

HIGHLIGHTS OF THE CITY OF PHOENIX WATER CONSERVATION PROGRAM

William R. Mee

**Administrator for Water Conservation and Resources
City of Phoenix Water and Wastewater Department**

The Phoenix Water and Wastewater Department serves over a million customers in a 420 square mile service area where average rainfall is only 7.5 inches per year. The Phoenix City Council first approved a water conservation program in March 1982, in response to a projected water shortage in a part of the service area. The 1980 Arizona Groundwater Management Act had also made it clear that cities in Arizona would need permanent conservation programs. That legislation requires that all agricultural, industrial, and municipal water users to increase the efficiency of water use to reduce groundwater pumping.

Phoenix' conservation efforts since 1982 have enabled the city to reduce its gallons per capita per day water consumption gradually from highs of 267 gpcd in 1980 and 281 in 1981. In 1989, a record hot year, water use was 258 gpcd. It has fallen to 236 in 1990.

From the program's organizing staff of a Conservation Coordinator and an Administrative Aide, staff levels grew to 13 in fiscal year 1990-91 besides five in administrative and water resource planning positions. Office staff now includes specialists in irrigation, botany, industrial water use, residential retrofits, and public information. Five field staff do retrofits and enforce a water waste ordinance.

Program Planning

In 1986 City Council approved the comprehensive Water Conservation Plan that established the framework for program development. This Plan identifies conservation programs which are effective in saving water, cost beneficial and publicly acceptable. The table, Ranking of Conservation Measures, shows the results of a study of potential measures analyzed

for inclusion in the Conservation Plan. The Turf Retrofit and Arid Landscape fee discount were not included in the Plan because of their net cost. Substantially modified versions of these are again under study. The water restrictions measure was reserved for use during droughts. Staff was concerned that effective enforcement would cause public resentment except during water shortage periods. All other measures were incorporated and have been implemented with the exception of limiting lawn size which is currently being reviewed by the Phoenix City Council.

Conservation has now become a significant component of water resource planning and is projected to reduce water supply deficits by two thirds over the next fifty years. This permits deferral of controversial water transfer projects and expensive potable reuse efforts.

The Phoenix City Council approved Phoenix' first Drought Management Plan in 1990. This plan outlines the role both emergency supplies and conservation programs will play during four different drought stages.

Public Education Components

Public awareness messages have continued throughout the program, using television and radio public service advertising, limited paid radio advertising, newsletters, bill inserts, billboards, bus signs and bus bench advertising, community and trade show exhibits, as well as speakers bureau presentations and public workshops. The program has relied extensively on local media coverage and donation of both advertising space and airtime.

TABLE 1.

RANKING OF CONSERVATION MEASURES

Measure	Average			Phoenix Water Department		Community		Social Acceptability		
	1990*	2035*	Rank	Net Benefits (\$)	B/C**	Net Benefits (\$)	B/C	Rank	Opinion Leaders	Community Rank
1980 code enforcement	1,074	5,065	10	5,712,000	8.1	51,094,000	64.7	2	3	2
Retrofit program	8,370	3,235	6	15,171,000	3.6	88,231,000	16.5	1	3	6
New plumbing code	1,140	21,945	2	17,912,000	15.6	19,006,000	1.7	4	3	2
Limiting lawn size	1,467	19,708	3	11,053,000	4.1	11,053,000	4.1	5	2	4
Turf retrofit (rebate)	1,372	6,670	5	8,720,000	9.8	-2,268,000	0.8	9	4	7
Arid landscape (new)	649	8,599	9	-25,420,000	0.2	-25,420,000	0.2	10	5	3
Turf management	1,112	1,360	11	4,360,000	3.4	4,360,000	3.4	8	-	-
Uniform rate	18,763	31,456	1	-	-	-	-	-	6	-
Watering restrictions	2,941	7,706	7	6,526,000	7.1	6,526,000	7.1	7	4	4
Comm / Ind BAT	6,334	10,486	4	21,818,000	23.5	21,818,000	23.5	3	1	1
School education	3,273	6,057	8	8,987,000	3.1	8,987,000	3.1	6	1	8

* score fact per year benefit / cost ratio

**

Source: Water Conservation Evaluation for the Phoenix Water Service Area by Planning and Management Consultants, Ltd. Carbondale, IL 62901.

Annual public information performance levels include:

- * Distribution of more than 4 million educational brochures or how-to articles.
- * Donation of an estimated \$250,000 by the media for public service advertising,
- * Staff participation in at least six major trade shows and community festivals with personal contact with over 500,000 residents.

Youth Education

In 1984, Phoenix staff and a consultant successfully developed and introduced an elementary education program to Phoenix public and private schools. HYDROFORCE ADVENTURES, the assembly-style program for kindergarten through sixth grade students uses magic and puppetry to impress upon students the importance of water and the need to conserve it. The program includes an integrated curriculum for classroom use to reinforce assembly programs. Over 40,000 Phoenix school children participate in the program each year. In 1986 the National Valley Forge Community Education Award for Excellence was awarded to Phoenix for the program.

In 1990 the youth education program was extended to the junior high and high schools on a limited basis. A high school advisory committee, comprised of science teachers from high schools in the Phoenix water service area, is helping in the development of a program to build on the awareness and behavior change gained in the elementary program. The high school program will improve understanding of the management of water resources and reinforce the need for individual responsibility to conserve our available water supplies. A performing arts magnet school in Phoenix produced a 12 minute video on water conservation that is now being used in high school classrooms. The advisory committee recommended this, and the video is now being used as an introduction to the classroom instruction.

Industry / Business / Government

This program was officially launched during Water Awareness Week, 1985, by Mayor Goddard. Company executives from thirty-one large industrial and commercial enterprises committed to join the city's water conservation effort as responsible corporate citizens. Many companies have, or are developing, water conservation plans.

In 1985, 1986, 1988 and 1989, the city was host to maintenance and plant engineers at one-day seminars presenting the latest water conservation and reuse technologies. Employee awareness tools were developed and distributed to the participating companies. This program model has been adapted for Austin, Denver, San Jose, and the State of California Department of Water Resources for statewide implementation. In 1989, Phoenix staff initiated development of a national industrial water conservation network called Incon Net, to help in sharing conservation information among major cities and corporations.

With the assistance of Black and Veatch Engineers, Phoenix completed a study on best available technologies (BAT) for commercial and industrial water using processes. Phoenix staff are now using the information gained from this study to develop commercial and industrial water conservation guidelines. Although commercial and industrial water use represents less than 25 percent of Phoenix total water production, the impact of water saved in this area will be significant. An advisory committee consisting of representatives of local industrial and commercial businesses has been established. The committee's purpose is to advise conservation staff on development of the nonresidential program.

The City of Phoenix is the largest water user in the service area, although its total water use is less than 5 percent. Phoenix started its In-City Water Awareness and Accountability Program in 1987. City departments were charged by the City Manager to have each of their employees attend

training sessions stressing the need to exhibit responsible water use on the job and at home. Departments have reduced annual water consumption by 500 million gallons per year and there are greater potential savings. Several single-page newsletters, distributed with paychecks made city employees aware of department accomplishments in water conservation. Recent efforts have focused on improving irrigation efficiency of city parks.

Indoor Residential Water Use

Indoor and outdoor residential water use represents 70 percent of the water that Phoenix produces. Most conservation public education and program effort has been targeted at this audience. Phoenix has also developed a program to reduce indoor water use through retrofitting existing toilets and showers and an ordinance to require new construction to use water conserving plumbing fixtures.

In 1985, Phoenix successfully completed what was then the nation's largest plumbing hardware retrofit program. In response to an emergency sewer flow situation, the retrofit was completed in less than ten weeks. Records show 41,000 residences were retrofitted with low-flow showerheads and toilet tank dams. This figure represents 93% of the 44,000 residences contacted. Follow up studies confirmed a water use reduction of 2.5 million gallons per day. An intensive analysis by Planning and Management Consultants, Ltd. of a sample of 1500 households, three years of water consumption, attitudes and socio-economic data showed savings of at least five gallons per capita per day. Several other areas have used the 1985 Phoenix retrofit program distribution method. Field checks of a small sample of homes retrofitted in 1985 show that the assumed 10 percent per year deterioration rate of program savings is on target. This confirms the need for returning to homes every five to ten years.

In Fiscal Year 1988-89, a pilot program designed to test new toilet flushing technology retrofitted 3500 homes. Projected savings from this are 100,000 gallons per day based on the types

of showerheads and toilet devices installed. Actual savings can only be determined by repeating the type of study done of the 1985 retrofit. This is due to the importance of human behavior on water consumption. The occupants of the homes may have larger or smaller families, take longer showers, flush their toilets or be less likely to fix toilet leaks. Twelve thousand homes were retrofitted in fiscal year 1989-90.

The testing of alternative flushing devices was expanded in fiscal year 1990-91 in an emergency program in response to a potential water delivery system failure. Phoenix staff supervised temporary employees to retrofit five thousand two hundred homes with 3700 toilet dams, 3500 early closing flappers and 1700 dual flush devices. The 1989-90 and 1990-91 programs included both direct installation of retrofit devices, and customer pick up of 29,000 retrofit kits in Water Department offices.

Through a Low-Income Assistance Retrofit Program, pre-qualified low-income homeowners are given extensive retrofit and leak repair assistance to reduce their water consumption. Since program implementation in 1987, 300-400 homeowners have been helped annually. A new Ultra-Low-Volume Plumbing Code has been adopted by the city. The proposed code specifies 1.6 gallon per flush toilets and other water-saving restrictions on indoor plumbing.

Xeriscape Education

Phoenix has joined with other cities in the nation in the promotion of the national landscaping program, Xeriscape, which encourages use of appropriate landscaping to conserve water. Publications, speaking engagements, trade and community exhibits and community workshops present Xeriscape concepts and methods to residents and landscape industry professionals. Phoenix and the other cities, through Arizona Municipal Water Users Association, sponsor annual Xeriscape seminars and a Xeriscape contest.

The water conservation staff has cooperated with other city departments in the implementation of Xeriscape (appropriate plant materials and irrigation methods) for landscaping around city buildings, street median islands and other rights-of-way. A policy on city landscaping, with emphasis on neighborhood compatibility and compliance with Arizona Department of Water Resources landscaping requirements was approved by the City Council in 1987.

Since the establishment of the conservation program, staff has worked with the Arizona Nursery, Landscape Contractors and Landscape Maintenance associations to improve their understanding of conservation requirements and the business potential which conservation Xeriscape landscaping offers them. A significant expansion of the Xeriscape program to include an ordinance, research, training and financial incentives is now under study.

Irrigation Management

Phoenix has lead the way in the development of a Large Turf Management Program to help large turf facilities, such as golf course, cemeteries and schools. An irrigation engineer is available to work with turf or irrigation managers to assist them in meeting water allotments mandated by the State of Arizona.

The City Council approved the Large Turf Ordinance in 1989. The ordinance promotes responsible management of water by limiting its use at large turf facilities (those 10 acres or larger) and for large water features such as lakes and swimming pools.

Phoenix was the first urban area to join the University of Arizona Extension Service Arizona Meteorological Network (AZMET) weather station system. Weather stations on two golf courses in Phoenix monitor and make available through AZMET daily ET (evapotranspiration) data. By using the daily ET figure (accessible by computer the daily papers or through an 800 number) the

turf manager can more accurately match turf water needs and irrigation.

Water Waste Control

In August, 1987, Phoenix transferred to the water conservation program the responsibility for enforcing city codes prohibiting the overflow of water from private property onto public streets. Two field inspectors complete four thousand investigations annually. They have successfully established a problem-solving, educational rapport with citizens and businesses. Mediation or voluntary citizen compliance resolves about 90% of the investigations.

Water Rate Studies

Another effective tool in managing water consumption is careful planning of the water rate structure. Customers in Phoenix follow national patterns in reducing water use in response to real increases in the price of water. The response for indoor use is only a one percent reduction for a 10 percent increase in real price, but outdoor use responds at the rate of five percent reduction for a 10 percent increase.

In 1982, Phoenix adopted an increasing block rate structure and higher prices during the six-month summer period. After three years of study, in 1990, rates were restructured again to promote additional conservation as well as to simplify the rate structure and make it more equitable. The new rate structure has no customer classes or rate blocks, but it further increases seasonal differentials with higher rates during a four-month summer period and lower rates during a four-month winter period. Spring and fall rates fall between summer and winter.

While the increase block and seasonal water rate structures encourage water conservation, they also make revenues more volatile. Weather becomes an increasingly important factor in projec-

tion of revenues. The good times for a water conservation view of water use are when it is cool and wet. These are the bad times for those collecting the revenue. To respond to this conflict and to maintain a rate structure encouraging water conservation, Phoenix is working on development of two computer models. One is being developed by Dr. David Maidment at the University of Texas. This is a five-year monthly water demand and revenue forecasting model. The model will estimate the volatility of demands and revenues due to weather and other variables. The second is a long range (20 year) financial forecasting model developed by Ernst and Young. These two tools will in part be used to identify the amount of a cash reserve necessary to insure financial stability with a volatile rate structure.

Conclusion

After several years Phoenix staff have gained extensive experience in both planning and implementing water conservation programs. This experience supports the cautious, analytical approach used by Phoenix. All conservation programs are not appropriate in all areas. Information on public attitudes, current and projected water use patterns and costs of water are essential for program planning. In addition, the effectiveness of individual programs elements depends on the other elements in place. For instance, the public response to a water rate increase can be accelerated with supporting public information and public assistance programs. Conversely, the incremental benefits of adding

additional program elements may be reduced because of savings already in place. For example, an ultra low flow toilet retrofit program is less effective in a community with a requirement for 1.6 gallon per flush toilets for new development than in one requiring 3.5 gallons per flush toilets. Now that most of the programs identified in the 1986 Water Conservation Plan have been implemented, Phoenix is updating the Plan to take into account program experience, new water demand projections, and the potential of additional program elements. As might be expected the mature long term conservation program will be more

complex than past efforts meant to be implemented quickly during droughts. The Landscape and Plumbing Fixture Retrofit Programs have developed into more diverse and complex efforts than originally envisioned. Both programs are now expected to include research, industry training, financial incentives, public education and city ordinances.

Phoenix is a unique desert city. Water resources planners and conservation program managers must work to balance available water resources and growing demand for water. Through comprehensive and thoughtful planning, the responsible application of best available water conservation technology, public education, and reuse of wastewater, our water resources can be managed to sustain projected growth.