FOURTH MANAGEMENT PLAN

TUCSON ACTIVE MANAGEMENT AREA

May 13, 2016

PROTECTING
ARIZONA'S WATER SUPPLIES
for ITS NEXT CENTURY

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1.1 INTRODUCTION

In May 2010 the Arizona Department of Water Resources (ADWR) published the *Demand and Supply Assessment 1985-2025, Tucson Active Management Area* (Assessment), a compilation and study of historical water demand and supply characteristics for the Tucson Active Management Area (TAMA) for the years 1985-2006 (ADWR, 2010). The Assessment also calculated seven water supply and demand projection scenarios through the year 2025. ADWR conducted the Assessment in preparation for promulgation of the *Fourth Management Plan for Tucson Active Management Area* (4MP) as required by the *1980 Groundwater Management Act,* also referred to as the *1980 Groundwater Code* (Code). After publication of the Assessment, ADWR presented a summary of the document to the Groundwater Users Advisory Council (GUAC) for the TAMA. The TAMA 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 the TAMA (A.R.S. § 45-420(A)).

The 4MP is effective from two full calendar years after the date of the 4MP noticing until the first effective date of the Fifth Management Plan (5MP). The Fifth Management Plan (5MP) will be developed to cover the period from 2020 through 2025.

The management plans serve as tools to assist ADWR in achieving the management goal of each Active Management Area (AMA). The statutorily established management goal of the TAMA is to attain safe-yield, on an AMA-wide basis, by the year 2025. Achievement of safe-yield requires that there be a long-term balance between the amount of groundwater pumped from the TAMA annually and the amount of water naturally and artificially recharged in the TAMA annually. Groundwater withdrawals in excess of natural and artificial recharge lead to groundwater overdraft. The Code identifies management strategies to reduce total groundwater withdrawals in the AMA. These management strategies may include conservation programs for all major water using sectors, as well as replacement of groundwater use with renewable water supplies. Management plans also include programs to encourage use of renewable supplies and a water management assistance program. Enforcement provisions and monitoring programs are also included in the management plans. A description of ADWR's overall water management approach for the TAMA is included in this management plan's conclusion in Chapter 12, Water Management Strategy.

The statutory management plan 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.

1.2 THE ASSURED WATER SUPPLY PROGRAM

The AWS Program was created by the Code 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 from ADWR a Certificate of Assured Water Supply (CAWS) for a new subdivision, 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: *www.azwater.gov/AzDWR/WaterManagement/AAWS*.

The AWS Rules require consistency with the management goal of the AMA. To meet this goal some providers may 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 Central Arizona Project (CAP) and reclaimed water, 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 allowed 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 a number of factors. The AWS Rules allow for a limited volume of groundwater to be pumped based on formulas for each AMA. For a CAWS in the TAMA, the amount of water that may be added to the groundwater allowance account is reduced over time, to zero by 2025. For new municipal providers seeking a DAWS, the initial groundwater allowance is set at zero.

The AWS Rules also allow applicants for a DAWS or CAWS in the TAMA 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.

Water users in the TAMA have made significant strides to reduce groundwater mining and increase the use of renewable water supplies. The TAMA was able to achieve a safe-yield condition in 2011, 2012, and 2013 because the volume of net natural recharge that occurred was supplemented by incidental recharge and the addition of cuts to the aquifer. In the TAMA, total groundwater use in these three years was about 13 percent greater than the 1985 - 2013 long-term average net natural recharge. Historical groundwater overdraft in the TAMA lowered water levels by up to 200 feet in the City of Tucson (Tucson Water) central well field. However, Tucson Water has reduced groundwater pumping and utilized more stored and recovered CAP and reclaimed water in recent years.

Historical land subsidence has occurred in several areas of the TAMA. Recent data obtained by ADWR through its land subsidence monitoring program indicates that land subsidence rates in the TAMA have been substantially reduced. In some areas, primarily associated with recharge sites, land subsidence has actually reversed and rebounding has been observed. But land subsidence is projected to increase if groundwater pumping continues in these areas. Decreased well productivity has been observed in some areas due to lowering of the water table and associated land subsidence.

The AWS requirements are an important tool to help move towards achievement of the management goal of the TAMA, but the AWS requirements only apply to new subdivisions, and are not enough by themselves to ensure achievement and maintenance of the TAMA's goal of safe-yield.

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 is also 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 Underground Water Storage and Recovery 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 Underground Water Storage, Savings and Replenishment (Recharge) Program, please see Chapter 8 and visit the ADWR website at *www.azwater.gov/AzDWR/WaterManagement/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. 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. In the TAMA, the cumulative sum of historical annual cuts to the aquifer as of 2013 was approximately 202,000 acre-feet (ac-ft).

1.4 GOVERNMENTAL AND INSTITUTIONAL SETTING

In the TAMA, water management activities are carried out by a number of 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 legislative and policy guidelines and educational programs relating to water resources use and conservation. The GUAC for each AMA advises the Statewide AMA Director and makes recommendations on groundwater management programs and policies for the AMA, and comments to the Statewide AMA Director on draft management plans for the AMA before they are promulgated by the agency director (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 Central Arizona Project (CAP) water or reclaimed water for these purposes. The AWPF Commission, with the ADWR Director serving as a nonvoting ex-officio member, oversees the 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 Tucson area include the US Bureau of Reclamation's (Reclamation) involvement in regional water supply planning and research into storage and use alternatives for CAP water. Reclamation also participates in negotiations to provide water resources to tribal communities on behalf of the US Secretary of the Interior and has trust responsibilities for reclaimed water allocated under the Southern Arizona Water Rights Settlement Act (SAWRSA). Additional Federal water management activities include a recent Army Corps of Engineers' River Basin Study, the Environmental Protection Agency's Superfund Program and the National Pollutant Discharge Elimination System (NPDES) permit program. The US 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.

1.5 TUCSON AMA WATER MANAGEMENT CHALLENGES

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

- *Meeting and Maintaining 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 TAMA Assessment revealed that the TAMA has been at or near the safe-yield goal in recent years. However, 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. All of these factors will be challenges for the TAMA to meet and maintain the goal of achieving safe-yield.

- *Utilization of Available CAP Supplies*

  A past challenge has been achieving full utilization of available CAP supplies, including excess supplies that may only be available in the short term. Augmentation efforts continue to be a focus during the fourth management period, in order to offset future shortages and to achieve other management objectives. CAP supplies remain the primary renewable water source for the TAMA, and full utilization is imperative to allow for future growth that is consistent with achieving and maintaining safe-yield.

- *Increased Utilization of Reclaimed Water*

  The Assessment identified potential for reduced groundwater dependency in the TAMA through increased direct reuse of reclaimed water. Reclaimed water represents an alternative renewable supply to CAP water that can be used to mitigate CAP shortages and protect against the impacts of drought. Developing mechanisms to maximize use of reclaimed water will be a water management focus in the TAMA during the fourth management period. ADWR will participate with other stakeholders in future discussions regarding potential uses for reclaimed water.

- *Physical Availability of Groundwater within the TAMA*

  Physical availability of groundwater within specific geographic sub-areas of the TAMA has been a challenge in the past and must continue to be addressed. While recognizing that the groundwater management goal for the TAMA 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...." Localized issues such as land subsidence may arise in areas experiencing rapid or marked declines in water tables. Other localized challenges may include water quality concerns and infrastructure limitations that constrain access to renewable water supplies. The AWS Rules require applicants to prove the physical availability of groundwater in the area for which the AWS is being applied. 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 water supply sources 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 TAMA's groundwater management strategy.

- *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-term 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 TAMA residents.

- *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 TAMA closer to safe-yield, conservation alone cannot bring the TAMA 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, can result in significant additional progress toward safe-yield.

In recent years the TAMA as a whole has been in a safe-yield or even surplus condition relative to overdraft. To continue on this path, effective water management must take a long-term perspective and be regional in scope. Water management programs must include both demand management and supply augmentation components in order to maintain safe-yield into the future. Integrated and coordinated adaptive water management strategies, which could be developed conjunctively with ADWR and water users, considering economic impacts and providing flexibility could ensure increased water supply stability in the future.

Some of the challenges to achieving and maintaining safe-yield include:

- Not all uses of groundwater are required to be replenished or offset by renewable supplies.
- The amount of net natural recharge is still (as of 2013) less than total groundwater withdrawals. See Chapter 3 of this plan. In recent years, the TAMA has been in a safe-yield condition in part due to cuts to the aquifer and incidental recharge.

- As mentioned above, achieving safe-yield AMA-wide is the TAMA goal. However, it is also important to be aware of localized areas within the TAMA becoming dewatered, resulting in potential land subsidence and wells going dry.
- Significant water management benefits have been realized through CAP water wheeling arrangements among Tucson AMA providers. In the future, additional wheeling arrangements, possibly including the wheeling of non-project water through CAP infrastructure, will be important to consider.

1.6 TUCSON 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 TAMA water supply
- Groundwater quality assessment for the TAMA
- Conservation assistance program
- Program for the purchase and retirement of grandfathered rights
- Recommendations to the AWBA

The regulatory requirements for groundwater users and water distribution systems are printed in italics for easy reference and are located at the ends of Chapters 4, 5, 6 and 8.

1.7 CONCLUSION

The 4MP outlines the statutorily mandated conservation requirements, discusses the region's water management needs and presents ADWR's suggestions for water users to achieve the TAMA's water management goals and objectives. Continued commitment from water users in the TAMA, ADWR and the public is necessary to reduce dependence on groundwater, to achieve the statutorily established water management goal of achieving safe-yield by 2025 and to maintain it thereafter. 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

ADWR. (2010). *Demand and Supply Assessment, Tucson Active Management Area.* Phoenix: ADWR.

CHAPTER TWO:
HYDROLOGY

2.1 GEOGRAPHY

The geology of the Tucson Active Management Area (TAMA) is characterized by broad, gently sloping alluvial basins separated by north to northwest trending fault-block mountains. The TAMA covers approximately 3,900 square miles (mi^2) and includes two parallel north-south trending alluvial basins that are separated by block-faulted mountains. The two alluvial basins divide the TAMA into two sub-basins, the Upper Santa Cruz (USC) Sub-basin and the Avra Valley Sub-basin *(See Figure 2-1*). The Avra Valley Sub-basin contains Altar Valley, south of the line between Township 15 and 16 South, and Avra Valley to the north of the line. Elevations within the TAMA range from 1,860 feet above mean sea level near Red Rock to 9,453 feet above mean sea level at Mount Wrightson located in the southeastern part of the TAMA.

The Santa Cruz River and its tributaries constitute the major surface water drainage within the TAMA. The Santa Cruz River enters the TAMA across its southern boundary from the Santa Cruz AMA (SCAMA) and exiting into the Pinal AMA (PAMA). The Santa Cruz River flows north through the USC Sub-basin before turning to the northwest and flowing across the northern part of the Avra Valley Sub-basin. Major tributaries to the Santa Cruz River include Rillito Creek, Tanque Verde Creek, Pantano Wash, Sabino Creek, Cañada del Oro Wash and Brawley Wash. The Avra Valley Sub-basin is drained by Brawley Wash, which flows south to north through the Sub-basin before emptying into the Santa Cruz River in the northwestern part of the TAMA *(See Figure 2-1*).

2.2 CLIMATE

The TAMA is located within the Sonoran Desert Sub-province of the Basin and Range physiographic province. The climate at the lower elevations is semiarid with sparse vegetation consisting of creosote, mesquite and cacti. Annual rainfall ranges from 11 to 16 inches on the valley floors to as much as 30 inches in the surrounding mountains. Higher rainfall volumes in the upper elevations of the mountains around the TAMA's margins support conifers and deciduous trees such as aspens, Douglas firs and oaks. In January, the mean daily maximum temperature is 66º F and the mean daily minimum temperature is 40º F. In July, the mean daily maximum temperature is 100º F and the mean daily minimum is 74º F (National Weather Service Forecast Office, 2016).

Precipitation occurs in the TAMA in two distinct seasons: a wet summer season from July to late September, referred to locally as the monsoon season, and a wet winter season from November to April *(See Figure 2-2*) (The Weather Channel). The summer rainy season of isolated, localized thunderstorms beginning in late June to early July provides a break from the dry spring season. Moisture drawn into southern Arizona from the Gulf of California and the Pacific Ocean combines with rising hot air to generate high-intensity, short-term thunderstorms. During the last stages of the summer rainy season, in September and October, dissipating tropical cyclones that originate in the Pacific Ocean off Mexico occasionally make their way into southern Arizona. The tropical cyclones generate large regional storm events that can cause intense precipitation and occasional flooding in southern Arizona. During the winter rainy season, from November to April, widespread low-intensity precipitation events are generated by large-scale regional low-pressure frontal systems. Individual winter precipitation events may not produce large rainfall totals locally, however, long duration winter storm events can produce substantial rainfall totals and severe flooding.

FIGURE 2-1
TUCSON ACTIVE MANAGEMENT AREA

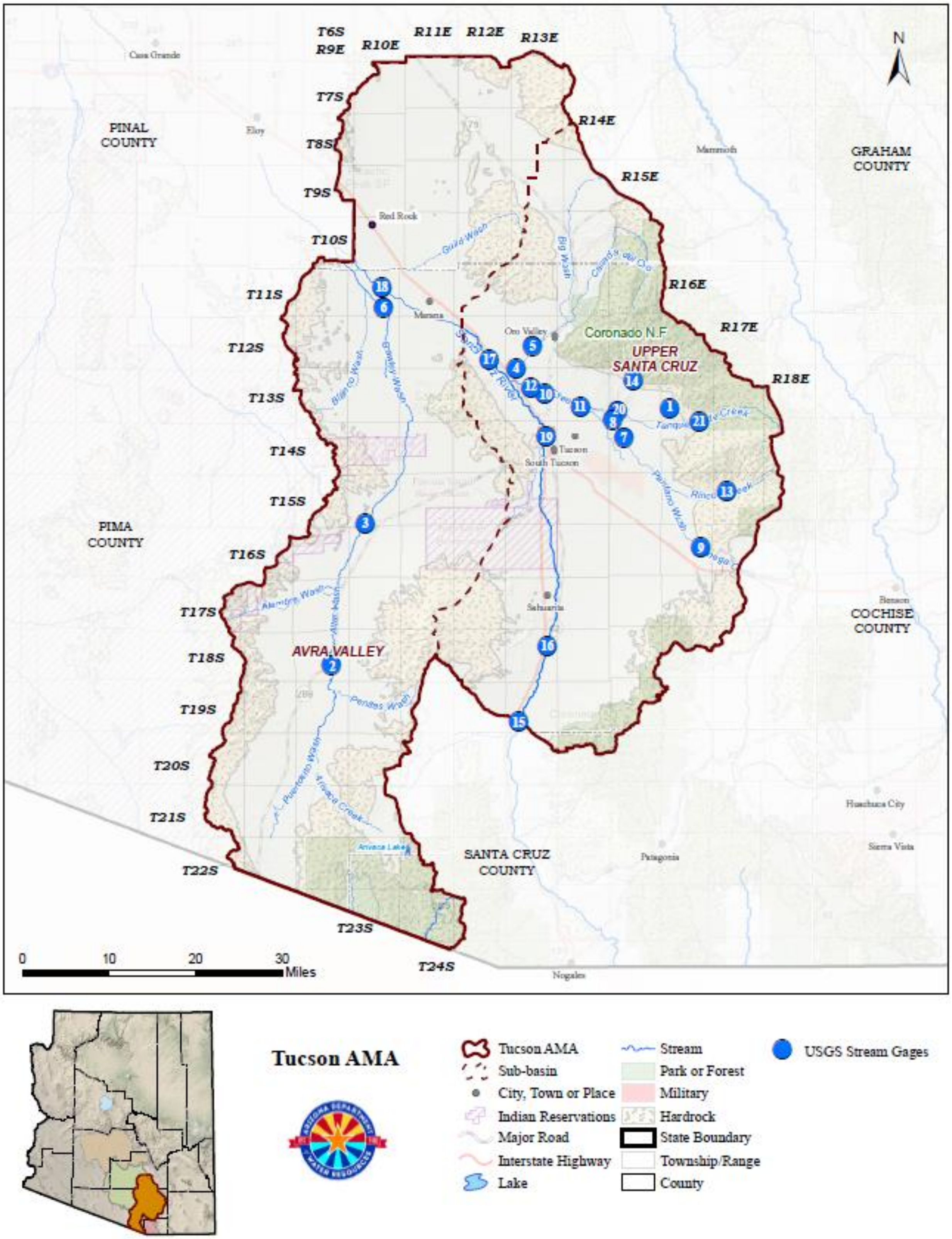
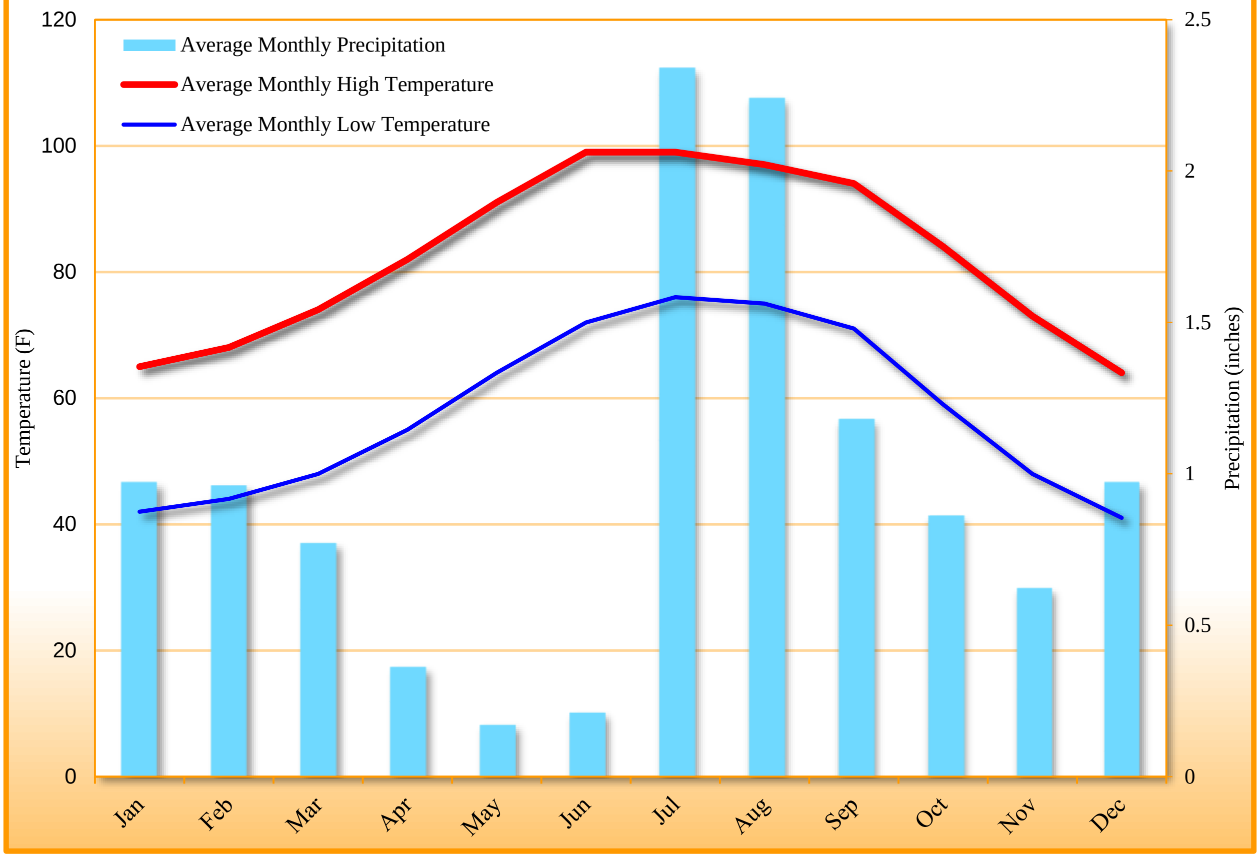


FIGURE 2-2
TUCSON AMA ANNUAL PRECIPITATION



2.3 SURFACE WATER RESOURCES

Most flows in the main surface water drainages in the TAMA are ephemeral and occur only in response to rainfall events or snowmelt. Individual flow events generated by direct precipitation falling in the valleys are usually of short duration, especially during the summer monsoon season. Some winter storms may last for several days and can generate substantial prolonged flow events. Stream infiltration from flow events provides an important component of the annual recharge to the TAMA regional aquifer.

The streambed of the Santa Cruz River occupies about 72 miles within the TAMA, entering from the south, flowing through both sub-basins, and exiting the TAMA in the northwest. Available US Geological Survey (USGS) stream gauge data for the Santa Cruz River show a very strong summer monsoonal flow signature with about 70 percent of annual flows occurring during July, August and September. Throughout most of the USC Sub-basin the Santa Cruz River is ephemeral, flowing only in response to local rainfall events. However, reclaimed water discharges into the riverbed from two Pima County Regional Wastewater Reclamation Department (PCRWRD) treatment plants have created a perennial reach downstream from the discharge points. Historically, reclaimed water discharges reached the TAMA - PAMA boundary between the Silver Bell and Picacho Mountains near the Santa Cruz River at Trico Road stream gauge *(See Figure 2-1*). Recent improvements in wastewater treatment facilities have improved the quality of the reclaimed water discharged, resulting in a higher percentage of the discharged water recharging, which has reduced or eliminated the flow of water across the AMA boundary into PAMA.

Major tributaries to the Santa Cruz River in the USC Sub-basin include Rillito Creek, Tanque Verde Creek, Sabino Creek, Pantano Wash and Cañada del Oro. USGS stream gauge data for the Rillito-Tanque Verde Creek system indicate a biannual flow distribution with a dominant winter flow regime from December to March and a fairly well defined summer monsoon flow signature. The one exception to this biannual distribution is Pantano Wash, which has a strong summer flow regime and a very weak winter flow signature.

In the Avra Valley Sub-basin, Altar Wash, Brawley Wash and Los Robles Wash form the main surface water drainages. Altar Wash drains the Altar Valley section of the Sub-basin. (Altar Wash is renamed Brawley Wash where it enters the Avra Valley part of the Sub-basin and is called Los Robles Wash just before it joins the Santa Cruz River in the northern part of the Sub-basin) *(See Figure 2-1)*. The available gauging data for Brawley Wash indicates that the system is dominated by short-duration, summer monsoon flows occurring mostly in July, August and September. These short-duration flow events tend to be localized and generally do not create flow throughout the entire drainage. Occasional long-duration flows from cyclonic events or winter frontal storms, usually from September to March, create flow events that affect the entire drainage. There are numerous years with either no significant flows or only small, local flows of very short duration in the flow record. Table 2-1 provides a summary of USGS stream gauges with flow data in and near the TAMA.

TABLE 2-1
TUCSON AMA GROUNDWATER MODEL
USGS STREAM DATA

Map Label	Gauge ID	USGS Station Name	Map Name	Gauge Records
1	9483200	AGUA CALIENTE WASH TRIB NEAR TUCSON	Agua Caliente	1965-1980
2	9486800	ALTAR WASH NEAR THREE POINTS	Altar	1966-2010
3	9487000	BRAWLEY WASH NEAR THREE POINTS	Brawley	1992-2010
4	9486350	CANADA DEL ORO BLW INA ROAD, NEAR TUCSON	Canada Del Oro #2	1995-2010
5	9486300	CANADA DEL ORO NEAR TUCSON	Canada Del Oro #1	1965-1978
6	9487250	LOS ROBLES WASH NEAR MARANA	Los Robles	1966-1983
7	9485450	PANTANO WASH AT BROADWAY BLVD AT TUCSON	Pantano #2	1998-2010
8	9485500	PANTANO WASH NEAR TUCSON	Pantano #3	1940-1977
9	9484600	PANTANO WASH NEAR VAIL	Pantano #1	1959-2010
10	9486000	RILLITO CR NEAR TUCSON	Rillito #2	1913-1975
11	9485700	RILLITO CREEK AT DODGE BLVD AT TUCSON	Rillito #1	1990-2010
12	9486055	RILLITO CREEK AT LA CHOLLA BLVD NEAR TUCSON	Rillito #3	1995-2010
13	9485000	RINCON CREEK NEAR TUCSON	Rincon	1993-2010
14	9484000	SABINO CREEK NEAR TUCSON	Sabino	1987-2010
15	9481770	SANTA CRUZ NR AMADO	Santa Cruz #1	2003-2009
16	9482000	SANTA CRUZ RIVER AT CONTINENTAL	Santa Cruz #2	1991-2010
17	9486500	SANTA CRUZ RIVER AT CORTARO	Santa Cruz #4	1993-2010
18	9486520	SANTA CRUZ RIVER AT TRICO RD NEAR MARANA	Santa Cruz #5	1989-2010
19	9482500	SANTA CRUZ RIVER AT TUCSON	Santa Cruz #3	1998-2010
20	9484500	TANQUE VERDE CREEK AT TUCSON	Tanque Verde #2	1940-2010
21	9483100	TANQUE VERDE CREEK NEAR TUCSON	Tanque Verde #1	1959-1974

2.4 HYDROGEOLOGIC UNITS AND AQUIFER CHARACTERISTICS

The TAMA is divided by block-faulted mountains into two separate groundwater sub-basins filled with alluvial sediments. The block-faulted mountains are composed of Precambrian through Tertiary age granitic, metamorphic, volcanic and consolidated sedimentary rock. The sedimentary deposits that fill the two sub-basins are collectively termed basin-fill deposits and make up the TAMA regional aquifer. The basin-fill deposits are composed of volcanic deposits and unconsolidated to consolidated sediments consisting of gravel, sand, silt and clay with minor amounts of gypsiferous and anhydrous sediments. The basin-fill sediments are generally coarse-grained along the basin margins, and grade into finer-grained and evaporite deposits in the central parts of the basins.

The thickness of the basin-fill deposits range from a thin veneer along the mountain-fronts to as much as 9,000 feet thick in the Avra Valley Sub-basin and 11,200 feet thick in the USC Sub-basin (Davidson, 1973)(Anderson, 1987)(Anderson, 1988)(Anderson, 1989)(Hanson, Anderson, & Pool, 1990)(Hanson & Benedict, 1994). The basin-fill deposits have been divided into a lower basin-fill unit and an upper basin-fill unit based on regional hydrogeologic characteristics and further sub-divided into stratigraphic units based on lithology and depositional environment (Pashley, 1966)(Davidson, 1973)(Pool, 1986)(Anderson, 1987)(Anderson, 1988)(Anderson, 1989). Generalized geologic cross-sections for each sub-basin are presented in Figures 2-3 and 2-4. The general characteristics of the basin-fill deposits are described below. For more information on the cross section locations shown in Figures 2-3 and 2-4, see modeling report number 13, "A Regional Groundwater Flow Model of the Tucson Active Management Area, Tucson, Arizona: Simulation and Application", found at:
http://www.azwater.gov/AzDWR/Hydrology/Modeling/Tucson_Home.htm.

2.4.1 Upper Basin-fill

The upper basin-fill unit ranges from several hundred feet to as much as 1,000 feet thick in both sub-basins. The unit consists mostly of semi-consolidated to unconsolidated gravel, sands and clayey silt. In the Avra Valley Sub-basin, the upper basin-fill consists largely of finer grained material in the north and central parts of the sub-basin (Moosburner, 1972)(Anderson, 1988). The upper basin-fill is generally coarser in the southern part of Avra Valley consisting of a thick sequence of coarse to medium sized sands. In the USC Sub-basin the upper basin-fill is generally coarser north of Township 13 South and finer grained throughout the rest of the sub-basin (Hanson & Benedict, 1994). The upper basin-fill has been divided into the upper Tinaja beds, the Fort Lowell Formation and the surficial alluvium deposits based on hydrogeologic properties.

The surficial alluvial deposits are composed of gravels, sands and silty sands and include alluvial-fan, terrace and stream-channel deposits. The surficial deposits are not hydrologically significant except for the stream-channel deposits, which are usually referred to as the Younger Alluvium. The Younger Alluvium is very permeable and ranges from 40 to 100 feet thick (Davidson, 1973).

The sediments of the Fort Lowell Formation are generally flat lying and are at most 300 feet to 400 feet thick (Davidson, 1973)(Anderson, 1988)(Anderson, 1989). The Fort Lowell Formation is generally unconsolidated to weakly cemented and composed of gravel, sands and clayey silt. In the northern areas of the USC Sub-basin the sediments of the Fort Lowell Formation are coarser-grained than in the central and southern parts of the sub-basin. In the Avra Valley Sub-basin the unit is generally more coarse-grained in the southern part of the sub-basin and finer-grained in the central and northern parts of the sub-basin.

The upper Tinaja beds are several hundred feet thick and consist of unconsolidated to slightly cemented gravels, sands and clayey silts. In the USC Sub-basin the sediments of the upper Tinaja beds are coarsest in the northern section of the sub-basin, becoming finer-grained in the central and southern sections of the sub-basin. The upper Tinaja beds are coarser in the central and southern parts of the Avra Valley Sub-basin and grade into finer grained deposits in the northern part of the sub-basin.

FIGURE 2-3
AVRA VALLEY SUB-BASIN CROSS SECTION

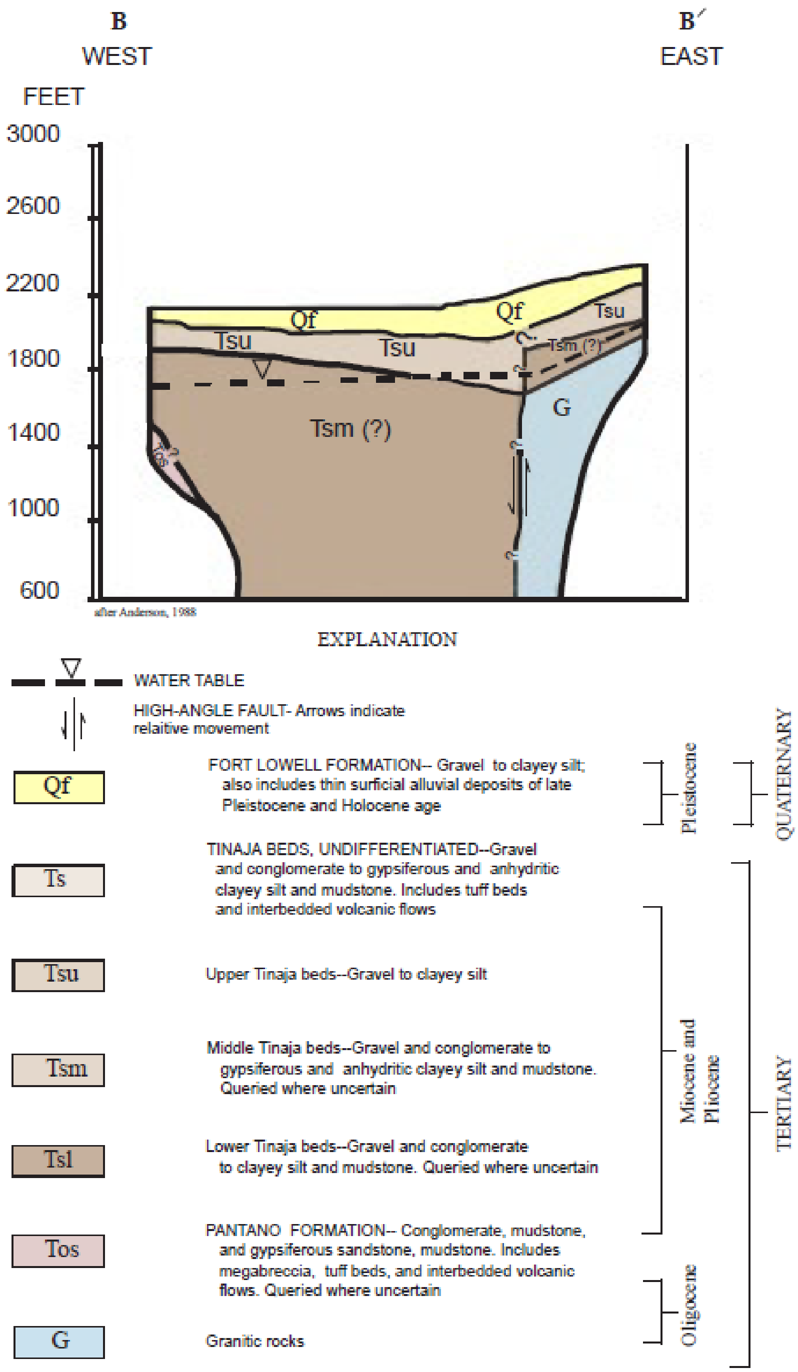
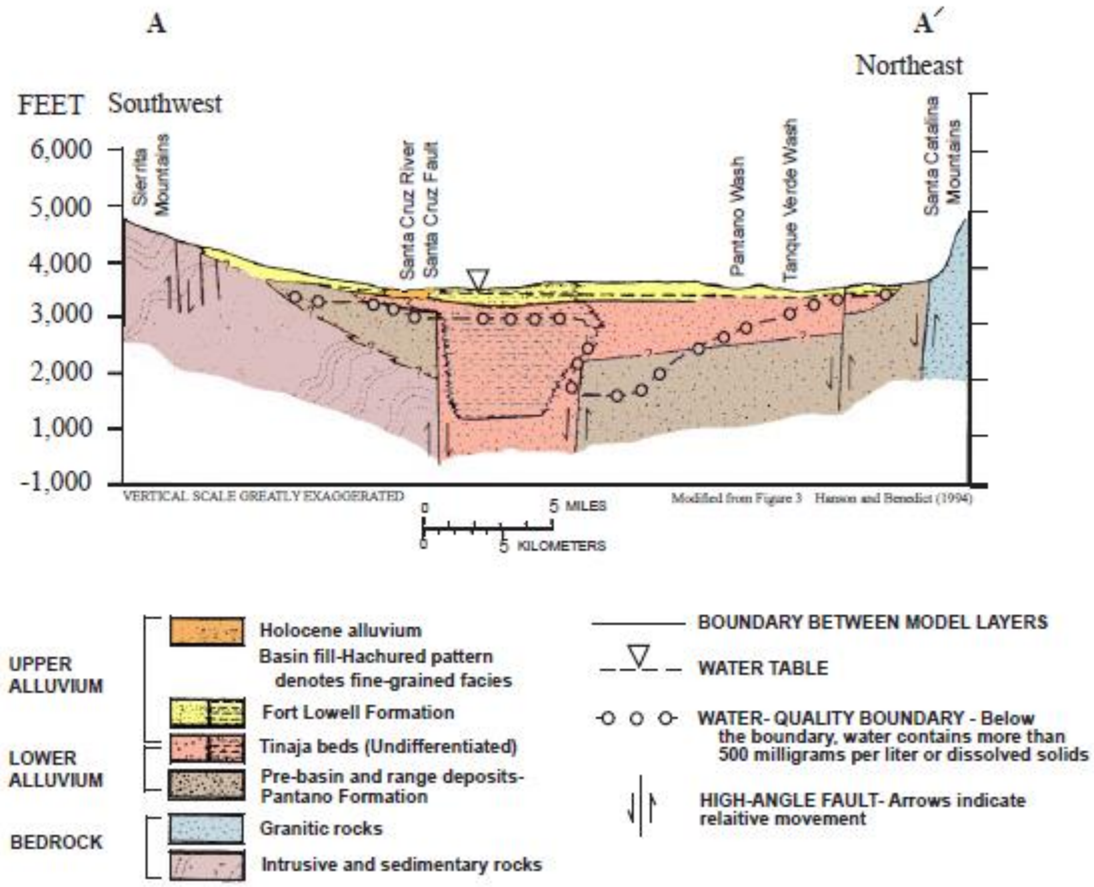


FIGURE 2-4
UPPER SANTA CRUZ SUB-BASIN CROSS SECTION



2.4.2 Lower Basin-fill

The lower basin-fill is several thousand feet thick and consists of conglomerates, gravels, sands, silts, anhydritic clayey silts and mudstones. In the Avra Valley Sub-basin the lower basin-fill grades from mostly sands, gravels and conglomerates in the southern part of the sub-basin to anhydritic clayey silts and mudstones in the central and northern parts of the sub-basin (Anderson, 1988), (Hanson, Anderson, & Pool, 1990). The lower basin-fill is more coarse-grained in the northern part of the USC Sub-basin with finer grained deposits, including extensive evaporite deposits, occurring in the central sections of the USC Sub-basin (Davidson, 1973)(Anderson, 1989)(Hanson & Benedict, 1994). The lower basin-fill has been divided into the middle and lower Tinaja beds and the Pantano Formation (Anderson, 1987)(Anderson, 1988)(Anderson, 1989).

The middle and lower Tinaja beds are several hundred to several thousand feet thick and their composition ranges from gravels and conglomerates to gypsiferous, anhydritic clayey silts and mudstones. The sediments of the middle and lower Tinaja beds are found in the downthrown blocks of the structural basins in the USC Sub-basin and the northern part of the Avra Valley Sub-basin. The middle Tinaja sediments are generally not present on the upthrown blocks, having been removed by erosion between periods of Basin and Range faulting (Anderson, 1987). In the downthrown blocks, the middle and lower Tinaja sediments are generally fine-grained and can contain thick deposits of gypsiferous and anhydritic clayey silts.

The Pantano Formation consists of semi-consolidated to consolidated conglomerates, sandstones, mudstones and gypsiferous mudstones (Davidson, 1973)(Anderson, 1987)(Anderson, 1988)(Anderson, 1989). The total thickness of the Pantano Formation is not known, but it is estimated to be several thousands of feet thick (Davidson, 1973). The unit is usually deeply buried by overlying Tinaja beds along the central axis of the USC Sub-basin in the downthrown structural blocks. Along the basin's margins, on the upthrown fault blocks, the Tinaja beds are much thinner, and the Pantano Formation is closer to the surface and sometimes exposed at the surface.

2.4.3 Aquifer Characteristics

Groundwater in the upper basin-fill generally occurs under unconfined or water table conditions. Localized perching conditions, caused by interbedded layers of fine-grained sediments, are known to exist in the USC Sub-basin in Township 15 South, Ranges 13 and 14 East, and in the northern sections of the Avra Valley Sub-basin *(See Figure 2-1*) (Babcock & Hix, 1981),(Anderson, 1988)(Anderson, 1989). The Fort Lowell Formation and upper Tinaja beds of the upper basin-fill are the most productive units within the regional aquifer. Most high capacity wells that provide water for municipal, industrial or irrigation uses are completed in one or the other of these units. Well yields and the hydrologic properties of the upper Tinaja beds and the Fort Lowell Formation are also generally similar and wells completed in these units are capable of producing 500 to 1,500 gallons per minute (Davidson, 1973)(Anderson, 1988)(Anderson, 1989).

The surficial alluvial deposits are not hydrologically significant except for the stream-channel deposits. The stream channel deposits are very permeable and prior to extensive groundwater development the stream channel deposits were probably partially-to-fully saturated along most of the Santa Cruz River and its tributaries. However, by the 1940s, water level declines from localized groundwater pumpage had drained much of the stream channel deposits along the Santa Cruz River and its tributaries. The stream channel deposits remain hydrologically important presently because they serve as a conduit for stream-flow recharge that infiltrates into the underlying regional aquifer.

The Fort Lowell Formation has significant saturated thickness throughout most of the USC Sub-basin and in the northern parts of the Avra Valley Sub-basin and is considered the main regional aquifer. However, the upper Tinaja beds have become a more important aquifer in areas where water level declines have reduced the saturated thickness of the Fort Lowell Formation. Throughout much of Avra Valley, the Fort Lowell Formation is either not saturated or has a smaller saturated thickness than in the USC Sub-basin. As a result, the upper Tinaja beds, along with the middle and lower Tinaja beds, are more significant aquifers in the Avra Valley Sub-basin. This is particularly true in the southern portions of the Avra Valley Sub-basin where the Fort Lowell Formation is unsaturated and the Tinaja beds consist of thick sequences of coarse-grained sand deposits. In this area, the Tinaja beds can be very productive and are the main water-bearing unit.

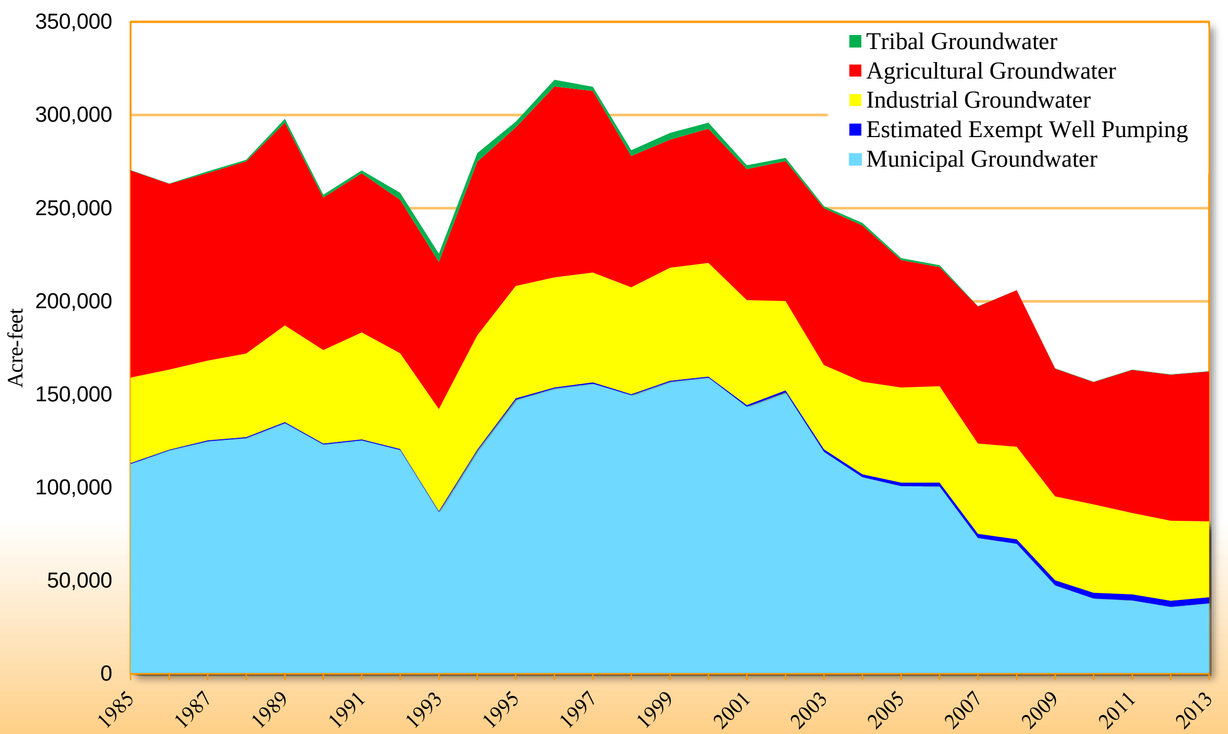
The middle and lower Tinaja beds and Pantano Formation of the lower basin-fill are generally not highly productive and have not been widely developed as a source of groundwater. This is due to several reasons, which may include depth of burial, increased consolidation and presence of large percentages of fine materials. Wells developed in the middle and lower Tinaja beds and Pantano Formation generally produce only small to moderate amounts of water. However, there are areas along the basin margins and in the southern sections of the Avra Valley Sub-basin where the middle and lower Tinaja and Pantano formation are an important source of groundwater.

2.5 GROUNDWATER RESOURCES

2.5.1 Historical Water Use

Groundwater pumpage for agricultural, municipal and industrial purposes is the single largest source of water withdrawals from the TAMA's regional aquifer. Groundwater pumpage has significantly impacted the groundwater system and water levels in many parts of the TAMA. Groundwater development for farming and to support the City of Tucson began as early as 1900. By the 1930s, estimated annual pumpage in the TAMA ranged from 30,000 to 45,000 ac-ft per year (Anning & Duet, 1994). By 1940, withdrawals increased to about 60,000 ac-ft per year, and since that time annual groundwater withdrawals have generally greatly exceeded annual natural recharge. In the mid-1970s, groundwater pumpage peaked at about 385,000 ac-ft per year (Mason & Bota, 2006). From 2000 to 2013, the average annual reported groundwater pumpage for the TAMA was approximately 214,000 ac-ft *(See Figure 2-5*). This figure does not include recovery of stored water from recovery wells.

FIGURE 2-5
TUCSON AMA GROUNDWATER PUMPING BY SECTOR, 1985-2013



Initially, most groundwater in the TAMA was used for irrigation, but by the mid-1970s, irrigation withdrawals began declining due to urbanization and farms being retired. At the same time, municipal and industrial demands began increasing along with population growth. By the mid-1980s, agricultural use and municipal water use were about equal, with each accounting for about 40 percent of the total groundwater withdrawn. Industrial use made up the remaining 20 percent. In 2013, municipal groundwater use was about 39,000 ac-ft, while agricultural groundwater use was about 81,000 ac-ft (not including in-lieu groundwater). However, total municipal withdrawals were greater than agricultural withdrawals because much of the municipal pumping was recovered annually or as long-term recharge credits, not groundwater. Total municipal demand in 2013 was 162,000 ac-ft whereas total agricultural demand was only 110,700 ac-ft. Industrial demand was 48,000 ac-ft and primarily consisted of groundwater. See Chapter 3 of this plan for more description of historical water uses by source of supply for each water use sector in the TAMA.

2.5.2 Avra Valley Sub-basin

Until the late 1970s, about 95 percent of groundwater withdrawals had been used for agricultural irrigation in the Avra Valley Sub-basin with the remaining five percent used by the municipal and industrial sectors. Farm acreage increased dramatically in the early to mid-1950s when agricultural development reached a peak of about 30,000 acres in production (White, Matlock, & Schwalen, 1966). The dominance of irrigation use has changed in the last 30 to 40 years due to urbanization and the retirement of farm lands within the sub-basin. In 2013, agricultural pumpage comprised 36 percent of total withdrawals in the sub-basin. Annual pumping in the sub-basin declined from a high of about 230,000 ac-ft in 1976 to about 117,000 ac-ft per year in 2013. Since about 2000, pumpage of recovered annual or long-term recharge credits for municipal use has increased, and in 2013 pumpage associated with recovery of recharge credits in the sub-basin was about 67,000 ac-ft.

2.5.3 Upper Santa Cruz Sub-basin

Agricultural pumpage accounted for 80 to 90 percent of the total pumpage in the USC Sub-basin until the mid-1950s. Since the mid-1950s the percentage of municipal and industrial pumpage has increased and the percentage of agricultural pumpage has decreased. The decline in agricultural withdrawals in the USC Sub-basin reflects the shift in water use from farming to supplying municipal and industrial water to the growing population of the Tucson area. Withdrawals in the USC Sub-basin increased from about 50,000 ac-ft per year in 1950 to over 270,000 ac-ft per year by 1976. Since 1976, withdrawals have generally declined, and by 2013, pumping was just under 173,000 ac-ft per year. Pumpage by sector for 2013 in the USC Sub-basin was 22 percent municipal, 21 percent agricultural and 29 percent industrial. The remaining pumping was recovery of stored water (recovered water was used primarily by the municipal sector).

2.5.4 Groundwater Recharge and Discharge

2.5.4.1 Recharge

Groundwater recharge components in the TAMA include: 1) mountain-front, 2) stream recharge, 3) underflow, 4) incidental recharge and 5) artificial recharge. For the purposes of this document, incidental recharge is defined as water that recharges the TAMA's regional aquifer during the course of its use for agricultural, industrial or municipal purposes. This includes water that is: 1) recharged as a result of irrigation activities, 2) reclaimed water that is released into the Santa Cruz River or used for irrigation and 3) water infiltrating from mine tailings ponds. 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 TAMA regional aquifer has been mountain-front recharge and streambed recharge along the Santa Cruz River and its major tributaries. Mountain-front recharge occurs along the margins of the TAMA where rainfall and snowmelt generate surface flows that infiltrate into the alluvial material and enter the regional aquifer. Based on results of the latest TAMA groundwater flow model, long-term average of mountain-front recharge is estimated to be 28,100 ac-ft per year (Mason & Hipke, 2012). Streambed recharge occurs during moderate to large flows along the Santa Cruz River and its major tributaries and, like stream flow, is highly variable. Historical annual stream-flow from gauges in the TAMA was analyzed and the resulting estimated annual stream recharge volumes were included in the updated Tucson groundwater flow model. The results of the model indicate that inclusion of annualized stream recharge pulses provide a better model calibration than using long-term average stream infiltration values. The stream-flow analysis and model calibration results suggest that from 1940 to 2013 stream

[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. § 45-802.01(4)).

recharge has varied from a low of 15,300 ac-ft per year to a high of 415,400 ac-ft per year. Annual rates of natural and incidental recharge and riparian demands for the years 1985 through 2013 are listed in Table 2-2.

TABLE 2-2
TUCSON AMA RATES OF ANNUAL NET NATURAL RECHARGE, 1985-2013 (ac-ft/year)

Year	Natural Recharge			Incidental Recharge		**Total Natural and Incidental Recharge**	Natural Discharge		Total Natural Discharge	**Net Recharge**
	Mountain front	Stream Channel*	Groundwater inflow	Canal Seepage	Lagged Ag Recharge		Riparian transpiration (GW)	Groundwater outflow		
1985	28,100	137,479	29,443	3,657	44,371	**243,050**	7,164	21,292	28,456	**214,594**
1986	28,100	113,599	29,790	3,657	45,469	**220,615**	6,920	22,597	29,517	**191,098**
1987	28,100	94,235	30,472	3,657	45,549	**202,013**	6,111	22,066	28,177	**173,836**
1988	28,100	75,898	29,838	3,657	44,942	**182,435**	4,032	19,771	23,803	**158,632**
1989	28,100	62,248	30,351	3,657	44,070	**168,426**	2,551	18,611	21,162	**147,264**
1990	28,100	94,773	30,757	3,657	43,236	**200,523**	2,761	21,244	24,005	**176,518**
1991	28,100	108,114	32,126	3,657	38,398	**210,395**	4,489	18,275	22,764	**187,631**
1992	28,100	113,067	31,503	3,657	39,212	**215,539**	5,850	18,539	24,389	**191,150**
1993	28,100	320,201	30,367	3,657	38,516	**420,841**	10,623	21,117	31,740	**389,101**
1994	28,100	91,285	32,012	3,657	35,402	**190,456**	7,762	20,120	27,882	**162,574**
1995	28,100	106,598	32,789	3,657	31,232	**202,376**	7,587	19,335	26,922	**175,454**
1996	28,100	61,162	32,320	3,657	30,069	**155,308**	3,872	18,499	22,371	**132,937**
1997	28,100	47,992	32,472	3,657	27,319	**139,540**	2,204	16,952	19,156	**120,384**
1998	28,100	118,228	32,291	3,657	25,774	**208,050**	3,877	15,798	19,675	**188,375**
1999	28,100	80,899	32,597	3,657	25,425	**170,678**	2,987	15,113	18,100	**152,578**
2000	28,100	171,267	31,399	3,657	25,457	**259,880**	2,581	13,633	16,214	**243,666**
2001	28,100	53,711	31,702	3,657	25,103	**142,273**	2,035	15,579	17,614	**124,659**
2002	28,100	46,386	32,109	3,657	23,093	**133,345**	1,103	16,072	17,175	**116,170**
2003	28,100	96,683	29,862	3,657	22,015	**180,317**	1,023	15,338	16,361	**163,956**
2004	28,100	75,049	29,806	3,657	23,173	**159,785**	1,254	14,788	16,042	**143,743**
2005	28,100	112,548	30,830	3,657	23,318	**198,453**	4,145	15,357	19,502	**178,951**
2006	28,100	144,088	31,865	3,657	26,072	**233,782**	5,397	15,859	21,256	**212,526**
2007	28,100	92,204	31,902	3,657	26,808	**182,671**	3,905	16,055	19,960	**162,711**
2008	28,100	87,745	32,028	3,657	23,245	**174,775**	4,065	14,542	18,607	**156,168**
2009	28,100	47,730	30,955	3,657	22,013	**132,455**	1,900	18,153	20,053	**112,402**
2010	28,100	87,766	31,885	3,657	23,039	**174,447**	3,470	18,035	21,505	**152,942**
2011	28,100	90,807	30,595	3,657	22,800	**175,959**	3,775	17,135	20,910	**155,049**
2012	28,100	114,848	30,400	3,657	24,150	**201,155**	3,890	17,560	21,450	**179,705**
2013	28,100	125,987	30,145	3,657	32,300	**220,189**	3,950	18,030	21,980	**198,209**

*Stream channel recharge includes the recharge of reclaimed water from the discharge points to the TAMA boundary with PAMA. Effluent discharge is included in the Stream channel recharge column for all years, except for the historical volumes that left the AMA prior to the recent improvements in the wastewater treatment facilities that resulted in higher quality water and a higher percentage of recharge.

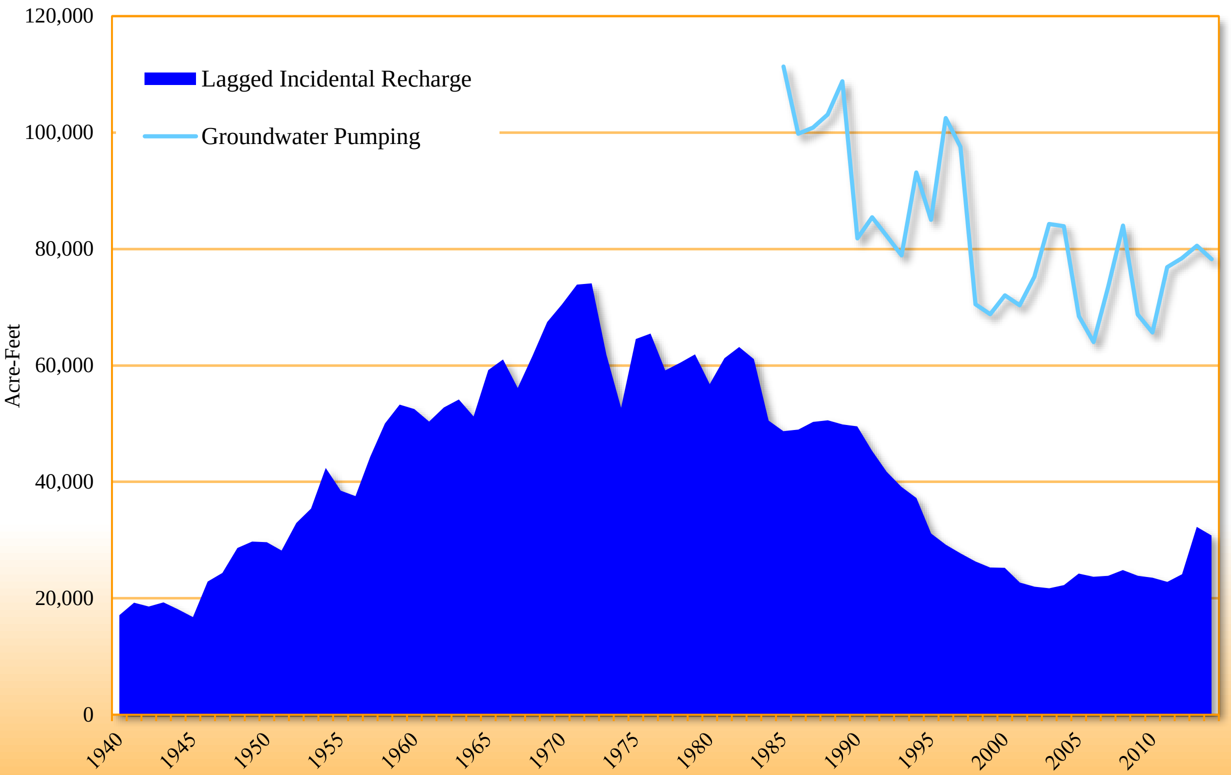
Artificial recharge is not shown in Table 2-2 because water that is artificially stored underground belongs to the storer, other than any cuts to the aquifer required by law (*See Chapter 8 of this plan*).

According to the USGS, underflow can be considered groundwater outflow from an area (a model, a basin, an aquifer), into another area that occurs within alluvial material that isn't measured at a stream gaging station *(See http://water.usgs.gov/wsc/glossary.html#G*). Underflow into the TAMA occurs from the south across the TAMA - SCAMA boundary and through bedrock gaps where Pantano Wash and Tanque Verde Creek enter the TAMA. Previous estimates of underflow into the TAMA from the SCAMA range from 5,600 ac-ft per year to 15,500 ac-ft per year (Mason & Bota, 2006). Groundwater underflow across the SCAMA – TAMA boundary has varied over time. Water level fluctuations caused by pumping on both sides of the boundary, infiltration of water from large stream flows and reclaimed water released from the Nogales International Wastewater Treatment Plant have impacted the underflow into the TAMA (Mason

& Bota, 2006), (Nelson, 2006). Groundwater model estimates of underflow into the TAMA range from 9,950 ac-ft per year to 22,545 ac-ft per year, and the average underflow from 1985 to 2010 is 21,045 ac-ft per year (Mason & Hipke, 2012). Estimates of underflow from Pantano Wash and Tanque Verde Creek into the study area are small and are included in mountain-front recharge estimates.

The Tucson groundwater flow model does not simulate groundwater flow in Altar Valley. The groundwater flow out of Altar Valley into southern Avra Valley is simulated as a constant flux along the model's boundary in southern Avra Valley. The underflow across the model boundary, located approximately at Township 17 South, is not believed to have changed greatly over time as evidenced by hydrographs in that area, which show fairly consistent water levels through time (Mason & Bota, 2006). The calibrated groundwater underflow into the model from Altar Valley is 10,270 ac-ft per year. This value is the sum of mountain-front recharge and stream-bed recharge for the Altar Valley portion of the Avra Valley Sub-basin.

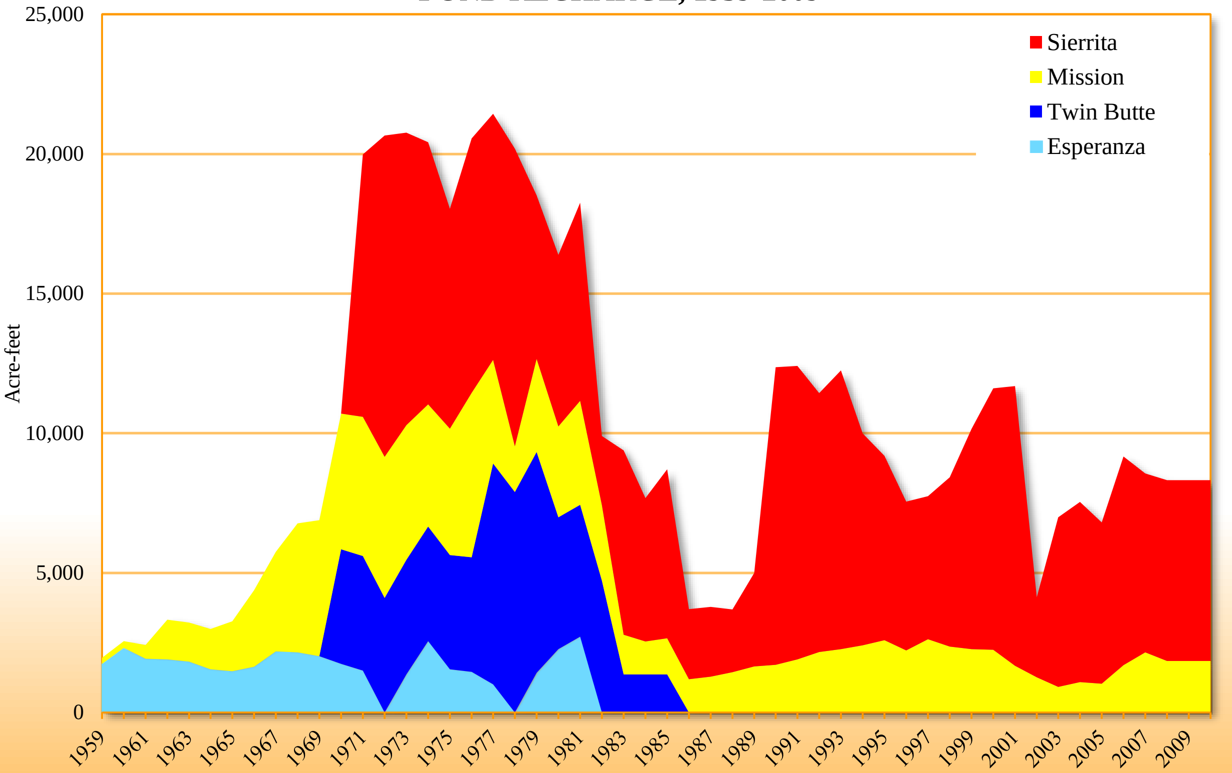
FIGURE 2-6
TUCSON AMA AGRICULTURAL GROUNDWATER DEMAND & LAGGED INCIDENTAL RECHARGE, 1940-2014



Incidental and artificial recharge have become a more important source of water to the regional aquifer as the TAMA's water resources have been developed. The Tucson groundwater flow model lags agricultural recharge based on an estimated rate of vertical movement and the depth to water through time. The result of the lagging is that agricultural recharge peaks during the early 1970s to the mid-1980s, and then declines. The agricultural recharge decline is offset in time but mirrors the decline in agricultural groundwater pumping (*See Figure 2-6)*.

Mine tailing recharge is water that is returned to the aquifer through seepage from tailing ponds associated with mining operations. Tailings pond recharge began in the early 1950s, soon after mining operations began and has generally varied annually along with various ore production. Estimates of tailing pond recharge volumes used in the Tucson groundwater flow model were developed based on information from the Arizona Department of Environmental Quality (ADEQ) reports and from reports provided to ADWR by Montgomery and Associates (Montgomery and Associates, 2009). The mine tailing recharge is limited to the southwestern portion of the USC Sub-basin. Figure 2-7 contains the model estimated annual mine tailings pond recharge values.

FIGURE 2-7
TUCSON AMA ESTIMATED MINE TAILINGS POND RECHARGE, 1959-2009



Reclaimed water from wastewater treatment plants (WWTP) has been used for irrigation in the Tucson area since the early 1900s (Schladweiler, 2001). From 1917 to 1969, reclaimed water was used to irrigate various city farmlands located within or near the city boundaries or delivered under contract to private farms. Direct delivery of reclaimed water for irrigation was discontinued in 1969, and since that time most reclaimed water from the Roger Road and the Ina Road WWTPs has been discharged directly into the Santa Cruz River. Note that the Roger Road WWTP was recently replaced by the Agua Nueva Water Reclamation Facility (WRF) and the Ina Road WWTP was extensively improved and renamed the Tres Rios WRF. Some reclaimed water continues to be used for agricultural and turf facility irrigation. The Cortaro-Marana Irrigation District (CMID) began receiving secondary treated reclaimed water for irrigation in 1977, and in 1984, the City of Tucson began operating a reclaimed water distribution system that supplies reclaimed water to turf facilities (parks, golf courses and cemeteries) within TAMA. From 2000 to 2013, discharges from the WWTPs into the Santa Cruz River bed have averaged 52,240 ac-ft per year. A portion of this water infiltrates and incidentally recharges the aquifer and is included in the total estimate of streambed recharge. The reclaimed water distribution system receives and distributes about 11,000 ac-ft per year. Table 2-3 shows the reclaimed water releases from 1950 to 2013.

Artificial recharge facilities have become significant sources of recharge to the TAMA regional aquifer since 2000. Artificial recharge has comprised over 50 percent of total recharge simulated in the Tucson groundwater flow model since 2005. CAP surface water and reclaimed water are both stored underground at constructed or managed artificial recharge projects called Underground Storage Facilities (USFs) that are permitted by ADWR. CAP surface water was introduced to the TAMA in 1993 and is utilized in several ways. The largest proportion of CAP water is recharged at artificial recharge facilities. A small amount of CAP water is used directly for agricultural irrigation and by the industrial sector. The CAP water used for agricultural irrigation is either CAP pool water, in which case no recharge credits are earned, or as *in-lieu* water. In-lieu water is stored at a Groundwater Saving Facility (GSF). A GSF is a facility, such as an irrigation district or specific farm, to which a renewable supply is delivered to a recipient who agrees to curtail groundwater pumping and use the renewable supply in-lieu of that groundwater. Typically, a separate entity holds the Water Storage Permit to store the in-lieu water (and has the legal right to the renewable supply) and accrues long-term storage credits for each acre-foot of water used in-lieu of the groundwater.

TABLE 2-3
TUCSON AMA RECLAIMED WATER RELEASES, 1950-2013, (ac-ft)*

Fiscal Year	Model Year	Ina Rd WPCF Discharge	Roger Rd WWTF Discharge	Tres Rios WRF Discharge	Average Discharge
1950-51	1951		798		798
1951-52	1952		4,182		4,361
1952-53	1953		4,539		4,252
1953-54	1954		3,966		4,410
1954-55	1955		4,854		3,207
1955-56	1956		1,559		786
1956-57	1957		12		11
1957-58	1958		9		5
1958-59	1959				
1959-60	1960				9
1960-61	1961		18		9
1961-62	1962				
1962-63	1963				
1963-64	1964				
1964-65	1965				
1965-66	1966				
1966-67	1967				
1967-68	1968				
1968-69	1969				
1969-70	1970		29,952		14,976
1970-71	1971		29,952		31,327
1971-72	1972		32,702		34,792
1972-73	1973		36,882		36,067
1973-74	1974		35,252		33,778
1974-75	1975		32,303		32,808
1975-76	1976		33,313		34,712
1976-77	1977	6,138	29,974		36,359
1977-78	1978	9,207	27,399		38,166
1978-79	1979	12,276	27,451		39,000
1979-80	1980	13,810	24,463		40,832

Fiscal Year	Model Year	Ina Rd WPCF Discharge	Roger Rd WWTF Discharge	Tres Rios WRF Discharge	Average Discharge
1980-81	1981	15,344	28,047		43,114
1981-82	1982	15,515	27,320		42,505
1982-83	1983	15,400	26,776		41,894
1983-84	1984	14,755	26,858		43,077
1984-85	1985	16,317	28,223		44,608
1985-86	1986	15,746	28,929		46,367
1986-87	1987	17,655	30,403		48,102
1987-88	1988	18,346	29,800		48,308
1988-89	1989	18,812	29,658		48,305
1989-90	1990	17,652	30,488		47,655
1990-91	1991	21,053	26,116		47,896
1991-92	1992	20,721	27,902		49,342
1992-93	1993	21,608	28,452		49,894
1993-94	1994	22,526	27,203		52,036
1994-95	1995	25,180	29,164		53,688
1995-96	1996	25,440	27,592		53,116
1996-97	1997	24,379	28,822		53,668
1997-98	1998	24,845	29,289		53,448
1998-99	1999	24,618	28,143		53,376
1999-00	2000	26,083	27,908		53,991
2000-01	2001	26,083	27,908		52,045
2001-02	2002				53,124
2003	2003	26,408	30,754		57,162
2004	2004	27,925	26,985		54,910
2005	2005	24,552	29,188		53,740
2006	2006	24,968	28,374		53,342
2007	2007	27,864	24,495		52,359
2008	2008	31,546	21,691		53,237
2009	2009	28,528	23,567		52,095
2010	2010	28,821	22,094		50,916
2011	2011	27,368	22,985		50,354
2012	2012	24,391	24,487		48,878
2013	2013		18,988	27,954	46,942

*As reported by Pima County Wastewater

2.5.4.2 Discharge

Groundwater is discharged from the TAMA's regional aquifer through pumpage, underflow and evapotranspiration (ET). Groundwater pumpage has been discussed above, and until about 2000, has far exceeded annual recharge (Mason & Hipke, 2012). Groundwater underflow exits in the TAMA and into the PAMA through the gap between the Silverbell and Picacho Mountains in the northwest corner of the TAMA (*See Figure 2-1*). Underflow out of the TAMA has varied through time due to changing water levels along the TAMA-PAMA boundary. The results of the Tucson groundwater flow model indicate that underflow out of the TAMA ranges from 14,200 to 35,700 ac-ft per year (Mason & Hipke, 2012). ET loss is a result of water utilized by phreatophyte plants. ET losses are primarily from riparian corridors located along the Santa Cruz River and its major tributaries where groundwater is shallow enough to support phreatophyte plants. Groundwater discharge estimates from the Tucson groundwater flow model are presented in Table 2-2 under groundwater outflow.

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-term and short-term water level trends and on aquifer storage changes. Water level data have been collected from wells within the TAMA since the early 1900s.

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 on-going groundwater conditions. Between 2000 and 2010, ADWR collected an average of 229 water levels per year in the TAMA. 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. AMA-wide water level sweeps completed in 1999-2000 and 2009-2010, resulted in 1,685 and 2,300 water level measurements, respectively. ADWR utilizes water level data collected by other entities in the TAMA 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.

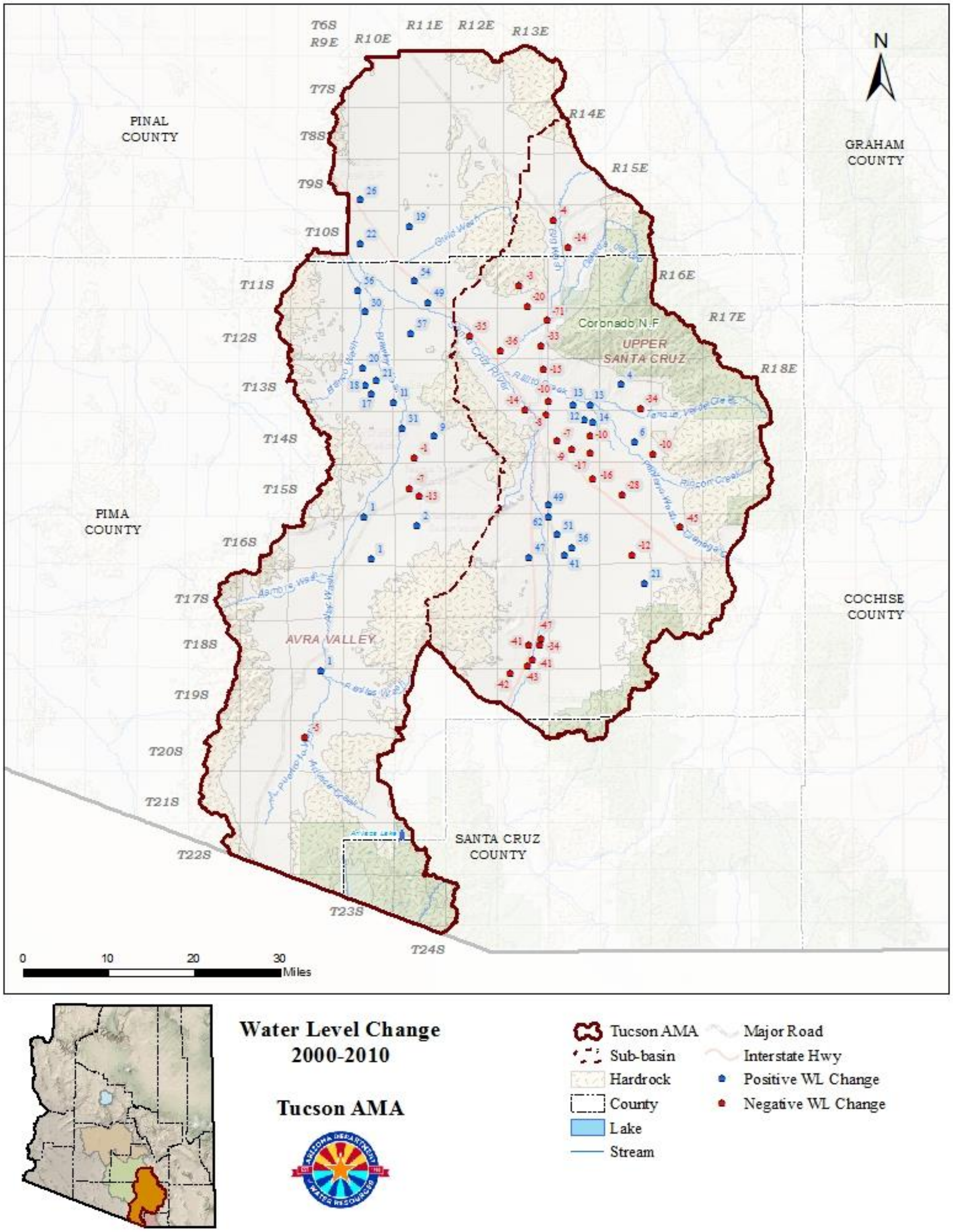
2.6.1 Water Level Trends, 1940-2010

Water level declines from the period 1940 to 2010 have had a large impact on the TAMA regional aquifer. Widespread water level declines of 100 feet to 250 feet have occurred in both the Avra Valley and USC Sub-basins, reducing overall aquifer storage and transmissivity. Water level declines due to the withdrawal of groundwater from storage has resulted in aquifer compaction and associated land subsidence in both sub-basins. Water level declines associated with pumping centers have created large cones of depression, changing the groundwater flow paths. Water level declines have also isolated shallow aquifers in some areas creating perched zones (*Figure 2-8*). *(See Tucson Model Report Appendix E for a map of hydrograph locations and hydrograph figures: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf).*

2.6.2 Upper Santa Cruz Sub-basin

Water levels in many areas of the USC Sub-basin have exhibited a long-term downward trend. Groundwater withdrawals in the north central area of the USC Sub-basin have resulted in water level declines of between 50 and 225 feet since the 1940s, as well as the formation of a large cone of depression in the metropolitan Tucson area. This is an area referred to as the central well field, where a large concentration of high-capacity wells provides water to the City of Tucson. Many of the wells in this area have experienced steep, long-term declines *(See hydrographs USC-7, USC-15, USC-19 and USC-21 in the Tucson Model Report Appendix E for a map of hydrograph locations and hydrograph figures: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf)*. Four of the hydrographs in the modeling report form a line that roughly transects the central well field from northwest to southeast. The hydrographs all show the long-term water level declines of 100 to 200 feet and are typical of water level declines observed in the central well field area. The shift of City of Tucson pumpage from the central well field area to recharge facilities in Avra Valley has resulted in either stabilization of water levels or water level recoveries in the central well field since the year 2000.

FIGURE 2-8
TUCSON AMA WATER LEVEL CHANGES, 2000-2010



Several smaller, localized cones of depression have formed in certain areas, reflecting localized groundwater withdrawals. In the Green Valley-Sahuarita area, located in the southern part of the USC Sub-basin, a cone has formed that parallels the Santa Cruz River, reflecting localized pumping. Water levels in the Green Valley-Sahuarita area declined about 100 to 150 feet between 1940 and the early 1980s. However, water levels in some areas have shown recoveries of 50 to 75 feet from the late 1980s to 2010. The recovery is due in part to reduced groundwater withdrawals, infiltration of flood flows in the Santa Cruz River and artificial recharge at the Pima Mine Road Recharge Facility *(See hydrographs USC-40 through USC-42 and USC-48 through USC-55 in the Tucson Model Report Appendix E: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf)*. Other cones of depression have formed in the north-eastern part of Township 12 South, Range 13 East, and in the eastern section of the USC Sub-basin in the northern part of Township 14 South, Range 15 East *(See hydrographs USC-22, USC-23, and USC-24 in: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf)*. These smaller cones have been created by groundwater pumping needed to meet local demands.

2.6.3 Avra Valley Sub-basin

Water levels in the northern part of the Avra Valley Sub-basin have declined by 150 feet to 200 feet from 1940 to the mid-1970s. Since the mid-1970s, water levels in some areas have stabilized or recovered by 75 to 100 feet *(See hydrographs AV-1 through AV-12 in: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf)*. The water level recovery is due to several factors, which include a large decrease in agricultural pumpage in the northern Avra Valley since the mid-1970s. This decrease was due to a combination of a reduction in irrigated acreage and increased use of renewable supplies. Other factors leading to water level recovery include agricultural recharge that has reached the water table after percolating through the unsaturated zone and recharge from artificial recharge facilities. Well hydrographs in northern Avra Valley all exhibit the U-shape of water level declines from the 1940s to mid-1970s, followed by the water level recovery beginning in the mid-1970s.

The water level declines in central Avra Valley, though less dramatic than in northern Avra Valley, have also stabilized and begun recovering. The recharge and recovery of CAP surface water at artificial recharge projects in central Avra Valley have contributed greatly to the observed water level recoveries from 2000 to 2010 *(See hydrographs AV-13 through AV-18 in: http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf)*. Two groundwater mounds are developing around the recharge facilities located in Township 14 South, Range 11 East, and the mounds are beginning to coalesce. Hydrographs for wells AV-16 and AV-17 in: *http://www.azwater.gov/AzDWR/Hydrology/Modeling/documents/Tucson%20Model%20Report_No_24_AppendixE.pdf* are located immediately adjacent to the major CAP recharge projects and show the impacts of the facilities on local groundwater levels.

2.6.4 2010 Water Level Elevation and Depth to Water Map

The 2010 water level elevation map for the TAMA is shown in Figure 2-9. 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 2010 is shown in Figure 2-10. 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, design and hydrologic interpretation.

FIGURE 2-9
TUCSON AMA WATER LEVEL ELEVATIONS, 2010

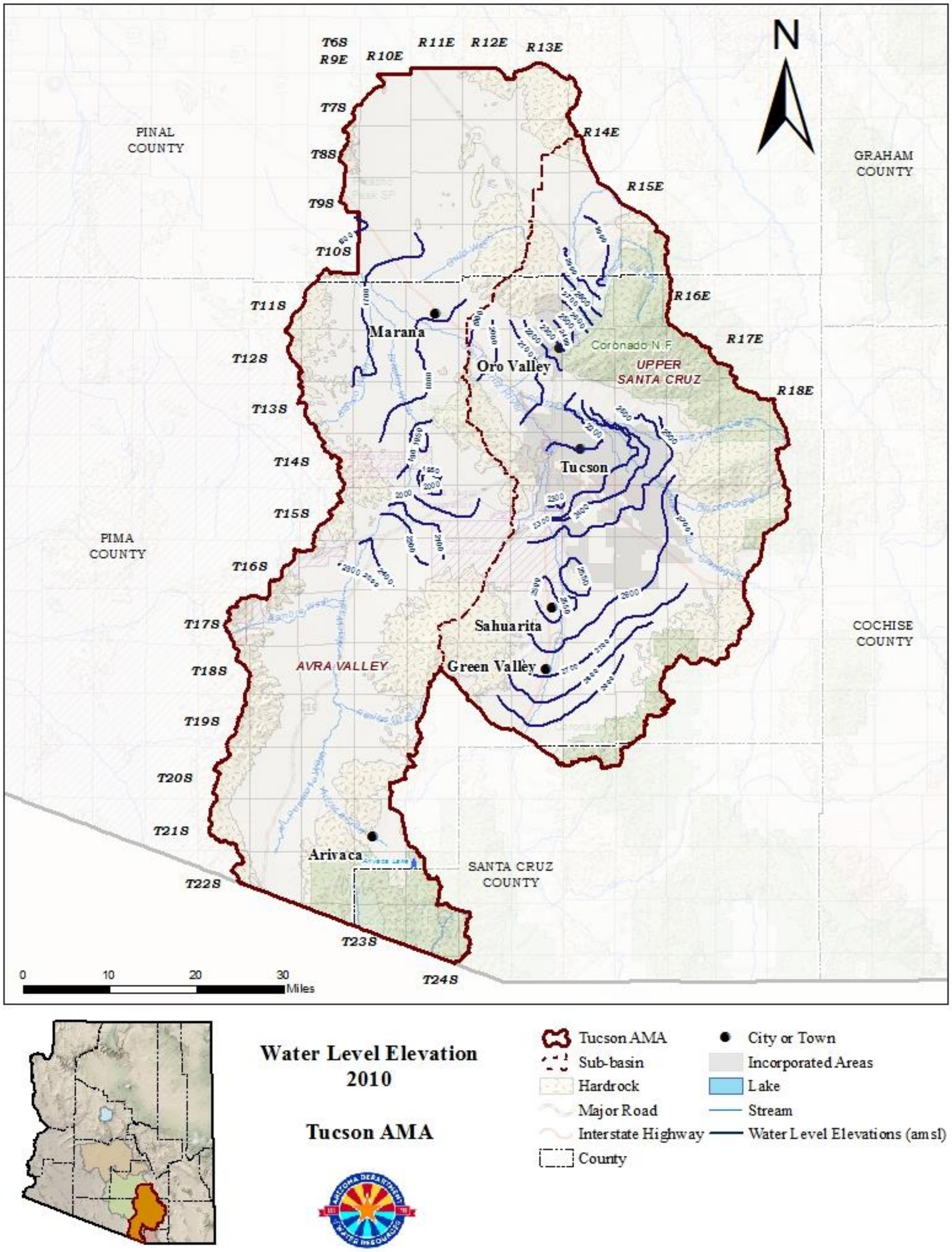
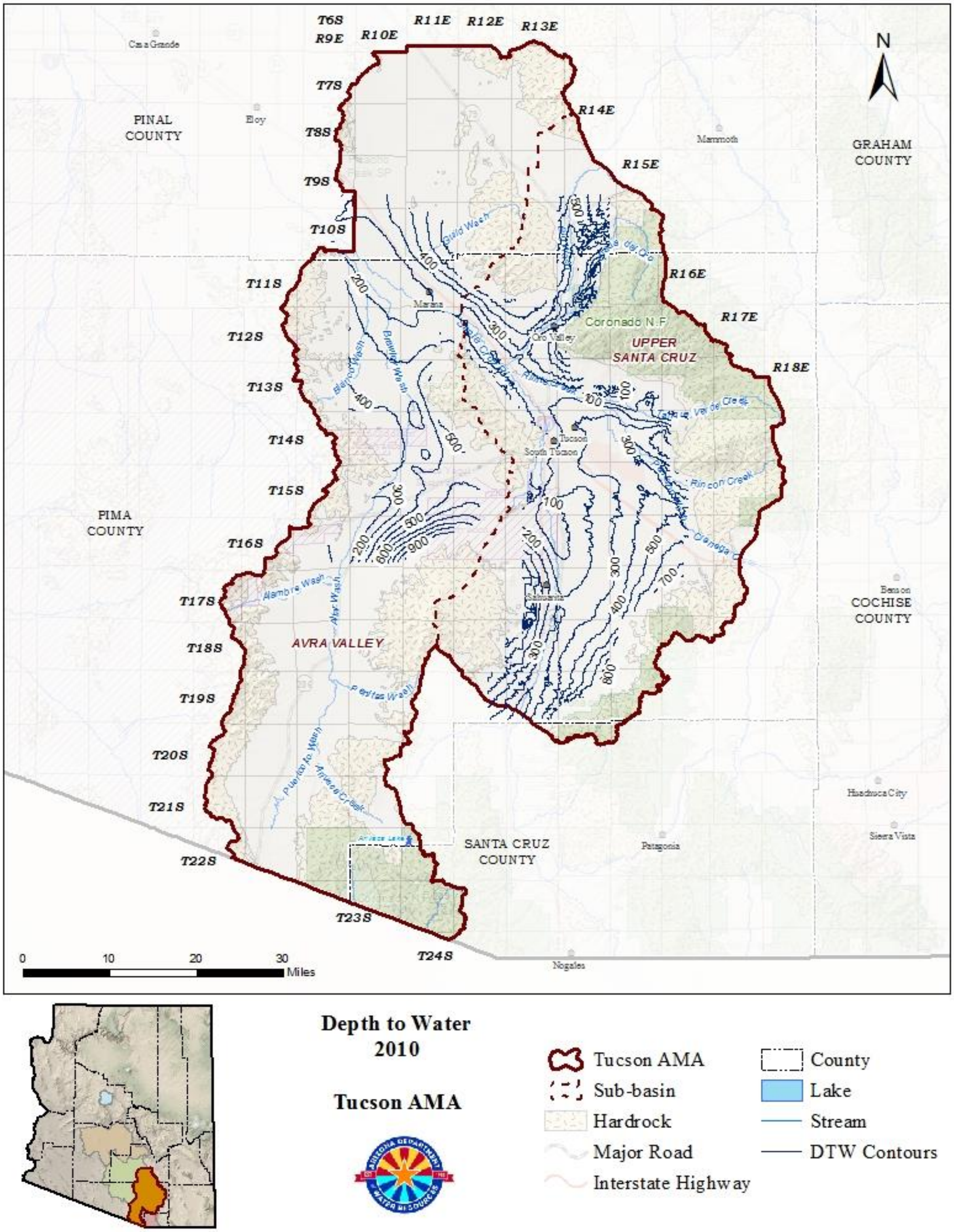


FIGURE 2-10
TUCSON AMA DEPTH TO WATER, 2010



2.6.4.1 Estimated Groundwater-in-storage and Change-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 Tucson groundwater flow model in 2010 is 49.3 million ac-ft (*See Table 2-4)*. The USC Sub-basin groundwater-in-storage is estimated to be 32.9 million ac-ft and the groundwater-in-storage for the Avra Valley portion of the Avra Valley Sub-basin is estimated at 16.3 million ac-ft (Mason & Hipke, 2012).

TABLE 2-4
TUCSON AMA GROUNDWATER IN STORAGE
ESTIMATE FLOW MODEL

Sub- Basin	Groundwater Storage estimated ac-ft
Upper Santa Cruz	32,929,700
Avra Valley	16,330,800
Pinal AMA	787,100
Santa Cruz AMA	282,200
TOTAL	**50,329,800**

Overdrafting of the TAMA regional aquifer since the 1940s and the accompanying water level declines resulted in a long-term loss in the volume of groundwater stored in the regional aquifer. The storage loss in the regional aquifer since 1940 has been estimated to range from 6 to 8 million ac-ft (ADWR, 1999). The Tucson groundwater flow model simulated a storage loss in the model domain from 1940 to 2010 of 6.6 million ac-ft (Mason & Hipke, 2012).

The loss of aquifer storage, or negative change-in-storage, has been reversed in the Avra Valley Sub-basin since 1995. Results of the Tucson groundwater flow model indicate that the aquifer in Avra Valley has recorded a net increase in storage of about 358,000 ac-ft since 1995. The positive change is primarily due to large volumes of CAP surface water applied at recharge facilities in northern and central Avra Valley. The aquifer storage recovery is supported by the observed water level recovery in many wells in the sub-basin. The USC Sub-basin aquifer has recorded a continuous net loss of aquifer storage since 1940. Recharge at the Pima Mine Road Recharge Facility (PMRF) has helped reduce the overall change-in-storage losses since 1995. The net loss of storage in the USC Sub-basin from 1995 to 2010 simulated by the Tucson groundwater flow model is 1.5 million ac-ft (Mason & Hipke, 2012).

2.7 LAND SUBSIDENCE

Land subsidence can occur when groundwater is withdrawn to such a degree that portions of an aquifer become dewatered and, due to the weight of overlying land, this material becomes compacted. This results in a drop in elevation at the land surface and can result in cracks and earth fissures at the land surface.

Land subsidence can cause considerable damage to sewer, water and gas pipelines, canals, wells, roads, buildings and other infrastructure. In addition, when aquifer material compacts several characteristics of the aquifer can change. The pore space available to store water is reduced. This in turn could reduce the ease with which water moves through the aquifer material and the productivity of wells in the area of compaction. If these changes occur, they are generally irreversible.

If land subsides at the same rate over a large area, there is less impact to the land surface and a decreased potential for damage to infrastructure than if adjacent land subsides at different rates. Such “differential subsidence” can occur when subsurface geologic conditions change over distance. This can occur near bedrock, around faults, and in areas where the composition of subsurface sediments changes abruptly. In the TAMA, there is some evidence of aquifer compaction and associated land subsidence attributed to aquifer dewatering. Fissuring, aquifer compaction, and subsidence have been observed in northern Avra Valley. In 1988, an earth fissure in Avra Valley damaged the CAP aqueduct, costing about $50,000 in repairs (Slaff, 1993). Sink holes have been reported near the Santa Cruz River within the San Xavier District (Hoffman, Pool, Konieczki, & Carpenter, 1997). These sinkholes are not directly related to regional subsidence but may be related to localized water level declines.

TABLE 2-5
TUCSON AMA LAND SUBSIDENCE, 1980-2009
(based on USGS Vertical Extensometer data)

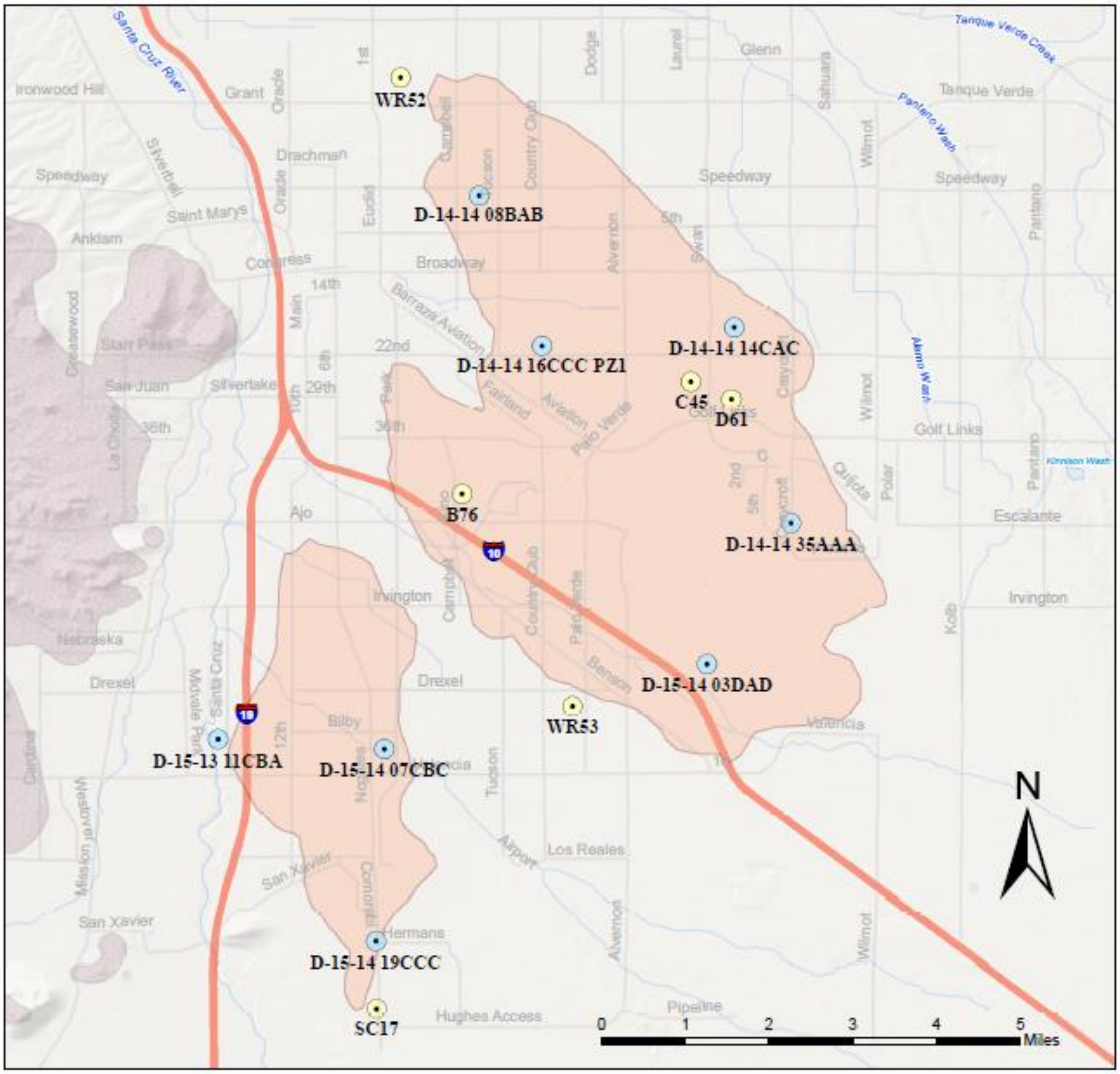
	USGS Vertical Extensometer	Total Compaction (ft)	Compaction Rate (ft/year)
06/1980 - 09/2011	B76	0.51	0.016
12/1979 - 09/2011	C45	0.465	0.015
01/1981 - 09/2011	D61	0.324	0.011
12/1979 - 12/2009	SC17	0.202	0.007
09/1982 - 09/2011	WR52	0.238	0.008
11/1983 - 07/2009	WR53	0.072	0.003

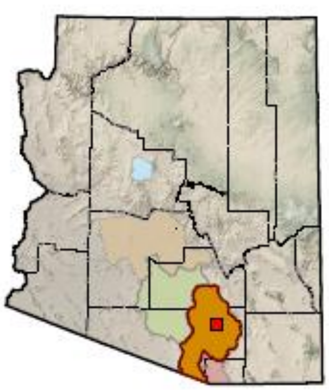
Aquifer compaction and associated land subsidence of nearly 0.5 feet had occurred south of Davis-Monthan Air Force Base from the 1940s to 1980 (Anderson, 1988) *(See Table 2-5).* Subsidence monitoring has been conducted since the early 1980s by the City of Tucson (Tucson Water) and the USGS using extensometers to measure aquifer compaction *(See Figure 2-11*). In the northern Avra Valley Sub-basin, subsidence has been measured at 1.1 feet (Anderson, 1989). Measurement of compaction at specific locations in the time period between 1980 and 1995 were reported in the Tucson Water Annual Static Water Level Report for 1995 (Tucson Water, 1997). Results indicated compaction of from 0.02 feet to 0.18 feet at seven locations in the USC Sub-basin and from 0.01 feet to 0.11 feet at seven locations in the Avra Valley Sub-basin. City of Tucson elevation survey data in the Tucson central well-field area from the early/mid 1990s to 2011 indicate subsidence as much as 0.9 feet *(See Figure 2-12*).

Based on the maximum subsidence potential projected in earlier USGS modeling studies (Hanson & Benedict, 1994), it appears the depth of land subsidence could vary from 2 feet to 10 feet in the vicinity of downtown Tucson by 2025 and from 2 feet to 14 feet in the central area of Avra Valley by 2025 (Hanson, Anderson, & Pool, 1990). The USGS land subsidence modeling studies used a one-dimensional model and a limited dataset. The USGS has since compiled an extensive dataset on groundwater change, aquifer storage change and land subsidence which should greatly improve any future land subsidence modeling/estimation projects for the TAMA. However, historical and current land subsidence data for the TAMA indicate the smaller USGS land subsidence estimates for the Avra Valley and downtown Tucson areas are more likely, especially considering the recent water level rises or stabilization measured in those areas.

Recent ADWR land subsidence monitoring and land subsidence maps are published annually on ADWR's website, *http://www.azwater.gov/AzDWR/Hydrology/Geophysics/LandSubsidenceInArizona.htm*. These maps provide further evidence of land subsidence in the TAMA, particularly in two areas in and near the Tucson central well-field area, which correlates to features identified by the USGS and Tucson Water; and a third area within the Town of Sahuarita. Land subsidence in the Avra Valley area no longer appears to be active.

FIGURE 2-11
METROPOLITAN TUCSON USGS EXTENSOMETERS AND GROUNDWATER MONITORING WELLS IN





Vertical Extensometers and Groundwater Wells Used for Monitoring Groundwater and Land Subsidence Conditions in the Tucson Active Management Area Around Active Land Subsidence Areas

Tucson AMA

- Hardrock
- GWSI Wells
- USGS Extensometers
- Land Subsidence Areas (Identified Using ADWR InSAR)
- Major Road
- Interstate Highway

FIGURE 2-12
CITY OF TUCSON ELEVATION SURVEY DATA

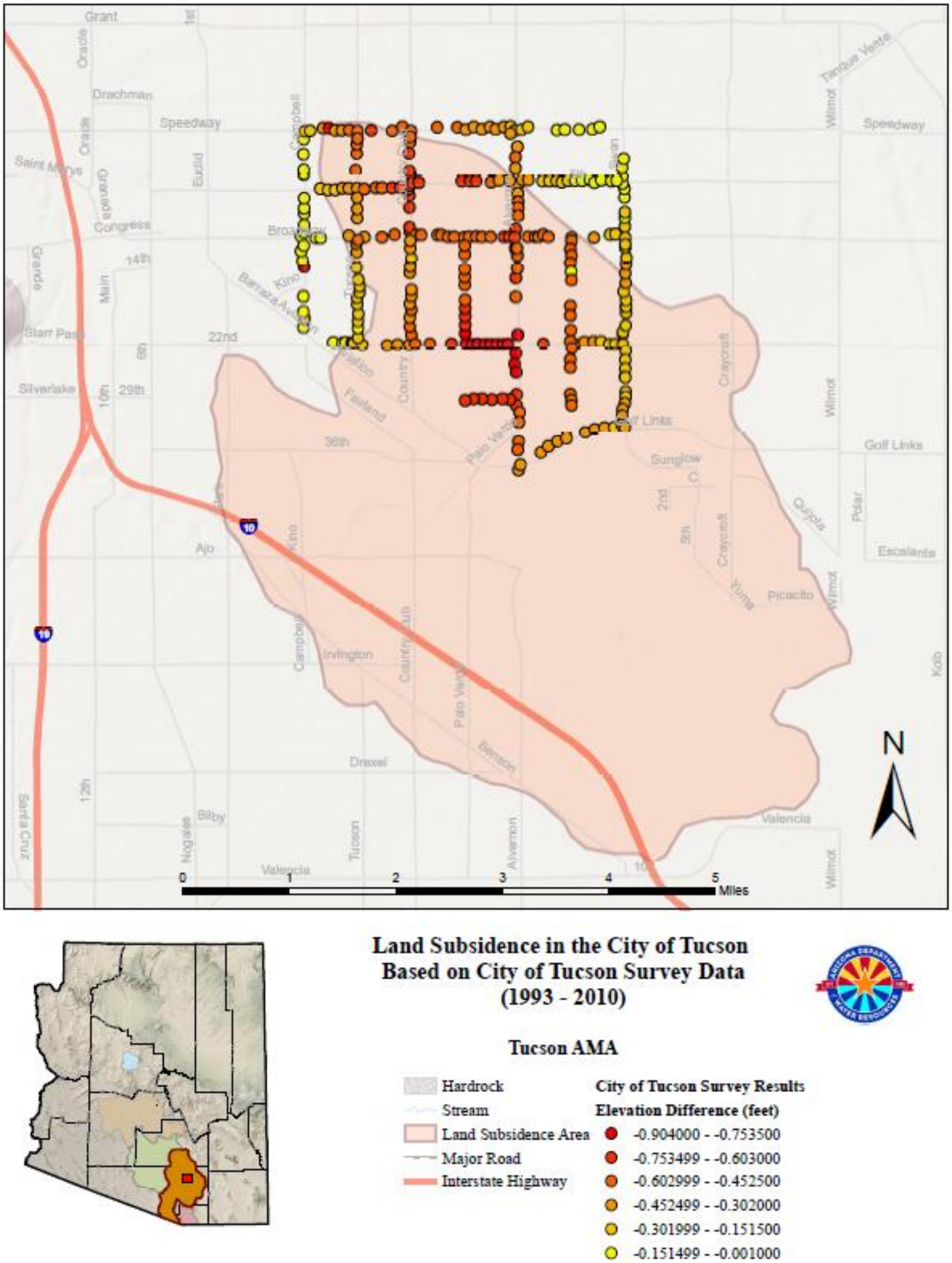
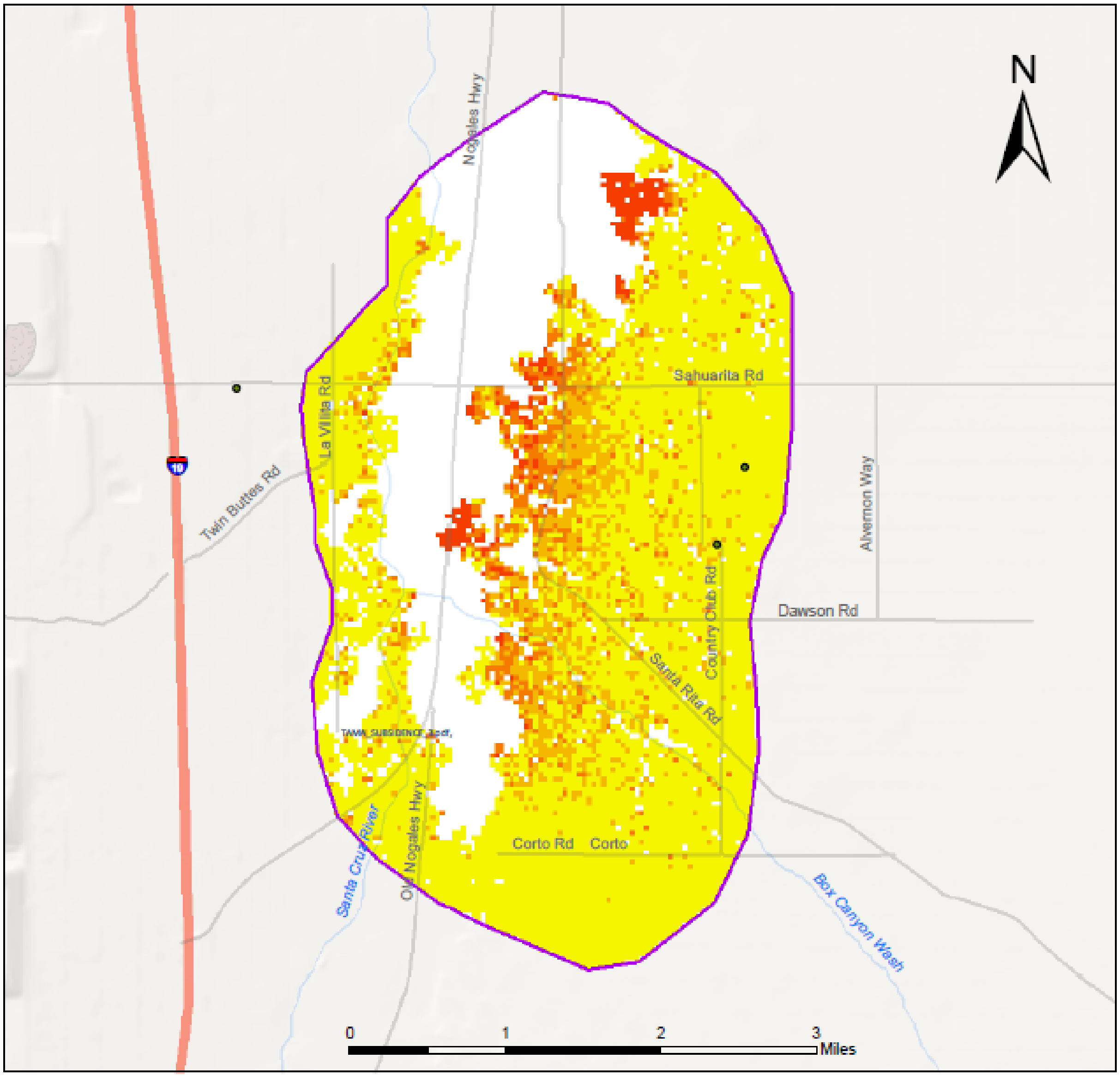
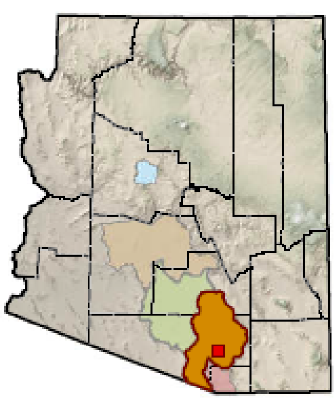


FIGURE 2-13
SAHUARITA AREA LAND SUBSIDENCE, FEB 2012 – APR 2013





Land Subsidence in Sahuarita and Green Valley
Based on ADWR Radarsat-2 InSAR Data
(02/22/2012 - 04/29/2013)

Tucson AMA

Decorrelation (white areas) are areas where the phase of the received satellite signal changed betrween passes causing the data to be unusable. This occurs in areas where the land surface has been distrubed (i.e. bodies of water, snow, agriculture areas, areas of development, etc).

Note! Colors assigned representing differing amounts of subsidence apply to this map only. Color codes may vary for other maps.

Subsidence Feature
Hardrock
Major Road
Interstate Highway
Decorrelation/No Data
2.0 To 4.0 cm
1.0 To 2.0 cm
0.5 To 1.0 cm
0 To 0.5 cm

ADWR has been monitoring land subsidence in the majority of the TAMA using a satellite-based remote-sensing system since 2005, collecting, processing and analyzing Interferometric Synthetic Aperture Radar (InSAR) data *(See Table 2-6*). Three separate land subsidence features have been detected in the TAMA using InSAR data. Two land subsidence features are located in the Tucson metropolitan area; the first feature is centered near Tucson's central well field near Alvernon Way and Golf Links Rd and the second is centered near Nogales Hwy. and Valencia Rd. The third feature is located in the Town of Sahuarita and is centered near Sahuarita Rd. and Old Nogales Hwy. The feature located in Sahuarita, referred to as the Green Valley Land Subsidence Feature by ADWR, is dominated by an elastic aquifer system and has seasonal deformation (uplift and subsidence). There had been times historically when the seasonal deformation was in equilibrium, resulting in no land subsidence (March 2008 to February 2009; and January 2010 to April 2011); and times when the subsidence was greater than the uplift *(See Figure 2-13*), resulting in land subsidence (February 2007 to March 2008, September 2010 to January 2010, and April 2011 to May 2012).

ADWR has processed archived and regularly scheduled InSAR data for the periods November 1993 to September 2000; February 2003 to January 2010; and May 2010 to April 2012 for the TAMA. The rate of land subsidence has decreased at the two Tucson metropolitan areas described above when comparing these sets of InSAR results *(See Figures 2-14 through 2-16).* Total compaction and subsidence rates for the three land subsidence areas are listed in Table 2-6.

TABLE 2-6
TUCSON AMA LAND SUBSIDENCE
(based on ADWR INSAR data)

	Valencia Feature Subsidence (ft)	Highest Rate-Valencia (ft/year)	Central Well Field Feature Subsidence (ft)	Highest Rate-Central Well (ft/year)	Green Valley Feature Subsidence (ft)	Highest Rate-Green Valley (ft/year)
11/1993 - 09/2000	0.79	0.11	0.43	0.06	ND	ND
02/2003 - 01/2010	0.33	0.05	0.26	0.04	ND	ND
05/2010 - 04/2012	0.02	0.01	0.06	0.03	ND	ND
04/2011 - 05/2012	ND	ND	ND	ND	0.13	0.12
Total Subsidence	**1.14**	**ND**	**0.74**	**ND**	**0.13**	**ND**

NOTE: ND means no measurement was recorded for that area.

Groundwater levels have been slowly rising in the areas around the Tucson well field and the Valencia land subsidence features since the early 2000s. (*See Figure 2-17(A-H) for hydrographs and Figure 2-18 for a map showing the location of the hydrograph wells.*) The groundwater level increase is most likely the cause for the decrease in land subsidence rates in the Tucson metropolitan area when comparing ADWR InSAR results. A number of groundwater monitoring wells *(See Table 2-7)* are measured annually, providing ADWR with accurate groundwater level change data that is analyzed with current and historical land subsidence data. Residual land subsidence may continue to occur even with the continued recovery of groundwater levels. Land subsidence will only ease and cease once the groundwater system reaches equilibrium. Even though groundwater levels may recover to previously high levels after land subsidence occurs, because the aquifer material has been compacted, the space available for groundwater storage is reduced so less groundwater is available for pumping. Also, once land subsidence has occurred, the addition of water to the subsurface cannot return the land to its full original elevation (Slaff, 1993).

TABLE 2-7
TUCSON AMA, TUCSON METRO AREA
GROUNDWATER MONITORING WELLS NEAR LAND SUBSIDENCE

Groundwater Monitoring Well	01/1994 - 02/2011 Water level Change (ft)	12/1993 - 01/2012 Water level Change (ft)	02/1994 - 12/2009 Water level Change (ft)
B-14-14 08BAB	-14		
B-14-14 16CCC PZ1		-19.5	
B-14-14 35AAA		-26.5	
B-14-14 14CAC			-26.5
B-15-14 03DAD		-6	
B-15-14 07CBC	15.2		
B-15-14 19CCC	18.3		
B-15-13 11CBA	-22.8		

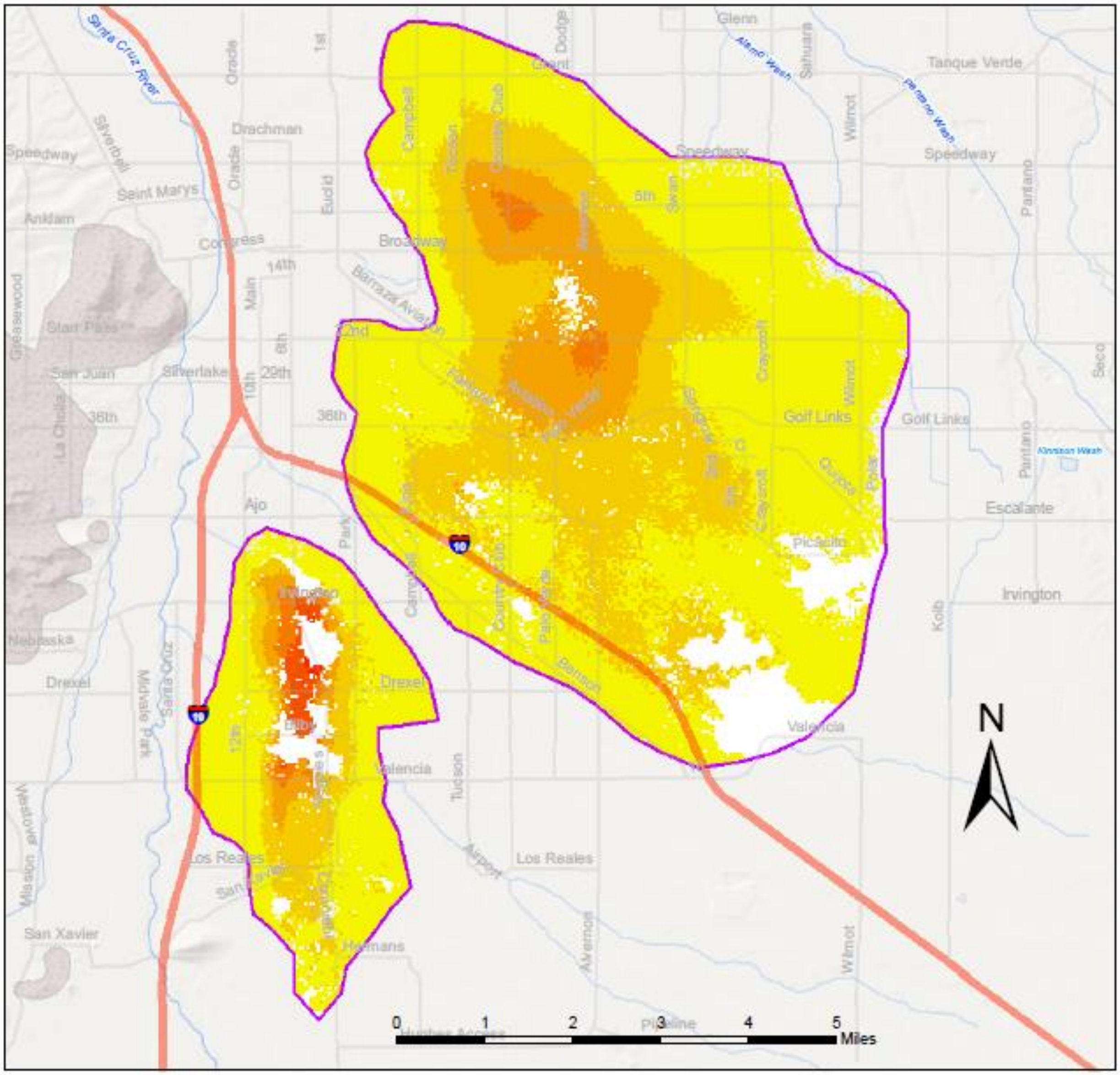
Note: A positive value represents rising water levels and a negative value represents dropping water levels)

Continued lowering of groundwater levels could result in additional land subsidence. Because there is potential for significant damage due to land subsidence in the TAMA, mitigation of groundwater overdraft in subsidence-prone areas continues to be a groundwater management issue for the TAMA. ADWR will continue to monitor land subsidence in the TAMA using regularly scheduled InSAR data collection and analysis.

2.8 GROUNDWATER QUALITY LIMITATIONS ON SUPPLY

Most groundwater supplies in the TAMA 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 it is unusable for many purposes without treatment. The extent and type of contamination varies by location and land use activities. Contaminated groundwater in the TAMA has generally been caused by human activity. Volatile organic compounds (VOCs) are a predominant contaminant in the TAMA and limit the direct use of some groundwater. Remedial processes are used to treat VOC contaminated water to drinking water quality standards, making this water available for either current or future direct potable use. Water supplies contaminated with other constituents must also be properly treated prior to use for drinking water supplies. Beneficial end uses of lower quality water can be identified but are only likely to take place if they are economically feasible. For more information on water quality in the TAMA, see Chapter 7 of this plan.

FIGURE 2-14
TUCSON METROPOLITAN AREA LAND SUBSIDENCE, NOV 1993 – SEPT 2000



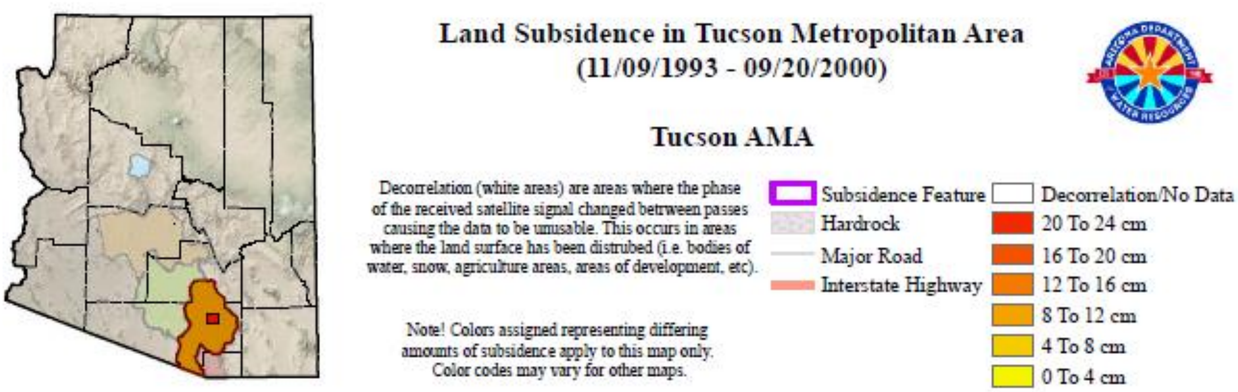


FIGURE 2-15
TUCSON METROPOLITAN AREA LAND SUBSIDENCE, FEB 2003 – JAN 2010

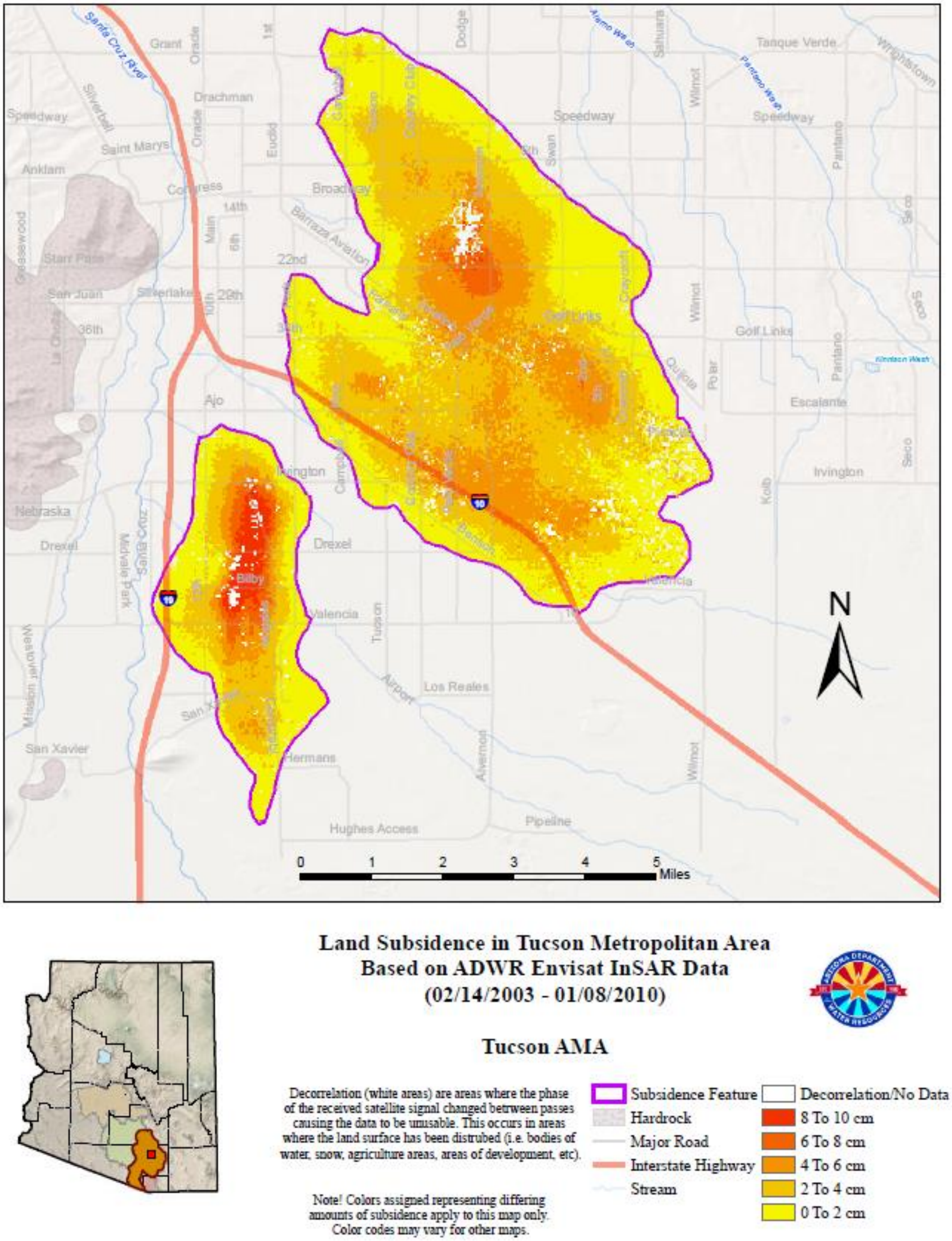


FIGURE 2-16
TUCSON METROPOLITAN AREA LAND SUBSIDENCE, MAY 2010 – APR 2012

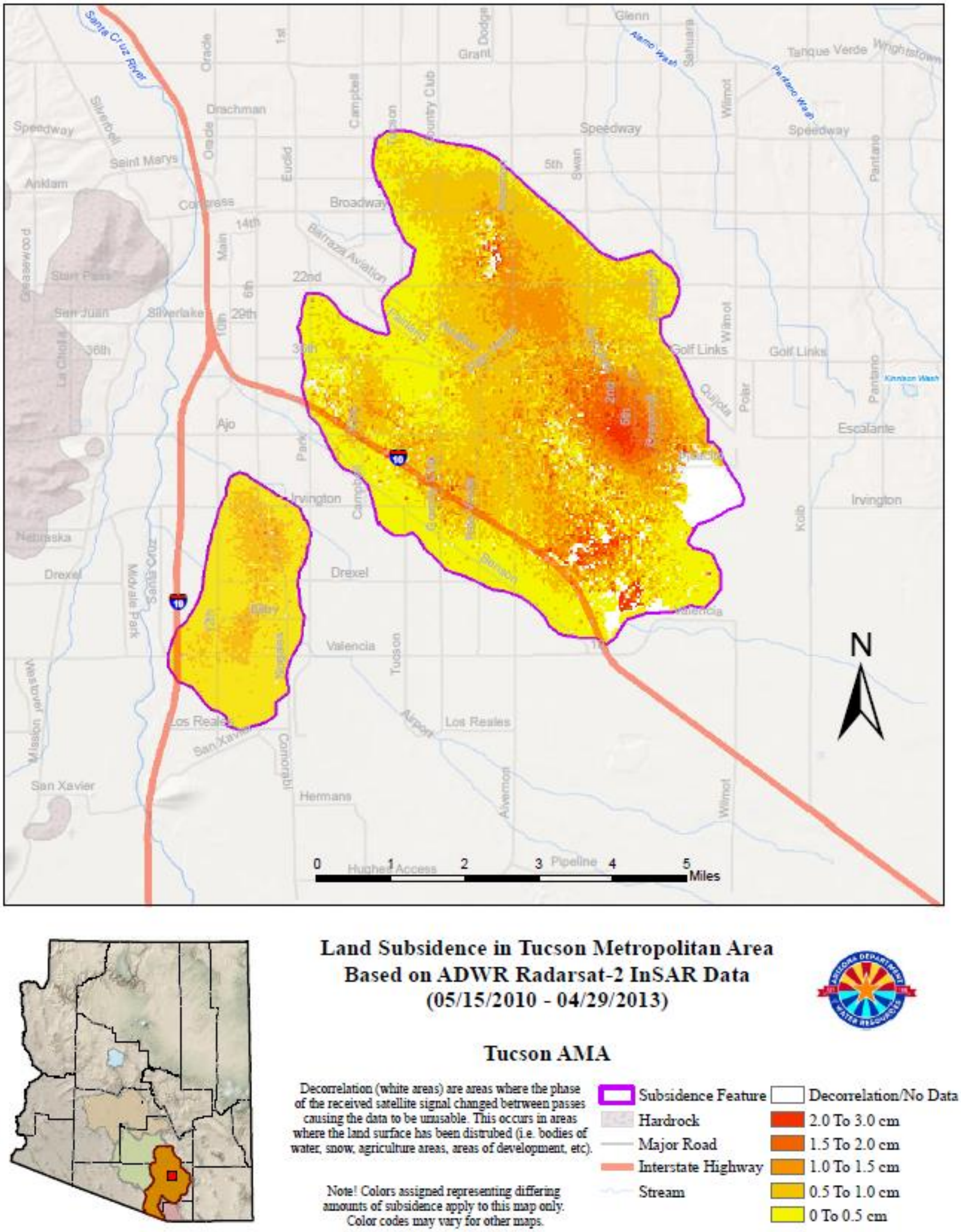


FIGURE 2-17 (A)
HYDROGRAPH FOR GW MONITORING Well 55-620173 D-14-14-08-BAB
in TUCSON AMA

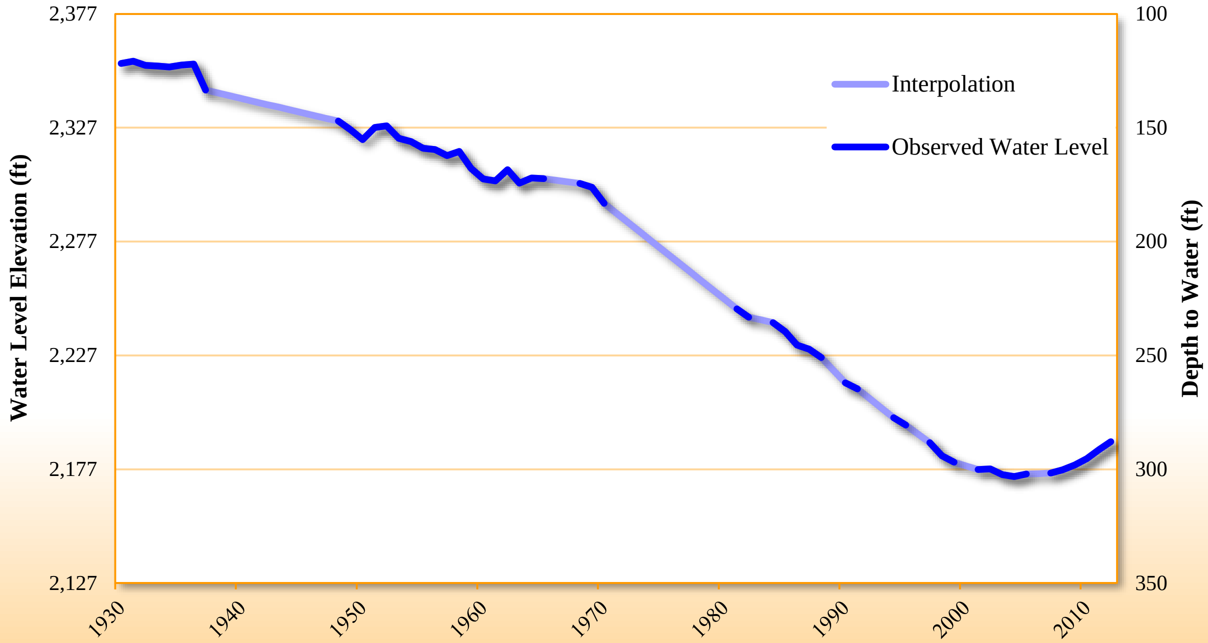


FIGURE 2-17 (B)
HYDROGRAPH FOR GW MONITORING Well D-14-14-16-CCC PZ1-2
in TUCSON AMA

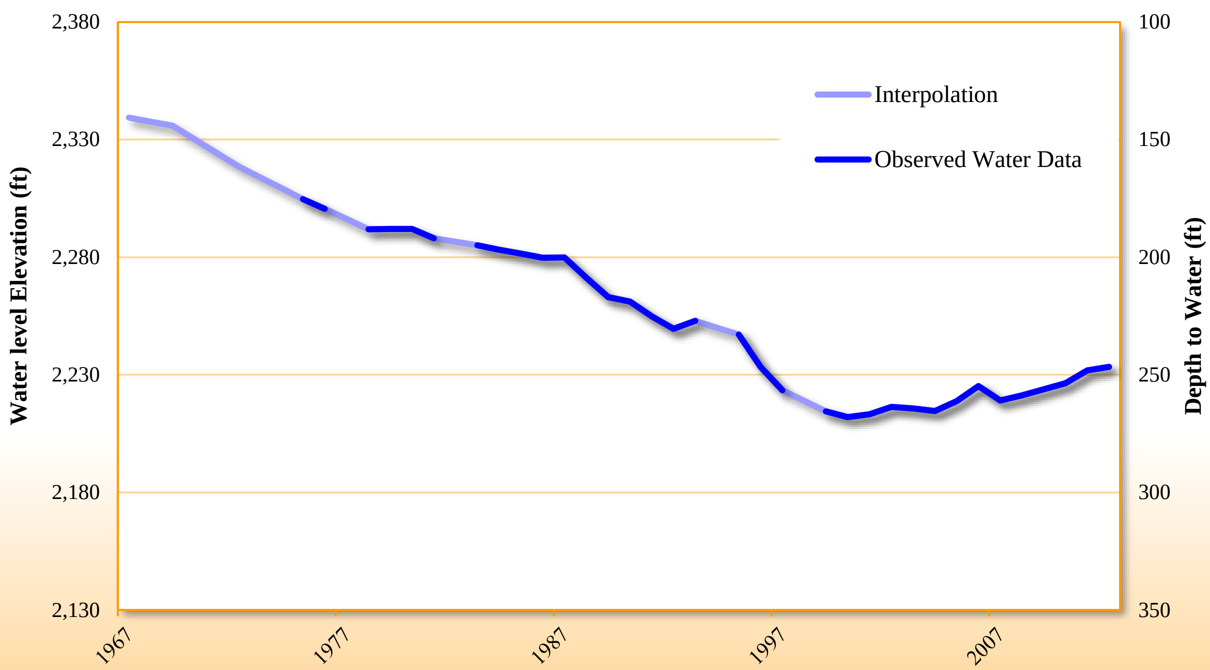


FIGURE 2-17 (C)
HYDROGRAPH FOR GW MONITORING Well 55-620042 D-14-14-14-CAC in TUCSON AMA

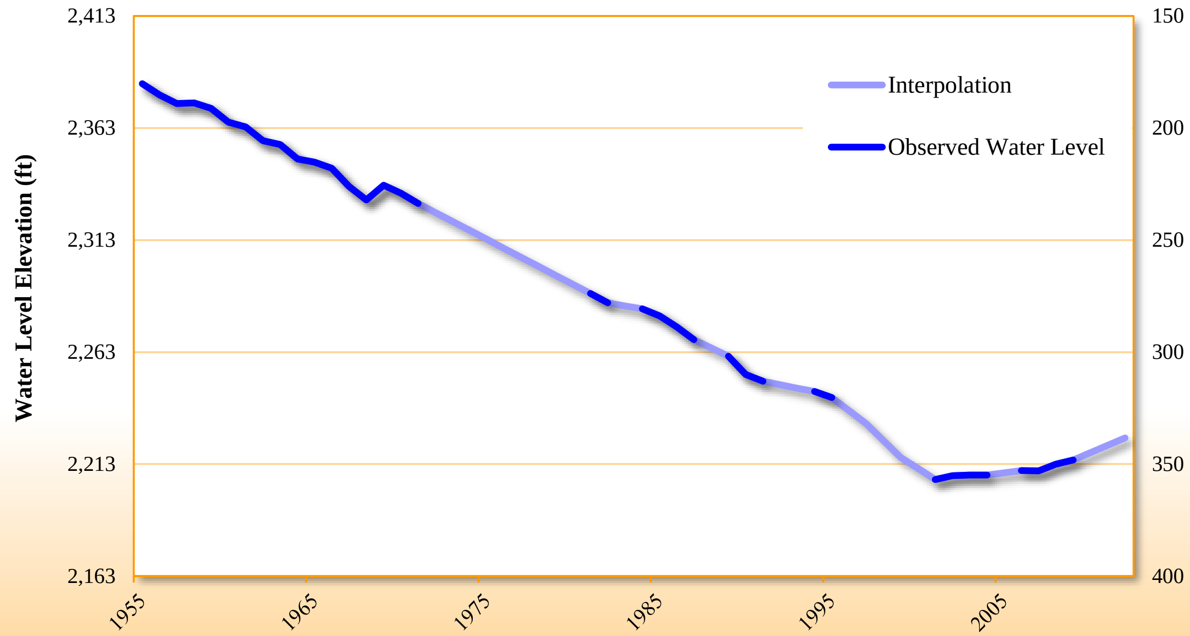


FIGURE 2-17 (D)
HYDROGRAPH FOR GW MONITORING Well 55-621581 D-14-14-35-AAA in TUCSON AMA

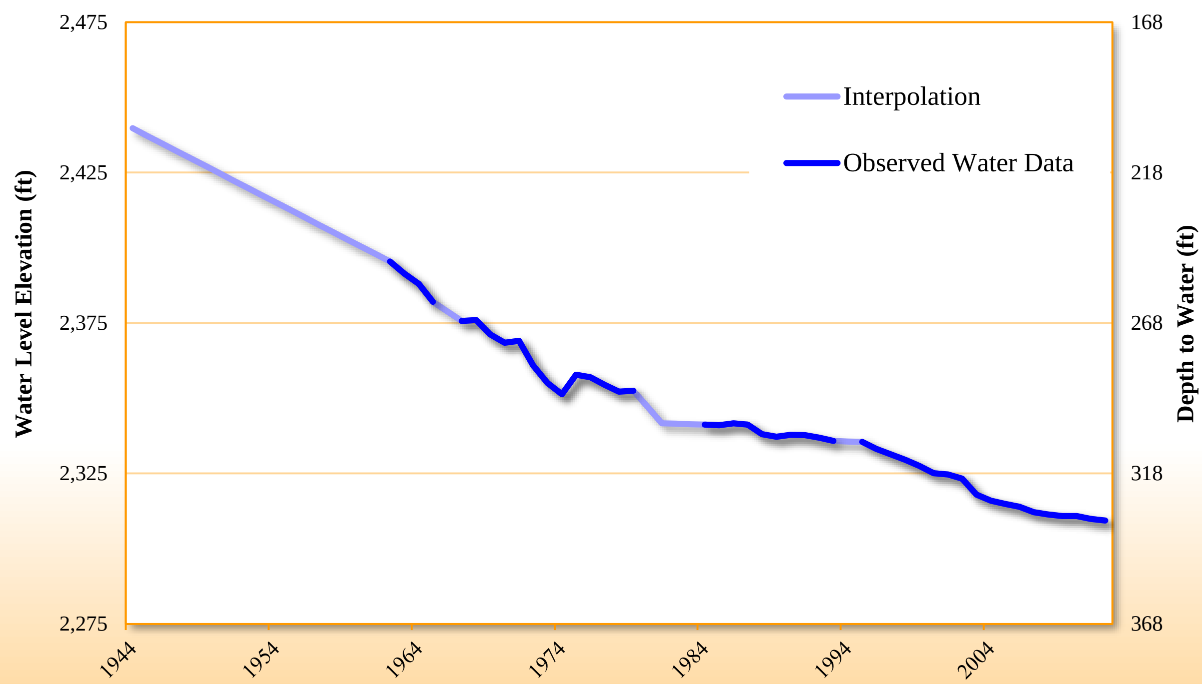


FIGURE 2-17 (E)
HYDROGRAPH FOR GW MONITORING Well 55-611361
D-15-14-03-DAD in TUCSON AMA

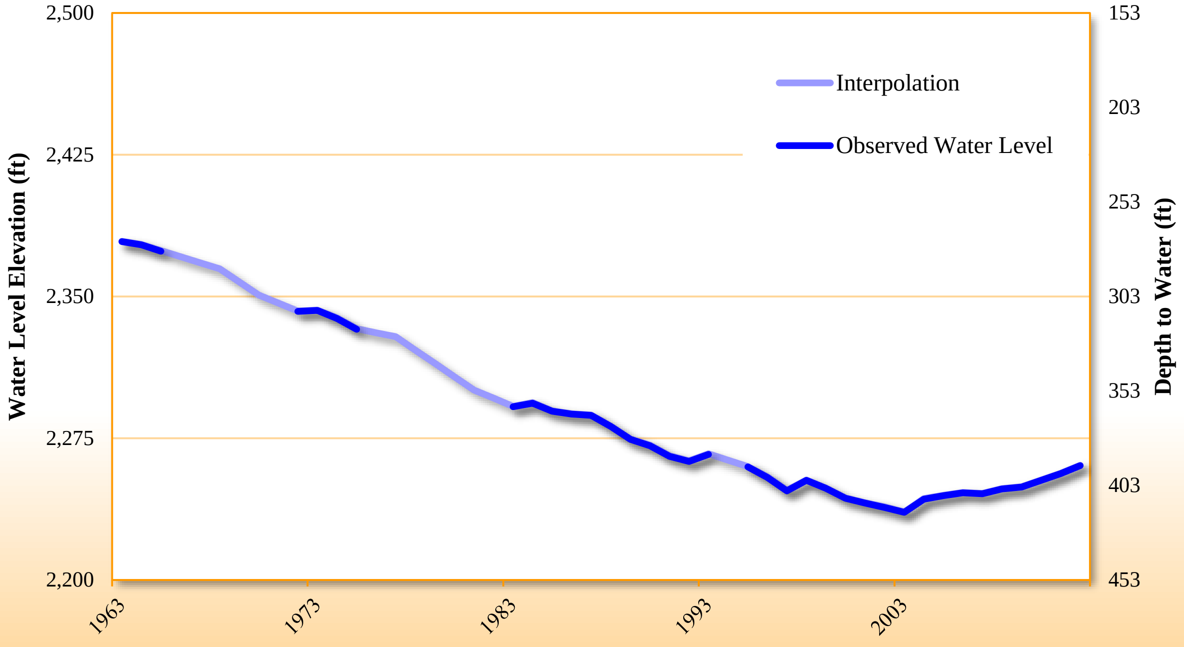


FIGURE 2-17 (F)
HYDROGRAPH FOR GW MONITORING Well 55-620003
D-15-14-07-CBC in TUCSON AMA

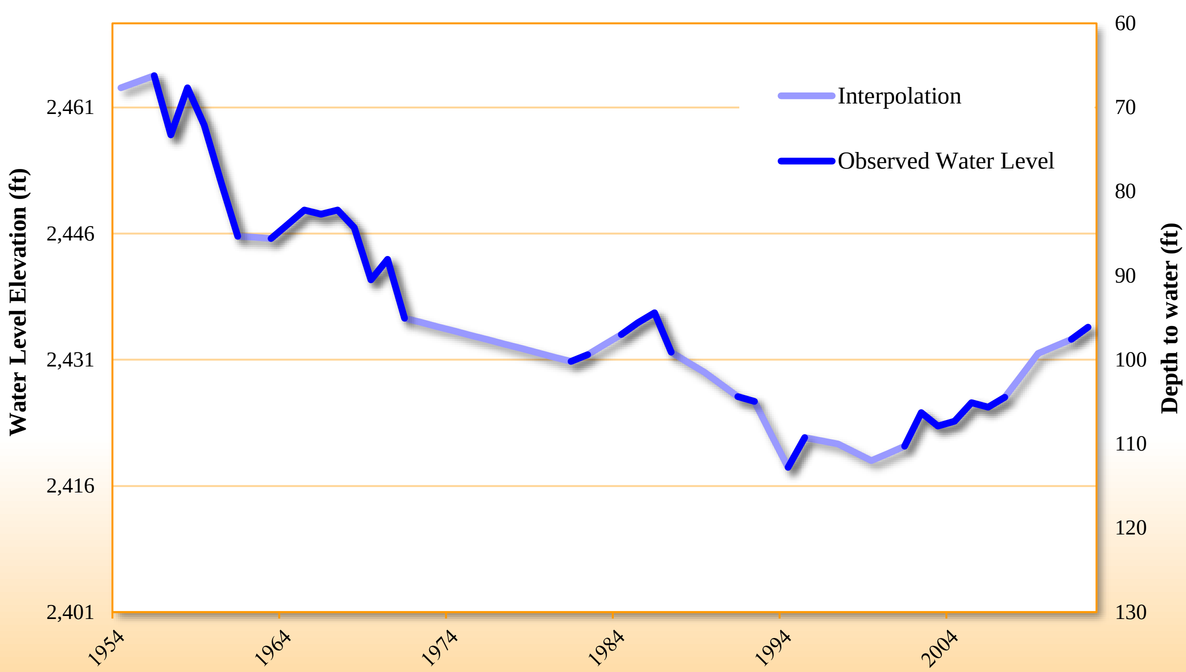


FIGURE 2-17 (G)
HYDROGRAPH FOR GW MONITORING Well 55-619881 D-15-14-19-CCC in TUCSON AMA

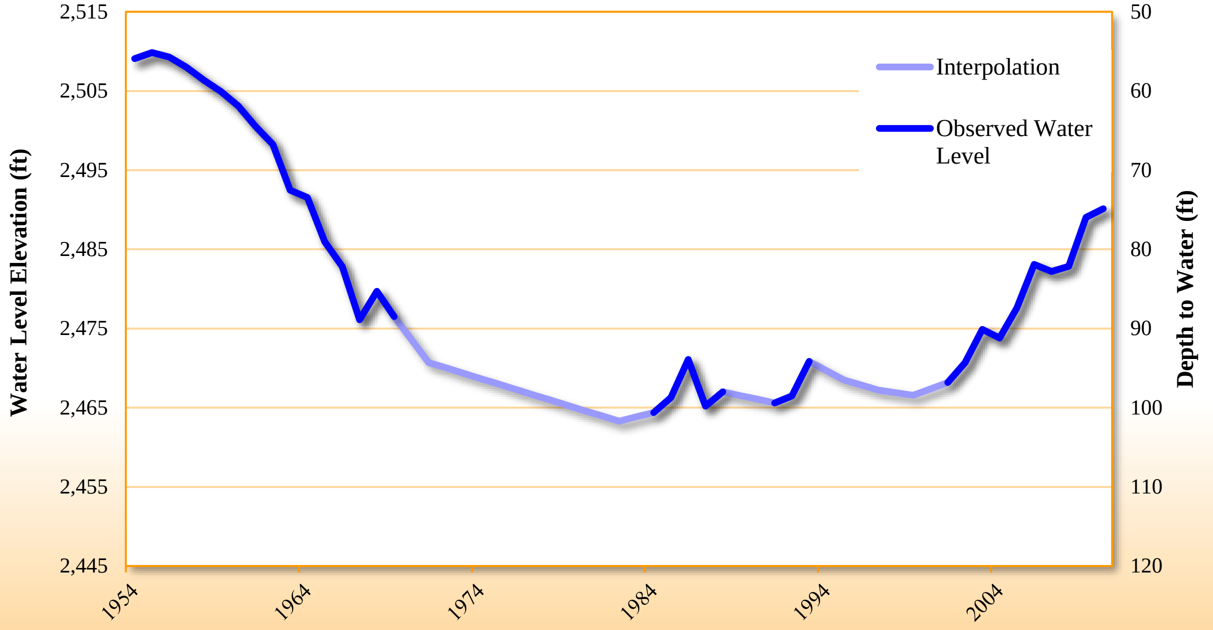


FIGURE 2-17 (H)
HYDROGRAPH FOR GW MONITORING Well 55-619918 D-15-13-11-CBA in TUCSON AMA

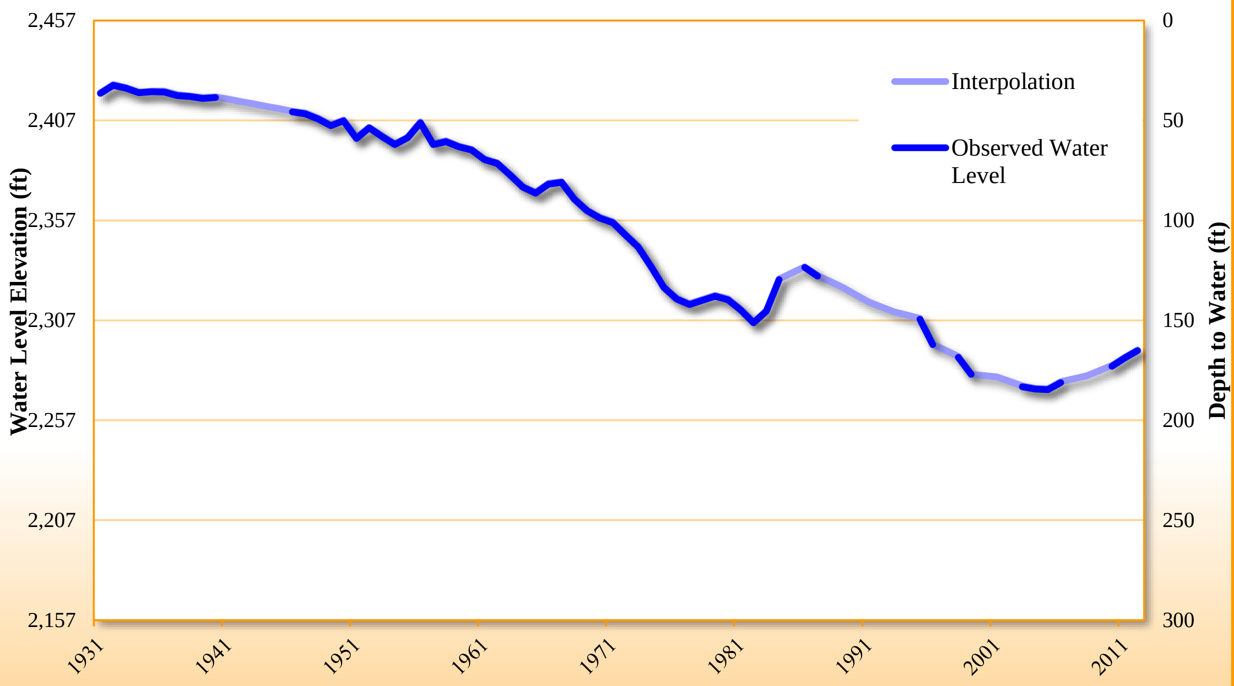
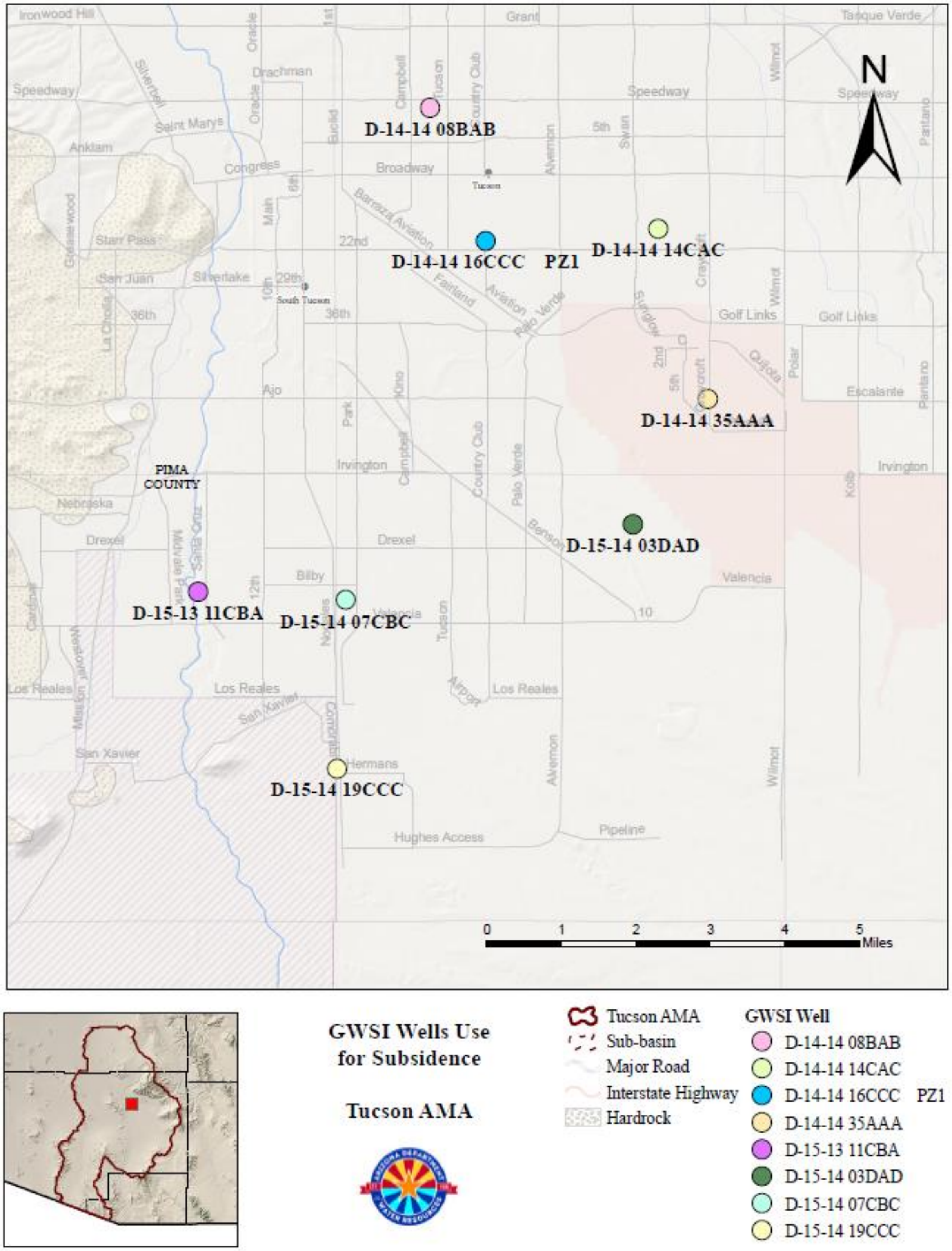


FIGURE 2-18
LOCATION OF HYDROGRAPHS, FIGURES 2-17 (A-H)



2.9 AVAILABLITY AND UTILIZATION OF RENEWABLE SUPPLIES

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

2.9.1 Reclaimed Water

In 2013, the total reclaimed water production for all wastewater treatment plants in the TAMA was 67,320 ac-ft (Pima County Regional Wastewater Reclamation Department, 2013). The majority of this reclaimed water was treated by Pima County Wastewater Management at two regional treatment plants located along the Santa Cruz River at Tres Rios WRF (Ina Road) and Agua Nueva WRF (Roger Road). Smaller amounts of reclaimed water were treated at a number of smaller capacity sub-regional plants. The majority of the reclaimed water is discharged into the Santa Cruz River where it infiltrates into the regional aquifer as a component of streambed recharge. Discharge to the river averaged 52,240 ac-ft per year between 2000 and 2013. Some of the reclaimed water generated at the regional plants is diverted into the Tucson Water's reclaimed water system for delivery to turf facilities throughout the Tucson metro area. Deliveries to the reclaimed water system from 2000 to 2013 averaged 13,150 ac-ft per year. A small portion of the reclaimed water is recharged at constructed underground storage facility sites or at on-site seepage basins at the sub-regional treatment facilities. For additional information on the volumes of reclaimed water stored and recovered in the TAMA, please see Chapter 8 of this plan. In the future, the reuse and recharge of reclaimed water would reduce the need to pump groundwater and help to minimize water level declines.

2.9.2 CAP Surface Water

CAP surface water is the most abundant renewable water supply in the TAMA. CAP allocations available to the TAMA total more than 260,000 ac-ft. The City of Tucson holds the highest share of the allocated water with 144,172 ac-ft. See Chapter 8 of this plan for a listing of CAP allocations in the TAMA and a map of the locations of the recharge facilities. Table 2-8 lists the Underground Storage Facilities (USFs) in the TAMA. The majority of the CAP water is delivered to underground storage facilities in the Avra Valley Sub-basin where the water is recharged to the regional aquifer. Six permitted recharge facilities are located in the USC Sub-basin; however, only the Pima Mine Road facility may store CAP water in this sub-basin. Between 2000 and 2013, approximately 1.9 million ac-ft of CAP water was recharged at permitted underground storage facilities in the TAMA.

TABLE 2-8
TUCSON AMA UNDERGROUND STORAGE FACILTIES

USF Permit Number	USF Permittee	USF Name	USF Type	Type of Water Recharged
71-564896	Metro Water District	Avra Valley Airport USF	Constructed	CAP
71-578806	Tucson Water	Central Avra Valley Storage & Recovery Project	Constructed	CAP
71-211284	Pima County RWRD	Corona De Tucson	Constructed	Reclaimed
71-591928	Tucson Water, Marana, CMID, AVIDD, Pima County, et al	Lower Santa Cruz Managed	Managed	Reclaimed
71-561366	Pima County FCD CAWCD	LSCRP-Constructed	Constructed	CAP
71-563876	Pima County FCD Town of Marana	Marana High Plains	Constructed	Surface & Reclaimed
71-577501	CAWCD	Pima Mine Rd	Constructed	CAP

USF Permit Number	USF Permittee	USF Name	USF Type	Type of Water Recharged
71-581379	Robson Ranch Quail Creek	Quail Creek-Robson Ranch	Constructed	Reclaimed
71-595209	Town of Sahuarita	Sahuarita WWTP	Constructed	Reclaimed
71-520083	Tucson Water	Santa Cruz-Sweetwater	Constructed	Reclaimed
71-211276	Tucson Water	Southern Avra Valley Storage & Recovery Project	Constructed	CAP
71-545944	Tucson Water	Santa Cruz River Managed	Managed	Reclaimed
71-221721	Saddlebrooke Utility Company	Saddlebrooke Water Reclamation Plan	Constructed	Reclaimed
71-222410	JPAR LLC	Project Renews	Constructed	CAP

In addition to its use at recharge facilities, some CAP water is used directly by the agricultural and industrial sectors. Agricultural use includes water that is provided to farms participating in ADWR's Groundwater Savings Facility (GSF) Program. At GSFs, CAP water is used in lieu of groundwater and the water storer receives credit for the groundwater "saved," which can then be used by the water storer in the future. From 2000 to 2013, CAP water use at GSFs has averaged more than 20,000 ac-ft. per year. CAP surface water is also supplied to the San Xavier District of the Tohono O'odham Nation for agricultural purposes. The total CAP water supplied to the Nation for agricultural purposes from 2000 to 2013 was approximately 203,300 ac-ft.

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CHAPTER THREE: WATER DEMAND AND SUPPLY

3.1 INTRODUCTION

The Arizona Department of Water Resources (ADWR) conducted the *Demand and Supply Assessment 1985-2025, Tucson 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 Tucson Active Management Area* (4MP). Chapter 3 of the 4MP updates the data included in the Assessment and analyzes and identifies the implications of that data.

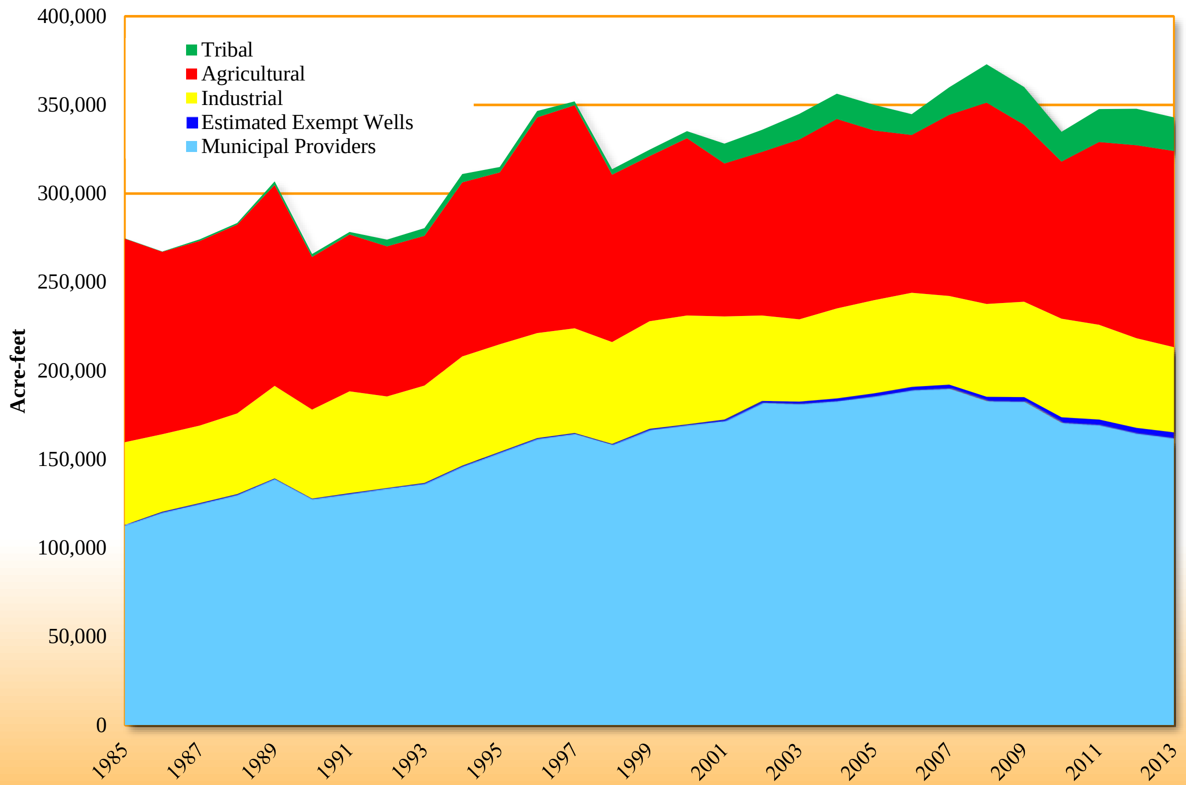
Until Central Arizona Project (CAP) water became available in the mid-1990s, water users in the Tucson AMA (TAMA) relied almost exclusively on groundwater. A small volume of reclaimed water was used in the municipal and agricultural sectors and a very small volume of surface water was used in the industrial sector. Underground storage and recovery began in 1993. For a detailed overview of the geography, hydrology, climate and environmental conditions in the TAMA, 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)*.

The proportion of water demand among the sectors shifted between 1985 and 2013. Demand from the municipal sector, comprised of large and small municipal water providers, increased from 41 percent of the total TAMA demand in 1985 to 47 percent in 2013. Due primarily to the fluctuation in commodity prices associated with mining operations, industrial sector demand fluctuated between approximately 15 and 20 percent of the total TAMA demand. Agricultural sector demand declined from 42 percent in 1985 to approximately 32 percent in 2013. Tribal demand, which is composed of municipal, industrial and agricultural demand on tribal reservations, increased from less than one percent in 1985 to six percent by 2013, primarily due to increased agriculture. Exempt wells accounted for approximately one percent of the total TAMA water demand in 2013.

Historically, water users in the TAMA relied heavily on groundwater. Over the past 30 years, utilization of renewable supplies has increased significantly. Although groundwater remains the primary source of supply for water users in the TAMA, the use of reclaimed water and CAP water is increasing. The City of Tucson (Tucson Water), the largest water user in the TAMA, began receiving direct delivery of CAP water in 1992. Peak direct delivery occurred in 1993. Treatment and delivery issues caused Tucson Water to cease direct delivery of CAP in 1994 and shift its use of CAP via recharge and recovery of CAP in the TAMA. Agricultural and industrial water users are also increasingly taking advantage of indirect utilization of CAP water and/or reclaimed water.

Figure 3-1 illustrates the trend of water demand by sector in the TAMA. Table 3-1(A) and Table 3-1(B) list the data for municipal, industrial, agricultural and tribal water use within the TAMA from 1985 through 2013, as well as estimated water use from private, domestic wells for the same period. In Table 3-1(A), 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. 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 water

FIGURE 3-1
TUCSON AMA WATER DEMAND BY SECTOR, 1985-2013



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 TAMA, industrial demand is composed of the following subsectors: mining, turf, sand and gravel, electric power, dairy, feedlot, de-watering and other uses. Agricultural demand 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 demand equates to 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, it is included in ADWR water budgets because of the physical impacts on the aquifer.

Municipal demand has been gradually increasing in the TAMA 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 indicates 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. Studies have also found passive water conservation (replacement of old fixtures and appliances with new more efficient ones) generated significant per capita use reductions. Increased efficiency of use has been observed in all water use sectors in the TAMA over time.

TABLE 3-1(A)
TUCSON AMA WATER DEMAND, 1985-2013 (ac-ft)
MUNICIPAL, EXEMPT WELLS & INDUSTRIAL

	Municipal				Exempt Wells	Industrial				
Year	**Ground water**	**CAP Water**	**Reclaimed Water**	**Surface Water**	**Ground water**	**Ground water**	**In-lieu Ground water**	**CAP Water**	**Reclaimed Water**	**Surface Water**
1985	112,655				425	45,896				720
1986	119,974				436	42,905				930
1987	124,837				447	42,770				934
1988	126,522		3,449		458	45,024				395
1989	134,587		4,263		470	51,990				178
1990	123,164		4,290		482	50,121				
1991	125,351		5,131		495	57,337				
1992	120,231	7,840	5,360		507	51,434			56	
1993	86,805	43,918	5,441		520	54,902			63	
1994	119,771	20,676	5,590		534	61,350			92	
1995	147,215		6,525		547	60,500			89	
1996	153,178		8,288		562	59,054			83	
1997	155,827		8,511		576	58,968			78	
1998	149,513		8,722		591	57,440				
1999	156,768		9,807		606	60,582			248	
2000	158,984	69	10,189		621	60,952		209	108	
2001	143,329	17,378	10,881		854	56,435		1,624	132	
2002	151,029	19,047	11,784		1,087	47,941			216	
2003	119,129	49,659	12,227	233	1,320	45,271		160	533	400
2004	105,553	64,340	12,744	173	1,554	49,622		178	565	400
2005	100,792	71,132	13,453	188	1,787	51,116		175	732	400
2006	100,641	72,179	15,947	210	2,020	51,665		135	883	400
2007	72,907	99,118	17,456	413	2,253	48,404	1,028		617	
2008	69,778	94,220	18,167	585	2,486	49,576	2,460		430	
2009	47,412	114,874	20,179		2,719	45,017	8,240		545	
2010	40,327	114,811	15,421	12	3,124	47,496	7,680		525	
2011	39,335	113,978	15,958	14	3,202	43,750	8,995	82	547	
2012	35,930	112,279	16,259	14	3,282	42,990	7,036	81	531	
2013	38,681	108,135	15,084	17	3,364	40,612	6,547	451	411	

NOTE: The columns above for Groundwater include remediated groundwater withdrawn and treated pursuant to a remedial action.

Although municipal demand has increased since 1985, beginning in 2000 the proportion of the demand met with groundwater has decreased as CAP storage and recovery have been actively pursued. Reclaimed water use has also steadily increased in the municipal sector. Industrial demand has historically been dominated by groundwater use, although reclaimed use also shows a steady increase in the industrial sector. Both the municipal and industrial sectors show small volumes of surface water use; however, there are no surface water reservoirs in the TAMA as exist in the Phoenix AMA (PHXAMA) and the Prescott AMA (PRAMA). Surface water displayed in Tables 3-1(A) and 3-1(B) reflects information reported by water users.

Agricultural water use in Table 3-1(B) includes water deliveries by the Cortaro-Marana Irrigation District as well as groundwater withdrawals pursuant to individual IGFR holders. In-lieu Groundwater is CAP water delivered to Groundwater Savings Facilities (GSFs). This water is referred to as in-lieu because the farmers use the CAP 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 which supplied the CAP water to the farmer. In-lieu water counts as groundwater in the farmer's flexibility account, which determines his compliance with his IGFR annual groundwater allotment. In-lieu groundwater is counted as groundwater in the calculation of overdraft. GSFs are discussed further in Chapter 8, titled Underground Water Storage, Savings & Replenishment. Tribal demand includes municipal, industrial and agricultural purposes. Beginning in the year 2000, CAP water has been used for tribal agricultural demand.

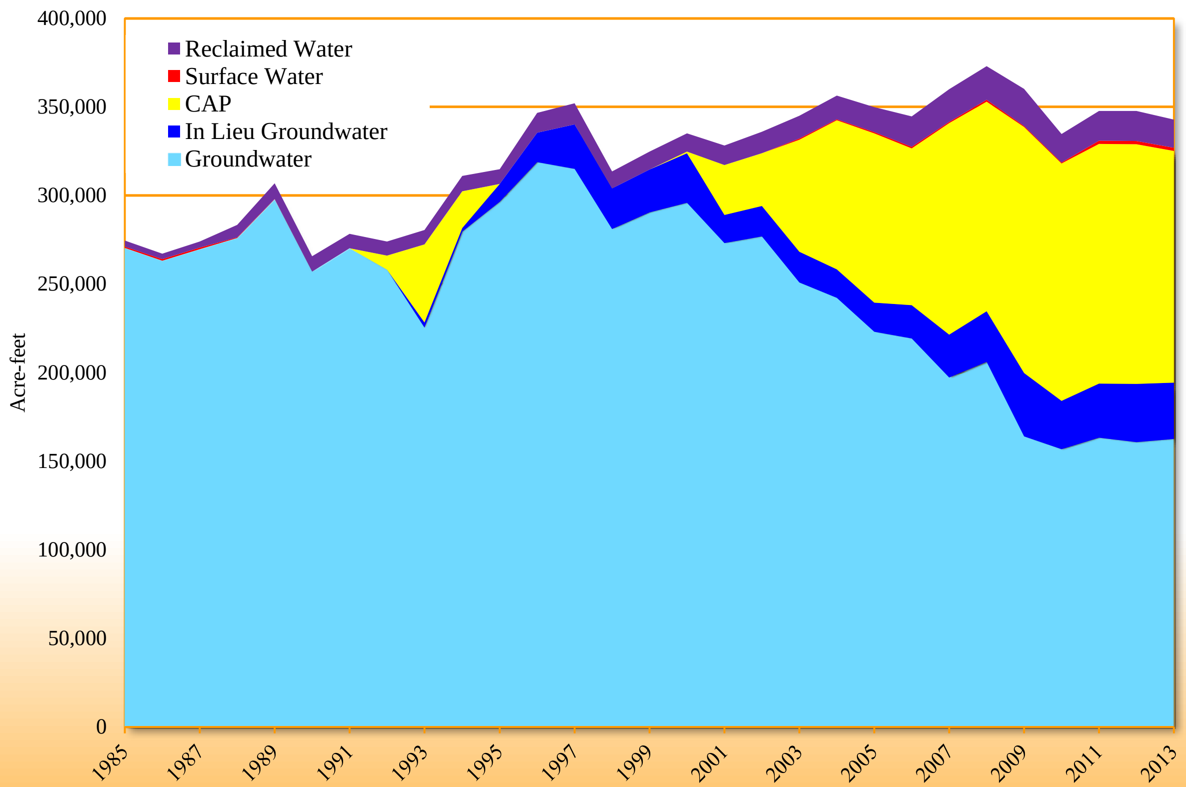
TABLE 3-1 (B)
TUCSON AMA WATER DEMAND, 1985-2013 (ac-ft)
AGRICULTURAL & TRIBAL

	Agricultural						Tribal	
Year	Ag. Allotment	Ground water	In-lieu Ground water	CAP Water	Reclaimed Water	Surface Water	Ground water	CAP Water
1985	212,718	111,333			3,546		72	
1986	214,227	99,808			3,102		75	
1987	214,645	100,874			3,420		810	
1988	214,359	103,104			3,572		902	
1989	213,742	108,808			4,518		2,091	
1990	215,192	81,843			4,375		1,516	
1991	214,133	85,461			3,047		1,557	
1992	209,327	82,208			2,629		3,800	
1993	209,724	78,915	2,900		2,684		4,349	
1994	204,819	93,176	2,014		3,056		4,786	
1995	169,053	85,005	10,137		1,801		3,089	
1996	169,788	102,497	16,661		2,676		3,566	
1997	170,957	97,525	25,095		3,199		2,210	
1998	168,253	70,490	22,924		980		2,988	
1999	164,310	68,782	24,289				3,675	
2000	156,876	72,033	27,973				3,258	702
2001	157,853	70,333	15,998				2,083	9,157
2002	162,701	75,223	17,085				1,626	10,882
2003	162,935	84,301	17,342				933	13,408
2004	162,271	83,900	16,113	6,950			1,507	12,752
2005	165,325	68,458	16,400	10,990			941	13,365
2006	159,792	64,040	18,794	5,450	270	419	984	10,635
2007	161,438	73,558	23,219	4,635	287	425	165	15,484
2008	158,875	84,038	26,176	2,635	274	507	170	21,476
2009	157,875	68,745	27,544	2,635	281	533	175	21,243
2010	157,931	65,674	19,502	2,635	251	524	180	16,617
2011	159,215	76,868	21,473	2,635	251	1,877	187	18,561
2012	157,744	78,425	25,728	2,635	184	1,875	194	20,323
2013	154,810	80,553	25,356	2,635	268	1,857	201	18,702

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 CAP water to the districts of the TON that are within the TAMA.

Figure 3-2 shows the sources of supply used to meet demand by all the sectors in the TAMA during the historical period from 1985-2013. Municipal groundwater demand declined significantly over the historical period as use of CAP water and reclaimed water increased. The industrial sector groundwater demand has fluctuated, but remained within the range of about 42,000 to 61,000 ac-ft per year. Industrial reclaimed water has increased over the historical period and some CAP in-lieu use has occurred in recent years. TAMA agricultural groundwater demand has also fluctuated over time but appears to be generally decreasing. Agricultural CAP in-lieu and direct CAP use, after an initial ramp-up, have been fairly stable for many years. Tribal groundwater demand increased through the year 1994, and then steadily declined while CAP use increased.

FIGURE 3-2
TUCSON AMA WATER SUPPLY SOURCES, 1985-2013



3.2 OVERVIEW OF DEMAND AND SUPPLY BY WATER USE SECTOR

3.2.1 Municipal Sector

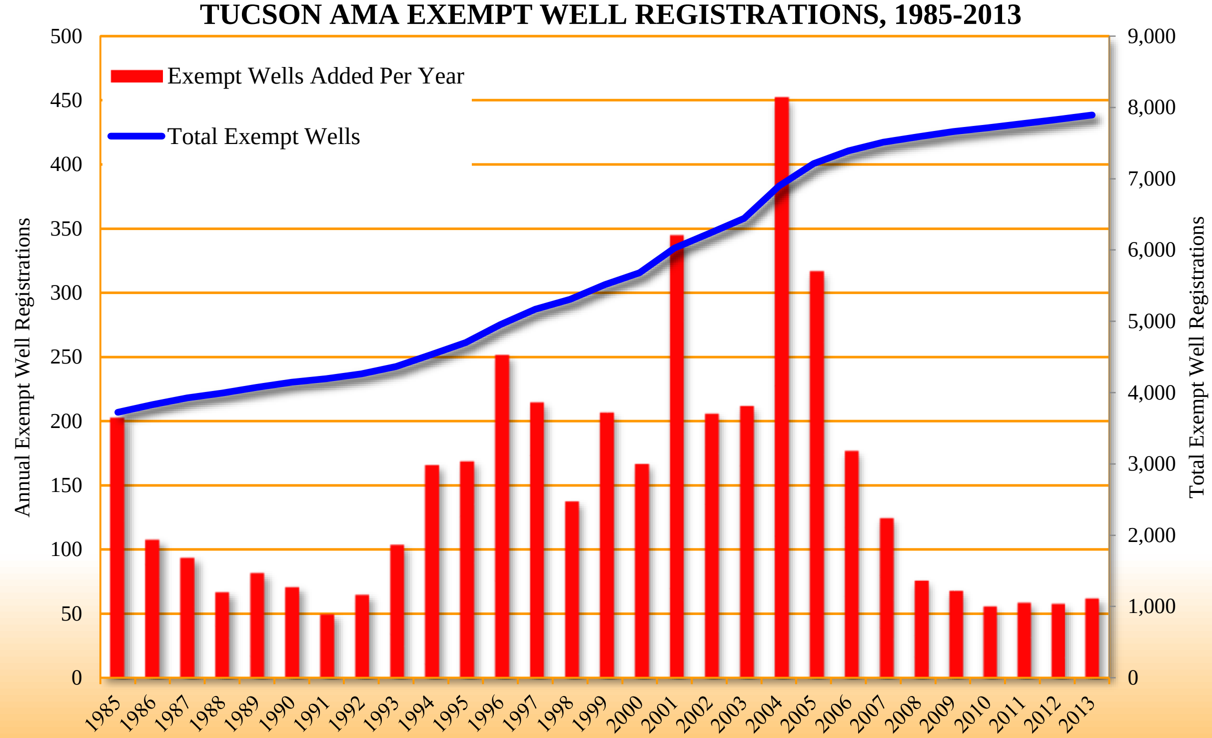
The TAMA includes portions of Pima, Santa Cruz and Pinal Counties. Incorporated cities and their 2010 Census populations include Tucson (520,116), South Tucson (5,652), Marana (34,961), Oro Valley (41,011) and Sahuarita (25,259). It is important to note that the incorporated area population and the population 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 TAMA 2010 Census population within unincorporated areas of the three counties totaled approximately 354,000 people. Part of the Schuk Toak District and the entire San

Xavier District of the Tohono O'odham Nation are located within the TAMA boundary, as are the Pascua Yaqui tribal lands. However, these tribal lands are not under the jurisdiction of ADWR.

The 2010 Census population on the Tohono O'odham District lands within the TAMA boundaries was approximately 2,814 people. The 2010 Census population on Pascua Yaqui tribal lands was approximately 912 people. More than 93 percent of the region's population resides within the northern part of the Upper Santa Cruz Valley Sub-basin which includes the Tucson metropolitan area, Oro Valley, the eastern portion of Marana, Green Valley and Sahuarita. The remaining population is centered in the Avra Valley Sub-basin communities of Three Points (Robles Junction), Arivaca and the western portion of Marana. In the Assessment ADWR projected the population in the TAMA to be between 1.4 and 1.5 million by 2025. This is an increase of 400,000 to 560,000 people over the 2010 Census population of 980,988 people within the TAMA, an increase of approximately 4 percent. The majority (72 percent) of the population in the TAMA is served by Tucson Water, the water utility operated by the City of Tucson.

Large provider population in the TAMA was 931,627 people in 2010. Small providers were comprised of 22,746 people in 2010. An exempt well is one equipped to pump 35 gallons per minute (gpm) or less. Withdrawals from exempt wells within AMAs are exempted from measuring and reporting requirements. ADWR estimates that in 2010 there were 26,615 people relying on exempt wells (or hauled water), who were not served by a municipal water provider.

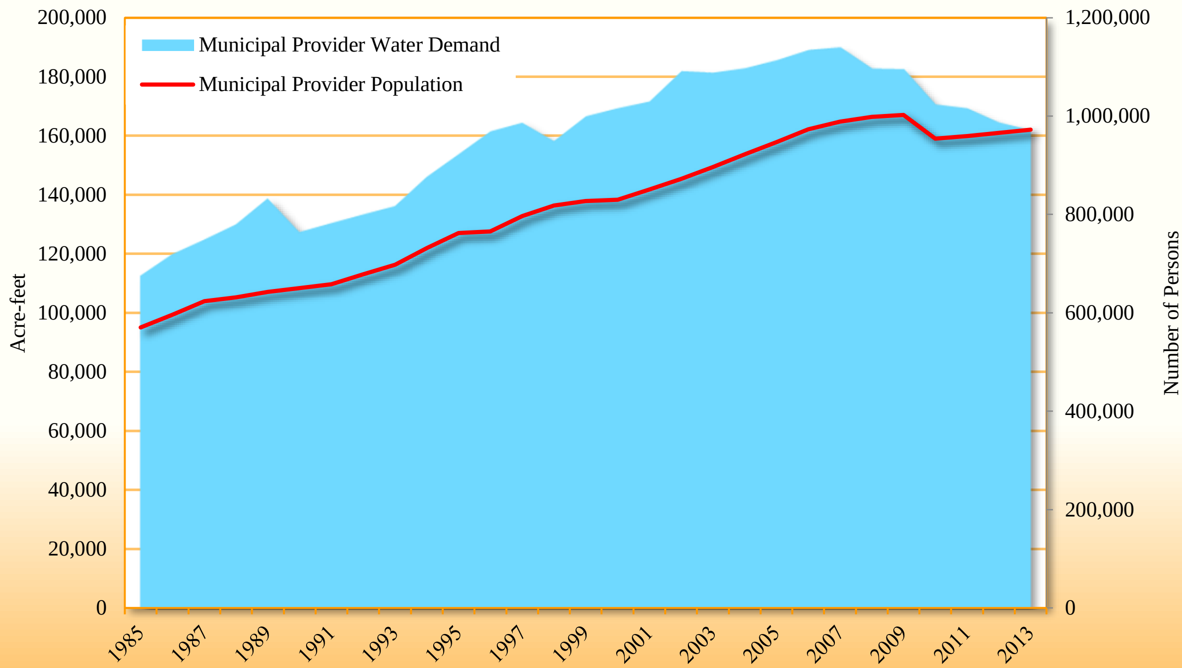
FIGURE 3-3
TUCSON AMA EXEMPT WELL REGISTRATIONS, 1985-2013



3.2.2 Exempt Wells

Since 1985, the number of exempt well registrations in the TAMA increased more than 100 percent, from 3,725 exempt well registrations in 1985 to 7,893 in 2013. The number of exempt well registrations added each year was higher from 1994 through 2006 than in years prior or since *(See Figure 3-3)*. There were more Notices of Intent (NOI) applications filed to drill exempt wells in 2004 than in any other year. Of the 452 NOIs submitted in that year 306 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 3-4
TUCSON AMA POPULATION & DEMAND, 1985-2013



3.2.3 Estimated TAMA 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 2013. Slight dips or increases in the population seem to occur as the over-or under-estimation of the population estimate is corrected by the actual Census data. Each decennial US Census is used to calibrate the inter-Census population estimates to the actual population count from the Census. Table 3-2 shows population figures based on the 2010 US Census.

TABLE 3-2
TUCSON AMA POPULATION BY WATER PROVIDER TYPE, 1985-2013

Year	Total AMA Population	Large Provider Population	Small Provider Population	Exempt Well Population	Number of Exempt Wells
1985	573,864	556,850	13,393	3,621	3,725
1986	600,087	582,538	13,836	3,713	3,833
1987	627,433	609,302	14,322	3,809	3,927
1988	635,604	617,086	14,611	3,907	3,994
1989	646,830	628,190	14,633	4,007	4,076
1990	654,576	635,076	15,390	4,110	4,147

Year	Total AMA Population	Large Provider Population	Small Provider Population	Exempt Well Population	Number of Exempt Wells
1991	662,250	643,415	14,620	4,215	4,197
1992	682,651	663,582	14,746	4,323	4,262
1993	702,540	684,441	13,665	4,434	4,366
1994	736,538	704,096	27,894	4,548	4,532
1995	766,719	735,893	26,161	4,665	4,701
1996	770,458	742,701	22,972	4,785	4,953
1997	801,651	774,204	22,540	4,907	5,168
1998	823,021	793,661	24,327	5,033	5,306
1999	832,129	802,336	24,631	5,162	5,513
2000	835,504	808,959	21,250	5,295	5,680
2001	858,091	829,513	21,297	7,281	6,025
2002	881,220	850,149	21,805	9,266	6,231
2003	907,646	874,191	22,203	11,252	6,443
2004	935,281	899,211	22,833	13,237	6,895
2005	961,900	923,938	22,739	15,223	7,212
2006	990,133	950,259	22,666	17,208	7,389
2007	1,007,487	965,190	23,104	19,194	7,514
2008	1,019,641	975,157	23,305	21,179	7,590
2009	1,025,552	977,923	24,464	23,165	7,658
2010	980,988	931,627	22,746	26,615	7,714
2011	986,892	936,695	22,916	27,281	7,773
2012	993,586	942,571	23,051	27,964	7,831
2013	1,000,934	949,100	23,171	28,664	7,893

Note: Assessment data for years 2007-2010 is from Baseline Scenario One projected.

Between the 2000 Census and the 2010 Census, the exempt well population appears to have increased by an estimated 21,320 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 US Census data to large municipal provider service areas included about 6,000 people who may actually have been served water via exempt wells.

Overestimation of population between Census years 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 at the Census years, the large municipal provider GPCD rate in the TAMA was 175 GPCD in 1990, 182 GPCD in 2000, and 159 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 could 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 TAMA large providers has reduced by just under 1.5 percent per year since the year 2000. GPCD rates for some individual large water providers decreased more than that rate, while some large providers in the TAMA experienced increased GPCD rates.

3.2.4 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 cattle feedlots, and expansions of those uses. Generally, industrial users withdraw water from their own wells that are associated with grandfathered groundwater water rights (Type 1 and Type 2 rights) or withdrawal permits. Although industrial users are primarily dependent on groundwater, some use renewable supplies such as CAP water or reclaimed water. Historically, industrial uses in the TAMA have included mining, turf related facilities, sand and gravel operations, electric power generation, dairies and others *(See Table 3-3)*.

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 the years 1975 and 1980. In 2013, under 30 percent of the TAMA's industrial rights and permit volumes were used.

TABLE 3-3
TUCSON AMA INDUSTRIAL WATER DEMAND BY SUB-SECTOR, 1985-2013 (ac-ft)

Year	Turf-Related Facilities	Metal Mining	Sand & Gravel	Large-Scale Power Plants	Dairies	Feedlots	Other	Total
1985	6,423	26,945	4,420	2,598	449	21	5,761	**34,432**
1986	6,097	25,005	4,074	2,295	399	21	5,944	**31,794**
1987	6,622	25,774	4,090	1,687	356	9	5,168	**31,915**
1988	7,147	26,854	3,609	2,736	338	15	4,719	**33,553**
1989	7,458	33,687	3,640	2,774	461	25	4,124	**40,587**
1990	6,914	33,955	3,467	1,950	58	31	3,745	**39,461**
1991	7,314	42,402	2,701	1,309	66	6	3,541	**46,483**
1992	6,453	36,531	3,026	1,772	50	25	3,633	**41,404**
1993	6,770	38,568	4,024	1,843	50		3,709	**44,485**
1994	7,130	43,072	4,664	2,524	70		3,984	**50,328**
1995	7,610	42,014	5,337	1,611	73		3,943	**49,036**
1996	7,651	39,916	4,897	1,970	85		4,619	**46,867**
1997	7,851	40,838	4,575	2,124	57		3,600	**47,594**
1998	7,484	39,243	4,416	2,427	85		3,784	**46,172**
1999	9,004	39,626	4,193	3,669	97		4,241	**47,585**
2000	8,085	39,573	4,497	4,935	115		4,064	**49,120**
2001	8,063	35,980	4,425	5,584	126		4,013	**46,115**

Year	Turf-Related Facilities	Metal Mining	Sand & Gravel	Large-Scale Power Plants	Dairies	Feedlots	Other	Total
2002	8,636	27,644	3,262	4,268	132		4,216	**35,305**
2003	8,349	26,725	4,626	2,885	114		3,664	**34,351**
2004	7,797	32,210	3,847	3,160	88		3,664	**39,305**
2005	8,393	33,742	3,306	3,083	124		3,775	**40,255**
2006	8,249	34,905	3,807	2,656	110		3,357	**41,478**
2007	7,873	32,516	1,739	2,923	131		4,867	**37,309**
2008	7,346	34,552	3,851	2,422	139		4,157	**40,963**
2009	8,213	36,630	3,343	2,277	83		3,256	**42,333**
2010	7,966	37,081	4,168	2,305	120		4,060	**43,674**
2011	7,788	38,929	976	2,241	125		3,315	**42,271**
2012	7,539	35,046	2,216	2,164	158		3,516	**39,584**
2013	7,679	32,094	3,385	1,643	153		3,068	**37,274**

Approximately 23 percent of the total Type 1, Type 2 and Withdrawal Permit allotments in the TAMA belong to Tucson Water, with a total allotment of 39,439 ac-ft. Another 26 percent of the total allotments in the TAMA belong to mining company Freeport-McMoRan, with a total allotment of 44,991 ac-ft.

Water use within the industrial sector in the TAMA has been relatively stable since 1985 with the exception of periodic fluctuations caused by its largest subsector, metal mining. The increase in industrial water use in 1994 and 1995 corresponds to a period of peak mining production. The non-mining subsector water use in the TAMA has remained relatively static at approximately 20,000 ac-ft per year over the last twenty years while mining use has fluctuated between 25,000 and 43,000 ac-ft per year depending on the condition of the commodities market. Groundwater has been, and continues to be, the primary source of industrial water supply in the TAMA as shown in Table 3-1(A).

Although the industrial sector has the authority to grow into its allotment, based on the historical trend of industrial water use in the TAMA it seems unlikely that this sector will reach a point at which the full allotments are being used.

Mining in the TAMA has historically relied on groundwater. However, the Southern Arizona Water Settlement Act (SAWRSA) gave the American Smelting and Refining Company (ASARCO) the right to use up to 10,000 ac-ft of CAP water from the Tohono O'odham Nation (TON) annually. Other mining entities in the TAMA continue to expand use of CAP and reclaimed water where available.

Turf-related facilities are the second largest industrial subsector in the TAMA. Many turf-related facilities are served reclaimed water or are supplied by municipal water providers; however, some use GFRs to withdraw groundwater. An ordinance in Pima County prohibits the use of groundwater on new turf-related facilities, so it is unlikely that groundwater demand by the turf-related subsector will increase in the future. Due in part to the economic downturn, some of the golf courses within the TAMA have seen reduced attendance resulting in decreased revenues.

There are two large-scale power plants located in the TAMA. In 2001, at the height of the California energy crisis, electric power generation water demand spiked to approximately 5,600 ac-ft because of an increase in local power generation and associated water use. The power sector in the TAMA currently holds over 10,000 ac-ft of withdrawal authority. The primary consumptive use of water at a thermal power plant is evaporation in the cooling towers. Electric power plants in the TAMA have relied solely on groundwater to meet their cooling needs.

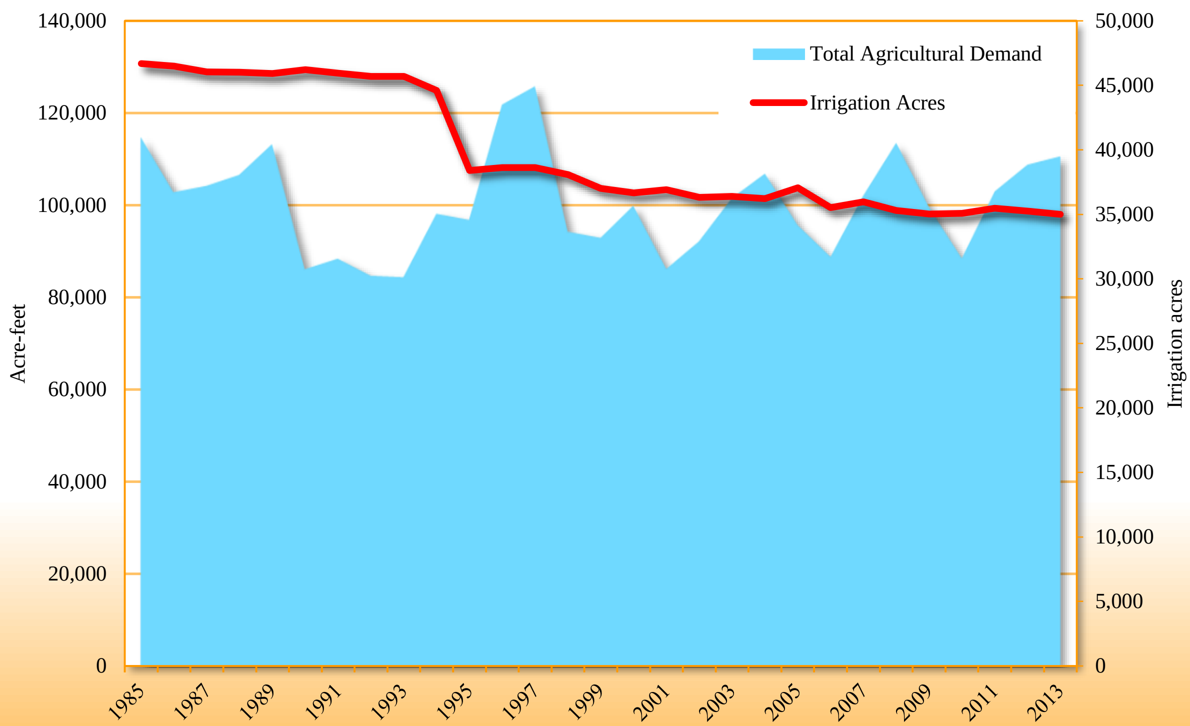
Water demand in the dairy and other industrial subsectors is not likely to dramatically increase. In the Assessment, industrial demand was projected to be between 55,000 and 70,600 ac-ft in the year 2013. Actual industrial demand in 2013 was about 48,000 ac-ft.

3.2.5 Agricultural Sector

The agricultural sector in the TAMA 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 Irrigation Grandfathered Right (IGFR) by ADWR. Water use pursuant to these rights must be reported to ADWR if the right is larger than 10 acres.

Agriculture is a smaller sector in the TAMA than the municipal sector but still significant. However, as municipal and industrial uses increase, the agricultural sector comprises a smaller percentage of overall AMA water demand. The TAMA contains one consolidated irrigation distribution system, operated by the Cortaro-Marana Irrigation District (CMID), which encompassed more than 70 farms and about one-third of the total number of IGFR active acres in the TAMA in the year 2013.

FIGURE 3-5
TUCSON AMA AGRICULTURAL WATER DEMAND vs IRRIGATION ACRES, 1985-2013



Water demand in the agricultural sector has fluctuated between 1985 and 2013, while total irrigation acres have declined. There are fewer than 200 active IGFRs in TAMA, with allotments totaling about 155,000 ac-ft. Figure 3-5 shows historical agricultural water use from 1985 through 2013 and the total acres eligible to be irrigated. The amount of irrigable acreage dropped significantly between 1993 and 1995. In 1994 small rights of less than ten acres were deregulated; however, the highest number of acres that were inactivated during this period were associated with IGFRs owned by Tucson Water and Farmers Investment Company.

Since 1995, there have been 23 IGFRs that were partially or fully extinguished in the TAMA pursuant to the AWS Rules. This accounts for about 1,270 acres that can no longer be used for agricultural production. Extinguishment of these rights generated 36,915 ac-ft of extinguishment credits, of which 1,149 have been pledged and 35,766 have not 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.

CMID, referred to as Area of Similar Farming Condition (ASFC) No. 2, is the only irrigation district in the TAMA with a consolidated distribution system. Since 2009, a little less than half of CMID's supplies have been groundwater. In-lieu water has fluctuated in recent years, as has use of CAP water. CMID has several surface water rights and wells claimed as points of diversion of surface water; however, ADWR has included this water in the groundwater supply category, pending the General Stream Adjudication. This volume of water was between 27 and 40 percent of CMID's demand between 2006 and 2013. Historically, CMID had a contract for reclaimed water (effluent) from Pima County, but the contract expired and no reclaimed water was used after 1998. Pima County is cooperating with Metro Water, CMID and the Bureau of Reclamation to deliver Metro Water and SAWARSA water to CMID lands under via a Groundwater Savings Facility. Also, Metro Water is exploring the idea of delivering reclaimed water to CMID in the future via a Groundwater Savings Facility (in-lieu) water storage permit for recharge credits.

The *Avra Valley* area in Marana (ASFC 3) includes the Avra Valley Irrigation District, BKW Farms and several other irrigators. Between 2006 and 2013, about half of Avra Valley's supplies were groundwater and 40 percent in-lieu water; the remaining water included small volumes of CAP water and surface water.

Farmer's Investment Company (FICO) operates a large pecan farm in the Green Valley-Sahuarita area (ASFC 5). Currently, all of FICO's demand is met with groundwater withdrawn from private wells.

The *Red Rock* area in Pinal County (ASFC 1) meets most of its demand, about 72 percent, with in-lieu water. CAP water averaged about 18 percent from 2006 to 2013. The remaining demand was met with surface water (about eight percent).

Between 2006 and 2013, irrigation rights in the remaining ASFCs accounted for less than five percent of the total TAMA demand.

Agriculture uses a relatively minor amount of water in the TAMA, although both the agricultural and industrial sectors largely rely on groundwater and thus affect safe-yield. Although slowly declining, a significant amount of agricultural land remains in the TAMA that could continue in production for some time into the future, depending on the economy and cropping patterns. The agricultural sector uses in-lieu CAP, direct CAP and reclaimed water; however, groundwater remains the principle source of supply for irrigation in the TAMA.

3.2.6 Tribal Sector

The Pascua Yaqui tribal lands, part of the Schuk Toak District, and the entire San Xavier District of the TON are located within the TAMA. Tribal water use is exempt from regulation by the state; however, the demand characteristics of these communities are included here because they have a hydrologic impact on the safe-yield goal. In Table 3-1(B), Tribal demand includes primarily agricultural demand with a small portion of municipal and industrial demand. Municipal demand is estimated to have been about 200 ac-ft. in 2013. Tribal industrial demand is reported as the delivery of groundwater from the San Xavier District to ASARCO's Mission mine. This use discontinued in 2006; subsequently, through the Southern Arizona Water Rights Settlement Act (SAWRSA), ASARCO agreed to decrease its groundwater pumping and use up to 10,000 ac-ft of the TON's CAP water. The TON receives long-term storage credits for the CAP water that ASARCO uses in-lieu of groundwater. The entire TON total CAP allocation is 74,000 ac-ft per year.

The SAWRSA and the subsequent settlement agreement specified that the TON was entitled to 79,200 ac-ft of water rights in the TAMA for use on the San Xavier District and the Eastern Schuk Toak District. Of this total 66,000 ac-ft is CAP water and 13,200 ac-ft is groundwater. The TON may also lease up to 15,000 ac-ft of CAP water to off reservation users. In 2008 ADWR determined that the use of TON CAP water by ASARCO meets the requirements of A.R.S. § 45-841.01. Beginning in 2010, ASARCO began reporting receiving in-lieu water from the San Xavier District pursuant to this statute, although CAP use by the mines occurred as early as 2007. Tribal CAP use is primarily for agricultural irrigation. Table 3-1(B) shows water use by water type for the agricultural sector and tribal uses.

3.3 CURRENT WATER BUDGET

The management goal of the TAMA 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 TAMA by the year 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. The cumulative overdraft between 1985 and 2013 is shown as a line on a second axis. By 2013, the cumulative overdraft in the TAMA since 1985 was approximately 1.8 million ac-ft. However, since 2005 the TAMA cumulative overdraft has been fairly flat, reflecting the reduction in groundwater use and increased use of renewable water supplies.

For purposes of the 4MP, overdraft includes use of the groundwater allowance. Despite these volumes of allowable 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 from the hydrologic model 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 year 1993. ADWR now has a greater understanding of the susceptibility of the TAMA aquifers to drought and natural recharge during wetter periods. Those updated figures, reflecting actual conditions from 1985 through 2013, are reflected in Figure 3-6. This period of record indicates that the TAMA has been close to safe-yield in recent years, but was in overdraft nearly every year in the 1985-2005 historical period with the exception of the 1993 flood. Values for Figure 3-6 are shown in Table 3-4. The net natural recharge in Chapter 2,

Table 2-2 and offsets to groundwater pumping in Table 3-4 do not match; this is because Table 3-4 includes incidental recharge from human activities, cuts to the aquifer and CAGRD replenishment, while Table 2-2 in Chapter 2 does not.

FIGURE 3-6
TUCSON AMA ANNUAL &
CUMULATIVE OVERDRAFT, 1985-2013 (ac-ft)

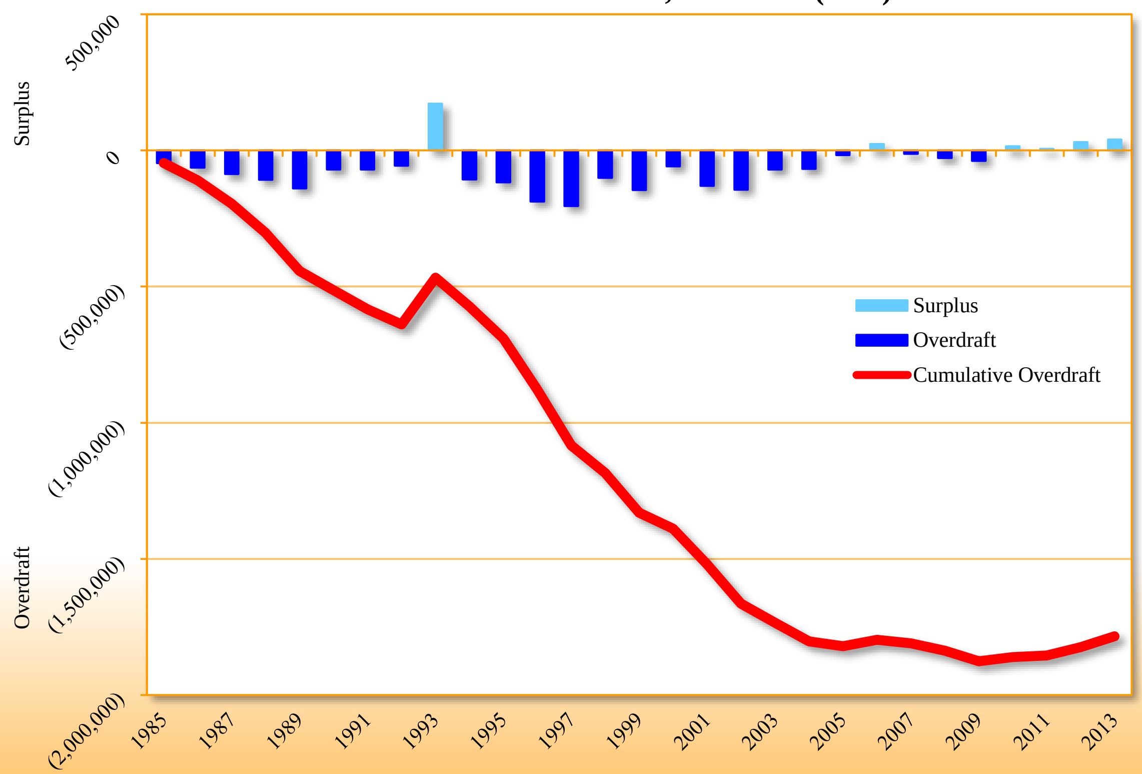


TABLE 3-4
TUCSON AMA WATER DEMAND BY SECTOR, 1985-2013 (ac-ft)

	Demand						Supply			
Year	Municipal	Estimated Exempt Well Pumpage	Industrial	Agriculture	Tribal	Total Demand	Renewable Supplies used*	Ground water Used	Offsets to GW Pumping**	Overdraft
1985	112,655	425	46,616	114,879	72	**274,647**	4,266	277,545	231,046	**(46,500)**
1986	119,974	436	43,834	102,910	75	**267,229**	4,032	270,118	207,293	**(62,825)**
1987	124,837	447	43,704	104,294	810	**274,092**	4,354	275,849	189,543	**(86,306)**
1988	129,971	458	45,419	106,676	902	**283,427**	7,416	280,043	172,583	**(107,460)**
1989	138,850	470	52,168	113,326	2,091	**306,905**	8,959	300,459	160,926	**(139,533)**
1990	127,454	482	50,121	86,217	1,516	**265,791**	8,665	259,854	189,866	**(69,988)**
1991	130,482	495	57,337	88,508	1,557	**278,380**	8,178	274,588	203,790	**(70,798)**
1992	133,431	507	51,490	84,837	3,800	**274,065**	15,885	263,879	208,024	**(55,856)**
1993	136,164	520	54,964	84,499	4,349	**280,497**	52,106	238,898	411,263	**172,365**
1994	146,037	534	61,442	98,246	4,786	**311,045**	29,414	289,239	182,942	**(106,297)**
1995	153,740	547	60,589	96,943	3,089	**314,909**	8,415	313,857	195,965	**(117,892)**

	Demand						Supply			
Year	**Municipal**	**Estimated Exempt Well Pumpage**	**Industrial**	**Agriculture**	**Tribal**	**Total Demand**	**Renewable Supplies used***	**Ground water Used**	**Offsets to GW Pumping****	**Overdraft**
1996	161,466	562	59,137	121,834	3,566	**346,564**	11,047	339,252	151,488	**(187,765)**
1997	164,338	576	59,046	125,819	2,210	**351,990**	11,789	342,349	137,365	**(204,984)**
1998	158,235	591	57,440	94,394	2,988	**313,647**	9,702	307,756	207,235	**(100,521)**
1999	166,575	606	60,831	93,071	3,675	**324,757**	10,055	317,642	172,024	**(145,618)**
2000	169,242	621	61,269	100,006	3,960	**335,099**	11,277	326,251	267,582	**(58,669)**
2001	171,588	854	58,191	86,331	11,240	**328,204**	39,172	284,547	153,602	**(130,944)**
2002	181,860	1,087	48,157	92,308	12,508	**335,921**	41,929	287,745	143,534	**(144,211)**
2003	181,248	1,320	46,364	101,643	14,341	**344,916**	76,620	262,457	191,704	**(70,753)**
2004	182,810	1,554	50,765	106,963	14,259	**356,351**	98,102	250,025	181,423	**(68,603)**
2005	185,565	1,787	52,423	95,848	14,306	**349,928**	110,435	239,720	222,311	**(17,409)**
2006	188,977	2,020	53,084	88,973	11,619	**344,672**	106,528	236,586	260,307	**23,721**
2007	189,893	2,253	50,049	102,124	15,649	**359,968**	138,434	219,000	206,231	**(12,770)**
2008	182,750	2,486	52,466	113,630	21,646	**372,977**	138,294	230,032	202,539	**(27,493)**
2009	182,464	2,719	53,802	99,738	21,418	**360,141**	160,289	192,270	153,616	**(38,654)**
2010	170,571	3,124	55,701	88,586	16,797	**334,777**	150,795	178,554	193,962	**15,408**
2011	169,285	3,202	53,374	103,104	18,748	**347,712**	153,903	189,196	194,882	**5,686**
2012	164,481	3,282	50,638	108,847	20,517	**347,764**	154,180	189,955	220,960	**31,006**
2013	161,916	3,364	48,020	110,669	18,903	**342,873**	148,448	193,349	233,137	**39,788**

*Includes CAP Water and Reclaimed Water

**Includes Incidental Recharge, Net Natural Recharge, cuts to the aquifer, CAGRD replenishment, effluent discharge, riparian use of managed effluent and canal seepage

3.4 CONCLUSION

Water users in the TAMA have made a strong commitment to increasing the use of reclaimed water and CAP supplies over the last decade. However, there are locations within the TAMA which are either isolated from renewable water sources or lack the infrastructure to retrieve them. It is important for the TAMA to continue to move toward a regional water management approach aimed at using renewable water supplies (CAP water and reclaimed water) to reduce reliance upon groundwater evenly and continuously throughout the TAMA.

The 4MP programs that follow were developed within current statutory guidelines. It is possible, as described in Chapter 11, for the TAMA to achieve safe-yield by the year 2025 with an increased commitment to use of renewable supplies. However, whether or not safe-yield is achieved and maintained will depend on individual choices of water right holders and the continued availability of renewable supplies. The commitment of the TAMA community to developing and putting into place a water management strategy that recognizes the need for additional water augmentation activities will help ensure the continued economic viability of the TAMA into the future and the achievement of the safe-yield goal. This situation is further discussed in Chapter 12.

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CHAPTER FOUR: AGRICULTURAL

4.1 INTRODUCTION

The Agricultural Conservation Program for the *Fourth Management Plan for the Tucson Active Management Area* (4MP) is nearly identical to the program included in the *Third Management Plan for the Tucson Active Management Area* (3MP), the only change being an adjustment to the irrigation distribution system requirements for irrigation districts. The *1980 Groundwater Code's* (Code) prohibition on new agricultural land being brought into production inside the Tucson Active Management Area (TAMA) has contributed to the TAMA meeting 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 have also contributed to meeting the TAMA's safe-yield goal.

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 crop types and irrigated acreage from the years 1975 to 1980. To irrigate means the growing of crops for sale, human consumption or livestock or poultry feed 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).

Agricultural Conservation Program Requirements

The Base Agricultural Conservation Program is an allotment-based program that 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 limit in their flexibility account. Since adoption of the Code, an alternative conservation program has been adopted for IGFR holders based on implementation of best management practices and conservation measures rather than meeting an allotment.

The Base Agricultural Conservation Program for the TAMA 4MP is identical to the program included in the 3MP. The provisions of this program are mandated by statute.

4.1.1 TAMA Agricultural Sector Description

In 1985, agricultural water demand in the TAMA exceeded municipal demand. Historically, agricultural demand has fluctuated with peaks in 1989, 1996 and 1997. However, agricultural irrigation acres have decreased since 1985. In 1985, the agricultural sector relied on groundwater to meet almost 97 percent of the demand, with a small volume of direct-use reclaimed water. Beginning in 1993, the agricultural sector began using in-lieu Central Arizona Project (CAP) water (see Chapter 8 for in-lieu or Groundwater Savings Facility water storage). This CAP water counts as groundwater for the agricultural user's compliance with their conservation requirement, but generates a water storage credit for the entity that provides the in-lieu water to the farm. Use of in-lieu CAP water gradually increased until its peak in the year 2000, then fluctuated with total agricultural demand. Direct use of reclaimed water for agricultural purposes was discontinued after 1998 and reinitiated in 2006 by the University of Arizona on their IGFRs. By 2013, groundwater met 73 percent of agricultural demand, in-lieu CAP water met 23 percent and direct use CAP and reclaimed water met the remaining four percent of agricultural demand (*See Table 4-1*). There was a sharp decrease in irrigation acres in 1994 with the deregulation of small IGFRs after legislation adopted in 1994 provided an exemption from reporting and conservation requirements for IGFRs less than ten acres in size that are not part of an integrated farming operation. In addition, between 1993 and 1995, both Tucson Water and Farmers Investment Company had IGFRs greater than ten acres in size that became inactive either due to development or extinguishment. Irrigation acres have otherwise been gradually decreasing.

TABLE 4-1
TUCSON AMA AGRICULTURE WATER SUPPLY & DEMAND, 1985-2013 (ac-ft)

	Source Supply							
Year	**Ground water**	**In-lieu Ground water**	**CAP Water**	**Reclaimed Water**	**Surface Water**	**Total Demand**	**Allotment**	**Irrigation Acres**
1985	111,333			3,546		**114,879**	212,718	46,689
1986	99,808			3,102		**102,910**	214,227	46,498
1987	100,874			3,420		**104,294**	214,645	46,051
1988	103,104			3,572		**106,676**	214,359	46,021
1989	108,808			4,518		**113,326**	213,742	45,907
1990	81,843			4,375		**86,217**	215,192	46,215
1991	85,461			3,047		**88,508**	214,133	45,938
1992	82,208			2,629		**84,837**	209,327	45,694
1993	78,915	2,900		2,684		**84,499**	209,724	45,695
1994	93,176	2,014		3,056		**98,246**	204,819	44,592
1995	85,005	10,137		1,801		**96,943**	169,053	38,395
1996	102,497	16,661		2,676		**121,834**	169,788	38,627
1997	97,525	25,095		3,199		**125,819**	170,957	38,618
1998	70,490	22,924		980		**94,394**	168,253	38,072
1999	68,782	24,289				**93,071**	164,310	37,009
2000	72,033	27,973				**100,006**	156,876	36,677
2001	70,333	15,998				**86,331**	157,853	36,904
2002	75,223	17,085				**92,308**	162,701	36,323
2003	84,301	17,342				**101,643**	162,935	36,398
2004	83,900	16,113	6,950			**106,963**	162,271	36,213
2005	68,458	16,400	10,990			**95,848**	165,325	37,056
2006	64,040	18,794	5,450	270	419	**88,973**	159,792	35,528
2007	73,558	23,219	4,635	287	425	**102,124**	161,438	35,980
2008	84,038	26,176	2,635	274	507	**113,630**	158,875	35,303
2009	68,745	27,544	2,635	281	533	**99,738**	157,875	35,036
2010	65,674	19,502	2,635	251	524	**88,586**	157,931	35,082
2011	76,868	21,473	2,635	251	1,877	**103,104**	159,215	35,468
2012	78,425	25,728	2,635	184	1,875	**108,847**	157,744	35,251
2013	80,553	25,356	2,635	268	1,857	**110,669**	154,810	34,995

4.1.2 History of TAMA Agricultural Regulatory Programs/4MP Goals Summary

ADWR is required by statute to develop and administer an Agricultural Conservation Program in all five AMAs. The original allotment-based program has been modified several times since the Code was adopted. Changes in the base program included: a farmer's ability to market some of his flexibility account credits to other farms; the treatment of reclaimed water in the compliance calculation; the exemption of IGFRs of ten or fewer acres from compliance and reporting requirements; and limitations on the maximum on-farm efficiency ADWR may use when calculating irrigation water duties. In 2002, the 3MP was modified to add alternative conservation programs for farmers who had difficulty staying in compliance with the base program. To qualify for entry into an alternative conservation program, a farm must first achieve compliance.

4.1.3 Agricultural Conservation Programs – History and Background

A person using groundwater within an AMA must comply with conservation requirements established in the management plan for each management period (A.R.S. § 45-563). For the TAMA 4MP, IGFR holders are subject to agricultural conservation requirements, which include irrigation water duties and maximum annual allotments (A.R.S. § 45-567). Conservation requirements also exist for irrigation districts and private water companies that distribute groundwater for irrigation purposes.

ADWR will calculate a maximum annual groundwater allotment in the fourth management period for each IGFR in the TAMA in accordance with the statutory provisions of A.R.S. § 45-567(A)(1). The fourth management period calculation is identical to that mandated by A.R.S. § 45-566. Under this Agricultural Conservation Base Program (Base Program), the water duty for a farm unit is calculated using an assigned irrigation efficiency of 80 percent, with certain exceptions. 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. All IGFRs in the TAMA will be regulated under the Base Program unless the owner of the IGFR has been accepted into one of the alternative conservation programs described below for the 4MP or was regulated under the BMP Program in the 3MP. As of 2015, all farms in the TAMA are enrolled in the Base Program.

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) the Historic Cropping Program and 2) the 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.

The Historic Cropping Program is similar to the Base Program in that it is allotment-based. The water duty for the farm unit is calculated based upon its 1975 to 1980 crop history and an assigned irrigation efficiency of 75 percent. This program also has a flexibility account provision. There is a limit, however, on the total amount of flexibility account credits and debits that may be accumulated. The Historic Cropping Program requires a high level of farm management. Participants in the Historic Cropping Program are required to 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.

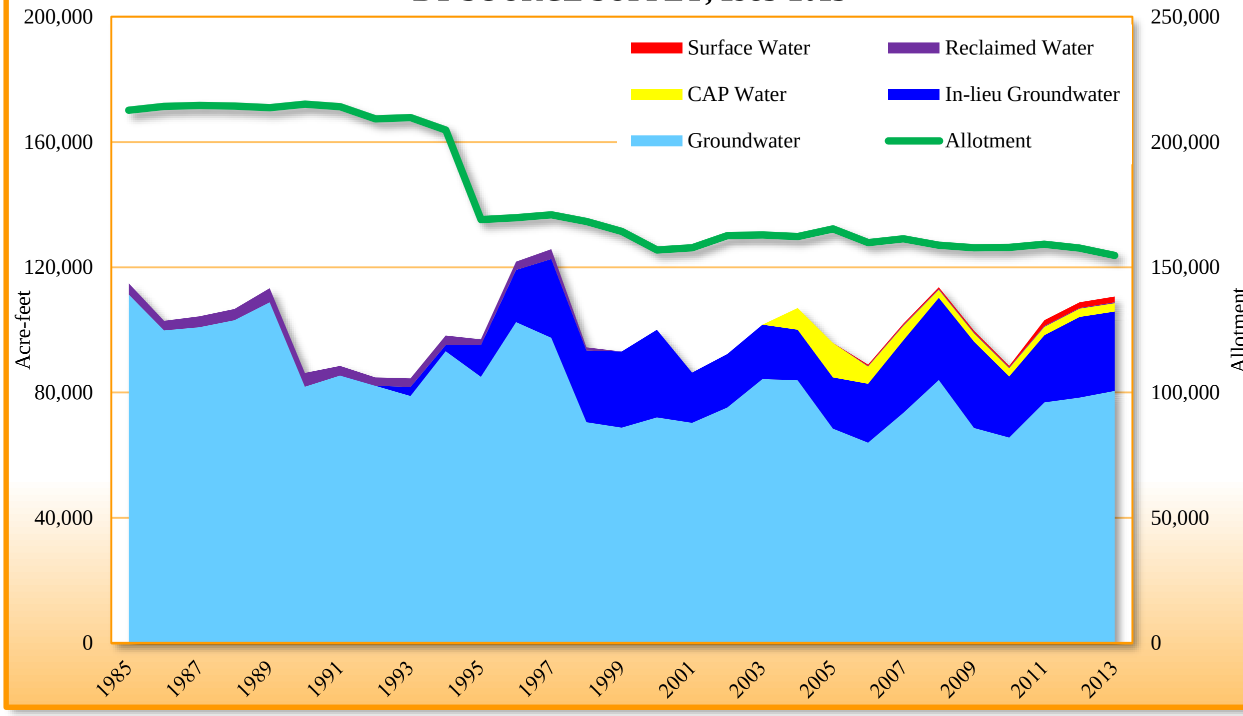
Unlike the Base Program or the Historic Cropping Program, participation in the BMP Program requires the implementation and maintenance of specific agricultural conservation practices. To efficiently use water, this program relies upon physical on-farm improvements and farm management practices. Since this program is not allotment-based, there is no provision for an operating flexibility account. The BMP Program allows participants flexibility to make decisions concerning their farming operation. As with the Base Program and the Historic Cropping Program, only acres irrigated between 1975 and 1980 may be irrigated under the BMP Program.

4.2 RELATIONSHIP OF THE AGRICULTURAL SECTOR TO ACHIEVEMENT OF THE TAMA WATER MANAGEMENT GOAL

Agricultural demand is second only to municipal demand within the Tucson AMA. Most agricultural demand is concentrated in the northwestern portion of the TAMA, in the Avra Valley Sub-basin within and near the Town of Marana and in the southeastern portion of the TAMA in the Upper Santa Cruz sub-basin near the Town of Sahuarita and the community of Green Valley (*See Figure 4-2*). Cortaro-Marana Irrigation District (CMID) is the only irrigation district in the TAMA with a consolidated distribution system, where the district owns and maintains its own irrigation distribution system including canals, ditches and wells. Cropping patterns have changed only slightly since 1985. Primary crops include cotton, pecans, small grains, alfalfa and pasture. Most of the semi-permanent orchards have not changed since 1985. However, the field crop mix has changed in response to changes in local growing conditions and markets.

Agricultural water demand in the TAMA has endured despite increased urbanization throughout the historical period *(See Figure 4-1)*. The majority of agricultural land has been located away from the path of historical development. There is no apparent correlation between changes in agricultural demand and the decrease in acreage and groundwater allotments. Many of the shifts in agricultural demand in the TAMA have been anecdotally linked to crop and commodity prices, along with Federal subsidy programs (both of which have been more clearly linked to water consumption in the Phoenix AMA and Pinal AMA). Because the flexibility account provisions permit farmers to bank certain unused portions of the groundwater allotment for future use, the groundwater allotment itself does not necessarily limit demand.

FIGURE 4-1
TUCSON AMA TOTAL AGRICULTURE WATER DEMAND BY SOURCE SUPPLY, 1985-2013

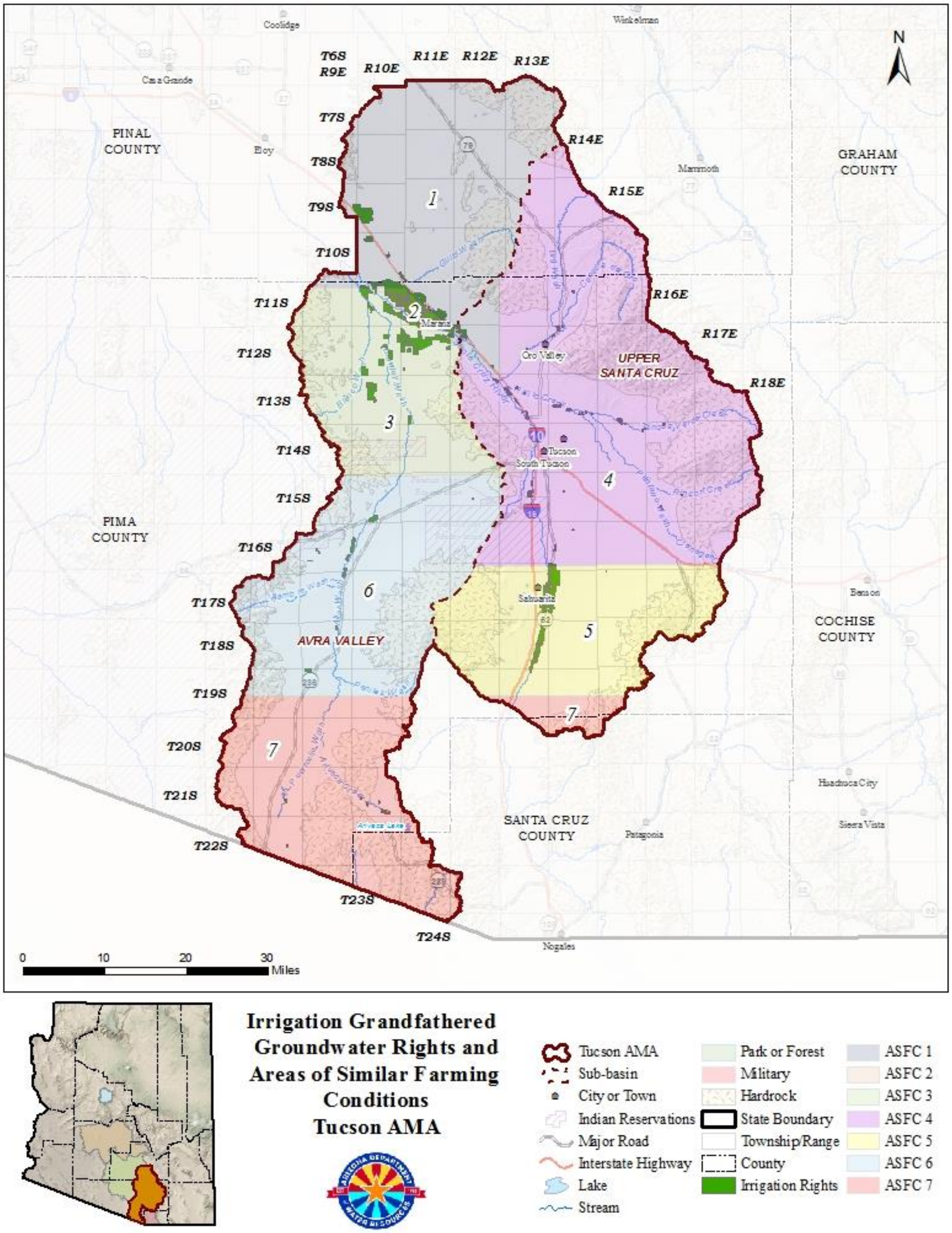


The *Demand and Supply Assessment, Tucson Active Management Area* (Assessment) (ADWR, 2010) projected agricultural demand in the TAMA to be between 57,000 and 112,000 ac-ft per year by 2025.

The total CAP Non-Indian Agricultural (NIA) settlement pool water, which is the source of direct CAP use for many agricultural users, will be reduced by 25 percent in 2017 and by an additional 25 percent in 2024, reducing to zero after 2030. Direct use of CAP settlement pool water in the TAMA has been stable since 2008.

CAP and reclaimed water may be delivered to Groundwater Savings Facilities (GSFs). As in the 2010 Assessment, GSF supply projections were based on current permits and the projected amount of supplies available for storage. This GSF supply is identified as in-lieu groundwater in the Assessment and the TAMA 4MP. Although gradually decreasing in recent years, GSF CAP water remains a significant supply used to meet agricultural demand in the TAMA.

FIGURE 4-2
TUCSON AMA AGRICULTURAL IRRIGATION ACRES



4.3 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIAL GROUNDWATER

The State of Arizona and ADWR have developed incentives to increase the use of non-groundwater supplies. A.R.S. § 45-467 excludes reclaimed water 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 reclaimed water on the farm without any of the reclaimed water being debited against the farm's flexibility account as a result of reclaimed water use. This incentivizes reclaimed water use.

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 (1999 Ariz. Sess. Law, H.B. 2189, § 51(B)). The criteria that must be met to qualify for this accounting are set forth in the legally enforceable provisions in Section 4-707 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.

During the fourth management period, ADWR will continue to support the increased use of reclaimed water in all sectors, including the agricultural sector. In the past, direct reclaimed water 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 reclaimed water (A.A.C. R18-11-301 thru 309). As water treatment techniques improve and reclaimed water becomes more accessible to the agricultural sector, ADWR expects that reclaimed water use for agricultural purposes will increase. The agricultural sector may also use reclaimed water 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. Reclaimed water stored underground is further treated as it infiltrates the aquifer. Reclaimed water stored underground and later recovered is treated in the same manner as direct-use reclaimed water in the calculation of the farm's flexibility account.

Significant reuse of reclaimed water has been ongoing in the TAMA in the municipal sector. See Chapter 3 of this plan for more details on historical use of reclaimed water by each water use sector.

4.4 NON-REGULATORY EFFORTS

In addition to the agricultural conservation programs previously described, other water resource management strategies have been developed to help achieve the water management goal for the TAMA. 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 expected to continue during the fourth management period. The Water Management Assistance Program is described more fully in Chapter 9 of this plan.

4.5 AGRICULTURAL CONSERVATION PROGRAM COMPONENTS AND CALCULATIONS

This section describes the Agricultural Conservation Program components for the TAMA 4MP. This program, which exists in all AMAs, consists of three conservation programs for IGFRs: 1) Base Program,

2) Historic Cropping Program and 3) 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 programs is described below.

4.5.1 Calculation of 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.

4.5.1.1 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:

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

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) and 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 TAMA. Although few farm units in the TAMA 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. About one-third of the active IGFRs in TAMA have been assigned an irrigation efficiency less than 80 percent.

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

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 TAMA. Appendix 4A lists the consumptive use requirement for each crop historically grown in the region.

Other Needs

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. For the fourth management period, no crops grown in the TAMA were identified as needing additional water for other needs.

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:

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

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 TAMA 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 TAMA. 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

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 TAMA, 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.

4.5.1.2 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.

4.5.2 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 the IGFR owner was regulated under the BMP Program in the 3MP. This statute requires ADWR to calculate the water duty for each farm unit by dividing the total irrigation requirement per acre of the crops historically grown on the farm unit by an assigned irrigation efficiency of 80 percent. A lower assigned irrigation efficiency may be used to calculate the water duties for farm units or portions of farm units that are determined by the Director as having limiting soils or excessive slopes.

A.R.S. § 45-567(A)(1) authorizes ADWR, subject to certain limitations, to reduce the highest 25 percent of the water duties within an area of similar farming conditions. ADWR chose not to implement this provision for the fourth management period. During the development of the 3MP, ADWR examined this provision and found that it: 1) did not result in significant water savings, 2) could result in increased administrative burden on the part of ADWR and the regulated community and 3) may be perceived as unfairly targeting specific farms growing certain crop types. The 3MP Agricultural Subcommittee recommended against implementing the provision in the 3MP and that recommendation has been carried through into the 4MP for the TAMA.

In the Base Program, the potential to accrue flexibility account credits is unlimited. 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 to other farm units or acquire flexibility account credits from other farm units during the second calendar year following the year in which the flexibility account credits were registered (A.R.S. § 45-467(O)).

4.5.3 Historic Cropping Program

ADWR developed the Historic Cropping Program pursuant to A.R.S. § 45-567.02. As required by this statute, ADWR will calculate the water duty by dividing the total irrigation requirement per acre of the crops historically grown on the farm unit by an assigned irrigation efficiency of 75 percent. In areas determined by the Director to have limiting soils, the Director may use an assigned irrigation efficiency of 70 percent for the water duty calculation. Currently there are no farms in the TAMA 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, 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 unless there is a change in ownership of the IGFR.

Under the Second Management Plan and 3MP, there were no IGFR owners in any AMA enrolled in the Historic Cropping Program.

4.5.4 Best Management Practices Program

As required by A.R.S. § 45-567.02(G), the Director has included a BMP Program in the 4MP. The BMP Program can best be characterized as 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 recovery from the administrative burden on both the 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 practices that involve on-farm irrigation system improvements and increased farm management. This combination of applied physical and management improvements is designed to assist farmers in achieving a high level of on-farm seasonal irrigation efficiency. Currently, there are no farms in the TAMA enrolled in the BMP Program.

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 assistance of the agricultural community, has developed a menu of approved BMPs to ensure that individual farmers can select practices that provide the greatest opportunity for increased water savings and efficient operation of their farms.

Approved BMPs are listed in Appendix 4B and are separated into four distinct categories: 1) Water Conveyance System Improvements; 2) Farm Irrigation Systems; 3) Irrigation Water Management Practices; and 4) Agronomic Management Practices. Each category contains specific ADWR approved BMPs, with point values based on their potential contribution to water conservation. To ensure a balance between categories, a person regulated under the BMP Program may only score a maximum of three points within each category. Furthermore, a person must score a minimum of two points in the Farm Irrigation Systems category, a minimum of one point in each of the other three categories, and at least 10 points overall. 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.

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.
- 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 Fifth Management Plan (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.

A person regulated under the BMP Program in the 3MP shall remain in the BMP Program in the 4MP without re-applying.

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 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 it applies and is accepted for regulation under the Historic Cropping Program.

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.

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 thirty 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.

4.5.4.1 BMP Advisory Committee

The Agricultural Water Conservation Best Management Practices Advisory Committee (BMP Advisory Committee) was established in 2002. The role of the BMP Advisory Committee, in consultation with ADWR and the agricultural community, is to review and analyze the effectiveness and administration of the BMP Program. Based on this information, the BMP Advisory Committee may recommend changing or terminating the program, and may also recommend the structure of a BMP Program for subsequent management periods.

4.5.4.2 BMP Technical Standards Assistance

In 2013, ADWR established a new partnership with the US 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.

The NRCS has made recommendations to the ADWR Director intended to improve the implementation of the BMP program during the fourth management period. These recommendations will be presented to the BMP Advisory Committee for consideration and approval.

4.6 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 requirements as well as the 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. CMID is the only irrigation district with a consolidated distribution system in the TAMA to which this requirement applies.

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.

4.7 AGRICULTURAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS

4-701. 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 4-701 through 4-707 of this chapter shall have the meanings set forth below, unless the context otherwise requires:

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

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

3. *"5MP" means the Fifth Management Plan for the Tucson 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: http://www.azleg.state.az.us/search/oop/qfullhit.asp?CiWebHitsFile=/ars/45/00402.htm&CiRestriction=402)*

9. *"Farm Unit" has the same definition as prescribed in A.R.S. § 45-402.(See: http://www.azleg.state.az.us/search/oop/qfullhit.asp?CiWebHitsFile=/ars/45/00402.htm&CiRestriction=402)*

10. *"Flexibility Account" is an account maintained under A.R.S. § 45-467.(See: http://www.azleg.state.az.us/search/oop/qfullhit.asp?CiWebHitsFile=/ars/45/00467.htm&CiRestriction=467)*

11. *"IGFR" means an Irrigation Grandfathered Right as prescribed in A.R.S. § 45-402. (See: http://www.azleg.state.az.us/search/oop/qfullhit.asp?CiWebHitsFile=/ars/45/00402.htm&CiRestriction=402*

12. *"Irrigation Acre" has the same definition as prescribed in A.R.S. § 45-402. (See: http://www.azleg.state.az.us/search/oop/qfullhit.asp?CiWebHitsFile=/ars/45/00402.htm&CiRestriction=402)*

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 which, for the 4MP, is the total irrigation requirement to produce the crops historically grown divided by the assigned irrigation efficiency.*

15. *"Lost Water" means water from any source, including reclaimed water, 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. *"Reclaimed water" has the same definition as "effluent" in A.R.S. § 45-101.*

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 reclaimed water, 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.*

4-702. 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 4-703 or the Best Management Practices Program described in section 4-704, 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, 2019, 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 TAMA are set forth in the document entitled "Supplement I to the 4MP for the TAMA," 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.*

4-703. 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 4-702, 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. *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 shall be denied.*

4-704. 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 the 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 K, 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 from 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 ten 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 three 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 and any person using groundwater pursuant to the IGFR, shall 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 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, 2019. 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, shall be regulated under the BMP Program beginning January 1, 2019, unless the IGFR owner provides written notification of intent to withdraw from the BMP Program 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 Requirements

A person regulated under the BMP Program is exempt from the maximum annual groundwater allotment conservation requirements set forth in section 4-702.

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 the BMPs the person was required to implement under the BMP Program in the 3MP, 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 thirty 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 the 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 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 thirty 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 4-702.*

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 a minimum of 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 paragraphs 2 and 3 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.*

4-705. 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 uses.

B. Conservation Requirements

By January 1, 2019 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 irrigation 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 reclaimed water, 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.*

4-706. 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 uses.

B. Monitoring and Reporting Requirements

Beginning with calendar year 2019 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 reclaimed water, 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 reclaimed water, 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.*

4-707. Remedial Groundwater Accounting for Conservation Requirements

A. Accounting

Remedial Groundwater used by a person subject to a conservation requirements 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 January 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 thirty 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 shall 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 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.

APPENDIX 4A
CONSUMPTIVE USE AND OTHER NEEDS BY CROP*

	Consumptive Use (ac-ft per acre)		Other Needs (ac-ft per acre)
Crop	**ASFC** 1 - 6**	**ASFC 7**	**All ASFCs**
Grain Crops			
Barley	1.83	1.83	-----
Corn, Grain	2.67	2.5	-----
Maize (Sorghum)	2.67	2.17	-----
Oats, Grain	1.83	1.83	-----
Rye	1.83	1.83	-----
Sorghum, Grain	2.67	2.17	-----
Wheat	1.83	1.83	-----
Field Crops			
Castor Beans	3.7	3.7	-----
Cotton	3.08	2.58	-----
Peanuts	2.75	-----	-----
Pinto Beans	-----	1.17	-----
Safflower	3.33	-----	-----
Soybeans	1.85	-----	-----
Orchard Crops (Nut)			
Pecans, without Groundcover	4.33	3.58	-----
Pecans, with Groundcover	5.67	-----	-----
Pistachios	4.17	3.5	-----
Forage Crops			
Alfalfa***	4.08	3.42	-----
Bermuda Grass	3.5	3.42	-----
Hay, Annual (Non-Alfalfa)	2.25	1.5	-----
Native Pasture	1.75	1.75	-----
Permanent Pasture (Fescue)	5.75	4.67	-----
Sudan Grass	2.25	1.5	-----
Vegetable Crops			
Carrots	1.38	-----	0.75
Chili Peppers	-----	2.33	0.5
Corn, Sweet	1.63	1.42	0.87
Lettuce, All	0.71	0.71	2.44
Onions, Dry	1.94	-----	0.75
Tomatoes, All	2	-----	0.5
Vegetables, Mixed	2	-----	0.5
Fruit			
Apricots	3.92	3	-----
Cantaloupe, Late	-----	1.33	0.5
Citrus, All	3.75	-----	-----
Grapes	-----	2.5	0.5
Peaches	3.92	-----	-----
Plums	3.92	-----	-----
Watermelons	1.75	-----	0.5
Miscellaneous Crops			
Jojoba	3	-----	
Christmas Trees	2.5	2.25	
Nursery Stock	3	-----	

*Based on crops that were reported in the 1975 to 1980 history.
**Areas of Similar Farming Conditions (see Chapter 3, section 3.2.5)
***Based on the average historical high yield of alfalfa in Pima County of 6.5 tons per acre and a consumptive use (CU) rate of 7.5 acre-inches per acre per ton of production, rounded to the nearest acre-inch. Farm units that demonstrated historic yields above this average were assigned higher CU rates accordingly, not to exceed a high CU value of 5.67 ac-ft per acre. ASFC 7 was based on an average historical high yield for Santa Cruz County of 5.5 tons per acre.

Sources: (Food and Agriculture Organization of the United Nations, 1977)
(United States Department of Agriculture, 1982)

APPENDIX 4A
ASSIGNED CONSUMPTIVE USE (CU) VALUES FOR CROPS ASSOCIATED WITH FARM UNITS TEN ACRES OR LESS

HIGH CONSUMPTIVE USE CROPS

Crops with a CU value of 4.30 ac-ft per acre or more in ASFCs[1] 1-6, are assigned a CU value of 5.00 ac-ft per acre. Crops with a CU value of 3.60 ac-ft per acre or more in ASFCs 7 are assigned a CU value of 4.50 ac-ft per acre.

Alfalfa
Pecans (with and without Groundcover)
Permanent Pasture (Fescue)
Pistachios

MEDIUM CONSUMPTIVE USE CROPS

Crops with a CU value of 2.25 to 4.30 ac-ft per acre in ASFCs 1-6, are assigned a CU value of 3.25 ac-ft per acre. Crops with a CU value of 2.25 to 3.60 ac-ft per acre in ASFCs 7 are assigned CU value of 3.00 ac-ft per acre.

Apricots	Grapes	Peaches
Bermuda Grass	Guayule	Peanuts
Corn, Grain	Jojoba	Plums
Cotton	Nectarines	Rappini
Citrus, All	Nursery Stock	Safflower
Chili Peppers	Olives	Sorghum (Grain, Double Cropped)
Christmas Trees	Okra	Sugar Beets

LOW CONSUMPTIVE USE CROPS

Crops with a CU value less than 2.25 ac-ft per acre in all ASFCs are assigned a CU value of 2.00 ac-ft per acre.

Barley	Cucumbers, All	Mixed Vegetables	Rye
Beets, Table	Ensilage	Native Pasture	Sorghum, Grain
Broccoli	Hay, Annual	Oats, Grain	Sudan Grass
Cabbage, All	(Non-Alfalfa)	Onions, All	Summer Squash
Cantaloupe, All	Lettuce, All	Parsnips	and Zucchini
Carrots	Maize	Pinto Beans	Tomatoes, All
Cauliflower	Melons, All	Potatoes	Turnips and Rutabaga
Corn, Sweet	Miscellaneous Vegetables	Radishes	Wheat

[1]ASFCs = Area of Similar Farming Conditions *(See Chapter 3, Section 3.2.5)*

APPENDIX 4B
BEST MANAGEMENT PRACTICES PROGRAM
APPROVED BEST MANAGEMENT PRACTICES

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 (open channel) in order to minimize transmission losses through seepage.

BMP 1.2 Pipelines

Any type of low or high-pressure pipeline (closed conduit) 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 Category 1: Water Conveyance System – Point 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 three 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
50-54	1.0
55-59	1.2
60-64	1.4
65-69	1.6
70-74	1.8
75-79	2.0
80-84	2.2
85-89	2.4
90-94	2.6
95-99	2.8
100	3.0

APPENDIX 4B
BEST MANAGEMENT PRACTICES PROGRAM
APPROVED BEST MANAGEMENT PRACTICES

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 - (1 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 - (1 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 - (2 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 - (2 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 - (3 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 - (3 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).

APPENDIX 4B
BEST MANAGEMENT PRACTICES PROGRAM
APPROVED BEST MANAGEMENT PRACTICES

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 three and the minimum number is two.

BMP CATEGORY 3. IRRIGATION WATER MANAGEMENT PRACTICES **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.

APPENDIX 4B
BEST MANAGEMENT PRACTICES PROGRAM
APPROVED BEST MANAGEMENT PRACTICES

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 ADWR sponsored educational irrigation water management program that includes irrigation water management topics such as soil water replacement needs, application rates, and irrigation scheduling. Must participate in such a program throughout the entire crop season annually.
BMP 3.8 Participation in a consultant or irrigation district sponsored irrigation scheduling service - (1 Point) Definition: Enrollment in a consultant or ADWR 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. Must participate in such a program throughout the entire crop season annually.
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. Must participate in such a program throughout the entire crop season annually.
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.

APPENDIX 4B
BEST MANAGEMENT PRACTICES PROGRAM
APPROVED BEST MANAGEMENT PRACTICES

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 three and the minimum number is one.

BMP CATEGORY 4. AGRONOMIC MANAGEMENT PRACTICES
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: Incorporation of crop residue 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 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 three and the minimum number is one.

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CHAPTER FIVE: MUNICIPAL

5.1 INTRODUCTION

Historically, the goal of the Municipal Conservation Program has been to assist the Tucson Active Management Area (TAMA) 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 reclaimed water.

What is a Municipal Water Provider?
The municipal water use sector includes water use by municipal water providers. 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. Municipal water providers can also include well co-operatives, mobile home parks or improvement districts. ADWR regulates those water providers serving more than 250 ac-ft of water for non-irrigation use annually as large municipal providers. Those providers serving 250 ac-ft or less annually are regulated as small municipal providers.

ADWR does not regulate uses of water by small, private, domestic wells, known as exempt wells, under the *1980 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 3,400 ac-ft in the TAMA in 2013. 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.

All large municipal providers not designated as having an Assured Water Supply (AWS) will be regulated under the Non-Per Capita Conservation Program (NPCCP) for the fourth management period pursuant to A.R.S. § 45-567.01(I). This is a best management practices type program requiring implementation of specific water conservation measures. Large municipal providers with a Designation of Assured Water Supply (DAWS) are regulated under the Total Gallons Per Capita per Day (Total GPCD) Program, which assigns a GPCD target to each large municipal provider based on a statistical analysis of each large municipal provider's GPCD trends. However, large municipal providers with a DAWS may elect to be regulated under the NPCCP as an alternative to the Total GPCD Program. The Total GPCD Program Total GPCD requirement is based on water use characteristics within the water service area and the large municipal provider's water conservation potential. Providers regulated under the NPCCP must implement a required number of best management practices within their service areas. Small municipal providers are required to reduce waste and improve water use efficiency within their service areas during the fourth management period.

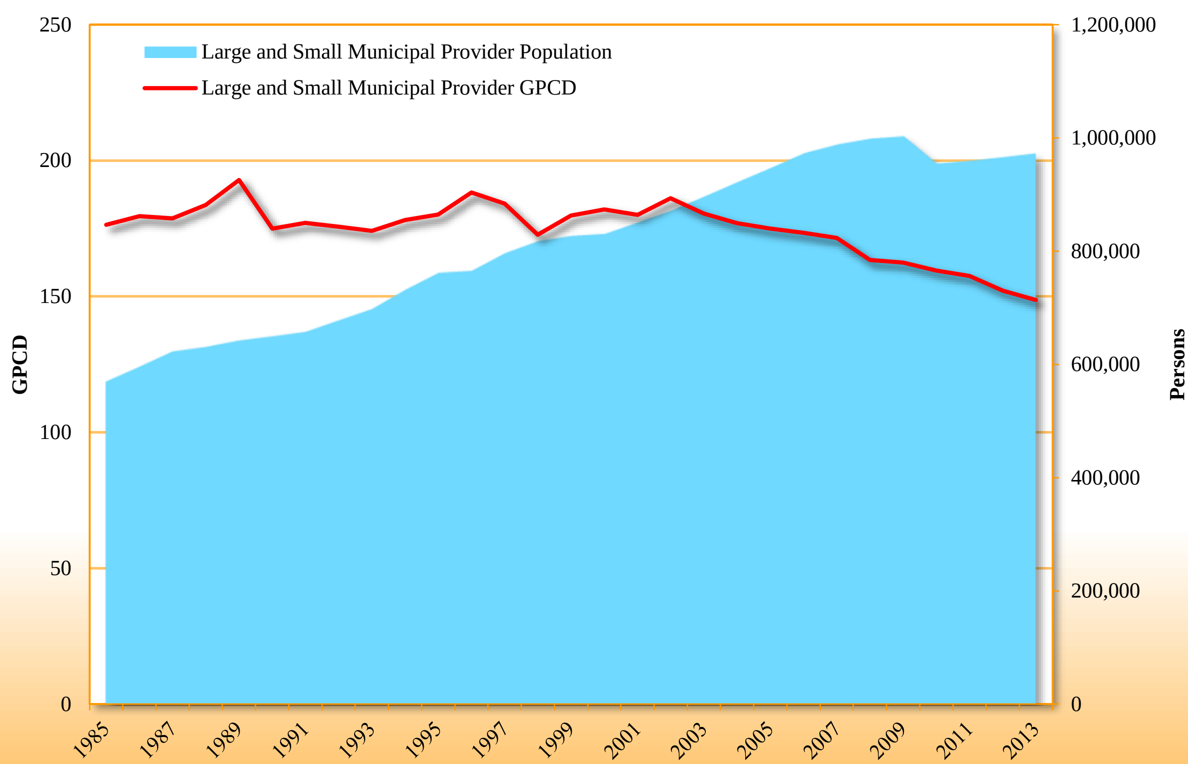
Municipal Conservation Program Requirements
All municipal water providers have maximum allowable lost and unaccounted for water requirements to minimize system losses. All municipal providers must also comply with monitoring and reporting requirements. Information on water use, growth and system losses must be reported to ADWR on an annual basis.

In the 4MP, ADWR is continuing its efforts to address water management challenges and minimize obstacles to further progress towards the achievement of the TAMA 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 TAMA groundwater uses with alternative supplies will help ensure a sustainable and secure water supply for the future.

5.1.1 TAMA Municipal Sector Description

The municipal sector in the TAMA used about 113,000 ac-ft in 1985 and more than 162,000 ac-ft in 2013. In 1985, the municipal sector accounted for just over 40 percent of the total water demand in the TAMA. By 2013, the municipal sector in the TAMA comprised 47 percent of the total TAMA demand. Population in the TAMA grew by more than 425,000 people, an increase of 74 percent from 1985 to 2013. Municipal demand over the historical period peaked in 2007 at 189,893 ac-ft, but has been lower from 2008 through 2013. This closely matches the period of economic downturn in those years; however, this reduction is also due to other factors including active and passive water conservation and potentially weather conditions. Groundwater use in the municipal sector in the TAMA has declined significantly since 1985. The total volume of groundwater used in the years 2009 through 2013 was less than half the 1985 volume. In 1985, groundwater was the only source of water supply used in the TAMA (113,000 ac-ft). By 2013, groundwater accounted for only 24 percent of the supply used to meet municipal demand. Use of CAP water has steadily increased since 2000. In 2013, recovered CAP water accounted for two-thirds of the supply to meet demand. Reclaimed use has also increased from zero in 1985 to approximately 10 percent each year in recent years.

FIGURE 5-1
TUCSON AMA MUNICIPAL POPULATION & GPCD, 1985-2013



5.1.2 History of TAMA Municipal Regulatory Programs/4MP Goals Summarized

Municipal provider conservation requirements from previous management plans have contributed to decreased groundwater use. GPCD rates in the TAMA fluctuated between 1985 and 2002, but have declined since 2002 (*See Figure 5-1*), which means that less groundwater is now required to serve the same number of people that were 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 *Fourth Management Plan* *for the Tucson Active Management Area* (4MP) 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 TAMA 4MP will be necessary to achieve the safe-yield goal of the TAMA by the year 2025 and to maintain safe-yield thereafter, as well as promote more effective and efficient water management within the TAMA. These additional efforts include, but are not limited to, the following: increased water conservation efforts; full utilization of CAP allocations; and maximized use of reclaimed water (which may, in part, be accomplished through artificial recharge).

5.1.3 Non-Per Capita Conservation Program and MODIFIED Non-Per Capita Conservation Program - History and Background

The initial Third Management Plan (3MP) included the original NPCCP in addition to the Total GPCD Program, the Alternative Conservation Program (ACP) and the Institutional Provider Program. The original NPCCP was intended to allow providers a way to meet the requirement to achieve additional water conservation outside of the Total GPCD and ACP programs. Some providers in other Active Management Areas (AMAs) applied for regulation under the original NPCCP during the third management period. However, large municipal providers in the TAMA continued in the Total GPCD Program until the Modified NPCCP (MNPCCP) was adopted.

The MNPCCP was developed as a result 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 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 the state's five AMAs being invited to further participate in the process through a series of public meetings *(See http://www.azwater.gov/AzDWR/WaterManagement/AMAs/MunicipalConservationProgram-ThirdManagementPlanReview.htm)*. In April 2007, legislation was passed to add a new regulatory program to the 3MP for AMAs- the MNPCCP. On April 1, 2008, the Director issued orders modifying the 3MP for each Active Management Area (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 http://www.azwater.gov/AzDWR/WaterManagement/AMAs/ThirdManagementPlan-SecondModification.htm)*. The first year of provider program implementation was 2010.

For the 4MP, there is only one non-per capita program- the NPCCP- that is required by A.R.S. § 45-567.01 and that corresponds to the MNPCCP in the 3MP. Throughout this chapter, references to the NPCCP mean the 4MP NPCCP. All large municipal providers that have been designated as having an AWS, 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 are not designated as having an AWS will be regulated under the NPCCP.

5.2 RELATIONSHIP OF THE MUNICIPAL SECTOR TO ACHIEVEMENT OF THE TAMA WATER MANAGEMENT GOAL

Municipal pumping in the TAMA has historically been centered in the Upper Santa Cruz Sub-basin where the population is concentrated in and around the City of Tucson (Tucson Water), as well as in the Avra Valley area to the northwest and along the Santa Cruz River. Municipal demand in the TAMA has reduced from a peak of nearly 190,000 ac-ft in the year 2007 to under 152,000 ac-ft in the year 2014. Groundwater pumping decreased with the availability of CAP water. Initially, this supply was used directly. Differences in water chemistry and issues with exiting distribution systems caused a shift to recharge and water recovery particularly by Tucson Water.

The *Demand and Supply Assessment, Tucson Active Management Area* (Assessment) (ADWR, 2010) projected municipal demand in the TAMA to be between 251,000 and 308,000 ac-ft by the year 2025. However, future municipal demand could also decrease as evidenced by recent Annual Water Withdrawal and Use Reports submitted by TAMA municipal providers and by a municipal use study conducted by Montgomery & Associates in 2014.

The 4MP assumes increased underground storage and recovery of CAP water. In the future, it may be necessary to construct additional underground storage facilities to maximize the use of CAP water in the TAMA. Finding appropriate locations for underground CAP water storage may be challenging. The total volume of permitted CAP recharge storage capacity is currently 344,674 ac-ft per year, of which 254,000 ac-ft is permitted at USF facilities and 90,674 ac-ft is permitted at GSF facilities.

The current permitted reclaimed recharge storage capacity is 73,373 ac-ft per year maximum, all of which is to be stored at USFs. To date, there are not any active reclaimed GSFs in the TAMA. Even if full utilization of CAP and maximized re-use of reclaimed water is achieved in the TAMA by 2025, additional renewable supplies will be needed to meet continued growth in the municipal sector. Although these demands could be met with groundwater, this is contrary to attaining the TAMA water management goal. Additional underground storage facilities, as well as direct treatment and re-use of renewable supplies, will also be needed post-2025 to continue the reduction in groundwater dependency in the TAMA.

TABLE 5-1
TUCSON AMA MUNICIPAL DEMAND, 1985-2013 (ac-ft)

Year	Demand	Groundwater	Remediated Groundwater	Direct Use Reclaimed Water	Recovered Reclaimed Water	Direct Use CAP	Recovered CAP	Surface Water
1985	**112,655**	112,655						
1986	**119,974**	119,974						
1987	**124,837**	124,837						
1988	**129,971**	126,522		3,449				
1989	**138,850**	134,587		4,263				
1990	**127,454**	123,164		4,290				
1991	**130,482**	125,351		5,131				
1992	**133,431**	120,231		5,360		7,840		
1993	**136,164**	86,805		2,823	2,618	43,918		
1994	**146,037**	119,771		2,526	3,065	20,676		
1995	**153,740**	147,215		3,764	2,761			
1996	**161,466**	153,178		5,767	2,521			
1997	**164,338**	155,827		5,369	3,143			
1998	**158,235**	149,513		4,348	4,374			
1999	**166,575**	156,768		4,758	5,049			
2000	**169,242**	158,984		4,607	5,582		69	
2001	**171,588**	136,946	6,383	4,117	6,764		17,378	
2002	**181,860**	143,770	7,259	2,868	8,916		19,047	
2003	**181,248**	112,327	6,802	2,413	9,814		49,659	233

Year	Demand	Groundwater	Remediated Groundwater	Direct Use Reclaimed Water	Recovered Reclaimed Water	Direct Use CAP	Recovered CAP	Surface Water
2004	**182,810**	96,160	9,393	6,279	6,466		64,340	173
2005	**185,565**	96,944	3,848	8,716	4,737		71,132	188
2006	**188,977**	93,790	6,852	9,951	5,996		72,179	210
2007	**189,893**	66,531	6,376	10,671	6,785		99,118	413
2008	**182,750**	61,673	8,105	10,179	7,988	503	93,717	585
2009	**182,464**	38,734	8,678	10,411	9,767	737	114,137	0
2010	**170,571**	32,882	7,445	7,200	8,221	955	113,856	12
2011	**169,285**	31,894	7,442	8,064	7,893	430	113,548	14
2012	**164,481**	29,592	6,338	7,279	8,980	249	112,030	14
2013	**161,916**	33,002	4,790	7,687	7,560	207	108,653	17
2014	**151,171**	21,780	6,507	7,575	7,357	49	107,903	

Table 5-1 shows the total demand in the municipal sector from 1985 through 2013 and the sources of supply used to meet the demand. Municipal groundwater demand in the TAMA fluctuated historically with a gradually increasing trend peaking in 2000 and then steadily declining. In the early 1990s, Tucson Water began delivery of CAP directly from its water treatment plant; however, due to issues with the difference in the water chemistry of the surface water from the local groundwater, direct delivery of CAP was discontinued shortly thereafter. Groundwater use continued to increase from 1995 to 2000. Recovery of stored CAP water began in the year 2000 and resulted in a dramatic reduction in dependency on groundwater.

Direct use of reclaimed water has also steadily increased over time as reclaimed distribution systems have expanded and more providers have begun reusing reclaimed water for landscape irrigation where feasible. In addition, storage and recovery of reclaimed water, initiated in the 1990s, has continued to increase over time.

Underground storage and recovery of renewable water supplies has reduced groundwater dependency in the TAMA municipal sector. However, the location of underground storage has not necessarily been in the same area where the recovery occurred. Over time, this has resulted in local imbalances where water levels in some areas declined (where pumpage occurred) and water levels rose where the water was stored. As Table 5-1 shows, the use of CAP and reclaimed water reduced groundwater dependency in the TAMA, but from a local geographic perspective some areas have experienced water level declines. There is recognition that there may not be a hydrologic connection between the location of recovery of stored water relative to the location of where the water is stored.

5.3 ROLE OF THE ASSURED WATER SUPPLY PROGRAM IN THE MUNICIPAL CONSERVATION PROGRAM

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). 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.RS. § 45-576(B)(C)).

There are two mechanisms for demonstrating that a proposed subdivision has an AWS. First, the subdivider may apply for and obtain a Certificate of Assured Water Supply from the Director of ADWR. Second, 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)). For both of these purposes, in the TAMA "Assured Water Supply" 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 TAMA; 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)).

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. When water is withdrawn outside the area of hydrologic impact of the storage, it does not add physical availability over and above the volume of naturally occurring groundwater beneath the land surface. Although the water "recovered" is legally considered non-groundwater and is, therefore, consistent with the achievement of safe-yield. It does not add any additional supplies to the place of use (i.e. location of pumping). As water levels continue to decline in areas where pumping has been concentrated historically, the need to recover from within the area of impact of where water is stored to demonstrate additional physical availability of water supply will increase.

Municipal providers who hold a DAWS are most prepared to address future needs, long-term drought and future climate variability and have an extensive "water portfolio" (e.g. the sources of water supply used to demonstrate an AWS). Should a shortage of CAP 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 and file with ADWR drought mitigation and response plans.

5.4 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIAL GROUNDWATER

Since the adoption of the Code, a number of 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 reclaimed water (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 most 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 pursuant to A.R.S. § 49-282.03, consistent with its accounting for surface water (1999 Ariz. Sess. Law, H.B. 2189, § 51(B)). See Chapter 7, Section 7.4.4.6 for more information. 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 2013, the Arizona Department of Environmental Quality (ADEQ) identified seven WQARF projects in the TAMA *(See http://www.azdeq.gov/environ/waste/sps/download/wqarf2013arr.pdf)*. 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 US 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 must also 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 that qualifies for the accounting must be metered and reported separately from groundwater not qualifying for the accounting (*See section 5-712 of the Municipal Conservation Requirements).*

5.5 NON-REGULATORY EFFORTS

ADWR has a program for water management assistance in the AMAs. Funding for the program comes from a portion of the annual withdrawal fees levied and collected from all non-exempt groundwater users in the AMAs. Since the Water Management Assistance Program (WMAP) began, the TAMA has funded several projects promoting prudent water management within the TAMA. (*See Chapter 9 of this plan)*.

5.6 PROGRAM DESCRIPTIONS

The Director has included two regulatory programs for large municipal providers in the 4MP: the NPCCP, a best management practices program; and the Total GPCD Program, with a total GPCD requirement for large municipal providers that are designated as having an AWS and that do not elect to be regulated under the NPCCP. A conservation program for small municipal providers is also included, as are requirements for the distribution of water for non-irrigation use by cities, towns, private water companies and irrigation districts. Appendix 5D lists the municipal water providers in the TAMA and whether they are a large municipal provider or a small municipal provider.

5.6.1. Non-Per Capita Conservation Program

5.6.1.1 Introduction

The NPCCP is a performance-based program designed to achieve water use efficiency in a municipal provider's service area. The level of efficiency is designed to be equivalent to the water use efficiency assumed by the Director in establishing the per capita conservation requirements under the Total GPCD Program. Each year while regulated under the NPCCP, a provider must implement a basic public information program and one or more additional best management practices (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.

Current members of the municipal BMP Advisory Committee are found on ADWR's website: *http://www.azwater.gov/AzDWR/WaterManagement/AMAs/ModifiedNon-PerCapita.htm* .

5.6.1.2 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.

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 and 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.

5.6.1.3 General requirements

Large municipal providers regulated under the NPCCP must also comply with individual user requirements, municipal distribution system requirements and monitoring and reporting requirements. Conservation requirements for individual users in the 4MP have not changed from those in the 3MP. These requirements pertain to turf-related facilities, large-scale cooling facilities and landscaping in publicly owned rights-of-way that receive groundwater from a large municipal provider.

The distribution system requirement that lost and unaccounted for water must be 10% 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 5-711).*

Providers in the NPCCP will be placed in tiers based on the providers' 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 and 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 BMPs that providers must implement is based on which tier they are in:

- Tier 1 – up to 5,000 service area connections: one additional BMP
- Tier 2 – 5,001 – 30,000 service area connections: five additional BMPs
- Tier 3 – more than 30,000 service area connections: ten additional BMPs

5.6.1.4 Provider Profile

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

- A description of the provider's existing service area characteristics and water use patterns;
- The total number of service connections to the provider's water distribution system;
- A description of the conservation measures the provider is currently implementing;
- A description of the basic public information program and additional BMPs that the provider intends to implement to comply with the NPCCP; and
- 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, 2019. Regulation under the NPCCP begins on January 1, 2019 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, and 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 either notice of their conservation requirements or notice of the termination of their DAWS. Regulation under the NPCCP begins on the date the provider's Profile is approved by the Director. 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 final until 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.

5.6.1.5 Basic public information program

All providers regulated under the NPCCP must implement a public education program *(See Appendix 5C, Section I)* 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, provider web page, post cards, newsletters or print pieces.

2. Providing free conservation materials to customers:
   Providers are required to make available to all customers, 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 also encouraged to distribute water conservation information at other locations (i.e. libraries, chamber of commerce, town hall).

5.6.1.6 Best Management Practices (BMPs)

The provider must select additional BMPs from the list of approved BMPs in Appendix 5C, Section II or any future modifications of the list approved by the Director. All of 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 of 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 I, 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 5.6.1.7).* If the Director determines that the substitute BMP is not reasonably relevant to the provider's existing service area characteristics or water use patterns, it will notify the provider of that determination and the provider must resume implementing the discontinued BMP or a substitute BMP that the Director approves. The Director's determination is an appealable agency action.

5.6.1.7 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:

- A description of the basic public information program and additional BMPs implemented during the year.
- The results of the activities implemented.
- An assessment of each BMP implemented as to what works and what needs modification.
- The provider's plan for implementation of BMPs during the current year.
- 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.
- A copy of the provider's current rate structure, unless no changes have been made to the rate structure since it was last submitted to ADWR.

5.6.1.8 Water Rate Structure

A large municipal provider regulated under the NPCCP must include a copy of its current water rate structure in its Annual Report due by March 31 of each year, unless no changes have been made to the rate structure since it was last submitted to the Director.

5.6.1.9 Records Retention

A large municipal provider regulated under the NPCCP must keep and maintain accurate records verifying that the provider implemented the required BMPs implemented during a year and records of its water use during the year. The records for a given calendar year must be kept and maintained for at least five years following that year.

5.6.1.10 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 5-709, the conservation requirements for municipal distributions systems in Section 5-710 and the monitoring and reporting requirements in Section 5-711.

5.6.1.11 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 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.

5.6.2 Total Gallons Per Capita per Day Conservation Program

For the 4MP, the Code allows the Director to determine if additional conservation requirements are needed above 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: US 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 TAMA 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 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 who has a DAWS and who does not enroll in the NPCCP will be regulated under the Total GPCD Program.

5.6.2.1 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. Reclaimed water 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.

5.6.2.2 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 TAMA 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 EPA "WaterSense" fixtures *(See http://www.epa.gov/watersense/)* and updated landscaping assumptions, the provider's 3MP non-residential component and ten 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 US Census, ADWR compiles the Census data to determine an updated decennial US 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 US Census base population for each provider, persons per housing unit and occupancy characteristics are obtained from the US 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 allow water providers flexibility for variations in weather, the flexibility account ADWR included in the 3MP will continue into the 4MP. The flexibility account allows large municipal providers regulated in the Total GPCD Program to accumulate a 30 GPCD credit or incur debits up to 10 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 reclaimed water or reclaimed water 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.

5.6.3 Lost and Unaccounted for Water
Large municipal providers must limit the amount of lost and unaccounted for water in their groundwater distribution systems to no more than 10 percent of the total quantity of water that enters its groundwater distribution system, calculated on an annual or three-year average basis *(See Section 5-710)*.

5.6.4 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 supplying in excess of 250 ac-ft of water for non-irrigation use per year after the date of adoption of the 4MP. All new large providers that have a DAWS will initially be notified for regulation under the Total GPCD Program. Their total GPCD requirement will be calculated consistent with the statistical methodology used for existing large municipal providers. ADWR will establish the base year for the municipal provider as the year preceding the year in which the provider began serving greater than 250 ac-ft per year, unless the Director determines that water usage during that year is not representative of its 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 reclaimed water or reclaimed water 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 reclaimed water to be produced to serve the entire facility. The adjustment will remain in effect until sufficient direct use reclaimed water, or reclaimed water 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 reclaimed water use increases. The adjustment will be terminated if the infrastructure necessary to deliver the reclaimed water 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 who has a DAWS cannot serve a turf-related facility under its existing per capita requirement, and direct use reclaimed water or reclaimed water 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 5-705. The provider must submit a Provider Profile containing the information described in section 5-705(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 5-705(B)(2) or (B)(3).

5.6.5 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, they 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 5-705(B)(1) within 60 days after the consolidation becomes effective. The consolidated provider will be regulated under the NPCCP described in section 5-705 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 they were regulated under 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.

5.6.6 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 as well as certain other reporting requirements described below.

5.6.7 Regulatory Requirements for All Municipal Providers

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

5.6.7.1 Individual User Requirements

An individual user is an entity that receives water from a municipal provider for non-irrigation use. For the 4MP, the Director is authorized to establish "additional conservation requirements for non-irrigation uses..." (A.R.S. § 45-567 (A)(2)). However, in the 4MP ADWR has not modified the 3MP individual user Requirements and has not included any additional conservation requirements for individual users from those included in the 3MP. In the 3MP, individual user requirements were established for turf-related facilities, publicly owned rights-of-way and large cooling towers. These requirements have remained unchanged for the 4MP.

Either the individual user or the municipal provider serving the individual user is responsible for complying with the individual user requirement. See Section 5-709(B) for determining responsibility for compliance with the individual user requirements.

5.6.7.2 Distribution System Requirements

Lost and unaccounted for water is defined as the total water from any source, withdrawn, diverted or received in a year that enters a municipal provider's groundwater distribution system, minus the total amount of authorized deliveries from the groundwater distribution system 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 during a calendar year and the total quantity of water that enters the provider's groundwater distribution system during the year. Small municipal providers must maintain lost and unaccounted for water at or below 15 percent. Large municipal providers are required to maintain their system so as to not exceed 10 percent lost and unaccounted for water. A provider is in compliance with its municipal distribution system requirements if it limits its lost and unaccounted for water to the maximum percentage on an annual or three-year average basis.

For the fourth management period, as in the third management period, ADWR will allow providers to exclude water that is metered or estimated using approved estimating procedures and used pursuant to other regulatory requirements, such as well purging and line flushing, from the lost and unaccounted for water calculation. Providers may also 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 5B provides a complete list of uses considered in the lost and unaccounted for water calculation, including those uses which can be estimated to determine the volume.

5.6.7.3 Monitoring and Reporting Requirements

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

- information on the total quantity of water withdrawn, diverted or received that enters the groundwater distribution system during the year;
- total quantity of water used within the service area and the total volume of water delivered for various municipal purposes;
- 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;
- 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;
- 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;
- an updated water service area and distribution system map delineating all distribution lines greater than 4 inches, all treatment works and all well sites;
- 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 5-705(E), 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.

5.7 MUNICIPAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS

5-701. 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 Tucson Active Management Area.*
2. *"5MP" means the Fifth Management Plan for the Tucson Active Management Area.*
3. *"ADWR" means the Arizona Department of Water Resources.*
4. *"ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA" means the list of low water / drought tolerant plants found on ADWR's website, http://www.azwater.gov/AzDWR/WaterManagement/AMAs/TucsonAMA/TAMAConservation.htm , 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 Central Arizona Project water.*
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 5-705(E).*
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 reclaimed water" 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 reclaimed water 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 ac-ft 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. *"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.*

23. *"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.*

24. *"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.*

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

26. *"NPCCP" means the Non-Per Capita Conservation Program.*

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

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

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

30. *"Reclaimed water" has the same definition as effluent in A.R.S. § 45-101*

31. *"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.*

32. *"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.*

33. *"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.

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

35. *"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.*

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

37. *"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 5-703, subsection C.*

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

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

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

41. *"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.*

42. *"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.*

43. *"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.*

5-702. Large Municipal Providers - Conservation Programs

A. *Except as provided in subsection D of this section, beginning with calendar year 2019 or the calendar year specified in Section 5-707(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 5-703, unless the provider elects to be regulated under the NPCCP described in section 5-705 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 5-705 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 5-705(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 5-705(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 5-705(A). The provider shall be regulated under the NPCCP described in section 5-705 beginning on January 1, 2019 or the date the Director approves the provider's Provider Profile pursuant to section 5-705(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 5-705, 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 5-703. 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 5-709, 5-710, and 5-711.

5-703. 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 5-702, subsection A or D, or Section 5-707 (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 5-704, 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 US Census year, and add that sum to the provider's decennial US Census service area population. The sum is the provider's service area population for the calendar year in question.*

5-704. 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 5-702(A) or (D), or Section 5-707(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 5-703(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 30, 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 -10, 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 5-704(A)(3)(b) the provider is out of compliance for that calendar year.

5-705. 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 5-705(B)(1) of this section no later than July 1, 2019.

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 5-705(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 5-703 shall submit to the Director a Provider Profile as described in 5-705(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, 2019 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.*

    b. *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	*One*
Tier 2- 5,001 to 30,000 connections	*Five*
Tier 3- Over 30,000 connections	*Ten*

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 sixty 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 5-711, 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.*

5-706. 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 5-703, unless the consolidated provider elects to be regulated under the Non-Per Capita Conservation Program described in section 5-705 as provided in section 5-705(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 shall also establish and maintain a flexibility account for the consolidated provider in accordance with section 5-704(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 5-705(B) within 60 days after the consolidation becomes effective. The consolidated provider shall be regulated under the NPCCP described in section 5-705 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 5-703 by providing the Director with written notice of the election as provided in Section 5-702(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 5-705(D)(1)(b) as a result of the acquisition, the provider shall submit to the Director a new Provider Profile pursuant to section 5-705(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 5-705(B)(1).*

3) *If the provider submits a new Provider Profile, section 5-705(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 5-704(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 5-703 by providing the Director with written notice of the election as provided in Section 5-702(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 5-705(D)(1)(b) as a result of the conveyance, the provider shall submit to the Director a new Provider Profile pursuant to section 5-705(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 5-705(B)(1).*

3) *If the provider submits a new Provider Profile, section 5-705(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 5-704 to take into account the reduction in the provider's service area.*

5-707. 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 5-703 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 5-704.*

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 5-705. 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 5-702(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 5-705.

5-708. Conservation Requirements for Small Municipal Providers

A. By January 1, 2019, 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.

5-709. 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 sections 6-1601 through 6-1605 of the Industrial Chapter of the 4MP, and shall comply with the monitoring and reporting requirements set forth in sections 6-1503 and 6-1605 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 6-1502 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 sections 6-2001 and 6-2002 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 6-1503 and 6-2003 and the conservation requirements contained in section 6-1502 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 Tucson 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 Tucson 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, 2019 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, 2019 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, 2019 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, 2019, 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.

5-710. Conservation Requirements for Municipal Distribution Systems

Beginning with calendar year 2019, 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 B) 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 B) 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.*

5-711. Monitoring and Reporting Requirements for Municipal Providers and Individual Users

Beginning with calendar year 2019, 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 5-705 shall include the following in its annual report required by A.R.S.§ 45-632:*

   a. *A CER as prescribed by section 5-705(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 5-709(A).*

5-712. 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 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 January 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 thirty 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 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.

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.

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 59 gallons per housing unit per day by the 2010 US 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. *21 GPCD.*

3. *Multiply the result from paragraph 2 above by the 2010 US Census population for the provider's service area,*

4. *Multiply the result from paragraph 3 above by 365 days in a year,*

5. *Divide the result from paragraph 4 above 0.9,*

6. *Divide the result paragraph 5 above by 365 days in a year,*

7. *Divide the result from paragraph 6 above by the 2010 US Census population for the provider's service area.*

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, 2019 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 REQUIREMENTFOR LARGE MUNICIPAL PROVIDERS

Provider	2000-2009 Median Total GPCD	Median Minus One Standard Deviation	Minimum Total GPCD Requirement	Maximum Total GPCD Requirement	Assigned Total GPCD Requirement
City of Tucson/Tucson Water	175	168	120	162	162
Flowing Wells Irrigation District	161	154	110	153	153
Metropolitan Domestic Water Improvement District – Main System	161	152	102	175	152
Metropolitan Domestic Water Improvement District – Diablo System	107	60	65	105	62
Metropolitan Domestic Water Improvement District – West System	ND[1]	ND	ND	ND	ND
Sahuarita Water Company	84	65	68	124	65
Town of Marana	147	125	69	132	125
Town of Oro Valley	236	225	153	211	211
Vail Water Company	100	76	68	121	76
Willow Springs Utilities	ND	ND	ND	ND	ND

[1]ND means "no data."

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

Lost & Unaccounted For Water Includes:

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

Water System Uses Include:

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

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.). A provider that implements multiple campaigns may be eligible to receive credit for more than one BMP if the campaigns can be shown to be separate and distinct from one another. The provider must submit documentation with its CER that describes the campaign and results.

1.2 Special Events/Programs and Community Presentations
The water provider provides speakers, conducts tours for the public, or participates in community events to display, provide or present information about water conservation and inform 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 describe them in the CER.

1.3 Market Surveys to Identify Customer Information Needs or Assess the Success of Conservation Messages
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 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.

1.4 Distribution Plan for Water Conservation Materials
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
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. A provider that implements multiple adult programs may be eligible to receive credit for more than one BMP if the programs can be shown to be separate and distinct from one another.

2.2 Youth Education Program
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 water facilities. A provider that implements multiple youth programs may be eligible to receive credit for more than one BMP if the programs can be shown to be separate and distinct from one another.

2.3 New Homeowner Landscape Information
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
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
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.) and outdoor components (e.g., irrigation system, pool, water feature, etc.) or both. Audits conducted by the provider may include a meter check and instructions on 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.

3.2 Landscape Consultations (Residential or Non-Residential)
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.

3.3 Water Budgeting Program

The water provider offers assistance in developing a monthly or annual water budget to one or more non-residential water user 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 or 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 Third 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. Descriptions of the water-budgeting assistance provided must be recorded and noted in the provider's CER.

3.4 Residential Interior Retrofit Programs

The water provider offers free or low cost plumbing fixtures or retrofits (e.g., faucet aerators, low-flow showerheads, toilets, toilet dams, etc.) to residential customers living in homes built prior to 1990 that have not been updated to today's water efficiency standards. The provider must offer the program to all residential customers meeting the above criteria unless the provider can demonstrate that targeting certain portions of its water service area is likely to yield the highest participation or potential water savings. The provider must select appropriate communication channels to advertise the program, and must keep a record of the number of retrofits provided and report this information in the CER.

3.5 Non-Residential Interior Retrofit Programs

The water provider offers free or low cost plumbing fixtures or fixture retrofits (e.g., faucets, faucet aerators, low flow showerheads, toilets, urinals, toilet dams, etc.) to non-residential customers with facilities built prior to1990 that have not been updated to today's water efficiency standards. The provider must offer the program to all non-residential customers meeting the above criteria unless the provider can demonstrate that targeting certain portions of its water service area is likely to yield the highest participation or potential water savings. The provider must select appropriate communication channels to advertise the program, and must keep a record of the number of retrofits provided and report this information in the CER.

3.6 Customer High Water Use Inquiry Resolution

The water provider designs and implements a program to assist customers who inquire about their water bill increase or high water use. 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, keep a record of inquiries and the type of assistance provided, and report this information in the CER.

3.7 Customer High Water Use Notification

The water provider develops a program to identify customers with high water use and contact them by telephone, email, door hanger, mail 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 type of notification and the criteria used for determining which customers are advised must be recorded and noted in the provider's CER.

3.8 Water Waste Investigations and Information

The water provider designs and implements a program to investigate water waste complaints and assist citizens in preventing water waste. An investigation would typically include a site inspection and some type of follow-up action, such as customer education to prevent water waste and a letter explaining enforcement (if applicable). The provider must follow-up on every water waste complaint, keep a record of complaints *and follow-up activities, and report this information in the 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 Leak Detection Program
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
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. A description of the program and each year's results must be noted in the provider's CER.

4.3 Comprehensive Water System Audit Program
The water provider conducts a systematic audit of its water distribution system, systems control equipment, and water records to identify and quantify water losses, and develops 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.

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
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.
Water waste or water tampering are prohibited on residential or non-residential properties.

5.3 Plumbing Requirements Stricter than Current Arizona Code.
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).
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
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
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
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
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
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
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
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
All new commercial, industrial, and institutional customers with projected annual water use of 10 ac-ft 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 three 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 Toilet Rebate Program for High Water Use Toilets
The water provider offers a financial rebate or incentive for the replacement of a high water- use toilet with a toilet that uses less than 1.6 gallons of water per flush. This incentive shall be offered to all owners of single-family or multi-family homes in its service area that were constructed prior to 1990 and have not been updated to today's water efficiency standards. A description of the program and its results must be noted in the provider's CER.

6.2 Rebate Program for Toilet that meets or exceeds the U.S. Environmental Protection Agency WaterSense Standards
The water provider offers a financial rebate or incentive to all owners of single-family or multi-family homes in its service area to replace a toilet with one that is more water-efficient and meets or exceeds the U.S. Environmental Protection Agency WaterSense standards. A description of the program and its results must be noted in the provider's CER.

6.3 Toilet Replacement Program
The water provider implements a program to replace toilets with ones that are more efficient and use 1.6 gallons of water per flush or less in single-family or multi-family homes in its service area. A description of the program and its results must be noted in the provider's CER.

6.4 Water Fixture Replacement/Rebate/Incentive Program for Older Homes
The water provider shall offer to replace fixtures (e.g., showerheads, aerators, toilet flappers) or provide a financial rebate or incentive for homeowners to replace fixtures in all single-family or multi-family homes within its service area constructed prior to 1990 that have not been updated to today's water efficiency standards. A description of the program and its results must be noted in the provider's CER.

6.5 Rebate for Water-efficient Hot Water Devices or Systems
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.

6.6 Water- Efficient Appliance or Fixture Rebate/Incentive Program
The water provider shall offer customers a financial rebate or incentive for the purchase and installation of water efficient appliances or fixtures. A description of the program and its results must be noted in the

provider's CER.

6.7 Graywater Retrofit Rebate or Other Incentive
The water provider offers customers 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. A description of the program and its results must be noted in the provider's CER.

6.8 Rainwater Harvesting Retrofit Rebate or Incentive
The water provider offers customers a financial rebate or 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. A description of the program and its results must be noted in the provider's CER.

6.9 Landscape Conversion Rebate or Incentive
The water provider offers customers a financial rebate or other incentive for the conversion of landscape to reduce water usage. Examples include replacing turf 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. A description of the program and its results must be noted in the provider's CER.

6.10 Rebate or Incentive for Installing Xeriscapes in New Landscapes
The water provider offers customers installing new landscapes a financial rebate or incentive for installing a xeriscape landscape. A description of the program and its results must be noted in the provider's CER.

2. <u>Non-residential</u>

6.11 Commercial and Industrial Rebate or Incentive Program
The water provider identifies commercial and industrial customers with the highest conservation potential and implements a water conservation program for those customers. The program may include rebates, replacements, retrofits, audits, incentives and grants. A description of the program and its results must be noted in the provider's CER.

6.12 Large Landscape Conservation Program
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.

6.13 No or Low Interest Loans for Implementing Water Conservation Measures
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 Implementation of an Emerging Technology
The provider implements an emerging technology that is designed to improve water efficiency or result in water savings. The provider must submit with its CER documentation that includes a description of the technology, any available information on water savings, a description of how the technology was implemented within the provider's service area and the results. This documentation shall be made available for public distribution.

7.2 Applied Research to Enhance Decision Making
The provider conducts or provides support for projects that will enhance their conservation program decision making and development (e.g., an analysis of certain water users in their service area). The provider must submit with its CER documentation that describes the research objectives, methods, results and the provider's involvement and method of support. 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 replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

7.3 Evaluation of New or Emerging Technologies and Practices
The provider conducts or provides support for an evaluation of a new or emerging technology or practice designed to reduce water use or improve water use efficiency. The provider must submit documentation with its CER stating the objectives of the evaluation, methods used to conduct the evaluation, a description of the provider's participation, and 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 replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

7.4 Analyzing a Best Management Practice (BMP) for Actual Water Savings
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 also 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 replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

7.5 Implementation of Smart Irrigation Technology
The provider installs smart irrigation technology and submits documentation with its CER describing the project location, implementation methods and estimates of irrigation efficiency.

7.6 Participation in Industry or Regional Partnerships for Water Conservation
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.

7.7 Development of New Conservation Technologies and Products
The provider contributes financial support or in-kind services for the research and development of new conservation technologies or products. The provider must describe its involvement/participation and method(s) of support, research objectives, methods, and results in its CER. 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 replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

7.8 Piloting a New Initiative, Program, or Best Management Practice
The provider implements a new initiative, program or potential new best management practice designed to improve water use efficiency or reduce water consumption. The provider must submit documentation with its CER that includes a description of the project or program, how it was implemented within the provider's service area, and the results. 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 replace this BMP with another BMP from categories 1 through 7 that is appropriate for its service area.

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 the 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
TUCSON AMA MUNICIPAL WATER PROVIDERS

Provider Number	Provider Name	Provider Type
56-000008.0000	ADOBE MANOR MHP	SMALL
56-000370.0000	ANWAY-MANVILLE LLC	SMALL
56-000014.0000	ARIVACA TOWNSITE CO-OP	SMALL
56-000268.0000	**ARIZONA BOARD OF REGENTS**	**LARGE**
56-000362.0000	**ARIZONA DEPARTMENT OF CORRECTIONS**	**LARGE**
56-000016.0000	**ARIZONA WATER COMPANY - ORACLE**	**LARGE**
56-000019.0000	**AVRA WATER CO-OP**	**LARGE**
56-000266.0000	BAKERS DOZEN WELL GROUP	SMALL
56-000275.0000	BEAN	SMALL
56-000021.0000	BERMUDA GARDENS MOBILE HOME PARK	SMALL
56-000032.0000	CAMPBELL ESTATES TRAILER PARK	SMALL
56-000034.0000	CAROLANNE DRIVE HOMEOWNERS	SMALL
56-000036.0000	CASITAS DE CASTILLIAN	SMALL
56-000038.0000	CATALINA COUNTRY MHP	SMALL
56-000151.0000	CATALINA VILLAGE APARTMENTS	SMALL
56-000001.0000	**CITY OF TUCSON / TUCSON WATER**	**LARGE**
56-000045.0000	COLONIAL MHP	SMALL
56-000046.0000	**COMMUNITY WATER COMPANY OF GREEN VALLEY**	**LARGE**
56-000335.0000	CORPORATION OF THE PRESIDING BISHOP OF THE LDS CHURCH	SMALL
56-000050.0000	CORTARO ACRES HOMEOWNERS	SMALL
56-000035.0000	CORTARO-MARANA IRRIGATION DISTRICT	SMALL
56-000053.0000	CRESCENT MANOR MHP	SMALL
56-000200.0000	CROSSROADS PARK, LLC	SMALL
56-000062.0000	DESERT SHORES RV & MHP	SMALL
56-000025.0000	DIAMOND GROVE ESTATES	SMALL
56-000058.0000	**DMAFB WATER SYSTEM**	**LARGE**
56-000288.0000	DUNFORD	SMALL
56-000354.0000	EVERGREEN AIR CENTER	SMALL
56-000078.0000	FAR HORIZONS COOP	SMALL
56-000079.0000	FAR HORIZONS EAST	SMALL
56-000080.0000	**FARMERS WATER COMPANY**	**LARGE**
56-000081.0000	FEDERAL CORRECTIONAL INSTITUTION	SMALL
56-000084.0000	**FLOWING WELLS IRRIGATION DISTRICT**	**LARGE**
56-000086.0000	FOOTHILLS MHP	SMALL
56-000105.0000	FOOTHILLS VISTA MHP	SMALL
56-000092.0000	GATOR WATER COMPANY	SMALL
56-000256.0000	GLOVER	SMALL
56-000347.0000	GOODMAN WATER COMPANY	SMALL
56-000302.0000	**GREEN VALLEY DWID**	**LARGE**
56-000099.0000	HALCYON ACRES NO. 2	SMALL
56-000098.0000	HALCYON ACRES WATER USERS ASSN	SMALL
56-000101.0000	HANNING SNYDER CO-OP	SMALL

Provider Number	Provider Name	Provider Type
56-000103.0000	HERMOSA VISTA WELL SITE	SMALL
56-000325.0000	HILLTOP & NORTH, INC.	SMALL
56-000106.0000	HOMEOWNER'S WATER CO-OP	SMALL
56-000359.0000	HUM WATER COMPANY	SMALL
56-000342.0000	IRONWOOD WELL	SMALL
56-000337.0000	JENSEN	SMALL
56-000121.0000	KINO MOBILE VILLAGE	SMALL
56-000366.0000	LA CASITA WATER COMPANY INC.	SMALL
56-000123.0000	LA CHOLLA AIR PARK	SMALL
56-000269.0000	LA CHOLLA MHP	SMALL
56-000245.0000	LAGO DEL ORO WATER COMPANY	LARGE
56-000270.0000	LARSEN	SMALL
56-000128.0000	**LAS QUINTAS SERENAS WATER COMPANY**	**LARGE**
56-000129.0000	LAZY 'A' MHP	SMALL
56-000130.0000	LAZY ACRES MHP	SMALL
56-000131.0000	LAZY 'C' WATER SERVICE	SMALL
56-000055.0000	LOEFFLER LANE HOMEOWNERS ASSOCIATION	SMALL
56-000137.0000	LOS ARBOLES MHP	SMALL
56-000138.0000	**LOS CERROS WATER COMPANY**	**LARGE**
56-000352.0000	LUZ SOCIAL SERVICES	SMALL
56-000141.0000	LYN LEE WATER COMPANY	SMALL
56-000246.0000	**MARANA DWID**	**LARGE**
56-000143.0000	MARTIN RANCH	SMALL
56-000144.0000	MESA DEL ORO WATER COMPANY	SMALL
56-000145.0000	MESALAND WATER COMPNAY	SMALL
56-000260.0000	MESQUITE WELL ASSOCIATION	SMALL
56-000068.0001	**METROPOLITAN DWID - DIABLO SYSTEM**	**LARGE**
56-000070.0001	METROPOLITAN DWID – E&T SYSTEM	SMALL
56-000244.0000	**METROPOLITAN DWID - HUB SYSTEM**	**LARGE**
56-000349.0000	**METROPOLITAN DWID - MAIN SYSTEM**	**LARGE**
56-000380.0000	METROPOLITAN DWID - WEST SYSTEM	SMALL
56-000146.0000	MIRABELL WATER COMPANY	SMALL
56-000365.0000	MISSION MATERIALS COMPANY	SMALL
56-000372.0000	MT LEMMON WATER DISTRICT	SMALL
56-000320.0000	OCOTILLO COMMUNITY WELL	SMALL
56-000154.0000	ORCHARD VALLEY MHP	SMALL
56-000017.0000	PALM VISTA ESTATES	SMALL
56-000319.0000	PAN CHIVA HILLS WATER COMPANY	SMALL
56-000305.0000	PANTANO PROPERTIES HOA	SMALL
56-000324.0000	PARK PLACE APARTMENTS	SMALL
56-000162.0000	PICACHO PEAK WATER COMPANY	SMALL
56-000345.0000	PIMA COUNTY PARKS & RECREATION	SMALL
56-000367.0000	**QUAIL CREEK WATER COMPANY INC.**	**LARGE**
56-000171.0000	RANCHO DEL CONEJO CO-OP	SMALL

Provider Number	Provider Name	Provider Type
56-000172.0000	RANCHO LA LINDA HOMEOWNERS INC.	SMALL
56-000173.0000	RANCHO LOS AMIGOS LTD PARTNERSHIP	SMALL
56-000176.0000	RANCHWOOD MOBILE HOME PARK	SMALL
56-000247.0000	**RAY WATER COMPANY**	**LARGE**
56-000379.0000	RED ROCK UTILITIES LLC	SMALL
56-000375.0000	**RIDGEVIEW UTILITY COMPANY**	**LARGE**
56-000182.0000	RILLITO WATER USERS INC.	SMALL
56-000301.0000	RINCON COUNTRY RV RESORT - EAST	SMALL
56-000183.0000	RINCON CREEK WATER COMPANY	SMALL
56-000185.0000	RINCON WATER COMPANY	SMALL
56-000186.0000	RIO VISTA MHP	SMALL
56-000187.0000	RIVERSIDE APTS, LLC	SMALL
56-000386.0000	RUBY STAR AIRPORT POA	SMALL
56-000135.0000	**SAGUARO WATER COMPANY**	**LARGE**
56-000191.0000	SAHUARITA VILLAGE WATER COMPANY	SMALL
56-000373.0000	**SAHUARITA WATER COMPANY**	**LARGE**
56-000192.0000	SAMALAYUCA IMPROVEMENT ASSOCIATION	SMALL
56-000193.0000	SANDARIO WATER COMPANY	SMALL
56-000323.0000	SHINN	SMALL
56-000369.0000	SIERRITA MOUNTAIN WATER CO-OP	SMALL
56-000321.0000	SIETE CASAS JOINT VENTURE	SMALL
56-000198.0000	SILVER CHOLLA PARK	SMALL
56-000170.0000	SPANISH TRAIL WATER COMPANY	SMALL
56-000308.0000	SPARGUR	SMALL
56-000355.0000	SPEEDWAY WELL OWNERS ASSOCIATION	SMALL
56-000360.0000	STATE OF ARIZONA	SMALL
56-000361.0000	STATE OF ARIZONA	SMALL
56-000204.0000	SUMMIT WATER COMPANY	SMALL
56-000205.0000	SUMMIT WATER CO-OP	SMALL
56-000328.0000	SUNKIST WELL HOA	SMALL
56-000309.0000	TEWA HEIGHTS HOA	SMALL
56-000209.0000	THIM UTILITY	SMALL
56-000210.0000	THIM WATER CORPORATION	SMALL
56-000382.0000	TIERRA LINDA HOA	SMALL
56-000377.0000	TORTOLITA WATER COMPANY INC.	SMALL
56-000218.0000	TOWN & COUNTRY MOBILE ESTATES	SMALL
56-000107.0000	**TOWN OF MARANA**	**LARGE**
56-000368.0000	**TOWN OF ORO VALLEY**	**LARGE**
56-000312.0000	TRIANO / BAKER	SMALL
56-000220.0000	TUCSON MEADOWS MHP	SMALL
56-000316.0000	TWIN PEAKS HOA	SMALL
56-000356.0000	US DEPT OF VETERANS AFFAIRS	SMALL
56-000060.0000	**VAIL WATER COMPANY**	**LARGE**
56-000225.0000	VAL VERDE INC.	SMALL

Provider Number	Provider Name	Provider Type
56-000227.0000	VALLE VERDE DEL NORTE WTR CO-OP	SMALL
56-000231.0000	VIA VERDE WEST MHP	SMALL
56-000232.0000	VILLA CAPRI MOB. HOME PARK LLC	SMALL
56-000234.0000	VISTA DEL NORTE MHP	SMALL
56-000221.0000	**VOYAGER WATER COMPANY**	**LARGE**
56-000387.0000	VP DWID	SMALL
56-000281.0000	WELL CO-OP	SMALL
56-000378.0000	WILD FLOWER WELL	SMALL
56-000237.0000	WINTERHAVEN WATER COMPANY	SMALL
56-000238.0000	WORDEN WATER COMPANY	SMALL

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CHAPTER SIX: INDUSTRIAL

6.1 INTRODUCTION

The Industrial Conservation Program for *the Fourth Management Plan for the Tucson 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 Industrial Conservation Program/Large-Scale Power Plant program is similar to the program in the 4MP for the other four Active Management Areas (AMAs). The objective of the Industrial Conservation Program is to move industrial users within the TAMA 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 towards the achievement and maintenance of the Tucson Active Management Area (TAMA) safe-yield goal.

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, Tucson Active Management Area,* (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 TAMA 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 Right (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 reclaimed water, 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 not part of a large-scale power plant. These users are referred to in the Municipal Conservation Program as "individual users."

Industrial Conservation Program Requirements

The TAMA 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. In addition, there are specific conservation requirements that apply to the following current or new industrial users in the TAMA:

- Turf-Related Facilities (≥10 acres)
- Sand and Gravel Facilities (>100 ac-ft/year)
- Metal Mining Facilities (>500 ac-ft/year)
- Large-Scale Power Plants (>25 megawatts)
- Large-Scale Cooling Facilities (>1,000 tons)
- Dairy Operations (monthly average ≥100 lactating cows/day)

- New Large Landscape Users (>10,000 square feet of water intensive landscape)
- New Large Industrial Users (>100 ac-ft/year)

In addition, all industrial users are required to comply with certain conservation requirements, including avoiding waste and making diligent efforts to recycle water.

6.1.1 TAMA Industrial Sector Description

Industrial uses of groundwater in the TAMA consist primarily of industrial processing, cooling and landscape watering. Industrial demand as a percentage of overall water use is higher in the TAMA than in any other AMA due to mining operations. Industrial users with groundwater rights or permits accounted for about 14 percent of the TAMA water use in 2013, or about 48,000 ac-ft. About 67 percent of this demand was for mining, 16 percent was for turf-related watering and the remaining demand was for sand and gravel operations, electric power generation, with a very small amount for dairies and other industrial uses. Groundwater was the primary source of supply, accounting for 85 percent. A small amount of poor quality groundwater, as well as direct and recovered reclaimed water, made up the remaining supply in 2013.

6.1.2 History of TAMA Industrial Regulatory Programs/4MP Goals Summary

The Industrial Conservation Programs for the various subsectors 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. The Code authorizes ADWR to include additional conservation requirements for non-irrigation uses if feasible in the 4MP, however, no additional conservation requirements for non-irrigation uses have been added for the 4MP.

6.1.3 Industrial Program Goal and Objectives for the TAMA 4MP

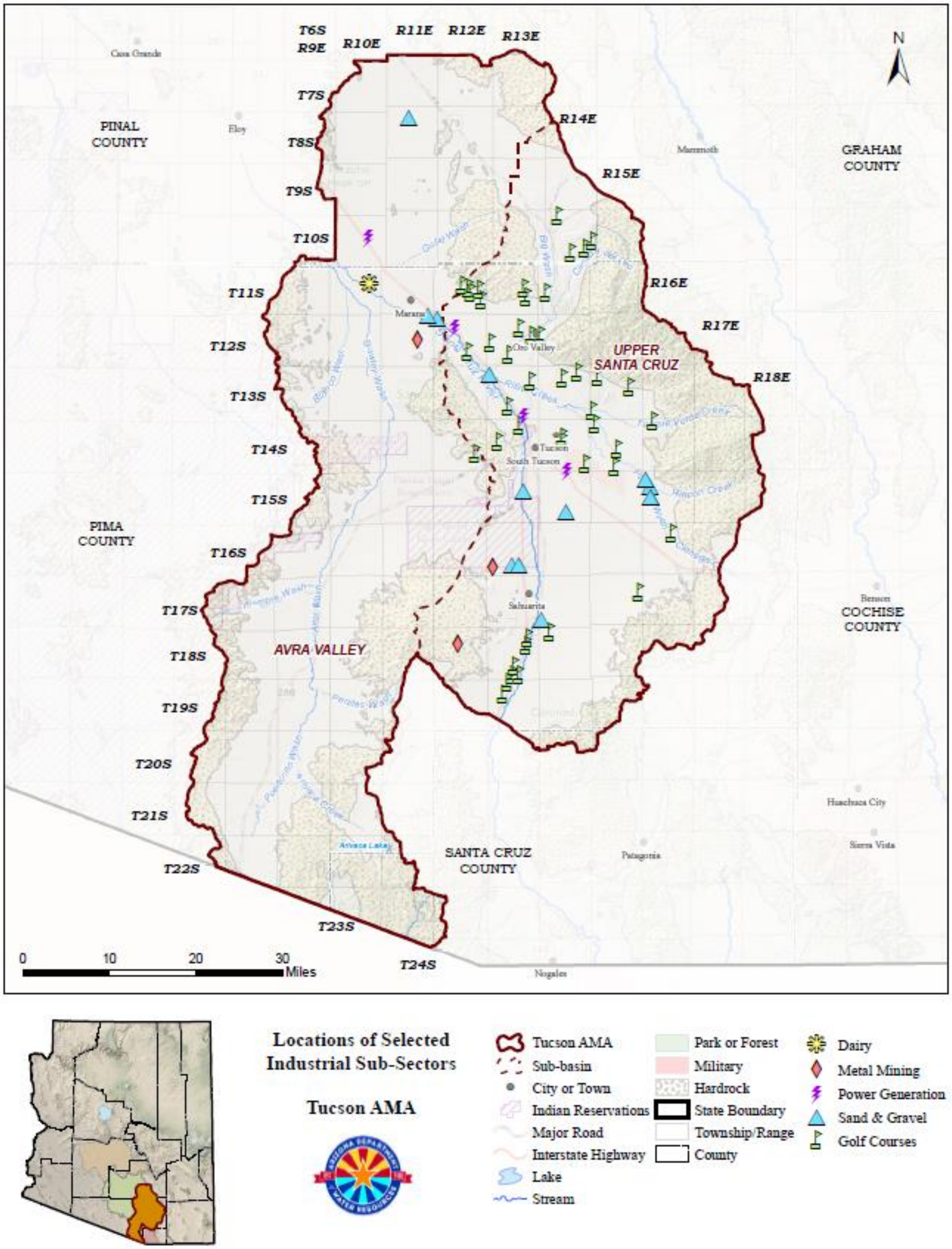
The purpose of the Industrial Conservation Program is to move industrial water users within the TAMA to the greatest level of efficiency economically attainable given use of the latest available water conservation technology. In addition to conservation, the program uses incentives to encourage the replacement of groundwater sources with renewable water supplies during the fourth management period. These measures will ensure that industrial users make effective strides toward contributing to the TAMA's statutorily mandated goal of safe-yield by the year 2025.

Conservation is an important tool in water demand management. Industrial facilities generally use water efficiently due to pumping costs and industrial discharge limitations that require them to recycle water and contain water on-site. The allotment-based conservation requirements for the turf industry have required turf-related facilities to comply with declining application rates per acre since the First Management Plan (1MP) became effective. This program has resulted in significant conservation through efficient use of water.

Industrial users have the legal authority to withdraw groundwater up to the annual allotment of their rights or permits subject to management plan conservation requirements. Because the cost of pumping groundwater is relatively low compared to the cost of other sources of water, there is no economic incentive for industrial users to switch to renewable water supplies. ADWR does not have the authority to require holders of industrial rights to use renewable supplies in place of groundwater, therefore it has developed meaningful incentives to encourage use of renewable supplies.

Some industrial users use surface water, reclaimed water or industrial wastewater. However, the majority of industrial water use is groundwater. The industrial sector uses a smaller volume of renewable water supplies than either the agricultural or municipal sector; therefore, the industrial sector's contribution to safe-yield is relatively small. As of 2013, the only industrial facilities that use reclaimed water in the

FIGURE 6-1
TUCSON AMA INDUSTRIAL FACILITIES BY SUBSECTOR



TAMA are turf-related facilities. However, almost all of this use is by individual users, not industrial right holders. Industrial right holders used 411 ac-ft of reclaimed water in 2013.

Users in several industrial categories have indicated that they may be interested in using renewable water supplies if such supplies were available and comparable in cost to groundwater. However, there are many factors that discourage industrial users from using renewable water supplies, including lack of proximity to renewable supplies, reliability, cost, supply ownership and water quality challenges. Use of this source by industrial users could require additional treatment to remove salts and other constituents.

In all the AMAs, significant amounts of industrial right allocations are unused. These unused allocations represent potential industrial groundwater pumping increases.

6.1.4 Industrial Conservation Programs – History and Background

All previous 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 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 reclaimed water incentive provision added for turf-related facilities. In the 3MP, separate Industrial Conservation Program categories were added 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 eight Industrial Conservation Program subsectors in the 4MP for the TAMA: 1) turf-related facilities, 2) sand and gravel facilities, 3) mining facilities, 4) large-scale power plants, 5) large-scale cooling facilities, 6) dairy operations, 7) new large landscape users and 8) new large industrial users.

6.2 RELATIONSHIP OF THE INDUSTRIAL SECTOR TO ACHIEVEMENT OF THE TAMA WATER MANAGEMENT GOAL

Mining is the predominant industrial use in the TAMA; copper is the primary ore mined. The majority of the mines are located in the Upper Santa Cruz Sub-basin in the Green Valley/Sahuarita area. Other mines are located south and southwest of Marana in the Avra Valley Sub-basin. Turf-related facilities are the second largest industrial subsector in the TAMA. Golf courses comprise the majority of the turf-related facility demand in TAMA. There are 45 golf courses in the TAMA that qualify as turf-related facilities. Sand and gravel operations are generally located within stream channels. Electric power generation facilities are generally located along the I-10 corridor, and other industrial subsectors are scattered throughout the TAMA *(See Figure 6-1).*

Industrial demand projections in the TAMA Assessment (ADWR, 2010) ranged from 56,000 to 71,000 ac-ft in the year 2025. In all projected scenarios in the 4MP, as in the Assessment, groundwater remains the primary water supply for the industrial sector.

TABLE 6-1
TUCSON AMA INDUSTRIAL DEMAND & ALLOTMENT, 1985-2013 (ac-ft/year)

	Groundwater	In-lieu Ground water	CAP Water	Reclaimed Water	Surface Water	Total Demand	Industrial Allotment
1985	45,896				720	**46,616**	**175,162**
1986	42,905				930	**43,834**	**178,146**
1987	42,770				934	**43,704**	**187,575**
1988	45,024				395	**45,419**	**184,369**
1989	51,990				178	**52,168**	**186,198**
1990	50,121					**50,121**	**188,071**
1991	57,337					**57,337**	**188,088**
1992	51,434			56		**51,490**	**187,180**
1993	54,902			63		**54,964**	**186,239**
1994	61,350			92		**61,442**	**187,189**
1995	60,500			89		**60,589**	**203,427**
1996	59,054			83		**59,137**	**203,341**
1997	58,968			78		**59,046**	**203,021**
1998	57,440					**57,440**	**204,108**
1999	60,582			248		**60,831**	**202,388**
2000	60,952		209	108		**61,269**	**204,058**
2001	56,435		1,624	132		**58,191**	**192,267**
2002	47,941			216		**48,157**	**192,258**
2003	45,271		160	533	400	**46,364**	**191,816**
2004	49,622		178	565	400	**50,765**	**185,266**
2005	51,116		175	732	400	**52,423**	**178,322**
2006	51,665		135	883	400	**53,084**	**178,415**
2007	48,404	1,028		617		**50,049**	**178,392**
2008	49,576	2,460		430		**52,466**	**183,619**
2009	45,017	8,240		545		**53,802**	**163,168**
2010	47,496	7,680		525		**55,701**	**162,499**
2011	43,750	8,995	82	547		**53,374**	**165,913**
2012	42,990	7,036	81	531		**50,638**	**166,612**
2013	40,612	6,547	451	411		**48,020**	**165,819**

The industrial sector in the TAMA has been relatively stable since 1985 with the exception of periodic fluctuations caused by mining, its largest subsector *(See Table 6-1)*. Mining used more than 40,000 ac-ft of water in 1991, 1994, 1995 and 1997 (*See Figure 6-2*). The sum of the annual water allotments for GFRs and permits is also shown in Table 6-1. Industrial allotments can increase as IGFRs 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, or through extinguishment of GFRs. As of 2013, the annual industrial demand was less than one third 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 2013 industrial allotment that was mining was 59,359 ac-ft. Historical water use in each of the industrial subsectors is shown in Table 6-2. Note that the columns "Non-Conservation Requirement/Non-Municipal Facilities" and "Drainage & Dewatering" are not included in the Total Industrial column since these industrial uses do not contribute to overdraft. For more information on these types of industrial uses, see the Assessment.

FIGURE 6-2
TUCSON AMA INDUSTRIAL DEMAND BY SUB-SECTOR, 1985-2013

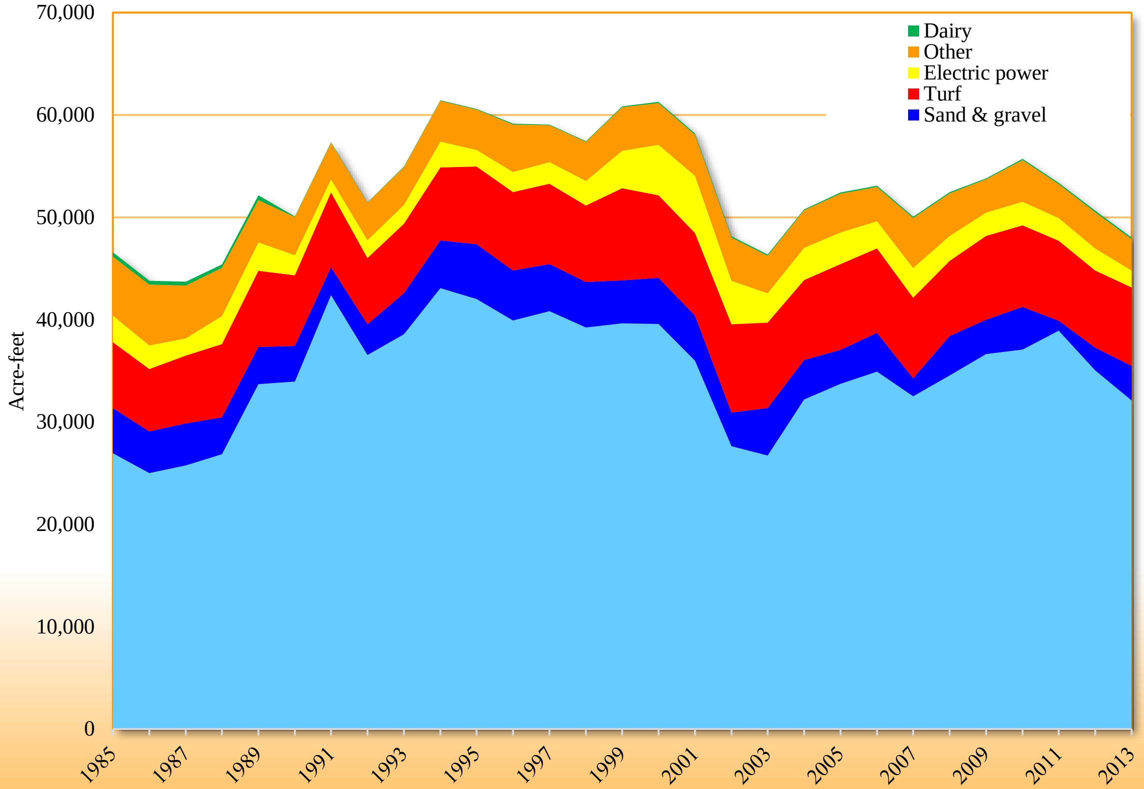


TABLE 6-2
TUCSON AMA INDUSTRIAL DEMAND BY SUBSECTOR, 1985-2013 (ac-ft)

Year	Total Industrial	Mining	Turf	Sand & Gravel	Electric power	Dairy	Feedlot	Other	Non-Conservation Requirement/Non-Municipal Facilities	Drainage & Dewatering
1985	**46,616**	26,945	6,423	4,420	2,598	449	21	5,761	9	29
1986	**43,834**	25,005	6,097	4,074	2,295	399	21	5,944	1	7
1987	**43,704**	25,774	6,622	4,090	1,687	356	9	5,168	1	2,787
1988	**45,419**	26,854	7,147	3,609	2,736	338	15	4,719	0	7
1989	**52,168**	33,687	7,458	3,640	2,774	461	25	4,124	44	1
1990	**50,121**	33,955	6,914	3,467	1,950	58	31	3,745	50	1

Year	Total Industrial	Mining	Turf	Sand & Gravel	Electric power	Dairy	Feedlot	Other	Non-Conservation Requirement/Non-Municipal Facilities	Drainage & Dewatering
1991	**57,337**	42,402	7,314	2,701	1,309	66	6	3,541	104	418
1992	**51,490**	36,531	6,453	3,026	1,772	50	25	3,633	182	302
1993	**54,964**	38,568	6,770	4,024	1,843	50	0	3,709	116	49
1994	**61,442**	43,072	7,130	4,664	2,524	70	0	3,984	161	1
1995	**60,589**	42,014	7,610	5,337	1,611	73	0	3,943	239	9
1996	**59,137**	39,916	7,651	4,897	1,970	85	0	4,619	137	931
1997	**59,046**	40,838	7,851	4,575	2,124	57	0	3,600	58	0
1998	**57,440**	39,243	7,484	4,416	2,427	85	0	3,784	67	0
1999	**60,831**	39,626	9,004	4,193	3,669	97	0	4,241	57	0
2000	**61,269**	39,573	8,085	4,497	4,935	115	0	4,064	162	0
2001	**58,191**	35,980	8,063	4,425	5,584	126	0	4,013	162	0
2002	**48,157**	27,644	8,636	3,262	4,268	132	0	4,216	116	0
2003	**46,364**	26,725	8,349	4,626	2,885	114	0	3,664	98	0
2004	**50,765**	32,210	7,797	3,847	3,160	88	0	3,664	151	2
2005	**52,423**	33,742	8,393	3,306	3,083	124	0	3,775	125	27
2006	**53,084**	34,905	8,249	3,807	2,656	110	0	3,357	165	27
2007	**50,049**	32,516	7,873	1,739	2,923	131	0	4,867	100	74
2008	**52,466**	34,552	7,346	3,851	2,422	139	0	4,157	617	42
2009	**53,802**	36,630	8,213	3,343	2,277	83	0	3,256	803	671
2010	**55,701**	37,081	7,966	4,168	2,305	120	0	4,060	1,454	567
2011	**53,374**	38,929	7,788	976	2,241	125	0	3,315	951	381
2012	**50,639**	35,046	7,539	2,216	2,164	158	0	3,516	1,181	444
2013	**48,020**	32,094	7,679	3,385	1,643	153	0	3,068	0	115

6.3 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIAL GROUNDWATER

The TAMA 4MP contains incentives to increase the use of non-groundwater supplies. For example, ADWR has included a reclaimed water 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 TAMA, ADWR will count each acre-foot of direct use reclaimed water or reclaimed water recovered within the area of impact of storage that is used by the facility as 0.7 acre-foot of water. This adjustment does not apply to reclaimed water recovered outside the area of impact of the stored water. In addition to the reclaimed water adjustment, facilities using reclaimed water 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 (1999 Ariz. Sess. Law, H.B. 2189, § 51(B)). The criteria that must be met to qualify for this accounting are set forth in the legally enforceable provisions in Section 6-1504 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.

6.4 NON-REGULATORY EFFORTS

ADWR has a program for water management assistance in the TAMA. 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 TAMA. Since the Water Management Assistance Program (WMAP) began, the TAMA has funded several projects that promote prudent water management within the TAMA *(See Chapter 9 of this plan)*.

6.5 INDUSTRIAL CONSERVATION PROGRAMS DESCRIPTION

The TAMA 4MP includes regulatory programs for the following eight industrial subsectors, as well as general requirements for all industrial uses:

- All Industrial Users
- Turf-Related Facilities (≥10 acres)
- Sand and Gravel Facilities (>100 ac-ft/year)
- Mining Facilities (>500 ac-ft/year)
- Large-Scale Power Plants (>25 megawatts)
- Large-Scale Cooling Facilities (>1,000 tons)
- Dairy Operations (monthly average ≥100 lactating cows/day)
- New Large Landscape Users (>10,000 square feet of water intensive landscape)
- New Large Industrial Users (>100 ac-ft/year)

Each Industrial Conservation Program is discussed under a separate subsection. Each subsection contains a description of the program followed by the regulatory requirements and any applicable appendices. In general, each of the subsections contains all or some of the following: an introduction, program goals and objectives, water use history by the subsector, challenges and objectives and program description.

6.6 ALL INDUSTRIAL USERS CONSERVATION PROGRAM DESCRIPTION

6.6.1 Introduction

The conservation requirements in this section apply to all industrial water users. In addition to these requirements, certain industrial users are also 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 must comply with the requirement in this section to use plants from the ADWR Low Water Use/Drought Tolerant Plant List for the TAMA *(See http://www.azwater.gov/azdwr/)* for any landscaping at the facility, if applicable; and, in addition, must comply with the conservation requirements 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, mining facilities, large-scale power plants, large-scale cooling facilities, dairy operations, new large landscape users and new large industrial users. 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.

6.6.2 Water Use by "Other Industrial Users"

"Other industrial users" in the TAMA used about 3,100 ac-ft of groundwater in 2013, which accounted for about nine percent of the total industrial groundwater withdrawals in the AMA in that year. Many different types of commercial and manufacturing uses are included in this category. Some of the largest users include aerospace facilities, cement manufacturing plants, electronics plants, hospitals, bottling plants, shopping centers and resorts. Water uses commonly include cooling, landscaping, sanitary, kitchen and industrial process uses.

It is uncertain the extent to which water use by other industrial users will grow. It is anticipated that most future industrial development will be served by municipal providers because commercial and industrial development generally occurs within their service areas and therefore will be accounted for as municipal use.

6.6.3 All Industrial User Program Description

The TAMA 4MP conservation program for all industrial users is identical to the 3MP program. All industrial users are required to avoid waste and 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 TAMA 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, industrial users have been prohibited from serving groundwater to vegetation planted in a public right-of-way on or after January 1, 2002 unless the plants are on the ADWR Low Water Use/Drought Tolerant Plant List for the TAMA. Industrial users have also been prohibited from serving groundwater to a water feature in the right-of-way if installed after January 1, 2002.

6.7 TURF-RELATED FACILITIES

6.7.1 Introduction

A turf-related facility is a facility with 10 or more acres of water-intensive landscaped area. Golf courses, parks, schools, cemeteries and common areas within residential developments are examples of facilities that often qualify as turf-related facilities. Because "irrigation" is defined in the Code as water applied for the purpose of growing crops for sale or for human or animal 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 turf-grass 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 also served groundwater by municipal water providers and thus are also subject to the conservation requirements set forth in this section through provisions of the Municipal Conservation Program *(See Chapter 5 of this plan)*. Municipally-served facilities are called individual users.

6.7.2 Turf Program Goals and Objectives

For the 4MP, the Code allows ADWR to include additional conservation requirements for non-irrigation uses if feasible. ADWR has not modified the Turf-Related Facilities Program from the program included in the 3MP. Since the 1MP, the Turf-Related Facilities Program has included a maximum annual allotment for turf-related facilities, stressed water use efficiency and provided an incentive for the use of reclaimed water. ADWR allows facility managers flexibility in selecting conservation techniques most appropriate to each facility. During the development of each management plan through the 3MP, ADWR conducted extensive data collection and analysis to determine whether additional reductions in turf-related facility allotments appeared feasible. Flexibility has been given in each management plan to turf-related facilities to account for varying weather conditions. First a three year averaging of water use was incorporated and then later, in some AMAs, a turf-related facility flexibility account. In each management plan prior to the 4MP, ADWR has increased the incentive to use reclaimed water for landscape irrigation. The objective is to reduce groundwater pumping for turf-related watering and replace that groundwater with reclaimed water to the maximum extent feasible to assist the TAMA in achieving safe-yield by 2025.

6.7.3 Turf Related Water Use History

ADWR has identified 122 turf-related facilities in the TAMA, including golf courses, parks, schools, cemeteries and common areas. 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 TAMA. The location of TAMA turf-related facilities that are golf courses are shown in Figure 6-1.

Total water use by all turf-related facilities in the TAMA was 24,904 ac-ft in 2013. Ninety-one of these facilities received all or a portion of their water from municipal providers and were classified as individual users. Their water use is included in the water demand for the municipal sector. The remaining 29 turf-related facilities are 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 moderately from using 6,423 ac-ft of water in 1985 to using 7,679 ac-ft in 2013. Total demand by industrial turf-related facilities is second only to the mining subsector in the TAMA.

In 2013, there were 45 golf courses in the TAMA; 17 were industrial users, while the other 28 were served by municipal water providers and thus categorized as individual users. Golf courses in the TAMA used about 20,167 ac-ft of water in 2013. Approximately 43 percent of this use was groundwater; the balance of the use was predominantly direct-use reclaimed 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.

6.7.4 Turf-Related Facilities Program Description

6.7.4.1 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 generally 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 rate to determine the allotment.

The allotment for all turf-related facilities in the TAMA is calculated by determining the actual acreage within the facility in each of the three landscaping categories mentioned above, and then multiplying the number of acres by the appropriate application rate *(See Table 6-3)*. The approach used for these facilities allows expansion of landscaped area. Beginning with the 1MP, ADWR recognized that the latest conservation technology for golf courses includes course design which concentrates water-intensive landscaping into areas that come into play and water management practices which adjust water application schedules for weather conditions and seasons of highest play. The allotment for golf course acreage that came into existence after December 31, 1984 is therefore capped to encourage efficiency in design, construction, water application, and over-seeding practices. These water allotment caps are described below.

TABLE 6-3
TUCSON AMA ANNUAL APPLICATION RATES
FOR TURF-RELATED FACILITIES

Type of Use	Application Rate (ac-ft per acre)
Turf	4.6
Water Surface Acres	5.8
Low Water Use Landscaping	1.5

Golf course acreage that came into existence from January 1, 1985 through December 31, 1991
For golf courses within the TAMA, the allotment for any turf acres that came into existence from January 1, 1985 through December 31, 1991 is limited to an amount calculated by multiplying the number of holes within those acres by 23 ac-ft of water per hole, plus any allotment additions described later in this section. This cap is sufficient to water 5 acres of turf at 4.6 ac-ft per acre. If the turf acres planted during that period are in fact limited to 5 acres per hole, there is no cap on the allotment for any bodies of water that came into existence within the facility from January 1, 1985 through December 31, 1991. However, if the turf acres planted from January 1, 1985 through December 31, 1991 exceed 5 acres per hole, the allotment for any bodies of water that came into existence during that period and that are not filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact is limited to an amount calculated by multiplying the number of holes within those turf acres by 0.8 ac-ft of water, plus any allotment additions described later in this section.

Golf course acreage that came into existence after December 31, 1991
For golf courses within the TAMA, the total allotment for turf acres and low water use landscaped area that came into existence after December 31, 1991 is limited to an amount calculated by multiplying the number of holes within those acres by 23 ac-ft of water, plus any allotment additions described later in this section. This cap is sufficient to water 5 acres of turf at 4.6 ac-ft per acre. If less than five acres of turf are planted per hole, the cap allows sufficient water for approximately 3 acres of low water use landscaping in place of each acre of turf not planted. The allotment for all bodies of water that came into existence after December 31, 1991 and that are not filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact is limited to an amount calculated by multiplying the number of holes within the turf acres that came into existence after December 31, 1991 by 0.8 ac-ft of water. This cap limits the allotment for such bodies of water to 0.14 acre of water surface per hole.

Golf courses may expand or develop any number of water-intensive landscaped acres and low water use landscaped area. 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 apply the allotment within the facility.

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 are the allotment additions allowed in the 4MP.

Reduction of Water-Intensive Landscaped Area
Conservation requirements for the fourth management period continue to provide an incentive to reduce water-intensive landscaped area. When calculating the maximum annual water allotment for a turf-related facility, the amount of water allotted to pre-1985 turf, water surface acres and low water use landscaping is based on the highest number of those acres in existence at the facility during the period from 1980 through 1984. Thus, removal of acreage planted during that period will not decrease the facility's allotment. All

turf-related facilities are encouraged to minimize the water-intensive landscaping to areas consistent with the intended use and enjoyment of the facility.

Allotment Addition for Establishment of Newly Turfed Area
An allotment addition is given to turf-related facilities for the establishment of newly planted turf. The allotment addition is equal to 1.0 ac-ft per acre of newly turfed area, and is limited to the 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 ac-ft 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 that will need only temporary supplemental water application after construction of a new or renovated facility. This allotment addition of up to 1.5 ac-ft 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 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 that 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 are allowed to accumulate in the soil, salinity may eventually reach levels toxic to turf-grass. Since most water supplies in the TAMA are of a quality that does not require an additional leaching allowance, a leaching allowance was not included in the maximum annual water allotment calculation. However, 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.

6.7.4.2 Additional Conservation Requirements
All turf-related facilities are required to prepare and maintain a water conservation plan within 180 days after notification of the conservation requirements. The plan update must outline the water management practices and technologies the facility will utilize to maximize water use efficiency. All turf-related facilities that are not golf courses 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 that 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 came into existence after December 31, 1991, so that no more than 75 percent of the total cemetery area within that portion of the cemetery is landscaped with plants not listed on ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA. 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.

6.7.4.3 Reclaimed Water Use Adjustment

Currently in the TAMA, reclaimed water is the only water supply that is expected to increase in availability throughout the fourth management period. Reclaimed water's 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 reclaimed water for turf watering, reclaimed water is currently underutilized as a source of water for turf-related facilities.

To encourage the maximum use of reclaimed water on turf-related facilities in the TAMA during the fourth management period, ADWR has maintained the reclaimed water incentive that was included in the 3MP. While the maximum annual water allotment will not change, each acre-foot of reclaimed water will be counted as 0.7 of an acre-foot when compliance with the maximum annual water allotment is determined. This adjustment does not apply to reclaimed water stored in a storage facility pursuant to a water storage permit and recovered outside the area of impact of the stored water. In addition to the reclaimed water adjustment, facilities using reclaimed water may apply to ADWR for an allotment addition to allow for leaching of salts below the root zone.

6.7.4.4 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 for fluctuations in water demand during hot or dry years.

6.7.4.5 Monitoring and Reporting Requirements

The TAMA 4MP includes 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 measured and reported.

6.8 SAND AND GRAVEL FACILITIES

6.8.1 Introduction

Regulated sand and gravel facilities are facilities that use more than 100 ac-ft 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.

Sand and gravel facilities in the TAMA used 3,385 ac-ft of water in 2013. Sand and gravel demand peaked in 1995 at 5,337 ac-ft. In 2013, there were 19 active sand and gravel operations in the TAMA. Increases in sand and gravel production and associated water use are closely tied to population growth and urbanization. Sand and gravel operations in the TAMA have historically relied solely on groundwater.

6.8.2 Sand and Gravel Facility Program Description

For the 4MP ADWR has not changed the Sand and Gravel Facility Program from the program included 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; and
- Costs associated with regulatory permitting.

6.9 MINING FACILITIES

6.9.1 Introduction

ADWR regulates mining facilities that mine and process ores and use or have the potential to use more than 500 ac-ft of water per year. Copper is the primary product of the mines in the TAMA. Two mining techniques are used in the TAMA. Open-pit mining followed by milling and flotation are the predominant mining techniques. Leaching followed by solvent extraction and electrowinning (SX/EW) is also used at some locations. Water is used in almost all steps of the mining process. Conservation requirements address specific process steps to reduce overall water use.

There are three active mines and one inactive mine in the TAMA. ASARCO owns and operates two of the active mines. The ASARCO Mission mine is an open pit mine in the Sahuarita area. The ASARCO Silver Bell Mine is a surface leaching mine located near the Pinal AMA/TAMA boundary close to the Silver Bell Mountains. Freeport McMoRan owns and operates the largest of the TAMA open pit mines, the Sierrita mine, located just west of the Sahuarita/Green Valley area. The Twin Buttes Mine, located adjacent to the Sierrita mine, is currently inactive.

6.9.2 Mining Program Goals and Objectives

ADWR has the authority under the Code to include additional conservation requirements for non-irrigation uses if feasible in the 4MP. ADWR has not modified the Mining Program from the 3MP. ADWR's Mining Program has always been a performance based, best management practices type of program with the exception of the requirement to achieve a specified tailings density. With each subsequent management plan, the required tailings density has increased.

6.9.3 Mining Water Use History

In 2013, the mining subsector had a combined total of 59,359 ac-ft of grandfathered groundwater rights and permits available. In 2013, it used 32,094 ac-ft of water, approximately 54 percent of its total allotment. Mining has been the dominant industrial subsector in the TAMA since 1985 and has averaged about two-thirds of the sector's total demand (*See Table 6-2)*. Mining water use in the TAMA shows two distinct troughs, one in the mid-1980s and another in the early 2000s. The highest year of mining occurred in 1994 when about 43,000 ac-ft of groundwater was used.

Mining in the TAMA has historically relied on groundwater. However, the Southern Arizona Water Rights Settlement Act gave ASARCO the right to use up to 10,000 ac-ft of CAP water from the Tohono O'odham Nation (TON) annually. ASARCO Mission Mine Complex, located adjacent to the San Xavier District of the TON, has historically received a portion of its groundwater supply from the TON's wells. In 1995, ASARCO pumped approximately 2,982 ac-ft of groundwater from three wells on the TON. In 2006, this amount had dropped to 842 ac-ft. Beginning in 2010, ASARCO began reporting receiving in-lieu water from the TON San Xavier District pursuant to A.R.S. § 45-841.01. Additionally, the TAMA mining sector used some direct CAP water starting in 2007.

6.9.4 Mining Conservation Program Description

The 4MP requirements for mines include the following provisions:

- Transport tailings at an average density of 48 percent solids by weight over a three-year running average at pre-1985 mines and at an average annual density of 50 percent at facilities built on or after 1985
- Reduce water loss from tailings impoundments by depositing tailings up slope from the free water surface in impoundments to reduce seepage, or by installing interceptor wells down gradient of impoundments to intercept seepage at pre-1985 mines
- Manage tailings impoundments to minimize the free water surface of stilling basins and recover decant water
- Recover and recycle tailings impoundment water
- Cap abandoned tailings impoundments to minimize water used for dust control
- Minimize water use in leaching processes
- Implement three of eight specified additional conservation techniques
- Comply with monitoring and reporting requirements

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.

6.10 LARGE-SCALE POWER PLANTS

6.10.1 Introduction

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. Regardless of whether the plant is a steam electric power plant or a combustion turbine 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.

There are two large-scale power plants located in the TAMA. The larger Wilson Sundt Generating Station (formerly the Irvington Station), is operated by Tucson Electric Power. It is located near Irvington Road and Interstate 10. The Saguaro Station, operated by Arizona Public Service, is a peaking plant and is located in the northern portion of the TAMA in Pinal County. Total water demand for the electric power generation sector in the TAMA was 2,598 ac-ft in 1985 and 1,643 ac-ft in 2013. In 2001, at the height of the California energy crisis, electric power generation water demand spiked to more than 5,500 ac-ft because of an increase in local power generation and associated water use. The power sector in the TAMA currently holds over 10,000 ac-ft of annual withdrawal authority.

6.10.2 Large-Scale Power Plant Conservation Program Description

6.10.2.1 Steam electric power plants

The 4MP requires steam electric 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 reclaimed water constitutes more than 50 percent of tower water supply. After this period, facilities may request an adjustment to full cycles of concentration requirements for reclaimed water-served towers based on the water quality of the reclaimed water 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.

6.10.2.2 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 either 120 mg/L of silica or 1,200 mg/L of total hardness in recirculating water, whichever is reached first, before blowing down;
- If needed, a facility may apply for an alternative blowdown standard for any towers using reclaimed water. During the initial 12-month period during which 50 percent or more of the water used by a tower is reclaimed water, 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 or total hardness.
- Facilities must record monthly and report annually the volumes of tower make-up water and blowdown water and the concentrations of silica, total hardness, or approved alternative constituent, in both make-up water and blowdown water.

6.11 LARGE-SCALE COOLING FACILITIES

6.11.1 Introduction

Currently, there are no large-scale cooling facilities subject to conservation requirements in the TAMA. However, ADWR has elected to continue to include this program in the 4MP. For the 4MP ADWR has not changed the Large-Scale Cooling Facility Conservation Program from the program included in the 3MP.

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 5-709 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.

6.11.2 Large-Scale Cooling Facility Conservation Program

The following 4MP conservation requirements apply to cooling towers that are located at large-scale cooling facilities and that have 250 tons or more of cooling capacity:

- Fully operational cooling towers with 250 tons or more of cooling capacity must achieve either 120 mg/L of silica or 1,200 mg/L of total hardness in recirculating water, whichever is reached first, before blowing down;
- If needed, a facility may apply for an alternative blowdown standard for any towers using reclaimed water. During the initial 12-month period during which 50 percent or more of the water used by a tower is reclaimed water, 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 or total hardness.
- Facilities must record monthly and report annually the volumes of tower make-up water and blowdown water and the concentrations of silica, total hardness, or approved alternative constituent, in both make-up water and blowdown water.

6.12 DAIRY OPERATIONS

6.12.1 Introduction

ADWR regulates dairy operations that annually house a monthly average of 100 or more lactating cows per day. The majority of water use at dairies occurs for animal drinking needs, udder washing, barn cleanup, and animal cooling.

In 2013, the one active dairy in the TAMA used 153 ac-ft of groundwater. This subsector currently has 210 ac-ft of annual groundwater withdrawal authority. Dairies in the TAMA have historically relied on groundwater.

6.12.2 Dairy Operation Conservation Program Description

6.12.2.1 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, dairy management practices and the type and effectiveness of the water use technology employed. Table 6-4 summarizes daily water needs for each dairy process, assuming use of appropriate water conservation technology and practices.

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 summer for at least a portion of the herd.

The assumptions of Table 6-4 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 number of lactating cows and non-lactating animals per day present at the dairy each year.

TABLE 6-4
TUCSON 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

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 for 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.

6.12.2.2 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 sanitizing 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 6B 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: BMP 2.1.2 (Udder Wash System); BMP 2.2.2 (Milking Parlor Floor and Wall Washing); BMP 4.1.1 (Milk Cooling and Vacuum Pump); all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning, and Feed Apron Flushing); all of the standard BMPs in Water Use Category No. 6 (Dairy Animal Cooling); and 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.

6.13 NEW LARGE LANDSCAPE USERS

6.13.1 Introduction

No new large landscape users served by their own wells, rather than a municipal water provider, were identified during the third management period. However, ADWR has elected to continue to include this program in the 4MP. For the 4MP, ADWR has not changed the New Large Landscape Users Program included in the 3MP.

New large landscape users are industrial users with a substantial water-intensive landscaped area that was planted after January 1, 1990. The conservation program differentiates between two types of new 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 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 Section 6.7 of this chapter.

6.13.2 New Large Landscape User Conservation 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: 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 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 reclaimed water or reclaimed water recovered within the area of impact, bodies of water used primarily for swimming, bodies of water filled and refilled exclusively with direct use reclaimed water or reclaimed water recovered within the area of impact and bodies of water allowed under an interim water use permit pursuant to the Lakes Bill (A.R.S. §§ 45-131-139) if the body of water will be filled and refilled exclusively with direct use reclaimed water or reclaimed water 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.

6.14 NEW LARGE INDUSTRIAL USERS

6.14.1 Introduction

ADWR has not identified any new large industrial users in the TAMA since 2015. However, ADWR has elected to continue to include this program in the 4MP. For the 4MP ADWR has not modified the New Large Industrial Users Program included in the 3MP.

New large industrial users are industrial users that use in excess of 100 ac-ft of water per year and commenced use after January 1, 2019. Most of the new large industrial users identified in the TAMA are industrial users subject to specific conservation requirements discussed elsewhere in this chapter (e.g., metal mines, turf-related facilities, etc.).

6.14.2 New Large Industrial User Conservation 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.

6.15 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR ALL INDUSTRIAL USERS

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 used in this chapter shall have the following meanings:

1. *"1MP" means First Management Plan for the TAMA.*

2. *"2MP" means Second Management Plan for the TAMA.*

3. *"3MP" means Third Management Plan for the TAMA.*

4. *"4MP" means Fourth Management Plan for the TAMA.*

5. *"5MP" means Fifth Management Plan for the TAMA.*

6. *"ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA" means the list of low water use/drought tolerant plants found on ADWR's website, www.azwater.gov 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. *"TAMA" means the Tucson Active Management Area.*

11. *"Reclaimed water" 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 reclaimed water.*

6-1502. Conservation Requirements

Beginning on January 1, 2019 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 who uses groundwater shall comply with the following requirements:

1. *Avoid waste; use only the amount of water from any source, including reclaimed water, 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 listed in ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA 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 6-1601, et seq., or as a new large landscape user under section 6-2201, 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 January 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, unless the plants are listed in ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA. 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 TAMA 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 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.*

6-1503. Monitoring and Reporting Requirements

A. Requirements

For calendar year 2019 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 groundwater 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 reclaimed water, 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 reclaimed water, withdrawn, diverted, or received during the reporting 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 reporting year.*

4. *An estimate of the quantity of wastewater recycled during the reporting year.*

5. *A description of the primary purposes for which water from any source, including reclaimed water, 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 TAMA during the calendar year as a result of removal of plants not on ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA. An industrial user regulated as a turf-related facility under sections 6-1601, et seq., or as a new large landscape user under section 6-2201, 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 ac-ft 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 ac-ft per year and withdraws more than 10 ac-ft of groundwater during the calendar year pursuant to those rights or permits.

6-1504. 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 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 January 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 thirty 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. 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.*

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.

6.16 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR TURF-RELATED FACILITIES

6-1601. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, and section 6-1501 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-1601 through 6-1605 shall have the following meanings:

1. *"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, recreational purposes, or regulatory storage.*

2. *"Common area" means an area or areas owned and operated as a single integrated facility and used for recreational or open space purposes. A common area is maintained for the benefit of the residents of a housing development.*

3. *"Contiguous" means in contact at any point along a boundary, or part of the same master planned community. Two parcels of land are contiguous if they are separated only by one or more of the following: a road, easement, or right-of-way.*

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

5. *"First management period new acres" means a water-intensive landscaped area or a low water use landscaped area that came into existence or was substantially commenced after December 31, 1984 and before January 1, 1992, but that was not substantially commenced prior to January 1, 1985.*

6. *"First management period new turf acres" means turf acres that came into existence or were substantially commenced after December 31, 1984 and before January 1, 1992, but that was not substantially commenced prior to January 1, 1985.*

7. *"Golf course" means a turf-related facility used for playing golf with a minimum of nine holes and including any practice areas.*

8. *"Hole" means a component of a golf course consisting of a tee and a green. A practice area or driving range is not a hole.*

9. *"Landscape watering" means the application of water from any source, including reclaimed water, to a water-intensive landscaped area, a low water use landscaped area or revegetation acres within a turf-related facility.*

10. *"Low water use landscaped area" means an area of land of at least one acre in aggregate, which is an integral part of a turf-related facility, watered by a permanent water application system and planted primarily with plants listed in ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA. Mature vegetation planted in a low water use landscaped area must cover at least 50 percent of the area.*

11. *"Newly turfed area" means, for a calendar year, an area of land planted with a warm-season grass species that was not planted with any warm-season grass species during the preceding calendar year.*

12. *"Overseeded area" means, for a calendar year, an area of land planted with any cool-season grass species that grows over a dormant warm-season grass species during the fall-winter period.*

13. *"Post-1991 acres" means a water-intensive landscaped area or a low water use landscaped area that was neither in existence nor was substantially commenced as of December 31, 1991.*

14. *"Pre-1985 acres" means a water-intensive landscaped area or a low water use landscaped area that was either in existence or was substantially commenced as of December 31, 1984.*

15. *"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 stored reclaimed water'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.*

16. *"Revegetation acres" means acreage within and/or contiguous to a turf-related facility that has been approved by the Director as qualifying for a revegetation allotment addition.*

17. *"Substantially commenced" means that all pre-construction permits and approvals required by federal, state, or local governments have been obtained or substantial capital investment has been made in the physical on-site construction.*

18. *"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.*

19. *"Turf acres" means an area of land 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 TAMA.*

20. *"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 ten or more acres. Turf-related facilities include, but are not limited to, those facilities listed in Appendix 6A.*

21. *"Water-intensive landscaped area" means, for a calendar year, the turf acres and water surface acres within a turf-related facility.*

22. *"Water surface acres" 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.*

6-1602. Conservation Requirements for Turf-Related Facilities

A. Maximum Annual Water Allotment

Beginning with calendar year 2019 or the calendar year in which landscape watering commences, 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 during the calendar year shall not withdraw, divert, or receive water for landscape watering purposes at the facility during a calendar year in an amount which exceeds the turf-related facility's maximum annual water allotment for the year as calculated in section 6-1603.

B. Conservation Plan

No later than 180 days after receiving official notice of conservation requirements, an industrial user who uses water at a turf-related facility shall have prepared 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 January 1, 2019 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 or a golf course 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.*

2. *Beginning on January 1, 2019 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 of post-1991 acres so that no more than 75 percent of the total cemetery area within the post-1991 acres is planted with plants not listed in ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA, unless the post-1991 acres are an expansion of the cemetery onto contiguous land that was under the same ownership as the cemetery as of December 31, 1984.*

6-1603. Calculation of Maximum Annual Water Allotment for Turf-Related Facilities

A. For each calendar year, the maximum annual water allotment for a turf-related facility 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 6-5 by the application rates listed in Table 6-5 and then adding together the products plus any allotment additions as determined under subsection B of this section. The maximum annual water allotment is subject to the conditions and restrictions set forth in Table 6-5.*

TABLE 6-5
APPLICATION RATES, CONDITIONS & ALLOTMENT RESTRICTIONS FOR TURF-RELATED FACILITIES
(From January 1, 2019 until the first compliance date for any substitute conservation requirement in the 5MP)

For All Facilities:	***Application Rate: (ac-ft per acre per calendar year)***
1. Pre-1985 Acres	
Turf Acres	*4.6*
Water Surface Acres	*5.8*
Low Water Use Landscaped Area	*1.5*
Conditions and Restrictions: *The allotment shall be calculated using the highest number of Pre-1985 acres in existence within the facility during any single calendar year after 1979.*	
2. First Management Period New Acres	
Turf Acres	*4.6*
Water Surface Acres	*5.8*
Low Water Use Landscaped Area	*1.5*
Conditions and Restrictions: *a. For golf courses, the allotment for first management period new turf acres shall not exceed an amount calculated by multiplying the number of holes within those acres by 23 ac-ft of water, plus any allotment additions as determined under subsection B of this section.* *b. For golf courses, if the first management period new turf acres exceed an area calculated by multiplying the number of holes within those acres by five acres, the allotment for all bodies of water within the first management period new acres not filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact shall not exceed an amount calculated by multiplying the number of holes within the first management period new turf acres by 0.8056 acre-foot of water, plus any allotment additions as determined under subsection B of this section. For purposes of this paragraph, any body of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact if the body of water will be filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact after the permit expires.*	
3. Post-1991 Acres	
Turf Acres	*4.6*
Total Water Surface Area	*5.8*
Low Water Use Landscaped Area	*1.5*
Conditions and Restrictions: *a. For golf courses, the total allotment for post-1991 turf acres and post-1991 low water use landscaped area shall not exceed an amount calculated by multiplying the number of holes within the post-1991 acres by 23 ac-ft of water, plus any allotment additions as determined under subsection B of this section.*	

For All Facilities:	Application Rate: (ac-ft per acre per calendar year)
b. For golf courses, the allotment for all bodies of water within the post-1991 acres not filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact shall not exceed an amount calculated by multiplying the number of holes within the post-1991 acres by 0.8056 acre-foot of water, plus any allotment additions as determined under subsection B of this section. For purposes of this paragraph, any body of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact if the body of water will be filled and refilled entirely with direct use reclaimed water or reclaimed water recovered within the area of impact after the permit expires.	

B. Allotment Additions

1. Newly Turfed Area Establishment Addition

For any year in which a warm-season turfgrass species is initially 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 5 ac-ft of water.

2. 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 of new acres. The Director may allow up to an additional 1.5 ac-ft of water per acre for up to three years if the following conditions apply to the acres for which the revegetation addition is sought:

a. The plants that are planted within the revegetation area are listed in ADWR's Low Water Use/Drought Tolerant Plant List for the TAMA or were adapted to the site prior to construction;

b. The aggregate area to be watered exceeds one acre and has at least 50 percent vegetative cover at maturity;

c. An allotment is not provided for the revegetation area under section 6-1703.A; and

d. All of the water applied to the revegetation acres is measured and reported as part of the total water use of the facility.

3. Body of Water Fill and Refill Addition

a. 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 January 1, 2019 within the facility. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.

b. *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.*

4. *Removed Acreage Addition*

A turf-related facility that removes pre-1985 acres of water-intensive landscaped area in existence within the facility prior to January 1, 1990 shall receive an allotment addition equal to the allotment the acres would have received pursuant to the 4MP if they had not been removed, provided that the acres were given a water allotment in the 1MP, the 2MP, the 3MP, or the 4MP.

5. *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:

Leaching Allotment Addition:
$$\left(\frac{1}{1-\left(\frac{EC_w}{5EC_e-EC_w}\right)}-1\right)\times\frac{CU}{0.85}$$

Where:

EC_w = *Electrical conductivity of water used*

EC_e = *Tolerance of the grass species grown to the soil salinity in electrical conductivity of the soil saturation extract*

CU = *Consumptive use requirement for the grass 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 5MP, whichever occurs first.

C. *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.

D. *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.*

6-1604. Compliance with Maximum Annual Water Allotment

A. Reclaimed Water Use Adjustment

For purposes of determining compliance with the maximum annual water allotment requirement, the Director shall count each acre-foot of direct use reclaimed water or reclaimed water recovered within the area of impact used at the facility for landscape watering purposes during the calendar year as 0.7 acre-foot of water.

B. Flexibility Account

The Director shall determine if a turf-related facility is in compliance with the maximum annual water allotment requirement through the maintenance of a flexibility account for the facility according to the following:

1. *Beginning with calendar year 2019 or the first full calendar year after the commencement of landscape watering, whichever is later, a flexibility account shall be established for a turf-related facility with a beginning balance of zero ac-ft.*

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 reclaimed water, 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 the calendar year for which the debits are registered by -0.2. If the account balance is less than 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 following a calendar year as provided for in subsection B, paragraph 2 of this section, causes the account to have a negative account balance less than the maximum negative account balance allowed in the flexibility account for the calendar year as calculated in subsection B, paragraph 3, subparagraph b of this section, the industrial user who uses water at the facility is 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 flexibility account.

6-1605. Monitoring and Reporting Requirements

A. *An industrial user who uses water at a turf-related facility that commences landscape watering within post-1991 acres after January 1, 2019 shall submit to the Director documentation of the new acreage within the facility no later than 90 days after commencing landscape watering within 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 2019 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 requirement 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, withdrawn, diverted, or received during the calendar year for landscape watering purposes at the facility, 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 reclaimed water, disaggregated by direct use reclaimed water,*

reclaimed water recovered within the area of impact, and reclaimed water recovered outside the area of impact that was withdrawn or received during the calendar year for landscape watering purposes at the facility, 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 turf acres within the facility during the calendar year, not including newly turfed area.*

4. *The number of acres of total water surface area within the facility during the calendar year.*

5. *The number of acres of low water use landscaped area within the facility during the calendar year.*

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 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.*

11. *The number of acres approved by the Director for a revegetation addition pursuant to section 6-1603, subsection B, paragraph 2 within the facility during the calendar year.*

12. *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 6-1603, subsection B, paragraph 3.*

13. *The number of acres of overseeded area within the facility during the calendar year.*

14. *If the facility is a golf course, the number of holes within the facility during the calendar year.*

15. *If the facility is a golf course, the number of holes added within newly turfed area during the calendar year.*

16. *An estimate of the quantity of water from any source, including reclaimed water, used for each purpose other than landscape watering purposes at the facility during the reporting 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 contiguous facilities are combined pursuant to section 6-1603, subsection C. The annual report shall report water use and landscaped areas of the contiguous facilities as required in subsection B of this section.*

6.17 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR SAND AND GRAVEL FACILITIES

6-1701. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-1501 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-1702 and 6-1703 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 ac-ft 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.*

6-1702. Conservation Requirements

A. Standard Conservation Requirements

Beginning on January 1, 2019 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.

6-1703. Monitoring and Reporting Requirements

For calendar year 2019, 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 the 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 reclaimed water, 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 reclaimed water, 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 reclaimed water, 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 used 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.*

6.18 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR METAL MINING FACILITIES

6-1801. 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 ac-ft 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 reclaimed water, 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.*

6-1802. Conservation Requirements for Pre-1985 Metal Mining Facilities

Beginning on January 1, 2019 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 2019, 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.*

6-1803. Conservation Requirements for Post-1984 Metal Mining Facilities

Beginning on January 1, 2019 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 6-1802, 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.

6-1804. 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 6-1802 and 6-1803, 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.*

6-1805. 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 6-1802 and 6-1803, 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 6-1802 and 6-1803, whichever is applicable, would likely result in a violation of any federal, state, or local environmental standards or regulations.*

6-1806. Preparation of a Long-Range Conservation Plan for Metal Mining Facilities

By January 1, 2019 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.

6-1807. Monitoring and Reporting Requirements for Metal Mining Facilities

A. *Water Measurement and Reporting*

For calendar year 2019 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 reclaimed water, 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 reclaimed water, 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 reclaimed water, 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.

6.19 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR LARGE-SCALE POWER PLANTS

6-1901. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-1501 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. *"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. *"Reclaimed water-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 reclaimed water.*

7. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat from a large-scale power plant that is generating electricity.*

8. *"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 and combustion turbine plants.*

9. *"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.*

10. *"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.*

11. *"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.

6-1902. Conservation Requirements for Steam Electric Power Plants

A. Conservation Requirements

Beginning on January 1, 2019 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 groundwater at a steam electric power plant shall comply with the following requirements:

1. *An annual average of 15 or more cycles of concentration shall be achieved during periods when the steam electric power plant is generating electricity.*

2. *The maximum amount of wastewater feasible, excluding blowdown water and sanitary wastewater, shall be diverted to the cooling process so long as this stream does not have a negative impact on the cycles of concentration or any other environmental requirement.*

B. Cycles of Concentration Adjustment Due to the Quality of Recirculating Water

An industrial user who uses groundwater at a steam electric power plant may apply to the Director for an adjustment to the cycles of concentration requirements set forth in subsection A of this section if 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.*

The Director shall grant the request if the Director determines that compliance with the cycles of concentration requirements 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 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.

C. Exemption and Cycles of Concentration Adjustment Due to the Quality of Reclaimed Water Make-up Water Supplies

1. *The cycles of concentration requirements set forth in subsections A and B of this section do not apply to any reclaimed water-served cooling tower at a steam electric power plant*

during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is reclaimed water.

2. *Within 30 days after the 12-month exemption period expires, the industrial user who uses water at the steam electric power plant may apply to the Director for a cycles of concentration adjustment to lower the cycles of concentration requirement for the reclaimed water-served cooling tower if compliance with the requirement would not be possible due to the presence of a limiting constituent in the reclaimed water 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 that includes the following information:*

   a. *The limiting constituent(s) that is present in the reclaimed water supplying the tower that results in the need to blow down a greater annual volume of water than that required in subsection A of this section.*

   b. *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 reclaimed water supplying the cooling tower results in the need to blow down a greater annual volume of water than that required in subsection A of this section. Any cycles of concentration adjustment granted pursuant to this paragraph shall apply only while the tower qualifies as a reclaimed water-served cooling tower.

D. *Substitute Conservation Requirements*

1. *An industrial user who uses groundwater at a steam electric power plant 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.*

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.*

E. *Waiver*

An industrial user who uses groundwater at a steam electric power plant may apply to the Director for a waiver of any applicable conservation requirement in subsection A of this section by submitting a detailed, long-term plan for beneficial reuse of 100 percent of 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.*

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.

6-1903. Conservation Requirements for Combustion Turbine Electric Power Plants

A. Beginning on January 1, 2019 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 groundwater 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, 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 reclaimed water-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 reclaimed water.*

   Within 30 days after the 12-month period expires, the person using water at the reclaimed water-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 or total hardness in the reclaimed water 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 or total hardness that is present in the reclaimed water 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 or total hardness in the reclaimed water 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 reclaimed water-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 or total hardness 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 or total hardness in recirculating water.

6-1904. Monitoring and Reporting Requirements

A. *Monitoring and Reporting Requirements for Steam Electric Power Plants*

1. *For calendar year 2019 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 groundwater at a steam electric power plant shall include in its annual report required by A.R.S. § 45-632 the following information:*

    a. *Source of water providing make-up water to each cooling tower at the facility.*

    b. *For each cooling tower at the facility that is exempt from cycles of concentration requirements pursuant to section 6-1902, subsection C, paragraph 1 or for which a cycles of concentration adjustment was granted pursuant to section 6-1902, subsection C, paragraph 2, the percentage of water served to the tower during the year that was reclaimed water.*

    c. *For all fully operational cooling towers subject to cycles of concentration requirements under section 6-1902, subsection A:*

        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.*

d. *For each large-scale steam electric power plant that is exempt from cycles of concentration requirements pursuant to section 6-1902, subsection C, paragraph 1, or for which an adjusted cycles of concentration requirement was granted pursuant to section 6-1902, subsection B or section 6-1902, subsection C, paragraph 2:*

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.*

e. *The amount of electricity generated each month or each partial month when the facility was generating electricity during the calendar year.*

2. *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.*

B. Monitoring and Reporting Requirements for Combustion Turbine Electric Power Plants

For calendar year 2019, 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 groundwater 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 6-1903, subsection A pursuant to section 6-1903, subsection B, paragraph 2 or for which an alternative blowdown level has been granted, pursuant to section 6-1903, subsection B, paragraph 2, the percentage of water served to the cooling tower during the year that was reclaimed water.*

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 or other approved limiting constituent established under section 6-1903, 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 6-1903, 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 or between electrical conductivity and another approved limiting constituent established pursuant to section 6-1903 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.*

6.20 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR LARGE-SCALE COOLING FACILITIES

6-2001. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-1501 of this chapter, unless the context otherwise requires, the following words and phrases used in section 6-2002 and 6-2003 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. *"Reclaimed water-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 reclaimed water.*

5. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat.*

6. *"Large-scale cooling facility" means a facility that 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 that 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.*

7. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity.*

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 back into the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

6-2002. Conservation Requirements

A. Conservation Requirements for Large-Scale Cooling Facilities

Beginning on January 1, 2019 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 requirement:

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 or 1,200 mg/l total hardness, 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 reclaimed water-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 reclaimed water.*

   After the 12-month period expires, the person using water at the reclaimed water-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 or total hardness in the reclaimed water 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 that includes the following information:

   a. *The limiting constituent other than silica or total hardness that is present in the reclaimed water 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 or total hardness in the reclaimed water 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 reclaimed water-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 or total hardness 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 that 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 or total hardness in recirculating water.*

6-2003. Monitoring and Reporting Requirements

For calendar year 2019, 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 6-2002, subsection B, paragraph 2 or for which an alternative blowdown level has been granted, pursuant to section 6-2002, subsection B, paragraph 3, the percentage of water served to the tower during the year that was reclaimed water.*

4. *The quantity of water from any source, specified by source, that 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 that 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 or other approved limiting constituent established under section 6-2002, 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 6-2002, 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, or between electrical conductivity and another approved limiting constituent established pursuant to section 6-2002 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.*

6.21 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR DAIRY OPERATIONS

6-2101. 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 6-2102 through 6-2105 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 an average of 100 or more lactating cows per day during a calendar year as calculated in section 6-2102.*

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.*

6-2102. Maximum Annual Water Allotment Conservation Requirements

A. Maximum Annual Water Allotment

Beginning on January 1, 2019 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 6-2104.

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 ac-ft per year as follows:*

$$C_L \times \frac{105\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for lactating cows (ac-ft per year)}$$

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 ac-ft per year as follows:*

$$A_N \times \frac{20\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for non-lactating animals (ac-ft per year)}$$

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, or*

3) Technologies are designed and/or implemented for cooling lactating cows and non-lactating animals that 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.

6-2103. 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.

6-2104. 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 6B, 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 6-2102 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 Practices 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 6B, 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 6B 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 6B 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 no 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 6-2102.

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 6-2102. 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 the 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 6-2102 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.*

6-2105. Monitoring and Reporting Requirements

For the calendar year 2019 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 reclaimed water, 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 that 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 that 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.*

6.22 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR NEW LARGE LANDSCAPE USERS

6-2201. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-1501 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-2202 and 6-2203 of this chapter shall have the following meanings:

1. *"Direct use reclaimed water" means reclaimed water transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use reclaimed water does not include reclaimed water 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. *"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 the 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/Drought Tolerant Plant List for TAMA and watered with a permanent water application system, except any area of land that is watered exclusively with direct use reclaimed water or reclaimed water 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 reclaimed water or reclaimed water 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 reclaimed water or reclaimed water recovered within the area of impact after the permit expires.*

6-2202. Conservation Requirements

A. Conservation Requirements for New Large Landscape Users that are not Hotels or Motels

Beginning on January 1, 2019 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; or2) 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, 2019 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.

6-2203. Monitoring and Reporting Requirements

For calendar year 2019, 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 reclaimed water, withdrawn, diverted, or received for use on the facility during the calendar 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. R12-15-901, 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 TAMA (except any area watered exclusively with direct use reclaimed water or reclaimed water 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 reclaimed water or reclaimed water 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 reclaimed water or reclaimed water recovered within the area of impact after the permit expires).*

6.23 INDUSTRIAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS FOR NEW LARGE INDUSTRIAL USERS

6-2301. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-1501 of this chapter, "new large industrial user" as used in section 6-2302 means an industrial user that begins using more than 100 ac-ft of water per year for industrial purposes after January 1, 2019.

6-2302. 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 ac-ft 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.

APPENDIX 6A
TURF-RELATED FACILTIES

Facility Name	Water Source	Water Supply	Right Number
GOLF COURSES			
(FORMER) MORRY CANOA HILLS GC	GREEN VALLEY DWID	Groundwater	56-000302.0000
ARIZONA NATIONAL GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
ARTHUR PACK GC	PIMA COUNTY WASTEWATER	Effluent	NA
CANOA RANCH GOLF COURSE	GREEN VALLEY DWID	Groundwater	56-00302.0000
CC OF GREEN VALLEY	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-101735.0001
DEL LAGO GOLF COURSE	RECOVERY WELL PERMITS		74-591933.0000
DELL URICH GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
DESERT HILLS GC	GREEN VALLEY DWID	Groundwater	56-000302.0000
DORADO CC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-108946.0000
DOVE MOUNTAIN #1 - RITZ	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
DOVE MOUNTAIN #2 - RITZ	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
EL CONQUISTADOR CC	TOWN OF ORO VALLEY WATER	Effluent	56-000368.0000
EL CONQUISTADOR RESORT GC	TOWN OF ORO VALLEY WATER	Groundwater	56-000368.0000
EL RIO GC	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
FORTY-NINER GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
FRED ENKE GC	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
GALLERY AT DOVE MOUNTAIN	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
GALLERY GOLF CLUB - SOUTH COURSE	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
GEN. WM BLANCHARD GC	DMAFB WATER SYSTEM	Effluent & Groundwater	56-000058.0000
HAVEN GC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-104567.0000
HERITAGE HIGHLANDS GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
LA PALOMA GOLF COURSE	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
LINKS AT CONTINENTAL RANCH (QUARRY PINES GOLF CLUB)	TYPE 1 GFR/TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112446.0006 58-160014.0015 58-160014.0016 58-160014.0020
MOUNTAIN VIEW GC	LAGO DEL ORO WATER CO.	Groundwater & Effluent	56-000245.0000
ORO VALLEY CC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-101530.0002
QUAIL CANYON GOLF COURSE	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-100274.0003
QUAIL CREEK CC	TYPE 1 GFR	Groundwater	58-105292.0036
RANDOLPH GC	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
ROLLING HILLS CC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112457.0001
SADDLEBROOKE GC	LAGO DEL ORO WATER CO.	Effluent	56-000245.0000
SADDLEBROOKE RANCH GOLF COURSE	RECOVERY WELL PERMITS	Recovered Effluent	74-593307.0002
SAN IGNACIO GC	GREEN VALLEY DWID	Groundwater	56-000302.0000
SANTA RITA CC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-107119.0000
SILVERBELL GC	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
SKYLINE CC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
STARRPASS GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
STONE CANYON GC	TOWN OF ORO VALLEY WATER	Effluent	56-000368.0000

APPENDIX 6A
TURF-RELATED FACILTIES

Facility Name	Water Source	Water Supply	Right Number
SUN CITY VISTOSO GC	TOWN OF ORO VALLEY WATER	Effluent	56-000368.0000
THE GOLF CLUB AT VISTOSO	TOWN OF ORO VALLEY WATER	Effluent	56-000368.0000
THE PRESERVE GOLF CLUB AT SADDLEBROOKE	RIDGEVIEW UTILITY COMPANY	Groundwater & Effluent	56-000375.0000
TORRES BLANCAS GC	TYPE 1 GFR/TYPE 2 NON-IRRIGATION GFR	Groundwater	58-101963.0032
TUCSON CC	CITY OF TUCSON/TUCSON WATER/TYPE 2 NON-IRRIGATION GFR	Groundwater & Effluent	58-106007.0002
TUCSON ESTATES GC	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
TUCSON NATIONAL GC	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-102307.0002
VENTANA CANYON GC	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
CEMETERIES			
EAST LAWN CEMETERY	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
EVERGREEN CEMETERY	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-109101.0000
HOLY HOPE CEMETERY	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-108519.0000
SOUTH LAWN CEMETERY	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-109112.0001
PARKS			
BRANDI FENTON PARK	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
CHRISTOPHER COLUMBUS PARK	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
EL CAMINO DEL CERRO PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
FORT LOWELL PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent & Groundwater	56-000001.0000
FREEDOM PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
GOLF LINKS SPORTS COMPLEX	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
HIMMEL PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
JACOBS PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
JAMES D. KRIEGH PARK	TOWN OF ORO VALLEY WATER	Groundwater	56-000368.0000
JESSE OWENS PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
JOAQUIN MURRIETA PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
KENNEDY PARK	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
KINO SPORTS PARK	CITY OF TUCSON/TUCSON WATER	Effluent & Groundwater & Rain Harvesting	56-000001.0000
LAKESIDE PARK	CITY OF TUCSON/TUCSON WATER	Other & Recovered Effluent	56-000001.0000
LINCOLN PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent & Groundwater	56-000001.0000
MANSFIELD PARK	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
MARANA PARK	RECOVERY WELL PERMITS	Recovered CAP	74-211278.0001

APPENDIX 6A
TURF-RELATED FACILTIES

Facility Name	Water Source	Water Supply	Right Number
MCCORMICK PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
MISSION PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
PALO VERDE PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
PIMA COUNTY FAIRGROUNDS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-100381.0006
REID PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent & Groundwater	56-000001.0000
RILLITO REGIONAL PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
RODEO PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
SANTA RITA PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
SILVERLAKE PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
SUNNYSIDE PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
THE CLUB AT LA MARIPOSA	TYPE 1 GFR	Groundwater	58-109720.0002
THE PRACTICE TEE	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
TOWN OF SAHUARITA LAKE PARK	TYPE 1 GFR	Groundwater	58-100316.0018
UDALL PARK	CITY OF TUCSON/TUCSON WATER	Recovered Effluent	56-000001.0000
SCHOOLS			
AMPHITHEATER HS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112278.0002
AMPHITHEATER MS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112278.0002
APOLLO MIDDLE SCHOOL	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
BOOTH-FICKETT MS	CITY OF TUCSON/TUCSON WATER	Effluent & Commingled	56-000001.0000
CANYON DEL ORO HS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112278.0002
CATALINA FOOTHILLS HS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
CATALINA HS	CITY OF TUCSON/TUCSON WATER	Effluent & Commingled	56-000001.0000
CHAPARRAL MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
CHERRY FIELD	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
CHOLLA HS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
CIENEGA HIGH SCHOOL	VAIL WATER COMPANY	Groundwater	56-000060.0000
CORONADO SCHOOL	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112278.0002
DESERT VIEW HS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
DOOLEN MS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
DUFFY SCHOOL	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
EMPIRE HIGH SCHOOL	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
ESPERERO MS	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
FLOWING WELLS HS	FLOWING WELLS IRR. DIST.	Groundwater	56-000084.0000
FLOWING WELLS JHS	FLOWING WELLS IRR. DIST.	Groundwater	56-000084.0000
GRIDLEY MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
IRONWOOD RIDGE HIGH SCHOOL	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
LIN CROSS JHS/HARELSON ELEMENTARY	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-112278.0002

APPENDIX 6A
TURF-RELATED FACILTIES

Facility Name	Water Source	Water Supply	Right Number
MAGEE MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
MARANA HS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-111064.0000
MARANA JHS	TYPE 2 NON-IRRIGATION GFR	Groundwater	58-111066.0002
NAYLOR MS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
ORANGE GROVE MS	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
PALO VERDE HS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
PISTOR MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
PUEBLO HS	CITY OF TUCSON/TUCSON WATER	Effluent & Commingled	56-000001.0000
RINCON HS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
SABINO HS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
SAHUARITA UNIFIED SCHOOL DIST #30	TYPE 2 NON-IRRIGATION GFR	Groundwater & Effluent	58-160083.0000
SAHUARO HS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
SANTA RITA HS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
SECRIST MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
TOWNSEND MS	CITY OF TUCSON/TUCSON WATER	Effluent	56-000001.0000
UTTERBACK MS	CITY OF TUCSON/TUCSON WATER	Commingled & Effluent	56-000001.0000
VAIL MS	CITY OF TUCSON/TUCSON WATER	Commingled	56-000001.0000
WILSON K-8 SCHOOL - AMPHI SCHOOL DIST	CITY OF TUCSON/TUCSON WATER	Groundwater	56-000001.0000
HOMEOWNERS ASSOCIATIONS			
GLADDEN FARMS HOA	TYPE 1 NON-IRRIGATION GFR	Groundwater	58-109009.0001
THE LAKES AT CASTLE ROCK HOA	TOWN OF MARANA, CORTARA MARANA IRR. DIST	Recovered CAP	56-000107.0000

APPENDIX 6B
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.
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 January 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.

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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.
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.

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DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

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.

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.

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.

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DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

	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.
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	

APPENDIX 6B DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM STANDARD BEST MANAGEMENT PRACTICES	
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.
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, Tucson Active Management Area.* ADWR.

CHAPTER SEVEN: WATER QUALITY

7.1 INTRODUCTION

Water quality is an important component of Tucson Active Management Area (TAMA) water supply management. ADWR's 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 aspect of meeting 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 TAMA.

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 TAMA is of acceptable quality for most uses. Most of the groundwater supplies in the TAMA meet federal and state drinking water standards, though contaminant levels exceed the US Environmental Protection Agency (EPA) National Primary Drinking Water Regulation limits *(See http://water.epa.gov/drink/standardsriskmanagement.cfm*) in a few areas. Within the TAMA there are seven Water Quality Assurance Revolving Fund (WQARF) sites, one US EPA National Priorities List (NPL) site, and one Department of Defense (DOD) site (*See Figure 7-1*). TAMA groundwater withdrawals from wells within these identified areas have been discontinued or are in the process of being cleaned up through remedial activities. Other areas of known contamination that are not being remediated are monitored to ensure that contaminants do not spread.

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 TAMA. 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 TAMA;

ADWR's objectives are designed to ensure that remedial action projects are not an impediment to achieving the safe-yield management goal for the TAMA 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 shall also 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 vertical cross-contamination by the well. The rules shall require that a new or replacement well in these types of location 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. § 49-290.01(A)). The director of water resources may also waive any regulatory requirement adopted pursuant to Title 45with 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 sixty-five thousand acre-feet (ac-ft) 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 ac-ft 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 discusses the regulatory agencies responsible for administering laws impacting groundwater and surface water quality as well as the federal laws and state programs impacting groundwater 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 US 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 only subject to an aquifer protection permit (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) permit 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 may negatively impact water quality for municipal providers and poses potential water management challenges 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 and remediation.

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 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 potential 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 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 reclaimed water, 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 reclaimed water 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 leaking USTs. ADWR can provide guidance for leaking 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 is also 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 TAMA.

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 of 1997, ADWR has increased its responsibility in its program to coordinate and provide assistance with 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 AMA.

As of 2016, six entities hold seven poor quality groundwater withdrawal permits in the TAMA, primarily at CERCLA and WQARF sites *(See Table 7-1).*

TABLE 7-1
TUCSON AMA POOR QUALITY WITHDRAWAL PERMITS

Permit Number	Permittee	Maximum Permitted Volume (ac-ft)	Site
59-205587.0001	Mission Linen Supply	5	Mission Linen remediation sites
59-209994.0001	City of Tucson	194	Los Reales Landfill
59-212083.0000	Union Pacific Railroad	100	Union Pacific Railroad remediation sites
59-221503.0000	Pima County DEQ	400	El Camino del Cerro Landfill
59-533726.0002	Texas Instruments	65	Tucson International Airport Area
59-583889.0001	City of Tucson	250	Harrison Rd. Landfill
59-586193.0002	ADEQ	2,100	Broadway-Pantano
	TOTAL	**3,114**	

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 (CAWS) 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 must also 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 AWS 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 water to meet the ADEQ standards.

As of 2013, there were 10 municipal water providers that hold DAWS in the TAMA. Two of these are not currently serving customers. 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 TAMA.)*

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 TAMA'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. Other 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 2014, the TAMA has 22 active permitted recharge facilities. Fifteen are Underground Storage Facilities (USFs) and seven are Groundwater Savings Facilities (GSFs). For more information on recharge facilities in the TAMA see Chapter 8 of this plan. There are 44 long-term storage account holders with long-term storage account balances totaling more than one million ac-ft as of 2013. 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 (A.C.C. 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 an unreasonable increasing damage on surrounding wells, additional regional land subsidence, or migration of poor quality groundwater.

The Notice of Intention to Drill a well statute (A.R.S. § 45-596*)* 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 may 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 water-tight 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 Site Cleanup and Management Process

The sections below describe ADWR's role and activities in implementing the Water Quality Assurance Revolving Fund (WQARF) Program.

Site Identification, Prioritization, 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 challenges 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 Site 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 up remedial sites. ADWR policies are geared towards 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 ac-ft 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 an important potential water resource***
  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 end use 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 Plans. The assessment provided detailed characterization of water quality and an overview of water quality concerns in the TAMA. A water quality assessment for the 4MP will be qualitative. The following sections discuss goals and objectives of the assessment for the fourth management period and water quality of renewable and groundwater supplies in the TAMA.

7.5.1 Assessment Goals and Objectives
The primary goal of this Water Quality Assessment is to provide a qualitative evaluation of groundwater and surface water quality conditions in the TAMA 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, state law prohibits direct use of treated reclaimed water for potable use, but 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 good 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 TAMA are primarily CAP water and reclaimed water. Other than imported CAP water, the volume of natural surface water supplies in the TAMA available for direct use is relatively small. The quality of renewable water supplies is discussed in this section.

7.5.2.1 Central Arizona Project Water

The largest renewable water supply available in the TAMA is CAP water, which is diverted and conveyed from the Colorado River in a primarily open canal. The direct delivery of CAP water for municipal water supply has in the past been met with controversy in the TAMA. The City of Tucson, the largest municipal CAP subcontractor in the state, faced many obstacles[1] in its attempt to put to use its CAP allocation beginning in 1992.

Many CAP water use alternatives were explored, including blending treated CAP water with groundwater, enhanced treatment of CAP water using membrane filtration, and implementing larger-scale recharge programs. To date the TAMA CAP subcontract holders and other users of CAP have elected to store the water and recover it pursuant to the Augmentation and Recharge Program, described in Chapter 8 of this plan.

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 TAMA. 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. Wastewater reuse rules are developed by ADEQ and establish standards for various classes of wastewater. Wastewater discharges require an AZPDES permit to ensure that water quality parameters are being met.

There are currently two wastewater treatment facilities that discharge reclaimed water into the Santa Cruz River within the TAMA boundaries. These facilities are the Agua Nueva Water Reclamation Facility (WRF), which replaced the now closed Roger Road Wastewater Treatment Facility; and the Tres Rios WRF, which is the renamed, upgraded and expanded Ina Road Water Pollution Control Facility. Both WRFs are operated by the Pima County Regional Wastewater Reclamation Department. Segments of the Santa Cruz River downstream from the reclaimed water discharges have perennial or continuous flows as a result of these discharges. Wastewater discharges to waters of the United States require an AZPDES permit and an APP to ensure that water quality standards are being met.

[1]See Third Management Plan for Tucson Active Management Area, 2000-2010, Chapter 5, page 5-9, section 5.5.2, "Use of Renewable Water Supplies," found here: http://www.azwater.gov/AzDWR/Watermanagement/AMAs/ThirdManagementPlan3.htm#Tucson.

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. A portion of the secondary reclaimed water is treated to a higher standard by filtering and disinfection and is directly delivered for non-potable uses in the TAMA. 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 are also 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 CAP Water

Most streams in the TAMA 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 surface water is limited. The surface water supplies other than CAP are an important source of natural aquifer recharge in the TAMA. 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 TAMA is of acceptable quality for most uses. However, some groundwater areas have been degraded as a result of contamination.

The introduction of contaminants into aquifer systems degrades groundwater quality and may post 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 TAMA 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. ADEQ has adopted a rule (A.A.C. R18-4-212), requiring that groundwater under the direct influence of surface water withdrawn from recharge facilities should undergo more extensive water quality analysis and treatment than groundwater. 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 of the specific groundwater contamination areas that have been identified in the TAMA. 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. In the TAMA, the El Camino del Cerro area, Miracle Mile Interchange area (including Silverbell Jail Annex), Park-Euclid site (Mission Linen), and the Broadway-Pantano site have each been ranked based on risk and other environmental factors. 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 TAMA 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.

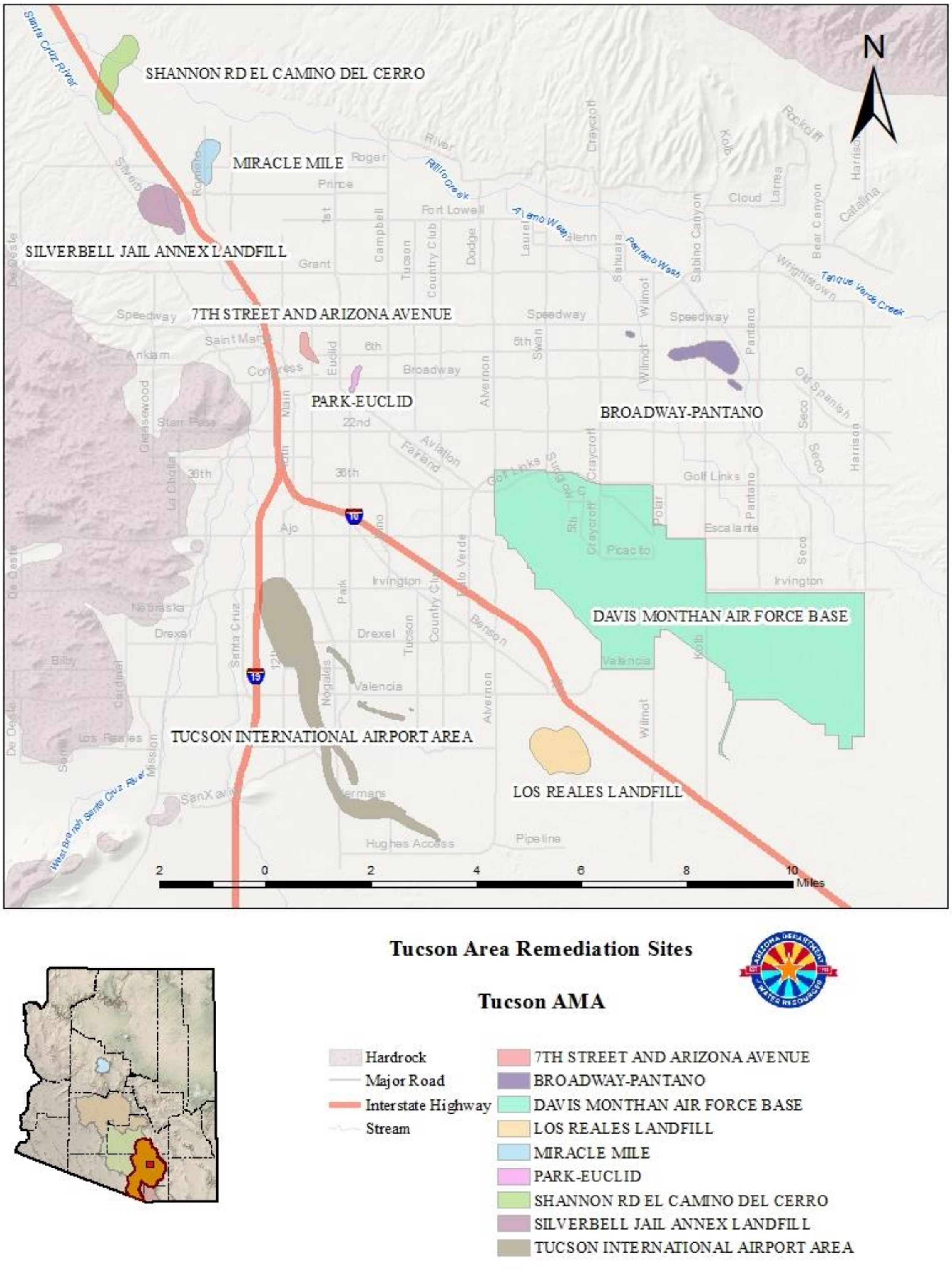
7.6.1 Non-Site-Specific Water Quality Management

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 USTs) 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.

FIGURE 7-1
TUCSON AMA WATER QUALITY REMEDIATION SITES



7.6.2 Preservation of TAMA 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 or increase. Remediated groundwater withdrawals reported to ADWR by municipal water providers for existing remedial sites within the TAMA averaged about 7,000 ac-ft per year from 2001 through 2014. The total reported remediated groundwater withdrawn by municipal providers in the TAMA over the period was about 90,000 ac-ft. Such withdrawals may occur as part of aquifer restoration or plume containment. These estimates merely represent preliminary projections based on data from only a portion of the existing sites within the TAMA. 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 TAMA. 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 will likely 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 used within the TAMA. 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 TAMA. 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 TAMA 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 it is unusable for direct consumption for many purposes. The extent and type of contamination vary by location and land use activities. Contamination of groundwater in the TAMA has generally been caused by human activity. Volatile Organic Compounds (VOCs) are a predominant contaminant in the TAMA and limit the direct use of some groundwater. Remedial processes are used to treat VOC contaminated water to drinking water quality standards making this water available for either current or future direct potable use. Water supplies contaminated with other constituents must also be properly treated prior to use for drinking water supplies. Beneficial end uses of lower quality water must be economically feasible.

As WQARF activities continue, 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 is also 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 TAMA on challenges related to WQARF cleanup activities assisting ADWR in carrying out its commitment to work closely with ADEQ to resolve groundwater quantity and quality challenges 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 Tucson Active Management Area* (4MP) conservation program efforts, is intended to support achievement of the safe-yield management goal for the Tucson Active Management Area (TAMA). Increasing the use of renewable water supplies, particularly Central Arizona Project (CAP) water and reclaimed[1] water in lieu 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 in lieu of groundwater. "Recharge" means storage of excess water (non-groundwater) 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 TAMA groundwater management goal of safe-yield applies to the TAMA as a whole, the objectives of the Recharge Program in the fourth management period serve to enhance water resource management on a localized sub-TAMA scale. A TAMA-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 possible 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 TAMA 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 TAMA. 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 TAMA 4MP. While the development and direct use of renewable water supplies is an important component of TAMA water management during the fourth management period, underground water storage provides a cost-effective means of utilizing available renewable water supplies that cannot currently be used directly.

8.2.1 Overview of Recharge and Recovery

Recharge statutes and 4MP provisions provide regulatory framework in which water may be stored and recovered. The statutes and the TAMA 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;

[1] In the TAMA 4MP, the term "reclaimed water" has the same definition as effluent in A.R.S. § 45-101.

- 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;
- 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 affected 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

There are several key components of recharge and recovery. Rights to recover water may be exercised annually or long-term. Any recoverable water can be recovered within the same year in which it was stored. Stored water may also be credited to a long-term storage account, which allows the account holder to recover the water at any point in the future, if certain conditions are met. These conditions assist the achievement of water management goals by minimizing the potential negative impacts. The definition of “Water that cannot reasonably be used directly” contained in A.R.S. § 45-802.01(22) limits the types of stored water for which long-term storage credits may be earned.

No time limit exists on the right to recover long-term storage credits. Long-term storage credits may be assigned to another person if that person can meet the same provisions for earning credits as the storer. In addition, once the water is recovered, it retains the same legal characteristics it had before storage.

The Underground Water Storage (UWS) Program is also 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.” The cuts apply to the storage of certain types of water for long-term storage credits. They do not apply to water that is stored and recovered annually. In the TAMA, cuts to the aquifer totaled more than 202,000 ac-ft between 1986 and 2013 from storage of reclaimed water at managed facilities[2], CAP water at constructed facilities[3] and CAP water stored at Groundwater Savings Facilities (GSFs)[4].

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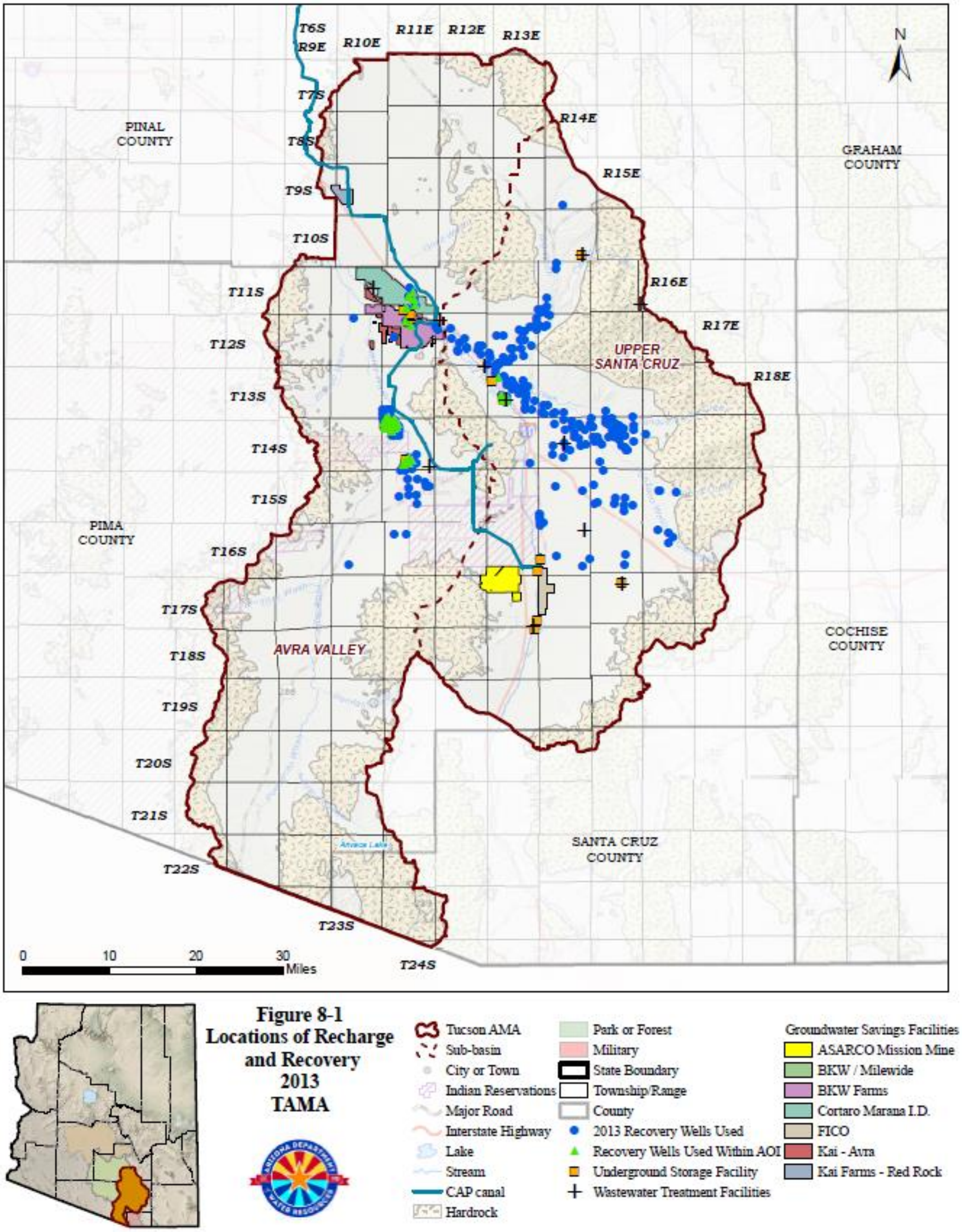
[2] “Managed underground storage facility means a facility . . . that is designed and managed to utilize the natural channel of a stream to store water underground pursuant to permits issued under this chapter through artificial and controlled release of water other than surface water naturally present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

[3] “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)).

[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 8-1
TUCSON AMA RECHARGE SITES & RECOVERY LOCATIONS



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 *Demand and Supply Assessment 1985-2025*, *Tucson Active Management Area* (Assessment) on ADWR's website:
http://www.azwater.gov/AzDWR/WaterManagement/Assessments/documents/FINALTAMAASSESSMENT.pdf.

8.3 PHYSICAL ASSESSMENT OF THE TUCSON AMA

Attaining safe-yield may not eliminate potential water supply challenges facing the TAMA water users such as high water tables in recharge areas, and land subsidence and earth fissuring in areas of groundwater level decline. There is a need to develop additional aquifer management strategies during the fourth management period to address the impacts of these varied local groundwater declines and physical availability challenges. Because of possible CAP water shortages projected by the US Bureau of Reclamation, continued drought contingency planning is important as well. In 2013, about 35 percent of water recovered as either annual or long-term storage credits was recovered within one mile of a USF or GSF where the recovered water was stored, minimizing the potential impacts of localized water level declines. Further data analysis is needed to quantify how much individual storers are recovering within the area of impact of storage. In 2013, the volume of water recovered within the area of impact in the TAMA was approximately 41,000 ac-ft out of 117,000 ac-ft of total water recovered in the TAMA.

8.3.1 Groundwater Overdraft

Total 2013 water demand in the TAMA was approximately 343,000 ac-ft. About 48 percent of this demand, 163,000 ac-ft, was met by groundwater. Groundwater overdraft in the TAMA has been declining due to the increased use of renewable supplies primarily by TAMA municipal water providers and the use of USFs and GSFs by other TAMA water use sectors, including the Arizona Water Banking Authority (AWBA). The cut to the aquifer for stored water helps to offset overdraft. In addition, net natural and incidental recharge offset overdraft. Between 1985 and 2013 there were 12 years where more than 100,000 ac-ft of annual stream channel recharge is estimated to have occurred.

Despite the TAMA population nearly doubling from 1985 to 2013, groundwater demand has decreased due to increased direct use and recharge and recovery of renewable water supplies. The statutory goal of reaching safe-yield by 2025 appears achievable in the TAMA with continued water conservation, supply augmentation and careful water management.

8.3.2 Consequences of Groundwater Overdraft

Although water users in the TAMA have made significant strides to reduce groundwater dependency, remaining groundwater pumping in the TAMA could still negatively impact the AMA's aquifers, particularly at the local level for areas with greater hydrologic sensitivity. Lower groundwater levels could reduce well productivity and increase pumping costs. Lower groundwater levels may increase land subsidence, reducing the aquifer's ability to store water introduced either naturally or artificially through recharge. As shown in Chapter 2 of this plan, land subsidence has already occurred in the TAMA due to groundwater overdraft. Continued lowering of water levels could potentially result in additional land subsidence. Because there is potential for damage due to land subsidence in the TAMA, reduction of groundwater overdraft and increased recharge in sub-regional areas of the TAMA could benefit the TAMA. The depletion of the groundwater supplies in local areas within the TAMA may also reduce the groundwater supply physically available for demonstration of an Assured Water Supply (AWS).

As described in Chapter 2 of this plan, groundwater overdraft results in groundwater level declines. During the period 1940 to 2010, maximum water level declines between 100 and 250 feet in total were observed in the TAMA. Figure 2-8 in Chapter 2 of this plan shows historical water level changes between 2000 and 2010. Since the year 2000, water levels in the City of Tucson's (Tucson Water's) central wellfield, which historically experienced significant water level declines, appear to have stabilized and in some cases even risen due to Tucson Water's increased storage of CAP water and shifting its pumpage closer to the area of storage in the Avra Valley area. Table 8-1 below summarizes the water storage and recovery through the year 2013 at the AMA level and for each of the two groundwater sub-basins in the TAMA.

TABLE 8-1
TUCSON AMA WATER STORAGE & RECOVERY SUMMARY, 1986-2013 (ac-ft)

	Sub-basin	**Avra Valley***	**Upper Santa Cruz**	**AMA TOTAL**
Delivered to be Stored through 2013	USF CAP	1,669,023	305,302	1,974,325
	USF Reclaimed	214,959	214,108	429,067
	USF Surface Water	957	0	957
	USF TOTAL	*1,884,939*	*519,410*	*2,404,349*
	GSF (CAP) TOTAL	*401,889*	*41,078*	*442,967*
	TOTAL DELIVERED TO BE STORED	**2,286,828**	**560,488**	**2,847,316**
Recovered through 2013	CAP	584,820	506,356	1,091,176
	Reclaimed	0	128,992	128,992
	Surface Water	870	0	870
	TOTAL RECOVERED	**585,690**	**635,348**	**1,221,038**
Recovered Water in 2013	CAP	67,061	41,942	109,003
	Reclaimed	0	8,018	8,018
	Surface Water	0	0	0
	Total	67,061	49,960	117,021
	Within 1 mile of any storage location	**34,949**	**5,814**	**40,763**
Recovered Water in 2005	CAP	24,617	46,344	70,960
	Reclaimed	0	5,358	5,358
	Surface Water	149	0	149
	Total	24,766	51,702	76,467
	Within 1 mile of any storage location	**7,372**	**4,655**	**12,027**

*Includes recharge projects that span both sub-basins.

8.3.2.1 Avra Valley Sub-basin

The Avra Valley Sub-basin has historically been dominated by agricultural water demand. In recent years, a significant volume of artificial recharge has occurred in this sub-basin. As of 2013, over two million ac-ft of water had been delivered for storage in the Avra Valley Sub-basin. Of this volume, 1.6 million ac-ft was CAP water delivered for storage at USFs, and more than 400,000 ac-ft of CAP was delivered to GSFs, primarily in the Avra Valley Area of Similar Farming Condition (ASFC). Most of the water stored in this sub-basin has been CAP water stored at USFs by Tucson Water. In addition to CAP water, there was nearly 215,000 ac-ft of reclaimed water stored in this sub-basin at USF facilities. A small volume of non-CAP surface water was stored as well.

About 48 percent of total TAMA recovered annual and long-term storage credits have been recovered in the Avra Valley Sub-basin to date, mostly by Tucson Water. Nearly all the water recovered in the Avra Valley Sub-basin has been CAP water.

8.3.2.2 Upper Santa Cruz Sub-basin

Historically, municipal demand has usually been concentrated in the Upper Santa Cruz (USC) Sub-basin in the TAMA. Over 93 percent of the TAMA population resides in this sub-basin, and accounts for the vast majority of municipal demand. There is significant agricultural demand in this sub-basin as well. About 47 percent of agricultural groundwater withdrawals in the TAMA in the year 2013 occurred in the USC Sub-basin.

By the end of 2013, more than 300,000 ac-ft of CAP water and more than 214,000 ac-ft of reclaimed water were stored in the USC Sub-basin. More than 635,000 ac-ft of this stored water has been recovered either annually or as long-term storage credits in this sub-basin. Of the water recovered in the USC Sub-basin, 506,000 ac-ft was recovered CAP water. The remainder of the water recovered in this sub-basin (approximately 129,000 ac-ft) was reclaimed water. Of the total volume of reclaimed water recovered, 93 percent was reclaimed water recovered within the area of hydrologic impact of where the water was stored. Under the management plan provisions, reclaimed water recovered within the area of impact of storage is considered “direct use” reclaimed water for purposes of determining compliance with conservation requirements.

The primary storer of water in the USC Sub-basin has been Tucson Water.

8.4 ALTERNATIVE WATER SUPPLIES ASSESSMENT

The primary renewable supplies in the TAMA are CAP water and reclaimed water, and are the primary alternative to groundwater use in the TAMA. Lack of surface water storage means that non-CAP surface water resources in the TAMA are a less significant renewable supply. The following section describes the major water supplies and how they are currently used in the TAMA. For a broader discussion of renewable supplies in the TAMA, see Chapter 2, section 2.9.

8.4.1 Colorado River Water and the Central Arizona Project

The CAP canal delivers Colorado River water to Pima, Pinal, and Maricopa Counties. Figure 8-1 shows the location of the CAP canal and terminal pipeline within the TAMA. The following sections describe the TAMA’s CAP water supply, current use by water use sectors, and supply reliability challenges related to allocation priorities, Tucson’s location at the end of the CAP line and water user needs. Additional discussion of CAP water use challenges may be found in Chapters 2, 5 and 6 and in Appendix 8.

8.4.1.1 Central Arizona Project Water Supply

The CAP is the largest source of renewable water supply available in the TAMA. Annual CAP water allocations for the TAMA total 263,298 ac-ft per year. Of this total, approximately 66,500 ac-ft per year are currently subcontracted to the Tohono O’odham Nation and Pascua Yaqui Tribe. The remaining 196,798 ac-ft per year consists mostly of municipal subcontracts. Additional CAP water may be allocated as a result of the Southern Arizona Water Rights Settlement Act and Non-Indian Agriculture (NIA) Priority CAP water reallocations.

A list of existing CAP water allocations/contracts for the TAMA is presented in Table 8-2. Agricultural and mining water users originally declined CAP water subcontracts; however, both Rosemont Copper and Freeport McMoRan Sierrita Inc. have applied for volumes of reallocated NIA Priority CAP water. TAMA

TABLE 8-2
TUCSON AMA CAP SUBCONTRACTS AND ALLOCATIONS

	Entity	Allocation (ac-ft)	Previous Allocation (ac-ft)
Municipal Subcontracts	City of Tucson	144,172	138,920
	Arizona State Land Department*	14,000	14,000
	Metropolitan Domestic Water Improvement District	13,460	8,858
	Flowing Wells Irrigation District	2,873	4,354
	Spanish Trail Water Company	3,037	3,037
	Green Valley Water Company	1,900	1,900
	Town of Oro Valley	10,305	2,294
	Avra Water Co-Op	808	0
	Midvale Farms	0	1,500
	Community Water Company of Green Valley	2,858	1,337
	Vail Water Company (formerly Del Lago Water Company)	1,857	786
	Town of Marana	1,528	47
Tribal Subcontracts	San Xavier (Tohono O'odham)	50,000	27,000
	Schuk Toak (Tohono O'odham)	16,000	10,800
	Pascua Yaqui	500	500
	TOTAL MUNICIPAL & TRIBAL SUBCONTRACTS	**263,298**	**215,333**
	(Other) ASARCO-Ray Mine	21,000	

*Per the Subcontract Among the United States, the Central Arizona Water Conservation District, and the State of Arizona by the Arizona State Land Department Providing for Water Service, dated July 13, 2007, in Appendix A of Addendum A.

agricultural CAP water use began in 2004 and has declined since 2006. Most agricultural CAP water use has been in-lieu CAP water delivered to GSFs. Overall, agricultural water use in the TAMA is likely to decline with urbanization.

Excess CAP water from unused entitlements and surplus Colorado River supplies have historically provided an opportunity to bring additional CAP water supplies into the TAMA beyond existing allocations. The volume of excess CAP water fluctuates depending on the use of CAP subcontracts and allocations and the availability of the overall CAP supply. Based on projections by the US 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, unused CAP supplies have been recharged by individual entities within the TAMA 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.

Central Arizona Project Water Supply Reliability

The reliability of CAP water supplies and delivery scheduling has implications for the use of CAP water by municipal water providers within the TAMA. Arizona's CAP 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. However, projected shortages are not expected to impact CAP's high priority Municipal and Industrial (M&I) subcontractors. The CAP water supply reliability and scheduling is important to the TAMA due to its lack of other available surface water supplies.

Municipal Use of Central Arizona Project Water

The municipal sector has the largest allocations of CAP water in the TAMA. The City of Tucson is the largest provider in the TAMA, serves 75 percent of the population in the TAMA, and holds the largest municipal CAP water contract in the state (144,172 ac-ft).

Several municipal providers have been storing water at the TAMA's recharge facilities since 1993. Table 8-3 shows the volume of water stored by entity since 1993 and the portion of that volume that has been stored from 2000 through 2013. 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 who are member service areas in the CAGRD.

See Chapters 2, 3 and 5 of the plan for additional information on CAP water use by municipal providers. See Chapter 7 for additional information on water quality challenges.

Figure 8-1 shows the locations of recharge sites. Table 8-4 lists the facilities, permitted storage volumes, and volume stored as of 2013. A total of 410,733 ac-ft were delivered to be stored at GSF's in the TAMA between inception of the program and the end of 2013.

Agricultural Use of CAP Water

While a small portion of agricultural demand is met with CAP agricultural pool water, additional CAP water has been made available to farmers in the TAMA through the institution of ADWR's GSF Program, which allows a water storer to earn storage credits for providing an alternative water supply to a water user who otherwise would have used groundwater. The cost of CAP water to a farmer operating a GSF varies depending on the CAP water provider and specific conditions of the storage agreement. However, GSF storage agreements typically provide CAP water to farmers at a cost lower than any other water source available to them. In such instances, there is an economic incentive for the farmer to use CAP water instead of groundwater. The entities supplying CAP water earn long-term storage credits. Because much of the agricultural land in the TAMA is close to the CAP canal, CAP water distribution costs are minimized.

TABLE 8-3
TUCSON AMA WATER STORED BY ENTITY (ac-ft)

Entity	Stored 2000 - 2013	Stored 1993 - 2013
Tucson Water	1,372,537	1,470,761
Arizona Water Banking Authority	703,396	739,974
Metropolitan Domestic Water Improvement District	138,328	156,128
US Bureau of Reclamation	104,372	104,372
Tohono O'odham Nation	97,628	97,628
Town of Oro Valley	53,216	58,018
Augusta Resource (Arizona) Corporation	45,000	45,000
Central Arizona Water Conservation District	2,478	8,840
CAWCD – CAGRD Sub-Account	8,840	8,904
CAGRD – Conservation District Account	3,910	3,910
CAGRD - Replenishment Reserve Account	17,297	17,297
Town of Marana	23,031	23,078
Robson Ranch Quail Creek LLC	16,323	16,323
Vail Water Company	16,272	16,272
Spanish Trail Water Company	11,130	42,877
Flowing Wells Irrigation District	10,590	10,590
Pima County Regional Wastewater Reclamation Department	7,987	7,987
Green Valley Domestic Water Improvement District	4,825	5,325
Town of Sahuarita	3,642	3,642
Aqua Capital Management LP	3,000	3,000
Pascua Yaqui Tribe	3,433	3,433
Robson Communities Inc.	1,000	1,000
Cortaro Marana Irrigation District	957	957
Community Water Company of Green Valley	0	2,000
TOTAL DELIVERED TO BE STORED	**2,649,192**	**2,847,316**

Agricultural use of in-lieu CAP water in the TAMA peaked in the year 2000 at 27,973 ac-ft. Since then, the volume has fluctuated. In the year 2013, in-lieu CAP was 25,356 ac-ft. Although agricultural use in the TAMA has fluctuated historically, it does not show a trend of reduction as growth has occurred in the municipal sector. See Chapter 4 for further discussion of agricultural CAP water use.

Direct use of CAP water for agricultural purposes historically has not been economically advantageous to various agricultural entities in the TAMA. The Cortaro Marana Irrigation District (CMID), Avra Valley Irrigation District (AVID) and Farmers Investment Company (FICO), declined their CAP water allocations in the 1980s, primarily due to CAP water costs. In the case of AVID and FICO, infrastructure cost for the conveyance of CAP water to their farms was also a challenge. Thus, historical use of CAP agricultural pool water in the TAMA in most years has been less than 3,000 ac-ft per year.

Tribal Use of Central Arizona Project Water

Tribal use of CAP water in the TAMA began in the year 2000 and has ranged from 10,000 to more than 21,000 ac-ft per year from 2002 through 2013. This CAP water is used entirely for agricultural irrigation on tribal land.

Industrial Use of Central Arizona Project Water

Most industrial users in the TAMA have chosen not to pursue CAP water supplies. Historically, the cost of CAP water compared to groundwater, lack of physical access to the CAP water supply, and infrastructure cost has constrained the use of CAP water by industry. Mines are the largest-volume industrial water user group in the TAMA. In-lieu use of CAP water by the mining sector began in 2007 and has increased to more than 6,500 ac-ft per year since 2009. The mining industry has been increasing their use of renewable CAP supplies by the use of recharge and recovery for current and future uses. Two mines have long-term storage accounts and water storage permits and one has been storing CAP water. See Chapter 6 for further discussion of current and potential CAP water use by industrial users.

TABLE 8-4
TUCSON AMA WATER STORAGE FACILITIES

Facility Name	Permit Volume (ac-ft/year)	Source water	Amount Stored (ac-ft)
ASARCO Facility	10,000	CAP	41,078
Avra Valley USF	11,000	CAP	100,510
BKW Farms GSF	14,317	CAP	143,976
BKW Milewide GSF	613	CAP	5,045
Black Wash USF	4,480	Reclaimed	0
CAVSARP USF	100,000	CAP	835,315
Corona De Tucson WRF	2,240	Reclaimed	1,313
Cortaro Marana Irrigation District GSF	20,000	CAP, Reclaimed	113,869
Farmers Investment Company GSF	22,000	CAP	0
Herb Kai - Avra Facility	12,513	CAP	0
Kai Farms GSF (Red Rock)	11,231	CAP	138,999
Lower Santa Cruz Replenishment Project USF	50,000	CAP	425,949
Lower Santa Cruz River Managed USF	43,000	Reclaimed	212,065
Marana High Plains USF	600	Reclaimed, Surface	3,851
Pima Mine Road USF	30,000	CAP	301,331
Project Renews USF	3,000	CAP	0
Robson Ranch Quail Creek USF	2,240	Reclaimed	16,323
Saddlebrooke Water Reclamation Plan USF	2,090	Reclaimed	0
Santa Cruz River Managed USF	9,307	Reclaimed	84,591
SAVSRP USF	60,000	CAP	307,250
Sweetwater USF	13,000	Reclaimed	108,239
Town of Sahuarita	896	Reclaimed	3,642
Tucson Water Injection Projects	NA	CAP	3,971
TOTAL	**422,527**		**2,847,317**

8.4.2 Reclaimed Water

In 2013, Pima County Regional Wastewater facilities produced 64,354 ac-ft of reclaimed water (Pima County Regional Wastewater Reclamation Department, 2013). ADWR annual report records indicate that about 15,400 ac-ft, or 24 percent of the volume of reclaimed water produced was directly reused on turf facilities or delivered to agricultural users. As a result of recent upgrades to wastewater reclamation facilities, there has been a reported increase in the rate of in-channel recharge. About 26,000 ac-ft, or 40 percent of the reclaimed water produced was stored at managed or constructed recharge facilities in the TAMA. Reclaimed water discharges to the Santa Cruz River have benefited riparian habitat, which provides ancillary benefits including recreational opportunities. However, reclaimed water also provides an important component of the total water supply available to the TAMA.

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 water level declines

Management of the reclaimed water supply is complicated by the decisions and policies of the jurisdictions controlling the supply. These decisions and policies regarding the distribution of reclaimed water will continue to affect the use of reclaimed water during the fourth management period. However, any and all use of reclaimed water either directly replaces current or future groundwater demand, or replaces CAP use, which then can replace current or future groundwater demand.

Pima County owns and operates the largest wastewater system in the TAMA but controls little of the reclaimed water produced. Under an agreement related to the Southern Arizona Water Rights Settlement Act (SAWRSA), the Secretary of the Interior is assigned 28,200 ac-ft per year of the reclaimed water discharged from Pima County's metropolitan wastewater treatment facilities. The City of Tucson controls 90 percent of the remaining reclaimed water produced by County facilities under a 1979 intergovernmental agreement (IGA), and ten percent is controlled by Pima County. Of the 90 percent of reclaimed water controlled by the City of Tucson, five other water providers (Metro Water District, Town of Oro Valley, Town of Marana, Flowing Wells Irrigation District and Spanish Trail Water Company) have signed IGAs with the City of Tucson and are entitled to reclaimed water generated from their service areas.

The City of Tucson owns and operates a distribution system for reclaimed water (post-secondary-treated wastewater). The reclaimed system is primarily used for turf irrigation. The Sweetwater Recharge Facility provides temporary underground storage and recovery to meet seasonal demands of the reclaimed water system. The facility uses spreading basins to recharge excess reclaimed water during the winter. The reclaimed water can be later recovered via on-site recovery wells for use in the hotter months when irrigation demands are higher. The Santa Cruz River Managed and Lower Santa Cruz River Managed Recharge Facilities are in-channel reclaimed water storage and recovery projects that have increased the volume of water that can be delivered through the reclaimed system.

Although the supply of reclaimed water offers opportunities for augmenting the water supply, the following factors could affect reclaimed water use in the TAMA:

- Expanding the City of Tucson's reclaimed water distribution system would be costly.
- There is currently no distribution system that could make reclaimed water available to many of the large agricultural users such as BKW Farms, AVID, and FICO.
- Chemical incompatibility of reclaimed water with metallurgical processes can make the use of reclaimed water in mining operations problematic.

There has been public interest within the TAMA in continuing discharges to the Santa Cruz River for purposes such as maintaining riparian vegetation. The Sonoran Institute's Living River program has created an initiative which monitors river flow rates, water quality and related factors such as existence of aquatic wildlife and social/recreational impacts.

Cooperative regional planning can help address some of the institutional, financial and regulatory barriers to efficient reclaimed water supply management and reclaimed water use. In 2011 the US Bureau of Reclamation published a report that discusses the potential to enhance reclaimed water recharge rates in the TAMA. The study found that, while costly, recharge at the Santa Cruz River Managed Recharge Project can be enhanced by diverting the reclaimed water to be stored into adjacent dry channels.

8.4.3 Surface Water

In the upper stream reaches in the Santa Catalina Mountains and a few other areas in the TAMA, surface water often flows year-round. Because the surface water eventually percolates to the groundwater aquifer as mountain front and stream bed recharge, this surface water is not a potential new source of renewable supply.

Most of the intermittent run-off in the TAMA recharges naturally along the mountain fronts and in the washes of the TAMA, and is not a source of renewable supply. In order to accrue recharge credits for recharge of storm water, one must demonstrate that the water stored would not have been naturally recharged within the TAMA (A.R.S. §§ 45-831.01(D)(1) and 45-852.01).

Changing the distribution of storm-water recharge in the basin may help meet local water management objectives. Large-scale recharge projects designed solely to recharge storm water are often not cost-effective due to the small number of days of flow during each year. Some small-scale, multiple-use projects incorporating storm-water recharge have been proposed in the TAMA. A large number of households retaining storm water by harvesting runoff in swales, micro-catchments and tanks could cumulatively result in reductions in municipal demand for outdoor use. Retaining storm water in the soil and applying tank-stored storm water to landscaping reduces the need to use groundwater, imported CAP water or reclaimed water to meet this demand.

8.4.4 Cooperative Efforts to Produce Water Management Solutions

Entities in the TAMA have worked cooperatively to create initiatives and projects that enhance augmentation and recharge in the AMA. The TAMA community encourages innovative programs that contribute positively to local achievement of water management goals, while fostering educational, recreational and tourism opportunities.

ADWR staff works in concert with the Safe Yield Task Force (SYTF), a technical working group that informs the Tucson Groundwater Users Advisory Council (GUAC). The SYTF is an ad-hoc group with participants from all water use sectors within the TAMA. An ongoing effort of the SYTF is the examination of different regions of the TAMA that have particular challenges such as local water level declines. During the fourth management period, ADWR, the GUAC and the SYTF will continue to identify and examine challenges within the TAMA and work to establish effective water management solutions.

8.5 TAMA 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 TAMA, the availability of renewable water supplies, the successes and shortcomings of the Recharge Program during the third management period in the TAMA and the water management challenges facing the TAMA during the fourth management period. ADWR has developed the goals and objectives of the Recharge Program for the fourth management period based upon these

TAMA considerations. The Recharge Program for the fourth management period is intended to move the TAMA 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 TAMA.
- Improve or maintain groundwater conditions in areas of the TAMA 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 Colorado River water and reclaimed water to reduce groundwater overdraft and ensure a safe, long-term, reliable water supply.
- Support efforts to utilize the CAP canal system to the fullest extent possible, to deliver excess Colorado River water and other water to the TAMA 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.
- Facilitate the settlement of Tribal water rights claims in the TAMA.

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 TAMA water management goal. To accomplish this, ADWR will first seek to identify all potential measures available to the TAMA. 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.

8.6 TAMA 4MP 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 TAMA'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.

8.6.1 Arizona Water Banking Authority

The AWBA was established in 1996 to: 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 Tribal water rights claims, 4) exchange water to assist Arizona's Colorado River communities and 5) explore opportunities for interstate water banking with Nevada and California. To this end, the AWBA has recharged nearly 4.2 million ac-ft (MAF) of excess CAP water within the Central Arizona Water Conservation District's (CAWCD) service area through 2014. Long-term storage credits (credits) accrued from this storage total 3.97 MAF and include 3.36 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 accrued 736,238 ac-ft of credits in the TAMA, of which 109,791 ac-ft are for SNWA. The highest percentage of credits that have been accrued at CAWCD's Lower Santa Cruz Recharge Project (43 percent), followed by CAWCD's Pima Mine Road Recharge Project (18 percent). The combined storage at Tucson Water's Central and Southern Avra Valley Storage and Recovery Projects accounts for 27 percent of total credits accrued by the AWBA in the TAMA.

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 ac-ft collected in the Tucson, Phoenix and Pinal 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 are also limitations on how each fund may be utilized by the AWBA to achieve its various goals.[5] The availability and use of funds for any given year are described in the AWBA's Annual Plan of Operation.

In addition to its primary funding sources, the AWBA also received funds from two other sources: shortage reparations and water storage capital charges assessed by CAWCD in Pima County. Under the Arizona-Nevada Shortage-Sharing Agreement executed on February 9, 2007, SNWA agreed to provide $8 million to the AWBA to assist Arizona in offsetting impacts from any shortages during the "Interim Period".[6] These 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. In 2004, the AWBA also began using monies from the water storage capital charges collected at CAWCD storage facilities in the TAMA. These revenues ($9/ac-ft) are deposited into CAWCD's 4¢ *ad valorem* tax fund for Pima County, where they are made available to the AWBA for M&I firming purposes. Revenues from the capital charge through 2014 total over $2.25 million.

TABLE 8-5
TUCSON AMA AWBA CREDITS ACCRUED & LOCATION THROUGH 2014

		AWBA Long-term Storage Credits (ac-ft)		
	Storage Facility	**Intrastate**	**Interstate**	**Total**
USF	Avra Valley Recharge Project	60,175	1,315	61,490
USF	Central Avra Valley Storage & Recovery Project (CAVSARP)	90,444	4,717	95,161
USF	Lower Santa Cruz Recharge Project	242,683	73,930	316,613
USF	Pima Mine Road Recharge Project	101,072	29,828	130,900
USF	Southern Avra Valley Storage & Recovery Project (SAVSARP)	103,607	0	103,607
	Subtotal	**597,980**	**109,791**	**707,772**
GSF	BKW Farms	1,641	0	1,641
GSF	Cortaro Marana Irrigation District	12,257	0	12,257
GSF	Kai Farms-Red Rock	14,336	0	14,336
GSF	ASARCO-Mission Mine Complex*	234	0	234
	Subtotal	**28,467**	**0**	**28,467**
	Total	**626,447**	**109,791**	**736,238**

*Long-term storage credits purchased from the Tohono O'odham Nation pursuant to § 45-841.01
NOTE: Totals may not add due to rounding.

[5] 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.
[6] The Interim Period is the period beginning on the date the US Secretary of the Interior 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).

Table 8-6 below identifies the volume of credits the AWBA has accrued in the TAMA for each funding source. The majority of the credits accrued (57 percent) are from use of the 4¢ *ad valorem* tax monies and represent 49 percent of the TAMA M&I firming goal of 864,000 ac-ft.

TABLE 8-6
TUCSON AMA AWBA CREDITS ACCRUED
PER FUNDING SOURCE THROUGH 2014*

Funding Source	Long-term Storage Credits (ac-ft)
Groundwater Withdrawal Fees*	103,306
Four-cent *Ad valorem* Tax	422,292
General Fund	54,546
Appropriation for Indian Firming	28,481
Shortage Reparation	17,822
Interstate Banking - Nevada	109,791
Total	736,238

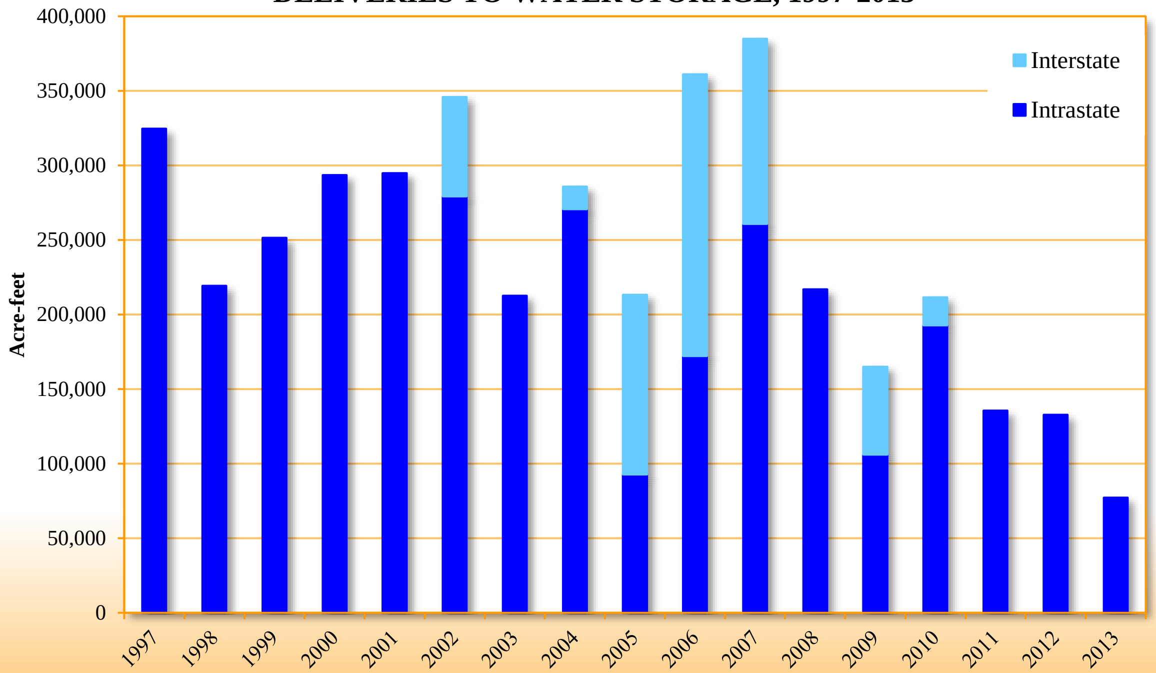
*Includes 234 ac-ft of credits purchased from the Tohono O'odham Nation pursuant to § 45-841.01

As illustrated in Figure 8-2, the volume of Excess CAP water available to the AWBA has historically been over 200,000 ac-ft per year with volumes peaking in 2006 and 2007 at 361,220 ac-ft and 384,890 ac-ft, 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.

Annual AWBA water storage in the TAMA are quantified in Figure 8-3 below. Though slow-paced at first, AWBA storage gradually increased as more recharge capacity became available within the TAMA. The AWBA further increased its storage opportunities in 2010, when it developed a pricing policy for GSFs that encouraged storage partnerships. Through 2014, nearly 780,500 ac-ft of water has been delivered for AWBA storage in the TAMA. By bringing additional CAP water into the AMA, the AWBA has played an important water management role in the TAMA. AWBA storage accounts for nearly 40,000 ac-ft of water provided as a benefit to the aquifer (5 percent cut). Because the AWBA is still behind in meeting its M&I firming goals for the TAMA, the AWBA has focused heavily in recent years on storage in the TAMA to make further progress on its M&I firming goal while Excess CAP supplies are still available for its use.

The location of AWBA storage is also an important factor for meeting water management objectives, particularly when that storage is for M&I firming because the stored water must also be recovered. This is of particular importance in the TAMA considering that CAP subcontractors use their entitlements primarily through annual storage and recovery. While there was emphasis historically on the AWBA's use of CAP demonstration projects, the AWBA, working with Tucson interests, has developed a priority system that focuses storage first at USFs with existing or future planned recovery wells (e.g. CAVSRP/SAVSRP, Pima Mine Road, and Avra Valley Recharge Projects), second at GSFs and third at the Lower Santa Cruz Recharge Project.

FIGURE 8-2
ALL AMAs ANNUAL AWBA
DELIVERIES TO WATER STORAGE, 1997-2013



NOTE: Storage in 2004 and 2009 included 10,000 ac-ft and 51,387 ac-ft, respectively, of Nevada's unused Colorado River apportionment stored on behalf of SNWA.

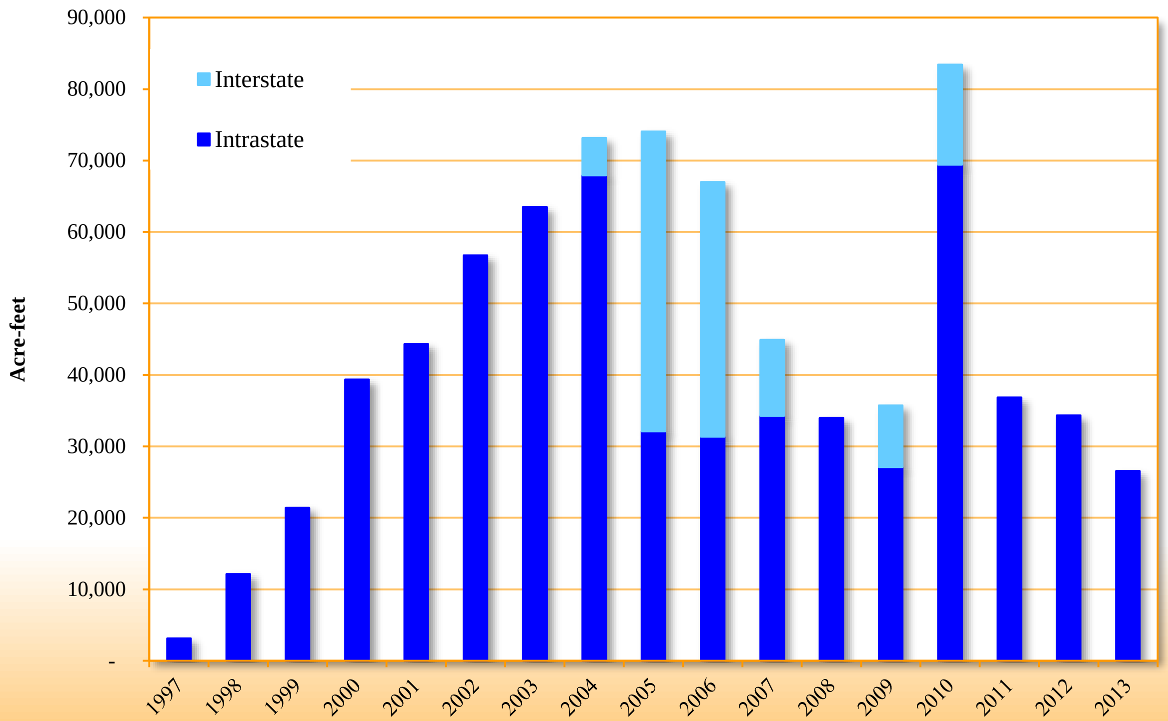
In April 2014, Metro DWID's Board of Directors directed Metro DWID staff to plan, design and construct an annual recharge and recovery project called CAP Recharge, Recovery and Delivery System for Metropolitan DWID Main System. MDWID purchased the Avra Valley Recharge Project from CAWCD in December 2010. A pipeline routing study and property acquisition have taken place, with construction currently planned for 2019.

Although much progress has been made toward the development of new recharge facilities in TAMA, a proposed recharge site located in the Sahuarita/Green Valley area that was recommended for AWBA storage was not realized during the third management period. Future facilities at or near this location could also benefit from AWBA storage.

8.6.1.1 Interstate Water Banking in the TAMA

The AWBA began storing water pursuant to its interstate water banking program in 2002. As illustrated in Figure 8-3, storage for interstate purposes in the TAMA began in 2004. The AWBA has since stored nearly 110,000 ac-ft of water in the TAMA on behalf of SNWA. Benefits from interstate storage in the TAMA are two-fold. First, there is a short-term benefit of additional water supplies imported into the TAMA in advance of when those supplies will be needed for interstate use. Second, as previously discussed, capital charges paid for interstate storage are subsequently deposited into CAWCD's 4-cent *ad valorem* tax fund for Pima County. Capital charges for interstate storage have increased the amount of funds available for M&I firming in the TAMA by nearly $1 million ($999,855).

FIGURE 8-3
TUCSON AMA AWBA DELIVERIES TO WATER STORAGE, 1997-2013



8.6.1.2 Assistance in Settlement of Tribal Water Rights Claims

The Arizona Water Settlements Act (AWSA) P.L. 108-451, which settles longtime claims to water by the Gila River Indian Community (Community) and the Tohono O'odham Nation (Nation), was enacted in December of 2004. The State, under Section 105(b)(2) of the AWSA, is required to: 1) firm 15,000 ac-ft of non-Indian agricultural (NIA) priority CAP water re-allocated to the Community, 2) firm 8,724 ac-ft of NIA priority CAP water re-allocated in the future to Arizona Tribes and 3) assist the US 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 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, created by the Arizona State Legislature (Legislature) to evaluate the potential alternatives for meeting the State's obligations under the AWSA, concluded that the AWBA is 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.

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 tribal communities to develop firming plans that will be used to meet its obligations. In the TAMA, the AWBA's settlement obligation involves assisting the Secretary in meeting its firming obligation to the Nation as described above. Under its agreement with the Secretary, the AWBA agreed to provide the $3 million in assistance by accruing an equivalent amount of long-term storage credits and to distribute those credits to the Secretary when a firming need arises. The AWBA fulfilled this obligation in 2009, accruing over 34,000 ac-ft of credits for this purpose. With enforceability of the AWSA in December of 2007, the AWBA has a firming responsibility through 2107.

8.6.1.3 Distribution and Recovery of AWBA Long-term Storage Credits in the TAMA

Based on current modeling projections, the AWBA does not anticipate the need to firm on-River or CAP M&I priority supplies before 2025.[7] While there is a chance (< 30 percent) that the AWBA will need to firm NIA priority supplies during this time as required under the AWSA, this firming requirement would only affect the Phoenix and Pinal AMAs. However, in its requirement to firm NIA priority supplies for the Nation, the Secretary could request that the AWBA distribute credits it has accrued in the TAMA for this purpose. The AWBA is not responsible for the recovery of those credits. Recovery for the development of Intentionally Created Unused Apportionment (ICUA) for Nevada is also not projected to occur until sometime after 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.[8] 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. The recovery plan also makes recommendations on opportunities for recovery within each AMA. In the TAMA, these recommendations are predominantly for the use of credit exchanges between CAWCD and CAP M&I subcontractors due to the nature of how these water providers utilize their entitlements. Direct recovery facilities in the vicinity of the Kai Farms Red Rock GSF and the Lower Santa Cruz Recharge Project will also be considered. By defining the location of future recovery sites, the recovery plan will also assist the AWBA in making future storage decisions.

8.6.1.4 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 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 TAMA

It is clear that water storage by the AWBA helps to meet the water management objectives of the TAMA. Because the AWBA is behind in meeting its M&I firming goal in the TAMA, ADWR recommends that the AWBA continue to prioritize storage for the TAMA, including the storage of additional supplies that may become available during the year, so that further progress can be made on achieving this goal. To ensure

[7] Arizona Water Banking Authority 2014 Annual Report.

[8] 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.

the storage of these additional supplies, ADWR also recommends that the AWBA work with storage facility operators to seek opportunities for additional storage capacity, particularly at facilities that have future recovery capabilities.

Advice to the AWBA on the Location of Water Storage in the TAMA
It is anticipated that most of the water that is stored by the AWBA in the TAMA will need to be recovered to firm CAP M&I subcontract supplies during future shortages or outages of the CAP. To better manage local aquifers, ADWR recommends that the AWBA continue to work with CAWCD and Tucson interests to select sites for recharge that are also expected to have future recovery capabilities such as at the Avra Valley Recharge Project. ADWR also recommends that the AWBA seek opportunities to store water in the Sahuarita/Green Valley area should storage facilities become available in this area in the future.

Advice to the AWBA on Water Storage Credit Extinguishment
While the extinguishment of withdrawal fee credits to provide water management benefits is always desirable, recognizing that the AWBA is behind in reaching its firming goal for the TAMA and that the AWBA may use withdrawal fee credits for this purpose, ADWR recommends that the AWBA hold these credits in reserve at this time. Additionally, ADWR recommends that the AWBA be conservative in how it distributes credits during times of shortage and only distribute credits to mitigate shortages for direct use demands, including demands that are met through annual storage and recovery. If withdrawal fee credits were to become available for extinguishment ADWR recommends that the AWBA develop a program in cooperation with TAMA water users and interested parties to extinguish storage credits in areas that best meet the TAMA's water management needs, such as in areas of ongoing overdraft.

8.6.2 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 TAMA'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 TAMA. Water management benefits to the TAMA would depend greatly on whether water recovered from an existing recovery well was stored in a remote area of the TAMA or in a large pumping center of the TAMA. Therefore, the criteria to determine whether the recovery location is consistent with the management plan and goal for the TAMA must also consider where water was stored.

The locations of storage and recovery are also important factors in addressing local and regional supply problems, particularly in areas experiencing severe water level declines, land subsidence, or other aquifer management challenges and in attempting to balance the TAMA's supplies during the fourth management period. For example, these locations are also crucial because future TAMA 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[9], 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. If a storage facility is found not to meet these criteria, the permit will include a notice to potential water storers that recovery of the stored water will be allowed only within the area of impact of storage until such time that the Director determines there is a demand for groundwater within the area of impact of the storage.

The requirement that recovery outside the area of impact of storage must be consistent with the TAMA'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.

8.6.3 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 may also 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.

8.7 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.

[9] Such as a Designation, Certificate, or Analysis of AWS.

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, 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.

TABLE 8-7
TUCSON AMA 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 TAMA (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.
Recharge	Reclaimed water stored at a constructed USF or a GSF does not have a cut to the aquifer requirement.

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.

ADWR has received requests from parties within the TAMA to consider the permitting of groundwater savings facilities for certain non-agricultural uses of reclaimed water, in order to expand the use of the supply of reclaimed water. ADWR will meet with stakeholders to explore this concept.

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) *(See Chapter 7).*

8.7.1 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 TAMA 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.

8.8 CONCLUSION

There are a number of challenges that will have to be addressed in order 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 TAMA 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. If all sectors reduce their groundwater pumpage substantially, the need to offset their groundwater pumpage will diminish

Multiple strategies will continue to be considered during the fourth management period to attempt to not only achieve the AMA-wide goal of safe-yield but to address water management challenges in specific geographic areas of the TAMA as the need arises. Many of these efforts will need to be undertaken in a cooperative approach with local stakeholders. Potential challenges 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 challenges will require partnerships with TAMA entities that are willing to make necessary changes, and support efforts to improve groundwater conditions.

8.9 AUGMENTATION AND RECHARGE REQUIREMENTS

8-901. 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.

8-902. 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 8A
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 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 development and implementation of conservation programs, facilitate augmentation and renewable water supply utilization and obtain information on hydrologic conditions and water availability in the Tucson Active Management Area (TAMA) (A.R.S. § 45-567(A)(5))(A.R.S. § 45-567(A)(7)).

The WMAP is funded primarily from groundwater withdrawal fees collected from each person withdrawing groundwater in an Active Management Area (AMA) from a non-exempt well (A.R.S. § 45-611(C)). Withdrawal fees are authorized by the *1980 Groundwater Code* (Code) and are levied based on the acre-foot volume of groundwater withdrawn on an annual basis. The groundwater withdrawal fee rate for augmentation of the water supply, conservation assistance to water users within the AMA and monitoring and assessing water availability within the AMA is set annually by the Director with input from the TAMA Groundwater Users Advisory Council (GUAC) and is limited to a maximum of two dollars per acre-foot per year (A.R.S. § 45-611(A)(2)).

9.2 DESCRIPTION

Programs funded by the WMAP help water users achieve efficient use of water supplies and help the TAMA meet its water management goal. The water management goal of the TAMA is to attain safe-yield by the year 2025.

9.2.1 Conservation Assistance

Conservation assistance helps water users plan and undertake conservation programs and lessens the number of enforcement actions related to conservation requirements. It is used for information and education services, including services that increase public awareness about the importance of water conservation and the TAMA's groundwater supplies. It also provides technical support designed to increase water use efficiency across the TAMA. Conservation assistance supports the ADWR's role as a central source for information on water conservation, augmentation and recharge.

9.2.2 Augmentation

Augmentation supplements the water supply of an AMA and includes water importation, water storage and artificial recharge (A.R.S. § 45-561(2)). Augmentation assistance helps water users study renewable resource options, design and construct renewable resource facilities and provides information to resolve technical feasibility challenges or to optimize recharge project operation. It also includes studies initiated or conducted by ADWR, cost-sharing grants for augmentation projects, studies initiated or conducted by others and 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 TAMA. Examples of the 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 migration of poor quality groundwater
- Impact of continued groundwater pumping, including water level declines and land subsidence
- Stream flows, 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)). Other sources of funding include one-half of the annual surcharge collected from persons holding a permit for interim groundwater use in bodies of water within the AMA and application fees for underground storage facility permits, groundwater savings facility permits, water storage permits and recovery well permits (A.R.S. § 45-133(E)) (A.R.S. § 45-871.01(A)).

No later than October 1 of each year, the Director must set the groundwater withdrawal fee for the following calendar year (A.R.S. § 45-614(A)). Prior to setting the fee, the GUAC for the AMA recommends to the Director how the fee should be set within the statutory limit. Within 30 days after setting the fee, the 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, 45-614(E).

TABLE 9-1
TUCSON AMA ANNUAL WMAP
WITHDRAWAL FEE* SUMMARY, 1997-2013

Year	Groundwater Pumped (ac-ft)	Withdrawal Fee** ($/ac-ft)	Monies Collected
1997	285,751	$0.50	$142,875.29
1998	260,458	$0.50	$130,229.02
1999	262,526	$0.50	$131,263.20
2000	288,503	$0.50	$144,251.45
2001	250,097	$0.50	$125,048.67
2002	241,221	$0.50	$120,610.68
2003	221,965	$0.50	$110,982.68
2004	208,168	$0.50	$104,084.14
2005	201,930	$0.50	$100,965.10
2006	192,760	$0.50	$96,380.15
2007	185,690	$0.50	$92,844.87
2008	183,423	$0.50	$91,711.33
2009	178,060	$0.50	$89,029.78
2010	154,228	$0.50	$77,114.17
2011	166,851	$0.50	$83,425.33
2012	161,725	$0.50	$80,862.30
2013	169,369	$0.50	$84,684.37

*Withdrawal fees and fees collected reflect only that portion of the groundwater withdrawal fee established to support the WMAP. Total withdrawal fees through 1997 have been greater than Table 1 fees, since the first one dollar per acre-foot of the annual withdrawal fee was established for general ADWR administrative purposes.
**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.

The total fund amount for each year is known by April, after the receipt of annual reports in March. 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.

All fees received by ADWR for the WMAP must be transmitted to the state treasurer (A.R.S. § 45-615). The state treasurer is required to hold the fees in a separate fund and to maintain within the fund separate accounts for each AMA (A.R.S. § 45-615(1)). Monies held in the fund for an AMA may be used only to finance the augmentation and conservation assistance programs for the AMA and to fund any projects that are authorized by the Director for monitoring and assessing water availability 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 2013.

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).

During the second management period (1990-2000), the TAMA funded approximately $1,200,000 in municipal, industrial and agricultural conservation programs and approximately $2,500,000 in augmentation programs between 1987 and 2000. Descriptions can be found in Chapter 9 of the Third Management Plan (3MP). *(See http://www.azwater.gov/azdwr/WaterManagement/AMAs/TucsonAMAFourthManagementPlan.htm).*

9.4.2 Third Management Period

The 3MP (2000-2010) 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 only on projects that provided maximum benefit, due to the decline in WMAP funds as a result of the reduction in the withdrawal fee and reductions in pumping due to renewable supply use. Program objectives included:

- Increasing efficiency of all water use,
- Assisting regulated water users in meeting their conservation requirements,
- Maximizing the effectiveness of conservation programs through cooperative activities and transferability of grant products,
- Targeting the water using sectors with the greatest conservation potential,
- Allocating staff resources for education, assistance and outreach efforts,
- Supporting activities that expedite the utilization of renewable water supplies to replace groundwater use, as well as facilitating regional cooperative efforts,
- Developing a more site-specific local resource management approach to address concerns about localized negative impacts of groundwater level changes and
- Collecting data about hydrologic conditions to determine aquifer storage and subsidence impacts

The process for applying for WMAP funds programs and projects changed during the third management period due to legislation enacted in 1999 (A.R.S. §§ 41-2701-2706). As a result, Chapter 9 was modified in 2003 to meet the requirements for soliciting and awarding grants as required by the new legislation. The legislation requires state agencies to follow specific procedures in soliciting and awarding grants, including: 1) publishing notice of a request for grant applications; 2) appointing at least three peers or other qualified individuals who are not members of the GUAC to evaluate the applications; and 3) keeping all information in the applications confidential until the grants are awarded.

Some of the projects that were funded with WMAP monies in the Tucson AMA during the third management period include:

- Tucson AMA Regional Xeriscape Contest
- Drop Your Water Use conservation campaign for classifying/labeling nursery stock
- Exterior water conservation workshops for professionals (“Smartscape: A Training Program for Landscape Professionals”) and for homeowners (“WaterSmart”)
- Water conservation educational materials geared toward grade school children
- Irrigation Conservation Assistance Program, assisting farmers with irrigation scheduling and water management techniques
- Project WET – Water Education for Teachers – provides elementary school teacher professional development that aids water stewardship and STEM (Science, Technology, Engineering and Math) literacy for students
- Residential GPCD study – investigating causes of recent declines in per-household water demand, experienced by numerous municipal providers
- Cost share with USGS – Subsidence monitoring activities
- Installation of water level monitoring equipment

9.5 NEEDS AND CHALLENGES FOR THE FOURTH MANAGEMENT PLAN

WMAP funds have declined with decreased groundwater withdrawals in the TAMA. A higher proportion of annual or long-term storage credit recovery in the future will result in lower WMAP funds but more progress towards the achievement of the TAMA safe-yield goal. If groundwater pumping increases, overdraft would increase but more funds would be available to the WMAP.

9.5.1 Future Needs Identified in the 3MP

In the 3MP, the TAMA identified the following needs:

- ADWR Staff to provide direct conservation assistance to regulated water users, facilitate regional planning efforts (e.g. bring CAP water to the Green Valley-Sahuarita area, study the implication of new drinking water standards on recharge and recovery operations), provide technical assistance and conservation information/education and facilitate cooperatively funded efforts.
- Monitoring projects to support a better understanding of the aquifer and the impact of groundwater depletion on land subsidence.
- A hydrologic model for the TAMA to aid in evaluating impacts on groundwater movement, mining, recharge and volumes in storage.
- Municipal sector assistance such as expanding renewable water utilization and evaluating conservation programs.
- Agricultural sector assistance such as irrigation water management, installation of efficient irrigation systems and infrastructure to convey renewable supplies to farms, monitoring crop and water use patterns and evaluating the impact of market conditions and regulatory programs on farming operations.
- Industrial sector assistance such as identifying opportunities for renewable supply use, evaluating the application rate and new irrigation technologies for turf facilities, researching the impact of reclaimed water and CAP water on cooling tower operation and the use of blowdown water for

irrigation and further investigation of cooling tower maintenance technologies.

9.5.2 TAMA Water Demand and Supply Assessment 1985 - 2025

The *Demand and Supply Assessment 1985-2025*, *Tucson Active Management Area* (Assessment), completed in 2010, *(See: http://www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm)* (ADWR, 2010) identified the following challenges:

- Difficulty projecting the nature of the economy
- Climate variability and drought impacts to availability of renewable supplies
- Relationship between power cost and water cost
- Ability to obtain additional renewable supplies
- Financial capability to import water supplies
- Potential for any future water agreements
- Local/regional cooperative water management
- Localized groundwater management
- Location of underground storage vs. location of annual or long-term storage credit recovery
- Climate variability planning and response program
- Short-term drought response program
- Additional infrastructure and funding
- Ability to respond positively to economic growth without increasing groundwater withdrawals
- Planning horizon beyond 2025.

9.6 PROCEDURES

The WMAP will continue to be implemented during the fourth management period. Following is a description of how projects are funded, identified, solicited, and awarded. A flow chart summarizes the process *(See Figure 9-1)*.

9.6.1 Identifying Priority Projects

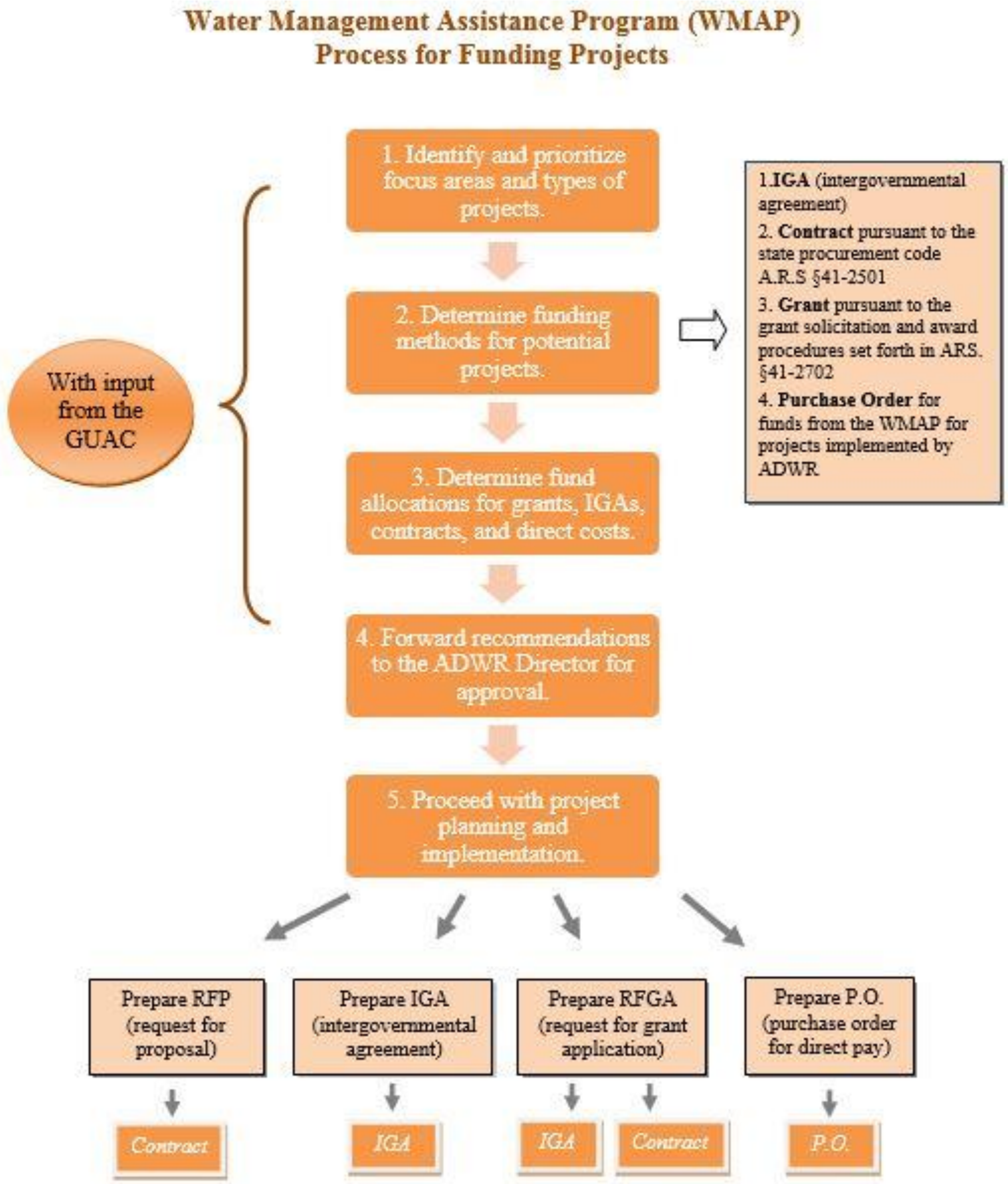
In an effort to apply available funding and technical assistance to the most qualified projects, ADWR identifies priorities with assistance from members of the water-using community and the GUAC. Information may potentially be gathered in the following ways:

- 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 (e.g. US Bureau of Reclamation) 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 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 is used to apply funds: Inter-Governmental Agreement (IGA), contract, grant and direct use by ADWR.

FIGURE 9-1
WMAP PROCESS



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

Fund management and administration of grants and contracts are coordinated between ADWR's Administration Division and the AMA staff. The Administrative Division's functions include management of the separate funds for each AMA and contract administration. 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. ADWR staff develops water conservation information materials, educational curricula and displays, and programs specific to water users within the AMAs. These materials and programs may be developed independently, with WMAP funding, or through partnerships with other government agencies, community groups or utilities. ADWR staff also maintains web-based or hard copy inventories of information and educational materials for distribution to water users, and provide water-related presentations to civic groups, schools and others.

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 to 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 TAMA.
- 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.
- Identify sets of criteria for evaluating proposals and contracts.
- In coordination with ADWR, participate in selecting evaluators for grants.

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 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:
    - 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). Water Demand and Supply Assessment 1985-2025, Tucson Active Management Area. Phoenix.

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 Tucson Active Management Area (TAMA). These 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

Within 30 days of adoption of the 4MP, 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 (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)(C)).

10.5 GROUNDWATER USE REPORTING REQUIREMENTS

The Groundwater Code (Code) contains a number of 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, are also 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 31st. 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 has also devoted significant efforts towards increasing the availability of public records from the 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 nonexempt wells in Active Management Areas (AMAs) to measure 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. 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 the 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 TAMA using annual reports, crop records, energy use records, aerial photography, and satellite-based remote sensing data. These procedures are also 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 conducts official audits of annual reports to check the accuracy of the reports and to verify suspected problems. An audit is a detailed review by ADWR staff of a person's water use records. Each person audited is requested to attend the audit. Audits ensure overall compliance with the Code and the management plan for the TAMA.

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. Notice is not required in the rare cases in which there is reason to believe that notice would impede enforcement efforts.

10.7 COMPLIANCE APPROACH

ADWR has developed a compliance program approach that includes education, assistance, and flexibility.

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 GPCD Program are required to comply with gallons per capita per day (GPCD) requirements. The requirements are similar to maximum annual water allotments in that they limit the amount of water that may be used during a year to a specified amount. 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 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 that 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; then 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 Assn. v. Arizona Dept. 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 (S*ee also Ariz. Water Co., v. Ariz. Dept. 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 CERCLA or title 49 is counted as surface water when certain conditions are met.

10.7.2.2 Specific Conservation Measures

Municipal providers regulated under the NPCCP 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 6-1502 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 6-2302 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 will 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. One possible provision would employ a groundwater replenishment option. This may involve storage of renewable water designated as non-recoverable, as defined by A.R.S. § 45-833.01, in a volume that would adequately compensate for the violation. 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.

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. §§ 45-634-635).

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 TAMA Management Goal: Safe-yield

Attainment of safe-yield by January 1, 2025 is the management goal of the TAMA. 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 TAMA cannot simply be viewed in the short-term, but rather must be viewed over a longer period of time. Further, establishing a *balance* is more complicated than comparing the total amount of groundwater withdrawals in the TAMA 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. <u>Groundwater pumpage</u>: Annual pumpage volumes from the TAMA'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 having been "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. Net natural recharge: 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. Incidental recharge: 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 TAMA, 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 mining 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 are also a component of the safe-yield supply.

The volume of groundwater that can be withdrawn while maintaining a safe-yield condition in the TAMA 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 actually 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

An effective conservation plan requires effective enforcement. ADWR is given wide ranging enforcement authority in the statutes to ensure that all water users are contributing their share to the overall goal of groundwater conservation and augmentation of water supplies. While the statutes allow the imposition of substantial monetary penalties for violating either water use limitations or conservation requirements, ADWR is also 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. This approach has worked well in the past, and has been particularly useful in making the transition from a state where groundwater use was essentially unregulated to a state where water regulation has become a fact of everyday life.

In the fourth management period, ADWR will continue its policy of reviewing each suspected violation on an individual basis. ADWR will also 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 will also 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 valuable support on most water management challenges.

CHAPTER ELEVEN: PROJECTED BUDGET

11.1 INTRODUCTION

The management goal of the Tucson Active Management Area (TAMA) is safe-yield. Monitoring the cumulative impact of demand on the aquifer is critical in identifying the TAMA's success toward achieving this goal. The Arizona Department of Water Resources (ADWR) uses this information to evaluate whether additional tools are necessary to assist the TAMA in achieving its goal.

Water demand and supply projections as well as water budget scenarios are prepared based on many assumptions and are some of the tools used to evaluate whether the TAMA is meeting its goal. As discussed and described in Chapter 3, since the publication of the *Demand and Supply Assessment, Tucson Active Management Area* (Assessment) (ADWR, 2010), ADWR's Hydrology staff has developed revised historical natural recharge components and subsequently revamped the projected natural recharge components in the water budgets. In the Assessment, long-term averages of stream channel and mountain front recharge were used. This method masks the annual variability and uncertainty of net natural recharge, which is an important characteristic to understand in making water management decisions in the TAMA.

The projection years in the *Fourth Management Plan for Tucson Active Management Area* (4MP) are from 2014 through 2040, and incorporate the actual historical natural recharge components. The 4MP includes one scenario based on normal delivery of CAP water (Normal Delivery Scenario) and one scenario with a Tier 1 (320,000 acre-foot) shortage (Tier 1 Shortage Scenario) occurring almost every year in the projected period. In taking this approach, ADWR is not projecting nor predicting that there will be a Tier 1 Shortage every year in the future. Rather, it is intended as a conservative approach to evaluate shortage impacts on the TAMA. The probability of shortage depends on many factors, including the volume of Colorado River water used on-river, changes in CAP customer water ordering patterns, the availability of alternative water supplies, water conservation efforts and the impact of rate increases (Central Arizona Project, 2015). Other factors can include climate variability and the timing, volume and location of precipitation. These factors are not constant, but vary every year and some are simply unknown. Additionally, the way these factors interact may not be fully known. In addition, there may be other factors than these that have not yet been identified. All of these factors and conditions result in a multitude of probable volumes of available CAP water in the future.

It is important to note that the US Geological Survey (USGS) indicates that "a statement of probability is not a forecast," and describes probability as "analysis of the variability of a sample" (Luna B. Leopold, 1959). In 2014, the Arizona Water Banking Authority (AWBA), ADWR and the CAP published a joint plan for the recovery of AWBA long-term storage credits which could occur to help offset the impact of a CAP shortage (AWBA, ADWR and CAP, 2014). Charts indicating the range of the probability of CAP shortage are included in the plan, which show increasing uncertainty with time. In the book *The Signal and the Noise*, author Nate Silver describes uncertainty as "risk that is hard to measure," (Silver, 2012), and this description seems appropriate regarding water demand and supply projections. The Tier 1 Shortage Scenario is included to give an idea of the potential impact of an extended shortage on groundwater overdraft, but is not intended as a prediction of shortage.

For the Normal Delivery Scenario, ADWR used the May 22, 2015 CAP Delivery Schedule through the year 2040 *(See Appendix 11A).* For the Tier 1 Shortage Scenario, ADWR subtracted 320,000 ac-ft from the volume projected to be delivered from the May 22, 2015 CAP Delivery Schedule in each year from 2015 through 2040. Although 2015 and 2016 will not be shortage years, ADWR has projected those years as shortage to illustrate the impact of a very long term Tier 1 Shortage for comparison purposes with the Normal Delivery Scenario. For water management planning purposes, it may be helpful to explore additional scenarios during the fourth management period. Actual CAP deliveries during the projection period of 2014 through 2040 could be more or less than these assumptions.

Further, on April 22, 2015 ADWR hosted a Colorado River Shortage Preparedness Workshop. Information presented at that workshop can be found at: *http://www.azwater.gov/azdwr/ColoradoRiverShortagePreparedness.htm*. In planning for the uncertainty and range of probability of a CAP shortage, ADWR, the AWBA and the CAP are working together to help mitigate impacts of a potential shortage of CAP water on water users in the CAP service area and on water users on the Colorado River.

Population projections in the 4MP are based on Traffic Analysis Zone (TAZ) projections ADWR obtained from the Pima Association of Governments (PAG) and the Central Arizona Association of Governments (CAG) in the year 2014 for the Pima County and Pinal County portions of the TAMA which extend out to the year 2040. The small portion of the TAMA located within Santa Cruz County uses projections from the Arizona Department of Administration (ADOA). ADWR will update the planning water budgets on its website on a regular basis throughout the fourth management period. A summary of the projection assumptions describing ADWR's general approach is included in the section below, followed by tables showing the results of those assumptions.

The overdraft values shown in the 4MP water budget for each scenario represent TAMA-wide balances at given points in time. The fourth management period constitutes one increment of time. However, both the management plan and the water budgets are affected by the Assured Water Supply (AWS) Program requirements and need to be understood in the context of the 100-year AWS planning time frame. Many of the decisions water providers and developers will make moving into the future will be made in the context of water management needs during this 100-year time frame. Likewise, decisions ADWR makes on water management policy are framed in this larger context, including the decision to allow a certain volume of groundwater mining by water providers.

In the TAMA 4MP, ADWR incorporated updated projections from those used in the Assessment and in the legislatively mandated Water Resource Development Commission (WRDC). Population projections generated by demographic agencies tend to mirror recent trends. When growth is strong, projections appear optimistic. In less robust economic times, when growth is slowed, projections tend to be lower. Water budgets used for planning purposes can be found on ADWR's website: *http://www.azwater.gov/azdwr/WaterManagement/AMAs/TucsonAMAFourthManagementPlan.htm*.

11.2 WATER BUDGET COMPONENTS AND SECTOR ASSUMPTIONS

Demand and supply assumptions used in both the Normal Delivery Scenario and the Tier 1 Shortage Scenario for the TAMA 4MP are as follows:

Population projections

- Population projections prepared by other agencies were used to develop a total TAMA population projection. In Pima and Pinal counties, the regional associations of government (PAG, CAG) projections were used. For the Santa Cruz County portion of the TAMA, ADWR used the ADOA projections.
- Population projections by TAZ were disaggregated to water provider boundaries by comparing a number of sources, including: water distribution line location data; Certificate of Convenience and Necessity (CC&N) boundaries for private water companies; incorporated area boundaries for cities and towns; and issued determinations of AWS by provider to the TAZ boundary. TAZs with no current water provider service but significant population growth were assigned to the closest likely

provider in most cases. Where a TAZ included current population but no water provider, this population was assumed to be served via privately owned (exempt) wells. An assumption was made that this exempt well population component would not grow due to the greater likelihood that the majority of growth would be served by a central distribution system.

- Small provider population within a TAZ was generally held at the proportion of the TAZ population served by the small provider in 2010 unless ADWR had information that either 1) the small provider was not likely to grow (built out subdivision, mobile home parks that have not grown historically, etc.) or 2) the small provider had great potential to grow based on issued determinations of AWS.

Large Municipal Provider Demand and Supply

- Each large municipal provider's demand was based on an individual analysis of each provider's GPCD trend, whether reducing, increasing or remaining constant, carried forward to 2040. A lower limit of 200 gallons per housing unit per day (GPHUD) was set; however, only one provider's calculated GPCD trend resulted in a GPHUD going below 200 GPHUD, and that provider's demand was then held at 200 GPHUD for the remainder of the projection period.
- Individual assumptions were made for each large municipal provider water supply based on historical supplies used. Not all municipal providers use the same water supplies. Each provider has their own unique pattern of water supply utilization. ADWR reviewed Designation of Assured Water Supply (DAWS) files and water rights information to project water supply utilization on a provider by provider, year by year basis. CAP water supplies available can include municipal and industrial subcontracts, leased CAP water, or NIA priority water *(See http://www.azwater.gov/AzDWR/PublicInformationOfficer/Non-IndianAgriculturalReallocationProcess.htm)*. In addition to the pending January 17, 2014 recommendation to the Secretary of the Interior to reallocate NIA priority water, there will be additional NIA priority reallocations during the projection period.

Small Municipal Provider Demand and Supply

- Small provider demand was projected using a trend line of the GPCD rate from 2005-2013.
- Small provider supply was all groundwater, except for a very small amount of surface water that has historically been used by one small provider, and which is assumed will continue.

Exempt Well Demand and Supply

- Exempt well demand was based on water use figures updated from the TAMA 3MP models for new single family homes (45 GPCD interior and 60 GPHUD exterior). The models were updated based on ADWR's review of reported water usage per lot for Central Arizona Groundwater Replenishment District (CAGRD) Member Lands and reported single family residential deliveries by month for CAGRD Member Service Areas.
- Exempt wells use all groundwater.

Industrial Demand and Supply Projections

- Industrial turf demand was projected using the log of 1985 through 2013 historical water use, and supplies would be used consistent with those used in the past.
- Mining demand was based on projections received from the Provider and Users Group of the Upper Santa Cruz Valley (PUG) and Freeport McMoRan[1] and the 1985 through 2013 historical supplies used.

[1] In 2015 Freeport McMoRan announced closure of the Sierrita Mine due to spending cuts. Projected demand for mines in the 4MP is about 35,900 ac-ft per year. It is unclear at the time of publication what impacts this change in mining operation may have on the TAMA water use. Like the housing downturn in the economic recession in the 3MP, global commodity price fluctuations impact agricultural, industrial and mining activities making specific long-term use projections challenging.

- Sand and gravel production water demand was projected to remain at the 1985 through 2013 historical average and supplies were projected to be used consistent with historical patterns over the same time span.
- Dairy use demand was held constant and supplies were presumed to be used consistent with the 1985 through 2013 historical patterns.
- Electrical power water demand was projected using the linear trend of the 1985 through 2013 historical water demand with supplies consistent with historical patterns over the same time period.
- "Other" industrial water demand was projected to remain at the historical average from 2004-2013 with water supplies consistent with the 2004 through 2013 historical pattern.

Agricultural Demand and Supply Projections

- Agricultural demand projections assumed:
  - Extensive residential and commercial development will occur in the Marana area (Area of Similar Farming Condition No. 2) resulting in fewer irrigable acres;
  - Orchard crop acreage will be reduced;
  - Agricultural demand was projected based on information supplied by major producers using their own assumptions; information provided by the PUG, or ADWR staff using trend lines over the 1985 through 2013 period.
- Agricultural supply was projected using information about the current water portfolios for each irrigation district, large farm or other entity that was included in the analysis. In certain cases, knowledge regarding supply availability from sector professionals, especially large-scale producers, was used. CAP supplies were based on projected available CAP Agricultural pool volumes, recent use, projected demand and planned expansions of delivery systems. The total CAP Agricultural pool water for all Active Management Areas (AMAs) will be reduced by 25 percent in 2017 and by an additional 25 percent in 2024, reducing to zero after 2030. For the purposes of these projections, reductions were applied proportionately to each allottee's supply. Groundwater Savings Facilities (GSF) supply projections were based on current permits and the projected amount of supplies available for storage. This supply is identified as in-lieu groundwater in the 4MP. Projected demands not met by CAP or in-lieu groundwater were assumed to be met by mined groundwater.

Tribal Demand and Supply Projections

- Tribal demand projections were focused on increased demands in tribal agriculture. Generally, demand was projected based on evaluating trends in the available historical data, or reasonable assumptions regarding use, based on the Southern Arizona Water Rights Settlement Act (SAWRSA) settlement documents. Tribal municipal demand was increased based on the on-reservation population growth between 2000 and 2010 and an assumed overall GPCD rate of 57 GPCD. For the 4MP tribal agricultural demand projection, a trendline based on the 2000 through 2013 tribal agricultural use was used. Supply is assumed to be CAP water for tribal agricultural use and groundwater for tribal municipal use.

11.3 ADDITIONAL SUPPLY ASSUMPTIONS

The volume of groundwater projected to be used is equal to the remainder of the projected demand after renewable supplies are subtracted. Generally, ADWR assumed that CAP subcontract utilization would increase over time, that excess CAP water would correspondingly decrease over time, and that any excess CAP water would either be replenished each year by the CAGRD, or stored by the AWBA or other excess users. Utilization of reclaimed water is assumed to increase throughout the projection period.

ADWR also assumed that additional artificial recharge would occur. In the TAMA, the majority of recharge activity consists of CAP storage at Underground Storage Facilities (USFs). Some CAP is stored at GSFs, although the number of agricultural acres in production with direct access to CAP supplies limits the volume of storage. The amount of GSF storage is driven by the available storage capacity, the water available to store, and historical patterns of GSF storage.

Reclaimed water storage was also projected to increase, since projected reclaimed uses keep pace with the rate of increase in reclaimed water production, and there is currently unused capacity in the TAMA's permitted reclaimed water storage facilities.

Natural components that result in net natural recharge used in the 4MP are different from those used in the Assessment, which had assumed a long-term average of stream channel recharge; this could give the false impression that stream channel recharge is a long-term reliable supply. Arizona’s arid climate is such that stream channel recharge is variable and can have significant peaks and periods of little or zero flow. To help simulate these naturally occurring conditions for the 4MP budgets, ADWR Hydrology staff examined the historical period of flow for the Santa Cruz and Rillito Rivers and the Tanque Verde Creek and used the 1999 through 2013 historical record as generally representative of “normal” conditions. In the Assessment, net natural recharge assumptions had remained at a constant long-term average in both the “normal” and “shortage” scenarios. Riparian transpiration also varies. Riparian transpiration tracks with stream channel recharge, groundwater inflow and outflow and lagged agricultural incidental recharge.

11.4 DIFFERENCES BETWEEN THE NORMAL DELIVERY SCENARIO AND THE TIER 1 SHORTAGE SCENARIO ASSUMPTIONS

Both scenarios project direct use and storage of CAP water for the three CAP AMAs in sum to avoid the possibility of double-counting the projected available CAP supply and to ensure that all CAP is fully utilized between the three AMAs. If the difference between the total projected CAP supply and the total projected CAP use (including storage) in any year is a positive number, the remaining amount is distributed among the three AMAs. If the result is a negative number, it is first subtracted from any unused CAP supply, beginning with the lowest priority users. The distribution of unused CAP water among the three AMAs is determined based on the trend in the historical ratio of CAP storage among the three AMAs. The historical trend in the ratio of CAP water stored between the three CAP AMAs indicates a slightly increasing proportion of CAP water stored in the TAMA.

The CAP agricultural pool has the lowest priority and was designed to decline over time, until the pool no longer exists by 2030. This approach is based on the idea that CAP use in the early years would be in the agricultural sector and would develop into the municipal and tribal sectors in later years. In the Tier 1 Shortage Scenario, the 320,000 acre-foot shortage cuts into the CAP agricultural pool each year of shortage, beginning in the first projected shortage year, 2015 through 2040. After 2030, with no CAP agricultural pool, shortage volumes will come out of any unused CAP supplies and the next highest pool of water, which is called the Non-Indian Agricultural (NIA) priority pool (which actually supplies municipal and tribal uses), if needed. This scenario, with a Tier 1 shortage of 320,000 ac-ft, shows results that the NIA priority pool will not be impacted through 2040. However, in reality additional shortage tiers and river conditions could occur and could bring shortages of larger volumes. These deeper shortages, combined with increasing demands in the other, higher priority CAP Municipal and Industrial (M&I) pool and the CAP Indian pool, could impact all of these pools in later years.

About 3.7 million ac-ft of recovery occurs in the Normal Delivery Scenario in the TAMA between 2014 and 2040; however, about 3.7 million ac-ft of the water projected to be stored in the TAMA during the

projection period remains in storage under the assumptions described above. Under the Tier 1 Shortage Scenario, the same volume of recovery takes place, but only about 2.4 million ac-ft of the water projected to be stored remains in storage by 2040. For more detail on supply assumptions used in these projections, please refer to ADWR's website:
http://www.azwater.gov/azdwr/WaterManagement/AMAs/TucsonAMAFourthManagementPlan.htm

11.5 RESULTS OF WATER BUDGET ANALYSES

Figure 11-1 illustrates historical and projected overdraft or surplus in the Normal Delivery Scenario in the TAMA from 2014 through 2040, given the actual historical and assumed projected demands, supplies utilized, and natural supply availability. In Figure 11-1 the historical data is shown with dark blue bars and projections in light blue. For the historical period of 1985 through 2013, there were a few years where the water supply, based on net natural recharge into the TAMA, exceeded the volume of pumping (surplus years). Those years are shown above the "0" axis.

FIGURE 11-1
TUCSON AMA HISTORIC & PROJECTED WATER BUDGET
NORMAL CAP DELIVERY, 1985-1940

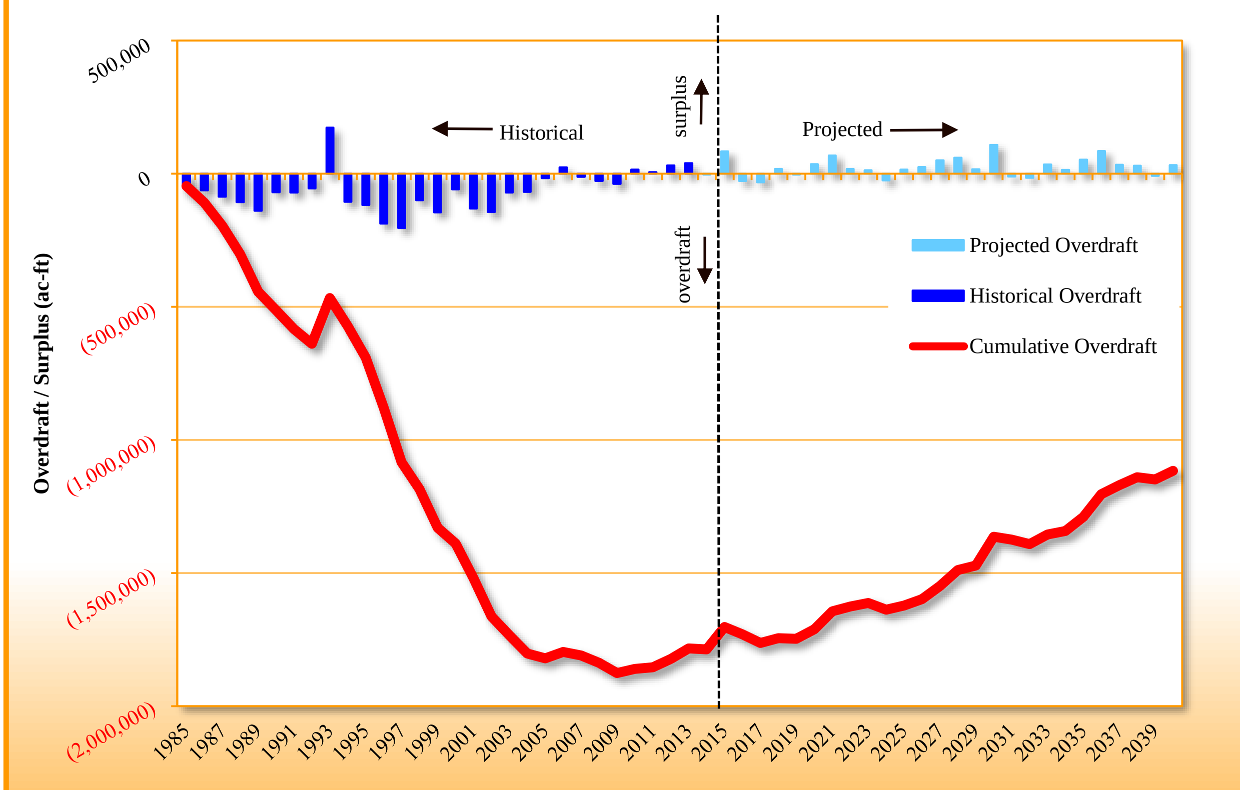
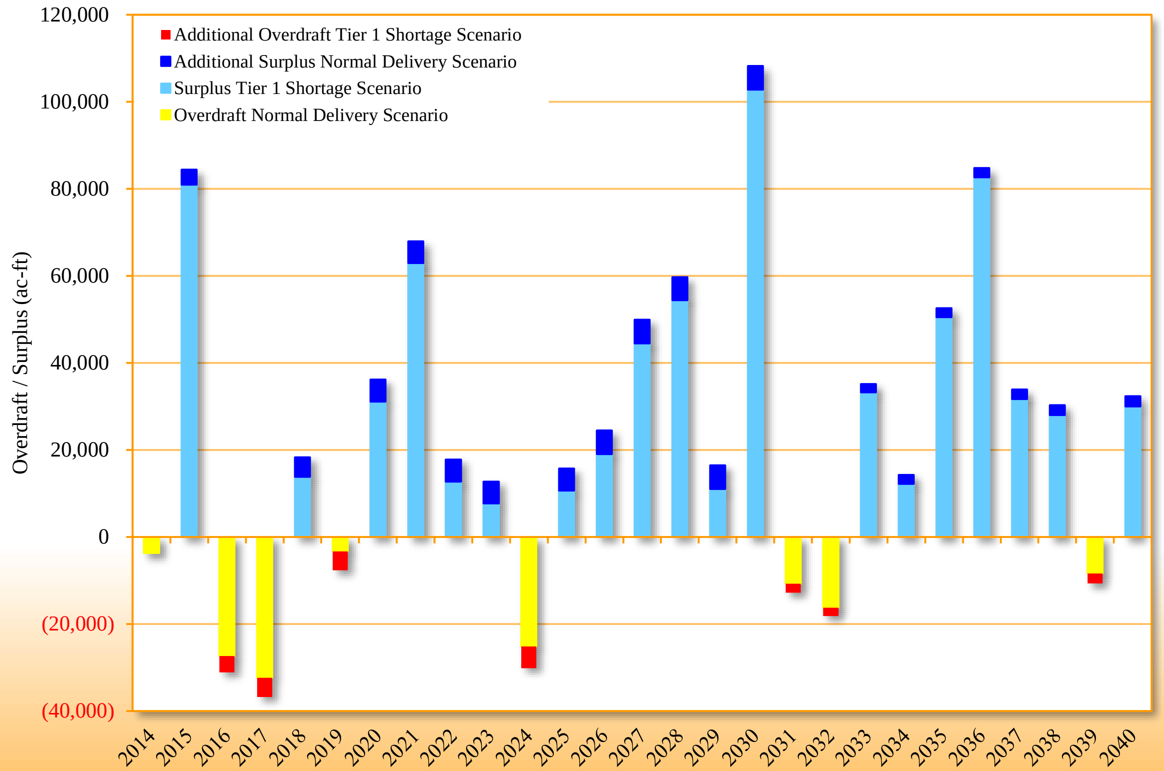


Figure 11-2 shows the water budget for the projected years, with both scenarios, CAP Normal Delivery and CAP Tier 1 Shortage, combined. Over the long-term, the Tier 1 Shortage Scenario results in less progress towards safe-yield. The Tier 1 Shortage Scenario affects the agricultural CAP pool availability and excess CAP water storage. The majority of CAP users in the TAMA are municipal and industrial, who are unaffected in the Tier 1 Shortage Scenario. In other AMAs where there is significantly greater agricultural

CAP pool use and significantly greater excess CAP storage, the difference between the two scenarios is greater. In some years, under the Tier 1 Shortage Scenario a surplus occurs. In those years, there is even greater surplus under the Normal Delivery Scenario. Likewise, under the Normal Delivery Scenario, in years with overdraft, there is more excessive overdraft in the Tier 1 Shortage Scenario. These results are shown as stacked bars.

FIGURE 11-2
TUCSON AMA COMBINED PROJECTED
WATER BUDGET SCENARIO, 2014- 2040



Both scenarios show more years of surplus than overdraft, although the Tier 1 Shortage Scenario in every year shows less surplus than the Normal Delivery Scenario. Much of the surplus is attributable to the assumptions for net natural recharge. The period of record used for net natural recharge included several years of typical flood flows on the Santa Cruz River and its tributaries in the TAMA, rather than prolonged drought conditions. Historical and projected net natural recharge, which includes streambed recharge as a primary component, is listed in Table 11-1. The conditions from 1999 through 2013 were repeated for the projection period of 2014 through 2040.

TABLE 11-1
TUCSON AMA HISTORIC & PROJECTED
NET NATURAL RECHARGE, 1985-2040 (ac-ft)

Year	Net Natural Recharge	Mountain Front	Streambed	Groundwater Inflow	Groundwater Outflow
1985	173,730	28,100	137,479	29,443	21,292

Year	Net Natural Recharge	Mountain Front	Streambed	Groundwater Inflow	Groundwater Outflow
1986	148,892	28,100	113,599	29,790	22,597
1987	130,741	28,100	94,235	30,472	22,066
1988	114,065	28,100	75,898	29,838	19,771
1989	102,088	28,100	62,248	30,351	18,611
1990	132,386	28,100	94,773	30,757	21,244
1991	150,065	28,100	108,114	32,126	18,275
1992	154,131	28,100	113,067	31,503	18,539
1993	357,551	28,100	320,201	30,367	21,117
1994	131,277	28,100	91,285	32,012	20,120
1995	148,152	28,100	106,598	32,789	19,335
1996	103,083	28,100	61,162	32,320	18,499
1997	91,612	28,100	47,992	32,472	16,952
1998	162,821	28,100	118,228	32,291	15,798
1999	126,483	28,100	80,899	32,597	15,113
2000	217,133	28,100	171,267	31,399	13,633
2001	97,934	28,100	53,711	31,702	15,579
2002	90,523	28,100	46,386	32,109	16,072
2003	139,307	28,100	96,683	29,862	15,338
2004	118,167	28,100	75,049	29,806	14,788
2005	156,121	28,100	112,548	30,830	15,357
2006	188,194	28,100	144,088	31,865	15,859
2007	136,151	28,100	92,204	31,902	16,055
2008	133,331	28,100	87,745	32,028	14,542
2009	88,632	28,100	47,730	30,955	18,153
2010	129,716	28,100	87,766	31,885	18,035
2011	132,367	28,100	90,807	30,595	17,135
2012	155,788	28,100	114,848	30,400	17,560
2013	166,202	28,100	125,987	30,145	18,030
2014	*121,769*	*28,100*	*80,899*	*31,270*	*18,500*
2015	*212,137*	*28,100*	*171,267*	*31,270*	*18,500*
2016	*94,581*	*28,100*	*53,711*	*31,270*	*18,500*
2017	*87,256*	*28,100*	*46,386*	*31,270*	*18,500*
2018	*137,553*	*28,100*	*96,683*	*31,270*	*18,500*
2019	*115,919*	*28,100*	*75,049*	*31,270*	*18,500*
2020	*153,418*	*28,100*	*112,548*	*31,270*	*18,500*
2021	*184,958*	*28,100*	*144,088*	*31,270*	*18,500*
2022	*133,074*	*28,100*	*92,204*	*31,270*	*18,500*
2023	*128,615*	*28,100*	*87,745*	*31,270*	*18,500*
2024	*88,600*	*28,100*	*47,730*	*31,270*	*18,500*
2025	*128,636*	*28,100*	*87,766*	*31,270*	*18,500*
2026	*131,677*	*28,100*	*90,807*	*31,270*	*18,500*
2027	*155,718*	*28,100*	*114,848*	*31,270*	*18,500*
2028	*166,857*	*28,100*	*125,987*	*31,270*	*18,500*

Year	Net Natural Recharge	Mountain Front	Streambed	Groundwater Inflow	Groundwater Outflow
2029	*121,769*	*28,100*	*80,899*	*31,270*	*18,500*
2030	*212,137*	*28,100*	*171,267*	*31,270*	*18,500*
2031	*94,581*	*28,100*	*53,711*	*31,270*	*18,500*
2032	*87,256*	*28,100*	*46,386*	*31,270*	*18,500*
2033	*137,553*	*28,100*	*96,683*	*31,270*	*18,500*
2034	*115,919*	*28,100*	*75,049*	*31,270*	*18,500*
2035	*153,418*	*28,100*	*112,548*	*31,270*	*18,500*
2036	*184,958*	*28,100*	*144,088*	*31,270*	*18,500*
2037	*133,074*	*28,100*	*92,204*	*31,270*	*18,500*
2038	*128,615*	*28,100*	*87,745*	*31,270*	*18,500*
2039	*88,600*	*28,100*	*47,730*	*31,270*	*18,500*
2040	*128,636*	*28,100*	*87,766*	*31,270*	*18,500*

The Tier 1 Shortage Scenario impacts the CAP agricultural pool, but does not affect municipal and industrial or tribal CAP water uses during the projection period. In the municipal sector, providers held sufficient long term storage (LTS) credits to maintain their DAWS requirement of consistency with the management goal. ADWR did not assume any AWBA credit recovery in the Tier 1 Shortage Scenario.

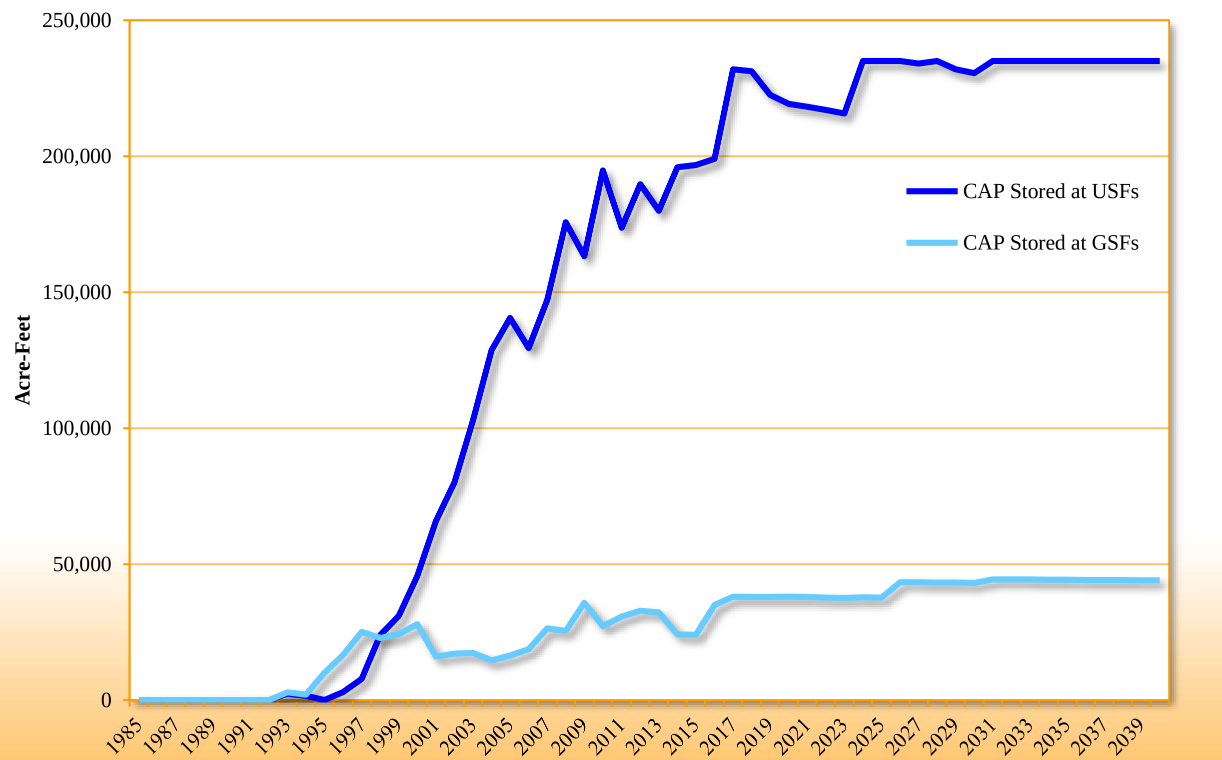
The projection assumptions are based on fairly low TAMA population growth along with an overall AMA municipal provider GPCD rate, including large and small providers, that declines by 14 percent, or about 0.5% per year, (from 149 GPCD to about 128 GPCD) from 2013 to 2040. The scenarios also assume that use of CAP water increases over time by subcontract holders, but not all subcontract holders use their CAP water during the projection period. In addition, it is presumed that NIA priority CAP reallocation water will be available for use beginning in the year 2017, and will be fully utilized in the TAMA when available.

In the Normal Delivery Scenario more than six million ac-ft of CAP water is stored at USFs, more than one million ac-ft of CAP water is stored at GSFs, and over 830,000 ac-ft of reclaimed water is stored at USFs in sum for the 26-year projection period from 2014 through the year 2040. *(See Figure 11-3.)* These figures are based on current permit limits and ADWR AWS determinations and legal authorities and policies currently in place. The budgets are based on approximate conservation and augmentation goals and are not intended to suggest limitations on individual water users or sectors.

Storage of CAP water is much less in the Tier 1 Shortage Scenario. In this scenario, only about 4.7 million ac-ft of CAP is stored at USFs. About the same volume (one million ac-ft) of CAP is assumed to be stored at GSFs. (Storage of reclaimed water is identical to the Normal Delivery Scenario.)

In the projection years, 2014 through 2040, overdraft and surplus vary year to year depending on the fluctuating natural condition assumptions, but the low growth and declining GPCD rates allow the TAMA to remain near a safe-yield condition or in surplus based on these assumptions. Allowable growth in the municipal and industrial sectors will eventually result in an increase overdraft in the TAMA.

FIGURE 11-3
TUCSON AMA HISTORIC & PROJECTED
ANNUAL CAP WATER STORED, 1985-2040



Depending on the volume of groundwater pumping in the TAMA, net natural recharge will be a greater or lesser determinant of whether the TAMA is in safe-yield or not on an annual basis.

Because the water table is greatly affected by localized recharge and withdrawal, achieving safe-yield TAMA-wide does not ensure that all local areas of the TAMA will attain a balance of supply and demand. There may be areas within the TAMA 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 TAMA will be an ongoing challenge for water management as the fourth management period proceeds.

11.5.1 Determining Factors

Many of the 1980 Groundwater Code (Code) provisions are designed to assist the TAMA in achieving safe-yield. These include mandatory conservation requirements, the AWS Program, AWBA excess CAP water storage, and incentives for use of renewable supplies. There are a number of factors that affect safe-yield that are not under ADWR's control. Many of these factors relate to under-utilization of CAP water while others relate to water pricing, municipal growth, changes in land utilization, and industrial demand.

ADWR will evaluate whether there is potential for additional conservation measures for inclusion in the Fifth Management Plan. Regardless of the stringency of conservation requirements, some volume of groundwater will need to be pumped on an ongoing basis to meet the municipal demand for users who are not required to meet AWS criteria. Additionally, groundwater will continue to be pumped to meet the demand associated with grandfathered rights under the Code. These continued uses of groundwater could result in further depletion of groundwater supplies.

The AWBA has stored a significant volume of excess CAP water, which will be made available to municipal and industrial (M&I) priority subcontractors and fourth priority on-river M&I users during declared shortages on the Colorado River. During the fourth management period, the AWBA may recharge CAP and extinguish the associated credits to provide water to the aquifer itself. Another possible future strategy could be to increase the groundwater withdrawal fees, which could be used to purchase and recharge CAP water and extinguish the credits.

The ultimate capacity for CAP recharge in the TAMA depends on multiple physical, economic and political variables. Pricing of CAP water is controlled by the Central Arizona Water Conservation District (CAWCD) and is slated to increase with time. The volume of available CAP water either for direct use or for recharge and recovery depends upon whether the Secretary of the Interior declares a shortage on the Colorado River, per the 2007 Record of Decision on the Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead.

Other diverse factors will affect the TAMA water use in the future. The price of potable water is controlled by water providers and the Arizona Corporation Commission, and is affected by the cost of energy, infrastructure needs, and other factors. Population growth can lead to replacement of agricultural land with housing. However, population growth can also result in higher water demand to support increased industrial and municipal demand. Ongoing mining demand and the possible addition of new non-golf turf-related facilities (schools, parks, homeowner's associations, etc.) can result in increasing water demand by the industrial sector.

Beyond the year 2025 and into the latter part of the next century, it is anticipated that some general trends in water supply and demand could appear. Agricultural production is likely to continue to decrease but may not disappear since some farmlands are in the floodplain and may never be developed. Mining could increase or decrease depending on the price of global commodities. Water use by other industries served by grandfathered groundwater rights and permits could increase in the long run. However, Pima County's prohibition on new golf courses using groundwater to meet turf demands partially limits the potential for increased Type 1 and Type 2 Grandfathered Groundwater Right withdrawals. Municipal water use is likely to continue to increase throughout the next century, further increasing the need for renewable water supplies in the TAMA. Maximizing the use of reclaimed water is a water management strategy for the fourth management period. In the long-term, increased direct use of reclaimed water could occur if it were treated to potable standards and delivered for direct potable use. The obstacles in terms of public acceptance of this strategy would likely be substantial. ADWR is participating in a statewide effort to establish a framework for direct potable reuse.

Long-term water use decisions made by municipal water providers who hold a DAWS will be driven by the need to meet AWS Program requirements. These decisions relate to the use of allowable mined groundwater, recharge and recovery of CAP water, recharge and recovery of reclaimed water and possible acquisition of additional CAP allocations. The physical availability of groundwater may increasingly affect water management decisions in the future. Declining groundwater levels could make recovery of CAP or effluent credits through groundwater pumping difficult or impossible in some areas of the basin. ADWR's computer model will be a valuable tool for evaluating the possible effects of various recharge and pumping scenarios inside the TAMA.

11.6 CONCLUSIONS

During the third management period water users in the TAMA made considerable efforts to reduce groundwater withdrawals and increase artificial recharge of CAP and reclaimed water, particularly in the municipal sector. The result of these efforts was that annual groundwater use in the TAMA was reduced by almost half between 1996 and 2013, from nearly 320,000 ac-ft of groundwater in 1996 to about 163,000 ac-ft in 2013.

The water budgets presented here indicate that given these assumptions and recent population projections, safe-yield by 2025 appears to be an achievable goal in the TAMA, provided that the commitment to water conservation, reduction in groundwater dependency and increased utilization of renewable supplies, particularly reclaimed water, continues during the fourth and fifth management periods. A variety of factors will affect whether safe-yield is achieved, including additional water conservation; CAP and reclaimed water recharge and recovery strategies selected by municipal water providers; strategies for the use of allowable mined groundwater; changes in population; agricultural acreage retirement; changes in mine production; changes in demand for other industries and changes in the available CAP supply.

Water budgets are useful planning tools when viewed in the long-term planning context. Water management decisions made in the next 10 years should increasingly reflect the need to balance current demands with the anticipated needs of future water users. The TAMA historical water budget will continue to be updated throughout the fourth management period as new data and water use plans become available. Water budget updates will be coordinated with ADWR's hydrologic modeling efforts so that changes in supply and demand can be understood in terms of their impacts on water levels in the TAMA. In this way the historical water budget will continue to be a key tool in understanding the progress the TAMA is making toward reaching and maintaining a balance in its groundwater supplies.

APPENDIX 11A
DELIVERY SCHEDULE THROUGH 2014

Year	CAP Delivery Supply (includes P4 and P3 (68,400))	Tier 1 Shortage Supply
2014	1,500,000	1,500,000
2015	1,500,000	1,180,000
2016	1,538,785	1,218,785
2017	1,537,841	1,217,841
2018	1,536,912	1,216,912
2019	1,535,999	1,215,999
2020	1,529,508	1,209,508
2021	1,528,372	1,208,372
2022	1,527,251	1,207,251
2023	1,526,148	1,206,148
2024	1,525,059	1,205,059
2025	1,523,988	1,203,988
2026	1,522,934	1,202,934
2027	1,521,898	1,201,898
2028	1,520,880	1,200,880
2029	1,519,882	1,199,882
2030	1,518,999	1,198,999
2031	1,518,290	1,198,290
2032	1,517,592	1,197,592
2033	1,516,907	1,196,907
2034	1,516,236	1,196,236
2035	1,515,579	1,195,579
2036	1,514,937	1,194,937
2037	1,514,308	1,194,308
2038	1,513,690	1,193,690
2039	1,513,086	1,193,086
2040	1,512,491	1,192,491

NOTE: For 2014 and 2015, ADWR assumed 1,500,000 would be the delivery supply. No shortage was taken from 2014. The first shortage year in the scenario is 2015.

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CHAPTER TWELVE: WATER MANAGEMENT STRATEGY

12.1 INTRODUCTION

The Tucson Active Management Area (TAMA) Fourth Management Plan (4MP) historical data analysis and projections indicate that it is possible for the TAMA to achieve safe-yield by 2025. In fact, the TAMA has achieved a safe-yield condition in some recent years. Achievement and maintenance of safe-yield requires that TAMA water users reduce groundwater pumping, increase underground storage of Central Arizona Project (CAP) and reclaimed water and continue to implement water conservation measures. How long the TAMA will be able to maintain a safe-yield condition will depend on additional water conservation and water augmentation measures, as well as natural water supply conditions and growth patterns.

12.2 WATER MANAGEMENT CHALLENGES

The TAMA has recently attained safe-yield for certain specific years, and could achieve long-term safe-yield by 2025 depending on choices made by holders of water rights and regional water management decisions as described below. Increased use of reclaimed water and full utilization of CAP supplies are fourth management period objectives. 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 conditions of drought and shortage, when CAP supplies are not available or experience reduced availability, 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. Refer to Chapter 8, Figure 8-1, for the location of water storage relative to the location of recovery wells. Planning for proximity of the location of recovery in relation to the location of storage can help mitigate these challenges.

The following section describes in more detail the major water management challenges facing the TAMA during the fourth management period and beyond.

12.2.1 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 increase and continue in perpetuity.

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 TAMA management goal. The trend through 2013 in the TAMA has been a gradual reduction in IGFRs, either through conversion to Type 1 GFRs or through extinguishment for AWS credits. Of the 11,000+ reduction in irrigation acres in the TAMA since 1985 about 1,300 acres are associated with extinguishments.

IGFR groundwater use represents a perpetual authority to withdraw groundwater without a replenishment requirement. Agricultural users in general within the TAMA have always used significantly less water than their allotments. Despite this, agricultural demand in the TAMA, although fluctuating over time, shows no trend of decline.

Voluntary use of renewable supplies by currently active farms is limited by economics. Without subsidies or financial incentives, the cost to deliver and use renewable supplies is generally higher than the cost to pump and use groundwater. Although the Groundwater Code prohibits new land from being brought into agricultural irrigation in the TAMA, there has historically been some land associated with IGFRs that is not under irrigation; agricultural groundwater use could increase beyond current levels if more of the acreage associated with IGFRs is farmed. If these IGFRs continue to be farmed through 2025 and beyond, then the agricultural sector could help move the TAMA closer to safe-yield through further reductions in agricultural groundwater use and increased use of renewable water supplies, combined with enhanced on-farm irrigation water management practices.

Industrial Sector

Industrial groundwater use is less likely to contribute to reaching the TAMA safe-yield goal due to the potential for growth in industrial groundwater use and existing constraints on replacing groundwater use with renewable supplies. 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. The available groundwater allotments of current industrial rights and withdrawal permits alone exceed the average annual volume of natural recharge that has occurred in the TAMA between 1985 and 2013. Of particular note in the TAMA is the long-term groundwater demand of the mining industry, which is projected to remain a major groundwater user for the foreseeable future. There is no regulatory or statutory authority at this time to require industrial water users to convert to renewable supplies; however, some users may choose to do so voluntarily.

Future industrial sector development in the TAMA will likely impact the achievement of safe-yield if currently unused Type 1 and Type 2 Grandfathered Groundwater Rights (GFRs) are used to meet water needs. However, in 2013, TAMA water used for industrial purposes was less than 30 percent of industrial GFR and permit allotments. Between 1985 and 2013, industrial users in the TAMA on average only used 28 percent of industrial GFR and permit allotments. Although the unused industrial GFR and permit allotments represent a significant potential groundwater demand, legal water management decisions and land use ordinances can reduce the groundwater impacts these allowable uses represent. For example, Pima County prohibits the use of groundwater on new golf courses[1].

The largest industrial subsector in the TAMA is for mining use, followed by water used by turf-related facilities including golf courses. Water use by mines in the TAMA fluctuates with the world commodities market. The expected lifetime of the existing mines in the TAMA extends well into the next century, but exactly how long will depend on the economic feasibility of the mining and extractive processes available to local operations. It is also possible that additional ore bodies may be developed, although most potential new sites are just outside the TAMA boundaries. Groundwater withdrawals within the TAMA to meet processing demand when these properties are developed will depend on the location of milling installations. To remain competitive, mines within the TAMA must consider, among other factors, the cost of the water supply needed to mine and process the ore. While a certain amount of the CAP allotment for the state was designated for mining operations, all subcontracts were declined by TAMA mining interests due to cost, contract terms and water quality considerations. However, at the completion of the 2014 Non-Indian Agricultural priority CAP water reallocation process, ADWR recommended to the US Secretary of the Interior that 6,802 ac-ft of CAP water be reallocated to Freeport-McMoRan-Sierrita and Rosemont Copper Company[2].

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[1] See Title 18, Chapter 18.59.040 of the Pima County Zoning Code.
[2] See ADWR's January 16, 2014 letter to the US Secretary of the Interior.

Municipal Sector
The municipal sector is the dominant water use sector in the TAMA. Municipal demand in 2013 was approximately 161,916 ac-ft. 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 has reduced by more than 78 percent since it peaked in the year 2000, with most of the reduction occurring since 2005. Many municipal providers in the TAMA have experienced declines in overall water demand in recent years. Montgomery & Associates' residential demand study conducted in 2014 also indicated a trend in reduction in municipal residential demand for several providers in the TAMA. However, it is important for municipal provider to monitor their water demand and respond if the trend reverses. Since the adoption of the AWS Rules in 1995, new subdivisions in AMAs and providers with a Designation of Assured Water Supply (DAWS) are required to offset their groundwater use to meet the AWS criterion of consistency with the TAMA management goal. The AWS requirements only apply to designated providers and to new subdivisions served by non-designated providers. Subdivisions platted before the 1995 AWS Rules became effective and un-subdivided land within undesignated service areas can continue to use groundwater without replenishing it.

Exempt Wells
As of 2013, ADWR estimates that about 29,000 people within the TAMA are self-supplied water 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 2.5 persons; and that each person self-supplied via an exempt well in the TAMA would use 45 gallons per capita per day for interior uses; and that exterior uses for each exempt well would be 60 gallons per day, 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. Without the collection of additional data, the ability to determine the precise impact of exempt wells on achievement of the TAMA safe-yield goal remains limited.

Groundwater Allowance and the Assured Water Supply Program
The AWS Rules, adopted in 1995, are a primary tool in achieving the TAMA'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.

When a DAWS or Certificate of Assured Water Supply (CAWS) is issued, a groundwater allowance account is established. ADWR may credit additional allowable groundwater use to these accounts under certain conditions. The AWS Rules describe under what circumstances the groundwater allowance can increase.

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. This volume is referred to as excess groundwater.

Municipal water use accounts for close to half of all water used in the TAMA. More than 90 percent of the TAMA population falls within service areas that have a DAWS. Once a provider has joined the CAGRD, the CAGRD is committed in perpetuity to replenish the excess groundwater demand associated with existing uses and with new developments within the provider's service area during the membership period. The AWS Program and CAGRD have significantly increased renewable water use in the TAMA.

Most private water companies have chosen not to be designated. As of 2014, there were only four private water companies in the TAMA with a DAWS: Sahuarita Water Company, Spanish Trail Water Company, Vail Water Company (formerly Del Lago), and Willow Springs Utilities. New developments in undesignated providers' service areas must have a CAWS. However, undesignated water providers are likely to continue to pump groundwater to serve their existing customers, as well as customers not associated with subdivision development. This ongoing groundwater use can affect the ability of the TAMA to reach and maintain safe-yield.

Table 12-1 shows the status of municipal provider DAWS. All of the designated providers listed below are or will be members of the CAGRD. As Metro – West and Willow Springs Utilities begin to add customers, they will complete their enrollment in the CAGRD as Member Service Areas. Nearly 86 percent of the TAMA population is within the service area of a provider with a DAWS.

The City of Tucson (Tucson Water), the largest municipal provider in the TAMA, is a designated provider. Pursuant to A.R.S. § 45-463, Tucson Water may, at a future date, request to have groundwater withdrawals associated with certain Type 1 Non-irrigation GFRs included in its designation. This represents a significant amount of groundwater, up to two million ac-ft (A.R.S. § 45-463(F)(3)). This amount is in addition to its AWS groundwater allocation of approximately 1.5 million ac-ft.

TABLE 12-1
TUCSON AMA AWS STATUS OF DESIGNATED PROVIDERS

Provider	2013 Water Service Area Population	2013 Water Demand (ac-ft)	Designation Volume (ac-ft)	2013 GW Allowance Balance (ac-ft)
Tucson Water	713,102	113,884	182,852	1,259,458
Metro - Main	44,102	7,670	8,975	120,237
Town of Oro Valley	42,903	9,734	15,049	13,473
Flowing Wells ID	15,820	2,404	2,863	43,865
Town of Marana	15,174	2,195	7,580	338
Sahuarita Water Co.	14,852	1,547	10,983	9,309
Vail Water Co.	11,039	1,197	3,749	559
Metro - Diablo	2,567	254	4,144	0
Spanish Trail Water Co.	866	183	4,388	487
Metro - West	0	0	1,014	0
Willow Springs Utilities	0	0	2,875	0
TOTAL	**857,858**	**139,068**	**244,472**	**1,447,726**

As of September 2014, there were 27 large providers (those serving more than 250 ac-ft) and approximately 113 small undesignated providers in the TAMA. Some undesignated providers may have the ability to participate in augmentation efforts. The 2013 groundwater demand by large providers in the TAMA that are not designated was 19,012 ac-ft. Large providers that do not have a DAWS served 91,242 people in 2013. Efforts to encourage use of renewable water supplies in this sector merit further attention as a component of the TAMA Underground Water Storage, Savings and Replenishment Program.

12.2.2 Underground Storage and Recovery

Not all recovered water is considered the same under the AWS Rules. When an entity stores water in one location but recovers it some distance away, that stored water, is considered to be consistent with the AMA management goal; however, the water is not adding any physical availability in the location where the water is recovered. If instead water is stored and recovered from the same area, the stored water recharges the aquifer in the same location as the wells are pumping, and thus the stored water is adding physical availability to the wells that recover the water from within the area of impact of storage. Consideration of the recovery location will be more important in the TAMA in the future as groundwater levels in certain areas decline due to annual groundwater demand exceeding the volume of water that naturally or artificially recharges the aquifer each year.

A.R.S. 45-852.01(C) provides that reclaimed water stored in a managed underground storage facility (USF) incurs a 50 percent cut to the aquifer, meaning the storer would get credit for only 50 percent of the water stored. The cessation of reclaimed water storage at the managed USFs on the Santa Cruz River could affect riparian habitat that has benefited as a result of reclaimed water discharges to the river. However, reducing the cut to the aquifer to five percent or less would have an end-result contrary to the TAMA safe-yield management goal. Discussion of this topic may continue during the fourth management period.

12.2.3 Groundwater Savings Facilities

Groundwater Savings Facilities (GSFs) were used during the third management period to increase CAP water use and save groundwater supplies for future times of shortage. However, not all GSF permits have been put to use. For example, during the third management period Farmers Investment Company (FICO) secured a GSF permit for its irrigation rights in the Green Valley and Sahuarita areas. However, as of 2014 there was no infrastructure in place to bring a physical supply of CAP water to the GSF location. Plans are underway for construction of infrastructure to deliver CAP water to the GSF during the fourth management period.

12.2.4 Limitations on Availability of New Recharge Sites

Availability of suitable recharge sites affects direct recharge efforts in the TAMA. 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 TAMA suitable for recharge, there are limited sites capable of accepting large volumes of water.

Availability of sites for basin or in-channel recharge is also limited by areas of existing contamination and potential contaminant sources. Some reaches of stream channels in the TAMA 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.

The 1995 Water Consumer Protection Act (WCPA)[3] discourages use of injection of raw CAP water, but not injection of recovered CAP delivered through the drinking water distribution system. However, at this time it is cost prohibitive to use injection technologies on a large scale.

Proximity of a recharge project to the source of water that is to be stored is a significant economic feasibility factor for siting reclaimed water and CAP water projects because of the cost to construct and operate conveyance and distribution systems. Hydrogeologically suitable sites for recharge in some of the critical water level decline areas within the TAMA may be too far from existing reclaimed water delivery systems and the CAP canal to economically develop the sites. Use of the existing potable water supply system for delivery of recovered CAP water could improve the economic viability of some recharge sites.

Recovery considerations are another constraint on potential recharge site development. Concerns include where the facility is located with respect to the final use, whether the recovered water is determined to be groundwater under the influence of surface water and will therefore require filtering and disinfection and whether the proposed recovery will be feasible under recovery permit requirements in areas of severe groundwater overdraft and high subsidence risk *(See Chapter 7).*

12.2.5 Water Quality

Protecting and managing groundwater quality and matching water supplies of different quality to user needs maximizes the amount and utility of water available to the TAMA. Chapter 7 describes ADWR's Water Quality Management Program in detail. Most of the groundwater supplies in the TAMA meet all Environmental Protection Agency (EPA) and state drinking water standards. However, groundwater from some areas has contaminant levels that exceed the National Primary Drinking Water Regulation limits *(See Chapter 7).* Public education efforts are also needed to match water quality with intended uses and encourage the beneficial use of remediated groundwater.

Tucson's 1995 Water Consumer Protection Act prohibits delivery of groundwater that has been treated by Tucson Water to remove contaminants, even if the resulting water quality meets all federal and state drinking water standards. Within the Tucson Water service area, use of treated groundwater supplies and achievement of maximum beneficial use of treated groundwater produced by mandated clean-ups are complicated by this provision.

Water quality considerations regarding recharge are site-specific. They are related to the ambient groundwater quality (which varies across the TAMA), the soil chemistry, the quantity of water to be recharged, the degree of mixing with the ambient groundwater, past land-use practices, percolation rates and the period of time the recharged water remains in the aquifer. The location, volume and timing of recovery activities also impact water quality.

Water withdrawn in the vicinity of a recharge site is often a mixture of the recharged water and ambient groundwater. In some areas of the TAMA, recharge of CAP water would improve the quality of the ambient groundwater; in other areas, CAP recharge may lead to increases in the concentration of total dissolved solids (TDS). TDS concentration is one of several parameters that affect the aesthetic qualities of drinking water. The typical concentration of TDS in CAP water is higher than the concentrations of TDS found in the groundwater currently being withdrawn from many areas of the TAMA. Generally, artificial recharge processes, including percolation of water from surface basins through vadose zone soils, do not remove TDS from recharging water. Additionally, older groundwater supplies in the vicinity of recharge site which are located in deeper parts of the aquifer than those layers that are currently being tapped are also likely to

[3] See *https://www.tucsonaz.gov/water/water-consumer-protection-act*.

have higher concentrations of TDS and other inorganic parameters than the groundwater currently being supplied.

Beginning in 1992, Tucson Water initiated the direct delivery of CAP water. Due to significant water chemistry differences in the new CAP supply versus the historical supply, public perception of the water quality was degraded due to aesthetics primarily resulting from higher TDS. As a result of the impact of the implementation problems Tucson Water experienced, direct delivery has affected CAP water use plans beyond the City of Tucson. Public perception of CAP water quality, in conjunction with infrastructure costs, has made other communities in the TAMA reluctant to consider direct delivery of CAP water in the short term. However, there is support for the use of CAP water through annual storage and recovery.

Augmentation funds have been used to assess potential water quality impacts of recharge activities. ADWR funded a study of selected disinfection by-product issues related to the recharge and recovery of CAP water. ADWR also funded a water quality impacts evaluation as part of a study to assess the feasibility of delivering CAP water to water users in the Sahuarita-Green Valley area. These projects are described further in Chapters 7 and 9.

12.2.6 Conservation Alone is Insufficient to Achieve Safe-yield

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 result in the achievement of safe-yield in the TAMA nor 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.

12.2.7 Reclaimed Water Use

The TAMA has a long history of using reclaimed water for turf-related watering. To encourage reclaimed water in particular for turf watering, ADWR has provided an incentive for the use of reclaimed water. The Turf Program in the industrial sector allows turf facilities to receive a discount on every acre-foot of reclaimed water used. This incentive was originally included in the management plans to encourage the replacement of groundwater with reclaimed water in the turf sector, which can help outweigh the additional cost of delivering and treating reclaimed water. However, this incentive may result in irrigation managers becoming less concerned about the volume of water being applied to the turf, and hence result in the application of more water than the minimum amount the turf actually needs, which might otherwise be stored underground and used to meet demand at a future date. However, the increased costs of reclaimed water versus groundwater may mitigate the concern for economic reasons.

Septic systems tend to be located in rural areas where no regional wastewater infrastructure exists. They require adequate percolation rates and densities greater than one residence per acre for approval. Use of septic systems reduces the amount of wastewater that may be reclaimed and re-used. Further, septic systems leachate cannot be directed to areas where water levels are declining as can wastewater collected through a centralized sewer system, which can be treated and stored underground under a water management strategy that addresses sub-regional areas within the TAMA.

In calculating the amount of long term storage credits (LTSCs) earned by a storer, there is currently no cut to the aquifer for reclaimed water stored at a constructed underground storage facility. This means that 100 percent of the water sent to store, minus evaporative losses and other debits, is recoverable.

12.2.8 Susceptibility of CAP Supplies to Shortage

The TAMA has taken significant strides in reducing its reliance on groundwater, most notably in the municipal sector, primarily by increasing the use of CAP water. However, there are indications that CAP may experience shortages in the coming years which could increase the use of groundwater in the future and affect the TAMA's progress on decreasing overdraft. However, this will be mitigated by the storage of water by the Arizona Water Banking Authority (AWBA) and others that has already occurred for later recovery during times of shortage.

12.2.9 Infrastructure

The 4MP has identified at least two areas of infrastructure need in the TAMA. The first is the ability to continue to enhance storage and recovery of stored water from within the area of impact of storage near recharge projects in the Avra Valley Sub-basin, rather than continuing to recover water in areas of the Upper Santa Cruz Sub-basin that are experiencing water level declines. To reverse this trend, Metro Water has been developing a cooperative regional recharge and recovery project. The second is the extension of the CAP canal to the Green Valley/FICO area, which is also experiencing reduced groundwater levels due to continued and historical pumpage.

12.2.10 Limitation on Renewable Supplies

The 4MP projects that CAP water will be fully utilized within the three AMA CAP water service area by the year 2025. Further, CAP water may experience a reduction due to shortage prior to that. The AWS Rules require future growth to use renewable water supplies. After 2025, no additional groundwater allowance for AWS determinations is granted in the AWS Rules. Reclaimed water use will become more important, and eventually the need to develop additional alternative supplies to groundwater will come.

The AWBA has not yet met its goal of firming CAP supplies in the TAMA; however, it has plans to be more aggressive in storing water in the TAMA in the future to work towards meeting the firming goal.

12.3 POSSIBLE SOLUTIONS

During the fourth management period, ADWR will continue to develop long-term water management solutions to address the challenges described in section 12.2 and work with the regulated community as well as other stakeholders within the TAMA to identify challenges and develop and implement solutions to water management challenges.

12.3.1 Agricultural Solutions

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 TAMA. 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 TAMA closer to the achievement of its safe-yield goal. ADWR, in conjunction with the BMP Advisory Committee, will monitor and analyze both existing and newly implemented BMPs.

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 TAMA and to evaluate the effects of ADWR programs on farming operations. The impacts of the agricultural market on water use trends will also be evaluated for future planning needs. ADWR will also encourage and evaluate incentives for the increased use of reclaimed water by the agricultural sector.

To completely eliminate overdraft in the agricultural sector, agricultural users would need to rely almost exclusively on renewable supplies or be required to replenish groundwater pumping.

12.3.2 Industrial Solutions

The future of industrial use in relation to the safe-yield goal for the TAMA is largely shaped by the potential for growth in groundwater use and existing constraints on replacing groundwater use with renewable supplies.

In order for the industrial sector to contribute more to the achievement of the TAMA goal, there must be continuing and enhanced water use efficiency, meaningful incentives for the use of renewable water supplies and viable administrative and physical renewable resource use mechanisms in place. The majority of reclaimed water use during the fourth management period is projected to continue to be used by municipally-served turf facilities through the Tucson Water regional reclaimed system. However, there may be potential for CAP and reclaimed water use by sand and gravel facilities and CAP use by mines or other facilities in the future. In order for this to occur, there would need to be either regional infrastructure cost sharing for direct use to make it economically viable to use a renewable supply, or low-cost replenishment mechanisms whereby pumped groundwater would be replenished by a renewable supply elsewhere in the TAMA under certain conditions. For mining use, CAP water would likely require additional treatment.

Apart from the groundwater right retirement provision in the Code and the groundwater right extinguishment provisions in the AWS Rules, there is currently no regulatory authority that could reduce grandfathered groundwater rights. ADWR has decided not to include a grandfathered right purchase and retirement program in the TAMA 4MP. The extent to which the extinguishment provisions in the AWS Rules will limit industrial use is impossible to predict. It may be necessary to explore groundwater replenishment approaches to offset a portion of industrial pumpage. Approaches such as expanding the authority of the CAGRD to recharge excess CAP water outside of the AWS Program or establishing a separate replenishment authority for industrial users are possible mechanisms. Statutory change would be necessary to implement either mechanism.

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 use by turf facilities in the TAMA has reduced over time; however, groundwater remains a large component of the water supply for turf-related facilities. ADWR's focus on increasing the direct use of reclaimed water during the fourth management period, the continuation of incentives to use reclaimed water 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.

Mining Program

The potential for additional groundwater conservation is limited at mines due to the current level of conservation and recycling being practiced and the need to continue to transport and dispose of tailings. Reducing groundwater dependency is the most viable method for the mining sub-sector to contribute to the achievement of the TAMA goal. During the fourth management period, ADWR will continue to explore opportunities for the mining sector to reduce groundwater dependency and incorporate use of renewable water supplies.

12.3.3 Municipal Solutions

The municipal sector is expected to continue to reduce its reliance on groundwater during the fourth management period by increasing use of CAP and reclaimed water. While municipal providers have expressed a strong commitment to maximizing the use of renewable supplies, the municipal sector is growing and is projected to be responsible for 50 percent of the TAMA water demand by 2025.

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 TAMA, including in the Oro Valley and Vail areas. Several providers within the TAMA have entered into wheeling agreements to allow use of Tucson Water's distribution infrastructure as a method of physically conveying recovered CAP water from recharge sites near the CAP canal to other providers' service areas. 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.

Local, multi-jurisdictional partnerships have proved to be beneficial in the TAMA. Examples of these groups include the Southern Arizona Water Users Association (SAWUA) *(See http://www.sawua.org/)*, the Upper Santa Cruz Providers and Users Group (USC/PUG) *(See http://uscpug.org/)* and the TAMA Safe Yield Task Force (SYTF). Progress in addressing water management challenges in the TAMA will take coordination, cooperation and consensus among different jurisdictions at the federal, state, county and local level and support from TAMA water users. Continued cooperation among these groups to find long-term solutions may require compromise and costs.

The AWS Program has partially addressed the utilization of renewable water supplies by municipal providers by limiting the amount of groundwater that can be used. However, there is still a certain amount of groundwater pumping allowed under the AWS Rules that could be evaluated in the context of its impact on safe-yield. In addition, the water use associated with existing customers of undesignated providers and municipal uses that are not subject to the AWS Rules represent a continuing demand on the aquifer. During the fourth management period, ADWR will assist water-users in investigating mechanisms, including possible legislative changes, to address this residual overdraft.

ADWR will continue to work with the Arizona Corporation Commission in the development of policies related to water conservation and supply acquisition and on conditions for appropriate recovery of costs for private utilities associated with ADWR's regulatory programs.

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. Others believe that water conservation occurs passively – without the implementation of water conservation measures by a provider or other entity, such as the county or the state. Further evaluation could include ADWR assisting in designing follow-up studies and analyses to evaluate program effectiveness. This could include exploration of Water Management Assistance Program projects on municipal research.

Throughout the fourth management period, ADWR will work to improve water use data collection to support both planning and conservation program evaluation efforts. ADWR will also continue to provide direct conservation assistance to water providers to assist them in meeting their regulatory requirements.

12.3.4 Augmentation Solutions

During the fourth management period and beyond, ADWR, working with the local jurisdictions, could consider potential solutions such as the following to increase the use of renewable water supplies in the TAMA, thereby further reducing groundwater dependency:

- Consider requiring replenishment of groundwater withdrawals by the agricultural and industrial demand sectors, minus incidental recharge by these sectors.
- Adopt a special increase in withdrawal fees to create a fund for augmentation projects.
- 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 of CAP and reclaimed water.
- 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. One possible avenue would be through encouragement of the storage of water in areas experiencing declines (where appropriate hydrologically) and recovering water where the water is stored. TAMA stakeholders have indicated support for the analysis and discussion of potential solutions addressing local areas within the AMA.
- Develop and adopt economic incentives to achieve water management objectives on the TAMA and local level.
- Resolve infrastructure challenges hindering efficient use and distribution of all water supplies.
- Address residual groundwater pumping and allowable groundwater pumping in the municipal sector.
- Consider the cost effectiveness of reclaiming brackish, high TDS or other poor quality water not previously considered for beneficial use.

12.4 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. As has been noted many times, the one aspect of the future that is certain is that it will be unlike the past. 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. Doing so will allow ADWR to better serve the State of Arizona and the AMAs in the next management periods.

This chapter has set the stage for activities within the TAMA that could contribute to the TAMA's goals and objectives. To ensure safe, dependable water supplies for existing and future residents of the TAMA we must efficiently use available renewable water supplies. Achieving safe-yield and adopting management techniques to address sub-regional areas within the TAMA will continue to be challenges. The ability to meet these challenges is dependent to a substantial degree on community and legislative support. New strategies and tools for water management may be required in the Tucson area in order to achieve the TAMA goals. A combination of education, cooperative efforts, and legislative changes may be required to address water challenges in the future. ADWR will continue to work with the TAMA community to develop innovative and cooperative solutions to respond to the area's changing needs.

12.5 FINAL THOUGHTS

Safe-yield is defined as a long-term balance that is both achieved by 2025, and maintained thereafter. 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 economic viability of the state and the TAMA?

The programs that were developed for the third management period focused on elements of water-supply management problems and strategies within the authority of ADWR which were feasible with the available agency resources. The program discussion and future directions sections of the TAMA 4MP highlight some of the potential opportunities for ADWR to utilize additional tools and acquire additional statutory authority or to contribute indirectly to the efforts of others to address the water management challenges facing the TAMA.