycled asphalt on all haul roads;

d. The placement of medium sized aggregate or "pea gravel" on all haul roads; or

e. A technology or technique designed to reduce water use for dust control not included in subparagraphs a through d of this paragraph that demonstrates water savings equivalent to any of the technologies or techniques listed in subparagraphs a through d, and that has been approved by the Director.

The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

4. At least one of the following techniques or technologies designed to reduce water use for cleaning shall be implemented at the sand and gravel facility:

a. Use of metered timers for truck washing and other cleanup activities;

b. Use of the "rock out method" of cleaning concrete from truck mixer drums;

c. Use of concrete set-arresting agent chemical applications to clean concrete from truck mixer drums; or

d. A technology or technique designed to reduce water use for cleaning that is not included in subparagraphs a through c of this paragraph that demonstrates water savings equivalent to any of the measures listed in subparagraphs a through c and that has been approved by the Director.

The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

B. Substitute Conservation Requirements

1. An industrial user who uses water at a sand and gravel facility may apply to the Director to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section. The Director may approve the use of substitute conservation technologies if both of the following apply:

a. The industrial user has submitted a detailed description of the proposed substitute technologies and the water savings that can be achieved by the use of those technologies, and

b. The Director determines that the proposed substitute conservation technologies will result in a water savings equal to or greater than the savings that would be achieved by the standard conservation requirements prescribed in subsection A of this section.

2. If the Director approves an industrial user's request to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section, the industrial user shall comply with the substitute *conservation technologies approved by the Director beginning on the date determined by the Director and continuing until the first compliance date for any substitute conservation requirement in the 5MP.*

C. Conservation Plan

1. *Not later than 180 days after receiving notice of these conservation requirements, an industrial user who uses water at a sand and gravel facility, including an industrial user who acquires ownership of an existing sand and gravel facility after the first compliance date of the 4MP, shall submit to the Director a plan to improve the efficiency of water use at the facility on a form provided by the Director. The plan shall analyze the economic feasibility of implementing all of the following at the facility:*

   a. *Disposal pond surface area reduction;*

   b. *The use of clarifiers for recycling water;*

   c. *Use of a renewable water supply if such a supply is available within a one mile radius of the facility.*

2. *The economic analysis must analyze the potential costs and savings associated with the following:*

   a. *Labor (including planning, construction, operation, maintenance, and management time);*
   b. *Equipment (values amortized over the projected life of the equipment);*
   c. *Land value (including value of mineral reserves);*
   d. *Water costs (including pumping costs, well maintenance, and withdrawal taxes);*
   e. *Costs for chemicals and raw materials,*
   f. *Fuel or energy costs;*
   g. *Industrial wastewater disposal costs;*
   h. *Changes in revenue caused by changing production rate, minimizing “down-time” or increasing the size of reserves;*
   i. *Regulatory permitting costs.*

6-803. Monitoring and Reporting Requirements

For calendar year 2023 or the calendar year in which the sand and gravel facility first commences using water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in 5MP, an industrial user who uses water at a sand and gravel facility shall include the following information in its annual report required by A.R.S. § 45--632.

1. *The quantity of water reclaimed from disposal ponds or clarifiers during the calendar year, as measured with a measuring device in accordance with ADWR’s measuring-device rules. A.A.C. R12-15-901, et seq.*

2. *The quantity of water from any source, including treated effluent, supplied to the wash plant during the calendar year, as measured with a measuring device in accordance with ADWR's measuring-device rules. A.A.C. R12-15-901, et seq.*

3. *The quantity of water from any source, including treated effluent, supplied to the asphalt plant during the calendar year, as measured with a measuring device in accordance with ADWR's measuring-device rules. A.A.C. R12-15-901, et seq.*

4. *The aggregate surface area of any disposal ponds.*

5. *The average depth of any disposal ponds.*

6. *The estimated quantity of water from any source, including treated effluent, used during the calendar year for:*

   a. *Industrial process purposes. Water used for industrial process purposes includes water used for sanitary waste disposal, but does not include water for cooling and cleaning purposes.*

   b. *Non-domestic cooling purposes.*

   c. *Non-domestic cleaning purposes. Water use for non-domestic purposes includes truck washing, truck mixer drum washing, or other non-domestic cleaning purposes.*

   d. *Road dust control.*

   e. *Landscape watering.*

   f. *Other purposes.*

7. *The tonnage of material washed during the calendar year.*

6.9 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR LARGE-SCALE POWER PLANTS

6-901. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-601 of this chapter, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. *"Blowdown water" means water discharged from a cooling tower recirculating water stream to control the buildup of minerals or other impurities in the recirculating water.*

2. *"Combined-cycle electric power plant" or "combined-cycle power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity by utilizing a combination of steam and combustion turbine power generation methods.*

3. *"Combustion turbine electric power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity by utilizing an internal combustion engine in which the expanding gases from the combustion chamber drive the blades of a turbine which turns a generator to produce electricity.*

3. *"Conservative mineral constituent" means a component of recirculating water in a cooling tower, the concentration of which is not significantly modified by precipitation, loss to the atmosphere, or the addition of treatment chemicals.*

4. *"Continuous blowdown and make-up" means patterns in cooling tower operation that include continuous blowdown and make-up or frequent periodic blowdown and make-up of recirculating water.*

5. *"Cycles of concentration" means the ratio of the concentration of total dissolved solids, other conservative mineral constituent, or electrical conductivity in the blowdown water to the concentration of this same constituent or electrical conductivity in the make-up water. This can be calculated by dividing the total make-up water by the total blowdown water.*

6. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat from a large-scale power plant that is generating electricity.*

7. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity including steam electric power plants, combustion turbine plants, and combined-cycle plants.*

8. *"Limiting constituent" means a chemical, physical, or biological constituent present in recirculating cooling tower water that, due to potential physical or biological factors or due to potential exceedance of any federal, state, or local environmental standards upon discharge as blowdown, should not be allowed to accumulate in recirculating cooling tower water above a certain concentration.*

9. *"Make-up water" means the water added to the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

10. *"Treated effluent-served cooling tower" means a cooling tower served by a make-up water supply that on an annual average basis, consists of 50 percent or more treated effluent.*

11. *"Post-1984 power plant" means either:*

    a. *A large-scale power plant that does not qualify as a pre-1985 power plant, and includes any expanded or modified portion of the power plant if the expansion or modification includes the construction or modification of one or more cooling towers, or*

    b. *Any expanded or modified portion of a pre-1985 power plant if the expansion or modification includes the construction or modification of one or more cooling towers and was not substantially commenced as of Dec. 31, 1984.*

12. *"Pre-1985 power plant" means a large-scale power plant that either produced electric power as of Dec. 31, 1984 or was substantially commenced as of Dec. 31, 1984 and includes any expanded or modified portion of such a power plant if the expansion or modification was substantially commenced as of Dec. 31, 1984 and included the modification or construction of one or more cooling towers.*

13. *"Steam electric power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity by utilizing the Rankin Steam Cycle in which water is heated, turns into steam and spins a steam turbine which drives an electrical generator.*

14. *"Substantially commenced as of Dec. 31, 1984" means, with regard to the construction, expansion, or modification of a large-scale power plant, that all preconstruction permits and approvals required by federal, state, or local governments for the construction, expansion, or modification of the plant were obtained by Dec. 31, 1984 or that a substantial capital investment in the physical on-site construction of the project was made within the 12 months prior to Dec. 31, 1984.*

6-902. Conservation Requirements for Pre-1985 Steam Electric Power Plants

Beginning on Jan. 1, 2023 and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a pre-1985 steam electric power plant shall comply with the following requirements:

1. *An annual average of seven or more cycles of concentration shall be achieved at fully operational cooling towers during periods when the steam electric power plant is generating electricity.*

2. *Blowdown water shall be discharged on a continuous basis, and make-up water shall be provided on a continuous basis.*

3. *The maximum amount of wastewater feasible, excluding blowdown water and sanitary wastewater, shall be diverted to the cooling process.*

6-903. Conservation Requirements for Post-1984 Steam Electric Power Plants and for Combined-Cycle Power Plants

Beginning on January 1, 2023 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a post-1984 steam electric power plant or at a combined-cycle power plant shall comply with the following requirements:

1. *An annual average of 15 or more cycles of concentration shall be achieved at fully operational cooling towers during periods when the power plant is generating electricity.*

2. *Blowdown water shall be discharged on a continuous basis, and make-up water shall be provided on a continuous basis.*

3. *The maximum amount of wastewater feasible, excluding blowdown water and sanitary wastewater, shall be diverted to the cooling process.*

6-904. Cycles of Concentration Adjustment Due to the Quality of Recirculating Water

A. *An industrial user who uses water at a steam electric power plant or at a combined-cycle power plant may apply to the Director for an adjustment to the cycles of concentration requirements set forth in section 6-902 or section 6-903, whichever is applicable, for any year in which compliance with the cycles of concentration requirements would likely result in damage to cooling towers or associated equipment or exceedance of federal, state, or local environmental discharge standards because of the quality of recirculating water. To apply for an adjustment to the cycles of concentration requirements based on recirculating water quality, an industrial user shall submit a request in writing to the Director that includes the following information:*

1. *Historic, current, and projected water quality data for the relevant constituent(s).*

2. *Documentation describing the potential damage to cooling towers or associated equipment, or documentation of environmental standards that are likely to be exceeded, whichever applies.*

B. *The Director shall grant the request if the Director determines that compliance with the cycles of concentration requirements set forth in section 6-902 or section 6-903, whichever is applicable, would likely result in damage to cooling towers or associated equipment or exceedance of federal, state, or local environmental discharge standards because of the quality of recirculating water. Any cycles of concentration adjustment granted pursuant to this subsection shall apply only while the quality of recirculating water would cause compliance with the cycles of concentration requirements to likely result in damage to cooling towers or associated equipment or exceedance of federal, state or local environmental discharge standards.*

6-905. Exemption and Cycles of Concentration Adjustment Due to the Quality of Treated Eeffluent Make-up Water Supplies

A. *The cycles of concentration requirements set forth in sections 6-902 and 6-903 do not apply to any treated effluent-served cooling tower at a steam electric power plant or at a combined-cycle power plant during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is treated effluent.*

B. *Within 30 days after the 12-month exemption period expires, the industrial user who uses water at the steam electric power plant or at a combined-cycle power plant may apply to the Director for a cycles of concentration adjustment to lower the cycles of concentration requirement for the treated effluent-served cooling tower if compliance with the requirement would not be possible due to the presence of a limiting constituent in the treated effluent supplying the tower. To apply for an alternative cycles of concentration requirement to address such a limiting constituent, an* *industrial user shall submit a request in writing to the Director which includes the following information:*

1. *The limiting constituent that is present in the treated effluent supplying the tower that results in the need to blow down a greater annual volume of water than that required in section 6-902 or section 6-903, whichever is applicable.*

2. *Documentation describing the concentration at which this limiting constituent(s) should be blown down, and the reason for the alternative cycles of concentration.*

The Director shall grant the request if the Director determines that the presence of a limiting constituent in the treated effluent supplying the cooling tower results in the need to blow down a greater annual volume of water than that required in section 6-902 or section 6-903, whichever is applicable. Any cycles of concentration adjustment granted pursuant to this paragraph shall apply only while the tower qualifies as a treated effluent-served cooling tower.

6-906. Substitute Conservation Requirements

A. *An industrial user who uses water at a steam electric power plant or at a combined-cycle power plant may apply to the Director to use conservation technologies other than the standard conservation requirements prescribed in section 6-902 or section 6-903. The Director may approve the use of substitute conservation technologies if both of the following apply:*

   1. *The industrial user has submitted a detailed description of the proposed substitute technologies and the water savings that can be achieved by the use of those technologies, and;*

   2. *The Director determines that the proposed substitute conservation technologies will result in a water savings equal to or greater than the savings that would be achieved by the standard conservation requirements prescribed in subsection A.*

B. *If the Director approves an industrial user's request to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section, the industrial user shall comply with the use of substitute conservation technologies approved by the Director beginning on the date determined by the Director and continuing until the first compliance date for any substitute conservation requirement in the 5MP.*

6-907. Waiver

A. *An industrial user who uses water at a steam electric power plant or at a combined-cycle power plant may apply to the Director for a waiver of any applicable conservation requirement in section 6-902 or section 6-903 by submitting a detailed, long-term plan for beneficial reuse of 100 percent of the blowdown water outside the cooling circuit, including an implementation schedule. Reuse of blowdown water includes the discharge of blowdown water into pipes, canals, or other means of conveyance if the discharged water is transported to another location at the plant or off the plant for reuse.*

B. The Director shall grant a waiver request if the Director determines that implementation of the plan will result in the beneficial reuse of 100 percent of blowdown water outside the cooling circuit. If a waiver request is granted, the industrial user shall implement the plan in accordance with the implementation schedule submitted to and approved by the Director.

6-908. Conservation Requirements for Combustion Turbine Electric Power Plants

A. Beginning on Jan. 1, 2023 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a combustion turbine electric power plant shall comply with the following requirement:

Each fully operational cooling tower with greater than or equal to 250 tons of cooling capacity at the combustion turbine electric power plant facility shall achieve a cycles of concentration level that results in blowdown water being discharged at an average annual minimum of either 120 milligrams per liter (mg/L) silica, or 1,200 mg/L total hardness, or 2,400 mg/L total dissolved solids, whichever is reached first.

B. Exemptions and Alternative Blowdown Standards

1. The requirement set forth in subsection A of this section does not apply to a combustion turbine electric power plant in any year in which the beneficial reuse exceeds the conservation requirement.

2. The requirement set forth in subsection A of this section does not apply to any treated effluent-served cooling tower at a combustion turbine electric power plant during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is treated effluent.

Within 30 days after the 12-month period expires, the person using water at the treated effluent-served cooling tower may apply to the Director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would not be possible due to the presence of a limiting constituent other than silica, total hardness, or total dissolved solids in the treated effluent supplying the cooling tower. To apply for an alternative blowdown level to address such a limiting constituent, an industrial user shall submit a request in writing to the Director which includes the following information:

a. The limiting constituent other than silica, total hardness, or total dissolved solids that is present in the treated effluent supplying the cooling tower which results in the need to blow down a greater annual volume of water than that required under subsection A of this section.

b. Documentation describing the concentration at which this limiting constituent should be blown down and the reason for the alternative blowdown level.

The Director shall grant the request if the Director determines that the presence of a limiting constituent other than silica, total hardness, or total dissolved solids in the treated effluent supplying the cooling tower results in the need to blow down a greater annual volume of water than that required under subsection A of this section. Any alternative blowdown level granted pursuant to this paragraph shall apply only while the cooling tower qualifies as a treated effluent-served cooling tower.

3. *A combustion turbine electric power plant may apply to the Director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would likely result in damage to cooling towers or associated equipment or exceedance of federal, state or local environmental discharge standards because of the accumulation of a limiting constituent other than silica, total hardness, or total dissolved solids in recirculating water. To apply for an alternative blowdown level for such a limiting constituent, an industrial user shall submit a request in writing to the Director which includes the following information:*

    a. *Historic, current and projected water quality data for the relevant limiting constituent(s).*

    b. *Documentation describing the potential damage to cooling towers or associated equipment, or documentation of environmental standards that are likely to be exceeded, whichever applies.*

    The Director shall grant the request if the Director determines that compliance with the blowdown level set forth in subsection A of this section would likely result in damage to cooling towers or associated equipment or exceedance of federal, state, or local environmental discharge standards because of the accumulation of a limiting constituent other than silica, total hardness, or total dissolved solids in recirculating water.

6-909. Monitoring and Reporting Requirements

A. *Monitoring and Reporting Requirements for Steam Electric Power Plants and Combined-Cycle Power Plants*

1. For calendar year 2023 or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the 5MP, an industrial user who uses water at a steam electric power plant or at a combined-cycle power plant shall include in its annual report required by A.R.S. § 45--632 the following information:

a.. *Cooling capacity (in tons) of each cooling tower at the facility.*

b. *Frequency of use and use periods of each cooling tower at the facility.*

c. *Source of water providing make-up water to each cooling tower at the facility.*

d. For each cooling tower at the facility that is exempt from cycles of concentration requirements pursuant to section 6-905, subsection A, or for which a cycles of concentration adjustment was granted pursuant to section 6-905, subsection B, the percentage of water served to the tower during the year that was treated effluent.

e. For all fully operational cooling towers subject to cycles of concentration requirements under section 6-902 or section 6-903:

i. The total quantity of blowdown water discharged from the cooling towers for each month or partial month when the facility was generating electricity during the calendar year.

ii. The total quantity of make-up water used at cooling towers for each month or partial month when the facility was generating electricity during the calendar year.

iii. The weighted average concentration of total dissolved solids or other conservative mineral constituent in make-up water and blowdown water at the cooling towers for each month or partial month when the facility was generating electricity during the calendar year, either:

1) Determined by direct analysis, or

2) Calculated based on average monthly electrical conductivity readings if the following conditions have been met: (a) correlations between electrical conductivity and total dissolved solids or between electrical conductivity and another conservative mineral constituent have been established over a period of one year or more in make-up and blowdown water and (b) documentation of these correlations has been provided to the Director.

f. For each large-scale steam electric power plant or combined-cycle power plant that is exempt from cycles of concentration requirements pursuant to section 6-905, subsection A, or for which an adjusted cycles of concentration requirement was granted pursuant to section 6-904 or section 6-905, subsection B:

i. The total quantity of blowdown water discharged from the cooling tower for each month or partial month when the facility was generating electricity during the calendar year.

ii. The total quantity of make-up water used at the cooling tower for each month or partial month when the facility was generating electricity during the calendar year.

iii. The weighted average concentration of total dissolved solids or other conservative mineral constituent in make-up water and blowdown water at the cooling tower for each month or partial month when the facility was generating electricity during the calendar year, either:

1) Determined by direct analysis, or

2) Calculated based on average monthly electrical conductivity readings if the following conditions have been met: (a) correlations between electrical conductivity and total dissolved solids or between electrical conductivity and another conservative mineral constituent have been established over a period of one year or more in make-up and blowdown water and (b) documentation of these correlations have been provided to the Director.

g. All time periods when the facility was not generating electricity.

h. The amount of electricity generated each month or each partial month when the facility was generating electricity during the calendar year.

i. The estimated quantity of water from any source, including treated effluent, used during the calendar year for each purpose other than electric power generation purposes.

B. Monitoring and Reporting Requirements for Combustion Turbine Electric Power Plants

For calendar year 2023, or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the 5MP, an industrial user who uses water at a large-scale electric power plant that is a combustion turbine electric power plant shall include in its annual reports required by A.R.S. § 45--632 the following information for all cooling towers with 250 tons or more of cooling capacity at the facility:

1. *Capacity in tons of each cooling tower.*

2. *For each cooling tower at the facility that is exempt from the requirements of 6-903, subsection A pursuant to section 6-903, subsection B, paragraph 2 or for which an alternative blowdown level has been granted, pursuant to section 6-903, subsection B, paragraph 2, the percentage of water served to the cooling tower during the year that was treated effluent.*

3. *The quantity of water from any source, specified by source, that was used for make-up water on an annual basis during the calendar year as measured with a measuring device in accordance with ADWR's measuring device rules. A.A.C. R12-15-901, et seq.*

4. *The quantity of water that was blown down on an annual basis during the calendar year as measured with a measuring device in accordance with ADWR's measuring-device rules. A.A.C. R12-15-901, et seq.*

5. *The average annual concentrations of silica, total hardness, total dissolved solids, or other approved limiting constituent established under section 6-903, subsection B, paragraph 2 or 3, in make-up and blowdown water during the calendar year, reported in mg/L or other measurement units established under section 6-903, subsection B, paragraph 2 or 3, and either:*

   a. Determined by direct analysis; or

b. *Calculated based on average monthly electrical conductivity readings for those portions of each month when cooling towers were fully operational if the following conditions have been met: (a) correlations between electrical conductivity and silica, between electrical conductivity and total hardness, between electrical conductivity and total dissolved solids, or between electrical conductivity and another approved limiting constituent established pursuant to section 6-903 subsection B, paragraph 2 or 3, have been established over a period of one year or more in make-up and blowdown water; and (b) documentation of these correlations has been provided to the Director.*

C. *A single annual report shall be filed for a pre-1985 power plant and a post-1984 power plant that are contiguous and owned by the same owner. The report shall describe the combined operations of the pre-1985 and post-1984 power plants as required in subsection A of this section.*

D. *All water measurements required in this section shall be made with a measuring device in accordance with ADWR's measuring-device rules. A.A.C. R12-15-901, et seq.*

6.10 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR LARGE-SCALE COOLING FACILITIES

6-1001. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-601 of this chapter, unless the context otherwise requires, the following words and phrases used in section 6-1002 and 6-1003 shall have the following meanings:

1. *"Blowdown water" means water discharged from a cooling tower recirculating water stream to control the buildup of minerals or other impurities in the recirculating water.*

2. *"Conservative mineral constituent" means a component of recirculating water in a cooling tower, the concentration of which is not significantly modified by precipitation, loss to the atmosphere, or the addition of treatment chemicals.*

3. *"Cycles of concentration" means the ratio of the concentration of a conservative mineral constituent or electrical conductivity in the blowdown water to the concentration of this same constituent or electrical conductivity in the make-up water.*

4. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat.*

5. *"Large-scale cooling facility" means a facility which has control over cooling operations with a total combined cooling capacity greater than or equal to 1,000*

tons. For the purposes of this definition, the minimum cooling tower size which shall be used to determine total facility cooling capacity is 250 tons. A large-scale cooling facility does not include a large-scale power plant that utilizes cooling towers to dissipate heat.

6. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity.*

7. *"Limiting constituent" means a chemical, physical, or biological constituent present in recirculating cooling tower water that, due to potential physical or biological factors or due to potential exceedance of any federal, state, or local environmental standards upon discharge as blowdown, should not be allowed to accumulate in recirculating cooling tower water above a certain concentration.*

8. *"Make-up water" means the water added back into the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

9. *"Treated effluent-served cooling tower" means a cooling tower served by a make-up water supply that on an annual average basis consists of 50 percent or more treated effluent.*

6-1002. Conservation Requirements

A. *Conservation Requirements for Large-Scale Cooling Facilities*

Beginning on Jan. 1, 2023 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a large-scale cooling facility shall comply with the following requirements:

Each fully operational cooling tower with greater than or equal to 250 tons of cooling capacity at the facility shall achieve a cycles of concentration level that results in blowdown water being discharged at an average annual minimum of either 120 mg/L silica, 1,200 mg/L total hardness, or 2,400 mg/L total dissolved solids whichever is reached first.

B. *Exemptions and Alternative Blowdown Standards*

1. *The requirement set forth in subsection A of this section does not apply to a large-scale cooling facility in any year in which 100 percent of facility blowdown water is beneficially reused.*

2. *The requirement set forth in subsection A of this section does not apply to any treated effluent-served cooling tower at a large-scale cooling facility during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is treated effluent.*

   After the 12-month period expires, the person using water at the treated effluent-served cooling tower may apply to the Director to use an alternative *blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would not be possible due to the presence of a limiting constituent other than silica, total hardness, or total dissolved solids in the treated effluent supplying the tower. To apply for an alternative blowdown level to address such a limiting constituent, an industrial user shall submit a request in writing to the Director which includes the following information:*

a. The limiting constituent other than silica, total hardness, or total dissolved solids that is present in the treated effluent supplying the tower which results in the need to blow down a greater annual volume of water than that required under subsection A of this section.

b. Documentation describing the concentration at which this limiting constituent should be blown down, and the reason for the alternative blowdown level.

The Director shall grant the request if the Director determines that the presence of a limiting constituent other than silica, total hardness, or total dissolved solids in the treated effluent supplying the cooling tower results in the need to blow down a greater annual volume of water than that required under subsection A of this section. Any alternative blowdown level granted pursuant to this paragraph shall apply only while the tower qualifies as a treated effluent-served cooling tower.

3. An industrial user may apply to the Director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would likely result in damage to cooling towers or associated equipment or exceedance of federal, state, or local environmental discharge standards because of the accumulation of a limiting constituent other than silica, total hardness, or total dissolved solids in recirculating water. To apply for an alternative blowdown level for such a limiting constituent, an industrial user shall submit a request in writing to the Director which includes the following information:

a. Historic, current, and projected water quality data for the relevant limiting constituent(s).

b. Documentation describing the potential damage to cooling towers or associated equipment, or documentation of environmental standards that are likely to be exceeded, whichever applies.

The Director shall grant the request if the Director determines that compliance with the blowdown level set forth in subsection A of this section would likely result in damage to cooling towers or associated equipment or exceedance of federal, state, or local environmental discharge standards because of the accumulation of a limiting constituent other than silica, total hardness, or total dissolved solids in recirculating water.

6-1003. Monitoring and Reporting Requirements

For calendar year 2023 or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the 5MP, an industrial user *who uses water at a large-scale cooling facility shall include in its annual report required by A.R.S. § 45--632 the following information for all cooling towers with 250 tons or more of cooling capacity at the facility:*

1. *Capacity in tons of each cooling tower.*

2. *Number of days per month that each cooling tower was fully operational.*

3. *For each cooling tower at the facility that is exempt from cycles of concentration requirements under section 6-1002, subsection B, paragraph 2, or for which an alternative blowdown level has been granted, pursuant to section 6-1002, subsection B, paragraph 3, the percentage of water served to the tower during the year that was treated effluent.*

4. *The quantity of water from any source, specified by source, which was used for make-up water on a monthly basis during the calendar year as measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq.*

5. *The quantity of water which was blown down on a monthly basis during the calendar year as measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq.*

6. *The average monthly concentrations of silica, total hardness, total dissolved solids, or other approved limiting constituent established under section 6-1002, subsection B, paragraph 2 or 3, in make-up and blowdown water for those portions of each month when cooling towers were fully operational during the calendar year, reported in mg/L or other measurement units established under section 6-1002, subsection B, paragraph 2 or 3, and either:*
    a. *Determined by direct analysis; or*

    b. *Calculated based on average monthly electrical conductivity readings for those portions of each month when cooling towers were fully operational if the following conditions have been met: (a) correlations between electrical conductivity and silica, between electrical conductivity and total hardness, between electrical conductivity and total dissolved solids, or between electrical conductivity and another approved limiting constituent established pursuant to section 6-1002 subsection B, paragraph 2 or 3, have been established over a period of one year or more in make-up and blowdown water; and (b) documentation of these correlations has been provided to the Director.*

6.11 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR DAIRY OPERATIONS

6-1101. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-1102 through 6-1105 of this chapter shall have the following meanings:

1. *"Dairy animal" means a lactating cow or a non-lactating animal present at a dairy operation.*

2. *"Dairy operation" means a facility that houses a monthly average of 100 or more lactating cows per day during a calendar year as calculated in 6-1102.*

3. *"Dairy wastewater" means any water that has been put to a beneficial use at the dairy operation, including water containing dairy animal wastes.*

4. *"Lactating cow" means any cow that is producing milk that is present on-site at a dairy operation and receives water through the dairy operation's watering system.*

5. *"Non-lactating animal" means a calf, heifer, mature dry cow, bull, or steer that is present on-site at a dairy operation and receives water through the dairy operation's watering system.*

6-1102. Maximum Annual Water Allotment Conservation Requirements

A. Maximum Annual Water Allotment

Beginning on Jan. 1, 2023 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user shall not withdraw, divert, or receive water for use at a dairy operation during a calendar year in a total amount that exceeds the dairy operation's maximum annual water allotment for the year as calculated in subsection B below, unless the industrial user applies for and is accepted into the Best Management Practices Program described in section 6-1104.

B. Calculation of Maximum Annual Water Allotment

A dairy operation's maximum annual water allotment for a calendar year shall be determined as follows:

1. *Calculate the average daily number of lactating cows and non-lactating animals that are present during the calendar year. The average daily number of lactating cows and non-lactating animals present during the calendar year shall be calculated as follows:*

    a. *Determine the total number of lactating cows and non-lactating animals present at the dairy operation on the last day of each month during the calendar year.*

    b. *For each category of animal, add together the total number of such animals present at the dairy operation on the last day of each month during the year in question and then divide the result by 12. The quotient is the average daily number of lactating cows and non-lactating animals present during the calendar year.*

2. *Calculate the dairy operation's maximum annual water allotment for the calendar year as follows:*

   a. *Multiply the average daily number of lactating cows present during the calendar year by 105 gallons per animal per day (GAD) and then convert to AF per year as follows:*

$$C_L \times \frac{105\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for lactating cows (AF per year)}$$

Where: C_L = *Average daily number of lactating cows*

GAD = Gallons per animal per day
g/af = Gallons per acre-foot
d/yr = Days in the year

The result is the dairy operation's maximum annual water allotment for lactating cows for the calendar year.

   b. *Multiply the average daily number of non-lactating animals present during the calendar year by 20 gallons per animal per day (GAD) and then convert to AF per year as follows:*

$$A_N \times \frac{20\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for non-lactating animals (AF per year)}$$

Where: A_N = *Average daily number of non- lactating animals*
GAD = Gallons per animal per day
g/af = Gallons per acre-foot
d/yr = Days per year

The result is the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year.

   c. *Add the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year as calculated in subparagraph b of this paragraph and the dairy operation's maximum annual water allotment for lactating cows for the calendar year as calculated in subparagraph a of this paragraph. The sum is the maximum annual water allotment for the dairy operation for the calendar year, except as provided in subparagraph d of this paragraph.*

   d. *Upon application, the Director may approve an additional allocation of water for the dairy operation consistent with industry health and sanitation objectives if the dairy operation requires more than its maximum annual water allotment because of one or more of the following:*

   1) *Milkings per lactating cow occur more than three times daily;*

2) Technologies are used to achieve industry health and sanitation objectives that require additional water use; and

3) Technologies are designed and/or implemented for cooling lactating cows and non-lactating animals, which increase milk production.

3. Nothing in this section shall be construed to authorize a person to use more water from any source than the person is entitled to use pursuant to a groundwater or appropriable water right or permit held by the person. Nor shall this section be construed to authorize a person to use water from any source in a manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.

6-1103. Compliance with Maximum Annual Water Allotment

An industrial user who uses water at a dairy operation is in compliance for a calendar year with the dairy operation's maximum annual water allotment if the Director determines that either of the following applies:

1. The volume of water withdrawn, diverted, or received during the calendar year for use at the dairy operation, less the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered groundwater right for a beneficial use, is equal to or less than the dairy operation's maximum annual water allotment for the calendar year; or

2. The three-year average volume of water withdrawn, diverted, or received for use at the dairy operation during that calendar year and the preceding two calendar years is equal to or less than the dairy operation's three-year average maximum annual water allotment for that calendar year and the preceding two calendar years. In calculating the three-year average volume of water withdrawn, diverted, or received for use at the dairy operation, the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered right for a beneficial use shall not be counted.

6-1104. Best Management Practices Program Conservation Requirements

A. Criteria for Approval of Application

An industrial user who uses water at a dairy operation may apply for regulation under the Best Management Practices Program (BMP Program) by submitting an application on a form provided by the Director. The Director shall approve a complete and correct application for regulation under the BMP Program if the Director determines that the applicant will implement all of the standard best management practices (BMPs) described in Appendix 6A, unless the Director approves a substitution of a standard BMP under subsection D of this section or a waiver of a standard BMP under subsection E of this section. If the Director approves a substitution of a standard BMP, the Director shall approve the application if the Director determines that the applicant will implement the substitute BMP or BMPs in addition to any remaining standard BMPs.

B. Exemption from Maximum Annual Water Allotment Conservation Requirements

An industrial user accepted for regulation under the BMP Program is exempt from the maximum annual water allotment conservation requirements set forth in section 6-1102 beginning on January 1 of the first calendar year after the industrial user's application for the BMP Program is approved, unless the Director approves an earlier date.

C. Compliance with Best Management Practice Program

Beginning on a date established by the Director and continuing thereafter until the first compliance date for any substitute conservation requirement established in the 5MP, an industrial user accepted for regulation under the BMP Program shall comply with all standard BMPs listed in Appendix 6A, unless the Director approves a substitution of a standard BMP under subsection D of this section, or a waiver of a standard BMP, under subsection E of this section. If the Director approves a substitution of a standard BMP, the industrial user shall comply with the substitute BMP or BMPs in addition to any remaining standard BMPs. The standard BMPs listed in Appendix 6A are broken into the following seven categories: (1) delivery of drinking water for dairy animals; (2) udder washing and milking parlor cleaning; (3) corral design and maintenance; (4) cleaning and sanitizing milking equipment; (5) dust control, calf housing cleaning, and feed apron flushing; (6) dairy animal cooling; and (7) dairy animal feed preparation.

D. Substitution of Best Management Practices

1. *The Director may allow an industrial user applying for the BMP Program to replace a standard BMP listed in Appendix 6A with a substitute BMP if the Director determines that the standard BMP cannot be achieved and that implementation of the substitute BMP will result in water use efficiency equivalent to that of the standard BMP. To apply for a substitution of a standard BMP, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and a description of how the substitute BMP will result in water use efficiency equivalent to that of the standard BMP.*

2. *An industrial user regulated under the BMP Program may apply to the Director for a substitution of an existing BMP that is no longer appropriate for the industrial user's dairy operation. The Director may allow the industrial user to replace the existing BMP with a substitute BMP if the Director determines that the substitute BMP will result in water use efficiency equivalent to that of the existing BMP.*

E. Waiver of Best Management Practices

1 *The Director may waive a standard BMP listed in paragraph 3 of this subsection if the Director determines that the standard BMP cannot be achieved and that no substitute BMP is appropriate. To apply for a waiver of a standard BMP listed in paragraph 3, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and why no substitute BMP is appropriate.*

2. *An industrial user regulated under the BMP Program may apply to the Director for a waiver of an existing BMP listed in paragraph 3 of this subsection if the BMP is no*

longer appropriate for the industrial user's dairy operation. The Director may waive the existing BMP if the Director determines that the existing BMP is longer appropriate for the industrial user's dairy operation and that no substitute BMP is appropriate.

3. *Only the following standard BMPs may be waived by the Director under this subsection: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning, and Feed Apron Flushing); (5) all of the standard BMPs in Water Use Category No. 6 (Dairy Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).*

F. *Five Year Review of Best Management Practices*

Five years after an industrial user is accepted for regulation under the BMP Program, the Director shall review the industrial user's BMPs to determine whether any changes in the BMPs are warranted. If the Director determines that any of the existing BMPs are no longer appropriate due to an expansion of the dairy operation or a change in management practices at the operation, the Director shall notify the industrial user in writing of that determination and the Director and the industrial user shall make a good faith effort to stipulate to a modification of the BMPs so that they are appropriate for the expanded operation or the change in management practices.

If the Director and the industrial user are unable to stipulate to a modification to the BMPs within 180 days after the Director notifies the industrial user of the determination that one or more of the existing BMPs are no longer appropriate, or such longer time as the Director may agree to, the industrial user shall no longer be regulated under the BMP Program, but shall thereafter be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-1102.

If the Director and the industrial user stipulate to a modification of the BMPs, the industrial user shall comply with the modified BMPs by a date agreed upon by the Director and the industrial user and shall continue complying with the modified BMPs until the first compliance date for any substitute conservation requirement in the 5MP.

G. *Change in Ownership of Dairy Operation*

1. *If an industrial user regulated under the BMP Program sells or conveys the dairy operation to which the BMPs apply, the new owner of the dairy operation shall continue to be regulated under the BMP Program until January 1 of the first calendar year after acquiring ownership of the dairy operation. Except as provided in paragraph 2 of this section, beginning on January 1 of the first calendar year after acquiring ownership of the dairy operation, the new owner shall comply with the maximum annual water allotment conservation requirements set forth in section 6-1102. The new owner may at any time apply for regulation under the BMP Program.*

2. *If the new owner submits a complete and correct application for regulation under the BMP Program prior to January 1 of the first calendar year after acquiring ownership of the dairy operation, the new owner shall continue to be regulated*

under the BMP Program until the Director makes a determination on the application. If the Director denies the application, the new owner shall be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-1102 immediately upon notification of the denial or January 1 of the first calendar year after acquiring ownership of the dairy, whichever is later. If the Director approves the application, the new owner shall continue to be regulated under the BMP Program until the first compliance date for any substitute conservation requirement in the 5MP.

6-1105. Monitoring and Reporting Requirements

For the calendar year 2023 or the calendar year in which water use is commenced at the dairy operation, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the 5MP, an industrial user who uses water at a dairy operation shall include the following information in its annual report required by A.R.S. § 45--632:

1. *The total quantity of water from any source, including treated effluent, withdrawn, diverted, or received during the calendar year for use by the dairy operation, as measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq.*

2. *The total quantity of water delivered during the calendar year to any uses other than the dairy operation from the well or wells which serve the dairy operation, as measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq.*

3. *The total quantity of dairy wastewater delivered to grandfathered rights other than the dairy operation, as measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R-12-15-901, et seq.*

4. *The total number of lactating cows and non-lactating animals which were present on-site at the dairy operation on the last day of each month during the calendar year.*

5. *If the dairy operation is regulated under the BMP Program, any documentation as required by the Director that demonstrates compliance with the program.*

6.12 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR CATTLE FEEDLOT OPERATIONS

6-1201. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-1202 through 6-1203 of this chapter shall have the following meanings:

1. *"Beef cattle" means cattle or calves fed primarily for meat production.*

2. *"Cattle feedlot operation" means a facility that houses and feeds an average of 100 or more beef cattle per day during a calendar year as calculated in section 6-1202.*

6-1202. Maximum Annual Water Allotment Conservation Requirements

A. Maximum Annual Water Allotment

Beginning on Jan. 1, 2023 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user shall not withdraw, divert, or receive water for use at a cattle feedlot operation during a calendar year in a total amount that exceeds the cattle feedlot's maximum annual water allotment for the year as calculated in subsection B below.

B. Calculation of Maximum Annual Water Allotment

A cattle feedlot operation's maximum annual water allotment for a calendar year shall be determined as follows:

1. *Calculate the average daily number of beef cattle present during the calendar year. The Director shall calculate the average daily number of beef cattle present during the calendar year as follows:*

   a. *Determine the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the calendar year.*

   b. *Add together the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the year in question and then divide the result by 12. The quotient is the average daily number of beef cattle present at the cattle feedlot operation during the calendar year.*

2. *Multiply the average daily number of beef cattle present at the cattle feedlot operation during the calendar year by a water allotment of 30 gallons per animal per day (GAD), and then convert to AF per year as follows:*

$$C_B \times \frac{30\ GAD}{325{,}851\ g/acre\text{-}foot} \times d/yr = \text{Maximum annual water allotment for the cattle feedlot operation (AF/year)}$$

Where:
C_B = Average daily number of beef cattle
GAD = Gallons per animal per day
g/acre-foot = Gallons per acre-foot
d/yr = Days in the year

C. Compliance with Maximum Annual Water Allotment

An industrial user who uses water at a cattle feedlot operation is in compliance for a calendar year with the cattle feedlot operation's maximum annual water allotment if the Director determines that either of the following applies:

1. *The volume of water withdrawn, diverted, or received during the calendar year for use at the cattle feedlot operation is equal to or less than the cattle feedlot operation's maximum annual water allotment for the calendar year; or*

2. *The three-year average volume of water withdrawn, diverted, or received for use at the cattle feedlot operation during that calendar year and the preceding two calendar years is equal to or less than the cattle feedlot operation's three-year average maximum annual water allotment for that calendar year and the preceding two calendar years.*

D. *Nothing in this section shall be construed to authorize a person to use more water from any source than the person is entitled to use pursuant to a groundwater or appropriable water right or permit held by the person. Nor shall this section be construed to authorize a person to use water from any source, including treated effluent, in a manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-1203. Monitoring and Reporting Requirements

For calendar year 2023 or the calendar year in which water use is first commenced at the cattle feedlot operation, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the 5MP, an industrial user who uses water at a cattle feedlot operation shall include the following information in its annual report required by A.R.S. § 45--632:

1. *The total quantity of water from any source, including treated effluent, withdrawn, diverted, or received during the calendar year for use at the cattle feedlot operation as measured with a measuring device in accordance with ADWR's measuring-device rules. A.A.C. R12-15-901, et seq.*

2. *The total number of beef cattle that were present on-site at the cattle feedlot operation on the last day of each month during the calendar year.*

6.13 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR NEW LARGE LANDSCAPE USERS

6-1301. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-601 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-1302 and 6-1303 of this chapter shall have the following meanings:

1. *"Direct use treated effluent" means treated effluent transported from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use treated effluent does not include treated effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

2. “Landscapable area” means the entire area of a lot less any areas covered by structures, parking lots, roads, or any other area not physically capable of being landscaped.

3. “New large landscape user” means a non-residential facility that has a water-intensive landscaped area in excess of 10,000 square feet and that has landscaping planted and maintained after January 1, 1990 or bodies of water, other than bodies of water used primarily for swimming purposes, filled and maintained after January 1, 1990, or both. The following facilities are excluded from this definition: schools, parks, cemeteries, golf courses, common areas of housing developments and public recreational facilities.

4. “Treated effluent recovered within the area of impact” means treated effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the area of impact of storage. For purposes of this definition, “area of impact” has the same meaning as prescribed by A.R.S. § 45-802.01.

5. “Water-intensive landscaped area” means, for the calendar year in question, all of the following areas within a non-residential facility:

a. Any area of land that is planted primarily with plants not listed in ADWR’s Low Water Use Plant List for PhxAMA and watered with a permanent water application system, except any area of land that is watered exclusively with direct use treated effluent or treated effluent recovered within the area of impact.

b. The total water surface area of all bodies of water within the facility, except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 if the bodies of water will be filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact after the permit expires.

6-1302. Conservation Requirements

A. Conservation Requirements for New Large Landscape Users that are not Hotels or Motels

Beginning on January 1, 2023 and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, the water-intensive landscaped area within a new large landscape user that is not a hotel or motel shall not exceed the greater of the following: 1) an area calculated by adding 10,000 square feet plus 20 percent of the facility’s landscapable area in excess of 10,000 square feet; or 2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S. § 45-131, et seq., and that qualify as water-intensive landscaped area.

B. Conservation Requirements for New Large Landscape Users that are Hotels or Motels

Beginning on January 1, 2023 and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, the water-intensive landscaped area within a new large landscape user that is a hotel or motel shall not exceed the greater of the following: 1) an area calculated by adding 20,000 square feet plus 20 percent of the facility's landscapable area in excess of 20,000 square feet; or 2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S.§ 45-131, et seq., and that qualify as water-intensive landscaped area.

C. Waiver of Conservation Requirements for the Use of 100 Percent Wastewater

The conservation requirements set forth in subsections A and B of this section shall not apply to a new large landscape user in any year in which all of the water used for landscaping purposes within the facility is wastewater.

6-1303. Monitoring and Reporting Requirements

For calendar year 2023 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the 5MP, an industrial user that applies water to a new large landscape user shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water from any source, including treated effluent, withdrawn, diverted, or received for use on the facility during the reporting year for landscape watering purposes, including bodies of water filled or refilled during the calendar year, as measured with a measuring device in accordance with ADWR's measuring device rules. A.A.C. R12-15-90,1 et seq.*

2. *The total amount of landscapable area within the facility.*

3. *The total amount of water-intensive landscaped area at the facility broken down into the area planted primarily with plants not listed in ADWR's Low Water Use/Drought Tolerant Plant List for PhxAMA (except any area watered exclusively with direct use treated effluent or treated effluent recovered within the area of impact) and the surface area of all bodies of water (except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit if the bodies of water will be filled and refilled exclusively with direct use treated effluent or treated effluent recovered within the area of impact after the permit expires).*

6.14 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR NEW LARGE INDUSTRIAL USERS

6-1401. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-601 of this chapter, "new large industrial user" as used in section 6-1402 means an industrial user that begins using more than 100 AF of water per year for industrial purposes after January 1, 2023.

6-1402. Conservation Requirements

A. Not later than 180 days after receiving notice of these conservation requirements, or within 180 days after the end of the first calendar year in which the facility first uses more than 100 AF of water for industrial purposes, whichever is later, a new large industrial user shall submit to the Director a plan to improve the efficiency of water use by the facility. The plan shall:

1. Specify the level of water conservation that can be achieved assuming the use of the latest commercially available technology consistent with reasonable economic return;

2. Identify water uses and conservation opportunities within the facility, addressing water used for the following categories as appropriate: landscaping; space cooling; process-related water use, including recycling; and sanitary and kitchen uses;

3. Describe an ongoing water conservation education program for employees; and

4. Include an implementation schedule.

B. If a person required to submit a plan under subsection A of this section is required to submit a conservation plan under another section of this chapter, the person may combine the plans into a single conservation plan.

6.15 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR METAL MINING FACILITIES

6-1501. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. "Abandoned tailings impoundment" means a tailings impoundment that the owner/operator of a metal mining facility does not plan to use for additional disposal of tailings.

2. "Alternative water supply" means a water source other than groundwater of drinking water quality.

3. "Decant water" means water removed from the stilling basin of a tailings impoundment either by gravity flow into a decant tower or by pumping.

4. "Heap and dump leaching" means the extraction of minerals using acid solutions applied to metallic ores that have been removed from their original location and heaped or dumped in a new location.

5. *"In situ leaching" means the extraction of metallic ores using acid leaching of ores that are not moved from their original natural location.*

6. *"In situ leaching sites" mean those portions of metal mining facilities at which in situ leaching and associated copper recovery operations occur, including surface applications of acid leaching solutions and deep well injection of acid leaching solutions.*

7. *"Large-scale metal mining and processing facility" means an industrial facility at which mining and processing of metallic ores is conducted and that uses or has the potential to use more than 500 AF of water per reporting year. For the purposes of this definition, the annual water use or potential annual water use includes all water from any source, including treated effluent, used or projected to be used within or by the facility, regardless of the nature of the use.*

8. *"Mill concentrator" means the structure at open-pit metal mines within which metallic ore is crushed and the flotation process is used to remove minerals.*

9. *"Mill circuit" means the flow of water used in the process of crushing ore, recovering copper at the mill concentrator, and transporting and disposing of tailings, and includes recovery of water at the tailings impoundments for reuse in the mill concentrator.*

10. *"Post-1984 metal mining facility" means either:*

    a. *A large-scale metal mining and processing facility that does not qualify as a pre-1985 metal mining facility, including any expanded or modified portion of the facility, or*

    b. *Any expanded or modified portion of a pre-1985 metal mining facility if the expansion or modification includes one or more new tailings impoundments, new mill circuits, or new leaching facilities, and was not substantially commenced as of December 31, 1984.*

11. *"Pre-1985 metal mining facility" means a large-scale metal mining and processing facility at which the mining and processing of metallic ores was occurring as of December 31, 1984, or that was substantially commenced as of December 31, 1984, and includes any expanded or modified portion of such a facility if the expansion or modification includes one or more new tailings impoundments, new mill concentrator circuits, or new wells, and was substantially commenced as of December 31, 1984.*

12. *"Seepage water" means water that has infiltrated from tailings impoundments into the material underlying the tailings impoundments.*

13. *"Substantially commenced as of December 31, 1984" means, with regard to the construction, expansion, or modification of a large-scale metal mining and processing facility, that the owner or operator of the facility had obtained all pre-construction permits and approvals required by federal, state, or local governments for the construction, expansion, or modification of the facility by*

December 31, 1984, or had made a substantial capital investment in the physical on-site construction of the project in the 12 months prior to December 31, 1984.

14. *"Tailings" mean the slurry of water and fine-grained waste rock material remaining after minerals have been removed in the mill concentrator and excess water has been recovered and returned to the mill concentrator.*

15. *"Tailings impoundment" means the final disposal site for tailings generated in the milling circuit.*

6-1502 Conservation Requirements for Pre-1985 Metal Mining Facilities

Beginning on January 1, 2023 and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a pre-1985 metal mining facility shall comply with the following requirements:

A. *Management of Tailings Density*

The industrial user shall transport tailings to the tailings impoundment area at the maximum density possible consistent with reasonable economic return; but, beginning with calendar year 2023, the three-year average density of the tailings during transport shall be 48 percent solids by weight or greater during the period consisting of the reporting year and the previous two years. The Director may reduce the density required for a period of time determined by the Director if the industrial user demonstrates that, due to the shutdown of ore processing or tailings transport equipment or due to the density of ore being mined, a three-year average density of 48 percent or greater cannot be achieved.

B. *Management of Pre-sliming/Interceptor Wells*

The industrial user shall comply with one of the following:

1. *Deposit a layer of tailings immediately up-slope from the free water level in each tailings impoundment. The tailings layer shall be 12 inches or more in thickness and shall minimize soil surface permeability.*

2. *Drill interceptor wells down-gradient from each tailings impoundment. The interceptor wells shall be designed, located, and operated in such a manner as to intercept the maximum amount of seepage water possible from each tailings impoundment. Water recovered from the interceptor wells shall be reused at the mining facility.*

C. *Management of Water in Tailings Impoundments*

The industrial user shall minimize the free water surface area in each tailings impoundment by complying with all of the following:

1. *Manipulate tailings that have been disposed of in a tailings impoundment, and manage new disposal of tailings in an impoundment, to create stilling basins that*

increase the rate of recovery of decant water from the stilling basins, and to minimize the free water surface area of stilling basins.

2. *Use decant towers, barge pumps, or sump pumps to recycle water from each tailings impoundment back to the mill concentrator.*

3. *Expand decant tower barge pumping capacity where necessary to increase the capacity to recycle water from each tailings impoundment back to the mill concentrator.*

4. *Use, to the maximum extent possible, tailings impoundment water, rather than pumping additional groundwater.*

D. *Capping Abandoned Tailings Impoundments*

The industrial user shall cap each abandoned tailings impoundment in a manner that minimizes the quantity of water used for dust control purposes and/or revegetation.

E. *Heap and Dump Leaching*

The industrial user shall apply water to heap and dump leaching operations in a manner that minimizes water use to the extent practicable, consistent with reasonable economic return.

F. *Additional Conservation Measures*

An industrial user who uses water at a metal mining facility shall comply with three of the following eight conservation measures at those portions of the facility that do not qualify as in situ leaching sites:

1. *When revegetating abandoned mine-related areas, utilize drought-tolerant vegetation.*

2. *Utilize multiple decant towers in single impoundments to increase decant rate.*

3. *Convert piping to high density polyethylene piping to increase density of transported tailings.*

4. *Harvest and reuse storm water runoff on site.*

5. *Reuse pit dewatering water.*

6. *Reduce evaporation from free-standing water surfaces in addition to evaporation reduction from stilling basins.*

7. *Reduce water used for dust control by reducing the number and extent of haul trips, using road binders, converting to conveyors for material transport, or using another dust control measure that reduces water use.*

8. *Reduce water used for delivery of acid/water solution for heap or dump leaching operations by using delivery methods that use less water than sprinkler delivery.*

6-1503 Conservation Requirements for Post-1984 Metal Mining Facilities

Beginning on January 1, 2023 or upon commencement of operations at the facility, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the 5MP, an industrial user who uses water at a post-1984 metal mining facility shall comply with conservation requirements applicable to pre-1985 metal mining facilities as prescribed in section 6-1502, subsections C through F, and the following additional requirements:

A. Management of Tailings Impoundments

The industrial user shall design and construct any post-1984 tailings impoundments to maximize recovery of water from the stilling basins and to minimize seepage water. Any interceptor wells down gradient of tailings impoundments shall be constructed to maximize recovery of seepage water.

B. Management of Tailings Density

The industrial user shall design, construct, and operate any post-1984 mill concentrators and their associated tailings transport systems to achieve the maximum tailings densities possible consistent with reasonable economic return, but the average annual density of tailings during transport shall not be less than 50 percent solids by weight.

C. Management of In Situ Leaching

The industrial user shall utilize water for in situ leaching in a manner that minimizes water use to the extent practicable, consistent with reasonable economic return.

6-1504 Alternative Conservation Program

An industrial user who uses water at a metal mining facility may apply to the Director to use conservation technologies other than the technologies prescribed in sections 6-1502 and 6-1503, whichever is applicable. The Director may approve the use of alternative conservation technologies if the Director determines that both of the following apply:

1. *The industrial user has filed with the Director a detailed description of the proposed alternative technologies and the water savings that can be achieved by the use of these technologies.*

2. *The industrial user has demonstrated to the satisfaction of the Director that the latest commercially available conservation technology consistent with reasonable economic return will be used.*

6-1505 Modification of Conservation Requirements for Metal Mining Facilities

A. An industrial user who uses water at a metal mining facility may apply to the Director to modify conservation requirements prescribed in sections 6-1502 and 6-1503, *whichever is applicable, for any year in which compliance with the conservation requirements would likely result in violation of any federal, state, or local environmental standards or regulations. To apply for a modification of conservation requirements, an industrial user shall submit a request in writing to the Director that includes the following information:*

1. *Documentation describing the conservation requirement(s) for which compliance with this requirement is likely to result in violation of environmental standards, and the environmental standards that are likely to be violated.*

2. *The proposed modification to the conservation requirements.*

B. *The Director shall grant a request for modification of conservation requirements if the Director determines that compliance with the conservation requirements prescribed in sections 6-1502 and 6-1503, whichever is applicable, would likely result in a violation of any federal, state, or local environmental standards or regulations.*

6-1506 Preparation of a Long-Range Conservation Plan for Metal Mining Facilities

By January 1, 2023 or three months prior to commencement of operations at the facility, whichever is later, an industrial user who uses water at a metal mining facility shall submit to the Director an updated long-range water conservation plan that describes the existing or planned design, construction, and operation of the facility, including a description of the ore type, method of mining, and method of metal extraction. The plan shall include an evaluation of the use of the latest commercially available conservation technology consistent with reasonable economic return. Prior to submitting the plan, the industrial user shall analyze the feasibility of applying the following conservation practices or technologies at the mine and shall report the results in the plan:

1. *Using alternative water sources for mining and metallurgical needs, including determining the source and volume of the alternative water sources being analyzed.*

2. *Reducing tailings impoundment evaporation through the application of the latest commercially available technologies for minimizing evaporation from the impoundments and through the application of improved tailings management.*

3. *Minimizing water use for dust suppression through the use of road binders, conveyors, paved haul roads, and other available dust control mechanisms.*

4. *Increasing tailings densities to 55 percent solids or greater by weight.*

The industrial user may include any additional conservation techniques or technologies in the plan. The plan shall include a schedule of the approximate dates for implementation of any conservation practices or technologies that the industrial user intends to implement.

6-1507 Monitoring and Reporting Requirements for Metal Mining Facilities

A. Water Measurement and Reporting

For calendar year 2023 or the calendar year in which the facility commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the 5MP, an industrial user who uses water at a metal mining facility shall include in its annual report required by A.R.S. § 45--632 the following information:

1. *The quantity of water from any source, including treated effluent, used during the calendar year for each of the following purposes: dust control, tailings revegetation, domestic use, and transportation of tailings to tailings impoundments. The quantity of water used for dust control and tailings revegetation shall be separately measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq. The quantity of water used for domestic use and transportation of tailings to tailings impoundments may be estimated.*

2. *The quantity of make-up water from any source, including treated effluent, used during the calendar year for each of the following purposes: equipment washing, leaching operations, and milling operations, as separately measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R12-15-901, et seq.*

3. *The quantity of water from any source, including treated effluent, reclaimed during the calendar year from each of the following: tailings impoundments and pit dewatering. These quantities shall be separately measured with a measuring device in accordance with ADWR's measuring-device rules, A.A.C. R-12-15-901, et seq.*

4. *The tons of ore milled during the calendar year.*

5. *The tons of ore stacked to heap and/or dump leach during the calendar year.*

6. *The tons of ore vat leached during the calendar year.*

7. *The tons of material mined during the calendar year.*

8. *The tons of mineral produced from mill circuits and from leach circuits during the calendar year.*

9. *The average gallons of water consumed per ton of mineral produced during the calendar year.*

10. *The average percentage of solids by weight in tailings transported to the tailings impoundments during the calendar year and in each of the previous two years.*

11. *The average annual depth of water at the deepest portion of the stilling basin(s).*

12. *Copies of aerial photos of tailings impoundments, with scale indicated, for use by ADWR in determining the wetted surface area of the tailings impoundments.*

13. A description of the additional conservation measures applied at the metal mining facility as prescribed in section 6-1802, subsection F.

B. Contiguous Facilities

A single annual report may be filed for a pre-1985 metal mining facility and a post-1984 metal mining facility that are contiguous and owned by the same owner. The combined operations of the metal mining facilities shall be described pursuant to reporting requirements specified in subsection A of this section.

APPENDIX 6A
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

WATER USE CATEGORY 1. DELIVERY OF DRINKING WATER FOR DAIRY ANIMALS

Description: The level of milk production, season of year and type of dairy animal housing has a significant effect on the water intake of a dairy animal. The drinking water needs of a lactating cow will vary from 25 to 45 gallons per day. As milk production per cow per day increases, drinking water intake will also increase. Conservation of dairy animal drinking water could best be accomplished by preventing and promptly repairing leaks in the drinking water system.

BMP 1.1

Install and maintain valves and floats throughout the drinking water system to allow for the isolation of leaks in lines and tanks.

The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all valves and floats. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the location of the valves or floats.

BMP 1.2

Inspect the drinking water system for leaks daily to ensure that leaks are promptly identified and repaired to prevent water loss. If a leak occurs, stop water flow by isolating the area of the leak and/or repair the leak within 72 hours.

WATER USE CATEGORY 2. UDDER WASHING AND MILKING PARLOR CLEANING

Description: Udder washing and milking parlor cleaning is the single largest water use at a dairy operation. Floor and wall wash and sanitation of the milking area is necessary for producing a safe product. These systems can be either manual or semi-automatic. The amount of water used also depends on weather conditions. Udder washing and milking parlor cleaning offer the greatest conservation potential at a dairy through management of the system.

2.1 UDDER WASH SYSTEM

BMP 2.1.1

Install and operate the udder washing system with automatic timers. When udder washing, use a maximum of one minute of water for the soak cycle followed by a minimum of two minutes off and a maximum of three minutes of water for the wash cycle followed by one minute off. Repeat with a second wash cycle if needed.

APPENDIX 6A
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

BMP 2.1.2

Install a grid no larger than six feet by five feet between sprinkler heads on wash pens installed or renovated after Jan. 1, 2002.

The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all sprinkler heads and the dimensions of the wash pens. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the location of the sprinkler heads or to the dimensions of the wash pens.

BMP 2.1.3

Install lock-out devices so that the wash system can be used only once per group of cows unless exceptional conditions require an override of the lock-out device.

The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all lock-out devices. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the location of the lock-out devices.

BMP 2.1.4

Establish and implement an inspection schedule to properly maintain and replace spray heads and timing devices. Inspect all spray heads and timing devices daily to ensure that they are operating correctly. If a device is found to be malfunctioning, repair or replace the device within 72 hours.

2.2 MILKING PARLOR FLOOR AND WALL WASHING

BMP 2.2.1

Equip all parlor hoses with shut-off valves. Inspect all hoses and valves daily. If a leak occurs, stop water flow by isolating the area of the leak and/or repair the leak within 72 hours.

BMP 2.2.2

If a semi-automatic floor flush system is used, it must be equipped with a timing device to limit the duration of cleaning and be designed to use no more water than necessary unless the water used is water recycled within the dairy operation.

The Annual Report required by A.R.S. § 45-632 shall include a description of the flush system that includes the flush schedule and the amount of water used for each flush. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the timing device.

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WATER USE CATEGORY 3. CORRAL DESIGN AND MAINTENANCE

Description: Proper corral design and maintenance will reduce water use in the cow wash pen prior to milking by reducing the amount of wash time necessary to clean the cow. Sloping and maintaining the corral in a dry condition keeps the cow in a cleaner condition.

BMP 3.1

Slope corrals to prevent standing water and to promote drainage to the wastewater system.

The Annual Report required by A.R.S. § 45-632 shall include a dairy facility map that shows the corral design and the direction of slope. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to corral design.

BMP 3.2

Scrape, harrow or drag corrals to eliminate holes and maintain corrals in a dry condition.

The Annual Report required by A.R.S. § 45-632 shall include a description of corral maintenance for wet and dry conditions and a maintenance schedule. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in corral maintenance.

WATER USE CATEGORY 4. CLEANING AND SANITIZING MILKING EQUIPMENT

Description: Cleaning and sanitizing milking equipment is necessary to provide a safe dairy product. Water is also used in pre-coolers and vacuum pumps during the milking operation. Water used for this purpose is usually between 5-10 percent of the total water use at the dairy operation. This water can be recycled for other uses at the dairy.

4.1 MILK COOLING AND VACUUM PUMP

BMP 4.1.1

If the milk cooling and vacuum pump system is water-cooled and is not a closed system, reuse water from the system to wash cow udders or pens, or for any other uses, consistent with state and federal sanitary codes.

The Annual Report required by A.R.S. § 45-632 shall include a description and diagram of how water is reused from the milk cooling and vacuum pump system. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in how water is reused from the milk cooling and vacuum pump system.

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4.2 MILK LINE WASHING

BMP 4.2.1

Install and operate the milk line washing system with an automatic or semi-automatic timing device.

The Annual Report required by A.R.S. § 45-632 shall include a description of how the milk line washing system operates. The description shall include the number of cycles per washing and the amount of water used per washing. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the number of cycles per washing and the amount of water used per washing.

4.3 BACK-FLUSH SYSTEMS

BMP 4.3.1

Maintain and service all back-flush systems in accordance with the manufacturer's design specifications and maintenance schedule.

The Annual Report required by A.R.S. § 45-632 shall include the manufacturer's design specifications and a maintenance schedule. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the back-flush system.

WATER USE CATEGORY 5. DUST CONTROL, CALF HOUSING CLEANING AND FEED APRON FLUSHING

Description: Control of dust, wastes and feed residues is necessary for fly control, sanitation and animal health. This requires water for cleaning and flushing feed aprons and calf housing and for wetting roadways. Conservation potential in this category includes recycling and reusing water, avoiding waste, and employing simple technologies that can reduce the amount of water needed for dust control.

BMP 5.1

If the dairy flushes the cow feed apron, design the systems to recycle water from the cow udder wash system or to pump wastewater and recycle it from the lagoon or wetland area.

The Annual Report required by A.R.S. § 45-632 shall include a description of how water is recycled at the operation, an estimate of the amount of water recycled, and the method of estimation. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to how water is recycled.

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BMP 5.2

If the calf housing utilizes a flush system to remove animal wastes, design and manage the system so that it uses only the minimum amount necessary and equip with a timer to minimize the duration of each flush.

The Annual Report required by A.R.S. § 45-632 shall include a description of how the system is designed and managed to minimize water use, the length of time of each flush and the number of times per day on average that the system is in operation, and a water system map of the facility showing the location of the timer. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the design or operation of the flush system.

BMP 5.3

If dust control practices are used at the facility, the following dust control methods should be used: paving, aggregate, chemical binding agents or dairy wastewater if consistent with state and federal standards. If potable water is used for dust control it must be used as efficiently as possible.

The Annual Report required by A.R.S. § 45-632 shall include a description of the dust control technology(ies) used and the area on which dust control is practiced, and the amount of water used for dust control. If water use is estimated, provide a description of how water use is estimated. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to dust control practices.

WATER USE CATEGORY 6. DAIRY ANIMAL COOLING

Description: Dairy animal cooling is an effective method to improve milk production per cow and reproductive efficiency, which are important factors in dairy profitability. Animal cooling is also an important factor in improving animal health. The amount of water required depends on the type of method or methods used to cool cows, on the maintenance practices for the system and on the hours of usage. Methods to conserve water for each cooling system are available to dairy-farm management.

6.1 HOLDING PEN COOLING

BMP 6.1.1

Design and operate independent fan and spray systems to ensure that water is used efficiently under all weather conditions.

The Annual Report required by A.R.S. § 45-632 shall include a diagram demonstrating that fans and spray systems are used independently and provide information on how the system is managed depending on weather conditions. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the fan and spray systems.

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6.2 COW EXIT AND RETURN LANES COOLING

BMP 6.2.1

Use leaf gate, wand switch, electric eye or motion (proximity) indicators to automatically activate the water valve.

The Annual Report required by A.R.S. § 45-632 shall include a description of the activation device used at the dairy operation and how it operates, including the length of time the water valve is in operation and the amount of water used, and include the average number of times per day that the device is activated in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in activation device.

6.3 FEED LINE COOLING

BMP 6.3.1

Locate the feed line cooling system to take advantage of prevailing winds in order to place water directly on the dairy animal. Equip the system with timers to control the duration of use.

The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all timers and the direction of prevailing winds. Report the length of time the timer is in operation and the average number of times per day that the system is in operation in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the feed line cooling system or timers.

6.4. CORRAL SHADE COOLERS

BMP 6.4.1

Equip corral shade coolers with thermostats or timers to control operation time.

The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all thermostats or timers and report the average daily length of time the coolers are in operation in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the thermostats or timers.

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BMP 6.4.2

Establish an inspection schedule to ensure regular maintenance of nozzles and water filter systems.

The Annual Report required by A.R.S. § 45-632 shall include an inspection and maintenance schedule. This schedule shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the maintenance schedule.

WATER USE CATEGORY 7. DAIRY ANIMAL FEED PREPARATION

Description: Water is used in the preparation of dairy animal feed at dairy operations to pre-soak cereal grain for processing, (rolling and flaking). A large use of water in feed preparation is its addition to the total mixed ration (TMR) to improve feed intake. The amount of water needed depends on the dryness of the feed in the ration. The total amount of water added to the feed could equal 20 percent of the ration. The greatest conservation potential for feed preparation rests with leak detection and prevention.

BMP 7.1

Install shut-off valves at each water source used for feed preparation to allow for the isolation of leaks. If a leak occurs, isolate the area of the leak and/or repair the leak within 72 hours.

The Annual Report required by A.R.S. § 45-632 shall include a water-system map of the facility showing the location of all valves. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the location of the valves.

Bibliography

ADWR. (2010). *Demand and Supply Assessment, Phoenix Active Management Area.* ADWR.

CHAPTER SEVEN: WATER QUALITY

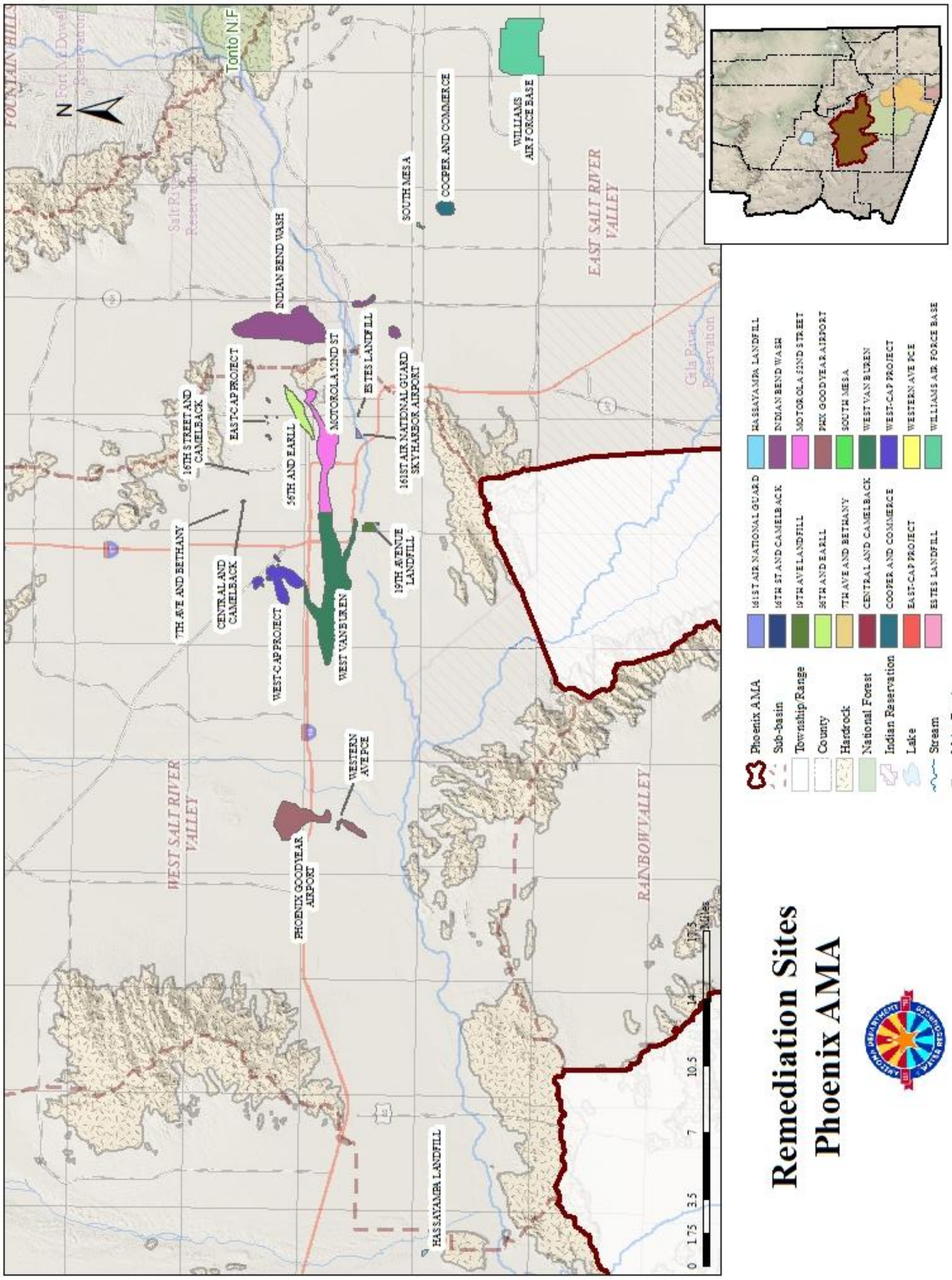
7.1 INTRODUCTION

Water quality is an important component of the Phoenix Active Management Area (PhxAMA) water supply management. The Arizona Department of Water Resources' (ADWR) role in water quality relates to the impacts of water quality on available water supplies. Protecting and managing water quality maximizes the overall quantity of usable water and matching the best use to the quality of water is a significant part of ADWR's water management objectives. This chapter describes ADWR's role and authority in meeting groundwater quality management objectives during the fourth management period and addresses water-quality impacts on water-supply management in the PhxAMA.

During the fourth management period, ADWR will continue to play a role in water quality challenges. ADWR's groundwater quality responsibilities include support of groundwater quality protection programs, assistance in the clean-up of contaminated areas, and assistance in matching water quality with the highest beneficial use.

In general, groundwater in the PhxAMA is of acceptable quality for most uses. Most of the groundwater supplies in the PhxAMA meet federal and state drinking water standards, though contaminant levels exceed the U.S. Environmental Protection Agency (EPA) National Primary Drinking Water Regulation limits *(See http://water.epa.gov/drink/standardsriskmanagement.cfm)* in a few areas. Within the PhxAMA there are 18 Water Quality Assurance Revolving Fund (WQARF) sites, seven U.S. EPA National Priorities List (NPL) sites, and two Department of Defense (DOD) sites (*See Figure 7-1*). PhxAMA groundwater withdrawals from wells within these identified areas have been discontinued or are in the process of being remediated. Other areas of known contamination that are not being remediated are monitored to ensure that contaminants do not spread.

FIGURE 7-1
PHOENIX AMA WATER QUALITY REMEDIATION SITES



7.2 GOALS AND OBJECTIVES

As the agency entrusted with managing and conserving Arizona's long-term water supplies, ADWR will ensure that use of groundwater withdrawn to achieve remedial action objectives is minimized and, where practicable, new groundwater uses are not created and groundwater supplies are conserved. While ADWR believes that it is possible to both achieve reductions in withdrawals of groundwater and provide incentives for the use of remediated groundwater, it recognizes that there is a delicate balance between the two responsibilities that will involve coordinated efforts between the Arizona Department of Environmental Quality (ADEQ) and ADWR to ensure that, on a case-by-case basis, no more groundwater is withdrawn than is necessary.

To implement its groundwater quality management responsibilities, ADWR will "coordinate and confer" with ADEQ regarding "water plans, water resource planning, water management, wells, water rights and permits, and other appropriate provisions of Title 45 pertaining to remedial investigations, feasibility studies, site prioritization, selection of remedies and implementation of the WQARF program pursuant to title 49, chapter 2, article 5" (A.R.S. § 45-105(B)(4)(c)).

ADWR's goals and objectives for groundwater quality management for the fourth management period are the following:

- to ensure that remediation of contaminated groundwater uses the minimal amount of groundwater necessary to facilitate the objectives of each remedial action project;

- to ensure that end uses of remediated groundwater minimize groundwater withdrawals and are consistent with the safe-yield goal for the PhxAMA. To this end, ADWR will favor end uses that minimize changes in groundwater storage such as reinjection and recharge over those that reduce groundwater in storage. Where remediated groundwater cannot be practicably or cost-effectively reinjected or recharged, ADWR will encourage replacing existing groundwater uses with remediated water; and discourage new permanent uses which would not have occurred without the poor-quality groundwater accounting and which would continue to rely on groundwater after the poor-quality groundwater is no longer available; and

- to ensure efficient use of the remediated water to help meet the water conservation goals of the PhxAMA;

ADWR's objectives are designed to ensure that remedial action projects are not an impediment to achieving the safe-yield management goal for the PhxAMA and that remedial actions are performed in a prudent and efficient manner from a water management perspective.

7.3 STATUTORY PROVISIONS

While ADEQ is the agency primarily responsible for regulating water quality in Arizona, ADWR also has certain limited responsibilities in this area. Statutory provisions pertaining to ADWR's limited authority to regulate groundwater quality are discussed below.

The 1980 Groundwater Code (Code) grants ADWR authority to regulate groundwater. Under the Code, ADWR has the following authority and responsibilities relating to water quality:

- "The director may . . . formulate plans and develop programs for the practical and economical development, management, conservation and use of surface water, groundwater and the watersheds in this state, including the management of water quantity and quality" (A.R.S. § 45-105(A)(1)).

- "The director may . . . conduct feasibility studies and remedial investigations relating to groundwater quality and enter into contracts and cooperative agreements under § 104 of the comprehensive environmental response, compensation, and liability act [CERCLA] of 1980 (P.L. 96-510) to conduct such studies and investigations" (A.R.S. § 45-105(A)(15)).
- For the fourth management period, the Director "may include in each plan, if feasible, in cooperation with the department of environmental quality, an assessment of groundwater quality in the active management area and any proposed program for groundwater quality protection. Any such program shall be submitted to the legislature for any necessary enabling legislation or coordination with existing programs of the department of environmental quality" (A.R.S. § 45-567(A)(6)).

- "The director shall consult with the department of environmental quality on water-quality considerations in developing and implementing management plans under this article" (A.R.S. § 45-573).

WQARF legislation, enacted in 1997 and amended in 1999, expanded ADWR's role in water-quality management. ADWR's responsibilities and authority under WQARF include:

- "The director of water resources, in consultation with the director of environmental quality, may inspect wells for vertical cross-contamination of groundwater by hazardous substances and may take appropriate remedial actions to prevent or mitigate the cross-contamination…" (A.R.S. § 45-605(A)).

- "The director shall notify an applicant for a permit or a person who files a notice of intent to drill a new or replacement well if the location of the proposed well is within a sub-basin where there is a site on the registry established pursuant to section 49-287.01, subsection D…" The Director also shall adopt rules requiring the review of notices and applications regarding new or replacement wells to identify whether a well will be located where existing or anticipated future groundwater contamination presents a risk of vertical cross-contamination by the well. The rules shall require that a new or replacement well in these types of locations be designed and constructed in a manner to prevent cross-contamination with an aquifer (A.R.S. § 45-605(E)).

- "The director of environmental quality and the director of water resources shall coordinate their efforts to expedite remedial actions, including obtaining information pertinent to site investigations, remedial investigations, site management and beneficial use of remediated water" (A.R.S. § 49-290.01(C)).

- "On consultation with the director of environmental quality, the director of water resources may waive its applicable permits, approvals or authorizations if the director of water resources determines that the permits, approval or other authorization unreasonably limits the completion of a remedial action and if the waiver does not conflict with the statutory intent of the permit, approval or other authorization." A.R.S. § 49290.01(A). "The director of water resources also may waive any regulatory requirement adopted pursuant to Title 45 -with respect to a site or portion of a site as part of a record of decision adopted pursuant to section 49-287.04 for that site or portion of a site if the regulatory requirement conflicts with the selected remedy, provided that the waiver does not “result in adverse impacts to other land and water users” (A.R.S. § 49-290.01(D)).

- “The department of water resources shall include in its management plans… provisions to encourage the beneficial use of groundwater that is withdrawn pursuant to approved remedial action projects…” (1999 Ariz. Sess. Law, H.B. 2189, § 51(A)). In order to encourage the beneficial use of remediated groundwater, “the department of water resources shall account for groundwater withdrawn pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes, except for groundwater withdrawn to provide an alternative water supply pursuant to section 49-282.03, Arizona Revised Statutes, consistent with the accounting for surface water” for purposes of determining compliance with management plan conservation requirements (1999 Ariz. Sess. Law, H.B. 2189, § 51(B)).

- “For each calendar year until 2025, the use of up to an aggregate of 65,000 acre-feet (AF) of groundwater withdrawn within all active management areas pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes,” except for groundwater withdrawn to provide an alternative water supply pursuant to section 49-282.03, Arizona Revised Statutes, shall be considered consistent with the management goal of the active management area as prescribed in A.R.S. § 45-576(J)(2), Arizona Revised Statutes (1999 Ariz. Sess. Law, H.B. 2189, § 52(A)).

- For the fourth management period, “twenty-five percent of the total volume of groundwater withdrawn pursuant to approved remedial action projects under CERCLA or title 49, Arizona Revised Statutes, except for groundwater withdrawn to provide an alternative water supply pursuant to section 49-282.03, Arizona Revised Statutes, in excess of the aggregate volume of sixty-five thousand AF of groundwater authorized in subsections A and C of this section shall be considered consistent with the management goal of the active management area as prescribed in section 45-576 (J)(2),Arizona Revised Statutes ...” (1999 Ariz. Sess. Law, H.B. 2189, § 52(B)).

- “The department of environmental quality and the department of water resources shall develop a method of sharing data, including cooperative data base development and integration between the departments that will provide the departments with the information necessary to protect the resources of the state” (1997 Ariz. Sess. Law, S.B. 1452, § 44(A)).

- “The directors of environmental quality and water resources shall enter into an agreement to coordinate the well inspection and remediation programs and to rank wells within an area of contamination according to each well’s potential to act as a conduit to spread contamination and to determine the appropriate remedial action regarding the wells with a potential to act as a conduit, including well reconstruction, well abandonment or no action.” 1997 Ariz. Sess. Law, S.B. 1452, § 45(A). Per S.B. 1465 (1997 Session Laws) §45(B), ADEQ and ADWR were required to establish rules with procedures to provide affected well owners with “the opportunity to comment on departmental investigations and remedial actions involving vertical cross-contamination” and “provide that well owners with wells with the highest potential to act as a conduit to spread contamination be notified of the status of these wells." This was accomplished in A.A.C. R12-15-850(A) and (B). See also, A.C.C. R12-15-812 and 821.

7.4 THE REGULATION OF GROUNDWATER QUALITY IN ARIZONA

To understand ADWR's role in regulating groundwater quality, it is important to understand the broad framework of laws and programs impacting both groundwater and surface water quality. Since groundwater quantity and quality challenges are interrelated, ADEQ and ADWR work together to prevent and mitigate groundwater quality and quantity challenges. ADEQ has the primary responsibility for protecting the State's groundwater and surface water quality, while ADWR secondarily manages groundwater quality concerns. This section will discuss the regulatory agencies responsible for administering laws impacting groundwater and surface water quality as well as the federal laws and state programs impacting groundwater quality and secondarily surface water quality.

7.4.1 Water Quality Regulatory Agencies

Water quality protection programs in Arizona are based on both federal and state law and are primarily administered by either ADEQ or the U.S. Environmental Protection Agency (EPA) Region IX. ADEQ has the responsibility to administer state water quality programs pursuant to state statutes and to administer federal water quality programs for which the EPA has delegated its authority to the state, referred to as "state primacy." EPA has the responsibility to administer federal water quality programs pursuant to federal statutes. The EPA delegates its authority to states where the state demonstrates that it can adequately administer the program and the federal statute provides for the delegation of the authority.

ADEQ has authority pursuant to the Environmental Quality Act (EQA) of 1986 (A.R.S. § 49-101 *et seq.*) to set water-quality standards and to regulate discharges that have the potential to impact the quality of groundwater by requiring such discharges to be made subject to an aquifer protection permits (APP). ADEQ has authority under the Clean Water Act (CWA) to set Arizona's surface water quality standards and to certify that discharges subject to federal permits do not violate state water quality standards.

EPA Region IX delegated authority to administer the CWA National Pollutant Discharge Elimination System (NPDES) permits and the pretreatment program to Arizona in 2002. The ADEQ program is a point source discharge permitting program and is called the Arizona Pollutant Discharge Elimination System (AZPDES). The United States Army Corps of Engineers (Corps), Los Angeles District, retains authority to administer CWA permits for the discharge of dredge or fill materials in Arizona's waters. EPA Region IX also has authority to require groundwater monitoring and remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

7.4.2 Federal Laws Impacting Groundwater Quality

The Safe Drinking Water Act (SDWA) is the primary federal law regulating drinking water quality which includes groundwater. The CWA, which regulates surface water, also impacts groundwater quality. CERCLA and the Resource Conservation and Recovery Act (RCRA) impact groundwater management through the regulation of hazardous waste and sites contaminated by hazardous waste. The following is a brief overview of these federal laws and their impacts on ADWR's water quality management.

7.4.2.1 Safe Drinking Water Act
The SDWA was enacted in 1974 to regulate drinking water. ADEQ has been delegated authority by the EPA to implement the SDWA and "to ensure that all potable water distributed or sold to the public through public and semi-public water systems is free from unwholesome, poisonous, deleterious, or other foreign substances and filth or disease-causing substances or organisms" (A.R.S. § 49-351(A)).

Although ADWR does not regulate drinking water quality, the presence of contaminants in groundwater does negatively impact water quality for municipal providers and poses significant water management issues for drinking water systems.

7.4.2.2 Clean Water Act
The CWA, first passed in 1972, is the comprehensive federal statute regulating surface water quality. It provides for area-wide, long-range planning processes to mitigate water quality control problems in selected areas which result from urban and industrial wastewater. Because such planning processes provide a comprehensive review of wastewater treatment and reuse options, ADWR participates in such planning and provides technical assistance to local councils of government who administer the plans.

7.4.2.3 Comprehensive Environmental Response, Compensation, and Liability Act
CERCLA and the Superfund Amendments and Reauthorization Act, commonly referred to as the Federal Superfund Program, authorize investigation and remediation of groundwater contaminated by releases of hazardous substances. In Arizona, CERCLA establishes a comprehensive response program which is administered by ADEQ in cooperation with the EPA. ADWR also plays an advisory role in this process, and regularly participates in CERCLA program activities. ADWR's concern regarding CERCLA sites is that any groundwater that is withdrawn and remediated must be put to reasonable and beneficial use. ADWR may participate on CERCLA technical committees and serve in an advisory capacity for monitoring and extraction well installation, source control projects, and permitting.

7.4.2.4 Resource Conservation and Recovery Act
RCRA established a national hazardous waste management program in 1976. Under RCRA, hazardous waste permits are issued for the treatment, storage and disposal (TSD) of hazardous wastes. Individual permits issued to these facilities specify design, performance and operational standards which include groundwater monitoring. Hazardous waste facilities also undergo a closure process once operations are reduced or terminated. Moreover, corrective action may be required at TSD facilities and may include groundwater monitoring.

ADEQ has been delegated authority for the implementation of RCRA requirements in Arizona. ADWR's participation at RCRA sites is important for water management activities, particularly in regard to well siting, use permits, and end-use issues.

7.4.3 ADEQ Programs that Impact ADWR Groundwater Quality Activities
The Environmental Quality Act (EQA) established the ADEQ and created a strong and comprehensive water quality management structure. ADEQ's programs that protect groundwater resources include water quality assessments, groundwater monitoring, pollutant discharge, permitting activities, and remediation activities. The following are selected water quality protection programs which fall under the jurisdiction of ADEQ and have a direct impact on ADWR activities.

7.4.3.1 Aquifer Protection Program

The most comprehensive ADEQ groundwater protection program is the Aquifer Protection Program (APP), established by the EQA in 1986 and implemented by rule in 1989. An individual or general permit is required for any person who discharges or who owns or operates a facility that discharges a pollutant from a facility either directly into an aquifer or to the land surface or the vadose zone in such a manner that there is a reasonable probability that the pollutant will reach an aquifer (A.R.S. §§ 49-201(11), 49-241).

ADWR may coordinate with ADEQ to review APP applications for potentially harmful water quality impacts on groundwater conditions. ADEQ advises ADWR of each APP application received for a facility that is an underground storage and recovery project. One of the conditions for the issuance of an underground storage facility permit is that ADEQ must determine that the facility is not in a location which will result in pollutants being leached to the groundwater table so as to cause unreasonable harm (A.R.S. § 45-811.01(C)). Facilities exempt from APP provisions may be required by ADWR, in consultation with ADEQ, to meet other requirements to mitigate harmful water quality impacts to the aquifer.

7.4.3.2 Wellhead Protection Program

An important addition to Arizona's groundwater protection program has been the development of the Wellhead Protection Program which fulfills Federal requirements of section 1428 of the SDWA by designating Wellhead Protection Areas around public drinking water systems. The Wellhead Protection Program is a voluntary program which encourages the protection of all wells, not just public drinking water system wells. Local entities that have the authority to control land use and exercise other management options can implement wellhead protection, therefore encouraging the creation of local programs.

7.4.3.3 Reuse Permits

Reuse permits are issued by ADEQ to facilities which provide treated wastewater for reuse. A reuse permit specifies the amount of reclaimed water to be reused and its chemical quality. ADEQ wastewater reuse rules (A.A.C. R18-9-701 *et seq.*) set the criteria for the use of treated effluent, or reclaimed water, for purposes such as agricultural irrigation, turf irrigation, and recharge. The current reuse rules prescribe numeric reclaimed water quality criteria and monitoring requirements for specific reuse applications. In general, these rules prescribe allowable limits for pH, total fecal coliform, turbidity, enteric viruses, and certain parasites. Reuse may be limited depending on the quality of source water and the intended use.

Wastewater reuse rules undergo periodic updating through ADEQ's rule-making process. ADWR reviews any proposed changes to the wastewater-reuse rules to ensure the protection of public health and groundwater supplies while maximizing the use of a significant renewable water supply. ADWR evaluates reclaimed water reuse permits issued by ADEQ and encourages the use of treated effluent where appropriate.

7.4.3.4 Underground Storage Tanks

ADEQ's Underground Storage Tank (UST) program was developed to ensure the proper operation of underground storage tanks and to prevent and remediate releases. Under state regulation and RCRA amendments, the UST program consists of notification requirements, technical standards for new and existing USTs, leak detection and closure criteria, corrective actions for remediation, and financial responsibility demonstrations. Leaking USTs in a concentrated area can present detrimental impacts on groundwater quality and supplies.

ADWR has the authority to issue poor quality groundwater withdrawal permits for water contaminated by USTs. ADWR can provide guidance for UST site remediation projects to ensure the beneficial use of remediated water.

7.4.3.5 Water Quality Assurance Revolving Fund

The WQARF Program, sometimes referred to as the state Superfund program, was created as part of the EQA. WQARF monies are used to protect the waters of our state against hazardous substances and may be used in conjunction with Federal funds. Funds can be used for statewide water quality monitoring, health and risk assessment studies, and remediating hazardous substances which threaten the waters of the state. Mitigation of non-hazardous substances also is allowed under specified conditions (A.R.S. § 49-286). ADEQ has developed a list of environmentally threatened sites which qualify for WQARF monies. Funds are used at those sites to mitigate existing contamination or to prevent further spread of pollutants which may threaten Arizona's water supplies. A registry of sites is maintained by ADEQ. Sites are added to the registry based on criteria such as the degree of risk to the environment and other available funding sources.

ADEQ follows a process for management and cleanup of WQARF sites that consists of site identification and characterization, site prioritization, remedy selection, identification of end uses, implementation and monitoring, and closure. ADWR will coordinate with ADEQ in the planning and implementation of any groundwater cleanup actions under WQARF in the PhxAMA.

7.4.3.6 Water Infrastructure Finance Authority

In 1989, the Arizona Legislature created the Wastewater Management Authority to administer funds granted to the state pursuant to the Federal SDWA. These funds, which required a 20 percent state match, are loaned to wastewater treatment systems in the state for assistance in meeting requirements of the SDWA. ADEQ made loans for this purpose from monies in the ADEQ wastewater treatment revolving fund. In 1997, this administrative body was amended by the Legislature and renamed the Water Infrastructure Finance Authority (WIFA).

The authority for WIFA was expanded to make loans available to drinking water systems in addition to wastewater treatment systems for assistance in meeting requirements of the SDWA. ADWR is required to participate on the advisory board that oversees the WIFA and has an interest in viability of water systems and SDWA compliance (A.R.S. § 49-1202(A)(8)).

7.4.4 ADWR Programs Related to Groundwater Quality

ADWR protects groundwater quality by considering groundwater quality issues in its permitting process and water quantity management programs. As a result of WQARF reform legislation in 1997, ADWR has increased its responsibility in the program to coordinate and provide assistance to WQARF activities. Among other things, the legislation provides for:

- annual funding for ADWR WQARF activities;
- database development and coordination with ADEQ;
- groundwater withdrawn pursuant to certain cleanups to be accounted for in the same manner as surface water for the purpose of determining compliance with conservation requirements;
- amendment of the Assured Water Supply (AWS) Rules;
- advisory participation by ADWR in site assessment, remediation, management, operation, and planning strategies;

- a WQARF Advisory Board on which ADWR has a seat; and
- a well inspection program through which wells that are contributing to vertical cross-contamination may be identified and modified.

ADWR's existing permits and programs which consider groundwater quality protection are discussed in the following section.

7.4.4.1 Poor Quality Groundwater Withdrawal Permits

Appropriate use of contaminated groundwater conserves the existing supply of potable groundwater. ADWR issues poor quality groundwater withdrawal permits to allow the withdrawal of groundwater which, because of its quality, has no other beneficial use at the present time (A.R.S. § 45-516). Withdrawal permits are issued by ADWR, and the withdrawal must be consistent with the AMA management plans. Permits are usually issued in conjunction with CERCLA, WQARF or leaking UST sites for pump-and-treat operations. To increase the appropriate uses of poor-quality groundwater during the fourth management period, ADWR will continue to encourage matching poor-quality groundwater with beneficial uses within the PhxAMA.

As of 2016, five entities hold eight poor quality groundwater withdrawal permits in PhxAMA, primarily at CERCLA and WQARF sites *(See Table 7-1)*.

TABLE 7-1
PHOENIX AMA POOR QUALITY WITHDRAWAL PERMITS

Permit Number	Permittee	Maximum Permitted Volume (AF)	Site
59-588107.0001	Arizona Department of Environmental Quality	290	Central and Camelback
59-533880.0000	City of Phoenix	80	Glenrosa Service Center
59-541491.0002	Freescale Semiconductor, Inc.	1,935	56th Street & Earll
59-586182.0003	Freescale Semiconductor, Inc.	1,200	Broadway and Dobson
59-530577.0002	Freescale Semiconductor, Inc.	1,314	52nd Street
59-533159.0001	Honeywell International, Inc.	4,840	Honeywell Peoria Avenue
59-570144.0002	Honeywell International, Inc.	150	Honeywell Deer Valley Computer Park
59-223478.0001	Nammo Talley, Inc.	1,290	Nammo Talley Plant #3
	TOTAL	**11,099**	

7.4.4.2 Assured Water Supply Program

The Assured Water Supply (AWS) Program is a consumer protection program that ensures that new subdivisions have a secure supply of water with adequate quality for at least 100 years. Pursuant to A.R.S. § 45-576, before land may be subdivided, the developer of the property must either obtain a Certificate of Assured Water Supply for the subdivision from ADWR, or a written commitment of water service for the subdivision from a city, town, or private water company with a Designation of Assured Water Supply (DAWS).

Pursuant to rules governing the AWS Program set forth in A.A.C. R12-15-701 *et seq.*, in order to establish an AWS, the applicant must prove that a supply of water is physically, legally, and continuously available for the 100-year period to meet the demands of the development that will be the subject of the AWS determination. In the case of a designation, the water supply must meet current and committed demands of the water provider for the 100-year period in addition to the projected demands of the new development. The applicant also must establish that projected water use will be consistent with achievement of the management goal for the active management area and that the applicant has the financial capability to construct the physical facilities necessary to serve the development. In addition, the applicant must establish that the water supply pledged for assured water supply purposes is of adequate quality.

In assessing the quality of a water supply pledged for AWS purposes, ADWR works closely with ADEQ to determine whether the water supply meets ADEQ standards for the purposes for which the water is pledged. If the water is not of adequate quality, the applicant may need to find alternative water sources or to expend additional resources treating the groundwater to meet the ADEQ standards.

As of 2016, there were 15 municipal water providers that hold DAWS in the PhxAMA. Other areas of the AMA develop by obtaining Certificates of AWS. *(See http://www.azwater.gov/azdwr/WaterManagement/AAWS/documents/documents/List_of_Designated_Providers_5.6.15.pdf for a list of providers who hold a DAWS in the PhxAMA.)*

7.4.4.3 Underground Water Storage and Recovery Program

Underground water storage, commonly referred to as artificial recharge, plays an important role in achieving the PhxAMA's goal of safe-yield. Recharge projects store renewable supplies such as CAP water and reclaimed water that is currently not used directly. Credits for recharged water are then available to water providers and developers to help meet the various requirements for an AWS. Some stored CAP water, particularly that water stored underground by the Arizona Water Banking Authority (AWBA), will be available to protect municipal and industrial CAP users from future shortages or outages on the CAP system.

The underground water storage program is administered by ADWR. Permits must be obtained from ADWR prior to undertaking recharge activities. ADWR coordinates closely with ADEQ to ensure that underground water storage does not adversely impact existing aquifer water quality and does not cause movement of existing groundwater contamination. If reclaimed water is stored underground, the applicant must obtain an APP from ADEQ, in addition to the underground storage permits required from ADWR. APPs specify monitoring requirements to assure that recharge waters are not negatively impacting the native groundwater. An APP is not required to store CAP water underground (A.R.S. § 49-250(B)(13)).

As of 2016, the PhxAMA has 56 permitted recharge facilities. There are 49 Underground Storage Facilities (USFs) and eight Groundwater Savings Facilities (GSFs). For more information on recharge facilities in the PhxAMA see Chapter 8 of this plan. There are 102 long-term storage account holders with long-term storage account balances totaling 6.4 million AF as of 2015. The potential volume recoverable per year pursuant to recovery well permits is variable.

7.4.4.4 Well Spacing/Impact Analysis

A.R.S. § 45-598 and ADWR's Well Spacing Rules (R12-15-1301 *et.* seq.) are in place to prevent unreasonable increasing damage to surrounding land or other water users due to the concentration of wells in an AMA. Specifically, these rules require well impact studies to evaluate the potential for new non-exempt wells and new withdrawals to cause damage to land and other water users. An applicant may submit a hydrologic report to demonstrate the proposed well's impact on surrounding wells but is not automatically required to do so. The Director may require the applicant to submit a hydrologic report if it is needed for the Director to make a determination under the rules. The well permit application may be denied if ADWR determines that the proposed well will cause unreasonable increasing damage on surrounding wells, additional regional land subsidence, or migration of poor-quality groundwater.

The "Notice of Intention to Drill" statute (A.R.S. § 45-596) governing well-drilling was modified in 2006 to allow the Director to deny the authority to drill a well if the Director determines that withdrawals from the well will cause the migration of contaminated groundwater from a remedial action site to another well, resulting in unreasonably increasing damage to the owner of the well, or persons using water from the well. The statute specifies that the Director shall use the same applicable criteria in the Well Spacing Rules used for wells inside of the AMA in making this determination.

7.4.4.5 Well Construction and Abandonment Requirements and Licensing of Well Drillers

If wells are not constructed, sealed, or abandoned properly they can act as conduits for contaminant flow from the surface to groundwater or between aquifers. ADWR's rules governing well construction, abandonment, and driller licensing, set forth at A.A.C. R12-15-801, *et. seq.,* are summarized below:

- Minimum well construction and abandonment requirements prevent entry of fluids at and near the surface and minimize the possibilities of migration and inadvertent withdrawal of poor-quality groundwater. These requirements also prohibit the use of hazardous materials in the construction of wells.

- Installation, modification, abandonment, or repair of all wells in Arizona must be performed by a driller licensed by ADWR. The licensing procedure includes the administration of written examinations to test the applicant's knowledge of state regulations, hydrologic concepts, and well construction principles and practices.

- Disposal site restriction prevents the use of wells as disposal facilities for any material that may pollute groundwater.

- Special standards may be required by ADWR if the minimum well construction requirements do not adequately protect the aquifer or other water users.

- Open wells must be capped with a watertight steel plate.

- Except for monitor and piezometer wells, no well shall be drilled within 100 feet of any septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area, or petroleum storage areas and tanks, unless authorized by the director.

Wells drilled prior to the enactment of the well construction rules (effective March 5, 1984) were not required to be constructed in accordance with minimum well construction standards. If a pre-rule well is replaced or modified, however, the new or modified well must meet the current well construction standards (A.R.S. §45-594).

7.4.4.6 ADWR's Role in the WQARF Program
The sections below describe ADWR's role and activities in implementing the Water Quality Assurance Revolving Fund (WQARF) Program.

ADWR Activities in the WQARF Site Cleanup and Management Process

Site Identification and Characterization
Existing WQARF sites are being managed by ADEQ. Additional sites may be identified in the future based on a preliminary investigation by ADEQ to determine the potential risk to public health, welfare, or the environment. The results of the preliminary investigation will be used by ADEQ for site scoring using a method to be established in rules adopted by the director of ADEQ. The completed preliminary investigation will be used by ADEQ to either make a determination of no further action on a site, or to prepare the site for inclusion on the Site Registry. In this latter case, a Site Registry report is prepared containing a description of the site, with its geographical boundaries indicated, and the site score.

After a site is added to the Registry, characterization is important because the nature and extent of contamination must be understood before remedies can be selected and implemented. An important part of site characterization is an evaluation of how contamination impacts current and future groundwater uses.

ADWR will assist ADEQ by providing resource data such as well location and groundwater withdrawal records, water rights information, and any other appropriate data recorded by ADWR. Other ADWR roles may include activities such as site inspections and evaluations, review of investigations, field work such as well inspection, identification of potential water management issues, and any other characterization as appropriate. ADWR computer models may be useful in characterizing groundwater flow patterns.

Remedy Selection
ADEQ has established a list of response actions to be considered when managing a site. Based on the potential impact on current and future water uses, a potential remedy must be evaluated and designed. Each remedy is site-specific. ADWR may assist in defining potential remedies to ensure that the remedy is consistent with ADWR management plans and sound groundwater management practices that are publicly acceptable. Ultimately, ADWR's level of assistance will vary based on the remedy selected.

ADWR is committed to the beneficial use of groundwater withdrawn and treated at WQARF sites and will assist ADEQ with the identification and facilitation of designated end uses for remedial projects. These end uses should be consistent with those determined for existing sites as well as the development of new end uses to match the intended use.

Implementation and Monitoring
The implementation and monitoring phase of a site activity includes construction, startup, monitoring, operation and maintenance, and any other appropriate activities. ADWR will assist ADEQ in this phase through the following activities where appropriate: field work, review of groundwater analyses, appropriate accounting for AWS determinations and for determining compliance with conservation requirements, and any other appropriate activities.

Site Closure
ADEQ must certify that site goals have been attained in order to discontinue cleanup activities. ADWR staff assists in evaluation of sites and certification of site closure. ADWR assists and may need to identify alternative water sources to replace remediated water when sites are closed.

ADWR Policies for WQARF and Other Applicable Cleanup and Management
In general, site plans should be consistent with the management goal of the AMA in which the site is located (A.R.S. §§ 49-282.06(F)). During the fourth management period ADWR will continue to cooperate with ADEQ on the cleanup of remedial sites. ADWR policies are geared toward ensuring that AMA goals are addressed when remedial actions are planned. ADWR generally supports proposed remedial projects that make sense from a groundwater management perspective. The principles which formulate these policies are described below.

- ***Water use should be consistent with water allocation concepts in Title 45***
  This policy requires that entities using water withdrawn pursuant to cleanups, whether under CERCLA, WQARF, RCRA, voluntary or other sites, possess groundwater withdrawal authority, such as permits or water rights.

- ***ADWR supports source control cleanups to protect water sources***
  Source control, which controls pollution at its source, can be a cost effective and practical approach to cleanups. Many wells have been rendered unsuitable for direct potable use due to migrating contamination. Source control projects to protect wells that are threatened by contaminant migration are generally supported by ADWR.

- ***Any groundwater withdrawn must be put to reasonable and beneficial use***
  Reasonable and beneficial use of groundwater withdrawn is a policy that applies to all cleanups. Any withdrawals of 100 AF or less annually may qualify for *de minimis* status and be exempted from beneficial use requirements, but ADWR will evaluate *de minimis* exemptions from this policy on a case-by-case basis. In the case of leaking UST sites, ADWR generally exempts sites that annually pump only a small volume of water.

- ***Contaminated groundwater represents a resource that will be important***
  Even if groundwater is contaminated, it represents a resource that can be potentially be used for both potable and non-potable uses. Potable uses must meet the state and federal drinking water standards that govern public consumption of potable water. ADEQ and the Arizona Department of Health Services intend to develop enduse standards for non-potable uses that, if implemented, will make large volumes of groundwater usable again. ADWR will cooperate in the development of non-potable end use standards and will develop policies for appropriate end uses based on the new standards.

ADWR does not encourage containment remedies that involve massive groundwater withdrawals to achieve regional groundwater flow control from a water management standpoint.

Statutory Mandates for ADWR's Participation in the WQARF Program
The WQARF reform legislation enacted in 1997 and amended in 1999 mandates that ADWR implement certain water quality programs and provides for expanded ADWR involvement in water-quality management. 1999 Ariz. Sess. Law, H.B. 2189, §§ 51 and 52 ADWR programs and responsibilities based on the WQARF reform legislation include the following:

- Coordination with ADEQ in Evaluating Proposed Remedial Actions - Pursuant to A.R.S. § 45-105(B)(4)(c), ADWR is required to coordinate and confer with ADEQ in evaluating proposed remedial actions to provide ADEQ with information regarding water resource considerations. ADWR will coordinate and confer with ADEQ prior to ADEQ's approval or denial of proposed remedial action plans. Once a remedial action plan is approved by ADEQ or the EPA pursuant to CERCLA or Title 49, Arizona Revised Statutes, ADWR will account for remediated groundwater in accordance with Laws 1997, Ch. 287, §§ 51 and 52. Among other things, ADWR will consider the following factors relating to proposed remedial actions in its recommendations to ADEQ:

    - Volume of remediated groundwater to be withdrawn - ADWR will encourage remedial actions that use the least amount of groundwater necessary to facilitate a project's remedial goal and will discourage remedial actions that are not prudent and efficient from a groundwater management perspective.

    - End uses to which remediated groundwater will be put - ADWR will encourage end uses that minimize groundwater withdrawals and that are consistent with the safe-yield goal because they will result in no change in groundwater storage. Where remediated groundwater cannot be practicably or cost-effectively re-injected or recharged, ADWR will encourage replacing existing groundwater uses with remediated groundwater and discourage new permanent uses which would not have occurred without the incentive to use remediated groundwater and which would continue to rely on groundwater after the remediated groundwater is no longer available.

    - While circumstances will be evaluated on a case-by-case basis, ADWR has adopted a substantive policy listing end-use preferences *(See: http://www.azwater.gov/AzDWR/Legal/LawsRulesPolicies/SubstantivePolicyStatement.htm, policy GW38, "Remediated Groundwater Incentives for Conservation Requirement Accounting for the Second Management Plan")*. Those preferences, listed in order from most to least preferred based on the impact on the active management area's management goal and the amount of groundwater in storage:

      Neutral to local aquifer
      - a. Re-inject or recharge in the same local area.
      - b. Replace existing groundwater uses in the same local area.

      Neutral to groundwater basin
      - c. Re-inject or recharge in the same active management area.
      - d. Replace existing groundwater uses in the same active management area.

      Reduce groundwater in storage
      - e. Replace existing non-groundwater use in the same active management area.
      - f. Beneficial uses of water for new purposes.
      - g. Artificial wetlands or artificial lakes.
      - h. Dispose to the sewer (unless the resulting reclaimed water is re-injected, recharged or replaces an existing groundwater use).

- Achievement of maximum beneficial use of waters and viability of proposed remedial action.

- Remedial actions must: assure the protection of public health and welfare and the environment; to the extent practicable, provide for the control, management or cleanup of hazardous substances so as to allow the maximum beneficial use of the waters of the state; and be reasonable, necessary, cost-effective and technically feasible (A.R.S. § 49-282.06(A)).

- Consistency with Title 45 - Groundwater withdrawn pursuant to an approved remedial action must be withdrawn and used consistent with Title 45, Arizona Revised Statutes.

Construction of New Wells in and Near Remedial Action Sites
ADWR will ensure that new or replacement wells in areas of known groundwater contamination are constructed in such a manner that cross-contamination does not occur. ADWR staff will screen Notices of Intent to Drill that are submitted to ensure that wells are properly constructed. ADWR will establish policies and procedures to implement this directive, including procedures to effectively communicate with well owners and drillers. ADWR will coordinate review of these notices of intent with ADEQ.

Abandonment of Wells in and Near WQARF Sites
ADWR staff will review and evaluate Notices of Intent to Abandon to ensure that abandonment of wells is done in accordance with ADWR rules and that potential for cross-contamination is minimized. ADWR will coordinate review of these notices of intent with ADEQ.

7.5 WATER QUALITY ASSESSMENT

A comprehensive water quality assessment was included in the Third Management Plan. The assessment provided detailed characterization of water quality and an overview of water quality concerns in the PhxAMA. A water quality assessment for the 4MP will be qualitative. The following sections discuss goals and objectives of the assessment for the fourth management plan period and water quality of renewable and groundwater supplies in the PhxAMA.

7.5.1 Assessment Goals and Objectives

The primary goal of the Water Quality Assessment is to provide a qualitative evaluation of groundwater and surface water quality conditions in the PhxAMA based on the comprehensive assessment performed during the third management period and to identify potential threats to groundwater quality and its link to the regional water supply. The impact of water quality on water resource management has become more important in recent years as water quality standards become more stringent and due to such factors as conjunctive use of water supplies, groundwater management at remediation sites and increasing levels of public concern.

The municipal, agricultural and industrial sectors have distinctive demand patterns and water quality requirements. For example, treated reclaimed water is used for turf irrigation, agricultural irrigation, industrial uses, and groundwater recharge. Water high in total dissolved solids (TDS) may be inappropriate for agricultural irrigation, but may be usable for some industrial applications. Conversely, water that is high in nitrate could provide a suitable end use for agriculture, but does not meet potable standards. During the fourth management period, ADWR will continue to encourage matching water quality characteristics with appropriate end uses while ensuring compliance with applicable laws and rules for each end use.

7.5.2 Renewable Water Supplies

The renewable water supplies available for use in the PhxAMA are primarily Colorado River water delivered through Central Arizona Project Infrastructure (CAP), non-CAP surface water, and reclaimed water. The quality of renewable water supplies is discussed in this section.

7.5.2.1 Central Arizona Project Water

An important surface water supply that augments the water supply of the PhxAMA is CAP water, which is diverted and conveyed from the Colorado River in a primarily open canal. With appropriate treatment, the quality of CAP water is acceptable for most uses.

Total dissolved solids concentrations in CAP water vary depending on the location within the CAP canal system. Seasonal data for TDS levels at various mileposts along the CAP aqueduct from the year 2014 were obtained from the CAP. The seasonal data for this year ranged from approximately 550 mg/l (milligrams per liter) to 670 mg/l for the McKellips Road milepost. At the Brady Pump Plant milepost, TDS concentrations ranged from about 560 mg/l to 640 mg/l.

7.5.2.2 Reclaimed Water

A.R.S. § 45-101(4) provides the following definition for “reclaimed water” (also called effluent):

> Water that has been collected in a sanitary sewer for subsequent treatment in a facility that is regulated pursuant to Title 49, Chapter 2. Such water remains reclaimed water until it acquires the characteristics of groundwater or surface water.

Sanitary sewers are defined as of any pipe or other enclosed conduit that carries any waterborne human wastes from residential, commercial, or industrial facilities (A.R.S. § 45-101(8)).

Reclaimed water treated at municipal wastewater treatment plants is a significant source of renewable water supply in the PhxAMA. Although not suitable for human consumption without advanced treatment, highly treated reclaimed water is suitable for turf irrigation, agricultural irrigation, sand and gravel washing and other industrial applications. For example, reclaimed water from the 91st Avenue Wastewater Treatment Facility (WTF) is used for industrial purposes at the Palo Verde Nuclear Power Generating Station. Wastewater reuse rules are developed by ADEQ that establish standards for various classes of wastewater. Wastewater discharges require an AZPDES permit to ensure that water quality parameters are being met.

Wastewater treatment facilities currently discharge reclaimed water into stream channels. The two largest facilities in the PhxAMA are the 23rd Avenue and 91st Avenue WTFs. The 23rd Avenue facility discharges reclaimed water into the Roosevelt Irrigation District canal system, while the 91st Avenue facility discharges into the Gila River downstream from its confluence with the Salt River. Segments of the Gila River downstream from wastewater discharges have perennial flows. Wastewater discharges to waters of the United States require an NPDES permit and an APP to ensure that water quality standards are being met.

Secondary reclaimed water, which is treated to AZPDES permit standards, usually contains Total Dissolved Solids (TDS), nitrate, sulfate, metals and bacteria at concentrations higher than those present in public water supply systems. Many facilities in the PhxAMA can meet higher classes of reclaimed water supply by filtering and disinfecting their effluent, which is directly delivered for non-potable uses. Wastewater reuse rules are developed by ADEQ and establish parameters for wastewater reuse options.

Constructed wetlands can be developed to further enhance the treatment of reclaimed water and to pretreat water prior to recharge or reuse. Vegetation and microbial activity in wetlands along with filtration of reclaimed water through the vadose zone (soil aquifer treatment) improves the quality of water containing high concentrations of nitrate and organic carbon. Constructed wetlands are occasionally used as a treatment for lower quality surface waters and agricultural return flows. Wetland projects, like at the Tres Rios Wetlands Project, also are being evaluated to determine their effectiveness as enhanced treatment for reclaimed water discharges to meet more stringent AZPDES permit requirements. In addition to improving water quality, wetlands enhance wildlife habitat and serve as an educational and recreational resource for the community.

7.5.2.3 Surface Water Other Than Central Arizona Project Water

Surface water quality in the PhxAMA is generally good. Most surface water that is not supplied by the CAP is supplied by the Salt River Project (SRP) which comes from the Salt and Verde Rivers. SRP surface water typically contains total dissolved solids (TDS) levels below 500 mg/l (milligrams per liter). TDS concentrations are generally a good indicator of overall water quality. Other constituent parameters of SRP surface water generally meet applicable water quality standards with appropriate treatment.

Other smaller streams and washes in the PhxAMA are ephemeral or intermittent. Because in-stream channel flows are typically short-term and occur in response to runoff from precipitation events, the direct use of this surface water is limited. The surface water supplies other than CAP and SRP are an important source of natural aquifer recharge in the PhxAMA. Water from these sources often contains bacteria, parasites, and/or viruses. Municipal and industrial storm water runoff also contributes to surface water contamination. In order to address contaminants in storm water runoff, the NPDES storm water program was developed to specifically control the amount of storm water pollutant discharges to waters of the United States.

7.5.3 Groundwater Supplies

Groundwater is one of the most important sources of water in Arizona. Most of the groundwater in the PhxAMA is of acceptable quality for most uses. However, some groundwater has been degraded as a result of contamination.

The introduction of contaminants into aquifer systems degrades groundwater quality and may pose a threat to public health and the environment. Contaminants can migrate into areas of potable groundwater due to groundwater pumping or regional groundwater flow patterns. Many areas of the PhxAMA are projected to remain dependent on groundwater pumping, thereby potentially causing contaminant migration. ADWR's role in managing potential contaminant migration is through involvement in site-specific and non-site-specific water quality management.

Groundwater that has been degraded has limited direct beneficial uses due to chemical, biological, or radiological contamination and may have high treatment and delivery costs associated with its use. Despite these limitations, ADWR considers poor-quality groundwater to be a valuable resource for future water management and encourages appropriate uses of this water supply. Matching the highest beneficial use with poor quality groundwater is an important aspect of water management. Frequently, poor quality groundwater is remediated and re-injected into the aquifer because it is not economically feasible to convey the treated water to another location for a higher beneficial use.

Recognizing that there may be groundwater quality impacts resulting from surface water recharge, the EPA requires states to develop a rule for groundwater under the influence of surface water (GUDI). ADEQ, in turn requires additional sampling and treatment of any water supply deemed as GUDI, so that it meets surface water treatment standards (A.A.C. R18-4-212). This additional analysis and treatment may increase the costs associated with the development and operation of underground water storage facilities. See Chapter 8, section 8.3.4, for further discussion of recharge water quality challenges.

7.5.4 Specific Contamination Areas

Figure 7-1 identifies the location of some specific groundwater contamination areas that have been identified in the PhxAMA. Unless otherwise indicated, each of these sites is listed on the WQARF Priority List or the NPL.

WQARF sites throughout the state have been scored based on criteria developed by ADEQ. The scores assigned to WQARF sites may change as more site-specific information becomes available and is evaluated by ADEQ. The WQARF Registry listing individual remedial sites in the state, including PhxAMA can be found on the ADEQ website at: *http://azdeq.gov/environ/waste/sps/index.html*.

7.6 FUTURE DIRECTIONS

ADWR's long-range plans for groundwater quality management will focus on two areas: (1) evaluation of groundwater quality challenges on a site and non-site-specific level to understand the impact of groundwater quality challenges on water resource management on a broader level, and (2) working with local stakeholders in management of remediated groundwater through reinjection and/or use.

7.6.1 Non-Site-Specific Water Quality Management

Non-site-specific groundwater quality management refers to groundwater quality management activities that may occur in general areas located outside of identified remedial action site boundaries. To address and mitigate dispersed contamination over large areas, a broader management strategy is needed. Areas that may need more intensive management may include those where public or private supply wells have been or may be affected by contamination. For instance, areas that are in the vicinity of major population centers or agricultural areas can be affected by contamination, especially if large volumes of groundwater are pumped, creating cones of depression.

Changes in groundwater levels can result in degradation of aquifer conditions. Rising water levels in areas of known landfills or other areas that have suspended contaminants in the vadose zone (e.g. leaking Underground Storage Tanks) have the potential for contaminant migration. Declining groundwater levels can impact aquifer water quality. Groundwater recharge projects can also affect aquifer conditions.

Groundwater quality management on a non-site-specific scale can enhance water management activities in sub-regional areas. Taking action to identify source groundwater quality and develop area-specific plans to match water quality with intended uses combined with strategies to evaluate and mitigate the effects of contamination in sub-regional areas can help preserve good quality groundwater for current and future uses. Coordination with ADEQ and with affected stakeholders ensures an informed approach. Contaminant management on a non-site-specific scale can be achieved in such a way that it would not affect rights to groundwater, well ownership, delivery responsibilities or existing permits.

7.6.2 Preservation of AMA Management Goals

The WQARF reform enacted in 1997 and amended in 1999 was designed to encourage the remediation of groundwater that has limited or no use due to contamination. Pump-and-treat groundwater remediation activities are anticipated to continue to be the predominant means of remediation during the fourth management period. Previously unavailable sources of groundwater from contaminated areas may be put to beneficial use during the fourth management period and thereafter.

Remediated groundwater withdrawals associated with WQARF, CERCLA, DOD, RCRA and voluntary site cleanups may continue to increase. Remediated groundwater withdrawals reported to ADWR by municipal water providers for existing remedial sites within the PhxAMA averaged about 6,000 AF per year from 2007 through 2015. The total reported remediated groundwater withdrawn by municipal providers in the PhxAMA over the period was about 56,740 AF. Such withdrawals may occur as part of aquifer restoration or plume containment. These estimates may be conservative due to the potential detection of unknown sites and because remedial activities on known contaminated areas are in different stages of development.

In the fourth management period, ADWR will monitor water levels, land subsidence and effects on local water providers at remedial project sites in areas of intensive pumping. While ADWR supports the remediation of contaminated groundwater, it also seeks to preserve the management goal of safe-yield in the PhxAMA. Water quality management is a long-term process that is expected to continue far beyond the duration of the fourth management period. Remedial activities will likely continue over the long-term and could result in considerable volumes of groundwater being pumped, treated, and subsequently used or reinjected.

The net effect of continued remediated groundwater withdrawals could result in a substantial increase in the overall volume of groundwater put to use within the PhxAMA. Proper water quantity and water quality management will be required to ensure that groundwater use created as a result of activities at remedial action sites does not negatively impact the goal of safe-yield in the PhxAMA. ADWR will seek to preserve the intent of the Code and the AMA management goals while cooperating with EPA, ADEQ and other water resource agencies to promote rational groundwater quality management.

7.7 SUMMARY

Most groundwater supplies in the PhxAMA are of acceptable quality for most uses. However, human activity and natural processes have resulted in the degradation of groundwater quality in some areas to the extent that the groundwater is unusable for direct consumption for many purposes. The extent and type of contamination vary by location and land-use activities. Contaminated groundwater has afflicted the upper aquifers throughout a large part of the PhxAMA with dissolved solids, nitrates, and other contaminants. Waterlogging down gradient of Phoenix has required drainage pumpage of groundwater with high concentrations of TDS. Pumpage centers that provide potable water can and do influence the migration of poor-quality

water in many areas of the AMA. The WQARF sites identified in the PhxAMA are in varying stages of development, from remedial investigations to actual site cleanup.
As WQARF activities progress, addressing water management challenges such as available supply and reuse options helps to ensure a long-term water supply of adequate quality. The ability to recognize specific groundwater management requirements for contaminated and degraded aquifer conditions also is important as the demand for water increases.

The WQARF reform legislation created an incentive for the use of groundwater withdrawn in accordance with approved remedial action projects pursuant to Title 49, Arizona Revised Statutes, or CERCLA. It provided that generally such groundwater must be accounted for consistent with accounting procedures used for surface water for purposes of determining compliance with management plan conservation requirements and that the use of certain volumes of such groundwater is consistent with achievement of the management goal of the AMA until the year 2025. ADWR has amended its AWS Rules to conform to these provisions, and also considers water-quality challenges more fully in its underground water storage program.

ADWR's Groundwater Permitting and Wells Section provides support to the PhxAMA on issues related to WQARF cleanup activities as part of its commitment to work closely with ADEQ to resolve groundwater quantity and quality issues throughout Arizona.

ADWR will continue to be directly involved in other remedial activities and management action plans such as those associated with WQARF and other cleanup sites. This will ensure that remedial activities meet ADWR's water management objectives and are consistent with the AMA's safe-yield goal.

CHAPTER EIGHT: UNDERGROUND WATER STORAGE, SAVINGS, AND REPLENISHMENT

8.1 INTRODUCTION

The purpose of the Underground Water Storage, Savings & Replenishment (Recharge) Program is to encourage the development, delivery, use, and storage of renewable water supplies now and in the future. The Recharge Program, in combination with the *Fourth Management Plan for the Phoenix Active Management Area* (4MP) conservation program efforts, is intended to support achievement of the safe-yield management goal for the Phoenix Active Management Area (PhxAMA). Increasing the use of renewable water supplies, particularly reclaimed water[1] and Colorado River water delivered through the Central Arizona Project infrastructure (CAP water) instead of groundwater, is a key component of achieving safe-yield.

For the purposes of this chapter, "augmentation" means increasing the availability and use of renewable water supplies such as CAP water and reclaimed water instead of groundwater. "Recharge" means storage of renewable water supplies for future use pursuant to the Underground Water Storage, Savings and Replenishment Act (A.R.S. § 45-801.01, *et seq*). Although the Arizona Department of Water Resources (ADWR) does not have the ability to implement an augmentation program, ADWR recognizes the need to continue to pursue and obtain additional water supplies into the future.

Although the PhxAMA groundwater management goal of safe-yield applies to the PhxAMA as a whole, the objectives of the Recharge Program in the fourth management period serve to enhance water resource management on a more localized scale. A PhxAMA-wide safe-yield balance between supply and demand of groundwater does not address local concerns regarding groundwater level declines and physical availability challenges. The 4MP recognizes these local challenges, taking these site-specific areas into consideration, and proposes solutions that can assist local stakeholders in addressing these challenges.

8.2 THE RECHARGE PROGRAM

The augmentation and recharge of renewable water resources is a principal mechanism by which the PhxAMA can reach both safe-yield and site-specific goals. During the fourth management period, ADWR will continue to encourage the development, efficient use, and recharge of renewable water supplies for the PhxAMA. Additionally, the Recharge Program is an effective tool to mitigate local water supply problems, depending where storage and recovery activities occur.

Recharge is an important water management tool in the PhxAMA 4MP. The development and direct use of renewable water supplies is an important component of PhxAMA water management, and new rules allowing Direct Potable Reuse of effluent present a valuable new tool in the development of those direct uses. However, underground water storage remains and will continue to be a cost-effective means of utilizing available renewable water supplies that cannot currently be used directly.

[1] In the PhxAMA 4MP, the term "reclaimed water" has the same definition as effluent in A.R.S. § 45-101.

8.2.1 Overview of Recharge and Recovery

Recharge statutes and 4MP provisions provide the regulatory framework in which water may be stored and recovered. The statutes and the PhxAMA 4MP, when read together, establish a number of objectives. These objectives include:

- To protect the general economy and welfare of the state by encouraging the use of renewable water supplies instead of groundwater, through a flexible and effective regulatory program for the underground storage, savings, and replenishment of water;
- To allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of renewable water instead of constructing renewable water treatment plants and pipeline distribution systems;
- To reduce overdraft and achieve the management goals of the Active Management Areas (AMAs);
- To store water underground for seasonal peak demand use and for use during periods of shortage; and
- To augment the local water supply to allow future growth and development.

Since the inception of the recharge and recovery program in Arizona in 1986, recharge and recovery have become increasingly flexible over time with regard to storage and recovery locations and the number and types of programs available. With the increased flexibility have come increased complexity and local water challenges. High or low water tables, water quality, physical availability, and third-party impacts are all challenges that can be impacted positively or negatively by recharge and recovery facilities. Thus, the regulation of the program to maximize benefits and minimize harm is crucial to an effective program.

8.2.2 Primary Program Components

Persons who elect to undertake recharge-related activities must obtain the necessary permits from ADWR. There are three recharge-related permit categories: (1) storage facility permits, composed of constructed or managed Underground Storage Facility (USF) permits and Groundwater Savings Facility (GSF) permits; (2) Water Storage (WS) permits; and (3) Recovery Well (RW) permits. For a detailed description of each of these permits, please see the Recharge program page on ADWR's website: https://new.azwater.gov/recharge. Storage facility permits allow entities to operate either a facility that stores water in an aquifer (USF) or a facility that receives renewable water in-lieu of pumping groundwater (GSF). Facilities can be permitted to recharge CAP water, reclaimed water, and/or surface water. Water storage permits allow the permit holder to store water at a USF or GSF. Recovery well permits are required for an entity to recover any stored water.

Rights to recover stored water may be exercised annually or long-term. Any recoverable water recovered within the same year in which it was stored is referred to as annual recovery. If the water is not recovered annually, it may be credited to a long-term storage account. The account holder may recover the water at any point in the future, if certain conditions are met. No time limit exists on the right to recover long-term storage credits. Long-term storage credits may be transferred to another entity if that entity can meet the same provisions for earning credits as the storer, pursuant to A.R.S. § 45-802.01(22). In addition, once the water is recovered, it retains the same legal characteristics it had before storage.

The Underground Water Storage (UWS) Program also is the mechanism by which the Central Arizona Groundwater Replenishment District (CAGRD) replenishes water on behalf of its members. The CAGRD may store water and accrue long-term storage credits or obtain credits already accrued. The CAGRD can request that ADWR transfer credits from the CAGRD's long-term storage account to its replenishment account, termed a "conservation district account" by statute, to offset the CAGRD replenishment obligations (A.R.S. § 45-859.01). Once the credits are transferred to the replenishment account, they may not be recovered, assigned, or moved back to the long-term storage account.

Finally, in many cases, a certain percentage of the volume of water stored is made non-recoverable by statute to benefit the aquifer. These required non-recoverable volumes are called "cuts to the aquifer" and are taken from storage of CAP water at constructed[2] and managed[3] facilities, reclaimed water at managed facilities, and CAP water at Groundwater Savings Facilities (GSFs)[4]. "Cuts to the aquifer" do not apply to water that is stored and recovered annually, with the exception of effluent stored at managed facilities.

8.2.3 Recharge Facilities and Storage Data

Approximately 8.7 million acre-feet (MAF) of renewable water supplies have been delivered to recharge facilities to be stored in the PhxAMA between the inception of the recharge program and the end of 2017. Of that amount, roughly 1.2 MAF was recovered annually, resulting in a "net storage" of more than seven MAF (Table 8-1). "Net storage" in this table means water delivered to be stored minus annual recovery and does not account for physical or other losses (evaporation, cut to the aquifer, etc.). In the PhxAMA, cuts to the aquifer totaled nearly 300,000 AF between 1986 and 2017. During the same time period, approximately 240,000 AF of long-term storage credits were recovered. Table 8-1 shows the annual breakdown of these totals.

Storage at USFs

Since the inception of the program through the end of 2017, a total of 4,213,332 AF of renewable water supplies were delivered to be stored at USFs in the PhxAMA. As of 2017, the PhxAMA has 50 active permitted USFs, comprised of 46 constructed and four managed facilities. Figure 8-1 shows the locations of all USF recharge sites. Table 8-2 lists the facilities, permitted storage volumes, and volumes stored through 2017. The USFs have a total combined permitted recharge capacity of 726,864 AF/year. Of that total, there is capacity to recharge up to 603,579 AF/year of CAP water at 20 of the 50 USFs. The largest of these facilities is the CAWCD Tonopah Desert USF which is permitted to store up to 150,000 AF/year. Reclaimed water can be stored at 36 PhxAMA USFs up to 349,060 AF each year. There are six USFs in the PhxAMA that are permitted to store up to 200,528 AF of surface water each year. The sum of the permitted volumes for each type of water exceeds the total permitted volume because eight of the USFs are permitted to store multiple types of water.

Storage at GSFs

A total of 4,297,061 AF of renewable water supplies was delivered in-lieu of groundwater pumping at GSFs in the PhxAMA between the inception of the program and the end of 2017. Table 8-2 lists the facilities, permitted storage volumes, and volumes stored through 2017.

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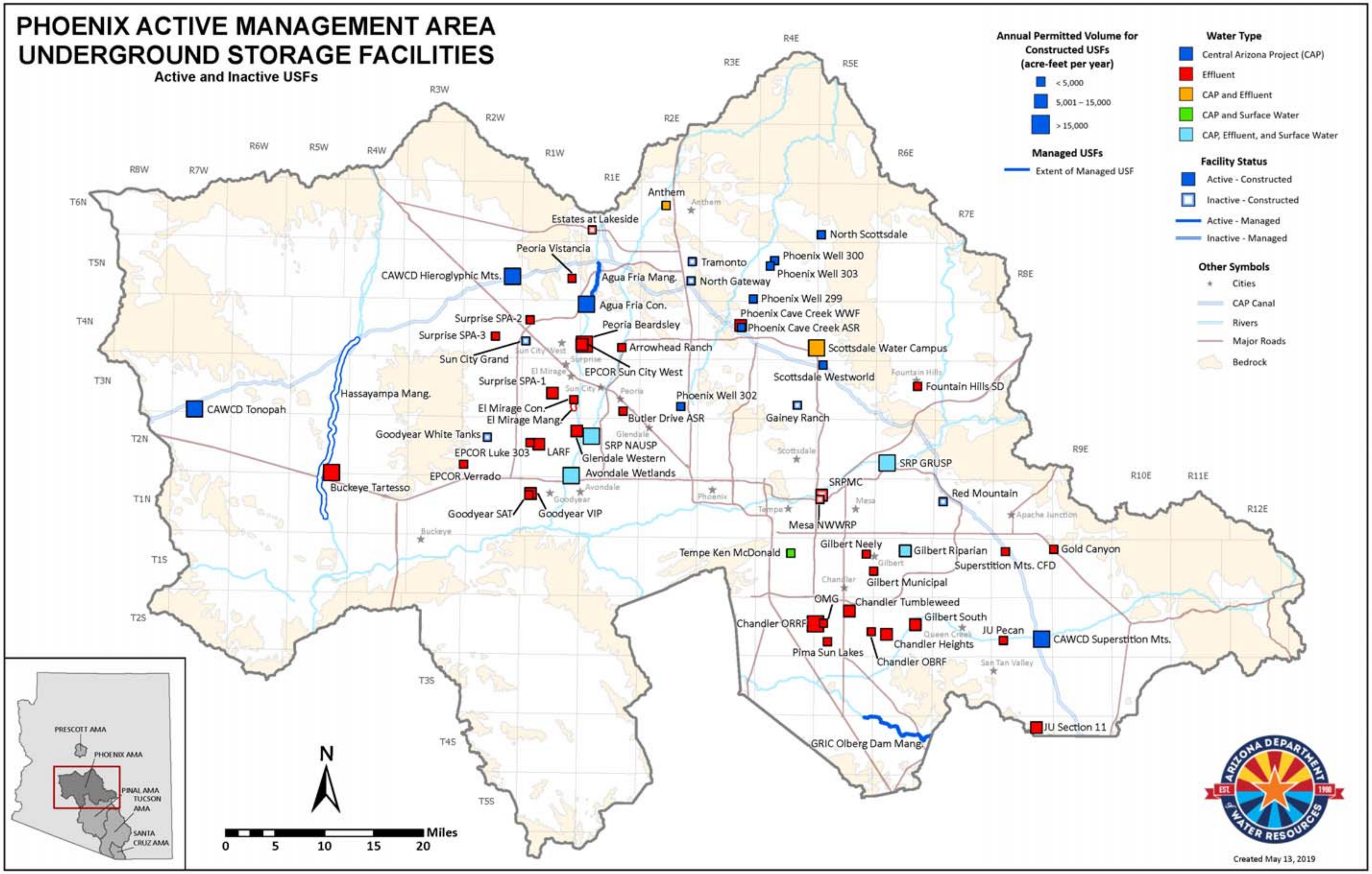
[2] "Constructed underground storage facility means a facility that . . . is designed and constructed to store water underground pursuant to permits issued under this chapter" (A.R.S. § 5-802.01(4)).
[3] "Managed underground storage facility means a facility . . . that is designed and managed to utilize the natural channel of a stream to store water underground pursuant to permits issued under this chapter through artificial and controlled release of water other than surface water naturally present in the stream" (A.R.S. § 45-802.01(12)).
[4] "Groundwater savings facility means a facility . . . in an active management area or an irrigation non-expansion area at which groundwater withdrawals are eliminated or reduced by recipients who use in-lieu water on a gallon-for-gallon substitute basis for groundwater that otherwise would have been pumped from within that active management area or irrigation non-expansion area" (A.R.S. § 45-802.01(8)).

Figure 8-2 shows the locations of the PhxAMA GSFs that have been permitted as of 2017. The PhxAMA GSFs have a total combined permitted recharge capacity of 393,899 AF/year at eight facilities across the AMA. Of that total, there is capacity to recharge up to 333,059 AF/year of CAP water at six of the eight PhxAMA GSFs. Reclaimed water can be stored at two PhxAMA GSFs up to 60,840 AF each year. There are two GSFs in the PhxAMA that are permitted to store up to 174,000 AF of surface water each year. The sum of the permitted volumes for each type of water exceed the PhxAMA total permitted volume because two of the GSFs are permitted to store both CAP water and surface water.

TABLE 8-1
PHOENIX AMA WATER STORAGE & RECOVERY SUMMARY
1989 – 2017 (AF)

Year	Delivered to be Stored	Annually Recovered	Net Storage	Long-term Storage Credits Recovered
1989	762	0	762	0
1990	2,251	108	2,144	0
1991	5,748	103	5,645	0
1992	88,664	169	88,495	0
1993	136,259	285	135,974	0
1994	61,975	1,251	60,725	2,833
1995	137,111	1,130	135,981	699
1996	200,473	5,154	195,319	2,727
1997	340,123	23,020	317,103	864
1998	201,214	10,504	190,710	197
1999	320,466	17,371	303,095	1,371
2000	341,854	25,589	316,265	18,709
2001	369,074	36,353	332,721	19,137
2002	373,791	66,895	306,896	13,868
2003	352,109	50,607	301,501	6,517
2004	441,941	50,824	391,118	6,395
2005	303,897	65,303	238,594	12,759
2006	407,428	63,640	343,788	6,938
2007	489,966	82,492	407,474	14,871
2008	395,698	79,395	316,302	11,593
2009	482,833	83,602	399,231	12,298
2010	427,557	54,311	373,246	8,904
2011	403,441	66,919	336,522	13,075
2012	333,775	71,148	262,627	17,918
2013	367,618	78,152	289,466	18,932
2014	412,210	84,696	327,514	17,279
2015	454,234	71,608	382,626	12,306
2016	465,045	94,209	370,836	4,847
2017	399,392	93,680	305,712	17,850
TOTAL	**8,716,909**	**1,278,518**	**7,438,391**	**242,885**



PHOENIX ACTIVE MANAGEMENT AREA
UNDERGROUND STORAGE FACILITIES
Active and Inactive USFs
Annual Permitted Volume for Constructed USFs (acre-feet per year)
< 5,000
5,001 – 15,000
> 15,000
Managed USFs
Extent of Managed USF
Water Type
Central Arizona Project (CAP)
Effluent
CAP and Effluent
CAP and Surface Water
CAP, Effluent, and Surface Water
Facility Status
Active - Constructed
Inactive - Constructed
Active - Managed
Inactive - Managed
Other Symbols
Cities
CAP Canal
Rivers
Major Roads
Bedrock
Anthem
Estates at Lakeside
Peoria Vistancia
CAWCD Hieroglyphic Mts.
Agua Fria Mang.
Agua Fria Con.
Surprise SPA-2
Surprise SPA-3
Peoria Beardsley
Sun City Grand
Arrowhead Ranch
EPCOR Sun City West
Surprise SPA-1
Hassayampa Mang.
CAWCD Tonopah
El Mirage Con.
El Mirage Mang.
Butler Drive ASR
Goodyear White Tanks
SRP NAUSP
EPCOR Luke 303
LARF
Glendale Western
EPCOR Verrado
Avondale Wetlands
Buckeye Tartesso
Goodyear SAT
Goodyear VIP
North Scottsdale
Tramonto
North Gateway
Phoenix Well 300
Phoenix Well 303
Phoenix Well 299
Phoenix Cave Creek WWF
Phoenix Cave Creek ASR
Scottsdale Water Campus
Scottsdale Westworld
Fountain Hills SD
Phoenix Well 302
Gainey Ranch
SRP GRUSP
SRPMC
Red Mountain
Mesa NWWRP
Tempe Ken McDonald
Gilbert Neely
Gilbert Riparian
Gold Canyon
Superstition Mts. CFD
Gilbert Municipal
OMG
Chandler Tumbleweed
Gilbert South
JU Pecan
Chandler ORRF
CAWCD Superstition Mts.
Chandler Heights
Pima Sun Lakes
Chandler OBRF
JU Section 11
GRIC Olberg Dam Mang.
PRESCOTT AMA
PHOENIX AMA
PINAL AMA
TUCSON AMA
SANTA CRUZ AMA
N
Miles
0 5 10 15 20
ARIZONA DEPARTMENT of WATER RESOURCES
EST. 1980
Created May 13, 2019

Figure 8-1

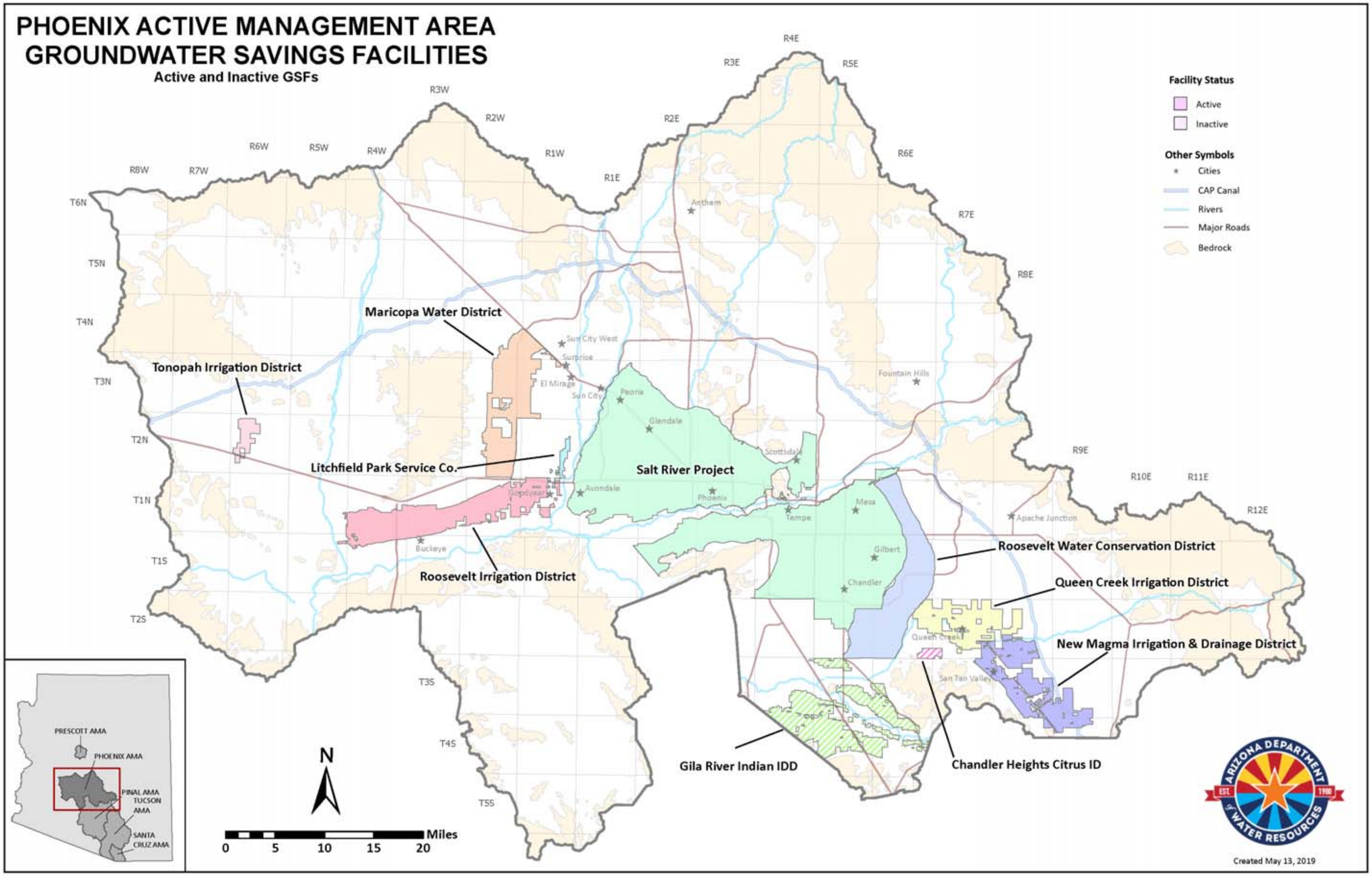

PHOENIX ACTIVE MANAGEMENT AREA
GROUNDWATER SAVINGS FACILITIES
Active and Inactive GSFs
Facility Status
Active
Inactive
Other Symbols
Cities
CAP Canal
Rivers
Major Roads
Bedrock
Maricopa Water District
Tonopah Irrigation District
Litchfield Park Service Co.
Salt River Project
Roosevelt Irrigation District
Roosevelt Water Conservation District
Queen Creek Irrigation District
New Magma Irrigation & Drainage District
Gila River Indian IDD
Chandler Heights Citrus ID
Sun City West
Surprise
El Mirage
Sun City
Peoria
Glendale
Scottsdale
Avondale
Goodyear
Phoenix
Tempe
Mesa
Gilbert
Chandler
Buckeye
Anthem
Fountain Hills
Apache Junction
Queen Creek
San Tan Valley
R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S
PRESCOTT AMA
PHOENIX AMA
PINAL AMA
TUCSON AMA
SANTA CRUZ AMA
N
0 5 10 15 20 Miles
ARIZONA DEPARTMENT of WATER RESOURCES
EST. 1980
Created May 13, 2019

Figure 8-2

TABLE 8-2
PHOENIX AMA WATER STORAGE FACILITIES

Facility Name	Permit Volume (AF/yr)	Source Water	Water Delivered to be Stored (through 2017) (AF)
Underground Storage Facilities			
BUCKEYE TARTESSO WATER RECLAMATION FACILITY USF	1,344	Reclaimed	1,184
AVONDALE WETLANDS USF	20,000	CAP, Reclaimed, Surface Water	173,070
CAWCD AGUA FRIA CONSTRUCTED USF	50,000	CAP	150,633
CAWCD AGUA FRIA MANAGED USF	50,000	CAP	245,616
CAWCD HIEROGLYPHIC MTNS RECHARGE PROJECT USF	35,000	CAP	415,876
CAWCD SUPERSTITION MOUNTAINS RECHARGE PROJECT USF	25,000	CAP	171,079
CAWCD TONOPAH DESERT RECHARGE PROJECT	150,000	CAP	810,300
CHANDLER OCOTILLO BRINE REDUCTION FACILITY (FMLY INTEL) USF	3,360	Reclaimed	15,363
CHANDLER TUMBLEWEED REGIONAL PARK USF	11,200	Reclaimed	68,443
CITY OF CHANDLER OCOTILLO RECHARGE AND RECOVERY FACILITY USF	16,000	Reclaimed	17,447
CITY OF CHANDLER/CHANDLER HEIGHTS RECHARGE PROJECT USF	6,725	Reclaimed	14,347
CITY OF PHOENIX 1-WELL 302 UNDERGROUND STORAGE FACILITY	3,000	CAP, Plan 6	-
CITY OF PHOENIX ASR 6A-WELL 299 USF	1,882	CAP	3,625
CITY OF PHOENIX ASR 9A-WELL 300 USF	1,060	CAP	880
CITY OF PHOENIX CAVE CREEK ASR-1 (CCASR-1) USF	2,903	CAP	2,786
CITY OF PHOENIX CAVE CREEK WASTEWATER FACILITY USF	8,961	Reclaimed	2,048
CITY OF SCOTTSDALE NORTH SCOTTSDALE AS&R PROJECT USF	3,642	CAP	17,345
CITY OF SCOTTSDALE WATER CAMPUS USF	28,314	CAP, Reclaimed	103,182
CITY OF SCOTTSDALE WESTWORLD GOLF COURSE USF	1,000	CAP	9,323
CITY OF SURPRISE SPA-1 (SOUTH) USF	8,066	Reclaimed	63,550
CITY OF SURPRISE SPA-2 REGIONAL WRF USF	2,240	Reclaimed	903
CITY OF SURPRISE SPA-3 WATER RECLAMATION FACILITY USF	4,256	Reclaimed	-
EL MIRAGE CONSTRUCTED RECHARGE FACILITY USF	3,360	Reclaimed	18,790
EPCOR SUN CITY WEST USF	5,600	Reclaimed	55,656
EPCOR VERRADO RECHARGE FACILITY USF	500	Reclaimed	59
EPCOR WATER ARIZONA INC. ANTHEM USF	500	CAP, Reclaimed	4,613
FOUNTAIN HILLS SANITARY DISTRICT USF	2,241	Reclaimed	13,768
GLENDALE ARROWHEAD RANCH RECHARGE FACILITY USF	2,300	Reclaimed	6,070

Facility Name	Permit Volume (AF/yr)	Source Water	Water Delivered to be Stored (through 2017) (AF)
GLENDALE WESTERN AREA RECHARGE FACILITY USF	7,841	Reclaimed	97,157
GOLD CANYON WWTP	1,120	Reclaimed	5,672
GOODYEAR SAT FULL-SCALE RECHARGE FACILITY	3,300	Reclaimed	24,563
GOODYEAR VIP USF	5,000	Reclaimed	155
GRIC OLBERG DAM PILOT SCALE USF	3,750	CAP	6,591
HASSAYAMPA MANAGED RECHARGE FACILITY USF	50,000	CAP	105,276
JOHNSON UTILITIES SECTION 11 RECHARGE FACILITY	1,680	Reclaimed	5,106
LIBERTY AQUIFER REPLENISHMENT FACILITY USF (LARF)	4,000	Reclaimed	1,294
LUKE 303 RECHARGE FACILITY	327	Reclaimed	-
OCOTILLO MANAGEMENT GROUP USF	1,000	Reclaimed	11,745
PEORIA BEARDSLEY ROAD WATER RECLAMATION FACILITY USF	4,480	Reclaimed	44,676
PEORIA VISTANCIA RECHARGE FACILITY USF	673	Reclaimed	410
PIMA UTILITY SUN LAKES USF	732	Reclaimed	9,415
SRP GRANITE REEF UNDERGROUND STORAGE PROJECT USF	93,000	CAP, Reclaimed Surface Water	1,082,422
SRP NEW RIVER AGUA FRIA UNDERGROUND STORAGE PROJECT USF	75,000	CAP, Reclaimed, Surface Water	191,726
SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT #1 USF	2,352	Reclaimed	13,064
TEMPE KEN MCDONALD GOLF COURSE USF	567	CAP, Plan 6	1,037
THE ESTATES AT LAKESIDE USF	67	Reclaimed	-
TOWN OF GILBERT MUNICIPAL CENTER USF	2,240	Reclaimed	1,374
TOWN OF GILBERT NEELY RECHARGE FACILITYUSF	2,240	Reclaimed	52,416
TOWN OF GILBERT RIPARIAN PRESERVE USF	8,961	CAP, Reclaimed, Surface Water	77,487
TOWN OF GILBERT SOUTH RECHARGE FACILITY USF	10,080	Reclaimed	22,095
Inactive/expired USF permits			73,696
Groundwater Savings Facilities			
TONOPAH IRRIGATION DISTRICT GSF	17,059	CAP	245,437
LPSCO GSF	840	Reclaimed	679
MARICOPA WATER DISTRICT GSF	40,000	CAP	381,959
NEW MAGMA IRRIGATION & DRAINAGE DISTRICT GSF	80,000	CAP	1,090,732
QUEEN CREEK IRRIGATION DISTRICT GSF	22,000	CAP	346,348
ROOSEVELT IRRIGATION DISTRICT GSF	60,000	Reclaimed	245,266

Facility Name	Permit Volume (AF/yr)	Source Water	Water Delivered to be Stored (through 2017) (AF)
ROOSEVELT WATER CONSERVATION DISTRICT GSF	85,000	CAP, Plan 6, Reclaimed	1,053,908
SALT RIVER VALLEY WATER USERS' ASSOCIATION GSF	89,000	CAP, Plan 6	802,473
Inactive/expired GSF permits			130,259

Storage by Water Type

Arizona's recharge program promotes the use of renewable water supplies, particularly Arizona's entitlement of Colorado River water. Since the inception of the program, 7,101,477 AF of CAP water have been delivered for storage at facilities in the PhxAMA, 2,863,256 AF at USFs and 4,238,222 AF at GSFs. Figure 8-3 shows the annual amounts of CAP water delivered to all recharge facilities in the PhxAMA through 2017. Figures 8-4 and 8-5 show the annual amounts of CAP water delivered to USFs and GSFs through 2017 respectively.

Since the inception of the program, a total of 1,152,920 AF of reclaimed water have been delivered for storage in the PhxAMA. An overwhelming majority of that total, 961,088 AF, was stored at USFs with the remaining 191,832 AF stored at GSFs. Figure 8-3 shows the annual amounts of reclaimed water delivered to all recharge facilities in the PhxAMA through 2018. Figures 8-4 and 8-5 show the annual amounts of reclaimed water delivered to USFs and GSFs through 2017 respectively.

Surface water from the Salt, Verde, Agua Fria, and Gila Rivers have historically been a major source of renewable water in the PhxAMA. Over the last 23 years, a total of 462,512 AF of surface water have been delivered to storage facilities. Most of that water has been stored at USFs (407,703 AF) with storage at GSFs totaling only 54,809 AF over that same time. Figure 8-3 shows the annual amounts of surface water delivered to all recharge facilities in the PhxAMA. Figures 8-4 and 8-5 show the annual amounts of surface water delivered to USFs and GSFs through 2017 respectively.

FIGURE 8-3

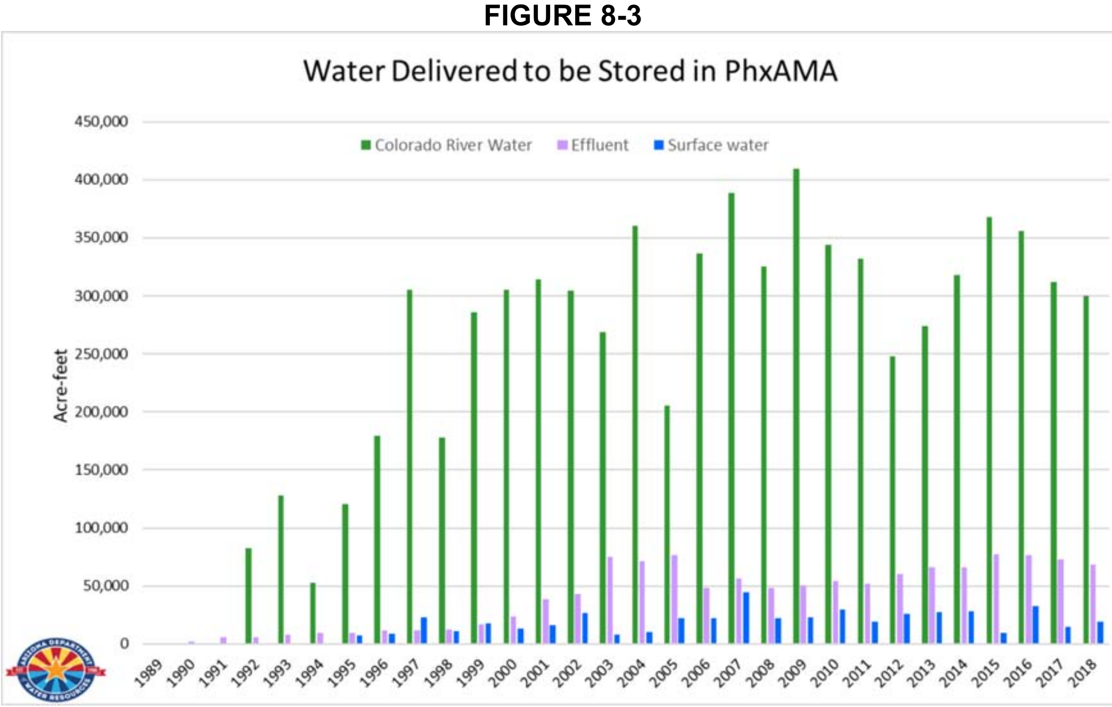


FIGURE 8-4

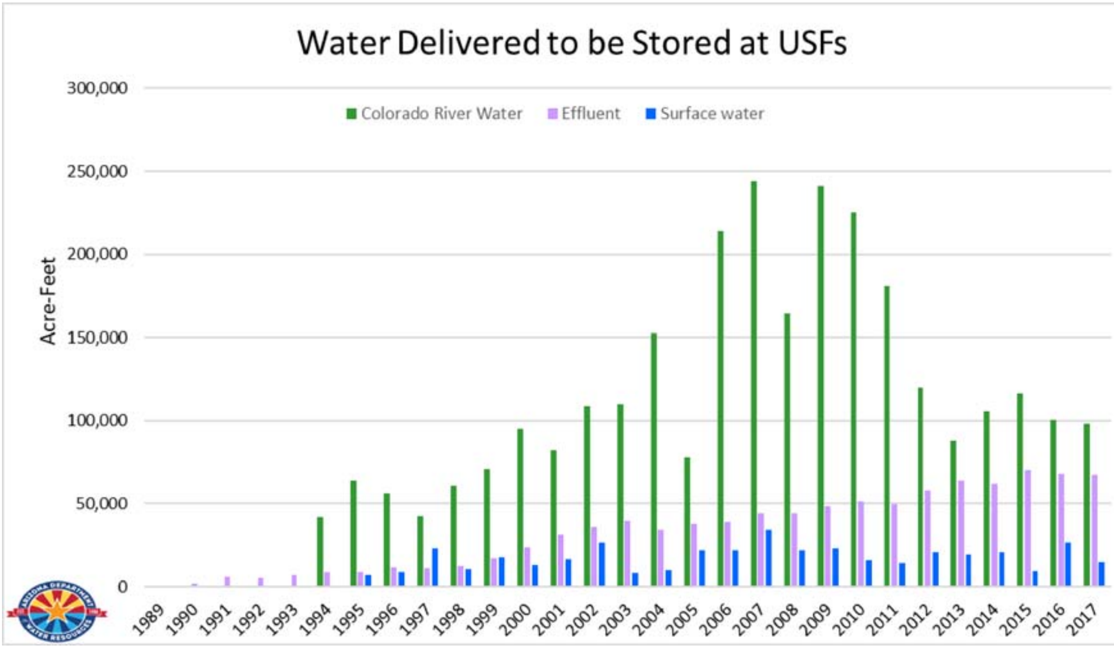
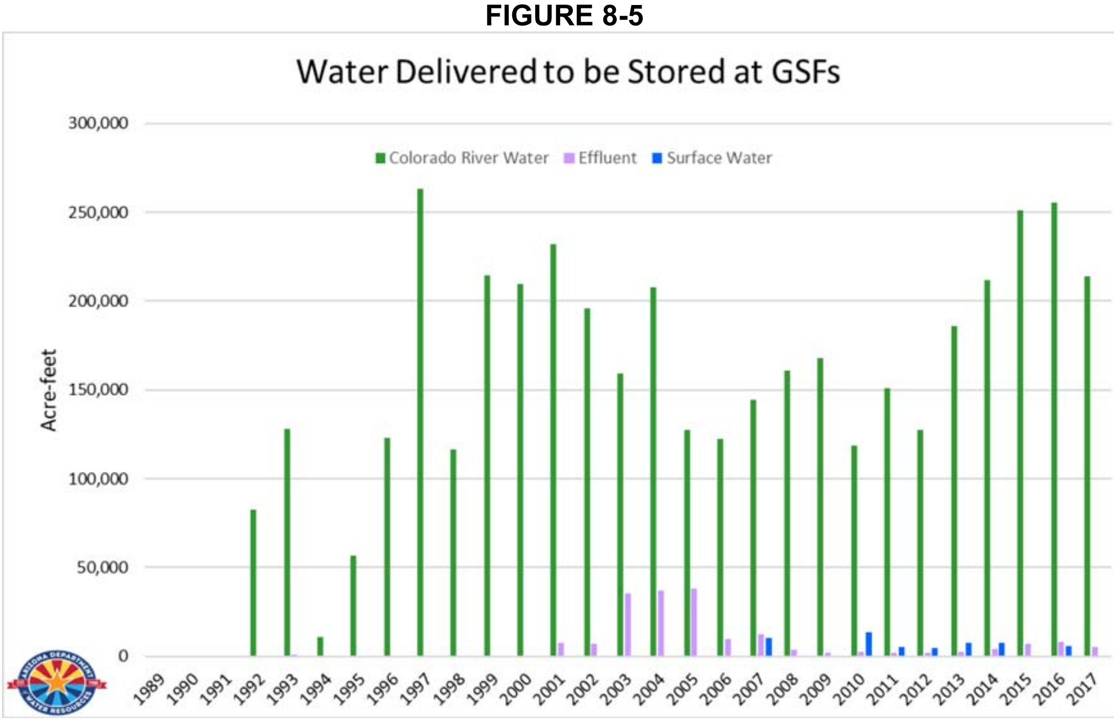


FIGURE 8-5



8.3 ALTERNATIVE WATER SUPPLIES ASSESSMENT

Renewable supplies in the PhxAMA are CAP water, reclaimed water, surface water, and Plan 6 water. The following section describes the major water supplies and how they are currently used in the PhxAMA. For a broader discussion of renewable supplies in the PhxAMA, see Chapter 2, Section 2.8.

8.3.1 Colorado River Water and the Central Arizona Project

The CAP infrastructure delivers Colorado River water (CAP water) to Maricopa, Pinal, and Pima counties. Figure 8-1 and Figure 8-2 show the location of the CAP infrastructure relative USF and GSF facilities in the PhxAMA respectively. The following sections describe the PhxAMA's CAP water supply, and supply reliability challenges related to allocation priorities. Additional discussion of CAP water use challenges may be found in Chapters 2, 5, and 6 and in Appendix 8.

8.3.1.1 Central Arizona Project Water Supply

CAP water is the second largest source of renewable supply available in the PhxAMA. Annual CAP water allocations for the PhxAMA total 834,298 AF per year. Of this total, approximately 480,000 AF per year are currently used by tribes. This amount includes 311,800 AF per year allocated to the Gila River Indian Community (GRIC), which has lands both in the PhxAMA and the Pinal AMA (PAMA). The GRIC have entered into long-term leases with several cities in the PhxAMA and with Freeport McMoran for more than 66,000 AF per year of the GRIC's total allocation. The Fort McDowell Indian Community settlement includes 18,233 AF of CAP water that may be leased for up to 100 years off-reservation within Pima, Pinal, and Maricopa counties. Of that amount, 4,300 AF is leased to the City of Phoenix. The Salt River Pima Maricopa Indian Community (SRPMIC) settlement agreement provided for a 98-year lease to PhxAMA cities (which commenced in the year 2000) of its 13,300 AF CAP allocation. The Ak-Chin Indian Settlement allows for the lease of its 85,000-acre-foot entitlement to users within the PhxAMA, Tucson AMA, or Pinal AMA, of which more than 6,000 AF has been leased to the Del Webb Corporation in the PhxAMA. Additionally, the San Carlos Apache Tribe may lease its 61,645-acre-foot entitlement of CAP water to users in Pima, Maricopa, and Pinal counties. The San Carlos Tribe has entered into a long-term lease agreement with the City of Scottsdale for 12,500 AF per year of the total San Carlos entitlement. Finally, the Yavapai-Prescott Indian Tribe was authorized to market its 500-acre-foot CAP allocation to the City of Scottsdale. The remaining 354,635 AF per year of CAP subcontracts consist mostly of municipal and industrial users. A list of existing CAP water allocations/contracts for the PhxAMA is presented in Table 8-2. Additional CAP water has been recommended to be allocated as a result of the Non-Indian Agriculture (NIA) reallocation.

Excess CAP water from unused entitlements and surplus Colorado River supplies has historically provided an opportunity to bring additional CAP water supplies into the PhxAMA beyond existing allocations. The volume of excess CAP water fluctuates depending on Colorado River mainstem demand and the use of CAP subcontracts and the availability of the overall CAP supply. Based on projections by the U.S. Bureau of Reclamation, there is a probability that CAP shortages may occur in the future. Lower than average precipitation on the Colorado River watershed may increase the likelihood of these shortages occurring. Because CAP delivers mostly lower priority Colorado River water, Colorado River supplies for the CAP (and certain on-river/mainstem users) have a junior priority compared with other on-river/mainstem users, Colorado River supplies for the CAP will be reduced in times of a declared shortage in the Lower Colorado River Basin. As insurance against the impacts of future shortages, CAP water supplies have been stored by the Arizona Water Banking Authority and recharged by individual entities within the PhxAMA holding water storage permits. In addition to long-term storage and recovery, CAP water is also stored and recovered annually. This mechanism, although it involves recharge, is analogous to direct use because no long-term storage credits are generated.

TABLE 8-3
PHOENIX AMA CAP CONTRACTS

Entity	Allocation (AF)
MUNICIPAL AND INDUSTRIAL SUBCONTRACTS	
Arizona Water Company - Superstition	6,285
Arizona Water Company - White Tanks	968
City of Avondale	5,416
Town of Buckeye	68
Carefree Water Company	1,300
Cave Creek Water Company	2,606
City of Chandler	8,654
Chandler Heights Citrus Irrigation District	0
Chaparral City Water Company	8,909
City of El Mirage	508
EPCOR, INC. (Agua Fria)	11,093
EPCOR, INC. (Paradise Valley)	3,231
EPCOR, INC. (Sun City)	4,189
EPCOR, INC. (Sun City West)	2,372
Town of Gilbert	7,235
City of Glendale	17,236
City of Goodyear	10,742
H2O Water Company	0
Maricopa County Parks and Recreation Department	665
City of Mesa	43,503
City of Peoria	25,236
City of Phoenix	122,204
Town of Queen Creek	495
Rio Verde Utilities, Incorporated	812
San Tan Irrigation District	236
City of Scottsdale	52,810
City of Surprise	10,249
City of Tempe	4,315
Valencia Water Company	0
Water Utilities Community Facilities District	2,919
Water Utility of Greater Tonopah	64
SUBTOTAL	**354,320**

TRIBAL USERS	
Ak-Chin	75,000
Fort McDowell	18,233
Gila River Indian Community	311,800
Salt River Pima-Maricopa Indian Community	13,300
Yavapai-Prescott	0
San Carlos Apache	61,645
SUBTOTAL	**479,978**

Central Arizona Project Water Supply Reliability
The reliability of CAP water supplies and delivery scheduling has implications for the use of CAP water by entities within the PhxAMA. Some of Arizona's Colorado River water holds a junior priority water entitlement to the Colorado River among the Lower Colorado River Basin States. It, and other junior priority uses in Arizona and Nevada, may be subject to reductions during times of shortage. Shortages under the 2007 Interim Guidelines are not expected to impact CAP's high priority Municipal and Industrial (M&I) subcontractors. However, with the recent adoption of the Drought Contingency Plan, there is a greater likelihood that the higher priority water users may be impacted under the projected shortages. The CAP water supply reliability and scheduling is important to the PhxAMA to meet current and future water demands.

Supplies of Central Arizona Project Water
PhxAMA entities began storing water at PhxAMA recharge facilities in 1989. Table 8-3 shows the volume of water stored by entity since 1989. Not all the water stored is recoverable. As discussed in section 8.2.2 of this chapter, water stored by the CAGRD is to offset groundwater pumping associated with post-1995 subdivisions that are enrolled as member lands in the CAGRD and for municipal water providers that are member service areas in the CAGRD.

TABLE 8-4
CAP WATER DELIVERED TO BE STORED BY ENTITY

ENTITY	Water Delivered to be Stored (through 2017) (AF)
Ak-Chin Indian Community (Phoenix AMA)	3,806
Apache Junction Water District	29,886
Aqua Capital Management LP	93
Arizona Public Service Co	2,118
Arizona Water Banking Authority	1,929,543
Arizona Water Banking Authority - SNWA	53,985
Arizona Water Company - Superstition	4,000
Arizona Water Company - White Tanks	875
Arizona-American Water Company (Agua Fria)	65,686
Arizona-American Water Company (Anthem)	3,009
Arizona-American Water Company (Paradise Valley)	12,924
Arizona-American Water Company (Sun City West)	43,385
Arizona-American Water Company (Sun City)	49,040

ENTITY	Water Delivered to be Stored (through 2017) (AF)
ASARCO LLC	21,000
Central Arizona Groundwater Replenishment District	475,969
Central Arizona Water Conservation District	428,623
Chaparral City Water Co.	2,900
Citizens Water Resources	75
Citizens Water Resources (Agua Fria)	5,300
Citizens Water Resources (Sun City West)	7,491
Citizens Water Resources (Sun City)	11,187
City of Avondale	270,160
City of Buckeye	790
City of Chandler	635,739
City of El Mirage	44,892
City of Glendale	200,525
City of Goodyear	224,144
City of Mesa	586,899
City of Peoria	292,722
City of Phoenix	264,935
City of Scottsdale	250,587
City of Surprise	128,496
City of Tempe	119,886
Del E. Webb LP	15,401
Del Webb Corporation	36,061
Del Webb Home Construction	909
DMB White Tank, LLC	102
EPCOR (Agua Fria) Water Arizona Inc.	3,995
EPCOR (Anthem) Water Arizona Inc.	321
EPCOR (Paradise Valley) Water Arizona Inc.	9,693
EPCOR (Sun City West) Water Arizona Inc.	10,181
EPCOR (Sun City) Water Arizona Inc.	20,945
Fountain Hills Sanitary District	12,466
Freeport Minerals Corporation	91,465
Gila River Indian Community	442,236
Global Water - Water Utility of Greater Tonopah	103,043
Gold Canyon Sewer Company	4,536
Hassayampa Ventures, LLC	5,001
Johnson Utilities - Phoenix	3,062
Liberty Utilities (Litchfield Park Water & Sewer) Corp	18,770
Ocotillo Management Group	10,572
Pebblecreek Properties LP	440

ENTITY	Water Delivered to be Stored (through 2017) (AF)
Pima Utility Company	11,199
Resolution Copper Company	231,267
Salt River Project	161,304
Superstition Mountains Community Facilities District No.1	10,300
The Hopi Tribe	2,000
Tohono O'Odham Nation of Arizona	199,402
Tonto Hills Domestic Water Improvement District	155
Town of Florence	2,048
Town of Gilbert	708,216
U.S. Bureau of Reclamation	62,342
Vanderbilt Farms LLC	1,568
Vidler Water Co Inc	8,352
Vidler Water Company	164,667

Tribal Supply of Central Arizona Project Water
The three Indian communities in the PhxAMA all have allocations of CAP water. The three communities are: (1) the Fort McDowell Indian Community, (2) the Gila River Indian Community, and (3) the Salt River Pima-Maricopa Indian Community.

Fort McDowell Indian Community
In 1990, the Fort McDowell Indian Community Water Rights Settlement Act (the 1990 Act) was ratified by Congress. The 1990 Act is an agreement between the Fort McDowell Yavapai Nation (FMYN) and neighboring non-Indian communities, including SRP, Roosevelt Water Conservation District, Chandler, Mesa, Phoenix, Scottsdale, Tempe, Gilbert, CAWCD, the United States and the State of Arizona. FMYN is provided an annual entitlement to 35,223 AF of water from the Verde River and CAP under this agreement. The 18,233 AF of CAP water in the water budget may be leased for 100 years or less off reservation within Pima, Pinal, and Maricopa counties. This settlement also provides for a minimum stream flow on the Lower Verde River of 100 cfs. In accordance with the 1990 Act, a fund for the development of agricultural and other beneficial uses of water on the reservation was created with $23 million from the United States and with a $2 million appropriation by the Arizona State Legislature (ADWR, 2010).

Gila River Indian Community
In December 2004, the President signed into law The Arizona Water Settlements Act (AWSA) P.L. 108-451. Title II of the Act provided approval of the Gila River Indian Water Settlement Agreement. The settlement awarded the GRIC an annual entitlement to 653,500 AF of water from various sources including CAP allocations, reclaimed (through CAP exchange), groundwater, and surface water from the Gila, Verde and Salt rivers. It also established a funding mechanism for on-reservation development of this Community's farming operations and gave leasing authority to the GRIC for its CAP water as long as the water is leased within Arizona (ADWR, 2010).

Salt River Pima-Maricopa Indian Community
In the Salt River-Pima Maricopa Indian Community (SRPMIC) Water Rights Settlement Act of

1988, Congress approved an agreement which gave the SRPMIC an annual entitlement to 122,400 AF of water plus storage rights behind Bartlett and modified Roosevelt Dams. Sources of water for the SRPMIC under the settlement include the Salt and Verde rivers, groundwater and CAP water. This Community is permitted to pump groundwater but must achieve safe-yield when the East Salt River sub-basin in the Phoenix AMA does so. The SRPMIC has leased its 13,000 AF CAP allocation to the Phoenix valley cities from 2000 to 2099. The Arizona State Legislature appropriated $3 million, which was added to $47 million from the United States for the SRPMIC's trust fund (ADWR, 2010).

8.3.2 Reclaimed Water

Reclaimed water provides an important component of the total water supply available to the PhxAMA. There are several benefits to increasing use of reclaimed water. The primary benefit is reserving high quality groundwater for potable use. Other benefits include the following:

- Use of reclaimed water for turf irrigation offsets the use of groundwater or other renewable supplies.
- Land subsidence caused by over-pumping of groundwater can be partially reduced by reclaimed water use/recharge.
- Reclaimed water may also be recharged or directly used in areas with severe groundwater level declines.

PhxAMA cities, towns, and water companies have spent millions of dollars in investments to construct wastewater treatment plants and recharge facilities to use and store reclaimed water in the PhxAMA over the past decade. Although reclaimed water use increased during the third management period, the production of reclaimed water also has increased with the population growth. As excess CAP water supplies decline, reclaimed water will be the only increasing renewable future supply. There is remaining potential for greater use of reclaimed water, both for direct uses and indirect uses and for potable and non-potable uses. Storage of reclaimed water underground can improve its quality while preserving it in the AMA for future use. Direct use of reclaimed water and its storage and recovery recycles water supplies. When reclaimed water is captured and reused, the original source water gets used more than once, and may cycle through the system multiple times prior to its full consumption. This increases the value of reclaimed water as a resource in the Phoenix AMA.

Water exchanges have contributed to the increased direct use of reclaimed water in the PhxAMA. The 1992 Water Exchange Act laid the legal framework for water exchanges, which has provided opportunities to manage renewable water supplies, including reclaimed water, more efficiently. For example, a three-way exchange between the City of Phoenix, Roosevelt Irrigation District, and the Salt River Project (SRP) has resulted in putting 30,000 AF per year of reclaimed water from the 23rd Avenue Wastewater Treatment Plant (WWTP) to beneficial use.

In 2017, municipal water providers in the PhxAMA reported producing approximately 307,744 AF of reclaimed water. Approximately 72,553 AF of the volume of reclaimed water produced was sent to constructed or managed recharge facilities in the PhxAMA compared to only 5,455 that was delivered to GSFs.

8.3.3 Surface Water

Surface water resources in the PhxAMA have historically met and continue to meet a large proportion of the demand in the AMA. Surface water supplies are not typically underutilized in the PhxAMA because they are an economical source, they are available in most years, and an extensive infrastructure exists to deliver the water to the water users.

Salt River Project (SRP) facilities have a maximum reservoir storage capacity of more than 2 million AF of Salt and Verde River water. The amount of SRP surface water delivered each year depends on the amount of surface water in storage each year. When reservoirs are low, SRP supplements its surface water deliveries with groundwater to meet customer demand. SRP surface water use is based on decreed and appropriative water rights and is available only to water users on SRP member lands.

Many providers with rights to surface water utilize USFs and recovery wells to manage their surface water supplies. Appropriable surface water generally must be recovered within the same month it is stored. If stored and recovered in this manner, it is considered a direct use of the supply. Through 2017, approximately 371,484 AF of Salt and Verde River water was put to use through annual storage and recovery activity.

8.3.4 Plan 6 Water

Plan 6 refers to the development of reservoir facilities for storing CAP water. Plan 6 included construction of New Waddell Dam on the Agua Fria River, modifications to Roosevelt Dam, and the proposed construction of Cliff Dam on the Verde River. The plans to construct Cliff Dam were halted in 1987 due to environmental concerns; however, Phoenix area cities were assured by the Arizona Congressional Delegation and the Secretary of Interior that they would receive water supplies necessary to replace the additional resources that would have been provided by Cliff Dam. This was provided through the assignment of the Hohokam Irrigation and Drainage District agricultural subcontract to certain cities in exchange for the payment of private and federal debts related to the district’s distribution system. Plan 6 water provides opportunities for additional surface water resources from the Agua Fria River and the Salt River to augment supplies in the AMA. Waddell Dam on the Agua Fria River was replaced by New Waddell Dam which has an increased storage capacity. The original dam and reservoir could store up to 150,000 AF while the new dam and reservoir can store up to 800,000 AF (Maricopa Association of Governments, 1993). Not only has this increased capacity allowed Colorado River water to be delivered into central Arizona for storage throughout the year (which was not possible previously), it resulted in additional appropriative rights to CAWCD of up to 698,800 AF of Agua Fria River water captured by the increased storage capacity. The Maricopa Water District (MWD) retained the historical appropriative and storage rights associated with the original Waddell Dam.

Plan 6 also included modifications to Roosevelt Dam on the Salt River, to address needed design upgrades. These modifications increased storage capacity in the reservoir by approximately 255,100 AF, not including flood control space. The appropriative rights to the additional surface water captured by the modified dam were obtained for municipal use by the cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe, which contributed funding toward the construction of the dam modifications. Unlike Salt and Verde River water, this Plan 6 water supply may be used off SRP member lands or recharged underground for long-term storage.

Through the year 2017, approximately 36,219 AF of Plan 6 water had been stored at USFs, with an additional nearly 54,809 AF stored at GSFs.

8.4 PHXAMA 4MP AUGMENTATION & RECHARGE PROGRAM GOALS AND OBJECTIVES

This Recharge Program chapter has thus far highlighted the physical groundwater supply conditions in various locations throughout the PhxAMA, the availability of renewable water supplies, the successes and shortcomings of the Recharge Program during the third management period in the PhxAMA, and the water management challenges facing the PhxAMA during the fourth management period. ADWR has developed the goals and objectives of the Recharge Program for the fourth management period based upon these PhxAMA considerations. The Recharge Program for the fourth management period is intended to move the PhxAMA toward its goal of safe-yield and to begin to address sensitive areas by emphasizing the following primary objectives:

- Encourage and facilitate the replacement of groundwater use with the efficient use of renewable supplies throughout the PhxAMA.
- Improve or maintain groundwater conditions in areas of the PhxAMA experiencing or projected to experience impacts due to water level declines.
- Explore options for managing local aquifer areas.
- Maximize storage of CAP water to offset future shortages.

During the fourth management period ADWR will work to:

- Maximize the beneficial use of renewable water supplies to reduce groundwater overdraft and ensure a safe, long-term, reliable water supply.
- Support efforts to utilize the CAP infrastructure to the fullest extent possible, to deliver excess Colorado River water and other water to the PhxAMA while these supplies are available.
- Support development of local water management, supply augmentation, and recharge plans consistent with groundwater management objectives.
- Develop groundwater monitoring programs, improve databases, and expand public information programs to support planning and management activities.
- Coordinate groundwater replenishment, AWBA activities, AWS activities, and related activities to facilitate achievement of groundwater management goals. These goals include ensuring that recharge activities protect the quality and storage capacity of the aquifer, and that facilities are sited in a manner that maximizes benefits and provides for future recovery as required.
- Support comprehensive regional water management efforts, including the development and beneficial use of alternative supplies.
- Develop incentives for augmentation of water supplies, including incentives that promote efficient use of renewable supplies.
- Identify and assess feasibility of potential future water supply augmentation measures.

The possibilities and need for augmentation during the fourth management period differ substantially among the five AMAs. ADWR will continue to assist water users in developing additional water supplies and maximizing the use of existing alternative water supplies in meeting the PhxAMA water management goal. To accomplish this, ADWR will first seek to identify all potential measures available to the PhxAMA. Proposed measures will be evaluated based on their cost and physical practicality in implementation. The amount of information available for water management has already increased through the development of groundwater and surface water monitoring programs by ADWR to facilitate effective implementation of water augmentation and recharge plans.

8.5 THE PHXAMA 4MP AUGMENTATION & RECHARGE PROGRAM

ADWR is required to include in the 4MP "if feasible, a program for additional augmentation of the water supply of the active management area, including incentives for artificial groundwater recharge" (A.R.S. § 45-567(A)(5)). Pursuant to A.R.S. § 45-561(2), "Augmentation means to supplement the water supply of an active management area and may include the importation of water into the active management area, storage of water or storage of water pursuant to chapter 3.1 of this title." The Recharge Program must be consistent with this statute, but, as described in the introduction, for purposes of this chapter *augmentation* means increasing the availability and use of renewable supplies such as reclaimed water in lieu of groundwater and *recharge* means storage of water pursuant to Title 45, Chapter 3.1, the Underground Water Storage, Savings and Replenishment Act. The Recharge Program, therefore, includes provisions for maximizing the use of renewable supplies and for storage of renewable water.

The principal responsibility for developing water supplies and for storing that water for future uses lies with the PhxAMA's water users. ADWR's responsibility under A.R.S. § 45-567(A)(5) is to design a program that encourages and facilitates the efforts of those water users. The program should particularly encourage augmentation and storage of water where groundwater supplies are limited. The Recharge Program also strives to avoid aggravating existing local water supply problems.

The Recharge Program for the 4MP includes the statutory requirements for storing and recovering water within an AMA. The key statutory provisions for storage facilities relate to hydrologic feasibility (A.R.S. § 45-811.01(C)(2)); protection of land and other water users from unreasonable harm (A.R.S. § 45-811.01(C)(3)); and avoidance of water quality impacts (A.R.S. § 45-811.01(C)(5)). The Underground Water Storage, Savings and Replenishment Act requires certain types of storage and recovery to be found consistent with the management plan and management goal for the AMA. The provision that governs non-recoverable storage includes a requirement that non-recoverable water storage must be consistent with the AMA's Recharge Program (A.R.S. § 45-833.01(A)). Provisions governing recovery allow stored water to be recovered outside the area of impact of the stored water only if certain conditions are met (A.R.S. § 45-834.01). One of the conditions is that the Director must determine that recovery at the proposed location is consistent with the management plan and management goal of the AMA (A.R.S. § 45-834.01(A)(2)(b)(ii)).

ADWR has developed the Recharge Program for the 4MP to address the goals and objectives identified in the previous section. The program components are discussed in the following sections.

8.5.1 Arizona Water Banking Authority

The AWBA was established in 1996 to store Arizona's unused allocation of Colorado River water for use in the future to meet the following objectives (1) protect municipal and industrial (M&I) users of CAP water from shortages or disruptions to the CAP system, (2) assist in meeting the management objectives of the state's Groundwater Code (Code), (3) assist in the settlement of Indian water rights claims, (4) exchange water to assist Arizona's Colorado River communities, and (5) provide a mechanism for interstate water banking with Nevada and California. To this end, the AWBA has recharged 4.35 million AF (MAF) of excess CAP water within the CAWCD service area through 2017. Long-term storage credits (credits) accrued from this storage total 4.2 MAF and include 3.6 MAF for Arizona uses and 0.6 MAF for interstate storage, specifically, the Southern Nevada Water Authority (SNWA).

As shown in Table 8-5, the AWBA has recharged and accrued 1,869,497 AF of credits in the PhxAMA, of which 51,009 AF are for SNWA. Additionally, the AWBA purchased 59,082 AF of credits from other entities[5] for a total of 1,928,579 AF of credits. The highest percentage of credits have been accrued at the Tonopah Desert Recharge Project (TDRP) (24 percent), followed by the Granite Reef Underground Storage Project (GRUSP) (23 percent) and the New Magma Irrigation and Drainage District (NMIDD) GSF (19 percent).

The AWBA is authorized to use four main revenue sources to accomplish its objectives:

- General Fund appropriations received at the discretion of the Legislature;
- Groundwater Withdrawal Fees of $2.50 per AF collected in the Tucson, Phoenix, and Pinal[6] AMAs collected by ADWR;
- An *ad valorem* property tax (4¢ tax) levied and collected by CAWCD in its three-county CAP service area; and
- Monies received for interstate banking

While the AWBA is authorized to use these funding sources, the revenues available from each source vary both on an annual basis and by the amounts collected within each AMA or county. There also are limitations on how each fund may be utilized by the AWBA to achieve its various goals.[7] The availability and use of funds for any given year are described in the AWBA's Annual Plan of Operation.

TABLE 8-5
PHOENIX AMA AWBA CREDITS ACCRUED & LOCATION THROUGH 2017

Storage Facility		AWBA Long-term Storage Credits (Acre-Feet)		
		Intrastate	**Interstate**	**Total**
USF	Agua Fria Recharge Project - Managed	66,624	0	66,624
	Agua Fria Recharge Project - Constructed	45,444	0	45,444
	Granite Reef Underground Storage Project	412,592	0	412,592
	Hieroglyphic Mountain Recharge Project	94,925	0	94,925
	Superstition Mountains Recharge Project	28,338	0	28,338
	Tonopah Desert Recharge Project	429,430	51,009	480,438
	Subtotal	**1,077,353**	**51,009**	**1,128,362**
GSF	Chandler Heights Citrus ID	4,517	0	4,517
	Maricopa Water District	47,171	0	47,171
	New Magma IDD	353,519	0	353,519
	Queen Creek ID	118,425	0	118,425

[5] AWBA governing statutes were amended in 2014 to allow the AWBA to purchase credits after all excess CAP supplies available annually have been scheduled for storage.
[6] From 2020 to 2026, no withdrawal fees will be collected for AWBA in the Pinal AMA, and instead up to $2.50 may be collected toward the Irrigation and Efficiency Fund created as a part of the DCP agreements.
[7] A.R.S. § 45-2425 describes how revenues are made available to the Arizona Water Banking Fund and A.R.S. § 45-2457 describes how these revenues may be used.

	Salt River Project	77,327	0	77,327
	Roosevelt Water Conservation District	108,575	0	108,575
	Tonopah ID	2,368	0	2,368
	Gila River Indian IDD	88,313	0	88,313
	Subtotal	**800,216**	**0**	**800,216**
	Total	**1,877,570**	**51,009**	**1,928,579**

In addition to its primary funding sources, the AWBA also received funds pursuant to the Arizona-Nevada Shortage-Sharing Agreement executed on February 9, 2007. Under this agreement, SNWA agreed to provide $8 million to the AWBA to assist Arizona in offsetting impacts from any shortages during the "Interim Period".[8] These "Shortage Reparation" funds have been used by the AWBA to accrue credits in each of the three AMAs. Any credits not utilized during the Interim Period will continue to be available to the AWBA for future firming purposes.

Table 8-6 identifies the volume of credits the AWBA has accrued in the PhxAMA for each funding source. The majority of the credits accrued (76 percent) are from use of the 4¢ *ad valorem* tax monies and represent 89 percent of the PhxAMA M&I firming goal of 1,566,000 AF.

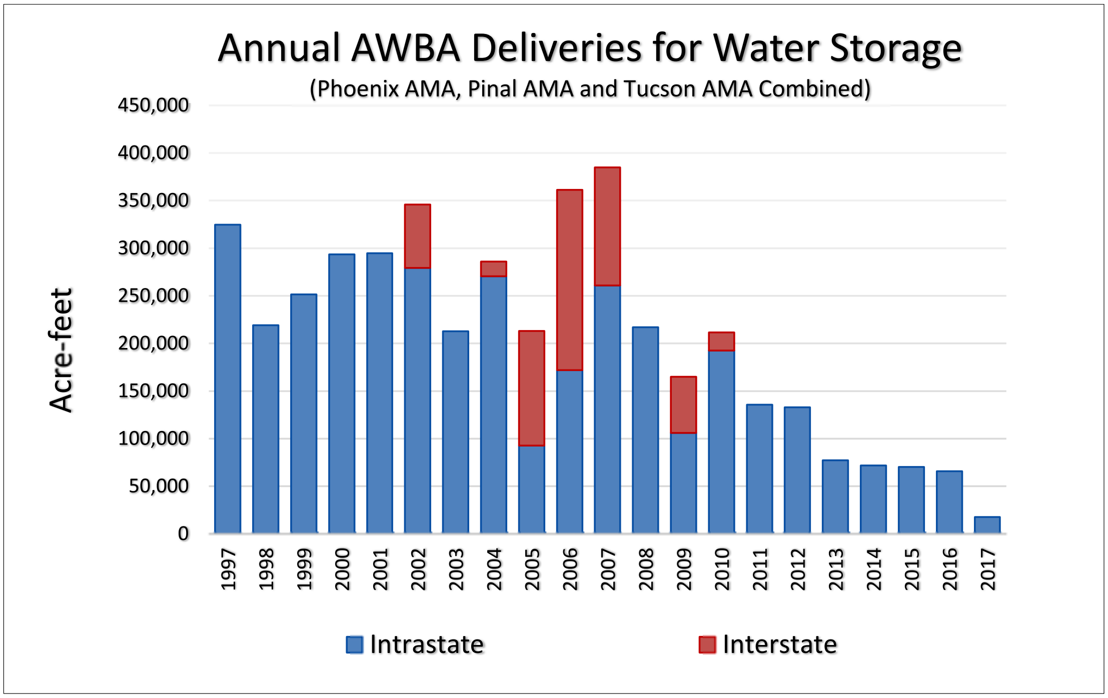
TABLE 8-6
PHOENIX AMA AWBA CREDITS ACCRUED
PER FUNDING SOURCE THROUGH 2017

Funding Source	Long-term Storage Credits (AF)
Groundwater Withdrawal Fees	335,972
Four-cent *Ad valorem* Tax	1,478,641
General Fund	42,316
Shortage Reparation	20,642
Interstate Banking - Nevada	51,009
Total	**1,928,579**

As illustrated in Figure 8-2, the volume of Excess CAP water available to the AWBA has historically been over 200,000 AF per year with volumes peaking in 2006 and 2007 at 361,220 AF and 384,890 AF, respectively. This trend began to shift in 2008 due to an increase in use by higher priority CAP water users, which decreased the amount of water available to the Excess Pool. The volumes available to the AWBA within the Excess Pool also decreased, fueled primarily by a decrease in the rate for incentive-priced recharge water. While it has always been anticipated that the amount of Excess CAP water available to the AWBA would decrease over time, these decreases occurred earlier than expected.

[8] The Interim Period is the period beginning on the date the Secretary issued the Colorado River Interim Guidelines for the Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead, December 13, 2007, and ending on December 31, 2025 (through preparation of the 2026 Annual Operating Plan).

FIGURE 8-6
ANNUAL AWBA DELIVERIES FOR WATER STORAGE



Storage in 2004 and 2009 included 10,000 AF and 51,387 AF, respectively, of Nevada's unused Colorado River apportionment stored on behalf of SNWA.

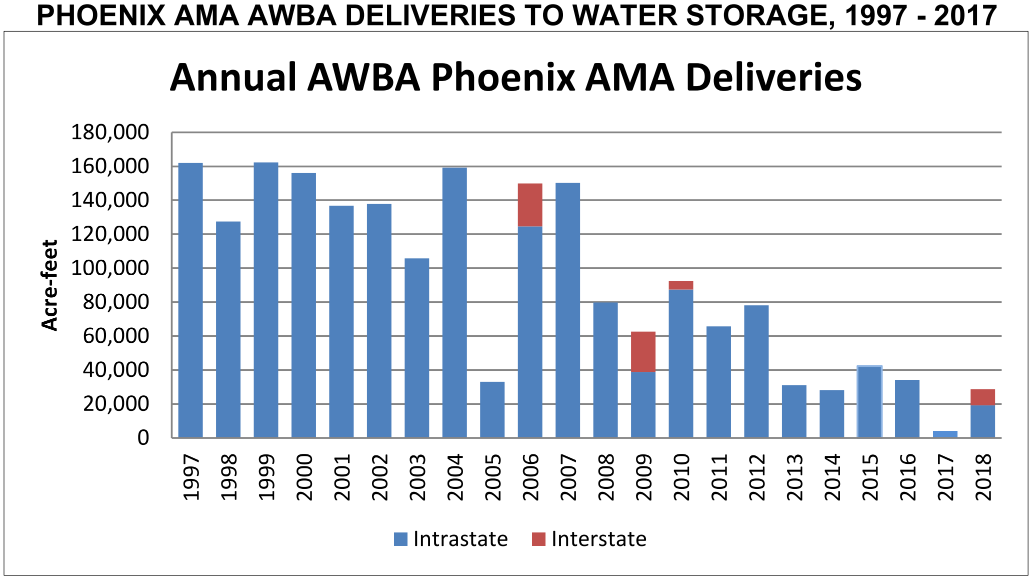
In June of 2009, recognizing that demand for excess CAP water was exceeding supplies and the beneficial value of the AWBA to both CAWCD and the AMAs for meeting water management objectives, the CAWCD Board of Directors (Board) created an excess pool of up to 175,000 AF that would be available to the AWBA from 2010 through 2014[9]. The AWBA shares this pool with the CAGRD for replenishment reserve purposes and the federal government for meeting its Indian firming responsibilities. The AWBA's statutes also were amended in 2010, affirming the AWBA's ability to store or replenish Excess CAP water made available by CAWCD exclusively for the AWBA. The CAWCD Board subsequently also discontinued its incentive-priced recharge pool since incentives for recharge were no longer needed. Even so, the amount of Excess CAP water available to the shared pool also decreased, limiting the AWBA's progress toward meeting its goals and obligations in the future. As a solution, the AWBA could seek other sources of renewable water supplies, including the purchase of existing credits, to achieve its objectives.

Annual AWBA water storage in the PhxAMA is quantified in Figure 8-3 below. Approximately 46 percent of all water stored by the AWBA has been in the PhxAMA and is a result of the higher amounts of storage capacity and funding available to the AWBA in the PhxAMA compared with the Pinal and Tucson AMAs. Most of the AWBA's storage early on occurred at GRUSP and the GSFs with storage at CAWCD's Agua Fria and Hieroglyphic Mountain Recharge Projects

[9] The CAWCD Board adopted a policy on March 6, 2014, creating a similar pool known as the "Statutory Firming Pool" that will be available to the AWBA, CAGRD, and the Bureau of Reclamation from 2015 through 2019.

beginning in 2001. These latter two provided additional capacity, but also gave the AWBA the opportunity to provide groundwater management benefits to the western portions of the Salt River Valley. By 2004, with an increase in storage by others, the volume of capacity available to the AWBA at these facilities started to decrease or discontinued altogether at the Maricopa Water District GSF, Roosevelt Water Conservation District GSF, Salt River Project GSF and GRUSP, although storage at GRUSP recommenced in 2015. In 2006, the opening of CAWCD's TDRP USF dramatically increased the AWBA's storage capacity with more than 91,000 AF of water delivered for storage that first year. At the same time, the AWBA entered into a water storage partnership with the Gila River Indian Irrigation and Drainage District (GRIIDD) to store water on the Gila River Indian Community lands at the newly permitted GSF, giving the AWBA additional opportunities for meeting future firming obligations. These storage facilities, although only three years for the GRIIDD GSF, gave the AWBA the additional storage capacity it needed to ensure the unused portion of Arizona's Colorado River entitlement could be stored. The start of operations at CAWCD's Superstition Mountain Recharge Project in 2011 further increased storage capacity availability and provided water management benefits to the Queen Creek and San Tan Valley region of the AMA. By bringing additional CAP water into the AMA, the AWBA has played an important water management role, augmenting supplies in locations considered areas of concern, and effectively reducing the amount of groundwater pumped by agricultural interests. AWBA storage accounts for 101,365 AF of water provided as a benefit to the aquifer (5 percent cut).

FIGURE 8-7
PHOENIX AMA AWBA DELIVERIES TO WATER STORAGE, 1997 - 2017



8.5.1.1 Interstate Water Banking in PhxAMA

The AWBA began storing water pursuant to its interstate water banking program in 2002. As illustrated in Figure 8-3, interstate storage in the PhxAMA did not occur until 2006 and has been significantly less than in PAMA and TAMA. A total of 51,009 AF of water was stored, which represents roughly eight percent of the 0.6 MAF of credits accrued on behalf of SNWA. The AWBA stored less water for interstate purposes in the PhxAMA because it had more funds available to store water for Arizona uses compared with the Pinal and Tucson AMAs. As shown in Table 8.5, interstate storage in the PhxAMA only occurred at the TDRP USF. While short-term, the PhxAMA has benefitted from the importation of the additional water supplies into the AMA in advance of when those supplies will be needed for interstate use.

8.5.1.2 Assistance in Settlement of Indian Water Rights Claims

The Arizona Water Settlements Act (AWSA), which settles longtime claims to water by the Gila River Indian Community (Community) and the Tohono O'odham Nation (Nation), was enacted in December 2004. The State, under Section 105(b)(2) of the AWSA, is required to: A) firm 15,000 AF of non-Indian agricultural (NIA) priority CAP water re-allocated to the Community, B) firm 8,724 AF of NIA priority CAP water re-allocated in the future to Arizona Indian tribes, and C) assist the Secretary of the Interior (Secretary) in its firming requirement for the Nation by providing $3 million in cash or in-kind goods or services, including water, to the Secretary. For a 100-year period and during times of shortage, the AWSA requires the State to firm delivery of CAP water to certain Arizona Indian tribes with NIA priority water to the same level of priority the State would likewise firm delivery of CAP water to M&I priority users. The Indian Firming Study Commission (IFSC), created by the Arizona State Legislature (Legislature) to evaluate the potential alternatives for meeting the State's obligations under the AWSA, estimated that the volume of water needed to meet the state's 100-year firming obligation under the AWSA was 550,000 AF: 350,000 AF for the Community and 200,000 AF for future settlements. The IFSC also concluded that the AWBA was the most appropriate entity to fulfill the State's firming obligations. The AWBA was subsequently given this authority pursuant to A.R.S. § 45-2491.

Presently, the AWBA's settlement obligation in the PhxAMA is limited to firming NIA priority CAP water re-allocated to the Community. This obligation is shared with PAMA since Community lands straddle the boundaries of both AMAs. In 2006, with the intent of getting an early start on fulfilling its obligation to the Community, the AWBA entered into a water storage agreement for storage at the GRIIDD GSF. The AWBA and the Community had agreed that upon enforceability of the AWSA, credits accrued by the AWBA at the GSF would be dedicated toward meeting future firming obligations to the Community. Specifically, the AWBA agreed to extinguish its credits and the Community agreed to accept the stored water as meeting an equal portion of the state's firming obligation. Storage at the GRIIDD GSF also required the issuance of two separate water storage permits, one for each of the AMAs. The AWBA subsequently accrued 105,390 AF of credits at the GRIIDD GSF: 88,313 AF for the PhxAMA and 17,077 AF for PAMA. The GSF permit expired when the Community began taking its CAP entitlement in 2010 in accordance with the payment schedule described under the AWSA.

On November 15, 2007, the AWBA and the Secretary entered into an agreement that defines the AWBA's obligation to firm water during times of shortage. The agreement also allows the AWBA to enter into separate agreements with Indian communities to develop firming plans that will be used to meet its obligations. With enforceability of the AWSA in December 2007, the AWBA has a firming responsibility through 2107. On June 16, 2015, the AWBA and the Community executed an intergovernmental agreement (IGA) that describes the procedures for developing and carrying out a firming plan during shortage years. It also identifies several methods that can be used for this purpose, which includes the use of the credits that were accrued at the GRIIDD GSF.

The AWBA also is required to firm up to 3,750 AF per year of NIA Priority CAP water under the White Mountain Apache Tribe (WMAT) Water Rights Quantification Agreement (Quantification Agreement), executed on December 8, 2010 as part of the Claims Resolution Act of 2010. This obligation is part of the 8,724 AF per year identified for re-allocation to future Arizona Indian

Tribes under the AWSA. Because this water will be leased by entities in the PhxAMA, the AWBA's responsibility will be to firm the leased water supplies during shortages.[10] The Quantification Agreement has an enforceable date of April 30, 2021, unless an extension is granted.

8.5.1.3 Distribution and Recovery of AWBA Long-term Storage Credits in PhxAMA

Based on current modeling projections, the AWBA does not anticipate the need to firm on-River or CAP M&I priority supplies before 2028.[11] However, there is a 25 to 31 percent chance that the AWBA will need to firm NIA priority supplies under Tier 1 or Tier 2 shortages during this time. Within PhxAMA, this obligation would currently include the AWBA's firming obligation to the Community. As previously mentioned, the AWBA and the Community have entered into an IGA that identifies several methods that can be used to satisfy a firming obligation. While most of these methods focus on the extinguishment of AWBA credits accrued on or near Community lands, traditional recovery by CAWCD also is an option. However, it would first require an agreement between the AWBA and CAWCD before this option could be used. Staff is currently working on such an agreement. This agreement also could include firming for the WMAT lessees, should the Quantification Agreement become enforceable, as well as future Indian firming responsibilities not yet identified. Recovery for the development of Intentionally Created Unused Apportionment (ICUA) for Nevada is not anticipated to occur until 2025.

To prepare for meeting future firming requirements and for the development of ICUA, the AWBA, CAWCD and ADWR, in cooperation with stakeholders, developed a recovery plan that provides a framework for how the AWBA's credits will be recovered in the future.[12] The recovery plan identifies various methods that can be used for recovering AWBA credits such as direct recovery by CAWCD, indirect recovery with third parties, and credit exchanges with recovery partners. There are potential opportunities within the PhxAMA for all three of these recovery methods thus creating flexibility for how water is made available during shortages or for developing ICUA. While the recovery plan provides a foundation, AWBA and ADWR convened the Recovery Planning Advisory Group (RPAG) in 2018 to review and provide guidance to recovery planning efforts.

8.5.1.4 Recommendations to the Arizona Water Banking Authority

One of the stated purposes of the legislation creating the AWBA is to "store water brought into this state through the CAP to fulfill the water management objectives of this state set forth in chapter 2 of this title." A.R.S. § 45-2401(H)(3). The AWBA is required to coordinate with the Director of ADWR, who serves as chair of the AWBA Commission, in the "storage of water and distribution and extinguishment of long-term storage credits . . . in accordance with the water management objectives set forth in chapter 2 of this title [the Code]." A.R.S. § 45-2423(A)(3). To meet these statutory requirements, ADWR must provide specific advice to the AWBA as to how to incorporate such objectives into the AWBA's activities. Specifically, the Groundwater Code requires that ADWR include recommendations to the AWBA in the 4MP regarding the following three questions: 1) whether additional water storage in the AMA would help to achieve the management goals of the AMA, 2) where the additional water storage would be most useful

[10] Lessees under the Quantification Agreement for which the AWBA will have a firming obligation include Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix and Tempe.
[11] Arizona Water Banking Authority 2017 Annual Report.
[12] The Preface to the *Recovery of Water Stored by the Arizona Water Banking Authority – A Joint Plan by AWBA, ADWR and CAP* that acknowledges the plan advances the objectives of the Intergovernmental Agreement among the Parties, was executed on May 6, 2014.

in achieving the management goal, and 3) whether the extinguishment of credits would assist in achieving the management goal. ADWR provides the following recommendations to the AWBA for water storage in the AMA.

Advice to the AWBA on Additional Water Storage in the AMA
It is clear that water storage by the AWBA helps to meet the water management objectives of the AMA. Although excess CAP water supply availability has diminished, ADWR recommends that the AWBA continue to store water in the AMA when funds and supplies are available, so that further progress can be made on achieving its M&I or Tribal firming goals in the PhxAMA,

Advice to the AWBA on the Location of Water Storage in the AMA
The AWBA has stored a considerable amount of water in both the east and west Salt River Valleys of the AMA, augmenting water supplies while also improving aquifer health in those areas. If excess CAP water or other renewable supplies are available, ADWR recommends that the AWBA continue to work with ADWR, CAWCD and PhxAMA interests to select sites for recharge that serve as many water management objectives as possible while also considering the future recovery of that water.

Advice to the AWBA on Water Storage Credit Extinguishment
While the extinguishment of withdrawal fee credits could provide water management benefits, because the AWBA has an obligation to meet the state's obligations under the AWSA and withdrawal fee credits may be used for this purpose, ADWR recommends that the AWBA hold these credits in reserve at this time. If withdrawal fee credits were to become available for extinguishment, ADWR recommends that the AWBA develop a program in cooperation with PhxAMA water users and interested parties to extinguish storage credits specifically in areas of ongoing localized overdraft.

8.5.2 Storage and Recovery Siting Criteria

Recharge Program water management benefits are dependent upon the location of storage and recovery. Because recovery outside the area of impact must be consistent with the PhxAMA's management plan and management goal, the locations of storage and recovery of water are inherently linked. Both must be considered when determining whether the future recovery of stored water meets the requirement for consistency with the management plan and management goal of the PhxAMA. Water management benefits to the PhxAMA would depend greatly on whether water recovered from an existing recovery well was stored in a remote area of the PhxAMA or in a large pumping center of the PhxAMA. Therefore, the criteria to determine whether the recovery location is consistent with the management plan and goal for the PhxAMA must also consider where water was stored.

The locations of storage and recovery also are important factors in addressing local and regional supply problems, particularly in areas experiencing severe water-level declines, land subsidence, or other aquifer management issues, and in attempting to balance the PhxAMA's supplies during the fourth management period. For example, these locations also are crucial because future PhxAMA water supplies may be diminished if water storage occurs in a remote location with no future demand for the stored water and recovery occurs in an area experiencing water-level declines. On the other hand, if storage occurs in an area experiencing high water levels and recovery occurs away from the area of impact, the water storage will contribute to those high-water levels. If dewatering is required as a *direct* result of water storage or savings, either the storage facility's operational plan should be adjusted to minimize impacts, which may include strategic recovery locations to mitigate impacts, or the storer may not be issued credits.

Pursuant to A.A.C. R12-15-716(B)(3)(c)(ii), the AWS Program protects the estimated water demand of AWS determinations, including groundwater and stored water to be recovered outside the area of impact, from being considered physically available to subsequent AWS applicants.

The Recharge Program criteria also link future use benefits to determinations under the AWS Program. If the recovery will occur outside the area of impact of storage, but the storage contributed to groundwater supplies that have been committed to establish an AWS determination[13], the recovery is deemed to be consistent with the management plan and achievement of the management goal. If recovery is to take place outside the area of impact, but is not contributing to groundwater supplies of an AWS determination, the recovery may still be consistent with the management plan and achievement of the management goal if the storage contributes to groundwater supplies accessible to current groundwater users, is a component of a remedial action project, or is otherwise determined by the Director to have contributed to the objectives of this chapter or achievement of the management goal.

The requirement that recovery outside the area of impact of storage must be consistent with the PhxAMA's management plan and management goal continues to be a requirement even after the recovery well permit has been issued. Thus, previously permitted recovery wells are subject to the criteria of the 4MP and future management plans.

8.5.3 Criteria for Storage of Non-Recoverable Water

Pursuant to A.R.S. § 45-833.01(A),

> "At the request of the applicant, the Director may designate a water storage permit as storing non-recoverable water. If the water storage occurs within an active management area, the water storage permit may be designated in this manner only if the storage is consistent with the active management area's augmentation program."

This designation has only been applicable in a few instances. In the second management period, non-recoverable storage occurred in association with certain augmentation grants that included storage of water to test the hydrologic feasibility of a recharge site. Under the 4MP, non-recoverable water storage also may occur as a result of an enforcement action associated with non-compliance of conservation requirements (see Chapter 10). For example, an entity out of compliance with its conservation requirements may agree to store water and extinguish any credits from that storage that might have otherwise accrued in the entity's long-term storage account of an equal volume to the volume of groundwater used in excess of the conservation requirement.

Water that is stored under a permit with this designation may not be recovered on an annual basis, may not be credited to a long-term storage account, and may not be used for replenishment purposes associated with a groundwater replenishment district. The same criteria for recovery and storage locations in the previous section exist for siting non-recoverable storage.

[13] Such as a Designation, Certificate, or Analysis of AWS.

8.6 REGULATORY INCENTIVES

Provisions established in the Agricultural, Municipal, and Industrial Conservation Programs of this management plan provide incentives for water users to utilize renewable resources. The programs to increase the use of renewable water supplies are not alternatives to conservation. All water use should be as efficient as possible.

Shortages are anticipated on the Colorado River system in the coming years. The Code (particularly through the AWS provisions) and the management plans require a long-term perspective on supply and demand. In the long-term, efficient use of *all* water supplies is necessary.

Achievement of water management goals over the long term is only possible in the context of serious, long-term conservation efforts and increased utilization of renewable supplies. The focus should not be a debate between conservation and augmentation, but rather, on efficiently using water. Matching the water resources to the most appropriate demand will continue to require sophisticated management of groundwater, surface water, and reclaimed water.

Incentives should be limited to applications where the desired response, such as substitution of use of renewable supplies for groundwater use or improved water conservation, would not otherwise have happened without the incentive.

Table 8-7 lists the 4MP incentives to use alternative supplies. Some of these incentives were established in the Second Management Plan. Because many of these incentives encourage use of alternative supplies at the expense of conservation, the augmentation incentives may need to be scaled back in the future in order to achieve safe-yield.

Although there may be a need to include specialized incentives to address sub-regional water declines, currently the only regulatory tool available to address these localized declines is to limit the recovery of recharged water in those areas, if it is recovered outside the area of impact of the stored water. Additional water management tools may need to be developed to help address this challenge in the future. The requirements described in Table 8-7 are designed to encourage direct use of reclaimed water rather than storage and recovery of reclaimed water.

Additional incentives to encourage use of remediated groundwater in lieu of high-quality supplies are provided in the AWS Rules and through legislative requirements in the Water Quality Assurance Revolving Fund (WQARF Program) Program *(See Chapter 7)*.

TABLE 8-7
RENEWABLE WATER SUPPLY UTILIZATION INCENTIVES

Sector	Incentive
Municipal	Delivery of reclaimed water by a municipal water provider does not count against the gallons per capita per day (GPCD) requirement, unless it is reclaimed water that is stored in one location and recovered outside the area of impact. This is an incentive for municipal providers to invest in reclaimed water systems *(Chapter 5, section 5-703.A)*.
Industrial	Reclaimed water use is discounted when calculating compliance with the annual allotment for a turf-related facility. For the 4MP, ADWR has retained the 30 percent discount that was included in the 3MP for the PhxAMA *(Chapter 6, section 6-1604.A).*
Industrial	Cooling towers that beneficially reuse 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements *(Chapter 6, section 6-2002.B).* Cooling towers that convert to at least 50 percent reclaimed water are exempt from the

	blowdown concentration requirements for one full year. If it is shown that they cannot meet the requirements, amended blowdown concentration levels may be applied *(Chapter 6, section 6-2002.B.2).*
Industrial	Large-scale power plants that recycle 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements *(Chapter 6, section 6-1902.C and 6-1903.B).*
Agricultural	Pursuant to A.R.S. § 45-467, reclaimed water use cannot contribute to a farm exceeding its allotment in any year. In determining whether a farm exceeds its maximum annual groundwater allotment for a year, total water use, including groundwater, reclaimed water, and surface water, is counted and any reclaimed water used that year is subtracted from the amount of groundwater that otherwise would have exceeded the farm's allotment.

8.6.1 Other Strategies to Address Water Management Challenges

As described in Chapter 2 and summarized in the physical assessment section of this chapter, certain areas within the PhxAMA are experiencing localized groundwater declines. These areas could continue to experience local declines even if safe-yield is achieved on an AMA-wide basis. A more localized approach to water management to address these areas could help offset these conditions. Therefore, ADWR will work to develop strategies to address the problems. Working cooperatively with stakeholders, ADWR's efforts may include: (1) developing local/state partnerships; (2) identifying areas of concern; (3) conducting hydrogeologic investigations as necessary; (4) examining new legislation and/or local ordinances; (5) developing programs; and (6) creating incentives that discourage or mitigate local water level declines.

8.7 CONCLUSION

Several issues will have to be addressed to facilitate achievement of safe-yield and other objectives discussed in this chapter. There is a growing recognition that the regulatory and non-regulatory tools that are available may not be sufficient to meet the PhxAMA water management objectives. As has been discussed, there are numerous factors that impact water use patterns, many of which are not regulated by ADWR. Although some Code provisions are directly linked to achieving the management goal, there are many ways in which water management tools could be improved. An evaluation of the roles and responsibilities of all groundwater users in reducing groundwater mining will be initiated as described in Chapter 12. A key consideration in evaluating the need for stronger regulatory programs is whether economic conditions alone can substantially reduce groundwater use across all sectors. Additional regulatory reforms and incentives will be considered in the 5th Management Plan.

Multiple strategies will continue to be considered during the fourth management period to attempt to achieve the AMA-wide goal of safe-yield and address water management challenges in specific geographic areas of the PhxAMA as the need arises. Many of these efforts will need to be undertaken in a cooperative approach with local stakeholders. Potential issues associated with groundwater pumping, such as large cones of depression, land subsidence, earth fissures, reduction in aquifer storage capacity, and the reduced physical availability of supplies may manifest themselves. The efforts to address these issues will require partnerships with PhxAMA entities that are willing to make necessary changes, and support efforts to improve groundwater conditions.

8.8 AUGMENTATION AND RECHARGE REQUIREMENTS

8-801 Storage and Recovery Siting Criteria

During the fourth management period, for the purposes of A.R.S. § 45-834.01(A)(2) recovery of stored water at a location is consistent with the management plan and achievement of the management goal for the active management area:

A. If recovery will occur within the area of impact of the stored water, regardless of whether the recovery well permit applicant was the storer of the water; or

B. If recovery will occur outside of the area of impact of the stored water, all of the following three criteria are met:

  1. The water storage that resulted in the right to recover water:

    a. Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or

    b. Is a component of a remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or

    c. Is otherwise determined by the Director to have contributed to the objectives of this chapter or the achievement of the management goal for the active management area.

  2. Either:

    a. At the time of the application, the maximum projected depth to water at the location of the recovery well after 100 years does not exceed the general 100-year depth-to-static water level for the active management area specified by A.A.C. R12-15-716 after considering: (1) the maximum proposed withdrawals from the recovery well; (2) withdrawals for current, committed, and projected demands associated with determinations made under A.R.S. § 45-576 that are reliant on the water which the recovery well will withdraw; and (3) withdrawals for other current or projected demands that are reliant on the water which the recovery well will withdraw; or

    b. The recovery will be undertaken within the applicant's service area and the applicant is a municipal provider designated as having an assured water supply.

  3. The recovery well is:

a. Located in an area experiencing an average annual rate of decline that is less than 4.0 feet per year; or

b. A component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or

c. Likely to contribute to the water management objectives of the geographic area in which the well is located, as determined by the Director.

8-802 Storage of Non-Recoverable Water

During the fourth management period, water storage that is designated as non-recoverable is consistent with the active management area's Recharge Program if one of the following criteria is met. The water storage:

1. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

2. *Is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

3. *Is otherwise determined by the Director to contribute to the objectives of this chapter or the achievement of the management goal for the active management area.*

APPENDIX 8
DECLINE RATE METHODOLOGY

In evaluating an application for a proposed recovery well permit, ADWR considers many factors in determining consistency with the average water level decline rate siting criteria. The time frame for which the average is calculated may vary based on data availability and the hydrologic characteristics of the area. Major trends in precipitation, water supply utilization over time, hydrogeologic data, and the modeling of projected impacts may be factors in evaluating this rate. Other considerations may also be appropriate depending on the location of the proposed recovery well.

Typically, ADWR examines the historic static water level data for the period of record for wells located in the section in which the proposed recovery well is located and in the eight sections that surround the section where the proposed well is located. The specific area examined depends on the availability and quality of water level data and the hydrogeology of the area. Bedrock outcrops, large pumping centers, and other features may affect the determination of pertinent data. Generally, wells that are screened in the aquifer of concern and regularly monitored using consistent methods for static water level data are good reference points (such as ADWR's statewide monitoring or index wells). ADWR examines the well hydrographs (graphs of static water levels over time) and evaluates the slope of the curve for the period of interest. The slope indicates whether the static water level in the monitoring well has risen or fallen over time. A horizontal line on the hydrograph indicates that water levels remained stable over time. ADWR identifies what activities may have caused the groundwater changes over time to see whether the activity still exists or has been reduced, eliminated, or increased over time.

This approach provides more flexibility and protection of the groundwater resource than would be provided by a simplistic evaluation of decline rates calculated for all water level data within a set radius and during the entire period of record. For example, if a recovery well is proposed for an area which historically had a rapid decline in groundwater levels due to activities that no longer exist (e.g., retirement of agriculture after heavy agricultural use in the 1940s and 1950s), and if the proposed area is not at high risk for land subsidence, the proposed recovery well might be deemed consistent with the average decline rate criteria by looking at the period of time after the historic change in use. Similarly, if water levels in the vicinity of the proposed recovery well were stable for decades, but recently a new use caused rapid rates of decline, the proposed recovery well may be deemed inconsistent with the criteria.

ADWR's groundwater models may be used to project future water levels and decline rates on a regional basis. Modeling may assist the permittee in evaluating recovery options. Where there are sufficient data, a model may give an indication of how long recovery within a region may remain permitted based on the current average decline rate criteria.

The most current procedures for establishing the average groundwater level decline rate in the vicinity of a proposed recovery well will be published in ADWR's Recovery Well Application Packet, however the general procedure is described below.

Decline Rate Procedure Description

To evaluate the four-foot decline criteria, ADWR will review water level data from all available, reliable sources of water level data in the vicinity of the proposed recovery well. Some sources include the ADWR Groundwater Site Inventory (GWSI) database, water levels submitted with the recovery well application from the applicant, or other water level data available.

The entire period of record for each well in the vicinity of the proposed recovery well is plotted on a hydrograph. The entire period of record of measurements is often used in the evaluation; however, sometimes the hydrograph reveals a pronounced inflection in average slope of the hydrograph, indicating that the entire period of record may not be representative of current conditions. The inflection may be attributed to conditions such as urbanization of previously irrigated acreage or the introduction of a new water source. The latest portion of the hydrograph that is most representative of current conditions, and will likely continue in the future, is then used in the analysis.

The average annual rate of decline for a given well is calculated by dividing the total change in water level for the selected period of record by the period of record, in years. The water level change for each well is averaged to arrive at an average water level change in the vicinity of the proposed recovery well. Care is taken to select wells for averaging near the proposed recovery well that are representative of nearby aquifer conditions.

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CHAPTER NINE:
WATER MANAGEMENT ASSISTANCE

9.1 INTRODUCTION

The Water Management Assistance Program (WMAP) is intended to provide financial and technical resources to assist water users in the AMA develop and implement conservation programs, facilitate augmentation and renewable water supply utilization, and obtain information on hydrologic conditions and water availability in the Phoenix Active Management Area (PhxAMA) (A.R.S. § 45-567(A)(5)) (A.R.S. § 45-567(A)(7)).

9.2 DESCRIPTION

Programs funded by the WMAP intend to help PhxAMA meet its water management goal of attaining safe-yield by the year 2025. Programs and projects funded by the WMAP fall under three categories, detailed below.

9.2.1 Conservation

Conservation assistance helps water users plan and undertake conservation efforts. It may be used for information and education services, including public awareness campaigns about the importance of water conservation and the AMA's groundwater supplies, and also may provide funding for technical support designed to increase water-use efficiency across the PhxAMA. Conservation assistance supports the Arizona Department of Water Resources' (ADWR) role as a central source for water conservation information.

9.2.2 Augmentation

Augmentation supplements the water supply of the AMA and includes water importation, water storage, and artificial recharge (A.R.S. § 45-561(2)). Augmentation programs may help water users study renewable resource options, design and construct renewable resource facilities, and provide information to resolve technical feasibility challenges or to optimize recharge project operation. It also may include studies initiated or conducted by ADWR, cost-sharing grants for augmentation projects, and studies initiated or conducted by others, as well as planning and technical support for AMA-wide and local area water management strategies.

9.2.3 Monitoring and Assessing Water Availability

Monitoring and water availability assessment activities provide information and data that are useful for developing strategies for reaching safe-yield, while also taking localized hydrologic conditions into account in the PhxAMA. Examples of information and data that can be obtained through monitoring and assessment activities include the following:

- Groundwater movement and volumes
- Locations of recharge and depletions
- Location and movement of poor-quality groundwater
- Impact of continued groundwater pumping, water-level declines and land subsidence
- Streamflow, snowmelt and precipitation data

9.3 FUNDING

9.3.1 Groundwater Withdrawal Fees

The WMAP is funded primarily from groundwater withdrawal fees levied and collected from each person withdrawing groundwater in an AMA from a non-exempt well (A.R.S. § 45-611(A)). Withdrawal fees are authorized by the *1980 Groundwater Management Code* (Code) and are levied based on the acre-foot volume of groundwater withdrawn on an annual basis. The WMAP portion of the fee is limited to a maximum of two dollars per acre-foot per year (A.R.S. § 45-611(A)(2)).

No later than October 1 of each year, the ADWR Director must set the groundwater withdrawal fee for the following calendar year (A.R.S. § 45-614(A)). Prior to setting the fee, the Groundwater Users Advisory Council (GUAC) for the AMA makes a recommendation to the ADWR Director how the fee should be set within the statutory limit. Within 30 days after setting the fee, the ADWR Director is required to give written notice of the fee to all counties, cities, towns, private water companies, political subdivisions, and holders of groundwater withdrawal permits in the AMA (A.R.S. § 45-614(C)). The fee is required to be paid to ADWR at the time the person withdrawing the water files an annual water withdrawal and use report (annual report) pursuant to A.R.S. § 45-632, A.R.S. § 45-614(E).

Total available funding for the programs varies from year to year depending on the amount of groundwater withdrawn and any carry-over of funds from previous years.

Monies held in the fund for an AMA may be used only to finance applicable programs and projects within the AMA (A.R.S. § 45-613(A)). Table 9-1 shows the total groundwater pumped, annual groundwater withdrawal fees, and total fees collected from 1997 through 2015.

TABLE 9-1
PHOENIX AMA ANNUAL WMAP
WITHDRAWAL FEE* SUMMARY, 1997-2015

Year	Groundwater Pumped (AF)	WMAP portion of Withdrawal Fee[2] ($/AF)	WMAP Monies Collected
1997	1,068,289	$0.25	$267,072.13
1998	785,228	$0.25	$196,306.90
1999	1,082,353	$0.25	$270,588.20
2000	1,030,823	$0.25	$257,705.70
2001	1,022,395	$0.25	$255,598.65
2002	1,131,570	$0.25	$282,892.62
2003	1,059,882	$0.25	$264,970.40
2004	1,030,466	$0.25	$257,616.54
2005	729,233	$0.25	$182,308.14
2006	707,598	$0.25	$176,899.51
2007	840,653	$0.25	$210,163.22
2008	671,877	$0.50	$335,938.49
2009	651,915	$0.50	$325,957.57
2010	614,440	$0.50	$307,219.97
2011	714,518	$0.50	$357,258.96
2012	841,421	$0.50	$420,710.39
2013	905,645	$0.50	$452,822.30
2014	923,801	$0.50	$461,900.30

Year	Groundwater Pumped (AF)	WMAP portion of Withdrawal Fee[2] ($/AF)	WMAP Monies Collected
2015	934,340	$0.50	$467,170.17

*Withdrawal fees collected reflect only the WMAP portion of the groundwater withdrawal fee. **The figures in the groundwater pumped column reflect the most recent information available in the AMA. This information may vary from the figures used at the time the groundwater withdrawal fees were actually collected.

9.4 HISTORY

9.4.1 Second Management Period

The Assistance Program originated during the second management period (1990-2000) as an augmentation program, including incentives for artificial recharge (A.R.S. § 45-565(A)(6)). A program for conservation assistance was required in 1990 (A.R.S. § 45-615(1)). In 1996, legislation authorized funding for monitoring and assessing water availability and land subsidence in addition to augmentation and conservation assistance (A.R.S. § 45-611). The addition of monitoring and assessing resulted in changing the name of the program from the "Conservation and Augmentation Fund" (as in the Second Management Plan) to the "Water Management Assistance Program" (as in the Third Management Plan).

From the beginning of the program in 1991 through 1998, the PhxAMA funded $6.5 million in municipal, industrial and agricultural conservation programs. Descriptions can be found in Chapter 9 of the Third Management Plan (3MP). (See https://new.azwater.gov/ama/management-plan/3).

9.4.2 Third Management Period

The 3MP required a program for "additional augmentation of the water supply of the AMA, if feasible, including incentives for artificial groundwater recharge" (A.R.S. §45-566(A)(6)) and a program for "conservation assistance to water users within the AMA." A.R.S. § 45-566(A)(8). During the third management period, the WMAP program intended to focus on the following objectives:

- Assisting water users or other eligible persons in achieving the conservation requirements of the 3MP;
- Developing augmentation and recharge projects to maximize the use of renewable sources of water such as Central Arizona Project, other surface water and effluent; and
- Monitoring the hydrologic conditions and potential impacts of continued groundwater pumping and water-level declines.

During the third management period, the PhxAMA funded a total of approximately $2.7 million in WMAP projects.

Some of the projects that were funded with WMAP monies in the PhxAMA during the third management period include:

- Water Conservation Management Program (WCMP)/Mobile Irrigation lab
- Water Use It Wisely Campaign
- Evaluation of the Management Plans
- Rinse Smart

- Conservation Program Planning Consultation
- Carefree/Cave Creek Sub-basin study
- Predicting Subsidence with Radar Interferometry
- Water Conservation Education to School Children
- Educational conservation displays
- HydroSmarts
- Arizona Project WET Workshops for teachers and students
- Colorado River Water Users Association (CRWUA) display
- Make a Splash Water Education Festivals
- Water Awareness Month
- Smart Irrigation Controller Study

9.5 NEEDS AND CHALLENGES FOR THE 4MP

WMAP funds may decline with decreased groundwater withdrawals in the PhxAMA. A higher proportion of annual or long-term storage credit recovery in the future may result in lower WMAP funds but more progress toward the achievement of the PhxAMA safe-yield goal.

9.5.1 Needs Identified in the 4MP

In the 4MP, the following needs were identified for the PhxAMA:

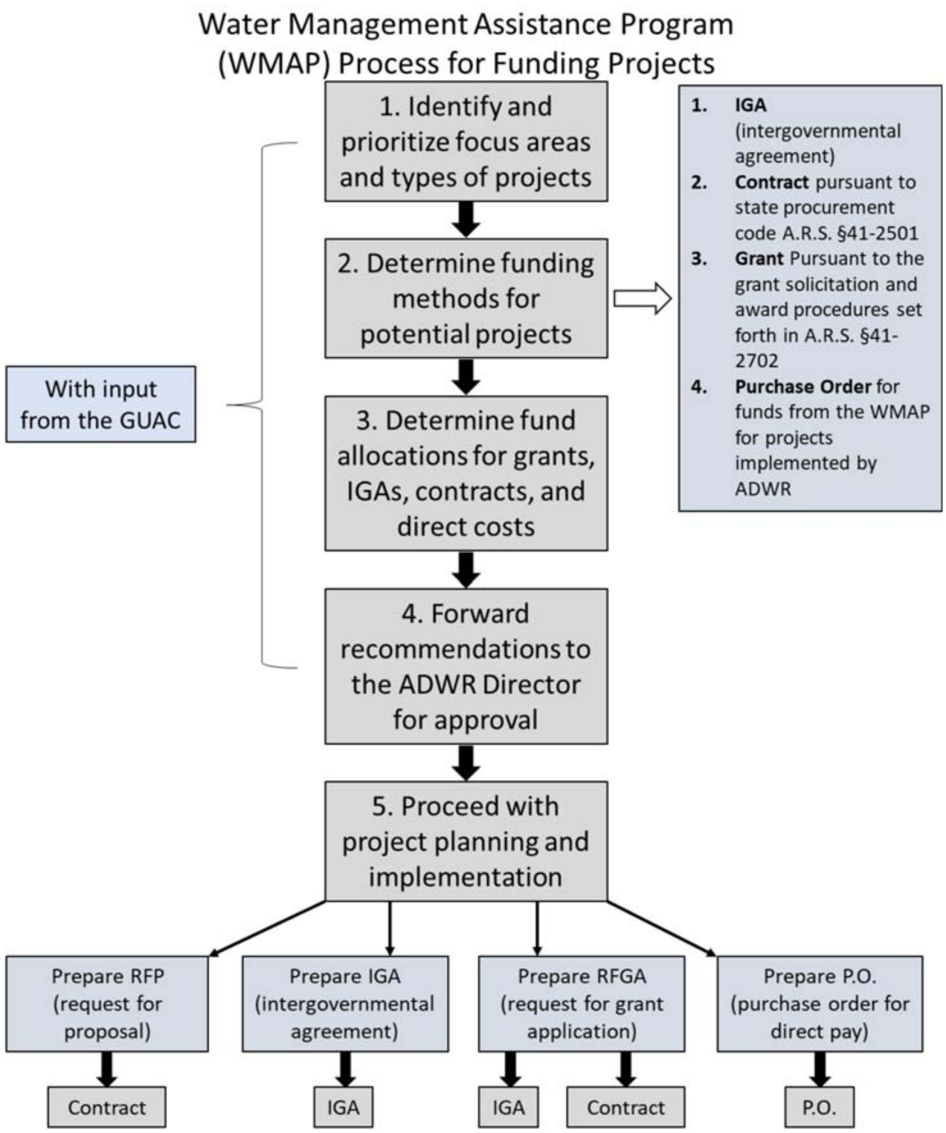
- Municipal Program Needs
  - Evaluation of the effectiveness of conservation programs
  - Programs that result in significant long-term savings
  - Urban landscape design
  - Water issue awareness campaign
  - Expanding the utilization of renewable water supplies
  - Conservation assistance and education
- Agricultural Program Needs
  - Irrigation water management assistance to farmers
  - Installation of efficient irrigation systems
  - Infrastructure to convey renewable supplies to farms
  - Monitoring crop and water-use patterns
  - Evaluation of the impact of market conditions and regulatory programs on farming operations
  - Expanding the utilization of renewable water supplies
  - Conservation assistance and education
- Industrial Program Needs
  - Developing opportunities and planning assistance for renewable supply use
  - Evaluation of the application rate and new irrigation technologies for turf facilities
  - Impact of effluent and Central Arizona Project water on cooling tower operation
  - Use of blowdown water from cooling towers for irrigation
  - Investigation of cooling tower maintenance technologies
  - Expanding the utilization of renewable water supplies
  - Conservation assistance and education
- Monitoring and Assessment Needs
  - Understanding the contributions of the water-using sectors to reaching safe-yield
  - Strategies to reach the goal of safe-yield in the context of the hydrologic conditions in the AMA

- Understanding groundwater movement, volumes, locations of groundwater recharge and depletions, and the location and movement of poor quality water
- Developing water-management strategies that take localized water conditions into account.
- Hydrologic modeling that takes into consideration all of the above

9.6 PROCEDURES

The WMAP will continue to be implemented during the fourth management period. Following is a description of how projects are identified, solicited, and awarded. A flow chart summarizes the process (See Figure 9-1).

FIGURE 9-1
WMAP PROCESS



9.6.1 Identifying Priority Projects

In an effort to apply available funding and technical assistance to the most important projects, ADWR identifies priorities with assistance from members of the water-using community and the GUAC. Information is gathered in the following ways:

- Soliciting public input at GUAC meetings from the GUAC and the public
- Soliciting ideas from conservation coordinators at the state level conservation information sharing meetings
- Meeting with technical administrators of currently funded projects to assess project progress and anticipate future needs
- Conducting surveys and/or requesting letters of intent so that stakeholders have the opportunity to put their ideas in writing
- Documenting expressions of interest and inquiries received via phone, email or in person
- Meeting with appropriate water-management staff to learn about agency needs, resources, and legal requirements relating to conservation in the industrial, municipal, agricultural and municipal/agricultural Best Management Practice (BMP) programs
- Reviewing current focus areas of other funding agencies and/or meeting with grant coordinators to identify needs, gaps and/or areas for collaboration

9.6.2 Applying Funds to WMAP Projects

ADWR identifies priorities for program assistance with input from members of the GUAC and the water-using community. Recommendations are made to the ADWR Director about allocating funds among the program categories: conservation, augmentation, and monitoring hydrologic conditions or assessing water availability. The type of project or program to be funded determines whether one of the following four methods are used to apply funds: Intergovernmental agreement (IGA), contract, grant, or direct use by ADWR.

A. Intergovernmental Agreement

ADWR may enter into an IGA with public agencies (as defined in A.R.S. § 11-951) (A.R.S. § 45-105(A)(8)). IGAs are appropriate when the source of the service requested is limited and the awards do not have to be competitive. The project must involve a joint exercise of powers common to the parties or an agreement for joint or cooperative action.

B. Contract

ADWR may enter into a contract for specific services by issuing a request for proposal (RFP). An RFP is used for specific services or a narrow scope of work and where the lowest bid is not necessarily the winning bid (A.R.S § 41-2534). An RFP is used for purposes of procuring a specific-end product in the form of materials, services or construction.

C. Grant

A grant process is used when selection requires a competitive process to be fair. It can be used for both governmental and non-governmental entities. The scope of the project should not be too specific as to single out only one or two possible entities and not too general so as to generate projects that do not meet project objectives. A.R.S. §41-2702 includes a set of requirements for the grants process including the following:

- Preparation of a Request for Grant Application (RFGA) that includes scope, funding amount and evaluation criteria;
- Confidentiality of applications until an award or awards are made; and

- Evaluation by at least three evaluators. Note that GUAC members may not serve as evaluators but can be involved in grant award selection.

D. Direct use by ADWR

If a project is to be implemented by ADWR, it will use monies directly from the WMAP.

9.6.3 Contract Development, Monitoring and Support

Each person receiving monies for WMAP purposes through a grant, IGA or contract must enter into a contractual agreement with ADWR. Contracts, prepared by ADWR staff, describe what tasks are to be accomplished and set deadlines for task completion and fund disbursements. ADWR staff track progress and review deliverables for compliance with contract requirements. ADWR authorizes and issues payments, modifies contracts as needed, and provides other legal and administrative support.

9.6.4 ADWR's Role in the WMAP

The following responsibilities may be assigned to ADWR staff:

- Prioritize, review and provide input on submitted proposals and identify areas of need for future project proposals
- Analyze potential projects and identify appropriate funding methods (grant, IGA, procurement contract)
- Administer IGAs, contracts and grants
- Implement ADWR projects
- Provide technical and field assistance
- Provide information and educational services

9.6.5 GUAC Role in the WMAP

The GUAC advises the AMA Director, makes recommendations on groundwater management programs and policies for the AMA and submits comments to the AMA Director and the ADWR Director on draft management plans (A.R.S. § 45-421). The following list describes the GUAC's role in the WMAP:

- Provide recommendations regarding withdrawal fees
- Provide input and recommendations about the goals and priority focus areas for the PhxAMA
- Assist ADWR in selecting general project ideas for funding prior to the solicitation of applications or proposals
- Allow public input and comment on potential projects at meetings

9.6.6 Criteria Used to Evaluate Projects

Specific sets of criteria are needed when developing RFGAs or RFPs. These criteria are established by ADWR with assistance from the GUAC. Certain criteria may be given greater weight, and any weighted system must be applied consistently. Following is a list of criteria to be considered:

- Does the project support augmentation of the water supply of the AMA; provide conservation assistance to water users with the AMA; and/or support monitoring and assessing water availability within the AMA?
- Is the project consistent with ADWR policies and programs, and the management goal of the AMA?

- Does the project benefit multiple water users or stakeholders? Is there community and/or sector support for the project?
- Is there the potential to leverage the project with other proposed or ongoing projects? Are there cost-sharing opportunities with the applicant or other parties? Would the project be otherwise implemented without WMAP funding?
- Can the effectiveness of the project be measured? Examples of metrics might include comparing pre-project water use and post-project water savings; scientific data collections and reporting methods; or pre-program and post-program surveys to verify project results.
- If the project is a continuation of ongoing activities, has the project been shown to be effective? If a new project is the proposed work duplicative of work that has previously been performed?
- Is the project proposal complete? In particular, proposals should include:
    - A clear statement of purpose, goals, methodology and list of deliverables (data collection, interim and final reports, etc.) and
    - Detailed project budget, including salary costs and benefits, retrofit device costs, equipment/supply purchases, etc.

Bibliography

ADWR. (2010). *Demand and Supply Assessment 1985-2025, Phoenix Active Management Area.* Phoenix: ADWR.

CHAPTER TEN: IMPLEMENTATION

10.1 INTRODUCTION

This chapter describes the process the Arizona Department of Water Resources (ADWR) will follow when implementing, determining compliance with, and enforcing the Fourth Management Plan (4MP) requirements for the Phoenix Active Management Area (PhxAMA). The plan elements will be carried out in accordance with ADWR's overall regulatory approach, which is described in Appendix 10A. The following topics are discussed in the order listed:

- Notice of Conservation Requirements and Compliance Dates
- Variance and Administrative Review Process
- Plan Modification Procedures
- Groundwater Use Reporting Requirements
- Monitoring and Audit Procedures
- Compliance Approach

10.2 NOTICE OF CONSERVATION REQUIREMENTS - COMPLIANCE DATES

ADWR will mail written notice of the irrigation water duties and conservation requirements established in the plan to the persons required to comply with the requirements within 30 days of adoption of the 4MP (A.R.S. § 45--567(C)). A person who receives notice of an irrigation water duty or conservation requirement established in the 4MP must begin complying with the requirement by the date specified in the notice, unless the person applies for and is granted a variance from or an administrative review adjustment to the requirement, as explained in section 10.3 (A.R.S. § 45--567(D)). A person who receives such a notice, must continue complying with the requirement until the effective date of any substitute irrigation water duty or conservation requirement established in the Fifth Management Plan (5MP). If a person receives notice of a 4MP irrigation water duty or conservation requirement that replaces an irrigation water duty or conservation requirement established for the person in the Third Management Plan (3MP), the person must continue complying with the 3MP irrigation water duty or conservation requirement until the effective date of the 4MP requirement.

The Director may give written notice of a conservation requirement at any time to a person with a right or permit to withdraw, distribute, or use groundwater that was not in existence when the management plan was adopted. The person given written notice must comply with the conservation requirement not later than the compliance date specified in the notice, unless the person applies for and is granted a variance (A.R.S. § 45-571.01(B) and (D)).

10.3 VARIANCE AND ADMINISTRATIVE REVIEW PROCESS

Upon receipt of a notice of a 4MP irrigation water duty or conservation requirement, a person may apply for a variance from or seek administrative review of the water duty or conservation requirement. In general, a variance gives a person additional time (not to exceed five years) to comply with an irrigation water duty or conservation requirement, while an administrative review takes place. The administrative review can result in an adjustment to the requirement for that management period. Each of these processes is described below.

10.3.1 Variance

If a person requires additional time to comply with a new irrigation water duty or conservation requirement, the person may apply for a variance. An application for a variance must be filed within 90 days of the receipt of the notice of the irrigation water duty or conservation requirement (A.R.S. § 45-574(A)). The Director may grant a variance for up to five years upon a showing that "compelling economic circumstances" will prevent the person from complying with the new irrigation water duty or conservation requirement by the compliance date specified in the notice. A person granted a variance must continue complying with any existing irrigation water duty or conservation requirement during the variance period, unless the Director establishes a schedule of intermediate water duties or conservation requirements to be reached at specified intervals during the variance period (A.R.S. § 45-574(C)).

10.3.2 Administrative Review

If a person believes that an error or omission was made in calculating the person's irrigation water duty or conservation requirement, or that the person's irrigation water duty or conservation requirement is unreasonable because of circumstances unique to the person, the person may request an administrative review of the irrigation water duty or conservation requirement. If granted, an administrative review can result in a permanent adjustment to the irrigation water duty or conservation requirement. An application for administrative review must be filed within 90 days of the date of the notice of the irrigation water duty or conservation requirement if the application is based on circumstances in existence as of the date of the notice (A.R.S. § 45-575(A)).

At any time while a 4MP irrigation water duty or conservation requirement is in effect, the person required to comply with the water duty or conservation requirement may seek administrative review of the person's irrigation water duty or conservation requirement based on a claim that "extraordinary circumstances not in existence as of the date of notice that was given 30 days after adoption of the management plan" justify an adjustment to the irrigation water duty or conservation requirement. The Director may adjust the irrigation water duty or conservation requirement based on clear and convincing evidence that extraordinary circumstances not in existence as of the date of notice make it unreasonable to require compliance with the irrigation water duty or conservation requirement (A.R.S. § 45-575(B)).

In determining whether extraordinary circumstances make it unreasonable to comply with an irrigation water duty or conservation requirement, the Director will consider, among other things, whether conditions that came into existence after the date of notice are significantly different from those conditions in effect at the date of notice.

Examples of extraordinary circumstances may include the following situations: changes in water quality that necessitate altering water application rates for irrigation grandfathered rights or turf-related facilities; changes in technology or economics that are significantly different from ADWR's projections or assumptions; and changes in federal, state, and local laws and regulations that prevent compliance with irrigation water duties or conservation requirements.

10.4 PLAN MODIFICATION PROCEDURES

At any time after the 4MP is adopted, the plan may be modified pursuant to the same public hearing and comment procedures required for adoption of the plan (A.R.S. § 45-572(A)). The Director may modify an irrigation water duty or conservation requirement established in the plan "only if the Director determines that extraordinary circumstances, errors, or mistakes justify the modification" (A.R.S. § 45-572(A)).

Within 30 days of a modification of an irrigation water duty or conservation requirement, ADWR must give written notice of the modification to the person required to comply with the modified requirement (A.R.S. § 45-572(B)). The person may request a variance from or an administrative review of the modified irrigation water duty or conservation requirement within 90 days of the date of the notice (A.R.S. § 45-572(B) and (C)).

10.5 GROUNDWATER USE REPORTING REQUIREMENTS

The Groundwater Code (Code) contains several provisions that enable ADWR to acquire needed information on water use. This information is used to evaluate compliance with the Code and ADWR rules, permits, and management plans. The water use monitoring and reporting requirements, which are summarized below, also are designed to give water users the data needed to assess their progress in attaining conservation requirements. Over the last decade ADWR has shifted to a more interactive, web-based reporting format. Beginning in 2009, ADWR discontinued mailing hard copy Annual Water Withdrawal & Use Report forms to right holders. Instead, each year, right holders are sent a one-page letter in January, reminding them of the requirement to report by March 31. While the hard copy of the annual report is still available, water users are encouraged to report online. Holders of several types of water rights and authorities may now file their reports using ADWR's Online Annual Reporting Tool (eAR). During the fourth management period, ADWR intends to increase the number of water rights and authorities for which an annual report may be filed using the eAR tool.

ADWR also has devoted significant efforts towards increasing the availability of public records from ADWR website, including well queries, pumpage queries, imaged records and interactive mapping tools. All of these are designed to not only answer public questions but allow water users access to their own information filed with ADWR to help them better manage their own water portfolio and comply with ADWR requirements.

10.5.1 Water Measurement

The Code requires persons withdrawing groundwater from non-exempt wells in Active Management Areas (AMAs) to measure those withdrawals using a water-measuring device approved by the Director (A.R.S. § 45-604). However, some small irrigation and non-irrigation users are exempt from the measuring-device requirements as outlined in sections B, C, and D in A.R.S. § 45-604.ADWR has adopted rules requiring the use of an approved device, or a combination of devices and methods, for measuring rates and volumes of groundwater withdrawals for the calculation of the total annual volume of groundwater withdrawn (A.A.C. R12-15-901, *et seq*). Persons subject to the measuring-device requirements must maintain the accuracy of the device within specific standards.

10.5.2 Records and Annual Reports

The Code requires most persons who own or lease a right or permit to withdraw, receive, or use groundwater to file an Annual Water Withdrawal and Use Report with the Director for each right or permit they hold. All persons required to file annual reports must maintain current and accurate records of water withdrawn, delivered, received, and used (A.R.S. § 45-632).

Persons withdrawing groundwater from exempt wells and most non-irrigation customers of cities, towns, private water companies, and irrigation districts are exempt from record keeping and reporting requirements. Persons receiving water pursuant to a grandfathered right or a groundwater withdrawal permit and persons assigned and noticed of individual user requirements must meet the record keeping and reporting requirements, although certain small right holders are exempted from those provisions.

10.6 MONITORING AND AUDIT PROCEDURES

ADWR has the authority to determine compliance with Code, management plan, and rule requirements. This authority is described below.

10.6.1 Measuring Devices

ADWR monitors compliance with the measuring-device requirements through review of Annual Water Withdrawal and Use Reports, field investigations, and evaluations of energy use. Before field visits, ADWR generally contacts well owners to ask for their cooperation and presence during the inspection. Standardized procedures and equipment are used to test the accuracy of measuring devices (A.A.C. R12-15-901, *et seq.*).

10.6.2 Irrigation Acreage and Water Use Monitoring

ADWR monitors irrigated acreage and irrigation water use in the PhxAMA using annual reports, crop records, energy-use records, aerial photography, and satellite-based remote sensing data. These procedures also are used to determine the accuracy of annual water use reports and to detect illegal irrigation. ADWR investigates any potential discrepancies or violations identified using these methods.

10.6.3 Annual Report Reviews and Audits

ADWR reviews all annual water withdrawal and use reports. This is ADWR's primary means for determining compliance with conservation requirements, measuring requirements, and groundwater use limitations.

ADWR may conduct official audits of right holders to check the accuracy of annual reports and to verify suspected problems. An audit is a detailed review by ADWR staff of a person's water-use records and/or facility processes. Each person audited is requested to attend the audit. Audits ensure overall compliance with the Code and the Management Plan for the PhxAMA. A Report of Audit must be sent to the audited person or entity within 30 days of the audit. A.R.S. §§45-633(D), 880.01(D), 1061(D); A.A.C. R12-15-1102(E).

10.6.4 Inspections

The Code allows ADWR to enter property where wells or other facilities that are used for the withdrawal, transportation, or use of groundwater are located. This authority allows ADWR to inspect facilities and lands subject to Code provisions and obtain data or access to records relating to the withdrawal, use, or transportation of groundwater (A.R.S. § 45-633).

ADWR is generally required to give persons reasonable notice of inspections unless entry is sought solely to inspect a measuring device. For inspections related to the Groundwater Code, recharge facilities, bodies of water and water exchanges, a Notice of Inspection is not required if reasonable grounds exist to believe that such notice would frustrate enforcement, or where entry is sought for the purpose of inspecting water-measuring devices required pursuant to A.R.S. §§ 45-604 and 871.01.

10.7 COMPLIANCE APPROACH

ADWR has developed a compliance program approach that includes education, assistance, and flexibility. To attain compliance with water resource management requirements, ADWR employs a variety of strategies, including education, compliance monitoring, investigation and enforcement. Additionally, public knowledge of ADWR compliance efforts may be the most significant factor in achieving a high rate of voluntary compliance and serves as a disincentive for future violations.

10.7.1 Education and Assistance

ADWR informs water users of their conservation and reporting requirements as described in section 10.2 of this chapter. ADWR also educates water users by explaining how the requirements were derived and how the user can achieve those requirements. This is done through advisory committees, detailed program descriptions contained in reports and issue papers, public presentations, the publication of this management plan, and individual meetings with interested users.

Annual flexibility account balance information is available to all affected users allowing them to monitor their compliance status. Irrigation grandfathered right holders who have exceeded the debit limits of their flex accounts, or who are close to exceeding them are notified of their status and given the opportunity to reduce water usage or purchase flex credits to avoid an enforcement action. However, irrigation grandfathered right holders regulated under the Historic Cropping Program may not purchase flex credits.

10.7.2 Determination of Compliance

The mandatory conservation programs in the 4MP are designed to achieve reductions in groundwater withdrawals and use. Consequently, the persons given notice of irrigation water duties and conservation requirements established in the plan are required to comply with those irrigation water duties and conservation requirements only in those years in which they withdraw, distribute, or receive groundwater. The following two sections describe how ADWR determines compliance with conservation requirements when groundwater is used.

10.7.2.1 Maximum Annual Water Allotments and Gallons Per Capita per Day Requirements

The 4MP establishes maximum annual water allotments for irrigation grandfathered rights, turf-related facilities, dairies, and cattle feedlots. Municipal providers regulated under the Total Gallons Per Capita per Day (GPCD) Program are required to comply with GPCD requirements. The requirements are analogous to maximum annual water allotments in that they limit the amount of water that may be used during a year to a specified volume. A person’s compliance with a maximum annual water allotment or GPCD requirement is generally determined by comparing the total amount of water used by the person during the year with the amount of water allowed by the allotment or GPCD requirement. However, the use of water in excess of the allotment or GPCD requirement during a year does not necessarily mean that the person is out of compliance for the year. To account for weather variations and other factors that may result in the use of more water in some years than others, ADWR determines compliance either through the operation of a flexibility account or through a three-year averaging method, depending on the type of use.

Flexibility accounts are used to determine compliance for municipal providers who are subject to GPCD requirements, turf-related facilities, and irrigation grandfathered rights. The total water use reported by the user for the year is compared with the amount of water the user was entitled to use during the year. Generally, if the total amount of water used during the year is less than the allotment for the year, the flexibility account is credited with the difference. If the water use exceeds the allotment, the flexibility account is debited with the difference. A user is out of compliance with its allotment or GPCD requirement in any year in which its flexibility account is debited with an amount of water that causes the account balance to exceed the maximum negative balance allowed for the use. The maximum positive account balances and the maximum negative account balances for each type of use can be found in chapters 4, 5, and 6.

For dairies and cattle feedlots subject to maximum annual water allotments, compliance is determined through a three-year averaging method. Under this method, the user will be in compliance with its allotment for any year in which its water use exceeds its allotment if the total amount of water used during that year and the previous two years does not exceed the sum of allotments for those three years.

If an irrigation grandfathered right, turf-related facility, or municipal provider uses water during a year in an amount which causes its flexibility account to exceed its maximum negative account balance, or if a dairy or cattle feedlot uses water during a three-year period in an amount that exceeds the sum of the allotments for those three years, a violation occurs, but only to the extent of the groundwater included in excess. ADWR determines the amount of groundwater in the excess by a process known as "stacking." This process was approved by the court in *Arizona Municipal Water Users Ass'n v. Arizona Dep't of Water Resources*, 181 Ariz. 136, 888 P.2d 1323 (App. 1994). Note, the Groundwater Code authorizes ADWR to count recovered effluent in determining municipal compliance with groundwater GPCD and the groundwater conservation requirements for municipal water distribution systems (See also *Ariz. Water Co., v. Ariz. Dep't of Water Resources*, 208 Ariz. 147, 91 P.3d 990 (2004)). ADWR may, under its "stacking" method, consider use of the CAP water in determining GPCD compliance.

Under the stacking process, water from all sources used by a person during a year, with certain exceptions, is counted when comparing the person's water use to the maximum annual water allotment or GPCD requirement. However, groundwater is counted last. The process of counting groundwater last is called stacking because the groundwater is added to, or stacked on top of, the non-groundwater sources. Because groundwater use is counted last, the amount of any water used by a person in excess of its allotment or GPCD requirement will be comprised, at least partially, of groundwater. Groundwater withdrawn pursuant to an approved remedial action project under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or U.S. Code: Title 49 is counted as surface water when certain conditions are met.

10.7.2.2 Specific Conservation Measures

Municipal providers regulated under the Non-Per Capita Conservation Program and irrigation grandfathered right holders regulated under the Agricultural Best Management Practices (BMP) Program are required to comply with specific conservation measures instead of GPCD requirements or maximum annual groundwater allotments. The following industrial users are required to comply with conservation measures specific to their type of use instead of maximum annual water allotments: dairies regulated under the Dairy BMP Program, sand and gravel facilities, mines, large-scale power plants, large-scale cooling facilities, and new large landscape users. For these municipal providers and industrial users, compliance will be determined by ascertaining whether they implemented their specific conservation measures in the manner required by the management plan, rather than by comparing their water use to a volumetric allotment. They are out of compliance if they fail to implement the conservation measures in the required manner.

All industrial users, including those subject to maximum annual water allotments, are required to comply with the conservation measures established for All Industrial Users in section 6-602 of Chapter 6. These conservation requirements include general requirements to avoid waste and make efforts to recycle water. They also include more specific requirements relating to low water use landscaping, landscaping and water features in publicly-owned rights of way, and single pass heating and cooling. In addition to these requirements, section 6-1402 of Chapter 6 requires that all new large industrial users submit a water conservation plan to the Director.

10.7.3 The Enforcement Process

When ADWR's monitoring program identifies a potential violation or when a third-party complaint is received about the activities of another user, an investigation is conducted to obtain the facts.

An investigation may involve a field inspection by ADWR staff or an audit at ADWR's office after notice to the potential violator. ADWR may request that the individual produce relevant records for the inspection or audit. Based on the investigation, ADWR will determine whether there has been a violation and, if so, what course of action to take.

Where the violation is minor and does not require corrective action, ADWR may bring the compliance action to a close with an advisory letter upon discontinuance of the violation. For more serious violations where there is reason to believe a person is violating or has violated a statute, permit, rule, or management plan provision, enforcement action may be taken by ADWR.

During the first and second management periods, ADWR took a nontraditional approach to enforcement. Given the recent enactment of the Code and adoption of the management plans, a high level of tolerance was employed. Fines were set at low levels and probationary provisions and advisory notices were widely used. In many instances, for unintentional violations of management plan requirements such as GPCD limits and maximum turf or irrigation grandfathered right allotments, ADWR deferred any monetary penalties. Instead, it allowed the violator to develop or expand conservation measures designed to help the violator reduce water use. ADWR felt that the long-term benefits of a properly designed and implemented conservation program, tightly structured and closely monitored, would exceed the benefits of a traditional monetary penalty program.

In each instance of a management plan violation, the violator was given the following options:

- Contest the enforcement action by requesting a hearing,
- Pay a predetermined monetary penalty, generally based on the amount of groundwater used in excess of the requirement, or
- Negotiate a mitigation program with ADWR designed to develop or expand conservation programs intended to assist the violator in achieving future compliance.

The results of this enforcement strategy have been mixed. Some mitigation programs developed under this approach have been successful in increasing water-use efficiency, while others have been less effective. In most cases, significant and sometimes disproportionate amounts of time and resources have been invested by both the violators and ADWR.

The 4MP approach to enforcement will exercise flexibility on a more limited scale. The arguments of "newness and complexity" will be less compelling in this management period. Previous violations will be considered in determining the appropriate compliance approach. In addition, ADWR may consider new compliance approaches during the management period for Code and management plan violations. A related approach may allow the purchase and extinguishment of long-term storage credits to offset a violation. The result of these approaches is a penalty that results in a positive water resource activity. If a water user anticipates a violation and informs ADWR of this expectation before receiving a notice of noncompliance, the Director may consider this voluntary disclosure to be a mitigating factor in determining the appropriate enforcement action.

ADWR attempts to respond to all instances of non-compliance. Every non-compliance action is not necessarily met with an identical response, but rather a response that ADWR determines is proportionate to a particular violation and takes into account the specific circumstances of each case.

Potential enforcement actions and penalties for failure to comply with Arizona Revised Statutes Title 45, Chapter 2, Groundwater Code are described below:

> Pursuant to A.R.S. § 45-635(A)(1): "A person who is determined pursuant to section 45-634 to be in violation of this chapter or a permit, rule, regulation or order issued or adopted pursuant to this chapter may be assessed a civil penalty in an amount not exceeding…one hundred dollars per day of violation not directly related to illegal withdrawal, use or transportation of groundwater."
>
> Pursuant to A.R.S. § 45-636(A): "Unless otherwise specified, a person who knowingly violates or refuses to comply with a provision of this chapter or a permit, rule, regulation or order issued or adopted pursuant to this chapter is guilty of a class 2 misdemeanor. A person who, after notice of this chapter or a permit, rule, regulation or order issued or adopted pursuant to this chapter is guilty of a separate offense for each day of violation."

Additional enforcement mechanisms are generally reserved for violators not amenable to the previously mentioned mechanisms. They include contested hearings, cease and desist orders, and civil penalties of up to $10,000 per day for violations directly related to illegal withdrawals, transportation, or use of groundwater (A.R.S. §§ 45-634 and 45-635).

Extremely serious cases may also be referred for criminal prosecution if persons knowingly violate or refuse to comply with the Code; or with a permit, rules, or order issued or adopted under the Code (A.R.S. § 45-636).

APPENDIX 10A
FOURTH MANAGEMENT PLAN REGULATORY APPROACH

ADWR's regulatory philosophy is based on its overall water management goals for the management plans: the conservation of groundwater through the efficient use of all water sources and the augmentation of water supplies to ensure a long-term, secure water supply. ADWR's regulatory programs are designed to be consistent with that regulatory philosophy.

The safe-yield goal and the overall mission statement of ADWR are guiding concepts in the agency's activities. An understanding of the basic framework of the regulatory programs requires knowledge of the components of the safe-yield goal and ADWR's compliance approach. The framework is described below.

The PhxAMA Management Goal: Safe-yield
Attainment of safe-yield by Jan. 1, 2025 is the management goal of the PhxAMA. Safe-yield is defined by A.R.S. § 45-561 as:

> "[A] groundwater management goal which **attempts to achieve** and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge in the active management area."

The statute specifies that safe-yield is *a long-term balance*. Thus, the hydrologic conditions in the PhxAMA cannot simply be viewed in the short-term, but rather must be viewed over a longer period. Further, establishing a *balance* is more complicated than comparing the total amount of groundwater withdrawals in the PhxAMA to the amount of recharge occurring in the area in a given year.

In analyzing whether an Active Management Area (AMA) is at a safe-yield condition, ADWR considers the following factors which impact groundwater levels and water in storage:

1. Groundwater pumpage: Annual pumpage volumes from the PhxAMA's aquifers are considered in the safe-yield calculation. Withdrawals associated with irrigation grandfathered rights, non-irrigation grandfathered rights, groundwater withdrawal permits, and municipal providers are calculated as debits to the groundwater system.

    a) *Committed demand*, pursuant to A.A.C. R12-15-716, is an important component in the determination of the physical availability of a water supply for an application for an Assured Water Supply (AWS), but it is not included in the annual overdraft calculation. Committed demand is associated with platted, undeveloped lots which will be served in the future. In the AWS demonstration process, all demands, including the committed demand, must be determined to be physically available. In the context of an application for a Designation of AWS (DAWS), the applicant must demonstrate the physical availability of a water supply for a 100-year period which includes sufficient water to serve current, committed, and projected demand. Outside of the DAWS process, committed demand is associated with unbuilt subdivisions for which a Certificate of AWS (CAWS) exists. This committed groundwater demand must be counted as already "allocated" when determining physical availability in proving an AWS. To do otherwise would allow groundwater to be allocated multiple times to multiple developments, resulting in an underestimation of the long-term demands on the AMA's aquifers.

b) Note that the safe-yield calculation considers as a debit to the system the volume of municipal groundwater pumping, the *groundwater allowance*, that is allowed through the AWS Program for each DAWS and CAWS issued prior to 2025. ADWR concluded in the development of the AWS Rules that a limited quantity of the groundwater in storage could be allocated as a portion of the allowable water supply for each applicant. This groundwater can be used at any time in the 100-year period by the entity to whom it was assigned, and the entity or water provider is not required to replenish this volume; however, it does count as groundwater pumping in the calculation of safe-yield. It was expected that this allowance would be used soon after a provider is designated while other supplies were being developed; however, many providers have chosen to hold onto their groundwater allowance in anticipation of years when renewable supplies are short and additional groundwater will need to be withdrawn to meet demand.

   The AWS Rules require the applicant to prove consistency with the management goal of the AMA in addition to proving the physical availability of the water supply. This requires that most of the groundwater used by a new subdivision, or in the service area of a DAWS provider, is replenished. Alternatively, renewable water stored underground can be recovered, and is counted as the type of water that was stored, and not as groundwater. However, the AWS Rules allow a small volume of groundwater to be used by a CAWS or DAWS applicant. This groundwater allowance is set at the time the AWS (the DAWS or CAWS) is issued but can be added to by extinguishing grandfathered groundwater rights until the year 2025. In addition, DAWS providers receive an incidental recharge factor addition to their groundwater allowance each year, based on the incidental recharge to the aquifer from the application of water for landscape uses within the provider's service area. All of this allowable groundwater use under the AWS Rules is considered to be consistent with the AMA management goal and while it does not legally "count" as overdraft, it physically represents pumpage that is not replenished. Therefore, for the purposes of the 4MP in the water budgets included in Chapter 3 and Chapter 11 of this plan, the groundwater allowance has not been subtracted out, so that the actual physical impact on the aquifer of groundwater use can be made more accurately.

2. <u>Net natural recharge</u>: Net natural recharge in a given year is the volume of water which naturally recharges the groundwater supply minus the natural depletions to the groundwater supply over the course of that year. The main components of net natural recharge which increase the groundwater supply are stream channel infiltration, mountain front recharge, and groundwater inflow into the AMA. The components which naturally deplete the groundwater supply are groundwater outflow out of the AMA and water loss due to evapotranspiration. Infiltration of treated effluent discharged to surface water channels is not a component of net natural recharge.

3. <u>Incidental recharge</u>: Incidental recharge originates as groundwater or surface water which percolates down to the water table during and after its use for human activity. In the PhxAMA, the volume of incidental recharge is largely dependent on the quantity of municipal effluent discharged into stream channels, and the volume and efficiency of agricultural and industrial water use. It should be noted that incidental recharge that occurs during the use of the water may not be permitted as an underground storage facility under the state's Underground Water Storage, Savings and Replenishment Act, (A.R.S. §§ 45-801.01 *et seq*). Water that is treated after its use for municipal purposes, becomes effluent, and is released into a natural streambed, however, is specifically recognized by the Underground Water Storage, Savings and Replenishment Act as eligible to become a managed underground storage activity (A.R.S. §§ 45-801.01 *et seq*). As is more fully explained below, storage credits that are

accrued through an effluent discharge that has been permitted as a managed storage facility cannot be counted as a contribution to safe-yield.

4. Artificial recharge: Under the state's Underground Water Storage, Savings and Replenishment Act, persons may undertake recharge projects to deliberately add water to an aquifer without the right to withdraw it in the future (A.R.S. §§ 45-801.01 *et seq.*). However, artificial recharge is commonly used as a storage mechanism to accrue credits with the expectation of future recovery. Stored water for which credits have been issued cannot be counted as a contribution to safe-yield because it is already allocated to the water storer and is considered a non-groundwater supply when recovered for use. Therefore, this type of water has no net impact on the safe-yield volume; however, it does result in a temporary increase in groundwater in storage.

   Not all water stored under the Underground Water Storage, Savings and Replenishment Act can be recovered. The volume of recharge that is allocated permanently to the aquifer ("cut to the aquifer"), which results from generation of certain types of recharge credits does benefit the aquifer and is a component of the safe-yield groundwater supply. In addition, any non-recoverable storage that is conducted in a given year can be included in the safe-yield volume for that year. Recharge credits that are generated and then subsequently extinguished prior to use also are a component of the safe-yield supply.

The volume of groundwater that can be withdrawn while maintaining a safe-yield condition in the PhxAMA is not a fixed amount; it will change due to annual variations in incidental, natural, and artificial recharge, as well as other factors listed above. The groundwater system is in a state of "overdraft" as long as groundwater withdrawals exceed the sum of the naturally and incidentally recharged volumes plus the portion of the artificially recharged volume that will not be withdrawn later as storage credits.

Water level change data are a direct indicator of groundwater storage changes and one of the factors used in the safe-yield analysis. Water level changes are expected to continue even after achievement of safe-yield, as stored credits are recovered and entities with DAWS and CAWS utilize their groundwater allowances. However, an AMA that is at safe-yield should not experience broad-ranging, significant, and continuing declines in average water levels after adjustments are made for the factors listed above.

Total Water Use Conservation Requirements and "Stacking"

With the wide array of water resources available in Arizona as an alternative to groundwater, including surface water, reclaimed water, CAP water, and remediated groundwater, ADWR provides incentives to promote use of these alternative supplies whenever and wherever possible. At the same time groundwater is often a very accessible and inexpensive source of supply, whereas the alternative sources can be expensive and difficult to access. ADWR also recognizes that groundwater is our state's "emergency" supply, and it must be available for use whenever the other alternatives run short. Groundwater is particularly valuable as a long-term drought supply to buffer the effect of changes in surface water availability. In order to maximize the supply of groundwater, and ensure sufficient supplies of water, all sources must be utilized efficiently.

For these reasons, ADWR believes that it is both impractical and unwise to consider groundwater use as the only measure of regulatory compliance. The level of groundwater use that is reasonable is relative to the amount of water used from other sources. To ensure that groundwater users make reasonable use of groundwater, and to encourage efficiency and flexibility in the use of alternative supplies, the regulatory strategy evaluates the total water use of each water user and provider and sets conservation requirements based upon that total water use. In keeping with ADWR's statutory obligations and limitations, however, the conservation requirements of the management plan only apply if groundwater is used. ADWR's regulatory program is, therefore, structured around the concept of "stacking" different types of water, by type, in a compliance hierarchy, with groundwater on top. If a total water use conservation requirement is exceeded by a groundwater user, the amount of the violation of that requirement will be measured by the amount of groundwater used in excess of the regulatory requirement. This strategy will ensure that if groundwater is being used, it is being used as wisely and efficiently as economically possible. This system also provides the flexibility needed by most users of commingled supplies, allowing groundwater to be used as needed to supplement alternative sources.

Flexibility in the Components of the Regulatory Plan

ADWR recognizes that water use varies by year and locality. Therefore, ADWR has provided maximum flexibility when administering the regulatory provisions of the management plan. For example, most regulatory provisions include a basic program, with one or more alternative programs designed to meet special circumstances. The basic program is generally designed to place simple numerical limits on water use, leaving the means of achieving those limits wholly up to the water user or provider. The alternative programs tend to remove numerical limits in favor of specific conservation measures more applicable to the water user.

Another component of regulatory flexibility is the establishment of *flexibility accounts* for most allotment-based requirements. These accounts generally allow water users to borrow or bank water from one year to the next in order to overcome the variation in use caused by weather or other unforeseen circumstances. Flexibility accounts are mandated by statute for agricultural users, and ADWR has used this example to incorporate flexibility accounting into municipal programs as well.

Administrative Review and Variance of Conservation Requirements

Even with the general flexibility of the regulatory programs, the Code recognizes that certain individual conservation requirements may pose hardship in certain circumstances. To allow relief in these situations, the Code provides for an administrative review and variance process. The emphasis in this process is on the impact of a particular conservation requirement as it is applied to an individual water user. Administrative review and variance process are fact-intensive inquiries which may result in some regulatory relief and are considered on a case-by-case basis.

Accounting for Water Use

Many water providers deliver a mix of water types. In order to determine compliance with conservation requirements, ADWR must adopt a set of policies for commingled systems. ADWR is continuing to develop policies for "volumetric" accounting.

Generally, a water provider delivering different types of water through a commingled system cannot determine which type of water a customer received. Therefore, the provider is generally required to account for all deliveries to its customers on a volumetric basis. This allows the provider to compute the percentage of each type of water delivered in a given year and apply that same percentage to the water delivered to each customer, regardless of the type of water actually received by the customer. This volumetric accounting policy works well for most providers because of its simplicity and certainty. Individual circumstances may warrant individual consideration, however, and ADWR is continually reviewing its policies on volumetric accounting to recognize necessary exceptions.

Enforcement

ADWR enforces the statutes and rules within its scope of authority and uses a variety of methods to ensure compliance with the regulatory programs. An effective conservation plan requires effective enforcement. ADWR is given wide ranging enforcement authority in rules and statutes to ensure that all water users are contributing their share to the overall goal of groundwater conservation and augmentation of water supplies. While rules and statutes allow the imposition of substantial monetary penalties for violating either water use limitations or conservation requirements, ADWR also is given considerable discretion in how that enforcement program will be managed. Overall, ADWR's philosophy has been that the ability to correct management deficiencies and save groundwater is more important than collecting monetary penalties. Therefore, most of ADWR's regulatory efforts to date have involved voluntary *consent orders* where the water user in violation agrees to adopt conservation measures, guarantee future compliance, or otherwise mitigate the impact of the violation on the state's groundwater resources in exchange for a waiver or reduction of the civil penalties.

In the fourth management period, ADWR will continue its policy of reviewing each suspected violation on an individual basis. ADWR also will continue its policy of working with any water user in violation of the groundwater laws to make certain that all the surrounding circumstances are understood and to explore alternative means by which the problem might be solved. In some cases, however, violations are not matters of inadvertence or misunderstanding, but are repeat offenses or voluntary decisions based on various circumstances. During the fourth management period, ADWR will strive to identify more frequent types of violations and may pursue more stringent corrective actions on the part of the violator to address the issue, including the expenditure of funds to implement additional proven water conservation measures. By so doing, ADWR intends to bring greater equity and fairness to the common goal of saving our groundwater supply. Alternative mechanisms to achieve compliance while encouraging achievement of local water management goals also will be explored.

The foregoing synopsis of ADWR's regulatory approach is intended to assist the reader in understanding the reasons behind the mandatory conservation requirements in the 4MP regulatory chapters. This chapter explains many of the administrative policies and procedures contained within the management plan. Finally, it is ADWR's policy to offer assistance to anyone seeking to better understand or comply with the conservation requirements imposed by the management plans, or the requirements of the Groundwater Code. ADWR staff can provide support on most water management challenges.

CHAPTER ELEVEN: WATER MANAGEMENT STRATEGY

11.1 INTRODUCTION

The Phoenix Active Management Area (PhxAMA) Fourth Management Plan (4MP) historical data analysis illustrates the degree to which the PhxAMA is affected by groundwater use. Since 1985, groundwater use in the PhxAMA has averaged about 780,000 acre-feet (AF) per year, as Colorado River water delivered through Central Arizona Project infrastructure (CAP water), treated effluent, and in-lieu groundwater uses have increased. The goal of the PhxAMA is to achieve safe-yield by 2025. The achievement of safe-yield will require additional reductions in groundwater pumping and increased use of renewable supplies beyond current levels.

11.2 WATER MANAGEMENT CHALLENGES

Once achieved, maintaining safe-yield is a concern that will need to be addressed in the future, as municipal growth continues, and renewable supplies are maximized. Management of drought and shortage conditions when Colorado River water supplies are reduced or not available is another important future consideration. Finally, although safe-yield is an AMA-wide calculation, the location where water is stored relative to the location where the stored water is recovered can be an important factor in addressing local water level declines, subsidence, earth fissures and reduced physical availability of groundwater for potential future development. Planning for proximity of the location of recovery in relation to the location of storage can help mitigate these challenges. As the state moves into a drier future, there will need to be additional tools developed and stronger conservation measures will need to be implemented in order to achieve and thereafter maintain safe-yield.

11.2.1 Changing Policy Landscape

Arizona is experiencing increased interest in water management as various supply pressures have moved more into public view. With these rapidly shifting frameworks, predictions and long-term projections become increasingly difficult. While arguments may be made about the value of projections and about the merits of particular methodologies, the range of potential variables and changes to policies have made it so that any projection is likely to be outdated by the time it is published. To this end, ADWR has moved to decouple these projections from the 4MP, in hopes that this shift will allow for more continuous updates to the various planning scenarios and to avoid placing too much reliance and weight on any single set of assumptions.

11.2.2 Susceptibility of Colorado River Water Supplies to Shortage

The Colorado River Basin is traversing two decades of drought. Lake Mead, the source of 40 percent of Arizona's water supply, has been declining. Arizona, California, Nevada, and the United States (U.S.) have crafted the Lower Basin Drought Contingency Plan (LBDCP) as an overlay to the 2007 Interim Guidelines to help protect Lake Mead from declining to those critically low elevations. The LBDCP requires Arizona, California, and Nevada to contribute additional water to Lake Mead storage at predetermined elevations. The Plan also creates additional flexibility to incentivize additional conservation of water for storage in Lake Mead. With the LBDCP in place, along with the additional conservation made by the U.S., Mexico, through Minute 323, also will implement the Binational Water Scarcity Contingency Plan (BWSCP). The BWSCP allows Mexico to contribute additional water to Lake Mead in parity and alignment with the Lower Basin states. For the complete list of incremental DCP contributions please visit the ADWR website at:
https://new.azwater.gov/sites/default/files/media/Attachment%20B%20-%20Exhibit%201%20LB%20Drought%20Operations.pdf

During the 2007 Guideline negotiations, modeling was performed on the probability that Lake Mead would drop to critically low elevations. In 2007 the risk of Lake Mead dropping to below 1,025 feet in 2026 was approximately 8 percent. In 2019, prior to the implementation of the LBDCP the chance of Lake Mead falling to critically low elevations in 2026 had risen dramatically to about 36 percent. After the implementation of the LBDCP that chance has now decreased significantly back down to less than 5 percent by 2026. Both the 2007 Guidelines and the LBDCP are in effect only until December 31, 2026. As per the 2007 assessment of the effectiveness of the Guidelines must begin prior to December 31, 2020.

Lower Basin – Lake Mead
Percent of Traces with Event or System Condition
Results from February 2020 MTOM/CRSS (using the Full Hydrology)
(values in percent)

Event or System Condition	2020	2021	2022	2023	2024
Surplus Condition – any amount (Mead ≥ 1,145 ft)	**0**	**0**	**2**	**7**	**11**
Surplus – Flood Control	0	0	<1	<1	2
Normal or ICS Surplus Condition (Mead < 1,145 and > 1,075 ft)	**100**	**100**	**88**	**62**	**52**
Recovery of DCP ICS / Mexico's Water Savings (Mead >/≥ 1,110 ft)	0	3	7	17	22
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,090 and > 1,075 ft)	100	80	71	41	32
Shortage Condition – any amount (Mead ≤ 1,075 ft)	**0**	**N**	**11**	**31**	**37**
Shortage / Reduction – 1st level (Mead ≤ 1,075 and ≥ 1,050)	*0*	*0*	*11*	*29*	*27*
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,075 and > 1,050 ft)	0	0	11	29	27
Shortage / Reduction – 2nd level (Mead < 1,050 and ≥ 1,025)	*0*	*0*	*0*	*2*	*9*
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,050 and > 1,045 ft)	0	0	0	1	3
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,045 and > 1,040 ft)	0	0	0	<1	2
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,040 and > 1,035 ft)	0	0	0	<1	2
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,035 and > 1,030 ft)	0	0	0	0	1
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,030 and ≥/> 1,025 ft)	0	0	0	0	1
Shortage / Reduction – 3rd level (Mead < 1,025)	*0*	*0*	*0*	*0*	*<1*
DCP Contribution / Mexico's Water Savings (Mead </≤ 1,025 ft)	0	0	0	0	<1

Notes:
[1] Modeled operations include the 2007 Interim Guidelines, Upper Basin Drought Response Operations, Lower Basin Drought Contingency Plan, and Minute 323, including the Binational Water Scarcity Contingency Plan.
[2] Reservoir initial conditions on December 31, 2020 were simulated using the February 2020 MTOM based on the CRRFC unregulated inflow forecast ensemble dated February 4, 2020.
[3] Each of the 35 initial conditions from MTOM were coupled with 113 hydrologic inflow sequences from the Full Hydrology that resamples the observed natural flow record from 1906-2018 for a total of 3955 traces analyzed.
[4] Percentages shown in this table may not be representative of the full range of future possibilities that could occur with different modeling assumptions.
[5] Percentages shown may not sum to 100% due to rounding to the nearest percent.
[6] The chance of a Lower Basin Shortage in 2021 is negligible.

— BUREAU OF — RECLAMATION

Chart from the United States Bureau of Reclamation regarding the probabilities of shortage triggered by the elevation of Lake Mead.

LBDCP cuts to Arizona's Colorado River allocation will result in earlier reductions to central Arizona agriculture and other low priority users. To implement LBDCP in Arizona, an intra-Arizona Implementation Plan (Implementation Plan) was crafted to partially mitigate the incremental impacts of DCP to the lower priority users. The Implementation Plan consists of two major components – a mitigation component and an offset component. The mitigation component provides mitigation water/resources to impacted parties – Agricultural pool, Non-Indian Agricultural pool (NIA pool), Municipal and Industrial and Indian priority pools. The offset component uses a combination of compensated system conservation and Intentionally Created Surplus (ICS) water to offset deliveries of ICS for mitigation.

One of the major effects of the LBDCP is that the Agricultural pool will likely be impacted under a Tier 1 shortage condition on the Colorado River. This will result in higher pumping volumes of groundwater earlier than expected. It is also anticipated that there will be no excess water to be used by the Arizona Water Banking Authority (AWBA) for firming obligations in the future. While DCP does reduce the risk of Lake Mead falling to critically low elevations, it does not guarantee that we will not go into shortage. The most recent modeling, as of the writing of this report, show the chance of Lake Mead reaching critically low elevations, below 1,025 feet, as less than 5 percent by 2026.

Inside the AMAs, any level of shortage conditions on the Colorado River would result in some level of impact to users, but this impact would not be evenly distributed across or within sectors. It is anticipated that there would be some level of reduced deliveries to storage facilities, increased groundwater pumping, and increased recovery of storage credits. All of these items taken individually would be anticipated to negatively impact progress toward the goal of safe-yield, so there is a potential for significant cumulative impacts with regards to safe-yield in times of shortage.

11.2.3 Allowable Groundwater Pumping

Several categories of water users, both existing and potential new users, may legally withdraw groundwater without replenishing or replacing that volume of water back into the aquifer. These uses contribute to overdraft and, under current regulatory framework, may continue or increase over time.

Agricultural Sector

As part of the adoption of the Code, Irrigation Grandfathered Groundwater Rights (IGFRs) were granted that allow farmers to withdraw groundwater for agricultural use. No new IGFRs may be created and the amount of land that may be irrigated is limited to that which was historically irrigated. However, an existing IGFR may be conveyed to a new owner, retired to a Type 1 Non-Irrigation Grandfathered Right (Type 1 GFR), or extinguished for credits that may be used to prove the Assured Water Supply (AWS) requirement of consistency with the PhxAMA management goal. The trend through 2017 in the PhxAMA has been a reduction in IGFRs, either through conversion to Type 1 GFRs or through extinguishment for AWS credits. Of the nearly 192,000 irrigation-acre reduction in the PhxAMA since 1985, about 34,000 acres have been extinguished.

IGFR groundwater use represents a perpetual authority to withdraw groundwater without a replenishment requirement. Although agricultural demand in the PhxAMA has declined since 1985, it has remained stable since 2005.

The cost to deliver and use renewable supplies is generally higher than the cost to pump and use groundwater. If existing IGFRs continue to be farmed through 2025 and beyond, then the agricultural sector could help move the PhxAMA closer to safe-yield through further reductions in agricultural groundwater use, increased use of renewable water supplies, and enhanced on-farm irrigation water management practices.

Industrial Sector

Industrial water users in some cases may acquire new groundwater withdrawal permits (e.g., general industrial use permits) and may obtain, through purchase or lease, currently unused non-irrigation grandfathered rights to pump groundwater. There is no regulatory or statutory authority at this time to require industrial water users to convert to renewable supplies. Some users may choose to do so voluntarily, and there are regulatory incentives for some subsectors to do so. For example, the Palo Verde Nuclear Generating Station (PVNGS) is the single largest user of treated effluent in any of the five AMAs and in any of the four water-demand sectors (agricultural, industrial, municipal and tribal). PVNGS annually uses approximately 75,000 acre-feet of treated effluent for cooling purposes.

Future industrial sector development of groundwater in the PhxAMA will impact the achievement of safe-yield if currently unused Type 1 and Type 2 Grandfathered Groundwater Rights (GFRs) are used to meet water needs. Between 1985 and 2015, industrial users in the PhxAMA have been using an increasing percentage of industrial GFR and permit allotments, growing from 58 percent of the allowable volume in 1985 to 83 percent in 2015.

The largest industrial subsector in the PhxAMA is the electrical power sector, followed by water used by turf-related facilities, including golf courses. Water use by power plants and turf-related facilities in the PhxAMA has steadily increased since 1985.

Municipal Sector

The municipal sector is the dominant water-use sector in the PhxAMA. Municipal demand in 2017 was approximately 1,081,451 AF. Currently, of the agricultural, industrial and municipal sectors, only new municipal use is legally required to utilize renewable supplies (through direct use or storage and recovery). Municipal groundwater demand was comparable in 2017 in volume to the volume used in 1985, after peaking in 2007. Many municipal providers in the PhxAMA have experienced flattening or declines in overall water demand in recent years.

Exempt Wells

As of 2017, ADWR estimates that about 75,000 people within the PhxAMA are self-supplied water users via exempt domestic wells. An exempt well is one equipped to pump less than 35 gallons per minute. ADWR does not impose any conservation requirements on exempt well-water use, nor does ADWR collect any data, annually or otherwise, pertaining to water withdrawals by exempt wells. In the projected demands for the 4MP, ADWR assumed each exempt well served about 2.67 persons, and that each person self-supplied via an exempt well in the PhxAMA would use 45 gallons per capita per day for interior uses. Further, ADWR assumed that exterior uses for each exempt well would be 132 gallons per day. This is based on recent information from the Central Arizona Groundwater Replenishment District (CAGRD), municipal provider Annual Water Withdrawal and Use Reports, and recent studies conducted on residential water uses.

Groundwater Allowance and the Assured Water Supply Program

The AWS Rules, adopted in 1995, are a primary tool in achieving the PhxAMA's management goals and ensuring sufficient water supplies for new development. Pursuant to the AWS Rules, a certain declining volume of groundwater is allowed to be used and not replenished or offset. These groundwater allowances are designed to help municipal providers transition from groundwater to renewable supplies. Certain other temporary exemptions allow the pumping of groundwater during periods when renewable supplies are unavailable.

The AWS Rules also allow credits to be added to the groundwater allowance of a DAWS or CAWS though extinguishment of grandfathered rights (IGFRs, Type 1, and Type 2 GFRs) within the same AMA. The methods of calculating these extinguishment credits are described in the AWS Rules and vary for each AMA. Groundwater use reported pursuant to a water provider's or subdivision's allowable groundwater volume is considered consistent with the management goal of the AMA and is not required to be replenished. However, this groundwater use contributes to overdraft.

Any groundwater use by a designated provider or by certificated land beyond the groundwater allowance must be replenished. If a CAWS or DAWS applicant does not have access to a renewable water supply, the subdivision or service area may be enrolled in the CAGRD to satisfy the AWS replenishment requirement. If a municipal provider is a member service area, or a subdivision is member land of the CAGRD, any groundwater withdrawn in excess of the groundwater allowance must be replenished within the AMA by the CAGRD.

11.2.4 Limitations on Underground Storage and Recovery

Most of the ideal locations for large-scale recharge facilities have already been permitted in the PhxAMA. This situation could affect possible future direct recharge efforts in the PhxAMA. Physical factors affecting recharge feasibility include infiltration rates, permeability, geochemistry, available storage and the existence and extent of lower permeability or impermeable layers in the vadose zone. Although there are many locations within the PhxAMA suitable for recharge, there are limited sites capable of accepting large volumes of water.

Availability of sites for basin or in-channel recharge also is limited by areas of existing contamination and potential contaminant sources. Some reaches of stream channels in the PhxAMA are not suitable sites for developing surface recharge because closed and active landfills, dumps and other land uses that could be sources of contaminants are located too close to stream channels.

Recharge using injection wells can be particularly useful in urban areas where there is insufficient space to develop a surface recharge site or land costs are too high for surface recharge to be economically viable.

Recovery considerations can be another constraint on potential recharge site development. Considerations include the need for improvements to recovery and delivery infrastructure and potential issues related to physical availability when recovery occurs outside the area of impact. The physical availability of groundwater may increasingly affect water management decisions in the future. Declining groundwater levels could make recovery of stored water difficult or impossible in some areas of the basin. ADWR's groundwater models will be a valuable tool for evaluating the possible effects of various recharge and pumping scenarios inside the PhxAMA.

Because the water table is greatly affected by localized recharge and withdrawal, achieving safe-yield PhxAMA-wide does not ensure that all local areas of the PhxAMA will attain a balance of supply and demand. There may be areas within the PhxAMA where localized groundwater declines will result in land subsidence, wells going dry, increased pumping costs, and water-quality changes. Conversely, the benefits of recharge may be confined to areas where recharge basins and stream channels are located. Addressing the impacts of local water level declines and recoveries in subareas of the PhxAMA will be an ongoing challenge for water management for the fourth management period and beyond.

11.2.5 Treated Effluent Use

Use of treated effluent in the PhxAMA has increased from less than 44,000 AF in 1985 to just less than 200,000 AF in 2017. The PhxAMA has a long history of using treated effluent for electric power cooling and turf-related watering. The Turf Program in the industrial sector allows turf facilities to receive a discount on every acre-foot of treated effluent used. This incentive was originally included in the management plans to encourage the replacement of groundwater with treated effluent in the turf sector, which can help outweigh the additional cost of delivering and treating treated effluent.

Municipal water use is likely to continue to increase throughout the next century, further increasing the need for renewable water supplies in the PhxAMA. Maximizing the use of reclaimed water is a water-management strategy for the fourth management period. Recent changes in the rules regarding Direct Potable Reuse of effluent present an opportunity for growth and method by which the use of those supplies might be maximized in the fourth management period and beyond.

11.2.6 Conjunctive Resource Management

Colorado River water, non-Colorado River surface water, and effluent are all regulated differently and owned or controlled by different persons or jurisdictions. As the PhxAMA uses significant amounts of all sources of water, the ability to directly manage only one source (groundwater) may weaken conservation requirements and use restrictions and make safe-yield attainment more difficult. The use of non-groundwater sources of water in an efficient manner allows more demand to be served by renewable water, meaning less reliance on groundwater. The ability to conjunctively manage all water supplies and work toward a safe and reliable water supply for the future is a logical long-term goal.

11.2.7 Integration of Land Use Planning and Water Management

A closer association between land use planning and water policy planning is needed. County and local land use and economic development planning programs must continue to plan for and incorporate water supply and infrastructure requirements. Principal areas to be considered in the development process are:

- The need to secure and utilize renewable water resources that meet the AWS Program criteria for new residential development.
- Strategic location of wastewater-treatment facilities and underground-storage facilities to maximize the effective use of renewable water sources and to stabilize the local-area aquifers.
- An understanding of the groundwater characteristics in local areas that may impact the community. These include changes in depth to groundwater, water quality changes, and land subsidence.
- The need to evaluate the water resource implications of development occurring on desert land rather than on retired farmland.

ADWR may be able to assist by providing relevant water demand and supply information, scenario analysis using hydrologic models, and planning assistance. The areas identified above need to be more closely linked to local general plans, zoning, infrastructure development, and other development decisions.

11.2.8 Factors Affecting Achievement of Safe-Yield Outside Influence of Water Management Programs

Many factors that affect the ability to achieve safe-yield are outside of the influence of current water management programs. Water demand is affected by economic, demographic, and climatic conditions. For example, as crop prices rise, so do the number of acres in production. More acres planted (within the total certified irrigation acres) in most cases results in higher water demand. Increases in population and industrial growth rates have a dramatic influence on water use. A key assumption of the Code was that urban growth would largely occur on retired agricultural land, with the water no longer needed by the farms being available to serve new houses and industries. In fact, much of the new growth is occurring on native desert land rather than on retired farmland. Development on desert land does not result in one type of demand replacing another; it results in a new demand being added to the existing demands, resulting in significantly greater demands than originally assumed.

Efficient use of all water supplies is prudent, especially in the arid Southwest. ADWR conservation programs encourage efficient use of all water supplies. However, conservation alone is not sufficient to achieve safe-yield in the PhxAMA or in any AMA, because replenishment is not required for most water demand sectors. Certain types of groundwater rights are perpetual and certain segments of municipal demand can continue to develop using groundwater.

During the third management period groundwater withdrawals stabilized and use of CAP and reclaimed water increased, particularly in the municipal sector. Despite this progress, challenges remain for the PhxAMA to achieve safe-yield. The water budgets presented in Chapter 3 of this plan indicate that it will be very challenging for the PhxAMA to reach safe-yield by 2025. In the context of a drier future, bolder moves and additional water management tools may be necessary in order to reach management goals.

11.3 POSSIBLE SOLUTIONS

During the fourth management period, ADWR will continue to develop long-term water management solutions to address the challenges described in section 11.2 and work with the regulated community as well as other stakeholders within the PhxAMA to identify challenges and develop and implement solutions to water management challenges.

As a part of the 4MP, ADWR will periodically publish an analysis of each AMA's progress toward its goal as a part of the Conservation Report required pursuant to A.R.S. § 45-563.01. This report was previously focused on the municipal conservation programs but will expand in scope to include this analysis of progress toward the goals as well as expanding to analyze the conservation programs of all three sectors. This publication is intended to serve as a communication tool regarding the effectiveness of the conservation programs in working toward safe-yield and also will serve to improve the transparency of the data and methodology that ADWR uses to assess safe-yield. These analyses can then in turn assist in the development of updates to existing conservation and in the development of new water management strategies. Summary AMA data is compiled yearly and is available at:
https://new.azwater.gov/ama/ama-data

11.3.1 Allowable Pumping Solutions

Throughout the fourth management period, ADWR will work to improve water use data collection to support both planning and conservation program evaluation efforts. ADWR also will continue to provide direct conservation assistance to water providers to assist them in meeting their regulatory requirements.

Agricultural Sector

Although IGFR holders will continue to hold the right to pump and use groundwater in perpetuity, reductions in agricultural groundwater use are beneficial in achieving and maintaining the goal of safe-yield in the PhxAMA. The increased utilization of renewable water supplies to replace groundwater use, combined with demand reduction efforts to enhance on-farm irrigation water management practices, are key factors in meeting this water resource management goal.

ADWR will continue to work cooperatively with the agricultural community to ensure that existing conservation requirements are effective and appropriate. In addition, ADWR also will work closely with the agricultural community throughout the fourth management period to ensure that the BMP Program is an effective and efficient agricultural water conservation program that helps move the PhxAMA closer to the achievement of its safe-yield goal. ADWR will continue to monitor crop and water use patterns during the fourth management period to assess agriculture's impact on achieving the goal for the PhxAMA and to evaluate the effects of ADWR programs on farming operations.

Industrial Sector

The future of industrial use in relation to the safe-yield goal for the PhxAMA is largely shaped by the potential for growth in groundwater use and existing constraints on replacing groundwater use with renewable supplies. The majority of treated effluent use during the fourth management period is projected to continue to be used by the electric power sector. However, there may be potential for additional Colorado River water and treated effluent use by the other industrial subsectors in the future.

Industrial water uses may change as new technologies are developed. Research may need to be conducted during the fourth management period to investigate water conservation opportunities associated with use of these technologies by certain industrial users. This research could be used to develop conservation requirements for the Fifth Management Plan (5MP).

Turf Program

Groundwater remains a large component of the water supply for turf-related facilities. ADWR's focus on increasing the direct use of treated effluent during the fourth management period, the continuation of incentives to use treated effluent, and aquifer management techniques to bring the location of recovered water closer to the area where the water is stored can assist the turf sector in further reducing its reliance on groundwater.

Municipal Sector

The municipal sector is growing and is projected to be responsible for 58 percent of the PhxAMA water demand by 2040. To promote renewable supply use, ADWR will continue to work with the municipal sector and others to develop additional meaningful and equitable incentives that are consistent with overall water management objectives. ADWR will continue to assist in regional planning activities and technical studies that result in direct use of renewable supplies by the municipal sector.

The development of sub-regional water management policies within AMAs will help protect against aquifer degradation such as land subsidence. This may include the development of water management strategies to promote withdrawals from areas experiencing recharge rather than areas experiencing severe declines.

During the third management period, modeling projections showed projected areas of water level decline in several areas within the PhxAMA. Some water users within the PhxAMA have entered into wheeling agreements to allow use of other entities' distribution infrastructure as a method of physically conveying renewable water to where it is needed. Such wheeling arrangements take advantage of existing infrastructure to address the challenge of groundwater pumpage and related groundwater level declines in areas not located near recharge sites.

There are ongoing discussions about the effectiveness of the existing water conservation programs. Although the existing mandatory water conservation programs have been effective in reducing the overall water demands, during the fourth management period, ADWR will continue to evaluate the effectiveness of existing water conservation programs. Some have suggested that Gallons Per Capita Per Day (GPCD) rates could be reduced even further, while others feel that BMP type programs are not effective in achieving water conservation. Further evaluation will include analyses to evaluate program effectiveness and inform future program development.

11.3.2 Augmentation Solutions

During the fourth management period and beyond, ADWR may consider potential solutions such as the following to increase the use of renewable water supplies in the PhxAMA and thereby further reducing groundwater dependency:

- Further incentivize the achievement of full utilization of renewable supplies, either directly or through underground storage and recovery within the area of impact of storage.
- Mitigate, through local water management incentives and regulations, the occurrence of subsidence, land fissuring, decreases in well productivity, water-level declines, and decreases in water quality due to water withdrawals.
- Develop and adopt incentives to achieve water management objectives on the PhxAMA and local level.
- Support the resolution of infrastructure challenges hindering efficient use and distribution of all water supplies.
- Develop new strategies for reducing allowable unreplenished groundwater withdrawals associated with all sectors.
- Consider the cost effectiveness of reclaiming brackish, high TDS, or other poor-quality water not previously considered for beneficial use.
- Additional consideration of augmentation may be found in the report, “Long-Term Water Augmentation Options for Arizona”, prepared for the Long-Term Water Augmentation Committee of the Governor’s Water Augmentation, Innovation, and Conservation Council. This report can be found at: https://new.azwater.gov/sites/default/files/Long-Term%20Water%20Augmentation%20Options%20final.pdf

11.4 SUMMARY

The key to effective water management is to anticipate change and to develop systems that are flexible enough to respond to conditions that are unlike those we experience today. The ability to identify and understand trends in water use and supply is central to the functions of ADWR. It will be helpful to expand basic monitoring programs, improve data management and improve hydrologic modeling and advanced planning capabilities in order to effectively manage the state’s water supplies in the future. To ensure safe, dependable water supplies for existing and future residents of the PhxAMA, we must efficiently use available renewable water supplies. The ability to meet current and future challenges is dependent to a substantial degree on community and legislative support. New strategies and tools for water management may be required in order to achieve the PhxAMA goals. ADWR will continue to work with the PhxAMA community to develop innovative and cooperative solutions to respond to the area’s changing needs.

11.5 FINAL THOUGHTS

On the horizon are additional water management questions and challenges which include, but are not limited to, the following:

- What happens after 2025?
- How can economic growth continue given finite water resources?
- What other options exist for long-term water management solutions to ensure the social and economic viability of the state and the PhxAMA?

The programs developed in the third management period focused on water supply management problems and strategies within the authority of ADWR, which were feasible with the available agency resources. ADWR may need to utilize additional tools and acquire additional statutory authority in order to meet the management goal and continue to facilitate sound water management in the PhxAMA into the fifth management period and beyond.