



City/County Water and Wastewater Study



Date: May 7, 2009

To: City/County Water and Wastewater
Study Oversight Committee

From: Mike Letcher *ML*
City Manager

Chuck Huckelberry *CH*
County Administrator

Re: **City/County Water Conservation Technical Paper**

Background

One of the goals included in the scope for Phase II of the City/County Water and Wastewater Study was for the City and County to identify opportunities to implement consistent water conservation ordinances and standards and to examine how water conservation can protect future water supplies, not simply making more population growth possible. A City and County interdisciplinary staff team was assembled to look at this issue and develop the attached report.

Conclusions

The City of Tucson and Pima County have a long history of support for conservation efforts and programs that encourage or mandate water conservation and water use efficiency. Both jurisdictions are engaged in on-going efforts to enhance the efficacy of these programs and identify additional strategies to strengthen regional water conservation.

With respect to the question of how to increase consistency in water conservation ordinances and standards, staff concluded that because of differences in authorities, mandates and drivers between the City of Tucson, Pima County and the Regional Flood Control District, it is not feasible to simply adopt exactly the same ordinances and development standards in all cases. However, similarities in water conservation related policies exist. The land use policies and sustainability program goals in both the City and County recognize that building in best management practices and integrated water resource planning from the start in new developments is critical to maximizing water conservation outcomes. The frontier of increased consistency in water conservation lies in the area of new construction where both the City and County, through their land use authorities, have an opportunity to maximize water conservation and resource efficiency outcomes.

The initial focus for increased consistency between the City and County should therefore be on developing shared water efficiency goals and strategies at different scales of development. Additionally, the City and County should adopt common

standards for water conservation mechanisms, such as water harvesting and greywater systems, and continue to evaluate existing ordinances and standards to further identify ways in which the two jurisdictions can compliment, rather than conflict, with each other's regulatory and policy mandates.

With respect to the question of how to ensure water conservation protects future supplies, staff concluded that there are differing goals and objectives for water conservation but that throughout all water conservation efforts is a shared ethic of wise stewardship of water resources. Other common objectives include complying with regulatory requirements, reducing water use, increasing water use efficiency, saving water for future generations, enhancing reliability of water supplies, saving money, avoiding subsidence, reducing vulnerability related to climate change, or achieving sustainability over a period of time. Defining clear goals and objectives of water conservation programs and selecting appropriate strategies and methods to achieve the objectives is an important facet of addressing the question how do we ensure that water conservation protects future supplies, not simply makes more growth possible.

Ultimately, water conservation is one tool for preserving options for the future and for improving current conditions such that water is available to sustain existing human, environmental, and economic needs. Specific opportunities are already in place, such as the Conservation Effluent Pool (CEP), to ensure that the City and County commit water to a balanced set of uses reflective of the quality of life values of existing residents. Greater public awareness of the opportunities currently in place, and identification of strategies for linking conserved water to specific environmental projects, building upon the Water Resources Research Center's "Conserve to Enhance" concept, are needed.

Following is a summary of key recommendations included in the paper:

- Engage regional jurisdictions, stakeholders and members of the public in a conversation about quality of life trade offs associated with water conservation, strategies to achieve goals and potential end uses for conserved water;
- Develop shared water use efficiency goals, standards and strategies for achieving water conservation at different scales of development: community wide, sub-regional, neighborhood and individual lot;
- Adopt common standards and best management practices, such as emerging water harvesting and greywater standards, and continue to evaluate opportunities for increased consistency in ordinances and standards.
- Pursue opportunities for joint education and communications programs to foster increased consistency in water conservation messages;
- Link water conservation to protecting future supplies by committing to specific projects, such as additional aquifer augmentation and environmental restoration and identify mechanisms that link saved water to specific uses;

- Enhance planning and evaluation of trends, water conservation potential, and impacts of water conservation measures.

Recommendation

It is respectfully recommended that the Committee consider this report and provide input to the City and County on its recommendations.

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**City/County
Water and Wastewater Study
Phase II**



**City of Tucson and Pima County
Water Conservation
Technical Paper**

May 2009

This paper was prepared by a joint team of City of Tucson and Pima County staff from the following departments: City of Tucson – Tucson Water, Office of Conservation and Sustainable Development, Development Services, Planning, and City Manager’s Office; Pima County – Regional Wastewater Reclamation Department, Regional Flood Control District, Development Services, the County Attorney’s Office, and the County Administrator’s Office.

City of Tucson and Pima County
Water Conservation Technical Paper
Water/Wastewater Infrastructure, Supply and Planning Study: Phase II
May 2009

Introduction

The scope of work for the *City of Tucson/Pima County Water and Wastewater Study* requires two key questions to be answered regarding water conservation: 1) how can the City and County implement consistent water conservation standards to help sustain long-term water supplies? 2) how can the City and County work together to ensure that water conservation protects future water supply, not simply makes more population growth possible?

This paper examines this request by providing:

1. Water conservation policies and legislation
2. An inventory of City and County Ordinances and Programs divided into two sections:
 - a. Water Utility-related conservation efforts to decrease water usage
 - b. Development-related conservation efforts which focus on land use regulations and new construction standards to decrease water usage
3. An analysis of opportunities and constraints to implementing consistent water conservation standards and ensuring water conservation protects future supplies
4. Recommendations for increased City/County consistency and effectiveness and for clarifying water conservation purposes.

Water conservation is a component of an overall water resources management strategy, which has many inter-related components such as drought and climate-change preparedness, maximizing the use of reclaimed water and effluent, water harvesting and stormwater management, securing additional water supplies, riparian protection, etc. Some of these topics are touched on here as they relate to water conservation and/or are covered in separate Phase II technical papers.

For purposes of this paper, water conservation is defined as reducing water usage through demand management, which primarily refers to water conservation efforts targeted to existing customers, and water efficiency measures. This paper addresses water utility-related conservation efforts, which focus primarily on demand management approaches including modifications to the existing built environment and customer behavior, and on land use and development-related conservation efforts, which focus on efficiency measures through land use regulations and new construction standards.

In considering opportunities for consistency and the question of why conserve, it is important to consider the different drivers of water conservation. Common to all water conservation efforts is a shared ethic of stewardship of water resources. For the City and County, key drivers for water conservation are compliance with regulatory requirements and operational constraints associated with seasonal demand. Other common drivers are to preserve and enhance the quality of life in our community, protect the environment, create an ethic of sustainability, be fiscally responsible, and conserve natural resources through planning.

The tools to accomplish these goals are education, incentives, land use regulations and building/development requirements and permits.

These drivers influence the various water conservation related policies and regulations and City/County programs and conservation mechanisms which are described below.

1. Water Conservation Policies and Legislation

Statewide:

- **The 1980 Groundwater Management Act** has established management goals in five Active Management Areas (AMAs) which are rapidly developing areas of the state. Goals of the Tucson Active Management Area (TAMA) are to attempt to eliminate groundwater overdraft, and to reach safe yield AMA-wide, by the year 2025. Safe yield is a balance between the amount of groundwater withdrawn in an AMA, and the amount of natural and artificial recharge in the AMA on an annual basis. The Tucson AMA extends from southern Pinal County down into northern Santa Cruz County and includes two major sub-basins (Avra Valley and Santa Cruz). Two water management tools in particular have been promulgated to help the AMA achieve the elimination of groundwater overdraft: Management Plans and the Assured Water Supply Rules (AWS).
- **The Arizona Department of Water Resources (ADWR) Third Management Plan (TMP)** sets forth conservation requirements for water providers. In the TMP, most providers have been regulated under the Total Gallons Per Capita Per Day (Total GPCD) program, which sets per capita water use targets at the water provider level. Tucson Water is currently regulated under the Total GPCD Program. A GPCD target is calculated each year based on the number of single family and multi-family housing units that are served by Tucson Water. An operating flexibility account is incorporated within the GPCD Program, which allows a provider to “bank” water during years when it serves less than its GPCD target volume. The flex account also allows the provider to draw against that balance during years when it would serve water in excess of its GPCD target, such as in exceptionally hot or dry years.

Beginning in January 2010, pursuant to a TMP modification, many large providers will be regulated under the Modified Non Per Capita Conservation Program (MNPCCP). Under this program, the provider is required to implement a number of specific conservation measures, depending on the number of connections it serves. Through either the Total GPCD Program, or the MNPCCP Program, each provider must determine the best way to meet its TMP conservation requirements.

For residential uses in the Municipal Sector, ADWR actually sets *standards* for both interior and exterior water use in *new* residential construction. It also requires a gradual reduction in usage per person for existing housing. ADWR does not directly regulate single family, multifamily or most non-residential users or uses of water. However, ADWR enforces the municipal conservation requirements at the utility scale, not the individual scale. The provider is held responsible for complying with municipal conservation requirements in the management plan. (A requirement of the

AWS rules is that a designated provider be in compliance with the conservation requirements of the management plan.)¹

ADWR does set *standards* and actually *regulates* some individual, non-residential users. For example “large turf users”, those sites with more than 10 acres of turf, are given an allotment of water per acre they can use and must report their use directly to ADWR each year.

- **Smart Growth Legislation (1998 and 2000)** - Recognizing the need to preserve Arizona’s quality of life and natural resources while sustaining economic prosperity, Arizona adopted comprehensive land use planning and zoning reforms for municipalities, counties, and state land department. The purpose of the Growing Smarter Act is to strengthen the ability of Arizona communities to plan for the future, preserve natural resources and develop strategies to address growth-related pressures. Central to the growing smarter statutes for municipalities and counties are requirements to plan for and address land use, environmental planning, water resources, energy, transportation, cost of development, and growth areas.

City of Tucson

- **Sustainability Framework** - The City of Tucson, in its roles as a civic institution, corporate entity, and service provider, has a fundamental responsibility for initiating and following through on actions necessary to ensure the environmental, social, and economic health to sustain the community. The concept of sustainability has emerged in recent years as an overarching and integrating principle that has been endorsed by Tucson’s Mayor and Council to help guide the City’s actions. The City formalized this commitment to promoting sustainability by adopting a Framework for Advancing Sustainability in July 2008 (<http://www.tucsonaz.gov/agdocs/20080617/ssjune17-08-195a.pdf>).

The guiding vision for this Framework is that the City: (1) lead by example through its own sustainable practices, (2) implement policies, regulations, and offer incentives and investments that encourage sustainable economic growth and development within the community, and (3) engage in partnerships to promote sustainable living throughout the Tucson region.

The City’s sustainability goals are driven, in large part, by the Mayors’ Climate Protection Agreement which was adopted by the Mayor and Council in September 2006. Among the City’s major sustainability initiatives are (1) development of a revised General Plan that has an overarching sustainability framework and includes a climate change element, (2) development of a sustainability plan for City operation and activities, and (3) creation of a Climate Change Mitigation and Adaptation Plan with the support of a newly-created Climate Change Committee.

¹ It should be noted, that if a provider relies 100% upon renewable supplies, it is not subject to per capita water use targets. Large turf users are not constrained to their turf allotments if they only use reclaimed effluent.

The relationship between climate change and water resources was strongly established in Phase I of the *City/County Water and Wastewater Study*.

- **Mayor's Climate Change Agreement** - Under the U.S. Conference of Mayors Climate Protection Agreement, signed by the Mayor of Tucson (2006) and the Mayors of 924 other U.S. cities, participating cities commit to meet or beat the Kyoto Protocol targets (seven percent reduction in greenhouse gases below 1990 levels by 2012) in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns. The Climate Protection Agreement specifically commits cities to evaluate opportunities to increase pump efficiency in water and wastewater systems. Further, the City of Tucson's 2008 Greenhouse Gas Inventory, also specified in the Agreement, identified the electricity use and greenhouse gas emissions associated with Tucson Water operations to be the single highest use of energy and associated release of greenhouse gases among all City operations (buildings, street lights, fleets, etc.) Any increase in water efficiency or decrease in water use through conservation or rain/storm water harvesting would result in a measurable decrease in Tucson Water's energy use and a commensurate reduction in greenhouse gases associated with energy used in Tucson Water operations.

- **City of Tucson General Plan** - The City has implemented a number of policies and regulations that govern water use within the Tucson Water service area. The City of Tucson's General Plan, passed by the voters in 2001, and includes a Water Resources Element stating that: "Water conservation practices will be promoted and required through restrictions on water intensive land uses, as well as promotion of native landscaping and expanded use of recycled effluent." The General Plan includes the following policies:
 - √ Implement conservation programs that meet state regulatory requirements, minimize the need for new water sources and reduce water waste;
 - √ Include conservation of water resources in plans and policies to guide land use decisions and protect natural ecological systems;
 - √ Implement Floodplain and Erosion Hazard Area Regulations to maintain drainage patterns and hydrologic and hydraulic processes and conserving groundwater recharge; and
 - √ Implement the provisions of the Watercourse Amenities, Safety, and Habitat (WASH) regulations to promote opportunities for groundwater recharge along certain washes within the urbanized area and protecting vegetation that supports wildlife;
 - √ Policies to coordinate regional water related communications and cooperation;
 - √ Urban Landscape Framework: Recognizing the landscape connections to the quality of life within the City, the greater Tucson region, and need to interface with Pima County's Sonoran Desert Conservation objectives, Mayor and Council endorsed the Urban Landscape Framework in March of 2008. The goals of the Urban Framework are to (1) advance the City's General Plan, (2) increase understanding of urban ecology, (3) examine and make choices about Tucson's natural and cultural landscape and (4) chart a course of action fostering civic health and environmental, social, and economic sustainability. The actions in the Framework begin to address the benefits of

increased water conservation through reduced water demand, storm water management and rainwater harvesting by:

- Strengthening interdepartmental communication and cooperation;
- Improving departmental standards and practices, and;

Pima County

- **Pima County's Sonoran Desert Conservation Plan (SDCP)** - The SDCP is a long term vision for protecting the heritage and natural resources of Pima County and embodies five elements: Ranch Conservation, Historic and Cultural Resources, Riparian Resources, Mountain Parks, and Critical Habitat and Biological Corridors. Riparian resources in a desert environment are vital places. Although sixty to seventy-five percent of animal and plant species in Arizona rely on a riparian environment at some point during their life cycle, a number of streams and springs in and near Tucson have ceased to flow year round or are affected by lower water tables. These streams and springs need protection and restoration.

The biological goals of the SDCP are designed to conserve critical and sensitive wildlife habitats through the protection of in-stream flows and water quality because groundwater resources are so limited. Storm water runoff, CAP water, and reclaimed water can be used to support riparian restoration in river corridors and floodplains. The challenge is to optimize the use of renewable water resources to protect and enhance the natural environment, while fostering a sustainable water supply for the growing urban environment.

- **Pima County Comprehensive Land Use Plan** - Arizona State statutes require counties to develop a comprehensive plan that conserves natural resources of the County, ensures efficient expenditure of public funds, and promotes health, safety, convenience and general welfare of the public (ARS §11-806B). Seven elements in the Comprehensive Plan guide long range planning in unincorporated Pima County. Two elements, in particular, have a relationship to water resources development.

a) Pima County Water Resource Element Regional Plan Policies (Resolution 2008-72)

In 2001 the Pima County Board of Supervisors adopted the Comprehensive Plan Update including Regional Plan Policies for seven elements: land use, circulation, open space, growth area, environmental, cost of development and water resources.² In December 2007 the Board of Supervisors strengthened the water resource element regional plan policies by adopting Resolution Number 2008-72.³ The water resources policies require staff to conduct water supply impact reviews on Comprehensive Plan amendments that are larger than four acres. The review evaluates five issues: water service and renewable water supply options; current and projected depth to

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http://www.pimaxpress.com/Planning/ComprehensivePlan/PDF/Policies_Legend/Policies_2007_Reg_Policies.pdf

³ http://www.rfcd.pima.gov/wrd/planning/pdfs/wrpolicyres2008_72.pdf .

groundwater and groundwater trend data; proximity to areas of known or potential ground subsidence; proximity to known groundwater-dependent ecosystems; and location within a hydro geologic basin, including depth to bedrock.

The water resource policies also require that staff of the Pima County Development Services Department conduct a water resource impact assessment on any rezoning request that requires a site analysis. Depending on the projected water demand, applicants may be required to provide additional water resource information that will be considered in staff's assessment. Adverse impacts can be mitigated through rezoning conditions, but the ultimate land use approval decision rests with the Pima County Planning and Zoning Commission and the Board of Supervisors. Applicants are required to include water conservation measures. As a result of the water resources policies, these decision makers will be able to more fully consider the water resource impacts of new development before land uses changes are approved.

b) Pima County's Conservation Lands System Environmental Guidelines

The Comprehensive Plan was adopted by the Pima County Board of Supervisors in 2001 to incorporate the Conservation Lands System (CLS) and the associated environmental guidelines into the planning process. The latest amendment to the guidelines was adopted June 25, 2005 (C07-03-12). The CLS and guidelines were developed to protect the most biologically important areas of Pima County. They are intended to be used to guide private development and public investments in infrastructure to the least biologically sensitive area of the County.

• Sustainability Action Plan for Pima County Operations

In August 2008, the Pima County Board of Supervisors adopted a Sustainable Action Plan for County Operations that includes goals, guiding principles, a five-year action plan, and success indicators in several areas including water conservation and management. The water conservation and management section contains 35 action items organized by facilities, parks and landscaping, natural resource protection, and education. The plan includes an implementation schedule for each of the 35 actions, and identifies the lead and supporting departments responsible for overseeing the activities.

The water conservation related goals include:

- √ Reducing water use in all County facilities by 15% by 2025;
- √ Doubling the number of County parks served by reclaimed water by 2018 (subject to voter approval of bond funds to extend reclaimed water lines);
- √ Maximizing County water resource assets including groundwater rights, surface rights, and the production and use of effluent to sustain and protect the natural environment.

2. Inventory of City and County Water Conservation Ordinances and Programs

Water Utility-related Conservation Programs

This section of the report provides a summary of conservation programs led by Tucson Water, which address modifications to the existing built environment and customer behavior.

Additionally, given Tucson Water's critical role in conservation programming, this section also provides a description of the drivers of utility conservation efforts, trends in per capita usage and compliance status, and a brief evaluation of Tucson Water's programming efforts. The Phase I Report also provides information on water use trends and factors Tucson Water considers in developing its water conservation programs. This report is available online at www.tucsonpimawaterstudy.com. Further information on Tucson Water's program planning and evaluation efforts are posted to the Study website: www.tucsonpimawaterstudy.com.

Utility drivers

Tucson Water follows a set of specific water policies adopted by the Mayor and City Council addressing a wide range of operational, revenue and planning issues. These water policies include supporting state regulation and emphasize that the City will "lead by example" in the water conservation promotion. For more than twenty-five years, Tucson Water has implemented many different strategies for reducing water consumption and increasing water use efficiency in our community including public education, conservation-sensitive water rates, direct assistance and training programs, and through specific water conservation ordinances.

The primary drivers for water utility-focused conservation efforts are reducing operating costs, reaching goals for reduction in the per capita water use imposed by ADWR, and stretching current water resource supplies to delay the need to acquire additional supplies.

For Tucson Water, balancing the decision-drivers can be difficult due to the need to balance water conservation goals with the need to have a predictable revenue stream to manage utility operations. As such, Tucson Water's conservation efforts are subject to rigorous planning with substantial stakeholder input, such as those undertaken by the Community Conservation Task Force (CCTF) as part of Tucson Water's long-range planning efforts outlined in Water Plan 2000-2050. Additional information on the comprehensive CCTF process can be found on the Study website at www.tucsonpimawaterstudy.com.

Trends Water Usage

Water usage within the Tucson Water service area has declined dramatically during the past few years. Water usage is typically measured in "gallons per capita per day" or GPCD, which can also serve as a metric for measuring the success of water conservation programs. Tucson Water's historical average rate over the past 25 years has been 177 GPCD. In recent years, this number has dropped to 166 GPCD (2007).

Annual Percent Change in Usage per Service for Selected Rate Classes



As shown the above graph, Tucson Water's single-family and multi-family per-customer usage has declined more than 20 percent since 1997, with the bulk of that decline having occurred since 2002; likewise, per-customer usage in the commercial class has declined more than 10 percent since 1997, with the majority of that decline having occurred since 2005.

Currently and historically, Tucson Water has been regulated under the ADWR total per capita program. The City fell out of compliance twice, once in 1989 and again in 1997. As part of a 1989 Compliance action, ADWR stipulated that Tucson Water implement a robust conservation program. Tucson Water's current conservation program originated from that stipulation and consent order. Tucson Water also entered a best management program (BMP) for three years from 1999 through 2001.

With per capita potable demand at its current level, Tucson Water could eliminate its conservation program and probably remain in compliance with ADWR requirements for years to come. So, while a regulatory hammer does exist, the City's commitment to conservation supersedes the current regulatory imperative.

Inventory of Tucson Water Efforts

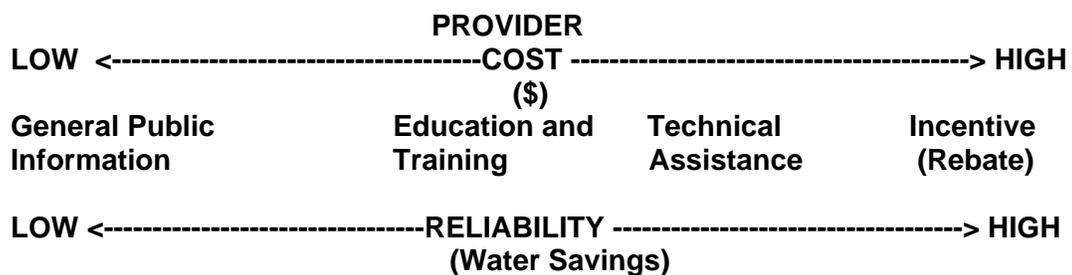
Tucson Water has a long history of water conservation programs focused on reducing demand for water on the customer side of the meter.

- **Tucson Water’s Base Program**

Tucson Water’s current base conservation programs are designed to provide a high level of public awareness and to help maintain compliance with ADWR conservation requirements. These programs include various community outreach and education efforts, and water waste enforcement, and are periodically reviewed and revised based on evaluation procedures. The Base Program focuses on conservation programming in five main areas as follows:

- **Public Information Program:** This includes distribution of printed materials and participation in community events.
- **Education and Training Programs:** This includes programs for school children and training programs for teachers, and adult education programs that focus on workshops on desert landscaping methods and improving irrigation techniques. The adult programs are broken into homeowner and professional landscape categories.
- **Rates:** Tucson Water utilizes rate structures that are designed to encourage water conservation. These rate structures are designed as either increasing block rates for residential customers, or a base-rate summer surcharge structure for commercial customers. Exceptions include a flat rate used for multi-family and reclaimed customers.
- **Direct Assistance Program:** Tucson Water provides assistance by offering water audits for customers.
- **Ordinances:** A variety of ordinances are in place that provide for more efficient water use in new construction, defines water waste and establishes enforcement provisions, and allows for response to emergency situations. (See above list and summary under regulatory drivers.)

This broad-based program employs projects that range from low cost/low reliability (with respect to quantifiable water savings), to programs which are high cost/high reliability. This relationship is characterized as follows:



With the exception of construction related ordinances and the newer rebate programs, the existing base program is designed to encourage changes in water use. A complete listing of current base program conservation efforts can be found on the Study website at www.tucsonpimawaterstudy.com.

In addition to the base program, a plan for the phased implementation of efficiency programs recommended by the Community Conservation Task Force (CCTF) was

submitted to Mayor and Council resulting in the development of a conservation fee. Funding for the Base Programs and the Efficiency Programs is now supported through a volumetric Conservation Fee charged to all customers, established at \$.03 per Ccf for Fiscal Year 2009, and \$.04 for FY 2010. Staff is currently finalizing the cost/benefit study initiated by the CCTF, and will provide recommendations for future programming beginning in FY 2011.

- **Tucson Water's Efficiency Program Recommended by the Community Conservation Task Force (CCTF)**

Tucson Water's Efficiency Programs are based on recommendations provided by the CCTF, as modified by Mayor and Council. These programs are designed to meet long-term water resource management goals identified in the *Water Plan 2000-2050*.

The CCTF reviewed an initial "Universe of Conservation Measures" submitted by a consultant team. The CCTF conducted a qualitative screening of 122 measures to develop a short list of 48 measures that would undergo a quantitative economic analysis by the project consultant. The short list screened out those programs that didn't fit Tucson for quantitative reasons. The CCTF used the results of an economic analysis as the foundation for developing its final recommendations.

The screening process itself had several steps. They included the following:

- 1) CCTF members completed a survey indicating the level of support they believed would exist from their constituency group on each of the 122 measures in the universe of conservation measures.
- 2) Tucson Water Staff simultaneously completed a qualitative screening of that same universe of conservation measures to help screen out measures that just didn't fit Tucson for qualitative reasons.
- 3) Results of the CCTF member survey and the Tucson Water staff screening were compiled and provided to the Task Force for consideration.
- 4) CCTF selected a short list of 48 measures that would undergo technical (economic) analysis.
- 5) An economic analysis of 48 potential conservation measures was conducted by Tucson Water consultant, Gary Fiske and Associates, and the results were presented to the CCTF.
- 6) CCTF requests for additional information were collected and responses provided by the consultant and Tucson Water staff.
- 7) CCTF developed a final list of recommended measures that they believe will reduce per capita water use, yield significant water savings, and provide benefits for both the community and the program participants.

This process differs from traditional approaches in that it sought community input in the initial screening of options, rather than having staff provide a pre-screened listing for review.

The CCTF Report presented to Mayor and Council includes a Draft Technical Report prepared by the project consultant. Since the draft report was issued, there have been significant changes to the designation of Tucson Water's service area, water and energy use projections, and economic issues related to the Efficiency Program strategies recommended by the Task Force. In addition, Mayor and Council directed staff to expand or modify several of the recommended conservation strategies based on additional input from town hall meetings held in the spring of 2008. In order for the final technical and economic analysis report to reflect these changes, the Department must review and revise various assumptions used in calibrating the planning model used to develop the benefit/cost results. Once finalized, the Technical Report data will be used to develop a conservation program plan consistent with Mayor and Council direction, City policy, and Long Range Water Resource Plan assumptions.

The full CCTF report "**Water Efficiency: Water Conservation Program Recommendations for Tucson's Water Future**" can be found at:
<http://www.tucsonaz.gov/water/cons-townhalls.htm>.

The CCTF recommended programs are technology-focused, attempting to accelerate the replacement of older, less efficient fixtures and technologies with newer technologies. The measures include rebates for High Efficiency Toilets (HET's), irrigation system upgrades, and greywater systems. Initial programs established in FY 2009 include HET rebate programs for Residential, Multi-Family, and Commercial HET fixtures, Commercial and Multi-Family Irrigation System Upgrade Rebate program, and a Low Income Toilet Replacement Program. In addition, Tucson Water has partnered with Southwest Gas and ADWR to distribute commercial dishwasher sprayers at no charge to qualifying customers. These Efficiency Programs have met the cost/benefit criteria established by the CCTF. Table 2 below provides a summary of program activity through December 31, 2008. For complete information on the CCTF process and recommendations please visit the Study website: www.tucsonpimawaterstudy.com.

Table 2 Efficiency Program Activity				
Project	FY09 Projected Expenditure	Participation (Received/Approved)	Expenditure	Balance
Residential Low-Income High-Efficiency Toilet (HET) Replacement Pilot Program	\$ 50,000	Program in development phase	\$ 0	\$ 50,000
<u>Multi-Family Low Income HET Replacement Pilot Program</u>	50,000	Program in development phase	0	50,000
<u>Commercial Irrigation System Upgrade Rebate Program</u>	114,471	1 / 1	763.70	113,707.30
<u>Single Family HET Rebate Pilot Program</u>	157,457	375 / 229	28,999.10	128,457.90
<u>Multi-Family HET Rebate Program</u>	42,872	5 / 4	291.65	42,580.35
<u>Commercial/Industrial HET Rebate Pilot Program</u>	23,121	2 / 0	0	23,121
<u>Pre-Rinse Spray Valve Rebate Program</u>	17,079	21 / 7	700.02	16,378.98
Totals	455,000	404 / 241	30,754.47	424,245.53

¹As of January 13, 2008

Evaluation of Tucson Water Efforts

The development of the current water conservation program under the guidance of the CCTF formally brought water conservation into the water resource planning framework. In this context, Tucson Water can now evaluate water conservation using an economic framework to determine how to most effectively expend its limited financial resources rather than solely focusing on how it may satisfy a regulatory requirement. This framework is also endorsed by the American Water Works Association for implementation in water utilities.

The Integrated Resource Planning (IRP) model selected for use in the CCTF process is endorsed by the American Water Works Association, as found in the document "Evaluating

Urban Water Conservation Programs; A Procedures Manual". An innovation in the IRP approach is that it allows for comparison of the costs of various conservation methods against the costs of various supply augmentation options. As a result, demand reductions can be put in the context of how they impact both the cost and timing of introducing new water supplies to the community. These factors can then be included in the Utility's strategic resource planning process.

For most conservation programs, the costs associated with each program participant are 'front loaded', that is, they are incurred at or near the time of customer enrollment in the program, while the benefits are spread over a much longer period of time.

For example, in an ultra-low-flush toilet rebate program, the cost of the toilet and installation occurs when the participant enters the program. The benefits, which result from the water savings, are spread over the useful life of the fixture, up to 25 years. To account for these timing disparities, the discounted *present values* of program benefits and of program costs are compared. The present value of a series of dollar amounts uses a *discount rate* to reflect the lower value of future dollars as compared to present dollars. This is a well-accepted, economically valid way to compare streams of benefits and costs. Additional information on the economic analyses reviewed by the CCTF to develop the current conservation program is available on the Study website: www.tucsonpimawaterstudy.com.

Land Use and Development-related Conservation Ordinances and Programs

This section of the report focuses on land use regulations and new construction standards aimed at decreasing water usage. Both the City and County regulate land use and development and the design of the built environment has a significant impact on long-term water usage rates. Incorporating low water usage development standards into new construction and establishing land forms that reduce the "water footprint" of the built environment are critical aspects of water conservation, because we have the opportunity to "build conservation in" from the beginning.

City of Tucson Water Conservation Ordinances and Programs

- **City of Tucson Regulations, Ordinances and Standards**

To achieve its General Plan policies, the City of Tucson has enacted a wide range of water conservation related ordinances such as low water use landscape requirements for new development, restrictions on water features, emergency water use measures, regulation of indoor plumbing, and a water waste and tampering. The ordinances give customers, developers, business and others clear-cut guidelines to work within to help the whole community meet long term planning goals for water. These ordinances were developed with stakeholder input and key examples are described below.

- **City of Tucson Water Harvesting Ordinances**

Since the mid 1990s, the City Land Use Code has required that sites make maximum use of site storm water runoff for supplemental irrigation. The sites subject to land use code requirements include new commercial sites, the common areas of subdivisions, public buildings, and public rights-of-way. This qualitative requirement does not specify that a certain amount of rainwater be used. With adoption in 2005 of the City's Water Harvesting Guidance Manual, more specific information was made available on how to design and implement water harvesting. In October 2008, the City of Tucson Mayor and

Council adopted a commercial Rainwater Harvesting Ordinance (No. 10597) that quantified water-harvesting requirements for the commercial sector. This ordinance mandates that new commercial development must utilize water-harvesting practices to meet 50% of the site landscape water requirement. This ordinance takes effect in 2010. In the interim, City staff is working to finalize a Development Standard. for implementation of the Commercial Water Harvesting Ordinance. The City is working with the commercial sector to establish pilot projects to test elements of the ordinance and development standard prior to the 2010 implementation date. Educational programs also are being developed for designers, installers, and the ultimate users of water harvesting to ensure water management goals are met without compromising public health or safety.

- **City of Tucson's Greywater Ordinance**

The City of Tucson adopted a residential greywater ordinance in September 2008. The ordinance mandates installation of interior plumbing features in new residential construction beginning July 2010 to facilitate the installation and use of greywater systems by subsequent homeowners. Builders of new single-family residences must provide additional drains for washers, showers, bathtubs and bathroom sinks, and stub out these drains to the outside wall of the house. These additional drains will allow homeowners to easily switch between discharge of drain water to the sewer or discharge to a greywater distribution system if one is installed by the homeowner.

- **City-wide Landscape Projects and Programs**

- ✓ Residential roadway curb cut detail standards to allow neighborhoods to add curb cuts and apply storm water harvesting principles to local streets in conjunction with street tree plantings;
- ✓ When possible, incorporate porous paving and passive water harvesting principles to new on-site public and rezoned private properties as conditions;
- ✓ To the greatest extent possible, where appropriate, utilize a plant palette of native vegetation species;
- ✓ All new public landscapes with irrigation are utilizing smart controllers and watering by the numbers (principles outlined in "Landscape Water by the Numbers- a Guide for the Arizona Desert"). Parks and Recreation utilizing Rainbird Smart Controllers. Streets utilizing Calsense controllers.

Pima County Water Conservation Ordinances and Programs

- **Pima County Water Conservation Ordinances**

Pima County ordinances to address water conservation include landscape restrictions on new development, restrictions on water features, restrictions on swimming pools, emergency water use measures, regulation of indoor plumbing, and a water waste and tampering ordinance.

The Pima County Board of Supervisors in 2006 approved water conservation ordinances aimed at new construction. Implementing water-conserving features during new building construction is more cost effective than retrofitting existing buildings. Changes to the landscape portion of the zoning code require new construction to have separate reclaimed-ready irrigation plumbing and irrigation with seasonal

adjustments and rain sensors. There are also restrictions on large water fountains and water features, and turf may only be installed for functional purposes, such as play and picnic areas.⁴

Amendments to the plumbing code⁵ and residential code⁶ were approved by the Board of Supervisors in 2007. The code amendments require waterless urinals and automatic faucets in commercial buildings, sub-water meters in multi-family construction so that water use can be measured and billed accordingly, and new pools to have pool covers to reduce evaporation.

The Board of Supervisors also adopted a change to the Golf Course Zone Ordinance that prohibits the use of groundwater for new golf courses.⁷ Instead, only reclaimed water or renewable water (such as CAP water) may be used to irrigate newly-zoned golf courses.

The above water conservation ordinances were developed with input from the building community, local water providers and the Water Conservation Alliance of Southern Arizona (Water CASA).

- **Pima County Landscape Projects and Programs**

- √ The Pima County Natural Resources Parks and Recreation Department (NRPR) is working with RFCD to develop design specifications and grading standards for rainwater harvesting for County parks and landscaping. NRPR also will examine reducing slopes on ball fields so that rainwater does not drain away as quickly supplementing landscape irrigation. NRPR staff is trained to operate and manage irrigation systems efficiently to reduce water use while maintaining the functionality of its parks. NRPR also consults with the University of Arizona about their initiatives for landscape irrigation, planting specifications, and rainwater harvesting techniques.
- √ The Pima County Department of Transportation is revising design standards to incorporate rainwater harvesting on sites where it is appropriate. The department will explore such things as the creation of “concave” graded medians to accommodate rainwater harvesting and the City of Tucson’s “water truck approach”

- **Pima County Information and Education Programs**

Pima County Regional Wastewater Reclamation Department supports the County’s adopted water conservation and resource management goals through cooperative public education and outreach programs such as:

- √ Community Outreach Events to civic and community groups
- √ Public Education for the Save our Sewers Campaign and the development of
- √ a Drought Campaign

⁴ Title 18, Chapter 73.030 of the Pima County Code found at <http://municipalcodes.lexisnexis.com/codes/pima/>

⁵ <http://www.pimaxpress.com/Building/PDFs/2007/2006%20International%20Plumbing%20Code.pdf>

⁶ Appendix G of:

<http://www.pimaxpress.com/Building/PDFs/2007/2006%20International%20Residential%20Code.pdf>

⁷ Title 18, Chapter 18.59 of the Pima County Zoning Code found at

<http://municipalcodes.lexisnexis.com/codes/pima/>

- **Pima County Incentive Programs**

Two incentive programs are offered by Pima County: 1) The Green Building Program and 2) LEED Certification. The Green Building Program is a voluntary effort that promotes the construction of sustainable homes through a certification program. The program gives credit to participants who demonstrate use of rain water harvesting, greywater use, interior plumbing fixtures that save water and other features water / energy efficient features.⁸

LEED for Homes awards points to projects in seven categories of environmental performance and requires water efficient landscaping with a goal to reduce water consumption by 50%. LEED also gives credits for eliminating potable water use in landscaping, and interior water reduction of 20% to 30%.

- **Rainwater and Storm Water Harvesting**

Pima County, through the Water Resources Element of the Comprehensive Plan Policy, Green Building Program and LEED Program encourages, as opposed to mandates, water harvesting. Rainwater harvesting for interior use will be incorporated into Voluntary Residential Green Building Standards. LEED also gives credit for eliminating potable water use in landscaping.

The Pima County Regional Flood Control District focuses on storm water harvesting consistent with its flood control statutory authority. In cases where harvesting storm water is used in place of groundwater to support landscape irrigation or to restore riparian habitat, it can be considered water conservation. A separate technical paper on storm water harvesting and management also was developed during Phase II of this study and is available on the project website at www.tucsonpimawaterstudy.com. The Study website also includes information on the cost effectiveness of storm water harvesting.

Examples of The Pima County Regional Flood Control District (RFCD) storm water management efforts that promote water conservation include:

- ✓ Incorporating beneficial use of storm water into development plans: Water harvesting will be considered as part of detention/retention requirements for development plans.
- ✓ Incorporating water harvesting as a strategy to limit the use of potable water: The Regional Flood Control District reviews specific plans to determine whether the development will impact sustainability of water resources as part of the recent Water Resources Element of the Comprehensive Plan Amendment.

Additionally, The Regional Flood Control District (RFCD) maintains six regional detention basins. One, the Kino Environmental Restoration Project, was a joint collaboration funded by RWRD, the Corps of Engineers and the RFCD. This project was designed to provide multiple benefits including reducing groundwater pumping by supplying turf and landscaping irrigation on the adjacent Kino Sports Complex athletic fields using the County's share of effluent, creating a native ecosystem, and controlling flooding.

⁸ <http://www.pimaXpress.com/Green/LEED%20Homes%20Handout.pdf> and <http://www.pimaXpress.com/Green/Green%20Building%20Program%20criteria.pdf>

Opportunities and Constraints

Two questions were posed regarding water conservation at the beginning of this chapter: 1) How can the City of Tucson and Pima County implement consistent water conservation standards to help sustain long-term supplies, and 2) How can the City and County work together to ensure that water conservation protects our future water supply, not simply makes more population growth possible? These questions will be addressed in turn in this section, followed by a list of recommendations for next steps in this process.

Scope Question #1: How can the City of Tucson and Pima County implement consistent water conservation standards to help sustain long-term supplies?

To identify opportunities related to this scope question, City/County staff examined various aspects including opportunities for consistency in goals, ordinances and standards, opportunities for enhanced planning and evaluation, and opportunities for enhanced and more consistent information and education efforts.

Consistent Goals

ADWR has established differing regulatory mandates (i.e. GPCD targets) for the various water providers in the region. This has resulted in disparate strategies, messages, and methods for achieving the per capita water use targets. In Phases III and beyond, there is an opportunity to work with the other water providers to develop more consistent strategies and tools for water conservation (e.g. education and information, incentives, regulations).

There is also an opportunity to explore the various goals and drivers for water conservation and to identify strategies, best management practices and conservation mechanisms applicable to new construction versus the existing built environment. This effort will also help build a common vocabulary among water providers, regulators, and the public, which can increase understanding of the various reasons for conserving water and thus greater incentives to conserve.

Examples of different goals, strategies and conservation mechanisms that would be applicable in the context of new construction (land use scale) versus existing construction (utility scale) are provide in tables 1.0 and 2.0 below.

**Table 1.0 New Construction Conservation Goals, Strategies and Mechanisms
(Land Use Scale)**

Category	Example Goals and Drivers	Example Strategy	Example Mechanisms
Environmental	Protect sensitive ecosystems while preserving water supplies for future growth	Discourage groundwater pumping adjacent to or near groundwater dependent ecosystems	<ul style="list-style-type: none"> • To extend infrastructure to suitable areas and discourage it in unsuitable areas • To transfer development rights from environmentally sensitive areas to areas suitable for development • To apply land use regulation such as increased set-aside • To levy higher impact fees • To purchase land for conservation
Economic	Defer the need to develop or import expensive water to serve existing and future populations and defer costly infrastructure expansions	Conserve water today and preserve options for the future	<ul style="list-style-type: none"> • Water Pricing • Programming (see Tucson Water list of conservation programs) • Limiting extensions of service • Land use policies • Maximizing use and reuse of locally generated water supplies such as rainwater harvesting, storm water capture and recharge, and effluent.
Cultural Values	Promote a conservation ethic	Raise awareness to change behaviors	<ul style="list-style-type: none"> • Programming (e.g. education on desert ethic) • Link cultural values with sustainability (“Going Green”)
Operational	Become more efficient in water use	Lower water demand	<ul style="list-style-type: none"> • Irrigation efficiency • Water audits
Sustainability	Resource Efficiency	Economic development near infrastructure	<ul style="list-style-type: none"> • Water harvesting • Plumbing codes • Land use policies

**Table 2.0 Existing Construction Conservation Goals, Strategies and Mechanisms
(Utility Scale)**

Category	Example Goals and Drivers	Example Strategy	Example Mechanisms
Regulatory	Tucson Water's Per Capita Water Use Reduction Goals imposed by ADWR	Reduce consumer demand for potable water	<ul style="list-style-type: none"> • Water Pricing (block rates) • Programming (see list of Tucson Water Programs) • Use and Reuse of locally generated water sources such as rainwater harvesting, greywater and effluent for irrigation. • Development standards and Building code requirements mandating water conserving practices for interior and exterior.
Economic	Defer the need to import expensive water to serve existing and future populations and defer costly infrastructure expansions	Conserve water today and control growth	<ul style="list-style-type: none"> • Water pricing (block rates) • Programming (see list of Tucson Water Programs) • Limiting extensions of service • Land use policies • Maximizing use and reuse of locally generated water supplies such as rainwater harvesting, storm water capture and recharge, and effluent.
Cultural Values	Promote a conservation ethic	Raise awareness to change behaviors	<ul style="list-style-type: none"> • Public education programs • Link cultural values with sustainability ("Going Green")
Operational	Become more efficient in supplying water to the consumer	Reduce lost and unaccounted for water	<ul style="list-style-type: none"> • Leak detection program • Meter replacement program • Capital improvements for maintenance and rehabilitation
Sustainability	Lead by example	Energy reduction; green house gas emissions Efficient utility operation	<ul style="list-style-type: none"> • Water savings and efficiency practices in utility operations • Increase of renewable energy (methane/solar) in water and wastewater utilities

Both the City and County strive to reduce water use through land use regulations and building codes. However, different strategies are needed when dealing with the existing built environment versus new developments. In the built environment there are opportunities to provide water harvesting with in-fill new construction, and to require water efficient plumbing and irrigation with renovations and remodeling of existing buildings. However, these opportunities to address water conservation through land use and building codes in the built environment are limited because most building uses are “grandfathered” as they precede the adoption of new regulation. Regulations such as Proposition 207 that effectively grandfather most existing uses of land or property make it difficult to retroactively impose new standards on existing construction. Of greater importance for conservation in the existing built environment are Tucson Water’s utility conservation goals for public education, water pricing, leak detection, and use of reclaimed water.

A significant opportunity to reduce future water demand is with new construction and establishment of new urban land forms that reduce the footprint of new construction. The County’s Comprehensive Plan and the City’s General Plan strive to protect the environment and to conserve water and lower future water demands by directing where and how development occurs.

The City can further direct growth and water conservation by limiting extension of water services or requiring infrastructure improvements including reclaimed water line extensions in new development within the Tucson Water obligated service area. This is critical to ensure sustainable development and to avoid burdening existing water customers with future costs for infrastructure associated with new development. In the past, developers in the City and County often created small water companies to address a subdivision’s water supply needs. For example, in the Vail area, there are five small water companies: Vail Water Company, Rincon Creek Water Company, Pantano Properties HOA, Saguaro Water Company, and Spanish Trail Water Company. While ADWR Assured Water Supply Rules control some of the problems associated with small water companies, these rules don’t address availability of renewable water sources (“wet water”).

The first step is to establish common water efficiency goals with jurisdictional, public and stakeholder input. By establishing a baseline of water efficiency, water conservation strategies can be tailored to different scales of development (individual lot, subdivision, sub-regional, community-wide). This can then lead to the identification of strategies that link the allocation of saved water to different uses.

Consistent Ordinances and Standards

In evaluating the opportunities for increased consistency in ordinances and standards, it is important to clarify the different ways in which water conservation can be regulated. Cities and counties can regulate at the rezoning phase through rezoning conditions. At the development phase, a jurisdiction can impose regulation through design standards. At the building phase regulation can occur through zoning and building codes. By contrast, incentives and education, rather than regulations, are the primary tools for achieving water conservation in existing structures.

There are many reasons why it makes sense for the City and County to work towards consistent ordinances and standards for water conservation. Chief among them is that the

regulated community prefers uniform conservation regulations. Developers and others prefer seamless building standards across jurisdictions.

The City and County have similar building codes. For example, both jurisdictions have adopted standardized technical building and plumbing codes. Specifically, both the International and Uniform Plumbing Codes contain provisions that mandate maximum water flows for typical residential and commercial plumbing fixtures. Additionally, the standardized codes have been modified at the local level to further incorporate local water conservation measures.

An additional area of similarity is in Green Building Programs. Pima County adopted a voluntary Green Building Program. The City of Tucson is in the final stages of adopting its voluntary Green Building Program for new residential construction, which is almost identical to Pima County's. These programs encourage builders to try more aggressive water conservation measures.

However, there are some constraints to regulatory consistency between the City and County. One constraint is that the City and County have differing authorities to regulate. The Arizona Constitution allows both cities and counties to either operate under their respective statutory authorities or, with voter approval, opt to establish charters. Charters provide some governing flexibility provided the City's or County's ordinances do not conflict with State law. The City of Tucson operates under its City Charter, whereas the County is limited to the powers given to it under State statute.

Another consideration is that residential, commercial and industrial developments have different opportunities and constraints. Unlike residential and commercial development, jurisdictions expend resources trying to attract industrial and manufacturing development to meet economic development goals. As such, there are trade offs associated with regulating industrial and manufacturing development that are not associated with regulating residential and commercial. This is a factor to consider when evaluating whether to adopt additional regulations to achieve water conservation goals.

Pima County has approval authority over zoning, subdivision plats, development plans, development agreements, and building permits in unincorporated Pima County. During the development and building stage, Pima County can require water conserving features in new construction through adoption of drainage standards, development standards, negotiated development agreements, and new building code requirements. Post construction, the County lacks tools for ongoing compliance monitoring other than through enforcement driven by complaints.

Pima County's Comprehensive Plan Water Resources Element requires that at the time land is rezoned, a water management plan assessing water supplies, impacts and mitigation measures be developed. Currently, incorporation of water conservation measures into site design can be a condition of rezoning. Developers may select from a menu of water conservation options to include in the water management plan. This information is provided to the Board of Supervisors for consideration when reviewing a rezoning request. If the rezoning request is approved, these conservation measures then become conditions for a rezoning. Pima County refers to this as "Performance Based" approach to distinguish it from more prescriptive regulatory approaches.

Currently, this mandate only applies to properties that are being rezoned not properties that already have their zoning but have yet to be developed. An opportunity to increase water conservation potential and consistency with the City of Tucson, is to consider adopting ordinances that would require a water resource management plan, similar to what is required in rezonings, for properties that are zoned, but undeveloped.

The County is currently developing its implementation standards for the Water Resources Element of the Comprehensive Plan Policies. The implementation standards will provide guidelines for how to develop an integrated water resources plan and where to find the information required. There is an opportunity to strengthen these guidelines by including a quantitative water conservation goal to offset the increased water use resulting from new development. Currently, there is no quantitative requirement. This would assist the developer by providing parameters for selecting from the menu of water conservation measures.

For properties that are developed under existing zoning, no water conservation measures can be applied other than those prescribed by existing codes or ordinances, as described in the inventory section of this report. Those ordinances are prescriptive.

Pima County's perspective is that to be effective, ordinances with specific measures and standards need to have meaningful enforcement mechanisms. Additionally, prescriptive regulatory approaches limit the ability to adapt to emerging technologies and to take advantage of the opportunities available during the land development process to employ innovative methodologies and to tailor methods to site specific conditions. As such, the County prefers the performance-based approach when feasible as an alternative to prescriptive regulations that specify a particular methodology.

The City and County have opportunities to establish water use baselines for new construction within the land development process. Projects can be designed to achieve a water use baseline target using best management practices and new technologies. LEED provides a model for this in that it has established standards for conservation, as well as for pegging performance to the Energy Policy Act of 1992 by establishing performance design reductions of water use. Another opportunity for increased consistency would be for the City of Tucson to consider incorporating a performance-based compliance option into their current prescriptive regulations.

A systematic evaluation of existing ordinances and standards will provide a better understanding of where similarities and differences exist in codes and ordinances of the two jurisdictions that would allow for consistency, or at a minimum, identify ways in which the two jurisdictions can compliment, rather than conflict, with each other's regulatory and policy mandates. Following are some additional opportunities based on staff's preliminary analysis:

- ***Rainwater Harvesting***

The City's Rainwater Harvesting Ordinance goal is to reduce outdoor watering with potable sources by 50 percent but only applies to commercial buildings. The City also requires water harvesting in subdivision common areas and public projects, but with no specific performance goal. The Water Resources Element of Pima County's Comprehensive Plan Policy will employ water conservation for both residential and commercial properties that go through a rezoning. Rain water harvesting is one

option among many that can be used to meet water conservation requirements in rezonings.

An initial approach to increased consistency in water conservation standards could be to jointly explore the option of adopting common standards for rainwater harvesting. The City is currently developing these standards and the County could participate in their process to identify opportunities for integrating these design standards into the menu of water conservation options in water management plans that are prepared for rezoning proposals. Additionally, these could be incorporated in a future ordinance for properties that are currently zoned at the discretion of the Board of Supervisors.

- ***Greywater***

The City and County share the goal of maximizing reuse and recycling of locally renewable water resources including greywater and making them as affordable as possible for the consumer. Pima County Development Services' residential and commercial green building programs provide incentive points for greywater. Greywater usage is also an option for mitigation of water usage in water plans presented at the time of a rezoning.

The Pima County Regional Wastewater Reclamation Department (RWRD) has determined that there are various existing areas within the conveyance system with flat sewers and small diameter sewers that have not been designed to handle lower flows. Those areas are monitored and maintained to avoid blockages and odor problems. However, RWRD supports use of greywater programs in new large residential projects and in commercial and industrial applications.

RWRD is evaluating its' sewer design standards which may be modified to accommodate lower flows that will result from greywater systems. The City of Tucson is also modifying their design standards for greywater. Once completed, the two jurisdictions will need to coordinate implementation of the respective standards.

There are trade-offs associated with greywater and other water conservation decisions. For example, maximizing use of greywater could result in reduced volumes of effluent generated at the treatment plants. As a result, this could impact wastewater flows, options for recharge, and environmental restoration. Efforts to evaluate quality of life trade-offs with public input is needed. In addition, efforts to gather data on the impacts of water conservation measures such as greywater would assist the ability to plan and appropriately size water and wastewater systems and ultimately achieve increased energy, cost and water resource efficiencies.

- ***Landscaping Codes***

Preliminary review of City of Tucson and Pima County landscape codes reveal similarities. For example, both incorporate low water use plant lists, require use of water conserving irrigation systems, and require water conserving design standards such as limitations on the amount of turf and the use of turf for functional purposes. However, there are opportunities to realize additional landscape water conservation potential through increased consistency.

An immediate opportunity for increased consistencies between the City and the County landscape regulations would be for the two jurisdictions to have a common low water use plant list of plants indigenous to the Sonoran Desert. The current ADWR low water use plant list allows for non-native plantings. A plant list that focuses on species indigenous to the Sonoran Desert would conserve even more water as these plants are better adapted to Tucson's seasonal precipitation patterns and drought conditions. Native plants may also provide the opportunity for removal of irrigation lines after establishment further lowering outdoor water use.

- ***Drainage Requirements***

Additionally, Pima County Regional Flood Control District (RFCD) requires that all on site drainage be retained within the boundaries of the site. This requirement often results in large retention/detention basins that are often disconnected from the landscape buffer yards, eliminating the potential use of the storm water for irrigation purposes. This presents an opportunity for increased coordination with flood control standards, landscape requirements, street standards, and site grading requirements. Increased coordination between these regulations would allow the required landscape areas to serve as retention/detention basins, with curb cuts allowing additional storm water to infiltrate the landscape areas. The County is integrating passive rainwater harvesting standards into drainage standards for common areas within subdivisions, commercial development and streetscapes. Further evaluation of the potential of small swales to minimize the need for larger retention/detention requirements is needed.

Increased coordination of the ordinances between the City Stormwater Management Section and County RFCD, the departments of transportation, and the development services departments' could help address the enforcement issues that hinder effective enforcement of landscape requirements after the project has been permitted.

Enhanced Planning and Evaluation

Conservation planning needs to incorporate more robust environmental, social, and economic impact analyses to accompany the analysis of options for acquiring new water resources. The cost benefit tradeoffs of conserving water versus acquiring new water need to be fully considered.

The recent study, "Evaluation and Cost Benefit Analysis of Municipal Water Conservation Programs" (EcoBA), sponsored by the local group Water Conservation Alliance of Southern Arizona (Water CASA), further strengthens the case for effective planning to ensure that water savings anticipated from water conservation programs are properly balanced against the financial investments made to implement them. According to the study, water utilities too often rely on simple estimates of water savings while "...there are simply too many factors and variables involved in reaching appropriate, tailor-made decisions for a given utility."⁹ Tucson Water, however, has undertaken a thorough planning process that examined all factors and variables, and through a strong public participation process, developed a list of recommendations tailor-made for the utility.

⁹ **Evaluation and Cost Benefit Analysis of Municipal Water Conservation Programs**, p.9, Water Conservation Alliance of Southern Arizona, 2006.

The development of the current water conservation program, under the guidance of the City's Community Conservation Task Force (CCTF), formally brought water conservation into the water resource planning framework endorsed by the American Water Works Association. This means that Tucson Water is now evaluating water conservation using an economic framework to determine how to most effectively expend its limited financial resources to achieve meaningful water conservation, rather than solely focusing on how it may satisfy a regulatory requirement.

Consistent Education and Information Programs

Tucson Water continues to implement many successful water conservation education programs such as Beat the Peak, which targets summer peak demand in an effort to reduce the need to invest in costly water infrastructure. Because Tucson Water already has many conservation education programs that are widely advertised even outside Tucson Water's service area, there seems little need for Pima County to duplicate well-advertised conservation themes. Recent declarations of drought have resulted in a renewed public message to conserve water among many area water providers. These messages can cause public confusion and frustration if they are inconsistent. A coordinated message from the policy makers about water conservation and efficiency is important to achieving the community's water conservation and sustainability goals.

There are widely varying interpretations as to what "conservation" means and the lack of a common vocabulary in these discussions too often results in a lack of clarity in the issues, opportunities, and constraints. Increasingly, water conservation and land use planning professionals are using the term "water use efficiency" to convey the concept of using water in a responsible and waste-free manner. Not only does this term better reflect the mix of water utility goals, but it reflects the broader goals associated with the City and County's land use and sustainability policies that foster an integrated approach to water resource planning and management. Greater education regarding the goals and strategies for achieving water use efficiency at both the utility and land use development scales, and use of a common vocabulary, can support greater public awareness of the reasons and beneficial outcomes of efficient water use.

Scope Questions #2: How can the City and County work together to ensure that water conservation protects our future water supply, not simply makes more population growth possible?

One of the most frequently cited definitions of sustainable development from the 1987 Brundtland Commission states: "Sustainable development is development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs." This definition hints at three important concepts: preserving options for the future, shoring up current conditions, and efficiency.

The question of "Why do we conserve water and who are we conserving for?" was a theme in the public input received during Phase I. Absent the ability of the existing residents to know the values of future residents, protecting future water supplies becomes an issue of preserving options for the future.

Water conservation is an essential responsibility of the current generation to preserve options for the future. By using water resources as efficiently as possible, future generations

are provided the best possible options for meeting their own water needs. Preserving options and flexibility also allows both current and future residents to adapt to uncertainty and rapid and unexpected change (such as a financial crisis, drought, or climate change).

As the City and County continue to diversify their water resources to address uncertainties, conservation is often the least expensive method of protecting future water supplies. Water conservation also reduces energy consumption, which is a significant component of treating and delivering water and wastewater services. City and County policies support conservation of future water supplies for human, economic, and environmental purposes, such as replenishing the aquifer with CAP, increasing the use of locally renewable resources, reducing groundwater pumping in areas that contain groundwater dependent ecosystems, maintaining target water levels for groundwater, streams, and springs, avoiding or mitigating the environmental impacts of developing new water resources, and continuing to reduce overall demand.

Specific opportunities are already in place, such as the Conservation Effluent Pool (CEP), to ensure that the City and County commit water to a balanced set of uses reflective of the quality of life values of existing residents. Greater public awareness of the opportunities currently in place, and identification of strategies for linking conserved water to specific environmental projects, building upon the Water Resources Research Center's "Conserve to Enhance" concept, are needed.

Further analysis of this complex issue is provided below including consideration of the following topics: (1) Shoring up Current Conditions; (2) Preserving Options for the Future; (3) Energy and Water Conservation; and (4) Quality of Life Trade Offs and (4) Providing Incentives to Conserve.

Protect and Restore Current Groundwater Conditions ("shore up")

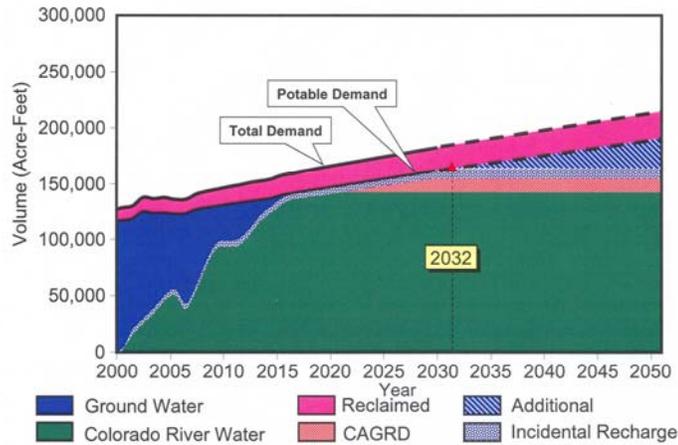
Water supplies are increasingly scarce in the southwest, competition for remaining supplies is fierce, and the Tucson population continues to grow. The region is dependent on pumping water uphill 336 miles to deliver Colorado River that is over-allocated and may be further compromised by regional shortages resulting from global climate change. Historical pumping patterns have depleted localized groundwater tables resulting in a significant reduction in riparian ecosystems. The City of Tucson's ability to pump groundwater is finite, and other available supplies are relatively small in magnitude. Given the uncertainty about future water supply for Tucson Water users and other residents of eastern Pima County, the public has expressed concerns that water conserved now will be used to support future population growth rather than as a means to shore up current groundwater conditions to allow for the protection and recovery of localized water tables. This shoring up of current groundwater conditions could include maintaining shallow water tables in areas of ground-water dependent riparian habitat, using conserved water to replace some portion of the drastically reduced riparian habitat, and/or allowing the recovery of depleted water levels. Finding ways to link the use of conserved water to projects such as these is one way to demonstrate that water conservation is a means to shore up current conditions, and not simply make more growth possible.

Preserving Options for the Future

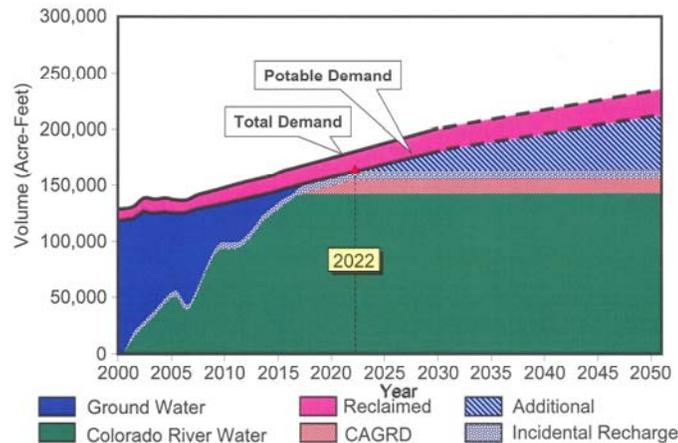
An important purpose of water conservation is protecting current water supplies and preserving options for the future. The City's Water Plan 2050 illustrates different scenarios in which future water supplies are needed at varying times in the future. The two variables at play that affect this "hinge point" (when future supplies are needed) are water usage rates and the number of people served. Other Phase II technical reports will focus on population scenarios and how these affect water resource planning.

The graphs below depict two scenarios for water supply in the future with the striped wedge indicating new water supplies being needed to meet demand. The difference between Scenarios A and B is a 10 percent reduction in water use (GPCD) by 2030. This 10 percent decrease in GPCD moves the "hinge point" and extends current water supplies for an additional 10 years. These graphs illustrate the dramatic affect that conservation has on protecting future water resources.

Scenario A



Scenario B



Delaying the need for new water supplies provides additional planning flexibility and spreads new capital expenditures and associated rate increases over time. Years before additional water is needed, steps must be taken to acquire, develop and deliver the water infrastructure. Pushing the date back in time allows decision-makers more time to consider these decisions thoughtfully and prepare for the additional financial investment that would be needed. Improvements in treatment technology may be developed in the interim that will save money and/or energy or further delay the need for additional water. The delay in time also allows more up-to-date information on population trends to be used in determining future needs.

Energy and Water Conservation

Water supply production and wastewater treatment both require large amounts of energy. Energy use also results in greenhouse gas emissions, which are a contributor to global climate change. The U.S. Environmental Protection Agency (EPA) considers water conservation to be one of the top actions to mitigate greenhouse gases, while water reuse and recycling technologies are seen as important elements in adapting to changing water conditions (Water and Wastes Digest, April 2009).

In 2007, potable and reclaimed water production accounted for nearly 90% of both City electricity and City natural gas usage for all municipal operations. Taking into account vehicle fuel usage and emissions associated with waste generation, potable water treatment and supply accounted for 52 percent of the City's total greenhouse gas emissions, with reclaimed water treatment and supply adding another 6.5 percent. The amount of greenhouse gas emissions associated with the potable water system has risen by 13 percent from 2000 to 2007, and emissions associated with the reclaimed water system have risen by 28 percent during that same period. Total City greenhouse gas emissions production has fallen by 6 percent between 2000 and 2007, so the proportion of that which is associated with water supply is steadily rising.

Similarly, approximately 32 percent of County electricity usage and 69% of County natural gas usage goes into wastewater treatment. In 2007, this activity accounted for about 31 percent of County greenhouse gas emissions, with the total emissions associated with wastewater treatment rising by 211 percent between 2000 and 2007.

Combined water supply production (both potable and reclaimed) and waste water treatment accounted for the production of more than 175,000 metric tons of CO₂ equivalents in 2007.

Water conservation does not only reduce energy use required for treatment and pumping; there is also an associated reduction in energy use within individual buildings. A reduction in irrigation, hot water production, and other water uses that require energy input will reduce the overall energy consumption in buildings.

Quality of Life Trade Offs

An important aspect of implementing long-term water conservation/efficiency programs is to ensure that quality of life is not negatively impacted or compromised. Quality of life can be measured in several ways, and at household, neighborhood, and community levels. In general, positive quality of life results in a community's needs being met without undue hardship or overall deterioration of the local environment. It is important to note that in order to maintain a high quality of life, the conservation program must respond appropriately to the resource management need.

A conservation program must emphasize lasting long-term improvements in water use efficiency. This allows for a variety of uses of water deemed acceptable by the community, with the emphasis being on ensuring that use of the water is efficient and minimizes waste. Rates can provide a tool to reinforce the concepts of efficiency for these uses, and outreach and education programs can provide the knowledge needed to implement efficient practices. In times of drought, curtailment programs can be used to restrict or control non-essential uses of water, in which case negative impacts on quality of life would be acceptable.

Achieving a low rate of water use may be an honorable goal of a conservation program, but caution must be taken in ensuring that unintended consequences do not degrade the overall quality of life from resulting reductions in water use. For example, landscape restrictions developed in the name of water conservation may lead to sparse landscapes that negatively impact the visual aesthetic of a community. These same restrictions may also aggravate other concerns, such as increased urban heat island impacts resulting from fewer tree plantings, or severe urban flooding from a decrease in landscape areas to absorb rainfall.

It is important to build upon substantive stakeholder engagement efforts of the past, such as the Tucson Water Community Conservation Task Force process, and continue the community conversation about quality of life values and the role water plays in maintaining and enhancing all aspects of quality of life. Future phases of this study and/or the upcoming updates to the County's Comprehensive Plan and the City's General Plan may provide a forum for this conversation.

Providing Incentives to Conserve

Particularly, in light of the current economic climate, incentives represent a critical strategy and a viable alternative to costly regulatory requirements to the development process.

Incentives are also needed to address the question of “why conserve” and “who are we conserving for?” During Phase I, the public expressed concerns that water conservation is intended to meet water needs for our growing population at the expense of the quality of life of existing water users and the water needs of the environment. This concern also was also expressed during the CCTF stakeholder process and is documented in the final report:

“... conservation programs intended to save water now so future water demand could be met do not address the impending long-term imbalance between increasing population, water demand, and available water supplies. Under the current scenario, there is no way to prevent conserved water from being used to meet the demands of future growth. Task Force members recognized that the issue of supplying water and accommodating growth are separated in utility planning, but are typically conflated by the public...”

Incentive mechanisms that establish a clear link to the benefits for conserved water represent another strategy to address these concerns. For example, the Water Resources Research Center has proposed the “Conserve To Enhance” concept which consists of an innovative financing approach that allows customers to earmark a portion of their water utility payments for environmental restoration projects. This approach was developed as a result of growing public interest in protecting natural flow in rivers, returning water to the environment, and enhancing riparian habitats. Tucson Water evaluated the Conserve to Enhance concept and supports the objective of earmarking saved water to specific projects. However, Tucson Water found significant implementation barriers with the concept as

originally proposed and is currently working with the Water Resources Research Center and other stakeholder groups to find other ways to implement this concept and achieve similar objectives. For details on the Conserve to Enhance proposal please visit: www.cals.arizona.edu/azwater/publications.php.

The CCTF also found that public willingness to participate in conservation programs might increase if water savings could be earmarked to provide a physical benefit to the aquifer in perpetuity. Page 14 of the final CCTF report states:

“Consideration should be given to earmarking water savings to provide greater direct hydrological and environmental benefits. Members of the Task Force suggested that public interest in preserving riparian and aquatic habitat could be a public education tool to drive the widespread adoption of conservation measures. Towards this end, the Utility may want to collaborate with others working in the Tucson Water service area on habitat conservation and/or restoration.”

Public perceptions about the relationship between water pricing and water conservation is another aspect of providing incentives to conserve. On the one hand, Tucson Water has an increasing block rate structure which is designed to create an incentive to conserve water. On the other hand, one of the common complaints about water efficiency efforts is that they will lead to an increase in water rates, which can be a disincentive to conserve.

All things being equal, this will happen. Any business where the fixed costs represent a high percentage of the total cost will see an increase in the average unit cost when the volume of sales falls. This is the case for the water and the wastewater business, particularly in the near to mid term when fixed costs can not be reduced.

Water utilities must juggle the need to meet revenue targets, establish equitable rate structures, and manage demand for water. The negative impacts that each of these requirements have on each other must be considered to ensure the financial health of the utility as well as public perception towards the efficacy of conservation programs. Unpredicted reductions in water use can substantially impact the need to raise rates. In such a case public perception towards efforts to “conserve” can be damaged resulting in the belief that conserving water will be penalized by increased water rates and raising questions about how the utility is spending ratepayer monies. Rates should reinforce the overall goal of water use efficiency while ensuring equity, protecting revenue requirements and encouraging efficient water use.

However, water rates also play an important role in supporting demand management efforts. The relationship between establishing rates to encourage water use efficiency or conservation and their potential impacts on annual revenue streams can be complicated and easily misunderstood. Water conservation programs, by nature, are designed to reduce overall consumption, so careful planning must be undertaken to reduce the potential for detrimental impact on revenue streams. While reductions in water use can result in a rate increase to recoup the lost revenues, consideration must be given to the reliability of the water savings attributed to a conservation program. Projects that are focused on technology improvements lend themselves well to predicting impact on water use patterns, whereas projects which rely on behavioral changes are less reliable. A distinction must also be made between reductions in water use attributed to a “conservation” program versus a drop in

consumption through curtailment of water uses from either a drought or emergency response or other reasons. The community response to the former can usually be predicted, but the reasons behind curtailment may not always be understood.

Future efforts to coordinate messages about the reasons to conserve water and again, the linking of water that is conserved to specific projects that reflect quality-of-life values, are ways to overcome the public perceptions that conserving water will ultimately hurt their quality of life and increase their water bills.

RECOMMENDATIONS

Scope Question #1: How can the City of Tucson and Pima County implement Consistent Water Conservation Standards to Help Sustain Long-term Supplies?

1. **Develop Consistent Water Conservation and Water Efficiency Goals:**
 - Evaluate, in cooperation with regional water providers, the feasibility and benefits of establishing a common, measurable water conservation goal (e.g. a voluntary, community-wide Gallons Per Capita Per Day (GPCD) target).
 - Identify shared water use efficiency goals, strategies and conservation mechanisms at the sub-regional and subdivision scales of new development.
 - In Phase III and beyond, engage regional jurisdictions, water providers, stakeholders and the public in a community conversation about quality of life trade-offs associated with GPCD reductions, strategies to achieve water conservation/efficiency goals, and potential end uses for conserved water. This effort could potentially occur in conjunction with the Pima County Comprehensive Plan and the City of Tucson General Plan updates.
 - Integrate shared water conservation and efficiency goals into the sustainable growth strategies of the City of Tucson's General Land Use Plan and the Pima County Comprehensive Plan in their next updates.

2. **Improve Consistency in Water Conservation Ordinances and Standards**
 - Continue discussions of interdisciplinary City/County teams to identify areas of similarities, differences, and opportunities to achieve greater compatibility, if not consistency.
 - Develop ordinances and development standards, compatible with the existing Water Resources Element of the Comprehensive Plan Policies, to establish a water conservation requirement on zoned, but undeveloped land in unincorporated Pima County.
 - For new construction at the building or individual lot scale, implement common baseline standards for interior and exterior water use reductions.
 - When completed, Pima County should evaluate integrating the City of Tucson's Rainwater and Greywater Harvesting Codes and Standards as appropriate into its development codes, standards and guidelines.
 - When completed, City of Tucson should evaluate integrating Pima County's performance-based approach to achieving water conservation at the subdivision and development plan stage (i.e. adopt a consistent menu of conservation measures).

3. Enhance and Increase Consistency in Information and Education

- Jointly build upon existing programs (e.g. CCTF process and recommendations) and develop a common vocabulary and new education and communications programs to:
 - √ Communicate community-wide water conservation and water efficiency goals
 - √ Raise awareness of progress in achieving water conservation goals at a community-wide and/or individual (building scale) user level (consider mapping areas based on thresholds of water use).
 - √ Explain the link between water consumption and energy needed to provide the water
 - √ Differentiate between water conservation and drought response measures to clarify public misperceptions
 - √ Promote consistent messages about the reasons for water conservation

4. Enhance Planning and Evaluation

Work with subject-matter experts to:

- Evaluate trends and identify water conservation potential, such as trends in indoor versus outdoor water use, lot size, persons per household, commercial and industrial accounts, impacts of reclaimed water deliveries in the potable water use of households in neighborhoods where reclaimed is available for domestic use (e.g. Tucson Country Club).
- Develop new or enhance existing measurement and reporting systems for use in developing metrics that quantify water use and water efficiency at the building scale, neighborhood scale, community scale and regional scale. This data can in turn be used to evaluate the efficacy of water conservation measures.
- Build upon previous advancements in water conservation program evaluation and development efforts, such as the Tucson Water Community Conservation Task Force (CCTF) process, and encourage additional innovation in water conservation research, methods, measurement and reporting.

Scope Question #2: How to ensure that water conservation protects our future water supply, not simply makes more population growth possible?

5. Link Water Conservation Incentives to Protecting Future Water Supplies and the Environment

- The City and County should identify incentives to conserve and continue to work with groups such as the Water Resources Research Center on developing voluntary ways for customers and residents to earmark water savings to specific projects that preserve options for the future and improve current conditions, such as expanding aquifer augmentation efforts, expanding green spaces (e.g. more ballparks and parks), and allocating water to sustain or restore riparian areas.
(Note: Additional facets of this discussion will be addressed in other technical papers on the topics of integrating land use and water management planning, environmental restoration, ecosystem protection, and new water resources.)
- Develop a common regional green building standard that incentivizes energy and water resource efficiency practices at the building scale, in both the City and County.