



City/County Water and Wastewater Study



Date: September 10, 2009

To: City/County Water and Wastewater
Study Oversight Committee

From: C.H. Huckelberry *CHH*
County Administrator

Mike Letcher
Mike Letcher
City Manager

Re: Additional Water Resources Technical Paper

As part of the scope for the Joint City of Tucson/Pima County Water and Wastewater Infrastructure Supply and Planning Study, the City and County were asked to review how regional collaboration can potentially facilitate securing additional renewable water resources as befits their respective missions and to discuss what could be done to ensure that the long-term future water supply is not acquired at the expense of our current residents or the environment.

The attached White Paper addresses the following issues:

Overview of Currently Available Water Resources

In Phase I an inventory was developed which summarized the currently available water resources of the City of Tucson/Tucson Water, Pima County, and certain water providers who elected to respond to the solicitation to participate; this inventory is available and can be accessed on the Study website. An excerpt of the inventory showing Tucson Water's and the County's currently available water resources as of 2007 is provided in the Appendix to the White Paper.

Tucson Water and Pima County Will Need Additional Water Resources

Tucson Water will require additional water resources in order to increase the reliability of existing available resources and to serve the unmet needs of infill and reinvestment in the Utility's existing service area as well as the needs of the still undeveloped areas within the Utility's Obligated Service Area. Pima County will also require additional water resources to meet the needs of proposed environmental enhancements that can not be met by its currently available supplies.

Given the many needs and interests vying to obtain supply for future growth or to buttress currently available resources to ensure their reliability, the competition may be fierce. Nonetheless, there may be opportunity to acquire locally available supplies for environmental

enhancement efforts through purchase or lease, or incentives may be developed which would provide multi-benefit resource development/environmental opportunities for specific supply sources.

Review of Potential Sources of Additional Supply

Potential sources of supply would either have to be imported into the Tucson Active Management Area (AMA) using the CAP Aqueduct or they would be acquired from local sources. The former would include accessing additional CAP water, non-CAP Colorado River water, and/or groundwater pumped from other groundwater basins in Arizona and imported into the Tucson AMA.

Acquiring additional locally-based water resources could potentially include the unused municipal effluent entitlements or storage credits of other local water providers in the Tucson AMA. Residential gray water and rainwater would also be potentially available sources of supply that could be further developed locally.

Overview of the Central Arizona Project's ADD Water Program

In its *2006 Strategic Plan*, the Central Arizona Project recognized that long term water demands in Maricopa, Pinal, and Pima Counties are expected to exceed currently available supplies. As a result, the Central Arizona Project created Project Acquisition, Development, and Delivery (ADD) Water in 2007 in order to establish a process to determine when new supplies will need to be acquired and what entities will get access to those supplies. ADD Water assumes that the Central Arizona Project will be the primary entity responsible for acquiring, developing, and delivering the additional water supplies to entities in its three-county service area.

Even though the stakeholder process continues to unfold and no final plan is as yet in place, certain planning concepts appear to be crystallizing. These are summarized in the bullets below:

- Central Arizona Project infrastructure will be used to import additional supplies into the three-county area.
- These additional supplies will be acquired primarily by the Central Arizona Project who will serve as the acquisition agent for all three-county parties. This will minimize the need for water entities to independently acquire their own supplies which in turn could cause greater competition and drive up the water acquisition costs for all parties interested in augmenting their water resource portfolios with a limited pool of potential resources.
- Additional supplies will have a reliability equal to but mostly greater than current CAP M&I allocations. This is important since these additional supplies will in part be needed to reinforce/buttress CAP's current supplies which are more vulnerable to shortage.
- The Central Arizona Project will likely have to add additional delivery capacity to its current facilities in order to bring all or part of the additional supplies to its three-county service area.
- These additional supplies will be more expensive than the Central Arizona Project's current CAP water supplies.

- The total cost will include not only the capital costs required to add additional delivery capacity to CAP's existing infrastructure but also the water-right acquisition cost and the power (O&M) cost to deliver the supply. The cost of the power will likely be higher since non-subsidized sources will likely be relied upon.
- The capital and O&M costs will likely be at a "postage stamp" rate which means all customers will pay the same unit cost regardless of how far or near they are to the new sources of supply. However, the "ADD Water" postage stamp rate will likely be higher than the rate assigned for CAP's current supplies. The postage stamp rate benefits water users in the Tucson AMA since they are farther from the water supply sources and at a higher elevation. With regard to the latter, this means that all ADD water users in the three-county area would help pay the expensive lift charges required to serve the Tucson AMA.
- All ADD Water supplies available at a given time will likely be pooled (blended) together which means it will not be possible for a given water user to pick one source of supply over another. This situation is analogous to electric power distribution where the user would use the power that is provided through the power grid network regardless of source. Similarly, under a pooled/blended ADD Water supply, the user would not be able to choose the type of supply to be delivered.
- It is likely that the additional water supply will be made available in discrete batches over time. The timing of batch availability may still require interested entities to purchase or reserve allotments of supply well in advance of the actual need. Since Tucson Water has extensive underground storage facilities in Avra Valley and the Tucson basin, it has the ability to purchase and store water in the local regional aquifers well in advance of its actual need. Notwithstanding, the first wet-water availability of ADD Water supplies may be one or more decades out in time.
- It is likely that changes will have to be made in state statutes to accommodate the ADD Water program; this may prove challenging given the many potentially contentious water supply issues within the State. Local water providers and users are coordinating their efforts in the ADD Water process through the Southern Arizona Water Users Association. This coordinated action will minimize competition among water users in the Tucson AMA and will help them to jointly advocate their common interests.
- There will also likely be a need to acquire federal authorization to use CAP-related infrastructure to convey "non-project" water to the three-county area.

As the ADD Water stakeholder process continues to evolve, even the most general ideas and concepts currently under discussion are subject to change. Stakeholders have a strong interest in seeing that the process succeeds since ADD Water holds the best opportunity to bringing in additional supplies to Maricopa, Pinal, and Pima Counties in a timely manner.

Recommendations

Planning to acquire additional supplies is but one part of a larger water-resource management strategy which includes Maricopa, Pinal, and Pima Counties. Tucson Water and all of the large water providers in the Central Arizona Project's three-county service area now depend on the

Colorado River for part if not all of their renewable potable supplies. This is also true for the other large urban areas which rely on the Colorado River for supply such as Los Angeles, San Diego, Las Vegas, and Denver. The need for water users to acquire additional water resources and ensure supply reliability of existing available supplies is leading to greater regional interdependence—always fertile ground for high-stakes inter-state conflict as well as creative cooperation.

At this time, the ADD Water process is looking for in-state opportunities to develop additional supplies through a creative, collaborative process in order to minimize intra-state conflict and maximize resource availability. Several recommendations are provided below which can help frame the issue of acquiring additional supplies and its place within the overall planning process.

1. As the ADD Water stakeholders' process proceeds, local water providers and users should continue to coordinate their activities through the Southern Arizona Water Users' Association in order to maximize opportunities to acquire ADD Water Supplies, to explore options to finance these additional supplies when they become available, and to collectively seek the necessary statutory changes that would benefit local water providers and water users in the Tucson AMA.

2. Tucson Water should take the necessary steps to have additional, more reliable water resources on hand well before 2025 to reinforce and buttress its CAP water allocation—a supply that will be vulnerable in times of severe shortage on the Colorado River. Such action would ensure the Utility will always have sufficient resources on hand to meet the supply needs of its customers.

3. The acquisition of additional water resources should emphasize reinforcing existing renewable supplies that are most vulnerable to shortage as well as the need to obtain additional supplies to support infill and reinvestment within the City of Tucson and for growth in the still undeveloped areas of Tucson Water's Obligated Service Area.

4. Tucson Water and other CAP-dependent water users in the Tucson AMA should continue to evaluate vulnerabilities of currently available renewable supplies and the associated supply reliability issues that will be caused by long-term drought and climate change.

5.

The City of Tucson, Pima County, and the Southern Arizona Water Users' Association should work with the Secretary of Interior to explore win-win opportunities to achieve full recharge credit of the SAWRSA effluent. This would help to maintain the viability of riparian habitat in the Santa Cruz River and would satisfy the Secretary's need to accrue more recharge credits to meet the federal SAWRSA obligation.

6. In conjunction with the above, the City and the County should coordinate their respective potential needs to acquire SAWRSA effluent to meet their respective municipal supply and environmental enhancement requirements.

7.

Tucson Water and Pima County Wastewater should continue to assess the potential demand management benefits as well as the adverse consequences of expanded gray water use within their respective service areas. This should include continued assessment of when gray water use should be encouraged and detailed evaluation of the costs and methods that the City and County could potentially undertake to increase gray water use where it is appropriate.

8. Tucson Water and Pima County will continue to evaluate opportunities to expand reclaimed water and remediated groundwater use to meet both municipal and environmental-enhancement supply needs.

9. The City of Tucson and Pima County will continue encouraging rainwater harvesting on both residential and commercial properties. The biggest economic driver for encouraging rainwater harvesting may be to avoid and/or delay the high costs associated with stormwater management as opposed to such costs associated with future water resource acquisitions.

10. Tucson Water and Pima County Wastewater should continue to jointly plan for the acquisition of additional supplies to maximize shared system efficiencies and to achieve their respective sustainability goals. These goals should collectively take into account social, economic, and environmental factors to ensure that all costs and benefits are taken into account.

11. The IGA for the Conservation Effluent Pool, which will annually provide up to 10,000 AF of effluent for additional environmental enhancements, should be finalized and brought before the City's Mayor & Council and Pima County's Board of Supervisors as soon as is practical.

12. In Phase III of this study, other local jurisdictions should be encouraged to participate so that their water resource and wastewater treatment needs can be taken into account as part of an integrated regional planning discussion.

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**CITY OF TUCSON and PIMA COUNTY
ADDITIONAL WATER RESOURCES TECHNICAL PAPER**

**WATER and WASTEWATER INFRASTRUCTURE,
SUPPLY, AND PLANNING STUDY
PHASE II**

September 8, 2009

As part of the scope for the Joint City of Tucson/Pima County Water and Wastewater Infrastructure Supply and Planning Study, the City and County were asked to review how regional collaboration can potentially facilitate securing additional renewable water resources as befits their respective missions and to discuss what could be done to ensure that the long-term future water supply is not acquired at the expense of our current residents or the environment.

Under Phase II of this multi-phase study, the focus is solely on the need for additional supplies for the City of Tucson Water Department (henceforth Tucson Water or the Utility) and unincorporated Pima County (henceforth Pima County or the County). It is assumed that the discussion will be expanded to other water providers in the region under Phase III. As a result, the scope of this paper addresses the following:

1. An overview of existing, currently available water resources held by Tucson Water and Pima County for municipal supply and for environmental/riparian enhancement;
2. A review of timeframes in which additional supplies may be respectively needed by Tucson Water and Pima County for municipal supply reliability, for future increases in water demand due to growth, and for future riparian enhancements;
3. A review of potential sources of additional supply for both municipal uses and environmental enhancement;
4. An overview of the Central Arizona Project's *ADD Water Program* which is currently under development; and
5. Recommendations.

1. Overview of Currently Available Water Resources

There is common confusion about the distinction between an available water resource and a water supply. For this paper, the former refers to Tucson Water's and the County's current legal entitlement to a given source water which may or may not have infrastructure currently in place to fully utilize it. A water supply, on the other hand, refers only to those water resources that can be physically accessed by existing water

infrastructure. For Tucson Water, that infrastructure consists of all facilities which support its potable and reclaimed water systems. For Pima County, that infrastructure constitutes all of its facilities that access its water resources for environmental enhancements and other designated non-potable uses. The set of available water resources is always larger than the corresponding set of accessible water supplies.

In Phase I of the Joint City of Tucson/Pima County Water and Wastewater Infrastructure Supply and Planning Study, an inventory was developed which summarized the currently available water resources of the City of Tucson/Tucson Water, Pima County, and certain water providers who elected to respond to the solicitation to participate; this inventory is available and can be accessed on line at http://www.tucsonpimawaterstudy.com/Reports/FinalReport/Vol3/Water_Resource_Inventory.pdf. An excerpt of the inventory showing Tucson Water's and the County's currently available water resources as of 2007 is provided in the Appendix.

The tabulated data in the Appendix serve as the baseline of water resources that are currently available to Tucson Water and to Pima County. Review of these data indicates that Tucson Water has an extensive and diverse water-resources portfolio which includes its annual surface (CAP) water allocation, an assortment of groundwater water rights and extinguishment credits, the City's effluent entitlement, and the City's CAGR D contract which could be met by the CAGR D with deliveries of additional CAP water, groundwater, and/or effluent. Given that Tucson Water's primary mission is municipal supply, its resources are first directed to meet the supply needs of municipal potable and non-potable uses and secondarily to environmental enhancements. For more detailed information on the water resources available to Tucson Water, refer to the Utility's *2008 Update to Water Plan: 2000-2050* (Section 4) which can be accessed on line at <http://www.tucsonaz.gov/water/longrange.htm>.

Pima County has a more limited water-resources portfolio which includes surface water rights, groundwater rights, and a municipal effluent entitlement. Since Pima County is not a municipal potable water provider, its resources are primarily directed to supporting environmental/riparian enhancements and its turf irrigation needs.

Some of these available resources can serve as annually sustainable sources of supply while others are finite and once used are no longer available for future supply. There are also those which are produced each year through the hydrologic cycle but which are not sustainable since their full annual availability is vulnerable to shortage.

2. When Tucson Water and Pima County Will Need Additional Water Resources

Tucson Water will require additional water resources in order to increase the reliability of existing available resources and to serve the unmet needs of infill and reinvestment in the Utility's existing service area as well as the needs of the still undeveloped areas within the Utility's Obligated Service Area. Pima County will also require additional water

resources to meet the needs of proposed environmental enhancements that can not be met by its currently available supplies.

Ensuring Resource/Supply Reliability

Resource reliability refers to the need to ensure adequate resources are still available to meet already committed needs in times of shortage. The shortage could be caused by planned or unplanned system infrastructure outages (such as in the CAP delivery system which originates at Lake Havasu) or to possibly longer-term shortages in the CAP supply due to extensive drought in the Colorado River Watershed. Infrastructure outages tend to be of shorter duration since they tend to be quickly remedied. In addition, Tucson Water is well positioned with its highly flexible recharge-and-recovery facilities to needs of its customers—this flexibility provides the Utility with added capacity to adapt to changing circumstances.

Shortages associated with reduced access to the City's full CAP allocation would prove more challenging if they were longer term in duration. Tucson Water currently stores unused portions of its current CAP allocation in its recharge facilities in the local Avra Valley and Tucson basin aquifers; this stored water will be utilized in times of future need. In addition, the Arizona Water Banking Authority is charged with "firming" the City's annual CAP allocation and is also storing CAP water in both the Avra Valley and Tucson basin aquifers where they can be recovered in times of shortage to meet the needs of Tucson Water customers.

To ensure that there is continuity of supply in times of longer term shortages, Tucson Water will seek to acquire additional resources to help reinforce and buttress currently available ones that will be subject to shortage. In other words, additional more reliable resources will be needed to replace those whose access could be reduced due to shortage. The City's CAP water allocation is the currently available resource most subject to shortage. Current worst-case projections by the Central Arizona Project indicate that municipal water providers with CAP subcontracts (like Tucson Water, the City of Phoenix, and others) in Maricopa, Pinal, and Pima Counties may be subject to shortage sometime after 2025 even though a shortage declaration could potentially be made by the U.S. Secretary of Interior as soon as 2015.

The reason why Tucson Water (and other municipal water providers with M&I CAP subcontracts in the three-county area) will not be impacted immediately upon such a declaration by the Secretary is due to the fact that they have higher priority CAP entitlements. Those who have lower priority CAP contractual agreements or who depend on excess supplies (surplus supplies that are currently not fully utilized by higher priority CAP contract and subcontract holders) will be shorted first. However, if future shortages on the Colorado River are severe enough, even the higher priority CAP M&I water users such as Tucson Water will eventually be impacted. For more details regarding the Central Arizona Project's hierarchical water priority structure, refer to the Phase I Report which can be accessed on line at http://www.tucsonpimawaterstudy.com/Reports/Phase1Final/Chapter2Final_5.09.pdf.

Given the certainty of future shortages, Tucson Water is seeking to have additional, more reliable water resources on hand well before 2025 to reinforce and buttress its most vulnerable water resources. Such action will ensure the Utility has sufficient renewable resources on hand to meet the supply needs of its customers when the time arises.

Ensuring Resource Availability for Infill, Revitalization, and Development in the Utility’s Obligated Service Area

Review of Tucson Water’s 2008 Update to Water Plan: 2000-2050 indicates that with future deliveries limited solely to the Utility’s Obligated Service Area and by implementing additional conservation measures (Scenario A), Tucson Water would exceed its currently available renewable water resources (excluding the unused portion of its effluent entitlement) by about 2032. This is graphically shown on Figure 1.

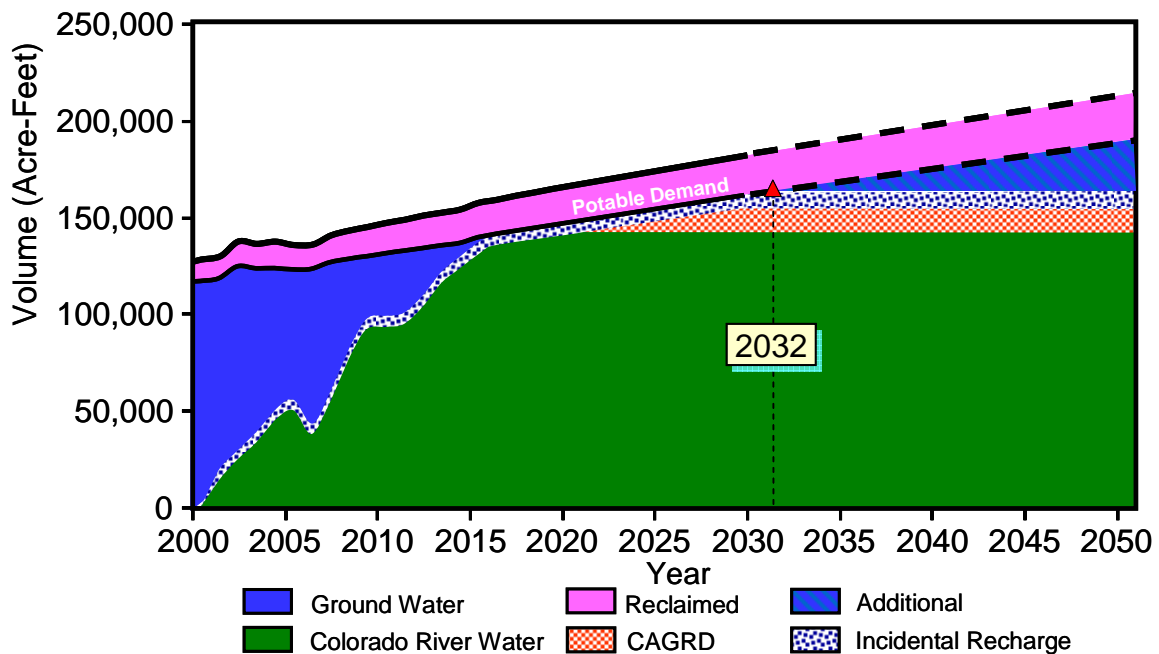


Figure 1: Tucson Water’s Projected Water Demand and Renewable Water-Resource Utilization Plan.

This resource-utilization projection was based on a set of planning assumptions which at the time were considered optimistic. However, with the continued reduction in total potable water use, a marked drop in per capita potable water usage, and a reduction in the rate of growth due in part to the current economic downturn, the onset of additional supply needs shown in the Scenario A projection may now be considered conservative. Assuming that per capita potable water usage continues to remain relatively low, it is likely that additional resources will not be needed for infill and reinvestment within the City as well as for growth in the currently undeveloped areas within the Utility’s Obligated Service Area until well after 2040. If more aggressive conservation

programming is implemented and depending on growth and possible population build-out scenarios, it is possible that Tucson Water's future water demand will not exceed the City's currently available renewable resources until after 2050. More compact development forms and higher development densities use less water per capita, and they can prove more efficient and less expensive to serve in terms of capital investment and operations. However, a caveat is in order when making such projections.

As noted in Tucson Water's *2008 Update to Water Plan: 2000-2050*, if the Utility's currently available renewable water resources are committed to growth areas outside the jurisdictional limits of the City and the Utility's Obligated Service Area, then the need for additional supplies to meet the needs for growth within the City will occur earlier in time. It is also possible that the City's own water supply needs may not be fully met in the future due to 1) the over-extension of its renewable water resources to areas outside of the City, and 2) the limited availability and/or high cost of acquiring additional supplies. What is certain is that additional resources will be aggressively sought after by many other water providers, developers, and other water users in Maricopa, Pinal, and Pima Counties. There may also be fierce competition for these same resources by water users and growth interests in areas located outside of the Central Arizona Project's service area. The Central Arizona Project's service area is shown in Figure 2.

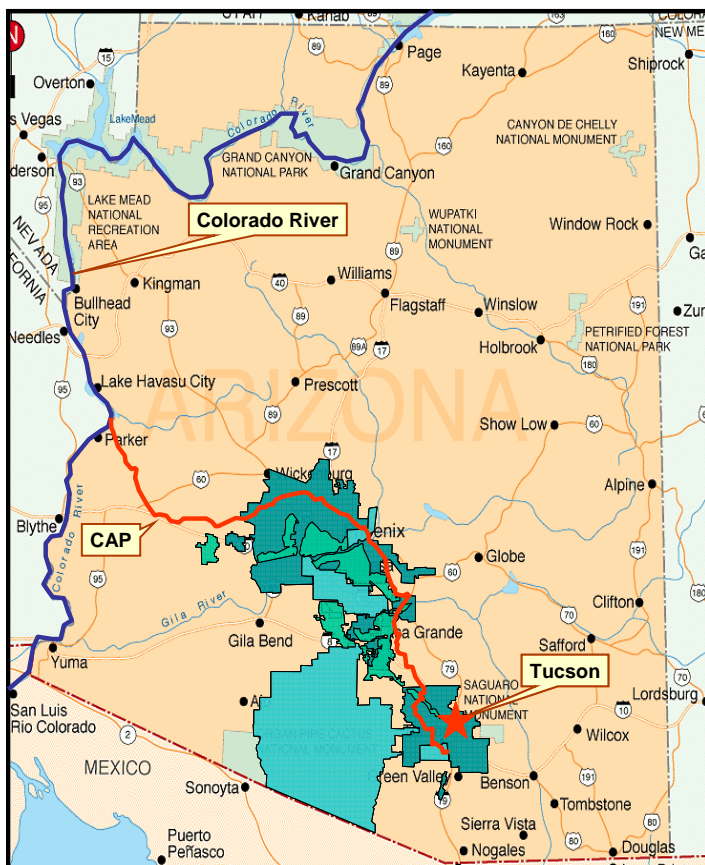


Figure 2: The Central Arizona Project's Service Area

Ensuring Resource Availability for Environmental Needs

While development has resulted in regional benefits, it has also changed the natural environment along the riparian corridors and in the surrounding desert. One of Pima County's primary missions is restoring and enhancing local environments in specified areas while the City encourages reclaimed reuse and riparian enhancement in concert with its management of its available water resources.

In the *Water for the Environment* technical paper recently completed under Phase 2 of this joint City-County study, environmental restoration, enhancement, and preservation in the greater Tucson area is important for a number of reasons including the community's general quality of life and its

concomitant economic benefits. Such environmental efforts generally require providing seasonal water supply or supplemental water for plant establishment or in times of extended drought. This may entail acquiring and reserving additional water resources to support such efforts. This will require considerable coordination because there will also be competing demand for any additional water that might be locally acquired.

In the *Water for the Environment* technical paper, potential environmental restoration and enhancement projects were identified and each would require some form of water supply. In the Santa Cruz River alone, it was estimated that about 40,000 AF will annually be required on a continuous basis to maintain the existing riparian habitat between Roger Road and the County line in Avra Valley. However, there currently is no water resource dedicated and reserved for this purpose. All the effluent currently discharged to the Santa Cruz River channel is “owned” by many parties and could potentially be diverted by these parties to other uses which can include potable use, expanded reclaimed water reuse, aquifer augmentation/water banking for supply reliability, and for potential environmental enhancements.

The need to acquire and dedicate locally available or importable water resources to help meet environmental supply needs will be one of the challenges that lie ahead. Given the many needs and interests vying to obtain supply for future growth or to buttress currently available resources to ensure their reliability, the competition may be fierce. Nonetheless, there may be opportunity to acquire locally available supplies for environmental enhancement efforts through purchase or lease, or incentives may be developed which would provide multi-benefit resource development/environmental opportunities for specific supply sources.

3. Review of Potential Sources of Additional Supply

Potential sources of supply would either have to be imported into the Tucson Active Management Area (AMA) using the CAP Aqueduct or they would be acquired from local sources. The former would include accessing additional CAP water, non-CAP Colorado River water, and/or groundwater pumped from other groundwater basins in Arizona and imported into the Tucson AMA.

Acquiring additional locally-based water resources could potentially include the unused municipal effluent entitlements or storage credits of other local water providers in the Tucson AMA. Residential gray water and rainwater would also be potentially available sources of supply that could be further developed locally.

Potentially Available Central Arizona Project Supplies

There are two potential sources of additional CAP water supplies and these include Excess CAP Water and potential Indian CAP water leases.

Excess CAP Water Supplies

There are currently available in the short to mid term excess CAP water supplies of various types. In 2007 and 2008, 1,093,772 AF and 889,191 AF of excess CAP water were respectively delivered for use in the three-county area. After 2030, there may greatly reduced or not any excess CAP water supplies available for three reasons. First, CAP contractors and subcontractors are expected to take their full annual allocations thus reducing the size of the overall excess water pool over time.

Second, in response to the Arizona Water Settlement Agreement, a total of 154,569 AF per year of Non-Indian Agricultural priority water was conditionally relinquished by non-Indian agricultural subcontractors. Of this total, 87,269 AF per year will become available for future reallocation to M&I water users and this volume could be an additional source of CAP supply for Tucson Water and other water providers in the three-county area. However, this reallocated water will retain its lower priority which means it will remain more vulnerable to shortage than the CAP's M&I allocations.

Third, and related to the above, Excess CAP Water will be the first of the CAP supplies to be shorted should water levels in Lake Mead drop below the threshold elevation of 1,075 feet. Of this overall lower priority pool, Non-Indian Agriculture Excess Water has the highest priority through 2030 and would therefore be less vulnerable to shortage than the other Excess Water supplies.

For the above reasons, excess CAP supplies will be considered less reliable sources in the near to mid terms and will likely not be significantly available in the longer term. Those water users who rely on Excess Water for their current supply needs should consider acquiring more reliable replacement supplies to offset their anticipated reduced (and unguaranteed) availability in the longer term.

Leasing Contracted Indian CAP Water

There is also opportunity to lease CAP water supplies from Indian tribes who have high priority CAP allocations (on par with the high priority of the City of Tucson's M&I CAP allocation). Any tribe with a CAP allocation can make lease arrangements with interested parties who are located in the three-county CAP service area. Some of the tribes have already made long-term water leases to non-Indian water interests and it is possible that additional leases can be negotiated in the future.

Long-term Indian lease arrangements would be attractive since they would be less vulnerable to shortage than other lower-priority CAP supply pools such as Excess CAP Water. Nonetheless, Indian leases would still be subject to shortage like the M&I CAP allocations. This means that the long-term reliability of such supplies is uncertain.

The Indian CAP contract entitlements total 555,806 AF per year and only a relatively small portion of this water is currently being used by the tribes which means the unused entitlement is available as Excess Water. In 2007 and 2008, 116,877 AF (21% of total

available) and 145,836 AF (26%) of Indian allocated CAP water was delivered to Indian contract holders. If this delivery trend to Indian contract holders were to continue into the long term and assuming that these contract holders would not take more than 30% of their collective allocations, this suggests that about 390,000 AF might potentially be available for lease in the future. However, such assumptions are not realistic and it is expected that Indian contract holders will increase their own use of their entitlements over time. This expected outcome would make less CAP water potentially available for longer-term lease. In addition, the Indian tribes have not expressed any interest in considering additional leasing arrangements in the three-county area.

Other Potential Imported Sources of Additional Supply

There are also potential sources of additional supply that are not considered CAP (i.e. “project”) water. The primary source of information about non-CAP project water resources that could be imported into the Tucson, Pinal, and Phoenix AMAs is the *Central Arizona Groundwater Replenishment District Plan of Operation* (Chapter 4.0) which was issued in 2004. The entire document is available for review on line at the CAGRDR web site at <http://www.cagrdr.com/includes/media/docs/submitted-plan.pdf>. According to this preliminary assessment, the main sources of additional imported supply that could be potentially available to the three-county area would be Colorado River water that is not currently allocated to the CAP Project and importable groundwater.

“Main-Stem” Colorado River Water

Arizona has an annual right to 2.8 million acre-feet (AF) of Colorado River water. Of this total, the CAP Project has a contractual right of about 1.5 million AF per year. The 1.3 million AF per year remaining is commonly called “main stem”, “on-river”, or “non-project” Colorado River water. Main-stem contract holders pump directly from the river and therefore do not depend on the CAP Project for supply.

A significant portion of the main-stem Colorado River water users include Indian tribes and non-Indian irrigators. Most if not almost all hold contracts which have a higher priority than CAP’s Colorado River contract; in other words, these potential on-river supplies would be less vulnerable to shortage. In fact, they would not be subject to any shortage until after all of the CAP’s 1.5 million AF of annual Colorado River water supplies have been cut. Because these potential supply sources have a higher reliability than CAP supplies, they are particularly attractive to those concerned about potential resource vulnerability due to extended drought, climate variability, and climate change in the Colorado River Watershed. According to the CAGRDR, up to 318,000 AF of main-stem Colorado River water could potentially be acquired and annually delivered to the three-county area.

The CAGRDR has also noted that transfer of high priority main-stem Colorado River water (for use in the three-county area *via* the CAP Project) would have to contend with significant complications and uncertainties. For instance, the *CAGRDR Plan of Operation*

stated that “[a]ny lease and transfer agreement with the Indian contractors’ water will likely require congressional approval in addition to approval from the tribal government and the Secretary of Interior. Acquisition of water supplies from non-Indian irrigators through land purchase, lease, fallowing, forbearance and/or conservation arrangements will require compliance with applicable state and federal regulations.” In addition, the CAGR D has also noted that third party impacts must also be addressed before main-stem Colorado River water could be made available for conveyance through the CAP Project.

Imported Groundwater

Groundwater from selected groundwater basins could potentially be pumped and conveyed to the three-county area. These basins include the Butler Valley, McMullen Valley, and the Harquahala Valley and they are shown on Figure 3. Relative to CAP M&I allocations, imported groundwater would be less vulnerable to shortage and hence could potentially serve as a highly reliable source of supply.

The *CAGR D Plan of Operation* noted, however, that importing “groundwater from any of these basins will require compliance with a number of statutory restrictions and limitations, as well as negotiated agreements with the owners of existing lands to which groundwater rights are appurtenant.” According to the CAGR D, up to 181,000 AF of groundwater could potentially be obtained and annually conveyed to the three-county area via the CAP Project.

There is another category of groundwater which would be considered “importable” to the Tucson and Pinal AMAs but which is potentially available within the Phoenix AMA. This category refers to the large volumes of brackish (salty) groundwater which occurs within the large regional aquifer in the Phoenix AMA. It is commonly assumed that this volume is very large but its potential annual availability for use is unknown at this time; therefore, it is not quantitatively estimated in this paper. Some if

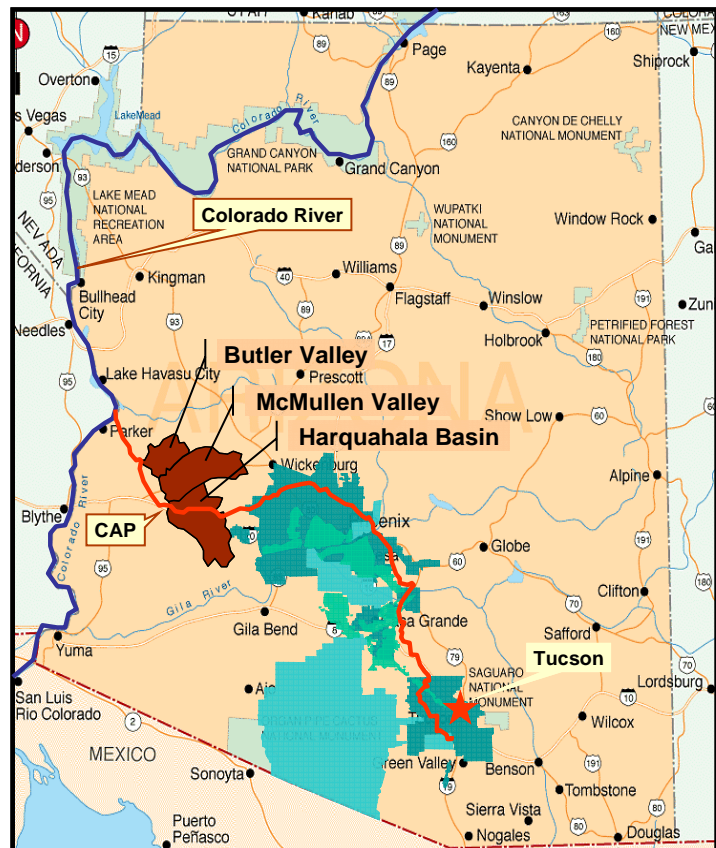


Figure 3: Locations of the Butler, McMullen, and Harquahala Valleys and Their Proximity to the Central Arizona Project Canal.

not all of this groundwater could be used, after expensive enhanced treatment has been applied, within the Phoenix AMA. However, there are legal prohibitions against the Central Arizona Project (and therefore the CAGR) from pumping any groundwater and delivering it to water users in an AMA where it already has replenishment obligations. There may also be issues with using CAP infrastructure to convey groundwater from one AMA for use in another. Statutory changes may be required to make such transfers possible. Finally, there may also be an interest in “exchanging” some portion of the treated brackish groundwater for another source water which can be legally exported out of the Phoenix AMA and delivered to the Pinal and Tucson AMAs *via* the Central Arizona Project.

Imported Desalinated Seawater

At the Arizona Investment Council’s recent conference titled *Meeting Arizona’s Water Needs Today & Tomorrow*, Herb Gunther, the Director of the Arizona Department of Water Resources, stated that ocean desalination was the ultimate solution to the State’s water resources needs. However, this source of supply will likely not be in the “next bucket” given its many complicating legal, technical, economic, and environmental challenges.

As noted by Mr. Gunther, the use of desalinated seawater for supply does not necessarily mean that seawater would be treated at an enhanced treatment plant located on a coast and that the product water would be delivered by a dedicated pipeline hundreds of miles long and thousands of feet uphill to urban areas within Arizona, California, or Nevada. It is conceptually possible and perhaps more feasible in the mid to longer term for large urban areas in these states to collectively contribute funds to build and operate a desalinated treatment plant which might be located, for instance, on the California coast. The product water from the plant might be used by Californian communities while a portion of California’s annual Colorado River water allocation (which totals 6.4 million AF) might be diverted from Lake Havasu to the three-county area via the Central Arizona Project. A more complicated variation of the same theme would be to enter into international agreements with Mexico whereby the large urban areas in these states might build and operate desal facilities in the Sea of Cortez and the product water would be distributed to nearby Mexican water users. In exchange, a portion of Mexico’s annual Colorado River water allocation (totaling 1.5 million AF) could be diverted to the three-county area again via the Central Arizona Project. Such water exchanges might be more feasible in the mid to long term but further out in the future, pipelines bringing desalinated seawater from a coast to the three-county area may be potentially feasible. However, an important caveat is in order whenever such statements are expressed.

At this point in time, all such ideas are at best conceptual and some might even say highly speculative, impractical, or even undesirable for a host of reasons. Such water supply augmentation projects would be hugely expensive and they would be fraught with daunting economic, environmental and technical issues—perhaps even international ones as well. Conversely, if the need is great enough and there is a desire

to address the many complicated issues as well as a willingness to pay the high costs, it may be possible for desalinated seawater to be a direct source of supply in the more distant future.

Summary of Potentially Importable Source Waters

A summary of potential main-stem Colorado River water and importable groundwater supplies which could be practically conveyed into the three-county area is shown in Table 1. The annual volumetric estimates shown below are preliminary, and they will

Potential Importable Supply/Resource Type	Annual Volume Potentially Acquirable (AF/yr)	Priority Compared to High-Priority CAP M&I Subcontracts	Requires Use of Excess CAP Aqueduct Capacity and/or Additional Capacity	Potential Term of Supply
Main-Stem Colorado River Water	318,000	Mostly Higher	Yes	Short & Long
Imported Groundwater	181,000*	Higher	Yes	Long
TOTAL	499,000*	-	-	-

* Does not include the potential for utilizing brackish groundwater located in the Phoenix AMA or desalinated seawater be it by exchange or direct use.

Table 1: Summary of Non-Project Supplies which can be potentially imported through the CAP Aqueduct System (modified from the *CAGR Plan of Operation*).

likely be further refined by the Central Arizona Project and others in the near term. What is certain is that acquiring and conveying additional “importable” supplies will be more expensive than existing CAP (“project”) supplies since more CAP aqueduct capacity will have to be built and non-subsidized power may be required to deliver the “non-project” supplies shown on Table 1.

As alluded to when discussing the potential use of brackish groundwater and possibly even the desalination of seawater, water-resource exchanges of various types could become more common in the future as water-resources and supply planning becomes increasingly integrated within the three-county area and between the Lower Basin States. This integration will afford win-win “resource-exchange” opportunities for large water providers and water users within the three-county area analogous to already existing inter-state agreements made between Arizona, California, and Nevada. Such win-win opportunities could even have an international dimension given Mexico’s own interests in Colorado River water and its associated water-resource issues.

Potential Local Sources of Additional Supply

For municipal water supply, the potential local sources of additional supply would be those that are located within the Tucson AMA. Such potential supplies for municipal use would include those that are currently available but not significantly utilized or those that may be generated locally in the future. With regard to Tucson Water, they would be those which may be potentially available within its Obligated Service Area and in external areas where the City has land holdings and water rights within the Tucson AMA. For the purposes of this paper, these potential local sources include locally generated municipal effluent entitlements other than the City's and County's, the Conservation Effluent Pool, remediated water produced via environmental mitigation projects, gray water, and rainwater.

There may also be opportunities to acquire additional surface water or groundwater resources for environmental enhancement projects located within the bounds of unincorporated Pima County but outside the Tucson AMA. Potential additional supplies could be acquired by Pima County for environmental/riparian preservation and/or restoration outside of the Tucson AMA.

Locally-Generated Effluent as Additional Supply Sources

In other reports prepared under Phase 1 and Phase 2 of the Joint City of Tucson/Pima County Water and Wastewater Infrastructure Supply and Planning Study, there has been much discussion regarding the City's and the County's current effluent entitlements. The Phase 1 information can be reviewed on line at http://www.tucsonpimawaterstudy.com/Reports/Phase1Final/Chapter2Final_5.09.pdf and in the Phase 2 reclaimed water report at http://www.tucsonpimawaterstudy.com/Reports/Phase2/Reclaimed_Technical_Report.pdf.

Review of the tabulated data in the Appendix of this report indicates that the City's and the County's effluent entitlements in 2007 were 31,055 AF and 8,349 AF, respectively. These respective annual volumes will likely increase over time as development occurs within Tucson Water's Obligated Service area and within unincorporated Pima County.

In the years to come, both the City of Tucson and the County plan to fully utilize their respective effluent entitlements. As a water utility, Tucson Water is planning to maximize the wet-water benefit of its renewable effluent resources for use in its Reclaimed Water System and for aquifer augmentation to meet its future resource reliability needs given that access to M&I CAP water will become increasingly vulnerable to shortage after 2025. Joint City and County efforts to increase the number of storage credits which might be accrued in effluent recharge facilities could help reduce supply vulnerabilities; a possible joint City-County effluent recharge project that is currently under discussion could be one such vehicle among many to accomplish this. In general, it will become increasingly important to prepare to mitigate projected shortages associated with extended drought and uncertainties related to longer term climatic variability.

The U.S. Secretary of Interior has legal access to 28,200 AF of locally-generated municipal effluent each year. This annual volume, referred to as the Southern Arizona Water Resource Settlement Act (SAWRSA) effluent entitlement, is managed by the U.S. Bureau of Reclamation on behalf of the Secretary. The SAWRSA effluent was a local contribution to the water rights settlement with the Tohono O'odham and is a resource available to the Secretary to assist in meeting his obligations under the settlement. Currently, it appears that approximately half of the SAWRSA effluent will be utilized to accrue storage credits that will be recovered and delivered to the Tohono O'odham when the Nation's full entitlement of settlement water is not available due to shortage on the Colorado River. The remaining half of the effluent and/or paper-water credits that will be accrued by recharging this water will likely be leased or sold to other parties to generate revenues necessary to meet the Secretary's obligation to pay the delivery costs of the Nation's settlement water. As a result, a significant portion of the SAWRSA effluent and/or associated paper-water credits could become available to the City of Tucson or to other local parties as an additional local potential source for municipal water supply to buttress existing renewable supplies vulnerable to shortage and/or for riparian enhancements. At this time, the Secretary only accrues credit for 50 percent of the effluent that recharges the aquifer along the Santa Cruz River and no credits beyond Trico Road which demarks the furthest downstream extent of the permitted managed in-channel recharge projects. The Secretary may in the future have an incentive to continue discharging the SAWRSA effluent into the Santa Cruz River if statutory provision is made whereby 100 percent of the recharge credits can be accrued along the permitted in-channel reaches.

The Town of Oro Valley is increasingly utilizing its effluent entitlement (2,348 AF in 2007) to meet its local non-potable needs; it is anticipated that the Town will fully utilize its entitlement in the near term. This means that excess or surplus supplies will likely not be available for lease or sale in future years. Metro Water, on the other hand, is currently not directly utilizing its entitlement (2,686 AF) to meet non-potable water demand within its service area; however, it has recovered some of its effluent paper water credits to off-set wet-water pumping in its well field. There may in the future be opportunity to purchase or lease some portion of Metro Water's wet-water effluent. Similarly, Metro Water may potentially have a future interest in selling some of its accrued paper-water storage credits to the City or other local parties in the Tucson AMA.

Finally, there is a local source of effluent to which neither the City nor Pima County are entitlement holders—the *Conservation Effluent Pool*. This 10,000 AF per year effluent supply is dedicated solely for environmental/riparian enhancements within Pima County. However, this supply is currently not being utilized since the proposed Intergovernmental Agreement (IGA) governing its allocation and use is still being negotiated by the City and County. Had the CEP been available in 2007, Tucson Water would have contributed 7,605 AF (76% of total), Pima County would have contributed 1,000 AF (10%), and the Metropolitan Domestic Water Improvement District and the Town of Oro Valley would have respectively each contributed 744 AF (7.4%) and 651

AF (6.6%). After the IGA is authorized by both the City's Mayor and Council and the County's Board of Supervisors, the Conservation Effluent Pool could serve as a significant additional supply source for the City and the County as well as other contributing entities who can meet the use criteria that will be specified in the finalized IGA.

Local Remediated Groundwater

In this context, remediated groundwater refers to groundwater that does not meet drinking water quality but which has been pumped and treated so that it can be used as a wet-water source for supply. For instance, this type of water can be associated with federal or state "superfund" sites where pump-and-treat remedial actions produce a stream of product water which can be used for potable or non-potable purposes. Relatively large annual volumes of remedial groundwater from such projects can be made available for decades depending on the time required to meet the overall action's remedial objectives. At some point in time, however, these projects will eventually come to an end. Hence, these sources of supply tend to be "temporary" in nature; as a result, they may be most appropriate for near to mid term supply needs.

There are other areas where groundwater does not meet drinking water standards for natural or land-use related reasons. For instance, arsenic treatment is currently occurring within the Tucson AMA and the product water is used for potable supply. There may also be localized areas where remediated groundwater can be used in the short term to help establish riparian habitat. Depending on the location of such treatment systems and local aquifer conditions, the resulting supply could be hydrologically sustainable in the short, mid, and longer terms.

Gray Water as an Additional Local Source of Supply

Gray water is a recycled water resource comparable to Tucson Water's reclaimed water system but with important differences. These two water types are derived from different water sources. Gray water is derived from potable water already delivered to customers for their indoor use. After this water is initially used by a home owner, for instance, it is intercepted before it can reach the sewer system, and a resident whose home is suitably equipped can divert it for outdoor water use. Recycled reclaimed water, in contrast, is derived from municipal wastewater effluent that has undergone at least secondary treatment and disinfection in a Pima County wastewater treatment facility. A portion of that water is diverted by Tucson Water to its reclaimed water facilities for additional treatment before it is distributed *via* its Reclaimed Water System to commercial and residential customers for outdoor uses.

Another critical difference is that gray water can be an additional source of potential supply to residents, but its use does not constitute an additional supply to water utilities who are responsible for providing the source waters from which gray water is derived. There are clear benefits to residents who can access this home-generated supply by investing in gray water facilities at their homes. Its use can over time help reduce their

cost for potable water they receive from water utilities and they can get more value or use for the water they purchase.

If implemented on a sufficiently large scale, increased gray water use could benefit water utilities since it could potentially reduce average potable *per capita* water demand and possibly even the rate in which total potable water demand increases over the longer term. In other words, water utilities like Tucson Water generally view gray water use as a demand management measure through which water supplies can be used more efficiently.

To appreciate the potential savings associated with expanded gray water use, the following calculation is provided for purposes of illustration. Assuming that there is a potential water savings of 40% per household from use of gray water systems and that there is a five percent participation rate countywide (or 22,000 homes), the annual water conservation potential would be approximately 4,000 AF. Assuming that all of these homes were located within Tucson Water's service area in 2007, this would have resulted in a three percent reduction in the Utility's potable water deliveries.

Because of the potential benefits, the City of Tucson and Tucson Water are taking steps to encourage gray water use in the following ways:

- Planning to implement an Incentive for Residential Gray Water Systems in 2010;
- Developing demonstration sites, educational materials and workshops for builders, architects, and homeowners to prepare for the new single-family home Gray Water Ordinance; for more information, go to the following City of Tucson web site: <http://www.ci.tucson.az.us/water/docs/graywaterord.pdf>;
- Providing presentations, brochures, resource list and booklets (ADEQ, WaterCasa, Tucson Water Rainwater Harvesting and Gray Water Resource List) at community events, meetings, and water conservation presentations; and
- Providing customer consultation on gray water systems, regulations, and state tax incentives.

Promoting greater gray water use may also have adverse consequences as well. For instance, extensive gray water use could also reduce the amount of revenue generated by water and wastewater utilities; this in turn could require increases in rates to cover baseline utility costs. Another is that the effluent entitlements of the City and County (as well as other urban water providers) may increase more slowly over time if at all. From the City's perspective, this could reduce the potential amount of reclaimed water available to meet the demands of large turf users who help cover system costs since they pay for the recycled supply delivered to them. Similarly, less reclaimed water could also be available for water banking (i.e. efficiently storing resources in the local regional aquifers) to help increase the reliability of the community's water resources during extended droughts and in the longer term to mitigate climate change.

From a wastewater utility's perspective, a large decrease in the amount of water entering into the sewer system due to extensive gray water usage or other indoor conservation measures could have adverse effects. Pima County Regional Wastewater Reclamation Department (RWRD) has determined that there are a number of areas within the existing conveyance system with flat and/or small diameter sewers that have not been designed to handle lower flows. Implementation of gray water systems in these areas may require flushing of sewer lines with potable water supplies thus offsetting the potential water savings from use of gray water. Outside of such areas, RWRD fully supports use of gray water programs.

Further study and analysis is needed on a number of fronts. First, RWRD is currently evaluating its sewer design standards which may be modified to accommodate lower flows that will result from gray water systems. The City of Tucson is also modifying their design standards for gray water systems. The City of Tucson and Pima County should coordinate their respective standards to ensure consistency. When planning sewer and wastewater treatment systems, they should be designed to have enough capacity to handle full household flow; this would be the case regardless of whether gray water systems are already installed in order to assure adequate capacity since an individual homeowners may choose not to use gray water. The potential for an increased wastewater "strength" caused by the reduction in dilution by gray water sources will increase treatment costs and therefore the cost of wastewater service. As a result, large-scale plans to expand the implementation of gray water use should include a comprehensive cost-benefit analysis which would take into account all such factors.

Rainwater as an Additional Local Source of Supply

As has been noted in other studies, rainfall is highly variable from year to year. As a result, the reliability of rainfall for an annual or seasonal source of water supply is a function of the timing, intensity and spatial distribution of precipitation throughout the year. The sporadic nature of rainfall requires that proposed uses be adaptable to seasonal rainfall patterns and annual variability both of which are typical of the local climate.

For these and other reasons, water utilities generally tend not to view rainfall as one of their sources of supply which can be delivered in a predictable and hence reliable manner. Instead, water utilities generally view use of rainfall as a demand management measure which can help reduce *per capita* water consumption. Nevertheless, rainfall could be an significant supplemental source of supply for local residents and commercial interests when it is available. Notwithstanding, those who utilize this resource should also be prepared to irrigate using more reliable sources of supply when the availability of precipitation is seasonally and annually limited. This harvested water is best suited to growing native drought-tolerant vegetation that once established thrive under conditions found in Pima County.

A simulation described in Appendix C of the *Phase 2 Stormwater Management* paper showed that prior to development, about 80 percent of the rainfall that falls on a typical

1/5 acre lot infiltrates into the soil, and approximately 20 percent leaves the site as runoff. However, after development, greater impervious surfaces result in about 50 percent of the rainfall leaving the site as runoff. Assuming that all of the water that would otherwise leave the site was harvested and a 5% adoption rate (22,000 homes) of all homes in Pima County, about 2,000 acre-feet of water could be harvested in an average year in Pima County. Assuming that all of these homes were located within Tucson Water's service area in 2007, this would have resulted in only a 1.5 percent reduction in the Utility's potable water deliveries. This simple calculation indicates that rainfall harvesting would not have a significant impact on the community's need for additional water supplies in the future; however, it could have marked implications for stormwater management as noted previously.

In its report titled *Water Efficiency: Water Conservations Program Recommendations for Tucson Water's Future*, the Community Conservation Task Force noted that community-scale water harvesting programs have accrued greater benefits by avoiding high stormwater management costs as opposed to high avoided water supply costs. So there may be multiple potential costs, benefits and beneficiaries and the potential long-term utility of any water harvesting application, especially at the neighborhood scale, should be assessed from a number of perspectives.

Unlike gray water, rainwater is a primary water source which is not dependent upon other imported or local water sources. Therefore, rainwater harvesting causes no significant off-setting consequences for either water or wastewater utilities. There are clear benefits to residents who can access this local resource when it is available because it can help reduce their almost total dependence on increasingly expensive potable and/or reclaimed water for outdoor use. For this reason, the City of Tucson and Tucson Water are taking steps to encourage rainwater harvesting:

- Developing demonstration sites, educational materials and workshops for builders and landscape architects to prepare for the new Commercial Rainwater Harvesting Ordinance and development standards; more information is available on line at <http://www.ci.tucson.az.us/water/docs/rainwaterord.pdf>;
- Providing presentations, brochures, resource lists and booklets (City of Tucson's Stormwater Management, University of Arizona-Cooperative Extension, Tucson Water Rainwater Harvesting and Gray Water Resource List) at community events, meetings, and water conservation presentations;
- Funding and marketing the SmartScape Program's WaterSmart classes on Harvesting Rainwater for Landscape Use and Desert Rain Gardens; and
- Providing customer consultation on rainwater harvesting systems, regulations, and state tax incentives.

Pima County Transportation has also extensive public outreach materials with its Water Harvesting Guidance Manual and its MS4 Stormwater Public Outreach and Education

which are also available through various community events, presentations, and meetings.

Rainwater harvesting is an ancient technology that is becoming increasingly appealing to many in southwestern urban areas. Its immediate appeal is to property owners who have considerable discretion about how best to make it work. Rainwater will likely become an increasingly popular source water which can be used to seasonally supplement currently available supplies.

4. Overview of the Central Arizona Project's ADD Water Program

In its *2006 Strategic Plan*, the Central Arizona Project recognized that long term water demands in Maricopa, Pinal, and Pima Counties are expected to exceed currently available supplies. As a result, the Central Arizona Project created Project Acquisition, Development, and Delivery (ADD) Water in 2007 in order to establish a process to determine when new supplies will need to be acquired and what entities will get access to those supplies. ADD Water assumes that the Central Arizona Project will be the primary entity responsible for acquiring, developing, and delivering the additional water supplies to entities in its three-county service area.

In 2008, the Central Arizona Project initiated a collaborative stakeholder process with the goal being to encourage fair competition and eliminate perceptions of unfair advantage. The current focus of this high-stakes process is to determine how to share and pay for the additional supplies. A range of potential alternatives for sharing and paying for the additional water needed to support the current and future population in the three counties are currently being developed and evaluated. It is anticipated that the stakeholder process will likely be completed in 2010.

Even though the stakeholder process continues to unfold and no final plan is as yet in place, certain planning concepts appear to be crystallizing. These are summarized in the bullets below:

- Central Arizona Project infrastructure will be used to import additional supplies into the three-county area.
- These additional supplies will be acquired primarily by the Central Arizona Project who will serve as the acquisition agent for all three-county parties. This will minimize the need for water entities to independently acquire their own supplies which in turn could cause greater competition and drive up the water acquisition costs for all parties interested in augmenting their water resource portfolios with a limited pool of potential resources.
- Additional supplies will have a reliability equal to but mostly greater than current CAP M&I allocations. This is important since these additional supplies

will in part be needed to reinforce/buttruss CAP's current supplies which are more vulnerable to shortage.

- The Central Arizona Project will likely have to add additional delivery capacity to its current facilities in order to bring all or part of the additional supplies to its three-county service area.
- These additional supplies will be more expensive than the Central Arizona Project's current CAP water supplies.
- The total cost will include not only the capital costs required to add additional delivery capacity to CAP's existing infrastructure but also the water-right acquisition cost and the power (O&M) cost to deliver the supply. The cost of the power will likely be higher since non-subsidized sources will likely be relied upon.
- The capital and O&M costs will likely be at a "postage stamp" rate which means all customers will pay the same unit cost regardless of how far or near they are to the new sources of supply. However, the "ADD Water" postage stamp rate will likely be higher than the rate assigned for CAP's current supplies. The postage stamp rate benefits water users in the Tucson AMA since they are farther from the water supply sources and at a higher elevation. With regard to the latter, this means that all ADD water users in the three-county area would help pay the expensive lift charges required to serve the Tucson AMA.
- All ADD Water supplies available at a given time will likely be pooled (blended) together which means it will not be possible for a given water user to pick one source of supply over another. This situation is analogous to electric power distribution where the user would use the power that is provided through the power grid network regardless of source. Similarly, under a pooled/blended ADD Water supply, the user would not be able to choose the type of supply to be delivered.
- It is likely that the additional water supply will be made available in discrete batches over time. The timing of batch availability may still require interested entities to purchase or reserve allotments of supply well in advance of the actual need. Since Tucson Water has extensive underground storage facilities in Avra Valley and the Tucson basin, it has the ability to purchase and store water in the local regional aquifers well in advance of its actual need. Notwithstanding, the first wet-water availability of ADD Water supplies may be one or more decades out in time.
- It is likely that changes will have to be made in state statutes to accommodate the ADD Water program; this may prove challenging given the many potentially contentious water supply issues within the State. Local water

providers and users are coordinating their efforts in the ADD Water process through the Southern Arizona Water Users Association. This coordinated action will minimize competition among water users in the Tucson AMA and will help them to jointly advocate their common interests.

- There will also likely be a need to acquire federal authorization to use CAP-related infrastructure to convey “non-project” water to the three-county area.

As the ADD Water stakeholder process continues to evolve, even the most general ideas and concepts currently under discussion are subject to change. Stakeholders have a strong interest in seeing that the process succeeds since ADD Water holds the best opportunity to bringing in additional supplies to Maricopa, Pinal, and Pima Counties in a timely manner.

5. Recommendations

Planning to acquire additional supplies is but one part of a larger water-resource management strategy which includes Maricopa, Pinal, and Pima Counties. Tucson Water and all of the large water providers in the Central Arizona Project’s three-county service area now depend on the Colorado River for part if not all of their renewable potable supplies. This is also true for the other large urban areas which rely on the Colorado River for supply such as Los Angeles, San Diego, Las Vegas, and Denver. The need for water users to acquire additional water resources and ensure supply reliability of existing available supplies is leading to greater regional interdependence—always fertile ground for high-stakes inter-state conflict as well as creative cooperation.

At this time, the ADD Water process is looking for in-state opportunities to develop additional supplies through a creative, collaborative process in order to minimize intra-state conflict and maximize resource availability. Several recommendations are provided below which can help frame the issue of acquiring additional supplies and its place within the overall planning process.

1. As the ADD Water stakeholders’ process proceeds, local water providers and users should continue to coordinate their activities through the Southern Arizona Water Users’ Association in order to maximize opportunities to acquire ADD Water Supplies, to explore options to finance these additional supplies when they become available, and to collectively seek the necessary statutory changes that would benefit local water providers and water users in the Tucson AMA.

2. Tucson Water should take the necessary steps to have additional, more reliable water resources on hand well before 2025 to reinforce and buttress its CAP water allocation—a supply that will be vulnerable in times of severe shortage on the Colorado River. Such action would ensure the Utility will always have sufficient resources on hand to meet the supply needs of its customers.

3. The acquisition of additional water resources should emphasize reinforcing existing renewable supplies that are most vulnerable to shortage as well as the need to obtain additional supplies to support infill and reinvestment within the City of Tucson and for growth in the still undeveloped areas of Tucson Water's Obligated Service Area.
4. Tucson Water and other CAP-dependent water users in the Tucson AMA should continue to evaluate vulnerabilities of currently available renewable supplies and the associated supply reliability issues that will be caused by long-term drought and climate change.
5. The City of Tucson, Pima County, and the Southern Arizona Water Users' Association should work with the Secretary of Interior to explore win-win opportunities to achieve full recharge credit of the SAWRSA effluent. This would help to maintain the viability of riparian habitat in the Santa Cruz River and would satisfy the Secretary's need to accrue more recharge credits to meet the federal SAWRSA obligation.
6. In conjunction with the above, the City and the County should coordinate their respective potential needs to acquire SAWRSA effluent to meet their respective municipal supply and environmental enhancement requirements.
7. Tucson Water and Pima County Wastewater should continue to assess the potential demand management benefits as well as the adverse consequences of expanded gray water use within their respective service areas. This should include continued assessment of when gray water use should be encouraged and detailed evaluation of the costs and methods that the City and County could potentially undertake to increase gray water use where it is appropriate.
8. Tucson Water and Pima County will continue to evaluate opportunities to expand reclaimed water and remediated groundwater use to meet both municipal and environmental-enhancement supply needs.
9. The City of Tucson and Pima County will continue encouraging rainwater harvesting on both residential and commercial properties. The biggest economic driver for encouraging rainwater harvesting may be to avoid and/or delay the high costs associated with stormwater management as opposed to such costs associated with future water resource acquisitions.
10. Tucson Water and Pima County Wastewater should continue to jointly plan for the acquisition of additional supplies to maximize shared system efficiencies and to achieve their respective sustainability goals. These goals should collectively take into account social, economic, and environmental factors to ensure that all costs and benefits are taken into account.
11. The IGA for the Conservation Effluent Pool, which will annually provide up to 10,000 AF of effluent for additional environmental enhancements, should be finalized and

brought before the City's Mayor & Council and Pima County's Board of Supervisors as soon as is practical.

12. In Phase III of this study, other local jurisdictions should be encouraged to participate so that their water resource and wastewater treatment needs can be taken into account as part of an integrated regional planning discussion.

Appendix

Summary of Existing and Available Water Resources held by the City of Tucson Water Department & Pima County in 2007

Inventory Items	City of Tucson Water Department	Pima County
1) Municipal Water Provider	YES	NO
1.a) Service Area Population in 2007	~750,000	-----
1.b) Service Area Right Number	56-000001.0000	-----
2) Other than Municipal Provider	-----	Pima County Government & Wastewater Provider
3) Potable Water Deliveries in 2007	123,411.7 AF	0 AF
3) Non-Potable Water Deliveries in 2007	13,026.27 AF	3,683 AF ¹
ASSURED WATER SUPPLY STATUS		
4) Assured Water Supply Designation	YES	NO

4.a) Total Annual Volume in Designation	183,956 AF/yr	-----
4.b) Term of Current Designation	2015	-----
5) Certificate of Assured Water Supply	NO	NO
5.a) Total Annual Volume in Certificate	-----	-----
6) Undesignated Municipal Provider	NO	NO
CAGRD MEMBERSHIP		
7) Member Service Area of CAGRD	YES	NO
7.a) Annual Limit on CAGRD Volume	YES	-----
7.a.1) Limited Annual Volume	12,500 AF/yr	-----
7.a.2) Non-Limited Annual Volume needed by 2035	-----	-----
7. b) Annual CAGRD Volume in Assured Water Supply Designation	12,500 AF/yr	-----
8) Serve Member Lands of CAGRD	NO	NO
8.a) Replenishment Obligation in 2007	-----	-----
GROUNDWATER		
9) Possess Grandfathered Groundwater Rights	YES	YES
9.a) Irrigation Rights	0 AF/yr	3,348 AF/yr
9.b) Type I Rights	37,843.83 AF/yr	2,593 AF/yr
9.b) Type II Rights	9,732.76 AF/yr	994 AF/yr

10) Plan to Extinguish Groundwater Rights	YES	NO
10.a) Maximum Volume of Extinguishment Credits	78,749.38 AF	----
10.b) Planned Extinguishment by What Year	2008	----
10.c) Plan to Pledge Extinguishment Credits to Assured Water Supply	YES	----
11) Allowable Groundwater Account Volume in 2007	~1.3 Million AF	----
12) Future Additions to Allowable Groundwater Account	YES	NO
12.a) Type	ARS 45-463(F) and Unpledged Extinguishment Credits	----
12.a) Year	~2024	----
12.a) Volume	2,502,600.63 AF	----
13) Volume of Incidental Recharge Calculated for 2006	5,830 AF	----
14) Extinguishment Credits in Allowable Groundwater Account	0 AF	----
15) Extinguishment Credits not in Assured Water Supply Designation (Unpledged)	423,851.25 AF	----
16) Utilized Remedial Groundwater in 2007	YES	NO
16.a) Included in Assured Water Supply	YES	----
16.b) Annual Volume in Assured Water Supply	1,189 AF/yr	----
CAP		
17) Central Arizona Project Subcontractor	YES	NO

17.a) Annual CAP Allocation	144,191 AF	-----
18) Contracted to Lease All/Part of a CAP Allocation of Another Party	NO	NO
18.a) Contracted Entity	-----	-----
18.b) Volume Contracted	-----	-----
18.c) Contract Expiration	-----	-----
19) Annual CAP Allocation in Assured Water Supply	135,966 AF/yr	-----
EFFLUENT ENTITLEMENT		
20) Entitlement to Municipal Effluent	YES	YES
20.a) Entitlement Volume in 2007	31,055 AF	8,349 AF ²
21) Possess Effluent Storage Credits in 2007	YES	YES
21.a) Annual Storage Credits	4,851 AF	0 AF
21.b) Long-Term Storage Credits	18,365 AF	2,535 AF ³
22) Effluent Entitlement Volume in Assured Water Supply Designation	15,800 AF/yr	-----
SURFACE WATER RIGHTS		
23) Possess Surface Water Right in Tucson Active Management Area	NO	YES
23.a) Quantity of Annual Right	-----	1,176 AF/yr ⁴
23.b) Right Exercised in 2007	-----	Not Reported
24) Annual Volume of Surface Water Rights in Assured Water Supply	-----	-----

RIGHTS OUTSIDE TUCSON AMA		
25) Possess Grandfathered Groundwater Rights Outside Tucson AMA	NO	YES
25.a) Irrigation Rights	----	160 AF/yr ⁵
25.a) Type I Rights	----	----
25.a) Type II Rights	----	----
26) Possess Surface Water Right Outside Tucson Active Management Area	NO	YES
26.a) Quantity of Annual Right	----	See Footnote ⁶
26.b) Right Exercised in 2007	----	Not Reported

¹ Metro: NRPR 907.1 AF; KERP: 159.3 AF; MHP 319.5 AF; Outlying: 2,297.1 AF (from 2007 Effluent Generation Report, pg 7-9, 11-13)

² Metro: 4,001.9 AF; Outlying: 4,347 AF

³ LSCMRP: 2,351 AF; MHPERP: 184 AF (from the 2007 Effluent Generation Report)

⁴ Total certificated surface water rights per ADWR. 8,002 AF/yr are filed with ADWR but these are not certificated. 62,999 AF/yr Statements of Claimant are Filed with ADWR and subject to the Gila River General Adjudication

⁵ Grandfathered irrigation rights in the Santa Cruz AMA along Sopori Wash.

⁶ Surface water rights in Bingham and Cienega are included in question 23.a above.