

# Water Resources E.I.S. Issue Paper

Sonoran Desert Conservation Plan

2002

Pima County, Arizona  
Board of Supervisors  
Ann Day, District 1  
Dan Eckstrom, District 2  
Sharon Bronson, Chair, District 3  
Raymond J. Carroll, District 4  
Richard Elías, District 5

County Administrator  
Chuck Huckelberry





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# MEMORANDUM

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Date: August 2, 2002

To: The Honorable Chair and Members  
Pima County Board of Supervisors

From: C.H. Huckelberry  
County Administrator

A handwritten signature in black ink, appearing to read "CH Huckelberry", is written over the typed name and title.

Re: **Water Resources Issue Paper**

## I. Background

In May of 2002, a cost model described future impacts and assessed costs for unincorporated Pima County's compliance with the Endangered Species Act. Four alternatives relative to the cost of implementing the Section 10 permit were presented: ranch conservation; mountain park expansion; high conservation value land on the northwest side; and riparian protection and restoration. This fall the Steering Committee for the Sonoran Desert Conservation Plan will recommend the approach they would like to see Pima County take in applying for a Section 10 permit. A combination of these alternatives might be recommended. To facilitate development of the Environmental Impact Statement (EIS) which must accompany the Section 10 multi-species conservation proposal, a series of issue papers is being published. The attached study discusses water resources in the context of the alternatives being considered to date.

## II. Report

The water resources issue paper is divided into four sections. The first section outlines the major discussion points, including: limitations on the water supply; water for riparian uses; water management; water law; and water quality. The second section provides a brief summary of thirteen studies which have been published on water issues as part of the Sonoran Desert Conservation Plan. The third section describes proposed actions and the fourth section describes the potential impacts under various permit alternatives.

## III. Alternatives

In the following text, each alternative, plus a no action alternative, is briefly described and possible impacts to water resources are discussed. The conclusions drawn for purposes of this discussion paper are of a general and comparative nature. When specific recommendations are forwarded by the Steering Committee or interested members of the community, the merits of each specific proposal can be weighed.



### No Action Alternative

Under the No Action Alternative there is a continuation of present growth patterns and water policies. The study concludes that "this alternative has the greatest potential for negatively impacting water supplies in specific areas."

### Mountain Park Expansion

Under this alternative, Pima County would expand natural resource parks and county-owned ranch lands by a total of 20,400 acres. The study concludes that while "park expansion could have some positive impact on water quality and supply, the impacts could be affected by how the area is managed."

### Riparian Protection and Restoration

The study concludes that "this alternative offers the greatest potential for preservation and protection of water supply for riparian areas and wildlife." It goes on to state that the "perennial and intermittent streams and shallow groundwater areas that would benefit most from additional protection are Davidson Canyon, Cienega Creek, Agua Caliente, Arivaca and Cienega Creek, and the middle San Pedro River. In all of these cases, construction of additional homes, businesses and roads has the potential to impact both water supply and water quality." A more detailed discussion of the effects of proposed actions is provided on pages 14 and 15 of the study.

### High Conservation Value Land on the Northwest Side

The study concludes that "this alternative will have little impact on either water supply or water quality for riparian and wildlife."

### Ranch Alternative

Under the Ranch Alternative, Pima County would establish a reserve of 20,400 acres of high resource value ranch land. The study details the water conservation issues in the ranch lands and concludes that "this alternative offers high potential for protection of both water supply and water quality in specific locations, depending on how the areas are managed."

## **IV. Conclusion**

Five alternatives have been presented for the Section 10 conservation program. With regard to water resources, findings are that the four conservation action proposals have "the potential to improve and enhance water supplies for riparian purposes and protection and reintroduction of aquatic species. There are no anticipated impacts on the water supplies for humans. There are no anticipated negative water quality impacts from SDCP proposals. There may be some water quality benefits from the various alternatives."



Draft issue papers have been forwarded on the topics of cultural resources, ranching and recreation. Each study ranked alternatives from most beneficial to least beneficial in light of goals of those particular resources. While the conclusions drawn for purposes of this discussion paper are of a general and comparative nature, the studies supported initial rankings of alternatives as follows:

Ranch Conservation Alternatives Analysis

Rank	Alternative
1	Ranch Conservation
2	Riparian Conservation
3	Mountain Park Expansion
4	High Conservation Value Land in Northwest Tucson
5	No Action

Cultural Resources Alternatives Analysis

Rank	Alternative
1	Ranch Conservation
2	Mountain park Expansion
3	Riparian Conservation
4	High Conservation Value Land in Northwest Tucson
5	No Action

Recreation Alternatives Analysis: The study of recreation resources indicates that Mountain Park expansion and Ranch land protection seem to hold the most promise for recreation goals, depending on the particular areas protected, the needs of the species in that area, and the level of impact associated with the recreation activity.

Water Resources Alternatives Analysis: The attached water resources issue paper concludes: "The riparian area and ranch land protection alternatives offer the greatest positive impacts to both water supplies for riparian purposes and water quality. The no action and emphasis on the northwest side [proposals] have the least positive impact."

The final recommendation for land to be included in the Section 10 permit will likely include a combination of lands from the ranch, mountain park, riparian and northwest areas. When a specific recommendation is forwarded by the Steering Committee or by interested members of the community, the merits of each specific proposal will be reviewed and published in light of considerations in the attached issue paper, and additional information that might be provided as part of future discussions.



# Potential Impacts of the Sonoran Desert Conservation Plan on Water Quality and Quantity in Pima County

**A Report for the Pima County Sonoran Desert Conservation Plan 2002**



# The Issues

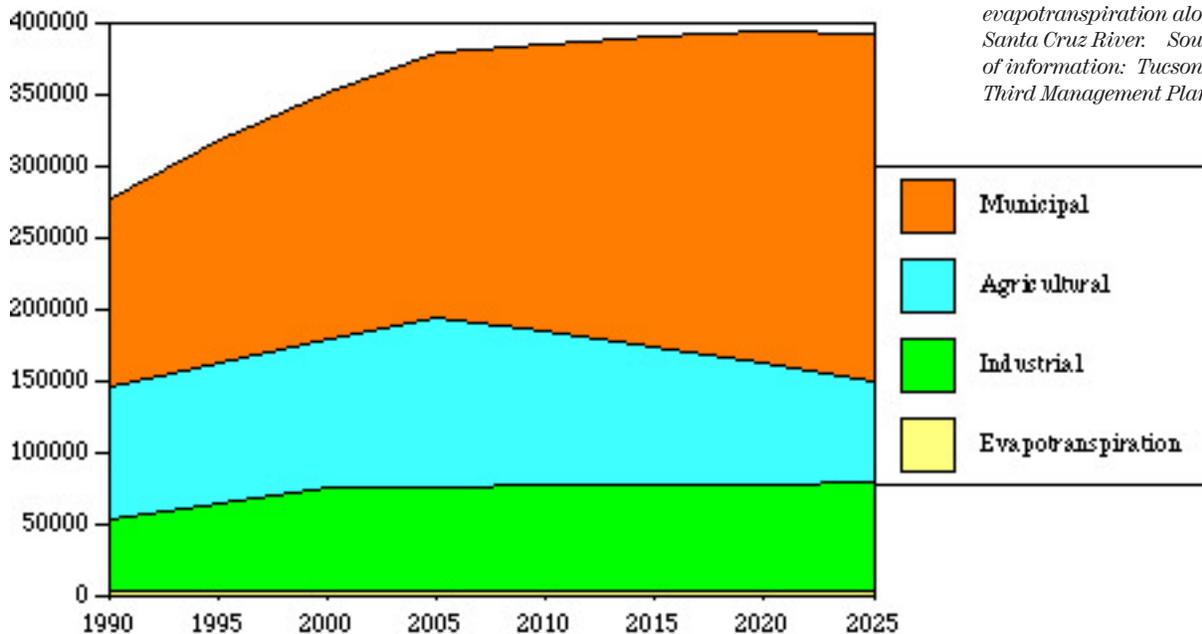
## Water Supply for Humans

For more than 100 years Pima County residents have been almost entirely dependent on groundwater for all uses. This has led to a significant decline in the water table in much of Eastern Pima County, which in turn presents a serious threat of land subsidence. Ever since the start of the twentieth century Tucsonans have had to go farther and farther away to find adequate water for their use. Once people could collect water from springs in what is now downtown. Water was brought from the river first near 22nd Street and later from as far south as Valencia. Road Once surface water was depleted, wells were used to supplement the supply and the search for new places to pump water went as far as the

Avra Valley, where Tucson gets a large portion of its water today.

Recently, water from the Colorado River, via the Central Arizona Project (CAP), has begun to supplement groundwater for customers of Tucson Water and some other users. This new supply will help to prolong the supply of water for people, agriculture, and industry, but will not in the long run prevent further mining of groundwater under current population projections. Depending on the assumptions, the demand for human use will begin to exceed renewable supplies in twenty to thirty years. Projections of the impacts of climate change are liable to change those assumptions if the local climate becomes warmer and periods of drought more extensive. The drought of

*Figure 1. Projected water use in the Tucson AMA. Agricultural use is projected to decline, so that increased municipal use will not substantially change the total use for a while. Amounts are in acre-feet. Groundwater mining will continue. Note that water for riparian protection is not calculated except for a small constant amount for evapotranspiration along the Santa Cruz River. Source of information: Tucson AMA Third Management Plan.*



the early 21st century is an indication of the tenuousness of our surface water supply. Droughts of several hundred years ago were far more long lasting and if they recurred in this century serious supply problems could result. Pima County residents are shielded from many of the short-term impacts of drought by using a combination of groundwater and surface water from the Colorado River. The surface water supplies are dependent on annual renewal of supplies by precipitation while groundwater is affected in the long term by lessened natural recharge.

Residents of western Pima County are entirely dependent on a very limited supply of groundwater and very low annual precipitation. There is almost no chance that CAP water will ever reach this area so water supplies are a clear limiting factor for growth. Residents of the middle San Pedro area have both groundwater and a small amount of surface water in the San Pedro River and tributaries. Neither of these areas is in the Tucson Active Management Area

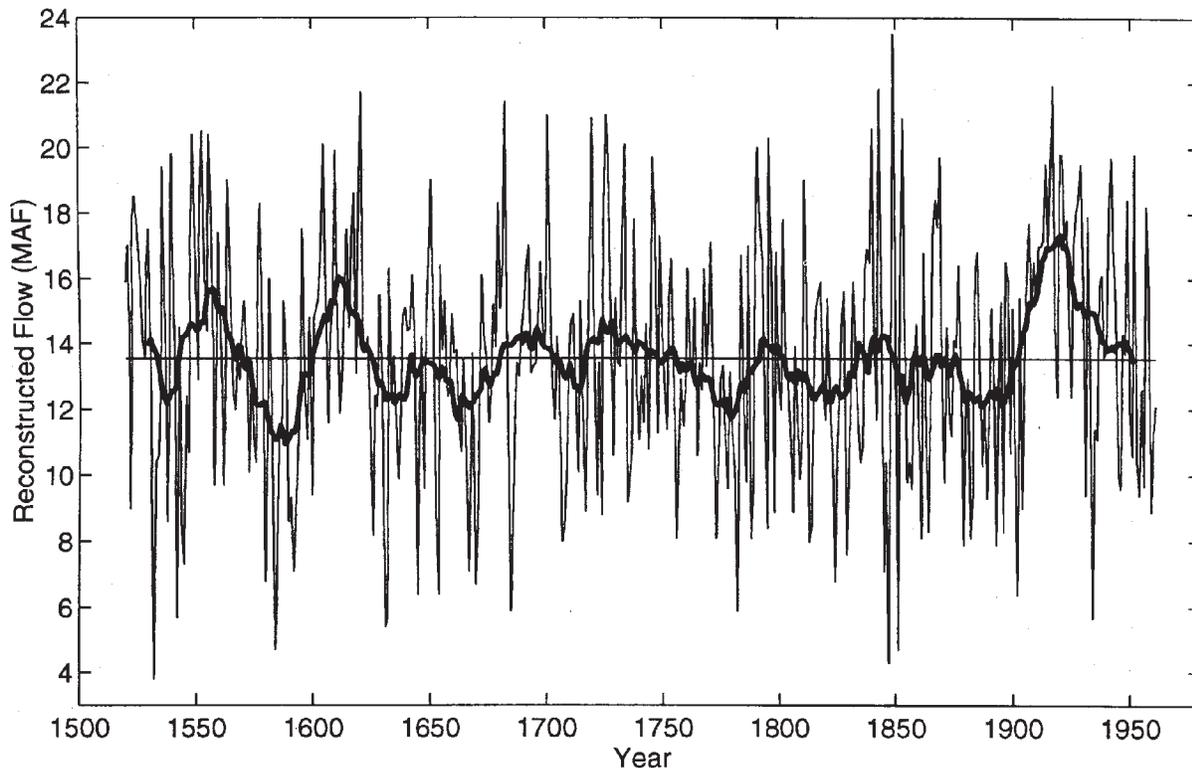
(TAMA) discussed below. Arivaca, on the other hand, is a relatively isolated basin within the AMA but hydrologically separate from the aquifers beneath the Tucson area. Replenishment in the metropolitan area would not benefit Arivaca where just a small increase in pumping could severely impact the cienega and streams.

Two techniques used for prolonging the supply are reuse and recharge. Only about ten percent of the effluent produced in Pima is directly reused, primarily for turf irrigation. The remainder is allowed to flow in the Santa Cruz River where most of it eventually recharges the water table, although some of that recharge occurs in Pinal County. Projects to recharge CAP water and effluent in the Avra Valley, at Pima Mine Road and along the Santa Cruz River save water for a time when it will be needed.

### Water for Riparian Use

In Pima County as in most other parts of Arizona, adequate water for human use has long taken priority while water

*Figure 2. Cycles of drought and plenty in the Colorado River basin based on studies of tree rings. Note the extended drought in the late 1500s and the extended period of plenty in the early twentieth century. Source: Meko, D et al. The Tree-Ring Record of Severe Sustained Drought. Water Resources Bulletin. October 1995. Page 798.*



for riparian and habitat needs has been secondary. When water budgets are calculated on the basis of human demands for water for agriculture, industry, and urban use are included, but water to preserve streamflow for riparian needs is not. Water for riparian uses can be assured by protecting the existing supply in shallow groundwater areas and along perennial and intermittent streams or by bringing in alternate sources of water.

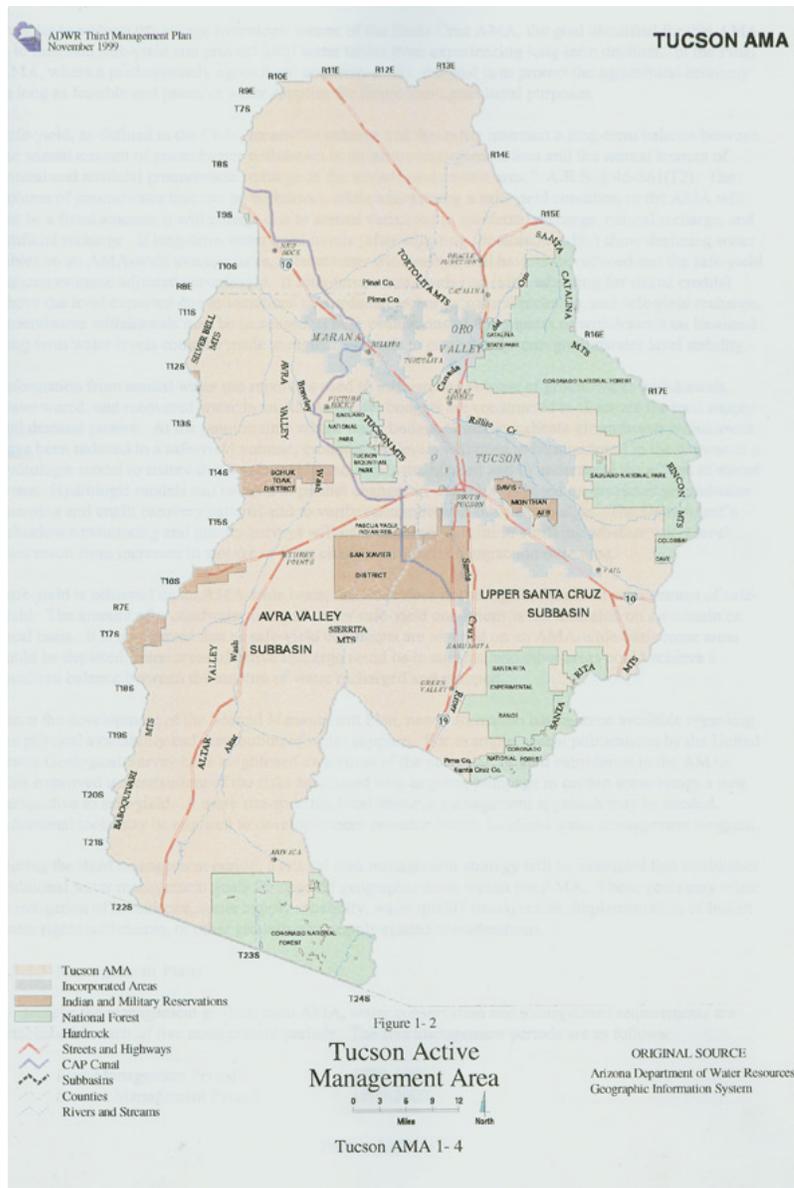
Protecting existing supplies can be accomplished by restricting groundwater pumping and by management of the watershed to optimize water supplies for the stream. The areas of shallow groundwater in Pima County as well as the perennial and intermittent streams and springs have been identified. Priority shallow groundwater areas most in need of protection are in the vicinity of Arivaca, Tanque Verde Creek, Cienega Creek and Davidson Canyon because there is potential for increased groundwater pumping in the area that would negatively impact the streams.

## Water Management

### *Authority to Influence Water Use*

More than 130 different water companies, irrigation districts, municipalities, and water cooperatives provide water in Pima County. More than 20,000 people and businesses have their own wells, as do many commercial users (most notably the mining companies) and agricultural entities. Within TAMA, The Department of Water Resources (ADWR) sets rules under the Groundwater Management Act, but there is no central water management agency. ADWR has no authority under state law to manage groundwater and surface water conjunctively to protect riparian areas as discussed below.

Pima County has little authority to regulate water use even in the unincorporated areas. What ability there is to regulate water use lies primarily in the Arizona Department of Water Resources and the many water providers in the area, the largest of which is Tucson



Water. Pima County does have the authority to implement land use policies that promote conservation, including golf course approval and floodplain regulation. Pima County processes most of the wastewater produced in the county, but because of an intergovernmental agreement with the City of Tucson, does not own most of the effluent or have the right to determine its use. Central Arizona Project Water in Pima County is primarily managed by the City of Tucson.

The Tohono O’odham Nation has a

*Figure 3. The Tucson Active Management Area. Note that it does not include the headwaters of Cienega Creek, the Pima County portion of the San Pedro River or anything west of Avra-Altar Valley. Source: Arizona Department of Water Resources.*

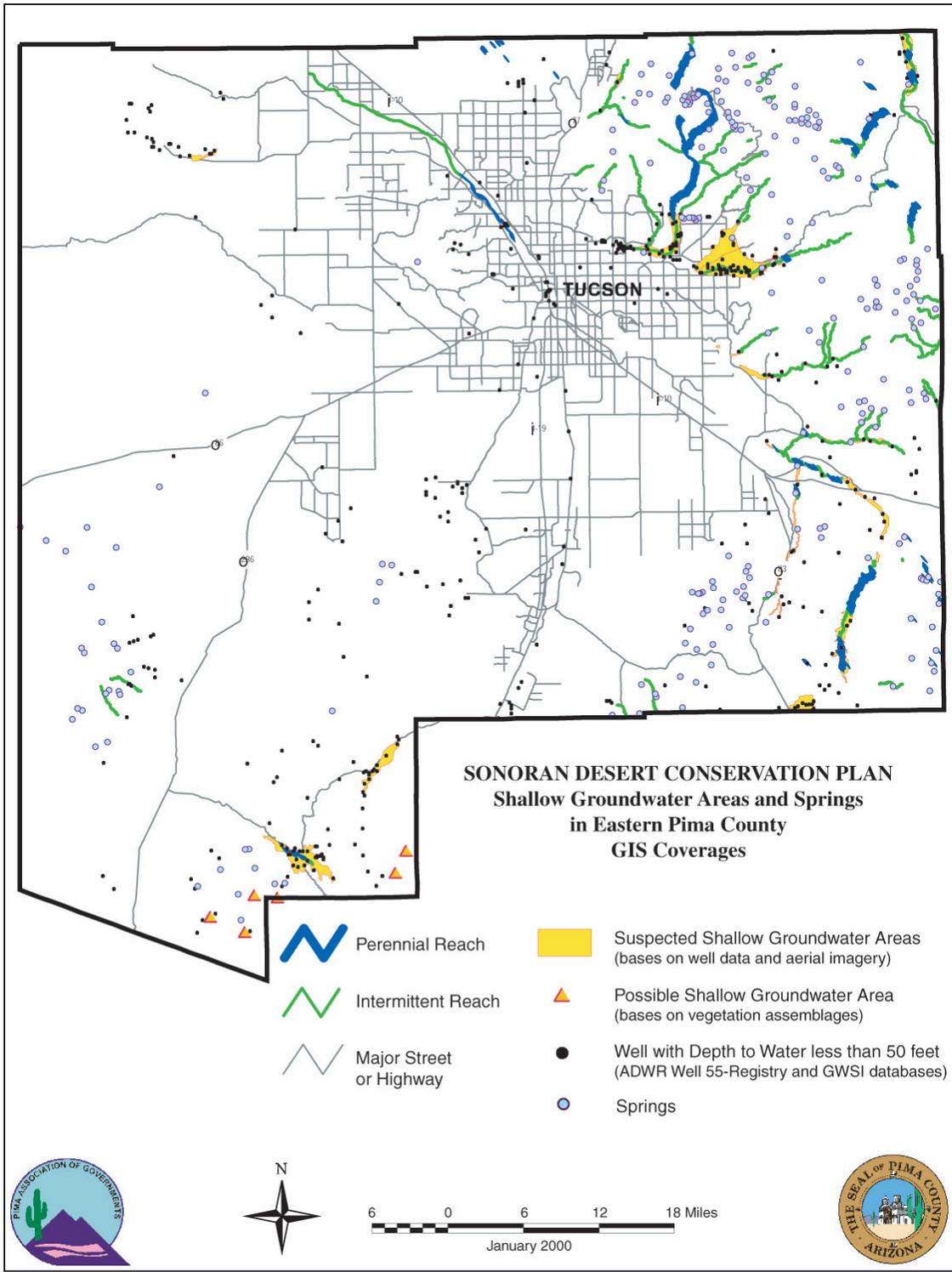


Figure 4. Shallow groundwater and springs in Eastern Pima County. Source: Pima County Technical Services Department.

significant CAP allocation, which the tribe uses in the San Xavier District and the Shuk Toak District and has control over use there. Most of the water is used for agriculture, but a portion in the San Xavier District is being used for riparian restoration projects. The tribe also has rights to a portion of the treated wastewater from Pima County facilities.

Outside TAMA ADWR has jurisdiction but the laws for those non-AMA areas are less stringent than they are in the AMAs.

### **Water Law**

Arizona water law makes a big distinction between groundwater and surface water. Surface water is legally considered a different entity from groundwater. Surface water is managed under the Prior Appropriation doctrine that requires people to apply for rights to use the water. People with seniority in terms of time of permit application have the right to use all of the water to which they are entitled even if junior users do not get water - "first in time, first in right." The only significant way a right can be lost is by failure to use the water beneficially over a period of time - "use it or lose it."

Within surface water law, there is a provision for granting instream flow permits, leaving water in the stream for the benefit of wildlife, riparian vegetation or recreation. Within Pima County a very small number of such permits have been granted. An instream flow permit does not guarantee a continued supply of water since senior rights holders have priority over these later permits, and because of the legal problems involved in protecting surface water rights holders from pumping of groundwater.

Groundwater, on the contrary is managed under the Groundwater Management Act, which has special provisions within Active Management Areas (AMA). Most of Pima County east of the Tohono O'odham Nation except for the San Pedro River watershed and a portion of the Cienega Creek watershed is in the Tucson Active Management

Area. The goal of the Tucson AMA is to attempt to reach Safe Yield by 2020, reach a balance between supply and demand. Large new wells may be drilled only if they meet certain conditions and the owner can demonstrate a legally defined 100-year supply exists, but small domestic wells are allowed with few or no restrictions. Within the AMA there are rules requiring conservation measures for industry, agriculture and water providers. Outside of the AMA there are very few legal restrictions on groundwater pumping.

Both inside and outside the AMA groundwater and surface water rights are separate. People may pump water even if it affects streamflow and the senior rights of surface water users. Arizona Supreme Court decisions, allow restrictions on pumping within the "sub-flow" area of a stream, but this remains to be fully defined. This failure to manage the waters conjunctively, even though they may be physically connected makes it difficult to use water law to protect streams in shallow groundwater areas in Pima County. Streams most in jeopardy from increased groundwater pumping in Pima County are Arivaca Cienega and Creek, Tanque Verde Creek, Rincon Creek, Davidson Canyon, Cienega Creek, Middle San Pedro River, and Agua Verde. Watersheds that would benefit most from improved management to improve water flow are those that are extensively grazed or used for recreational purposes such as off-road driving, especially where grazing or vehicle use occurs in a riparian area.

### **Water Quality**

Having adequate water supplies depends not only on water quantity, but also on having water of a quality adequate for the desired use whether it be for humans or wildlife. For the most part, the water in Pima County is of high quality for both purposes. There are, however, a number of locations in the urban area where the groundwater has been contaminated to the point that drinking water standards are exceeded.

Surface water in Pima County generally meets standards for its designated uses.

According to the Environmental Protection Agency (EPA) the major sources of water pollution nationally are industrial releases, urban storm runoff, agriculture and grazing, landfills, septic tanks, spills in transportation corridors, and leaking underground storage tanks. Sedimentation from cleared land, burned lands, and eroded watersheds is also a concern.

Because there is so little surface water in the areas of Pima County that are not within National Forest, National Park or State Park boundaries, there have been few surface water contamination problems. The Cienega Creek Preserve is traversed by railroad tracks and Interstate

10, spills from which could contaminate the water. Some surface water contamination has been caused by improper grazing techniques even on protected lands.

More study is needed of the impacts of septic systems, especially in shallow groundwater areas. While the use of septic systems can benefit water supply through direct recharge, it can negatively affect groundwater quality through recharge of inadequately treated water either because the area was not suitable for septic systems or because of poor maintenance.

More study is also needed of the water quality impacts of recreations uses, especially trail use by horses and by off-road vehicles. Erosion leading to sedimentation is a major concern but the impacts are not well documented.

Figure 5. Generalized table of water supplies for the various subareas of Pima County.

	Surface water	Groundwater	CAP	Reclaimed Wastewater
San Pedro	MINOR	YES	NO	NO
Cienega-Rincon	MINOR	YES	PLANNED	FUTURE
Upper Santa Cruz	NO	YES	YES	FUTURE
Middle Santa Cruz	NO	YES	PLANNED	YES
Tortolita	NO	YES	PLANNED	YES/FUTURE
Altar	MINOR	YES	NO	NO
Avra	NO	YES	YES	MINOR
Western Pima	NO	YES	NO	NO

# Brief Summaries of SDCP Reports

The reports discussed below have provided a strong body of background material for water-related proposals and for evaluating impacts of those proposals on water supply and water quality for humans and wildlife.

## *Water Resources and the Sonoran Desert Conservation Plan (1999)*

This report provided the first general overview of SDCP-related water issues in Pima County. It examined the peculiarity of Arizona water law that treats groundwater and surface water as separate entities making conjunctive management extremely difficult. It generally looked at how mining of groundwater has affected the area, its riparian systems, and its wildlife. This report also looked at five strategies for dealing with these problems, including adopting a regional water policy, adopting strategies to reach Safe Yield, develop a recovery plan for riparian systems, adopt a multi-species conservation plan and an integrated regional effluent, recharge and reclamation plan that maximized use of renewable resources. In the conclusion, the author stated that in the “next century, beneficial use will have to recognize hydrologic principles and environmental realities in addition to consumptive uses.”

## *Water Resources in the Arivaca Area (2000)*

This report, written by the Arivaca Water Education Task Force, looked at how

additional groundwater pumping would affect surface water in the area. It concludes that even with no new zonings or new groundwater pumping rights, the cienega would be negatively affected.

## *GIS Coverages of Perennial and Intermittent Streams and Areas of Shallow Groundwater (2000)*

This study mapped perennial streams, intermittent streams, and areas of shallow groundwater. The areas mapped then became available as GIS data layers to use in developing protection and recovery strategies. The report identified 55 perennial stream reaches and 82 intermittent stream reaches on a total of 74 different streams. A high proportion of the identified streams are on land already at least partially protected by some level of government, especially the U.S.D.A. Forest Service. In conclusion, the authors recommended that further study be made of some specific areas. Continued monitoring was considered important in maintaining an up-to-date information base. The authors also expressed the hope that a similar inventory could be done of streams on the Tohono O’odham Nation.

## *Water Uses Along Selected Streams in Pima County (2000)*

This study mapped out wells within one mile of identified perennial and intermittent streams and areas of shallow groundwater, including exempt wells in those areas. It also identified water



*Figure 6. Arivaca Cienega is in a shallow groundwater area that is highly threatened by increased groundwater pumping. Photo:*

users and amount of water being used, with emphasis on pumping, although some surface water diversions were also examined. The authors concluded that more information is needed to determine a variety of factors that influence water available for riparian needs.

#### *Springs in Pima County (2000)*

This study provided mapping of springs in Pima County, many of which were well-documented for the first time in this report. The information was provided as a GIS layer to be used in a variety of purposes. A high proportion of the springs are on already at least partially protected lands, especially the U.S.D.A. Forest Service. Some very significant springs, however, occur on lands that do not have protected status. The report also identified species of plants, fish and other wildlife associated with springs. The authors recommended that more information be gathered, that biological inventories be conducted, that certain springs be evaluated in terms of the protection potentially available to protect them, and the necessary legal measures be taken.

#### *Water Conservation in Pima County (2001)*

This report looked at the development of water conservation measures in Pima County, including actions by the Arizona Department of Water Resources, Tucson Water and private water providers. Options for additional measures that Pima County could adopt were offered. These measures were adopted as part of the Pima County Comprehensive Plan in December 2001.

#### *Lower Cienega Basin Source Water Study (2001)*

This study investigated the source of water for the lower-most perennial reach of Cienega Creek. It was determined, using water chemistry data, stable isotope data, and hydrologic data, that the source of flows was upstream reaches of Cienega Creek, rather than Agua Verde Creek, which is a significant tributary, or the surrounding bedrock aquifer. The study also noted that Cienega Creek and the bedrock aquifer seemed to be in hydraulic connection.

#### *Water Resources in Pima County (2001)*

This report looked at availability of water supplies in Pima County from four perspectives:

1. Would the Tucson Active Management Area meet and continue to meet the goal of Safe Yield as required under state law?
2. Would Pima County as a whole have adequate water for human use?
3. Would specific regions within Pima County have water supply problems even if the region as a whole did achieve a balance?
4. Would there be adequate water to meet the goals of riparian protection and restoration under SDCP?

The report concluded that if all assumptions were valid regarding CAP water availability, effluent use, recharge, and changes in state water law, there would be adequate supplies for human use for

at least the next quarter of a century or so, although subsidence could be a consideration. It concluded, however, that water for riparian uses is not generally calculated in the regional water budget and as human uses increase, water supplies for riparian protection and restoration could be in short supply, especially in some specific areas where alternate supplies are not available.

#### *Groundwater Level Changes in the Tanque Verde Valley Update, (2002).*

In this report and two preceding studies of the same area, the authors looked at how groundwater pumping along a portion of Tanque Verde Creek affects riparian vegetation along the creek. The major pumping in the area is by Tucson Water, but quite a few private wells also pump water from the area. The report noted that since arrival of CAP water in the urban area, Tucson Water has attempted to reduce its pumping in the area to maintain a high water table.

#### *Water Quality Issues (2001)*

This study identified improving or maintaining groundwater quality, dealing with contamination from leaking underground storage tanks, landfills, industrial operations and other land uses, and septic tanks as the issues most in need of attention. With regard to surface water, the issues were spills, runoff from urban areas leading to sedimentation, erosion, and discharge of household chemical such as pesticides. The report recommended additional monitoring, attention to the needs of aquatic species, and proper watershed management plans. The authors recommended a number of policies with emphasis on making land use decisions in light of possible impacts of new development on cumulative impacts on streams and aquatic species. Policies for improvement of wastewater quality and emphasizing regional treatment in a few large well-managed treatment plants, rather than a proliferation of smaller facilities. It also recommended the use of effluent for riparian restoration.

#### *Water Quality of Priority Streams in Pima County (2002)*

This report looked at the quality of 21 priority streams in the county. The conclusion that overall the quality is very good. Seven streams were recommended for more investigations and monitoring. Most of the priority streams are at least partly within protected lands and unlikely to experience significant deterioration. The authors recommend that land use planning identify which future land uses are appropriate near the streams, that impacts of those land uses be minimized, and that the quality be regularly monitored.

#### *Water Quality in Pima County (2002)*

This report summarizes water quality for groundwater and surface water in Pima County. The report discusses more than ten groundwater contamination sites in the urban area, stormwater quality, monitoring of surface water, effluent quality and quality of CAP water. The conclusions are that except for some contaminated groundwater sites, groundwater is of good quality, stormwater runoff meets EPA standards as does treated wastewater and that in the few streams with surface water, the quality is adequate for the intended use.

#### *Water Quality Requirements of Native Aquatic Species in Pima County (2002)*

The report looked at the water quality requirements of priority vulnerable aquatic species, including two frog species and six fish species. The findings were that native aquatic species have a relatively high tolerance for wide ranges in temperature, pH levels and salinity. The study also looked at sites with multiple species. The report concluded that water quality was generally within the required range for supporting native species. It concludes with the statement that the greatest threats to aquatic species are loss of habitat and water supply and introduction of non-native invasive species.

# SDCP Proposed Actions

## **Water Conservation**

New water conservation ordinances and policies including encouraging water harvesting and the use of domestic gray water will help to reduce water use. These measures include retrofit of indoor conservation devices in older homes when ownership changes, new commercial landscape requirements, and stricter conditions for water use in newly constructed golf courses.

## **Floodplains**

Proposals to further limit construction on floodplains and acquire floodprone lands will promote recharge of the aquifer by allowing water to percolate along the floodplains. Land acquisition will mean that the county can build fewer new flood control structures to protect buildings and infrastructure in and close to flood and erosion areas. This approach has proved successful in the case of Cienega Creek where the county acquired a perennial stretch of stream using flood control funds, arguing that preserving the natural functions of the stream would lower future flood control and damage repair costs, while promoting recharge. Proposals to purchase additional floodprone land in selected areas will have multiple benefits.

## **Water for Riparian Protection and Restoration**

Pima County and the City of Tucson have signed an intergovernmental agreement to reserve 10,000 acre-feet of treated wastewater to use for habitat enhancement and restoration purposes. Projects to make optimal use of this water source

will benefit aquatic and riparian habitat.

Pima County will also look to alternate sources of water to protect streamflow. One option is to provide incentives to persuade landowners in shallow groundwater areas to stop pumping in those areas and connect to an alternate supply. Pima County is seeking ways to acquire water rights in Cienega Creek through trading for an alternate water source.

Making arrangements with Tucson Water or other entities for the use of CAP water for riparian purposes is another option under consideration.

## **Land and Water Rights Acquisition**

Acquisition of land and water rights to minimize groundwater pumping in the vicinity of certain perennial and intermittent streams and springs will help preserve priority areas. Finding ways to help people with wells in shallow groundwater areas find alternate water sources, such as CAP water or purchase from a utility such as Tucson water can also help protect flows in specific areas.

## **Changes in Arizona Water Law**

Pima County has worked with the Governor's Water Management Commission in an attempt to make significant changes in Arizona water law. The Commission made significant riparian protection recommendations, but Arizona Legislature did not deal with those recommendations in the 2002 session. Pima County will continue to work for needed changes in the water law in order to have more tools for protection of riparian areas.

# Potential Impacts under Alternatives

None of the alternatives involve construction of any potentially polluting facilities or introduction of hazardous wastes, thus no negative water quality impacts are anticipated. None of the alternatives involve increasing human water use in the area as a whole or in any specific location, thus no negative water supply impacts are anticipated. Some of the alternatives involve increasing water use for riparian use and protection or reintroduction of priority species. Since this water will also be desired for human use in some situations, conflicts may arise, especially in the later years if the population continues to increase as projected. Building infrastructure to transport water to where it will be used could possibly have negative environmental impacts.

Since none of the proposed alternatives involve reducing total population levels, but instead accept PAG projections, none of the alternatives will substantially alter the total human water budget for the region. Some of the alternatives, however, will alter the local water availability projections for specific areas, especially with regard to water for wildlife and riparian protection and restoration.

None of the alternatives will significantly impact water quality. The main threats to groundwater quality would be possible migration of existing contaminant plumes and the main threats to the water quality of priority streams would be sedimentation from non-point sources and degraded range conditions in the watersheds. No serious human health



*Figure 7. Preservation of natural watercourses where appropriate rather than radically altering them is a goal of SDCP. Photo: Barbara Tellman*

effects are anticipated to occur from these sources under any alternative. Decrease of water quality for wildlife may occur in a few situations, but the greatest concern for wildlife and riparian areas is reduction of water supply rather than impairment of water quality.

### **Continuation of present growth patterns (No Action)**

This alternative has the greatest potential for negatively impacting water supplies in specific areas. For example, if growth and water use increase in the Arivaca area, the water supply for the Arivaca Cienega and creek are liable to be severely impacted. Increases in pumping in shallow groundwater areas such as Tanque Verde Creek will negatively impact riparian vegetation. Subdivision development in the vicinity of the Cienega Creek Preserve could affect water levels if local water sources are used. If Pima County succeeds in transferring the downstream water right in the area, the perennial reach of the creek would lengthen, but development near the creek in that area could still impact the riparian area. In all cases, further construction in watersheds could lead to deterioration of water quality, especially an increase in sedimentation. Allowing additional septic tanks in certain areas could negatively impact water quality, although further studies are needed to demonstrate impacts in specific areas.

### **Expansion of County Parks**

While in all the options discussed below, park expansion could have some positive impact on water quality and supply, the impacts could be affected by how the area is managed. In particular, recreational use of the area would have to be managed to minimize negative impacts from use of trails and off-trail travel by horses, off-road vehicles, and hikers. Illegal dumping is often a problem in undeveloped areas and less so in preserves.

Expansion of Tucson Mountain Park would have little direct impact on water supply or water quality since there are no perennial or intermittent streams

or shallow groundwater areas on the periphery of the park. Expansion of the park, however, might mean fewer new homes are built in the area, which, in turn, would mean that fewer septic tanks would be constructed there, and less sedimentation would occur, both of which could impact downstream water quality.

Expansion of Colossal Cave or the Cienega Creek Preserve could have a major beneficial impact on water supply and quality on this far east side of the metropolitan area. The major stream near Colossal Cave is Agua Verde Creek. Other perennial streams are within Saguaro National Monument for the most part, although Rincon Creek extends outside the park boundary. Agua Verde Creek would receive additional protection from impacts of septic tanks, wells, and urban runoff if it were included in the park expansion. Removal of cattle from the area would benefit the stream, which is perennial and has native fish. Expansion of parks in this area would probably also serve to protect the water supplies for numerous significant limestone caves in the general area.

Expansion of Tortolita Mountain Park would not have a significant impact on perennial or intermittent streams, as the only such streams are at the edge of the park boundary and within incorporated Oro Valley. Limiting of new subdivisions on the Tortolita Fan, however, could have a positive impact in that less urban runoff and sedimentation would occur in this very active floodplain region.

### **Emphasis on riparian area protection**

This alternative offers the greatest potential for preservation and protection of water supply for riparian areas and wildlife. The majority of perennial and intermittent streams and shallow groundwater areas are in areas already at least partially protected. The perennial and intermittent streams and shallow groundwater areas that would benefit most from additional protection are Davidson Canyon, Cienega Creek, Agua Caliente,

Arivaca Cienega and Creek, and the middle San Pedro River. In all of these cases, construction of additional homes, businesses, and roads has the potential to impact both water supply and water quality. The overall impacts can be found in the Riparian Area Issue Paper. In this paper, only the water quality and quantity impacts are discussed.

Additional pumping in shallow groundwater areas is liable to impact water supplies for the riparian area and thus any measures to assure that new pumping does not occur would benefit the area. Purchase of land in these areas will have a major direct positive impact on water supplies by reducing the potential for new pumping. In addition, acquisition of a surface water right at the downstream end of Cienega Creek would help to protect and extend the perennial reach.

Adoption of new riparian protection legislation at the state level would greatly assist Pima County in protecting certain riparian areas.

Availability of treated wastewater and CAP water for use in riparian projects will benefit habitat by creating or expanding existing riparian/wetland habitat in selected areas.

Reintroduction of rare or extirpated aquatic species of flora and fauna will be dependent on using alternate water supplies and protecting existing water supplies for perennial and intermittent areas. Using alternate water supplies to reconstruct or simulate relatively natural streamflow functions in areas where those have been impaired would be crucial to most successful reintroduction.

### **Emphasis on limiting development in the unincorporated areas on the Northwest side of the metropolitan area**

This alternative will have little impact on either water supply or water quality for riparian areas or wildlife. The only perennial/intermittent stretches of streams in this area are either in protected areas (Tortolita Mountain Park, Catalina State Park or the Coronado National Forest) or in incorporated areas (Oro Valley and Marana).

Limiting further growth in this area would, however, help preserve a limited supply of groundwater in this area. Water for most of the area is, or can be, made available by several water providers in the area.

### **Emphasis on ranch conservation**

This alternative offers high potential for protection of both water supply and water quality in specific locations, depending on how the areas are managed. If ranchlands were used for either wildcat or subdivision development strains on the local water supplies would increase wherever the development occurs since there are few alternate supplies in the more remote areas.

Ranch conservation in the Altar Valley could be highly beneficial to preserving surface water supplies by limiting new groundwater pumping which would happen if more people moved into the area. Studies by the Arivaca Water Education Taskforce show that just a small increase in the amount of pumping in the area would reduce water supplies for the cienega and creek. Since there are no options within current Arizona water law for preventing additional pumping by legal means, land acquisition is the most feasible method for limiting new groundwater use.

The water quality in the Altar Valley is quite high except for a manmade lake upstream of the town of Arivaca. According to the Arizona Department of Environmental Quality this lake is contaminated by leakage from abandoned mines in the area and no workable measures have yet been found to clean up the contamination. Land acquisition or cooperative agreements with ranchers would have no impact on this problem.

Water quality in the area may to some extent be affected by grazing, although little information is available. Water quality in the streams appears to be generally of high quality. Control of grazing along riparian areas is liable to have a beneficial impact on water quality.

Ranch conservation in the Avra Valley

would have less of an impact on water supply and water quality since there are no priority streams in the area.

Ranch conservation along the San Pedro River could be beneficial to water supply. Reduction or elimination of irrigated agriculture through land acquisition or cooperative agreements would benefit the river by increasing water supply. The Arizona Nature Conservancy has begun to acquire land with water rights along the river especially downstream of the Pima County portion of the river and thereby reduce agricultural water use along the river. The possibility of ranches being acquired for subdivision development in this area is much lower than in the Altar or Avra Valleys because of remoteness of the area and lack of a paved road. Acquisition of land to prevent subdivision development in the area would probably be less beneficial than acquisition elsewhere.

### **Summary**

SDCP has the potential to improve and enhance water supplies for riparian purposes and protection and reintroduction of aquatic species. There are no anticipated impacts on water supplies for humans.

There are no anticipated negative water quality impacts from SDCP proposals. There may be some water quality benefits from the various alternatives.

The riparian area and ranchland protection alternatives offer the greatest positive impacts to both water supplies for riparian purposes and water quality. The No action and emphasis on the northwest side have the least positive impact.

### **References**

The SDCP reports discussed above contain extensive references and are the basis for much of the information in this summary report. The most significant of the references are:

Arizona Department of Water Quality.  
web site [www.deq.az.us](http://www.deq.az.us)

Gelt, J. et al. 1999. Water in the Tucson Area: Seeking Sustainability. Water Resources Research Center. University of Arizona. Tucson. and WRRRC web site [www.ag.arizona.edu/azwater/](http://www.ag.arizona.edu/azwater/)

Tucson Active Management Area. 1997. Third Management Plan and web site [www.water.az.gov](http://www.water.az.gov)