Arizona Groundwater

ARIZONA GROUNDWATER MANAGEMENT

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INTRODUCTION

During my first-ever sabbatical this spring 2012, I traveled to four continents as part of my project on comparative policy analysis. I participated in the 6th World Water Forum in Marseille, shared lessons learned with Australian, Israeli and other water researchers and professionals, and heard views on good groundwater governance practices in Latin America and South America as a member of the team working with the Global Groundwater Governance Project (www.groundwatergovernance.org). These experiences have reminded me that Arizona's approach to groundwater management is unique in the nation — and in the world.

Unique Approach

Water Banking

Arizona's water banking program is of interest to many, including Australian water management researchers and professionals. Our most populous areas' utilization of Colorado River water through the 336-mile constructed Central Arizona Project, which moves massive quantities of water uphill, has enabled us to deploy some innovative and successful water management methods. I often use the graphic of the glass half-full and half-empty in my seminars and lectures to signify the status of Arizona's water situation. Although it is easy to dwell on our many outstanding water challenges — and there are many — Arizona water policy makers and managers have in fact accomplished a lot.

Tools Development & Unresolved Issues

In this article, I discuss Arizona groundwater management with a look at the tools that have been developed to support achievement of multiple policy objectives. The geographic focus is Central Arizona, the location of Arizona's most populated metropolitan regions. I explain how the foundation of the 1980 Groundwater Management Act has been built upon to facilitate meeting groundwater policy objectives. The framework allows for significant flexibility — or choices — on the part of those who must comply with the regulations. I also discuss several unresolved issues, or, as we sometimes call them, "holes in our water bucket." I hope the article will leave you with an appreciation of the value associated with sharing water management approaches.

It is important that we draw upon the lessons of others as, in keeping with the theme of the 6th World Water Forum, we continue our search for solutions.

ARIZONA'S 1980 GROUNDWATER MANAGEMENT ACT

Groundwater Concerns

As Arizona's population and economy grew after World War II and pumping technology improved, groundwater levels in many parts of Arizona declined. Concerns about: the extent of groundwater "mining" (overdraft in excess of maintaining aquifer levels); legal decisions related to the transport and use of groundwater away from the overlying land; and the need to show the federal government that Colorado River water delivered through the Central Arizona Project (CAP) would at least in part substitute for groundwater use, led to the 1980 adoption during a special session of the Arizona Legislature of the Groundwater Management Act (GMA). Arizona Revised Statutes, Title 45, Section 401 ff. *See* www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf for a brief overview of the GMA. [The Arizona Department of Water Resources' website (www.azwater.gov) contains additional overview information. For a good overview of Arizona water management, see the chapters in Bonnie G. Colby and Katharine L. Jacobs, eds., Arizona Water Policy: *Management Innovations in an Urbanizing, Arid Region*, RFF Press, Washington, DC, 2007.]

Regulatory Framework

Arizona's GMA was, and likely still is, the most far-reaching groundwater management regulatory framework in the United States. The law established the Arizona Department of Water Resources (ADWR) to implement and monitor GMA compliance. The GMA was designed primarily to address significant groundwater overdraft in areas designated by statute as Active Management Areas (AMAs). The law specified groundwater management goals for each of the AMAs and required a system of groundwater rights and permits for most groundwater pumpers. The statutorily mandated AMA Management Plans would establish conservation regulations, which would be periodically updated, for the municipal, industrial, and agricultural sectors. These Management Plans, which are approved by the ADWR Director after review and public input, have the force of administrative rule. The GMA limited the footprint of agriculture by restricting use of water for irrigation to lands that had been irrigated at some time during 1975 through 1979. This non-expansion of agriculture included all lands in the AMAs, as well as lands

Management Plans

Arizona Groundwater

Assured Supply

Safe-Yield

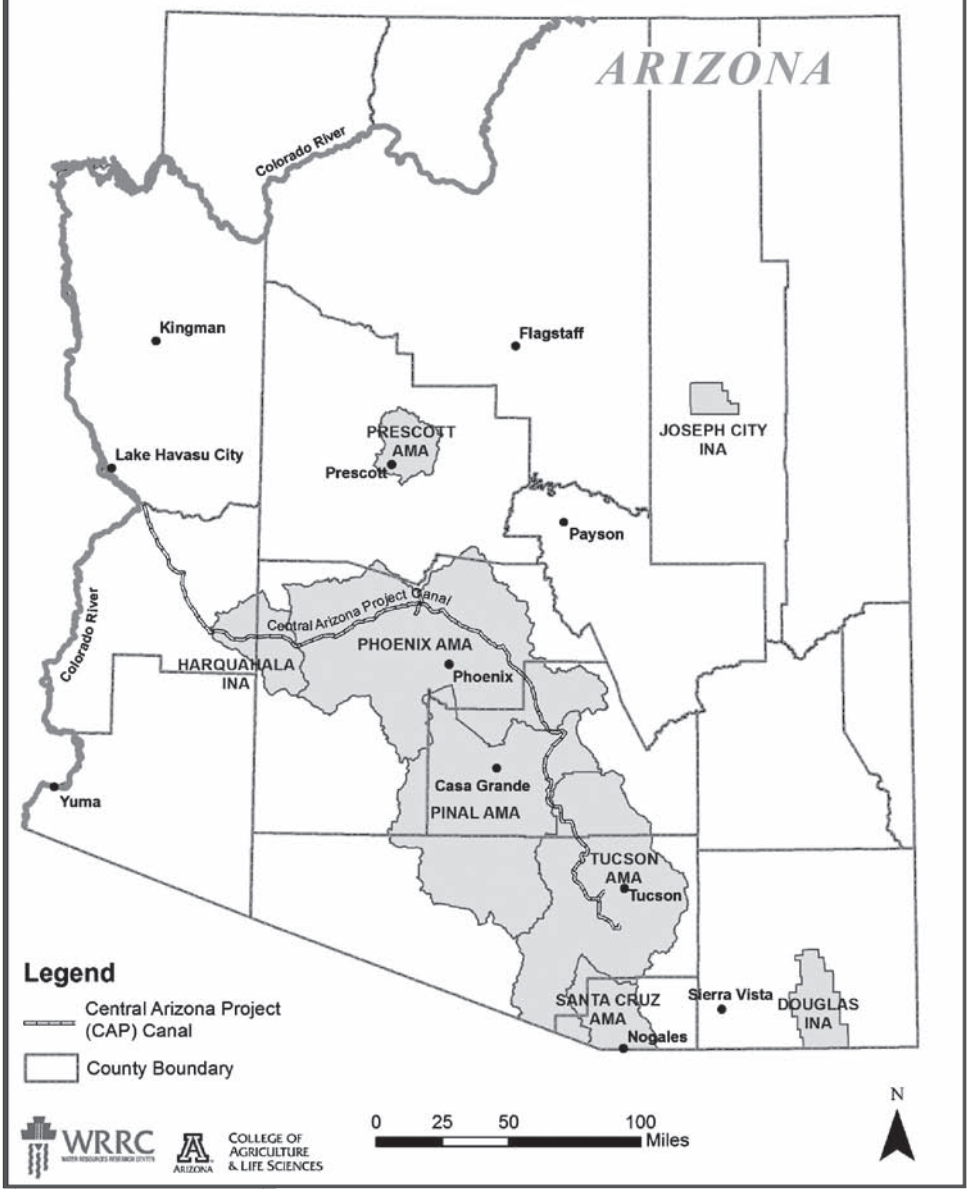
AMAs & INAs

included in areas designated by law as Irrigation Non-expansion Areas (INAs). INAs are not subject to groundwater regulations other than this non-expansion provision. Also included were requirements for owners of large wells to meter/measure groundwater pumping and to report groundwater withdrawals.

The truly path-blazing provision of the GMA was the requirement for an **a**ssured **w**ater **s**upply (AWS) program. The AWS program, which was fully implemented by administrative rule in 1995, requires that new municipal growth in the AMAs be based on a 100-year supply of legally, physically, and continuously available water that meets water quality standards. Water providers serving new development, whether operated by municipalities or privately owned companies, would also have to show they had the financial wherewithal to meet the requirements of the rules. Finally, water use would have to be consistent with the AMA management plan and with the statutory management goal for the AMA, which in three of the four initial AMAs was safe-yield. Safe-yield "means 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" (ARS 45-561).

Figure 1 shows the location of the five current AMAs and three INAs. AMA boundaries were largely determined by hydrological considerations. AMAs include parts of counties and some include parts of more than one county. The Santa Cruz AMA was separated from the Tucson AMA in 1994 in order to better acknowledge and address the different groundwater conditions in the two regions. The Phoenix, Prescott, and Tucson AMAs have safe-yield as their water management goal. The goal for the largely agricultural Pinal AMA is "to allow development of non-irrigation uses…and to preserve existing agricultural economies in the active management area for as long as feasible, consistent with the necessity to preserve future water supplies for non-irrigation uses." The Santa Cruz AMA goal is "to maintain a safe-yield condition in the active management area and to prevent local water tables from experiencing long-term declines." This goal recognizes the shallow aquifer conditions or micro-basins in parts of the Santa Cruz AMA and effectively connects groundwater use to the surface water flows that recharge these micro-basins. The non-AMA portions of Arizona are not subject to groundwater regulation.

Figure 1: Arizona Active Management Areas and Irrigation Non-Expansion Areas



Since 1980, the focus of the safe-yield AMAs has been achieving/maintaining safe-yield by the statutory deadline of 2025. ARS 45-462 states: "The management goal of the Tucson, Phoenix and Prescott active management areas is safe-yield by January 1, 2025, or such earlier date as may be determined by the director." Although the GMA Act specifies this deadline for achieving the management goal, recall that the definition of the safe-yield goal includes the word "attempts." It would appear that a documented "attempt" to achieve and thereafter maintain a balance between inputs and outputs of groundwater could signal meeting the goal. Moreover, there are no penalties established in the GMA for non-compliance.

Arizona Groundwater

Detailed Assessments

Efforts to develop the Fourth Management Plan for each AMA are ongoing. In preparation, ADWR staff developed detailed Assessments for each AMA, which are available on the ADWR website (www.azwater.gov). These Assessments characterized water use by source and by sector and projected groundwater overdraft. To put the available numbers in context, the sources and uses of water statewide are shown for 2006 in Figure 2. Components of these figures are estimated, as water use is not reported for certain users and from many parts of the State. Groundwater constituted almost 39 percent of the 6.86 million acre feet of water diverted or extracted. The comparable percentage reliance on groundwater for the Phoenix, Pinal, and Tucson AMAs, as reported in the Assessments posted on the ADWR website, are 31 percent, 42 percent, and 39 percent respectively. For the municipal sector, the figures are even lower in each of the AMAs, as shown in Table 1.

Colorado River Water

CENTRALITY OF THE CENTRAL ARIZONA PROJECT

We see that Colorado River water delivered through the CAP (hereafter "CAP water") figures prominently. The CAP was constructed to deliver the approximately1.5 million acre feet of Arizona's 2.8 million acre foot Colorado River entitlement that is not otherwise used by Arizona's on-River users into CAP's three-county service area — i.e., Maricopa, Pinal and Pima Counties. The CAP started water deliveries to the Phoenix area in the mid-1980s, with deliveries as far south as Tucson occurring in the early 1990s. From Figure 1, we can see that the borders for the three counties do not correspond exactly to the three Phoenix, Pinal, and Tucson AMAs. Although this lack of congruent boundaries introduces certain complexities, for purposes of this article, it is sufficient to note that the users of CAP water are water users in the three AMAs that reside in the three aforementioned counties.

CAP water is a critical enabler of plans to meet the statutory and other water management goals of the Central Arizona AMAs. It is used to reduce groundwater mining in the municipal sector and substitute for groundwater use by the agricultural sector. The institutions and mechanisms used to accomplish these goals are involved and sometimes interrelated. This is especially true with regard to the requirements of the rules related to showing an Assured Water Supply. These institutions and mechanisms include: 1) recharge and recovery; 2) membership in the Central Arizona Groundwater Replenishment District; and 3) the Arizona Water Banking Authority. A quick explanation of each of these will help inform the more detailed discussion which follows.

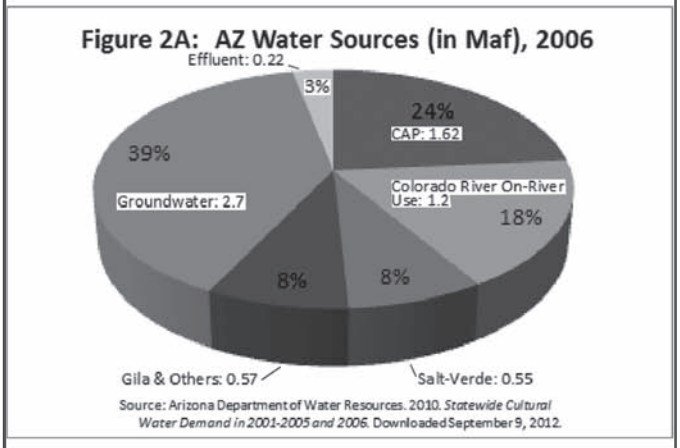
Recharge and Recovery

Not all who wish to use CAP water have long-term contractual agreements for its use, and not all CAP water users, whether with or without contracts, have direct access to the canal. CAP water requires treatment before use for potable purposes. One option for meeting drinking water standards is to directly treat CAP water for potable use. Another is to make use of Arizona's statutorily authorized underground storage (recharge) and recovery program. Through recharge, the CAP water seeps into groundwater basins, thereby using the filtration ability of soils. The CAP water is then diluted/mixed with groundwater, and later water is recovered for use using wells either in the area of hydrologic impact of the recharge or outside it.

Central Arizona Groundwater Replenishment District

A main driver for using CAP water is the Assured and Adequate Water Supply Rules (AWS Rules), which were approved in 1995. The AWS Rules for the Central Arizona AMAs allow groundwater to be used to demonstrate the 100-year assured physically available water supply required to serve new development, but most of that groundwater use must be offset by recharge of renewable supplies. This demonstration can occur two ways. The first way involves a water provider establishing it can comply with the component of the AWS Rules for its entire

Figure 2: Statewide Sources and Uses of Water for 2006



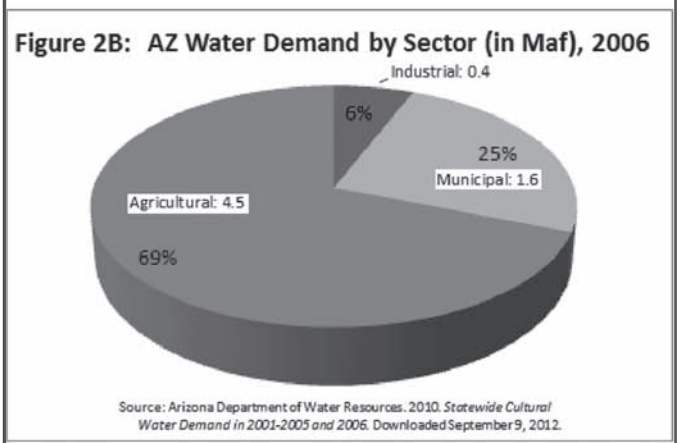


Table 1: Groundwater as % of Total Municipal Water Use by AMA 1985, 1995 and 2006

	1985	1995	2006
Phoenix	36%	32%	23%
Pinal	100%	96%	88%
Tucson	100%	96%	53%

Source: AMA Assessment Reports, Arizona Department of Water Resources web site (azwater.gov), Downloaded September 23, 2012.

Arizona Groundwater

Limiting GW Use

After-the-Fact Replenishment

Demand Exceeds Supply

Climate Considerations

Junior Rights

Storage & Recovery

Tribal Rights

Accounting Framework

Infiltration Mediums

Savings Facilities

service area. If it can do so, ADWR qualifies the service provider with a "Designation of Assured Water Supply" and the public or private water company is called a "designated water provider." The other option is for new development to certify that it will be served by a non-designated water provider and that the development's water use will meet the requirements of the AWS Rules. In these instances, the development receives a "Certificate of Assured Water Supply," and the land subject to development is known as "certificated land." A key requirement of the AWS Rules is that the proposed water use be consistent with the AMA management goal. For the safe-yield Phoenix and Tucson AMAs, as well as the Pinal AMA, which does have to preserve sufficient groundwater for future municipal growth, this means limiting groundwater use. Those demonstrating an Assured Water Supply are granted an allocation of groundwater they draw upon, much like individuals have a bank account of funds upon which they can draw, and they can use the water according to their desired schedule. For the rest of the water supplied, they must show annually that they are using non-groundwater sources. Use of CAP water directly through treatment and delivery, storage of CAP water in advance of recovery, and/or after-the-fact replenishment allow for meeting requirements to stay within groundwater allocations. The after-the-fact replenishment mechanism is carried out by a subsidiary unit within the CAP, which was named the Central Arizona Groundwater Replenishment District (CAGRD) by statute. The CAGRD relies on Arizona's storage and recovery framework to meet its statutory obligations.

Arizona Water Banking Authority

Clearly, there is significant demand for CAP water, both by those with long-term entitlements and those looking to purchase on a year-by-year basis. This demand has already exceeded the available supply to Central Arizona. The challenge of meeting ongoing water demand is compounded by climate variability considerations — including the inevitability of periods of low flows.

Most know that Arizona is currently in a drought period. Overlay expected climate variables with the knowledge that tree ring studies indicate that average annual Colorado River flows are much lower than the amount allocated to the Upper Colorado River Basin states (Colorado, Utah, New Mexico, and Wyoming), the Lower Basin States (Arizona, California and Nevada) and the Republic of Mexico. Then add the additional uncertainty associated with climate change. Even without consideration of the latter, Central Arizona has to be concerned about shortage conditions along the river due to its junior status in times of shortage. CAP water is among the first to be cut in times of shortage. All CAP deliveries will be curtailed before California experiences any cutbacks in its deliveries. This junior priority status was one of the factors leading to the 1996 formation of the Arizona Water Banking Authority (AWBA), with the responsibility for storing CAP water for interruptions of deliveries due to shortage or canal outage. Water stored by the AWBA and later recovered must comply with Arizona's storage and recovery framework, again pointing to the central role of recharge in meeting Arizona water policy objectives.

Arizona Indian Nations also have rights to significant quantities of CAP water. A discussion of Native American utilization of CAP water is beyond the scope of this article. The water use of Native American Nations is managed by the respective tribal governments and on-reservation use does not fall under the GMA or any of its provisions.

ARIZONA'S RECHARGE AND RECOVERY FRAMEWORK

The statutory provisions for recharge (storage) and recovery were added in the mid-1980s and thoroughly revised in 1994 (ARS 45-801 ff). These provisions provide a regulatory and accounting framework that considers: the water quality and quantity impacts on aquifers; procedures for operating and maintaining recharge facilities; accounting for storage; and accounting for recovery.

Facility Permits

Permits are issued by ADWR to the owner and operator of storage facilities, which include both **u**nderground **s**torage **f**acilities (USFs) and Groundwater Savings Facilities (GSFs). The USF category applies where water infiltrates down to aquifers and includes definitions of subcategories of USF. The most commonly deployed USF involves shallow constructed infiltration basins. Another USF involves infiltration using a river or stream as the infiltration medium and a third involves use of injection wells. GSFs are the other major facilities type and, as the name suggests, these are facilities where a non-groundwater source, such as CAP water of effluent, is used in place of (to save) groundwater. GSFs are most commonly agricultural lands. Facility permits are issued for a set number of years and specify the maximum amount of storage that can occur annually and the maximum total amount that can be held in storage at the facility.

Arizona Groundwater

Storage Permits

Permitted Storage

The second type of permit used in this framework is the storage permit. Storage permits can be issued to the facility permit holder as well as others. If not the owner/operator of a facility, the holder of a storage permit must enter into an agreement with the facility owner. Storage permits can be issued to multiple parties for amounts that in combination exceed the annual permitted volume — however, the actual volume stored in a given year cannot exceed this amount. For example, two entities could have storage permits for 1,000 acre-feet a storage facility permitted for 1,000 acre-feet annually. Both entities could not store that full amount in one year. It could be that in one year entity A stores 1,000 acre-feet and in the next year entity B stores 1,000 acre-feet — *or*, in any given year, they might split storage of the allowed total of 1,000 acre-feet in any number of ways.

Storage Credits

Associated with storage is the issuance of credits for water stored. The amount of credits issued will depend on several factors. Among them are evaporation, whether the water will be withdrawn in the same year as the storage, and, in some cases, the type of water stored (CAP versus effluent). The permitting process is a rigorous and technical process.

Recovery Permits

Recovery Provisions

The third type of permit is the recovery permit, which allows wells to be used for recovery of the water stored. Key criteria for recovery well permitting relate to whether the well is within or outside of the area of hydrologic impact of the storage and, if outside, the rate of decline in groundwater levels in the vicinity of the well under consideration. If water level declines have exceeded a level established in the AMA Management Plan, a recovery well permit for recovery outside the area of hydrologic impact will not be issued. This provision is designed to guard against recovering stored water where water levels are declining more than a certain level. The accounts are kept by AMA. When recovered, the water retains the characteristic of the water that was stored. So, if CAP water was placed into the aquifer, the water recovered through a permitted recovery well is considered CAP water, even if the water was stored at a distance from the well. In fact, it is considered CAP water if stored anywhere within the AMA. Water stored in an AMA must be recovered within that same AMA.

Additional Permits

Effluent Storage

Additional permits may be required from the Arizona Department of Environmental Quality (ADEQ). State law does not require a permit for CAP recharge, although ADEQ examines facility permit applications. For example, there may be requirements for piezometer installation and monitoring near landfills, with storage curtailment requirements if water levels rise to levels established in the permit. ADEQ must issue a permit prior to operation of a recharge facility for storing effluent.

Framework Funding

Property Tax

The Arizona Legislature facilitated storage of CAP water in the early 1990s when it authorized a temporary property tax to support the development of demonstration facilities for recharge of CAP water. This tax, authorized at up to $.04 dollars per $100 of secondary assessed valuation in Pima County and Maricopa County, was levied by the Central Arizona Water Conservation District, the formal name for the body that operates the CAP. The CAP Board has the responsibility of setting the tax rate annually. The Arizona Legislature later extended the tax to 2016 and to Pinal County and specified that its use would be for CAP purposes, such as payment or repayment (to the federal government) of CAP construction or annual operations, maintenance and replacement costs. Funds not so used are to be deposited in the Arizona Water Banking Fund at the office of the State Treasurer.

CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT

Reducing Groundwater Reliance

Recall that an Assured Water Supply program was required by the GMA, which was approved in 1980. It was expected that CAP water would play a critical role in reducing groundwater reliance by the municipal sector. Not all entities were at the table at the time the CAP allocations were determined and many did not have their own facilities in place (or expected to be in place) for utilizing CAP water. Developers, in particular, many of whom develop large-scale projects outside of the service areas of existing water providers, expressed their willingness to work with ADWR on an AWS rules package if they were assured a facilitating mechanism for compliance with the expected requirement that renewable water supplies be used. In other words, the development of an agency or institution to facilitate compliance with the expected AWR Rules was a prerequisite for final approval of the Rules.

Thus, the Central Arizona Groundwater Replenishment District (CAGRD) was borne. The CAGRD authorizing legislation was approved in 1993, fully two years before the AWS Rules were effective. The CAGRD is not an actual district but rather an operating unit or subsidiary within the CAP. It operates in CAP's three-county service area.

Arizona Groundwater

Replenishing Water

There are many complexities associated with the CAGRD, as there are with most aspects of Arizona groundwater law. The complexities often stem from the flexible strategies associated with complying with the many requirements. Fundamentally, membership in the CAGRD by member service areas and member lands establishes for ADWR that the AWS designation or certificate is in compliance with the requirement that water use be consistent with the AMA management goal. The CAGRD assumes the responsibility for replenishing water that is deemed excess groundwater by the annual reports filed at ADWR by CAGRD members. Membership comes with some fees and application review (particularly a demonstration of physical availability of groundwater to ADWR), but CAGRD cannot turn away qualifying members if they meet ADWR's requirements. The CAGRD must develop a Plan of Operation every 10 years, in which it shows the replenishment obligation for existing members and members expected to join within the 10 year period. The replenishment obligation is projected for 100 years, and the CAGRD must show how it expects to meet the replenishment obligation, with the expectation that the last 80 years are less predictable than the first 20. ADWR must review and approve the plan. The approved plan basically certifies that the AWS designations and certificates for CAGRD members are in full force. The last Plan of Operation was submitted to ADWR in 2004. It showed a 100-year replenishment obligation of over 225,000 acre feet (See C.A. Avery et al., "*Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District,*" Arizona Law Review, Vol 49, No. 2, 339-359, Summer 2007).

Water Acquisition Strategy

The slow-down in growth and land development associated with the recession has resulted in a much lower growth in the CAGRD replenishment obligation, and the CAGRD has successfully met its replenishment obligation to date. However, replenishment obligations, even in the short run, still exceed the water under contract to the CAGRD. With the expectation that CAP water available for purchase on a short-term (annual) basis will not be available in the not-too-distant future, the CAP Board has authorized a CAGRD water acquisition strategy. The next CAGRD Plan of Operation will be prepared in 2014. The CAGRD has established a replenishment reserve to help get through times of fluctuations in water available for replenishment, but the replenishment reserve is not the solution to the need for water supplies for long-term replenishment.

Storage v. Recovery Disconnect

Along with the issue of future replenishment obligation, the CAP Board and its stakeholders have long been focusing on the question of the location of replenishment relative to pumping. Pumping is done by the water providers. Replenishment is done after the pumping by the CAGRD. There is no legal requirement that the replenishment be hydrologically connected to the pumping, although it must occur within the same AMA. This effectively means that replenishment occurs in the same, usually large, groundwater basin as the pumping, but not necessarily the same sub-basin. Replenishing in a location hydrologically connected to the pumping would involve significantly higher costs for the CAGRD's customers. While all recognize that water costs will continue to go up, there is concern about the significantly higher costs associated with requiring that replenishment occur close to the pumping in all cases. What might be good for the aquifer is not always good for the wallet. It should be noted that this disconnect between storage and recovery is allowed under Arizona's statutory framework and not an issue only for CAGRD replenishment activities.

New Guiding Principles

The CAP Board approved in September 2012 a set of Guiding Principles for the CAGRD. The intent is for the CAGRD staff and members of the CAGRD & Underground Storage Committee of the CAP Board to work intensively with stakeholders to lay the foundation for the next Plan of Operation. These guiding principles: address issues related to member land de-enrollment (member service areas already can de-enroll); enrollment of new members; hydrologic location of replenishment; conservation; collection of water assessment from member lands; and direct water deliveries by CAP. [The Guiding Principles document is available at http://cap-az.com/Portals/1/BoardMeetings/09-06-12%20Board%20Meeting/11bi.%20CAGRD%20Guiding%20Principles%20revCOMBINED.pdf.]

THE ARIZONA WATER BANKING AUTHORITY

Future Shortages

The Arizona Water Banking Authority (AWBA) is the last of the mechanisms created by the Arizona Legislature that utilizes the recharge and recovery framework to address issues related to utilization of CAP water in Central Arizona. The AWBA was established in 1996 and began water storage in 1997. Its operations are well documented on its website (www.azwaterbank.gov), where Annual Plans of Operation and Annual Reports can be found. The AWBA was created to assist Arizona in making full utilization of CAP water and storing for future water shortage or canal outage. Through 2011, nearly 3.7 million acre-feet of water have been stored in Central Arizona for multiple purposes.

Interstate Banking

Included in the cumulative figure is storage of approximately 600,000 acre-feet on behalf of Nevada as part of an interstate water banking agreement. A significant portion of the remaining 3.1 million acre-feet has been stored to firm municipal water supplies in the three Central Arizona AMAs in times of shortage. This storage has occurred through use of both Underground Storage Facilities and Groundwater Savings Facilities. It is expected that this water will be recovered by CAP to meet delivery obligations to municipal users. To

Arizona Groundwater

Storage Credits Sale

date, no water has had to be recovered for Central Arizona as an official shortage has not been declared pursuant to the Shortage Sharing Record of Decision. Work on recovery planning is ongoing. [See, *Record of Decision, Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead*, December 2007, available at: www.usbr.gov/lc/region/programs/strategies/RecordofDecision.pdf and CAP's *Colorado River Shortage Issue Brief*, available http://cap-az.com/Portals/1/Documents/Shortage-Issue-Brief-Jan-19.pdf.]

In addition to storage by the AWBA, individual water providers and others are storing water for future use. There may be a strong market for credits as water supplies get tighter and tighter. Arizona law does allow for sale or assignment of storage credits. Examination of ADWR's long-term storage credit accounts will confirm that banking of water has been ongoing by several entities for many years.

CONCLUDING REMARKS

While challenges remain, Arizona has made great strides in groundwater management in the Central Arizona AMAs. Great progress is being made in reducing reliance on groundwater by the municipal sector at the same time that non-municipal uses of groundwater may still grow. Arizona's innovative recharge and recovery framework is strong and provides opportunity to meet various regulations in a cost-effective and flexible manner, but some aquifers are experiencing drawdown as pumping occurs at locations not benefiting from active recharge programs.

Groundwater Overdraft

A key question is whether the AMAs are moving toward meeting their statutory management goals. ADWR has tracked groundwater overdraft by AMA. The AMA Assessments include detailed tables of water use by sector and water source for the years 1986, 1996 and 2006 and projections for 2025 for three scenarios. The calculations are complicated by several factors, including how groundwater allocations per the Assured Water Supply Rules and groundwater not pumped as part of the Groundwater Savings storage program are considered (see S.B. Megdal and T. Shipman, "*Gains from Trade: Arizona's Groundwater Savings Program*" available at: https://wrrc.arizona.edu/publications/gains-trade-arizonas-groundwater-savings-program, 2010). Though the interested reader should refer to the AMA Assessments for more information, suffice it to say that the middle projections for 2025 show that neither the Tucson AMA nor the Phoenix AMA is projected to be in safe-yield.

Regional Augmentation

Work is ongoing. ADWR is considering aquifer management as it develops the AMA Fourth Management Plans. The search for water supplies to meet the CAGRD replenishment obligation will be a long-term and likely expensive effort. Non-AMA areas of the State are growing, too. Communities throughout Arizona are looking to the long term and identifying options for addressing supply-demand imbalances. The legislatively authorized Water Resources Development Commission (WRDC) has recommended regional water augmentation authorities be formed, but did not recommend a particular funding option. A WRDC working group examined the water needs of riparian systems, but legislative action to address environmental water needs is not contemplated (For a discussion of Arizona water law and the environment, see, Megdal et al., "*The Forgotten Sector: Arizona Water Law and the Environment*" Arizona Journal of Environmental Law and Policy, Vol. 1, No. 2 (2011), pp.243-293; available at: www.ajelp.com/). Privately owned water companies are important to many Arizona communities, but they often face more hurdles in gaining approval to incorporate certain costs into their rate structures than municipally operated companies.

Arizona's groundwater management, though not perfect, has led to significant changes in water using behaviors. A growing state in a semi-arid region, Arizona has to keep its eye on its water bucket. Others can learn from our practices, just as we should look to learn from the successful approaches of others.

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