

As the present unfolds into the future, change is the only certainty. This reinforces the need for continuous planning to ensure wise water management.

CHAPTER EIGHT

FUTURE ISSUES AND CHALLENGES

The scenario planning process described in Chapters Six and Seven was used to identify the range of possible futures and to develop pathways to realize those futures. Tucson Water analyzed the pathways to identify common elements and decision points within the 50-year planning horizon. This chapter focuses on the issues that will shape the future course of events and the challenges that lie ahead.

The recommended plan will periodically be reassessed and revised as planning assumptions and circumstances change over time. New possible futures will materialize while those currently envisioned may evolve or fade away. Tucson Water will continue to update and improve the planning tools that were developed to support this planning process. These tools will allow the Utility to annually update planning projections and to complete comprehensive revisions in an expeditious manner. Future comprehensive revisions to this plan may be initiated by the following:

- Significant change in PAG's updated, spatially distributed population projections.
- Significant changes in the current or projected availability of water resources.
- Advent of new technologies that could alter costs and/or the technical effectiveness of planning elements.
- Marked changes in the regulatory environment in terms of water-quality and/or water-use requirements.
- Major shifts in the preferences of Tucson Water customers.
- Specific direction provided by the City of Tucson's Mayor and Council.

LEGAL/REGULATORY ISSUES

Complying with federal, state, and local laws and regulations is among the most critical planning priorities of water providers. The legal and regulatory environment is in a constant state of flux as governing statutes and rules undergo continuous revision. Legal and regulatory uncertainties are among the greatest challenges that water providers will have to face in the coming years. More information on the regulatory framework under which the Utility operates appears in Appendix E: *Federal, State, and Local Regulations and Policies*.

Increasing Stringency of Water-Quality Regulations

Water-quality regulations are established and enforced at the federal, state, and local levels to protect the quality of source waters and to ensure the safety of potable and non-potable water systems. Many of the primary drinking-water and aquifer water-quality regulatory requirements have become more stringent over the years. This increasing stringency is partly being driven by recent advances in technology that have greatly improved the ability of laboratories to quantify the presence of substances at increasingly small concentrations. In most cases, potential human health risks posed by the presence of constituents at such low levels of detection have yet to be determined. Further research will be needed to guide regulators in determining which substances require treatment.

There is inherent uncertainty and complexity in balancing the various regulatory requirements with one another. The uncertainty increases when the requirements are moving targets. When one regulatory requirement changes, compliance with other regulations is often affected as well. Changes and additions to existing regulatory rules are currently in progress at the state and federal levels with regard to the Enhanced Surface Water Treatment Rule, the Disinfectants/Disinfection Byproducts Rule, and the Total Coliform Rule. Assuming the trend of more stringent regulation will continue, costly water-quality treatment programs of proven effectiveness may have to be implemented. This trend could also have unintended consequences. Water resources that are currently considered “available” may no longer be utilized unless sufficient funds or practical remedial technologies are in place to address increasing regulatory stringency.

Emerging Contaminants of Concern

Constituents that have recently been detected in water sources may become regulated substances in the future. These constituents include currently unregulated chemical compounds, microbiological organisms, and radiological substances. As new information becomes available through the development of increasingly sensitive analytical tools, concerns are being raised about the potential health risks and the seeming proliferation of these substances.

There are many emerging constituents of potential concern. Among the more prominent are organic wastewater contaminants that include pharmaceuticals and personal care products. These constituents have been detected in surface waters that receive effluent discharges from municipal wastewater treatment plants as well as in ground water downgradient from these

facilities. The potential health risks of these substances at such small concentrations are not known. For regulators and water providers alike, there is considerable uncertainty regarding the significance of analytical data currently being generated. As constituents become regulated substances over time, Tucson Water will comply with these new requirements. This is occurring at a time when water-resource planners across the nation are looking at municipal effluent as an increasingly important source for future potable supply. It is prudent to treat effluent to a higher standard than required to meet regulations if it is utilized for indirect potable supply. An enhanced level of treatment will be necessary to remove any future constituents of concern.

Protection of Endangered Species

Adding to the array of institutional considerations is the issue of protecting the habitats of endangered species. The Endangered Species Act (ESA) of 1973 was passed by Congress “to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.” There are many sections of the ESA that apply to the development of public works projects such as recharge and recovery facilities. Section 10 of the ESA specifies processes for landowners to develop and implement an approved “habitat conservation plan.” Section 7 allows for individual projects to proceed based on case-by-case consultations. These processes enable development of lands inhabited by endangered species under certain conditions. Entities with proposed development projects that are approved by the U.S. Fish and Wildlife Service receive an “incidental take” permit that allows project implementation to proceed.

The City of Tucson has begun work on a habitat conservation plan that will provide a pre-determined path that project planners can use to mitigate potential harm caused to an endangered species. However, these plans may not provide mitigation for species declared as endangered in future years. Such plans may provide Tucson Water with only limited certainty and assurance when adding expensive capital improvements to its supply infrastructure.

Gila River Adjudication and Conflicting Water Rights

The Gila River Adjudication is an ongoing proceeding initiated in Maricopa County Superior Court in 1974 to determine the relative priorities of rights to use surface water in the Gila River System. The Santa Cruz River is in one of the seven major watersheds that are the focus of the Adjudication. Sixteen Native American reservations also are involved. The appropriative allocations at stake are among the most coveted in Arizona. Historically, Tucson Water has relied on ground water as its sole source for municipal supply. The outcome of the Gila River Adjudication may bring some water that was formerly considered ground water within the purview of the Adjudication Court. This could hinder the Utility’s ability to withdraw water from certain well fields in order to protect water users with senior appropriative rights.

PUBLIC ACCEPTANCE OF RENEWABLE SOURCES OF SUPPLY

Public acceptance also shapes water-resource-planning decisions. Water quality must meet or exceed all federal, state, and local standards. The public may also require even stricter discretionary local standards for aesthetic reasons that could require levels of treatment well beyond those specified in regulations.

Meeting Discretionary Water-Quality Standards for Colorado River Water

Aesthetic drinking water-quality standards for TDS, hardness, sulfate, and other constituents are not regulated and are left to the discretion of water providers and the communities they serve. Portions of Tucson Water's service area received directly treated Colorado River water deliveries from 1992 to 1994. Water delivery problems occurred and were traced to the pH level of the new source water. The water reacted with potable distribution system mains and customer plumbing. The water's higher mineral content was not a factor (Malcolm Pirnie, Inc., 1998). Tucson Water returned to ground water as the sole source of supply until these problems were resolved.

Based on the results of studies and public input associated with the *At the Tap Program*, Tucson Water's customers have indicated that a blend of ground water and Colorado River water with a TDS concentration of about 450 mg/L would be aesthetically acceptable to most people as opposed to the 650 mg/L concentration of Colorado River water. Meeting this discretionary standard in the long term means that some form of enhanced treatment would eventually be required at significant expense to Tucson Water customers.

It may not be necessary to incur the added expense of treating Colorado River water to a discretionary potable standard if the mineral content of effluent is reduced via enhanced treatment prior to recharging the aquifer. The subsequently blended water would have a TDS concentration significantly lower than Colorado River water and may satisfy the aesthetic requirements of Tucson Water customers. Because enhanced treatment will have to be utilized for future effluent reuse to augment ground-water supplies, the focus on mineral content management should be addressed in the same treatment process. In this way, only one enhanced treatment plant would be required to meet the water supply needs of Tucson Water customers.

The Community's Acceptance of Effluent as a Source of Supply

The community has supported the use of tertiary-treated effluent (reclaimed water) for non-potable uses since the early 1980s. However, local public acceptance of effluent to supplement the potable supply remains uncertain even though highly treated effluent is being used by several communities in this fashion (Water Environmental Federation, American Water Works Association, 1998). Tucson Water's scenario planning process identified this issue as a critical uncertainty. The extent to which effluent can be more fully utilized in the future will help limit Tucson Water's vulnerability to extended periods of drought on the Colorado River and to limited ground-water availability.

Chlorine vs. Chloramines as Secondary Disinfectants

Chlorine is added to the drinking water supply at well sites, reservoirs, and other facilities to ensure that water in the delivery system remains free of microbiological contamination. Chloramine, an alternative secondary disinfectant, is created when chlorine and ammonia are simultaneously introduced into a water supply. Tucson Water is studying the potential use of chloramine instead of chlorine as a disinfectant. Chloramine may be more appropriate as Tucson Water shifts from reliance on ground water to renewable water supplies. The use of chloramine may require a more complex operating system, new safety requirements, and added monitoring. Tucson Water is currently evaluating the use of each type of disinfectant in its potable systems.

RESOURCE MANAGEMENT ISSUES

Tucson Water has identified a number of water-resource issues whose uncertainties could impact planning decisions in the years ahead. Changes in water chemistry, climatic change, and policy shifts are resource-management issues that are being taken into account.

Managing Salinity

Accumulations of dissolved minerals in water supplies could become an issue if steps are not taken to manage the higher dissolved mineral content in Colorado River water and effluent. Ground water and Colorado River water are currently used in Tucson Water's service area for potable supply. Colorado River water delivered through the Central Arizona Project has an average TDS concentration of 650 mg/L; this is higher than local ground water which averages 280 mg/L. Effluent produced from the use of these potable source waters has a TDS concentration that is about 250 to 300 mg/L greater than the original potable sources (Bureau of Reclamation, 2003; PAG, 1994). Managing the salinity of Colorado River water and effluent will be necessary since the subsequent recycling and blending of these source waters could boost the TDS concentration in water supplies. Tucson Water's recommended plan would manage TDS when effluent is treated for indirect potable use.

Planning for Droughts and Colorado River Water Shortages

A prolonged drought in the Colorado River basin could have a detrimental effect on the statewide availability of Colorado River water and on the City of Tucson's annual Central Arizona Project allocation. A long-term shortage could tax Tucson Water's available but limited ground-water resources. Shortages on the river will eventually occur and will cause Tucson Water as well as other Central Arizona Project water users to rely more heavily on "banked" (stored) Colorado River water, ground-water pumping, and locally generated effluent. If effluent is fully integrated into Tucson Water's portfolio of available water resources, its customers will be less vulnerable to droughts in the Colorado River basin and to shortfalls in the supply of Colorado River water.

Storing and Recovering Colorado River Water for Firming

The Arizona Legislature created the Water Bank in 1996 to store unused portions of Arizona's allocation of Colorado River water to firm (secure) local supplies in times of emergency or shortage. When and where additional water is recharged and stored in the Tucson AMA as well as within the State is the subject of ongoing discussion. It is Tucson Water's position that firming water must be readily recoverable from local recharge facilities with integrated recovery capabilities such as CAVSARP and the proposed SAVSARP project.

The Water Bank has established a goal of storing 810,000 acre-feet of Colorado River water for firming within the Tucson AMA by 2017. The Water Bank has four potential sources of funding to pay for this activity: an *ad valorem* property tax; a portion of ground-water withdrawal fees obtained in the Tucson, Phoenix, and Pinal AMAs; general fund appropriations; and interstate banking activities. However, the Water Bank currently projects only enough funding to store about 600,000 acre-feet in the Tucson AMA by 2017. If the Water Bank does not achieve its goal, the future availability of Colorado River water will be less secure in times of shortage. Tucson Water will continue to partner with the Water Bank to ensure that its originally established firming goal for the Tucson AMA can be achieved.

The Case for Sustainable Ground-Water Pumping

The AWS Program administered by ADWR is intended to ensure that providers and communities limit aquifer overdraft and shift from mining ground water to utilizing renewable water sources for supply. Tucson Water chose to obtain an AWS designation for a number of reasons, one of which was its consistency with the community's goal of long-term sustainability. However, the AWS Program does not currently recognize the existence of annually renewable ground water. Hydrologically, a certain amount of ground water is naturally recharged each year; in addition, a volume of ground-water underflow annually enters into the service area. A conservative estimate of annually renewable ground water that is available for sustainable pumping in Tucson Water's projected service area is about 50,000 acre-feet. The City of Tucson views hydrologically sustainable ground-water pumping as an important source of renewable supply that should be incorporated into ADWR's AWS Program. This approach would replace the "allowable groundwater" portfolio program in the current AWS regulations and would extend indefinitely the time that ground water would be legally available as a resource in the future.

Even without this regulatory change, pumping ground water within the projected service area at or below the hydrologically sustainable rate is the most prudent long-term ground-water management approach. From a wet-water management perspective, sustainable ground-water pumping would ensure that water-level declines would stabilize and that they would even recover in some areas. This in turn would reduce the potential for additional aquifer compaction and associated land subsidence in the metropolitan area.

Conservation Programming as Demand Management

Tucson Water's conservation program has held per capita water usage constant over the past 20 years. A more aggressive conservation program designed to achieve a targeted per capita usage rate will be evaluated by Tucson Water. This assessment should target all sectors of potable water use including residential, commercial, and industrial customers and could include technology-oriented, quantifiable, and possibly mandatory conservation efforts. Conservation programming will require continuing reassessment of its effectiveness to document potential water savings.

Stewardship of the Regional Aquifer

Tucson Water has set a planning goal of managing ground-water withdrawals from the regional aquifer to ensure that this water resource will be available in the long term as a hydrologically sustainable source of supply. An emphasis on aquifer stewardship within the Tucson AMA means that the locations of water storage and recovery should be based on wet-water management strategies. Such efforts will not be successful in a regional context if other ground-water users do not similarly adhere to the same principles of stewardship. Ground-water users within the Tucson AMA must work together to hydrologically balance wet-water withdrawals with natural and artificial recharge. Tucson Water will work with ADWR to promote hydrologically based principles of aquifer stewardship in the Tucson AMA.

JURISDICTIONAL ISSUES

Jurisdictional issues present their own unique set of challenges some of which are intertwined with the future actions of other water providers or users in the region. Examples of these potential issues are discussed below.

Matching Tucson's City Limits with the Projected Service Area

The City of Tucson operates Tucson Water as a municipal utility under charter authority from the State which allows the City to operate the Utility both within and outside the City limits. Tucson Water is subject to the authority of the City of Tucson Mayor and Council and all fees, rates, and charges for water service are subject to its approval. Tucson Water does not provide exclusive service within the City limits and is under no obligation to expand its service area outside the City of Tucson. Within Tucson Water's service area, the Utility is obligated to provide service to the public at reasonable rates and under reasonable conditions.

Tucson Water's system has expanded over the years to areas inside and outside the jurisdictional boundaries of the City of Tucson. This expanded system has allowed for favorable economies of scale and opportunities to make water management decisions of a more regional nature. This expansion has also resulted in a department of the City of Tucson serving customers who live outside the City and who cannot directly shape future policy by voting in City elections. Future City annexations of unincorporated areas served by Tucson Water would give such customers direct input on Mayor and Council deliberations and on the direction the governing body provides to the Utility.

Wheeling Agreements with Other Water Providers

Tucson Water is one of many water providers in the Tucson AMA with an annual allocation of Colorado River water delivered through the Central Arizona Project; however it is the only one currently with direct access to this water source for potable supply. Tucson Water also is the only water provider with a reclaimed water system that treats and delivers tertiary effluent to its customers for non-potable uses. Other water providers in proximity to Tucson Water's service area may not find it economically feasible to build facilities for treatment and delivery of their own allocations of Colorado River water and/or recycled effluent. For instance, the Town of Oro Valley is planning to begin receiving reclaimed water wheeled to its own reclaimed water distribution system through Tucson Water's system in June 2005.

Similarly, Tucson Water could partner with other local water providers by treating and delivering (wheeling) their Central Arizona Project and/or effluent allocations through Tucson Water's distribution systems. Contractual relationships between Tucson Water and other providers would have to be established to formalize responsibilities and commitments among the parties. This would ensure each provider would be able to take full advantage of its available renewable supplies. These relationships should be established so that the Utility can plan and implement wheeling agreements that equitably benefit all interested parties.

The Need for a Regional Water Cooperative

The supply uncertainties that Tucson Water must address are in many ways similar to those of other water providers in the region. A mix of short-term actions and long-term planning will be needed to meet these and other challenges that will undoubtedly surface. The extent to which such issues can be addressed may depend on regional cooperation among water providers.

As water resources become increasingly limited locally and statewide, water providers and other water users will compete for future supplies. Given that the competition will be statewide in scope, local water providers would have greater leverage if they banded together to form a regional water cooperative.

Such a cooperative could also provide for coordinated water management and conservation programs within the region. It could set guidelines for members to act in a unified manner with respect to Colorado River issues such as reallocations of Central Arizona Project water and main stem Colorado River water, the acquisition of other additional sources of supply, implementation of an integrated regional salinity control program, and the wheeling of renewable resources. Despite the potential gains to be had, establishing a regional water cooperative may prove challenging. The long-standing competition between local interests should be replaced with a more collaborative ethic to ensure long-term sustainability in the greater Tucson area. While working with other local water providers to establish a more cooperative water-management approach, the City of Tucson's efforts to pursue additional water resources will proceed. If these efforts are successful, they could benefit all cooperating entities.

BEYOND 2050

Tucson Water currently has access to sufficient water supplies to extend its AWS designation to 2035 and to meet projected annual water demands through 2050. There may also be opportunity to augment existing supplies by acquiring additional water sources in the future. Such “potentially available” sources can range from the likely to what may currently seem improbable. The likely sources could be long-term Central Arizona Project water leases with Native American communities or purchases of high-priority Colorado River water from agricultural interests located along the Colorado River. The currently improbable sources of supply might include the desalinization of sea water, weather modification to increase local precipitation, watershed modification to increase runoff and basin recharge, and of course iceberg harvesting among others. Where the practical end of the spectrum grades into the improbable is not clear and cost may not be a limiting factor if there is a great enough need.

There may be a theoretical limit on the number of people who can sustainably reside in the Tucson area. To expand beyond this limit is to cross the critical threshold from a community growing with sustainable water resources to one that depends on gradual resource depletion. Taking full advantage of all water resources currently available, obtaining access to additional sources of supply, and/or developing a more aggressive conservation program to manage water demand could move that critical threshold further out in time well beyond 2050. Conversely, a decision to ignore any available water resources, such as municipal effluent for indirect potable reuse, could limit future options and bring that threshold closer in time.

Current water demand projections indicate that failure to acquire additional water resources and/or not utilizing effluent in a timely manner means that Tucson Water would have to deplete its finite paper-water allotment of ground-water credits to satisfy near- and mid-term demands. As a result, Tucson Water’s AWS designation could be put in jeopardy in the mid and long terms. By following the recommended plan outlined in Chapter Seven, Tucson Water can establish a foundation for long-term sustainability. For this foundation to be stable beyond 2050, Tucson Water must fully utilize its Central Arizona Project allocation, locally available effluent, and any additional water supplies it can acquire. This also requires responsible use of Tucson Water’s ground-water supply with emphasis on establishing wet-water management and aquifer stewardship as primary operating goals.

Water Plan: 2000-2050 will be updated in the years ahead. As the present unfolds into the future, change is the only certainty. This recognition reinforces the need for continuous planning and wise water management.