Appendix 3B Innovative Municipal and Industrial Water Conservation and Reuse Program Case Studies

3B Innovative Municipal and Industrial Water Conservation and Reuse Program Case Studies

As part of the *Moving Forward* effort, the Municipal and Industrial (M&I) Water Conservation and Reuse Workgroup solicited information on innovative, unique, and successful M&I conservation and reuse efforts implemented within the metropolitan areas receiving Colorado River water. The intent of this effort was to highlight specific case studies and to provide a better understanding of the tools potentially available to expand successful efforts. This appendix includes case studies selected by the Workgroup members covering the major types of water conservation and reuse programs throughout the metropolitan areas receiving Colorado River water.

3B.1 Water Conservation and Reuse Program Categories

More than 400 programs were initially identified during the Workgroup's data collection process. These programs were grouped into 7 major categories of water conservation and reuse programs, as described below.

Metering and Billing

This category of conservation programs uses water meters, billing structures, and consumer water use information to promote reductions in water use. Water metering is an essential element for water conservation because it improves the understanding of water use, can support leak detection, informs billing structures, and can serve as platform for communicating water use and conservation messages with consumers.

Public Education and Community Outreach

Conservation programs in this category represent efforts to develop a conservation ethic among water consumers. Conservation programming and messaging works best when it is locally relevant and promotes conservation behaviors as a community norm or way of life. These programs can support water conservation across all customer types such as residential or commercial users and have been implemented in all major metropolitan areas.

Water Loss Characterization and Reduction Practices

Water losses occur in water distribution systems and are unavoidable. Obvious major breaks are addressed quickly, but smaller leaks can go undetected, resulting in significant water loss if not corrected. Various measures and actions are being taken throughout areas that receive Colorado River water to quantify and characterize these yet undetected losses and when economically feasible, eliminate these losses.

Residential Indoor Practices

Conservation practices for reducing residential indoor water use often include ordinances, and incentives for plumbing and fixture retrofits and the encouragement of the purchase of water/energy-efficient appliances. Some cities receiving Colorado River water began revising ordinances and initiating incentive programs to install low-flow toilets and fixtures in the 1980s.

Commercial, Industrial, and Institutional Practices

Similar to residential indoor water conservation programs, the retrofits and incentive programs to replace fixtures are also main components of Commercial, Industrial, and Institutional (CII) water conservation practices. Many of the programs in this category are targeted to specific industries, commercial activities, or institutional users.

Outdoor Landscaping Practices

Outdoor landscape irrigation is the single largest consumptive water use in the M&I sector. Water conservation practices to reduce water consumption include water conservation gardens, landscape consultations and audits, landscape irrigation budgets, rebates, and incentives to use smart irrigation technology and/or convert landscaping and restrictions on irrigation amount and timing. Outdoor landscaping irrigation efficiency measures have been the focus of many water providers. These measures seek to reduce excess irrigation and allow for improved irrigation efficiencies through best practices and new technologies.

Reuse

Municipal providers have implemented a range of reuse programs throughout the metropolitan areas receiving Colorado River water. As water demands have increased in the past decades, water supplies available to water providers have not substantially increased. The potential for imbalances have led to increasing focus on reuse to meet existing or future demands. Three general categories of reuse describe the method in which reclaimed water is developed and used: direct non-potable reuse, indirect potable reuse, and direct potable reuse.

3B.2 Selected Case Studies from Water Conservation and Reuse Program Data Collection

From the identified programs, 34 were selected by the Workgroup as case studies to represent the breadth of innovative water conservation and reuse efforts throughout the major metropolitan areas. The locations of the selected programs are shown in Figure 3B-1.



TABLE 3B-2 Selected Water Conservation and Reuse Program Case Studies				
Type of Program	State	Agency/Institution	Program	ID
Metering and Billing	California	Eastern Municipal Water District, Rancho California Water District and Western Municipal Water	Water Budget-Based Tiered Rates	1
	Colorado	Aurora Water	Water Use Efficiency Mapping and Identification Integrated with the System Incentive Program Project	2
	Colorado	Fort Collins	Home Water Reports	3
	Utah	Washington County Water Conservancy District	Water Conservation Easement	4
	Utah	Weber Basin Water Conservancy District	Secondary Water Metering (untreated residential irrigation)	5
	Arizona	Coalition Partners	Water—Use It Wisely	6
	Colorado	City of Boulder, Public Works Department	Commercial, Industrial, Institutional Water Audit Tool	7
	New Mexico	New Mexico Office of the State Engineer's	Water Conservation Planning Guide for Public Water Suppliers	9
Public	New Mexico	New Mexico Office of the State Engineer's and New Mexico State University	Southwest Plant Selector Application	10
and Outreach	Nevada	Southern Nevada Water Authority	WaterSmart Innovations Conference and Exposition	11
	Utah	Jordan Valley Water Conservancy District/Governor's Water Conservation Team	Slow the Flow, Save H_2O	12
	Wyoming	City of Cheyenne	Recycled Water Public Information and Outreach Campaign ¹	13
	Arizona	City of Tempe	Distribution System Replacement and Repair	14
System Water Loss	Colorado	Denver Water	Denver Water Pipe Replacement Program	15
	Utah	Central Utah Water Conservancy District	Provo Reservoir Canal Enclosure Project	16
	Arizona	The University of Arizona, Water Resources Research Center	Conserve2Enhance [™] (C2E) ²	17
Residential Indoor	California	Eastern Municipal Water District	High Efficiency Clothes Washers	18
	California	Metropolitan Water District of Southern California	Innovative Conservation Program	19
	Colorado	Colorado Springs Utilities	WaterSense® New Homes Builder Incentive Program	8
	New Mexico	Albuquerque Bernalillo County Water Utility Authority	Albuquerque Bernalillo Water Conservation Program	20
	New Mexico	City of Santa Fe Water Division, Water Conservation Office	City Rebate and Water Bank Program	21
	California	West Basin Municipal Water District	Cash for Kitchens	22

TABLE 3B-2 Selected Water Conservation and Reuse Program Case Studies				
Type of Program	State	Agency/Institution	Program	ID
Commercial, Industrial, and Institutional	California	Eastern Municipal Water District	Public School Retrofit Program	23
	Wyoming	National Center for Atmospheric Research Wyoming Supercomputing Center (NWSC)	NWSC Conservation Program	24
	Arizona	Parkway Improvement District (PKIDs)	PKIDs Water Conservation Program	25
Outdoor Landscaping	California	Metropolitan Water District of Southern California/Western Municipal Water District	Free Sprinkler Nozzles	26
	Nevada	Southern Nevada Water Authority	Water Smart Landscapes	27
	Nevada	Southern Nevada Water Authority	Water Use Restrictions and Land Development Code	28
	Utah	Central Utah Water Conservancy District	Central Utah Gardens ³	29
	Arizona	City of Scottsdale	Reclaimed Water Distribution System	30
Reuse	Arizona	Palo Verde Nuclear Generating Station	Zero Discharge: Palo Verde Nuclear Generating Stations and Redhawk Power Plant	31
	California	Irvine Ranch Water District	Crean Lutheran High School	32
	Colorado	Denver Water	Denver Zoo Recycled Water	33
	Nevada	Southern Nevada Water Authority	Southern Nevada Water Reuse	34

¹ Also a Reuse Program
² Also a CII and Outdoor Landscaping Program
³ Also a Public Education and Outreach Program

Water Budget-Based Tiered Rates

Eastern Municipal Water District, Rancho California Water District, Western Municipal Water District, California

Program Overview

Between 2009 through 2011, Eastern Municipal Water District (EMWD), Rancho California Water District (RCWD), and Western Municipal Water District (Western) all implemented water budget-based rate programs. Under the programs, every customer receives a personalized water budget designed to meet their specific indoor and outdoor water needs. This personalized water budget means that no matter the size of a household or yard, users should be able to remain within their allotted water budget and pay the lowest available price.

Residential water budgets are calculated based on each customer's amount of landscaping, real-time localized weather data, and the number of residents in each home, among other factors. The water agencies are committed to seeing that everyone has a water budget that provides the water necessary to efficiently meet their needs. The water budget structure includes simple steps to adjust the budget established for an account, should the consumer have a legitimate need for more water.

Water use exceeding the budget is discouraged through steep pricing tiers. Most customers' water use regularly remains within specified water budgets, and users are billed at the lowest available rates. The only customers who are billed in the higher tiers (Tiers 3 through 5) are those whose use exceeds their water budget. The districts work closely with these customers to help reduce water use and lower water costs.

A water budget consists of two parts: indoor and outdoor. Western calculates the indoor budget at 60 gallons per day for each person in a household. Other factors such as licensed in-home child care are used to increase an individual indoor water budget. Sixty gallons per person per day provide adequate water for all indoor water uses such as cooking, cleaning, sanitation, and laundry. California Water Code Section 10608.20(b)(2)(A) states that 55 gallons per person per day is a provisional standard for determining an urban retail water supplier's urban water use target. Western's indoor water budgets provide for a minimum of three persons for every family residential household.

Agency

Eastern Municipal Water District, Rancho California Water District, Western Municipal Water Agency

Project Status

Ongoing

Targeted Use Sector Residential

Estimated Annual Savings

0.04 to 0.07 acre-feet per year per single-family residential meter - estimated 15 percent savings

Estimated Annual Cost \$20 to \$35 per single-family residential meter

Estimated Unit Water Cost

\$50 to \$66 per acre-foot over 10 years; cost for water saved will continue to decrease as long as the rate is in place

Key Program Elements

- Set water budgets for customers based on lot size and on number of inhabitants per household
- Steep tiered rates discourage over-budget use
- Measurable water savings as total consumption reduction



Western bases outdoor budgets on the square footage of irrigated area, a plant water-use factor, and microzone evapotranspiration data. Weather information is updated each day to calculate plant water needs in specific microzones. When temperatures increase, the outdoor water budget increases. When weather is cooler, the outdoor water budget decreases. University research and State law established maximum allowable water application to urban landscapes. The maximum was defined as 80 percent of the local evapotranspiration rate.

Outdoor water used within the water budget (Tier 2) is charged at the second lowest rate. The rate in Tier 2 is a blend of the costs to produce local water and purchase more expensive imported water.

Main Program Elements

Costs

Implementation costs varied for each agency and ranged from \$0.8 million to \$3.0 million. Costs include revising the agencies' billing software, budget development, consultant support, and customer support. The cost per meter ranges from \$20 to \$35.

Implementation Resources

- Involves staff across several departments.
- Customer outreach.
- Information on persons per household.
- Information to set landscape budgets.
- Staff must be available to process variances and customer resources.

Level of Participation

Participation varies from all customers to just landscape and residential customers. EMWD has over 130,000 connection on water budget-based rates. RCWD reports 41,304 water service connections.

Program Outcomes

Water Savings

Water saving varies for each agency. Agency estimates of water savings range from 4 percent to 20 percent for participants. The University of California, Riverside, completed an analysis of EMWD tiered rates that estimated a 15 percent water savings for residential customers.

Program Challenges

- Requires extensive customer outreach.
- Developing budgets may be challenging.
- Additional customer service is needed after initial implementation.
- The high level of variance requests requires processing.

- Elizabeth Lovsted, Program Manager, Eastern Municipal Water District
- Western Municipal Water District, Understanding Water Budgets, retrieved from: http://yourwaterbudget.wmwd.com/understandingwater-budgets

Water Use Efficiency Mapping and Identification Integrated with the System Incentive Program Project

Aurora, Colorado

Program Overview

The Water Use Efficiency Mapping and Identification Integrated with the System Incentive Program (SIP) project is being developed by Aurora Water in coordination with the Colorado Water Conservation Board through its grant program. The project is ongoing and will last approximately 3 years. The City of Aurora was mapped to determine pervious areas in each parcel. Inefficient customers can be identified by assigning water requirement values to each property and linking actual water consumption.

Once Aurora Water identifies the inefficient customers and contacts them, customers are requested to go through Aurora Water's water calculator, which allows them to input specific information to receive a prioritized list of actions they can take to become more water efficient. The SIP will include a rebate for the customer over time.

This program and mapping tool will be used to continue the new rebate program and slowly phase out existing rebates.

The goal is to identify inefficient water users and work with them to determine effective ways for them to become more water efficient through both retrofits and behavioral changes.

Main Program Elements

Costs

The total cost of the project is estimated at roughly \$167,000, with additional need for about 850 staff hours. Funding has been supported by the Colorado Water Conservation Board grant program.

Implementation Resources

In addition to the project cost estimate, about 850 staff hours will be needed to complete the tools and program.

Level of Participation

The project is currently in the planning stages. It is estimated that up to 200 customers will have been contacted through the calculator and SIP program by 2014.

Agency

Aurora Water

Project Status

2013 - Ongoing

Targeted Use Sector

Residential, Commercial, Industrial, and Institutional, Residential Irrigation, Commercial and Industrial Irrigation

Estimated Annual Savings

Estimated savings of 44 acre-feet per year by targeting the top 200 most inefficient customers

Estimated Annual Cost

\$63,729 (annualized capital investment plus operation and maintenance cost)

Estimated Unit Water Cost

\$1,448 per acre-foot per year (based on the estimated annual cost)

Key Program Elements

- Program is in planning phase
- Established tool that identifies highly inefficient customers
- Uses grant sources to fund the program
- An estimated 200 customers are planned to use the tool and go through the SIP program by June 2014



Water Use Efficiency Map – Parcels can be analyzed and displayed by water use efficiency *Source: Aurora Water*

Program Outcomes

Water Savings

To date, no water savings have been achieved because the project is still in the planning stages.

Program Challenges

Major classification errors during the automated land cover classification put the project behind schedule and added expense.

Sources

• Lyle Whitney, Water Conservation Supervisor, City of Aurora • City of Aurora, March 2011, Grant Application to Colorado Water Conservation Board, Water Use Inefficiency Mapping and Identification Integrated with the System Incentive Program (SIP) Project, retrieved from:

http://cwcbweblink.state.co.us/WebLink/Electronic File.aspx?docid=155952&&dbid=0

Home Water Reports

Fort Collins, Colorado

Program Overview

In 2009, Fort Collins Utilities (Utilities) began distributing Home Energy Reports to single-family electric customers with an estimated electricity savings of 2.6 percent for those receiving them. Similarly, Home Water Reports were found by the Utilities to be a cost-effective method to save up to 5 percent of a customer's total water use. Utilities determined that delivering Home Water Reports would be an effective way to help the City of Fort Collins reach its water reduction goal established in the 2009 Water Conservation Plan.

In fall 2014, Utilities began delivering Home Water Reports to single-family water customers, alternating months with the delivery of Home Energy Reports. Utilities aims to motivate households to reduce their water use through changes in behavior or adoption of more water efficient technology. The approach is based on research on social norms marketing; the idea that much of people's behavior is influenced by their perceptions of what "normal" or "typical" is.

Main Program Elements

Implementation Resources

A control group has been established to allow an analysis of the water savings for households that receive the report. The reports provide information about current water usage and compare it to their past usage, the average of similar households, and the usage of the most efficient households. This data is coupled with actionable information on ways to more efficiently use water around the home.

Level of Participation

Starting in fall 2015, Utilities will expand the program to 15,000 customers and to 20,000 in 2016, reaching 75 percent of the households served water by Fort Collins.

Agency

Fort Collins Utilities

Project Status 2014 - Ongoing

Targeted Use Sector Single Family Residential

Estimated Annual Savings

2-5 percent per family receiving the report

Key Program Elements

- Effective program to reach water reduction goals by motivating people to change water use patterns or adopt more efficient technology
- Partnership with electric utility
- Program approach based on social norms marketing; people's behavior is influenced by their perception of "normal" or "typical"



Program Outcomes

Water Savings

Utilities found Home Water Reports to be a costeffective method to reduce a customer's total water use. After delivery of two reports, water savings was estimated at 1.6 percent or 3.2 million gallons.

Sources

 City of Fort Collins, Home Energy Reports, retrieved from: http://www.fcgov.com/utilities/residential/conserve /home-water-reports/

Water Conservation Easement

Washington County Water Conservancy District, Utah

Program Overview

Washington County Water Conservancy District (WCWCD) assesses impact fees for new development based on meter and lot size. If the lot is more than 10,000 square feet, the applicant can qualify for a minimum impact fee by signing a water conservation easement. This easement generally restricts the lot to 5,000 square feet of irrigated landscape. By assessing impact fees and requiring users to pay based on irrigated landscape area, incentives are provided for water conservation. Impact fees and water conservation easements apply to all culinary (potable) water users in the District's wholesale and retail systems, including residential and commercial users, so the incentives to reduce outdoor water use by limiting irrigated landscape are widespread.

The water conservation easement program is part of WCWCD's Regional Water Supply Agreement with its seven major municipal customers. This Agreement also encourages conservation by eliminating the "takeor-pay" contract incentive for municipal customers to sell water because they must pay for it whether or not it is used. Municipal customers pay only for water as it is delivered from the WCWCD system, allowing them to actively promote conservation without creating budget issues. Additional provisions call for water conservation rate structures, time of day water use and landscape ordinances, and maximum use of secondary irrigation and water reuse systems.

Main Program Elements

Costs

The Agreement provides that impact fees will be paid at the time of platting or building permit issuance. Impact fees are paid by developers or lot owners and must be segregated to pay for system costs as set forth in WCWCD's Regional Water Capital Facilities Plan and Impact Fee Analysis. Accordingly, WCWCD does not budget separately for this program, but rather absorbs the costs of its operation into general staffing allocations.

Agency

Washington County Water Conservancy District

Project Status 2006 – Ongoing

Targeted Use Sector Residential/Commercial, Industrial irrigated landscape

Estimated Annual Savings 2,000 acre-feet per year

Estimated Annual Cost Budget included in general staffing allocations

Key Program Elements

- Increased awareness of developers and lot owners of the costs of irrigated landscape
- Limits outdoor watering with every new connection
- Financial incentives to reduce irrigated landscape and consequently outdoor water us.
- WCWCD and municipal customers partner under terms of the Regional Water Supply Agreement with its seven municipal customers to eliminate the "take or pay" contract



Impact Fees in New Developments Source: Washington County Water Conservancy District

Implementation Resources

The water conservation easement, which limits landscape area, is a benefit offered to avoid additional impact fee charges. This option is part of the processing of impact fees and is explained in published materials and on WCWCD's website (wcwcd.org). Because many unique circumstances are presented at the time impact fees are processed, WCWCD staff works with developers and lot owners to find ways to make the water conservation easement work in varying circumstances. The availability of the water conservation easement allows WCWCD to emphasize the importance of limiting outdoor watering with every new connection within its municipal customer boundaries, reaching 90 percent of Washington County's population.

Level of Participation

Since the program's inception in 2006, more than 3,000 water conservation easements have been executed, amounting to over 50 percent of the impact fees paid for lots more than 10,000 square feet.

Program Outcomes

Water Savings

WCWCD estimates that more than 15.5 million square feet of irrigated landscape have been eliminated by offering the water conservation easement for new connections. These benefits will continue for many years to come, both in terms of existing and future water conservation easements. To date, this program has reduced annual demand by over 2,000 acre feet, and that number will continue to increase. Savings to municipal customers in terms of wholesale water costs amounted to almost \$500,000 in 2013.

Program Challenges

• Administrative, legal, and management obligations associated with implementation of the program

- Barbara Hjelle, Associate General Manager/Counsel, Washington County Water Conservancy District
- Washington County Water Conservancy District, Impact Fees, retrieved from: http://www.wcwcd.org/customer-support/impactfees

Secondary Water Metering (Untreated Residential Irrigation)

Weber Basin Water Conservancy District, Utah

Program Overview

The Weber Basin Water Conservancy District (District) has been studying and tracking data on meters for secondary (untreated residential irrigation) water for the past decade. Metering residential secondary irrigation (untreated pressurized irrigation water) is now taking on importance because meters have not been reliable on systems with poor water quality. Historically, secondary water has been allocated and used based on parcel size, with the payment of that water being assessed once per year. Today, meters exist that can handle the poor water quality and deliver reliable water use data.

In 2010, the District partnered with the Bureau of Reclamation (Reclamation) to install 1,100 meters in the Uintah Bench and South Weber areas; this was the first large installation project for secondary water meters. Since 2010, the meter studies have continued with the adoption of additional meter types (there are now four types of meters in the field) and a total of 2,613 meters installed as of April 2015. It was also determined that there was a need to purchase an electronic read system that has the capability to collect data in hourly increments. The Itron Automated Meter Reading system, using the 100-Watt electronic radio transmitter, was selected because it could meet the data needs and was compatible with various brands of meters.

The District's long-term goal is to have all of its retail secondary water users (approximately 17,650) metered within the next 10 years. The District is also providing the metering data to other secondary irrigation systems throughout Davis and Weber Counties and encouraging them to begin implementing a metering program.

Main Program Elements

Costs

The initial meter project was funded with help from Reclamation and cost \$784,175, of which \$290,000 was funded through a WaterSMART Grant. Since that time, the total costs have risen to \$1,700,000, and the projected annual budget going forward will be approximately \$500,000. WBWCD will continue to seek grant funding to increase the rate at which

Agency

Weber Basin Water Conservancy District

Project Status 2010 – Ongoing

Targeted Use Sector Residential Landscape Irrigation

Estimated Annual Savings

0.25 acre-feet per year (average) per metered connection

Estimated Annual Cost

\$500,000 budgeted annually until all connections are metered. Approximately \$800 per metered connection (install only)

Estimated Unit Water Cost

\$200 per acre-foot per year, based on 25 percent savings per connection at a cost of \$800 per connection

Key Program Elements

- Accountability for all users will bring an overall reduction in water use - secondary irrigation water has been unmetered
- Providing use information with educational material and helpful tips helps reduce outdoor water use
- Objective is to delay future water development projects by reducing current water use through metering and end user accountability



Automated Meters Source: Weber Basin Water Conservancy District

meters can be installed as the District continues to budget for and install meters each year. The approximately cost per metered connection (parts and install only) is \$800.

Implementation Resources

The potential conservation savings are large, and WBWCD recommended that all secondary connections have meters installed and begin conducting customer education on how to reduce their landscape water needs.

Some of the success of metering is associated with being able to address the users' questions, gather and use quantifiable data on usage and conservation, be able to incorporate Geographic Information Systems (GIS) and mapping technology to show on a larger scale where high use areas are, and indicate which users may struggle to understand proper landscape water needs.

Level of Participation

The District has been the primary agency involved in the metering project. The first phase of the project involved Reclamation with funding and Utah State University doing a parallel study on public perception about receiving a meter on previously unmetered irrigation water. Consultants were retained the first year to conduct open house events and provide public information targeted to those who would receive meters in an effort to educate and to eliminate rumors, skepticism, and other concerns. To date, fewer than 10 percent of Weber Basin's secondary connections have a meter. Additional participation will be necessary to continue the project and meet the goal of all secondary connections being metered.

The program will continue to be evaluated through analysis of water use data from existing meters. As more meters are installed and time passes, significant data will become available to confirm that water use will be reduced because users will know what they consume and will be accountable for it.

Program Outcomes

Water Savings

Overall, metering is proving to be effective in helping consumers understand how much they are using and how to adjust usage to meet target needs for their yards. It is difficult to calculate the total water savings at this point in the program because there was no baseline established at the beginning of the project. Going forward, usage data will show water savings specific to the landscape. These data can then be compared to other water savings and use programs. In the table below, meter group usage comparisons are presented for the years 2012-2014 based on data from 1,057 meters.

Year	2012	2013	2014
Used Gallons	284,912,371	220,146,962	205,346,968
Used Acre- Feet (AF)	874	675.3	629.9
Average Used AF/Gross Acre	2.69	2.08	1.94
Average Used AF/Landscape Area Acre	3.9	3	2.8
Average % of Allocation Used	83	64	59.6
Average % of Estimated Need Used	136.2	105.10	97.90
Average Allocation Per Parcel Per Year (average parcel size = 0.3 acres)	1	1	1

Program Challenges

- Repair and replacement of the metering systems.
- Ensuring consumers of the system's accuracy.
- Informing and educating the public about the metering system.
- Program costs and system items to retrofit for meters.
- Having all secondary water providers use the same program with their customers to provide a more unified message to achieve regional savings, not just from certain entities.

Sources

• Scott Paxman, Assistant General Manager, Weber Basin Water Conservancy District

Water – Use It Wisely®

Coalition Partners, Arizona

Program Overview

The Water – Use it Wisely® (WUIW) program is a comprehensive, multi-media water conservation awareness campaign that provides an ongoing, visible, and regionally consistent call to action. "Don't tell us to save water. Show us how." That was the sentiment of Arizona residents when local cities studied the best messages to use with water conservation outreach. Originally developed by the cities of Mesa, Scottsdale, and Phoenix, other municipalities, organizations, agencies, and private water providers soon joined the Arizona coalition to build the campaign regionally. The award-winning campaign has been adopted by 400 public and private entities nationwide. It includes television, radio, print, web, and social media advertising.

Since 1999, the WUIW conservation campaign has made smart water use fun, easy, and practical for everyone. This campaign is all about giving voice to water. The program has developed a variety of ways to use WUIW as a tool to help spread a unique water conservation message for business, home, classroom, or municipality audiences.

Partners of the regional campaign benefit significantly, as campaign monies are consolidated and used directly to purchase media space or time, bolstering the campaign's effectiveness. Partners have realized considerable savings in creative development costs, which a separate advertising program would otherwise incur.

The campaign includes a multi-media presence (TV, radio, print, web, movie theater slides) and social media presence, including a top-ranking consumer website for water conservation. Facebook, Twitter, Pinterest, YouTube and a website and blog round out the social media. Face-to-face outreach occurs three to five times a year with Earth Day, water conservation festivals, and other events. Non-traditional tactics include the Water – Use It Wisely® mascot, Wayne Drop, a life-sized, eye-catching blue water drop used for events and promotions. A travelling display is also shared by partners in the form of a 16-foot-tall pyramid built with

Entities

Arizona Coalition Partners

Project Status 1999 – Ongoing

Targeted Use Sector

Residential: Women and Men, ages 25-54, Children, ages 8-14

Estimated Annual Impact & Engagement

Annual Media/Digital Impressions: 4.7 million; Website: 2,600 daily visitors; E-Newsletter subscribers: 2,750; Facebook followers: 2,880; Twitter followers: 5,559; Pinterest followers: 71, six boards.

Estimated Annual Cost \$300,000

Key Program Elements

- Comprehensive multi-media water conservation awareness campaign. Includes television, radio, print, Web, and social media advertising
- Universal water conservation message that provides an ongoing, visible, and regionally consistent call to action
- Partnership results in considerable savings of creative development costs



136 one-gallon empty milk containers, demonstrating the average amount of water that is used by an Arizonan each day.

By acting regionally, the partnership further provides greater marketing possibilities for sponsorship. Through the years, sponsors have included the Arizona Diamondbacks, the Phoenix Coyotes, Reclamation, Salt River Project, Maracay Homes, Wells Fargo, and others.

Main Program Elements

Costs

The budget varies depending on the number of partners and funding availability. The WUIW campaign dollars have been as high as \$475,000, but typically average \$300,000 annually. Partners can participate for a minimum of \$2,000 per year.

Implementation Resources

Advertising agency account executive and creative staff contribute approximately 800 to 900 hours per year. Steering Committee partners meet monthly to oversee and direct activities. The campaign includes a media presence, social media presence, and face-to-face outreach. The budget does not include the staff time of partner representatives who provide technical support or attend planning meetings.

Level of Participation

Partners include the cities of Mesa, Phoenix, Scottsdale, Tempe, Peoria, Chandler, Glendale, Avondale, Surprise, Fountain Hills, and Queen Creek, as well as the Arizona Municipal Water Users Association, Global Water Resources, EPCOR Water, and Salt River Project.

Following Arizona's lead, nearly 400 towns, cities, states, utilities, and private and public organizations have adopted the Water – Use It Wisely campaign, making it one of the world's largest conservation educational outreach programs.

The private sector has also joined in. Home Depot and Lowes have featured Water – Use It Wisely® in their stores throughout Arizona. Manufacturers such as Rain Bird, Fisher & Paykel, and Hinz Horticulture have also been active campaign sponsors.

Program Outcomes

Program Challenges

- Measuring success
- Funding
- Keeping the public engaged

Sources

• Water – Use It Wisely, retrieved from: http://wateruseitwisely.com

Commercial, Industrial, Institutional Water Audit Tool

City of Boulder, Colorado

Program Overview

The City of Boulder has developed a Commercial, Industrial, and Institutional (CII) water audit tool in conjunction with Brendle Group who was contracted by the city based on similar CII work done with the non-profit, Colorado Water Wise. The tool references United States Environmental Protection Agency (EPA) and United States Department of Energy standards for water and energy and seeks to produce a simple report to show water, energy, and cost savings potential and encourage implementation of efficiency improvements. The tool is customizable for the Professional Engineer (PE) or utility professional who wants to make changes to the assumptions or add in a rate structure. However, it also has pre-populated assumptions on factors such as flow estimates, use frequencies, and costs to support the less experienced tool user in conducting a facility assessment and identifying opportunities. The City of Boulder worked with EPA to pilot the tool with a large group of users/stakeholders in the summer of 2014 and has since made the tool available free for use by water conservation professionals and CII facility representatives.

Main Program Elements

Costs

No budget was specified. The tool is available free of charge.

Implementation Resources

The City of Boulder and Brendle Group implemented a pilot with EPA to help vet and make updates to the tool. The revised version is now currently hosted and accessible from the Brendle Group website.

Level of Participation

Level of participation has not yet been identified and is dependent on the City of Boulder's coordination with EPA.

Program Outcomes

Water Savings

The tool is new to the EPA website and water savings have not yet occurred.

Agency

City of Boulder, Public Works Department

Project Status 2013 – Ongoing

Targeted Use Sector Commercial, Industrial, and Institutional

Estimated Annual Savings

No reported savings yet - tool is newly developed

Key Program Elements

- CII auditing tool developed for free use
- Tool customizable and has the ability to be operated by both PEs and end users
- Piloted with EPA and a large group of users/stakeholders



- Russ Sands, City of Boulder Watershed Sustainability & Outreach Supervisor, City of Boulder
- MaryAnn Nason, City of Boulder Water Conservation & Outreach Coordinator, City of Boulder
- Beck Fedak, Principal Engineer, Brendle Group
- CII Water Assessment Tool: www.brendlegroup.com/water_conservation/cii_w ater_tool/cii-water-assessment-tool

WaterSense® New Homes Builder Incentive Program

Colorado Springs, Colorado

Program Overview

The WaterSense® New Homes Builder Incentive Program is designed to provide financial incentives for residential builders to construct, inspect, and label new homes to meet the EPA WaterSense New Homes Criteria. These criteria are designed to be 20 percent more water-efficient than standard code-compliant new construction through indoor and outdoor conservation. The program builds on and complements Colorado Springs Utilities' existing EPA ENERGYSTAR New Home Builder Incentive Program.

The program was launched in 2013 and will be ending after 2015 due to statewide WaterSense Legislation which will make it obsolete. The program was designed to help transform the local home building market, and will be in place until reasonable penetration, yet to be determined, is achieved.

Main Program Elements

Costs

Builders receive an incentive of \$750 per home upon successful inspection and certification. In 2015, 8 new homes have been certified and received the incentive at a total cost of \$6,000. The source of funding was not specified.

Implementation Resources

In addition to annual cost, the program requires approximately 100 hours of staff time each year to manage. The operational cost is estimated to be \$3,700.

Level of Participation

Since the program launched in June 2013, 19 homes have been certified.

Program Outcomes

Water Savings

If the 20 percent water savings goal is achieved, each new home will use about 24,000 gallons less each year than a standard new home. This savings equates to a potential annual water savings of more than 450 thousand gallons or about 1.5 acre-feet.

Agency

Colorado Springs Utilities

Project Status 2013 – 2015

Targeted Use Sector Residential

Estimated Annual Savings 29.5 acre-feet per year

Estimated Annual Cost \$4,424

Estimated Unit Water Cost \$139 per acre-foot per year

Key Program Elements

- Water conservation goal is to reduce water consumption by 20 percent in new homes
- Program builds on and complements existing EPA ENERGYSTAR New Home Builder Incentive Program
- Builders receive incentives upon successful inspection and certification



Program Challenges

- Cost to builders of meeting WaterSense specifications.
- Convincing builders that the WaterSense label sells.
- State WaterSense legislation makes program obsolete.

- Scott Winter, Colorado Springs Utilities
- Colorado Springs Utility, Builder Incentive Program, retrieved from: https://www.csu.org/Pages/bip-rebate.aspx

Water Conservation Planning Guide for Public Water Suppliers

Office of the State Engineer, New Mexico

Program Overview

The New Mexico's Water Conservation Planning Guide for Public Water Suppliers (Planning Guide) provides tools and step-by-step directions for developing a measureable and effective water conservation plan for public water suppliers (PWSs). Developing and implementing effective water conservation programs is a critical component of a water conservation plan. Implementation of a water conservation program is a key action that can achieve the objectives and goals articulated by PWSs. Programs are at the heart of any successful conservation effort.

Water conservation programs are particularly critical in New Mexico, which is located in the high desert of the Southwest where water has always been limited in quantity. The State Water Plan embraces the goal of ensuring a sustainable source of water for New Mexico through healthy watershed management. Water conservation is an essential part of this goal, and the process of water conservation planning is a continuous effort. Data management is fundamental to ensure a measurable and effective process.

The first tool presented in the Planning Guide is the American Water Works Association (AWWA) Water Loss Control Committee Free Water Audit Software© ("Audit"). This software, which is offered by AWWA at no charge, provides a nationally recognized systematic method to organize water diversion data and track its path through the distribution system. An important result of this analysis is "nonrevenue water," which is an estimation of water losses, theft, meter inaccuracies, and non-billed authorized consumption. The Audit requires financial data to help value nonrevenue water. The Audit also provides a measure of confidence in the output.

The second tool presented in the Planning Guide is the New Mexico Office of the State Engineer (NMOSE) Gallons per Capita per Day Calculator (GPCD Calculator). This tool, also available at no charge, provides a standard method for organizing water diversions and end use. The GPCD Calculator has been extensively tested in New Mexico and is incorporated into many PWSs NMOSE permit conditions.

Agency

New Mexico Office of the State Engineer

Project Status

The guidebook was published in September of 2013

Targeted Use Sector Public Water Suppliers

Estimated Annual Savings

Varies by PWS; depends on audit results and implementation by Public Water Suppliers

Estimated Annual Cost

Varies, dependent on PWSs

Key Program Elements

- Data management tool for developing a water conservation plan
- Provides instructions to use two useful tools: AWWA Water Loss Control Committee Free Water Audit Software and NMOSE GPD Calculator
- Step-by-step directions for developing measureable and effective water conservation plan



The tool provides a breakdown of water use into end use categories that can provide baseline data and help to identify trends. This enables PWSs to compare the effectiveness of end-use (demand-side) conservation programs to baseline use patterns.

Main Program Elements

Costs

The total cost for the planning guide and GPCD Calculator was approximately \$52,000, including inkind labor. The NMOSE used grant funding from Reclamation to create the Planning Guide, which was developed through a research process. This process allowed NMOSE staff to present the best available methods and technologies in water conservation. The NMOSE began by researching existing regional and national water conservation planning documents, papers, reports, journals, and guidebooks. The planning guide presents the best data management tools available for developing a water conservation plan.

Implementation Resources

The Planning Guide was made available to the public in September 2013.

Level of Participation

The general concepts of the Planning Guide are used by many of the PWSs in New Mexico. An overhaul of New Mexico's PWSs grant and loan process requires compliance with the Planning Guide's principles. Additionally, as an ongoing effort, the NM State Engineer requires conservation planning as part of the water rights permitting process.

Program Outcomes

Water Savings

As noted, the Planning Guide and GPCD calculator concepts have been used by many of the PWSs in New Mexico. Two notable water conservation efforts have been implemented by the Albuquerque Bernalillo County Water Utility Authority and the City of Santa Fe. However, at this time, there is not a direct correlation between use of the guide and a reduction in water use.

NM PWSs requested guidance in developing an acceptable water conservation plan for funding processes and the NMOSE's permitting process. 2015 is the first year the Planning Guide was a requirement of the revamped funding process, many applicants have indicated that this has provided much-needed direction to ensure that they would have a complete application.

Program Challenges

The Guide has been promoted through regional presentations at Rural Water technical conferences and through informational meetings to community technical advisors. Wider promotion is limited by staff resources, but is part of the revamped PWS funding process and the NMOSE's permitting process. Another challenge is the collection of baseline data/information needed to complete the AWWA Audit and GPCD Calculator.

- Julie M. Valdez, Senior Water Resource Specialist, New Mexico Office of the State Engineer, Water Use & Conservation Bureau
- New Mexico Office of the State Engineer, 2013, New Mexico's Water Conservation Planning Guide for Public Water Suppliers, retrieved from: http://www.ose.state.nm.us/WUC/PDF/Planning% 20Guide_Final_.pdf

Southwest Plant Selector Application

Office of the State Engineer, New Mexico

Program Overview

The Southwest Plant Selector Application fills a critical need for more information on desert-adapted low water use landscape plants and is the only application of expert-recommended xeric landscape plants specifically for New Mexico, El Paso, and surrounding areas. This application was created from the New Mexico Office of the State Engineer's (NMOSE) online database of New Mexico landscape plants. It teaches homeowners and landscapers how xeriscape can be more than covering an area with gravel or rocks. The application includes references for hundreds of plants to choose from when designing low-water-use yards. All plants thrive on little or no supplemental water and are typically both available and used in regional xeriscapes. The Southwest Plant Selector Application is the first of its kind to deal specifically with plants that are both suitable to residential yards and commercially available in New Mexico.

Information and photos can be accessed for the wide variety of trees, shrubs, perennials, annuals, cacti, turf grasses, ornamental grasses, groundcover and vine plants in the database of water-wise plants developed by the NMOSE. Users can search by a plant's scientific or common name as well as other plant criteria such as plant type and category, region, and sun exposure. Water requirements are specified for each region as well as plant size, flower color and bloom time, soil needs, and brief descriptions to help with homeowners' landscape designs. Users can also build a list of favorite plants to use at a nursery or in discussion with a landscaper.

An upgrade to the Southwest Plant Selector was made available in 2013 as an application for mobile devices (app) for iPad, iPhone, and iPod Touch.

The app also allows users to sort by bloom color, in addition to the original sort criteria of plant name, region, sun requirements, and plant category and type. Users can still build a list of favorites for further research or for easy reference at a retail store or with a landscaper and new features include the ability to email plant selections and, for industry people, the ability to work in a scientific mode.

Agency

The NMOSE, New Mexico State University's Center for Landscape Water Conservation, and NMSU Media Productions

Project Status

The app was launched in June 2012 and upgraded May 2013

Targeted Use Sectors

Residential and Commercial and Industrial Irrigation

Estimated Annual Savings

70 acre-feet (assuming 10 percent level of adoption and 50 percent water reduction)

Estimated Annual Cost

\$52.80 per acre-foot per year (not including annual operation and maintenance cost)

Key Program Elements

- Users can browse through a database of 700+ plants or search based on specific criteria
- Useful to landscapers, but also understandable by general public
- Each plant includes photo(s) and relevant information on use and care
- A person's "favorites" can be marked for quick access at the nursery or in the yard



Users can also access an "Irrigation Calculator" web page to calculate more precise supplemental water applications for each plant.

Main Program Elements

Costs

The NMOSE used grant funding from Reclamation to create the Interactive Plant List, which provided all of the data for the application approximately \$30,000, including in-kind labor, was spent on this project.

Implementation Resources

The State Engineer's database had a rich source of information and it made sense to put it in a mobile format where people could access it away from their computer. This app is the first data-driven app built by New Mexico State University media production. The goal of the design team was to build a resource that would be useful to landscapers, but also understandable by people who have less knowledge. The user can search with the scientific name or common name of the plant. It was important to make it accessible and fun to browse. Being able to browse the plants visually is a major feature of the app. The team spent a lot of time getting colorful photos of the plants that the user can browse through.

Level of Participation

As of February 2014, there were 6,794 downloads, with an average of about 50 downloads per week.

A Gold Medal Award was given by the Association of Communication Excellence (ACE) in Agriculture, Natural Resources, and Life and Human Sciences for the app. The ACE Critique and Awards program recognizes individuals and teams for excellence in communication and technology skills. The app also earned an Honorable Mention Award for Best Innovative Use of Communication Technology.

Program Outcomes

Water Savings

New Mexico's statewide average GPCD is 150. Generally, it is assumed that 50 percent of the GPCD is for outdoor water use. Using 75 GPCD as the existing landscape water use (excluding other outdoor uses), and assuming a 50 percent savings converting to a xeric landscape based on the app's plant list, and a 10 percent adoption rate for the existing users (6,800), it is estimated that 70 acre-feet per year have been saved.

Outdoor water use quantities are generally affected by climate and latitude. Given that New Mexico is about 370 miles in length and has elevation differences of 10,000 feet, the water savings, and potential water savings, vary significantly by location. Two locations were reviewed: a southern location at an elevation of approximately 4,200 feet (the warmer/southern latitude location or WSL), and a northern location at an elevation of 8,600 feet (the cooler/northern latitude location, or CNL). As a baseline, a Kentucky Bluegrass dominated landscape is considered. This is contrasted with a landscape that has equal parts of trees/shrubs, buffalo grass, and a xeric garden. The xeric profile is based on the plant types in the app's database. For the WSL, Kentucky Bluegrass consumes 56 gallons/square foot/year, compared to xeric at 30 gallons/square foot/year, roughly a 40 percent reduction. For the CNL, Kentucky Bluegrass consumes 12 gallons/square foot/year, compared to xeric at 4 gallons/square foot/year, roughly a 70 percent reduction.

Program Challenges

- Many of the original photos in the database were low resolution and need to be upgraded for the app.
- Publicizing the app; resources are not currently available to promote the use of the app by landscapers and their clients.

- Julie M. Valdez, Senior Water Resource Specialist New Mexico Office of the State Engineer, Water Use and Conservation Bureau
- Southwest Plant Selector, retrieved from: www.xericenter.com/swplants
- Sutherin, Stefan, Kevin Lombard, and Rolston St. Hilaire. "Southwest Plant Selector: A Mobile App." Horttechnology 23.5 (2015): 602-09. Print.
- Sutherin, Stefan, Kevin Lombard, and Rolston St. Hilaire. "Website? Video? Facebook? Mobile App? One Group's." *Journal of Extension* 1FEA1 53.1 (February 2015): 1-12. Print.

WaterSmart Innovations Conference

Southern Nevada Water Authority, Nevada

Program Overview

The Southern Nevada Water Authority (SNWA) hosts the annual WaterSmart Innovations Conference and Exposition (WSI) in Las Vegas each year. The event includes workshops, technical sessions, an exposition, an awards luncheon, tours, and other activities highlighting all aspects of urban water efficiency. WSI has a sustained standing as the world's largest Urban Water Efficiency conference. Since its inception in 2008, approximately 6,400 attendees from 45 states and 27 counties have participated in the conference. WSI is truly the first interdisciplinary event for urban water efficiency. The event leverages a broad array of national and international partnerships and allows exchange of ideas between product designers and manufacturers, irrigation and plumbing practitioners, facility engineers, policy-makers, academics, nongovernmental organizations and water agencies,

The event provides entrepreneurs with connections to some of the most innovative water agencies and market partners in the world. Each year, new water-efficient technologies are introduced at the conference and research results are shared with the conservation community.

Main Program Elements

Costs

SNWA provided seed money to initiate the conference in 2008. The conference generates adequate registration and exhibition revenue to be financially sustainable. The annual budget is approximately \$300,000.

Implementation Resources

A committee of nine SNWA professionals oversees the planning and implementation of the conference. More than 20 additional agency staff members provide operational support for one or more days during the four-day event. Collectively, the SNWA provides approximately 0.95 FTE of professional time to plan and host the event.

WSI has 12 national and international partner organizations that represent the most influential professional organizations in water management and policy-making. These partners are responsible to evaluate and rank presentation proposals.

Agency

Southern Nevada Water Authority

Project Status 2008 – Ongoing

Targeted Use Sector Other Non-Categorized Use

Estimated Annual Cost

Approximately \$300,000 annual budget. Costs are covered by event revenue

Key Program Elements

- World's largest urban-water efficiency conference
- Accelerates awareness and adoption of innovative water efficiency technologies and concepts
- Accessible and affordable
- Financially self-sustaining
- Interdisciplinary format with multiple professional content tracks



All proposals are rated "blind," without the speaker's name, to encourage diversity in presentations and topics.

Level of Participation

WSI attracts 900 to 1,100 attendees annually. From 2008 to 2013 approximately 6,400 attendees from 45 states and 27 countries have attended.

Program Outcomes

Water Savings Not applicable.

Program Challenges

- Travel restrictions imposed by public agencies.
- Competition for limited travel dollars.
- Sustaining sponsorships.

- Doug Bennett, Conservation Manager Southern Nevada Water Authority
- WaterSmart Innovations Conference and Exposition, retrieved from: https://www.watersmartinnovations.com

Slow the Flow, Save H₂O

Jordan Valley Water Conservancy District, Utah

Program Overview

In 1999, Jordan Valley Water Conservancy District (JVWCD) created a public education and media campaign named "Slow the Flow, Save H2O." The original purpose of the campaign was to increase water conservation awareness and education throughout JVWCD's service area, which lies within the fastest growing portions of Salt Lake County, Utah. During its inception, the campaign grew rapidly, receiving good brand recognition as its messaging was being heard throughout the state.

In 2001, the third consecutive year of a worsening drought, the governor recognized that water conservation savings would be needed not only in response to the drought, but also to provide for a longterm sustainable water supply. It was at that time that JVWCD's local Slow the Flow, Save H2O campaign was elevated to a statewide effort with the objective of creating a long-term water conservation ethic among all Utahns. Since then, input and direction for the campaign has been provided by the Governor's Water Conservation Team, comprised of managers from the State Division of Water Resources (DWRe) and the five largest water districts in Utah. Over the years, the campaign has continued to achieve successful brand recognition through the use of television and radio advertising, various social media avenues, conservation programs, and event promotion. With JVWCD's leadership, Slow the Flow, Save H2O has evolved into a media umbrella campaign for all water conservation messaging and advertising throughout the state.

Main Program Elements

Costs

The Slow the Flow, Save H2O campaign was initially funded by JVWCD at a cost of \$400,000. Since 2001, the campaign cost has been jointly funded by the DWRe, the Metropolitan Water District of Salt Lake and Sandy, and the water conservancy districts of Jordan Valley, Central Utah, Weber Basin and Washington County.

To date, a total of approximately \$4.0 million has been spent collectively on the campaign. Since 2002, JVWCD's cost share has averaged \$50,000 annually.

Entities

Jordan Valley Water Conservancy District and Governor's Water Conservation Team

Project Status 1999 – Ongoing

Targeted Use Sector Primarily Residential Irrigation

Estimated Annual Savings 365 acre-feet per year in JVWCD's service area

Estimated Annual Cost

\$ 69,305 (annualized capital investment plus operation and maintenance cost)

Estimated Unit Water Cost

\$190 per acre-foot per year

Key Program Elements

- Increased public awareness of water conservation throughout Utah
- Achieved brand recognition through television advertising, conservation program branding, and event promotion
- Provided a means of consistent and uniform water conservation messaging throughout Utah



Implementation Resources

Slow the Flow, Save H2O campaign messaging, advertising and programming is developed jointly by the campaign partners under an interlocal agreement. The campaign partners are assisted by a media consultant retained through a competitive process every 5 years. The media consultant contract is administered annually by the DWRe. The campaign partners meet several times each year to build consensus and provide direction for each year's campaign.

Level of Participation

The cooperative efforts and participation by the campaign partners has allowed for consistent water conservation messaging efforts for all water purveyors throughout Utah.

The Slow the Flow, Save H2O campaign is evaluated every year, either by a quantitative (telephone and online survey) or qualitative (focus groups) analysis. Four focus group sessions were recently completed to evaluate campaign effectiveness and to help design new campaign messaging. The focus groups were held with residents from four locations in the state:

- Weber and Davis Counties
- Salt Lake County
- Utah County
- Washington County

Based on recent survey results, 72 percent of all respondents recall Slow the Flow, Save H2O messaging, and 61 percent of respondents felt that the water conservation messaging they encountered had an impact on their water usage habits.

Program Outcomes

Water Savings

JVWCD established a goal to achieve a 2 percent reduction in water use due to its Slow the Flow, Save

H2O campaign. Since 2000, JVWCD has achieved a total water conservation savings of approximately 15 percent due to all of its water conservation efforts and programs, as measured by per capita water use reduction. As such, a 2 percent savings is considered to be a conservatively low estimate of the savings achieved by the Slow the Flow, Save H2O campaign. Nonetheless, assuming a 2 percent reduction in water use due to the campaign, an average annual savings of 365 acre feet and a cumulative savings of 4,743 acre feet has been realized within JVWCD's service area since 1999.

Program Challenges

Building consensus and receiving timely approvals among the funding partners for annual program objectives and budget amounts.

- Bart Forsyth, Assistant General Manager, Jordan Valley Water Conservancy District
- Slow the Flow, Save H2O, retrieved from: http://slowtheflow.org

Recycled Water Public Information and Outreach Campaign

City of Cheyenne, Wyoming

Program Overview

In the midst of a multi-year drought, and facing more stringent discharge regulations for their wastewater treatment plant to Crow Creek, the City of Cheyenne Board of Public Utilities (Board) saw an opportunity to fulfill a commitment made 50 years ago by a former Board president. That commitment was to use water so that 1 gallon of the supply provided by nature would perform the duty of 2 gallons as it is now used. Water reuse could simultaneously address supply concerns and help meet the more stringent discharge requirements. Today, this reuse system is affectionately called the recycled water system by Cheyenne residents.

A perceived challenge to this plan was garnering public support. For that reason, the Board launched an innovative public information and outreach campaign. For nearly a year, the campaign prepared elected officials, coaches, teachers, irrigators, and Board employees on how to respond to questions on the benefits, safety, and water quality of recycled water. These community leaders received presentations and tours. Board managers and design engineers responded to their questions. Ultimately, elected officials, coaches, teachers, irrigators, and employees became enthusiastic recycled water ambassadors. When the Board publicly announced plans to use recycled water, these leaders responded to questions and concerns from their patrons and publics. This response resolved concerns and recycled water use was embraced by the community. The campaign created community ownership and pride in Chevenne's recycled water system.

The objectives of this program are:

- Communicate that recycled water is a droughtresistant source of water for irrigating parks, athletic fields, and green spaces.
- Describe the safeness of recycled water.
- Reinforce the Board's reputation as the source of water quality.
- Embrace Cheyenne's water heritage by communicating that the search for, and innovative use of, water is part of Cheyenne's history and is a common part of living in the arid West.

Agency

City of Cheyenne Board of Public Utilities

Project Status

2005 - Ongoing

Targeted Use Sector

Commercial, Industrial, and Institutional indoor and irrigation: park patrons, sports organizations, schools, recreation users, and elected officials

Estimated Annual Savings

510 acre-feet per year

Estimated Annual Cost

\$737,500 (annualized capital investment plus operation and maintenance cost)

Estimated Unit Water Cost

\$1,446 per acre-foot per year

Key Program Elements

- Successful outreach curriculum to educate end users and residents to use Cheyenne's water resources wisely by irrigating with recycled water
- Collaborative decision-making process bringing contractors, subcontractors, consultants, regulators, State Revolving Fund, and local representatives together prior to beginning the project for successful planning
- Use of community leaders, coaches, and employees as ambassadors of large-scale reuse programs during the development phase - these groups are considered experts by the general public



Recycled Water Sign at Dutcher Field Source: City of Cheyenne Board of Public Utilities

Main Program Elements

Costs

Project funding was provided by the City of Cheyenne Water and Sewer Enterprise Funds, Wyoming State Loans, and Wyoming State Grants. Debt service on the loans is paid using revenue provided by water and sewer sales. The implementation timeframe included the following:

- 2002: Drought impacts Cheyenne's water system and improvements planned for the wastewater treatment plants to meet increasingly stringent discharge requirements.
- 2005: Public information and outreach campaign launched.
- 2006: Class A reuse capabilities added to Crow Creek Water Reclamation Facility.
- 2007: Phase I of recycled distribution system constructed and first recycled water delivered.
- 2009: Recycled distribution system expanded.

The cost associated with the construction of the plant and public outreach are shown below.

Construction and Outreach	Cost (\$ million)
Information and Outreach	0.06
Treatment capabilities at Crow Creek Water Reclamation Facility	5.77
Phase I of distribution system	5.76
Phase II of distribution system	1.72
Total (through 2013)	13.31

Level of Participation

The information and outreach campaign was selected as the 2008 WateReuse Public Education Program of the Year by the WateReuse Association. The recycled water system received the EPA Region 8 Performance and Innovation in the State Revolving Fund Creating Environmental Success (PISCES) award in 2006.

Program Outcomes

Water Savings

As of the end of 2013, Cheyenne's recycled water system irrigates approximately 300 acres of parks, athletic fields, and green spaces. The system produces up to 3 million gallons of Class A water per day reducing demand on potable water sources by 4 percent. Since startup in 2007, the recycled water system has saved 2,900 acre-feet of drinking water.

Program Challenges

• Funding for system expansions

Sources

- Clint Bassett, Water Conservation Specialist, City of Cheyenne Board of Public Utilities
- WateReuse Press Release, September 17. 2008, WateReuse Presents Annual Awards in Dallas, retrieved from: https://www.watereuse.org/informationresources/press-room/news-releases/news 091708
- EPA, Performance and Innovation in the SRF Creating Environmental Success (PISCES) Award, 2006, retrieved from:

http://water.epa.gov/grants_funding/cwsrf/upload/2 006_11_14_cwfinance_cwsrf_final_2006pisces.pd f

Distribution System Replacement and Repair

City of Tempe, Arizona

Program Overview

The City of Tempe has implemented a comprehensive water audit and loss control program per standards set forth in the American Water Works Association (AWWA) M36 manual. All water consumption and loss within the city system is identified, measured, and verified. Detailed reporting of all water supplies, deliveries, and losses is submitted annually to the Arizona Department of Water Resources, per state requirements. Advanced billing system software includes checks and balances, flagging potential problems that are investigated and resolved by staff.

Accounts exhibiting abnormal patterns in water use, which might indicate leaks, excessive water use, or other problems, are identified and customers are notified and provided direct assistance by city staff to address the problem. The city regularly tests, repairs, and replaces water meters for the system's 43,000 connections (100 percent metering is required under state law). The city maintains a goal to replace all meters, residential and commercial, every 10 years. A program is currently underway to replace all the city's analog meters with Automatic Meter Readers within 5 years. Also, system pressure is monitored in real-time by a supervisory control and data acquisition (SCADA) system and managed around the clock to ensure it is maintained steadily across the system at 55 to 60 pounds per square inch.

Since 2002, the city's program has included a rigorous and methodical audit of 1,000 miles of mains, valves, and hydrants to assess system efficiency and uncover and eliminate losses. The process occasionally identifies leaks in customer service lines as well. At a minimum, the entire system is completely surveyed at least once every 10 years. As funding is available, additional miles are surveyed. 200 to 250 miles of the distribution system are audited annually and repairs are completed as necessary. The program pays for itself by recovering revenue that would have otherwise been lost.

Agency

City of Tempe

Project Status 2002 – Ongoing

Targeted Use Sector Losses and Other Non-Categorized Use

Estimated Annual Savings

78 acre-feet per year (average value, savings varies depending on miles audited and volume of leaks. Approximately 0.59 acre-feet /audited mile)

Estimated Annual Cost

Estimated \$35,000 for contractors plus the utility staff, resulting in approximately \$360/mile or \$36,000 - no initial investment required

Estimated Unit Water Cost

\$462 per acre-foot per year

Key Program Elements

- Potential leak problems are flagged using advanced billing system and system pressure monitoring
- Partial system audits uncover potential savings and to make the case to continue the effort
- Program enables ongoing annual savings and essentially pays for itself through avoided revenue loss
- Hydrants have been identified as a key source of leaks



Using a Correlator Microprocessor Unit to Determine Leak Location Source: M.E. Simpson Co., Inc.

Main Program Elements

Costs

The water utility department budgets \$35,000 annually for the contract to audit the system. On average, approximately 130 contractor staff-hours are required to complete 100 miles.

Implementation Resources

The city currently contracts with a technical service company providing leak survey programs, large meter testing and repair programs, water main location, valve assessment, and computer mapping programs.

Surveys are conducted using state-of-the-art equipment. The leak detection systems are electronically enhanced listening devices that can determine the exact location of leaks in the pipeline network. All hydrants and accessible valves are used as listening points to identify leaks.

Level of Participation

Since the inception of the program, the city has covered the complete system. Every year fire hydrants that have not been closed properly and minor leaks are discovered. All leaks are addressed quickly, and fire hydrants are closed properly or replaced. From 2002 through 2013, 1,569 miles of the city's distribution system were audited and repairs were made to address losses. The city has committed to continuing to audit the entire 1,000 miles of its system, at a minimum, every 10 years, surveying as much as 20 percent or more of the distribution system annually.

Program Outcomes

Water Savings

Audits conducted between 2002 and 2013 resulted in a total estimated savings of 303,561,000 gallons (932 acre-feet) derived from 738 leaks detected and repaired within the 1,569 miles of the city's distribution system. Annual savings during that same period varied due to the number of miles audited and the number and volume of leaks identified. For the 12-year period, an estimated average of 25.3 million gallons have been saved annually. The table below shows the estimated savings by year since program inception.

Year ¹	Number of Miles Audited	Staff Hours	Number of Leaks Detected ²	Estimated Annual Savings,afy ³
2002	78.2	112	63	42
2003	71.5	97	63	194
2004	72.3	1111	84	18
2005	201.5	314	90	94
2006	193.7	217	138	127
2007	202.9	189	82	92
2008	69.2	71	8	8
2009	89.1	100	41	67
2010	130.0	2001	43	419
2011	50.0	771	12	23
2012	211.0	3251	28	76
2013	200.0	3081	86	126

Notes:

Estimated assuming 130 staff-hours are required to complete 100 miles.

²Includes consumer side service lines, fire hydrants, and valves. ³Estimated based on gallons per day times 365.

Program Challenges

It was apparent from the first 2 years of auditing that the vast majority of leaks were due to fire hydrants that weren't completely closed after exercising or regular use. In 2004, the city's water conservation office purchased \$6,000 of sounding equipment for the crew exercising the hydrants to ensure hydrants were properly closed. However, this clearly remains a challenge. At the end of the 12 years, 88 percent of the total leaks were due to leaking hydrants. Over the last 5 years, on average, 95 percent of the leaks were found in hydrants. This is likely because the fire department and others using the hydrants do not have sounding equipment and are not able to independently confirm that the hydrants are fully closed.

Location of Leak	Number	Percent of all leaks
Customer side service line	2	0.3%
Service line	13	1.8%
Valves	75	10.2%
Hydrants	648	87.8%

- Pete Smith, Water Conservation Coordinator, City of Tempe
- City of Tempe, Water Operations, retrieved from: • http://www.tempe.gov/city-hall/publicworks/water
Denver Water Pipe Replacement Program

Denver Water, Colorado

Program Overview

Denver Water has 2,428 miles of water main pipes in its water distribution systems, serving 1.3 million customers with drinking water. This major asset needs to be managed to minimize problems caused by pipe breaks. Compared to ongoing leaks that usually do not reach the surface, pipe main breaks can cause large holes and surface flows that not only interrupt water service but also cause traffic disruption, local damage, and other inconveniences, and are a significant loss of water. All water utilities suffer pipe breaks and have various methods for replacing pipes over time to reduce the impacts from breaks.

Since the 1970s, Denver Water has used a common "reactive" system based on actual previous breaks in a pipeline to determine which pipelines and segments of pipelines would be replaced to reduce break problems. In 2013, an innovative, "proactive" pipe replacement system was added to complement the ongoing reactive program.

Main Program Elements

Costs

The current cost of pipe replacement is about \$770,000 per mile (\$145 per foot). Denver Water crews install or replace an average of 60,000 feet of pipe a year. Depending on budget availability, the goal is to increase pipe main replacement by 3,500 feet per year for the next several years. The annual budget for pipe replacement is about \$9 million. This is about 10 percent of the total funds for capital projects.

Implementation Resources

The proactive system uses a GIS system and statistical methods to estimate the probability of breakage, assess the consequences of breakage, and assign a risk score to each pipe segment in the distribution system. The probability of breakage is estimated from a statistical analysis of breaks of pipes of similar age and type of materials. The consequences of breakage are estimated from pipe location factors including how many and what type of customers would be affected by a break, the pressure within the pipe, traffic loading of the roadway, and any critical customers who would lose water service due to a break.

Agency

Denver Water

Project Status 2003 – Ongoing

Targeted Use Sector Losses and Other Non-Categorized Use

Estimated Annual Savings

There is no measurable metric available to estimate the reduction in pipe breaks using the proactive replacement method. Overall, there is the potential to save roughly several thousand acre-feet by reducing system losses. While the primary purpose of the proactive approach is to reduce inconvenience caused by main breaks, this new approach is expected to save more water per dollar spent on replacements compared to the traditional pipe replacement approach.

Estimated Annual Cost

\$4 million for the proactive pipe replacement program

Key Program Elements

- Proactive system for pipe replacement
- Use of GIS system and statistical method to assign a risk score to each pipe segment in system
- Investment of 10 percent of total funds for capital programs on pipe replacement program

Level of Participation

The proactive main replacements make up about onehalf of Denver Water's total annual pipe replacements. Crews install or replace an average of 60,000 feet of pipe a year. Depending on budget availability, the goal is to increase pipe main replacement by 3,500 feet per year for the next several years.

Program Outcomes

Water Savings

The new, proactive approach has substantially reduced the number of breaks in pipe mains and the problems caused by breaks, including the loss of water. So far there is not a measurable metric available to estimate the reduction in pipe breaks using the proactive method. Therefore a water savings estimate is not possible. There is an overall potential to save several thousand acre-feet per year through reducing water system losses. While the primary purpose of the proactive approach is to reduce the inconveniences caused by main breaks, it is expected to save more water per dollar spent on replacements compared to the traditional pipe replacement approach.

Program Challenges

- Aging distribution system that required increasing maintenance expenditures to maintain current standards and stringent regulations.
- Need to increase replacement and rehabilitation rates to keep up with its aging infrastructure.

• Rise of future maintenance needs with aging infrastructure. Deferral of replacement may mean an increased incidence of leaks, unscheduled disruption of service, and damage of property.

Sources

• Denver Water, Pipe Replacement, retrieved from: http://www.denverwater.org/WaterServiceSupport/ TroubleshootingRepairs/PipeReplacement

Provo Reservoir Canal Enclosure Project

Central Utah Water Conservancy District, Utah

Program Overview

The Provo Reservoir Canal Enclosure Project (PRCEP) consisted of the installation of 21 miles of 126-inch pipe to enclose the entire length of the canal and made minor modifications to the diversion from the Provo River into the canal. Two major siphons and the turnouts for users were replaced. Metering stations were installed to accurately report water usage.

Main Program Elements

Costs

The PRCEP was jointly funded by Provo River Water Users Association, Jordan Valley Water Conservancy District, Metropolitan Water District of Salt Lake and Sandy, and the Central Utah Water Conservancy District (CUWCD). A portion of the funding from CUWCD came through the Central Utah Water Completion Act Water Conservation Credit Program (WCCP), which receives federal funding through the Department of the Interior. The final cost of the PRCEP was \$150 million. Under a Master Agreement for the PRCEP, CUWCD provided 50 percent of the cost, with \$39 million of CUWCD's portion coming from the WCCP.

Implementation Resources

To facilitate construction of the pipeline, cooperating agreements were necessary with among the funding partners.

Level of Participation

The agencies worked closely together to formulate, design and construct the canal enclosure. Along with funding, the agencies provided technical expertise to the project.

Program Outcomes

Water Savings

The Master Agreement for the PRCEP provided that the water conserved by the project (8,000 acre-feet in average annual seepage savings) will be turned back to the Department of Interior through the WCCP for fishery flows in the Lower Provo River. The 2013 water year resulted in 11,185 acre-feet conserved.

Agency

Provo River Water Users Association

Project Status In operation, constructed March 2010-April 2013

Targeted Use Sector Losses and Other Non-Categorized Use

Estimated Annual Savings 8,000 acre-feet per year

Estimated Annual Cost Initial Investment: \$150 million

Operation Cost Data not yet available, limited operational history

Key Program Elements

- Converted open channel canal to 126-inch steel pipe
- Water conservation
- Canal safety, security
- Conserved water used for endangered fish
- Reliable water delivery
- Restore canal capacity
- Improved water delivery efficiency



Provo Reservoir Canal Enclosure Project Source: Jordan Valley Water Conservancy District

Program Challenges

- Large-scale construction project.
- Up-front capital costs.
- Maintaining water deliveries during construction.

- Heather Anderson, Public Information Officer, Central Utah Water Conservancy District
- Provo River Water Users Association, Provo Reservoir Canal Enclosure, retrieved from: http://www.prwua.org/master-plan-of-systemimprovements/featured-project-prcep.php

Conserve2Enhance[™]

University of Arizona, Arizona

Program Overview

Conserve2EnhanceTM (C2E) connects voluntary water conservation to community action by linking participant donations, based on their water savings, to funding for environmental enhancement projects. Participating homes and businesses create accounts on the free C2E Water Use Dashboard (www.conserve2enhance.org) to track their water use, learn conservation tips, and donate to the C2E program of their choice. The Dashboard provides a suggested donation, but C2E participants are able to donate more or less than the suggested donation or set up a recurring donation. Projects funded through C2E are based on community priorities and can range from securing instream flows to green infrastructure development to riparian restoration. Working with utilities, nongovernmental organizations, and businesses, C2E directly engages residential and commercial water users to save water.

The University of Arizona Water Resources Research Center (WRRC) developed and currently manages the C2E program. WRRC offers use of a C2E Program Development Toolkit, the C2E Water Use Dashboard, and technical assistance to communities and organizations interested in crafting their own program. C2E has been helping make conservation count since 2011, when a pilot program was launched in Tucson, Arizona through collaboration between the WRRC, the local water utility Tucson Water, and nonprofits Sonoran Institute and Watershed Management Group (WMG). Since that time, formal C2E programs have developed in Tucson and four other communities throughout the Southwest. This case study focuses on information from the Tucson C2E pilot (2011-2013); visit www.conserve2enhance.org to learn about all active C2E programs.

Main Program Elements

Costs

Funding for the WRRC's C2E program has been provided by Reclamation and the Walton Family Foundation to develop the program concept, marketing materials, and the C2E Water Use Dashboard. An initial program investment of \$650,000 allowed C2E to develop a C2E Program Development Toolkit and the

Entities

University of Arizona Water Resources Research Center, Tucson Water, Sonoran Institute and Watershed Management Group

Project Status

2011 - Ongoing; Tucson C2E Pilot: 2011-2013

Targeted Use Sectors

Residential, Commercial, Industrial, & Institutional, Residential Irrigation, Commercial & Industrial Irrigation

Estimated Annual Savings

8.2 acre-feet in 2014 by 100 residential and commercial C2E participants

Estimated Annual Cost

Varies by community; about 15 percent FTE staff time

Key Program Elements

- Voluntary water efficiency program that links municipal water conservation with environmental benefits
- Well received by locals as the program ensures water savings benefit the community
- Provides funding for local and regional enhancement projects



C2E Water Use Dashboard, as well as offer technical assistance to communities. The Tucson C2E pilot program benefited from these resources, which were made available to the community at no cost.

During the pilot phase of the Tucson C2E program, community project funding was raised from an "Open Space and Riparian Enhancement" check box on the Tucson Water bill as well as direct C2E participant donations made to WMG. Combined check box and participant donations between 2011-2013 raised nearly \$40,000 for Tucson C2E and supported an annual grant program. The average annual water savings achieved by Tucson C2E pilot participants (residential users only) was 21,000 gallons per household. This led to participants achieving an annual water bill savings of \$47.40 per household, which they were then encouraged to donate to the Tucson C2E program. Moderate staffing was needed for operation of the pilot program; this continues to be true for the fully implemented Tucson C2E program, which presently utilizes the Tucson Water check box as well as the C2E Dashboard's integrated donation portal to raise funds. The annual cost of developing a C2E program will vary depending on the organizational structure established, existing partnerships, and identified priority projects.

Implementation Resources

Laying the foundation for a C2E Program takes approximately six months to one year; program development involves establishing a local program manager, a fiscal agent, and priority projects. Once the program is in place using the C2E Water Use Dashboard, a program requires staff time to message participants, run data queries, and, if partnering with a local utility, upload water use data. Staff time may be needed to market the program to water customers and can vary depending on existing partnership and project opportunities. The Tucson C2E pilot program development was resource intensive, but new C2E programs can expedite the process by utilizing the C2E Program Development Toolkit. This newly developed resource allows programs to achieve a much lower estimated unit water cost than the Tucson C2E program.

Level of Participation

The Tucson C2E pilot program has been well received, and a growing number of communities throughout the Colorado River Basin have begun to develop their own C2E programs to encourage conservation. For the Tucson pilot program, around 850 participants donated to the local C2E fund through the Tucson Water bill check box or as active C2E participants to WMG.

Program Outcomes

Water Savings

Since the development of the Tucson C2E pilot program, C2E participants employing conservation strategies ranging from behavioral changes to rainwater harvesting installations have conserved 20 acre-feet of water and supported seven community-led environmental enhancement projects.

Program Challenges

- Water customer messaging to build the connection between water conservation and enhancements that benefit the community.
- Gaining endorsement by municipalities.
- Identifying opportunities for local environmental enhancement.

- Brittany Xiu and Kelly Mott Lacroix, University of Arizona, Water Resources Research Center
- Conserve2Enhance, retrieved from: www.conserve2enhance.org

High Efficiency Clothes Washers

Eastern Municipal Water District, California

Program Overview

In 2010, the Eastern Municipal Water District EMWD, implemented a program to help fund the installation of high-efficiency clothes washers through the Southern California Gas Company (SoCalGas) energy savings assistance program. Through this program, EMWD, in partnership with Reclamation and the Metropolitan Water District of Southern California (MWD) helped retrofit 1,700 clothes washers for low income households in EMWD's service area.

Main Program Elements

Costs

The program was funded through Reclamation's WaterSmart Water and Energy Grant, and through the MWD-funded, Member Agency Administered funding program. EMWD and SoCal Gas coordinated on advertising the program, identifying customers, and encouraging participation. EMWD also verified the EMWD retail customers with washers installed and complete reporting and invoice requirements for MWD and Reclamation. Total project costs were \$1,236,257 during the period of 2010-2013.

The Reclamation grant agreement was completed in June 2013. Now EMWD has moved forward to continue offering supplemental funding for water saving devices installed through the SoCalGas energy savings assistance program. Currently, EMWD and SoCal Gas are updating their agreement.

Implementation Resources

- Staff time to administer invoices.
- Agreement between agencies.
- Budget.
- No marketing required by water agency.

Level of Participation

Approximately 6 percent of eligible homes in Riverside County have participated.

Program Outcomes

Water Savings

The program replaced washers that use an average of 42 gallons or more per 3-cubic-foot load of clothes,

Agency

Eastern Municipal Water District

Project Status 2010- 2013

Targeted Use Sector Residential Indoor

Estimated Annual Savings 57.8 acre-feet per year for 1,700 Washers

Estimated Annual Cost \$412,100

Estimated Unit Water Cost \$1,528 per acre-foot per year

Key Program Elements

- Water and energy savings
- 20 percent water savings by 2020 requirement
- Creates partnership between water and energy agencies
- Assists low-income families



Residential High Efficiency Clothes Washer Source: Eastern Municipal Water District

with high-efficiency clothes washers that use a maximum of 12 gallons for the same size load. The project produced a quantifiable reduction of demand by single-family residential customers participating in the program of 57.80 acre-feet per year.

Program Challenges

- Lengthy agreement process.
- Customer data reconciliation (for example, customers may be on well).
- Multiple water agencies within Gas Company's boundary.

Sources

• Elizabeth Lovsted, Program Manager Eastern Municipal Water District

- Eastern Municipal Water District, Residential Programs & Rebates, retrieved from: http://www.emwd.org/use-waterwisely/residential-programs-rebates
- SoCalGas Energy Savings Assistance Program, retrieved from: http://www.socalgas.com/for-yourhome/assistance-programs/esap

Innovative Conservation Program

The Metropolitan Water District of Southern California, California

Program Overview

The Innovative Conservation Program (ICP) began in 2001. This competitive grant process provides a way to have water saving ideas from entrepreneurs and water agencies evaluated against one other. The ICP is open to everyone including colleges, universities, entrepreneurs, and water agencies. It is available throughout The Metropolitan Water District of Southern California (MWD) service area and beyond, and applications are accepted from inside and outside the U.S. For the 2013/2014 cycle, the program partners with Reclamation, the Southern Nevada Water Authority (SNWA), and the Central Arizona Project. The goal is to test new technologies and theories; if they prove out, then they are added to the MWD rebate program.

The ICP provides funding in cooperation with Reclamation, SNWA, and the Central Arizona Project for research that will document water savings and reliability of innovative water-saving devices. The objective is to evaluate the water-saving potential and reliability of innovative water-saving devices, technologies, and strategies.

New projects are identified and evaluated every other year. The next round of funding is scheduled for July 2015. All interested parties including public, private, or non-profit organizations are eligible for funding.

Main Program Elements

Costs

Funding consist of MWD contributions of \$250,000 per grant cycle (every other year), \$100,000 from Reclamation, \$50,000 from SNWA and \$50,000 from CAP. Total funding for this round of ICP was \$450,000.

Implementation Resources

The grant, which is open for a few months, is advertised by MWD, Reclamation, SNWA, and the Central Arizona Project to their customers. Grant applications are filled out online. When the grant period closes, the applications are reviewed and scored by an independent panel made up of the funding partners and outside groups including NGOs. The projects rated highest by the panel are funded.

Agency

The Metropolitan Water District of Southern California

Project Status

2013/14 ICP Grant completed; fifty applications received and 13 projects selected; contracts vary from 1 to 2 years, depending on the project

Targeted Use Sector

2013/14 grants targeted landscape and commercial projects; however, all projects were accepted - each round of grants may target different areas

Estimated Annual Cost

\$125,000 (\$250,000 per grant cycle) for MWD

Key Program Elements

- Because the program is applicable in every state, other states are joining the program. Smaller states or water agencies can have smaller grant amounts agencies can target grant to any specific areas
- New technologies have emerged from the ICP grant program and into the mainstream rebate program; examples include connectionless food steamers, xray film processing, water brooms, and irrigation nozzles



Level of Participation

During the 2013/14 ICP grant period, 50 applications were received requesting more than \$2 million. Since 2001, the MWD has funded more than \$1.5 million in grants.

Program Outcomes

Program Challenges

Contract management

2013 Innovative Conservation Program Awarded Projects

Project Title	Entity	Project Description		
Biochar: Waste-to-Energy by Product	California Turf Grass and Landscape Foundation (Non- Profit)	Study the effectiveness of BioChar as a soil amendment that reduces irrigation needs. BioChar is a charcoal by-product of waste-to-energy conversions.		
CII water audit mobile application and web based database (AquaDx)	Proteus Consulting	Study the effectiveness of a new mobile application that performs commercial water use audits both indoors and outdoors.		
Conserving Water Using Aqua Smart	AquaSmart Enterprises (Business)	Study the water savings of AquaSmart, a polymer coated sand that holds water around the root zone.		
Evaluating rain water harvesting conservation savings and strategies in coastal regions	Santa Monica Bay Restoration Foundation (Non-Profit)	Study of comprehensive rainwater harvesting approaches used in residential sites.		
Hydrogels Injected Below the Root Zone of Existing Turf	Aqua Cents Management (Business)	Study the water saving of a hydrogel that is injected underneath existing turf potentially		
Development and Evaluation of a Landscape Drip Schedule Application	University of Arizona (Higher Education)	Develop a computer program that assists customers in scheduling their drip irrigation systems for trees and shrubs.		
Landscape Water Savings using SoilFoodWeb BMP	Green Gardens Group (Business)	Study the effectiveness of Actively Aerated Compost Tea (AACT) as a soil amendment that reduces irrigation needs. AACT is a byproduct of composting with worms.		
Nexus reCycler Innovative Grey Water Treatment and Resuse System	NEXUS eater (Business)	Study the effectiveness of the first whole home greywater system that adheres to California Plumbing Code.		
ECCO wireless soil moisture sensors	Digital Spring (Business)	Study effectiveness of a novel moisture sensor that is wireless, enclosed in plastic, shaped like a spike for easy install and regulates irrigation per zone.		
Plant sensing approach to improving irrigation in agriculture	Fruition Sciences (Business)	Study the water saving potential of a sensor for vineyards plants that bases irrigation on sap flow through plant.		
Project Pressure Regulating Stem (PRS)	Rain Bird Corporation (Business)	Study the effects of pressure regulation on rotors and spray heads in "real world" scenarios.		
High Efficiency Conveyer Dishwater Study	Fisher-Nickel (Business)	Study the water savings potential of a conveyer dishwashing product with optimized spray nozzles and multiple rinse stages.		
Sprinkler Flow Control Study	Sprinkler Flow Control (Business)	Study the savings of a product that reduces over-pressurization and breakage of irrigation nozzles.		

- William P. McDonnell, The Metropolitan Water District of Southern California
- The Metropolitan Water District of Southern California, bewaterwise.com, retrieved from: http://www.bewaterwise.com/icp.html

Albuquerque Bernalillo Water Conservation Program

Albuquerque Bernalillo County Water Utility Authority, New Mexico

Program Overview

The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) began this program in 1995 with a per capita use of more than 250 GPCD; the per capital use is now 134 GPCD. The program targets all customer classes and is a blend of mandatory measures and incentive programs. Rebates are offered to all customer classes for reducing indoor and outdoor water use through high-efficiency toilets, xeriscape, washing machines, rain barrels, and more. Residential construction since 1995 is allowed only 20 percent of the irrigable area of the lot to be planted in high water use (sprinkler-irrigated) plants. New non-residential is prohibited from installing turf. The ABCWUA uses a tiered rate structure during the irrigation season from April through October that increases as water use increases. The objective of all programs is to reduce overall water use and thus build up the groundwater supply. Particular emphasis is placed on consumptive (outdoor) water use.

Main Program Elements

Costs

The annual budget is \$1.3 million which is funded from a dedicated rate increase to customer water bills. \$1 million is returned to customers annually as rebates and remaining funds are for advertising, public relations, and K-12 education programs.

Level of Participation

All customer classes participated in the conservation efforts, including residential, commercial, multi-family, industrial, institutional, and irrigation-only. Residential customers have already reduced their water use by more than 40 percent and will be expected to contribute less to future conservation efforts. About 23 percent of customers have participated in a least one aspect of the conservation program. To continue to reduce water consumption, educational outreach efforts will need to increase.

Program Outcomes

Water Savings

Since 1995, the ABCWUA has decreased customer consumption from 250 GPCD to 134 GPCD.

Agency

Albuquerque Bernalillo County Water Utility Authority, New Mexico

Project Status 1995 – Ongoing

Targeted Use Sectors

Residential, Commercial, Industrial, Institutional and Irrigation

Estimated Annual Savings 82,859 acre-feet per year

Estimated Annual Cost \$1,400,000 (operation costs)

Estimated Unit Water Cost \$661 per acre-foot per year

Key Program Elements

- Since 1995, the program has helped decrease consumer consumption rates from 250 to 134 GPCD
- Uses a blend of mandatory requirements and incentive programs
- Program success is directly linked to customer education and involvement - using a broad range of customer education campaigns has helped achieve success
- Program success is evaluated annually based on water savings achieved both overall and by customer class
- The University of New Mexico Department of Economics conducted a study on the efficiency of individual rebate programs; the conservation program was retooled based on the results



Providing rebates for replacement of turf with desertfriendly plants (i.e., xeriscaping) is just one way the Water Authority is encouraging conservation in its service area.

Source: Albuquerque Bernalillo County Water Utility Authority

In addition, peak daily demand has been reduced from about 205 million gallons per day to about 143 million gallons per day since 1995. 27 billion gallons are saved annually (82,859 acre-feet) when compared to annual water use without conservation. Cumulative water savings exceed 280 billion gallons (859,288 acre-feet) since the program began. Participation and water savings has been highest among residential users, followed by commercial and multi-family customers.

Program Challenges

• Ensuring steady revenue while continuing to reduce water usage.

• Maintaining the tree canopy while encouraging a reduction on outdoor water use.

Sources

- John M. Stomp III, Chief Operating Officer, Albuquerque Bernalillo County Water Utility Authority
- Albuquerque Bernalillo County Water Utility Authority, Conservation and Rebates, retrieved from:

http://abcwua.org/Conservation_and_Rebates.aspx

City Rebate and Water Bank Program

City of Santa Fe Water Division, New Mexico

Program Overview

The Water Conservation Rebate aspect of the City of Santa Fe Water Bank Program quantifies and "banks" water savings garnered from water conservation rebates. The program provides reimbursement for replacement of existing fixtures with new, highefficiency fixtures. Currently, the program provides rebates for high-efficiency toilets, Tier 3 washing machines (highest level of water use efficiency issued by the Consortium for Energy Efficiency), waterless urinals, and rainwater harvesting.

The intent of the program is to increase system-wide conservation to facilitate offsetting impacts on the city's water supply system from new development and to supply water for other municipal uses by replacing less efficient uses with higher-end water saving devices and appliances. This program applies to City of Santa Fe Water Utility customers. Water saving credits derived from this program are deposited in the City's Water Bank and may be allocated for programs including affordable housing and the "living river." Some of the credits may also be available for purchase by developers.

Main Program Elements

Costs

Although a rebate program existed prior to 2010, the program was revamped with funding in part with a grant from the American Recovery and Reinvestment Act of 2009, and per Resolution 2010-20, the water savings resulting from the new rebate program were banked. The initial program ended in July 2010 due to depletion of funds. The program was reestablished in fiscal year 2010/2011 using funding from the City's Water Conservation Fund that is funded through an annual charge to all customers in the city's service area. The city has invested approximately \$1.3 million in this project since 2010. All of this funding has come directly from grants or from the water conservation fund mil-levy. The city allocates about \$350,000 per year for this program, which includes the credited amount of rebates awarded to customers and the direct marketing and outreach budgeted. Not included in the cost estimates is budget for dedicated staff time to process rebates.

Agency

City of Santa Fe Water Division, Water Conservation Office

Project Status 2010 – Ongoing

Targeted Use Sectors Residential, Commercial

Estimated Annual Savings 7.6 acre-feet (2011-2013 average)

Estimated Annual Cost \$350,000

Key Program Elements

- Rebate aspect of program was grant funded in first year, enabling larger dollar amounts rebated and higher participation numbers
- Targeted marketing should be done to ensure continued participation in program
- Water saving credits are deposited in the City's Water Bank and may be allocated for programs including affordable housing, the "living river" and may also be available for purchase by developers



Implementation Resources

The program is marketed through fairly standard channels: the city website, the Water Conservation Office website, print ads, press releases, and community outreach at water-related events. Local retailers provide support by allowing the Water Conservation Office to place information and rebate forms in their stores. Retailers are trained by Water Conservation Staff about terms and conditions of rebate programs.

The Water Conservation Office has worked with managers of several large commercial customers, primarily in the hotel/ motel industry, to facilitate large projects requiring replacement of more than 50 toilets or the installation of water recycling systems found at commercial laundries. Additional resources needed for this effort includes staff dedicated to implementation of these tasks and effective public outreach, both purchased and earned media.

Level of Participation

A total of 2,425 water division customers have participated in the program over the last 3 years. Both residential and commercial customers have participated. The success of these efforts is manifested in a steady year-over-year decline in annual gallons per capita per day use rates.

Program Outcomes

Water Savings

The program has resulted in a total water savings of 55.26 acre feet since 2010:

- 2010: 32.4626 acre-feet (primarily due to American Recovery and Reinvestment Act of 2009 funding to support this rebate. The State of New Mexico also offered a rebate for clothes washers so customers were allowed to take advantage of both rebates at the same time).
- 2011: 9.0402 acre-feet

- 2012: 7.1504 acre-feet
- 2013: 6.6061 acre-feet

Banked water can be used for three main purposes:

- Santa Fe's "Living River" program, set via ordinance allocates 1,000 acre-feet of water to be used for summertime flows in the river.
- Conserved water from rebates are used for affordable housing developments within Santa Fe.
- The banked water can be purchased by independent developers to offset water use for new developments.

Program Challenges

- Continued promotion and increased participation.
- Need for improved rebates processing and documents management systems.
- Continued coordination between Water Division and Land Use staff on the amount of water allocated to the bank.
- Water bank challenges include adequacy of consistent and accurate record keeping and database management.

- Laurie Trevizo, Water Conservation Manager, City of Santa Fe
- Save Water Santa Fe, Water Conservation Rebates and Incentives, retrieved from: http://savewatersantafe.com/rebates

Cash for Kitchens

West Basin Municipal Water District, California

Program Overview

In 2009, the West Basin Municipal Water District (WBMWD) was awarded funding by The Metropolitan Water District of Southern California (MWD) under the Enhanced Conservation Program to create Cash for Kitchens (C4K or the Program), specifically designed to address inefficiencies and to increase water awareness and water efficiency in the food service sector. West Basin, together with the South Bay Environmental Services Center (SBESC) and funding partner, the Water Replenishment District of Southern California, provide restaurants and other food service facilities (corporate kitchens and hotels) with a wateruse assessment. The assessment provides information about current water usage, strategies on how to conserve water, and free materials to assist management in training their employees to be more water-efficient.

The program offers free audits and free high-efficiency devices such as faucet aerators, faucet-flow restrictors, pre-rinse spray valves, and water brooms to replace older, high-volume equipment and to improve indoor and outdoor cleaning practices. Program auditors also provide water and energy rebate information related to commercial kitchens/restaurants and training materials, including a water efficiency manual and a poster with tips on low-cost and no-cost ways to save water.

Main Program Elements

Costs

In 2012, an average of 5 to 7 hours per week for an annual total of about 315 hours were spent administering the program by scheduling visits, performing audits and follow-up, and maintaining the inventory of devices and other items such as the training poster. The annual budget for the entire program is about \$40,000 including labor and materials.

The program was initially funded with seed money from MWD and a match from WBMWD. This grant paid for the water-saving devices as well as the development of marketing and outreach materials. Now that the materials are created, the program is relatively

Entities

West Basin Municipal Water District, South Bay Environmental Services Center, Southern California Gas Company, City of Torrance Municipal Water Department

Project Status 2009 - Ongoing

Targeted Use Sectors Commercial, Industrial and Institutional

Estimated Annual Savings Approximately 25 acre-feet per year (2010-2013

average)

Estimated Annual Cost \$40,000 (initial investment, no operational cost included)

Estimated Unit Water Cost

\$360 per acre-foot per year

Key Program Elements

- Successful means of outreach to a targeted business sector - well suited for areas with large commercial kitchen sector
- Visits scheduled for 60 minutes within optimal timeframe for food service sector; visits are conducted in both English and Spanish and are documented with photos for website or social media outlets to promote participating businesses
- The direct device distribution method works well with these customers - devices easy to install; Program includes training sessions upon request to encourage behavioral change. Training available in English and Spanish; materials available in English, Spanish and Mandarin.



The program is currently funded by WBMWD. WBMWD pays SBESC for a variety of tasks related to promoting water conservation and efficiency, including administering various aspects of WBMWD's efficiency programs, organizing public outreach events, and running social media campaigns.

Implementation Resources

WBMWD coordinates closely with the SBESC, the City of Torrance, and the Southern California Gas Company (SoCalGas) to implement C4K. Each partner brings a particular expertise to benefit commercial kitchen owners/managers and help them save water, energy, and money. A bilingual outreach strategy developed by the SBESC targets the common Spanishspeaking staff. In 2011, the SoCalGas collaboration brought additional energy efficiency benefits that have greatly improved customers' experience with the program. Further outreach to restaurant associations and Chambers of Commerce helped gain more recognition for the program.

Level of Participation

Between 2009 and 2013, SBESC staff distributed more than 900 devices to more than 250 participants. Additionally, over 70 percent of the audits were combined gas and water audits. C4K has been meeting its goal to audit 75 facilities per year. SBESC staff perform follow-up activities for 20 to 25 percent of all past participating sites annually to gauge program effectiveness.

Program Outcomes

Water Savings

The water savings for the program is estimated to be 28 million gallons from the 900+ devices distributed over the past 4 years. Water savings are assumed as 0.07 acre-feet per year for the faucet aerators and flow restrictors and 0.153 acre-feet per year for the water broom and pre-rinse spray valve.

The pre-rinse spray valve device retrofits alone account for 0.88 million gallons per year, 35 percent of annual program savings, with only 113 devices (11 percent of total retrofit installed). This device uses large amounts of hot water and therefore saves customers both water and energy.

Number of Devices Distributed

Device	Faucet Aerators	Faucet Flow Restrictors	Water- Broom	Pre-Rinse Spray Valve
2009/2010	76	18	19	13
2010/2011	180	62	33	48
2011/2012	154	70	23	34
2012/2013	146	62	25	18
Total	556	212	100	113

Program Challenges

- Convincing owners/managers to change equipment and make other significant changes was difficult due to the economy.
- Time is of the essence in commercial kitchen facilities and the quicker information and devices can be distributed, the better. Recommendations are made and devices distributed to owners/managers during the initial visit.
- The combined water-energy audit is beneficial to customers, but there are limitations to the SoCalGas role. Their participation is currently free; therefore, the realized benefits come at no cost. However, because the water-saving devices are only distributed rather than directly installed, SoCalGas is not allowed to claim the estimated energy savings from those devices. As a result, the benefit of their participation in the program is mostly limited to increased customer satisfaction, greater customer outreach, and reduced staff time. There has been discussion about hiring a third party to install the devices, although this option has been cost-prohibitive.
- Larger, national chain restaurants often require permission from their corporate headquarters to make changes and do not seem as interested in the program.

- Cash for Kitchens Enhanced Conservation Program Final Report, December 2011, retrieved from: http://www.westbasin.org/files/c4k/westbasin-cash-for-kitchens-final-report-to-mwdincluding-appendices.pdf
- Elise Goldman, Water Efficiency/Recycled Water Program Specialist for West Basin Municipal Water District

Public School Retrofit Program

Eastern Municipal Water District, California

Program Overview

The Public School Retrofit Program was launched to save water in public schools through the installation of water-efficient devices. The program provided the direct installation of water-efficient devices at no cost to schools. Devices installed include toilets, urinals, faucets, aerators, pre-rinse spray valves, irrigation controllers, and sprinkler nozzles. The program allowed schools to participate in regional conservation programs by eliminating the need for up-front funding and lengthy forms and applications. The program had three goals: save water, encourage water use efficiency, and remove barriers limiting school participation in conservation programs. The program was implemented over a period of 3 years, from August 2008 to August 2011.

Main Program Elements

Costs

The program was jointly funded by Eastern Municipal Water District (EMWD, Reclamation, the CALFED Bay Delta Program, and the MWD with a budget of \$670,000. The final program cost amounted to \$682,000; of which Reclamation with CALFED contributed \$300,000 and the MWD rebates amounted to \$262,000. EMWD invested both monetary and inkind services amounting to \$122,000.

Implementation Resources

EMWD staff dedicated more than 300 hours to implementing the program. Staff performed landscape evaluations, shared knowledge of irrigation technology, processed paperwork, and prepared reports for funding partners. Additional partnering with the City of Perris and the Rancho California Water District enabled the program to be extended beyond the EMWD boundaries.

Level of Participation

EMWD staff met with school district facility planners to communicate the goals and objectives of the program. With input from school districts, 11 eligible schools were targeted and 8 schools chose to participate. Each school received a site evaluation, resulting in a list of devices to be installed.

Agency

Eastern Municipal Water District

Project Status 2008 – 2011

Targeted Use Sector Commercial, Industrial, & Institutional

Estimated Annual Savings 205.6 acre-feet per year

Estimated Annual Cost

\$227,000 (not including operation and maintenance costs)

Estimated Unit Water Cost

\$379 per acre-feet per year (not including operation and maintenance costs)

Key Program Elements

- Provided direct installation of water efficient devices to 48 schools, at no cost to the schools
- Program goals were to save water, encourage water use efficiency, and remove barriers limiting conservation
- Program was extended beyond the EMWD boundaries; one community college district qualified to participate



Devices selected for installation were based on evaluation results, savings assumptions, lifespan of devices, and average cost per acre-foot saved. Upon completion of the initial eight schools, the program was made available to all schools within the EMWD service area. EMWD staff began educating schools on the benefits of water-efficient technology available to encourage participation in the program. By the end of the program, 48 schools participated, receiving varying combinations of high efficiency nozzles, evapotranspirative controllers, and indoor water conservation devices.

Program Outcomes

Water Savings

Initially, the program estimated water savings for 11 schools receiving indoor and outdoor retrofits at 79.63 acre-feet per year with a lifetime savings of 1,050 acrefeet. After the initial schools were completed, funds were used to retrofit additional schools, primarily focusing on outdoor measures. Outdoor devices included irrigation controllers and high-efficiency sprinkler nozzles. By the end of the program, approximately 30 percent of eligible schools received varying combinations of water conservation devices, with estimated water savings of 206 acre-feet per year and lifetime savings of 2,195 acre-feet.

Program Challenges

- Motivating schools to participate.
- The need to have school staff onsite during device installation affected by the school's ability to participate.

- Elizabeth Lovsted, Program Manager, Eastern Municipal Water District
- Eastern Municipal Water District, Public School Retrofit Program Report, retrieved from: http://www.usbr.gov/lc/socal/reports/PublicSchool RetrofitRiversideCty.pdf

National Center for Atmospheric Research – Wyoming Supercomputing Center Conservation Program

Cheyenne, Wyoming

Program Overview

The National Center for Atmospheric Research (NCAR) Wyoming Supercomputing Center (NWSC) was designed with energy efficiency and sustainability in mind, setting it up to be 89 percent more efficient than typical data centers, and up to 10 percent more efficient than state-of-the-art facilitates operating today. Almost 92 percent of the NWSC energy is going directly to its core purpose as a data center powering supercomputers to enable scientific discovery. The design of the NWSC utilized a holistic sustainability approach that went well beyond energy efficiency. The facility implemented a water conservation and efficiency effort that has resulted in a reduction of the total water use by nearly 40 percent over comparable facilities that utilized cooling towers.

Evaporative cooling towers for the Rocky Mountain West region are an exceptionally efficient method for cooling but do evaporate a considerable amount of water. Two primary methods were employed to increase the water efficiency for the NWSC. The first method is a computer-based control scheme (see figure) that allows the facility to optimize water use by sensing outside conditions: on very cold days water simply is cycled outside and does not evaporate at all, on moderate temperature days water runs over the cooling tower but is not forced with fans, and in the heat of summer, the cooling tower behaves like a conventional cooling tower, with fans continuously circulating the air for maximum evaporation. The second method that saves a great deal of water is the implementation of a near-zero blowdown non-chemical water treatment of condenser water. The water treatment system for nearzero cooling tower blowdown is used. The cooling tower water treatment system creates a high total dissolved solids (TDS) and high pH to maintain biostatic conditions without scaling issues. Cooling tower sump sweep piping/nozzles and a filtration system with solids separator with 0.35 micron filtration allows for zero water purge, eliminating impacts on the municipal sewer system and the flushing of towers to maintain TDS and pH.

Agency

National Center for Atmospheric Research

Project Status 2011 – Ongoing

Targeted Use Sector Commercial, Industrial, & Institutional

Estimated Annual Savings 16.9 acre-feet per year

Estimated Annual Cost \$12,452 (without operation & maintenance costs)

Estimated Unit Water Cost

\$738 per acre-foot per year (without operation & maintenance costs)

Key Program Elements

- This project demonstrates and implements technologies that enhance efficiency and have three- to five-year payback periods
- Project reduces cooling energy use by up to 89 percent over typical data center configurations and water use from evaporative cooling towers by 40 percent



Optimization of Water Use based on Outside Temperature

Source: University Corporation for Atmospheric Research

Notes: Region 1: Cooling tower without fans, 46 percent of the year; Region 2: Cooling tower with fans, 48 percent of the year; Region 3: Chiller operates, 7 percent of the year The objectives of this project are to:

- Reduce cooling energy use by up to 89 percent over typical data center configurations.
- Reduce water use from evaporative cooling towers by 40 percent.
- Ensure that all overhead costs and waste are minimized, assuring value for taxpayer dollars
- Demonstrate and implement technologies that enhance efficiency and have three- to five-year payback periods.

Main Program Elements

Costs

The complete supercomputing facility investment approached \$70 million. The total investment for the zero blowdown water treatment system is \$258,000.

The NWSC is the result of a broad public-private partnership between the University Corporation for Atmospheric Research (UCAR), the State of Wyoming, the University of Wyoming, Cheyenne LEADs and Wyoming Business Council

The implementation timeframe included the following:

- 2008-2009: Design
- 2010: Construction
- 2011: Building completion and commissioning
- 2012: Supercomputing installation and production computing

Implementation Resources

The NWSC is operated by the National Center for Atmospheric Research under sponsorship of the National Science Foundation

Level of Participation

The NWSC has achieved all of the design parameters and in some cases is poised to exceed them. The

application of this approach to water optimization can be applied to any industry that has significant cooling requirements ranging from data centers, hospitals and industrial applications.

The facility has been recognized for its sustainable design and operation, including:

- Leadership in Energy and Environmental Design (LEED TM) Gold Certification
- Green Datacenter of the Year 2013 Data Center Dynamics
- Winner Green Enterprise IT Awards 2013 Uptime Institute

Program Outcomes

Water Savings

Estimated water savings is about 5.5 million gallons (16.9 acre-feet) of water annually.

Program Challenges

Data centers like many industrial applications tend to be risk averse and want to stay with tried and true technologies. The NWSC offers an example of what can be done with tried and true technologies but applied in a different way.

- Aaron Andersen, Deputy Director Operation and Services, National Center for Atmospheric Research, Computational and Information Lab
- NCAR-Wyoming Supercomputing Center, green technology, retrieved from: http://www.nwsc.ucar.edu/green
- Water Conservation Technology International, Inc, retrieved from: http://www.watercti.com/published-papers.html

Parkway Improvement Districts Water Conservation Program

Town of Gilbert, Arizona

Program Overview

Eleven Gilbert neighborhoods are organized into separate Parkway Improvement Districts (PKIDs) to maintain their own common areas such as parks, retention areas, entryways, and street rights-of-way. The PKIDs include 39.8 acres of turf and 19.8 acres of decomposed granite planted areas.

Partnerships between PKID neighborhoods and Gilbert have resulted in changes to landscaping, playground enhancements, and improvements requested by residents. The PKID conservation program has included water budgeting for irrigation and turf conversion to low-water-use plant material and the retrofitting/replacement of aging irrigation systems to increase efficiency, requiring less water while still maintaining the health of the landscape plant material.

In 2009, the Water Conservation Office and Parks Department personnel partnered to explore whether there were any potential water savings at the PKIDs. The landscape water requirement was calculated based on the square footage of the irrigated areas for each of the PKID communities and compared to historical water use. This allowed consumption to be compared to the anticipated requirement, rather than just what had been used in the past.

A monthly meeting was established to monitor water consumption and identify anomalies at each PKID community. When unexpected water consumption was detected, individual meters and the corresponding irrigation systems were inspected and corrective actions were determined.

In addition to the enhanced water management program already in place, an improvement program included the conversion of 145,716 square feet of turf to low-water-use plant material, and the retrofitting/ replacement of aging irrigation systems was developed to increase efficiency while maintaining the health of the landscape plant material.

Main Program Elements

Costs

While Gilbert owns the common area properties, State law requires the Town to levy taxes on all homes in the

Agency

Arizona Coalition Partners

Project Status 2009 – Ongoing

Targeted Use Sector Commercial & Industrial Irrigation

Estimated Annual Savings 76.7 acre-feet per year

Estimated Annual Cost \$6.360

Estimated Unit Water Cost \$83 per acre-foot per year

Key Program Elements

- Potential water savings from irrigation was tracked by in-house trained personnel, which allowed more control in implementing the program
- Healthy landscape has been maintained while enhancing irrigation efficiency
- Staff performance and service to residents has improved significantly because problems are now more thoroughly identified and investigated



Ryan Morasch, Senior Grounds Maintenance Worker, improving landscape irrigation to achieve the water use reductions. Source: Town of Gilbert

PKIDs to fund annual expenses to maintain and improve these areas.

PKID projects are funded by taxing neighborhood property owners. The funds for operation and maintenance of the PKID are collected as a special assessment tax district based on the property tax bill. The annual budget amount is developed by staff (including any input from the neighborhood) and then adopted by the Council. An annual mailing to every address in each PKID informs residents about the proposed assessment and the budget. The annual labor cost to run and compile the reports and the Park's personnel time to attend the meetings is estimated to be \$6,360. This amount includes salaries only (if full benefit packages were included, it would be approximately double). The operational cost is still considered to be very low.

Implementation Resources

While neighborhoods that are PKIDs may have covenants, codes, and restrictions (CC&Rs), most do not have homeowners associations (HOAs) that are organized to enforce them. As with all land CC&Rs, PKID CC&Rs may be enforced by private individuals. Unlike HOAs, PKID neighborhoods do not own common property and do not hire property management companies to maintain their neighborhoods. The Gilbert Community Services hires and oversees contractors who bid for individual contracts for each of the 11 neighborhoods.

Level of Participation

The eleven Gilbert neighborhoods participating are Cassia Place, Circle G Meadows II, Circle G Meadows III, Circle Ranches VI, Circle Ranches VII, Madera Park, Morning Ridge, Park Village, Spring Meadows, Templeton Place, and Val Vista Park.

Program Outcomes

Water Savings

The calculated water requirement for landscape, based on the square footage for all of the PKIDs, was 49,482,000 gallons per year. The calculated expected water requirements are based on historical weather to account for yearly weather fluctuations and to account for irrigation system hardware malfunctions. The goal is to be within 20 percent of these calculated water requirements. Being within 10 percent of these calculated water requirements is considered to be exceptional landscape water management.

The table below shows the estimated savings by calendar year since program inception.

Year ¹	Water Require- ments ²	Water Used ²	Over- irrigation ³	Water Savings⁴
2010	49.5	55.9	13%	-27%
2011	49.4	50.4	2%	-34%
2012	49.4	51.9	5%	-32%
2013	46.5	47.9	3%	-37%

Notes:

¹ Calendar year

² Millions of gallons

³ Deviation from water requirement estimate

⁴ Savings from 2009 water use level

In 2009, 76,552 million gallons of water were used to irrigate the PKID landscapes. The enhanced PKID landscape water management partnership between the Parks Department and the Water Conservation Office has saved a total of 100.2 million gallons from 2010 through 2013. The bulk of the savings (97 percent) was realized by measuring and monitoring water use, as well as quick response to spikes in water use identified in the monthly update meetings. A small portion of the savings can be attributed to the conversion of turf to xeriscape in 2013. In the first year, water use was reduced to be within the standards for effective landscape water management. In the next three years, water use has been managed well into the standards for exceptional landscape water management.

Program Challenges

- Overlap with other conservation programs such as turf conversion and irrigation system upgrades that changed the planned water requirements and resulted in unexpected changes in water demand made quantification of water savings tricky.
- Program effectiveness to reduce water consumption may be less when landscape maintenance is contracted out, as it normally includes the programming of irrigation controllers and the irrigation inspection.

- Jeff Lee, Water Conservation Specialist; Town of Gilbert
- Gilbert, Arizona PKID process, retrieved from: http://www.gilbertaz.gov/departments/developmen t-services/engineering-services/pkid/pkid-process

Free Sprinkler Nozzles

Western Municipal Water District, California

Program Overview

Western Municipal Water District (Western) targets landscape water use by offering vouchers for efficient sprinkler nozzles through its FreeSprinklerNozzles.com website. The nozzles offered are designed to reduce landscape water use through lower precipitation rates as well as increase efficiency through improved distribution uniformity. By pairing a web-based public interface with state-of-the-art water saving technology, the FreeSprinklerNozzles.com program offers an effective and innovative approach to landscape water conservation. Residential water customers are eligible to receive up to 25 nozzles for free; commercial customers can receive 100 nozzles or more based upon the number of existing spray nozzles at the site. Vouchers for free nozzles are delivered to customers via email only after the customer has reviewed a series of educational online videos. The videos explain how the nozzles work, describe the installation process, and teach the customer how to perform an irrigation system survey prior to redeeming their free nozzle voucher and installing their new nozzles.

Main Program Elements

Costs

The program costs an estimated \$180 per acre-foot of water conserved.

Implementation Resources

The program is offered by Western as a turn-key design and costs water agencies \$3.25 per nozzle. Agencies sign a Memorandum of Understanding with Western and provide customer data, sample bills, and agency logo. Western administers all program operations including website development, updates, maintenance, and hosting, customer support as well as supplier management and payments. In addition, Western develops template marketing materials and conducts outreach to landscape industry professionals and large landscape customers.

Toro conducts supplier recruitment and training and provides customer technical support. Western secures purchase orders with participating suppliers and pays supplier invoices. Western, in turn, invoices the participating agencies and provides regular reporting.

Agency

Western Municipal Water District

Project Status 2010 – Ongoing

Targeted Use Sector

Residential Irrigation, & Commercial and Industrial Irrigation

Estimated Annual Savings

4,112 acre-feet per year

Estimated Annual Cost \$1.043.340

Estimated Unit Water Cost \$180 per acre-foot

Key Program Elements

- Western offers vouchers for efficient sprinkler nozzles through its website FreeSprinklerNozzles.com
- Program generates cost-effective water savings, educates consumers, is simple to expand, and readily accepts new partners to the program
- Each nozzle provided by the program is estimated to save 0.004 acre-feet per year



Agencies are expected to market the program to their customers.

Level of Participation

Because of the program's success, Western expanded the scope to include 25 additional participating water agencies, both within and outside of Western's service area. Since its inception in the summer of 2010, the FreeSprinklerNozzles.com program has distributed 1,028,000 nozzles throughout California.

Program Outcomes

Water Savings

Since its inception in the summer of 2010, the FreeSprinklerNozzles.com program has distributed 1,028,000 nozzles (3-year period) throughout California with an estimated water savings of 20,554 acre-feet over the life of the nozzles. Annual water savings estimates for the program were calculated using The Metropolitan Water District of Southern California's (MWD) estimation of the amount of water saved through the installation of high efficiency nozzles.

Program Challenges

As part of the FreeSprinklernozzles.com program, customers are responsible for installation and any

payment required. For larger landscape sites, many customers do not understand the return on investment for any landscape upgrades. Paying for the installations can be a barrier that impacts participation.

- Tim Barr, Water Use Efficiency Manager, Western Municipal Water District
- Free Sprinkler Nozzles, retrieved from: http://freesprinklernozzles.com

Water Smart Landscape

Southern Nevada Water Authority, Nevada

Program Overview

Landscape irrigation is the single largest consumptive water use in southern Nevada. A Southern Nevada Water Authority (SNWA) joint study with Reclamation determined that lawns receive four times as much water as desert-adapted landscapes. The Water Smart Landscapes Rebate Program offers financial incentives to replace water-thirsty lawn with water-efficient landscaping. The current program rebate is \$1.50 per square foot for the first 5,000 square feet of lawn converted and \$1 for each additional square foot, up to \$300,000 per year, per customer. Since program inception, nearly \$200 million in rebates have been issued for conversion of 168 million square feet of landscape. As of April 2014, the program produces more than 9 billion gallons of annual water savings and has a cumulative savings of nearly 69 billion gallons.

In Fiscal Year 2013, SNWA issued more than \$7.3 million in rebates for conversion of over 5.85 million square feet of turf on more than 2,400 properties. The estimated annual savings from this year's projects alone is over 1,002 acre-feet, which will be sustained perpetually.

Main Program Elements

Costs

In Fiscal Year 2013, SNWA invested more than \$7.36 million dollars in customer rebates for conversion of turf to water efficient landscaping. Since program inception, \$190 million has been spent to date on landscape rebates. In addition to rebate monies, the SNWA estimates approximately 15 percent more on overhead costs to administer the program. Between 2010 and 2014, SNWA used \$2.6 million in grants awarded by Reclamation to expand the program.

From 2000 to 2008, operating funds were used to pay rebates. Since 2009, the SNWA has capitalized the costs by using bond proceeds. To ensure compliance with the requirements for use of bond proceeds, the SNWA requires property owners to convey an easement that guarantees the conversion will be sustained in perpetuity.

Agency

Southern Nevada Water Authority

Project Status 2000 – Ongoing

Targeted Use Sector Landscape Irrigation (all customer classes)

Estimated Annual Savings 28,740 acre-feet per year

Estimated Unit Water Cost \$454 per acre-foot per year

Key Program Elements

- Financial incentives to replace turf with waterefficient landscaping
- Targets consumptive demand
- Sustains quality of life and economic uses
- Cumulative savings of more than 78 billion gallons of water to date
- Covenant and easement protects water savings in perpetuity



Conversion to water efficient landscaping Source: Southern Nevada Water Authority

Implementation Resources

Implementation requires field and office staff, vehicles, geographic information systems (GIS), and other data management systems and marketing. The SNWA created a custom database to manage conservation programs that include scheduling functions, customer management, and financial processing.

Staff conduct pre-conversion and post-conversion visits at each project. Field measurements are combined with GIS measurements to document project areas to calculate the rebate amount and produce project documentation.

A partnership program with the landscape industry (Water Smart Contractor) assures that a pool of qualified contractors trained by SNWA in installation of water efficient landscapes and knowledgeable of the Water Smart Landscapes Program is available to serve the community. SNWA, by maintaining a listing of these contractors on the website allows customers to easily find firms they can feel confident in hiring to perform the landscape conversions.

Aerial multi-spectral imagery is used annually to conduct community-wide vegetation change detection and to target potential program clients for direct marketing.

Level of Participation

The program is available to all customer classes. More than 51,000 individual projects have been completed between 2000 and April 2014. Although single-family homes comprise 90 percent of the projects, they account for just 35 percent of all square footage converted. Sixty-five percent of conversion areas are attributable to commercial, industrial, institutional, and multi-family properties. Golf courses and Home Owners' Associations (HOAs) have been very active, converting tens of millions of square feet through largescale, multi-phase projects that may encompass more than 6 acres per project. Many large property owners conduct multiple phases as a result of the maximum \$300,000 annual rebate cap. A survey conducted in 2009 determined that the SNWA program converted more than 10 times as much landscape as all other similar programs in the United State combined.

Participation in the program peaked twice; once in 2004 during the height of drought awareness and again in 2007 when the SNWA offered a temporary promotional rebate of up to \$2.00 per square foot.

Program Outcomes

Water Savings

As of April 2014, total program savings exceeds 28,740 acre-feet (9.4 billion gallons) annually and more than 210,000 acre-feet (68.4 billion gallons) since program inception. Research shows a per square foot savings from converted turf of 55.8 gallons per year (Soyocool et al, 2002). SNWA has used conserved water as an asset for local and interstate water banking.

Program Challenges

- Easement requirement may deter some clients.
- Seasonal program demand characteristics (heavy spring, light winter).
- Market saturation and resistant late adopters (turf has been limited in new development since 2003, thus there is a fixed market for the incentive program).

- Doug Bennett, Conservation Manager, Southern Nevada Water Authority
- Southern Nevada Water Authority, Water Smart Landscape Rebate, retrieved from: http://www.snwa.com/rebates/wsl.html
- Southern Nevada Water Authority, 2005, Xeriscape Conversion Study, Final Report
- Sovocool, Kent A., Mitchell Morgan, and Doug Bennett. 2002. An in-depth investigation of Xeriscape. Journal of the American Water Works Association. 98:2. February 2002.

Water Use Restrictions and Development Code

Southern Nevada Water Authority, Nevada

Program Overview

The first modern water conservation policies were enacted in Southern Nevada Water Authority (SNWA) in the early 1990s. In 2003, as a response to severe drought in the Basin, SNWA's seven-member agencies and Clark County cooperatively developed stronger, more effective water conservation oriented policies including:

- Prohibition on lawn grass (turf) in non-residential development and restriction on turf use in residential development (no lawn in new home front yards, 50 percent in residential backyards).
- Mandatory, seasonal assigned watering schedules.
- Prohibition and fee assessments for waste of water.
- Restrictions on creation and use of ornamental water features.
- Restrictions on vehicle and surface washing.
- Restrictions on use of mist systems for human comfort.
- Golf course turf limitations and water budgets.

In 2009, these drought restrictions were adopted into permanence to support long-term resource management.

The most significant of these policies limit use of turf grass for new development. A prior joint study by SNWA and Reclamation determined that lawn grass irrigation used four times as much water as the irrigation of water-efficient landscapes. The development code has been essential to current and future water conservation savings and seeking to achieve regional water conservation goals by improving per capita water use performance and ensuring WaterSmart Landscapes rebate dollars are applied to pre-2003 properties.

Water waste prohibitions and mandatory watering schedules were implemented through water utility service rules as a "condition of service." When compared to the issuance of citations, this approach streamlines enforcement, reduces complexity, and

Agency

Southern Nevada Water Authority

Project Status 2003 – Ongoing

Targeted Use Sector Landscape irrigation (all customer classes), other consumptive uses, and inefficiency

Estimated Annual Savings

Landscape Development Codes: 25 percent in Single-Family Sector. Unknown for other sectors.

Golf Course water Budgets: 14 percent

Estimated Annual Cost

No hard costs were associated directly with implementation

Key Program Elements

- Effective water conservation oriented policies to limit use of turf grass for new developments and golf courses
- Development of uniform policy between allied jurisdictions
- Focus on consumptive uses and reduction of waste
- Equity among customer sectors



No Lawn in Front Yards of New Homes Source: Southern Nevada Water Authority

preserves relationships between the utilities and their customers. Customers with violations are afforded due process and a right to an objective hearing. Violation fees are assessed directly to the water bill and increase dramatically with each successive violation.

Main Program Elements

Budget

No direct costs were incurred in the development and implementation of these policies. Significant personhours were invested by agency staff and stakeholder groups in the development of the policies and implementation processes.

Implementation Resources

An environment that fosters collaboration between jurisdictional parties is necessary to develop common provisions. In this case, the drought provided political capital to develop and implement highly-effective policy.

Significant stakeholder processes and work with code officials is needed to develop prohibitions on water use.

SNWA adhered to the following principles in development of its drought response measures:

- Reduce consumptive uses.
- Avoid restricting non-consumptive uses unnecessarily.
- Wherever possible, sustain economic vitality.
- Reduce non-essential uses and waste.
- Provide reasonable opportunities for large consumptive water users to determine their own operational strategies within a water budget.
- Consider the positive public perception of limiting highly visible uses of water even if they produce nominal efficiency gains.
- Pursue equity among various sectors' contributions.
- Provide special emphasis on the need for extraordinary, visible leadership from government-sector water users.

• Seek high levels of citizen and stakeholder involvement, particularly from sectors impacted by the policies and provisions.

Level of Participation

All jurisdictions participated. Compliance was mandatory and largely accomplished through the existing development and inspection process.

Many stakeholder interactions occurred.

Program Outcomes

Water Savings

SNWA has found that these policies significantly contributed to a 33 percent reduction in GPCD between 2002 and 2013. SNWA research has found that turf grass limits in Southern Nevada reduce outdoor use an average of 25 to 28 percent at single-family homes. Prior studies show water efficient landscaping uses 75 percent less water than lawn grass (SNWA). In another SNWA study, the Golf Course Water Use Under Water Budgets, indicated that the golf course water budgets reduced sector demand by 14.4 percent (1.3 billion gallons or 4000 acre-feet per year).

Program Challenges

- Limitations on outdoor water features, misters, and vehicle washing yield minimal water savings, but created the largest portion of public concern.
- Developing uniform policy and enforcement is challenging among multiple jurisdictions.
- Some grandfathered master development plans limit the applicability of new restrictions.
- Unintentional system demand shifts had to be considered in the development of assigned watering days

- Doug Bennett, Conservation Manager, Southern Nevada Water Authority
- Southern Nevada Water Authority restrictions, retrieved from: www.snwa.com/consv/restrictions.html

Central Utah Gardens

Central Utah Water Conservancy District, Utah

Program Overview

Central Utah Water Conservancy District's (CUWCD) ongoing commitment to water conservation has put the District at the forefront of Utah's water management and conservation efforts. Central Utah Gardens is a natural extension and expression of that commitment and leadership.

Section 207 of the 1992 federal legislation known as the Central Utah Project Completion Act directed that CUWCD institute a variety of measures to encourage the conservation and wise use of water and achieve beneficial reductions in water use and system costs. After submission of a feasibility study and review by the Water Conservation Credit Program Prioritization Committee and a public hearing, Central Utah Gardens was granted Section 207 funds for a portion of its construction costs.

Central Utah Gardens began construction in 2006 and the gardens officially opened to the public on May 17, 2007. The education garden demonstrates the 7 principles of water-efficient landscaping and educates visitors about the importance of water conservation. Approximately 67 percent of Utah residents' water is used to irrigate outdoor landscapes. Trained interns use garden demonstrations to teach the public how to reduce their outdoor water use without sacrificing landscape beauty. Before the education garden existed, the water district's property was covered chiefly in Kentucky Bluegrass lawn. Following the construction and establishment of the education garden, water use was decreased by 50 percent. Home owners are encouraged to follow this example in their own yards.

7 Steps of Water-Efficiency Landscaping

- 1. Planning and Design
- 2. Soil Analysis
- 3. Plant Selection
- 4. Lawn Areas
- 5. Efficient Watering
- 6. Use of Mulches
- 7. Proper Yard Care

Agency

Central Utah Water Conservation District

Project Status 2007 – Ongoing

Targeted Use Sector Primarily residential water use

Estimated Annual Cost Initial investment: \$1.3 million; annual cost: \$90,000

Key Program Elements

- Increased public awareness of outdoor water conservation throughout Utah
- Educate members of the public about the steps of water-efficient landscaping in a way that allows them to put them into action in their own landscapes
- Eliminate the false concept that low-water landscaping is sparse and unattractive



Main Program Elements

Costs

Funding for Central Utah Gardens came from Section 207 of the Central Utah Project Completion Act and from the CUWCD. The initial cost for the education garden was \$1.3 million dollars. The education garden has an annual budget of approximately \$90,000.

Implementation Resources

Central Utah Gardens messaging, classes and events are advertised mainly through an outdoor digital sign, mailers and postcards. Education garden visitors are informed about outdoor water conservation through viewing demonstrated plant material and designs, gardening classes, children's' classes, seasonal events, summer concerts and garden tours.

Level of Participation

Since the education garden's opening in 2007, there have been significant increases in program participation and attendance. The average class attendance during the first season was 11 individuals. In 2014, the attendance average was 97 per class. Event attendance also increased from 100 to 300 people at events in the first few years to 1,000 to 2,200 people at events in recent years. Total garden attendance has doubled since the gardens first opened, going from 4,100 in 2007 up to 8,250 in 2014.



Program Outcomes

Program Challenges

Helping members of the public overcome preconceived ideas about outdoor water conservation. Many people believe that low-water landscaping involves rock, cactus, and very little plant material.

- Heather Anderson, Public Information Officer, Central Utah Water Conservancy District
- Central Utah Gardens, retrieved from: http://www.centralutahgardens.org

Reclaimed Water Distribution System

City of Scottsdale, Arizona

Program Overview

In 1989, the City of Scottsdale mandated that golf courses begin using reclaimed wastewater for irrigation instead of groundwater or potable water to address declining groundwater levels. The key to the Reclaimed Water Distribution System Project is an ongoing public-private partnership to expand and enhance infrastructure, treatment process, and reuse. The project allows the majority of Scottsdale's golf courses to utilize reclaimed water to meet their daily turf and landscape irrigation needs. This innovative partnership between the city and the 22 golf courses provides a solution that benefits the golf courses, the economy, the aquifer, and the sustainability of the city's water supplies.

Main Program Elements

Costs

An initial infrastructure investment of \$27.8 million was funded entirely by the golf courses. The city operates and maintains the system with capital replacement and annual operating and maintenance costs paid by the courses through an annual rate setting process. The treatment, distribution, operation and maintenance costs are \$8,420,828 per year.

Implementation Resources

The infrastructure required to provide reclaimed water to these golf courses is extensive and includes approximately 14 miles of reclaimed water trunk-line, plus numerous turnout lines to individual golf courses. Additionally, the system has an 8 million gallon storage reservoir, four mainline booster stations, and 20 million gallons per day of treatment and conveyance capacity.

Level of Participation

Since 1989, the majority of Scottsdale's golf courses have used reclaimed water to meet their daily irrigation needs. Today, approximately two dozen golf courses receive reclaimed water through the Reclaimed Water Distribution System to irrigate the turf and landscape areas of these courses.

Agency

City of Scottsdale

Project Status 1989 – Ongoing

Targeted Use Sector Commercial and Industrial Irrigation

Estimated Annual Savings 22,403 acre-feet per year

Estimated Annual Cost \$8,420,828

Estimated Unit Water Cost \$ 436 per acre-foot per year

Key Program Elements

- Partnered with private sector to assist in funding the project
- Successfully implemented reclaimed water irrigation for the majority of Scottsdale golf courses
- Excess reclaimed water is used to recharge groundwater aquifer



Program Outcomes

Water Savings

Up to 20 million gallons per day of reclaimed water is conveyed to golf courses for irrigation purposes. If the irrigation demand is lower, excess water is recharged into the underlying vadose zone at the city's Water Campus. Adding this continuous and renewable water source to Scottsdale's portfolio is one of the many ways the city is making the most of its water use every day. By meeting golf course irrigation needs through the use of reclaimed water, the city preserves Colorado River water for its current and future municipal demand.

Program Challenges

- Salinity of reclaimed supplies poses difficulties for turfgrass management.
- Extensive infrastructure expansion and upgrades was needed at the city's Advanced Water Treatment Facility to reduce salinity. This includes microfiltration, reverse osmosis and advanced oxidation processes to help reduce the salt content in the reclaimed water.
- The resulting salinity reduction allows the golf courses to more efficiently manage their water use.
- The city is undertaking a multi-year pilot project to reduce salinity levels throughout the community's wastewater stream.

- Kathy Rall, Water Resources Advisor, City of Scottsdale Water Resources Division
- City of Scottsdale, reclaimed water, retrieved from: http://www.scottsdaleaz.gov/Water/Water_Supply _Planning/Sustainable_Supply/Reclaimed_Water

Zero Discharge: Palo Verde Nuclear Generating Station and Redhawk Power Plant

Wintersburg, Arizona

Program Overview

Palo Verde is the only nuclear plant in the United States that does not sit on a large body of water. Most plants use large natural bodies of water such as lakes, oceans, or large rivers as the source of cooling water, but Palo Verde is located in the dry Sonoran Desert, where water is precious. It is the only nuclear power plant in the world that uses reclaimed wastewater from surrounding cities as its cooling water. Wastewater is transported to Palo Verde through 36 miles of underground pipe from the 91st Avenue and Tolleson Wastewater Treatment Facilities.

Unlike other nuclear plants, Palo Verde maintains "zero discharge," with no water being discharged to rivers, streams, or oceans. Instead, it recycles more than 20 billion gallons of municipal effluent each year to meet its cooling needs. The treated water is piped to two storage reservoirs with a combined capacity of approximately 1 billion gallons. The reservoirs provide about 14 days storage of makeup water for the three nuclear units operating at full capacity during peak conditions in the hot, summertime weather. Water is routed through condensers and cooling towers for an average of 25 cycles until the total dissolved solids levels approach 30,000 milligrams per liter, then the blowdown is discharged to evaporation ponds (220 acres, 250 acres, and 180 acres) for final disposal on site.

Main Program Elements

Costs

Due to location, both Palo Verde and Redhawk are not located near a large body of water; therefore, a sizable investment was made in the Water Reclamation Facility (WRF) to use treated effluent. The total investment of the WRF, if it were built today and not including the cost of purchasing the effluent, would be approximately \$685 million. Some of the large expenditures for the WRF included land acquisition, storage reservoirs, evaporation ponds, pipeline, and all necessary equipment needed to construct a WRF.

Entity

Palo Verde Nuclear Generating Station

Project Status Ongoing

Targeted Use Sector Self-Supplied Industrial

Estimated Annual Savings 61,400 acre-feet per year

Initial Investment \$685 million

Key Program Elements

- Zero discharge plants, no water is being discharged to rivers, stream or oceans
- Uses treated wastewater effluent from surrounding cities for cooling purposes
- Limits the use of groundwater and Colorado River water
- Partnership with nearby cities to purchase treated effluent wastewater



Palo Verde Nuclear Generating Station Source: Arizona Public Service Company

Implementation Resources

To secure the water needed for Palo Verde and Redhawk into the future, Arizona Public Service on behalf of the owners of Palo Verde, negotiated a contract with the City of Phoenix, City of Mesa, City of Tempe, City of Scottsdale, and the City of Glendale (collectively referred to as the Subregional Operating Group) to purchase their effluent. A separate agreement with the City of Tolleson was also negotiated to purchase their treated effluent. Pursuant to the Subregional Operating Group Agreement, the cities are committed to make available up to 80,000 acre-feet per year of effluent until December 31, 2050, unless extended by mutual agreement of the parties. These arrangements benefit the local economy through the purchase of 20 billion gallons of effluent each year. It also conserves higher quality groundwater and surface water for other uses like drinking water for local residents.

Level of Participation

The Palo Verde Nuclear Generating Station and the Redhawk Power Plant both use treated effluent as a cooling source. The effluent produced by the cities could be utilized by other power plants but both the Palo Verde conveyance pipeline and the WRF are at full capacity.

Program Outcomes

Water Savings

At Palo Verde, the water undergoes further treatment at the site's WRF — one of the world's largest advanced water treatment facilities. Treated water is stored in the site's 85-acre and 45-acre reservoirs for use in the cooling towers. Palo Verde also uses groundwater for site potable demands, as well as a source of supply for the production of ultra-pure water that is used in the primary and secondary systems of the plant. Palo Verde's 2012 water use was 2,269 acre-feet of groundwater and 70,170 acre-feet of effluent, for a total water use of 72,439 acre-feet.

Redhawk uses 100 percent tertiary effluent from the Water Reclamation Plant at Palo Verde for cooling water but has the option to use groundwater, if necessary. Redhawk is also a zero liquid discharge plant. Redhawk's 2012 water use was 521 acre-feet of groundwater and 3,713 acre-feet of effluent for a total water use of 4,234 acre-feet.

Program Challenges

- Sizable investment required for the WRF.
- Large expenditures required for land acquisition, storage reservoirs, evaporation ponds, and pipeline.

- Scott Miller, Water Resources Analyst, Water Resources Management
- Presentation by Bob Lotts, June 20, 2014, Water and Energy in Arizona, retrieved from: http://www.azenergy.gov/doclib/6-20-14_AMC-PVNGS_B.Lotts.pdf

Case study 32

Crean Lutheran High School

Irvine Ranch Water District, California

Program Overview

The project goal is to incorporate a conservation principle by conserving potable water. Crean Lutheran, a private high school, uses recycled water for toilets, urinals, and priming floor drains in its buildings. Crean Lutheran was the first high school in the Irvine Ranch Water District (IRWD) service area and possibly the State of California to use recycled water for indoor plumbing. Its two dual-plumbed buildings serve more than 500 students and 30 staff members. The two dualplumbed buildings are its classroom building and the gym, which is a tensioned fabric membrane structure. The school also uses recycled water to irrigate its 9 acres of landscaped area.

Main Program Elements

Costs

Cost to install the irrigation system and dual-plumbing was funded by the project proponent, and operation and maintenance costs are covered by the Crean Lutheran High School.

Implementation Resources

Title 22 of the California Code of Regulations allows for the use of disinfected tertiary recycled water in toilets and urinals at schools. The California Plumbing Code provides the required measures to dual-plumb a building.

The school's dual-plumbed, two-story modular classroom building was constructed differently from other dual-plumbed buildings. The modules were constructed in numerous sections in Perris, California, and then brought to the Irvine location and assembled.

Level of Participation

In order to get the participant schools, it is important that the project proponent supports the project and the additional measures to fulfill the regulatory requirements. The success of this project led to the construction of another new dual-plumbed high school and the dual-plumbing of a new building at Irvine Valley College. In 2012 IRWD began serving the Cypress Recreational Center, a public facility, the first such dual-plumbed facility in IRWD's service area.

Agency

Irvine Ranch Water District

Project Status Completed in November 2010

Targeted Use Sector Institutional: School

Estimated Annual Savings 31 acre-feet per year

Key Program Elements

- First high school in California to use recycled water for indoor plumbing
- Toilets and urinals flush with recycled water in the classroom building and gymnasium building
- Landscape irrigated with recycled water
- Fully integrates recycled water into campus life



Irrigation with Recycled Water Source: Crean Lutheran High School

Program Outcomes

Water Savings

The combined use of recycled water used in the dualplumbed buildings and the school's landscaping saves more than 10 million gallons (31 acre-feet) of drinking water per year. Crean Lutheran High School was honored by California WateReuse as a 2012 Recycled Water Customer of the Year.

In addition to water savings, the high school also saves money. The IRWD's base rate for potable water is currently \$1.27 per 100 cubic feet. IRWD's base rate for recycled water for irrigation uses is \$1.11 per 100 cubic feet (~10 percent savings), and the base rate for recycled water for non-irrigation uses (toilets/urinals) is \$0.76 per 100 cubic feet (40 percent savings).

Program Challenges

• Staying in contact with Crean Lutheran High School, their contractors, and the regulatory agencies throughout the project.

Sources

• Gabriel Vargas, Recycled Water Project Specialist, Irvine Ranch Water District

- WateReuse Award Press release, March 29, 2012, retrieved from: https://www.watereuse.org/press-release/032912
- Elizabeth Lovsted, 2013, Watershed Recycled Water Demands and Projections
Case Study 33

Denver Zoo Recycled Water

Denver, Colorado

Program Overview

The zoo has successfully used recycled water since 2004 and now aims to replace 75 percent of its potable water demand with recycled water. The Denver Zoo's Toyota Elephant Passage exhibit achieved Leadership in Energy and Environmental Design (LEEDTM) certification at the platinum level, the highest level granted, for a number of "green" design components including the use of recycled water to fill outdoor pools. Toyota Elephant Passage is the first large animal exhibit complex in the country to achieve the certification

In 2011, the Denver Zoo was recognized as WateReuse "Customer of the Year," in recognition of the zoo's innovative use of recycled water. In that same year, Denver Zoo became the first recipient of the Association of Zoos and Aquariums' Green Award recognizing the Zoo's progressive sustainability practices.

Main Program Elements

Level of Participation

The Zoo's Toyota Elephant Passage exhibit, uses 1.1 million gallons of water. The deepest foundation of the elephant passage includes 20 foot deep settling chambers for the 900,000 gallons of water re-circulated to the outdoor pools. The source of the water for the outdoor pools Denver Water's recycled water system.

As of 2012, over \$ 1 million has been committed to connect approximately 30 percent of zoo's water infrastructure to non-potable, recycled water supply from Denver Water.

Program Outcomes

Water Savings

Through improvements and innovations in our water filtration systems, maximizing the use of reuse water, and utilizing water wise landscaping, Denver Zoo has saved on average 214 million gallons annually over the last 15 years. These projects, as well as operational changes have reduced overall annual water usage from approximately 380 million gallons in 1999 to approximately 152 million gallons in 2014, a 60 percent reduction in overall water use.

Agency

Denver Water

Project Status 2004 – Ongoing

Targeted Use Sector Commercial & Industrial Irrigation

Key Program Elements

- The Denver Zoo uses recycled water for animal exhibits, landscape irrigation, and cleaning
- Zoo hopes to convert more than 75 percent of the campus water infrastructure to recycled water
- Received LEED™ Platinum certification for Toyota Elephant Passage
- Received AZA Green Award in 2011



Denver Zoo Elephant Exhibit Denver Zoological Foundation

In the future, the zoo hopes to convert more than 75 percent of the campus water infrastructure to recycled water.

Sources

- Denver Zoo, retrieved from: http://www.denverzoo.org/awards-list, and http://www.denverzoo.org/save-worldsustainability
- Your Water Colorado blog, September 17, 2012, retrieved from: http://www.denverzoo.org/save-world-sustainability

Case Study 34

Southern Nevada Water Reuse

Southern Nevada Water Authority, Nevada

Program Overview

The Southern Nevada Water Authority (SNWA) is a cooperative, not-for-profit agency formed in 1991 to address Southern Nevada's water needs on a regional basis. SNWA has 7 member agencies that include Big Bend Water District, Boulder City, Clark County Water Reclamation District, Henderson, Las Vegas, Las Vegas Valley Water District, and North Las Vegas. These member agencies collectively reclaim and treat water that flows through taps and down the drain and use it as a resource in Southern Nevada. Reclaimed water accounts for roughly 40 percent of the water used, making it Southern Nevada's second-largest water resource. The reclaimed water is either returned to the Colorado River for indirect reuse as return flow credits, or delivered to other municipal uses for direct non-potable reuse, such as irrigation at golf courses, street medians, parks, and industrial uses.

In 2008, the SNWA Board of Directors adopted a policy for the Continued Development of Water Recycling to continue to maximize the use of recycled water. Nevada's 300,000 acre-feet per year allocation of Colorado River water currently supplies about 90 percent of the region's water and is defined in consumptive use terms. For each acre-foot of Colorado River water the SNWA member agencies treat and return to the Colorado River, Southern Nevada receives an equal amount of return flow credits that allows Nevada to divert more than 300,000 acre-feet per year of water from the Colorado River.

Main Program Elements

Costs

SNWA member agencies fund wastewater treatment within their corresponding service areas. In addition, a number of purveyors entered into interagency wastewater treatment agreements. Due to complexity of accounting for capital and operating expenses, and multiple (cost-sharing) agreements made over the past half-a-century, it is not currently feasible to estimate the budget of reuse programs among the SNWA member agencies.

Agency

Southern Nevada Water Authority

Project Status Ongoing

Targeted Use Sectors

All sectors

Estimated Annual Savings

Approximately 200,000 acre-feet per year in return flow credits to the Colorado River and 21,000 acre-feet in direct reuse

Estimated Annual Cost

Varies from agency to agency

Estimated Unit Water Cost

Varies from agency to agency

Key Program Elements

- Direct non-potable reuse by high treated effluent for use in industry and outdoor irrigation
- Indirect reuse in Southern Nevada is represented by highly treated wastewater returned to the Colorado River for return flow credits and comprise the dominant portion of reuse in Southern Nevada
- Additional direct reuse where return flow credits are available do not increase the SNWA resource portfolio, as this would offset or reduce indirect reuse through Colorado River return flow credits



Source: Southern Nevada Water Authority

Implementation Resources

The SNWA agencies work in concert with state and federal (Reclamation) agencies to manage and oversee water reuse. Resources vary from agency to agency.

Level of Participation

SNWA member agencies recycle nearly 99 percent of indoor water use. The treatment plants and recycling sites in Las Vegas Valley have a maximum treatment capacity of over 300,000 acre-feet per year as listed in table below.

Las Vegas Valley Water Recycling Facilities Maximum Treatment Capacity

Facility	Capacity (mgd)	Primary Use
City of Las Vegas Water Pollution Control Facility	91	Return to Colorado River, golf courses, power plant cooling, construction water
Clark County Water Reclamation District Flamingo Water Resource Center	150	Return to Colorado River, golf courses, wetlands park power plant cooling, Silver Bowl Park, streetscape
City of Henderson Kurt R. Segler Water Reclamation Facility	32	Return to Colorado River, golf courses, construction water, median irrigation, cemetery irrigation
City of Las Vegas Bonanza Mojave Water Reclamation Facility	1	Golf courses
City of Las Vegas Durango Hills Water Resource Center	10	Golf courses
Clark County Water Reclamation District Desert Breeze Water Resource Center	5	Golf courses, public park
City of North Las Vegas Water Reclamation Facility	25 to 50	Return to Colorado River, golf courses, industrial uses
City of Henderson Southwest Water Reclamation Facility	8	Golf courses, construction water, median irrigation

Program Outcomes

Water Savings

Recycling through direct non-potable and indirect reuse extends overall resources by supplying approximately 40 percent of the communities water use. See the "Southern Nevada Regional Water Recycling Study" for additional information on regional recycling practices.

Program Challenges

• Continued maximization of the use of recycled water may warrant additional direct reuse, where return flow to the Colorado River water is not practical.

Sources

- Jeff Johnson, Division Manager, Water Management & Planning, Southern Nevada Water Authority
- Southern Nevada Water Authority, Reclaimed Water and Reuse, retrieved from: http://www.snwa.com/ws/reclaimed.html
- Southern Nevada Water Authority, Clean Water Coalition, Black & Veatch, March 2009, Southern Nevada Regional Water Recycling Study