ECoBA

Evaluation and Cost Benefit Analysis of Municipal Water Conservation Programs

Water Conservation Alliance
of Southern Arizona

WATER
C·A·S·A

Drachman Institute ■ College of Architecture & Landscape Architecture ■ University of Arizona

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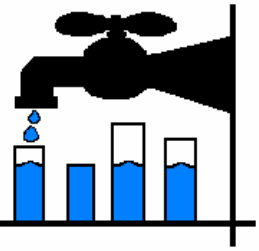
About WATER CASA



Celebrating its eighth year, the Water Conservation Alliance of Southern Arizona (Water CASA) continues to provide a means for member water providers to augment their individual conservation programs and to improve the region's overall water conservation efforts. Today, members include: Community Water Company of Green Valley, Flowing Wells Irrigation District, Town of Marana Water Department, Metro Water District, Oro Valley Water Utility, Pima County, and the U.S. Bureau of Reclamation

Water CASA provides a broad array of services to members and uses economies of scale to make conservation purchases for them. In addition, Water CASA provides a strong and unified voice for water use efficiency in the region, and is active in conducting innovative applied research to increase the knowledge base and inform water demand management decision making.

ACKNOWLEDGEMENTS

The ECoBA research initiative was made possible by members of the Water Conservation Alliance of Southern Arizona (Water CASA). Additional grant funding was provided by the US Bureau of Reclamation Science and Technology Program, the University of Arizona Water Sustainability Program, the Arizona Department of Water Resources and the City of Tucson Water Department. Water CASA is grateful for this generous support.

Three years in the making, ECoBA was only possible because the many utilities contacted agreed to pull together large quantities of disparate data, to answer many, many questions and, in general, to offer up their water conservation efforts for scrutiny, comparison and detailed analysis. Willingness of utilities to participate exceeded our wildest expectations. For every utility included in this research, there are at least ten others who were contacted, who wanted to participate, and who were eventually eliminated because complete data was simply not obtainable. Water CASA thanks them for their efforts as well.

We are indebted to several reviewers of the project who were invaluable to us as we developed the methodology for our analysis and for their ongoing advice as the research developed. Thanks to Heather Campbell, Bonnie Colby, Elizabeth Corley, Jason Davis, David Esposito, Roger Hartley, Tanya Heikkila, Ken Seasholes, and Jackie Moxley.

During the course of the research several key water conservation professionals were particularly helpful in our efforts to find appropriate cases to analyze and to appropriately use dissimilar data sets. We acknowledge the key efforts of Chris Dundon, Kim Pickett,
Kim O'Cain and Kelly Kopp
in the ECoBA experience.

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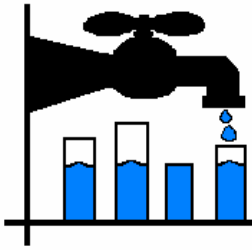


INTRODUCTION

The ECoBA project came about as the Water Conservation Alliance of Southern Arizona (Water CASA) members expressed the need for more rigorous evaluation of conservation efforts. We were searching for more or better ways to determine what we should do more of, do less of, or do next, in our efforts.

WHAT THIS STUDY IS:

An apples-to-apples comparison of water conservation programs, which to the degree possible, incorporates similar types of costs and benefits of the programs (administrative costs, rebate costs , savings on water bills).

A snapshot in time of what results conservation programs are actually achieving.

WHAT THIS STUDY IS NOT:

A place to find easy answers to conservation programming. It can serve only as a source for facts and data intended to inform the water resource management decision-making process.

An attempt to justify or defend water conservation programs. The case for conservation has been well made by many others, many different ways.

An attempt to quantify every possible cost and benefit.

In 2001, the board and staff of Water CASA, in consultation with our benefactors at the US Bureau of Reclamation, began to think in broad terms about what information was needed to bring about increased effectiveness in water conservation efforts. It was decided that an investigation of the **actual** water savings for actual water conservation programs and the comparable direct costs related to achievement of those savings would greatly inform our future efforts in water use efficiency.

ECoBA is meant to provide water conservation decision-makers at all levels of government, and within water utilities, a thorough analysis of conservation measures which have been, or are currently being implemented, in order to ascertain the **actual** water savings, and the direct costs and benefits related to each program's implementation.

This analysis is meant to serve as a decision-making tool, offering the reader a large amount of information not currently available. And, while it does not provide any easy answers, this information will, we hope, enable anyone with an interest in better water resource management to make increasingly more suitable water conservation program choices.

WHY WE NEEDED TO DO THIS

The situation as we found it: actual water savings for a given conservation measure was almost impossible to find. With a few exceptions, after-the-fact assessment of water conservation measures is rarely done. Instead, quantification of water savings, costs, etc. are often seen only as estimates prior to program implementation, when they are used as the rationale for implementing the measure.

Estimating potential levels of water savings has often proved to be inaccurate.

Costs and benefits of water conservation efforts need to be considered and presented in the same quantifiable manner that infrastructure and other water management options are developed and evaluated.

HOW DO YOU DECIDE :

What to do first if you are going to begin a water conservation program for your utility or municipality?

What program to implement next if you plan to increase or augment your current water conservation efforts?

What conservation programs to eliminate or strengthen as your demand management efforts evolve and your need to conserve increases?

Saving the 'next increment of water' is going to be more difficult, therefore more costly, so our decisions must be ever more sound.

The likelihood of continued scarcity of dollars for water conservation efforts necessitates greater rigor in our expenditure decisions for conservation efforts.

PROJECT OBJECTIVES

- To evaluate ACTUAL water conservation programs, comparing water use data within measures as well as between them.
- To provide a thorough analysis of conservation measures that have been, or are currently being implemented, to ascertain the ACTUAL water savings, and the direct comparable costs and benefits related to each program's implementation.
- To ultimately increase the amount of water saved per staff hour and dollars expended on demand management efforts.

LESSONS & RECOMMENDATIONS

- **There are no easy answers in water conservation program development. There are simply too many factors and variables involved in reaching appropriate, tailor-made decisions for a given utility. Those in decision-making positions will quickly discover that a one-size-fits-all approach does not work.**
- **At all levels of water resource management, COMMITMENT to conservation as a water management tool is necessary in order to achieve maximum program effectiveness.**
- **Everyone working in conservation needs to fully understand, and factor into their program recommendations, the social and economic factors of their service areas.**
- **Conservation programs should more often target areas of actual high inefficiency rather than just overall high water use.**
- **Make the often thankless and frightening effort to go back and evaluate your programs: be willing to change direction, doing more of what is working and less of what is not.**
- **There is a disconnect between the conservation staff and the rest of the water resource management team in many utilities. Also, there is often an even a greater disconnect between the conservation folks and those who are the utility data 'gatekeepers'. These issues need to be addressed in order to achieve the most meaningful program selection, implementation and evaluation possible.**
- **The balance between soft conservation efforts (public awareness, customer service, utility goodwill) and the hard, goal based (gallons or AF saved) targeted programs needs to be more clearly understood by the public and by decision-makers. Though both types of program efforts are very necessary, programs are often ascribed as a conservation effort when in fact little in savings has been achieved. Additionally, the effort was not evaluated by the utility for its ability to either raise public awareness or to save water.**
- **A higher premium should be placed on good record keeping: the back up of all data, the recording and monitoring of all program related expenditures and results. Consumption records need to be kept as far back as possible.**
- **The importance of tracking program participation in detail, including water consumption for participants and similar non-participating households, or the whole customer class can not be overstated.**
- **Passive conservation is occurring and ongoing everywhere with ordinances, code changes, natural replacement of fixtures, and new technologies, so there will be diminishing savings to be achieved with water conservation actions taken now compared to times past. The cost to save the next increment of water will only be higher than to save the previous increment, so sound program decisions are ever more vital.**

SUGGESTED AREAS OF ADDITIONAL STUDY

We wish we had had more cases for comparison, particularly more ordinance and water use assessments, and water harvesting and gray-water incentive efforts. These types of programs are increasingly used by utilities, but there is not yet adequate post-measure data to analyze.

We wish we had been able to look at more multifamily, commercial and industrial programs. There are fewer of them being implemented and they are more difficult to compare as many are tailored for a specific facility. The potential for savings may well be higher in these sectors than in single family.

"The majority of water providers have not assessed the cost-effectiveness of their particular conservation programs. Although detailed benefit/cost analyses are often conducted to justify structural water supply improvements, this level of analysis for water use efficiency measures is virtually non-existent."

Smart Water Report, Western Resource Advocates, 2003

Effectiveness of a variety of environmental education and public awareness efforts needs in-depth study. Looking at actual campaigns and curriculum evaluations with the goal of trying to tease out water savings and attempting to get at quantifiable costs and benefits of these efforts is a worthy effort.

There is a need to develop estimates of water savings degradation across program types and to have better estimates of the occurrence of free riders for different types of programs.

More work is essential on the **value** of conservation programs: quantifiable and intangible costs and benefits, replacement costs, etc.

HOW TO USE THIS REPORT

The entire contents of this ECoBA Study are contained on the CD-ROM which accompanies this document.

ECoBA is organized by type of water conservation measure. Please see the **TABLE OF CONTENTS** (page 6). Following this **INTRODUCTION** are the **METHODOLOGIES** and **ASSUMPTIONS** used for our analysis.

OVERALL FINDINGS come next, followed by **DATA TABLES**, and then **WORKSHEETS** for the **INTERACTIVE CALCULATOR,** which accompanies this report. This calculator enables any utility to perform an analysis of their own conservation programs using a slightly simplified version of the ECoBA methodologies and assumptions. Next are the **FINDINGS** for each type of measure (see Table of Contents).

The complete **CASE NARRATIVES** and analysis for each program from each participating utility are found only on the accompanying CD-ROM. These narratives are grouped by type of measure, not alphabetically (see Table of Contents).

The final piece of the ECoBA report is the **BIBLIOGRAPHY**.

STUDY LIMITATIONS

GENERALIZABILITY

The results of each analysis are unique to the situation of the utility, and are not meant to be used as an exact predictor of savings or costs, but rather as a general guide. Costs and benefits (and the resulting economic analyses) are especially prone to variations from program to program.

NOT ALL COSTS AND BENEFITS WERE QUANTIFIED

In order to make comparison of analyses more valid, only direct costs and benefits that could be quantified for all programs were included. Therefore, there are costs and benefits that could have been quantified, but were not. Most notably, savings to the participant on sewer bills and savings to the utility in avoided costs of supply are not included. These and other, more intangible, costs and benefits are listed at the end of each case narrative. Often, the unquantified benefits outweigh the unquantified costs, resulting in an understatement of the net benefit of the programs.

WATER SAVINGS CALCULATIONS LIMITED BY THE ACCURACY OF THE CONTROL GROUP

In most cases, the control group includes all single family residential connections or all residential connections. In a case where the participants were categorically different than the rest of the population, the water savings will be less accurate. An example of this is washing machine rebate programs, where participants have a higher average water use than other customers.

SIMPLIFYING ASSUMPTIONS

A number of assumptions were made to simplify the analyses. These assumptions limit the accuracy of calculations. However, by making them across the board we are still able to compare different types of programs in a similar way. An example of this is the assumption that there is no degradation in water savings over time.

". . . water managers and planners need to measure the effectiveness of their conservation efforts. Unfortunately, most will readily admit that water conservation programs have been poorly quantified in the past . . .

Cost-Effective Cost Effectiveness:
Quantifying Conservation on the Cheap, AWWA Toronto 1996

NO SENSITIVITY ANALYSIS
No sensitivity analysis was conducted to show a range of possible results based on differing assumptions.

NO CONTROL GROUP FOR CERTAIN PROGRAMS
Analyses of programs that were utility-wide, or included a whole segment of the utility, such as residential, do not include a control group. Water savings are therefore solely the difference in water use from pre-measure to post-measure. This does not take into account other factors in customer water use, most notably changes in weather.

"NEGATIVE" WATER SAVINGS
Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

"NEGATIVE" COST PER ACRE FOOT SAVED
Some analyses show a "negative" cost per acre foot of water saved. Though awkward in its presentation, this indicates that the utility incurred costs related to the program and that there were no water savings attributable to those costs; that actually an increase in participant water use, relative to the control groups water use, occurred.

"Accurately measuring . . . the effectiveness of conservation efforts has been the Achilles heel of urban water planning for many years".

Residential End Uses of Water, AWWA 1999

METHODOLOGY

WATER SAVINGS METHODOLOGY

- For all program participants, water use data was acquired for two calendar years before their participation in the program (pre-measure) and two calendar years after their participation (post-measure).

- Unless otherwise stated in individual analyses, water use data was acquired for all single family residential households in the utility for the same time periods; these households form the control group for single family residential programs.

- For cases in which all single family residential households were used as the control group, participants and their water use were removed from the data. The participants were subtracted from the number of single family connections for a given year and the total participant water use was subtracted from the total single family residential water use for that same year.

- For analyses in which the control group furnished by the utility varies in number by year, a weighted average of water use is calculated to determine pre-measure average water use, and post-measure average water use.

- For residential programs, only participant households whose residents resided there for the full analysis period were included in the study. The results of the study refer to those participants only; no data was extrapolated for participants other than those directly included in the study.

- The actual amount of water saved, attributable to the conservation measure in question, was determined by using both pre-measure and post-measure water use data, and participant and control group water use data. Mean water use was calculated for both groups pre-measure and post-measure. Water savings were calculated as the difference in the percent increase (or decrease) of average control group and participant water use from pre-measure to post-measure.

ECONOMIC METHODOLOGY

- In addition to water use data, all available cost and benefit data was compiled. Any costs or benefits that accrued over time were projected into the future; however, any costs or benefits that were one-time costs or benefits were not projected into the future. Any water savings and benefit data that were extrapolated were done so according to the estimated lifespan of the measure.

- Costs and benefits were discounted to the base year (the first year

of the analysis) using the Office of Management and Budget's (OMB) Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs".

- Once discounted, costs and benefits were inflated to current year dollars so that any reported $1 benefit or cost is the same as any other reported $1 benefit or cost. This inflation was done using the Consumer Price Index (CPI) for all Urban Consumers in the following the equation:

$$\text{Dollars at current year} = \text{dollars at base year} \times \frac{\text{CPI for current year}}{\text{CPI for base year}}$$

- The cost benefit analysis was performed by subtracting discounted costs from discounted benefits on a year-by-year basis. This resulted in a net value of the program for each year of the analysis. Yearly net values were summed to form a net present value of the program as a whole for the analysis period.
- In addition to the net present value, the costs were divided by the water savings to determine the cost per acre foot (AF) of water saved for each case study.
- For many of the programs analyzed, we looked at only a snapshot of a longer running, or ongoing, program.
- For multi-year programs, each year was analyzed separately. While each year is essentially an individual case, the first year of the multi-year analysis was considered the base year for cost and benefit calculations.

ASSUMPTIONS

GENERAL ASSUMPTIONS

- There was no degradation in water savings over the time period of the analysis. Though there would actually be some degradation, two years of post-measure data was determined to be inadequate to establish a trend; therefore, no degradation was assumed.
- The participant group was assumed to be a representative sample of the control group.
- The Consumer Price Index (CPI) for All Urban Consumers published by the US Bureau of Labor Statistics was used as rate of inflation.
- Nominal Treasury Interest Rates listed in 'Guidelines & Discount Rate for Benefit-Cost Analysis of Federal Programs (Circular A-94), published by the Office of Management and Budget, was used as the discount rate.
- The water savings for all extrapolated years was assumed to be equal to the average water savings of the two years following the year analyzed.
- The billing rates for water at any given utility did not change over the period of analysis, unless otherwise noted.
- Any change in the difference between the participant group and the control group water use, from pre-measure to post-measure, was assumed to be due to the specific conservation program being analyzed.
- Lost revenue was not included as a cost or a benefit because it was assumed to be recovered over time through rate adjustments.
- We did not consider the avoided costs of infrastructure improvements, delivery, treatment, or increasing supply unless the utility provided those figures to us.
- Free ridership was not addressed in any analysis.
- Any information in the narrative not considered to be common knowledge was obtained from a questionnaire completed by the utility, unless otherwise cited.
- January 1st of the year in question is used as the start date for benefit calculations, unless otherwise indicated for a specific case.

AUDIT ASSUMPTIONS

- The lifespan of an audit was assumed to be 5 years, which was used as the period of analysis.

DEVICE GIVEAWAY ASSUMPTIONS

- The lifespan of the devices given out was assumed to be 5 years, which was used as the period of analysis.

WASHING MACHINE REBATE ASSUMPTIONS

- The lifespan of a RESIDENTIAL washing machine was assumed to be 12 years, which was used as the period of analysis.
- The lifespan of a COMMERCIAL washing machine was assumed to be 2 years, which was used as the period of analysis.

LANDSCAPE REBATE ASSUMPTIONS

- The lifespan of a landscape conversion was assumed to be 10 years, which was used as the period of analysis.

TOILET REBATE AND DISTRIBUTION ASSUMPTIONS

- The lifespan of a toilet was assumed to be 20 years, which was used as the period of analysis.

RATE CHANGE ASSUMPTIONS

- The lifespan of a rate structure change is 20 years, which was used as the period of analysis.

ORDINANCE ASSUMPTIONS

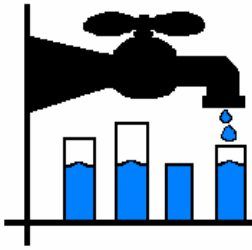
- The lifespan of the ordinance is assumed to be 10 years; which was used as the period of analysis.

SURCHARGE ASSUMPTIONS

- The lifespan of a surcharge is 5 years, which was used as the period of analysis.

CONSERVATION CLASSES

- The lifespan of a conservation class is 5 years, which was used as the period of analysis.



OVERALL FINDINGS

The ECoBA project analyzed a total of 88 separate cases (defined as one year of a program), from 42 different programs offered by 30 utilities. The programs analyzed occurred between the years 1994 and 2003. The size of the participating utilities varied greatly, serving a population of as many as 1,500,000 to as few as 13,500.

ALL ECoBA PROGRAMS

Total Cases Analyzed:	**88**
Total Programs Analyzed:	**42**
Participating Utilities:	**30**
Case Years Analyzed:	**Between 1994 and 2003**

As we found utilities willing to participate in the ECoBA project and determined that they had the water use data and the direct cost information that we would need to do the analyses, the cases gathered into several distinct categories: **AUDITS, DEVICE GIVEAWAYS, WASHING MACHINE REBATES, LANDSCAPE CONVERSIONS, TOILET REBATES, TOILET DISTRIBUTIONS, RATES and MISCELLANEOUS.**

For purposes of comparison between conservation measures we have, in some instances, chosen to look at the rate cases and miscellaneous programs separately. We have noted these inclusions and exclusions as they occur.

Participants in all the analyzed programs had overall water use ranging from 87% and 144% of their control groups prior to the measures studied, and their water use ranged from 77% to 132% of control group water use after the measures.

FINDINGS OF NOTE

- **TOILET REBATE programs showed only 63% of the predicted water savings, while TOILET DISTRIBUTION programs showed 228% of what was predicted in water savings.**
- **AUDIT programs and WASHING MACHINE programs attracted significantly higher water users than typical.**
- **LANDSCAPE CONVERSION programs attracted significantly lower than typical water users.**
- **The greatest variation in range of savings was seen with WASHING MACHINE REBATE programs followed by TOILET DISTRIBUTIONS.**

(cont'd on page 18)

FINDINGS OF NOTE, cont'd

Excluding the single ordinance, class, and surcharge programs analyzed:

- **TOILET DISTRIBUTION programs showed the greatest savings per participant (27,000 gallons annually) followed by LANDSCAPE CONVERSION programs (22,000 gallons annually).**
- **TOILET DISTRIBUTION programs showed the greatest persistence in savings from year one to year two after the program, saving 77% more water per participant the second year after the program compared with year one.**
- **AUDITS showed the highest costs to save an AF of water ($1,284) followed by Landscape Conversions ($1,099).**
- **TOILET DISTRIBUTIONS showed the lowest cost to save an AF of water ($181).**
- **LANDSCAPE CONVERSIONS showed the highest per participant costs to the Utility and Other Funders ($650) followed by TOILET DISTRIBUTIONS ($330), TOILET REBATES ($151), WASHING MACHINE programs ($144), AUDITS ($116), and DEVICE GIVEAWAYS ($4).**

Ranges:

- **The tightest range of savings per participant was realized with TOILET REBATE programs, followed by DEVICE GIVEAWAYS (consistently little or no savings).**
- **The most variable range of savings was with WASHING MACHINE REBATE programs followed by TOILET DISTRIBUTIONS.**

Side Note: There was a relationship between the size of the utilities studied and the cost to save an AF of water (see page 26).

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

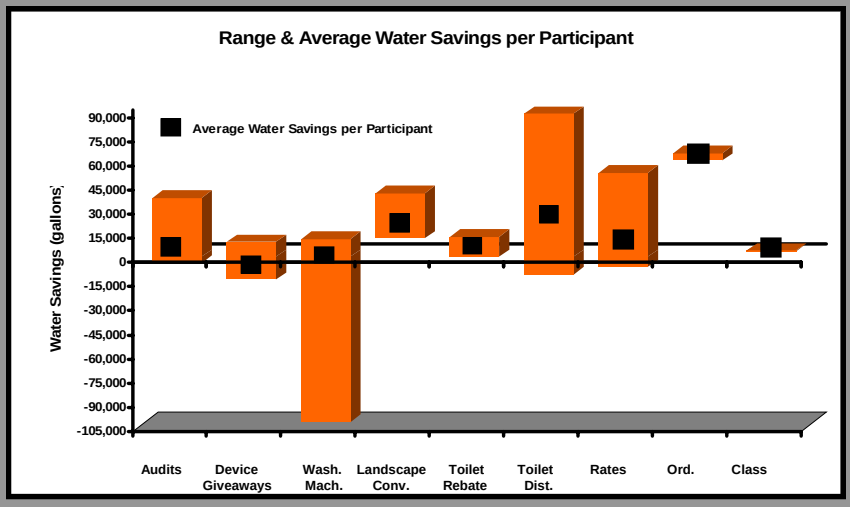
RANGE & AVERAGE SAVINGS

For **AUDIT** programs, water savings per participant varied from 36,490 gallons to -4,152 gallons (a relative increase in water use) for the eight cases we examined. **The average water savings for program participants was 8,690 gallons, a savings of 5.0%**.

Water savings for **DEVICE GIVEAWAY** programs varied from 9,229 gallons per participant per year to -14,341 gallons (a relative increase in water use) per participant. **The average annual water savings for**

these programs was -6,692 gallons, a savings of - 4.7%.

W A S H I N G M A C H I N E programs showed a range of savings per participant per year from 11,242 gallons to -103,987 gallons (a relative increase in water use). Without **Utility W-1**, the range was 11,242 gallons to -7,941 gallons, and **the average water savings was 3,176 gallons, or 2.0%.**

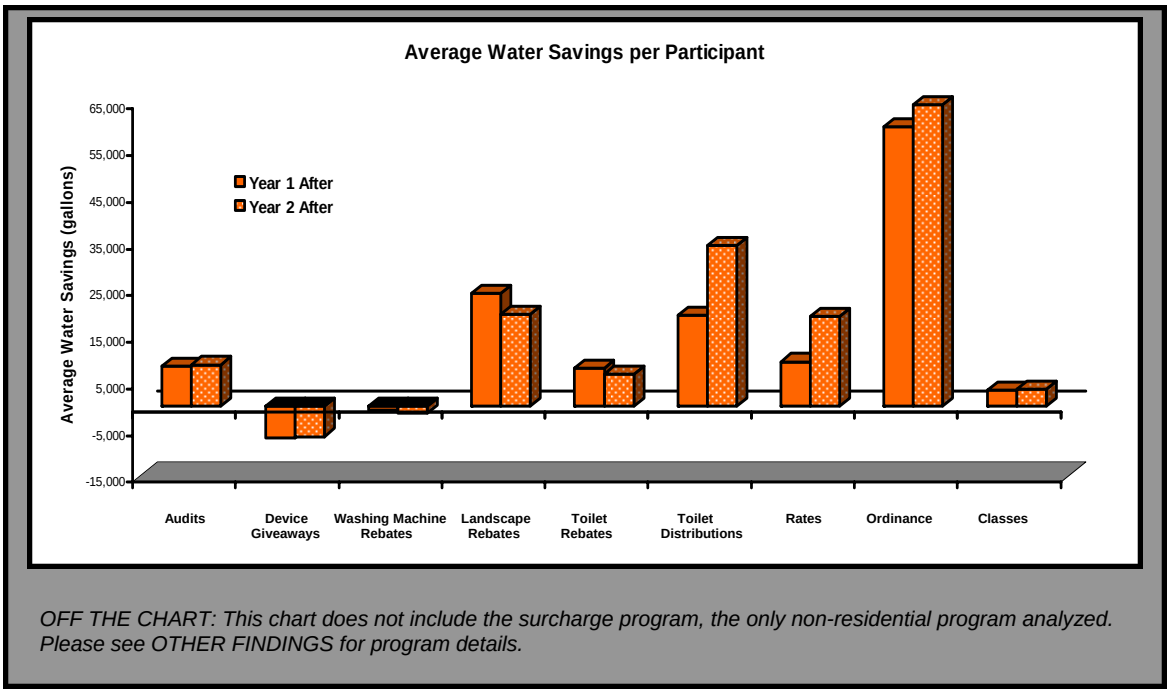


OFF THE CHART: This chart does not include the surcharge program, the only non-residential program analyzed. Please see OTHER FINDINGS for program details.

For **LANDSCAPE CONVERSIONS**, water savings per participant per year ranged from 11,387 gallons to 39,665 gallons per participant. **The average water savings per participant was 21,897 gallons, or 11.6%.**

Water savings for customers taking advantage of **TOILET REBATE** programs we studied varied from 12,504 gallons to a -760 gallons per participant per year (a relative increase in water use). **The average water savings per participant was 7,440 gallons, a savings of 6.7%**.

TOILET DISTRIBUTION programs showed a range of water savings



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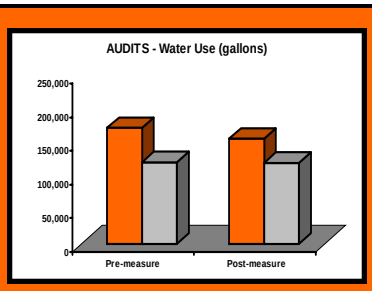
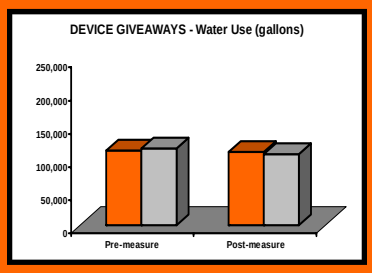
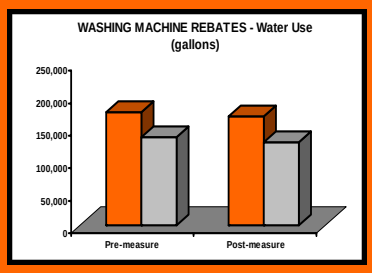
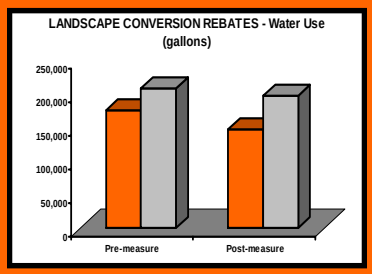
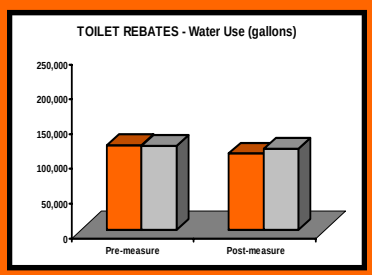
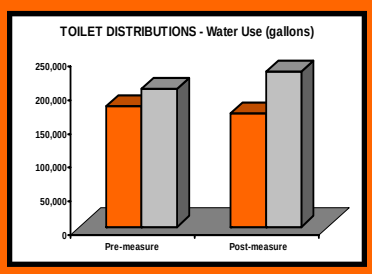












Participant Groups
Control Groups

PRE & POST MEASURE RELATIVE WATER USE

The water use characteristics of participants compared with their control groups varied between programs and are reflected in the charts to the left. Customers receiving audits and washing machine rebates are substantially higher water users than average. Those receiving conservation devices and toilet rebates almost exactly reflect the single family residential populations of their utilities, and participants in the landscape conversion and toilet replacement programs are substantially lower than average water users even before taking advantage of these utility offerings.

Those availing themselves of **AUDITS** offered by their utility showed water use at 144% of the control group prior to the audit and 132% after. These are significantly higher water users than average. Some of the utilities studied actively target their high water users for auditing while it appears that other utilities who offer audits to all customers are attracting higher water users who may be more conscious of the need to lower their water use expenditures.

Water use among folks accepting free **CONSERVATION DEVICES** was so close to control group water use as to be statistically insignificant: 97% prior to obtaining the devices, and 101% after.

There is a significant difference between water use among customers who availed themselves of **WASHING MACHINE REBATES** and the control group. Prior to acquiring the new washing machines, participants used 130% of the typical single family customer in their utility. The two years following the installation of the new machine, these same customers actually used 132% of the control group. This is not a significant change.

Customers who took advantage of their utility's **LANDSCAPE CONVERSION REBATES** had water use that was 87% of the control group prior to the conversion and 77% following the conversion. These rebates were available to all customers so they weren't actively targeting high water users. The programs seemed to attract folks who were already thriftier than average and who were looking to cut their water use even farther, perhaps have less maintenance, and take full advantage of other side benefits of the program.

Water use for customers who took advantage of **TOILET REBATE** programs offered by their utilities was very similar to the control group:104% prior to receiving their rebates and 96% following the rebates.

TOILET DISTRIBUTION programs were targeted to a certain demographic area within the boundary of the utility and those receiving the distributed toilets used 91% of average water per household control group prior to the toilet distribution and 78% the two years following the distribution

per participant of 89,116 gallons to -11,078 gallons per participant per year (a relative increase in water use). **The average savings per participant was 26,890 gallons, a savings of 15.1%.**

RATE CHANGE programs showed a range of water savings per participant of 52,188 gallons to -6,394 gallons per participant per year (a relative increase in water use). **The average savings per participant was 14,335 gallons, a savings of 4.8%.**

The ORDINANCE program showed an average savings per participant per year of 62,208 gallons, or 30.5%.

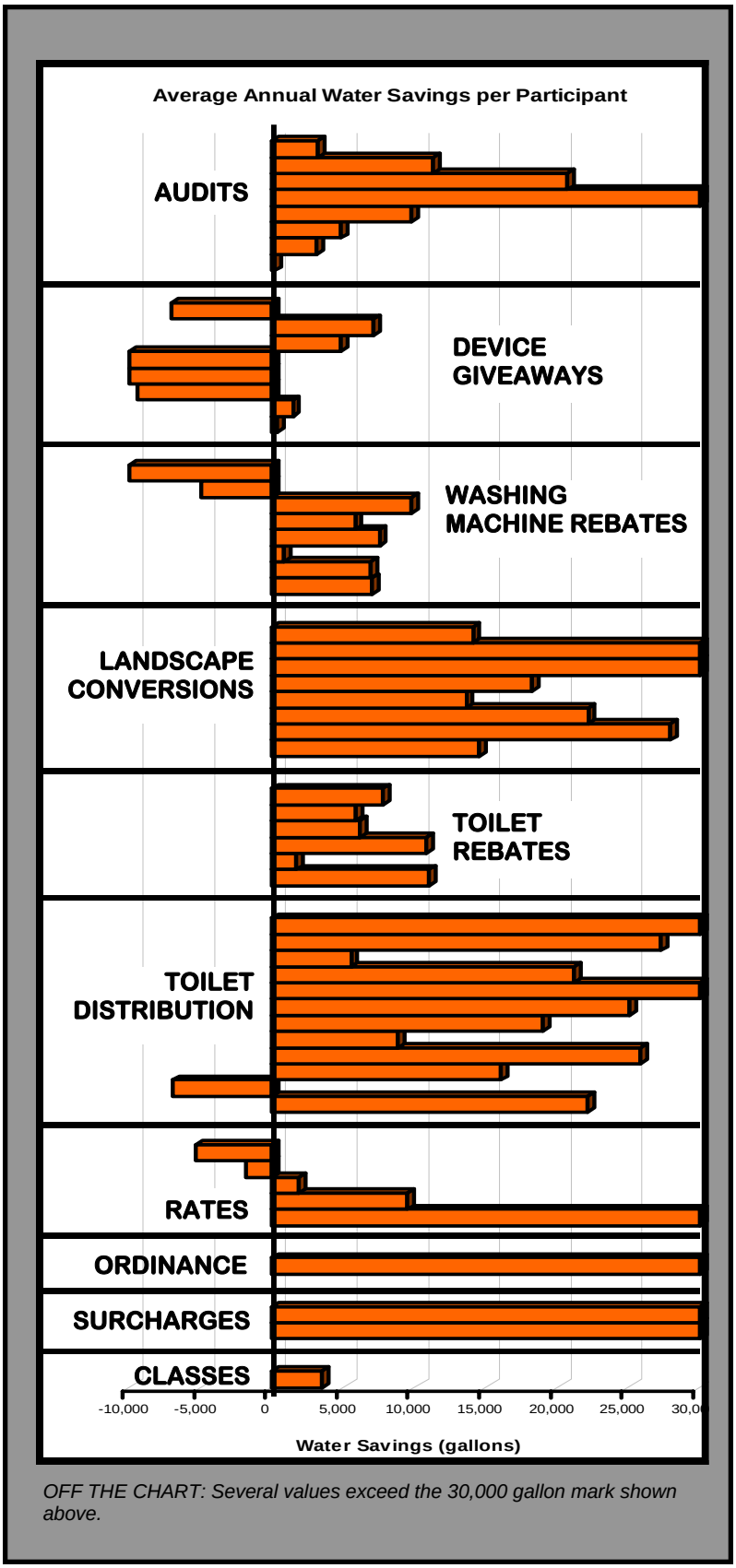
The SURCHARGE program showed an average savings per participant per year of 241,157 gallons, or 12.5%.

The CONSERVATION CLASS showed an average savings per participant per year of 3,524 gallons, or 2.7%

PERSISTENCE OF SAVINGS

In the first year following the **AUDITS,** the average water savings per participant was 8,543 gallons. Year two following the audits showed a savings per participant of 8,838 gallons. This is a 3.5% increase in water savings from year one to year two.

For **DEVICE GIVEAWAYS**, no water savings were documented. There was an average savings of -6,846



OFF THE CHART: Several values exceed the 30,000 gallon mark shown above.

gallons per participant (a relative increase in water use) the first year following the program and -6,538 gallons (a relative increase in water use) the second year following. This is a 4.5% increase in water savings from year one to year two.

Customers who participated in the **WASHING MACHINE REBATE** programs saved an average of -915 gallons (a relative increase in water use) the first year following the rebate. The average water savings per participant the second year following the program was -1,600 gallons (another relative increase). Without **Utility W-1**, the savings was 2,823 gallons the first year and 3,529 gallons the second year after the rebate. This is an increase in water savings of 25.0% from year one to year two.

LANDSCAPE CONVERSION programs showed an average water savings per household of 24,121 gallons the first year following the conversion to a low water using landscape and an average savings of 19,673 gallons for year two, for a fall off of 18.4%.

TOILET REBATE programs showed an average water savings per participant of 8,063 gallons the first year after the incentive was received, and a savings of 6,816 gallons the second year after the incentive. This is a fall off in water savings of 15.5% from year one to year two.

Average water savings for **TOILET DISTRIBUTION** programs varies markedly from the toilet rebate programs' water savings. The first year following the distributions, average water savings per participant was 19,403 gallons and the second year following, the average savings was 34,377 gallons. This is a 77% increase in water savings from year one to year two after the program.

RATE CASE programs showed a water savings of 9,518 gallons per participant the first year after and 19,151 gallons per participant the second year after the program. This is a 102.3% increase in water savings from year one to year two after the program.

The water savings shown with the **ORDINANCE** program was 59,854 gallons per participant the first year after and 64,562 gallons per participant the second year after the program. This is a 7.9% increase in water savings from year one to year two after the program.

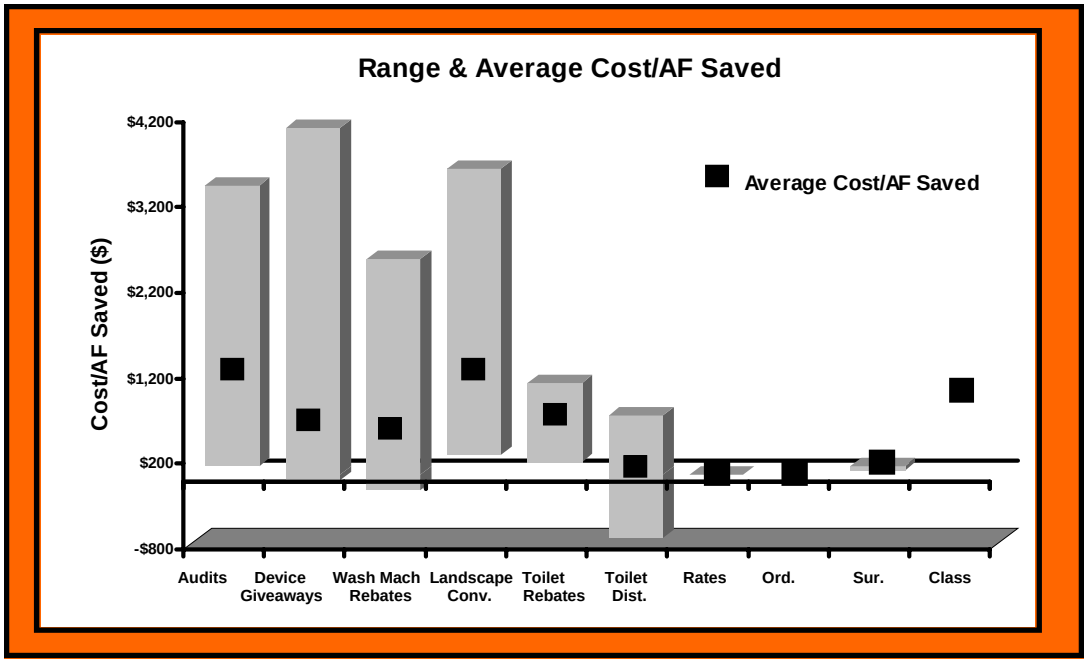
The **SURCHARGE** program showed a water savings of 303,210 gallons per participant the first year after and 179,104 gallons per participant the second year after the program. This is a 41.0% decrease in water savings from year one to year two after the program.

The **CONSERVATION CLASS** showed a water savings of 3,442 gallons per participant the first year after and 3,606 gallons per participant the second year after the program. This is a 4.8% increase in water savings from year one to year two after the program.

ECONOMIC ANALYSIS

RANGE, AVERAGE, MEDIAN COST PER ACRE FOOT SAVED

The costs to the utility to save an acre foot (AF) of water with **AUDITS** ranged between $101 and $55,315. Without including one year of Utility A-4's analysis, the range was $101 to $3,276. **The average**



cost, without that year, to save an AF of water was $1,284. The median cost per AF of savings was $873.

DEVICE GIVEAWAYS showed a wide range of costs to save an AF of water. Even though the programs themselves were inexpensive to fund they resulted in such poor water savings as to impact the cost/AF of savings in many cases. Costs per AF ranged from a -$57 to $4,059. **The average cost to save an AF of water with these giveaways was $457, with a median cost of -$3.**

The range of costs per AF for **WASHING MACHINE REBATE** programs was -$184 to $2,519. **The average cost per AF saved was $404, and the median was $7.**

Utilities spent between $236 and $3,338 to save an AF of water with **LANDSCAPE CONVERSION REBATE** programs. **Their average cost to save an AF was $1,099, and the median cost per AF among the programs studied was $942.**

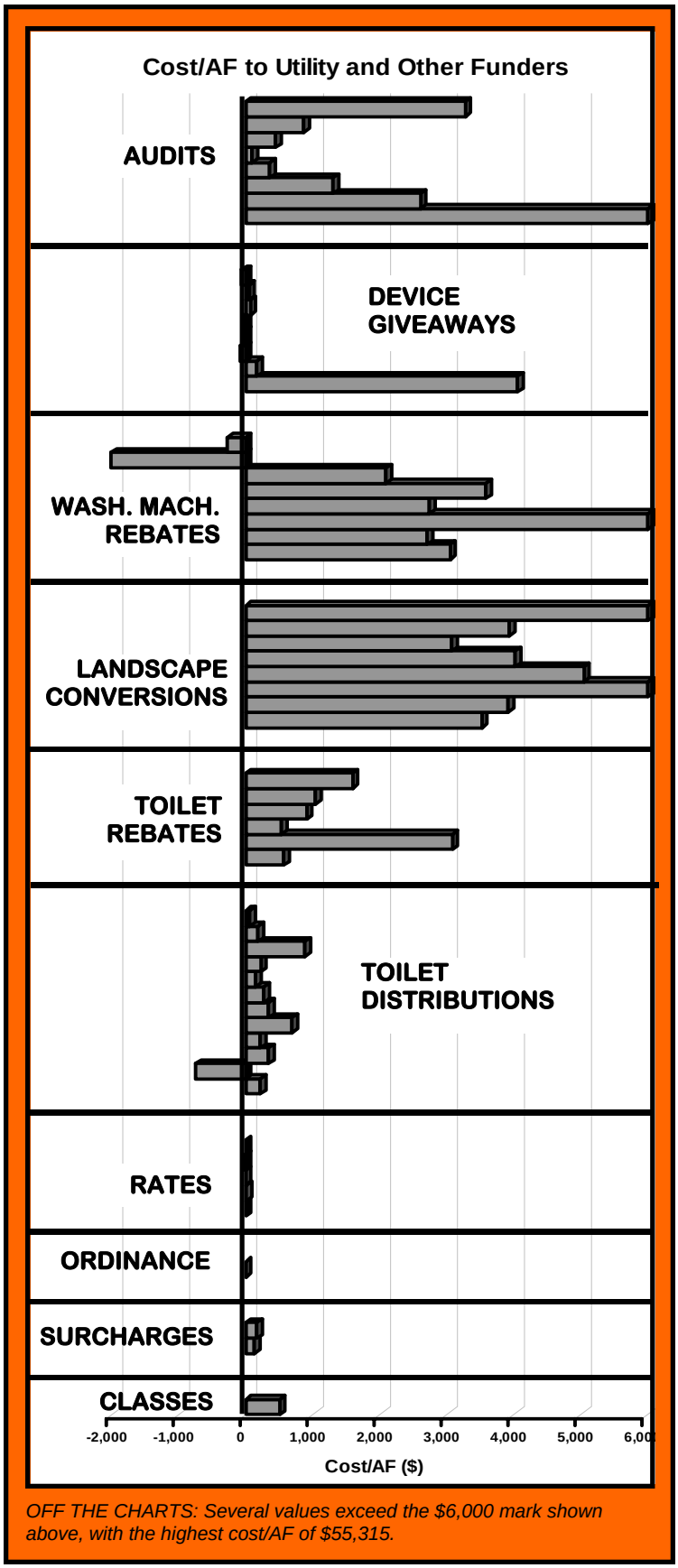
Toilet programs proved to have the tightest ranges of costs with **TOILET REBATES** ranging between $155 to $926 to save an acre foot of water. **The average cost to save an AF of water was $436, with a median cost of $297.**

TOILET DISTRIBUTION programs had a range of costs to save an AF of water between -$742 and $695. **The average cost per AF saved was $181 and the median of the costs was $223.**

RATE CASE programs had a range of costs to save an AF of water between -$22 and $6. **The average cost per AF saved was -$3 and the median of the costs was $0.**

The utility spent $2 to save an AF of water with the **ORDINANCE** program.

The **SURCHARGE** program had a range of costs to save an AF of



OFF THE CHARTS: Several values exceed the $6,000 mark shown above, with the highest cost/AF of $55,315.

water between $46 and $59. **Both the average and median cost per AF saved was $53.**

The utility spent $513 to save an AF of water with the **CONSERVATION CLASS**.

COST TO THE UTILITY PER PARTICIPANT

AUDIT programs cost the utilities we studied an average of $116 per participant. There were no outside funders for any of the audit programs in the study.

Utilities spent an average of $5 on their **DEVICE GIVEAWAYS**, with additional funding from other sources averaging $2. This is a total cost of $7 for all funding.

WASHING MACHINE REBATE programs had an average cost to the utilities offering the rebates of $54. Several of the utilities had outside funders to augment these programs and their costs averaged $91 per participant. The overall costs from all funders was $144.

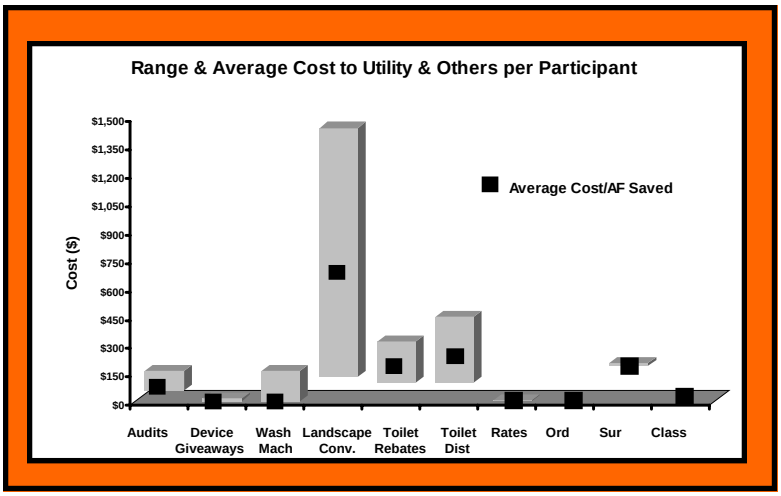
The cost per participant for **LANDSCAPE CONVERSION REBATES** averaged $650, and there were no outside funders for any of these incentive programs studied.

There were no outside funders for any of the **TOILET REBATE** programs examined and the average cost to the utilities was $151 per participant.

TOILET DISTRIBUTIONS cost the utility on average $291 per participant. A couple of the programs studied had some outside funding support that averaged $39 per participant.

There were no outside funders

for any of the **RATE CASE** programs examined and the average cost to the utilities was $0.82 per participant (per connection).



The cost per participant for the **ORDINANCE** was $4, and there were no outside funders for this program.

There were no outside funders for the **SURCHARGE** program and the cost to the utility averaged $193 per participant.

There were also no outside funders for the **CONSERVATION CLASS** and the cost to the utility was $28 per participant.

COST TO PARTICIPANTS

There were no quantified costs to the participants of the **AUDIT, DEVICE GIVEAWAY, RATES or CONSERVATION CLASS** programs .

The cost to the participants of the **WASHING MACHINE REBATE** programs ranged from $616 to $630 per participant to buy the washing machines. The average cost to the participants was $624 per participant. The median cost per participant was $630.

The cost to the **LANDSCAPE CONVERSION REBATE** participants to actually get their new landscapes in the ground ranged from $1,181 to $5,258 per participant. The average cost to the participants was $2,401 per participant, and the median cost per participant was $2,051.

The cost to the **TOILET REBATE** participants to buy the toilets and have them installed ranged from $193 to $444 per participant. The average cost to the participants was $270 per participant, and the median cost per participant was $248.

The cost to the **TOILET DISTRIBUTION** participants to install the toilets ranged from $0 to $48 per participant. The average cost to the participants was $26 per participant. The median cost per participant was $31.

The cost to the **ORDINANCE** participants was $0.12 per participant.

The cost to the **SURCHARGE** participants was $351 per participant.

NET PRESENT VALUE

The net present value is the result of all of the quantified costs minus all of the quantified benefits of the program. In this study, it includes costs like rebate costs, costs of administering the programs, cost of buying toilets or washing machines, etc., and benefits like receiving rebates and savings on water bills. It does not include all of the cost or all of the benefits of each program.

Many of the benefits of these programs, in particular, are difficult to

quantify and were not quantified for the study. Therefore, we think that these values are underestimated. It is beneficial to view them not so much as their absolute values, but look at them in comparison to each other, since they were derived with the same methodology across the board.

In general, when determining if a program is "worthwhile", a positive value is considered good and a negative value is considered bad. However, as already mentioned, these values are underestimated and you would not necessarily expect hard benefits to the utility anyway.

The Net Present Values can be found in the individual FINDINGS sections.

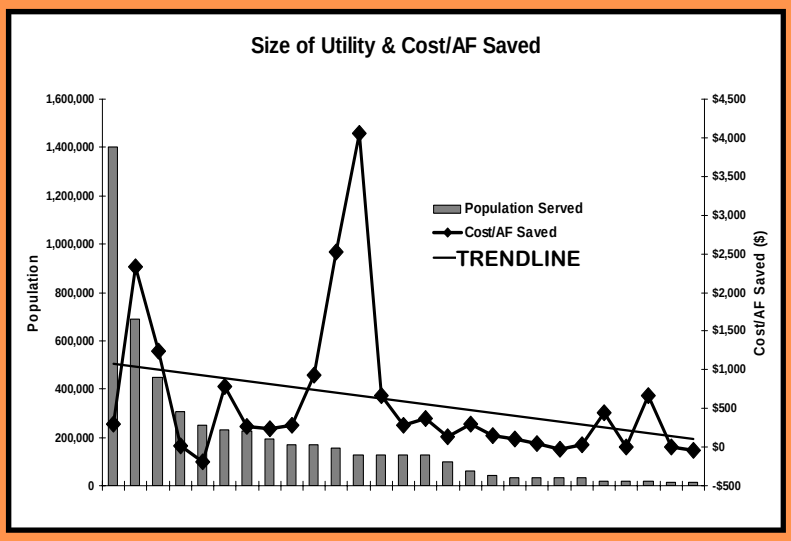
UTILITY SIZE & COST PER AF OF WATER SAVED

In looking at the data and organizing it in a variety of ways to tease out information such as ranges, averages, costs to save, and amounts of savings, we began to see what appeared to be a trend for larger utilities to have higher costs to save an AF of water. The graph below shows this tendency.

Two possible factors creating this trendline come to mind:

Larger utilities will tend to have more bureaucratic factors at play in their overall management, such as entrenchment, higher overhead costs, resistance to change, etc.

On the other hand, large utilities tend to be the utilities that have lead the way in water conservation over the past two or three decades. Perhaps they have achieved all the easy, cheap savings some time ago and are now at work on the more costly efforts to save that next increment of water.



AUDIT FINDINGS

We looked at 8 audit cases from 4 separate utilities for a total of 2,217 audits. Audit programs analyzed took place between 1999 and 2003.

The utilities we examined were: 2 large utilities (serving over 200,000 customers), 1 mid-sized utility (100,000 to 199,999 customers) and 1 small utility (less than 100,000 customers).

The programs varied from balanced indoor and outdoor auditing to almost entirely outdoor in scope. We are unable to analyze the programs based on this emphasis.

AUDIT PROGRAMS	
Total Audits:	**2,217**
Participating Utilities:	**4**
Cases Analyzed:	**8**
Customers Analyzed:	**SF**
Years Analyzed:	**1999 - 2003**

Utility A-1 audits were 70% targeted to high summer users and 30% referred from Customer Service, not necessarily high water users. The program has evolved through the years to put greater emphasis on outdoor water use. Marketing has also changed to target the utility's higher water users.

Utility A-2 has an untargeted audit program, based on response to customer requests. This was the first year the program had been offered by this utility.

Utility A-3 offers an untargeted program, in response to customer requests.

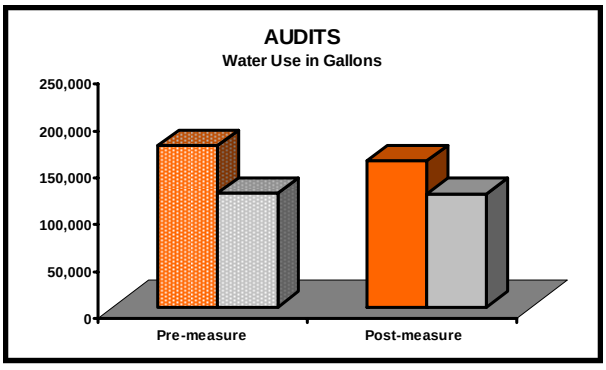
Utility A-4 also has an untargeted program, responding to customer requests.

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

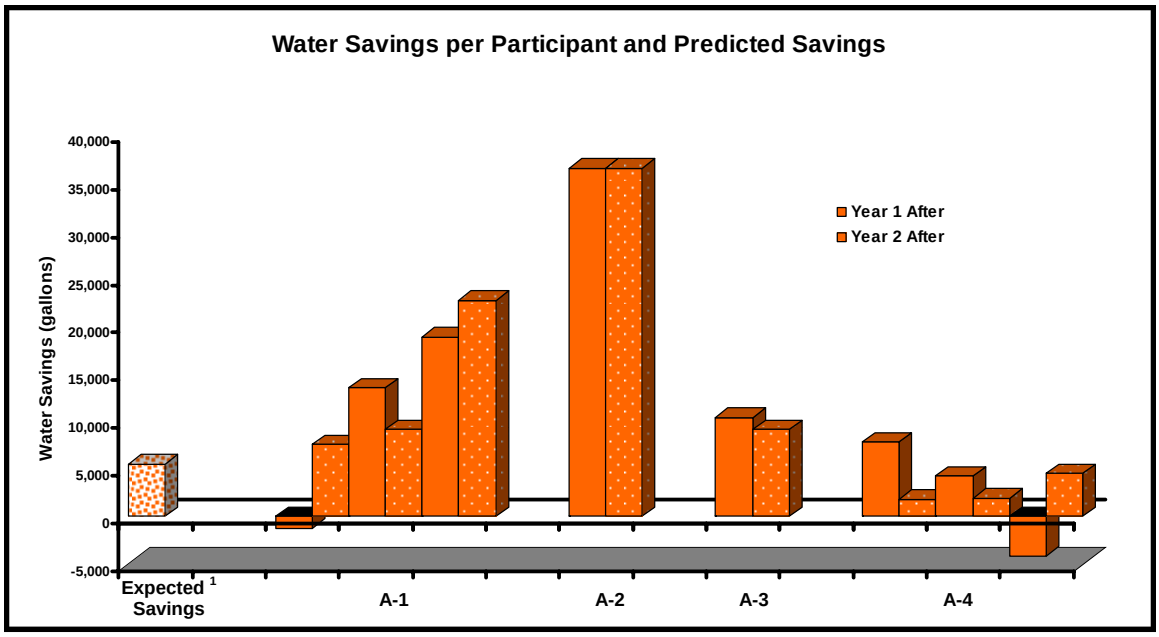
PRE- & POST- MEASURE RELATIVE WATER USE

The overall water use of participants in these audit programs ranged from 114% of the control group to 159%, with **an average of 144% of the control group before the audits to 132% of control group after the audits.**



RANGE, AVERAGE, MEDIAN SAVINGS

Water savings per participant varied from -4,152 gallons (a relative increase in water use) to 36,490 gallons per participant for the eight cases looked at. The



average savings was 8,690 gallons per participant.

We used annual water savings of 5,474 gallons (15 gpd)[1] as a predictor for expected savings. The prediction is indicated as column number one(1) above. The average water savings was 159% of expected.

PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was 8,543 gallons for year one after the programs and 8,838 gallons for year two after, which shows a 19% increase in water savings from the first year after to the second year after the programs. This translates to a savings of 156% of expected for year one after and 161% for year two after the program.

This was one of the programs we examined that actually showed an increase in average water savings for year two. Because of the short lifespan of audits and because no major hardware is involved, we expected to see some percentage of fall off in water savings for year two.

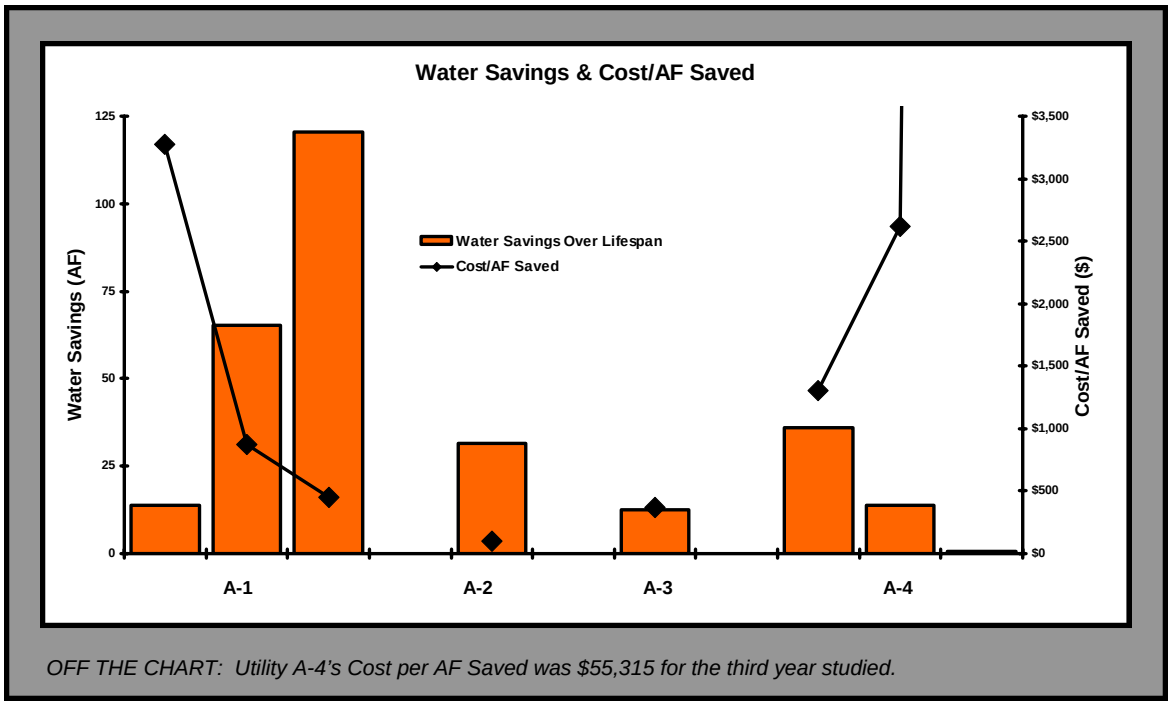
ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

The cost to the utility to save an acre foot of water with the audit programs studied ranged from a high of $55,315 to a low of $101. **The average cost to save an acre foot of water was a $8,038 and the median cost to save an AF was $1,090. If the most anomalous cost per AF ($55,315) is not included,, the average cost to save an AF of water is $1,284 and the median cost is $873.**

Utility A-1 appears to have adapted their audits through time to become more efficient and effective, thereby saving increasing amounts of water each year and cutting their costs to save an acre foot of water substantially.

[1] Gary Fiske & Associates. California Urban Water Agencies Urban Water Conservation Potential Final Report. 2001.

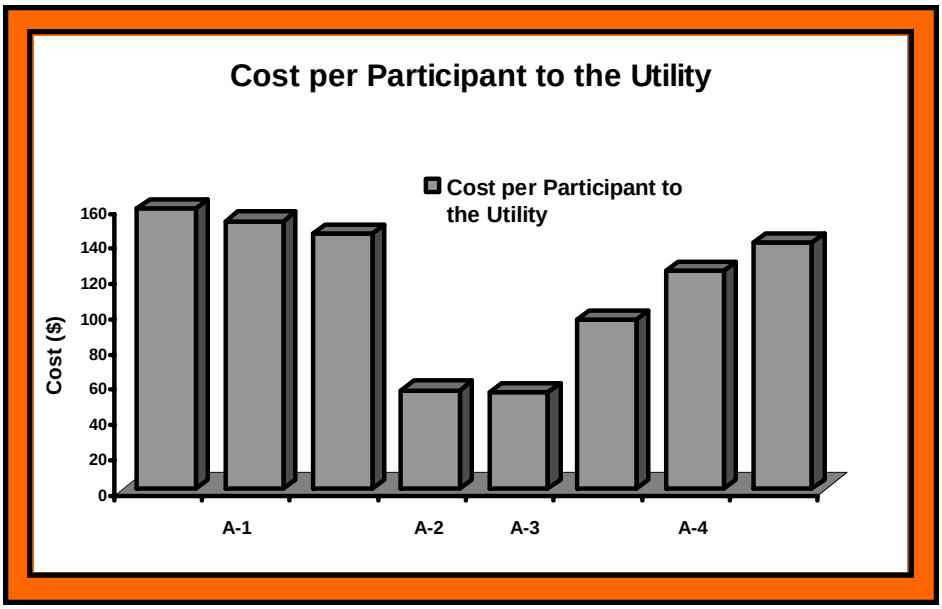


OFF THE CHART: Utility A-4's Cost per AF Saved was $55,315 for the third year studied.

Utility A-4 seems to have lost focus on efficiency through time and become less effective at cutting participant's water use. By the third year studied, they were saving practically no water and their cost per participant had gone up 146%, which creates a skyrocketing cost to save an acre foot of water of over $55,000.

COST TO UTILITY AND OTHERS PER PARTICIPANT

The cost to the utilities to administer the programs and perform the audits ranged from $55 to $159 per participant. There were no outside funders for these audit programs. **The average cost to the utilities offering the auditswas $116 per participant.**



COST TO PARTICIPANTS

There were no quantified costs to the participants of the audit programs.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from -$3,162 to -$46,923, with an average of -$29,235. The Net Present Value to the participants ranged from -719 to -$105,743, with an average of -$35,809. The overall Net Present Value ranged from -$7,587 to -$76,762, with an average of -$25,795.

Thoughts on AUDITS

- **The wide range of savings achieved and the large variation in costs to save an AF of water may indicate that the auditor is key to program success, as is targeting the customers with the greatest potential for water savings.**
- **This type of measure benefits from focus on potential for savings through size of facility, age of property and the irrigation system as well as overall water use. The potential for savings is generally higher with large multifamily and commercial properties.**
- **Audits are excellent customer service tools, putting a face on the utility with a personal visit.**
- **Coupling audits with ordinances that focus on a certain standard of irrigation system performance can be highly effective. Used together they may yield greater savings that each effort individually.**
- **Rather surprisingly, there was no fall-off in water savings from the first to the second year after the audit.**

DEVICE GIVEAWAY FINDINGS

We were able to study eight device giveaway programs from five separate utilities. These giveaway programs took place between 1995 and 2003.

Four of the five utilities studied were classified as small (less than 100,000 customers) and one was mid-sized (100,000 to 199,999 customers).

Utility D-5 put a relatively larger investment, in both staff time and advertising, into their giveaway program with little to show for that additional effort.

Utilities D-1, D-3 and **D-4** each spent next to nothing and achieved water savings that are not statistically meaningful.

DEVICE GIVEAWAY PROGRAMS	
Total Participants:	**533**
Participating Utilities:	**5**
Cases Analyzed:	**8**
Customers Analyzed:	**SF**
Years Analyzed:	**1995 - 2003**

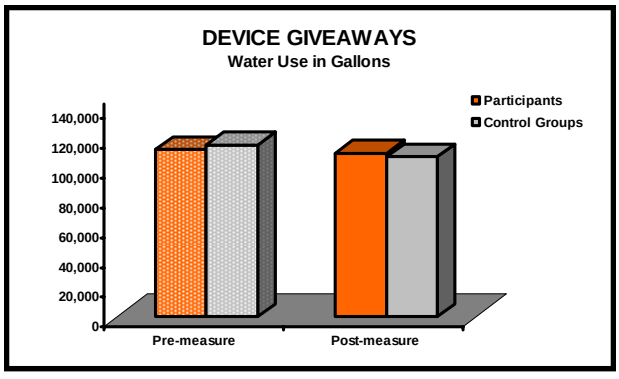
Utility D-2 did not have a method to confirm that devices were actually installed which may account for at least a portion of the increase in water usage.

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

PRE- & POST- MEASURE RELATIVE WATER USE

The participant's overall water use varied from 92% of the control group to 115% of the control group. **The average water use of the participants was 97% of control group water use prior to receiving the devices and 101% of control after receiving the devices.**

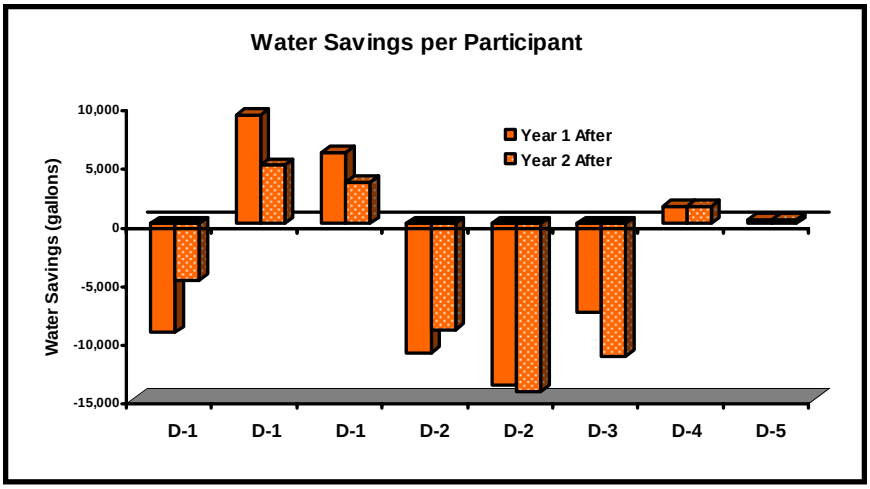


RANGE, AVERAGE, MEDIAN SAVINGS

Water savings per participant varied from 9,229 gallons per year to -14,341 gallons per year (a relative increase in water use). **The average water savings per participant per year was -6,692 gallons (a relative increase in water use).**

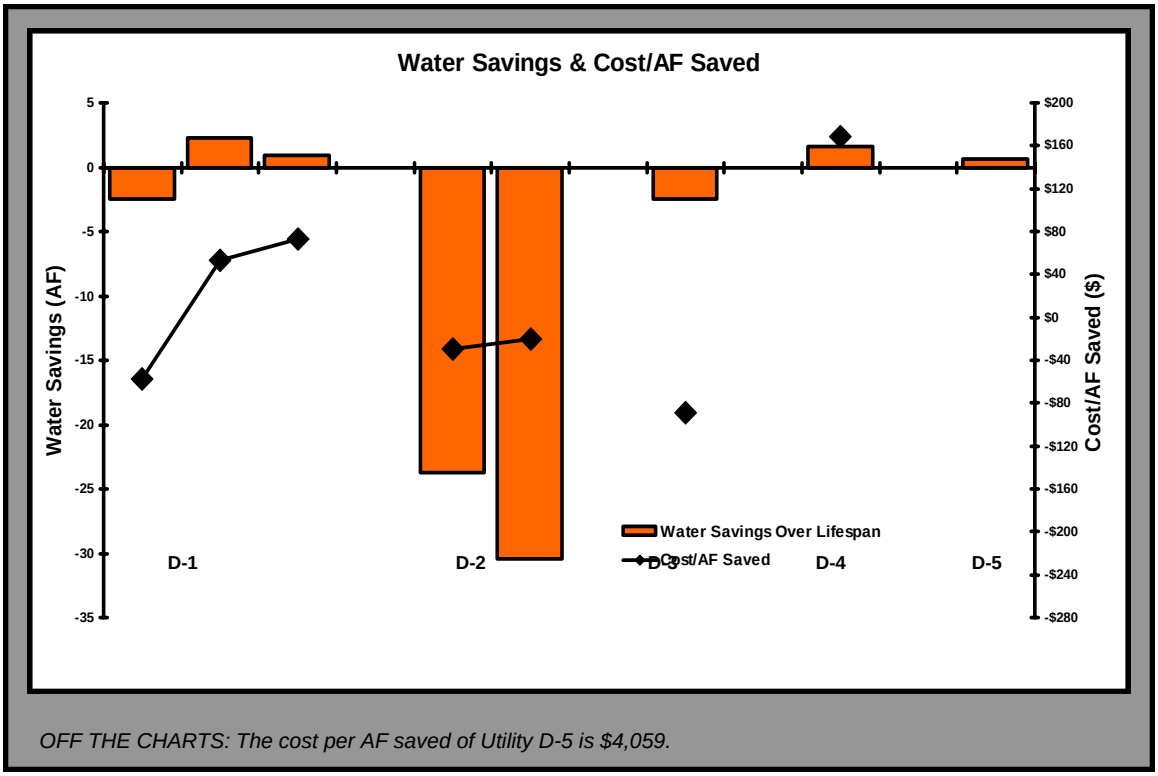
PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was -6,846 gallons the first year after the programs and -6,538 gallons the second year after (relative increases in water use), which shows a 3% increase in water savings from the first year after to the second year after the programs.



OVERALL LIFESPAN SAVINGS

The water savings over the entire 5 year lifespan varied from 2.3 AF to -54.2 AF, with an average savings of -6.7 AF and a median savings of -6.7 AF (relative increases in water use).

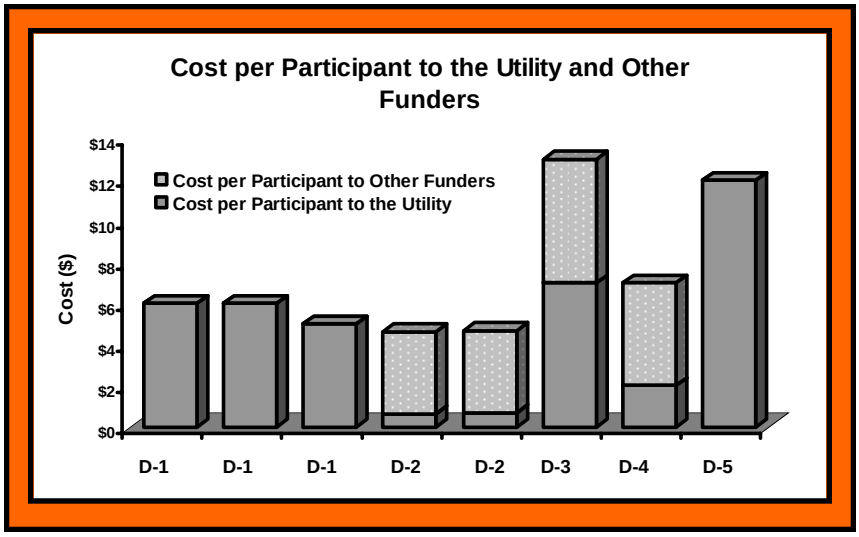


OFF THE CHARTS: The cost per AF saved of Utility D-5 is $4,059.

ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

The cost to the utility to save an acre foot of water with device giveaway programs studied ranged from a high of $4,059 to a low of -$57. This wide range highlights the variability and unpredictability of this type of program. The negative cost to save an acre foot of water reflects "negative" water savings. The magnitude of negative costs per acre foot of water saved are meaningless, and could be thought of as infinitely high positive values. **The average cost to save an acre foot of water was $515 and the median cost was $21.**



Two of the five utilities examined had outside funders of their device giveaway programs. **When the costs to the utilities and these outside funders are aggregated, the average cost to save an acre foot of water increased to $520 and the median cost decreased to $17**.

COST TO UTILITY AND OTHERS PER PARTICIPANT

The cost to the utilities to administer the programs and distribute the devices ranged from $1 to $12 per participant. The range jumps to between $5 and $12 per participant when the cost to both the utilities and outside funders is considered.

The average cost to the utilities offering the rebates was $5 per participant. The total cost to the utilities and outside funders was $7, on average. The median cost per participant was $6 to the utility, with a median of $6 of combined costs.

COST TO PARTICIPANTS

There were no quantified costs to the participants of the device giveaway programs.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from -$70 to -$1,546, with an average of -$283. The Net Present Value to the participants ranged from $938 to -$9,480, with an average of -$2,377. The overall Net Present Value ranged from $663 to -$10,076, with an average of -$2,834.

Thoughts on DEVICE GIVEAWAY Programs

- **From the standpoint of water savings alone, giving away conservation devices such as low-flow shower heads, faucet aerators, and shut-off valves for showers and faucets is not able to make a meaningful difference in overall water use. It does not appear to even be an effective bribe or have the ability to raise the conservation awareness of the customers to show any increased efficiency in their overall water use.**

- **These technologies may in fact be at their best as good customer service tools and good reminders to the water customers of the importance of conservation, but the actual savings is negligible or nonexistent.**

- **Is it possible that customers receiving these devices think that having them gives them license to use water somewhat more freely elsewhere?**

- **Since these giveaways were not targeted programs, it is a shotgun approach to water savings that doesn't prove cost-effective to the utility. While there is relatively little cost involved, the returns appear to match the inputs. It should be mentioned that for the purposes of this study we have not attempted to quantify the goodwill engendered by these types of freebies.**

- **As an aside, the water is so hard in Southern Arizona, that even a high-volume fixture quickly becomes low volume.**

WASHING MACHINE REBATE FINDINGS

We were able to study eight washing machine rebate programs from seven separate utilities. These rebate programs took place between 2001 and 2003.

All seven utilities studied were classified as small (less than 100,000 customers).

Utility W-1 offered a rebate of $300 and showed an actual increase in water use relative to control group water use. The participant group's water use was double the control group's water use before the rebates, however, so the "negative" water savings may be at least partially explained by the lack of a good control group.

Utility W-2 offered $125 vouchers and also showed slightly negative water savings.

Utility W-3 offered a $100 rebate, with the highest water savings of the seven utilities.

WASHING MACHINE REBATE PROGRAMS	
Total Participants:	1,034
Participating Utilities:	7
Cases Analyzed:	8
Customers Analyzed:	SF
Years Analyzed:	2001 - 2003

Utility W-4 offered a $75 rebate one year and a $150 rebate the following year, with increased average water savings the second year.

Utility W-5 offered a $75 rebate, with minimal water savings.

Utility W-6 offered a $50 rebate and **Utility W-7** offered a $125 credit on customers' water bills, both with substantial water savings.

The program offered by **Utility WR-1** was a replacement of several coin-operated washing machines. This program is not included in comparative analysis or charts because of the differences between this and the other washing machine rebate programs.

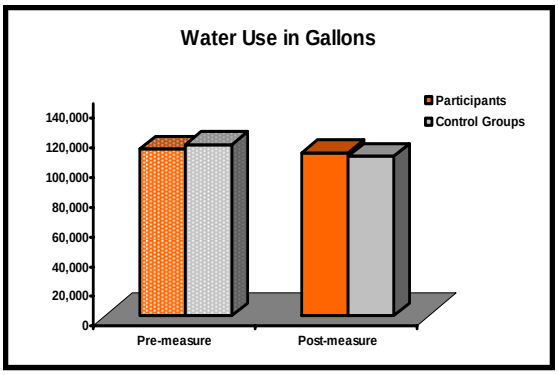
None of the washing machine rebate programs analyzed actively targeted high water users.

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

PRE- & POST-MEASURE RELATIVE WATER USE

There was a significant difference between water use among the participants of the washing machine rebate programs and the control groups. The overall water use range of the participants varied from 101% of the control group to 221% of the control group. The average of participants was 130% of control

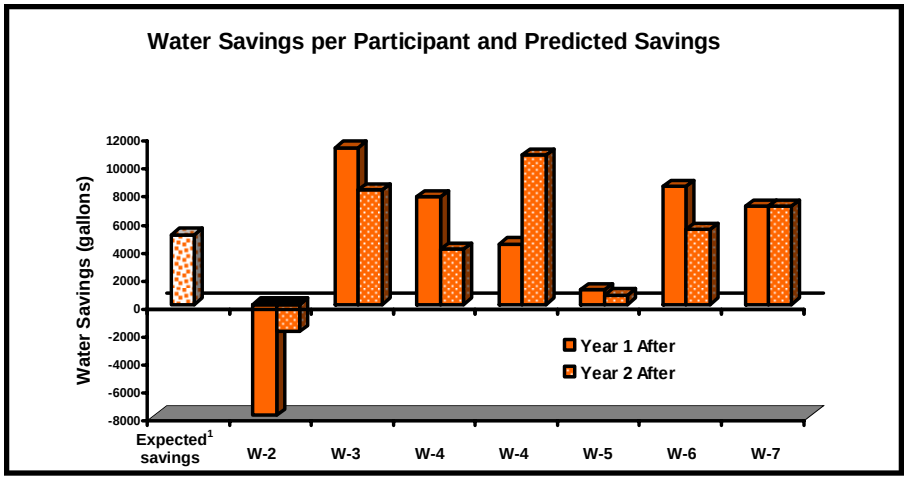


prior to receiving the rebates and 132% of control after receiving the rebates.

RANGE, AVERAGE, MEDIAN SAVINGS

Water savings per participant per year varied from 11,242 gallons to -103,987 gallons (a relative increase in water use).

Predicted savings for washing machine rebate programs are about 5,000 gallons per household per year.[1] We found an average water savings of -1,257 gallons per household per year (a relative increase in water use) including **Utility W-1** results, and an average savings of 3,176 gallons not including the results from **Utility W-1**.



OFF THE CHART: Utility W-1 is not included in this chart.

PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was -915 gallons the first year after the programs and -1,600 gallons the second year after (relative increases in water use). Without **Utility W-1**, these savings are 2,823 gallons and 3,529 gallons the first year and second year after the programs, which shows a 25% increase in water savings from the first year to the second year after.

OVERALL LIFESPAN SAVINGS

The water savings over the entire 12-year lifespan varied from -168.8 AF to 79.6 AF, with an average savings of -6.0 AF (a relative increase in water use) and a median savings of 14.1 AF. Not including **Utility W-1**, the range of water savings was -47.5 AF to 79.6 AF, with an average of 17.3 AF and a median of 19.7 AF.

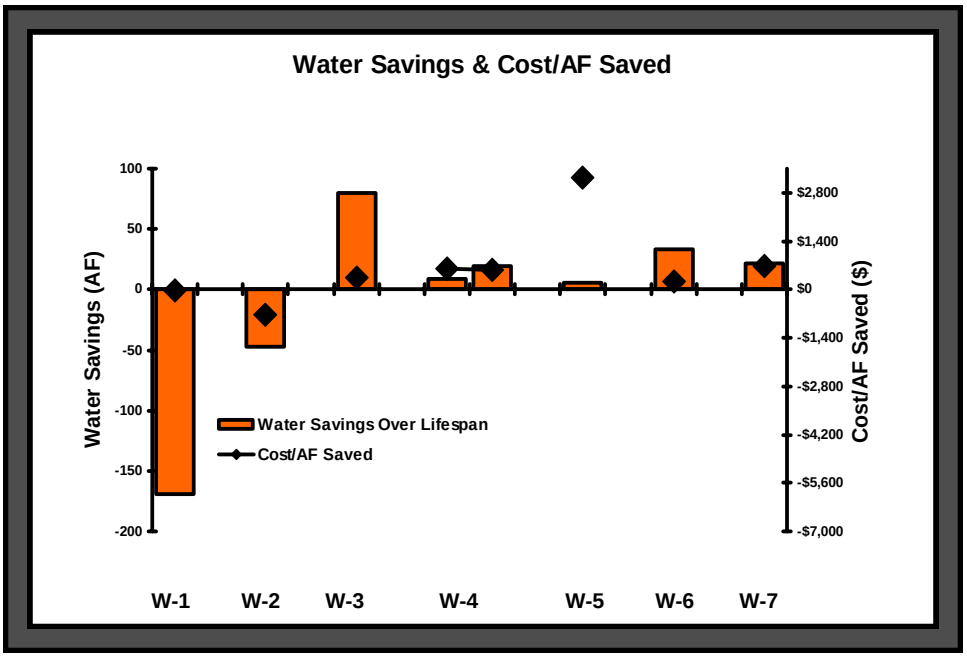
ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

The cost to the utility to save an acre foot of water with washing machine rebate programs studied ranged from a high of $2,519 to a low of -$184. This negative cost to save an acre foot of water reflects "negative" water savings. The magnitude of negative costs per acre foot of water saved are meaningless, and could be thought of as infinitely high positive values. The average cost to save an acre foot of water was $404 and the median cost was $7.

Five of the eight programs examined had outside funding of their programs. When the costs to the utilities and these outside funders are aggregated, the average cost to save an acre foot of water increased to $613 and the median cost increased to $449 per acre foot.

[1] Vickers, Amy. Table 2.17: "Estimated water use and savings by high-efficiency clothes washers in households," Water Use and Conservation, pg. 118.

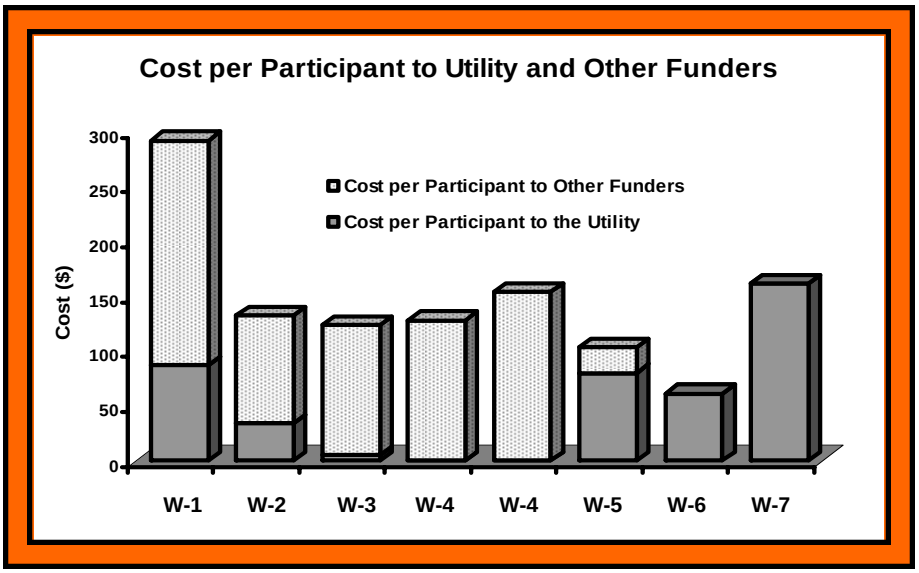


COST TO UTILITY AND OTHERS PER PARTICIPANT

The cost to the utilities to administer the programs and distribute the rebates ranged from $0 to $161 per participant. The range jumps to $61 to $292 per participant when the cost to both the utilities and outside funders is considered.

The average cost to the utilities offering the rebates was $54 per participant. Several of the utilities had outside funders to augment these programs and their costs averaged $91 per participant. The total cost to the utilities and outside funders was $144, on average.

The median cost per participant was $48 to the utilities, $109 to outside funders, with a median of $130 of combined costs.



COST TO PARTICIPANTS

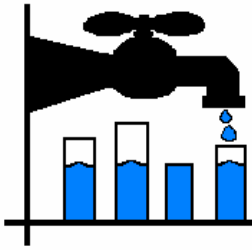
The cost to the participants to buy the washing machines ranged from $616 to $630 per participant. The average cost to the participants was $624 per participant. The median cost per participant was $630.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from $0 to -$13,869, with an average of $7,101. The Net Present Value to the participants ranged from -$24,563 to -$166,112, with an average of -$89,825. The overall Net Present Value ranged from -$38,221 to -$200,556, with an average of -$108,697.

Thoughts on WASHING MACHINE REBATE Programs

- **The potential for water savings is not huge for this type of incentive program: about 5,000 gallons per participant per year. It appears that the water use for many of those customers taking advantage of this incentive is so high that any water savings achieved with the new machine is lost within overall consumption.**
- **Are these programs requiring that the purchases be certified that they are the lowest water using models?**
- **Is this type of program just cherry picking customers who were going to get a new washing machine anyway and took advantage of the rebate?**
- **Would targeting neighborhoods, family size, etc. , where there might be a high percentage of old, highest water using machines still in use, be more cost effective?**



LANDSCAPE PROGRAM FINDINGS

We looked at 8 cases from 3 separate utilities for a total of 1,003 residential landscape conversion rebates. The conversions took place between 1997 and 2002.

The conversions we examined were offered by 2 large utilities (serving over 200,000 customers) and one mid-size utility (100,000 to 199,999 customers).

Utility L-1 provided an incentive of $0.40 per square foot, with a minimum conversion of 500 square feet.

LANDSCAPE CONVERSION PROGRAMS

Total Participants:	**1,003**
Participating Utilities:	**3**
Cases Analyzed:	**8**
Customers Analyzed:	**SF**
Years Analyzed:	**1997 - 2002**

Utility L-2 offered a rebate of $200. The minimum conversion was 1,000 square feet, and both the front and back yards must have been converted.

Utility L-3 offered a rebate of $100, with no minimum conversion. However, both the front and back yards must have been converted.

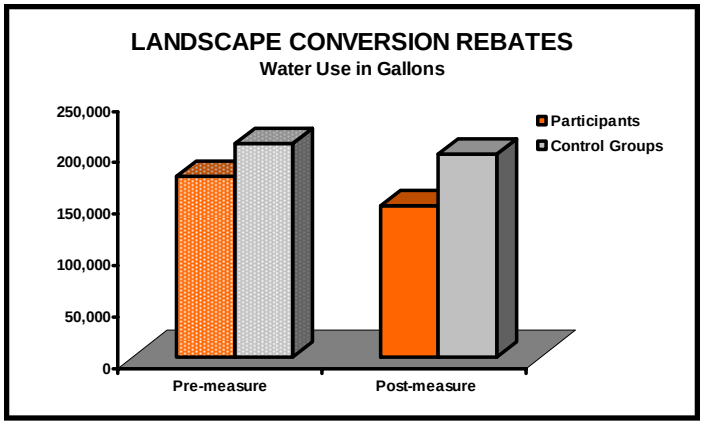
All programs studied were untargeted, other than the criteria to qualify for the rebate.

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

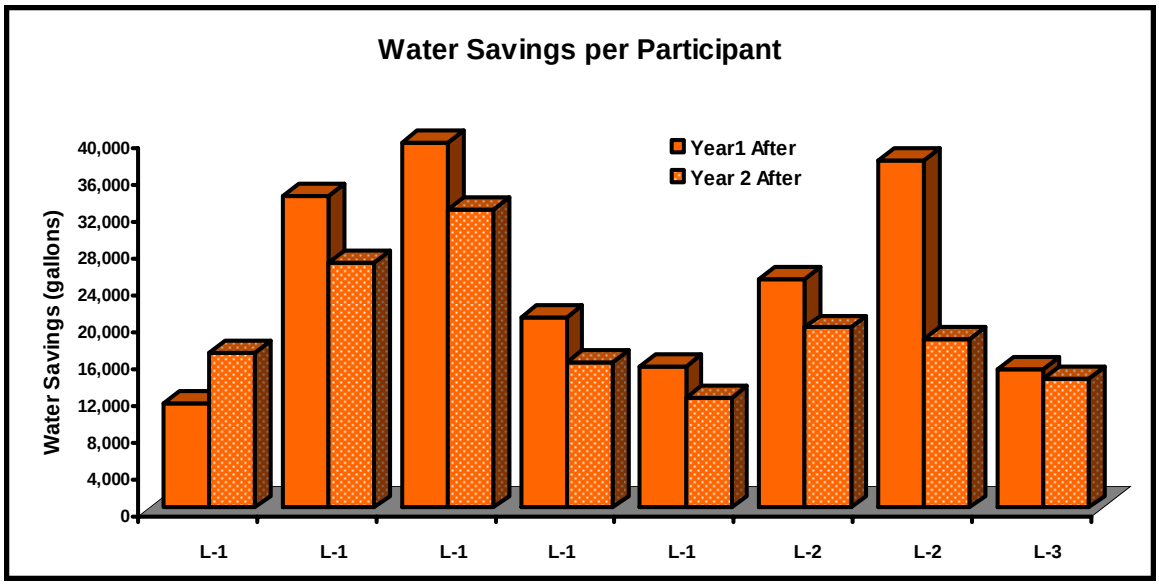
PRE- & POST-MEASURE RELATIVE WATER USE

The overall water use of participants in these conversion programs ranged from 63% of the control group to 109%, **with an average of 87% of the control group before the conversion to 77% of control group after the conversion.**



RANGE, AVERAGE, MEDIAN SAVINGS

Annual water savings per participant varied from 11,387 gallons to 39,665 gallons per participant. **The average water savings per participant per year was 21,897**.



PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was 24,121 gallons the first year after the programs and 19,673 gallons the second year after, which shows a 18% decrease in water savings from the first year to the second year after the programs.

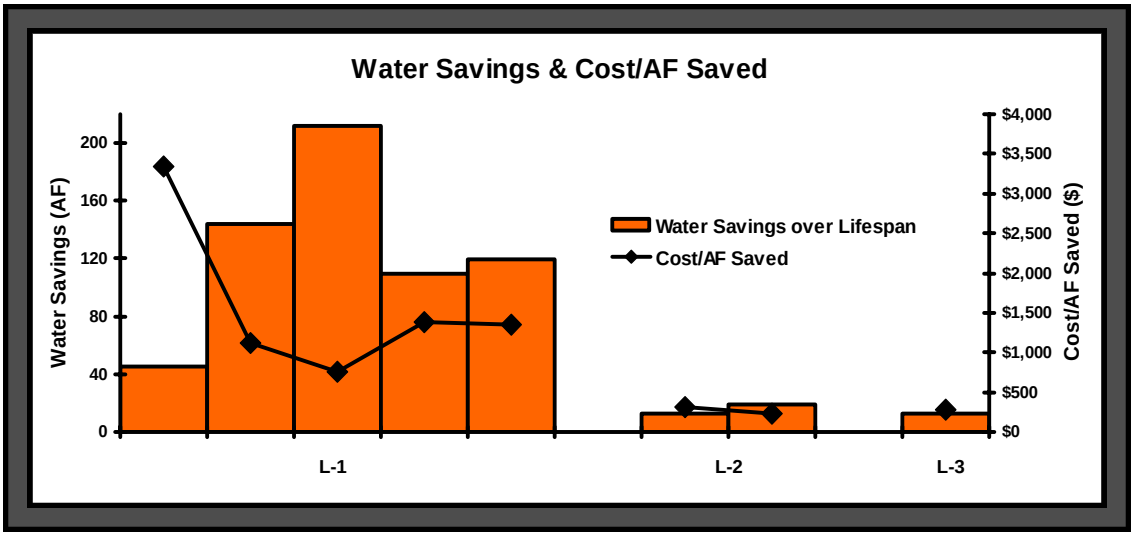
OVERALL LIFESPAN SAVINGS

The water savings over the entire 10-year lifespan varied from 12.2 AF to 212.1 AF, with an average savings of 84.3 AF and a median savings of 77.4 AF.

ECONOMIC ANALYSIS

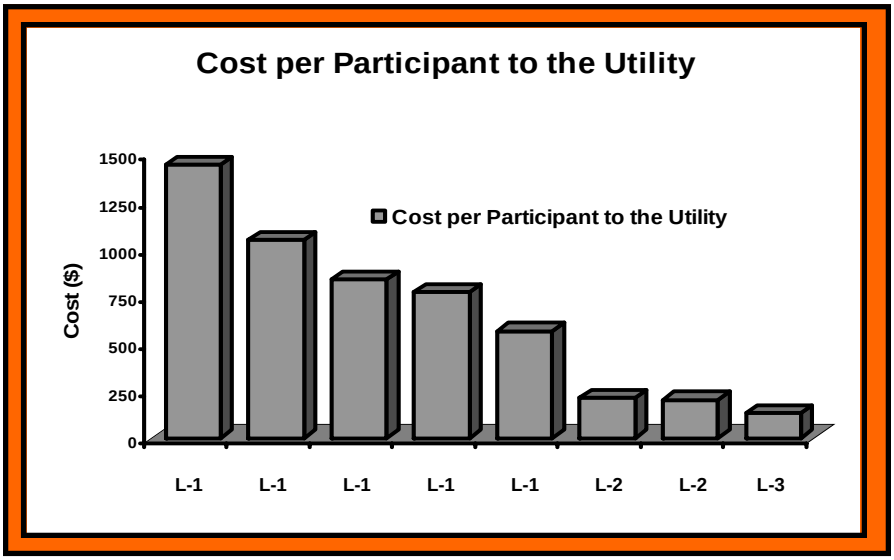
COST PER ACRE FOOT SAVED

The cost to the utility to save an AF of water for the landscape conversion programs we studied varied from a low of $236 per AF to a high of $3,338 per AF. **The average cost was $1,099 and the median was $942.**



COST TO THE UTILITY PER PARTICIPANT

The direct costs to the utility to administer these programs and provide the rebates ranged from $129 per participant to a high of $1,442 per participant. **The average cost to the utility was $650 per participant and the median was $667**.



COST TO PARTICIPANTS

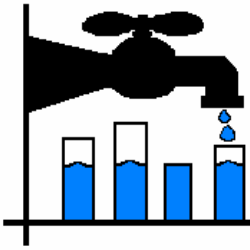
The cost to the participants to actually get their new landscapes in the ground ranged from $1,181 to $5,258 per participant. The average cost to the participants was $2,401 per participant, and the median cost per participant was $2,051.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from -$3,593 to -$162,046, with an average of -$99,722. The Net Present Value to the participants ranged from -$34,730 to -$369,233, with an average of -$166,532. The overall Net Present Value ranged from -$38,323 to -$529,778, with an average of -$289,593.

Thoughts on LANDSCAPE CONVERSION REBATE Programs

- **Results showed an 18% fall-off in water savings from year one after the conversion to year two. We might have expected the opposite, as the amount of water needed to establish landscaping is higher the first year after installation than for the second year, when irrigation can be cut back some.**
- **This result brings to mind the findings in the AWWA REUW Study that discovered households with automatic timers and drip irrigation systems use more water than those without. Are customers who received these conversion incentives letting up on seasonal adjustments to their irrigation systems as time goes by?**



TOILET REBATE FINDINGS

We studied six toilet rebate programs from five separate utilities. These rebate programs took place between 2001 and 2003.

Three of the five utilities studied were classified as small (less than 100,000 customers), and two were classified as medium (between 100,000 and 199,000 customers).

None of the toilet rebate programs analyzed actively targeted high water users.

Utility TR-1 offered a rebate of $150, or 75% of the cost of the toilet, whichever was less.

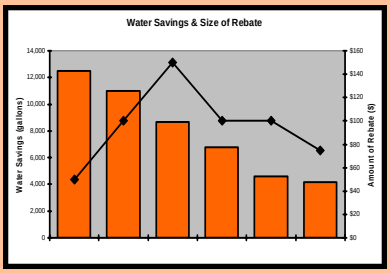
Utility TR-2 offered a rebate of 50%, up to $100.

Utility TR-3 offered a $50 rebate for the first toilet and a $40 rebate for any additional toilets.

Utility TR-4 offered a rebate of 50% of the cost of the toilet, up to $75.

Utility TR-5 offered a $100 credit on customers' water bills.

TOILET REBATE PROGRAMS	
Total Participants:	**569**
Participating Utilities:	**5**
Cases Analyzed:	**6**
Customers Analyzed:	**SF**
Years Analyzed:	**2001 - 2003**



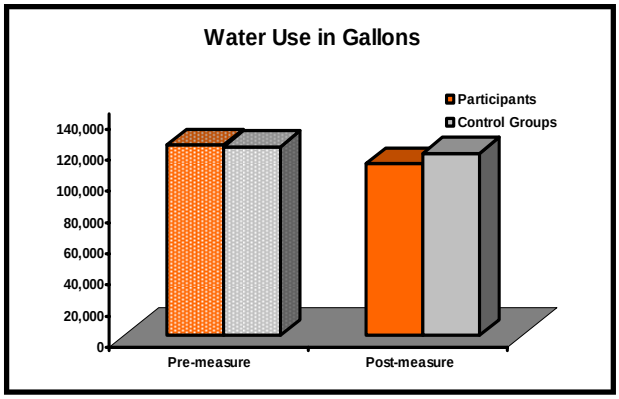
No correlation between the amount of the rebate (line) and water savings (column) achieved.

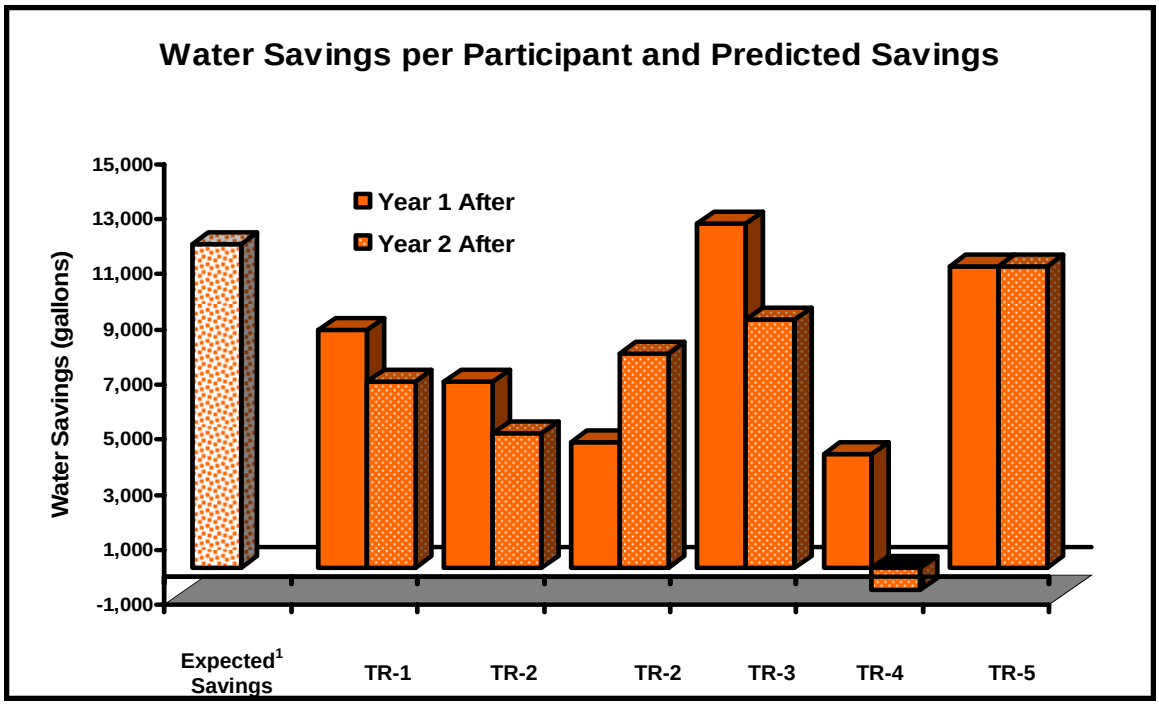
WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

PRE- & POST-MEASURE RELATIVE WATER USE

There was only a slight difference between water use among the participants of the toilet rebate programs and the control groups. The overall water use range of the participants varied from 84%up to 118% of the control group. Prior to acquiring the new toilets, participants used 104% of their control group, on average. The two years following the installation of the new toilet, these same customers used 96% of the control group, on average.





RANGE, AVERAGE, MEDIAN SAVINGS

Water savings per participant per year varied from 12,504 gallons to -760 gallons (a relative increase in water use).

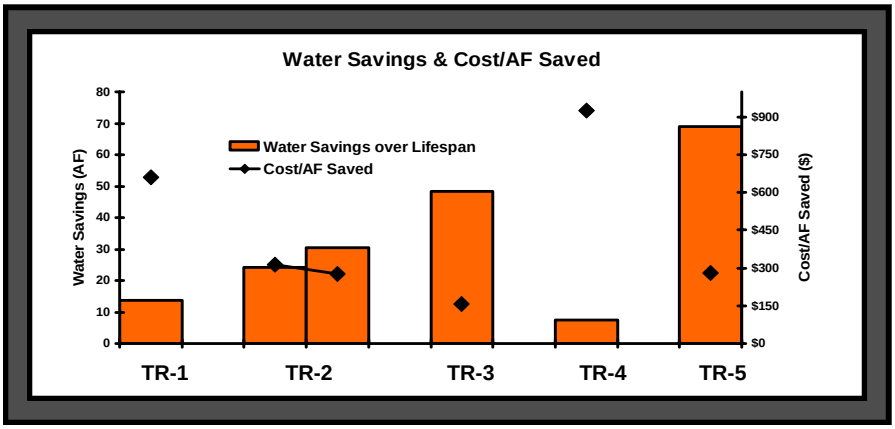
Predicted savings for toilet rebate programs are 11,794 gallons per household per year.[1] We found an average savings of 7,440 gallons per household per year, which was 63% of predicted savings.

PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was 8,063 gallons the first year after the programs and 6,816 gallons the second year after, which shows a 15% decrease in water savings from the first year to the second year after.

OVERALL LIFESPAN SAVINGS

The water savings over the entire 20-year lifespan varied from 7.4 AF to 68.8 AF, with an average savings of 32.1 AF and a median savings of 27.2 AF.



[1] Vickers, Amy. Table 2.2: "Estimated water use and savings by low-volume toilets in households," Water Use and Conservation, pg. 25.

ECONOMIC ANALYSIS

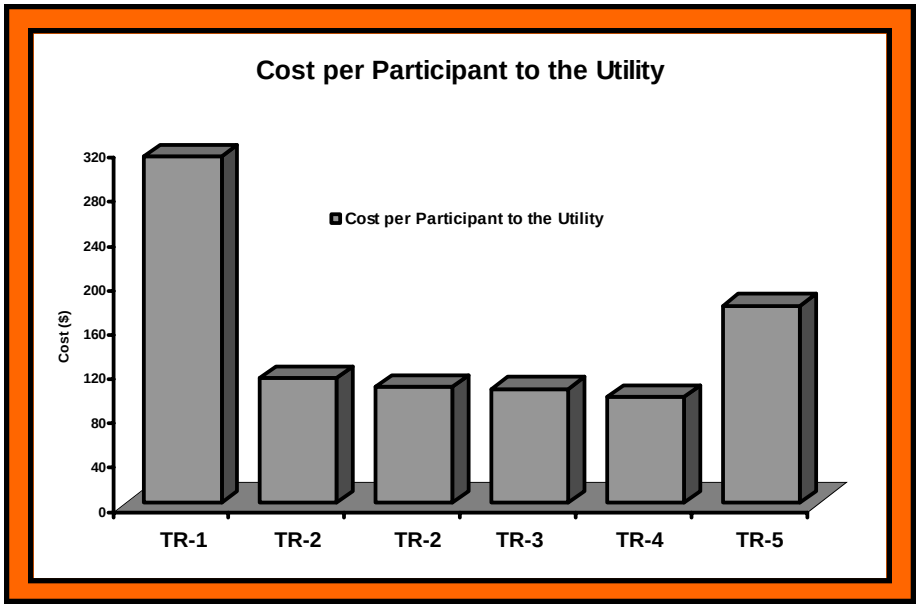
COST PER ACRE FOOT SAVED

The cost to the utility to save an acre foot of water with toilet rebate programs studied ranged from a high of $926 to a low of $155. The average cost to save an acre foot of water was $436 and the median cost was $297.

COST TO UTILITY AND OTHERS PER PARTICIPANT

The cost to the utilities to administer the programs and distribute the rebates ranged from $96 to $313 per participant.

The average cost to the utilities offering the rebates was $151 per participant. The median cost per participant was $109.



COST TO PARTICIPANTS

The cost to the participants to buy the toilets and have them installed ranged from $193 to $444 per participant. The average cost to the participants was $270 per participant, and the median cost per participant was $248.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from -$6,822 to -$18,153, with an average of -$9,596. The Net Present Value to the participants ranged from -$8,414 to $38,474, with an average of $9,181. The overall Net Present Value ranged from -$15,236 to $20,321, with an average of $415 and a median of $248.

Thoughts on TOILET REBATE Programs

- **These programs are abundant and have been around a long time. Utilities need to assess the savings still to be realized by these types of rebates relative to their service areas, especially age of housing stock. Targeting older neighborhoods or looking at a toilet distribution program instead might be a good idea.**

- **Savings with toilet rebate programs were not as high as expected. Perhaps those taking advantage of the rebate were changing out 3.5 or 5 gpf instead of the oldest 7 gpf toilets.**

TOILET DISTRIBUTION FINDINGS

We studied twelve toilet distribution programs from three utilities. These programs took place between 1994 and 2001.

Two of the utilities studied were classified as small (less than 100,000 customers) and one was a large utility (over 200,000 customers).

Utility TD-1 distributed the toilets at a local high school, and with the assistance of the high school. The toilet was a Niagara 2202. The distribution was first come, first served.

Utility TD-2 also distributed the toilets with the assistance of a local high school. The advertising for the distribution targeted homes built before 1980.

TOILET DISTRIBUTION PROGRAMS	
Total Participants:	**1,186**
Participating Utilities:	**3**
Cases Analyzed:	**12**
Customers Analyzed:	**SF**
Years Analyzed:	**1994 - 2001**

Utility TD-3's program was different than the other two studied because not only were toilets replaced, but also leaks were repaired and conservation devices installed. Homes in need of assistance were targeted, and plumbing students made the necessary repairs and replacements. Along with these services came higher costs.

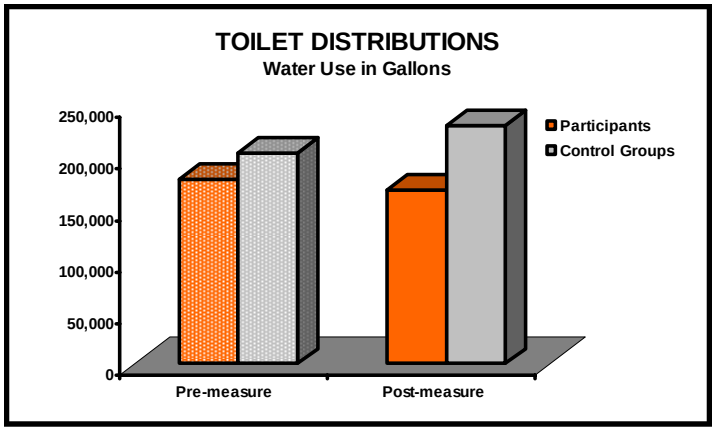
The overall water savings from these distributions were higher than the predicted savings for toilet retrofits.

WATER SAVINGS

Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

PRE- & POST-MEASURE RELATIVE WATER USE

The water use of the participants of these toilet distribution programs was usually lower than the control group, both before and after the distribution. The overall water use range of the participants varied from 61% of the control group to 117% of the control group. **The average of participants was 91% of control prior to receiving the toilets and 78% of control after receiving the toilets.**



RANGE, AVERAGE, MEDIAN SAVINGS

Water savings per participant per year varied from 89,116 gallons to

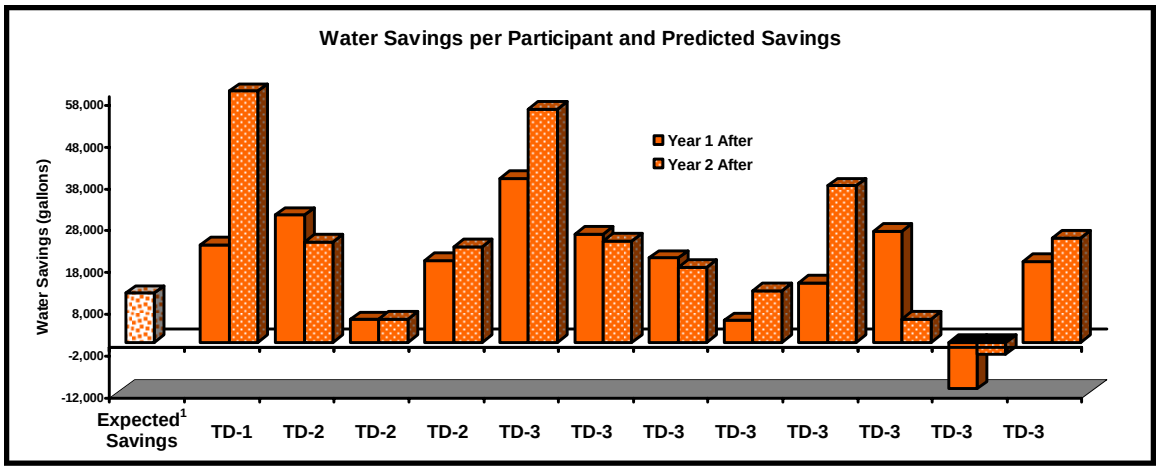
[1] Vickers, Amy. Table 2.2: "Estimated water use and savings by low-volume toilets in households," Water Use and Conservation, pg. 25.

-11,078 gallons (a relative increase in water use).

Predicted savings for toilet distribution programs are 11,794 gallons per household per year.[1] We found an average savings of 26,890 gallons per household per year, or 228% of expected savings.

PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was 19,403 gallons the first year after the programs and 34,377 gallons the second year after, which shows a 77% increase in water savings from the first year to the second year after the program.



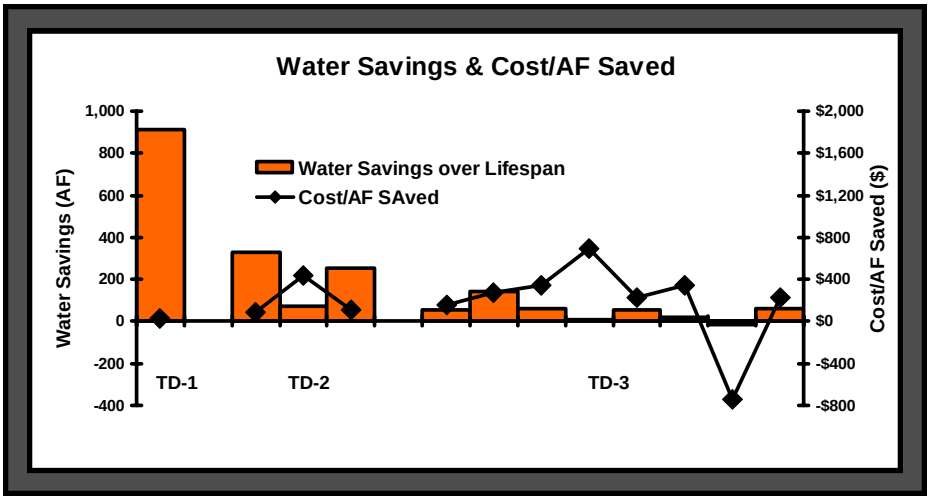
OVERALL LIFESPAN SAVINGS

The water savings over the entire 20-year lifespan varied from -12.4 AF (a relative increase in water use) to 911.2 AF, with an average savings of 163.1 AF and a median savings of 62.1 AF.

ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

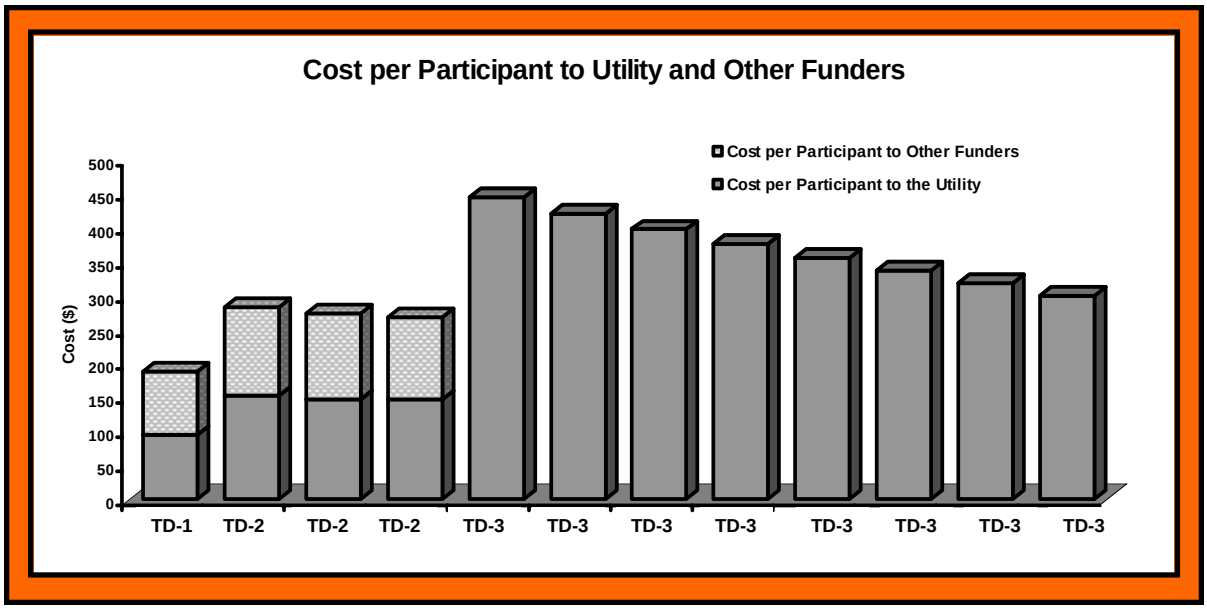
The cost to the utility to save an acre foot of water with the toilet



[1] Vickers, Amy. Table 2.2: "Estimated water use and savings by low-volume toilets in households," Water Use and Conservation, pg. 25.

distribution programs studied ranged from a high of $695 to a low of -$742. This negative cost to save an acre foot of water reflects "negative" water savings. The magnitude of negative costs per acre foot of water saved are meaningless and could be thought of as infinitely high positive values. **The average cost to save an acre foot of water was $181 and the median cost was $223.**

Four of the twelve programs examined had outside funding of their programs. When the costs to the utilities and these outside funders are aggregated, the average cost to save an acre foot of water increases to $228 and the median cost remains $223 per acre foot.



COST TO UTILITY PER PARTICIPANT

The cost to the utilities to administer the programs and distribute the toilets ranged from $95 to $444 per participant. The range jumps to $187 to $444 per participant when the cost to both the utilities and outside funders is considered.

The average cost to the utilities offering the toilets was $291 per participant. The median cost per participant was $327. Costs to outside funders averaged $39 per participant. The total cost to the utilities and outside funders was $330 on average.

COST TO PARTICIPANTS

The cost to the participants to install the toilets ranged from $0 to $48 per participant. The average cost to the participants was $26 per participant. The median cost per participant was $31.

NET PRESENT VALUE

The Net Present Value to the utilities ranged from -$6,383 to -$39,053, with an average of -$19,235. The Net Present Value to the participants ranged from -$5,249 to $261,988, with an average of $60,845. The overall Net Present Value ranged from -$30,678 to $224,564, with an

average of $34,598 and a median of $11,763.

Thoughts on TOILET DISTRIBUTION Programs

- **These programs can be tightly targeted to housing stock of a certain age, to areas where incomes are such that not a lot of remodeling is occurring, etc.**
- **Also, the utility can assert total quality control by offering only a toilet model, or models, that are highly efficient and the utility can see to it that the fixture is properly installed.**
- **Economy of scale can be achieved with the bulk purchase of fixtures.**
- **This type of program showed the highest savings per participant on average and the highest persistence in water savings of all the programs analyzed.**

RATE CASE FINDINGS

We looked at four rate increases or rate structure changes from four utilities and one actual rate decrease (**Utility R-1**), found on page 305. **Utility R-1**, because of its differences from the other rate cases, is not included in any charts.

The rate changes occurred between 1997 and 2003. Because of the complexity of the rate structures we investigated, we were unable to determine a percentage increase to each rate case; therefore, we can make no assumptions about the extent of the rate increase as a factor in the amount of water saved. The complete rate structure for each case is available in the individual case narratives.

RATE CASES	
Total Participants:	**83,821**
Participating Utilities:	**5**
Cases Analyzed:	**5**
Customers Analyzed:	**SF**
Years Analyzed:	**1997 - 2003**

The utilities examined were all small utilities (less than 100,000 customers) except for **Utility R-5**, which serves a bit over 100,000 customers.

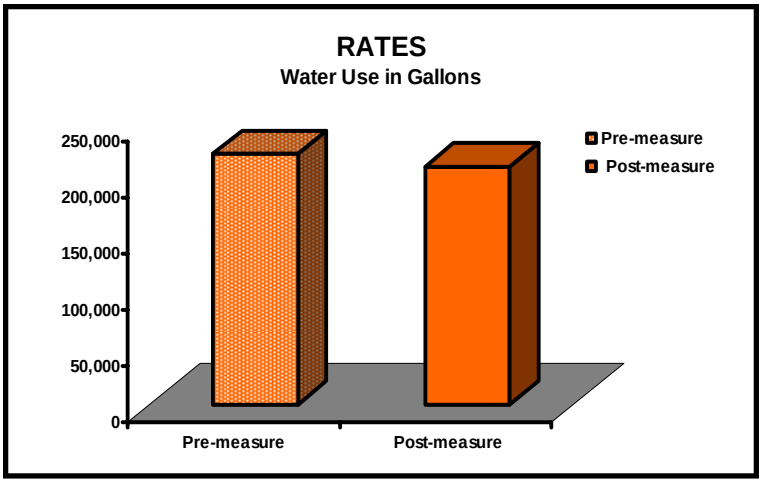
WATER SAVINGS

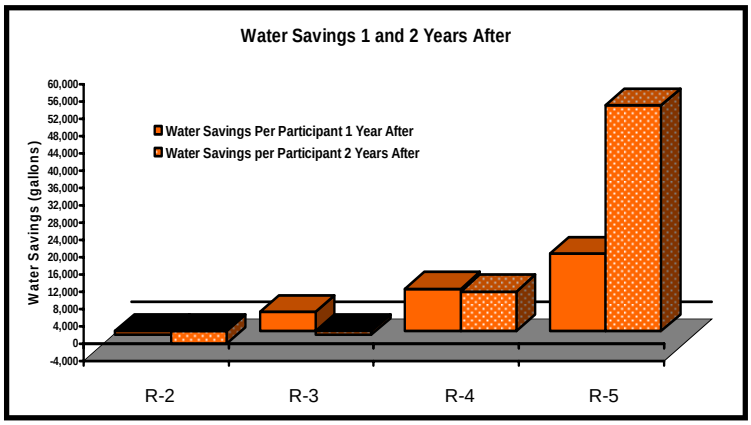
Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

RANGE, AVERAGE, MEDIAN SAVINGS

A lack of water savings with **Utility R-1** was to be expected as it was a rate decrease. The water use savings amounted to an average of -5,337 gallons per year (a relative increase in water use). Because this rate decrease occurred as a result of acquisition of a portion of a service area, we were able to determine that the water use for these customers went from 62% of typical for this utility to 71%.

Annual water savings for **Utility R-2** through **Utility R-5** varied from -2,892 gallons per customer (a relative increase in water use) to 52,188 gallons per customer. The average water savings per customer, per year was 14,335 gallons. These estimates of water savings do not take into account changes in weather or any other factors that may affect water use, as no control group was available for these cases.





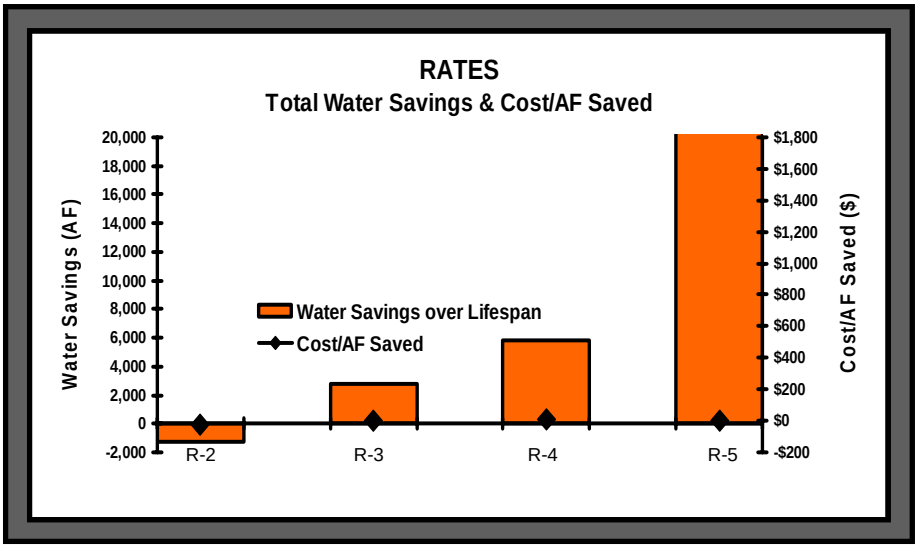
PERSISTENCE OF SAVINGS

The average water savings per participant for these programs was 9,518 gallons the first year after the rate changes and 19,151 gallons the second year after the changes, which shows a 102% increase in water savings from the first year to the second year. This is mostly due to a large increase in water savings in the second year after for **Utility R-5**.

Utility R-1, with the rate decrease, showed a savings of -4,279 gallons per customer the first year after the rate decrease and -6,394 gallons the second year after the change (these are relative increases in water use).

OVERALL LIFESPAN SAVINGS

Excluding **Utility R-1**, the water savings over the entire 20-year lifespan varied from -1,274.6 AF to 57,270.0 AF, with an average savings of 16,162.8 AF and a median savings of 4,328.0 AF.

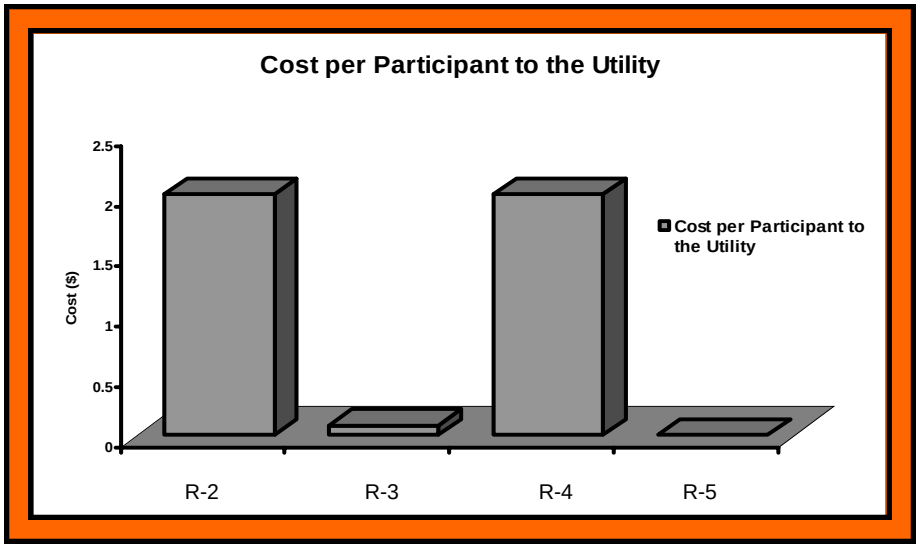


ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

None of the utilities studied had appreciable costs related to the rate changes, so whatever water savings occurred did so very cost effectively.

Not including **Utility R-1**, the costs associated with the water savings varied from -$22 to save an AF of water to $6 to save an AF. The average cost to save an acre foot of water was -$4 and the median cost was $1.



COST TO THE UTILITY PER PARTICIPANT

The cost to the utilities to plan and implement the rate changes ranged from $0 to $2 per participant. The average cost to the utilities was $1 per participant. The median cost per participant was $1.

COST TO PARTICIPANTS

There were no quantified costs to the customers.

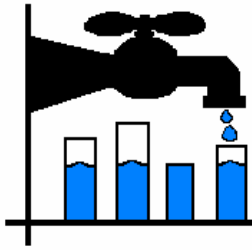
NET PRESENT VALUE

The Net Present Value to the utilities ranged from $0 to -$37,332, with an average of -$16,703. The Net Present Value to the participants ranged from -$460,127 to $6,842,739, with an average of $2,658,841. The overall Net Present Value ranged from -$487,551 to $6,842,739, with an average of $2,642,139.

Thoughts on RATES

- **Although not strictly a conservation measure, rates are often touted as a way to send a conservation message to customers: to align rates to increase the revenue burden on high water users and lighten the burden or reward the lower water users. One problem with this is that there is not necessarily a high correlation between amount of water use and the efficiency of that use. That being said, and acknowledging that rates are often changed to yield the revenue necessary to effectively run the utility (i.e. provide a consistent revenue stream), we ran analyses in the same manner as we did all other conservation programs studied; except that there was no control group for comparison.**

- **Perhaps because these utilities were of a smaller size, they did not pay a rate consultant to develop their new structures. This would probably not be the case with larger utilities. Using a rate consultant could greatly change the cost to save an AF of water.**



OTHER PROGRAM FINDINGS

We were able to study four miscellaneous programs from three utilities. We looked at one ordinance (Utility O-1) two years of an ICI water budget/surcharge program (Utility S-1) and a water conservation class (Utility C-1). These programs took place between 2001 and 2003.

Two of the utilities studied were classified as small (less than 100,000 customers) and one was classified as large (over 200,000 customers).

Utility O-1 enacted an ordinance aimed at reducing the water use of residential, municipal, and commercial customers, including measures such as watering restrictions. This utility saw the highest water savings of the three due to the widespread nature of the ordinance along with high per-participant water savings.

OTHER PROGRAMS	
Total Participants:	**21,707**
Participating Utilities:	**3**
Cases Analyzed:	**4**
Customers Analyzed:	**various**
Types of Programs:	**ordinance, surcharge, conservation class**
Years Analyzed:	**2001 - 2003**

Utility S-1 enacted a surcharge system in which commercial and municipal customers using more water than their annual water budget allowed were fined in accordance with the amount of use over their budget. This utility saw the highest per-participant water savings of the three.

Utility C-1 offered residential customers water conservation classes. After participating in the class, customers would not be required to follow the restriction on watering every-third-day. Participants would then water when needed instead of every third day. This utility saw a modest water savings compared to the other two utilities, and this was most likely due to the small scope and behavior-oriented nature of the program.

WATER SAVINGS

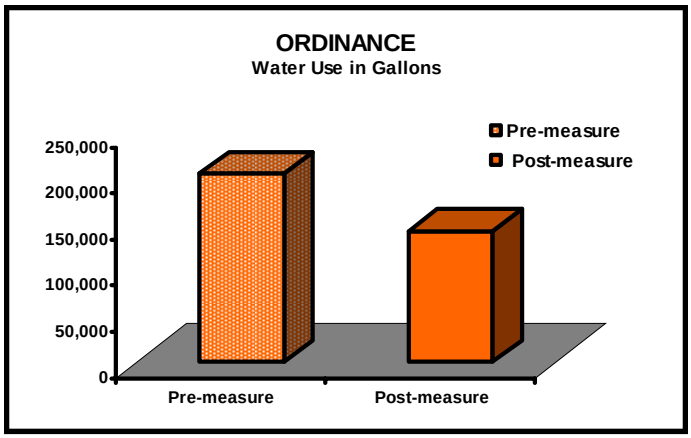
Some analyses show "negative" water savings, where control group water use decreased more (or increased less) than participant water use.

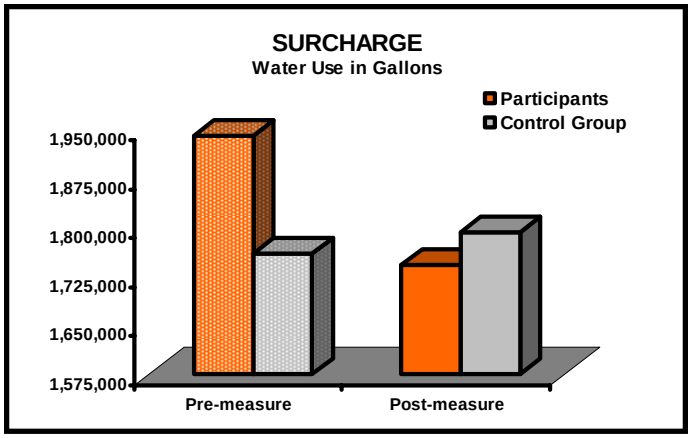
PRE- & POST-MEASURE RELATIVE WATER USE

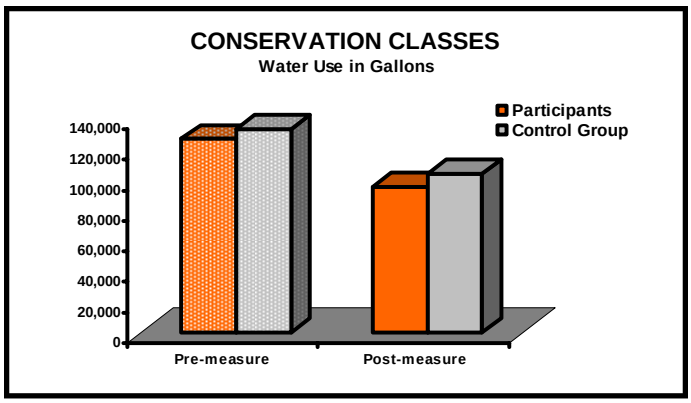
The participants of the ordinance, **Utility O-1**, did not have a control group. Their water use decreased by 31%, on average, from pre-ordinance to post-ordinance.

The surcharge program, **Utility S-1**, did have a control group, and the participants used 117% of the control group prior to the surcharge and 102% of control after the surcharge.

The conservation class program, **Utility C-1**, also had a control group,







and the participants used 95% of the control group prior to the class and 92% of control after the class.

RANGE, AVERAGE, MEDIAN SAVINGS

The average water savings per participant per year for the **ORDINANCE** was 62,208 gallons.

The average water savings per participant per year for the **SURCHARGE** program was 241,157 gallons.

The average water savings per participant per year for the **CONSERVATION CLASSES** was 3,524 gallons.

PERSISTENCE OF SAVINGS

The water savings per participant for the ordinance was 59,854 gallons after the first year and 64,562 gallons the second year after, which shows an 8% increase in water savings from the first year to the second year after the program.

The water savings per participant for the surcharge program was 303,210 gallons after the first year and 179,104 gallons after the second year , which shows a 41% decrease in water savings from the first year to the second year after the program.

The water savings per participant for the conservation classes was 3,442 gallons after the first year and 3,606 gallons after the second year , which shows a 5% increase in water savings from the first year to the second year after the program.

OVERALL LIFESPAN SAVINGS

The water savings over the entire 20-year lifespan of the **ORDINANCE** was 38,372.9 AF.

The water savings over the entire 5-year lifespan of the **SURCHARGE** program was 673.5 AF.

The water savings over the entire 5-year lifespan of the **CONSERVATION CLASSES** was 2.0 AF.

ECONOMIC ANALYSIS

COST PER ACRE FOOT SAVED

The cost to **Utility O-1** to save an acre foot of water with the ordinance was $2.

The cost to **Utility S-1** to save an acre foot of water with the surcharge program was $52.

The cost to **Utility C-1** to save an acre foot of water with the conservation classes was $513.

COST TO UTILITY AND OTHERS PER PARTICIPANT

The per-participant cost to **Utility O-1** was $4. The per-participant cost to **Utility S-1** was $193. The per-participant cost to Utility C-1 was $28.

COST TO PARTICIPANTS

The cost to the **ORDINANCE** participants was $0.12 per participant. The cost to the **SURCHARGE** participants was $351 per participant. The cost to the **CONSERVATION CLASS** participants was $0 per participant.

NET PRESENT VALUE

The Net Present Value to the utilities were -$89,288 for **Utility O-1**, $30,359 for **Utility S-1**, and -$1,027 for **Utility C-1**.

The Net Present Value to the participants were $34,217,013 for **Utility O-1**, $324,628 for **Utility S-1**, and $1,947 for **Utility C-1**.

The overall Net Present Value were $34,127,725 for **Utility O-1**, $354,987 for **Utility S-1**, and $920 for **Utility C-1**.

PROGRAM UTILITY	YEAR[1]	Program Participants	WATER SAVED OVERALL in AF		WATER SAVED PER PARTICIPANT in GAL		COST/AF OF WATER SAVED OVERALL in $$			COST OF WATER SAVED PER PARTICIPANT in $$		
			Ave/YR[2]	Lifespan[3]	Year 1 After	Year 2 After	Utility[4]	Other Funders	Total[5]	Utility	Other Funders	Total
AUDITS - SF				**5 year lifespan**								
A-1	1999	286	2.8	13.9	-1,228	7,542	$3,276	$0	$3,276	$159	$0	$159
A-1	2000	376	13.0	65.2	13,505	9,106	$873	$0	$873	$152	$0	$152
A-1	2001	379	24.1	120.6	18,820	22,638	$454	$0	$454	$145	$0	$145
A-1	All Years	1041	39.9	199.6	11,393	13,603	$787	$0	$787	$151	$0	$151
A-2	2003	56	6.3	31.4	*36,490	36,490	$101	$0	$101	$56	$0	$56
A-3	2002	95	2.5	12.4	10,355	9,129	$365	$0	$365	$55	$0	$55
A-4	1999	488	7.2	35.9	7,808	1,782	$1,307	$0	$1,307	$96	$0	$96
A-4	2000	294	2.8	13.9	4,255	1,916	$2,615	$0	$2,615	$124	$0	$124
A-4	2001	243	0.1	0.6	-4,152	4,482	$55,315	$0	$55,315	$140	$0	$140
A-4	All Years	1025	10.1	50.4	3,953	2,460	$2,327	$0	$2,327	$115	$0	$115
DEVICE GIVEAWAYS - SF				**5 year lifespan**								
D-1	1995	23	-0.5	-2.5	-9,320	-4,819	-$57	$0	-$57	$6	$0	$6
D-1	1996	13	0.5	2.3	9,229	4,954	$53	$0	$53	$6	$0	$6
D-1	1997	21	0.2	1.0	6,043	3,542	$73	$0	$73	$5	$0	$5
D-1	All Years	57	0.2	0.8	1,018	688	$447	$0	$447	$6	$0	$6
D-2	2000	154	-4.8	-23.8	-11,058	-9,054	-$4	-$25	-$29	$1	$4	$5
D-2	2001	141	-6.1	-30.4	-13,802	-14,341	-$3	-$17	-$20	$1	$4	$5
D-2	All Years	295	-10.8	-54.2	-12,369	-11,581	-$4	-$20	-$24	$1	$4	$5
D-3	1998	17	-0.5	-2.5	-7,554	-11,313	-$47	$0	-$47	$7	$6	$13
D-4	2002	37	0.3	1.6	*1,436	1,436	$45	$124	$169	$2	$5	$7
D-5	2003	127	0.1	0.7	*337	337	$4,059	$0	$4,059	$12	$0	$12

[1] Program year of analysis: the year the customer participated and that costs were incurred. Water savings was analyzed for two (2) years prior and two (2) years following the implementation.
[2] Average amount of water saved, per year, by the utility (if any), expressed in acre feet (AF) per year, for the two (2) years following the program.
[3] Predicted water savings over the lifespan of the program, based on the actual water savings the two (2) years following the program.
[4] Amount spent by the utility to save an AF of water, based on lifespan water savings.
[5] Amount spent by the utility and other funders to save an AF of water, based on the lifespan water savings.
* These annual savings were based on 18 months of data.

PROGRAM UTILITY	YEAR[1]	Program Participants	WATER SAVED OVERALL in AF		WATER SAVED PER PARTICIPANT in GAL		COST/AF OF WATER SAVED OVERALL in $$			COST OF WATER SAVED PER PARTICIPANT in $$		
			Ave/YR[2]	Lifespan[3]	Year 1 After	Year 2 After	Utility[4]	Other Funders	Total[5]	Utility	Other Funders	Total
WASHING MACHINE REBATES - SF												
				12 year lifespan								
W-1	2003	51	-14.1	-168.8	-75,798	-103,987	-$26	$0	-$26	$87	$205	$292
W-2	2002	261	-4.0	-47.5	-7,941	-1,940	-$184	-$541	-$725	$34	$98	$132
W-3	2002	222	6.6	79.6	11,242	8,219	$13	$329	$342	$5	$119	$124
W-4	2001	40	0.7	8.6	7,681	3,935	$0	$598	$598	$0	$128	$128
W-4	2002	71	1.6	19.7	4,338	10,711	$0	$556	$556	$0	$154	$154
W-4	All Years	111	2.4	28.2	5,542	8,270	$0	$569	$569	$0	$145	$145
W-5	2002	174	0.5	5.5	1,053	666	$2,519	$726	$3,245	$80	$23	$103
W-6	2002	130	2.8	33.2	8,465	5,386	$240	$0	$240	$61	$0	$61
W-7	2003	85	1.8	22.0	*7,026	7,026	$672	$0	$672	$161	$0	$161
WASHING MACHINE REPLACEMENT - COMMERCIAL												
				2 year lifespan								
WR-1	2003	N/A	0.3	0.7	N/A	N/A	$0	$0	$0	$0	$0	$0
LANDSCAPE CONVERSIONS - SF												
				10 year lifespan								
L-1	1997	104	4.5	45.0	11,387	16,777	$3,338	$0	$3,338	$1,442	$0	$1,442
L-1	1998	155	14.4	144.0	33,814	26,571	$1,127	$0	$1,127	$1,045	$0	$1,045
L-1	1999	192	21.2	212.1	39,665	32,327	$757	$0	$757	$836	$0	$836
L-1	2000	197	11.0	109.9	20,636	15,729	$1,378	$0	$1,378	$769	$0	$769
L-1	2001	287	12.0	119.8	15,300	11,910	$1,352	$0	$1,352	$565	$0	$565
L-1	All Years	935	63.0	630.4	24,161	19,879	$1,247	$0	$1,247	$841	$0	$841
L-2	2001	18	1.2	12.2	24,759	19,561	$314	$0	$314	$213	$0	$213
L-2	2002	22	1.9	18.9	37,670	18,240	$236	$0	$236	$202	$0	$202
L-2	All Years	40	3.1	31.1			$266	$0	$266	$207	$0	$207
L-3	2001	28	1.2	12.5	15,036	13,982	$288	$0	$288	$129	$0	$129

[1] Program year of analysis: the year the customer participated and that costs were incurred. Water savings was analyzed for two (2) years prior and two (2) years following the implementation.
[2] Average amount of water saved, per year, by the utility (if any), expressed in acre feet (AF) per year, for the two (2) years following the program.
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[4] Amount spent by the utility to save an AF of water, based on lifespan water savings.
[5] Amount spent by the utility and other funders to save an AF of water, based on the lifespan water savings.
* These annual savings were based on 18 months of data.

PROGRAM UTILITY	YEAR[1]	Program Participants	WATER SAVED OVERALL in AF		WATER SAVED PER PARTICIPANT in GAL		COST/AF OF WATER SAVED OVERALL in $$			COST OF WATER SAVED PER PARTICIPANT in $$		
			Ave/YR[2]	Lifespan[3]	Year 1 After	Year 2 After	Utility[4]	Other Funders	Total[5]	Utility	Other Funders	Total
TOILET REBATES - SF				**20 year lifespan**								
TR-1	2001	29	0.7	13.8	8,687	6,805	$661	$0	$661	$313	$0	$313
TR-2	2000	67	1.2	24.1	6,797	4,923	$314	$0	$314	$113	$0	$113
TR-2	2001	80	1.5	30.4	4,585	7,780	$278	$0	$278	$105	$0	$105
TR-2	All Years	147	2.7	54.5	5,593	6,478	$294	$0	$294	$109	$0	$109
TR-3	2002	73	2.4	48.3	12,504	9,033	$155	$0	$155	$103	$0	$103
TR-4	2001	71	0.4	7.4	4,143	-760	$926	$0	$926	$96	$0	$96
TR-5	2003	102	3.4	68.8	*10,995	10,995	$280	$0	$280	$178	$0	$178
TOILET DISTRIBUTIONS - SF				**20 year lifespan**								
TD-1	1997	264	45.6	911.2	23,352	89,116	$26	$25	$51	$95	$92	$187
TD-2	1998	196	16.4	327.4	30,418	24,020	$91	$78	$169	$152	$130	$282
TD-2	1999	222	3.8	75.4	5,491	5,573	$431	$371	$802	$147	$126	$273
TD-2	2000	194	12.6	252.2	19,510	22,854	$113	$92	$205	$147	$120	$267
TD-2	All Years	612	32.8	655.0	17,918	16,959	$139	$117	$256	$148	$125	$273
TD-3	1994	19	2.8	55.3	39,186	55,684	$153	$0	$153	$444	$0	$444
TD-3	1995	93	7.1	142.9	25,900	24,165	$273	$0	$273	$420	$0	$420
TD-3	1996	54	3.2	63.0	20,143	17,893	$340	$0	$340	$397	$0	$397
TD-3	1997	17	0.5	9.2	5,266	12,343	$695	$0	$695	$376	$0	$376
TD-3	1998	33	2.6	52.3	14,259	37,417	$224	$0	$224	$355	$0	$355
TD-3	1999	20	1.0	19.7	26,520	5,543	$341	$0	$341	$336	$0	$336
TD-3	2000	29	-0.6	-12.4	-11,078	-2,857	-$742	$0	-$742	$318	$0	$318
TD-3	2001	45	3.1	61.1	19,343	24,920	$221	$0	$221	$300	$0	$300
TD-3	All Years	310	19.6	391.2	18,968	22,147	$298	$0	$298	$376	$0	$376

[1] Program year of analysis: the year the customer participated and that costs were incurred. Water savings was analyzed for two (2) years prior and two (2) years following the implementation.
[2] Average amount of water saved, per year, by the utility (if any), expressed in acre feet (AF) per year, for the two (2) years following the program.
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PROGRAM UTILITY	YEAR[1]	Program Participants	WATER SAVED OVERALL in AF		WATER SAVED PER PARTICIPANT in GAL		COST/AF OF WATER SAVED OVERALL in $$			COST OF WATER SAVED PER PARTICIPANT in $$		
			Ave/YR[2]	Lifespan[3]	Year 1 After	Year 2 After	Utility[4]	Other Funders	Total[5]	Utility	Other Funders	Total
RATES - ALL CLASSES				**20 year lifespan**								
R-1	1997	ALL 3,650	-8.4	-168.7	-4,279	-6,394	$0	$0	$0	$0	$0	$0
R-2	2000	ALL 11,845	-63.7	-1,274.6	-852	-2,892	-$22	$0	-$22	$2	$0	$2
R-3	2003	ALL 21,300	139.6	2,791.3	4,482	-834	$1	$0	$1	$0	$0	$0
R-4	2001	ALL 20,156	293.2	5,864.7	9,755	9,182	$6	$0	$6	$2	$0	$2
R-5	2001	ALL 26,870	2,863.5	57,270.0	17,905	52,188	$0	$0	$0	$0	$0	$0
CONSERVATION ORDINANCE				**10 year lifespan**								
O-1	2003	ALL 21,525	3,837.3	38,372.9	59,854	64,562	$2	$0	$2	$4	$0	$4
SURCHARGE				**5 year lifespan**								
S-1	2001	96	65.6	327.9	300,224	144,990	$59	$0	$59	$200	$0	$200
S-1	2002	86	69.1	345.6	306,544	217,184	$46	$0	$46	$186	$0	$186
S-1	All Years	182	134.7	673.5	303,210	179,104	$52	$0	$52	$193	$0	$193
CLASSES				**5 year lifespan**								
C-1	2003	37	0.4	2.0	3,442	3,606	$513	$0	$513	$28	$0	$28

[1] Program year of analysis: the year the customer participated and that costs were incurred. Water savings was analyzed for two (2) years prior and two (2) years following the implementation.
[2] Average amount of water saved, per year, by the utility (if any), expressed in acre feet (AF) per year, for the two (2) years following the program.
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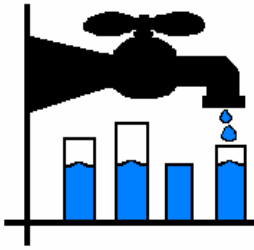
* These annual savings were based on 18 months of data.



INTERACTIVE CALCULATOR WORKSHEETS

WATER SAVINGS

The Interactive Calculator will work for one year of the program. If you want to analyze multiple years of your program, each must be analyzed separately.

Items that are shaded require input.

Necessary information:

- Participant average annual water use 2 years before through 2 years after the measure was implemented.
- Control group average annual water use 2 years before through 2 years after.
- Lifespan (from list or choose your own).
- Number of participants being analyzed.

	Number of Participants		Length of lifespan in years (from list page 65)

Participant average annual water use:		Control group average annual water use:	
	2 years before		2 years before
	1 year before		1 year before
	year of the program		year of the program
	1 year after		1 year after
	2 years after		2 years after

	Participant Average Pre-measure		Control Average Pre-measure
	Participant Average Post-measure		Control Average Post-measure

	Water savings 1 year after (%)
	Water savings 2 years after (%)
	Water savings per participant 1 year after (gallons)
	Water savings per participant 2 years after (gallons)
	Water savings 1 year after (gallons)
	Water savings 2 years after (gallons)
	Average water savings per year (gallons)
	Total water Savings over lifespan (gallons)

ECONOMIC ANALYSIS

The Interactive Calculator will work for one year of the program, if you want to analyze multiple years of your program, each must be analyzed separately.

Items that are shaded require input.

Necessary information:

- Discount rate (from list page 65).
- Rate of inflation (from list page 65).
- Cost for the year (exact cost for the number of participants included).
- Average water rates over time (per 1,000 gallons).

Costs:

Costs to the utility

Costs to participating customers

Costs to any other organizations (ex., funders)

Discount rate - % (from list page 65)

Average water rates (per 1,000 gallons)

Benefits:

Benefits to the utility

Benefits to participating customers (other than water bill)

Benefits to any other organizations

Current year CPI (from list page 65)

Base year CPI (year of the program)

Cost to the utility over lifespan

Cost to participating customers over lifespan

Cost to any other organizations over lifespan

Total costs

Net present value (NPV), utility perspective

Net present value (NPV), per AF saved, participant perspective

Net present value (NPV), overall perspective

Benefit to the utility over lifespan

Benefit to participating customers over lifespan

Benefit to any other organizations over lifespan

Total benefits

Cost per AF saved, utility perspective

Cost per AF saved, participant perspective

Cost per AF saved, overall perspective

OMB CIRCULAR A-94

5-January-2005

BUDGET ASSUMPTIONS Nominal Treasury Interest Rates

for Different Maturities (from the annual budget assumptions for the first year of the budget forecast)

Calendar Year	3-Year	5-Year	7-Year	10-Year	30-Year
1990	7.4	7.5	7.6	7.7	7.8
1991	7.2	7.4	7.4	7.5	7.7
1992	6.1	6.5	6.7	7.0	7.1
1993	5.6	6.0	6.3	6.7	6.8
1994	5.0	5.3	5.5	5.7	5.8
1995	7.3	7.6	7.7	7.9	8.1
1996	5.4	5.5	5.5	5.6	5.7
1997	5.8	5.9	6.0	6.1	6.3
1998	5.6	5.7	5.8	5.9	6.1
1999	4.7	4.8	4.9	4.9	5.0
2000	5.9	6.0	6.0	6.1	6.3
2001	5.4	5.4	5.4	5.4	5.3
2002	4.1	4.5	4.8	5.1	5.8
2003	3.1	3.6	3.9	4.2	5.1
2004	3.0	3.7	4.2	4.6	5.5
2005	3.7	4.1	4.4	4.6	5.2

CONSUMER PRICE INDICES

1990	130.7
1991	136.2
1992	140.3
1993	144.5
1994	148.2
1995	152.4
1996	156.9
1997	160.5
1998	163.0
1999	166.6
2000	172.2
2001	177.1
2002	179.9
2003	184.0
2004	188.9

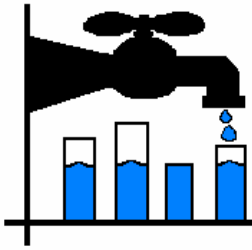
ECOBA LIFESPANS USED - IN YEARS

Audits	5
Device Giveaways	5
Washing Machine Rebates	12
Landscape Conversions	10
Toilet Programs	20
Rates	20
Ordinances	10
Surcharges	5
Classes	5

NOTES

AUDIT
CASE NARRATIVES

PAGES



Contra Costa Water District

Residential Audit Program

Contra Costa Water District (CCWD) is a retail and wholesale water provider serving communities in northern, central, and eastern Contra Costa County, CA. CCWD provides water directly to 230,000 people, and indirectly to another 220,000 people through other local utilities. As of the 2000 Census, the 1999 median household income in Contra Costa County was $63,675, which is higher than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

As of 2004, CCWD had 59,080 connections, 88.5% of which were residential. Of their total connections, 52,313 were single family residential, 2,482 were multifamily residential, 2,707 were commercial, 6 were industrial, 218 were institutional, 1,282 were irrigation, 72 were raw water customers. CCWD also provides wholesale water to the cities of Antioch, Bay Point (Cal Cities Water), Oakley (Diablo Water District), Pittsburg, and Martinez.

SINGLE FAMILY AUDIT PROGRAM	
Type of Program:	Audit
Indoor or Outdoor:	Both
Eligible Customers:	SF
Customers Analyzed:	SF
Program Years:	1991-present
Years Analyzed:	1999, 2000, 2001

CCWD's retail service area includes Concord, Clayton, Clyde, Pacheco, Port Costa, and parts of Martinez, Pleasant Hill, and Walnut Creek. The total service area is 214.26 square miles. The total amount of treated water use in 2004 was 38,314 acre-feet. Based on the estimated population of 230,000 people, the average per capita water use was 149 gallons per capita per day as of 2004.

UTILITY RATE STRUCTURE AND PRICES

CCWD has a uniform rate structure. The 2004 daily service demand charges are $0.55 per day ($16.50 per month) for 5/8" meters, which includes zero gallons of water. The charge per hundred cubic feet (ccf) of water is $2.16 per ccf ($2.89 per 1,000 gallons). There is also a variable energy surcharge, which ranges from $0.07 per ccf to $0.51 per ccf ($0.10 to $0.68 per 1,000 gallons), depending on the elevation of the customer's dwelling.

CURRENT CAPACITY AND WATER SOURCES

CCWD's primary source of water is its Central Valley Project (CVP) contract for 195,000 acre-feet per year. CCWD receives its water from the Sacramento-San Joaquin Delta. Water is pumped from the Delta into the Contra Costa Canal, where it is transported to the Bollman Water Treatment Plant and then into the distribution system. The plant is able to treat up to 75 million gallons of water per day.

[1] US Census Bureau. QuickFacts.

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FUTURE PLANS TO MEET DEMAND

The population within CCWD's service area grew by 37% between 1985 and 2001, during which time overall water use decreased by 3%. Water conservation, water transfers, and water reuse are the main components of the CCWD's future plans to meet demand.

OTHER CCWD CONSERVATION PROGRAMS

Public education, *1980–present*
Multifamily Indoor Audits, *1990-present*
Large Landscape Audits, *1990-present*
Showerhead/Aerator Replacement, *1990-present*
ICI Indoor Audits, *1991-present*
Toilet Replacement Program, *1994-present*
ICI Equipment & Irrigation Upgrade Rebates, *1994-present*
Green Business Program, *2000-present*
Large Landscape Water Budgets, *2000-present*
Washing Machine Rebates, *2001-present*
Pre-rinse Spray Nozzle Rebates, *2003-present*

AUDIT PROGRAM—DESCRIPTION

CCWD's Single Family Residential Audit Program is an indoor and outdoor audit program initiated in 1991. During the indoor portion of the survey, the surveyor checks for leaks, tests flow volumes, and provides any necessary devices. During the outdoor portion, the surveyor checks the irrigation system, conducts precipitation tests on stations, programs a monthly irrigation schedule into the controller, and teaches the customer how to operate the system.

The audit takes about 1 to 1½ hours. CCWD targets high summer water users for this program, however, about 30% of the audits performed are referrals from the Customer Service Department, and are not necessarily high water users.

The program has evolved significantly over time. From 1991 to 1994 the emphasis was on toilets and other indoor areas, with only a quick look outside. Between 1994 and 1999 the emphasis shifted to outdoor areas, and in 2000 the indoor component of the audit was reduced to 15 minutes and the landscape and irrigation became the focus of the survey. Marketing strategies were also changed in 2000 to more closely target high water using customers.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that were surveyed during the years 1999, 2000, and 2001. The water savings were calculated and a cost benefit analysis was performed for the years 1999, 2000, and 2001. The findings refer to these three years only, not to the ongoing program. The lifespan of the audits, which is used as the period of analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (1999) and inflated to 2004 dollars. The discount rate used in this analysis was 4.8%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1999 value of 166.6.

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286 usable participants out of 899 total participants in 1999, 376 out of 568 in 2000, and 379 out of 496 in 2001, for a total of 1,041 usable participants out of 1,963. Forty-seven percent, or 922, of the possible participants were unusable because they moved during the period of the analysis.

1999 audits: average water savings/year	**2.8AF**
2000 audits: average water savings/year	**13.0AF**
2001 audits: average water savings/year	**24.0AF**

The utility was able to refine its audit protocol, showing a marked increased in water savings and greater efficiency in use of their fiscal resources each successive year.

All CCWD single family residential households that were not participants in this analysis were used as the control group. However, the average pre-measure water use of the participants (174,895 gallons) was higher than that of the weighted annual pre-measure average of the control group (120,330 gallons). This is most likely due to the fact that the program was designed to target high-water using customers.

- For 1999 audits, the control group consisted of 50,087 households in 1997, 50,340 in 1998, 50,696 in 1999, 51,061 in 2000, and 51,249 in 2001.
- For 2000 audits, the control group consisted of 50,250 households in 1998, 50,606 in 1999, 50,971 in 2000, 51,159 in 2001, and 51,476 in 2002.
- For 2001 audits, the control group consisted of 50,603 households in 1999, 50,968 in 2000, 51,156 in 2001, 51,473 in 2002, and 51,829 in 2003.

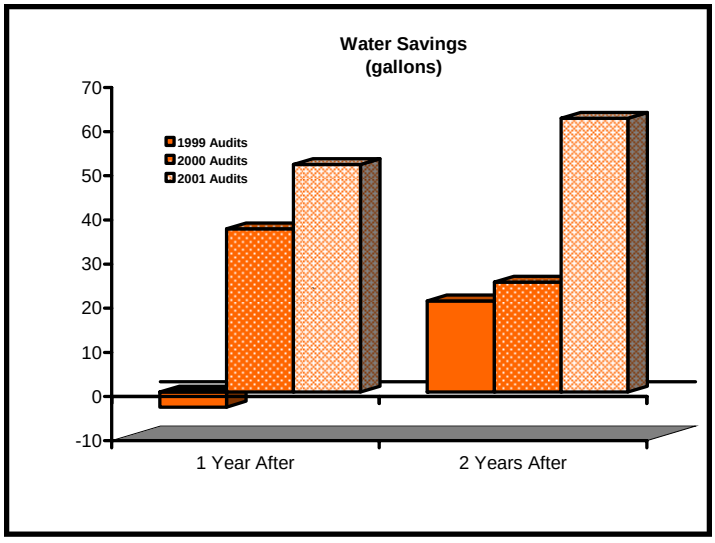
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of single family connections used in the analysis (to form the control group) is from December of the year in question.

The discount rate used in this analysis was 4.8%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1999 value of 166.6.



The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water. $2.63/1,000 gallons in 2000, $2.69/1,000 gallons in 2001, $2.75/1,000 gallons in 2002, $2.81/1,000 gallons in 2003, $2.89/1,000 gallons in 2004 and the balance of the lifespan.

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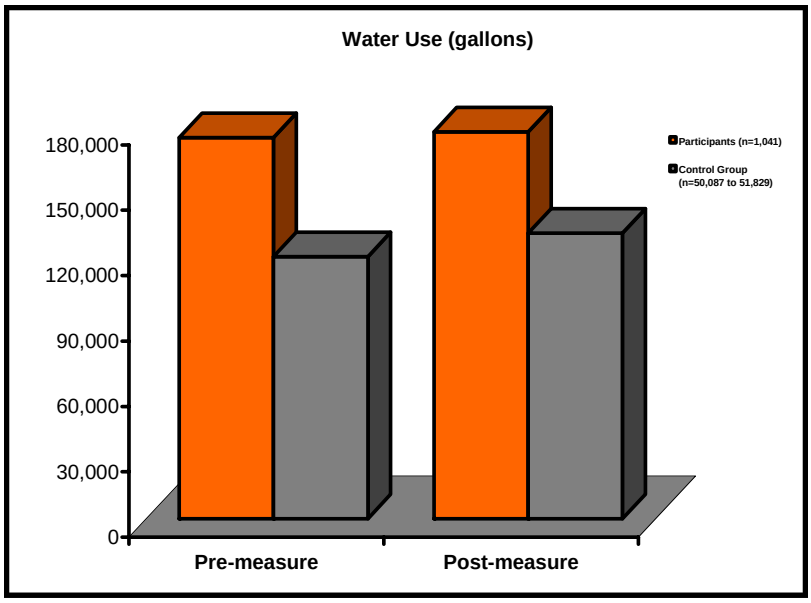
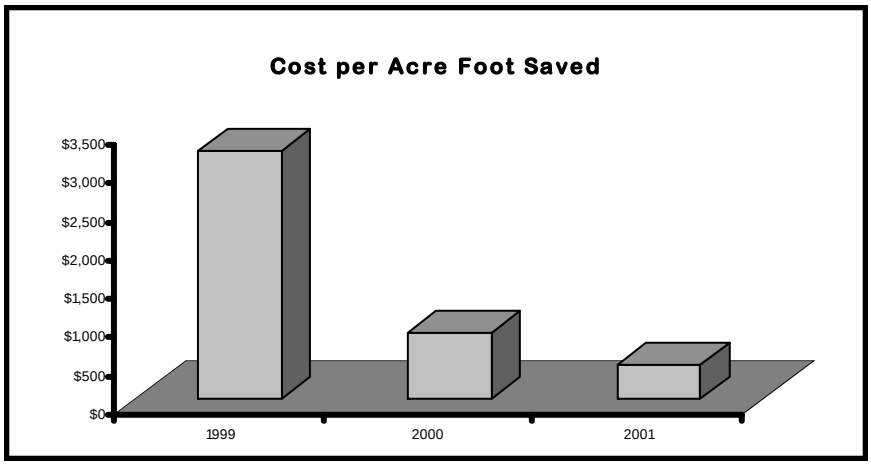
RESULTS—WATER SAVINGS

In the first year after the 1999 audits, no water savings occurred. There was an increase in participant water use, relative to control group water use, of 351,076 gallons, or 1,228 gallons per participant per year (gppy) (0.7% of pre-measure water use). The second year after the audits, the water savings was 2,157,103 gallons, or 7,542 gppy (4.3% of pre-measure water use). The average savings per year was 903,013 gallons (2.8 AF), or 3,157 gppy (1.8% of pre-measure water use).[2] The total savings over the five year assumed lifespan of the audits was 4,515,067 gallons (13.9 AF), or 15,787 gallons per participant.



The first year after the 2000 audits, water savings amounted to 5,077,989 gallons, or 13,505 gppy (8.8% of pre-measure water use). The second year, water savings was 3,423,908 gallons, or 9,106 gppy (5.9% of pre-measure water use). The average savings per year was 4,250,948 gallons (13.0 AF), or 11,306 gppy (7.4% of pre-measure water use). The total savings over the five year assumed lifespan was 21,254,742 gallons (65.2 AF), or 56,529 gallons per participant.

The first year after the 2001 audits, water savings amounted to 7,132,709 gallons, or 18,820 gppy (9.6% of pre-measure water use).



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[2] This value approximates the water savings per audit, but not perfectly. Of the 1,041 participants, 59 received more than one audit. Most of the successive audits were follow-up to the first.

The second year after, water savings amounted to 8,579,938 gallons, or 22,638 gppy (11.5% of pre-measure water use). The average savings per year was 7,856,323 gallons (24.1 AF), or 20,729 gppy (10.5% of pre-measure water use). The total savings over the five year assumed lifespan was 39,281,617 gallons (120.6 AF), or 103,645 gallons per participant.

Total water savings for the three years studied amounted to 11,859,622 gallons, or 11,393 gppy (6.5% of weighted pre-measure water use) during the first year after and 14,160,948 gallons, or 13,603 gppy (7.8% of weighted pre-measure water use) during the second year after the audits. **The total water savings over the five year assumed lifespan of the audits was 65,051,426 gallons (199.6 AF), or 62,489 gallons per participant.**

During the two years before participating in the audit program, participants' water use was 145.0% of the control group's use, on average. During the two years after participating in the audit program, their wateruse was 136.0% of the control group's use, on average. The participants' water use increased by 1.6% from pre-measure to post-measure, whereas the control group's use increased by 9.0%. **The resulting overall water savings attributed to this program was 7.4%.**

1999	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Materials	$6,846	Not Quantified		Not Quantified	Water Bill Savings	$12,839
Labor	$38,914					
Total	$45,400				Total	$12,839

RESULTS—COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

1999 AUDITS

- The quantified cost to the utility was $45,400, including materials ($6,486), and labor ($38,914). This translates to a cost of $159 per participant: $23 for materials, $136 for labor.
- The quantified benefit to the utility was $0.
  This is a benefit of $14 per participant.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $12,839.
  This includes water bill savings, $12,839.
  This is a benefit of $45 per participant.

UTILITY PERSPECTIVE - 1999

Results of the cost benefit analysis show a net benefit (net present value) of -$45,400 from the utility perspective. This is a net benefit of -$159 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $3,276.**

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PARTICIPANT PERSPECTIVE - 1999
Results of the cost benefit analysis show a net benefit (net present value) of $12,839 from the participant perspective. This is a net benefit of $45 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no costs to the participants.**

OVERALL PERSPECTIVE - 1999
Results of cost benefit analysis show a net benefit (net present value) of -$32,560 from an overall perspective. This is a net benefit of -$114 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $3,276.**

2000 AUDITS

- The quantified cost to the utility was $59,952. This includes the cost of materials, $8,136, and the cost of labor, $48,816. This is a cost of $152 per participant, including $22 for materials and $130 for labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $59,284. This includes water bill savings, $59,284. This is a benefit of $158 per participant.

2000		Quantified Costs and Benefits				
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Materials	$8,136	Not Quantified		Not Quantified	Water Bill Savings	$59,284
Labor	$48,816					
Total	$56,952				Total	$59,284

UTILITY PERSPECTIVE - 2000
Results of the cost benefit analysis show a net benefit (net present value) of -$59,952 from the utility perspective. This is a net benefit of -$151 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $873.**

PARTICIPANT PERSPECTIVE - 2000
Results of the cost benefit analysis show a net benefit (net present value) of $59,284 from the participant perspective. This is a net benefit of $158 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no costs to the participants.**

OVERALL PERSPECTIVE - 2000
Results of cost benefit analysis show a net benefit (net present value) of $2,332 from an overall perspective. This is a net benefit of $6 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per**

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2001 AUDITS

- The quantified cost to the utility was $54,777. This includes the cost of materials, $7,825, and the cost of labor, $46,952. This is a cost of $145 per participant, including $21 for materials and $124 for labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $105,744. This includes water bill savings, $105,744. This is a benefit of $279 per participant.

UTILITY PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$54,777 from the utility perspective. This is a net benefit of $145 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $454.**

PARTICIPANT PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of $105,744 from the participant perspective. This is a net benefit of $279 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no costs to the participants.**

OVERALL PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of $50,966 from an overall perspective. This is a net benefit of $134 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $454.**

2001	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Materials	$7,825	Not Quantified		Not Quantified	Water Bill Savings	$105,744
Labor	$46,952					
Total	$54,777				Total	$105,744

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ALL YEARS - COMBINED ANALYSIS

- The quantified cost to the utility was $157,129. This includes the cost of materials, $22,447, and the cost of labor, $134,682. This is a cost of $151 per participant, including $22 for materials and $129 for labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $177,805. This includes water bill savings, $177,805. This is a benefit of $171 per participant.

ALL YEARS	Quantified Costs and Benefits				
Utility				Participants	
Costs		Benefits		Costs	Benefits	
Materials	$22,447	Not Quantified		Not Quantified	Water Bill Savings	$177,805
Labor	$134,682					
Total	$157,129				Total	$177,805

UTILITY PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$157,129 from the utility perspective. This is a net benefit of -$151 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $787.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of $177,805 from the participant perspective. This is a net benefit of $171 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no costs to the participants.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Customers' time spent during the audit.**

Benefits

- **Financial savings on sewer bill for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness of the need to conserve water.**
- **Increased customer satisfaction with the utility.**
- **Reinforcing the need to conserve.**
- **Water saved for future utility use.**
- **Customers received new fixtures.**

OVERALL PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of $20,675 from the overall perspective. This is a net benefit of $20 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the overall perspective was $787.**

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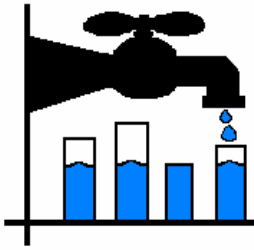

Contra Costa Water District

Residential Audit Program

Results of Cost Benefit Analysis-Lifespan (5 Years) 1999

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	45,400	NA	45,400
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$45,400	$0	$45,400
Present Value Benefits			
Total Water Savings	13.86 AF	13.86 AF	13.86 AF
Total Benefits to Utility	0	NA	0
Total Benefits to Participants	NA	12,839	12,839
Benefits to Others	NA	NA	0
Total Benefits	$0	$12,839	$12,839
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$45,400	$12,839	-$32,560
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$3,276 /AF		$3,276 /AF

Results of Cost Benefit Analysis-Lifespan (5 Years) 2000

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	56,952	NA	56,952
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$56,952	$0	$56,952
Present Value Benefits			
Total Water Savings	65.23 AF	65.23 AF	65.23 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	59,284	59,284
Benefits to Others	NA	NA	0
Total Benefits	$0	$59,284	$59,284
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$38,482	$59,284	$2,332
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$873 /AF		$873 /AF

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Contra Costa Water District

Residential Audit Program

2001

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	54,777	NA	54,777
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$54,777	$0	$54,777
Present Value Benefits			
Total Water Savings	120.55 AF	120.55 AF	120.55 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	105,744	105,744
Benefits to Others	NA	NA	0
Total Benefits	$0	$105,743	$105,744
Cost-Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$54,777	$105,743	$50,966
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$454 /AF		$454 /AF

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	157,129	NA	157,129
Costs to Customers	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$157,129	$0	$157,129
Present Value Benefits			
Total Water Savings	199.64 AF	199.64 AF	199.64 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	177,805	177,805
Benefits to Others	NA	NA	0
Total Benefits	$0	$177,805	$177,805
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$102,134	$177,805	$20,675
Cost Effectiveness Analysis (CEA)	$787 /AF		$787 /AF

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Oro Valley Water Utility

Audit Program

Oro Valley Water Utility (OVWU) serves the Town of Oro Valley, which is located in northern Pima County, six miles north of the Tucson city limits. Median household income in Oro Valley was $67,562[1] as of the 2000 census, which was higher than the statewide average of $40,558.

UTILITY DEMOGRAPHICS

OVWU provides service to an area of 31.5 square miles encompassing a population of approximately 32,000. As of November 2003, OVWU served 14,247 single family residential connections, 1,096 multifamily residential connections, 205 commercial, 292 industrial, 334 irrigation, and 55 other types of connections. As of 2004, the utility's total water use in gallons per capita per day (gpcd) was 200, and their residential use was 119 gpcd.

AUDIT PROGRAM

Indoor / Outdoor	**Both**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**March 2003 – present**
Years Analyzed:	**Jan – Dec 2003**

UTILITY RATE STRUCTURE AND PRICES

OVWU employs a tiered rate structure. Effective November 2003, the base rate for 5/8" meters, most of the utility's connections, is $12.30 and does not include any water. Single family residential usage charges are as follows:

Usage	Price
≤10,000 gallons per month	$1.92 per 1,000 gallons
10,001-25,000 gallons per month	$2.55 per 1,000 gallons
>25,000 gallons per month	$3.25 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

The storage capacity was not reported, however, OVWU has a 100 year assured water supply as required by law.

FUTURE PLANS TO MEET DEMAND

The population within OVWU's service area grew 7.2% per year, on average, between 2000 and 2004.[2] The utility plans to meet future demand with current capacity and sources, as well as by implementing water conservation measures and using reclaimed water. A new groundwater preservation fee is also in place. Starting August 2005, OVWU started using reclaimed water for some turf and golf courses, with plans to move all golf courses to reclaimed water use.

AUDIT PROGRAM - DESCRIPTION

OVWU's audit program is offered free to all of its customers. They provide indoor and outdoor water audits. OVWU advertises the program in newsletters, billings and on their website. Participation is upon

[1] U.S. Census Bureau, CenStats Databases.
[2] *Population Change – 2000 Census to July 1, 2004 Estimate for Arizona, Counties, and Incorporated Places*. Arizona Department of Economic Security.

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request of the customer, however staff are also trained to assist customers and recommend an audit where necessary. A checklist of questions is used to narrow down the focus of the audit.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes single family households that received audits between July and December 2003, and 14 who received audits in May and June 2003. The water savings were calculated and a cost benefit analysis was performed for July through December 2003. Our findings refer to this time period only, not to the ongoing program. The lifespan of the audits, which is used as the period of analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 3.6%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

OTHER ORO VALLEY WATER UTILITY CONSERVATION PROGRAMS

Conservation Ordinances, ***March 2003-present***
The OVWU and its commission have also developed a Water Conservation and Use Restriction Ordinance.

Device Giveaway, ***2000 -present***
Residential customers can request free showerheads and aerators.

Since two complete years of pre- and post-measure water use could not be acquired for this analysis, water use data for the participants was acquired from 18 months before the program and 18 months after the program for all households that were residing there for that full period. The pre-measure period includes January 2002 to June 2003, and the post-measure period includes January 2004 to June 2005.

The population studied for this analysis was comprised of all participants who received audits between May and December 2003. There were 56 usable participants out of a total 81 during the period under analysis. Of the 81 participants, 25 had moved or had incomplete consumption data for the period of analysis.

All OVWU single family residential households that were not participants in this analysis were used as the control group. The number of households in the control group varied, but ranged from 14,369 to 16,099. The average annual pre-measure water use of the participants (176,488 gallons) was higher than that of the control group (121,472 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The discount rate used in this analysis was 3.6%.

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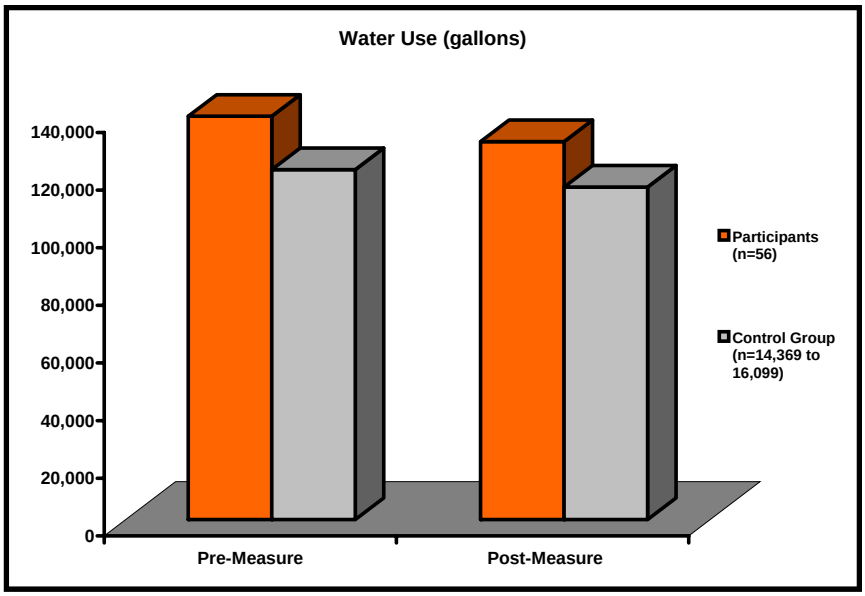
The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.
The price of water used in determining the benefits to customers from the first tier of utility's price of water ($1.92 per 1,000 gallons in 2004 and $1.98 per 1,000 gallons in 2005 and beyond).

Participants who had two or more consecutive months of no water use were not included in the study.

The cost was assumed to be $55 per audit.

RESULTS - WATER SAVINGS

In the 18 months after receiving the audits, the water savings amounted to 3,065,176 gallons, or 54,735 gallons per participant (20.7% of pre-measure water use). The average savings per year was 2,043,451 gallons, or 36,490 gallons per participant per year (gppy) (20.7% of pre-measure water use). **The total savings over the five year assumed lifespan was 10,217,254 gallons (31.4 AF), or 182,451 gallons per participant.**



During the 18 months before participating in the device giveaway program, the participant group's water use was, on average, 145.3% of the control group's use. During the 18 months after, the participant group's water use was 113.7% of the control group's use, on average. The participant group's water use decreased by 25.7%, whereas the control group's use decreased by 5.0%. **The resulting overall water savings attributed to this program was 20.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility was $3,162, which includes the cost of labor ($56 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $18,580 ($332 per participant). This benefit reflects participant water bills savings.

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Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$3,162	Not Quantified	Not Quantified	Water bill savings	$18,580
Total	$3162			Total	$18,580

UTILITY PERSPECTIVE
Results of the cost benefit analysis show a net benefit (net present value) of -$3,162 from the utility perspective over the five year assumed lifespan of the audits. This is a net benefit of -$56 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $101.**

PARTICIPANT PERSPECTIVE
Results of the cost benefit analysis show a net benefit (net present value) of $18,580 from the perspective of the participant. This is a net benefit of $332 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE
Results of the cost benefit analysis show a net benefit (net present value) of $15,418 from an overall perspective. This is a net benefit of $275 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $101.**

UNQUANTIFIED COSTS AND BENEFITS

Costs
- Customers' time spent during the audit.

Benefits
- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Reduced energy bills for participants.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Reinforces need to conserve water and desirability of conserving.
- Improved public relations for the utility.

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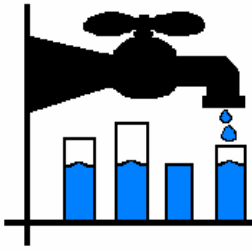

Oro Valley Water Utility
Audit Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	3,162	NA	3,162
Costs to Participants	NA	0	0
Costs to Others (Water CASA)	NA	NA	0
Total Costs	$3,162	$0	$3,162
Present Value Benefits			
Total Water Savings	31.36 AF	31.36 AF	31.36 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	18,580	18,580
Benefits to Others	NA	NA	0
Total Benefits	$0	$18,580	$18,580
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$3,162	18,580$	$15,418
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$101 /AF	$0 /AF	$101 /AF

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City of Peoria Utilities Dept.

Residential Audit Program

The City of Peoria Utilities Department (CPUD) serves the City of Peoria, northwest of Phoenix in Maricopa County, Arizona. As of the 2000 Census, median household income in the City of Peoria was $52,199, which is higher than the statewide median of $40,558.[1]

UTILITY DEMOGRAPHICS

As of 2004, the City of Peoria Utilities Department had approximately 37,700 connections. Of these connections, 35,522 were single family residential, 590 were multifamily residential, 1,285 were commercial, 320 were irrigation, and 41 were flood irrigation connections.

The City's total service area is 165 square miles. The population of this service area is approximately 125,600. As of 2004, the City of Peoria's gross water use was 7.4 billion gallons with a total utility water use of 188 gallons per capita per day (gpcd).[2]

SINGLE FAMILY AUDIT PROGRAM

Type of Program:	**Audit**
Indoor or Outdoor:	**Both**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**2002- present**
Years Analyzed:	**2002**

UTILITY RATE STRUCTURE AND PRICES

The City of Peoria uses a base rate that depends on the service line size. As of January 2004, the monthly base rate for residential customers with 5/8"-3/4" meters is $14.05, which includes 1,000 gallons of water. The volume charges are as follows:

Usage	Price
2,000 - 5,000 gallons	$1.48 per 1,000 gallons
6,000 - 10,000 gallons	$2.67 per 1,000 gallons
11,000 - 25,000 gallons	$3.21 per 1,000 gallons
26,000 + gallons	$3.82 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

As of 2004, the City of Peoria's water sources were comprised of Central Arizona Project (CAP) water, which originates from the Colorado River, local groundwater and Salt River Project (SRP) water, which comes from the Salt and Verde Rivers. Peoria has joined with the City of Glendale in their Pyramid Peak Water Treatment Plant, which treats Colorado River Water. Peoria operates its own Greenway Water Treatment Plant, which treats Salt and Verde River water.[3] The City's maximum production is 69 MGD. Peoria also recharges effluent produced at its Beardsley Road Water Reclamation Facility as well as CAP water at the Agua Fria and Hieroglyphics Recharge Projects. In addition, effluent produced at the Jomax Water Reclamation Facility is directly reused in decorative lakes and for landscape irrigation.

[1] U.S. Census Bureau: American Fact Finder.
[2] City of Peoria Utilities Department: Water Report 2005
[3] City of Peoria Utilities Department: Water Division Quick Facts

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FUTURE PLANS TO MEET DEMAND

In the future, the City will fully utilize its SRP and CAP supplies and may utilize the Central Arizona Groundwater Replenishment District (CAGRD) as a replenishment agent if needed. Peoria's other plans to meet future demands include expanding its use of recovered recharge and direct water reuse, doubling the capacity of its Greenway Water Treatment Plant from 16 MGD to 32 MGD, building an additional CAP water treatment plant, continuing their water conservation efforts, and purchasing additional water supplies.

OTHER PEORIA CONSERVATION PROGRAMS

Xeriscape/Landscape Conversion Rebates, *July2003-present*
Conservation Rates, *1990-present*
Leak Detection Service for Customers, *1997 -present*
Public Education, *1997-present*
Conservation Ordinances, *1998-present*

AUDIT PROGRAM - DESCRIPTION

Since 2002, the City of Peoria has offered an indoor/outdoor audit service to their customers. Upon request, a City employee will investigate leaks, meter accuracy, irrigation system function, and other water use as appropriate. The employee will make recommendations on reducing water use and provide conservation literature. The extent of the audit varies depending on the needs of the customer. The audits in this analysis are regular audits as described above.

In addition, assisted self-audits or partial regular audits are available for both indoor and outdoor water use. The city provides a Complete Guide to Home Water Management to customers who would like to perform a self-audit.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the audit program during 2002. The findings refer to this year only, not to the ongoing program. The lifespan of the audits, which is used as the period of this analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used in this analysis was 4.5%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of participants who received an audit during 2002. There were 83 usable participants out of a total of 208. Sixty percent, or 125, of the participants were unusable during this year because there was not complete water consumption data for all years of the analysis.

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All City of Peoria single family residential customers that were not participants in this analysis were used as the control group. Participant pre-measure water consumption was 165,416 gallons while control pre-measure water consumption was 130,049 gallons. For the audit program, the control group consisted of 32,038 households in 2000, 33,377 in 2001, 34,144 in 2002, 35,298 in 2003, and 37,832 in 2004.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of single family connections used in the analysis (to form the control group) is from December of the year in question.

Assumed $20/hour in labor at 2.5 hours per audit.

Participant pre-measure water use was 13,274 gallons. Therefore, they fall into the category of 11,000 – 25,000 gallons, with a price per 1,000 gallons of $3.38 in 2003 and $3.21 in 2004 and beyond.

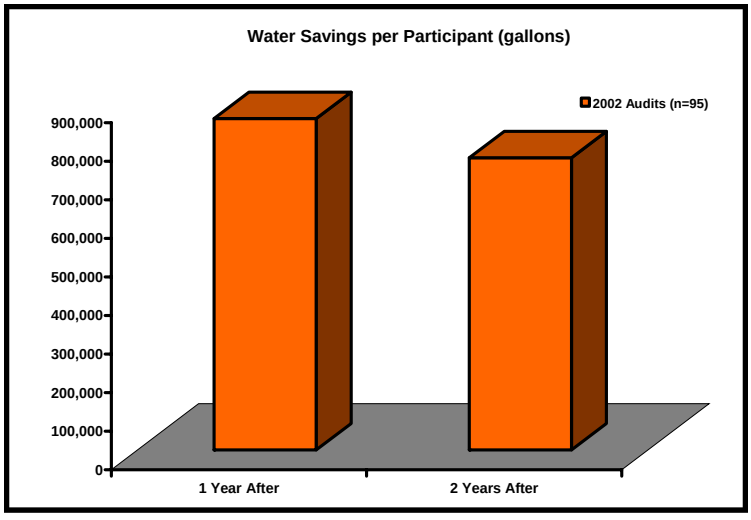
Participants who had two or more consecutive months of no water use were not included in the study.

The discount rate used in this analysis was 4.5%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

RESULTS - WATER SAVINGS

In the first year after the 2002 audit program, water savings amounted to 859,461 gallons, or 10,355 gallons per participant per year (gppy) (6.3% of pre-measure water use). The second year after the audit program, water savings amounted to 757,740 gallons or 9,129 gppy (5.5% of pre-measure water use). The average savings per year was 808,600 gallons (2.5 AF), or 9,742 gppy (5.9% of pre-measure water use). **The total savings over the five year assumed lifespan was 4,043,002 gallons (12.4 AF), or 48,711 gallons per participant.**



During the two years before participating in the audit program, participants' water use was 127% of the control group's use, on average. During the two years after participating in the program, their water use was 120% of the control group's use, on average. The participants' water use decreased by 9.1% from pre-measure to post-measure, whereas the control group's use decreased by 3.4%. **The resulting overall water savings attributed to this program was 5.7%.**

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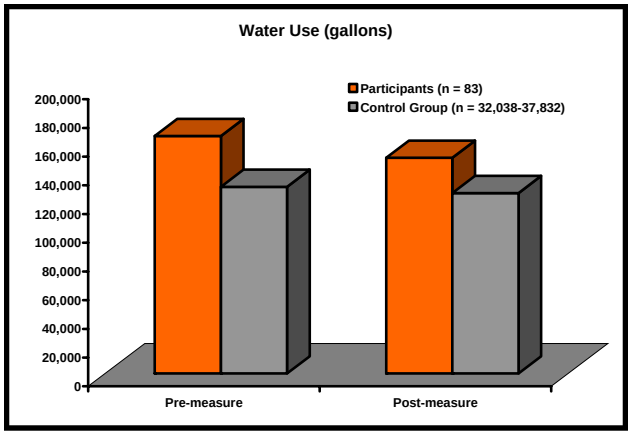
RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility was $4,532. This includes the cost of labor, $4,358, and materials, $174. This is a cost of about $55 per participant, with a cost of $53 per participant for labor and $2 for materials.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants due to water bill savings was $12,119. This is a benefit of $146 per participant.



UTILITY PERSPECTIVE

Results of the cost-benefit analysis show a net benefit (net present value) of -$4,532 from the utility perspective. This is a net benefit of -$55 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $365.**

PARTICIPANT PERSPECTIVE

Results of the cost-benefit analysis show a net benefit (net present value) of $12,119 from the participant perspective. This is a net benefit of $146 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of cost-benefit analysis show a net benefit (net present value) of $7,587 from an overall perspective. This is a net benefit of $91 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $365.**

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$4,358	Not Quantified	Not Quantified	Water Bill Savings	$12,119
Materials	$174				
Total	$4,532			Total	$12,119

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City of Peoria Utilities Dept.
Residential Audit Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	4,532	NA	4,532
Costs to Customers	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$4,532	$0	$4,532
Present Value Benefits			
Total Water Savings	12.41 AF	12.41 AF	12.41 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	12,119	12,119
Benefits to Others	NA	NA	0
Total Benefits	$0	$12,119	$12,119
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$4,532	$12,119	$7,587
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$365 /AF		$365 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs
- The customers' time spent with the auditor.

Benefits
- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Water saved for future municipal use.
- Improved public relations for the utility.
- Utility avoids the cost of developing new water sources.
- Utility avoids the costs of constructing new storage facilities.

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Tucson Water Dept.
Audit Program

The City of Tucson Water Department serves parts of the community of Tucson and some adjacent areas in Pima County, located in southern Arizona. Median household income in Tucson was $30,981 as of the 2000 Census.[1]

UTILITY DEMOGRAPHICS

As of 2003, the City of Tucson Water Department maintained an average of 205,000 connections. The total service area of the City of Tucson Water Department is 190 square miles. The population of this service area is 690,000. As of 2004, average customer water use in gallons per capita per day (gpcd) was 160.

The City of Tucson Water Department has 181,000 single family residential, 9,700 multifamily residential, 14,000 commercial, and 500 construction connections.

AUDIT PROGRAM

Indoor or Outdoor:	**Both**
Eligible Customers:	**SF, MF, ICI**
Customers Analyzed:	**SF**
Program Years:	**1996-present**
Years Analyzed:	**1999, 2000, 2001**

UTILITY RATE STRUCTURE AND PRICES

The City of Tucson Water Department uses a tiered rate structure. The monthly base rate for service is $5.35 for single family customers, which includes zero gallons of water. Single family residential usage charges are as follows:

Usage	Price
<16 ccf (<11,967 gal)	$1.03 per ccf ($1.38/1,000 gal)
16 - 30.99 ccf (11,968 - 23,187 gal)	$3.60 per ccf ($4.81/1,000 gal)
31 - 46 ccf (23,188 – 34,407 gal)	$5.05 per ccf ($6.75/1,000 gal)
>46 ccf (>34,408 gal)	$7.13 per ccf ($9.53/1,000 gal)

CURRENT CAPACITY AND WATER SOURCES

The City of Tucson Water Department has a storage capacity of 279 million gallons. They currently use groundwater and Central Arizona Project (CAP) water as their water sources, along with reclaimed water for non-potable uses.

FUTURE PLANS TO MEET DEMAND

In the future, the City of Tucson Water Department plans to more fully use CAP water, become more aggressive with conservation programs, expand effluent reclamation facilities, add, expand, or more fully utilize existing facilities, and possibly acquire more water resources through purchase.

AUDIT PROGRAM DESCRIPTION

The Zanjero Program is an audit program first initiated in 1996 and is continuing. During the audit, a City staff person reviews customers' indoor and outdoor water use. The staff person checks interior plumbing fixtures for leaks, and installs low flow showerheads and aerators for the customer. The staff person checks for irrigation leaks, reviews the setting of irrigation timers, and gives the customer tips on

[1] U.S. Census Bureau, American Fact Finder.

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plant irrigation. The customer is present at the time of the audit. The audit takes about one to one and one half hours, and is available to all residential and commercial customers. The audit process may vary slightly from customer to customer depending on the specific needs and questions of the customer.

OTHER CITY OF TUCSON CONSERVATION PROGRAMS
Conservation Rates: increasing block rate*, 1988-present*
Conservation Ordinances*, 1984-present, 1991-present*

The initial design of the program included marketing the program to high volume users by direct mailings. There was a low response with this method, so the program was opened to all customers in 1997. Appointments are now made through customer requests and referrals from Customer Service for customers calling in with high water bills.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the program during the years 1999 through 2001. The water savings were calculated and a cost benefit analysis was performed for the years 1999, 2000, and 2001. Our findings refer to these three years only, not to the ongoing program. The lifespan of the audits was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (1999) and inflated to 2004 dollars. The discount rate used in this analysis was 4.8%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1999 value of 166.6.

There were 488 usable participants out of 1,722 total in 1999, 294 out of 1,276 in 2000, and 243 out of 1,076 in 2001, for a total of 1,025 usable participants out of 4,074. Approximately 75 percent of the participants over these three years were unusable because insufficient data was available to perform the analysis.

All City of Tucson Water Department single family residential households were used as the control group in this analysis. The average annual pre-measure water use of the participants (171,887 gallons) was higher than that of the control group (112,465 gallons).

The exact number of households in the control group is unknown, as the utility provided average yearly single family residential water use for the years in question. As a result, the participant data could not be removed from the control group. Despite being unable to remove participants from the control sample, a significant difference in the average water use would be unlikely because the control group is so large (approximately 181,000 households).

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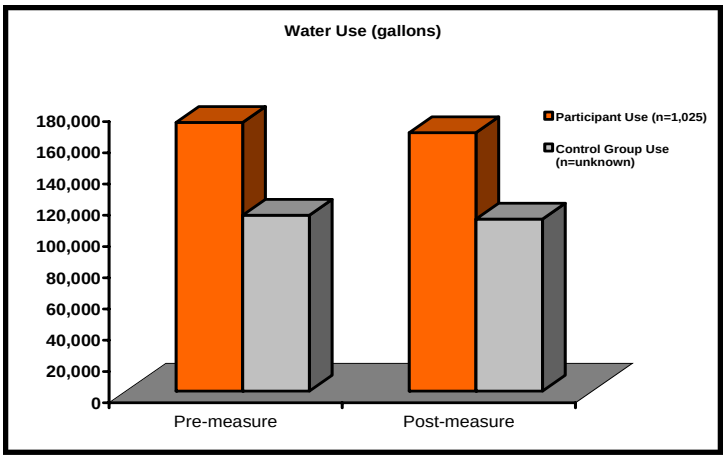
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The total cost for the program over the three year period of 1999 through 2001 was divided by three for a total cost for each of the three years.

The weighted average could not be used in determining control group pre- and post-measure average water use as the number of participants with which to weight these were not known. The average was used instead.



The utility saves $122 in variable costs for each AF of water saved.

The utility saves $200 in replenishment avoidance for each AF of water saved.

The value of the water saved was calculated by multiplying the amount of water saved by the price of water ($4.81 per 1,000 gallons) at the average level of use of the participants (falls into the second tier: 11,968 – 23,187 gallons per month).

Participants who had two or more consecutive months of no water use were included in the study.

The discount rate used in this analysis was 4.8%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1999 value of 166.6.

RESULTS - WATER SAVINGS

The first year after the 1999 Zanjero Program, the water savings amounted to 3,810,175 gallons, or 7,808 gppy (5.1% of pre-measure water use). The second year after, the water savings amounted to 869,591 gallons, or 1,782 gppy (1.2% of pre-measure water use). The average savings per year was 2,339,883 gallons, or 4,795 gppy (3.1% of pre-measure water use). **The total savings over the five year assumed lifespan was 11,699,415 gallons (35.9 AF), or 23,974 gallons per participant.**

The first year after the 2000 Zanjero Program, the water savings amounted to 1,251,063 gallons, or 4,255 gppy (2.5% of pre-measure water use). The second year after, the water savings amounted to 563,200 gallons, or 1,916 gppy (1.1% of pre-measure water use). The average savings per year was 907,131 gallons, or 3,085 gppy (1.8% of pre-measure water use). **The total savings over the five year assumed lifespan was 4,535,657 gallons (13.9 AF), or 15,427 gallons per participant.**

The first year after the 2001 Zanjero Program, no water savings

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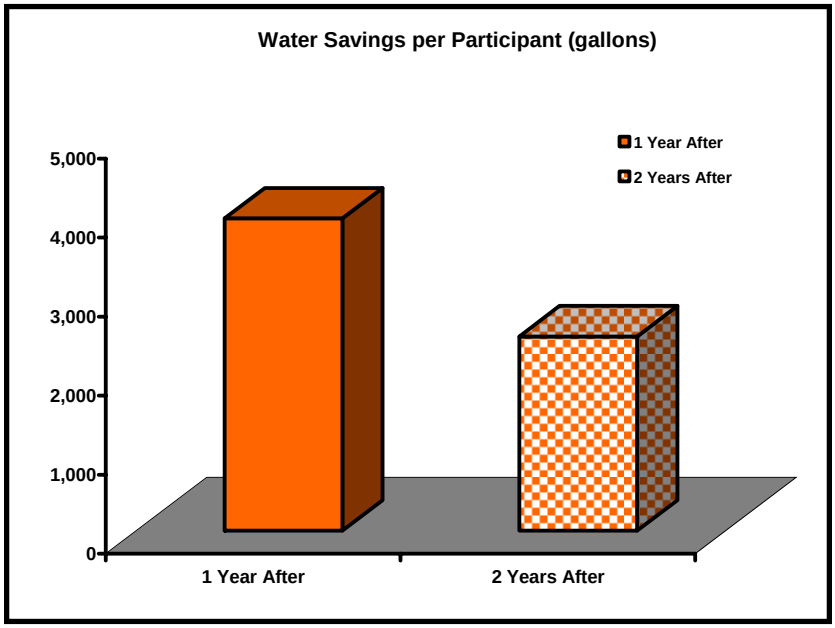
occurred. There was an increase in participant water use, relative to control group water use, of 1,008,906 gallons, or 4,152 gppy (2.4% of pre-measure water use). The second year after, the water savings amounted to 1,089,130 gallons, or 4,482 gppy (2.6% of pre-measure water use). The average savings per year was 40,112 gallons, or 165 gppy (0.1% of pre-measure water use). **The total savings over the five year assumed lifespan was 200,560 gallons (0.6 AF), or 825 gallons per participant.**



Total water savings for the three years studied was 4,052,332 gallons, or 3,953 gppy (2.3% of weighted pre-measure water use) during the first year after and 2,521,921 gallons, or 2,460 gppy (1.4% of weighted pre-measure water use) during the second year after. **The total savings over the five year assumed lifespan was 16,435,632 gallons (50.4 AF), or 16,035 gallons per participant.**

During the two years before participating in the audit program, the participant group's water use was, on average, 159.1% of the control group's use. During the two years after, the participant group's water use was 156.7% of the control group's use, on average. The participant group's water use decreased by 3.8%, whereas the control group's use decreased by 2.1%. **The resulting overall water savings attributed to this program was 1.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

1999 PROGRAM

- The quantified cost to the utility was $46,923 ($96 per participant). This cost includes capital expenditures and labor, $46,923.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $55,828 ($114 per participant). This benefit reflects participant water bill savings, $55,828.

UTILITY PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of -$46,923 from the utility perspective over the five year assumed

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1999	Quantified Costs and Benefits				
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Capital & Labor	$46,923	Not Quantified	Not Quantified	Water Bill Savings	$55,828
Total	$46,923			Total	$55,828

lifespan. This is a net benefit of -$96 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1,307.**

PARTICIPANT PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of $55,828 from the participant perspective over the five year assumed lifespan. This is a net benefit of $114 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of $8,905 from an overall perspective over the five year assumed lifespan. This is a net benefit of $18 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $1,307.**

2000 PROGRAM

- The quantified cost to the utility was $36,405 ($124 per participant). This cost includes capital expenditures and labor, $36,405.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $21,357 ($73 per participant). This benefit reflects participant water bill savings, $21,357.

UTILITY PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$36,405 from the utility perspective over the five year assumed lifespan. This is a net benefit of -$125 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $2,615.**

PARTICIPANT PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of $21,357 from the participant perspective over the five year assumed lifespan. This is a net benefit of $73 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$15,046 from an overall perspective over the five year assumed lifespan. This is a net benefit of -$51 per participant. The quantified

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costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $2,615.**

2001 PROGRAM

- The quantified cost to the utility was $34,046 ($140 per participant). This cost includes capital expenditures and labor, $34,046.

2000	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Capital & Labor	$36,405	Not Quantified		Not Quantified	Water Bill Savings	$21,357
Total	$36,405				Total	$21,357

- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $719 ($3 per participant). This benefit reflects participant water bill savings, $719.

UTILITY PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of -$34,046 from the utility perspective over the five year assumed lifespan. This is a net benefit of -$140 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility.

2001	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Capital & Labor	$34,046	Not Quantified		Not Quantified	Water Bill Savings	$719
Total	$34,046				Total	$719

The cost per acre-foot of water saved from the utility perspective was $55,315.

PARTICIPANT PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of $719 from the participant perspective over the five year assumed lifespan. This is a net benefit of $3 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of -$33,328 from an overall perspective over the five year assumed lifespan. This is a net benefit of -$137 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $55,315.**

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ALL YEARS

- The quantified cost to the utility was $117,373 ($115 per participant). This cost includes capital expenditures and labor, $117,373.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $84,974 ($83 per participant). This benefit reflects participant water bill savings, $84,974.

ALL YEARS		Quantified Costs and Benefits			
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Capital & Labor	$117,373	Not Quantified	Not Quantified	Water bill savings	$84,974
Total	$117,373			Total	$84,974

UTILITY PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$117,373 from the utility perspective over the five year assumed lifespan. This is a net benefit of -$115 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $2,327.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $84,974 from the participant perspective over the five year assumed lifespan. This is a net benefit of -$83 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$32,398 from an overall perspective over the five year assumed lifespan. This is a net benefit of -$32 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $2,327.**

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UNQUANTIFIED COSTS AND BENEFITS

Costs

- Landfill disposal of old devices.

Benefits

- Financial savings on sewer bills for participants.
- Avoided costs of acquisition and distribution of water saved.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Improved public relations for the utility.
- Reinforces need to conserve water and desirability of conserving.
- Participants received new water saving devices..

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Tucson Water Dept.
Audit Program

Results of Cost Benefit Analysis-Lifespan (5 Years) — **1999**

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	46,923	NA	46,923
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$46,923	$0	$46,923
Present Value Benefits			
Total Water Savings	35.90 AF	35.90 AF	35.90 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	55,828	55,828
Benefits to Others	NA	NA	0
Total Benefits	$0	$55,828	$55,828
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$46,923	$55,828	$8,905
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1,307 /AF	$0 /AF	$1,307 /AF

Results of Cost Benefit Analysis-Lifespan (5 Years) — **2000**

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	36,403	NA	36,403
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$36,403	$0	$36,403
Present Value Benefits			
Total Water Savings	13.92 AF	13.92 AF	13.92 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	21,357	21,357
Benefits to Others	NA	NA	0
Total Benefits	$0	$21,357	$21,357
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$36,403	$21,357	-$15,046
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$2,615 /AF	$0 /AF	$2,615 /AF

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Tucson Water Dept.
Audit Program

2001

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	34,046	NA	34,046
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$34,046	$0	$34,046
Present Value Benefits			
Total Water Savings	0.62 AF	0.62 AF	0.62 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	719	719
Benefits to Others	NA	NA	0
Total Benefits	$0	$719	$719
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$34,046	$719	-$33,328
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$55,315 /AF	$0 /AF	$55,315 /AF

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	117,373	NA	117,373
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$117,373	$0	$117,373
Present Value Benefits			
Total Water Savings	50.44 AF	50.44 AF	50.44 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	84,974	84,974
Benefits to Others	NA	NA	0
Total Benefits	$0	$84,974	$84,974
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$117,373	$84,974	-$32,398
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$2,327 /AF	$0 /AF	$2,327/AF

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DEVICE GIVEAWAY
CASE NARRATIVES

PAGES

Community Water of Green Valley
Device Giveaway Program

Community Water Company of Green Valley (CWCGV), a cooperative water utility, is one of five water utilities that serve the town of Green Valley located in the Santa Cruz Valley of Southern Arizona. As of 2003, the town's population was approximately 18,700.[1] The median household income as of the 2000 census was $40,213. [2]

UTILITY DEMOGRAPHICS

As of 2003, CWCGV had approximately 9,800 connections, 49.8% of which were residential. Of their total connections, 4,866 were single family residential, 4,672 were multifamily residential, 233 were commercial, 16 were government, and 11 were construction. CWCGV provides service to a population of 15,500 and currently maintains 10,817 connections. CWCGV's total service area is eight square miles. As of 2004, CWCGV's customer water use for the utility as a whole, in gallons per capita per day (gpcd), was 142.

DEVICE GIVEAWAY PROGRAM

Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**1992 to present**
Years Analyzed:	**1995, 1996, 1997**

UTILITY RATE STRUCTURE AND PRICES

CWCGV has a uniform price structure. The minimum monthly charge for 5/8" meters, which account for the majority of the utility's connections, is $12.50 and includes 2,000 gallons of water. Customers pay $1.07 for every 1,000 gallons over 2,000 gallons. This rate structure has been in place since 1987, with no subsequent rate increases.

CURRENT CAPACITY AND WATER SOURCES

CWCGV depends solely on groundwater and maintains and operates four wells. The company has a current storage capacity of five million gallons.

FUTURE PLANS TO MEET DEMAND

The population within CWCGV's service area is growing at 6% per year. CWCGV plans to meet future demand with current capacity and water sources, and by implementing water conservation measures. CWCGV, in conjunction with other utilities, is studying the possibility of using Central Arizona Project (CAP) water in Green Valley.

DEVICE GIVEAWAY PROGRAM - DESCRIPTION

In 1992, CWCGV began distributing free conservation packets with two low-flow showerheads, two faucet aerators, and one low-flow faucet fixture. The packets are primarily given to customers upon request. However, CWCGV also gives them away once per year at the local county fair. The conservation packet giveaway is an ongoing program.

[1] Arizona Department of Commerce: Green Valley Community Profile.
[2] U.S. Census Bureau: Profile of General Demographic Characteristics 2000.

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OTHER COMMUNITY WATER COMPANY CONSERVATION PROGRAMS

Public Education, ***continuous***
CWCGV has sponsored workshops on a variety of outdoor water conservation topics and publishes monthly water saving tips in the local newspaper.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received water conservation kits during the years 1995, 1996, and 1997. The water savings were calculated and a cost benefit analysis was performed for the years 1995, 1996, and 1997. The findings refer to these three years only, not to the ongoing program. The lifespan of the conservation devices, which is used as the period of analysis, was assumed to be five years.[3]

All quantified costs and benefits have been discounted to the first year of the analysis (1995) and inflated to 2004 dollars. The discount rate used in this analysis was 7.3%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1995 value of 152.4.

The population studied for this analysis was comprised of all participants who received a water conservation kit during 1995, 1996, and 1997. There were 23 usable participants out of 32 total in 1995, 21 out of 31 in 1996, and 13 out of 22 in 1997, for a total of 57 usable participants out of 85. Thirty-three percent, or 28, of the possible participants were unusable because they appear to have moved during the period of the analysis or there was insufficient raw data.

All CWCGV single family residential households that were not program participants and were from districts similar to the participants' were used as the control group in this analysis. There were a total of 25,039 single family residences in the control group, which includes 3,342 customers in 1993, 3,449 in 1994, 3,540 in 1995, 3,599 in 1996, 3,657 in 1997, 3,686 in 1998, and 3,766 in 1999. The average pre-measure annual water use of the participants (66,743 gallons) was lower than the weighted average pre-measure water use of the control group (72,166 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of connections is an average of connections from throughout the year.

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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The control group is comprised of single family residential households served by Community Water Company that are characteristically comparable to program participants (Districts 2, 4, 7, 12, 13, 16, 18, and 32).

The discount rate used in this analysis was 7.3%.

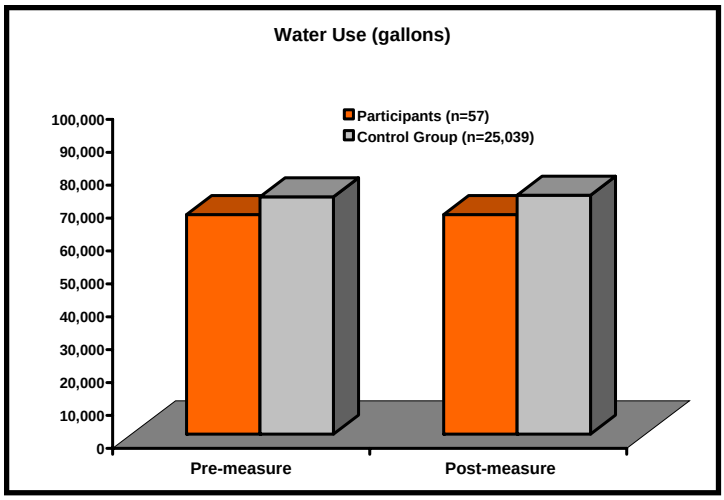
The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1995 value of 152.4.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water. $1.07 per 1,000 gallons was used throughout the analysis (including future years).

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the first year after the 1995 showerhead and faucet aerator giveaways, there was an increase in participant water use, relative to control group water use, of 214,355 gallons, or 9,320 gallons per participant per year (gppy) (14.2% of pre-measure water use). The second year after, there also was an increase in participant water use, relative to control group water use, of 110,832 gallons, or 4,819 gppy (7.3% of pre-measure water use). On average, relative water use increased by 162,594 gallons (0.5 AF), or 7,069 gppy (10.8% of pre-measure water use). **Over the five year assumed lifespan of the 1995 device giveaway, no water savings occurred; relative water use increased by 812,969 gallons (2.5 AF), or 35,346 gallons per participant.**



The first year after the 1996 showerhead and faucet aerator giveaways, the water savings was 193,801 gallons, or 9,229 gppy (12.1% of pre-measure water use). The second year after, the water savings was 104,031 gallons, or 4,954 gppy (6.5% of pre-measure water use). The average water savings per year was 148,916 gallons (0.46 AF), or 7,091 gppy (9.3% of pre-measure water use). **The total water savings over the five year assumed lifespan of the 1996 device giveaway was 744,579 gallons (2.3 AF), or 35,456 gallons per participant.**

The first year after the 1997 showerhead and faucet aerator giveaways, the water savings was 78,562 gallons, or 6,043 gppy (11.3% of pre-measure water use). The second year after, the water savings was 46,044 gallons, or 3,542 gppy (6.6% of pre-measure water use). The average water savings per year was 62,303 gallons (0.19 AF), or 4,793

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gppy (9.0% of pre-measure water use). **The total water savings over the five year assumed lifespan of the 1997 device giveaway was 311,515 gallons (1.0 AF), or 23,963 gallons per participant.**

Total water savings for the three years studied was 58,007 gallons, or 1,018 gppy (1.5% of weighted pre-measure water use) during the first year after and 39,243 gallons, or 688 gppy (1.0% of weighted pre-measure water use) during the second year after the device giveaway. **The total water savings over the five year assumed lifespan of the conservation devices was 243,125 gallons (0.75 AF), or 4,265 gallons per participant.**

During the two years before participating in the showerhead and faucet aerator giveaway program, participants' water use was 92.5% of the control group's use, on average. During the two years after participating in the program, their water use was 91.9% of the control group's use, on average. The participants' water use decreased by 0.1% from pre-measure to post-measure, whereas the control group's use increased by 0.6%. **The resulting overall water savings attributed to this program was 0.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

1995 DEVICE GIVEAWAY

- The quantified cost to the utility was $143. This includes the cost of conservation devices, $143. This is a cost of $6 per participant.
- The quantified cost to participants was $0.
- The quantified benefit to the utility was $0.
- The quantified benefit to the participants was -$881. This reflects the value of water bill savings, -$881. This is a benefit of -$38 per participant.

1995 Quantified Costs and Benefits					
Utility			**Participants**		
Costs		**Benefits**	**Costs**	**Benefits**	
Conserva-tion Devices	**$143**	**Not Quantified**	**Not Quantified**	**Conservation Devices**	**$0**
				Water Savings	**-$881**
Total	**$143**			**Total**	**-$881**

UTILITY PERSPECTIVE - 1995

Results of cost benefit analysis show a net benefit (net present value) of -$143 from the utility perspective. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was not calculated, as there were no water savings.**

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PARTICIPANT PERSPECTIVE - 1995

Results of cost benefit analysis show a net benefit (net present value) of -$881 from the participant perspective. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was not calculated, as there were no water savings and no quantified costs to the participants.**

OVERALL PERSPECTIVE - 1995

Results of cost benefit analysis show a net benefit (net present value) of -$1,024 from an overall perspective. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was not calculated, as there were no water savings.**

1996 DEVICE GIVEAWAY

- The quantified cost to the utility was $121. This includes the cost of conservation devices, $121. This is a cost of $6 per participant.
- The quantified cost to participants was $0.
- The quantified benefit to the utility was $0.
- The quantified benefit to the participants was $752. This reflects the value of water bill savings, $752. This is a benefit of $36 per participant.

1996 Quantified Costs and Benefits					
Utility				Participants	
Costs		Benefits		Costs	Benefits	
Conservation Devices	$121	Not Quantified		Not Quantified	Conservation Devices	$0
					Water Savings	$752
Total	$121				Total	$752

UTILITY PERSPECTIVE - 1996

Results of cost benefit analysis show a net benefit (net present value) of -$121 from the utility perspective. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $53.**

PARTICIPANT PERSPECTIVE - 1996

Results of cost benefit analysis show a net benefit (net present value) of $752 from the participant perspective. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there was no quantified cost to the participants.**

OVERALL PERSPECTIVE - 1996

Results of cost benefit analysis show a net benefit (net present value) of $631 from an overall perspective. The quantified costs to the participants and utility were less than the quantified benefits to the

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participants and utility. **The cost per acre-foot of water saved from the overall perspective was $53.**

1997 DEVICE GIVEAWAY

- The quantified cost to the utility was $70. This includes the cost of conservation devices, $70. This is a cost of $5 per participant.
- The quantified cost to participants was $0.
- The quantified benefit to the utility was $0.
- The quantified benefit to the participants was $293. This reflects the value of water bill savings, $293. This is a benefit of $23 per participant.

1997 Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Conservation Devices	$70	Not Quantified	Not Quantified	Conservation Devices	$0
				Water Savings	$293
Total	$70			Total	$293

UTILITY PERSPECTIVE - 1997

Results of cost benefit analysis show a net benefit (net present value) of -$70 from the utility perspective. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $73.**

PARTICIPANT PERSPECTIVE - 1997

Results of cost benefit analysis show a net benefit (net present value) of $293 from the participant perspective. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no costs to the participants.**

OVERALL PERSPECTIVE - 1997

Results of cost benefit analysis show a net benefit (net present value) of $223 from an overall perspective. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $73.**

ALL YEARS

- The quantified cost to the utility was $334. This includes the cost of conservation devices, $334. This is a cost of $6 per participant.
- The quantified cost to participants was $0.
- The quantified benefit to the utility was $0.
- The quantified benefit to the participants was $164. This reflects the value of water bill savings, $164. This is a benefit of $3 per participant.

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UTILITY PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$334 from the utility perspective. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $447.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $164 from the participant perspective. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0 as there were no quantified costs to the participants.**

ALL YEARS	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Conservation Devices	$334	Not Quantified		Not Quantified	Conservation Devices	$0
					Water Savings	$164
Total	$334				Total	$164

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$170 from an overall perspective. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $447.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Cost of participants installing the devices
- Cost to CWCGV of managing the program
- Landfill deposit of old devices

Benefits

- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Environmental benefits from reduced water use
- Increased public awareness about water conservation
- Increased energy savings from reduced hot water use
- Participants received new fixtures

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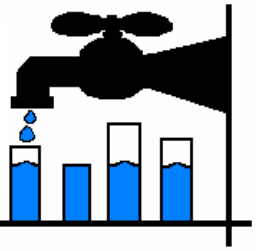
Community Water of Green Valley

Device Giveaway Program



1995

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	143	NA	143
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$143	$0	$143
Present Value Benefits			
Total Water Savings	-2.49 AF	-2.49 AF	-2.49 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-881	-881
Benefits to Others	NA	NA	0
Total Benefits	$0	-$881	-$881
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$143	-$881	-$1,024
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$57 /AF	0 /AF	-$57 /AF

1996

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	121	NA	121
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$121	$0	$121
Present Value Benefits			
Total Water Savings	2.29 AF	2.29 AF	2.29 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	752	752
Benefits to Others	NA	NA	0
Total Benefits	$0	$752	$752
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$121	$752	$631
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$53 /AF	$0 /AF	$53 /AF

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Community Water of Green Valley
Device Giveaway Program

Results of Cost Benefit Analysis-Lifespan (5 Years) **1997**

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	70	NA	70
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$70	$0	$70
Present Value Benefits			
Total Water Savings	0.96 AF	0.96 AF	0.96 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	293	293
Benefits to Others	NA	NA	0
Total Benefits	$0	$293	$293
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$70	$293	$223
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$73 AF	$0 /AF	$73 /AF

Results of Cost Benefit Analysis-Lifespan (5 Years) **ALL YEARS**

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	334	NA	334
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$334	$0	$334
Present Value Benefits			
Total Water Savings	0.75 AF	0.75 AF	0.75 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	164	164
Benefits to Others	NA	NA	0
Total Benefits	$0	$164	$164
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$334	$164	-$170
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$447 /AF	$0 /AF	$447 /AF

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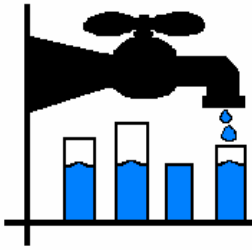

Flowing Wells Irrigation Dist.

Device Giveaway Program

Flowing Wells Irrigation District (FWID) is a municipality which serves an area just northeast of I-10 and Miracle Mile in Tucson, Arizona. Between 15,000 and 16,000 people reside in the area served by FWID. In general, the population served by the District tends towards single family residences, mobile home parks, apartment complexes, and light industrial use.

UTILITY DEMOGRAPHICS

FWID currently maintains approximately 3,294 connections. Residential customers account for 85.9% of total connections. The utility currently serves 2,498 single family residential users, 330 multi-family residential users, 403 commercial users and 63 industrial users. The service area encompasses an area of 5 square miles.

UTILITY RATE STRUCTURE AND PRICES

The monthly base rate varies according to meter size, and includes 1,000 gallons of water. Most residential connections have ¾ inch meters, with a base rate of $5.25 per month. The commodity rate is $1.08 for every 1,000 gallons in excess of the base amount regardless of meter size.

FWID also has a seasonal rate, effective May through October. Customers whose summer use exceeds their winter average plus 10% will be assessed a summer surcharge of $0.45 per 1,000 gallons in addition to the commodity rate. The winter use is calculated using November through April water use.

CONSERVATION DEVICE GIVEAWAY

Devices Distributed:	**Showerheads, faucet aerators, literature**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**2000-2003**
Years Analyzed:	**2000, 2001**

CURRENT CAPACITY AND WATER SOURCES

FWID's water source is groundwater. They have a maximum pumping capacity of 8 million gallons per day (mgd) and a storage capacity of 4.5 million gallons. Peak daily use is approximately 4.5 mgd.

FUTURE PLANS TO MEET DEMAND

FWID's service area is built-out, with a 0% population growth rate. The District plans to meet future demand within the service area by first utilizing its current capacity and water sources. They also plan to use their Central Arizona Project allocation (4,354 AF/year) for recharge.

DEVICE GIVEAWAY PROGRAM - DESCRIPTION

From October 2000 to October 2003, Flowing Wells Irrigation District distributed showerheads and faucet aerators as a part of its conservation program. During this device giveaway program, FWID distributed 200 conservation packets each year. The packets were

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distributed to single and multi-family residential users and contained one low-flow showerhead, one kitchen aerator, and two bathroom aerators as well as conservation literature from Water CASA. The packets were distributed door-to-door or given to property managers. It is unknown how many of the devices were installed.

OTHER FLOWING WELLS IRRIGATION DISTRICT CONSERVATION PROGRAMS

Conservation Rates/Surcharge Fees, *2001*
The surcharges are effective during the summer (May-October). Starting in November 2003, the District also began an annual rate increase based on the difference between the previous year's revenues and the upcoming year's expenses. All customers are affected by the rate increases and surcharge fees.

Indoor/Outdoor Audits, *2000-2003*
Each month a total of ten customers with the highest usage in their classification were selected to receive a contact letter and a water use questionnaire. Those customers who responded and requested, received a customized packet of water conservation information and a follow-up letter offering a free water audit of their home and property.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received conservation device packets during the years 2000 and 2001. The water savings were calculated and a cost benefit analysis was performed for the years 2000 and 2001. The findings refer to these two years only, not to the ongoing program. The lifespan of the conservation devices, which is used as the period of analysis, was assumed to be five years.[1]

All quantified costs and benefits have been discounted to the first year of the analysis (2000) and inflated to 2004 dollars. The discount rate used in this analysis was 6.0%. The CPI values that were used in this analysis were the 2004 value of 188.9, and the 2000 value of 172.2.

The population studied for this analysis was comprised of all participants who received conservation packets during 2000 and 2001. There were 154 usable participants out of 200 total participants in 2000, and 141 out of 200 in 2001, for a total of 295 usable participants out of 400. Twenty-six percent, or 105, of the possible participants were unusable because they moved during the period of analysis.

All FWID single family residential households that were not participants in this analysis were used as the control group. However, the weighted average pre-measure water use of the participants (142,654 gallons) was higher than the weighted average pre-measure use of the control group (134,858 gallons).

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[1] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

- For 2000 device giveaways, the control group consisted of 2,147 households in 1998, 2,150 in 1999, 2,154 in 2000, 2,166 in 2001 and 2,203 in 2002.

- For 2001 device giveaways, the control group consisted of 2,173 households in 1999, 2,180 in 2000, 2,192 in 2001, 2,229 in 2002, and 2,230 in 2003.

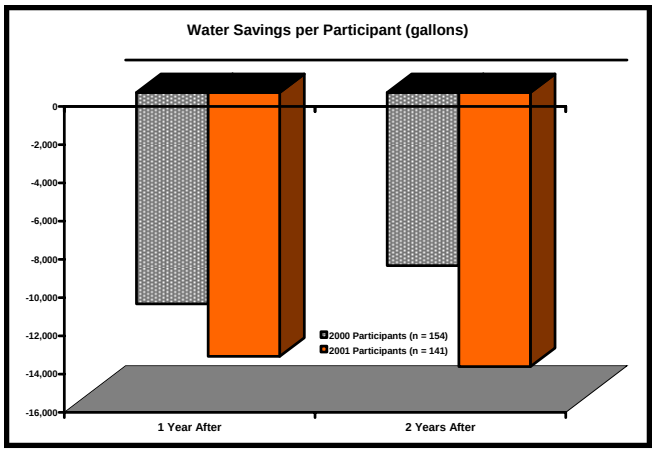
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of connections an average of connections from throughout the year.

The labor costs for the analysis were calculated assuming 6 hours of labor per year at $15/hour.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water at the participants' average level of consumption (11,888 gallons per month). The prices were $0.95 per 1,000 gallons in 2000 to 2002, $1.00 per 1,000 gallons in 2003, and $1.08 per 1,000 gallons in 2004 and on.



Participants who had two or more consecutive months of no water use were not included in the study.

The discount rate used in this analysis was 6.0%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2000 value of 172.2.

RESULTS - WATER SAVINGS

In the first year after the 2000 device giveaways, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 1,702,928 gallons, or 11,058 gallons per participant per year (gppy) (8.2% of pre-measure water use). The second year after the device giveaways, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 1,394,342 gallons, or 9,054 gppy (6.7% of pre-measure water use). On average, no water savings were documented; relative water use increased by 1,548,635 gallons (4.8 AF), or 10,056 gppy (7.5% of pre-measure water use). Over the five year assumed lifespan of the conservation devices, no water savings were documented; relative water use increased by 7,743,174 gallons (23.8 AF), or 50,280 gallons per participant.

The first year after the 2001 device giveaways, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 1,946,037 gallons or 13,802 gppy (9.1%

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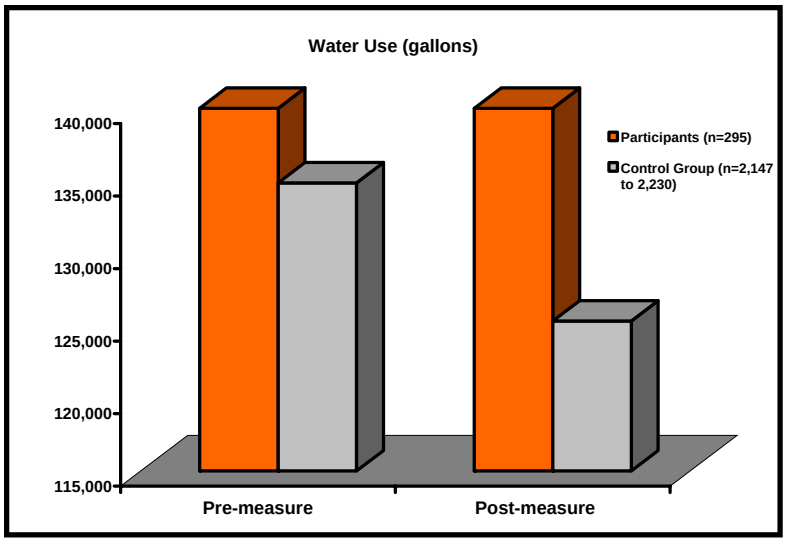
of pre-measure water use). The second year after the device giveaways, no water savings were documented. There was an increase in participant water use, relative to control group water use of 2,022,141 gallons or 14,341 gppy (9.5% of pre-measure water use). On average, no water savings were documented; relative water use increased by 1,984,089 gallons (6.1 AF) or 14,072 gppy (9.3% of pre-measure water use). Over the five year assumed lifespan, no water savings were documented; relative water use increased by 9,920,445 gallons (30.4 AF) or 70,358 gallons per participant.



No water savings were documented for the two years studied. There was an increase in participant water use, relative to control group water use, of 3,648,965 gallons, or 12,369 gppy (8.7% of weighted pre-measure water use) during the first year after and 3,416,483 gallons, or 11,581 gppy (8.1% of weighted pre-measure water use) during the second year after the device giveaways. The total increase in relative water use over the five year assumed lifespan of the conservation devices was 17,663,618 gallons (54.2 AF) or 59,877 gallons per participant.

During the two years before the device giveaway program, the participant group's water use was 105.8% of the control group's water use, on average. During the two years after the replacement program, the participant group's water use was 115.3% of the control group's water use, on average. The participant group's water use increased by 1.3% whereas the control group's water use decreased by 7.1%. **The resulting overall water savings attributed to this program was -8.4%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

2000 DEVICE GIVEAWAYS

- The quantified cost to the utility was $99. This includes the cost of labor, $99. The cost per participant was $0.64.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was -$7,218. This includes water bill savings, -7,218. This is a benefit of -$47 per participant.
- The quantified cost to others was $583. This includes the cost to Water CASA to provide the devices, $583. This is a cost of $4 per participant.
- The quantified benefit to others was $0.

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[2] The Water Conservation Alliance of Southern Arizona was a non-profit funding source, providing the Flowing Wells Irrigation District with conservation devices for distribution.

UTILITY PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$99 from the utility perspective. This is a net benefit of $0.64 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was not calculated, as there were no water savings.**

PARTICIPANT PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$7,218 from the participant perspective. This is a net benefit of -$47 per participant. The quantified costs to the participants were greater than the quantified benefits to the participant. **The cost per acre-foot of water saved from the participant perspective was not calculated as there were no water savings.**

2000 Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$99	Not Quantified	Not Quantified	Water Bill Savings	-$7,218
Total	$99			Total	-$7,218

2000 Quantified Costs and Benefits		
Water CASA		
Costs		Benefits
Conservation Devices	$583	Not Quantified
Total	$583	

OVERALL PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$7,900 from an overall perspective. This is a net benefit of -$51 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was not calculated as there were no water savings.**

2001 DEVICE GIVEAWAYS

- The quantified cost to the utility was $93. This includes the cost of labor, $93. The cost per participant was $0.66.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was -$9,480. This includes water bill savings, -$9,480. This is a benefit of -$67 per participant.
- The quantified cost to others was $503. This includes the cost to Water CASA to provide the devices, $503. This is a cost of $4 per participant.
- The quantified benefit to others was $0.

UTILITY PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of -$93 from the utility perspective. This is a net benefit of $0.66 per

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participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was not calculated as there were no water savings.**

PARTICIPANT PERSPECTIVE - 2001
Results of cost benefit analysis show a net benefit (net present value) of -$9,480 from the participant perspective. This is a net benefit of -$67 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was not calculated as there were no water savings.**

OVERALL PERSPECTIVE - 2001
Results of cost benefit analysis show a net benefit (net present value) of -$10,076 from an overall perspective. This is a net benefit of -$71 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was not calculated as there were no water savings.**

DEVICE GIVEAWAYS - BOTH YEARS

- The quantified cost to the utility was $192. This includes the cost of labor, $192. The cost per participant was $0.65.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was -$16,161. This includes water bill savings, -$16,161. This is a benefit of -$55 per participant.
- The quantified cost to others was $1,086. This includes the cost to Water CASA to provide the devices, $1,086. This is a cost of $4 per participant.
- The quantified benefit to others was $0.

2001 Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$93	Not Quantified	Not Quantified	Water Bill Savings	-$9,480
Total	$93			Total	-$9,480

2001 Quantified Costs and Benefits		
Water CASA		
Costs		Benefits
Conservation Devices	$503	Not Quantified
Total	$503	

UTILITY PERSPECTIVE - BOTH YEARS
Results of cost benefit analysis show a net benefit (net present value) of -$192 from the utility perspective. This is a net benefit of $0.65 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was not calculated as there were no water savings**.

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PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$16,161 from the participant perspective. This is a net benefit of -$55 per participant. The quantified costs to the participants were greater than the quantified benefits. **The cost per acre-foot of water saved from the utility perspective was not calculated as there were no water savings.**

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$192	Not Quantified	Not Quantified	Water Bill Savings	-$16,161
Total	$192			Total	-$16,161

Quantified Costs and Benefits		
Water CASA		
Costs		Benefits
Conservation Devices	$1,086	Not Quantified
Total	$1,086	

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$17,439 from an overall perspective. This is a net benefit of -$59 per participant. The quantified costs to the participants, utility, and non-profit funding sources were greater than the quantified benefits to the participants, utility, and non-profit funding sources. **The cost per acre-foot of water saved from the utility perspective was not calculated as there were no water savings.**

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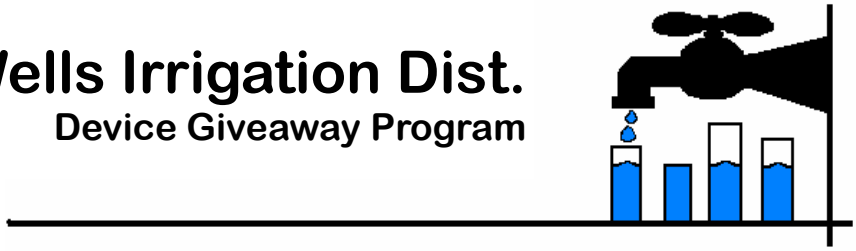
Flowing Wells Irrigation Dist.

Device Giveaway Program



2000

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	99	NA	99
Costs to Participants	NA	0	0
Costs to Others (Water CASA)	NA	NA	583
Total Costs	$99	$0	$682
Present Value Benefits			
Total Water Savings	-23.76 AF	-23.76 AF	-23.76 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-7,218	-7,218
Benefits to Others	NA	NA	0
Total Benefits	$0	-$7,218	-$7,218
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$99	-$7,218	-$7,900
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$4 /AF	$0 /AF	-$29 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Customer installation of device.**
- **Disposal of old devices.**
- **Environmental damage resulting from increased water use.**

Benefits

- **Financial savings on sewer bills to participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction with the utility.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Customers received new fixtures.**

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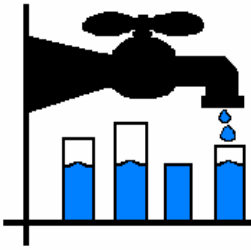

Flowing Wells Irrigation Dist.

Device Giveaway Program

2001

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	93	NA	93
Costs to Participants	NA	0	0
Costs to Others (Water CASA)	NA	NA	503
Total Costs	$93	$0	$596
Present Value Benefits			
Total Water Savings	-30.44 AF	-30.44 AF	-30.44 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-9,480	-9,480
Benefits to Others	NA	NA	0
Total Benefits	$0	-$9,480	-$9,480
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$93	-$9,480	-$10,076
Cost Effectiveness Analysis (CEA)) (Total Costs ÷ Total Water Savings)	-$3 /AF	$0 /AF	-$20 /AF

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	192	NA	192
Costs to Participants	NA	0	0
Costs to Others (Water CASA)	NA	NA	1,086
Total Costs	$192	$0.00	$1,278
Present Value Benefits			
Total Water Savings	-54.21 AF	-54.21 AF	-54.21 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-16,161	-16,161
Benefits to Others	NA	NA	0
Total Benefits	$0	-$16,161	-$16,161
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$192	-$16,161	-$17,439
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$4 /AF	$0 /AF	-$24 /AF

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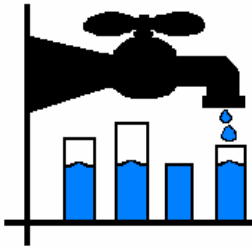

Town of Marana Water Dept.

Device Giveaway Program

The Town of Marana Municipal Water Department (Marana MWD) is located in Marana, Arizona, approximately 28 miles northwest of downtown Tucson in the Santa Cruz valley. Marana MWD serves a portion of the Town of Marana. The Town of Marana's population as increased an average of 18% per year since 2000, from a population of 13,556 in 2000 to 23,520 in 2004.[1] Median household income in Marana was $52,870 as of the 2000 census, which was higher than the statewide average of $40,558.[2]

UTILITY DEMOGRAPHICS

As of September 2004, Marana MWD maintained 2,542 connections of which 2,421 were single family residential, 14 were multifamily residential, 88 were commercial, and 19 were government. The total service area of the Marana MWD is approximately 70 square miles, which includes undeveloped areas that are currently not served but will be served by Marana MWD once developed. The total service area that is currently served is approximately 11 square miles, and the population of this service area is 7,067. As of 2004, average customer water use in gallons per capita per day (gpcd) was 123.

CONSERVATION DEVICE GIVEAWAY

Devices Distributed:	**Showerhead, tap saver, tap saver deluxe, and a toilet mizer**
Eligible Customers:	**SF, MF, ICI**
Customers Analyzed:	**SF**
Program Years:	**1998 – present**
Years Analyzed:	**May – Sep 1998**

UTILITY RATE STRUCTURE AND PRICES

The Town of Marana Water Department uses a uniform rate structure with a monthly minimum of $14.00 (includes first 1,000 gallons of water) and a commodity rate of $2.55 per 1,000 gallons for 5/8 inch meters.

CURRENT CAPACITY AND WATER SOURCES

Currently, the capacity of existing potable water sources within the Town of Marana can provide approximately 9.2 million gallons of water per day or 10,400 acre-feet of water per year. The current source of water for the Town of Marana is groundwater from the Lower Santa Cruz portion of the Tucson Basin aquifer, Central Arizona Project (CAP) water, and reclaimed water.[3]

FUTURE PLANS TO MEET DEMAND

The Town of Marana plans to meet future demand by using and expanding upon current sources, and through conservation. In addition, as agriculture is retired, irrigation wells for agriculture may be reconditioned and brought to potable standards.

[1] *Population Change – 2000 Census to July 1, 2004 Estimate for Arizona, Counties, and Incorporated Places*. Arizona Department of Economic Security.
[2] U.S. Census Bureau, American FactFinder.
[3] Marana General Plan, Water Resources Element.

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DEVICE GIVEAWAY PROGRAM - DESCRIPTION

In 1998, 115 packets of water-saving devices, including a showerhead, tap saver, tap saver deluxe, and a toilet mizer, were given to single family and multifamily residences, and businesses. Customers installed their own devices. The device giveaway program began in 1998 and has continued to the present. This analysis includes customers who received devices between May 5, 1998 and September 8, 1998.

OTHER MARANA CONSERVATION PROGRAMS

Conservation Rate Structure
Customer Service and Field Service Conservation Audits
Currently drafting an extensive array of Water Conservation Ordinances

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The water savings were calculated and a cost benefit analysis was performed for May 5 through September 8, 1998. Our findings refer to this time period only, not to the ongoing program. The lifespan of the devices, which is used as the period of analysis, was assumed to be five years.[4]

All quantified costs and benefits have been discounted to the first year of the analysis (1998) and inflated to 2004 dollars. The discount rate used in this analysis was 5.7%. The CPI values used in this analysis were the 2004 value of 188.9 and the 1998 value of 163.0.

There were at least 20 and no more than 115 participants during May 5 to September 8, 1998. At least three participants were not included because they moved during the period of analysis. There were 17 usable participants out of an unknown total number of participants for the time period under analysis.

All Town of Marana Municipal Water Department residential households, excluding the 17 participants included in the analysis, were used as the control group. The average yearly pre-measure water use of the participants (137,643 gallons) was lower than that of the control group (146,128 gallons). The control group includes 1,008 residences in 1997, 1,033 in 1998, 1,151 in 1999, and 1,176 in 2000.

This analysis differs from other analyses in this study in two ways. First, only July through December water use was collected and analyzed for each year. Second, instead of two years pre-measure water use data and two years post-measure water use data, there is 6 months pre-measure data (July to December, 1997) and one year post-measure data (July to December 1999 and July to December 2000).

[4] California Urban Water Conservation Council. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* Los Angeles, CA: Prepared by A&N Technical Services. September 1996.

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ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

Household water use during the months January through June is not significantly different, on average, from water use during the months July through December.

Assumed $75 in labor and $25 in materials for this program.

The number of connections is an average of connections from throughout the year.

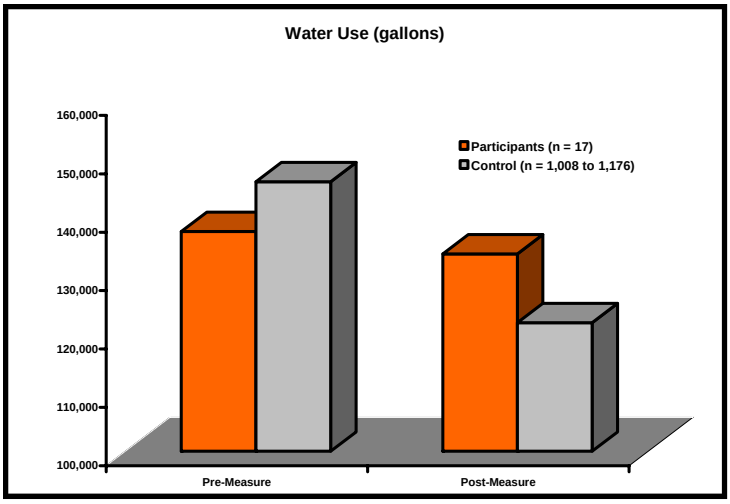
The control group is comprised of residential households other than those included in the study.

The discount rate used in this analysis was 5.7%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1998 value of 163.0.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water, $2.55 per 1,000 gallons.

Participants who had two or more consecutive months of no water use were included in the study.



RESULTS - WATER SAVINGS

In the first year after the 1998 showerhead and aerator giveaways, there was an increase in participant water use, relative to control group water use, of 128,424 gallons, or 7,554 gallons per participant per year (gppy) (11.0% of pre-measure water use). The second year after, there also was an increase in participant water use, relative to control group water use, of 192,323 gallons, or 11,313 gppy (16.4% of pre-measure water use). On average, relative water use increased by 160,373 gallons (0.5 AF), or 9,434 gppy (13.7% of pre-measure water use). **Over the five year assumed lifespan of the program, relative water use increased by 801,867 gallons (2.5 AF), or 47,169 gallons per participant.**

During the year before the giveaway, participant water use was 94.2% of the control group's use, and during the two years after the giveaway, their use was 109.7% of the control group's use. The participant group's water use decreased by 2.8%, whereas the control group's use decreased by 16.5%. **The resulting overall water savings attributed to this program was 13.7%.**

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RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility totaled $116 ($7 per participant). This includes the cost of materials, $29 ($2 per participant), and labor, $87 ($5 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was -$2,008 (-$118 per participant), which is the increase in their water bills.
- The quantified cost to others was $104 ($6 per participant). This was the cost to Water CASA for providing the devices.
- The quantified benefit to others was $0.

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Materials	$29	Not Quantified	Not Quantified	Water bill savings	-$2,008
Labor	$87				
Total	$116			Total	-$2,008

Quantified Costs and Benefits		
Water CASA		
Costs		Benefits
Conservation Devices	$104	Not Quantified
Total	$104	

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) from the utility perspective of -$116 over the five year assumed lifespan of the devices. This is a net benefit of -$7 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was -$47.**

PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) from the participant perspective of -$4,016 over the five year assumed lifespan of the devices. This is a net benefit of -$236 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0**.

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$4,236 from an overall perspective over the five year assumed lifespan of the devices. This is a net benefit of -$249 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was -$89.**

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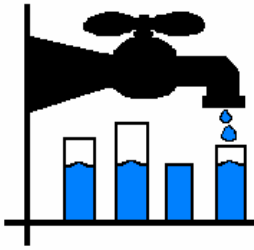

Town of Marana Water Dept.

Device Giveaway Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	116	NA	116
Costs to Customers	NA	0	0
Costs to Others (Water CASA)	NA	NA	104
Total Costs	$116	$0	$220
Present Value Benefits			
Total Water Savings	-2.5 AF	-2.5 AF	-2.5 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	-2,008	-2,008
Benefits to Others (Water CASA)	NA	NA	0
Total Benefits	$0	-$2,008	-$2,008
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$116	-$2,008	-$2,228
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$47 /AF	$0 /AF	-$89 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Customer time spent installing the devices.
- Environmental damage resulting from increased use of water.
- Disposal of old devices.

Benefits

- Increased public awareness about water conservation.
- Avoided cost of acquisition and distribution of water saved.
- Increased customer satisfaction with the utility.
- Reinforces need to conserve water and desirability of conserving.
- Customers received new fixtures.

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Oro Valley Water Utility

Device Giveaway Program

Oro Valley Water Utility (OVWU) serves the Town of Oro Valley, which is located in northern Pima County, six miles north of the Tucson city limits. Median household income in Oro Valley was $67,562[1] as of the 2000 census, which was higher than the statewide average of $40,558.

UTILITY DEMOGRAPHICS

OVWU provides service to an area of 31.5 square miles encompassing a population of approximately 32,000. As of November 2003, OVWU served 14,247 single family residential connections, 1,096 multifamily residential connections, 205 commercial, 292 industrial, 334 irrigation, and 55 other types of connections. As of 2004, the utility's total water use in gallons per capita per day (gpcd) was 200, and their residential use was 119 gpcd.

DEVICE GIVEAWAY PROGRAM

Devices Distributed:	**Showerheads, faucet aerators**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**2000 – present**
Years Analyzed:	**Jan – June 2002**

UTILITY RATE STRUCTURE AND PRICES

OVWU employs a tiered rate structure. Effective November 2003, the base rate for 5/8" meters, most of the utility's connections, is $12.30 and does not include any water. Single family residential usage charges are as follows:

Usage	Price
≤10,000 gallons per month	$1.92 per 1,000 gallons
10,001-25,000 gallons per month	$2.55 per 1,000 gallons
>25,000 gallons per month	$3.25 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

The storage capacity was not reported, however, OVWU has a 100 year assured water supply as required by law.

FUTURE PLANS TO MEET DEMAND

The population within OVWU's service area grew 7.2% per year, on average, between 2000 and 2004.[2] The utility plans to meet future demand with current capacity and sources, as well as by implementing water conservation measures and using reclaimed water. A new groundwater preservation fee is also in place. Starting August 2005, OVWU started using reclaimed water for some turf and golf courses, with plans to move all golf courses to reclaimed water use.

[1] U.S. Census Bureau, CenStats Databases.
[2] *Population Change – 2000 Census to July 1, 2004 Estimate for Arizona, Counties, and Incorporated Places*. Arizona Department of Economic Security.

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DEVICE GIVEAWAY PROGRAM - DESCRIPTION

In October 2000, OVWU began giving away free showerheads and aerators to residential customers both by request and at the Greater Oro Valley Arts Council Art & Jazz Festivals. The program is also mentioned occasionally in the OVWU newsletter.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received devices between January and June 2002. The water savings were calculated and a cost benefit analysis was performed for January to June 2002. Our findings refer to this time period only, not to the ongoing program. The lifespan of the devices, which is used as the period of analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used in this analysis was 4.5%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

Since two complete years of pre- and post-measure water use could not be acquired for this analysis, water use data for the participants was acquired from 18 months before the program and 18 months after the program for all households that were residing there for that full period. The pre-measure period includes July 2000 to December 2001, and the post-measure period includes July 2002 to December 2003.

OTHER ORO VALLEY CONSERVATION PROGRAMS

Water Audits, *March 2003-present*
OVWU conducts single family outdoor water audits. The audits are free and the program is aimed at high-usage customers.

Conservation Ordinances, *March 2003-present*
The OVWU and its commission have also developed a Water Conservation and Use Restriction Ordinance.

The population studied for this analysis was comprised of all participants who received the devices between January and June 2002. There were 37 usable participants out of an unknown total during the six month period under analysis.

All OVWU single family residential households that were not participants in this analysis were used as the control group. The number of households in the control group was 12,572 for July to December 2000, 13,140 for January to December 2001, 13,729 for July to December 2002, and 14,063 for January to December 2003. The average yearly pre-measure water use of the participants (111,362 gallons) was lower than that of the control group (116,842 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

Assumed $20 per year in labor and $60 per year in advertising for this program.

The number of connections is an average of connections from throughout the year.

The control group is comprised of single family residential households other than those included in the study.

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Advertising	$63	Not Quantified	Not Quantified	Water bill savings	$938
Labor	$10				
Total	$275			Total	$938

The discount rate used in this analysis was 4.5%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9

Quantified Costs and Benefits		
Water CASA		
Costs		Benefits
Conservation Devices	$202	Not Quantified
Total	$202	

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water at the level of consumption of the participants. Since the average monthly water use of the participants was below 10,000 gallons, the price of $1.90 per 1,000 gallons was used for 2003 and $1.92 per 1,000 gallons was used for 2004 and beyond.

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the 18 months after receiving the devices, the water savings amounted to 159,396 gallons, or 4,308 gallons per participant[3] (2.6% of pre-measure water use). The average savings per year was 106,264 gallons, or 1,436 gallons per participant per year (gppy) (2.6%). **The total savings over the five year assumed lifespan was 531,321 gallons (1.6 AF), or 14,360 gallons per participant.**

During the 18 months before participating in the device giveaway program, the participant group's water use was, on average, 95.3% of the control group's use. During the 18 months after, the participant group's water use was 93.0% of the control group's use, on average. The participant group's water use increased by 5.5%, whereas the

[3] This value approximates the water savings per packet of devices, as each customer received only one packet.

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control group's use increased by 8.1%. **The resulting overall water savings attributed to this program was 2.6%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility was $74. This cost includes the cost of advertising, $63, and labor (assembling the newsletter advertisement), $11. This is a cost of $2 per participant, including $1.70 for advertising and $0.30 for labor.
- The quantified cost to the participants was $0.
- The quantified cost to others was $202 ($5 per participant). This was the cost to Water CASA for providing the devices.
- The quantified benefit to others was $0.

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$73 from the utility perspective over the five year assumed lifespan of the devices. This is a net benefit of -$2 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $45.**

PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $938 from the perspective of the participant. This is a net benefit of $25 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $663 from an overall perspective. This is a net benefit of $18 per participant. The quantified costs to the participants, utility, and others were less than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from the overall perspective was $169.**

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Oro Valley Water Utility
Device Giveaway Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	74	NA	74
Costs to Participants	NA	0	0
Costs to Others (Water CASA)	NA	NA	202
Total Costs	$74	$0	$275
Present Value Benefits			
Total Water Savings	1.63 AF	1.63 AF	1.63 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	938	938
Benefits to Others	NA	NA	0
Total Benefits	$0	$938	$938
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$74	$938	$663
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$45 /AF	$0 /AF	$169 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs
- Cost of installing new devices.
- Landfill disposal of old devices.

Benefits
- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Reduced energy bills for participants.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Reinforces need to conserve water and desirability of conserving.
- Improved public relations for the utility.
- Participants received new water-saving devices.

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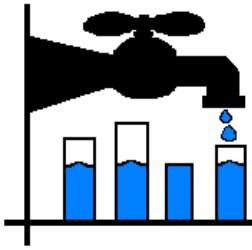

Thornton Water Res. Div.

Showerhead Exchange Program

The City of Thornton Water Resources Division (TWRD) is located in Thornton, Colorado, approximately 10 miles north of downtown Denver. As of March 31, 2005, the population served by TWRD was 127,832, where 111,002 reside inside the city and 16,830 reside outside the city. Median household income was $54,445 as of the 2000 census, which was higher than the statewide average of $47,203.[1]

UTILITY DEMOGRAPHICS

As of May 2005, TWRD maintained 34,259 connections of which 94.3% were residential. Of their total connections, 30,377 were single family residential, 1,937 were multifamily residential, 628 were ICI, and 1,317 were irrigation accounts, including city parks. In addition to providing water to individual retail customers, TWRD provides 2.0 million gallons per day (mgd) of treated water to the City of Westminster. TWRD's total service area is 19 square miles. As of 2004, average customer water use in gallons per capita per day (gpcd) was 142 for all customers and 129 for residential customers.

SHOWERHEAD EXCHANGE

Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**2003 – present**
Years Analyzed:	**2003**

UTILITY RATE STRUCTURE AND PRICES

As of 2004, the domestic inside-city monthly service charge is $2.46 for a 5/8 x 3/4 inch meter and the outside-city charge is $3.69 per month. TWRD has an increasing block rate structure. The four-tier structure categorizes rates by determining how much a customer uses relative to their Average Winter Consumption (AWC) and their Monthly Outdoor Allowance (MOA)

Usage	Price	
	INSIDE CITY	**OUTSIDE CITY**
0 gallons - AWC	$3.00/1,000g	$4.50/1,000g
> AWC, up to AWC + MOA	$3.00/1,000g	$4.50/1,000g
> AWC + MOA, up to AWC + 2xMOA	$4.50/1,000g	$6.75/1,000g
> AWC + 2xMOA	$9.00/1,000g	$13.50/1,000g

CURRENT CAPACITY AND WATER SOURCES

Currently, the capacity of existing raw water storage from reservoirs is 26,594 acre-feet. Their treated water storage capacity is 27 mgd. TWRD has two water treatment plants that have a combined capacity of 65 mgd. TWRD's primary water sources are Clear Creek and the South Platte River.

FUTURE PLANS TO MEET DEMAND

The City of Thornton's growth rate has decreased from 5.0% in 2002 to 3.8% in 2004. The city's plans to meet future demand through a number of different actions. They plan to continue use of current

[1] U.S. Census Bureau, American FactFinder.

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capacity and sources, implement a planned surface water supply project from the Cache la Poudre River basin, expand storage and treatment facilities, continue conservation efforts, purchase and exchange additional water rights, and develop water reuse projects.

SHOWERHEAD EXCHANGE - DESCRIPTION

On May 17, 2003, the Showerhead Exchange Program began, which offers Niagara 2.0 gallon per minute (gpm) showerheads to single family customers whose homes were built before 1994. Customers are allowed to exchange up to two showerheads. The program is advertised in billing inserts, on TWRD's website, on television ads, at festivals, and in TWRD's quarterly magazine.

OTHER THORNTON CONSERVATION PROGRAMS
Toilet Rebates, ***May 1, 2003 - present***
Washing Machine Rebates, ***May 1, 2003-present***
Tiered Conservation Rates, ***effective May 15, 2003***
Public Education, ***May 2002-present***
Water Conservation Ordinances, ***various start dates***

During the time of the showerhead exchange program, especially from 2002 to 2004, the area was experiencing a drought and there was ongoing water conservation campaigns to mitigate the effects of the drought. However, a major snowstorm in March 2003 improved TWRD's water supply situation. Another important measure taking place during the period of the showerhead exchange program was the utility-wide transition from a flat rate structure to a conservation rate structure in May 2003.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received showerheads between May 17 and December 31, 2003. The water savings were calculated and a cost benefit analysis was performed for this time period. Results refer to this time period, not to the ongoing program. The lifespan of the showerheads, which is used as the period of analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 3.6%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

Since two complete years of pre- and post-measure water use could not be acquired for this analysis, water use data for the participants was acquired from 18 months before the program and 18 months after the program for all households that were residing there for that full period. The pre-measure period includes January 2002 to June 2003, and the post-measure period includes January 2004 to June 2005.

The population studied for this analysis was comprised of all participants who received showerheads between May 17 and December 31, 2003. There were 127 usable participants out of 322 total participants during the period under analysis.

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All TWRD single family households, including the participants, were used as the control group. The average annual pre-measure water use of the participants (103,894 gallons) was lower than that of the control group (107,839 gallons). The number of control group connections varied by month, from a minimum of 20,148 to a maximum of 24,532.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2003 CPI value, 184.0, and the 2004 CPI value, 188.9, were used in this analysis.

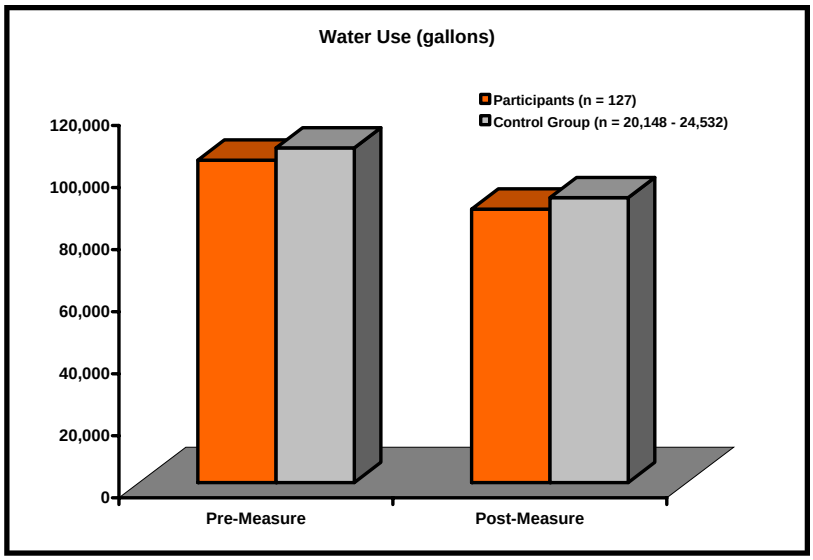
Participants who participated in any other conservation program during the period of analysis were not included in the study.

Participants who had two or more consecutive months of no water use were not included in the study.

Any participants that had 11 to 13 months of usage per year were included in the study.

The control group consisted of all single family residential connections, including participants.

The percentage of showerhead exchange program participants who lived inside the city was 95%. However, it was assumed that 100% of participants lived inside the city, thus Inside-City rates apply for all cost benefit analysis calculations.



Since all participants were assumed to reside inside the city, Outside-City connections were not included in the control group.

It was assumed that average participant water use falls into tier 1 or 2 of the increasing block rate structure implemented in 2003.

RESULTS - WATER SAVINGS

During the 18 months after participating in the showerhead program, water savings amounted to 64,248 gallons or 506 gallons per participant (0.3% of pre-measure water use). The average annual water savings was 42,832 gallons, or 337 gallons per participant per year (gppy) (0.3% of pre-measure water use). **The total water savings over the five year assumed lifespan was 214,158 gallons (0.66 AF), or 1,686 gallons per participant.**

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During the 18 months before participating in the showerhead program, the participant group's water use was, on average, 96.3% of the control group's use. During the 18 months after, the participant group's water use was 95.9% of the control group's use, on average. The participant group's water use decreased by 15.2%, whereas the control group's use decreased by 14.9%. **The resulting overall water savings attributed to this program was 0.3%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility was $1,546 ($12 per participant). This cost includes advertising, $91 ($1 per participant), devices, $532 ($4 per participant), and labor, $922 ($7 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $594 ($5 per participant), which includes water bill savings.

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Advertising	$91	Not Quantified	Not Quantified	Water Bill Savings	$594
Devices	$532				
Labor	$922				
Total	$1,546			Total	$594

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$1,546 from the utility perspective over the five year assumed lifespan of the devices. This is a net benefit of -$12 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $2,352.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $594 from the perspective of the participant. This is a net benefit of $5 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$952 from an overall perspective. This is a net benefit of -$7 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $2,352.**

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Thornton Water Res. Div.
Showerhead Exchange Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	1,546	NA	1,546
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$1,546	$0	$1,546
Present Value Benefits			
Total Water Savings	0.66 AF	0.66 AF	0.66 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	594	594
Benefits to Others	NA	NA	0
Total Benefits	$0	$594	$594
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$1,546	$594	-$952
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$2,352 /AF	$0 /AF	$2,352 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs
- **Disposal of old devices.**

Benefits
- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Reduced energy bills for participants.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Improved public relations for the utility.**

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WASHING MACHINE REBATE
CASE NARRATIVES

PAGES

Camrosa Water District
Washing Machine Rebate Program

Camrosa Water District (CWD) provides potable, non-potable, and reclaimed water for communities in the southern portion of Ventura County, CA. The population of CWD's service area is 31,000. As of the 2000 Census, the median household income in Ventura County was $59,666, which is higher than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

As of 2004, the District maintained 11,507 connections, 84% of which were residential. Of their total connections, 9,065 were single family residential, 544 were multifamily residential, 1,280 were commercial, 133 were industrial, 298 were irrigation, 108 were agricultural irrigation, and 79 consisted of fire suppression, line flushing, construction meters, and temporary meters. Camrosa Water District's total service area is 31 square miles. As of 2004, the average per capita water use for the utility as a whole was 290 gallons per capita per day (gpcd).

WASHING MACHINE REBATE

Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**March 2003 – Present**
Years Analyzed:	**FY 2003**

UTILITY RATE STRUCTURE AND PRICES

Camrosa Water District employs an increasing block rate structure. As of February 2005, the monthly base rate for service is $5.60 for ¾ inch meters (or $0.19 per day), which includes zero gallons of water. Single family and multifamily residential usage charges are $1.10 per HCF for the first 12 HCF of water and $1.46 per HCF thereafter ($1.47-$1.95 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

The current sources of supply for the customers and properties within CWD's service area comprise a mix of public and private sources including purchasing imported water from Calleguas Municipal Water District (CMWD), groundwater from three groundwater basins, surface water diverted form Conejo Creek, and recycled water from CWD's Water Reclamation Facility. The utility's total capacity from these sources is 46.0 million gallons per day (mgd).

FUTURE PLANS TO MEET DEMAND

The population within CWD's service area is growing at a rate of 0.9% per year. CWD plans to meet future demands through maintaining current sources, water conservation programs, water transfers, and water reuse.

WASHING MACHINE PROGRAM - DESCRIPTION

Camrosa Water District began a washing machine rebate program on March 25, 2003. They issued 93 rebates between March 25 and June 2, 2003. They have since given out 139 additional rebates. The rebate amount was $300, paid for equally by CWD, Calleguas Municipal Water District (CMWD), and Metropolitan Water District of Southern California

[1] U.S. Census Bureau, QuickFacts.

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CAMROSA WATER DISTRICT CONSERVATION PROGRAMS

1st Toilet Distribution, *February 8, 1997*
2nd Toilet Distribution, *June 13, 1998*
3rd Toilet Distribution, *August 13, 1998*
4th Toilet Distribution, *April 26, 1999*
Ongoing Toilet Distribution, *1999-present*
Showerhead Giveaways, *1997-present*
Home Water Survey (indoor/outdoor audits), *1994-present*
Landscape Water Survey (outdoor audits), *1994-present*
Protector del Agua, *1997-present*
Public Education, *on-going*

(MWDSC). The rebate amount was reduced to $225 for FY 2006.

The washing machines must be from a list of qualifying high efficiency washing machines on CWD's website. Qualifying machines have a water factor of 9.5 or less. Participants fill out the rebate form and return it along with the original receipt. Camrosa Water District customers were also eligible for washing machine rebates from Southern California Edison and Southern California Gas Company. CWD advertises the program through brochures sent out in customers' water bills and on their website.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the program during fiscal year (FY) 2003. The findings refer to this period only, not to the ongoing program. The lifespan of the washing machines installed, which is used as the period of this analysis, was assumed to be twelve years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 4.38%. The CPI values used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

The population studied for this analysis was comprised of participants who received a washing machine rebate during FY 2003. There were 51 usable participants out of a total of 93. Forty-two, or 45%, of the participants were unusable because they moved during the period of analysis or there were periods of two or more months with no water use.

All CWD residential customers that were not participants in this analysis were used as the control group. Participant pre-measure water consumption was 439,157 gallons per year while control group pre-measure water consumption was 244,774 gallons per year. The control group consisted of 8,976 households in FY 2001, 9,032 in FY 2002, 9,015 in FY 2003, 9,169 in FY 2004, and 9,321 in FY 2005.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The estimated average cost of high efficiency washers was $1000 each and high water use washers were $400 each. The difference between

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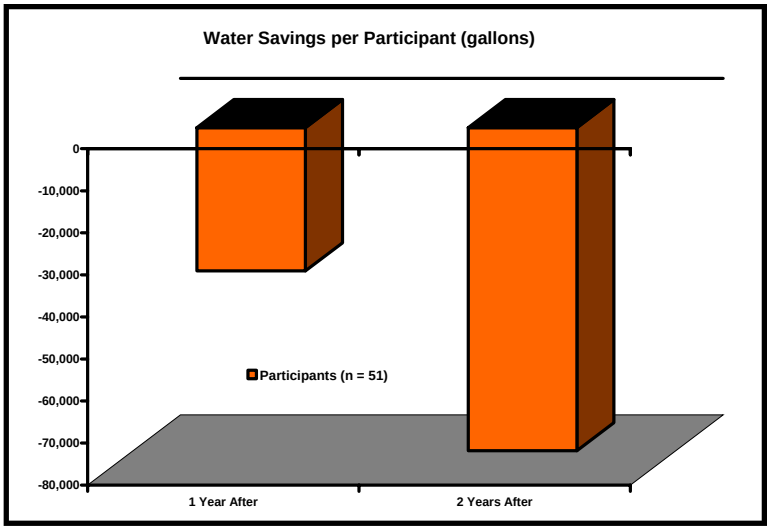
the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.

The average cost of installation of a washing machine was assumed to be $0. This is because many appliance stores offer free installation with the purchase of a new washing machine.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of CWD's price of water at the tier in which the participants' average water use falls (tier 2: use of 13 or more ccf per month). The price in FY 2004 was $1.93 per 1,000 gallons, and the price in FY 2005 was the average of the 2004 and 2005 prices ($1.94 per 1,000 gallons).



Participants who had two or more consecutive months of no water use were not included in the study.

Calleguas Municipal Water District and Metropolitan Water District of Southern California each paid $100 per rebate. Camrosa Water District paid $100 per rebate for 55% of the rebates and $0 per rebate for 45% of the rebates.

Advertising costs were $1500 for the year.

Each rebate took 15 minutes to process at $30 per hour.

RESULTS - WATER SAVINGS

In the first year after the rebates, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 3,865,693 gallons, or 75,798 gallons per participant per year (gppy) (17.3% of pre-measure water use). The second year after the rebates, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 5,303,321 gallons, or 103,987 gppy (23.7% of pre-measure water use). On average, no water savings occurred; relative water use increased by 4,584,507 gallons (14.1 AF), or 89,892 gppy (20.5% of pre-measure water use). **Over the twelve year assumed lifespan of the conservation devices, there were no water savings; relative water use increased by 55,014,089 gallons (168.8 AF), or 1,078,708 gallons per participant.**

Before the washing machine rebate program, the participant group's water use was **179.4%** of the control group's use, on average. After the program, their water use was **220.9%** of the control group's use, on average. The participant group's water use increased by 9.0% from pre-measure to post-measure, whereas the control group's use

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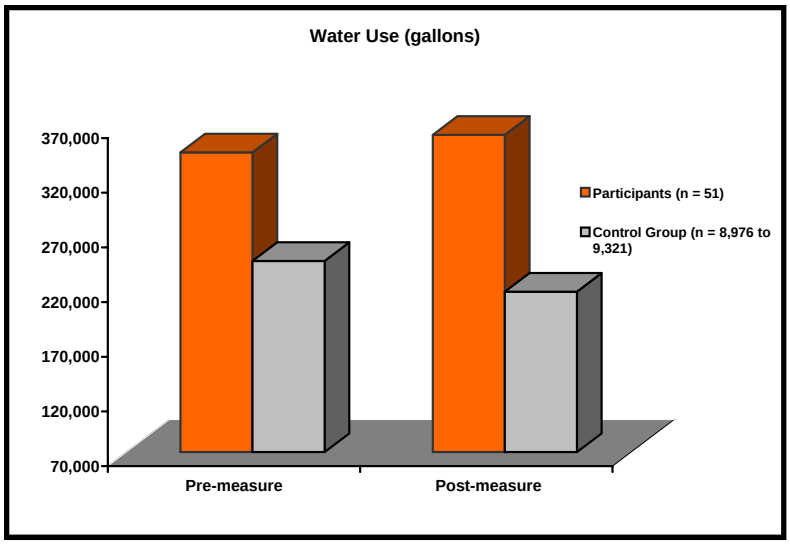
decreased by 11.5%. **The resulting water savings attributable to this program was -20.5%.**



RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

- The quantified cost to the utility was $4,435 ($87 per participant). This includes payment of financial incentives, $2,880 ($56 per participant), and advertising, $1,555 ($30 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $31,415 ($616 per participant), which includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to the participants was -$67,954 (-$1,332 per participant), which includes water bill savings, -$83,661 ($1,640 per participant), and financial incentives, $15,707 ($308 per participant).
- The quantified cost to others was $10,472 ($205 per participant). This includes the cost to CMWD and MWDSC of financial incentive payments.
- The quantified benefit to others was $0.

2003 Quantified Costs and Benefits							
Utility				**Participants**			
Costs		**Benefits**		**Costs**		**Benefits**	
Advertising	**$1,555**	**Not Quantified**		**Equipment**	**$31,415**	**Water Bill Savings**	**-$83,661**
Incentive Payments	**$2,880**					**Incentive Payments**	**$15,707**
Total	**$4,435**			**Total**	**$31,415**	**Total**	**-$67,954**

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) from the utility perspective of -$4,435, or -$87 per participant. The quantified benefits to the utility were less than the quantified costs to the utility. **The cost per acre-foot of water saved from the utility perspective was -$26.**

PARTICIPANT PERSEPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$99,369 from the participant perspective, or -$1,948 per participant. The quantified benefits to the participant were less than the

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quantified costs to the participant. **The cost per acre-foot of water saved from the participant perspective was -$186.**

OVERALL PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) from an overall perspective of -$114,275, or -$2,241 per participant. The quantified benefits to the utility, participant, and others were less than the quantified costs to the utility, participant, and others. **The cost per acre-foot of water saved from an overall perspective was -$274.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent installing new washing machines.**
- **Possible landfill disposal of old washing machines.**

Benefits

- **Savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Some participants were eligible for an additional rebate from their energy company.**
- **Environmental benefits of reduced use of water.**
- **Potential income from sale of old washing machines.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Water saved for future municipal use.**
- **Customers received new washing machines.**

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Camrosa Water District

Washing Machine Rebate Program

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	4,435	NA	4,435
Costs to Participants	NA	31,415	31,415
Costs to Others	NA	NA	0
Total Costs	$4,435	$31,415	$46,322
Present Value Benefits			
Total Water Savings	-168.83 AF	-168.83 AF	-168.83 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-67,954	-67,954
Benefits to Others(CMWD & MWDSC)	NA	NA	0
Total Benefits	$0	$67,954	-$67,954
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$4,435	-$99,369	-$114,275
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$26 /AF	-$186 /AF	-$274 /AF

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Helix Water District
Washing Machine Program

Helix Water District (HWD) is a public water provider serving San Diego County communities, located in Southern California. As of August 2004, the population served by Helix Water District was 251,586 people. As of the 2000 census, San Diego County median household income was $47,067, which is lower than the statewide value of $47,493.[1]

UTILITY DEMOGRAPHICS

Helix Water District supplies water to the San Diego County communities of La Mesa, El Cajon (and nearby unincorporated areas), Lakeside, Lemon Grove, and Spring Valley. As of August 2004, the district maintained 54,742 connections, 92.1% of which are residential. Of their total connections, 45,647 were single family residential, 4,778 were multifamily residential, 3,262 were commercial/industrial, 495 were government, 439 were irrigation, and 121 were other types of connections (i.e. construction, temporary). Helix Water District's total service area encompasses approximately 50 square miles. As of 2004, HWD's total water use, in gallons per capita per day (gpcd) was 142. Their metered water use was 39,956 AF.[2]

WASHING MACHINE VOUCHER PROGRAM

Voucher Amount:	**$125**
Eligible Customers:	**SF, MF, ICI**
Customers Analyzed:	**SF**
Program Years:	**2000-present**
Year Analyzed:	**FY 2002**

UTILITY RATE STRUCTURE AND PRICES

Helix Water District has an increasing block rate structure. As of July 1, 2005, the monthly base rate for service to single family residences was $27.80 for 5/8" meters. The monthly service charge includes zero gallons of water. The fee structure for water consumption is as follows:

Usage	Price
0 – 10 ccf (up to 7,480 gal.)	$1.54 per ccf ($2.06 per 1,000 gal.)
11 – 30 ccf (8,228 – 22,440 gal.)	$1.95 per ccf ($2.61 per 1,000 gal.)
≥ 31 ccf (23,188 gal.)	$2.38 per ccf ($3.18 per 1,000 gal.)

CURRENT CAPACITY AND WATER SOURCES

Helix Water District has a current storage capacity of 63 million gallons, with the ability to treat up to 106 million gallons per day. Over 80% of their water is a blend of Colorado River water and northern California water from the State Water Project. Helix Water District purchases this water from the San Diego County Water Authority. The remaining water is supplied by runoff from winter rain and snow releases.

FUTURE PLANS TO MEET DEMAND

The population within Helix Water District's service area is stable, with no significant population growth reported. HWD intends to meet future

[1] U.S. Census Bureau, QuickFacts.
[2] HWD at-a-glance, Helix Water District.

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water demand by maintaining its current capacity and sources. Future water demand will also be met by continuing conservation and public education.

VOUCHER PROGRAM - DESCRIPTION

Helix Water District's High Efficiency Washing Machine Voucher program was initiated in 2000. The district provides $125 vouchers to single family residential, multifamily residential and commercial customers who purchase high efficiency clothes washers. As of January 2005, 2,322 vouchers had been awarded.

OTHER HELIX WATER DISTRICT CONSERVATION PROGRAMS

Toilet Vouchers, *1992 to present*
Showerhead and Aerator Giveaway, *1996 to present*
Water Budget Program, *currently in development*
Irrigation Controller Installation Incentive, *January 2005 to present*
Leak Detection Service, *offered since Helix has been in existence*
Indoor/Outdoor Audits, *September 1994 to present*
Outdoor Audits, *August 1990 to present*
ICI Program, *May 1993 to present*
Vouchers available toward the purchase of ultra-low flow toilets, urinals and waterless urinals, cooling tower conductivity controllers, and coin-operated high efficiency clothes washers.
Public Education, *1965 to present*
Conservation Ordinances, *various start dates*

Retailers regard the vouchers as coupons, so customers immediately receive the discount when they purchase the qualifying washing machine. Vouchers have to be presented at the time of purchase, as rebates are not offered for previous washing machine purchases. Customers are informed of the program via billing statement inserts, newsletters and newspaper articles, television coverage, the utility website, brochures, and the utility's conservation hotline. On November 1, 2004, Helix Water District decreased the voucher amount from $125 to $100.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family residential customers who received vouchers during fiscal year (FY) 2002 (July 1, 2001 – June 30, 2002). The water savings were calculated and a cost benefit analysis was performed for FY 2002. The findings refer to this year only, no to the ongoing program. The lifespan of the high efficiency clothes washing machines, which is used as the period of analysis, was assumed to be 12 years.[3]

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used for this analysis was 5.17%. The CPI values used in this analysis

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of all participants who received vouchers during FY 2002. During FY 2002, 268 single family residential customers participated in the program. Of those 268 participants, 261 were usable for this analysis. Seven, or 2.6%, of program participants were unusable because sufficient raw data was not available to perform the analysis.

The control group in this analysis was comprised of a random selection of 200 Helix Water District single family residential customers. The average participant pre-measure water use (260,307 gallons) was greater than that of the control group (165,620 gallons).

ASSUMPTIONS

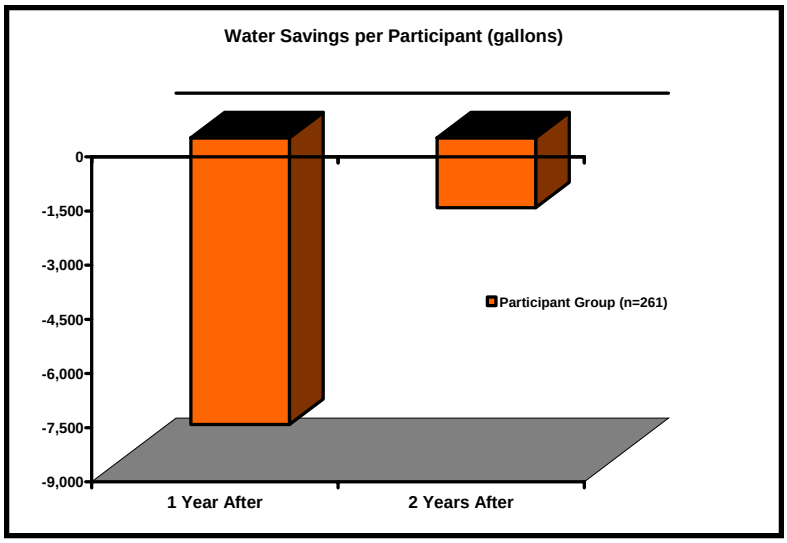
Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The price of water used in this calculation is the price for the category in which the average bi-monthly use of the participants falls (31+ ccf). The price at this category is 2.19 per ccf, or 2.93 per 1,000 gallons in 2003, and 2.28 per ccf, or 3.05 per 1,000 gallons in 2004 and beyond.

The estimated average cost of high efficiency washers was $1000 each and high water use washers was $400 each. The difference between the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.

The discount rate used in this analysis was 5.17%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.



RESULTS - WATER SAVINGS

In the first year after receiving the washing machine vouchers, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 2,072,662 gallons, or 7,941 gallons per participant per year[4] (gppy) (3.1% of pre-measure water use). The second year after receiving the vouchers, no water savings were documented. There was an increase in participant water use, relative to control group water use, of 506,220 gallons, or 1,940 gppy (0.8% of pre-measure water use). On average, no water savings were documented; relative water use increased by 1,289,441 gallons, or 4,940 gppy (1.9% of pre-measure

[4] This value also represents the average water savings per voucher, as each participant only received one voucher.

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water use). Over the twelve year assumed lifespan of the high efficiency washing machines, no water savings were documented; relative water use increased by 15,473,296 gallons (47.5 AF), or 59,285 gallons per participant.

During the two years before replacing the high water use washing machines with efficient washing machines, the participants' water use was 157.2% of the control group's use, on average. During the two years after replacing the washing machines, the participants' water use was 160.4% of the control group's use, on average. The participant group's water use decreased by 4.5% whereas the control group's water use decreased by 6.4% on average. **The resulting overall water savings attributed to this program was -1.9%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
HWD Incentive Payments	$8,751	Not Quantified		Washing Machines	$164,434	Incentive Payments	$34,444
						Water Bill Savings	-$36,122
Total	$8,751			Total	$164,434	Total	-$1,678

Quantified Costs and Benefits		
MWDSC and SDCWA		
Costs		Benefits
Incentive Payments	$25,693	Not Quantified
Total	$25,693	

- The quantified cost to the utility was $8,751. This includes Helix Water District's contribution to the financial incentives. This is a cost of $34 per participant.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $164,434. This cost reflects the estimated cost of new high efficiency washing machines. This is a cost of $630 per participant.
- The quantified benefit to the participants was -$1,678. This value includes the amount that participants received in financial incentives, -$34,444 and water bill savings, -$36,122. This is a benefit of -$6 per participant, including $132 per participant in financial incentives, and -$138 in water bill savings.
- The quantified cost to others was $25,693. This includes contributions to the financial incentives by Metropolitan Water district of Southern California (MWDSC) and San Diego County Water Authority (SDCWA). This is a cost of $98 per participant.
- The quantified benefit to others was $0.

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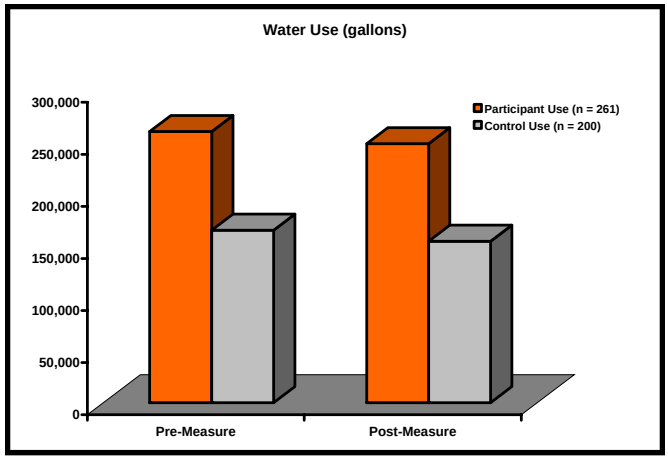
UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of
-$8,751 from the utility perspective. This is a net benefit of -$34 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was -$184**.

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$164,434 from the participant perspective. This is a net benefit of -$630 per participant. The quantified costs to participants were greater than the quantified benefits to participants. **The cost per acre foot of water saved from the participant perspective was -$3,463.**



OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of
-$200,556 from an overall perspective. This is a net benefit of -$768 per participant. The quantified costs to the utility, participants, and others were greater than the quantified benefits to the utility participants, and others. **The cost per acre-foot of water saved from an overall perspective was -$4,188.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Advertising costs.
- Cost of processing vouchers.
- Increased surface water use.
- Laundry detergent specially designed for high efficiency machines.
- Removal/disposal of old washing machines.

Benefits

- Increased public awareness about water conservation.
- Avoided cost of acquisition and distribution of water saved.
- Potential income from the sale of old washing machines.
- Need for reduced quantities of detergent.
- Increased customer satisfaction with the utility.
- Reinforcement of the desirability of water conservation.
- Participant satisfaction with the new washing machines.

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Helix Water District
Washing Machine Program

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	8,751	NA	8,751
Costs to Participants	NA	164,434	164,434
Costs to Others (MWDSC & SDCWA)	NA	NA	25,693
Total Costs	$8,751	$164,434	$198,878
Present Value Benefits			
Total Water Savings	-47.49 AF	-47.49 AF	-47.49 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-1,678	-1,678
Benefits to Others (MWDSC & SDCWA)	NA	NA	0
Total Benefits	$0	-$1,678	-$1,678
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$8,751	-$166,112	-$200,556
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$184 /AF	-$3,463 /AF	-$4,188 /AF

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Irvine Ranch Water District

Washing Machine Rebate Program

Irvine Ranch Water District (IRWD), located in Irvine, California, provides domestic water service, sewage collection, and water reclamation for the city of Irvine and portions of surrounding communities. The 1999 median household income in Irvine was $72,057, which is higher than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

IRWD serves the City of Irvine, the Santa Ana Heights community, and portions of Tustin, Newport Beach, Costa Mesa, Orange, and Lake Forest.

As of June 2004, IRWD had 85,278 connections, 88.4% of which were residential. Of their total connections, 46,110 were single family residential, 29,312 were multifamily residential, 3,547 were reclaimed water, 3,278 were commercial, 1,827 were irrigation, 891 were industrial, 216 were institutional, and 97 were agricultural.

WASHING MACHINE REBATE PROGRAM

Type of Program:	**Rebate**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**2002- present**
Years Analyzed:	**2002**

IRWD's total service area is 132.8 square miles. As of 2004, the population of IRWD's service area was approximately 308,400. The total amount of treated water use was 55,139 acre-feet. The average residential per capita water use was 90 gallons per capita per day (gpcd).

UTILITY RATE STRUCTURE AND PRICES

IRWD has a conservation rate structure based on five tiers of water use: low volume, conservation, inefficient, excessive, and wasteful. Customers are given both an indoor and outdoor water allocation, which is determined by the number of people per household and the square-footage of the outdoor landscaped area. The standard allocation of 75 gallons per day is based on a four person household with a 1,300 square foot landscaped area; unless they provide documentation showing that they have more people in the household and/or more landscaped area. Each tier corresponds to a percentage of allocated water used by the customer, who will in turn receive a rate based on that percentage. A *Low Volume* customer uses 0-40% of their water allocation, a *Conservation* customer uses 41-100%, an *Inefficient* customer uses 101-150%, an *Excessive* customer uses 151-200%, and a *Wasteful* customer uses +201%.

Tier	% Use of Allocation	2004 Rates
Low Volume	0-40%	$0.69 per ccf
Conservation	41-100%	$0.75 per ccf
Inefficient	101-150%	$1.50 per ccf
Excessive	151-200%	$3.00 per ccf
Wasteful	+201%	$6.00 per ccf

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[1] US Census Bureau.

Other Irvine Ranch Conservation Programs

Device Giveaways, *1990-present*
Irrigation System Incentives, *1992-1997*
Conservation Rate Structure, *1991-present*
Toilet rebates, *1996-present*
Indoor/Outdoor Audits, *1991-present*
Public education, *various start dates*
Conservation Rules and Regulations, *2002*
Other Rebate Programs, *various start dates*

CURRENT CAPACITY AND WATER SOURCES

IRWD purchases approximately 35 percent of its drinking water from the Metropolitan Water District of Southern California (MWDSC). This imported water comes from the Colorado River and Northern California. The remaining 65 percent of the supply comes from local wells.[2]

FUTURE PLANS TO MEET DEMAND

The population within IRWD's service area is growing at a rate of 3% per year as of 2004. Water conservation and water reuse are the main components of the IRWD's plans to meet demand.

WASHING MACHINE REBATE PROGRAM - DESCRIPTION

Since 2002, the Irvine Ranch Water District, with funding and staff support provided by both MWDSC and MWDOC, has offered a $100 rebate to residential customers that replace their old washing machines with new High Efficiency Clothes Washers (HECW). Currently, machines must be purchased between July 1, 2005 and December 31, 2006. The HECW must be from a list of eligible machines. These machines, with a water factor of 6.0 or less, use 15 to 25 gallons less water per load. Depending on use, this can save 7,000 gallons of water per year.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the program during 2002. The findings refer to this year only, not to the ongoing program. The lifespan of the washing machines installed, which is used as the period of this analysis, was assumed to be twelve years.

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used in this analysis was 5.17%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of single family households that received a rebate during 2002. There were 222 usable participants out of a total of 249 single family participants rebated during 2002. Twenty-seven, or 10.8%, of the participants were not included in the analysis because they had two or more consecutive months with no water use. There were also 267 multifamily participants during 2002, which were not included.

A sample of IRWD single family residential customers were used as the

[2] IRWD Fact Sheet, July 2005.

control group. Starting with all single family accounts, certain service villages were eliminated based on data from the participant group. Accounts with ages of housing construction, landscape size, and landscape design similar to the participants were chosen. From this group, a random sample was taken.

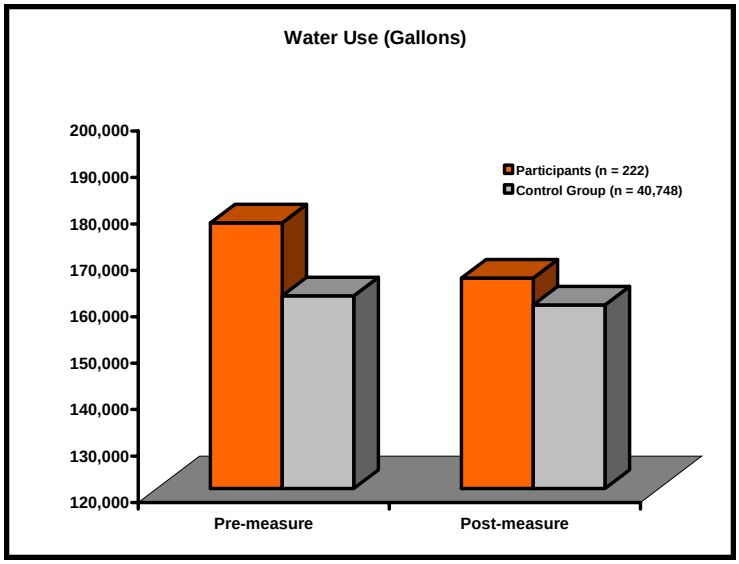
Participant pre-measure water consumption was 177,212 gallons while control pre-measure water consumption was 161,515 gallons. The control group consisted of 40,748 households for all years (2000-2004).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2002 CPI value, 179.9, and the 2004 CPI value, 188.9, were used in this analysis.

The estimated average cost of high efficiency washers was $1000 each and high water use washers was $400 each. The difference between the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.



The average cost of installation of a washing machine was assumed to be $0. This is because many appliance stores offer free installation with the purchase of a new washing machine.

It was assumed that 17% of single family residential customers fall into the Low Volume water use category, 68% fall into the Conservation category, 12% fall into the inefficient category, 2% fall into the excessive category, and 1% fall into the wasteful category.

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the first year after the 2002 rebates, water savings amounted to 2,495,694 gallons (7.66 AF), or 11,242 gallons per participant per year (gppy) (6.3% of pre-measure water use). The second year after, water savings amounted to 1,824,683 gallons (5.6 AF), or 8,219 gppy (4.6% of pre-measure water use). The average water savings per year was 2,9160,188 gallons (6.6 AF), or 9,731 gppy (5.5% of pre-measure water use). **The total water savings over the twelve year assumed lifespan was 25,922,261 gallons (79.6 AF), or 116,767 gallons per participant.**

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During the two years before participating in the rebate program, participants' water use was 109.7% of the control group's use, on average. During the two years after participating in the rebate program, their water use was 103.6% of the control group's use, on average. The participants' water use decreased by 6.7% from pre-measure to post-measure, whereas the control group's decreased by 1.2%. **The resulting overall water savings attributed to this program was 5.5%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

- The quantified cost to the utility was $1,050 ($5 per participant). This includes the cost of advertising.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $139,864 ($630 per participant). This cost includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to the participants was $46,595 ($210 per participant). This includes water bill savings, $23,284 ($105 per participant), and financial incentives, $23,311 ($105 per participant).
- The quantified cost to others was $26,183 ($119 per participant). This includes a cost to MWDOC for advertising, $187 ($1 per participant), staff-time, $354 ($2 per participant), and a cost to MWDSC for financial incentives and administration, $25,642 ($116 per participant).
- The quantified benefit to the society was $0.

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs		Benefits	
Advertising	$1,050	Not Quantified	Washing Machines	$139,864	Water Bill Savings	$23,284
					Financial Incentives	$23,311
Total	$1,050		Total	$139,864	Total	$46,595

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$1,050 from the utility perspective. This is a net benefit of -$5 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $13.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$93,269 from the participant perspective. This is a net benefit of -$420 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $1,758.**

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OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$120,502 from an overall perspective. This is a net benefit of -$543 per participant. The quantified costs to the participants, society, and the utility were greater than the quantified benefits to the participants, society, and utility. **The cost per acre-foot of water saved from an overall perspective was $2,100.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent during the installation and rebate process.**

Benefits

- **Financial savings on sewer bill for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction with the utility.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Water saved for future municipal use.**
- **Customers received new washing machine.**
- **Possible income from the sale of old machines.**
- **Participants have decreased energy and sewer bills.**
- **High-efficiency machines use less detergent.**

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Irvine Ranch Water District

Washing Machine Rebate Program

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	1,050	NA	1,050
Costs to Participants	NA	139,864	139,864
Benefits to Others (MWDSC & MWDOC)	NA	NA	26,182
Total Costs	$1,050	$139,864	$167,096
Present Value Benefits			
Total Water Savings	79.55 AF	79.55 AF	79.55 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	46,595	46,595
Benefits to Others (MWDSC & MWDOC)	NA	NA	0
Total Benefits	$0	$46,595	$46,595
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$1,050	-$93,269	-$120,502
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$13 /AF	$1,758 /AF	$2,100 /AF

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Port Angeles Utilities Dept.

Washing Machine Rebate Program

The City of Port Angeles Public Works and Utilities Department serves the city of Port Angeles in Clallam County, Washington. As of the 2000 Census, the median household income in Port Angeles was $33,130, which is lower than the statewide median of $45,776.[1]

UTILITY DEMOGRAPHICS

As of 2004, the City of Port Angeles had 7,928 connections, 89% of which was residential. Of their total connections, 6,900 were single family residential, 195 were multifamily residential, 831 were commercial, and 2 were industrial.

The City of Port Angeles' total service area is 14 square miles. The population of this service area as of the 2000 census is approximately 18,000. As of 2004, the City of Port Angeles' total water use was 155 gallons per capita per day (gpcd) and their residential water use was 84 gpcd.

WASHING MACHINE REBATE PROGRAM

Voucher Amount:	**$75**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**2001-present**
Years Analyzed:	**2001-2002**

UTILITY RATE STRUCTURE AND PRICES

The City of Port Angeles uses a flat rate structure. Effective January 1, 2005, the monthly base rate for service is $14.95 for 5/8" meters, which includes zero gallons of water.[2] Consumption charges for single family and multifamily residential connections are $1.19 per ccf ($1,59 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

The City of Port Angeles has a storage capacity of approximately 18 million gallons. The City of Port Angeles' water supply is groundwater, accessed by a 60 foot deep collector well near the Elwha River. The pumping system is currently able to provide 11 millions gallons per day.

FUTURE PLANS TO MEET DEMAND

The population within the City of Port Angeles' service area is growing at a rate of 1%. The District plans to meet future water demand through the use of current sources. They are permitted to use up to 32.5 mgd through the year 2015.

WASHING MACHINE REBATE PROGRAM - DESCRIPTION

The City of Port Angeles' washing machine rebate program was first initiated on June 1, 2001 and is continuing. The rebate is offered with the purchase of an efficient washing machine. The washing machine must be an Energy Star machine, and the customer must have an electric water heater to qualify. The initial rebate amount was $75.
Since the program began, there have been several changes in the

[1] US Census Bureau. QuickFacts
[2] City of Port Angeles website

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rebate amount offered to customers. The rebates offered for 2001, 2002, 2003, 2004, and 2005 were $75, $150, $100, $100, and $50 respectively. The financial incentives are funded by the Bonneville Power Administration energy conservation program.

OTHER PORT ANGELES CONSERVATION PROGRAMS

Showerhead & Aerator Giveaway, ***July 2001-present***

Conservation Ordinance, ***2000-present***
Adopted as part of a drought response plan, with water shortage stages and corresponding water conservation actions.

The District informs its customers about the washing machine rebate program through bill inserts, newspaper articles, radio advertisements, television advertisements, and internet. In addition, plumbing retailers have encouraged customers to participate in the program upon purchasing new ultra low flow toilets.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received a rebate in 2001 and 2002. The water savings were calculated and a cost benefit analysis was performed for the years 2001 and 2002. The findings refer to these two years only, not to the ongoing program. The lifespan of the washing machines was assumed to be twelve years.[3]

All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used in this analysis was 5.39%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

The population studied for this analysis was comprised of participants who received rebates in 2001 or 2002. One hundred twenty-two customers received rebates during this time period. Of those 122 participants, 111 customers were usable for this analysis. Sufficient raw data was not available for 11 program participants (9.0%).

A random sample of 133 City of Port Angeles single family residential households were used in the control group for this analysis. The average pre-measure water use of the 2001 participants (78,839 gallons) was higher than that of the control group (77,031 gallons). The pre-measure water use of the 2002 participants (92,921 gallons) was also higher than the control group (75,532 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The control group is a random sample of single family connections.

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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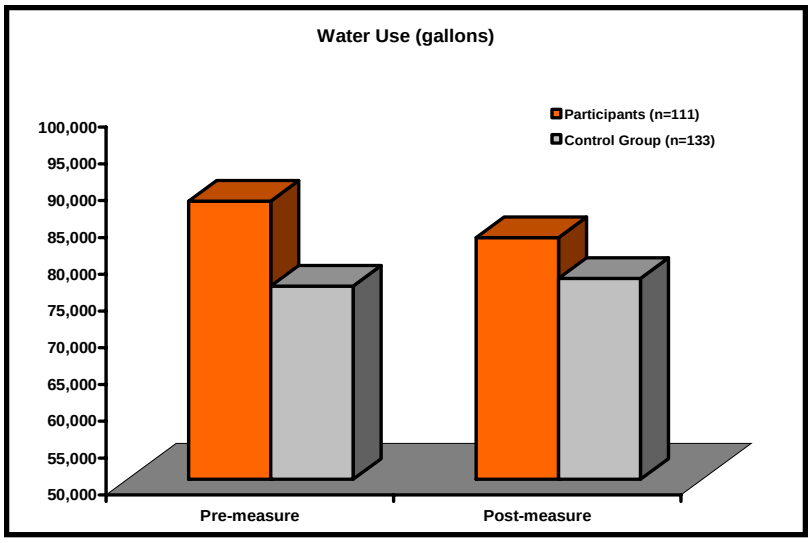
The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the customers' water bill ($1.07 per ccf in 2002, $1.11 per ccf in 2003, $1.16 per ccf in 2004, and $1.19 per ccf in 2005 and beyond).

Participants who had two or more consecutive months of no water use were not included in the study.

The estimated average cost of high efficiency washers was $1000 each and high water use washers was $400 each. The difference between the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.



The discount rate used in this analysis was 5.39%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

RESULTS - WATER SAVINGS

In the first year after the 2001 washing machine rebate program, the water savings amounted to 307,233 gallons, or 7,681 gallons per participant per year (gppy) (9.7% of pre-measure water use). The second year after, the water savings amounted to 157,416 gallons, or 3,935 gppy (5.0% of pre-measure water use). The average savings per year was 232,324 gallons or 5,808 gppy (7.4% of pre-measure water use). **Over the twelve year lifespan of the washing machine, the total water savings was 2,787,890 gallons (8.6 AF), or 69,697 gallons per participant.**

In the first year after the 2002 rebate program, the water savings amounted to 307,968 gallons, or 4,338 gallons per participant per year (gppy) (4.7% of pre-measure water use). The second year after, the water savings amounted to 760,506 gallons, or 10,711 gppy (11.5% of pre-measure water use). The average savings per year was 534,237 gallons or 7,524 gppy (8.1% of pre-measure water use). **Over the twelve year lifespan of the washing machine, the total water savings was 6,410,843 gallons (19.7 AF), or 90,294 gallons per participant**.

Total water savings for the two years studied was 615,201 gallons, or 5,542 gppy (6.3% of weighted pre-measure water use) during the first year after the rebates and 917,921 gallons, or 8,270 gppy (9.4% of weighted pre-measure water use) during the second year after the

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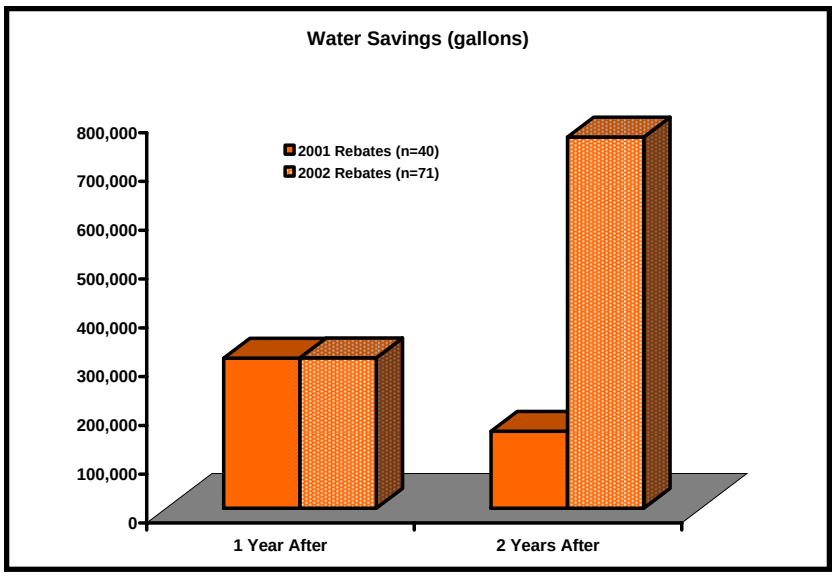
rebates. **The total savings over the twelve year assumed lifespan of the washing machines was 9,198,733 gallons (28.2 AF), or 82,871 gallons per participant.**

During the two years before participating in the program, participants' water use was 115.2% of the control group's use, on average. During the two years after participating in the audit program, their water use was 107.2% of the control group's use, on average. The participants' water use decreased by 5.7% from pre-measure to post-measure, whereas the control group's use increased by 1.4%. **The resulting overall water savings attributed to this program was 7.1%.**



RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

2001 REBATES

- The quantified cost to the utility was $0.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $25,599 ($640 per participant). This cost includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to the participants was $8,468 ($212 per participant). This includes water bill savings, $3,348 ($84 per participant), and financial incentives $5,120 ($128 per participant).
- The quantified cost to others was $5,120 ($128 per participant), including payment of financial incentives by the Bonneville Power Administration.
- The quantified benefit to others was $0.

UTILITY PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective. This is a net benefit of $0 per participant. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0.**

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PARTICIPANT PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$17,131 from the participant perspective. This is a net benefit of -$428 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,992.**

OVERALL PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of -$22,251 from an overall perspective. This is a net benefit of -$556 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $3,590.**

2001 Quantified Costs and Benefits					
Utility			Participants		
Costs	Benefits		Costs		Benefits	
Not Quantified		Equipment	$25,599	Water Bill Savings	$3,348
				Financial Incentives	$5,120
		Total	$25,599	Total	$8,468

2001 Quantified Costs and Benefits		
Bonneville Power Administration		
Costs		Benefits
Financial Incentive Payments	$5,120	Not Quantified
Total	$5,120	

2002 REBATES

- The quantified cost to the utility was $0.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $43,115 ($607 per participant). This cost includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to the participants was $18,307 ($258 per participant). This includes water bill savings, $7,377 ($104 per participant), and financial incentives $10,930 ($154 per participant).
- The quantified cost to others was $10,930 ($154 per participant), including payment of financial incentives by the Bonneville Power Administration.
- The quantified benefit to others was $0.

UTILITY PERSPECTIVE - 2002

Results of the cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective. This is a net benefit of $0 per participant. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0.**

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PARTICIPANT PERSPECTIVE - 2002
Results of the cost benefit analysis show a net benefit (net present value) of -$24,807 from the participant perspective. This is a net benefit of -$349 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,191.**

OVERALL PERSPECTIVE - 2002
Results of cost benefit analysis show a net benefit (net present value) of -$35,738 from an overall perspective. This is a net benefit of -$503 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $2,747.**

2002 Quantified Costs and Benefits				
Utility		Participants		
Costs	Benefits	Costs		Benefits	
Not Quantified		Equipment	$43,115	Water Bill Savings	$7,397
				Financial Incentives	$10,930
		Total	$43,115	Total	$18,307

2002 Quantified Costs and Benefits		
Bonneville Power Administration		
Costs		Benefits
Financial Incentive Payments	$10,930	Not Quantified
Total	$10,930	

BOTH YEARS

- The quantified cost to the utility was $0.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $68,714 ($619 per participant). This cost includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to the participants was $26,775 ($241 per participant). This includes water bill savings, $10,725 ($97 per participant), and financial incentives $16,050 ($145 per participant).
- The quantified cost to others was $16,050 ($145 per participant), including payment of financial incentives by the Bonneville Power Administration.
- The quantified benefit to others was $0.

UTILITY PERSPECTIVE - BOTH YEARS
Results of the cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective. This is a net benefit of $0 per participant. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0.**

PARTICIPANT PERSPECTIVE - BOTH YEARS
Results of the cost benefit analysis show a net benefit (net present

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value) of -$41,938 from the participant perspective. This is a net benefit of -$378 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,434.**

BOTH YEARS Quantified Costs and Benefits					
Utility		Participants			
Costs	Benefits	Costs		Benefits	
Not Quantified		Equipment	$68,714	Water Bill Savings	$10,725
				Financial Incentives	$16,050
		Total	$68,714	Total	$26,775

BOTH YEARS Quantified Costs and Benefits		
Bonneville Power Administration		
Costs		Benefits
Financial Incentive Payments	$16,050	Not Quantified
Total	$16,050	

OVERALL PERSPECTIVE - BOTH YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$57,989 from an overall perspective. This is a net benefit of -$522 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $3,003.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent installing the washing machines.**
- **Proper disposal of old washing machines.**
- **Advertising and administration costs of the program.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Water saved for future municipal use.**
- **Program participants received new washing machines.**
- **Possible income to participants from the sale of old washing machines.**
- **Environmental and monetary benefits of reduced use of energy.**
- **Improved public relations for the utility**

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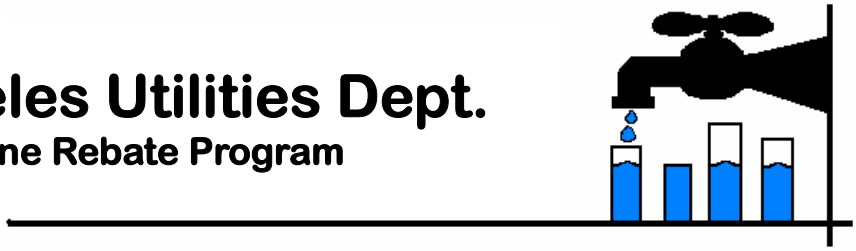
Port Angeles Utilities Dept.
Washing Machine Rebate Program



2001

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL	
Present Value Costs				
Costs to Utility		0	NA	0
Costs to Participants		NA	25,599	25,599
Costs to Others		NA	NA	5,120
Total Costs		$0	$25,599	$30,719
Present Value Benefits				
Total Water Savings		8.56 AF	8.56 AF	8.56 AF
Benefits to Utility		0	NA	0
Benefits to Participants		NA	8,468	8,468
Benefits to Others		NA	NA	0
Total Benefits		$0	$8,468	$8,468
Cost Benefit Calculations				
Net Present Value (NPV) (Total Benefits - Total Costs)		$0	-$17,131	-$22,251
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)		$0 /AF	$2,992 /AF	$3,590 /AF

2002

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	0	NA	0
Costs to Participants	NA	43,115	43,115
Costs to Others	NA	NA	10,930
Total Costs	$0	$43,115	$54,045
Present Value Benefits			
Total Water Savings	19.67 AF	19.67 AF	19.67 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	18,307	18,307
Benefits to Others	NA	NA	0
Total Benefits	$0	$18,307	$18,307
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$0	-$24,807	-$35,738
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$0 /AF	$2,191 /AF	$2,747 /AF

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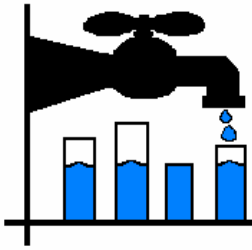

Port Angeles Utilities Dept.

Washing Machine Rebate Program

BOTH YEARS

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	0	NA	0
Costs to Customers	NA	68,714	68,714
Costs to Others	NA	NA	16,050
Total Costs	$0	$68,714	$84,764
Present Value Benefits			
Total Water Savings	28.23 AF	28.23 AF	28.23 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	26,775	26,775
Benefits to Others	NA	NA	0
Total Benefits	$0	$26,775	$26,775
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$0	-$41,938	-$57,989
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$0 /AF	$2,434 /AF	$3,003 /AF

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City of Santa Rosa Utilities

Washing Machine Rebate Program

The City of Santa Rosa Utilities (CSRU) serves the City of Santa Rosa, north of San Francisco in Sonoma County, California. The 1999 median household income in the City of Santa Rosa was $50,931, which was higher than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

As of December 2004, the City of Santa Rosa Utilities had 48,779 connections. Of these connections, 41,310 were single family residential, 3,046 were multifamily residential, 2,737 were commercial, 1,673 were irrigation, and 13 were recycled water connections. The City of Santa Rosa's total service area is 40.5 square miles. The population of this service area was 154,379 as of January 2004. The City of Santa Rosa's 2004 gross water use was 136 gallons per capita per day (gpcd) and the total residential water use was 99 gpcd.

WASHING MACHINE REBATE PROGRAM

Type of Program:	**Rebate**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**1997 - present**
Years Analyzed:	**2002**

UTILITY RATE STRUCTURE AND PRICES

The City of Santa Rosa uses a uniform rate structure. As of 2004, the monthly base rate for water service was $4.65 for 5/8" meters, which includes zero gallons of water. Single family and multifamily residential usage charges are $1.98 per hundred cubic feet (ccf) or $2.65 per 1,000 gallons. The fixed charge for wastewater was $10.79 for 5/8" meters, with a variable charge of $4.94 per ccf ($6.61 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

The City of Santa Rosa has a storage capacity of 18.7 million gallons. The City of Santa Rosa purchases its water from the Sonoma County Water Agency (SCWA). This water, in turn, is from Lake Mendocino and Lake Sonoma, both located on tributaries of the Russian River.[2]

FUTURE PLANS TO MEET DEMAND

The population within the City of Santa Rosa's service area is growing at an annual rate of about 1.2%, making it one of the fastest growing cities in the state. The City of Santa Rosa plans to meet future demand by continuing the use of current water supply sources, continuing water conservation programs, water reuse, and possibly developing the use of the City's groundwater resources.

REBATE PROGRAM— DESCRIPTION

Since 1998, the City of Santa Rosa has offered a rebate to customers

[1] US Census Bureau.
[2] Sonoma County Water Agency. *Water Supply.*

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that purchase qualifying water conserving washing machines. From 1998 to 2004, the city offered a $75 rebate per washing machine.

In July 2004, the rebate amount increased to $100–150 per qualifying washing machine depending on its efficiency, as determined by the Consortium for Energy Efficiency's rating system for water and energy efficiency. For washing machines in Tiers 1, 2 and 3A, the rebate is $100. For washing machines in Tier 3B, the rebate is $150.

SCWA manages the washing machine rebate program and Electric and Gas Industries Association (EGIA) provides processing and administrative support. During the period of this analysis, customers were eligible for an additional rebate from Pacific Gas and Electric (PG&E).

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single-family households that participated in the program during 2002. The findings refer to this year only, not to the ongoing program. The lifespan of the washing machines installed, which is used as the period of this analysis, was assumed to be twelve years.

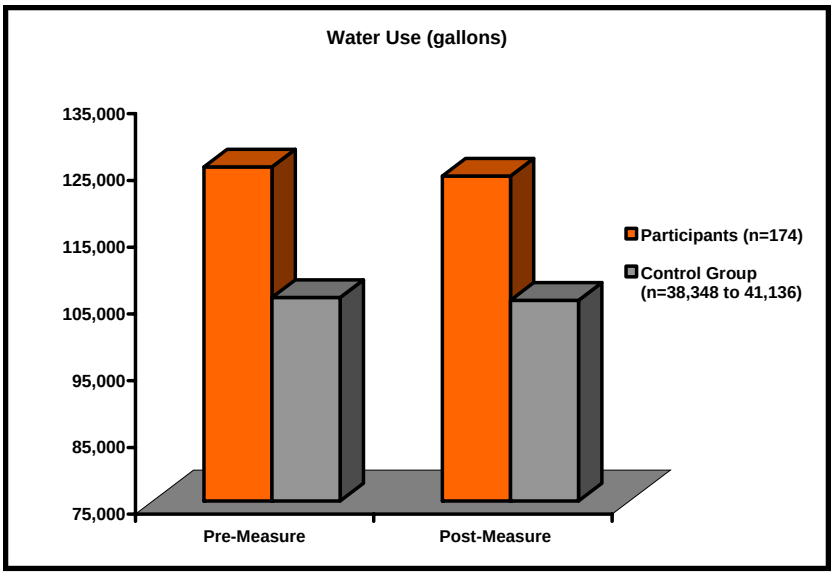
OTHER CSRU CONSERVATION PROGRAMS

Public Education, *1992-present.*
Commercial & Multifamily Washing Machine Rebates, *April2000-present*
Low-Flow Device Giveaway and Rebates, *1992-2002*
Efficient Irrigation Rebate Program, *2002-present*
Irrigation customers earn $1.53 for every 1,000 gallons they save below their Efficient Irrigation Goal for each calendar year.
Audit Program, *1998-present*
Water Waste Ordinance, *adopted 1999*
Best Available Technologies Program, *1997-present*
Reduces sewer demand fees for new laundromats and restaurants that install the most water efficient technologies.
Sustained Reduction Rebate Program, *1998-present*
Rebates $100 for every 1,000 gallons of water an ICI customer saves through means other than a toilet, showerhead, or aerator replacement.
Pre-Rinse Spray Nozzle Replacement Program, *2002-present*

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used in this analysis was 5.17%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of households that received a rebate during 2002. There were 174 usable participants out of a total of 456 households rebated during 2002. Two hundred forty, or 53%, of the participants were unusable because they

moved during the period of analysis. Thirty-seven, or 8%, of the participants were unusable because they had participated in more than one conservation program during the time period of analysis. Five participants (1%) were not included in the analysis because they had two or more consecutive months with no water usage.All City of Santa Rosa single-family residential customers that were not participants in the analysis were used as the control group. Participant pre-measure water consumption was 125,037 gallons while control group pre-measure water consumption was 105,482 gallons. The control group consisted of 38,348 households in 2000, 39,476 in 2001, 40,240 in 2002, 40,651 in 2003, and 41,136 in 2004.



ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2002 CPI value, 179.9, and the 2004 CPI value, 188.9, were used in this analysis.

The estimated average cost of high efficiency washers was $1000 each and high water use washers was $400 each. The difference between the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.

The average cost of installation of a washing machine was assumed to be $0. This is because many appliance stores offer free installation with the purchase of a new washing machine.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the City's price of water. $2.43 per 1,000 gallons in 2002 and 2003, $2.65 per 1,000 gallons in 2004 (and assumed to be $2.65 for the rest of the lifespan).

Participants who had two or more consecutive months of no water use were not included in the study.

Participants who participated in any other conservation program during the years 2000 through 2004 were not included in the study.

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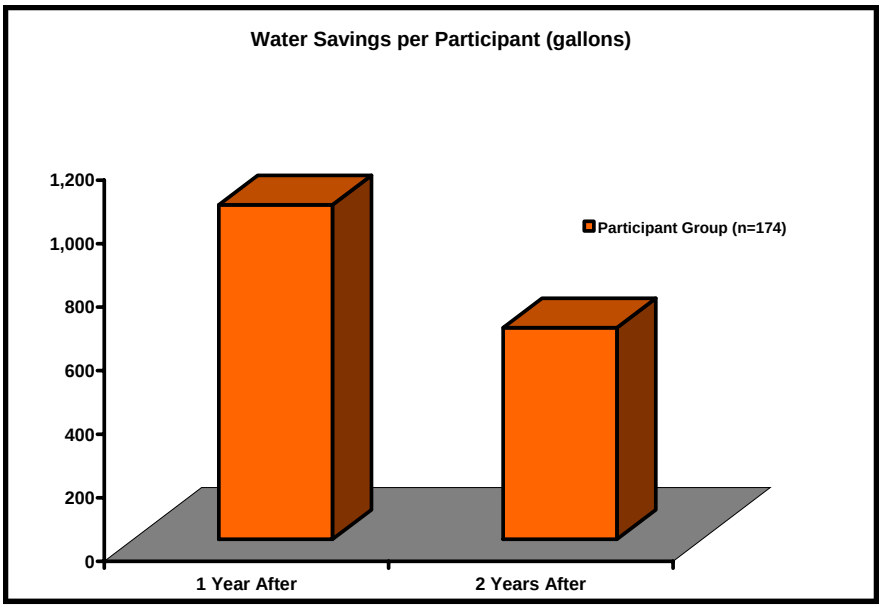
RESULTS—WATER SAVINGS

In the first year after the 2002 washing machine rebates, the water savings were 183,175 gallons, or 1,053 gallons per participant per year (gppy) (.84% of pre-measure water use). The second year after the rebate program, water savings were 115,801 gallons or 666 gppy (0.53% of pre-measure water use). The average savings per year was 149,488 gallons (0.46 AF), or 859 gppy (0.69% of pre-measure water use). **The total savings over the twelve year assumed lifespan was 1,793,854 gallons (5.5 AF), or 10,310 gallons per participant.**



During the two years before participating in the washing machine rebate program, participants' water use was 119% of the control group's use, on average. During the two years after participating in the program, their water use was 118% of the control group's use, on average. The participants' water use decreased by 1.1% from pre-measure to post-measure, whereas the control group's use decreased by 0.4%. **The resulting overall water savings attributed to this program was 0.7%.**

RESULTS—COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

- The quantified cost to the utility was $13,869, including the cost of financial incentive payments, $13,703, and in-house administration costs, $166. This is a cost of about $80 per participant, composing of $79 for financial incentive payments and $1 for administration.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $109,623. This exclusively includes the cost of equipment, $109,623. This is a cost of $630 per participant.
- The quantified benefit to the participants was $17,319. This includes water bill savings, $3,616; and financial incentives $13,703. This is a benefit of $100 per participant, including $21 for water bill savings and $79 for financial incentives.
- The quantified costs to OTHERS was $3,996. This includes the cost to SCWA, $2,457, and EGIA, $1,539, to administer the program. This is a cost of $23 per participant, including $14 to SCWA and $9 to EGIA.

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cost to SCWA, $2,457, and EGIA, $1,539, to administer the program. This is a cost of $23 per participant, including $14 to SCWA and $9 to EGIA.

- The quantified benefits to OTHERS was $0.

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Financial Incentives	$13,703	Not Quantified		Equip.	$109,623	Water Bill Savings	$3,616
Admin. Costs	$166					Financial Incentives	$13,703
Total	$13,869			Total	$109,623	Total	$17,319

Quantified Costs and Benefits		
OTHERS (SWCA, EGIA)		
Costs		Benefits
EGIA admin.	$13,703	Not Quantified
SCWA admin.	$166	
Total	$13,869	

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$13,869 from the utility perspective. This is a net benefit of -$80 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $2,519.**

PARTICIPANT PERSPECTIVE

Results of the cost-benefit analysis show a net benefit (net present value) of -$92,304 from the participant perspective. This is a net benefit of -$530 per participant. The quantifiable costs to the participants were greater than the quantifiable benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $19,913.**

OVERALL PERSPECTIVE

Results of cost-benefit analysis show a net benefit (net present value) of -$110,169 from an overall perspective. This is a net benefit of -$633 per participant. The quantifiable costs to the utility, the participants, and outside funders were greater than the quantifiable benefits to the utility, the participants, and outside funders. **The cost per acre-foot of water saved from an overall perspective was $23,158.**

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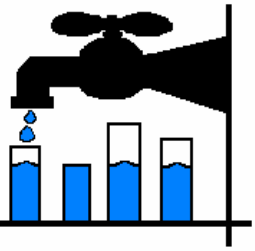
City of Santa Rosa Utilities

Washing Machine Rebate Program



Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	13,869	NA	13,869
Costs to Participants	NA	109,623	109,623
Costs to Others (SWCA, EGIA)	NA	NA	3,996
Total Costs	$13,869	$109,623	$127,488
Present Value Benefits			
Total Water Savings	5.51 AF	5.51 AF	5.51 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	17,319	17,319
Benefits to Others	NA	NA	0
Total Benefits	$0	$17,319	$17,319
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$13,869	-$147,116	-$164,981
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$2,519 /AF	$19,913 /AF	$23,158 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Customers' time spent installing new washing machines.
- Possible landfill disposal of old washing machines.

Benefits

- Savings on sewer bills.
- Avoided cost of acquisition and distribution of water saved.
- Some participants were eligible for an additional rebate from their energy company.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Water saved for future municipal use.
- Program participants received new washing machines.
- Improved public relations for the utility.
- Potential income from sale of old washing machines.

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Tualatin Valley Water District
Washing Machine Rebate Program

Tualatin Valley Water District (TVWD), located in eastern Washington County, Oregon, serves the communities of Cedar Hills, Oak Hills, Terra Linda, Cedar Mill, Reedville, Rock Creek, Cooper Mountain, The Bluffs, Progress, Metzger, Bonny Slope, Aloha, and Orenco. In addition, TVWD also serves portions of the cities Tigard, Beaverton, Portland, and Hillsboro. The District serves a population of approximately 192,000 people. The area's economy has been sustained through the development of high technology, retail, and distribution businesses.[1] As of the 2000 census, the median household income for Washington County was $52,122, which is higher than the statewide value of $40,916.[2]

WASHING MACHINE REBATE PROGRAM

Rebate Amount	**$50**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**2002- present**
Years Analyzed:	**2002**

UTILITY DEMOGRAPHICS

As of March 2004, Tualatin Valley Water District maintained 52,933 connections. Single family and multifamily residential customers accounted for about 94% of total connections (49,553 single family users and 709 multifamily users). The remaining 6% of connections are distributed among commercial users (1,372), industrial users (52), irrigation users (692), and miscellaneous users (555). TVWD's service area encompasses approximately 45 square miles. TVWD's average water use jn 2004, in gallons per capita per day (gpcd), was 117. TVWD delivered over 8.8 billion gallons of water in FY2003.[3]

UTILITY RATE STRUCTURE AND PRICES

Tualatin Valley Water District has an increasing block rate structure. As of November 1, 2004, the bimonthly base rate for service to a typical residential connection is $13.88. The price per unit of water is as follows:

Usage	Price
0 to 50 ccf (0 – 37,400 gallons)	$1.63 per ccf ($2.18 per 1000 gallons)
>50ccf (>37,400 gallons)	$2.61 per ccf ($3.49 per 1000 gallons)

CURRENT CAPACITY AND WATER SOURCES

The current storage capacity of Tualatin Valley Water District is over 53 million gallons, spread over 24 covered reservoirs.[4] TVWD purchases its water from the Portland Water Bureau, which comes primarily from the Bull Run Watershed, and the Joint Water Commission, which comes from the Barney Reservoir. Both are surface water sources.

[1] *About Our District*. Tualatin Valley Water District
[2] US Census Bureau.
[3] *Annual Report 2004*. Tualatin Valley Water District.
[4] *Annual Report 2004*. Tualatin Valley Water District.

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FUTURE PLANS TO MEET DEMAND

TVWD plans to meet its future water needs by continuing the use of current sources, through conservation, possibly purchasing more water from their wholesale water providers, and possibly expanding current sources and facilities.

OTHER TUALATIN VALLEY CONSERVATION PROGRAMS

Landscape Rebate Program, *March 2004-present*
Water-Saving Kit Distribution, *2002-present*
Outdoor Audits, *1997-present*
Leak Detection Program, *1970's-present*
Conservation Rates, *1994-present*
Public Education, *1990-present*

REBATE PROGRAM - DESCRIPTION

Since May 2002, Tualatin Valley Water District has offered a rebate of $50 off the purchase price to single family residential customers who replace high water use washing machines with Energy Star machines. TVWD issues a rebate check directly to the customer. Residents of Oregon also are eligible for a tax credit of up to $180 of the purchase price of an Energy Star washing machine.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received a rebate in 2002. The water savings were calculated and a cost benefit analysis was performed for the year 2002. The findings refer to this year only, not to the ongoing program. The lifespan of the washing machines installed, which is used as the period of this analysis, was assumed to be twelve years.[5]

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used for this analysis was 4.29%. The Consumer Price Index values used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of participants who received rebates in 2002. One hundred sixty customers received rebates during this time period. Of those 160 participants, 130 customers (who received 130 rebates) were usable for this analysis. Sufficient raw data was not available for 30 program participants (18.8%). It is possible that some of the remaining 130 households did not live in the household for the full period of analysis.

Tualatin Valley Water District single family residential households,

[5] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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excluding those included in this analysis, were used as the control group. The control group consisted of 44,667 households in 2000, 46,053 in 2001, 47,370 in 2002, 48,536 in 2003, and 49,578 in 2004.

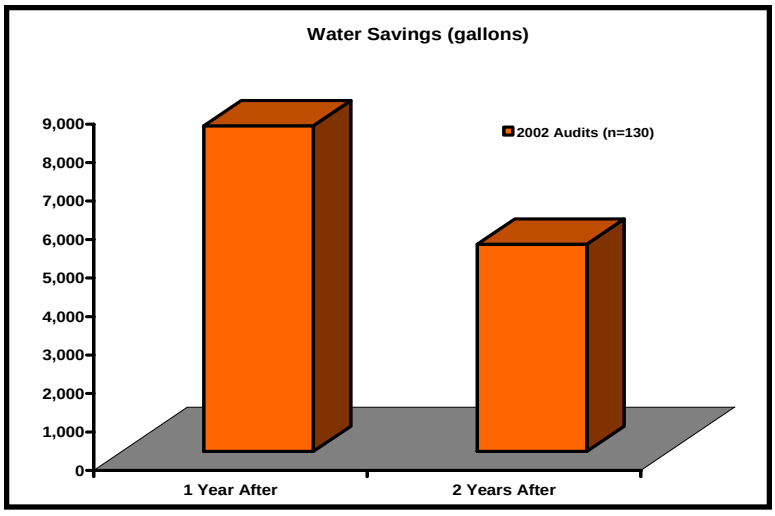
The average pre-measure annual water use of the participants (102,442 gallons) was greater than that of the control group (87,313 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of single family residential connections used for the control group is an average from throughout the year.

The costs for the program in 2002 were assumed to be $200 for program start-up ($2000 over 10 years), $20 for evaluation, $8 per rebate for processing, $0.03 per participant for a program brochure, and $0.02 per participant for advertising in their newsletter.



The price of water used in determining the benefits to customers from reduced water bills is the price from the range where the participants' pre-measure average bimonthly use fell. Average bimonthly use fell into the first tier, so the water rate used was $1.46 per ccf for 2003, $1.50 per ccf for 2004, and $1.63 per ccf for 2005 and beyond.

Participants who had two or more consecutive months of no water use were not included in the study.

The estimated average cost of high efficiency washers was $1000 each and high water use washers was $400 each. The difference between the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.

RESULTS - WATER SAVINGS

The first year after the rebate program, the water savings amounted to 1,100,459 gallons, or 8,465 gallons per participant per year (gppy) (8.3% of pre-measure water use). The second year after the rebates, the water savings amounted to 700,160 gallons or 5,386 gppy (5.3% of pre-measure water use). Average savings per year was 900,309 gallons or 6,926 gppy (6.8% of pre-measure water use). Total savings over the twelve year assumed lifespan was 10,803,716 gallons (33.2 AF) or about 83,106 gallons per participant.

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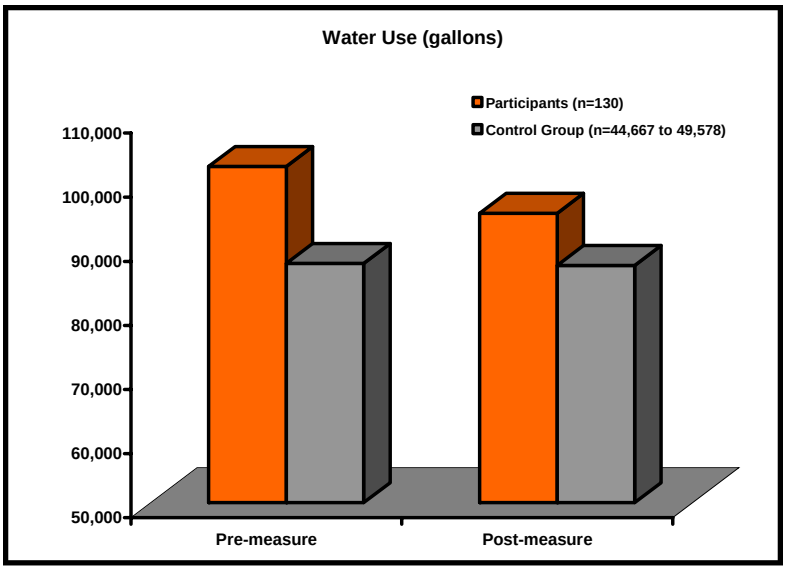

During the two years before replacing the high water use washing machines, the participant group's water usage was 117.3% of the control group's usage, on average. During the two years after replacing the washing machines, the participant group's water usage was 109.4% of the control group's usage, on average. The participant group's water use decreased by 7.1%, whereas the control group's use decreased by 0.4%. **The resulting overall water savings attributed to this program was 6.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

- The quantified cost to the utility was $7,945 ($61 per participant). This cost includes the cost of incentive payments, $6,825 ($53 per participant), labor, $1,092 ($8 per participant), consulting, $21 ($0.16 per participant), and advertising, $7 ($0.05 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to participants was $81,902 ($630 per participant). This cost includes the difference between the average cost of the high-efficiency washing machines and high water use washing machines.
- The quantified benefit to participants was $25,493 ($197 per participant). This value includes water bill savings, $18,668 ($144 per participant), and the amount that the customers received in financial incentives, -$6,825 ($53 per participant).

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Incentive Payments	$6,825	Not Quantified		Washing Machines	$81,902	Water Bill Savings	$18,668
Labor	$1,092					Financial Incentives	$6,825
Consulting	$21						
Advertising	$7						
Total	$7,945			Total	$81,902	Total	$25,493

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UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$7,945 from the utility perspective. This is a net benefit of -$61 per participant. This is a negative result; the quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $240.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$56,409 from the participant perspective. This is a net benefit of -$434 per participant. This is a negative result; the quantified costs to program participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,470.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$64,354 from an overall perspective. This is a net benefit of -$495 per participant. This is a negative result; the quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $2,710.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Possible landfill disposal of old washing machines.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided costs of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness about water conservation.**
- **Water saved for future municipal use.**
- **Reduced groundwater depletion, subsidence and surface water use.**
- **Program participants received new washing machines.**
- **Possible income from the sale of old machines.**
- **Some machines are refurbished and given to low-income families.**
- **Participants receive a tax credit from the State of Oregon for up to $180.**
- **Participants have decreased energy and sewer bills.**
- **High-efficiency machines use less detergent.**

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Tualatin Valley Water District

Washing Machine Rebate Program

Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	7,945	NA	7,945
Costs to Participants	NA	81,902	81,902
Costs to Others	NA	NA	0
Total Costs	$7,945	$81,902	$89,847
Present Value Benefits			
Total Water Savings	33.16 AF	33.16 AF	33.16 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	25,493	25,493
Benefits to Others	NA	NA	0
Total Benefits	$0	$25,493	$25,493
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$7,945	-$56,409	-$64,354
Cost Effectiveness Analysis (CEA (Total Costs ÷ Total Water Savings)	$240 /AF	$2,470 /AF	$2,710 /AF

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Thornton Water Res. Div.

Washing Machine Rebate Program

The City of Thornton Water Resources Division (TWRD) is located in Thornton, Colorado, approximately 10 miles north of downtown Denver. As of March 31, 2005, the population served by TWRD was 127,832, where 111,002 reside inside the city and 16,830 reside outside the city. Median household income was $54,445 as of the 2000 census, which was higher than the statewide average of $47,203.[1]

UTILITY DEMOGRAPHICS

As of May 2005, TWRD maintained 34,259 connections of which 94.3% were residential. Of their total connections, 30,377 were single family residential, 1,937 were multifamily residential, 628 were ICI, and 1,317 were irrigation accounts, including city parks. In addition to providing water to individual retail customers, TWRD provides 2.0 million gallons per day (mgd) of treated water to the City of Westminster. TWRD's total service area is 19 square miles. As of 2004, average customer water use in gallons per capita per day (gpcd) was 142 for all customers and 129 for residential customers.

WASHING MACHINE REBATE

Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**2003 – present**
Years Analyzed:	**2003**

UTILITY RATE STRUCTURE AND PRICES

As of 2004, the domestic inside-city monthly service charge is $2.46 for a 5/8 x 3/4 inch meter and the outside-city charge is $3.69 per month. TWRD has an increasing block rate structure. The four-tier structure categorizes rates by determining how much a customer uses relative to their Average Winter Consumption (AWC) and their Monthly Outdoor Allowance (MOA):

USAGE	PRICE	
	INSIDE CITY	OUTSIDE CITY
0 gallons - AWC	$3.00/1,000g	$4.50/1,000g
> AWC, up to AWC + MOA	$3.00/1,000g	$4.50/1,000g
> AWC + MOA, up to AWC + 2xMOA	$4.50/1,000g	$6.75/1,000g
> AWC + 2xMOA	$9.00/1,000g	$13.50/1,000g

CURRENT CAPACITY AND WATER SOURCES

Currently, the capacity of existing raw water storage from reservoirs is 26,594 acre-feet. Their treated water storage capacity is 27 mgd. TWRD has two water treatment plants that have a combined capacity of 65 mgd. TWRD's primary water sources are Clear Creek and the South Platte River.

FUTURE PLANS TO MEET DEMAND

The City of Thornton's growth rate has decreased from 5.0% in 2002 to 3.8% in 2004. The city's plans to meet future demand through a

[1] U.S. Census Bureau, American FactFinder.

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number of different actions. They plan to continue use of current capacity and sources, implement a planned surface water supply project from the Cache la Poudre River basin, expand storage and treatment facilities, continue conservation efforts, purchase and exchange additional water rights, and develop water reuse projects.

REBATE PROGRAM - DESCRIPTION

On May 1, 2003, the Washing Machine Rebate program began, which offers single family customers a $125 credit on their water bill for the purchase of a new high-efficiency washing machine. The rebate is limited to one per household. Washing machines must be on a list of qualifying models to be eligible. Participants must take a picture of the new, installed washing machine and attach it to the rebate application. Participants can also be selected for inspection of their new washing machine and their original sales receipt. The program is advertised in billing inserts, on TWRD's website, on television ads, at festivals, and in TWRD's quarterly magazine.

OTHER THORNTON CONSERVATION PROGRAMS

Toilet Rebates, ***May 1, 2003 - present***
Tiered Conservation Rates, ***effective May 15, 2003***
Public Education, ***May 2002-present***
Water Conservation Ordinances, ***various start dates***

During the time of the washing machine rebate program, especially from 2002 to 2004, the area was experiencing a drought and there were ongoing water conservation campaigns to mitigate the effects of the drought. However, a major snowstorm in March 2003 improved TWRD's water supply situation. Another important measure taking place during the period of the washing machine rebate program was the utility-wide transition from a flat rate structure to a conservation rate structure in May 2003.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received a washing machine rebate between May 1 and December 31, 2003. The water savings were calculated and a cost benefit analysis was performed for this time period. Results refer to this time period, not to the ongoing program. The lifespan of the washing machines, which is used as the period of analysis, was assumed to be 12 years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 4.38%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

Since two complete years of pre- and post-measure water use could not be acquired for this analysis, water use data for the participants was acquired from 18 months before the program and 18 months after the program for all households that were residing there for that full period. The pre-measure period includes January 2002 to June 2003, and the

post-measure period includes January 2004 to June 2005.
The population studied for this analysis was comprised of all participants who received washing machine rebates between May 1 and December 31, 2003. There were 85 usable participants out of 174 total participants during the period under analysis.

All TWRD single family households, including the participants, were used as the control group. The average annual pre-measure water use of the participants (122,976 gallons) was higher than that of the control group (107,839 gallons). The number of control group connections varied by month, from a minimum of 20,148 to a maximum of 24,532.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2003 CPI value, 184.0, and the 2004 CPI value, 188.9, were used in this analysis.

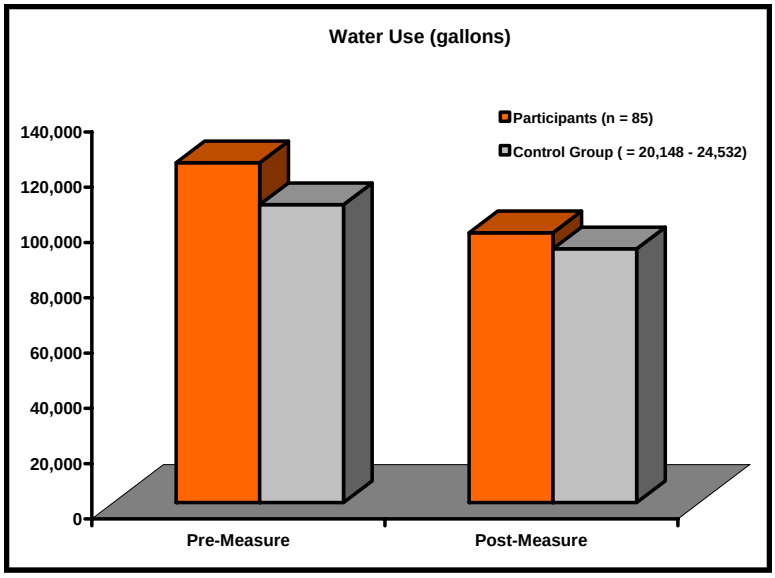
Participants who participated in any other water conservation program during the period of analysis were not included in the study.

Participants who had two or more consecutive months of no water use were not included in the study.

Any participants that had 11 to 13 months of usage per year were included in the study.

The control group consisted of all single family residential connections, including participants.

The percentage of washing machine rebate program participants who lived inside the city was 97%. However, it was assumed that 100% of participants lived inside the city, thus Inside-City rates apply for all cost benefit analysis calculations.



Since all participants were assumed to reside inside the city, Outside-City connections were not included in the control group.

It was assumed that average participant water use falls into tier 1 or 2 of the increasing block rate structure implemented in 2003.

The average cost of installation of a washing machine was assumed to be $0. This is because many appliance stores offer free installation with the purchase of a new washing machine.

The estimated average cost of high efficiency washers was $1000 each and high water use washers were $400 each. The difference between

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the two costs ($600) is used as the cost to the participant, as it is assumed that they would have purchased a high water use washer had they not received the rebate.

RESULTS - WATER SAVINGS

During the 18 months after receiving the washing machine rebates, water savings amounted to 895,796 gallons or 10,539 gallons per participant (5.7% of pre-measure water use). The average savings per year was 597,197 gallons, or 7,026 gallons per participant per year (gppy) (5.7% of pre-measure water use). **The total savings over the twelve year assumed lifespan was 7,166,367 gallons (22.0 AF), or 84,310 gallons per participant.**

During the 18 months before participating in the washing machine rebate program, the participant group's water use was, on average, 114.0% of the control group's use. During the 18 months after, the participant group's water use was 106.4% of the control group's use, on average. The participant group's water use decreased by 20.6%, whereas the control group's use decreased by 14.9%. **The resulting overall water savings attributed to this program was 5.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twelve years).

- The quantified cost to the utility was $13,659 ($161 per participant). This cost includes the cost of financial incentives, $10,908 ($128 per participant), labor, $2,659 ($31 per participant), and advertising, $91 ($1 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $52,358 ($616 per participant), which includes the cost of the washing machines.
- The quantified benefit to the participants was $27,796 ($327 per participant). This includes the benefits of water bills savings, $16,888 ($199 per participant), and financial incentives, $10,908 ($128 per participant).

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Financial Incentives	$10,908	Not Quantified		Washing Machines	$52,358	Water bill savings	$16,888
Labor	$2,659					Financial Incentives	$10,908
Advertising	$91						
Total	$13,659			Total	$52,358	Total	$27,796

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$13,659 from the utility perspective over the twelve year assumed lifespan of the washing machines. This is a net benefit of -$161 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $621.**

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PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$24,563 from the perspective of the participant. This is a net benefit of -$289 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,381.**

OVERALL PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$38,221 from an overall perspective. This is a net benefit of -$450 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to te participants and utility. **The cost per acre-foot of water saved from an overall perspective was $3,002.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Possible landfill disposal of old washing machines.**

Benefits

- **Financial savings on sewer bill for participants.**
- **Utility avoids the cost of acquiring and distributing the water saved.**
- **Reduced energy bills for participants.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Improved public relations for the utility.**
- **Water saved for future municipal use.**
- **Participants received new washing machines.**
- **Possible income from the sale of old machines.**
- **Participants have decreased energy and sewer bills.**
- **High-efficiency machines use less detergent.**

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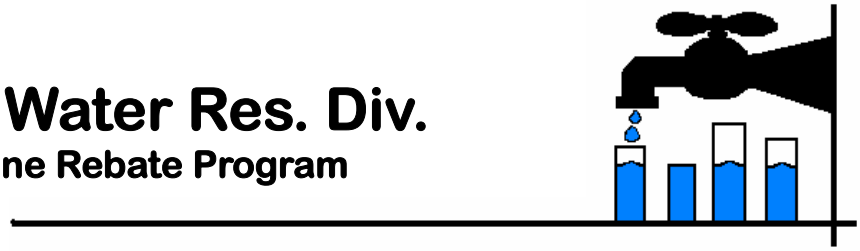
Thornton Water Res. Div.

Washing Machine Rebate Program



Results of Cost Benefit Analysis-Lifespan (12 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	13,659	NA	13,659
Costs to Participants	NA	52,358	52,358
Costs to Others	NA	NA	0
Total Costs	$13,659	$52,358	$67,139
Present Value Benefits			
Total Water Savings	21.99 AF	21.99 AF	21.99 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	27,796	27,796
Benefits to Others	NA	NA	0
Total Benefits	$0	$27,796	$27,796
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$13,659	-$24,563	-$38,221
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$621 /AF	$2,381 /AF	$3,002 /AF

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Community Water of Green Valley
Commercial Washing Machine Program

Community Water Company of Green Valley (CWCGV), a cooperative water utility, is one of five water utilities that serve the town of Green Valley located in the Santa Cruz Valley of Southern Arizona. As of 2003, the town's population was approximately 18,700.[1] The median household income as of the 2000 census was $40,213.[2]

UTILITY DEMOGRAPHICS

As of 2003, CWCGV had approximately 9,800 connections, 49.8% of which were residential. Of their total connections, 4,866 were single family residential, 4,672 were multifamily residential, 233 were commercial, 16 were government, and 11 were construction. CWCGV provides service to a population of 15,500 and currently maintains 10,817 connections. CWCGV's total service area is eight square miles. As of 2004, CWCGV's customer water use for the utility as a whole was 142 gallons per capita per day (gpcd).

UTILITY RATE STRUCTURE AND PRICES

CWCGV has a uniform price structure. The minimum monthly charge for 5/8" meters, which accounts for the majority of the utility's connections, is $12.50 and includes 2,000 gallons of water. Customers pay $1.07 for every 1,000 gallons over 2,000 gallons. This rate structure has been in place since 1987, with no subsequent rate increases.

WASHING MACHINE REPLACEMENT

Eligible Customers:	**Condominium Complex**
Years Analyzed:	**Installation: March 2003**
	Water Use 2000 - 2004

CURRENT CAPACITY AND WATER SOURCES

CWCGV depends solely on groundwater and maintains and operates four wells. The company has a current storage capacity of five million gallons.

FUTURE PLANS TO MEET DEMAND

The population within CWCGV's service area is growing at 6% per year. CWCGV plans to meet future demand with current capacity and water sources, and by implementing water conservation measures. CWCGV, in conjunction with other utilities, is studying the possibility of using Central Arizona Project (CAP) water in Green Valley.

COMMERCIAL WASHING MACHINE REPLACEMENT PROGRAM - DESCRIPTION

In March 2003, six washing machines were replaced in one of the Villas West Condominiums' community laundromats. The Villas West Condominiums is a condominium complex built in 1964, with 672 units. It is an age restricted community (55+). There are four laundromats at the complex and the particular facility where these machines were

[1] Arizona Department of Commerce: Green Valley Community Profile.
[2] U.S. Census Bureau: Profile of General Demographic Characteristics 2000.

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replaced is heavily used by residents. Top loading Speed Queen washing machines were replaced by front loading Maytag Neptune commercial high efficiency washing machines. The top loading Speed Queen machines use approximately 30 gallons per cycle. The Maytag Neptune machines use approximately 13 gallons per cycle.

Villas West Condominiums contracts with WEB Service Company for laundromat management. This contract entails the provision of washing machines, service, and maintenance. The company considers the property's needs (e.g. the need for new machines, as well as the need to cut water and energy costs) in addition to the nature of the contract when making decisions regarding machine selection and/or replacement. WEB Service Company purchased the new washing machines for $725 each. The approximate retail price for these machines is $1,600 each. Community Water Company of Green Valley was not involved through incentive or any other means in this washing machine replacement; however, it does provide water to the condominiums.

OTHER CWCGV CONSERVATION PROGRAMS

Public Education, ***ongoing.***
CWCGV has sponsored workshops on a variety of outdoor water conservation topics and publishes monthly water saving tips in the local newspaper.

Showerhead and Faucet Aerator Giveaway, ***1992 – present***
CWCGV distributes free conservation packets with two low-flow showerheads, two faucet aerators, and one low-flow faucet fixture.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes one laundromat at Villas West Condominiums. This laundry facility is served by one meter for which water use data was acquired for three years before and one year following the washing machine replacement. The analysis findings refer only to the washing machine replacements at this particular laundromat during the specified time period only, and not to subsequent washing machine replacements. The lifespan of the washing machines was assumed to be two years because they were intended for commercial use.[3] Given this assumption, water savings, costs, and benefits were extrapolated to March 2006.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used for this analysis was 3.1%. The Consumer Price Index value used in this analysis was the 2004 value of 188.9 and the 2003 value of 184.0.

Water use data was acquired for three years before and one year after the washing machine replacement at Villas West Condominiums. Given the nature of this analysis, no control group was available.

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of best Management Practices for Urban Water Conservation.* California, 1996.

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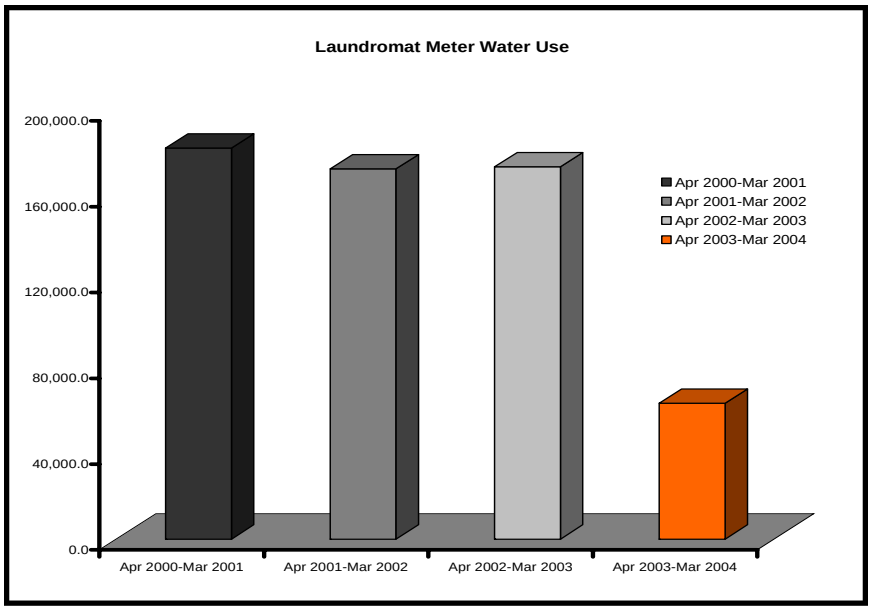

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

There was no control group for this analysis as only one facility's water use was being analyzed before and after the installation of water conserving appliances.

The discount rate used was 3.1%, for a 3-year lifespan (the minimum specified in OMB Circular A-94) from 2003.

The Consumer Price Index value used in this analysis was the 2004 value of 188.9 and the 2003 value of 184.0.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the utility's price of water. $1.07 per 1,000 gallons was used throughout the analysis (including future years).

RESULTS - WATER SAVINGS

In the year after the installations, the water savings amounted to 112,767 gallons, or 0.35 AF (64% of pre-measure use). **The total savings over the two year assumed lifespan was 225,533 gallons, or 0.69 AF.**

During the year after the washing machine replacements, water use at the laundry facility was 36.0% of the average water use during the three years before the replacements. **The resulting overall water savings attributed to this program was 64%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (three years).

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Quantified Costs and Benefits					
Utility			Participant		
Costs	Benefits		Costs		Benefits	
Not Quantified			Washing Machines	$4,466	Water Bill Savings	$237
			Total	$4,466	Total	$237

- The quantified cost to the utility was $0.
- The quantified benefit to the utility was $0.
- The quantified cost to Villas West Condominiums was $4,466. This includes the cost of six washing machines purchased in bulk through WEB Services at $744 each.
- The quantified benefit to Villas West Condominiums was $237. This includes water bill savings, $237.

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0 as there was no quantified cost to the utility.**

PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$4,235 from Villas West Condominiums' perspective. The quantified costs to the condominium were greater than the quantified benefits to the condominium. **The cost per acre-foot of water saved from the participant perspective was $6,452.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$4,229 from an overall perspective. The quantified costs to the condominium and utility were greater than the quantified benefits to the condominium and utility. **The cost per acre-foot of water saved from an overall perspective was $6,452.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Disposal of old washing machines**
- **Laundry detergent specially designed for high efficiency washing machines**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Reduced energy bills**
- **Environmental benefits from reduced water use**
- **New washing machines**
- **Resident satisfaction with new laundry facility**

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Community Water of Green Valley

Commercial Washing Machine Program

Results of Cost Benefit Analysis-Lifespan (2 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	0	0	0
Costs to Customers	NA	4,465	4,465
Costs to Others	NA	0	0
Total Costs	$0	$4,465	$4,465
Present Value Benefits			
Total Water Savings	0.69 AF	0.69 AF	0.69 AF
Benefits to Utility	0	0	0
Benefits to Customers	NA	237	237
Benefits to Others	NA	NA	0
Total Benefits	$0	$237	$237
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$0	-$4,229	-$4,229
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$0 /AF	$6,452 /AF	$6,452 /AF

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LANDSCAPE CONVERSION REBATE
CASE NARRATIVES

PAGES

Albuquerque Water Res. Div.

Landscape Rebate Program

The City of Albuquerque Water Resources Division is a municipal water provider serving the City of Albuquerque, a large city located in north central New Mexico. The Division provides water to approximately 449,000 people. The 1999 median household income in Albuquerque was $38,272, which is higher than the statewide median of $34,133.[1]

UTILITY DEMOGRAPHICS

As of 2003, the City of Albuquerque Water Resources Division had 162,608 connections, 90.1% of which were residential. Of their total connections, 146,484 were single family residential, 13,177 were commercial (multifamily residential connections are included with commercial), 114 were industrial, approximately 1,000 were irrigation, and 1,833 were institutional (schools, government agencies, hospitals) water customers. The city's total service area is approximately 180 square miles. As of 2004, Albuquerque customers' water use, in gallons per capita per day (gpcd), was 177.[2]

LANDSCAPE REBATE PROGRAM

Rebate Amount:	**$.40 sq./ft., max $800**
Eligible Customers:	**SF, ICI**
Customers Analyzed:	**SF**
Program Years:	**1996 - present**
Analysis Years:	**1997 - 2001**

UTILITY RATE STRUCTURE AND PRICES

The City of Albuquerque has a uniform rate structure. The 2004 monthly water charges are $6.04 for 5/8'' and 3/4'' meters, which includes zero gallons of water. The charge per hundred cubic feet (ccf) of water is $1.23 per ccf ($1.64 per 1,000 gallons). The commodity rate includes the cost per unit, state of New Mexico conservation fee, contributions to the Sustainable Water Supply program, and contributions to the Water Resources Management Program.[3]

CURRENT CAPACITY AND WATER SOURCES

As of 2003, the Water Resources Division had storage capacity of 211 million gallons per day of treated water.[4] The utility's 94 wells are supplied by the Santa Fe Group Aquifer.[5]

FUTURE PLANS TO MEET DEMAND

The population of Albuquerque increased substantially between 1990 and 2000; during that decade, the population increased by 15.9%.[6] The City of Albuquerque continues to grow at a rate of 1.5% per year.[7] The utility plans to meet future demand by reducing groundwater use, expanding and changing water sources, implementing and continuing conservation programs, reusing water, purchase, and constructing a purification facility.

[1] US Census Bureau.
[2] City of Albuquerque Water Conservation Home.
[3] City of Albuquerque Water Utility Department.
[4] City of Albuquerque. Citizen Services—Frequently Asked Questions.
[5] City of Albuquerque. Water Quality Report 2003.
[6] US Census Bureau.
[7] US Census Bureau.

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REBATE PROGRAM - DESCRIPTION

The City of Albuquerque Landscape Rebate Program is an incentive program for residential and commercial customers who convert their high water use turf to Xeriscape. Eligible customers receive $0.40 per square foot converted, and must convert at least 500 square feet of high water use landscape. The maximum rebate for residential and commercial customers is $800 and $5,000, respectively. Customers wishing to participate in the rebate program must first submit an application to the city detailing their landscaping plans. City inspectors visit the property to ensure that existing landscape is in fact high water use (customers with existing water efficient landscapes are ineligible). If the application is approved, customers have six months in which to complete the conversion. Upon project completion, customers must arrange a final inspection, thereafter, the appropriate rebate amounts are credited to customers' accounts.[8]

OTHER CITY OF ALBUQUERQUE CONSERVATION PROGRAMS

Toilet Rebates, *1996-present*
Showerhead/Aerator Rebates and Replacements, *2000-present*
Washing Machine Rebates, *2000-present*
Water Harvesting System Rebates, *2002-present*
Graywater System Rebates, *2003-present*
Irrigation System Rebates, *2003 -present*
Conservation Rates, *2001-present*
Indoor/Outdoor Audits, *1998-present*
Leak Detection for Customers, *1998-present*
Public education, *1999–present*
Conservation Ordinances, *1996-present*
Dishwasher/Hot Water Recirculator Rebate Program, *2003-present*

The program has significantly increased in popularity since its initiation in 1996. Changes to the financial incentive amount have contributed to the programs rising popularity. From 1996 to 1999, the rebate amount was $0.25 per square foot converted. In 2000, the rebate amount increased to $0.40 per square foot converted. In 2003, the city increased the maximum rebate amount for commercial users to $5,000, which resulted in increased commercial participation.

The landscape rebate program is part of the city of Albuquerque's larger water conservation campaign (financial incentives, public education, water use audits, etc.). The city specifically targets high water users for all conservation programs.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received landscape conversion rebates during the years 1997 through 2001. The water savings were calculated and a cost benefit analysis was performed for the years 1997, 1998, 1999, 2000, and 2001. The findings refer to these five years only, not to the ongoing program. The

[8] Xeriscape Rebate and Designs.

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lifespan of the landscape conversion, which is used as the period of analysis, was assumed to be 10 years.

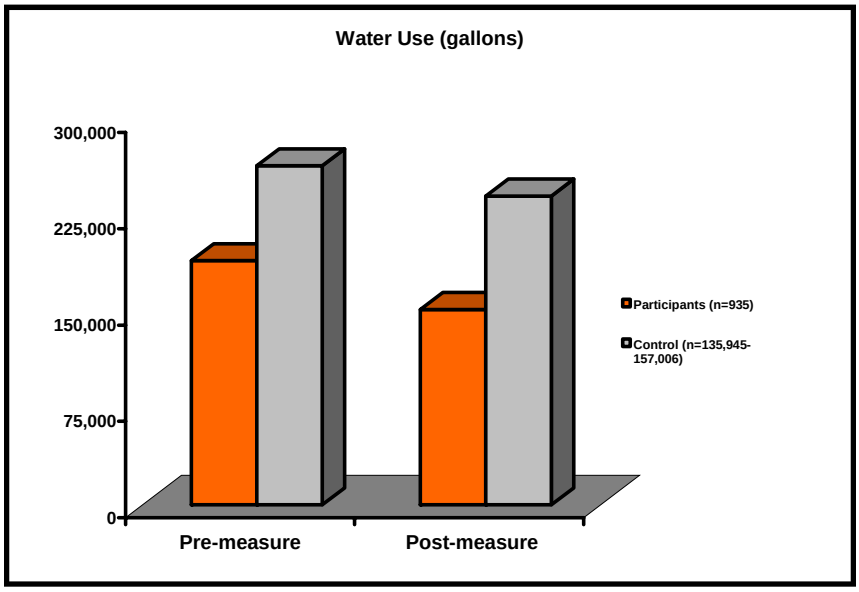
All quantified costs and benefits have been discounted to the first year of the analysis (1997) and inflated to 2004 dollars. The discount rate used for this analysis was 6.1%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1997 value of 160.5.

The population studied for this analysis was comprised of all participants who received a landscape conversion rebate during 1997, 1998, 1999, 2000, and 2001. There were 104 usable participants out of 104 total participants in 1997, 155 out of 159 in 1998, 192 out of 195 in 1999, 197 out of 201 in 2000, and 287 out of 294 in 2001, for a total of 935 usable participants out of 953. Approximately 2%, or 18, of the possible participants were unusable because there was insufficient raw data, they were not single family residential customers, or they have moved during the period of analysis.

All City of Albuquerque single family residential households that did not participant in the landscape conversion rebate program were used as the control group. However, the weighted average annual pre-measure water use of the participants (190,236 gallons) was lower than that of the control group (264,155 gallons).

For 1997 landscape conversion rebates, the control group consisted of 135,841 households in 1995, 138,467 in 1996, 140,708 in 1997, 143,241 in 1998, and 146,430 in 1999.

For 1998 landscape conversion rebates, the control group consisted of 138,416 households in 1996, 140,657 in 1997, 143,190 in 1998, 146,379 in 1999, and 148,985 in 2000.



For 1999 landscape conversion rebates, the control group consisted of 140,620 households in 1997, 143,153 in 1998, 146,342 in 1999, 148,948 in 2000, and 151,813 in 2001.

For 2000 landscape conversion rebates, the control group consisted of 143,148 households in 1998, 146,337 in 1999, 148,943 in 2000, 151,808 in 2001, and 154,735 in 2002.

For 2001 landscape conversion rebates, the control group consisted of 146,247 households in 1999, 148,853 in 2000, 151,718 in 2001, 154,645 in 2002, and 156,719 in 2003.

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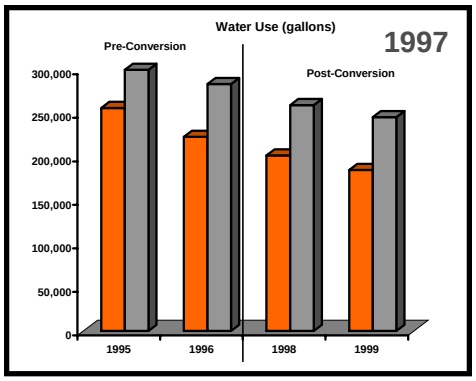
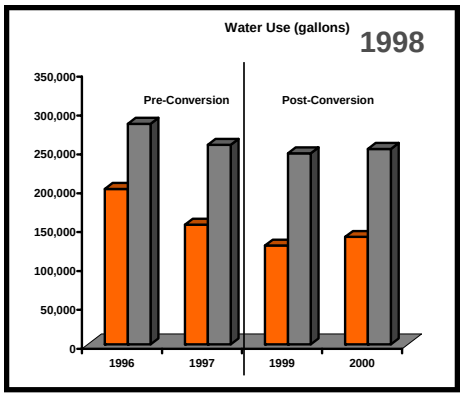
ASSUMPTIONS

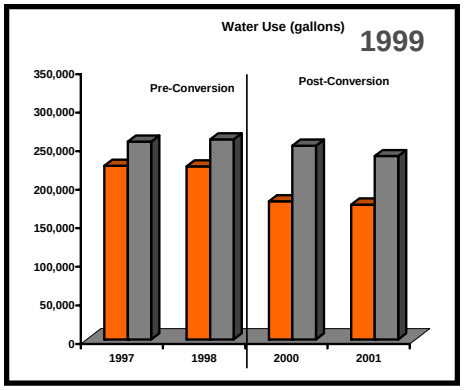
Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

There was a no minimum square footage requirement for the landscape conversions.

The number of connections is an average of connections from throughout the year.







PARTICIPANTS

CONTROL GROUP

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We estimated $50,000 per year in advertising costs for this program.

We estimated $70,000 per year in labor for this program, including Xeriscape inspector ($50,000/yr) and clerical staff ($20,000/yr).

We assumed a cost of $3.50 per square foot to the participant for labor and materials for the landscape conversion.

We assumed the variable water rate of $1.23 per ccf since 1997.

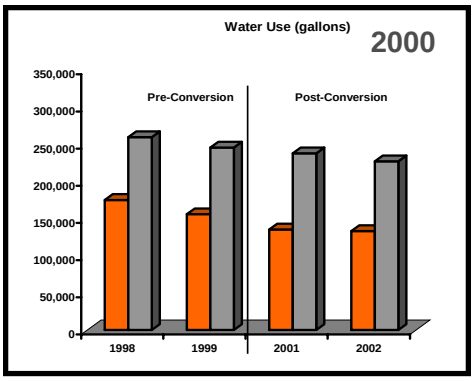
RESULTS - WATER SAVINGS

In the first year after the 1997 landscape conversion rebates, water savings amounted to 1,184,258 gallons, or 11,387 gallons per participant per year (gppy) (4.8% of pre-measure water use). The second year after the landscape conversion rebates, water savings amounted to 1,744,853 gallons, or 16,777 gppy (7.0% of pre-measure water use). The average water savings per year was 1,464,556 gallons (4.5 AF), or 14,082 gppy (5.9% of pre-measure water savings). **The total water savings over the ten year assumed lifespan of the landscape conversions was 14,645,557 gallons (44.9 AF), or 140,823 gallons per participant.**

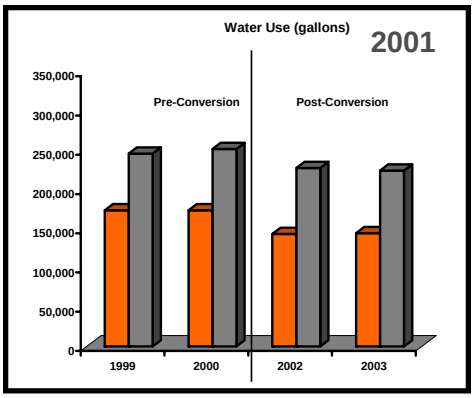
The first year after the 1998 landscape conversion rebates, water savings amounted to 5,241,184 gallons, or 33,814 gppy (19.1% of pre-measure water use). The second year after the rebates, water savings amounted to 4,118,516, or 26,571 gppy (15.0% of pre-measure water use). The average water savings per year was 4,679,850 gallons (14.4 AF) or 30,193 gppy (17.1% of pre-measure water use). **The total savings over the ten year assumed lifespan of the landscape conversions was 46,798,504 gallons (143.6 AF), or 301,926 gallons per participant**.

The first year after the 1999 landscape conversion rebates, water savings amounted to 7,615,701 gallons, or 39,665 gppy (17.7% of pre-measure water use). The second year after the rebates, water savings amounted

to 6,206,817 gallons, or 32,327 gppy (14.4% of pre-measure water use). The average water savings per year was 6,911,259 gallons (21.2 AF) or 35,996 gppy (16.0% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the landscape conversions was 69,112,591 gallons (212.1 AF), or 359,961 gallons per participant.**



The first year after the 2000 landscape conversion rebates, water savings amounted to 4,065,211 gallons, or 20,636 gppy (12.5% of pre-measure water use). The second year after the rebates, water savings amounted to 3,098,622 gallons, or 15,729 gppy (9.5% of pre-measure water use). The average water savings per year was 3,581,917 gallons (11.0 AF) or 18,182 gppy (11.0% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the landscape conversions was 35,819,166 gallons (109.9 AF), or 181,823 gallons per participant.**



The first year after the 2001 landscape conversion rebates, water savings amounted to 4,390,978 gallons, or 15,300 gppy (8.8% of pre-measure water use). The second year after the rebates water savings amounted to 3,418,305 gallons, or 11,910 gppy (6.9% of pre-measure water use). The average water savings per year was 3,904,642 gallons (12.0 AF) or 13,605 gppy (7.9% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the landscape conversions was 39,046,418 gallons (119.8 AF), or 136,050 gallons per participant.**

PARTICIPANTS
CONTROL GROUP

In the first year after the landscape conversions, the total water savings for the five years studied amounted to 22,497,333 gallons, or 24,061 gppy (12.7% of weighted pre-measure water use). In the second year after the landscape conversions, the total water savings amounted to 18,587,114 gallons, or 19,879 gppy (10.5% of weighted pre-measure use). **The total water savings over the ten year assumed lifespan of the landscape conversions was 205,422,235 gallons (630.4 AF), or 219,703 gallons per participant.**

During the two years before participating in the program, participants' water use was 72.0% of the control group's use, on average. During the two years after participating in the program, their water use was 63.3% of the control group's use, on average. The participants' water use decreased by 20.0% from pre-measure to post-measure, whereas the control group's use decreased by 8.9%. **The resulting overall water savings attributed to this program was 11.1%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (ten years).

1997 LANDSCAPE CONVERSION REBATES

- The quantified cost to the utility was $150,005. This includes the

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cost of advertising, $58,847, the cost of financial incentives, $8,772, and the cost of labor, $82,386. This is a cost of $1,442 per participant, including $566 for advertising, $84 in financial incentives, and $792 in labor.

- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $122,805. This includes the cost of the landscape conversion and relevant materials, $122,805. This is a cost of $1,181 per participant.
- The quantified benefit to the participants was $29,451. This includes financial incentives, $8,772, and water bill savings $20,679. This is a benefit of $283 per participant, including $84 in financial incentives and $199 in water bill savings.

UTILITY PERSPECTIVE - 1997

Results of the cost-benefit analysis show a net benefit (net present value) of -$150,005 from the utility perspective. This is a net benefit of -$1,442 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $3,338.**

1997 Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Advertising	$58,847	Not Quantified		Conversion Materials	$122,805	Financial Incentives	$8,772
Financial Incentives	$8,772					Water Bill Savings	$20,679
Labor	$82,386						
Total	$150,005			Total	$122,805	Total	$29,451

PARTICIPANT PERSPECTIVE - 1997

Results of the cost benefit analysis show a net benefit (net present value) of -$93,355 from the participant perspective. This is a net benefit of -$898 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,732.**

OVERALL PERSPECTIVE - 1997

Results of cost benefit analysis show a net benefit (net present value) of -$243,360 from an overall perspective. This is a net benefit of -$2,340 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $6,070.**

1998 LANDSCAPE CONVERSION REBATES

- The quantified cost to the utility was $161,872. This includes the cost of advertising, $55,464, the cost of financial incentives $28,758, and the cost of labor, $77,650. This is a cost of $1,045 per participant, including $358 for advertising, $186 in financial incentives, and $501 in labor.
- The quantified benefit to the utility was $0.

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- The quantified cost to the participants was $402,614. This includes the cost of the landscape conversion and relevant materials, $402,614. This is a cost of $2,598 per participant.
- The quantified benefit to the participants was $91,179. This includes financial incentives, $28,758, and water bill savings, $62,421. This is a benefit of $589 per participant, including $186 in financial incentives, and $403 in water bill savings.

1998			Quantified Costs and Benefits			
Utility			Participants			
Costs		Benefits	Costs		Benefits	
Advertising	$55,464	Not Quantified	Conversion Materials	$402,614	Financial Incentives	$28,758
Financial Incentives	$28,758				Water Bill Savings	$62,421
Labor	$77,650					
Total	$161,872		Total	$402,614	Total	$91,179

UTILITY PERSPECTIVE - 1998

Results of the cost-benefit analysis show a net benefit (net present value) of -$161,872 from the utility perspective. This is a net benefit of -$1,045 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1,127.**

PARTICIPANT PERSPECTIVE - 1998

Results of the cost-benefit analysis show a net benefit (net present value) of -$311,434 from the participant perspective. This is a net benefit of -$2,009 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,803.**

OVERALL PERSPECTIVE - 1998

Results of cost benefit analysis show a net benefit (net present value) -$473,306 from an overall perspective. This is a net benefit of -$3,054 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $3,930.**

1999 LANDSCAPE CONVERSION REBATES

- The quantified cost to the utility was $160,545. This includes the cost of advertising, $52,275, the cost of financial incentives $35,085, and the cost of labor, $73,185. This is a cost of $836 per participant, including $272 for advertising, $183 in financial incentives, and $381 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $491,191. This includes the cost of the landscape conversion and relevant materials, $491,191. This is a cost of $2,558 per participant.
- The quantified benefit to the participants was $121,958. This includes financial incentives, $35,085, and water bill savings,

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$86,873. This is a benefit of $635 per participant, including $183 in financial incentives, and $452 in water bill savings.

1999 Quantified Costs and Benefits						
Utility			Participants			
Costs		Benefits	Costs		Benefits	
Advertising	$52,275	Not Quantified	Conversion Materials	$491,191	Financial Incentives	$35,085
Financial Incentives	$35,085				Water Bill Savings	$86,873
Labor	$73,185					
Total	$160,545		Total	$491,191	Total	$121,958

UTILITY PERSPECTIVE - 1999
Results of the cost-benefit analysis show a net benefit (net present value) of -$160,545 from the utility perspective. This is a net benefit of -$836 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $757.**

PARTICIPANT PERSPECTIVE - 1999
Results of the cost-benefit analysis show a net benefit (net present value) of -$369,233 from the participant perspective. This is a net benefit of -$1,923 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,316.**

OVERALL PERSPECTIVE - 1999
Results of cost-benefit analysis show a net benefit (net present value) of -$529,779 from an overall perspective. This is a net benefit of -$2,759 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $3,073.**

2000 LANDSCAPE CONVERSION REBATES

- The quantified cost to the utility was $151,426. This includes the cost of advertising, $49,270, the cost of financial incentives $33,178, and the cost of labor, $68,978. This is a cost of $769 per participant, including $250 for advertising, $169 in financial incentives, and $350 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $290,310. This includes the cost of the landscape conversion and relevant materials, $290,310. This is a cost of $1,474 per participant.
- The quantified benefit to the participants was $75,624. This includes financial incentives, $33,178, and water bill savings, $42,446. This is a benefit of $384 per participant, including $169 in financial incentives, and $215 in water bill savings.

UTILITY PERSPECTIVE - 2000
Results of the cost-benefit analysis show a net benefit (net present value) of -$151,426 from the utility perspective. This is a net benefit of -

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$769 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1,378.**

2000 Quantified Costs and Benefits						
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Advertising	$49,270	Not Quantified		Conversion Materials	$290,310	Financial Incentives	$33,178
Financial Incentives	$33,178					Water Bill Savings	$42,446
Labor	$68,978						
Total	$151,426			Total	$290,310	Total	$75,624

PARTICIPANT PERSPECTIVE - 2000

Results of the cost-benefit analysis show a net benefit (net present value) of -$214,686 from the participant perspective. This is a net benefit of -$1,090 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,641.**

OVERALL PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$366,112 from an overall perspective. This is a net benefit of -$1,858 per participant. The quantified costs to the participants and the utility were greater than the quantified benefits to the participants and the utility. **The cost per acre-foot of water saved from an overall perspective was $4,019.**

2001 LANDSCAPE CONVERSION REBATES

- The quantified cost to the utility was $162,046. This includes the cost of advertising, $46,437, financial incentives, $50,597, and labor, $65,012. This is a cost of $565 per participant, including $162 for advertising, $176 in incentives, and $227 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $442,723. This includes the cost of the landscape conversion and relevant materials, $442,723. This is a cost of $1,543 per participant.
- The quantified benefit to the participants was $94,203. This includes financial incentives, $50,597, and water bill savings, $43,606. This is a benefit of $328 per participant, including, $176 in financial incentives and $152 in water bill savings.

UTILITY PERSPECTIVE - 2001

Results of the cost-benefit analysis show a net benefit (net present value) of -$162,046 from the utility perspective. This is a net benefit of -$565 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1,352.**

PARTICIPANT PERSPECTIVE - 2001

Results of the cost-benefit analysis show a net benefit (net present value) of -$348,520 from the participant perspective. This is a benefit of -$1,214 per participant. The quantified costs to the participant were

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greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $3,695.**

2001 Quantified Costs and Benefits						
Utility			Participants			
Costs		Benefits	Costs		Benefits	
Advertising	$46,437	Not Quantified	Conversion Materials	$442,723	Financial Incentives	$50,597
Financial Incentives	$50,597				Water Bill Savings	$43,606
Labor	$65,012					
Total	$162,046		Total	$442,723	Total	$94,203

OVERALL PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$510,567 from an overall perspective. This is a net benefit of -$1,779 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $5,047.**

LANDSCAPE CONVERSION REBATES - ALL YEARS

- The quantified cost to the utility was $785,895. This includes the cost of advertising, $262,294, the cost of financial incentives, $156,390, and the cost of labor $367,211. This is a cost of $841 per participant, including $281 for advertising, $167 in financial incentives, and $393 in labor.
- The quantified benefit to the utility was $0
- The quantified cost to the participants was $1,749,643. This includes the cost of the landscape conversion and relevant materials $1,749,643. This is a cost of $1,871 per participant.
- The quantified benefit to the participants was $412,414. This includes financial incentives, $156,390, and water bill savings, $256,024. This is a benefit of $441 per participant, including $167 in financial incentives, and $274 in water bill savings

UTILITY PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$785,895 from the utility perspective. This is a net benefit of -$841 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1,247.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$1,337,229 from the participant perspective. This is a net benefit of -$1,430 per participant. The quantified costs to the participants were greater than the quantified benefit to the participants. **The cost per acre-foot of water saved from the participant perspective was $2,775.**

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OVERALL PERSPECTIVE - ALL YEARS

Results of cost-benefit analysis from an overall perspective show a net benefit (net present value) of -$2,123,124 from an overall perspective. This is a net benefit of -$2,271 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $4,022.**

ALL YEARS	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Advertising	$262,294	Not Quantified		Conversion Materials	$1,749,643	Financial Incentives	$156,390
Financial Incentives	$156,390					Water Bill Savings	$256,024
Labor	$367,211						
Total	$785,895			Total	$1,749,643	Total	$412,414

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Landfill disposal of high water use landscaping.**
- **Time spent converting the landscape.**
- **Time spent arranging and awaiting pre- and post-conversion inspections by the city.**
- **Aesthetics.**
- **Loss of function.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided costs of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness about water conservation.**
- **Water savings for future municipal water use.**
- **Reduced surface water use.**
- **Newly xeriscaped landscapes.**

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Albuquerque Water Res. Div.
Landscape Rebate Program

1997 Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	150,005	NA	150,005
Costs to Participants	NA	122,805	122,805
Costs to Others	NA	NA	0
Total Costs	$150,005	$122,805	$272,810
Present Value Benefits			
Total Water Savings	44.95 AF	44.95 AF	44.95 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	29,450	29,450
Benefits to Others	NA	NA	0
Total Benefits	$0	$29,450	$29,450
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$150,005	-$93,355	-$243,360
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$3,338 /AF	$2,732 /AF	$6,070 AF

1998 Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	161,872	NA	161,872
Costs to Participants	NA	402,614	402,614
Costs to Others	NA	NA	0
Total Costs	$161,872	$402,614	$564,485
Present Value Benefits			
Total Water Savings	144 AF	144 AF	144 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	91,179	91,179
Benefits to Others	NA	NA	0
Total Benefits	$0	$91,179	$91,179
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$161,872	-$311,434	-$473,306
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1,127/AF	$2,803 /AF	$3,930 /AF

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Albuquerque Water Res. Div.
Landscape Rebate Program

Results of Cost Benefit Analysis-Lifespan (10 Years) 1999

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	160,545	NA	160,545
Costs to Participants	NA	491,190	491,190
Costs to Others	NA	NA	0
Total Costs	$160,545	$491,190	$651,736
Present Value Benefits			
Total Water Savings	212.10 AF	212.10 AF	212.10 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	121,957	121,957
Benefits to Others	NA	NA	0
Total Benefits	$0	$121,957	$121,957
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$160,545	-$369,233	-$529,778
Cost Effectiveness Analysis(CEA) (Total Costs ÷ Total Water Savings)	$757 /AF	$2,316 /AF	$3,073 /AF

Results of Cost Benefit Analysis-Lifespan (10 Years) 2000

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	151,425	NA	151,425
Costs to Participants	NA	290,309	290,309
Costs to Others	NA	NA	0
Total Costs	$151,425	$290,309	$441,735
Present Value Benefits			
Total Water Savings	109.92 AF	109.92 AF	109.92 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	75,623	75,623
Benefits to Others	NA	NA	0
Total Benefits	$0	$75,623	$75,623
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$151,425	-$214,686	-$366,112
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1,378 /AF	$2,641 /AF	$4,019 /AF

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Albuquerque Water Res. Div.
Landscape Rebate Program

2001

Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	162,046	NA	162,046
Costs to Participants	NA	442,723	442,723
Costs to Others	NA	NA	0
Total Costs	$162,046	$442,723	$604,769
Present Value Benefits			
Total Water Savings	119.83 AF	119.83 AF	119.83 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	94,203	94,203
Benefits to Others	NA	NA	0
Total Benefits	$0	$94,203	$94,203
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$162,046	-$348,520	-$510,566
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1,352 /AF	$3,695 /AF	$5,047 /AF

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	785,894	NA	785,894
Costs to Customers	NA	1,749,642	1,749,642
Costs to Others	NA	NA	0
Total Costs	$785,894	$1,749,642	$2,535,537
Present Value Benefits			
Total Water Savings	630.42 AF	630.42 AF	630.42 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	412,413	412,413
Benefits to Others	NA	NA	0
Total Benefits	$0	$412,413	$412,413
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$785,894	-$1,337,228	-$2,123,123
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1,247 /AF	$2,775 /AF	$4,022 /AF

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Chandler Utilities Dept.

Landscape Rebate Program

The City of Chandler is located in the southeast region of the Greater Phoenix area, and is home to a population of approximately 228,000 residents. The 1999 median household income in Chandler was $58,416, which is higher than the statewide median of $40,558.[1]

UTILITY DEMOGRAPHICS

As of 2004, the City of Chandler had approximately 66,239 connections. Of their total connections 62,170 were single family residential, 857 were multifamily residential, 1,418 were commercial, 45 were industrial, 1,674 were irrigation, 32 were educational/ medical, and 43 were reclaimed water. Chandler's total service area is 72 square miles. Their residential water use, in gallons per capita per day (gpcd), is about 133.

LANDSCAPE REBATE PROGRAM

Rebate Amount:	**$200, minimum 1,000 sq. ft.**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**1990-present**
Years Analyzed:	**2001, 2002**

UTILITY RATE STRUCTURE AND PRICES

Since 1997, the City of Chandler has employed a seasonal rate structure. Most residences have 3/4" or 1" meters. The residential monthly base charge for both 3/4" and 1" meters, which includes zero gallons of water, is $16.28 for residents inside the city and $29.30 for residents outside the city. In addition to the monthly base charge, all water is charged at the following rate per thousand gallons:

	Winter Rate		Summer Rate	
	In City	Outside City	In City	Outside City
First 10,000	$0.96	$1.73	$0.96	$1.73
Next 10,000	$1.19	$2.14	$1.27	$2.29
Next 80,000	$1.37	$2.47	$1.86	$3.35
Over 100,000	$1.19	$2.14	$1.86	$3.35

CURRENT CAPACITY AND WATER SOURCES

The City of Chandler has a storage capacity of 117 million gallons and delivers an average of 52 million gallons each day. The City of Chandler receives its water from Chandler's water treatment plant, 22 groundwater wells, Central Arizona Project (CAP) water, the Salt River Project (SRP), and reclaimed water. The water treatment plant treats and disinfects water from the Salt River, Verde River, CAP water (from the Colorado River), and SRP wells.

FUTURE PLANS TO MEET DEMAND

The City of Chandler is one of the fastest growing cities in Arizona and the United States, having grown 9.7% per year, on average, between 1990 and 2000.[2] Chandler plans to meet future water demand by continuing with current capacity and sources, adding to their CAP supply, expanding their existing water treatment plant, possibly adding another plant, through water conservation, and through reuse.

[1] US Census Bureau, QuickFacts.
[2] Arizona Department of Commerce: Chandler Community Profile.

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REBATE PROGRAM - DESCRIPTION

The City of Chandler's Low Water Use Landscape Rebate Program, initiated in 1990, offers a $200 rebate to residents who convert their landscape from turf to low water use landscaping (xeriscape) or who install xeriscape at a new home. The rebate amount changed from $150 to the current amount of $200 in 2000. To qualify for a rebate, the entire front and back yards must be landscaped and the total landscapable area must exceed 1000 square feet. In addition, a minimum of 50% of the total landscapable area must be non-turf inorganic ground cover after conversion and primary accent plants for the landscapable area must be drought resistant shrub and trees. A Water Conservation Specialist will then visit a qualifying resident to discuss irrigation scheduling, timer operation and system maintenance. The City has issued over 9,000 rebates since 1990.

OTHER CITY OF CHANDLER CONSERVATION PROGRAMS

Toilet Rebate, *1990-1996*
Water Saver Kits, *1991-present*
Water Audits/Self-Audits, *1991-present*
Low Water Use Landscape Packets, *2000-present*
Automatic Irrigation Controller Rebate, *1991-present*
Public Education, *various start dates*

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

This analysis includes only single family households that received rebates for landscape conversions during the years 2001 and 2002. The water savings were calculated and a cost benefit analysis was performed for the years 2001 and 2002. The findings refer to these two years only, not to the ongoing program. The lifespan of the landscape conversions, which is used as the period of analysis, was assumed to be ten years.[3]

All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used in this analysis was 5.4%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

The population studied in this analysis includes participants who received rebates for converting their turf landscapes (as opposed to installing new landscapes) during 2001 and 2002. There were 18 usable participants out of 24 total in 2001 and 22 out of 40 in 2002, for a total of 40 usable participants out of 64. The participants that were unusable either did not complete the landscape conversion during the same year that the rebate was received, or they were not residents for the full period of analysis.

For 2001 rebates, the period of analysis consisted of one calendar year

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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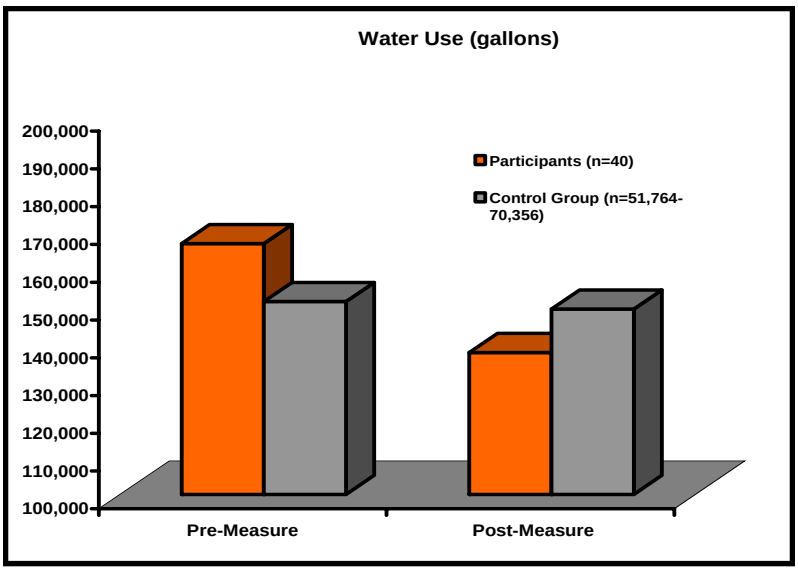
prior to the landscape conversion and two calendar years after. For the 2002 rebates, a full two calendar years prior to the landscape conversion and two calendar years after were analyzed.

All Chandler single family residential households that were not participants in this analysis were used as the control group. The average pre-measure water use of the participants (166,438 gallons) was higher than that of the control group (151,078 gallons).



For 2001 rebates, the control group consisted of 51,768 households in 2000, 56,436 in 2002, and 59,597 in 2003.

For 2002 rebates, the control group consisted of 51,764 households in 2000, 54,119 in 2001, 56,432 in 2002, 59,593 in 2003, and 70,356 in 2004.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

Single family residential accounts that did not participate in the landscape rebate program were used as the control group.

We assumed that customers paid an average of $2 per square foot to convert their landscape, per conversation with the utility.

The price of water used in determining the benefits to customers from reduced water bills is the price from the range where the participants' pre-measure average monthly use fell. Ex.: Pre-measure average monthly use = 13,870 gallons, which is within the range of 10,000 to 20,000 gallons, and so the price per 1,000 gallons was $1.19.

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the first year after the 2001 rebates, the water savings amounted to 445,670 gallons, or 24,759 gallons per participant per year (gppy) (17.4% of pre-measure water use). The second year after the rebates, the water savings amounted to 352,105 gallons, or 19,561 gppy (13.8% of pre-measure water use). The average savings per year was 398,888 gallons, or 22,160 gppy (15.6% of pre-measure water use). The total savings over the ten year assumed lifespan for the 2001 rebates was 3,988,877 gallons, or 221,604 gallons per participant.

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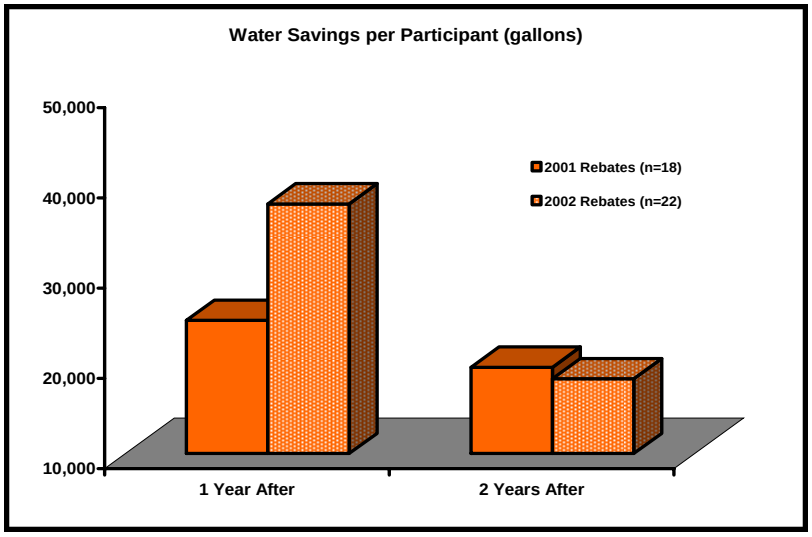
The first year after the 2002 rebates, the water savings amounted to 828,743 gallons, or 37,670 gppy (20.2% of pre-measure water use). The second year after the rebates, the water savings amounted to 402,249 gallons, or 18,284 gppy (9.8% of pre-measure water use). The average savings per year was 614,496 gallons, or 27,977 gppy (15.0% of pre-measure water use). The total savings over the ten year assumed lifespan was 6,154,961 gallons, or 279,771 gallons per participant.



In the first year after the rebates the total water savings for the two years studied was 1,274,414 gallons, or 31,860 gppy (19.1% of weighted pre-measure water use). In the second year after the rebates the total water savings were 754,354 gallons, or 18,859 gppy (11.3% of weighted pre-measure water use). **The total savings over the ten year assumed lifespan of the landscape conversions was 10,143,848 gallons, or 253,596 gallons per participant.**

During the two years before replacing high water use landscape with xeriscape, participants' water use was 108.6% of the control group's use, on average. During the two years after replacing the high water use landscape, participants' water use was 92.0% of the control group's use, on average. The participants' water use decreased by 17.3% whereas the control group's use decreased by 1.3%.**The resulting overall water savings attributed to this program was 16.0%.**

2001	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Incentive Payments	$3,840	Not Quantified		Landscape Conversion	$94,646	Water Bill Savings	$3,096
						Financial Incentives	$3,840
Total	$3,840			Total	$94,646	Total	$6,936

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (ten years).

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2001 REBATES

- The quantified cost to the utility was $3,840 ($213 per participant). This includes the cost of financial incentive payments.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $94,646 ($5,258 per participant). This includes the estimated cost of landscape conversion and relevant materials.
- The quantified benefit to the participants was $6,936 ($385 per participant). This includes water bill savings, $3,096 ($172 per participant), and financial incentives, $3,840 ($213 per participant).

UTILITY PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$3,840 from the utility perspective. This is a net benefit of -$213 per participant. The quantifiable costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $314.**

PARTICIPANT PERSPECTIVE- 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$86,970 from the participant perspective. This is a net benefit of -$4,832 per participant. The quantifiable costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $7,732.**

OVERALL PERSPECTIVE- 2001

Results of cost benefit analysis show a net benefit (net present value) of -$90,809 from an overall perspective. This is a net benefit of -$5,045 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $8,045.**

2002 REBATES

- The quantified cost to the utility was $4,452 ($202 per participant). This includes the cost of financial incentive payments.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $69,436 ($3,156 per participant). This includes the estimated cost of landscape conversion and relevant materials.
- The quantified benefit to the participants was $8,442 ($383 per participant). This includes water bill savings, $3,990 ($181 per participant), and financial incentives, $4,452 ($202 per participant).

2002	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Incentive Payments	$4,452	Not Quantified		Landscape Conversion	$69,436	Water Bill Savings	$3,990
						Financial Incentives	$4,452
Total	$4,452			Total	$0	Total	$8,442

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UTILITY PERSPECTIVE - 2002
Results of the cost benefit analysis show a net benefit (net present value) of -$4,452 from the utility perspective. This is a net benefit of -$202 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $236.**

PARTICIPANT PERSPECTIVE - 2002
Results of the cost benefit analysis show a net benefit (net present value) of -$60,038 from the participant perspective. This is a net benefit of -$2,729 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $3,676.**

OVERALL PERSPECTIVE - 2002
Results of cost benefit analysis show a net benefit (net present value) of -$64,491 from an overall perspective. This is a net benefit of -$2,931 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $3,912.**

ALL YEARS
- The quantified cost to the utility was $8,293 ($207 per participant). This includes the cost of financial incentive payments.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $164,082 ($4,102 per participant). This includes the estimated cost of landscape conversion and relevant materials.
- The quantified benefit to the participants was $15,894 ($397 per participant). This includes water bill savings, $7,602, ($190 per participant), and financial incentives, $8,293, ($207 per participant).

ALL YEARS	Quantified Costs and Benefits					
Utility			Participants			
Costs		Benefits	Costs		Benefits	
Incentive Payments	$8,293	Not Quantified	Landscape Conversion	$164,082	Water Bill Savings	$7,602
					Financial incentives	$8,293
Total	$8,293		Total	$164,082	Total	$15,895

UTILITY PERSPECTIVE - ALL YEARS
Results of the cost benefit analysis show a net benefit (net present value) of -$8,293 from the utility perspective. This is a net benefit of -$207 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $266.**

PARTICIPANT PERSPECTIVE - ALL YEARS
Results of the cost benefit analysis show a net benefit (net present value) of -$146,367 from the participant perspective. This is a net

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benefit of -$3,659 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $5,271.**

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$154,660 from an overall perspective. This is a net benefit of -$3,866 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $5,537.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent converting their landscape.**
- **The cost to the utility for site visits and processing of rebates.**

Benefits

- **Financial savings to water savings for participants**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction with the utility.**
- **Reinforces need to conserve water and desirability of conserving.**

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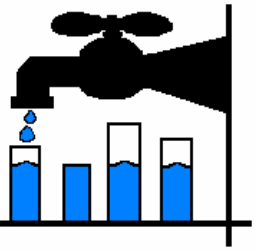
Chandler Utilities Dept.
Landscape Rebate Program



2001

Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	3,840	NA	3,840
Costs to Participants	NA	94,646	94,646
Costs to Others	NA	NA	0
Total Costs	$3,840	$94,646	$98,486
Present Value Benefits			
Total Water Savings	12.24 AF	12.24 AF	12.24 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	7,677	7,677
Benefits to Others	NA	NA	0
Total Benefits	$0	$7,677	$7,677
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$3,840	-$86,969	-$90,809
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$314 /AF	$7,732 /AF	$8,045 /AF

2002

Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	4,453	NA	4,453
Costs to Participants	NA	69,436	69,436
Costs to Others	NA	NA	0
Total Costs	$4,453	$69,436	$73,889
Present Value Benefits			
Total Water Savings	18.89 AF	18.89 AF	18.89 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	9,398	9,398
Benefits to Others	NA	NA	0
Total Benefits	$0	$9,398	$9,398
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$4,453	-$60,038	-$64,491
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$236 /AF	$3,676 AF	$3,912 /AF

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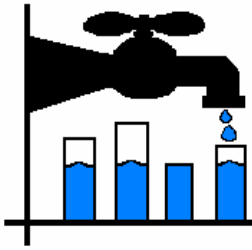

Chandler Utilities Dept.

Landscape Rebate Program

Results of Cost Benefit Analysis-Lifespan (10 Years) **ALL YEARS**

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	8,293	NA	8,293
Costs to Participants	NA	164,082	164,082
Costs to Others	NA	NA	0
Total Costs	$8,293	$164,082	$172,375
Present Value Benefits			
Total Water Savings	31.13 AF	31.13 AF	31.13 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	17,715	17,715
Benefits to Others	NA	NA	0
Total Benefits	$0	$17,715	$17,715
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$8,293	-$146,367	-$154,660
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$266 /AF	$5,271 /AF	$5,537 /AF

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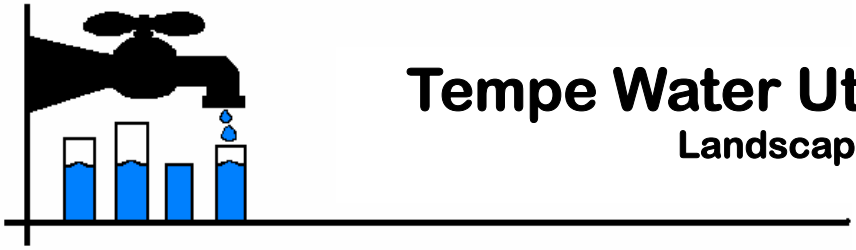

Tempe Water Utilities Dept.

Landscape Rebate Program

The City of Tempe Water Utilities Department serves the communities of Tempe and Guadalupe, located in central Arizona. Combined, these communities have a population of approximately 170,000 people. The area's economy is heavily supported by a state university and hundreds of manufacturing and technology firms[1]. As of the 2000 census, Tempe's median family income was $55,237.[2]

UTILITY DEMOGRAPHICS

The City of Tempe Water Utilities Department currently maintains approximately 42,000 connections 84.6% of which were residential. Of their total connections, 31,350 were single family residential, 4,200 were single family residential, 3,230 were commercial, 88 were industrial, 3,300 were irrigation and flood irrigation, and 200 government and miscellaneous customers. The City of Tempe Water Utilities Department's total service area encompasses 41.5 square miles. Approximately 99% of the utility's customers are within the City of Tempe, with the remaining connections in Guadalupe. The total amount of treated water use in 2004 was 52,711 AF. The average per capita residential water use was 148 gallons per day, as of 2004.

Landscape Rebate Program

Rebate Amount:	**$100**
Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**1992-present**
Analysis Years:	**March 2001 – February 2002**

UTILITY RATE STRUCTURE AND PRICES

The City of Tempe Water Utilities Department has an increasing block rate structure. The monthly base rates for service to single family residences are $8.39 within Tempe city limits, and $10.82 outside Tempe city limits. The monthly service charge includes zero gallons of water. The fee structure for water consumption inside Tempe and Guadalupe, as of November 1, 2002, is as follows:

0 – 8,000 gallons	$0.83 per 1,000 gallons
8,001 – 15,000 gallons	$0.88 per 1,000 gallons
15,001 – 25,000 gallons	$0.97 per 1,000 gallons
25,001 – 50,000 gallons	$1.03 per 1,000 gallons
50,001 – 100,000 gallons	$1.13 per 1,000 gallons
≥ 100,000 gallons	$1.17 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

The City of Tempe Water Utilities Department has a current storage capacity of 38.8 million gallons, over 95% of which is drawn from surface water sources which include the Salt River Project, the Central Arizona Project (CAP), and the Modified Roosevelt Dam New Conservation Storage.

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[1] Arizona Department of Commerce: Tempe Community Profile.
[2] U.S. Census Bureau, American Fact Finder.

FUTURE PLANS TO MEET DEMAND

The population within the City of Tempe grew 0.35% annually, on average, between 2000 and 2004. The utility intends to meet future water demand within the service area by first utilizing its current capacity and water sources. The utility has plans to expand and change water sources and infrastructure to allow the utilization of increased amounts of reclaimed water. Additionally, the City of Tempe Water Utilities Department is seeking additional CAP water supplies. Lastly, the utility will meet further demand by increasing groundwater and recovery well production capacity and continuing its programs to encourage customer conservation.

OTHER CITY OF TEMPE CONSERVATION PROGRAMS

Toilet Rebate Program, *October 1992- present*
Plumbing Retrofit Kit Giveaway, *October 1992- present*
Free plumbing retrofit kits provided to water customers whose homes were built before 1980.
School Gardening Grants, *awarded every September since 2000*
Public Education, *1990- present*
Conservation Based Rate Structure, *1999- present*
Water Waste Ordinance, *1999- present*
Industrial Grant Program, *1999- present*
The grants cover 25-50% of costs up to $20,000.

REBATE PROGRAM - DESCRIPTION

Since 1992, the City of Tempe Water Utilities Dept. has offered $100 rebates to single family customers for converting turf landscapes to xeriscape. Since the program's beginning, 855 customers, all from within Tempe city limits, have participated in the landscape rebate program and over 2,000,000 square feet of turf has been removed. Of the 855 rebates processed, over 90% have been for landscape conversions, with the remainder for new landscapes. The utility does not require a minimum amount of turf to be removed, only that an entire front or back yard is converted to xeriscape. The utility increased the rebate amount to $250 for a front or back yard, for a maximum rebate of $500, in September, 2004.

The utility issues rebate checks to single family residential customers participating in the landscape rebate program. Customers are informed of the program via bill inserts, mailings from the utility, newsletter articles, public service announcements, newspaper articles, as well as information on the utility website.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single-family households that received landscape conversion rebates between March 2001 and February 2002. The water savings were calculated and a cost benefit analysis was performed for the time period of March 2001 to February 2002. The findings refer to this yearlong period only, not to the ongoing program. The lifespan of the landscape conversion was assumed to be ten years[3].

[3] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used for this analysis was 5.4%. The Consumer Price Index values used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

The population studied in this analysis includes participants who received rebates for converting their turf landscapes (as opposed to new landscapes). Fifty-one customers participated from March 2001 to February 2002. There were 28 usable participants out of 51 total participants. Forty-five percent, or 23, of the participants were unusable because they moved during the period of analysis, or sufficient raw data was not available.

All City of Tempe single-family residential households that did not participate in the landscape conversion rebate program were used as the control group. However, the average pre-measure water use of the participants (169,629 gallons) was lower than that of the control group (208,676 gallons). There were 29,972 customers in the control group.

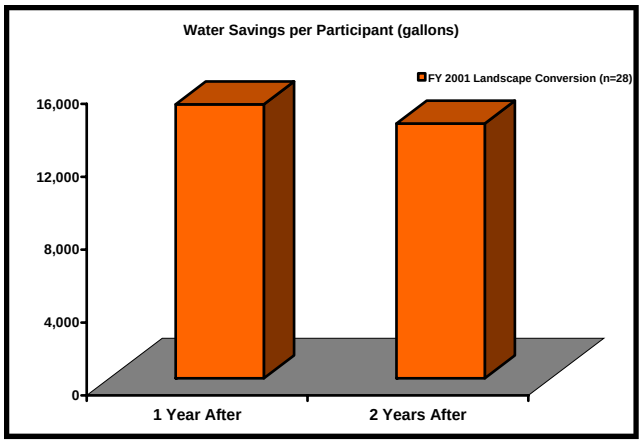
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

We assumed 30,000 single-family residential connections for each recognizing that this is not entirely accurate. The utility was unable to provide an actual count. After removing participants from this figure, the control group totaled 29,972 users.

We assumed that 65% of the converted square footage cost $1,000 on average, and the remaining 35% cost $2,000 on average.

There was no minimum square footage requirement for the yard conversions.



The price of water used in determining the benefits to customers from reduced water bills is the price from the range where the participants' pre-measure average monthly use fell. Ex.: Pre-measure average monthly use = 14,825 gallons, which is within the range of 8,001 to 15,000 gallons, and so the price per 1,000 gallons was $0.86 per 1,000 gallons in 2002, $0.88 per 1,000 gallons in 2003, and assumed to be $0.88 for the remainder of the lifespan.

Participants who had two or more consecutive months of no water use were included in the study.

RESULTS - WATER SAVINGS

The first year after the landscape conversion rebates, water savings amounted to 421,013 gallons, or 15,036 gallons per participant per year (gppy) (8.8% of pre-measure water use). The second year after the

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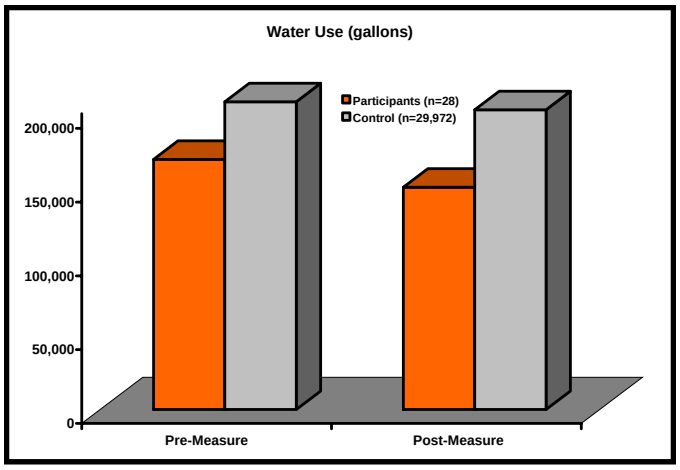

conversion rebates, water savings amounted to 391,492 gallons, or 13,982 gppy (8.2% of pre-measure water use). The average water savings per year was 406,252 (1.2 AF), or 14,509 gppy (8.6% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the landscape conversions was 4,062,521 gallons (12.5 AF), or 145,090 gallons per participant.**

During the two years before replacing high water use landscape with Xeriscape, participants' water use was 81.3% of the control group's use, on average. During the two years after replacing the high water use landscape, participants' water use was 74.2% of the control group's use, on average. The participants' water use decreased by 11.1% whereas the control group's use decreased by 2.6%. **The resulting overall water savings attributed to this program was 8.5%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (ten years).

- The quantified cost to the utility was $3,593. This includes the cost of materials, $80, advertising, $53, labor, $473, and incentive payments, $2,987. This is a cost of $129 per participant, which includes materials, $3, advertising, $2, labor, $17, and incentive payments, $107.
- The quantified benefit to the utility was $0.
- The approximate quantified cost to the participants was $40,319. This includes the estimated cost of landscape conversion and relevant materials. The cost per participant is $1,440.
- The quantified benefit to the participants was $5,867. This includes financial incentives, $2,987 and water bill savings, $2,880. This is a benefit of $210 per participant, including $107 in financial incentives and $103 in water bill savings.

Quantified Costs and Benefits						
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Materials	$80	Not Quantified		Landscape Conversion	$40,319	Financial Incentives	$2,987
Advertising	$53						
Labor	$473					Value of Water Saved	$2,880
Incentive Payments	$2,987						
Total	**$3,593**			**Total**	**$40,319**	**Total**	**$5,867**

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UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$3,593 from the utility perspective. This is a net benefit of -$128 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $288.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$34,452 from the participant perspective. This is a net benefit of -$1,230 per participant. The quantified costs to the participant were greater than the quantified benefits to the participant. **The cost per acre-foot of water saved from the participant perspective was $3,234.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$38,045 from an overall perspective. This is a net benefit of -$1,359 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $3,522.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Landfill disposal of turf.
- Aesthetics.
- Loss of function.

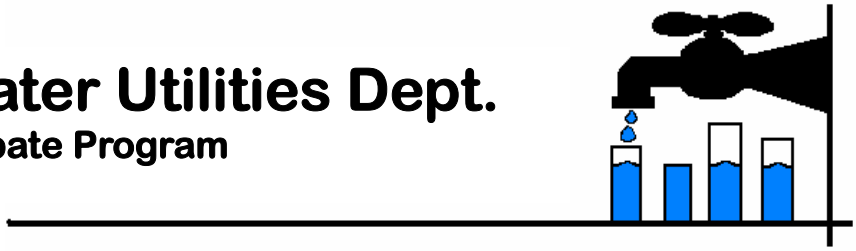
Benefits

- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Environmental benefits of reduced water use.
- Increased public awareness about water conservation.
- Water saved for future municipal use.
- Reduced surface water use.
- Program participants received newly xeriscaped yards.
- Reinforces need to conserve water and the desirability of conservation.
- Increased customer satisfaction with the utility.
- Aesthetics.

L-3

Tempe Water Utilities Dept.

Landscape Rebate Program



Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	3,593	NA	3,593
Costs to Participants	NA	40,319	40,319
Costs to Others	NA	NA	0
Total Costs	$3,593	$40,319	$43,912
Present Value Benefits			
Total Water Savings	12.47 AF	12.47 AF	12.47 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	5,589	5,589
Benefits to Others	NA	NA	0
Total Benefits	$0	$5,589	$5,589
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$3,593	-$34,730	-$38,323
Cost Effectiveness Analysis(CEA) (Total Costs ÷ Total Water Savings)	$288 /AF	$3,234 /AF	$3,522 /AF

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TOILET REBATE
CASE NARRATIVES

PAGES

Coastside County Water Dist.

Toilet Rebate Program

Coastside County Water District (CCWD) serves Half Moon Bay, in San Mateo County, California, and parts of the unincorporated areas of the county including Miramar, Princeton by the Sea, and El Granada. As of the 2000 Census, the 1999 median household income in San Mateo County was $70,819, which is higher than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

As of 2004, Coastside County Water District had 6,564 connections. Of these connections, 4,788 were single family residential, 1,326 were multifamily residential, 363 were commercial, 37 were industrial,
and 50 were irrigation.

Coastside County Water District's total service area is 14 square miles. The population of this service area is approximately 18,000. As of 2004, CCWD's overall customer water use was 131 gallons per capita per day (gpcd).

TOILET REBATE PROGRAM

Rebate Amount:	**$150, or 75%**
Eligible Customers:	**SF, MF, ICI**
Customers analyzed:	**SF**
Program Years:	**1991 - present**
Years Analyzed:	**2001**

UTILITY RATE STRUCTURE AND PRICES

Coastside County Water District uses a tiered rate structure. As of July 2004, the bi-monthly base rate for service is $15.30 for 5/8" meters (or $0.26 per day), which includes zero gallons of water. Single family and multifamily residential usage charges are as follows:

Usage	Price
0 to 8 CCF (0 – 5,984 g)	$2.50 per ccf ($3.34/1,000 g)
9 to 25 CCF (6,732 – 18,700 g)	$2.76 per ccf ($3.69/1,000 g)
26 to 40 CCF (19,448 – 29,920 g)	$3.58 per ccf ($4.79/1,000 g)
> 41 CCF (>30,668 g)	$4.43 per ccf ($5.92/1,000 g)

CURRENT CAPACITY AND WATER SOURCES

Coastside County Water District has a storage capacity of approximately 7.65 million gallons. CCWD's water supply includes local surface water and groundwater sources, making up 35% of their supply, and water purchased from the San Francisco Water Department, making up 65% of their supply.[2]

FUTURE PLANS TO MEET DEMAND

The population within Coastside County Water District's service area is growing at a rate of 1-2% per year. The District plans to continue the use of current water supply sources and treatment plants, expand the use of groundwater and/or develop desalination capabilities and continue their water conservation programs to meet future water demand.

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[1] US Census Bureau. http://quickfacts.census.gov/qfd/states/06/06081.html
[2] CCWD – District Map and Water Information. http://www.coastsidewater.org/water-district-map.html

REBATE PROGRAM DESCRIPTION

CCWD's ULFT rebate program has been continuously operating since it was first initiated in March 1991. For each toilet replaced that is greater than or equal to 3.5 gpf, the residential/commercial toilet retrofit program stipulates that participants receive $150, or 75% (whichever figure is lower), of the actual cost. CCWD completely funds the reimbursements to the participants once the application has been submitted, receipts for materials have been produced, labor has been completed (if applicable), and after CCWD has inspected the newly installed ULFT.

From 1991 through 2004, an average of 75 participants per year have had toilets replaced (primarily single family residents). This is approximately 1,050 participants throughout the entire program.

The District informs its customers about the toilet rebate program through bill inserts, newsletters, website updates, and local newspaper advertisements. In addition, plumbing retailers have encouraged customers to participate in the program upon purchasing new ultra low flow toilets.

OTHER CCWD CONSERVATION PROGRAMS

Washing machine rebates, *FY 2001/2002-present*
Provides a $100 or $150 rebate for replacement of inefficient washers depending on the Water Factor and Modified Energy Factor of the new washer.

Conservation rates, *1976- present*
All residential accounts are on an increasing block rate structure with basic lifeline rates and minimum consumption.

Public education, *1991-present*
Efforts are in the form of training, school workshops, brochures, bill inserts, newsletters, local newspaper and television ads, service club presentations, social events, and a 4th grade water awareness education program. Topics of discussion include drought issues, water-wise measures, and general water conservation.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the program during 2001. The findings refer to this year only, not to the ongoing program. The lifespan of the toilets installed, which is used as the period of this analysis, was assumed to be twenty years.

All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used in this analysis was 5.35%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

The population studied for this analysis was comprised of all participants who received a rebate during 2001. There were 29 usable participants out of a total of 53. Twenty-four, or 45%, of the participants were unusable during this year because there was not enough water consumption data to perform the analysis for these customers.

TR-1

All CCWD residential customers that were not participants in this analysis were used as the control group. Participant pre-measure water consumption was 82,564 gallons while control pre-measure water consumption was 85,503 gallons. For the ULFT rebate program, the control group consisted of 4,382 households in 1999, 4,539 in 2000, 4,608 in 2001, 4,701 in 2002, and 4,756 in 2003.

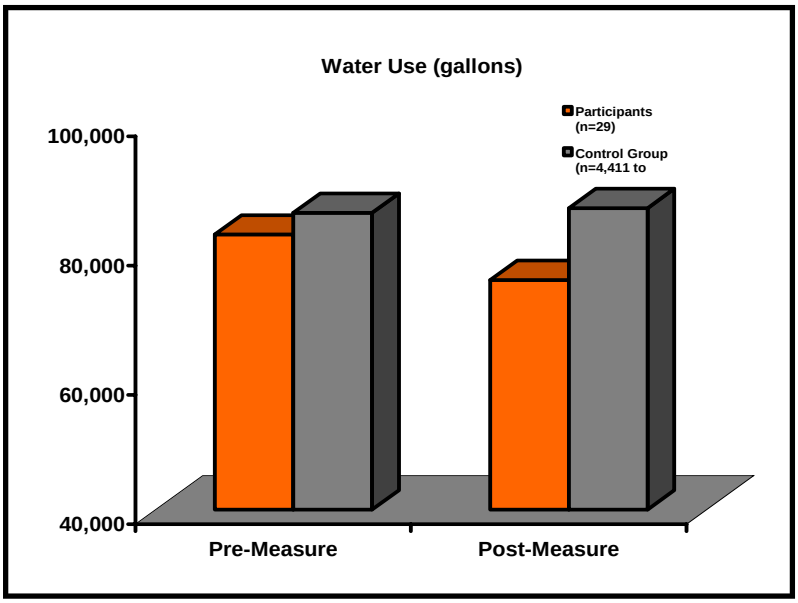
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2001 CPI value, 177.1, and the 2004 CPI value, 188.9, were used in this analysis.

The average cost for a ULFT and materials was $207 in 2001.

The average cost of installation of a toilet in the Coastside area is $167 (from conversations with plumbers in the Coastside area).



Forty percent of the participants in this analysis had their new toilets professionally installed; 60% installed them on their own.

CCWD labor for inspections was $40/hour with ½ hour per inspection.

CCWD administrative costs were $30/hour with 15 minutes per rebate.

The price of water used in determining the benefits to customers from reduced water bills is the price from the range where the participants' pre-measure average monthly use fell. Ex.: Pre-measure average monthly use = 12.3 ccf. 12.3 ccf is within the range of 9 to 25 ccf, and so the price per ccf is currently $2.76 (according to CCWD's rate schedules). For past years, old rate schedules were used to determine price.

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the first year after the toilet program in 2001, there was a decrease in water use of 251,934 gallons (.77AF), or 8,687 gallons per participant per year (gppy) (10.5% of pre-measure water use). The second year after the toilet program, there was a decrease in water use of 197,337 gallons (.60AF), or 6,805 gppy (8.2%). The average savings per year was 224,635 gallons, or 7,746 gppy (9.4%). **The total savings over the twenty year assumed lifespan was 4,492,702 gallons, or 154,921 gallons per participant (9.4%).**

TR-1

During the two years before participating in the toilet rebate program, participants' water use was 96.1% of the control group's use, on average. During the two years after participating in the program, their water use was 87.2% of the control group's use, on average. The participants' water use decreased by 8.5% from pre-measure to post-measure, whereas the control group's use increased by 0.9%. **The resulting overall water savings attributed to this program was 9.4%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $9,112. This includes the cost of advertising, $533; financial incentive payments, $7,728; the cost of labor, $619; and in-house administration costs, $232. This is a cost of $313 per participant, including $18 for advertising, $266 for financial incentive payments, $21 for labor, and $8 for administration.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $12,885. This includes the cost of equipment, $10,819; and specialist labor, $2,066. This is a cost of $444 per participant, including $373 for equipment and $71 for specialist labor.
- The quantified benefit to the participants was $15,631. This includes water bill savings, $7,903; and financial incentives $7,728. This is a benefit of $539 per participant, including $273 for water bill savings and $266 for financial incentives.

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$9,112 from the utility perspective. This is a net benefit of -$313 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $661.**

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Advertising	$533	Not Quantified		Equipment	$10,819	Water Bill Savings	$7,903
Financial Incentive	$7,728			Specialist Labor	$2,066	Financial Incentives	$7,728
Labor	$619						
Admin.	$232						
Total	$9,112			Total	$12,885	Total	$15,631

PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $2,746 from the participant perspective. This is a net benefit of $95 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $935.**

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OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$6,336 from an overall perspective. This is a net benefit of -$218 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility**. The cost per acre-foot of water saved from an overall perspective was $1,595.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent installing new toilets.**
- **Landfill disposal of old toilets.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided costs of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Water saved for future municipal use.**
- **Program participants received new toilets.**

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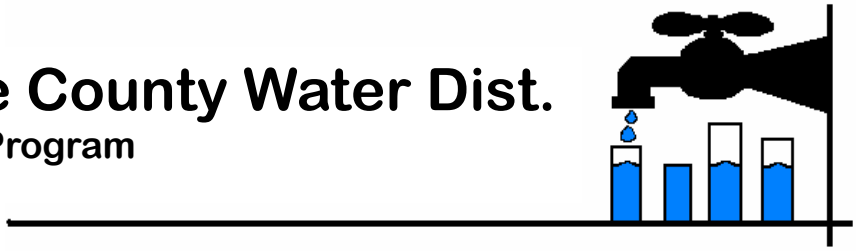
Coastside County Water Dist.

Toilet Rebate Program



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	9,112	NA	9,112
Costs to Participants	NA	12,885	12,885
Costs to Others	NA	NA	0
Total Costs	$9,112	$12,885	$21,997
Present Value Benefits			
Total Water Savings	13.79 AF	13.79 AF	13.79 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	15,631	15,631
Benefits to Others	NA	NA	0
Total Benefits	$0	$15,631	$15,631
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$9,112	$2,746	-$6,366
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$661 /AF	$935 /AF	$1,595 /AF

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Flagstaff Water Utility
Toilet Rebate Program

The City of Flagstaff Water Utility serves the community of Flagstaff, AZ, a city of 61,000 people located in northern Arizona. The city's economy includes a sizeable tourism industry and a state university. Median household income was $37,586 as of 1999.[1]

UTILITY DEMOGRAPHICS

As of December 2003, the City of Flagstaff Water Utility had 16,937 connections, 89.5% of which were residential. Of their total connections, 12,553 were single family residential, 2,600 were multifamily residential, 1,492 were commercial, 40 were manufacturing, and 252 were landscaping meters. The City of Flagstaff is 64.4 square miles. As of 2004, the City of Flagstaff's residential water use, in gallons per capita per day (gpcd) was 125. The utility's total water deliveries in 2004 were 8,249.2 AF.[2]

TOILET REBATE PROGRAM

Rebate Amount:	**50%, up to $100**
Eligible Customers:	**SF, MF, ICI**
Customers analyzed:	**SF**
Program Years:	**1991 - 2005**
Years Analyzed:	**2000, 2001**

UTILITY RATE STRUCTURE AND PRICES

The City of Flagstaff has a tiered rate structure. The monthly base rate for service is $6.48 for single family customers, which includes zero gallons of water. The fee structure for water consumption for ¾ inch meters is as follows:

Usage	Price
0 – 5,000 gallons	$2.83 per 1,000 gallons
5,001 – 15,000 gallons	$3.32 per 1,000 gallons
15,000+ gallons	$4.71 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

The City of Flagstaff has a capacity of 20.5 million gallons per day, 13 million gallons per day, or 63.4%, of which comes from local wells. The remaining 7.5 million gallons per day, or 36.6%, comes from local surface water.

FUTURE PLANS TO MEET DEMAND

The population within the City of Flagstaff's service grew at an average rate of 4.0% per year between 2000 and 2004.[3] For short- to mid-term needs, additional groundwater wells may be drilled. Long-term needs may require the acquisition of surface water rights from farms, and the use of Central Arizona Project (CAP) water. Conservation and reuse are currently the main strategies by which the city is working to ensure the future water supply.

[1] U.S. Census Bureau, American Fact Finder
[2] *2004 Consumer Confidence Report*. City of Flagstaff Water Utility.
[3] *Population Change – 2000 Census to July 1, 2004 Estimate for Arizona, Counties, and Incorporated Places*. Arizona Department of Economic Security.

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TOILET REBATE PROGRAM - DESCRIPTION

From 1991 to 2004, the City of Flagstaff offered a rebate of 50%, or up to $100 per toilet, for replacement of high water use toilets with ultra low flush toilets (toilets with a 1.6 gallon or less flush volume). The rebate was in the form of either a credit on the customer's water bill or as a check issued to the customer. Single family, multifamily, and commercial customers were eligible for the rebate; however, new homes were not eligible.

OTHER FLAGSTAFF WATER UTILITY CONSERVATION PROGRAMS

Conservation Rates, *increasing block rate, 1988-present*
Conservation/Drought Response Ordinance, *1988-present*
Showerhead & Aerator Replacement, *Mid-1980's-present*
Rain Barrel Distribution, *July 2003-present*
Landscape Conversion Incentives, *2004-present*
High Efficiency Washing Machine Rebates, *July 2005-present*
Hot Water Recirculator Rebates, *July 2005-present*

In January 2004, the maximum rebate was reduced to $50 per toilet. In addition, the rebate was offered to new homes if choosing dual-flush toilets ($50 rebate) or waterless urinals ($100 rebate). A resident could replace an ultra low flush toilet with a dual flush toilet and still receive the $50 rebate.

In July 2005, the rebate for ultra low flush toilets was terminated. The City implemented a rebate of $100 for dual flush and high efficiency pressure assisted toilets (1.2 gallons per flush or less).

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received toilet rebates during the years 2000 and 2001. The water savings were calculated and a cost benefit analysis was performed for the years 2000 and 2001. The findings refer to these years only, not to the ongoing program. The lifespan of the toilets, which is used as the period of analysis, was assumed to be twenty years.[4]

All quantified costs and benefits have been discounted to the first year of the analysis (2000) and inflated to 2004 dollars. The discount rate used in this analysis was 6.2%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2000 value of 172.2.

The populations studied for this analysis was comprised of all participants who received rebates for one or more toilets. There were 67 usable participants out of 113 total in 2000, and 80 out of 132 in

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[4] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

2001, for a total of 147 usable participants out of 245. Forty percent, or 98, of the possible participants were unusable because they moved during the time period of the analysis.

All City of Flagstaff single family residential households that were not participants in this analysis were used as the control group. The average pre-measure water use of the participants (92,560 gallons) was higher than the weighted average pre-measure water use of the control group (78,400 gallons).

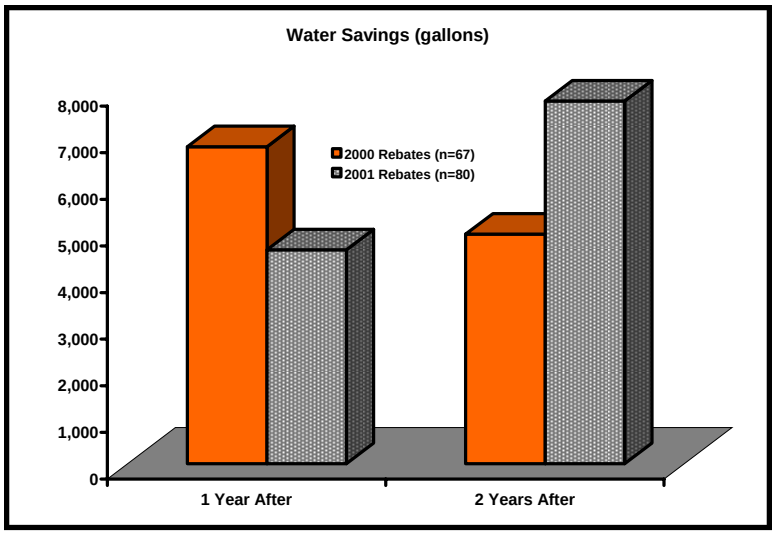
- For year 2000 toilet rebates, the control group consisted of 11,054 households in 1998, 11,361 households in 1999, 11,573 households in 2000, 11,788 households in 2001, and 12,403 in 2002.

- For year 2001 toilet rebates, the control group consisted of 11,348 households in 1999, 11,560 households in 2000, 11,775 households in 2001, 12,390 households in 2002, and 12,624 households in 2003.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of connections is the maximum number of connections billed from throughout the year.



The average cost of installation of a toilet in the Flagstaff area is $80 (from conversations with plumbers in the Flagstaff area).

Forty percent of the participants in this analysis had their new toilets professionally installed; 60% installed them on their own.

The value of the water saved was calculated by multiplying the amount of water saved by the price of water ($3.32 per 1,000 gallons) at the average level of use of the participants (falls into the second tier: 5,000 – 15,000 gallons per month).

Labor costs included 50 hours of labor for processing of rebates at $15 per hour.

An annual cost of $20 for program materials was assumed.

An annual cost of $20 for advertising of the program was assumed.

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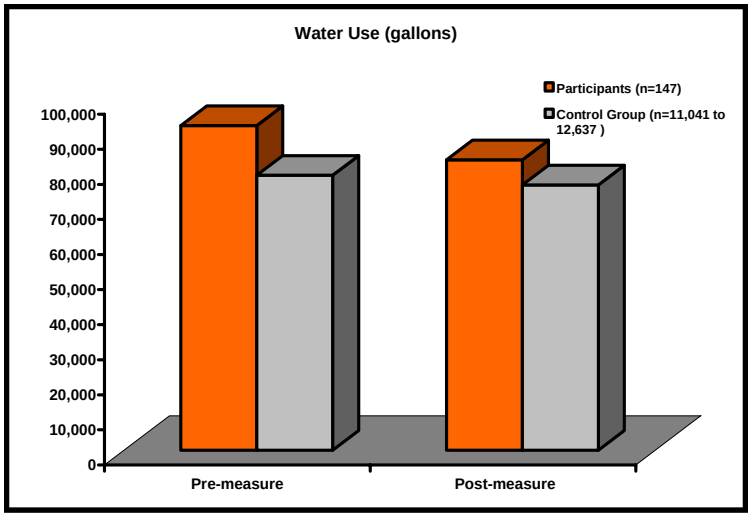
RESULTS - WATER SAVINGS

In the first year after the 2000 toilet rebates, the water savings amounted to 455,391 gallons, or 6,797 gallons per participant per year (gppy) (7.7% of pre-measure water use). The second year after the toilet rebates, the water savings amounted to 329,874 gallons, or 4,923 gppy (5.6% of pre-measure water use). The average water savings per year was 392,632 gallons (1.2 AF), or 5,860 gppy (6.6% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 7,852,643 gallons (24.1 AF), or 117,204 gallons per participant.**



The first year after the 2001 toilet rebates, the water savings amounted to 366,792 gallons, or 4,585 gppy (4.8% of pre-measure water use). The second year after the toilet rebates, the water savings amounted to 622,364 gallons, or 7,780 gppy (8.1% of pre-measure water use). The average water savings per year was 494,578 gallons (1.5 AF), or 6,182 gppy (6.5% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 9,979,984 gallons (30.4 AF), or 123,644 gallons per participant.**

Total water savings for the two years studied was 822,183 gallons, or 5,593 gppy (6.0% of weighted average pre-measure water use) during the first year after, and 952,237 gallons, or 6,478 gppy (7.0% or weighted average pre-measure water use) during the second year after. **The total savings over the twenty year assumed lifespan of the toilets was 17,744,200 gallons (54.5 AF), or 120,709 gallons per participant.**

During the two years before replacing high water use toilets with ultra low-flush toilets, participants' water use was ----117.6% of the control group's use, on average. During the two years after replacing the toilets, their use was 109.7% of the control group's use, on average. The participants' water use decreased by 10.5% from pre-measure to post-measure, whereas the control group's use decreased by 3.5% during the same period. **The resulting overall water savings attributed to this program was 7.0%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

2000 REBATES

- The quantified cost to the utility was $7,565. This cost includes the cost of materials, $22, advertising, $22, labor, $823, and incentive

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payments, $6,698. This is a cost of $113 per participant, including $0.33 for materials, $0.33 for advertising, $12 for labor, and $100 in incentive payments.

- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $17,563. This cost includes the cost of the toilets, $15,211, and installation, $2,352. This is a cost of $262 per participant, including $227 for the toilets and $35 for installation.
- The quantified benefit to the participants was $20,384. This benefit includes water bill savings, $13,685, and toilet rebates, $6,698. This is a benefit of $304 per participant, including $204 in water bill savings, and $100 in toilet rebates.

2000 Quantified Costs and Benefits							
Utility				**Participants**			
Costs		**Benefits**		**Costs**		**Benefits**	
Materials	**$22**	**Not Quantified**		**Toilets**	**$15,211**	**Rebates**	**$6,698**
Advertising	**$22**						
Labor	**$823**			**Installation**	**$2,352**	**Water Bill Savings**	**$13,685**
Incentive Payments	**$6,698**						
Total	**$7,565**			**Total**	**$17,563**	**Total**	**$20,384**

UTILITY PERSPECTIVE - 2000

Results of the cost benefit analysis show a net benefit (net present value) of -$7,565 from the utility perspective. This is a net benefit of -$113 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot saved from the utility perspective was $314.**

PARTICIPANT PERSPECTIVE - 2000

Results of the cost benefit analysis show a net benefit (net present value) of $2,820 from the participant perspective. This is a net benefit of $42 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $729.**

OVERALL PERSPECTIVE - 2000

Results of the cost benefit analysis show a net benefit (net present value) of -$4,744 from an overall perspective. This is a net benefit of -$71 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $1,043.**

2001 REBATES

- The quantified cost to the utility was $8,430. This cost includes the cost of materials, $21, advertising, $21, labor, $775, and incentive payments, $7,614. This is a cost of $105 per participant, including $0.26 for materials, $0.26 for advertising, $10 for labor, and $95 in incentive payments.
- The quantified benefit to the utility was $0.

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- The quantified cost to the participants was $19,250. This cost includes the cost of the toilets, $16,606, and the cost of installation, $2,644. This is a cost of $241 per participant, including $208 for the toilets and $33 for installation.
- The quantified benefit to the participants was $24,486. This benefit includes water bill savings, $16,872, and toilet rebates, $7,614. This is a benefit of $306 per participant, including $211 in water bill savings, and $95 in toilet rebates.

2001 Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Materials	$21	Not Quantified		Toilets	$16,606	Toilet Rebates	$7,614
Advertising	$21						
Labor	$775			Installation	$2,644	Water Bill Savings	$16,872
Incentive Payments	$7,614						
Total	$8,430			Total	$19,250	Total	$24,486

UTILITY PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$8,430 from the utility perspective. This is a net benefit of -$105 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot saved from the utility perspective was $278.**

PARTICIPANT PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of $5,236 from the participant perspective. This is a net benefit of $65 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $634.**

OVERALL PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$3,194 from an overall perspective. This is a net benefit of -$40 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $912**

ALL YEARS

- The quantified cost to the utility was $15,995. This cost includes the cost of materials, $43, advertising, $43, labor, $1,597, and incentive payments, $14,312. This is a cost of $109 per participant, including $0.29 for materials, $0.29 for advertising, $11 for labor, and $97 in incentive payments.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $36,813. This cost includes the cost of the toilets, $31,817, and the cost of installation, $4,996. This is a cost of $250 per participant, including $216 for the toilets and $34 for installation.

TR-2

- The quantified benefit to the participants was $49,581. This benefit includes water bill savings, $35,269, and toilet rebates, $14,312. This is a benefit of $337 per participant, including $240 in water bill savings, and $97 in toilet rebates

ALL YEARS		Quantified Costs and Benefits					
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Materials	$43	Not Quantified		Toilets	$31,817	Toilet Rebates	$14,312
Advertising	$43						
Labor	$1,597			Installation	$4,996	Water Bill Savings	$35,269
Incentive Payments	$14,312						
Total	$15,995			Total	$36,813	Total	$49,581

UTILITY PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$15,995 from the utility perspective. This is a net benefit of -$109 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot saved from the utility perspective was $294.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of $12,768 from the participant perspective. This is a net benefit of $87 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $676.**

OVERALL PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$3,227 from an overall perspective. This is a net benefit of -$22 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $970.**

TR-2

Flagstaff Water Utility
Toilet Rebate Program

2000 **Results of Cost Benefit Analysis-Lifespan (20 Years)**

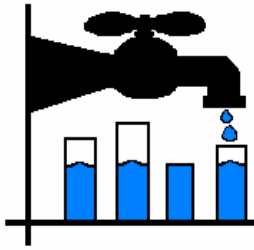
	PARTICIPANT	OVERALL	UTILITY	
Present Value Costs				
Costs to Utility		7,564	NA	7,564
Costs to Participants		NA	17,563	17,563
Costs to Others		NA	NA	0
Total Costs		$7,564	$17,563	$25,128
Present Value Benefits				
Total Water Savings		24.10 AF	24.10 AF	24.10 AF
Benefits to Utility		0	NA	0
Benefits to Participants		NA	20,384	20,384
Benefits to Others		NA	NA	0
Total Benefits		$0	$20,384	$20,384
Cost Benefit Calculations				
Net Present Value (NPV) (Total Benefits - Total Costs)		-$7,565	$2,820	-$4,744
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)		$314 /AF	$729 /AF	$1,043 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs
- **Landfill disposal of old toilets.**
- **Energy and water consumed to manufacture new toilets.**

Benefits
- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction with the utility.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Water saved for future municipal use.**

TR-2



Flagstaff Water Utility

Toilet Rebate Program

2001

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	8,430	NA	8,430
Costs to Participants	NA	19,250	19,250
Costs to Others	NA	NA	0
Total Costs	$8,430	$19,250	$27,680
Present Value Benefits			
Total Water Savings	30.36 AF	30.36 AF	30.36 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	24,486	24,486
Benefits to Others	NA	NA	0
Total Benefits	$0	$24,486	$24,486
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$8,430	$5,236	-$3,194
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$278 /AF	$634 /AF	$912 /AF

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	15,995	NA	15,995
Costs to Customers	NA	36,814	36,814
Costs to Others	NA	NA	0
Total Costs	$15,995	$36,814	$52,808
Present Value Benefits			
Total Water Savings	54.45 AF	54.45 AF	54.45 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	49,581	49,581
Benefits to Others	NA	NA	0
Total Benefits	$0	$49,581	$49,581
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$15,995	$12,768	-$3,227
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$294 /AF	$676 /AF	$970 /AF

TR-2

Metro Water District
Toilet Rebate Program

Metro Water District (MWD) is located in the northwest region of metropolitan Tucson, Arizona. MWD is comprised of residential areas, but has a growing number of commercial connections as well. Median household income in Tucson was $30,981 as of the 2000 census, which was lower than the statewide average of $40,558.[1]

UTILITY DEMOGRAPHICS

As of 2005, MWD maintained 17,083 connections, of which 95% were residential. Of total connections, 16,098 were single family residential, 110 were multifamily residential, 573 were commercial, 291 were irrigation, and 11 were public authority meters. MWD's total service area is approximately 25 square miles, and the population of this service area is approximately 44,000. As of 2003, average residential customer water use in gallons per capita per day (gpcd) was 135.

TOILET REBATE PROGRAM

Rebate Amount:	**$50 first toilet, $40 second**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**1995-present**
Years Analyzed:	**2002**

UTILITY RATE STRUCTURE AND PRICES

From November 1995 through April 2004, MWD had both a tiered and seasonal rate structure in place. The summer rate was 33% higher in the summer months as in the winter. There was also a high user surcharge for those customers using more than 25,000 gallons per month.

On May 1, 2004, MWD implemented a new tiered rate structure in which the customer pays a higher rate per 1,000 gallons when their usage exceeds one of the tiers. The base rate, which includes the first 1,000 gallons, is $11.96 for a 5/8 inch meter. The variable rates are as follows:

Usage	Price
1-12,000 gallons	$1.98 per 1,000 gallons
12,001-20,000 gallons	$2.88 per 1,000 gallons
20,001-32,000 gallons	$3.62 per 1,000 gallons
32,001+ gallons	$4.82 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

MWD uses only groundwater. They do have an allocation for Central Arizona Project (CAP) water, which they are currently recharging.

FUTURE PLANS TO MEET DEMAND

MWD plans to meet future demand through continuing its use of groundwater supply, seeking ways to use its 8,858 acre-foot allocation of CAP water for recharge of groundwater, expanding facilities with new wells, implementing more conservation, and using allocated effluent for outdoor water use.

[1] U.S. Census Bureau, American FactFinder.

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REBATE PROGRAM - DESCRIPTION

Metro Water District began its toilet rebate program in 1995 and it has continued since. The program offers a $50 rebate to a customer who replaces a high water use toilet with an ultra-low flush (1.6 gallon or less) toilet. For any additional toilets replaced at the residence, the rebate is $40 per toilet. Rebates are primarily given to single family customers.

OTHER METRO WATER DISTRICT CONSERVATION PROGRAMS

Faucet Aerator Giveaway, *January 1997-present*
Graywater and Water Harvesting System Rebates, *September 2002-present*
Conservation Rates, *1995 and 2004*
Implemented a seasonal rate structure in 1995,
an increasing block structure in 2004.
Leak Detection Program, *2000 and 2003*
Outdoor Water Self-Audits , *1999-2000*

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received toilet rebates in 2002. The water savings were calculated and a cost benefit analysis was performed for this time period only, not to the ongoing program. The lifespan of the toilets, which is used as the period of analysis, was assumed to be twenty years.

All quantified costs and benefits have been discounted to the first year of the analysis (2002) and inflated to 2004 dollars. The discount rate used in this analysis was 5.45%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2002 value of 179.9.

The population studied for this analysis was comprised of all single-family participants who received toilet rebates in 2002. There were 73 single family participants in 2002, and all 73 had sufficient water use data to be included in the analysis.

All single family residential households in MWD's main service area (Metro Main) that did not receive rebates were used as the control group. The number of households in the control group was 13,759 in 2000, 14,084 in 2001, 14,399 in 2003, and 14,550 in 2004. The average annual pre-measure water use of the participants (145,001 gallons) was higher than that of the control group (125,792 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2002 CPI value, 179.9, and the 2004 CPI value, 188.9, were used in this analysis.

A discount rate of 5.45% was used in this analysis.

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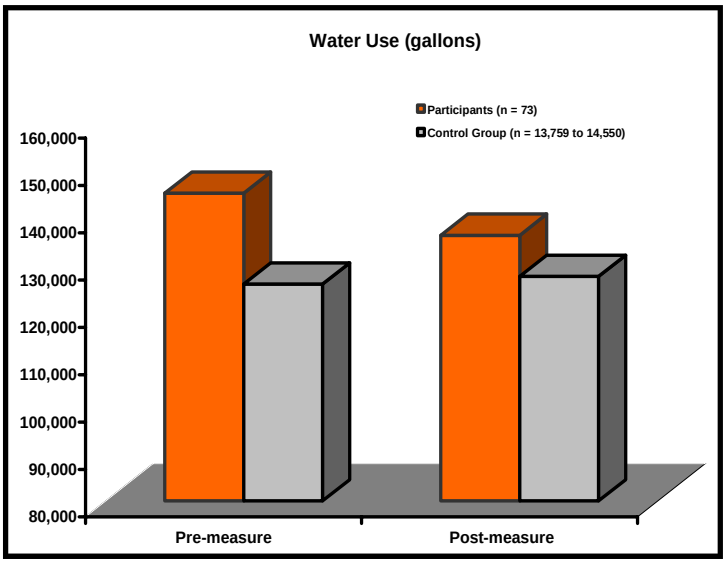
The average cost of a toilet in the MWD service area was assumed to be $120.



It was assumed that thirty percent of the participants in this analysis had their new toilets professionally installed at a cost of $80 per participant; the other 70% installed the toilets themselves.

The value of the water saved was calculated by multiplying the amount of water saved by the price of water ($2.52 per 1,000 gallons in 2003 and $1.98 per 1,000 gallons in 2004 and beyond). The 2003 price was the average of the winter and summer rates. The 2004 price was at the average level of use of the participants (falls into the first tier: 1– 12,000 gallons per month).

Labor costs included $17.89/hour for processing rebates, which took approximately 20 minutes per rebate.

An annual cost of $300 for advertising of the program was assumed.

RESULTS - WATER SAVINGS

In the first year after the rebates, the water savings amounted to 912,827 gallons, or 12,504 gallons per participant per year (gppy) (8.6% of pre-measure water use). The second year after, the water savings amounted to 659,401 gallons, or 9,033 gppy (6.2% of pre-measure water use). The average water savings per year was 786,114 gallons, or 10,769 gppy (7.4% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 15,722,276 gallons (48.2 AF), or 215,374 gallons per participant.**

During the two years prior to receiving rebates, participants' water use was 115.3% of the control group's use, on average. During the two years after, their water use was 106.8% of the control group's use, on average. The participants' water use decreased by 6.1% from pre-measure to post-measure, whereas the control group's use increased by 1.3%. **The resulting overall water savings attributed to this program was 7.4%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $7,492 ($103 per participant), which includes the cost of financial incentive payments, $6,353 ($87 per participant), labor, $824 ($11 per participant), and advertising, $315 ($4 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $18,598 ($255 per

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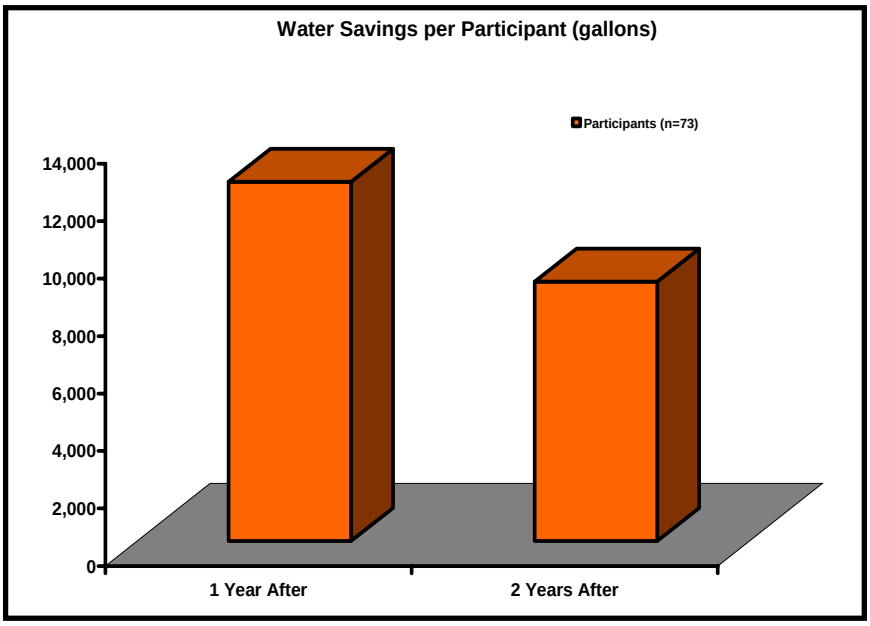
participant), which includes the cost of the toilets, $16,758 ($230 per participant), and installation, $1,840 ($25 per participant).

- The quantified benefit to the participants was $32,822 ($450 per participant), which includes water bill savings, $20,116 ($276 per participant), and financial incentives, $6,353 ($87 per participant).



UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$7,492 from the utility perspective. This is a net benefit of -$103 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $155.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $14,224 from the participant perspective. This is a net benefit of $195 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $385.**

Quantified Costs and Benefits							
Utility				Participants			
Costs				Costs		Benefits	
Financial Incentives	$6,353	Not Quantified		Toilets	$16,758	Water bill savings	$20,116
Labor	$824			Installation	$1,840	Financial Incentives	$6,353
Advertising	$315						
Total	$7,492			Total	$18,598	Total	$32,822

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OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $6,732 from an overall perspective. This is a net benefit of $92 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $541.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Time spent installing new toilets, when not professionally installed.**
- **Landfill disposal of old toilets.**

Benefits

- **Financial savings on sewer bills for participant.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Improved public relations for the utility.**
- **Participants received new toilets.**

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Metro Water District

Toilet Rebate Program

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	7,492	NA	7,492
Costs to Participants	NA	18,598	18,598
Costs to Others (CMWD & MWDSC)	NA	NA	0
Total Costs	$7,492	$18,598	$26,090
Present Value Benefits			
Total Water Savings	48.25 AF	48.25 AF	48.25 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	32,822	32,822
Benefits to Others	NA	NA	0
Total Benefits	$0	$32,822	$32,822
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$7,492	$14,224	$6,732
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$155 /AF	$385 /AF	$541 /AF

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Tempe Water Utilities Dept.

Toilet Rebate Program

The City of Tempe Water Utilities Department serves the communities of Tempe and Guadalupe, located in central Arizona. Combined, these communities have a population of approximately 170,000 people. The area's economy is heavily supported by a state university and hundreds of manufacturing and technology firms.[1] As of the 2000 census, the median family income was $55,237.[2]

UTILITY DEMOGRAPHICS

The City of Tempe Water Utilities Department currently maintains approximately 42,000 connections 84.6% of which were residential. Of their total connections, 31,350 were single family residential, 4,200 were single family residential, 3,230 were commercial, 88 were industrial, 3,300 were irrigation and flood irrigation, and 200 government and miscellaneous customers. The City of Tempe Water Utilities Department's total service area encompasses 41.5 square miles. Approximately 99% of the utility's customers are within the City of Tempe, with the remaining connections in Guadalupe. The total amount of treated water use in 2004 was 52,711 AF. The average per capita residential water use was 148 gallons per day, as of 2004.

TOILET REBATE PROGRAM

Rebate Amount:	**50%, up to $75**
Eligible Customers:	**SF, MF**
Customers analyzed:	**SF**
Program Years:	**1992-present**
Years Analyzed: March 2001 – February 2002	

UTILITY RATE STRUCTURE AND PRICES

The City of Tempe Water Utilities Department has an increasing block rate structure. The monthly base rate for service to single-family residences is $8.39 within Tempe city limits, and $10.82 outside Tempe city limits. The monthly service charge includes zero gallons of water. The fee structure for water consumption inside Tempe and Guadalupe, as of November 1, 2002, is as follows:

Usage	Price
0 – 8,000 gallons	$0.83 per 1,000 gallons
8,001 – 15,000 gallons	$0.88 per 1,000 gallons
15,001 – 25,000 gallons	$0.97 per 1,000 gallons
25,001 – 50,000 gallons	$1.03 per 1,000 gallons
50,001 – 100,000 gallons	$1.13 per 1,000 gallons
≥ 100,000 gallons	$1.17 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

The City of Tempe Water Utilities Department has a current storage capacity of 38.8 million gallons, over 95% of which is drawn from surface water sources which include the Salt River Project, the Central Arizona Project (CAP), and the Modified Roosevelt Dam New Conservation Storage.

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[1] Arizona Department of Commerce: Tempe Community Profile.
[2] U.S. Census Bureau, American Fact Finder.

FUTURE PLANS TO MEET DEMAND

The population within the City of Tempe grew 1.2% annually, on average, between 1990 and 2000.[3] The utility intends to meet future water demand within the service area by first utilizing its current capacity and water sources. The utility has plans to expand and change water sources and infrastructure to allow the utilization of increased amounts of reclaimed water. Additionally, the City of Tempe Water Utilities Department is seeking additional CAP water supplies. Lastly, the utility will meet further demand by increasing groundwater and recovery well production capacity and continuing its programs to encourage customer conservation.

OTHER CITY OF TEMPE CONSERVATION PROGRAMS

Landscape Rebate Program, *October 1992- present*
Plumbing Retrofit Kit Giveaway, *October 1992- present*
Free plumbing retrofit kits provided to water customers whose homes were built before 1980.
School Gardening Grants, *awarded every September since 2000*
Public Education, *1990- present*
Conservation Based Rate Structure, *1999- present*
Water Waste Ordinance, *1999- present*
Industrial Grant Program, *1999- present*
Offered to industries that reduce overall water use by 15%. The grants cover 25-50% of costs up to $20,000.

TOILET REBATE PROGRAM - DESCRIPTION

Since 1992, the City of Tempe Water Utilities Dept. has offered rebates of 50% of the purchase price, or up to $75, to single family utility customers who replace high water use toilets (3.5 gallons per flush) with ultra low-flush toilets (1.6 gallons or less per flush). The utility issues rebate checks to customers participating in the toilet rebate program. The program primarily targets single-family residential customers; however, some multifamily water customers have participated in the program. Since the program began, 1,132 customers have participated; of which 1,109 have been single family residential.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single-family households that received a toilet rebate between March 2001 and February 2002 (FY 2001). The water savings were calculated and a cost benefit analysis was performed for the period of March 2001 through February 2002. The findings refer to this year-long period only, not to the ongoing program. The lifespan of the toilets, which is used as the period of analysis, was assumed to be twenty years.[4]

[3] Arizona Department of Commerce: Tempe Community Profile.

[4] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

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All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used for this analysis was 5.35%. The Consumer Price Index values used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

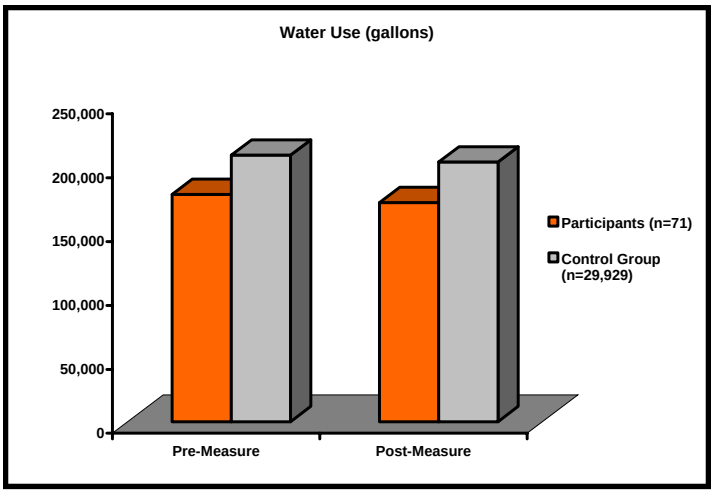
The population studied for this analysis was comprised of all participants who received rebates from March 2001 to February 2002. There were a total of ninety-eight participants who received rebates for 143 toilets during this time period. There were 71 usable participants who received 92 toilets. Of the total participants, 27, or 27.6%, were unusable because they moved during the period of the analysis, they had multiple rebates (in which case they were only counted once), they were multifamily residential or there was insufficient raw data available.

All City of Tempe single-family residential customers that were not participants in the conservation program were used as the control group. The average pre-measure annual water use of the participants (177,901 gallons) was lower than that of the control group (208,691 gallons). There were 29,929 customers in the control group.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

We assumed that there were 30,000 single-family residential connections for each year. We recognize that this is not entirely accurate, but the utility was unable to provide an actual count. After removing participants from this figure, the control group totaled 29,929 users.



We assumed that 40% of participants used a professional to install their new toilet(s) at a cost of $120 per participant.

We assumed that half of the rebate forms were mailed out and half were distributed by other means.

Many customers were using their new toilet before March 1st 2002 (our start of benefits calculations), but we had to start with one date and chose March 1st.

The price of water used in determining the benefits to customers from reduced water bills is the price from the range where the participants' pre-measure average monthly use fell. Ex.: Pre-measure average monthly use = 14,825 gallons, which is within the range of 8,001 to 15,000 gallons, and so the price per 1,000 gallons was $0.86 per 1,000 gallons in 2002, $0.88 per 1,000 gallons in 2003, and assumed to be $0.88 for the remainder of the lifespan.

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Participants who had two or more consecutive months of no water use were included in the study.

RESULTS - WATER SAVINGS

In the first year after the FY 2001 toilet rebates, water savings amounted to 294,117 gallons, or 4,143 gallons per participant per year (gppy) (2.3% of pre-measure water use). The second year after the toilet rebates, there was an increase in participant water use, relative to control group water use, of 53,982 gallons, or 760 gppy (0.4% of pre-measure water use. The average water savings per year was 120,067 gallons (0.37 AF), or 1,691 gppy (1.0% of pre-measure water use).[5] **The total water savings over the twenty year assumed lifespan of the toilets was 2,401,347 gallons (7.4 AF), or 33,822 gallons per participant.**

During the two years before participating in the toilet rebate program and replacing high water use toilets with the ultra low-flush toilets, participants' water use was 85.2% of the control group's usage, on average. During the two years after replacing the toilets, participants' water use was 84.4% of the control group's usage, on average. The participants' water use decreased by 3.5% whereas the control group's water use decreased by 2.6%. **The resulting overall water savings attributed to this program was 0.9%.**

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Materials	$13	Not Quantified		Toilets	$12,275	Financial Incentives	$6,138
Advertising	$53						
Labor	$618			Installation	$3,635	Value of Water Saved	$1,358
Incentive Payments	$6,138						
Total	$6,822			Total	$15,910	Total	$7,496

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The total cost to the utility was $6,822. This cost includes the cost of materials, $13, advertising, $53, labor, $618, and incentive payments, $6,138. The cost per participant is $96, which includes materials, $0.18, advertising, $1, labor, $9, and incentive payments, $86.
- The total benefit to the utility was $0.
- The approximate total cost to participants was $15,910. This cost includes the estimated cost of the toilets, $12,275, and estimated installation costs of $3,635. The estimated cost per participant is $224 including the cost of the toilets, $173, and installation, $51.
- The total benefit to program participants was $7,496. This value includes the amount that participants received in financial

[5] This value closely approximates the water savings per toilet, but not perfectly. A number of participants purchased multiple toilets. Some purchased one toilet earlier in FY 2001, and later purchased additional toilets. Those participants were counted only once in the analysis, although water use data furnished by the utility counted them for each rebate.

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incentives, -$6,138 and water bill savings, $1,358. The benefit per participant is $105, including financial incentives, $86, and water bill savings, $19.

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$6,822 from the utility perspective. This is a net benefit of -$96 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $926.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$8,414 from the participant perspective. This is a net benefit of -$119 per participant. The quantified costs to program participants were greater than the quantified benefits. **The cost per acre-foot of water saved from the participant perspective was $2,159.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$15,236 from an overall perspective. This is a benefit of -$215 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $3,085.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Landfill disposal of old toilets

Benefits

- Financial savings on sewer bills for participants.
- Environmental benefits of reduced water use
- Avoided cost of acquisition and distribution of water saved.
- Increased public awareness about water conservation
- Water saved for future municipal use
- Reinforces need to conserve and the desirability of conserving
- Increased customer satisfaction with the utility
- Reduced groundwater depletion, subsidence and surface water use
- Program participants received new toilets

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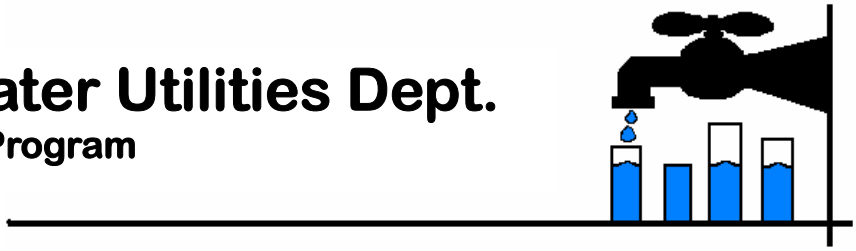
Tempe Water Utilities Dept.

Toilet Rebate Program



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	6,822	NA	6,822
Costs to Customers	NA	15,910	15,910
Costs to Others	NA	NA	0
Total Costs	$6,822	$15,9210	$22,732
Present Value Benefits			
Total Water Savings	7.37 AF	7.37 AF	7.37 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	7,496	7,496
Benefits to Others	NA	NA	0
Total Benefits	$0	$7,496	$7,496
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$6,822	-$8,414	-$15,236
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$926 /AF	$2,159 /AF	$3,085 /AF

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Thornton Water Res. Div.

Toilet Rebate Program

The City of Thornton Water Resources Division (TWRD) is located in Thornton, Colorado, approximately 10 miles north of downtown Denver. As of March 31, 2005, the population served by TWRD was 127,832, where 111,002 reside inside the city and 16,830 reside outside the city. Median household income was $54,445 as of the 2000 census, which was higher than the statewide average of $47,203.[1]

UTILITY DEMOGRAPHICS

As of May 2005, TWRD maintained 34,259 connections of which 94.3% were residential. Of their total connections, 30,377 were single family residential, 1,937 were multifamily residential, 628 were ICI, and 1,317 were irrigation accounts, including city parks. In addition to providing water to individual retail customers, TWRD provides 2.0 million gallons per day (mgd) of treated water to the City of Westminster. TWRD's total service area is 19 square miles. As of 2004, average customer water use in gallons per capita per day (gpcd) was 142 for all customers and 129 for residential customers.

TOILET REBATE PROGRAM

Rebate Amount:	**$100**
Eligible Customers:	**SF**
Customers analyzed:	**SF**
Program Years:	**2003 - present**
Years Analyzed:	**2003**

UTILITY RATE STRUCTURE AND PRICES

As of 2004, the domestic inside-city monthly service charge is $2.46 for a 5/8 x 3/4 inch meter and the outside-city charge is $3.69 per month. TWRD has an increasing block rate structure. The four-tier structure categorizes rates by determining how much a customer uses relative to their Average Winter Consumption (AWC) and their Monthly Outdoor Allowance (MOA).

Usage	Price	
	INSIDE CITY	**OUTSIDE CITY**
0 gallons - AWC	$3.00/1,000g	$4.50/1,000g
> AWC, up to AWC + MOA	$3.00/1,000g	$4.50/1,000g
> AWC + MOA, up to AWC + 2xMOA	$4.50/1,000g	$6.75/1,000g
> AWC + 2xMOA	$9.00/1,000g	$13.50/1,000g

CURRENT CAPACITY AND WATER SOURCES

Currently, the capacity of existing raw water storage from reservoirs is 26,594 acre-feet. Their treated water storage capacity is 27 mgd. TWRD has two water treatment plants that have a combined capacity of 65 mgd. TWRD's primary water sources are Clear Creek and the South Platte River.

[1] U.S. Census Bureau, American FactFinder.

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FUTURE PLANS TO MEET DEMAND

The City of Thornton's growth rate has decreased from 5.0% in 2002 to 3.8% in 2004. The city's plans to meet future demand through a number of different actions. They plan to continue use of current capacity and sources, implement a planned surface water supply project from the Cache la Poudre River basin, expand storage and treatment facilities, continue conservation efforts, purchase and exchange additional water rights, and develop water reuse projects.

REBATE PROGRAM - DESCRIPTION

On May 1, 2003, the Toilet Rebate Program began, which offers single family customers a $100 credit on their water bill for the replacement of a high water use toilet with a 1.6 gallon per flush (gpf) or less toilet. Customers are limited to two rebates per household. Participants must break the toilet and take a picture of the old, broken toilet to attach to their rebate application. Participants can also be selected for inspection of their new toilet and their original sales receipt. The program is advertised in billing inserts, on TWRD's website, on television ads, at festivals, and in TWRD's quarterly magazine.

OTHER THORNTON CONSERVATION PROGRAMS

Washing Machine Rebates, ***May 1, 2003-present***
Toilet Rebates, ***May 1, 2003 - present***
Tiered Conservation Rates, ***effective May 15, 2003***
Public Education, ***May 2002-present***
Water Conservation Ordinances, ***various start dates***
Showerhead & Aerator Exchange, ***May 17, 2003 - present***

During the time of the toilet rebate program, especially from 2002 to 2004, the area was experiencing a drought and there were ongoing water conservation campaigns to mitigate the effects of the drought. However, a major snowstorm in March 2003 improved TWRD's water supply situation. Another important measure taking place during the period of the toilet rebate program was the utility-wide transition from a flat rate structure to a conservation rate structure in May 2003.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that received toilet rebates between May 1 and December 31, 2003. The water savings were calculated and a cost benefit analysis was performed for this time period. Results refer to this time period, not to the ongoing program. The lifespan of the toilets, which is used as the period of analysis, was assumed to be twenty years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 4.65%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

Since two complete years of pre- and post-measure water use could

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not be acquired for this analysis, water use data for the participants was acquired from 18 months before the program and 18 months after the program for all households that were residing there for that full period. The pre-measure period includes January 2002 to June 2003, and the post-measure period includes January 2004 to June 2005.

The population studied for this analysis was comprised of all participants who received the toilet rebates between May 1 and December 31, 2003. There were 102 usable participants out of 131 total participants during the period under analysis.

All TRWD single family households, including the participants, were used as the control group. The average annual pre-measure water use of the participants (113,129 gallons) was higher than that of the control group (107,839 gallons). The number of control group connections varied by month, from a minimum of 20,148 to a maximum of 24,532.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2003 CPI value, 184.0, and the 2004 CPI value, 188.9, were used in this analysis.

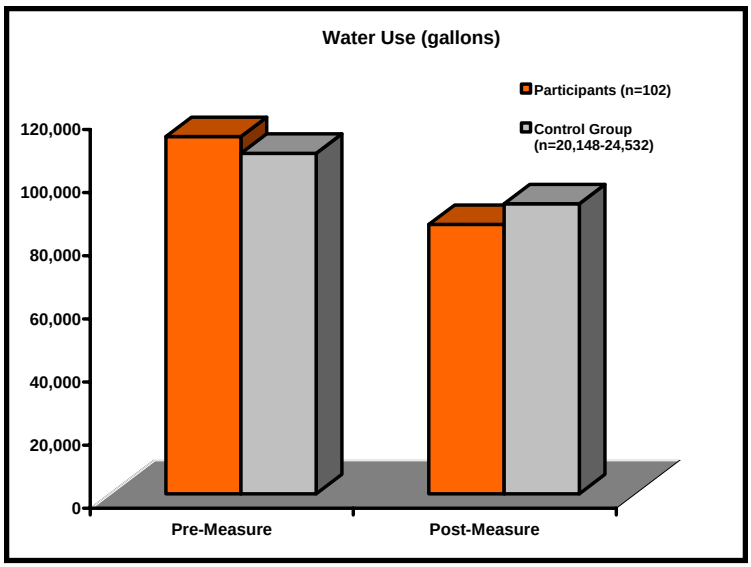
Participants who participated in any other water conservation program during the period of analysis were not included in the study.

Participants who had two or more consecutive months of no water use were not included in the study.

Any participants that had 11 to 13 months of usage per year were included in the study.

The control group consisted of all single family residential connections, including participants.

The percentage of toilet rebate program participants who lived inside the city was 90%. However, it was assumed that 100% of participants lived inside the city, thus Inside-City rates apply for all cost benefit analysis calculations.



Since all participants were assumed to reside inside the city, Outside-City connections were not included in the control group.

It was assumed that the average number of toilets rebated per participant was 1.32.

It was assumed that 30% of the toilet rebate participants paid $80 for professional installation, and 70% installed the toilet themselves.

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It was assumed that average participant water use falls into tier 1 or 2 of the increasing block rate structure implemented in 2003.

RESULTS - WATER SAVINGS

During the 18 months after receiving the toilet rebates, water savings amounted to 1,682,181 gallons, or 16,492 gallons per participant (9.7% of pre-measure water use). The average savings per year was 1,121,454 gallons, or 10,995 gallons per participant per year (gppy) (9.7% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 22,429,075 gallons (68.8 AF), or 219,893 gallons per participant.**

During the 18 months before participating in the toilet rebate program, the participant group's water use was, on average, 104.9% of the control group's use. During the 18 months after, the participant group's water use was 92.9% of the control group's use, on average. The participant group's water use decreased by 24.6%, whereas the control group's use decreased by 14.9%. **The resulting overall water savings attributed to this program was 9.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $18,153 ($178 per participant). This cost includes the cost of financial incentives, $13,823 ($136 per participant), labor, $4,239 ($42 per participant), and advertising, $91 ($1 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $19,699 ($193 per participant). This includes the estimated cost of the toilets, $17,186 ($168 per participant) and installation, $2,513 ($25 per participant).
- The quantified benefit to the participants was $58,173 ($570 per participant). This includes the benefits of water bills savings, $44,351 ($435 per participant) and financial incentives, $13,823 ($136 per participant).

Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Financial Incentives	$13,823	Not Quantified		Toilets	$17,186	Water bill savings	$44,351
Labor	$4,239			Installation	$2,513	Financial Incentives	$13,823
Advertising	$91						
Total	$18,153			Total	$19,699	Total	$58,173

UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of -$18,153 from the utility perspective over the twenty year assumed lifespan of the toilets. This is a net benefit of -$178 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $264**.

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PARTICIPANT PERSPECTIVE

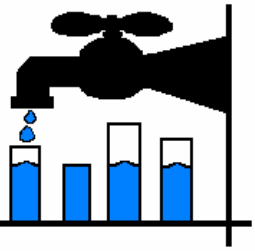
Results of the cost benefit analysis show a net benefit (net present value) of $38,474 from the perspective of the participant. This is a net benefit of $377 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $286.**

OVERALL PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $120,321 from an overall perspective. This is a net benefit of $199 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $550.**

Thornton Water Res. Div.

Toilet Rebate Program



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	18,153	NA	18,153
Costs to Participants	NA	19,699	19,699
Costs to Others	NA	NA	0
Total Costs	$18,153	$19,699	$38,974
Present Value Benefits			
Total Water Savings	68.83 AF	68.83 AF	68.83 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	58,173	58,173
Benefits to Others	NA	NA	0
Total Benefits	$0	$58,173	$58,173
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$18,153	$38,474	$20,321
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$264 /AF	$286 /AF	$550 /AF

TR-5

TOILET DISTRIBUTION
CASE NARRATIVES

PAGES

Camrosa Water District

Toilet Distribution Program

Camrosa Water District (CWD) provides potable, non-potable, and reclaimed water for communities in the southern portion of Ventura County, CA. The population of CWD's service area is 31,000. As of the 2000 Census, the median household income in Ventura County was $59,666, which is higher than the statewide median of $47,493[1].

UTILITY DEMOGRAPHICS

As of 2004, the District maintained 11,507 connections, 83.5% of which were residential. Of their total connections, 9,065 were single family residential, 544 were multifamily residential, 1,280 were commercial, 133 were industrial, 298 were irrigation, 108 were agricultural irrigation, and 79 consisted of fire suppression, line flushing, construction meters, and temporary meters. Camrosa Water District's total service area is 31 square miles. The average per capita water use for the utility as a whole was 290 gallons per capita per day (gpcd) as of 2004.

UTILITY RATE STRUCTURE AND PRICES

Camrosa Water District employs an increasing block rate structure. As of February 2005, the monthly base rate for service is $5.60 for ¾ inch meters (or $0.19 per day), which includes zero gallons of water. Single family and multifamily residential usage charges are $1.10 per HCF for the first 12 HCF of water and $1.46 per HCF thereafter ($1.47-$1.95 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

The current sources of supply for the customers and properties within CWD's service area comprise a mix of public and private sources including purchasing imported water from Calleguas Municipal Water District (CMWD), groundwater from three groundwater basins, surface water diverted form Conejo Creek, and recycled water from CWD's Water Reclamation Facility. The utility's total capacity from these sources is 46.0 million gallons per day (MGD).

TOILET DISTRIBUTION PROGRAM

Eligible Customers:	**SF**
Customers Analyzed:	**SF**
Program Years:	**February 1997-present**
Years Analyzed:	**1997**

FUTURE PLANS TO MEET DEMAND

The population within CWD's service area is growing at a rate of 0.9% per year. Current sources, water conservation, water transfers, and water reuse are the main components of the District's future plans to meet demand.

TOILET DISTRIBUTION PROGRAM - DESCRIPTION

The program under analysis is an ultra low flush toilet distribution program. The program is partly funded by the Metropolitan Water District of Southern California (MWDSC) and Calleguas Municipal Water District.

[1] U.S. Census Bureau. QuickFacts.

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The distribution was held at a local high school. The toilets were distributed on a first come first served basis at the high school on February 8, 1997. The customers provided their photo ID and water bill to prove that they were a CWD customer. They then picked up one or more ultra low flush toilets to replace their less efficient models. They were required to return their old toilets to the same location on February 22, 1997.

CWD and Calleguas Municipal Water District paid the high school $15 for each old toilet returned for recycling. If the old toilets were not returned by February 22, 1997 the participants would be charged up to $100 per toilet. However, there was a 100% return rate for the program. Since all 800 old toilets were returned, the high school earned $12,000.

The toilets distibuted were Niagara 2202 toilets. Calleguas Municipal Water District provided 400 toilets and CWD provided 400. There were about 20 students and high school staff, 5 CWD staff, and 1 Calleguas Municipal Water District staff present at the distribution.

CWD held three additional distribution events in 1998 and 1999, and provided the free toilets on request through phone inquiries.

OTHER CWD CONSERVATION PROGRAMS

Toilet Distribution, ***June 13, 1998***, ***August 13, 1998***, ***April 26, 1999***
Ongoing Toilet Distribution, ***1999-present***
Free ULFTs were distributed on customer inquiry.
Washing Machine Rebate Program, ***March 25, 2003-June 2, 2003***
$300 rebate to replace inefficient washers with qualifying high efficiency washing machines.
Showerhead Giveaways, ***1997-present***
Home Water Survey (indoor/outdoor audits), ***1994-present***
Landscape Water Survey (outdoor audits), ***1994-present***
Protector del Agua, ***1997-present***
Classes and seminars for residents and landscape professionals coordinated through Camrosa Water District by the Irrigation Training and Research Center at California Polytechnic University in San Luis Obispo.
Public Education, ***on-going***

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the distribution occurring on February 8, 1997. The findings refer to this distribution only, not to the ongoing program. The lifespan of the toilets installed, which is used as the period of this analysis, was assumed to be twenty years.

All quantified costs and benefits have been discounted to the first year of the analysis (1997) and inflated to 2004 dollars. The discount rate

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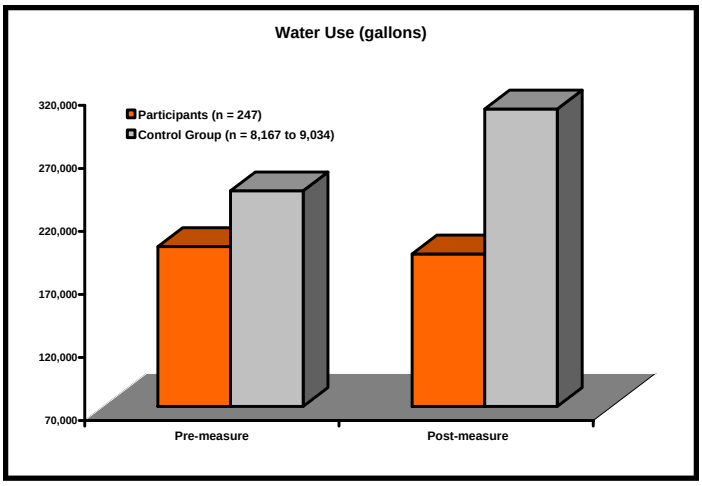
used in this analysis was 6.2%. The CPI values used in this analysis were the 2004 value of 188.9 and the 1997 value of 160.5.

The population studied for this analysis was comprised of participants who received a toilet during 1997. There were 247 usable participants out of a total of 415. One hundred sixty-eight, or 40%, of the participants were unusable because they moved during the period of analysis or there were periods of two or more months with no water use.



All Camrosa Water District residential customers that were not participants in this analysis were used as the control group. Participant pre-measure water consumption was 196,822 gallons per year while control group pre-measure water consumption was 241,020 gallons per year. For the 1997 toilet distribution program, the control group consisted of 8,167 households in 1995, 8,853 in 1996, 9,034 in 1997, 8,936 in 1998, and 9,004 in 1999.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 1997 CPI value, 160.5, and the 2004 CPI value, 188.9, were used in this analysis.

The price paid by Calleguas MWD and MWDSC for each toilet was assumed to be $62.

Assumed that 20% of participants paid for professional installation of their toilet at $100 per participant.

The price of water used in determining the benefits to customers from reduced water bills is the variable portion of the City's price of water. We used the price from the first tier (0-12 ccf of water use per month) which was $1.01 per ccf in 1998 and 1999, $1.03 per ccf 2000 through 2004, and $1.10 per ccf thereafter (for 2005 and assumed for the rest of the lifespan).

Participants who had two or more consecutive months of no water use were not included in the study.

RESULTS - WATER SAVINGS

In the first year after the 1997 distribution, the water savings amounted to 13,788,899 gallons, or 55,826 gallons per participant per year (gppy) (28.4% of pre-measure water use). The second year after, the water

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savings amounted to 15,267,258 gallons or 61,811 gppy (31.4% of pre-measure water use). The average savings per year was 14,528,079 gallons, or 58,818 gppy (29.9% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 290,561,570 gallons (891.7 AF), or 1,176,363 gallons per participant.**

Before the toilet distribution program, the participant group's water use was 81.7% of the control group's use, on average. After the program, their water use was 62.4% of the control group's use, on average. The participant group's water use decreased by 2.9% from pre-measure to post-measure, whereas the control group's use increased by 27.0%. **The resulting overall water savings attributed to this program was 29.9%.**

Quantified Costs and Benefits						
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Cost of Toilets	$18,352	Not Quantified		Installation Costs	$11,840	Water Bill Savings	$273,828
Materials	$391						
Advertising	$330						
High School Payment	$4,440			Total	$11,840	Total	$273,828
Total	$23,513						

Quantified Costs and Benefits			
CMWD, MWDSC, and High School			
Costs to CMWD & MWDSC		Benefits to High School	
Cost of Toilets	$18,352	Receiving Incentive	$8,880
Payment to High School	$4,440		
Total	$22,792	Total	$8,880

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $23,513 ($95 per participant). This includes the cost of the toilets, $18,352 ($74 per participant) materials, $391 ($2 per participant), advertising, $330 ($1 per participant), and payment to the high school, $4,440 ($18 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $11,840 ($48 per participant) in installation costs.
- The quantified benefit to the participants was $273,828 ($1,109 per participant), which is the total amount that they saved on their water bills during the twenty year lifespan of the toilets.
- The total cost to others was $22,792 ($92 per participant). This includes the cost to CMWD and MWDSC of the toilets, $18,352 ($74 per participant) and incentive payment to the high school, $4,440 ($18 per participant).
- The total benefit to others was $8,880. This includes the benefit to the high school of receiving incentive payments, $8,880 ($36 per participant).

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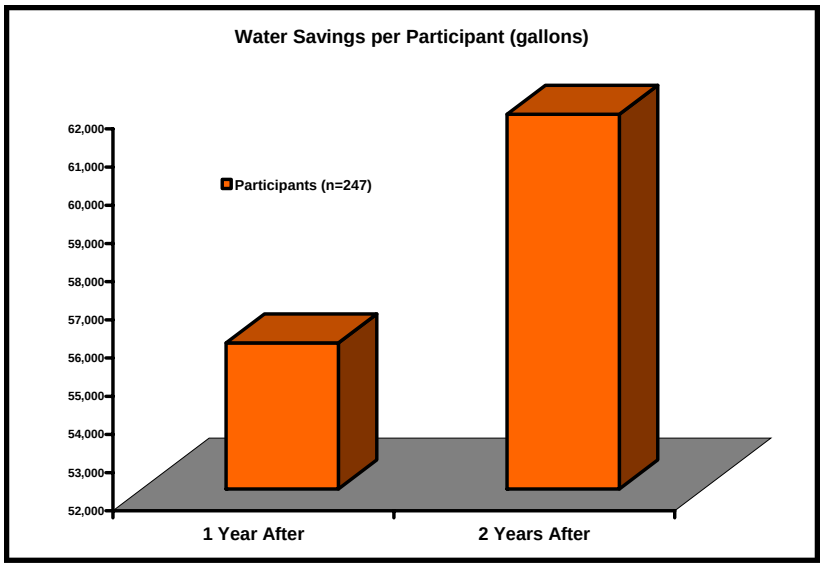
UTILITY PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present

value) from the utility perspective of -$23,513, or -$95 per participant. The quantified benefits to the utility were less than the quantified costs to the utility. **The cost per acre-foot of water saved from the utility perspective was $26.**

PARTICIPANT PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) of $261,988 from the participant perspective, or $1,061 per participant. The quantified benefits to the participant were greater than the quantified costs to the participant. **The cost per acre-foot of water saved from the participant perspective was $13.**



OVERALL PERSPECTIVE

Results of the cost benefit analysis show a net benefit (net present value) from an overall perspective of $224,564, or $909 per participant. The quantified benefits to the utility, participant, and others were greater than the quantified costs to the utility, participant, and others. **The cost per acre-foot of water saved from an overall perspective was $65.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent during the pick-up and drop-off events.**
- **Customers' time spent installing toilets.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Water saved for future municipal use.**
- **Customers received new fixtures.**

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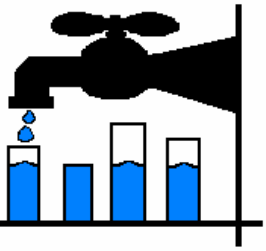
Camrosa Water District

Toilet Distribution Program



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	23,513	NA	23,513
Costs to Participants	NA	11,840	11,840
Costs to Others (CMWD, MWDSC)	NA	NA	22,792
Total Costs	$23,523	$11,840	$58,144
Present Value Benefits			
Total Water Savings	911.20 AF	911.20 AF	911.20 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	273,828	273,828
Benefits to Others (High School)	NA	NA	8,880
Total Benefits	$0	$273,828	$282,709
Cost-Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$23,513	$261,988	$224,564
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$26.37 /AF	$13.28 /AF	$65.21 /AF

TD-1

Walnut Valley Water District
Toilet Distribution Program

Walnut Valley Water District (WVWD) is located in the San Gabriel Valley, approximately 20 miles east of Los Angeles, in Walnut, California. WVWD provides water to over 98,000 customers in six communities. As of the 2000 census, the median household income in Walnut was $81,015, which is higher than the statewide median of $47,493. [1]

UTILITY DEMOGRAPHICS

As of 2005, WVWD had 26,005 connections, 95.2% of which were residential. Of their total connections, 23,777 were single family residential, 1,002 were multifamily residential, 820 were commercial, 149 were industrial, 257 were irrigation users.

WVWD's service area includes Diamond Bar, and parts of Walnut, Industry, Pomona, West Covina, and Rowland Heights. Their total service area is 29 square miles. Average annual water delivery is 22,621 acre-feet. WVWD's total water use was 215 gallons per capita per day (gpcd) as of 2005.

TOILET DISTRIBUTION PROGRAM

Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**1998-present**
Years Analyzed:	**1998,1999**, 2000

UTILITY RATE STRUCTURE AND PRICES

WVWD has a flat block rate structure. As of 2004, the monthly base rate for service to a residence is $11.01, which includes zero gallons of water. The charge per hundred cubic feet (ccf) of water is $1.68 ($2.25 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

Walnut Valley Water District is primarily dependent on surface water from the Metropolitan Water District of Southern California (MWDSC), which gets its water from the Colorado River and Northern California. WVWD has a storage capacity of 85.4 million gallons.

FUTURE PLANS TO MEET DEMAND

The population within Walnut Valley Water District's service area is growing at a rate of approximately 1% per year. Utilization of its current capacity and water sources, continuation of water conservation programs, and the possibility of expanding its recycled water system are the main components of WVWD's plans to meet future demand.

TOILET DISTRIBUTION PROGRAM - DESCRIPTION

Since 1998, Walnut Valley Water District has held an annual ultra low-flush toilet (ULFT) distribution event. WVWD has offered ULFTs (1.6 gallons per flush) at no cost to residential customers who will replace their high water use toilets. Homes built prior to 1980 are targeted by sending postcards to those residences. Local high school students and teachers assist in the distribution program.

[1] US Census Bureau. QuickFacts

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The distributions are held at the Walnut Valley Water District Office. Toilets are distributed by students from 3 or 4 local high schools, school staff and Water District staff members. Water District staff verify the customers' account, and the students assist with traffic control, loading the toilets into vehicles, and registration paperwork.

OTHER WALNUT VALLEY CONSERVATION PROGRAMS

Washing Machine Rebate Program, *2002-present*
Eligible customers can receive a $100 rebate on the purchase of a qualifying high-efficiency clothes washer.

Two weeks later, there is a return day, where the old toilet is brought to the District office. The Water District pays the schools $5 for each toilet returned for recycling. If the toilet is not delivered on the return day, the participant is charged $120 on their next water bill.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the ULFT distribution program during the years of 1998, 1999, and 2000. The water savings were calculated and a cost benefit analysis was performed for this time period. The findings refer to these three years only, not to the ongoing program. The lifespan of the toilets installed was assumed to be twenty years.

All quantified costs and benefits have been discounted to the first year of the analysis (1998) and inflated to 2004 dollars. The discount rate used for this analysis was 6.0%. The Consumer Price Index values used in this analysis were the 2004 value of 188.9 and the 1998 value of 163.0.

The population studied for this analysis was comprised of participants who received toilets during the program years 1998, 1999, and 2000. There were 196 usable participants out of 280 total participants in 1998, 222 out of 347 in 1999, and 194 out of 306 in 2000, for a total of 612 usable participants out of 933. Thirty-four percent, or 321, of the possible participants were unusable because there was not sufficient pre- and post-measure data to perform the analysis or the participant moved during the period of analysis.

A random sample of all WVWD single family residential households, not including ULFT participants, was used as the control group for each program year. The average annual pre-measure water use of the participants (164,796 gallons) was lower than the weighted annual pre-measure average of the control group (222,555 gallons). The control group consisted of 810 households for the 1998 program year, 797 households for the 1999 program year, and 781 households for the 2000 program year.

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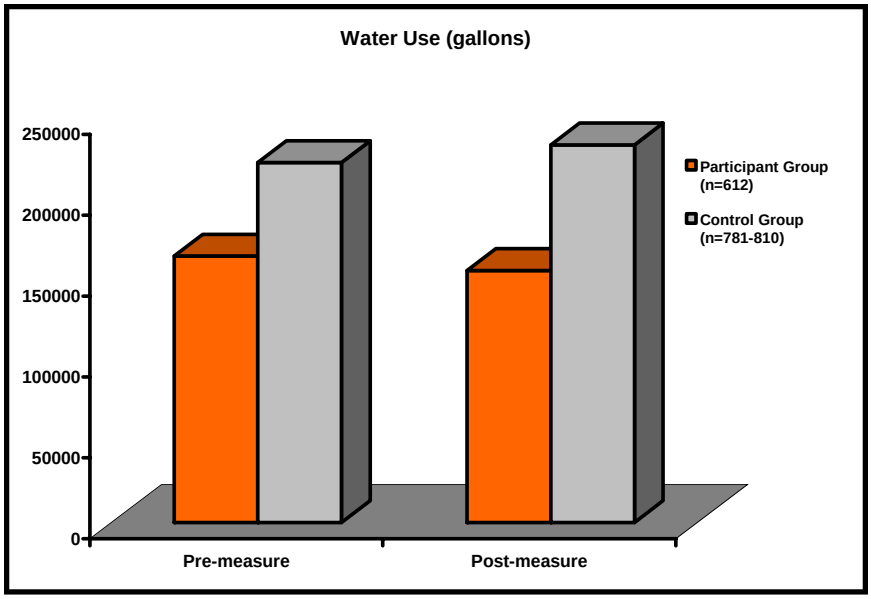
[2] Pekelney, D.M. et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.* California, 1996.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The value of the water saved was calculated by multiplying the amount of water saved by the average price of water for the year ($1.97 per 1,000 gallons in 1999, $2.01 per 1,000 gallons in 2000, $2.04 per 1,000 gallons in 2001, $2.10 per 1,000 gallons in 2002, $2.18 per 1,000 gallons in 2003, $2.23 per 1,000 gallons in 2004, and $2.25 per 1,000 gallons in 2005 and beyond).

The toilets were paid for by the Metropolitan Water District of Southern California ($60 per toilet each year) and WVWD ($55 per toilet in 1998 and 1999, $58.80 per toilet in 2000).



The control group is a random sample of all single family residential connections.

Assumed 30% of participants paid for professional installation of their toilets at $100 per participant.

Participants who had two or more consecutive months of no water use were not included in the study.

Participants who had less than 11 months of water use data in a calendar year, or less than 6 months during period of bi-monthly billing, were not included in the study.

Assumed $10 per toilet in labor costs to the utility.

The discount rate used in this analysis was 6.0%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1998 value of 163.0.

RESULTS - WATER SAVINGS

In the first year after the 1998 ULFT distribution program, the water savings amounted to 5,961,844 gallons, or 30,418 gallons per participant per year (gppy) (19.1% of pre-measure water use). The second year after, the water savings amounted to 4,707,916 gallons, or 24,020 gppy (15.1% of pre-measure water use). The average water savings per year was 5,334,880 gallons, or 27,219 gppy (17.1% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 106,697,600 gallons (327.4 AF), or 544,376 gallons per participant.**

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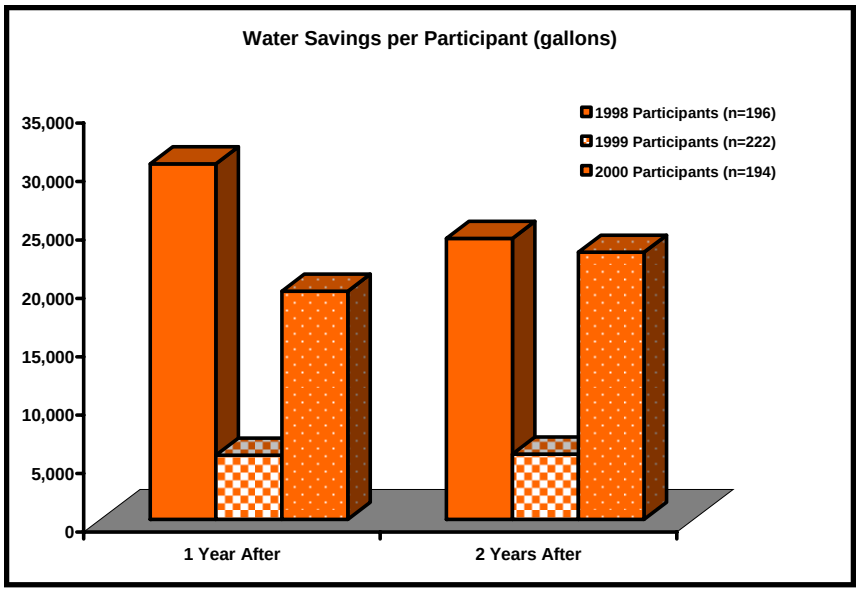
The first year after the 1999 ULFT distribution program, the water savings amounted to 1,219,018 gallons, or 5,491 gppy (3.6% of pre-measure water use). The second year after, the water savings amounted to 1,237,249 gallons, or 5,573 gppy (3.7% of pre-measure water use). The average water savings per year was 1,228,133 gallons, or 5,532 gppy (3.6% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 24,562,667 gallons (75.4 AF), or 110,643 gallons per participant.**

The first year after the 2000 ULFT distribution program, the water savings amounted to 3,784,896 gallons, or 19,510 gppy (10.6% of pre-measure water use). The second year after, the water savings amounted to 4,433,729 gallons, or 22,854 gppy (12.4% of pre-measure water use). The average water savings per year was 4,109,313 gallons, or 21,182 gppy (11.5% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the toilets was 82,186,253 gallons (252.2 AF), or 423,640 gallons per participant.**



Total water savings for the three years studied amounted to 10,965,758 gallons or 17,918 gppy (10.9% of weighted pre-measure water use) during the first year after and 10,378,894 gallons, or 16,959 gppy (10.3% of weighted pre-measure water use) during the second year after the program. **The total water savings over the twenty year assumed lifespan of the toilets was 213,446,520 gallons (655.0 AF), or 348,769 gallons per participant.**

During the two years before participating in the ULFT distribution program, participants' water use was 75.8% of the control group's use, on average. During the two years after, their water use was 68.3% of the control group's use, on average. The participants' water use decreased by 5.4% from pre-measure to post-measure, whereas the control group's use increased by 4.9%. **The resulting overall water savings attributed to this program was 10.3%.**

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RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

1998 PROGRAM

- The quantified cost to the utility was $29,772 ($152 per participant). This includes half of the cost of the toilets, $23,392 ($119 per participant), the cost of labor, $4,253 ($22 per participant), and payment to the high schools, $2,127 ($11 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $6,814 ($35 per participant).
- The quantified benefit to the participants was $154,417 ($788 per participant), which includes water bill savings.
- The quantified cost to MWDSC, a funding source for the program, was $25,519 ($130 per participant), which includes half of the cost of the toilets.
- The quantified benefit to the high schools was $2,127 ($11 per participant).

1998 Quantified Costs and Benefits							
Utility					Participants		
Costs		Benefits			Costs		Benefits	
Toilets	$23,392	Not Quantified			Installation	$6,814	Water Bill Savings	$154,417
Labor	$4,253							
Payment to High Schools	$2,127							
Total	$29,772	Total	$0		Total	$6,814	Total	$154,417

UTILITY PERSPECTIVE - 1998

Results of cost benefit analysis show a net benefit (net present value) of -$29,772 from the utility perspective. This is a net benefit of $152 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $91.**

1998 Quantified Costs and Benefits			
MWDSC & High Schools			
Costs – MWDSC		Benefits – High Schools	
Toilets	$25,519	Incentive Payments	$2,127
Total	$25,519	Total	$2,127

PARTICIPANT PERSPECTIVE - 1998

Results of cost benefit analysis show a net benefit (net present value) of $147,603 from the participant perspective. This is a net benefit of $753 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $21.**

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OVERALL PERSPECTIVE - 1998

Results of cost benefit analysis show a net benefit (net present value) of $94,439 from an overall perspective. This is a net benefit of $482 per participant. The quantified costs to the participants, utility, and others were less than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $190.**

1999 PROGRAM

- The quantified cost to the utility was $32,526 ($147 per participant). This includes half of the cost of the toilets, $25,556 ($115 per participant), the cost of labor, $4,647 ($21 per participant), and payment to the high schools, $2,323 ($11 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $6,429 ($29 per participant).
- The quantified benefit to the participants was $33,833 ($152 per participant), which includes water bill savings.
- The quantified cost to MWDSC, a funding source for the program, was $27,879 ($126 per participant), which includes half of the cost of the toilets.
- The quantified benefit to the high schools was $2,323 ($11 per participant).

1999 Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Toilets	$25,556	Not Quantified		Installation	$6,429	Water Bill Savings	$33,833
Labor	$4,647						
Payment to High Schools	$2,323						
Total	$32,526			Total	$6,429	Total	$33,833

1999 Quantified Costs and Benefits			
MWDSC & High Schools			
Costs – MWDSC		Benefits – Schools	
Toilets	$27,879	Incentive Payments	$2,323
Total	$27,879	Total	$2,323

UTILITY PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of -$32,526 from the utility perspective. This is a net benefit of $147 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $431.**

PARTICIPANT PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of $27,404 from the participant perspective. This is a net benefit of $123 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $85.**

OVERALL PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of -$30,678 from an overall perspective. This is a net benefit of -$138 per participant. The quantified costs to the participants, utility, and others were greater than the quantified benefits to the participants,

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utility, and others. **The cost per acre-foot of water saved from an overall perspective was $887**.

2000 PROGRAM

- The quantified cost to the utility was $28,544 ($147 per participant). This includes half of the cost of the toilets, $22,742 ($117 per participant), the cost of labor, $3,868 ($20 per participant), and payment to the high schools, $1,934 ($10 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $6,003 ($31 per participant).
- The quantified benefit to the participants was $107,641 ($555 per participant), which includes water bill savings.
- The quantified cost to MWDSC, a funding source for the program, was $23,207 ($120 per participant), which includes half of the cost of the toilets.
- The quantified benefit to the high schools was $1,934 ($10 per participant).

2000 Quantified Costs and Benefits							
Utility				Participants			
Costs		Benefits		Costs		Benefits	
Toilets	$22,742	Not Quantified		Installation	$6,003	Water Bill Savings	$107,641
Labor	$3,868						
Payment to High Schools	$1,934						
Total	$28,544			Total	$6,003	Total	$107,641

UTILITY PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$28,544 from the utility perspective. This is a net benefit of -$147 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $113.**

2000 Quantified Costs and Benefits			
MWDSC & High Schools			
Costs – MWDSC		Benefits – High Schools	
Toilets	$23,207	Incentive Payments	$1,934
Total	$23,207	Total	$1,934

PARTICIPANT PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of $101,639 from the participant perspective. This is a net benefit of $524 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $24.**

OVERALL PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of $51,821 from an overall perspective. This is a net benefit of $267 per participant. The quantified costs to the participants, utility, and others were less than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $229.**

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ALL YEARS

- The quantified cost to the utility was $90,842 ($148 per participant). This includes half of the cost of the toilets, $71,691 ($117 per participant), the cost of labor, $12,767 ($21 per participant), and payment to the high schools, $6,384 ($11 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $19,246 ($31 per participant).
- The quantified benefit to the participants was $295,891 ($483 per participant), which includes water bill savings.
- The quantified cost to MWDSC, a funding source for the program, was $76,605 ($125 per participant), which includes half of the cost of the toilets.
- The quantified benefit to the high schools was $6,384 ($11 per participant).

UTILITY PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of -$90,842 from the utility perspective. This is a net benefit of -$148 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $139.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $276,645 from the participant perspective. This is a net benefit of $452 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $29.**

ALL YEARS	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs		Benefits	
Toilets	$71,691	Not Quantified		Installation	$19,246	Water Bill Savings	$295,891
Labor	$12,767						
Payment to Schools	$6,384						
Total	$90,842			Total	$19,246	Total	$295,891

ALL YRS	Quantified Costs and Benefits		
MWDSC & High Schools			
Costs – MWDSC		Benefits – Schools	
Toilets	$76,605	Incentive Payments	$6,384
Total	$76,605	Total	$6,384

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $115,582 from an overall perspective. This is a net benefit of $189 per participant. The quantified costs to the participants, utility, and others were less than the quantified benefits to the participants, utility, and others. **The cost per acre-foot of water saved from an overall perspective was $285.**

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UNQUANTIFIED COSTS AND BENEFITS

Costs

- **The customers' time spent during the distribution and installation.**
- **Landfill disposal of old toilets.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided costs of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Increased customer satisfaction with the utility.**
- **Involves youth in community conservation efforts.**
- **Water saved for future municipal use.**
- **Customers received new fixtures.**

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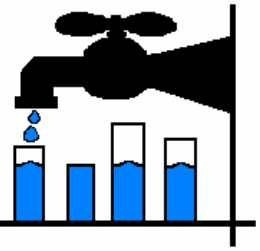
Walnut Valley Water District

Toilet Distribution Program



1998

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	29,772	NA	29,772
Costs to Participants	NA	6,814	6,814
Costs to MWDSC	NA	NA	25,519
Total Costs	$29,772	$6,814	$62,105
Present Value Benefits			
Total Water Savings	327.44 AF	327.44 AF	327.44 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	154,417	154,417
Benefits to MWDSC	NA	NA	2,127
Total Benefits	$0	$154,417	$156,544
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$29,772	$147,603	$94,439
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$91 /AF	$21 /AF	$190 /AF

1999

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	32,526	NA	32,526
Costs to Participants	NA	6,429	6,429
Costs to MWDSC	NA	NA	27,879
Total Costs	$32,526	$6,429	$66,833
Present Value Benefits			
Total Water Savings	75.38 AF	75.38 AF	75.38 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	33,833	33,833
Benefits to MWDSC	NA	NA	2,323
Total Benefits	$0	$33,833	$36,156
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$32,526	$27,404	-$30,678
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$431 /AF	$85 /AF	$887 /AF

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Walnut Valley Water District
Toilet Distribution Program

Results of Cost Benefit Analysis-Lifespan (20 Years) — 2000

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	28,544	NA	28,544
Costs to Participants	NA	6,003	6,003
Costs to MWDSC	NA	NA	23,207
Total Costs	$28,544	$6,003	$57,754
Present Value Benefits			
Total Water Savings	252.22 AF	252.22 AF	252.22 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	107,641	107,641
Benefits to MWDSC	NA	NA	1,934
Total Benefits	$0	$107,641	$109,575
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$28,544	$101,639	$51,821
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$113 /AF	$24 /AF	$229 /AF

Results of Cost Benefit Analysis-Lifespan (20 Years) — ALL YEARS

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	90,842	NA	90,842
Costs to Participants	NA	19,246	19,246
Costs to MWDSC	NA	NA	76,605
Total Costs	$90,842	$19,246	$186,692
Present Value Benefits			
Total Water Savings	655.04 AF	655.04 AF	655.04 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	295,891	295,891
Total Benefits	$0	$295,891	$302,275
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$90,842	$276,645	$115,582
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$139 /AF	$29 /AF	$285 /AF

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Phoenix Water Services Dept.

Toilet Distribution Program

The City of Phoenix Water Services Department (WSD) serves the city of Phoenix, AZ, a city of approximately 1.3 million people located in central Arizona. As of the 2000 Census the median household income for the City of Phoenix was $41,207, which is higher than the statewide median of $40,558.[1]

UTILITY DEMOGRAPHICS

As of 2005, the City of Phoenix Water Services Department maintained 377,072 connections. Of these connections, 331,458 were single family residential users, 16,290 were multifamily residential, 23,735 were commercial, 185 were industrial, 2,893 were government, and 2,511 were other users. The City of Phoenix covers an area of 514 square miles, but the utility provides service beyond those borders, servicing 546 square miles. The population of this service area is approximately 1.4 million. As of 2004, the Phoenix WSD produced 103.1 billion gallons annually. Their average per capita water use was 208 gallons per capita per day (gpcd), with a residential per capita water use of 170 gpcd.

TOILET DISTRIBUTION PROGRAM

Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF**
Program Years:	**1994-present**
Years Analyzed:	**1994-2001**

UTILITY RATE STRUCTURE AND PRICES

The City of Phoenix has a seasonal rate structure. The monthly base rate for service, as of March 2, 2005, is $5.16 for 5/8" meters inside the city and $7.74 outside the city, which includes zero gallons of water. An environmental charge of $0.24 per 1,000 gallons is applied to all usage. The fee structure for water consumption is as follows:

Usage	**Price**	
	Inside City	**Outside City**
Low Months (Dec – Mar)	$1.84/1,000 gal.	$2.77/1,000 gal.
Med Months (Apr – May, Oct – Nov)	$2.18/1,000 gal.	$3.28/1,000 gal.
High Months (Jun – Sep)	$2.75/1,000 gal.	$4.13/1,000 gal.

CURRENT CAPACITY AND WATER SOURCES

About 95 percent of the water used by Phoenix WSD comes from surface sources, including the Salt, Verde and Colorado Rivers; the remaining 5 percent comes from wells. Surface water is delivered to the city by the Central Arizona Project (CAP) and the Salt River Project (SRP). The water is treated at five water treatment plants with a combined capacity of about 630 million gallons per day.

FUTURE PLANS TO MEET DEMAND

Phoenix WSD will meet future demand by continuing to use their allotment of CAP water, through water conservation, water reuse, and expanding facilities.

1 US Census Bureau. CenStats Databases.

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NEIGHBORS HELPING NEIGHBORS PROGRAM - DESCRIPTION

In 1994 the City of Phoenix Water Services Department, in a partnership with Metro Tech High School and the Phoenix Revitalization Corporation (PRC), initiated the Neighbors Helping Neighbors program in which plumbing students helped install conservation devices in low-income homes at no direct cost to customers. Targeted neighborhoods were also undergoing blight cleanup and crime prevention programs.

The program was designed to conserve water by replacing high capacity toilets with 1.6 gallon per flush toilets as well as replacing other fixtures as needed, such as faucets and showerheads. Students benefited from the training experience while providing the community a service. Initial funding for the program was provided by the Arizona Department of Water Resources. However, the exact amount and timing of support could not be determined, so all costs were considered costs to the utility.

OTHER PHOENIX CONSERVATION PROGRAMS

Public Education, ***various start dates***

Water Conservation Ordinances, ***various start dates***

In 2001, the program began providing a small number of retrofits throughout the city in cooperation with the Southwest Gas program called Seniors-Helping-Seniors. In addition, a part time worker was hired specifically for the program. The program also began targeting city council designated neighborhoods. In 2003, WSD staff began placing door hangers on all residences of targeted neighborhoods, which increased response rates to 20%.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family households that participated in the program during the years 1994 through 2001. The water savings were calculated and a cost benefit analysis was performed for the years 1994, 1995, 1996, 1997, 1998, 1999, 2000, and 2001. Our findings refer to these eight years only, not to the ongoing program. The lifespan program was assumed to be twenty years.[2]

All quantified costs and benefits have been discounted to the first year of the analysis (1994) and inflated to 2004 dollars. The discount rate used in this analysis was 5.75%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1994 value of 148.2.

Approximately 1,500 households participated in the program between 1994 and 2001. Of these, 310 are included in this analysis. Those not included in the analysis either were multifamily residences or moved during the period of analysis. Included in the analysis are 19 participants in 1994, 93 participants in 1995, 54 participants in 1996, 17 participants in 1997, 33 participants in 1998, 20 participants in 1999, 29 participants in 2000, and 45 participants in 2001.

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[2] Pekelney, D.M., et al. *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation*. California, 1996.

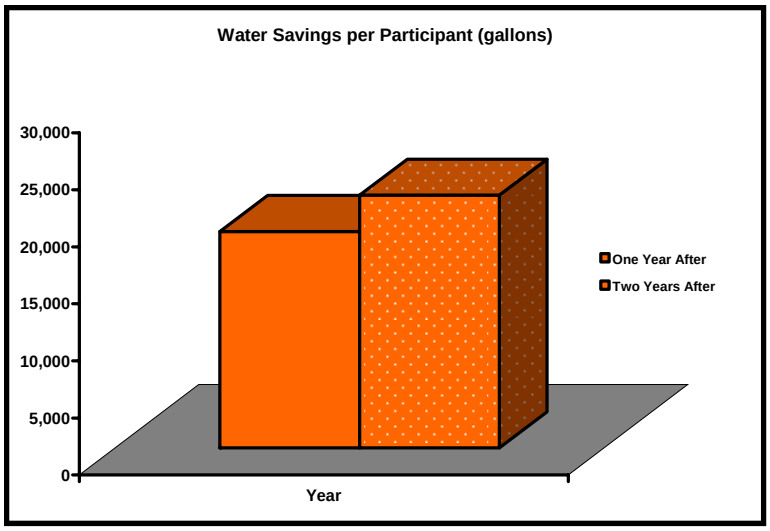
The control group consists of 548 single family residential households from the participant groups' neighborhoods. However, the average pre-measure water use of the participants (203,379 gallons) was higher than that of the control group (149,022 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

One hundred percent of participating households received a toilet, 5% received a handicap toilet, 50% received kitchen faucets, 50% received bathroom faucets, and 100% received showerheads.

Assumed the water savings occur equally throughout the year because the program addresses indoor water use. As a result, the value of the water saved was calculated by multiplying the amount of water saved by the average price of water from throughout the year ($1.05 per ccf in 1994, $1.11 per ccf in 1995, $1.17 per ccf in 1996, $1.24 per ccf in 1997, $1.29 per ccf in 1998, $1.29 per ccf in 1999, $1.37 per ccf in 2000, $1.44 per ccf in 2001, $1.53 per ccf in 2002, $1.53 per ccf in 2003, $1.59 per ccf in 2004, and $1.69 per ccf in 2005 and beyond). The City's environmental charge of $0.18 per ccf was also included in the value of water saved.



Assumed that each site visit cost $175 to the City of Phoenix in labor.

Participants and control group members who had two or more consecutive months of no water use were included in the study.

The discount rate used in this analysis was 5.75%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 1994 value of 148.2.

Each toilet cost $102.22, each handicap toilet cost $141.22, each kitchen faucet cost $65.67, each bathroom faucet cost $41.67, and each showerhead cost $2.00.

RESULTS - WATER SAVINGS

In the first year after the 1994 Neighbors Helping Neighbors program, the water savings amounted to 744,531 gallons, or 39,186 gallons per participant per year (gppy) (21.2% of pre-measure water use). The second year after the retrofits, the water savings amounted to 1,057,987 gallons, or 55,684 gppy (30.1% of pre-measure water use). The average savings per year was 901,259 gallons, or 47,435 gppy (25.6% of pre-measure water use). **The total savings over the twe**nty

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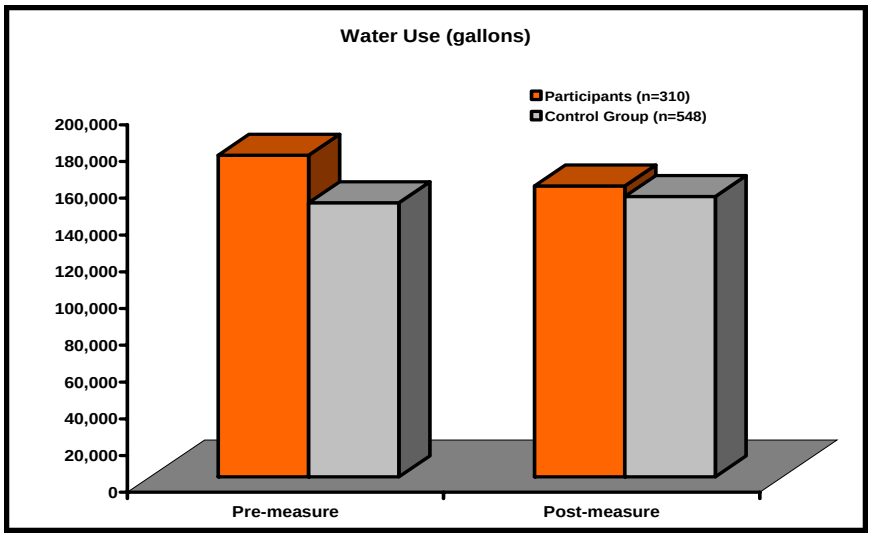
year assumed lifespan was 18,025,181 gallons (55.3 AF), or 948,694 gallons per participant.

The first year after the 1995 Neighbors Helping Neighbors program, the water savings amounted to 2,408,743 gallons, or 25,900 gppy (15.5% of pre-measure water use). The second year after the retrofits, the water savings amounted to 2,247,361 gallons, or 24,165 gppy (14.4% of pre-measure water use). The average savings per year was 2,328,052 gallons, or 25,033 gppy (14.9% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 46,561,040 gallons (142.9 AF), or 500,656 gallons per participant.**



The first year after the 1996 Neighbors Helping Neighbors program, the water savings amounted to 1,087,719 gallons or 20,143 gppy (11.9% of pre-measure water use). The second year after the retrofits, the water savings amounted to 966,224 gallons, or 17,893 gppy (10.5% of pre-measure water use). The average savings per year was 1,026,972 gallons, or 19,018 gppy (11.2% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 20,539,434 gallons (63.0 AF), or 380,360 gallons per participant.**

The first year after the 1997 Neighbors Helping Neighbors program, the water savings amounted to 89,516 gallons, or 5,266 gppy (3.3% of pre-measure water use). The second year after the retrofits, the water savings amounted to 209,827 gallons, or 12,343 gppy (7.8% of pre-measure water use). The average savings per year was 149,671 gallons or 8,804 gppy (5.6% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 2,993,429 gallons (9.2 AF), or 176,084 gallons per participant.**

The first year after the 1998 Neighbors Helping Neighbors program, the water savings amounted to 470,535 gallons, or 14,259 gppy (7.2% of pre-measure water use). The second year after the retrofits, the water savings amounted to 1,234,758 gallons, or 37,417 gppy (18.8% of pre-measure water use). The average savings per year was 852,647 gallons, or 25,838 gppy (13.0% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 17,052,937 gallons (52.3 AF), or 516,756 gallons per participant.**

The first year after the 1999 Neighbors Helping Neighbors program, the water savings amounted to 530,402 gallons, or 26,520 gppy (16.1% of

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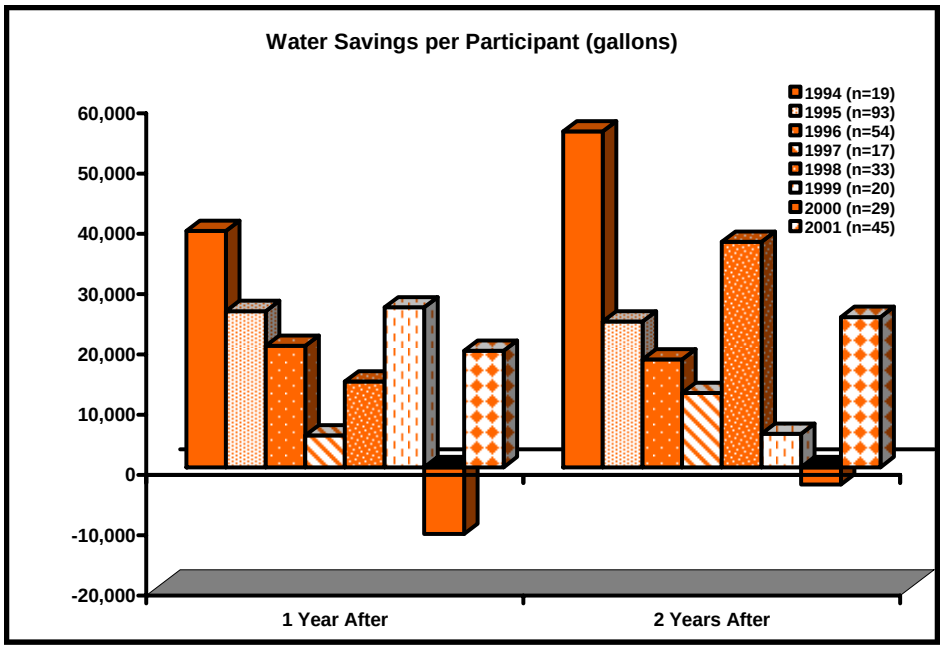
pre-measure water use). The second year after the retrofits, the water savings amounted to 110,856 gallons, or 5,543 gppy (3.4% of pre-measure water use). The average savings per year was 320,629 gallons, or 16,031 gppy (9.7% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 6,412,575 gallons (19.7 AF), or 320,629 gallons per participant.**

The first year after the 2000 Neighbors Helping Neighbors program, there was an increase in participant water use, relative to control group water use, of 321,270 gallons, or 11,078 gppy (6.7% of pre-measure water use). The second year after the retrofits, there was an increase in participant water use, relative to control group water use, of 82,854 gallons, or 2,857 gppy (1.7% of pre-measure water use). On average, relative water use increased by 202,062 gallons, or 6,968 gppy (4.2% of pre-measure water use). **Over the twenty year assumed lifespan of the program, relative water use increased by 4,041,236 gallons (12.4 AF), or 139,353 gallons per participant.**

The first year after the 2001 Neighbors Helping Neighbors program, the water savings amounted to 870,035 gallons, or 19,334 gppy (10.1% of pre-measure water use). The second year after the retrofits, the water savings amounted to 1,121,387 gallons, or 24,920 gppy (13.0% of pre-measure water use). The average savings per year was 995,711 gallons, or 22,127 gppy (11.6% of pre-measure water use). **The total savings over the twenty year assumed lifespan was 19,914,217 gallons (61.1 AF), or 442,538 gallons per participant.**



Total water savings for the eight years studied was 5,880,211 gallons, or 18,968 gppy (10.9% of weighted pre-measure water use) during the first year after and 6,865,546 gallons, or 22,147 gppy (12.7% of weighted pre-measure water use) during the second year after the retrofits. **The total savings over the twenty year assumed lifespan was 127,457,578 gallons (391.2 AF), or 411,153 gallons per participant.**

Before the Neighbors Helping Neighbors program, the participant group's water use was 117.3% of the control group's use, on average.

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After the Neighbors Helping Neighbors program, their water use was 103.8% of the control group's use, on average. The participant group's water use decreased by 9.5%, whereas the control group's use increased by 2.3%. **The resulting overall water savings attributed to this program was 11.8%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

1994 PROGRAM

- The quantified cost to the utility was $8,437. This includes the cost of conservation devices, $4,199 and the cost of labor, $4,238. This is a cost of $ 444 per participant, including $221 for devices and $223 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $29,552, which includes the value of water bill savings. This is a water bill savings of $1,555 per participant.

1994	Quantified Costs and Benefits				
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Cost of Devices	$4,199	Not Quantified	Not Quantified	Water Bill Savings	$29,552
Labor	$4,238				
Total	$8,437			Total	$29,552

UTILITY PERSPECTIVE - 1994

Results of the cost benefit analysis show a net benefit (net present value) of -$8,437 from the utility perspective. This is a net benefit of -$444 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $153.**

PARTICIPANT PERSPECTIVE - 1994

Results of the cost benefit analysis show a net benefit (net present value) of $29,552 from the participant perspective. This is a net benefit of $1,555 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1994

Results of cost benefit analysis show a net benefit (net present value) of $21,115 from an overall perspective. This is a net benefit of $1,111 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $153.**

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1995 PROGRAM

- The quantified cost to the utility was $39,053. This includes the cost of conservation devices, $19,436 and the cost of labor, $19,616. This is a cost of $420 per participant, including $209 for devices and $211 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $73,808, which includes the value of water bill savings. This is a water bill savings of $793 Per participant.

1995 Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Cost of Devices	$19,436	Not Quantified	Not Quantified	Water Bill Savings	$73,808
Labor	$19,616				
Total	$39,053			Total	$73,808

UTILITY PERSPECTIVE - 1995

Results of the cost benefit analysis show a net benefit (net present value) of -$39,053 from the utility perspective. This is a net benefit of -$420 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $273.**

PARTICIPANT PERSPECTIVE - 1995

Results of the cost benefit analysis show a net benefit (net present value) of $73,808 from the participant perspective. This is a net benefit of $793 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1995

Results of cost benefit analysis show a net benefit (net present value) of $34,755 from an overall perspective. This is a net benefit of $374 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $273.**

1996 PROGRAM

- The quantified cost to the utility was $21,443. This includes the cost of conservation devices, $10,762 and the cost of labor, $10,771. This is a cost of $397 per participant, including $199 for devices and $198 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $31,399, which includes the value of water bill savings. This is a water bill savings of $581 per participant.

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1996	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Cost of Devices	$10,762	Not Quantified		Not Quantified	Water Bill Savings	$31,399
Labor	$10,771					
Total	$21,443				Total	$31,399

UTILITY PERSPECTIVE - 1996
Results of the cost benefit analysis show a net benefit (net present value) of -$21,443 from the utility perspective. This is a net benefit of -$397 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $340**.

PARTICIPANT PERSPECTIVE - 1996
Results of the cost benefit analysis show a net benefit (net present value) of $31,399 from the participant perspective. This is a net benefit of $581 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1996
Results of cost benefit analysis show a net benefit (net present value) of $9,956 from an overall perspective. This is a net benefit of $184 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $340.**

1997 PROGRAM

- The quantified cost to the utility was $6,384. This includes the cost of conservation devices, $3,177 and the cost of labor, $3,207. This is a cost of $376 per participant, including $187 for devices and $189 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $4,394, which includes the value of water bill savings. This is a water bill savings of $258 per participant.

UTILITY PERSPECTIVE - 1997
Results of the cost benefit analysis show a net benefit (net present value) of -$6,384 from the utility perspective. This is a net benefit of -$376 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $695.**

PARTICIPANT PERSPECTIVE - 1997
Results of the cost benefit analysis show a net benefit (net present value) of $4,394 from the participant perspective. This is a net benefit of $258 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

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1997	Quantified Costs and Benefits				
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Cost of Devices	$3,177	Not Quantified	Not Quantified	Water Bill Savings	$4,394
Labor	$3,207				
Total	$6,384			Total	$4,394

OVERALL PERSPECTIVE - 1997

Results of cost benefit analysis show a net benefit (net present value) of -$1,989 from an overall perspective. This is a net benefit of -$117 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $695.**

1998 PROGRAM

- The quantified cost to the utility was $11,718. This includes the cost of conservation devices, $5,832 and the cost of labor, $5,886. This is a cost of $355 per participant, including $177 for devices and $178 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $24,069, which includes the value of water bill savings. This is a water bill savings of $729 per participant.

UTILITY PERSPECTIVE - 1998

Results of the cost benefit analysis show a net benefit (net present value) of -$11,718 from the utility perspective. This is a net benefit of -$355 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $224.**

PARTICIPANT PERSPECTIVE - 1998

Results of the cost benefit analysis show a net benefit (net present value) of $24,069 from the participant perspective. This is a net benefit of $729 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1998

Results of cost benefit analysis show a net benefit (net present value) of $12,351 from an overall perspective. This is a net benefit of $374 per participant. The quantified costs to the participants and utility were

1998	Quantified Costs and Benefits				
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Cost of Devices	$5,832	Not Quantified	Not Quantified	Water Bill Savings	$24,069
Labor	$5,886				
Total	$11,718			Total	$24,069

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less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $224.**

1999 PROGRAM

- The quantified cost to the utility was $6,715. This includes the cost of conservation devices, $3,342 and the cost of labor, $3,373. This is a cost of $336 per participant, including $167 for devices and $169 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $8,843, which includes the value of water bill savings. This is a water bill savings of $442 per participant.

1999	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Cost of Devices	$3,342	Not Quantified		Not Quantified	Water Bill Savings	$8,843
Labor	$3,373					
Total	$6,715				Total	$8,843

UTILITY PERSPECTIVE - 1999

Results of the cost benefit analysis show a net benefit (net present value) of -$6,715 from the utility perspective. This is a net benefit of -$336 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $341.**

PARTICIPANT PERSPECTIVE - 1999

Results of the cost benefit analysis show a net benefit (net present value) of $8,843 from the participant perspective. This is a net benefit of $442 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 1999

Results of cost benefit analysis show a net benefit (net present value) of $2,127 from an overall perspective. This is a net benefit of $106 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $341.**

2000 Program

- The quantified cost to the utility was $9,208. This includes the cost of conservation devices, $4,583 and the cost of labor, $4,625. This is a cost of $318 per participant, including $158 for devices and $160 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was -$5,249, which includes the value of water bill savings. This is a water bill savings of $181 per participant.

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2000 Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Cost of Devices	$4,583	Not Quantified	Not Quantified	Water Bill Savings	-$5,249
Labor	$4,625				
Total	$9,208			Total	-$5,249

UTILITY PERSPECTIVE - 2000

Results of the cost benefit analysis show a net benefit (net present value) of -$9,208 from the utility perspective. This is a net benefit of -$318 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was -$742.**

PARTICIPANT PERSPECTIVE - 2000

Results of the cost benefit analysis show a net benefit (net present value) of -$5,249 from the participant perspective. This is a net benefit of -$181 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - 2000

Results of cost benefit analysis show a net benefit (net present value) of -$14,457 from an overall perspective. This is a net benefit of -$499 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was -$742.**

2001 PROGRAM

- The quantified cost to the utility was $13,511. This includes the cost of conservation devices, $6,725 and the cost of labor, $6,787. This is a cost of $300 per participant, including $149 for devices and $151 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $24,686, which includes the value of water bill savings. This is a water bill savings of $495 per participant.

UTILITY PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of -$13,511 from the utility perspective. This is a net benefit of $300 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility**. The cost per acre-foot of water saved from the utility perspective was $221.**

PARTICIPANT PERSPECTIVE - 2001

Results of the cost benefit analysis show a net benefit (net present value) of $24,686 from the participant perspective. This is a net benefit of $495 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

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2001	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Cost of Devices	$6,725	Not Quantified		Not Quantified	Water Bill Savings	$24,686
Labor	$6,787					
Total	$13,511				Total	$24,686

OVERALL PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of $11,174 from an overall perspective. This is a net benefit of $195 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $221.**

ALL YEARS

- The quantified cost to the utility was $116,469. This includes the cost of conservation devices, $57,965 and the cost of labor, $58,504. This is a cost of $376 per participant, including $187 for devices and $189 in labor.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the participants was $191,363, which includes the value of water bill savings. This is a water bill savings of $617 per participant.

ALL YEARS	Quantified Costs and Benefits					
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Cost of Devices	$57,965	Not Quantified		Not Quantified	Water Bill Savings	$191,363
Labor	$58,504					
Total	$116,469				Total	$191,363

UTILITY PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of -$116,469 from the utility perspective. This is a net benefit of -$376 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $298.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of the cost benefit analysis show a net benefit (net present value) of $191,363 from the participant perspective. This is a net benefit of $617 per participant. The quantified costs to the participants were less than the quantified benefit to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis from an overall perspective show a net benefit (net present value) of $74,894 from an overall perspective. This is a net benefit of $242 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the

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participants and utility. **The cost per acre-foot of water saved from an overall perspective was $298.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Landfill disposal of replaced equipment.
- Energy and water consumed to manufacture new equipment.

Benefits

- Financial savings on sewer bills for participants.
- Avoided cost of acquisition and distribution of water saved.
- Environmental benefits of reduced use of water.
- Increased public awareness for conservation programs.
- Improved public relations for the utility.
- Reinforces desirability and need for water conservation.
- Customers received new fixtures.
- Plumbing apprentices gain plumbing experience.

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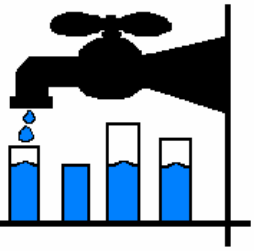
Phoenix Water Services Dept.

Toilet Distribution Program



1994

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	8,437	NA	8,437
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$8,437	$0	$8,437
Present Value Benefits			
Total Water Savings	55.32 AF	55.32 AF	55.32 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	29,552	29,552
Benefits to Others	NA	NA	0
Total Benefits	$0	$29,552	$29,552
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$8,437	$29,552	$21,115
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$153 /AF	$0 /AF	$153 /AF

1995

Results of Cost Benefit Analysis-Lifespan (20Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	39,053	NA	39,053
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$39,053	$0	$39,053
Present Value Benefits			
Total Water Savings	142.89 AF	142.89 AF	142.89 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	73,808	73,808
Benefits to Others	NA	NA	0
Total Benefits	$0	$73,808	$73,808
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$39,053	$73,808	$34,755
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$273 /AF	$0 /AF	$273 /AF

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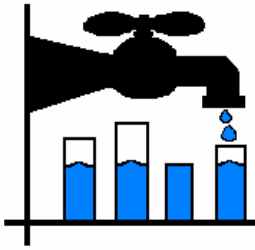

Phoenix Water Services Dept.

Toilet Distribution Program

1996

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	21,443	NA	21,443
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$21,443	$0	$21,443
Present Value Benefits			
Total Water Savings	63.03 AF	63.03 AF	63.03 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	31,399	31,399
Benefits to Others	NA	NA	0
Total Benefits	$0	$31,399	$31,399
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$21,443	$31,399	$9,956
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$340 /AF	$0 /AF	$340 /AF

1997

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	6,383	NA	6,383
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$6,383	$0	$6,383
Present Value Benefits			
Total Water Savings	9.19 AF	9.19 AF	9.19 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	4,394	4,394
Benefits to Others	NA	NA	0
Total Benefits	$0	$4,394	$4,394
Cost-Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$6,383	$4,394	-$1,989
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$695 /AF	$0 /AF	$695 /AF

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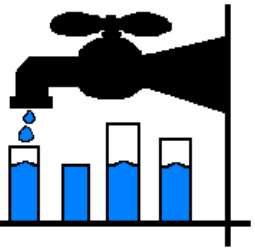
Phoenix Water Services Dept.

Toilet Distribution Program



1998

Results of Cost Benefit Analysis-Lifespan (20Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	11,718	NA	11,718
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$11,718	$0	$11,718
Present Value Benefits			
Total Water Savings	52.33 AF	52.33 AF	52.33 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	24,069	24,069
Benefits to Others	NA	NA	0
Total Benefits	$0	$24,069	$24,069
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$11,718	$24,069	$12,351
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$224 /AF	$0 /AF	$224 /AF

1999

Results of Cost Benefit Analysis-Lifespan (20Years)

OVERALL		UTILITY	PARTICIPANT
Present Value Costs			
Costs to Utility	6,715	NA	6,715
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$6,715	$0	$6,715
Present Value Benefits			
Total Water Savings	19.68 AF	19.68 AF	19.68 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	8,843	8,843
Benefits to Others	NA	NA	0
Total Benefits	$0	$8,843	$8,843
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$6,715	$8,843	$2,127
Cost Effectiveness Analysis (CEA)	$341 /AF	$0 /AF	$341 /AF

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Phoenix Water Services Dept.

Toilet Distribution Program

2000

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	9,208	NA	9,208
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$9,208	$0	$9,208
Present Value Benefits			
Total Water Savings	-12.40 AF	-12.40 AF	-12.40 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-5,249	-5,249
Benefits to Others	NA	NA	0
Total Benefits	$0	-$5,249	-$5,249
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$9,208	-$5,249	-$14,457
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$742 /AF	$0 /AF	-$742 /AF

2001

Results of Cost Benefit Analysis-Lifespan (20 Years)

OVERALL	UTILITY	PARTICIPANT	
Present Value Costs			
Costs to Utility	13,511	NA	13,511
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$13,511	$0	$13,511
Present Value Benefits			
Total Water Savings	61.11 AF	61.11 AF	61.11 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	24,686	24,686
Benefits to Others	NA	NA	0
Total Benefits	$0	$24,686	$24,686
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$13,511	$24,686	$11,174
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$221 /AF	$0 /AF	$221 /AF

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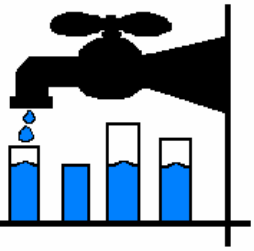
Phoenix Water Services Dept.

Toilet Distribution Program



ALL YEARS

Results of Cost Benefit Analysis-Lifespan (20Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	116,469	NA	116,469
Costs to Customers	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$116,469	$0	$116,469
Present Value Benefits			
Total Water Savings	391.15 AF	391.15 AF	391.15 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	191,363	191,363
Benefits to Others	NA	NA	0
Total Benefits	$0	$191,363	$191,363
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$116,469	$191,363	$74,894
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$298 /AF	$0 /AF	$298 /AF

TD-3

RATES
CASE NARRATIVES

Community Water of Green Valley

Rate Decrease

Community Water Company of Green Valley (CWCGV), a cooperative water utility, is one of five water utilities that serve the town of Green Valley located in the Santa Cruz Valley of Southern Arizona. As of 2003, the town's population was approximately 18,700.[1] The median household income as of the 2000 census was $40,213. [2]

UTILITY DEMOGRAPHICS

As of 2003, CWCGV had approximately 9,800 connections, 49.8% of which were residential. Of their total connections, 4,866 were single family residential, 4,672 were multifamily residential, 233 were commercial, 16 were government, and 11 were construction. CWCGV provides service to a population of 15,500 and currently maintains 10,817 connections. CWCGV's total service area is eight square miles. As of 2004, CWCGV's customer water use for the utility as a whole, in gallons per capita per day (gpcd), was 142.

RATE DECREASE

Cost to Customers:	**N/A**
Eligible Customers:	**SF, MF**
Customers Analyzed:	**SF, MF**
Program Years:	**1997**
Year Analyzed:	**1997**

UTILITY RATE STRUCTURE AND PRICES

CWCGV has a uniform price structure. The minimum monthly charge for 5/8" meters, which account for the majority of the utility's connections, is $12.50 and includes 2,000 gallons of water. Customers pay $1.07 for every 1,000 gallons over 2,000 gallons. This rate structure has been in place since 1987, with no subsequent rate increases.

CURRENT CAPACITY AND WATER SOURCES

CWCGV depends solely on groundwater and maintains and operates four wells. The company has a current storage capacity of five million gallons.

FUTURE PLANS TO MEET DEMAND

The population within CWCGV's service area is growing at 6% per year. CWCGV plans to meet future demand with current capacity and water sources, and by implementing water conservation measures. CWCGV, in conjunction with other utilities, is studying the possibility of using Central Arizona Project (CAP) water in Green Valley.

RATE DECREASE - DESCRIPTION

In 1997, CWCGV acquired New Pueblo Water Company. After the acquisition, CWCGV was legally obligated to adjust the rates of New Pueblo Water Company customers to equal the rates of other customers. As a result, the former New Pueblo Water Company customers experienced a commodity rate reduction from $3.50 per 1,000 gallons to $1.07 per 1,000 gallons.

[1] Arizona Department of Commerce: Green Valley Community Profile.
[2] U.S. Census Bureau: Profile of General Demographic Characteristics 2000.

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METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family residential former New Pueblo Water Company customers who were affected by the rate change in 1997. The findings refer to the actual participants analyzed during this time period only, not to any subsequent rate changes or further acquisitions by CWCGV. The lifespan of the rate change was assumed to be 20 years.

OTHER CWCGV CONSERVATION PROGRAMS

Public Education, ***ongoing.***
CWCGV has sponsored workshops on a variety of outdoor water conservation topics and publishes monthly water saving tips in the local newspaper.

Showerhead and Faucet Aerator Giveaway, ***1992 – present***
CWCGV distributes free conservation packets with two low-flow showerheads, two faucet aerators, and one low-flow faucet fixture.

All quantified costs and benefits have been discounted to the first year of the analysis (1997) and inflated to 2004 dollars. The discount rate used in this analysis was 6.2%. The CPI values used in this analysis were the 2004 value of 188.9, and the 1997 value of 160.5

Water use data was acquired for former New Pueblo Water Company customers the two years before and the two years after the rate change. There were a total of 513 New Pueblo Water Company accounts affected by the acquisition.

The control group in this analysis was comprised of all CWCGV single family residential households in districts similar to participant districts. Districts were chosen based upon consumption levels.

The control group consisted of 3,540 customers in 1995, 3,599 in 1996, 3,657 in 1997, 3,686 in 1998, and 3,766 in 1999. The average number of households in the control group per year was 3,650. The average participant pre-measure water use (41,894 gallons) was less than that of the weighted average pre-measure water use of the control group (67,124 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The number of connections is an average of connections from throughout the year.

The rate decrease for New Pueblo customers was a one-time decrease.

Former New Pueblo customers will experience any and all future rate changes as deemed necessary by CWCGV.

The control group is comprised of single family residential households served by CWCGV that are characteristically comparable to the water customers who experienced the rate decrease (Districts 2, 4, 7, 12, 13, 16, and 18).

The price of water used in determining the benefits to customers from

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reduced water bills is the variable portion of the utility's price of water. $1.07 per 1,000 gallons was used throughout the analysis (including future years).

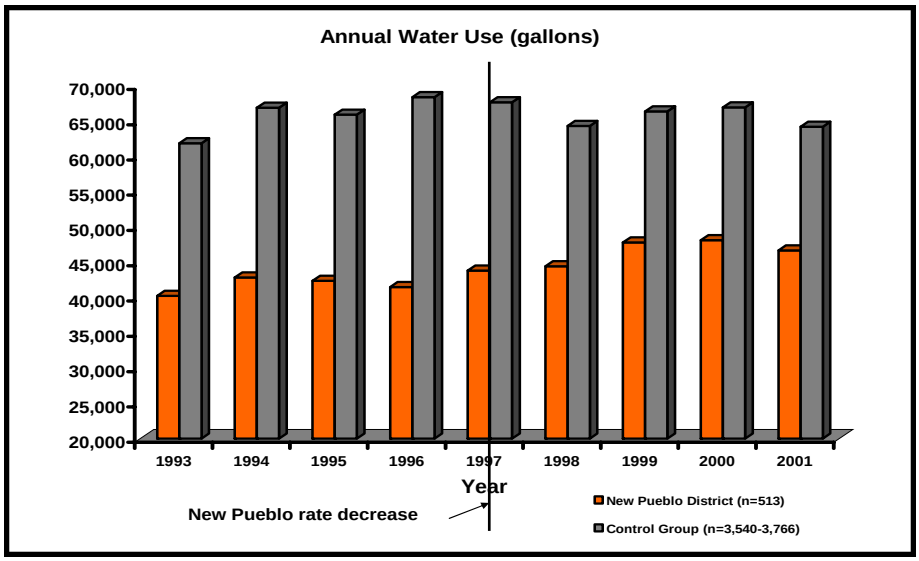
Participants who had two or more consecutive months of no water use were included in the study.

The Consumer Price Index value used in this analysis was the 2004 value of 188.9 and the 1997 value of 160.5.

RESULTS - WATER SAVINGS

In the first year after the rate decrease, no water savings were documented. During that first year, there was an increase in New Pueblo customer water use, relative to control group water use, of 2,186,691 gallons, or 4,279 gallons per participant per year (gppy) (10.2% of pre-measure water use). The second year after the rate decrease, there were no water savings. During that second year, there was an increase in New Pueblo customer water use, relative to control group water use, of 3,312,035 gallons, or 6,394 gppy (15.3% of pre-measure water use). On average, there were no water savings; relative water use increased by 2,749,363 gallons (8.4 AF), or 5,337 gppy (12.7% of pre-measure water use). **Over the twenty year assumed lifespan of the rate decrease, there were no water savings; relative water use increased by 54,987,261 gallons (168.7 AF), or 107,229 gallons per participant.**

During the two years before the rate change, participant water use was 62.4% of the control group's use, on average. During the two years after the rate change water use was 70.6% of the control group's use, on average. The participants' water use increased by 10.0% from pre-measure to post-measure, whereas the control group's use decreased by 2.7%. **The resulting overall water savings attributed to this program was –12.7%.**



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RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $0.
- The quantified benefit to the utility was $0.
- The quantified cost to participants was $0.
- The quantified benefit to the participants was -$39,037. This reflects water bill savings. This is a benefit of -$76 per participant.

QUANTIFIED COSTS AND BENEFITS						
Utility				Participants		
Costs		Benefits		Costs	Benefits	
Rate Change	$0	Not Quantified		Not Quantified	Water Bill Savings	-39,037
Total	$0				Total	-$39,037

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective over the twenty year assumed lifespan of the rate decrease. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0 as there was no quantified cost to the utility and there were no water savings.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$39,037 from the participant perspective over the twenty year assumed lifespan of the rate change. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0, as there was no quantified cost to the participants, and there were no water savings.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$39,037 from an overall perspective over the twenty year assumed lifespan of the rate change. The quantified benefits to the participants and utility were less than the quantified costs to the participants and utility. **The cost per acre-foot of water saved from the overall perspective was $0 as there were no quantified costs to the utility or the participants, and there were no water savings.**

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Community Water of Green Valley

Rate Decrease

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	0	NA	0
Costs to Customers	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$0	$0	$0
Present Value Benefits			
Total Water Savings	-168.7 AF	-168.7 AF	-168.7 AF
Benefits to Utility	0	NA	0
Benefits to Customers	NA	-39,037	-39,037
Benefits to Others	NA	NA	0
Total Benefits	$0	-$39,037	-$39,037
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$0	-$39,037	-$39,037
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$0 /AF	$0 /AF	$0 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Cost to utility of implementing and managing the rate decrease.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental costs of increased water use.**
- **Utility faces the cost of developing new water sources.**
- **Utility faces the cost of constructing new storage facilities.**

Benefits

- **New information pertaining to customer behavior following rate decreases.**

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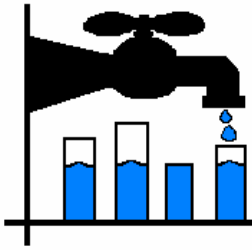

Indian Wells Valley Water Dist.

Conservation Rates: Increasing Block

Indian Wells Valley Water District (IWVWD) provides water to the City of Ridgecrest, California, and portions of western San Bernardino County and eastern Kern County. IWVWD serves a population of approximately 26,500. As of the 2000 Census, the median household income in Ridgecrest was $44,971, which is lower than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

IWVWD's retail service area is 38 square miles. As of 2005, IWVWD had 11845 connections, 94.7% of which were residential. Of their total connections, 10,845 were single family residential, 373 were multifamily residential, 580 were commercial, 34 were fire service connections, and 13 were construction meters.

INVERTED BLOCK RATES

Affected Customers:	**All**
Customers Analyzed:	**Residential, Master Metered, Commercial, Public**
Effective Date:	**February 1, 2000**

UTILITY RATE STRUCTURE AND PRICES

IWVWD initially adopted increasing block rates for all customers in 1992. See the following analysis of the rate changes for details.

CURRENT CAPACITY AND WATER SOURCES

IWVWD's primary source of water is from groundwater drawn from the Indian Wells Valley Aquifer. IWVWD has a storage capacity of 14.6 million gallons.

FUTURE PLANS TO MEET DEMAND

The population of IWVWD's service area is growing at a rate of about 2.7% per year. IWVWD plans to meet future demands through current sources, adding new wells to the system, and possibly treating brackish water and importing water.

RATE STRUCTURE - DESCRIPTION

IWVWD adopted an increasing block rate structure for all customers on October 26, 1992. The structure was an eight-tier structure, with the highest tier including 8,000 gallons or more of bimonthly residential water use. The average bimonthly water use of residential customers was 34,492 gallons between 1998 and 2004, so for many customers rate structure was, in effect, flat. The rate at the highest tier was $1.25 per 1,000 gallons. Customers were charged a bimonthly service fee of $28.00 in addition to the variable charge:

The water district adopted a new, more aggressive rate structure on February 1, 2000. This is the rate structure we are analyzing for the purposes of this study. This rate increase was also an increasing block rate structure, varying by meter size instead of customer class. Customers were then charged a monthly service fee of $11.77 for 5/8"

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[1] US Census Bureau. FactFinder.

x 3/4" meters in addition to the variable charges. The highest tier started at 19,449 gallons per month, with average residential monthly use at 17,249 gallons per month. The rate structure was as follows:

Usage	Price
0-7,480 gallons	$0.80 per 1,000 gallons
7,481-9,724 gallons	$1.00 per 1,000 gallons
9,725-11,968 gallons	$1.20 per 1,000 gallons
11,969-14,212 gallons	$1.40 per 1,000 gallons
14,213-16,456 gallons	$1.58 per 1,000 gallons
16,457-19,448 gallons	$1.75 per 1,000 gallons
19,449+ gallons	$1.93 per 1,000 gallons

The structure changed slightly again on April 1, 2003. The tiers changed and rate increases were set to increase by 3% per year from 2003 through 2006, and increases in the monthly service fee to $13.20. This analysis does not include the 2003 changes. The new structure as of 2005 is as follows:

Usage	Price
0-3,740 gallons	$0.79 per 1,000 gallons
3,741-7,480 gallons	$0.99 per 1,000 gallons
7,481-11,220 gallons	$1.22 per 1,000 gallons
11,221-14,960 gallons	$1.48 per 1,000 gallons
14,961-18,700 gallons	$1.78 per 1,000 gallons
18,701-22,440 gallons	$1.98 per 1,000 gallons
22,441+ gallons	$2.14 per 1,000 gallons

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The rate change that was analyzed here was the change that became effective February 1, 2000. The methodology for this analysis is different from most of the cases in the study because no control group was available for comparison. This is because the rate structure change affected all customers. Instead of using a control group, the water savings were calculated solely from the difference in pre- and post-measure water use of residential, master metered, commercial, and public connections. The pre-measure and post-measure time periods were two years each, January 1998 through December 1999 and January 2001 through December 2002. The average yearly water savings from the two years after the rate change was extrapolated for twenty years, the assumed lifespan of the rate change.

OTHER INDIAN WELLS VALLEY CONSERVATION PROGRAMS

Showerhead & Aerator Giveaway Program, ***ongoing***

Public Education, ***2005-present***
Xeriscape Workshops and a water conservation website page.

The customer classes analyzed were residential, master metered, commercial, and public. The water savings were calculated for each and the total of the four categories. The cost benefit analysis was performed on the total of the four categories. IWVWD's other customer

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classes (construction and fire connections) were not included in the analysis.

All quantified costs and benefits have been discounted to the first year of the analysis (2000) and inflated to 2004 dollars. The discount rate used in this analysis was 6.2%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2000 value of 172.2.

It was not possible to follow the individual customers that were present at the time of implementation of the rate change. Instead, the number of connections was used as a proxy. The number of connections varied by month. There was an average of 10,184 residential connections, 346 master metered connections, 473 commercial connections, and 90 public connections, for an average of 11,093 connections total for the period of analysis. The average number of connections over the twenty year lifespan of the rate change was 11,966, which is the value used in the cost-benefit calculations.

ASSUMPTIONS

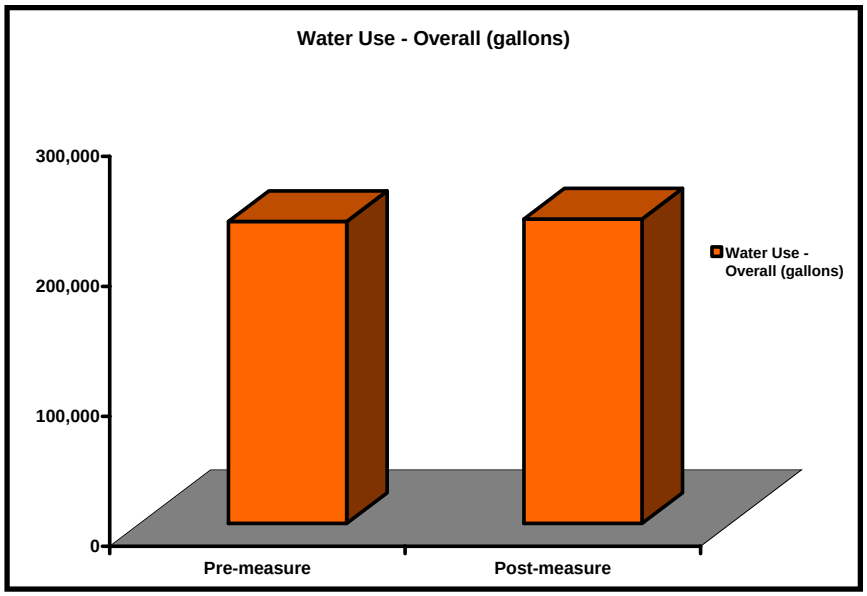
Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

In calculating the average number of connections over the twenty year period of analysis, it was assumed that the annual growth in connections was equal to the average annual growth between 1998 and 2004.

The discount rate used in this analysis was 6.2%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2000 value of 172.2.

The calculation of water savings and any benefits derived from water savings started the date of the rate structure change, February 1, 2000.



The cost to the utility was $25,000 for a cost-of-service study preparing for the rate change.

It was assumed that from 2000 through 2002, customers' average water use fell into the 6th tier, regardless of class or meter size. The price at the 6th tier is $1.75 per 1,000 gallons. It was assumed that from 2003 on, customers' use fell into the 5th tier, regardless of class or meter size. Price at 5th tier was $1.67 in 2003, $1.72 in 2004, $1.78 in 2005, and $1.83 in 2006 and beyond. These assumptions are based on the average monthly use of residential customers from 1998 through 2002 (17,246 gallons per month).

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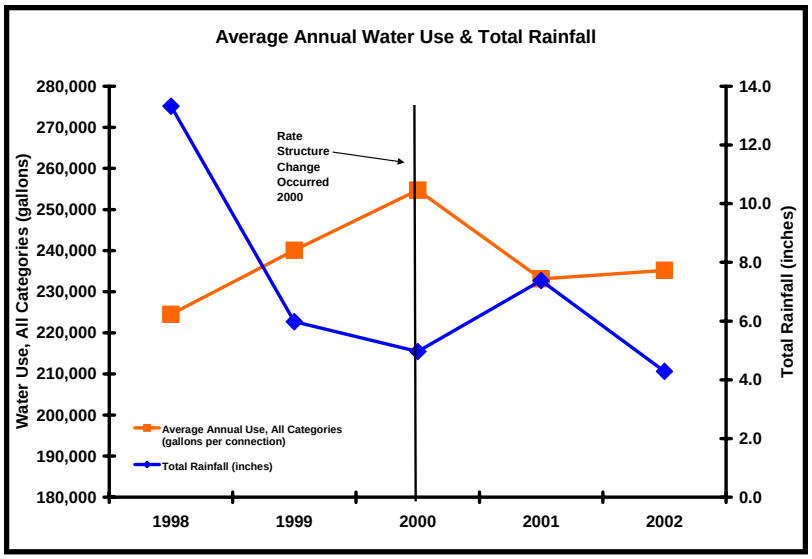
RESULTS - WATER SAVINGS

For **residential** customers, during the first year after the rate change, no water savings occurred. There was an increase in participant water use of 46,875,895 gallons, or 4,603 gppy (2.3% of pre-measure water use). The second year after, no water savings occurred. There was an increase in participant water use of 73,287,239 gallons, or 7,196 gppy (3.6% of pre-measure water use). On average, no water savings occurred; relative water use increased by 60,081,567 gallons (184.4 AF), or 5,899 gppy (3.0% of pre-measure water use). **Over the twenty year assumed lifespan of the rates, no water savings occurred; relative water use increased by 1,201,631,335 gallons (3,687.7 AF), or 109,086 gallons per participant.**



For **master metered customers**, during the first year after the rate change, no water savings occurred. There was an increase in participant water use of 28,326,576 gallons, or 81,835 gppy (15.0% of pre-measure water use). The second year after, no water savings occurred. There was an increase in participant water use of 32,998,985 gallons, or 95,333 gppy (17.4% of pre-measure water use). On average, no water savings occurred; relative water use increased by 30,662,781 gallons (94.1 AF), or 88,584 gppy (16.2% of pre-measure water use). **Over the twenty year assumed lifespan of the rates, there were no water savings; relative water use increased by 613,255,615 gallons (1,882.0 AF), or 1,657,149 gallons per participant.**

For **commercial customers**, during the first year after the rate change, no water savings occurred. There was an increase in participant water use of 7,788,970 gallons, or 16,462 gppy (4.3% of pre-measure water use). The second year after, water savings amounted to 2,694,506 gallons, or 5,695 gppy (1.5% of pre-measure water use). On average, no water savings occurred; relative water use increased by 2,547,232 gallons (7.8 AF), or 5,384 gppy (1.4% of pre-measure water use). **Over the twenty year assumed lifespan of the rates, there were no water savings; relative water use increased by 50,944,636 gallons (156.3 AF), or 104,054 gallons per participant.**

For **public customers**, during the first year after the rate change, water savings amounted to 53,193,041 gallons, or 592,916 gppy (34.0% of pre-measure water use). The second year after, water savings amounted to 47,322,058 gallons, or 527,475 gppy (30.3% of pre-

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measure water use). The average savings per year was 50,257,550 gallons (154.2 AF), or 560,196 gppy (32.1% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the rates was 1,005,150,991 gallons (3,084.7 AF), or 11,021,392 gallons per participant.**

For **all customers** analyzed, during the first year after the rate change, no water savings were documented. There was an increase in participant water use of 9,454,878 gallons, or 852 gppy (0.4% of pre-measure water use). The second year after, no water savings were documented. There was an increase in participant water use of 32,079,546 gallons, or 2,892 gppy (1.2% of pre-measure water use). On average, no water savings were documented; relative water use increased by 20,767,212 gallons (63.7 AF), or 1,872 gppy (0.8% of pre-measure water use). **Over the twenty year assumed lifespan of the rates, no water savings were documented; relative water use increased by 415,344,237 gallons (1,274.6 AF), or 34,709 gallons per participant.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $27,425 ($2 per participant). This includes consulting costs, $27,425 ($2 per participant).
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to participants was -$460,127 (-$1,702 per participant). This includes water bill savings, -$460,127.

Quantified Costs and Benefits					
Utility				Participants	
Costs		Benefits		Costs	Benefits
Consulting	$27,425	Not Quantified		Not Quantified	Water Bill Savings -$460,127
Total	$27,425				Total -$460,127

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$27,425 from the utility perspective. This is a net benefit of -$2 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was -$22.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$460,127 from the participant perspective. This is a net benefit of -$38 per participant. The quantified costs to the participants were greater than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

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OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$487,551 from an overall perspective. This is a net benefit of -$41 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was -$22.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Cost of instituting rate structure.

Benefits

- Environmental benefits of reduced use of water.
- Avoided cost of acquisition and distribution of water saved.
- Increased public awareness about water conservation.
- Reinforces need to conserve water and desirability of conserving.
- Delays capital improvement projects.
- Water saved for future municipal use.

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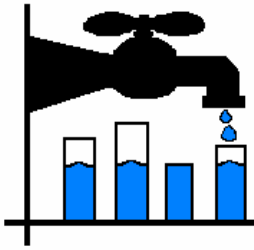

Indian Wells Valley Water Dist.

Conservation Rates: Increasing Block

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	27,425	NA	27,425
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$27,425	$0	$27,425
Present Value Benefits			
Total Water Savings	-1,274.64AF	-1,274.64AF	-1,274.64 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	-460,127	-460,127
Benefits to Others	NA	NA	0
Total Benefits	$0	-$460,127	-$460,127
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$27,425	-$460,127	-$487,551
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	-$22 /AF	$0 /AF	-$22 /AF

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Medford Water Commission

Conservation Rates: Increasing Block

Medford Water Commission (MWC) provides retail water service to the City of Medford, Oregon, and provides retail water to unincorporated urban and suburban lands. MWC also provides wholesale water to the cities of Central Point, Eagle Point, Jacksonville, Phoenix, and Talent. MWC serves a retail population of approximately 82,000. As of the 2000 Census, the median household income in Medford was $36,481, which is lower than the statewide median of $40,916.[1]

UTILITY DEMOGRAPHICS

MWC's retail service area is 36.3 square miles. As of August 2005, MWC had 26,370 connections, 88.7% of which were residential. Of their total connections, 21,300 were single family residential, 2,100 were multifamily residential, 2,400 were commercial, 125 were industrial, 85 were municipal, and 360 were fire service connections. The average residential water use is approximately 155 gallons per capita per day (gpcd), and total utility water use is approximately 225 gpcd.

INCREASING BLOCK RATES

Affected Customers: Single Family Residential
Customers Analyzed: Single Family Residential
Effective Date: March 1, 2003

UTILITY RATE STRUCTURE AND PRICES

On March 1, 2003, MWC adopted an increasing block rate structure for single family residential customers. Other customer classes remained with a seasonal rate structure. Customers are currently charged a monthly service fee of $6.35 for 5/8" x 3/4" meters in addition to a variable charge. The variable charge for single family residential customers is as follows:

Usage	Price	
	Inside City	Outside City
≤ 15,000 gallons	$0.46/1,000g	$0.63/1,000g
> 15,000 gallons	$0.64/1,000g	$0.81/1,000g

CURRENT CAPACITY AND WATER SOURCES

MWC's primary source of water is from Big Butte Springs, with a secondary source of water from the Rogue River. MWC has a storage capacity of 36.5 million gallons.

FUTURE PLANS TO MEET DEMAND

The population of MWC's service area is growing at a rate of 4% per year. MWC plans to meet future demands through current sources, by purchasing additional water rights on the Rogue River, by expanding treatment and transport facilities, through continuing water conservation efforts, and possibly through reuse.

[1] US Census Bureau. FactFinder.

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RATE STRUCTURE - DESCRIPTION

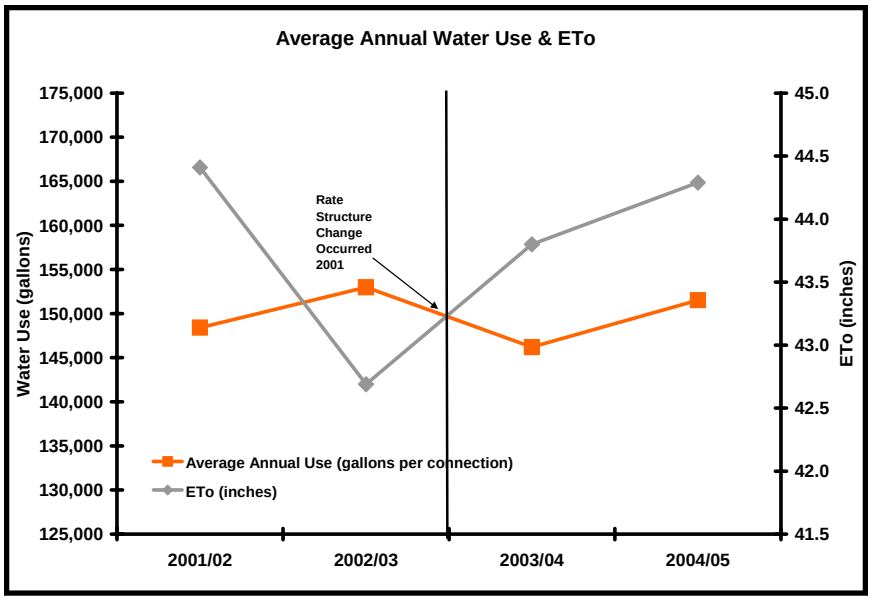
MWC adopted an increasing block rate structure for their single family residential customers on March 1, 2003. The rate change was viewed as a first step to charging those customers most responsible for peak costs for those peaks, recognizing that rates overall would still be quite low.

OTHER MEDFORD CONSERVATION PROGRAMS

Outdoor Audits, *2001-present*
Public Education, *1992-present*
Newsletter articles, a demonstration garden, an ET phone line, high use notifications, and water conservation website.
Seasonal Rate Structure, *start date unknown*
All customer classes except single family residential.

Prior to the change, all customers were subject to a seasonal rate structure, with summer rates $0.05 per 1,000 gallons higher than winter rates. At the time of the change, the rates inside the city were $0.40 per 1,000 gallons during the winter, and $0.45 per 1,000 gallons during the summer.

The new rate structure includes two tiers, with water use in the second tier charged at $0.18 more per 1,000 gallons than water use in the first tier. The second tier starts at 15,000 gallons of water use per month. The average monthly water use of a single family residential customer in the City of Medford is between 12,000 and 13,000 gallons per month.



Water rates are also evaluated for possible increases on March 1 of each year. At the time of the rate change, the price was $0.40 per 1,000 gallons in the first tier, and $0.58 per 1,000 gallons in the second tier.

A comparison of average annual water use with reference evapotranspiration (ETo) is inconclusive. Water use would be expected to go up with increasing ETo, which is the case only between 2003/04 and 2004/05.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The methodology for this analysis is different from most of the cases in the study because no control group was available for comparison. This

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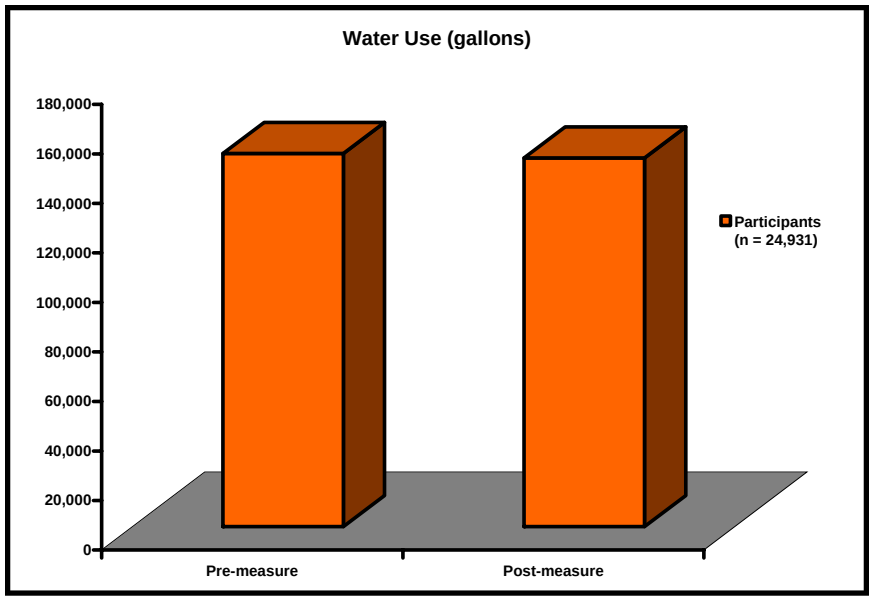
is because the rate structure change affected all single family residential customers. Instead of using a control group, the water savings were calculated solely from the difference in pre- and post-measure water use of inside-city and outside-city single family residential water use. The pre-measure and post-measure time periods were two years each, March 2001 through February 2003 and March 2003 through February 2005. The average yearly water savings from the two years after the rate change was extrapolated for twenty years, the assumed lifespan of the rate change.

The customer classes analyzed were single family residential, both inside the City of Medford and outside the city. The water savings were calculated for each and the total of the two categories. The cost benefit analysis was performed on the total of the two categories. MWC's other customer classes were not included in the analysis because their rate structure did not change.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 4.8%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.



It was not possible to follow the individual customers that were present at the time of implementation of the rate change. Instead, the number of single family residential connections was used as a proxy. The number of connections varied by month. There was an average of 17,338 inside-city single family residential connections, and 1,572 outside-city single family residential connections, for an average of 18,910 connections total.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

In calculating the average number of connections over the twenty year period of analysis, it was assumed that the annual growth in connections was equal to the average annual growth between 1999 and 2005.

The price of water used in calculating the benefits from water savings was the residential rate at the tier where the average customer's water use fell (tier 1), $0.42 in 2004/05 and $0.46 in 2005/06 and beyond.

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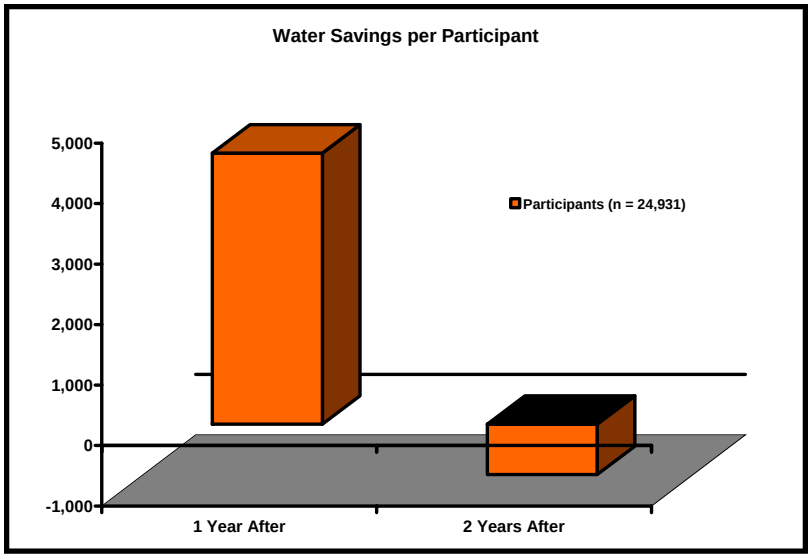
The discount rate used in this analysis was 4.8%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

The calculation of water savings and any benefits derived from water savings started the date of the rate structure change, March 1, 2003.



The cost to the utility was $2,000 in staff time preparing for the rate change.

RESULTS - WATER SAVINGS

For inside-city single family residential customers, during the first year after the rate change, water savings amounted to 103,687,119 gallons, or 4,546 gppy (3.1% of pre-measure water use). The second year after, no water savings were documented. Relative water use increased 23,106,630 gallons, or 1,013 gppy (0.7% of pre-measure water use). The average savings per year was 40,290,245 gallons (123.6 AF), or 1,767 gppy (1.2% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the rates was 805,804,898 gallons (2,472.9 AF), or 35,332 gallons per participant.**

For outside-city single family residential customers, during the first year after the rate change, water savings amounted to 8,726,862 gallons, or 3,908 gppy (2.4% of pre-measure water use). The second year after, water savings amounted to 1,026,698 gallons, or 460 gppy (0.3% of pre-measure water use). The average savings per year was 4,876,780 gallons (15.0 AF), or 2,184 gppy (1.3% of pre-measure water use). The total water savings over the twenty year assumed lifespan of the rates was 97,535,600 gallons (299.3 AF), or 43,674 gallons per participant.

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Labor	$2,053	Not Quantified	Not Quantified	Water Bill Savings	$269,229
Total	$2,053			Total	$269,229

For all customers analyzed, during the first year after the rate change, water savings amounted to 111,753,307 gallons, or 4,482 gppy (3.0% of pre-measure water use). The second year after, no water savings were documented. Relative water use increased 20,800,016 gallons, or 834 gppy (0.6% of pre-measure water use). The average savings per

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year was 45,476,646 gallons (139.6 AF), or 1,824 gppy (1.2% of pre-measure water use). The total water savings over the twenty year assumed lifespan of the rates was 909,532,911 gallons (2,791.3 AF), or 36,482 gallons per participant.

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $2,053 ($0.08 per participant). This includes labor costs, $2,053.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to participants was $269,229 ($11 per participant). This includes water bill savings, $269,229.

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$2,053 from the utility perspective. This is a net benefit of -$0.08 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $1.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $269,229 from the participant perspective. This is a net benefit of $11 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $267,176 from an overall perspective. This is a net benefit of $11 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $1.**

Results of this analysis show a net loss of revenue to the utility resulting from the rate change, however, this may not be the case depending on how much water was used in higher tiers.

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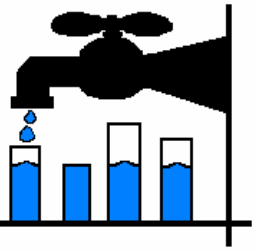
Medford Water Commission

Conservation Rates: Increasing Block



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	2,053	NA	2,053
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$2,053	$0	$2,053
Present Value Benefits			
Total Water Savings	2,791.25 AF	2,791.25 AF	2,791.25 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	269,229	269,229
Benefits to Others	NA	NA	0
Total Benefits	$0	$269,229	$269,229
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$2,053	$269,229	$267,176
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$1 /AF	$0 /AF	$1 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **n/a**

Benefits

- **Savings on sewer bills.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Delays capital improvement projects.**
- **Water saved for future municipal use.**

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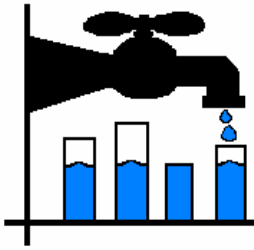

St. Johns County Utility Dept.
Conservation Rates: Increasing Block

St. Johns County Utility Department (SJCUD) provides retail water and wastewater services to St. Johns County located in northeastern Florida along the Atlantic coast. SJCUD serves a population of approximately 55,000. As of the 2000 Census, the median household income in St. Johns County was $50,099, which is higher than the statewide median of $38,819.[1]

UTILITY DEMOGRAPHICS

SJCUD's service area is 72.3 square miles. As of August 2005, SJCUD had 20,156 connections, 95% of which were residential. Of their total connections, 19,068 were single family residential, 149 were multifamily residential, 863 were commercial, 5 were industrial, 43 were governmental, and 28 were s mixed use connections. The average single family residential water use is approximately 145 gallons per capita per day (gpcd), as of 2004.

INCREASING BLOCK RATE

Affected Participants:	**Whole Utility**
Participants Analyzed:	**Single Family, Multi-family, Commercial, Governmental**
Effective Date:	**April 1, 2001**

UTILITY RATE STRUCTURE AND PRICES

On April 1, 2001, SJCUD adopted an increasing block rate structure. Since 2001, the individual prices per block have increased. As of July 2005, participants are charged a monthly service fee of $9.81 for 5/8" x 3/4" meters in addition to a variable charge:

CURRENT CAPACITY AND WATER SOURCES

SJCUD's primary source of water is from Floridan and surficial wells. SJCUD has a storage capacity of 7.5 million gallons.

FUTURE PLANS TO MEET DEMAND

The population of SJCUD's service area is growing at a rate of 9% per year. SJCUD plans to meet future demands by adding capacity and converting to a reverse osmosis treatment plant.

RATE STRUCTURE - PROGRAM DESCIPTION

SJCUD adopted an increasing block rate structure on April 1, 2001. Prior to the change, all participants were subject to a base charge that included up to 4,000 gallons and an additional charge per 1,000 gallons thereafter. Just before the rate change, the price was $5.26 per 1,000 gallons above 4,000 gallons per month.

As of the April 2001 rate change, the new rate structure included a monthly base rate and four usage categories:

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[1] US Census Bureau. FactFinder.

Usage	Price
0-4,000 gallons	$2.92 per 1,000 gallons
4,001-8,000 gallons	$3.94 per 1,000 gallons
8,001-15,000 gallons	$5.32 per 1,000 gallons
15,001 gallons and over	$7.18 per 1,000 gallons

Water rates have increased on October 1st of each year since 2001 and on July 1st in 2005. In 2005, the usage categories changed slightly, so that current prices are as follows:

Usage	Price
0-5,000 gallons	$2.49 per 1,000 gallons
5,001-10,000 gallons	$3.11 per 1,000 gallons
10,001-20,000 gallons	$5.24 per 1,000 gallons
20,001 gallons and over	$7.60 per 1,000 gallons

METHODOLOGY

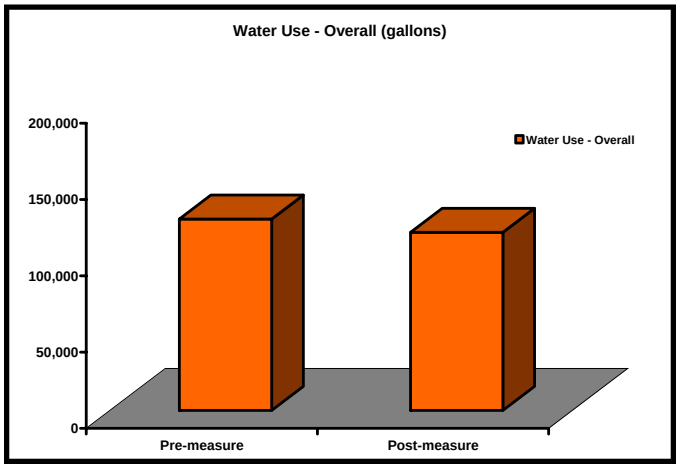
Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The methodology for this analysis is different from most of the cases in the study because no control group was available for comparison. This is because the rate structure change affected all participants. Instead of using a control group, the water savings were calculated solely from the difference in pre- and post-measure water use. The pre-measure and post-measure time periods were two years each, April 1999 through March 2001 and April 2001 through March 2003. The average yearly water savings from the two years after the rate change was extrapolated for twenty years, the assumed lifespan of the rate change.

OTHER ST JOHNS CONSERVATION PROGRAMS

St. Johns County Utility Department had no other conservation measures in place during the period of this conservation ordinance analysis.

All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used in this analysis was 5.35%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.



It was not possible to follow the individual participants that were present at the time of implementation of the rate change. Instead, the number of connections was used as a proxy. The number of connections varied by month. There was an average of 10,351 single family residential connections, 98 multifamily connections, 480 commercial connections, and 40 governmental connections, for an average of 10,969 connections total

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for the period of analysis. The average number of connections over the twenty year lifespan of the rate change was 18,804, which is the value used in the cost-benefit calculations.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

In calculating the average number of connections over the twenty year
period of analysis, it was assumed that the annual growth in connections was equal to the average annual growth between April 1999 and March 2003.

The price of water used in calculating the benefits from water savings were averages of "block 3" rates from the period from April 2001 to October 2004.

Accounts that had zero usage during the course of the year were eliminated from the total connections for that year.

The discount rate used in this analysis was 5.35%.

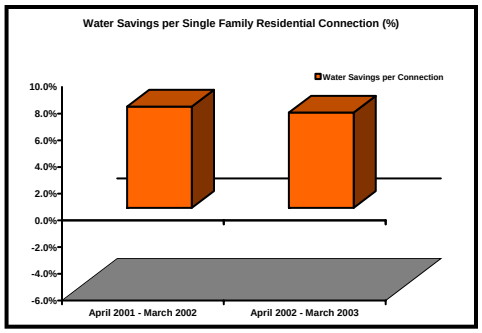
The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

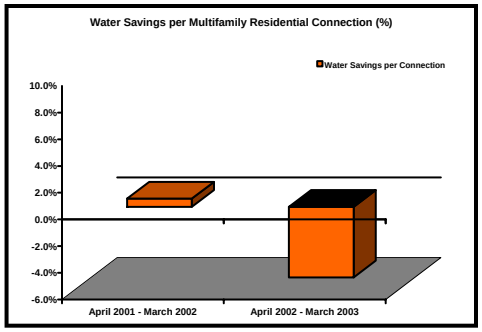
The calculation of water savings and any benefits derived from water savings started the date of the rate structure change, April 1, 2001.

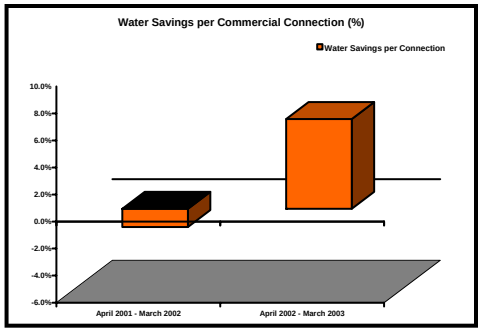
RESULTS - WATER SAVINGS

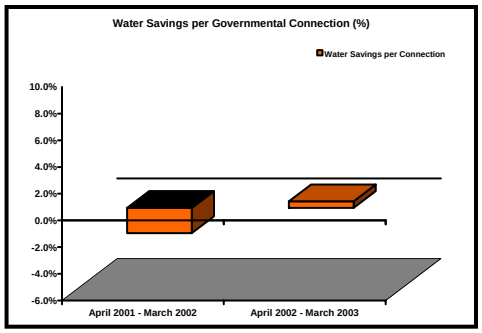
For single family residential connections, during the first year after the rate change, the water savings amounted to 100,975,570 gallons, or 9,755 gallons per participant per year (gppy) (7.6% of pre-measure water use). The second year after, water savings amounted to 95,040,259 gallons, or 9,182 gppy (7.1% of pre-measure water use). The average savings per year was 98,007,915 gallons (300.8 AF), or 9,468 gppy (7.4% of pre-measure water use). The total water savings over the twenty year assumed lifespan of the rates was 1,960,158,294 gallons (6,015.5 AF), or 107,992 gallons per participant.

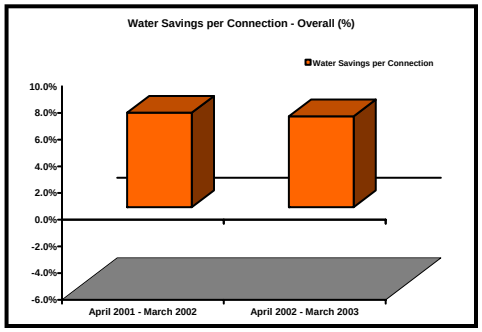
For multifamily residential connections, during the first year after the rate change, the water savings amounted to 39,715 gallons, or 407 gallons per participant per year (gppy) (0.6% of pre-measure water use). The second year after, no water savings occurred. There was an increase in water use of 341,619 gallons, or 3,504 gppy (5.3% of pre-measure water use). On average, no water savings occurred; water use increased by 150,952 gallons (0.5 AF), or 1,548 gppy (2.3% of pre-measure water use). Over











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the twenty year assumed lifespan of the rates there were no water savings; water use increased by 3,019,043 gallons (9.3AF), or 25,694 gallons per participant.

For commercial connections, during the first year after the rate change, no water savings occurred. There was an increase in water use of 495,996 gallons, or 1,034 gallons per participant per year (gppy) (1.4% of pre-measure water use). The second year after, water savings amounted to 2,441,536 gallons, or 5,089 gppy (6.7% of pre-measure water use). The average savings per year was 972,770 gallons (3.0 AF), or 2,028 gppy (2.7% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the rates was 19,455,404 gallons (59.7 AF), or 32,211 gallons per participant.**

For governmental connections, during the first year after the rate change, no water savings occurred. There was an increase in water use of 46,428 gallons, or 1,161 gallons per participant per year (gppy) (1.9% of pre-measure water use). The second year after, water savings amounted to 12,134 gallons, or 303 gppy (0.5% of pre-measure water use). On average, no savings occurred; water use increased by 17,147 gallons (0.1 AF), or 429 gppy (0.7% of pre-measure water use). **No water savings occurred over the twenty year assumed lifespan of the rates; water use increased by 342,936 gallons (1.1 AF), or 6,659 gallons per participant.**

For all connections analyzed, during the first year after the rate change, the water savings amounted to 97,396,518 gallons, or 8,880 gallons per participant per year (gppy) (7.1% of pre-measure water use). The second year after, water savings amounted to 93,704,669 gallons, or 8,543 gppy (6.8% of pre-measure water use). The average savings per year was 95,550,593 gallons (293.2 AF), or 8,711 gppy (6.9% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the rates was 1,911,011,870 gallons (5,864.7 AF), or 10,163 gallons per participant.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

Quantified Costs and Benefits					
Utility			Participants		
Costs		Benefits	Costs	Benefits	
Planning & Research	$37,332	Not Quantified	Not Quantified	Water Bill Savings	$6,842,739
Total	$37,332			Total	$6,842,739

- The quantified cost to the utility was $37,332 ($2 per connection), which includes the costs of planning and research.
- The quantified benefit to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to participants was $6,842,739 ($364 per connection), which includes the benefit of water bill savings.

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UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$37,332 from the utility perspective. This is a net benefit of -$2 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $6.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $6,842,739 from the participants perspective. This is a net benefit of $364 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $6,805,407 from an overall perspective. This is a net benefit of $362 per participant. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $6.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Cost of instituting rate structure.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced use of water.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Delays capital improvement projects.**
- **Water saved for future municipal use.**

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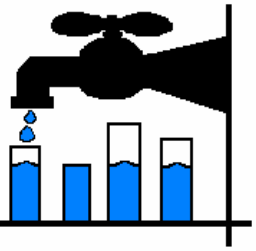
St. Johns County Utility Department
Conservation Rates: Increasing Block



Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	37,332	NA	37,332
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$37,332	$0	$37,332
Present Value Benefits			
Total Water Savings	5,864.67 AF	5,864.67 AF	5,864.67 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	6,842,739	6,842,739
Benefits to Others	NA	NA	0
Total Benefits	$0	$6,842,739	$6,842,739
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$37,332	$6,842,739	$6,805,407
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$6 /AF	$0 /AF	$6 /AF

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Sandy City Public Utilities Dept.

Seasonal Conservation Rates

Sandy City Public Utilities Department serves the community of Sandy, Utah, located west of the Wasatch Mountains, and south of Salt Lake City in Salt Lake County. According to Utah Demographics and Statistics, the approximate population of Sandy is 89,319[1]. As of the 2000 Census, median household income in Sandy was $66,458[2].

UTILITY DEMOGRAPHICS

The total service area of the Utilities Department is 24.6 square miles. The population of this service area is 100,000. As of 2004, Sandy City Public Utilities Department's customers' water use was 216 gallons per capita per day (gpcd).

Sandy City Public Utilities Department has a total of 26,870 connections in its service area. Of these connections, 24,861 are single family residential, 483 are multifamily residential, 1,064 are commercial, 96 are irrigation, 248 are parks/ landscape, 42 are school, 34 are municipal, and 42 are unmetered connections.

SEASONAL CONSERVATION RATES

Type of Program:	**Rate Structure**
Eligible Customers:	**ALL**
Customers Analyzed:	**ALL**
Program Years:	**2001**
Years Analyzed:	**2001**

UTILITY RATE STRUCTURE AND PRICES

Sandy City Public Utilities Department uses a seasonal rate structure. The monthly base rate for service is $15.33 for single family customers, which includes 8,000 gallons of water. Single family residential usage charges are as follows: ≥8,001 gallons

APRIL—SEPTEMBER	$0.93 per 1,000 gallons
OCTOBER—MARCH	$1.68 per 1,000 gallons

CURRENT CAPACITY AND WATER SOURCES

Sandy City Public Utilities Department has a storage capacity of 32.4 million gallons. The utility's current water sources are groundwater and surface water.

SEASONAL RATE STRUCTURE—DESCRIPTION

Sandy City Public Utilities Department adopted its conservation rate structure in April, 2001. It replaced a uniform rate structure. The new structure is a seasonal rate structure; the variable rate is 81% higher in the summer months ($1.68 per 1,000 gallons April through September) than in the winter months ($0.93 per 1,000 gallons October through March). The first 8,000 gallons of water are included in the customer's base charge throughout the year.

Around the time that the utility implemented the seasonal rate structure, there were additional factors that may have also affected water use

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[1] U.S. Bureau of the Census, Sub county Population Estimates 2000-2003.
[2] U.S. Census Bureau, American Fact Finder.

among utility customers. In 2001, a coalition formed by Utah's governor expanded Jordan Valley Water Conservancy District's Slow-the-Flow water conservation campaign statewide. The Division of Water Resources distributed a second version of Utah's M&I Water Conservation Plan in 2001. In May 2001, Sandy City Public Utilities Department updated its water conservation plan. There was also a continuing drought in the area.

OTHER SANDY CITY CONSERVATION PROGRAMS

Audits, ***1999-present***
Administered by Utah State University Extension.

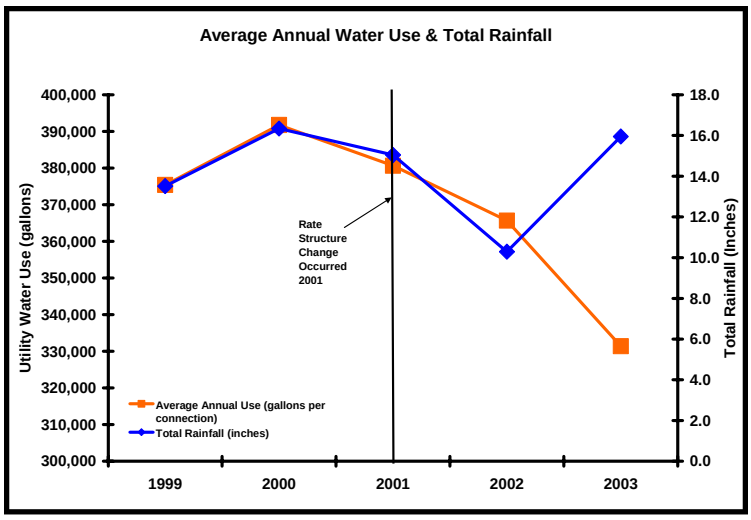
Conservation Ordinances, ***2001-present***
In 2001, a landscape ordinance was amended to include a time of day watering restriction.

Public Education, ***2001-present***
Conservation packets, brochures, newsletter articles, booths at Exposition Centers, a water conservation garden, and teaching conservation in schools.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The methodology for this analysis is different from most of the cases in the study because no control group was available for comparison. This is because the rate change affected all of the utility's customers. Instead of using a control group, the water savings was calculated solely from the difference in pre- and post-measure water use of the participants (the entire utility). The pre-measure and post-measure time periods were two years each. The average yearly water savings from two years after the rate change was extrapolated for twenty years, the assumed lifespan of the rate change.



All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used in this analysis was 5.35%. The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

It was not possible to follow the individual customers of the utility at the time of the rate change. Instead, the total number of connections at the utility was used as a proxy. The number of connections varied by year. There were 25,642 in 1997, 26,351 in 1998, 25,945 in 1999, 26,217 in 2000, 26,360 in 2001, 26,595 in 2002, and 26,634 in 2003.

In addition to data collected to estimate water savings and perform cost benefit analysis, historical weather data was collected for additional

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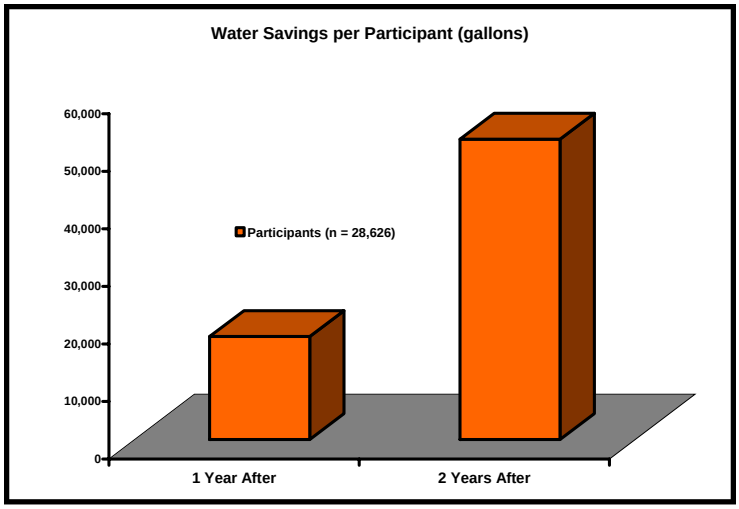
information. Two gauges of weather were gathered; mean annual temperature and total annual rainfall. This data was collected from the National Climatic Data Center, data file Surface Data, Monthly U.S. TD3220**.**

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.



The rate change occurred in April, 2001. However, the calculation of water savings and any benefits derived from water savings were not started until January 1, 2002.

The price of water used in the analysis was a weighted average of summer and winter rates, with summer use occurring at 6 times the amount of winter use. The resulting price was),$1.39 per 1,000 gallons in 2002, $1.48 per 1,000 gallons in 2003, and $1.57 per 1,000 gallons in 2004 (and assumed to be $1.57 for the rest of the lifespan.

The number of connections at the utility in 2003 was unknown. The average increase in connections per year was determined. This figure was added to the number of 2002 connections to result in the assumed number of connections for 2003.

RESULTS -- WATER SAVINGS

The first year after the 2001 rate change, there was a water savings of 476,178,322 gallons, or 17,905 gppy (4.7% of pre-measure water use). The second year after the rate change, water savings were 1,389,969,644 gallons, or 52,188 gppy (13.6% of pre-measure water use). The average water savings per year was 933,073,983 gallons (2863.5 AF), or 35,046 gppy (9.1% of pre-measure water use). **The total water savings over the twenty year assumed lifespan of the rate change was 18,661,479,664.3 gallons (57,270.0 AF), or 651,918 gallons per participant.**

The directional change in water use from year to year marginally corresponds with the change in temperature from year to year. Two observations are not consistent with the pattern of the rest of the data.

From 1990-1991, the average yearly temperature decreased while average yearly water used increased. The converse occurred from 2002-2003 —average yearly temperature increased while average yearly water use decreased. There are most likely other unaccounted for variables (which may or may not be quantified) that have impacted the average yearly water usage over the period of the analysis.

[3] The savings on participants' water bills was calculated by multiplying the amount of water saved by the price of water ($1.57 per 1,000 gallons) at Sandy City Public Utilities

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In addition, the magnitude of change corresponds less closely. Utility water use is less correlated with yearly rainfall than with average yearly temperature. Both the direction and magnitude of change from year to year are varied.

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (twenty years).

- The quantified cost to the utility was $0.
- The quantified cost to the participants was $0.
- The quantified benefit to the utility was $0.
- The quantified benefit to the participants was $3,983,524. This benefit includes the savings on participants' water bills, $3,983,524 ($139 per participant).

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $0 from the utility perspective. The quantified costs to the utility were equal to the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $0.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $3,983,524 from the participant perspective. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

Quantified Costs and Benefits				
Utility		Participants		
Costs	Benefits	Costs	Benefits	
Not Quantified		Not Quantified	Water Bill Savings	$3,983,524
			Total	$3,983,524

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $3,983,524 from an overall perspective. The quantified costs to the participants and utility were greater than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $0.**

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Sandy City Public Utilities Dept.

Seasonal Conservation Rates

Results of Cost Benefit Analysis-Lifespan (20 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	0	NA	0
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$0	$0	$0
Present Value Benefits			
Total Water Savings	57,269.90 AF	57,269.90 AF	57,269.90 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	3,983,524	3,983,524
Benefits to Others	NA	NA	NA
Total Benefits	$0	$3,983,524	$3,983,524
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$0	$3,983,524	$3,983,524
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$0 /AF	$0 /AF	$0 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- Administrative costs to develop the rate structure.
- Printing rate schedules.
- Inform customers.

Benefits

- Environmental benefits of reduced water use.
- Avoided cost of acquisition and distribution of water saved.
- Increased public awareness of the need to conserve water.
- Increased customer satisfaction with the utility.
- Reinforcing the need to conserve.
- Reduced groundwater depletion, surface water consumption.

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OTHER PROGRAM
CASE NARRATIVES

PAGES

Cheyenne Public Utilities
Conservation Ordinance

The City of Cheyenne Board of Public Utilities (BOPU) provides water and wastewater services for the City of Cheyenne, Wyoming. Cheyenne BOPU serves a population of approximately 66,550. As of the 2000 Census, the median household income in Cheyenne was $38,856, which is higher than the statewide median of $37,892.[1]

UTILITY DEMOGRAPHICS

Cheyenne BOPU supplies water to the City of Cheyenne, South Cheyenne, the F.E. Warren Air Force Base (Warren AFB), and some county users. The total service area is 40 square miles. As of April 2005, the BOPU had 21,525 connections, 91.9% of which were residential. Of their total connections, 18,597 were single family residential, 1,192 were multifamily residential, 1,565 were commercial, 26 were industrial, and 147 were for city services. Cheyenne BOPU has a storage capacity of 39,420 acre-feet. As of 2004, the average residential water use was 76 gallons per capita per day (gpcd), and total utility water use was 141 gpcd.

CONSERVATION ORDINANCE

Affected Customers:	**All**
Customers Analyzed:	**ICI, City Services, Residential, Warren AFB**
Ordinance Effective Date:	**March 2003**

UTILITY RATE STRUCTURE AND PRICES

In July 2004, Cheyenne BOPU adopted an increasing block rate structure in order to encourage water conservation. Customers are charged a monthly service fee of $4.00 for 5/8" and 3/4" meters in addition to a variable charge:

Usage	Price	
	Inside City	**Outside City**
≤ 6,000 gallons	$2.76/1,000 gal	$4.14/1,000 gal
6,001 – 24,000 gallons	$3.45/1,000 gal	$5.18/1,000 gal
24,001 – 42,000 gallons	$4.31/1,000 gal	$6.47/1,000 gal
≥ 42,001 gallons	$5.39/1,000 gal	$8.09/1,000 gal

CURRENT CAPACITY AND WATER SOURCES

The BOPU's sources of water include the Little Snake/Douglas Creek System, which supplies approximately 12,000 acre-feet per year, Crow Creek, which provides 3,500 acre-feet per year, and four well fields that provide approximately 4,000 acre-feet per year. Surface water resources are stored in five reservoirs; they are Rob Roy, Lake Owen, North Crow, Granite Springs, and Crystal.[2]

FUTURE PLANS TO MEET DEMAND

The population of Cheyenne BOPU's service area is growing at an annual rate of 1%. The BOPU plans to meet future demands by expanding water sources, expanding facilities, through water reuse, and through water conservation.

[1] US Census Bureau. QuickFacts.
[2] City of Cheyenne Board of Public Utilities.

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ORDINANCE - DESCRIPTION

Cheyenne BOPU adopted a Short-term Drought-based Water Restrictions Ordinance in March 2003 as a response to the continuation of drought conditions that impacted Cheyenne's water supply. The ordinance was to be in effect for one year. The goal of the restrictions was to reduce the amount of water supplied during the 2003 calendar year by 25-35% or about 5,400 acre-feet. The ordinance was primarily aimed at reducing outdoor water use.

OTHER CHEYENNE CONSERVATION PROGRAMS

Leak Detection Service*, ongoing*
Surcharge fees*, March 2003-Febuary 2004*
March 2003 - February 2004,
a $0.80/1,000 gallons surcharge.
Conservation Rates*, May 2004-present*
Public Education*, May 2003-present*

The ordinance set forth measures that aimed to reduce water use through time-of-day and day-of-week restrictions on lawn irrigation, water conservation and prevention of water waste, including limitations to reduce over-watering and prevent inefficient watering. The restrictions specified watering schedules for residential customers, and required special use permits for watering golf courses, athletic fields, parks and greenways, large turf areas, and cemeteries. Commercial restrictions included restaurants serving water by request only, and lodging establishments offering guests staying more than one night the option of not changing linen, towels, etc. Areas maintained by the City (City Services) were given an annual water budget, and were also asked to save 5% more water than other customer classes.

The program also implemented a surcharge of $0.80 per 1,000 gallons to the variable water rate during a Level 3 drought. In addition, violators of water restrictions were penalized with a warning on the first violation, a fine of $300 for a second violation, and $500 for third and subsequent violations. The utility switched from a flat rate structure to an increasing block rate structure in May 2004.

In November 2004, modifications were made to the ordinance and it was adopted for permanent use as the City's Wise Water Use Plan.[3]

Also, 2004 was a wet and cool year, with frequent rain events much of the summer. Many of Cheyenne's customers do not have automated irrigation systems. As a result, a greater proportion of the reduction in 2004 water use was likely due to the weather than in other years.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses..

The methodology for this analysis is different from most of the cases in the study because no control group was available for comparison. This is because the conservation ordinance affected all of the utility's customers. Instead of using a control group, the water savings were calculated solely from the difference in pre- and post-measure water use of the customer classes analyzed. The pre-measure and post-

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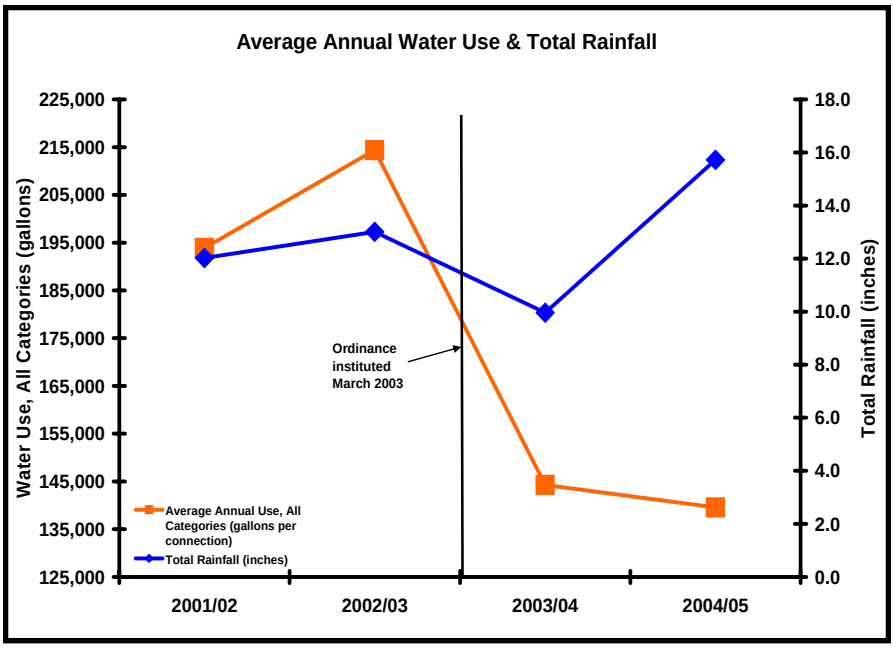
[3] BOPU website. "Wise Water Use Plan."

measure time periods were two years each, May 2001 through April 2003 and May 2003 through April 2005. The average yearly water savings from the two years after the implementation of the conservation ordinance was extrapolated for ten years, the assumed lifespan of the ordinance.

The customer classes analyzed were institutional, commercial, and industrial (ICI), city services, residential, and the Warren AFB. The water savings were calculated for each customer class and the total of the four classes. The cost benefit analysis was performed on the total of the four classes. The utility's other customer classes were not included in the analysis because they had primarily indoor water use or they had a combination of residential and ICI connections (i.e., South Cheyenne).

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The discount rate used in this analysis was 4.2%. The CPI values used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.



It was not possible to follow the individual customers of the utility at the time of implementation of the ordinance. Instead, the number of connections for each customer class was used as a proxy. The number of connections varied by month. There were an average of 1,626 ICI connections, 155 City Services connections, 18,301 residential connections, and 18 Warren AFB, for an average of 20,100 connections total.

In addition to data collected to estimate water savings and perform cost benefit analysis, historical weather data was collected for additional information. Two gauges of weather were gathered; mean annual temperature and total annual rainfall. This data was collected from the National Climatic Data Center, data file Local Climatological Data, Edited.

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

In calculating the average number of connections over the ten year period of analysis, it was assumed that the annual growth in

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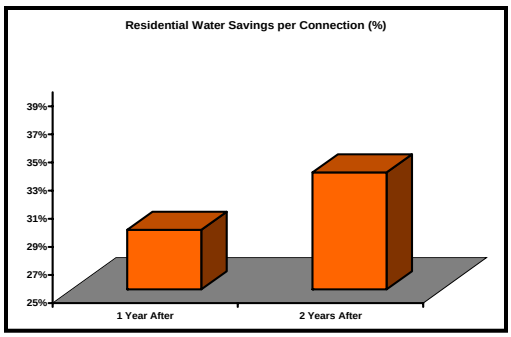
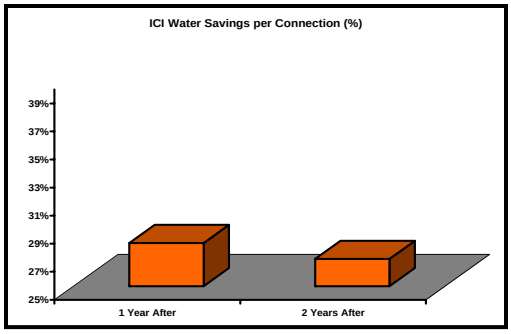
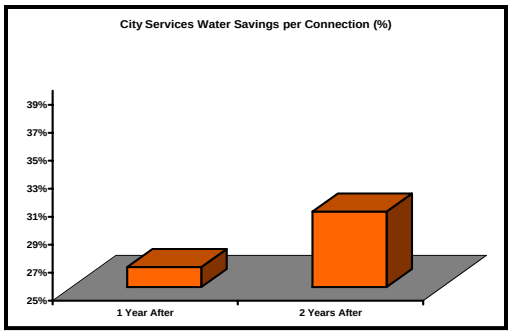
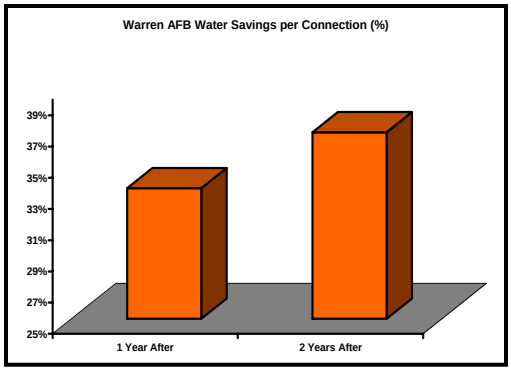
connections was equal to the average annual growth between 2001 and 2005.

The price of water used in calculating the benefits from water savings was $3.32, the average between the commercial rate, $3.18, and the residential rate at the tier where the residential customers' water use fell (tier 2), $3.45.









The discount rate used in this analysis was 4.2%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.

RESULTS - WATER SAVINGS

For **residential customers**, during the first year after the ordinance, water savings amounted to 653,075,618 gallons, or 35,685 gppy (29.2% of pre-measure water use). The second year after, water savings amounted to 744,458,221 gallons, or 40,678 gppy (33.3% of pre-measure water use). The average savings per year was 698,766,920 gallons (2,144 AF), or 38,181 gppy (31.3% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the ordinance was 6,987,669,197 gallons (21,444 AF), or 381,813 gallons per participant.**

For **ICI customers**, during the first year after the ordinance, water savings amounted to 267,043,739 gallons, or 164,245 gppy (28.1% of pre-measure water use). The second year after, water savings amounted to 256,201,943 gallons, or 157,577 gppy (26.9% of pre-measure water use). The average savings per year was 261,622,841 gallons (802.9 AF), or 160,911 gppy (27.5% of pre-measure water use). The total water savings over the ten year assumed lifespan of the ordinance was 2,616,228,410 gallons (8,028.9 AF), or 1,609,107 gallons per participant.

For **city services customers**, during the first year after the ordinance, water savings amounted to 114,158,367 gallons, or 737,331 gppy (26.4% of pre-measure water use). The second year after, water savings amounted to 131,313,741 gallons, or 848,135 gppy (30.4% of pre-measure water use). The average savings per year was 122,736,054 gallons (376.7 AF), or 792,733 gppy (28.4% of pre-measure water use). The total water savings over the ten year assumed lifespan of the ordinance was 1,227,360,543 gallons (3,767 AF), or 7,927,334 gallons per participant.

For **Warren AFB customers**, during the first year after the ordinance, water savings amounted to 176,519,133 gallons, or 9,780,206 gppy (33.4% of pre-measure water use). The second year after, water

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savings amounted to 195,490,442 gallons, or 10,831,329 gppy (37.0% of pre-measure water use). The average savings per year was 186,004,788 gallons (570.8 AF), or 10,305,767 gppy (35.2% of pre-measure water use). The total water savings over the ten year assumed lifespan of the ordinance was 1,860,047,875 gallons (5,708.3 AF), or 103,057,674 gallons per participant.

For all customers analyzed, during the first year after the ordinance, water savings amounted to 1,203,073,321 gallons, or 59,854 gppy (29.3% of pre-measure water use). The second year after, water savings amounted to 1,297,701,899 gallons, or 64,562 gppy (31.6% of pre-measure water use). The average savings per year was 1,250,387,610 gallons (3,837.3 AF), or 62,208 gppy (30.5% of pre-measure water use). **The total water savings over the ten year assumed lifespan of the ordinance was 12,503,876,101 gallons (38,372.9 AF), or 622,082 gallons per participant.**

RESULTS -- COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (ten years).

- The cost to the utility was $89,288 ($4 per participant). This includes the cost of capital expenditures, $34,979 ($1 per participant), and operation and maintenance costs, $54,309 ($3 per participant).
- The benefit to the utility was $0.
- The cost to the participants was $2,458 ($0.12 per participant). This includes the cost of ordinance violation fines, $2,458.
- The benefit to participants was $34,219,471 ($1,702 per participant). This includes water bill savings, $34,219,471.

Quantified Costs and Benefits						
Utility			Participants			
Costs		Benefits	Costs		Benefits	
Capital Expenditures	$34,979	Not Quantified	Fines	$2,458	Water Bill Savings	$34,219,471
Operation & Maintenance	$54,309					
Total	$89,288		Total	$2,669	Total	$34,219,471

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$89,288 from the utility perspective. This is a net benefit of -$4 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $2.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $34,217,013 from the participant perspective. This is a net benefit of $1,702 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.06.**

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OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $34,127,725 from an overall perspective. This is a net benefit of $1,697 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $2.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- The customers' time spent maintaining compliance with ordinance.

Benefits

- Financial savings on sewer bill for participants.
- Environmental benefits of reduced use of water.
- Increased public awareness about water conservation.
- Replenishing reservoirs to full capacity.
- Reinforces need to conserve water and desirability of conserving.
- Delays capital improvement projects.
- Avoided construction of new facilities.
- Water saved for future municipal use.
- Provided drought recovery.
- Extended capacity of the water supply system.

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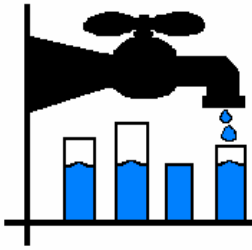

Cheyenne Public Utilities
Conservation Ordinance

Results of Cost Benefit Analysis-Lifespan (10 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	89,288	NA	89,288
Costs to Participants	NA	2,458	2,458
Costs to Others	NA	NA	0
Total Costs	$89,288	$2,458	$91,746
Present Value Benefits			
Total Water Savings	38,372.94AF	38,372.94AF	38,372.94 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	34,219,471	34,219,471
Benefits to Others	NA	NA	0
Total Benefits	$0	$34,219,471	$34,219,471
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$89,288	$34,217,013	$34,127,725
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$2 /AF	$0.06 /AF	$2 /AF

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Eastern Municipal Water Dist.

Surcharge Program

Eastern Municipal Water District (EMWD) is located in Riverside County, California. EMWD provides water to approximately 530,000 people, in addition to deliveries to eight local water agencies and municipalities. As of the 2000 census, the median household income in Riverside County was $42,887, which is lower than the statewide median of $47,493.[1]

UTILITY DEMOGRAPHICS

As of 2004, EMWD maintained 111,122 connections, 97% of which were residential. Of their total connections, 106,728 were single family residential, 1,129 were multifamily residential, 1,425 were commercial, 119 were industrial, 1,018 were irrigation, and 703 were dedicated landscape meters.

EMWD's service area includes Moreno Valley, Temecula, Perris, San Jacinto, Hemet and parts of Murietta. The total service area is 555 square miles. EMWD's average per capita water use was 151 gallons per capita per day (gpcd) as of 2004.

WATER BUDGET SURCHARGE

Surcharge Amount:	**Up to $500**
Eligible Customers:	**Landscape meters**
Customers Analyzed:	**Landscape meters**
Program Years:	**1992-present**
Years Analyzed:	**2001-2002**

UTILITY RATE STRUCTURE AND PRICES

EMWD has a flat rate structure, though rates vary according to area. As of January 2005, the daily service demand charge was $0.253 for the entire service area, which includes zero gallons of water. As of 2004, the charge per hundred cubic feet (ccf) of water varies from $0.90 per ccf to $1.62 per ccf ($1.20 per 1,000 gallons to $2.17 per 1,000 gallons). The current commercial rate is $1.51 per ccf ($2.01 per 1,000 gallons).

CURRENT CAPACITY AND WATER SOURCES

EMWD's primary source of water, approximately 80%, is imported water purchased through the Metropolitan Water District of Southern California (MWDSC), which is pumped from the Colorado River and Northern California. The other 20% is drawn from local groundwater wells mostly located in the Hemet and San Jacinto areas. EMWD has a current storage capacity of 176 million gallons.

FUTURE PLANS TO MEET DEMAND

The population within Eastern Municipal Water District's service area is growing at a rate of 11.6%. The utility intends to meet future water demands within the service area by utilizing its current capacity and sources, expanding the wastewater recycling system, as well as continuing conservation and reuse programs.

[1] US Census Bureau. QuickFacts.

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SURCHARGE PROGRAM - DESCRIPTION

The surcharges being analyzed are part of EMWD's Water Budget Program, established in January of 1992. The program is an effort to limit the irrigation water use of large landscapes. All new public and private landscapes of 3,000 square feet or more must have a dedicated landscape meter and are automatically a part of the water budget program. EMWD provides the owner with both a target water budget and an annual maximum allowable water budget (AMAWB) to be used in the scheduling of the irrigation system.

OTHER EMWD CONSERVATION PROGRAMS

Toilet Rebate Program, *May 1997-present*
Toilet Giveaway Program, *1992-1997*
Washing Machine Rebate Program, *February 2001-present*
Indoor/Outdoor Audits, *1993-present*
Public Education, *1992-present*
Irrigation System Replacement, *March 1996*
Installation of landscape moisture sensors on designated landscape meters having difficulty meeting water budgets.
Pressurized Water Broom Rebate Program, *2004-present*
$100 rebate on the purchase of a pressurized water broom.
X-Ray Film Processor Rebate Program, *2003-present*
$2000 rebate on X-ray film processor recycling system.
Cooling Tower Program, *2003-present*
$500 rebate on cooling tower conductivity controller.
Pre-Rinse Sprayer Rebate Program, *2003-present*
$50 rebate on pre-rinse sprayers for restaurants.
Water Conservation Ordinances, *1992-present*

The AMAWB is the upper limit of water use for the entire landscaped area per irrigation meter. The AMAWB is determined by the reference evapotranspiration (ETo), which refers to the quantity of water that is evaporated from surfaces and transpired by plants during a specific time.

If the customer uses more than their AMAWB they are issued a "non-compliance" surcharge, which ranges from $100 to $500 based upon the percentage of excess water use. Every month EMWD monitors and reports to the owner their monthly target, usage, adjustments, ETo in inches, monthly ETo in billing units, the AMAWB, and any non-compliance surcharges that will be charged.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes customers that received a surcharge for exceeding their water budget at least once between January 2001 and December 2002. The water savings were calculated and a cost benefit analysis was performed for this time period. The findings refer to this two year period only, not to the ongoing program. The lifespan of the effect of the surcharges was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2001) and inflated to 2004 dollars. The discount rate used for this analysis was 5.4%. The Consumer Price Index values

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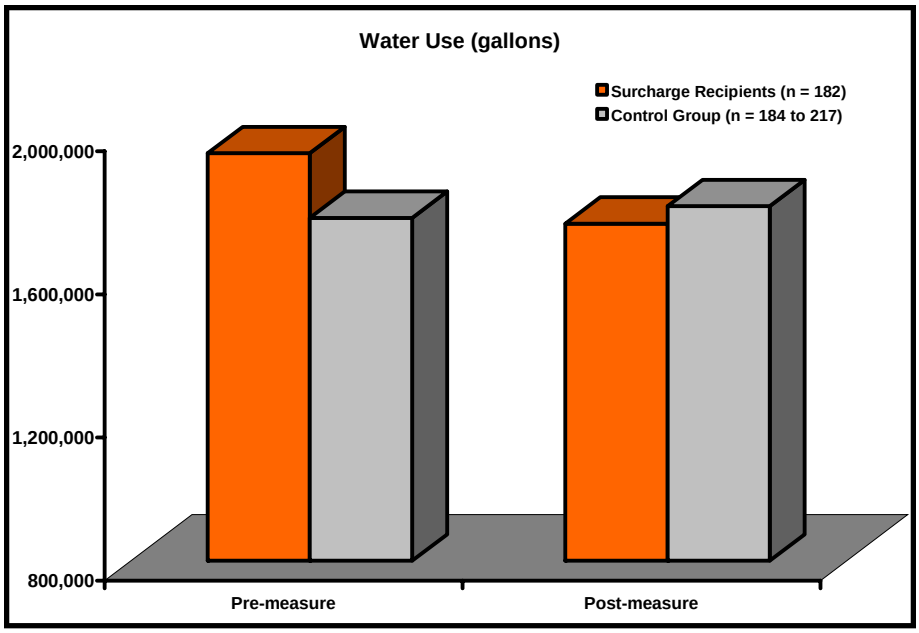
used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.



The population studied for this analysis was comprised of participants who received surcharges from January 2001 to December 2002. There were 96 usable participants out of 98 total participants in 2001, and 86 out of 93 in 2002, for a total of 182 usable participants out of 191. Five percent, or 9, of the possible participants were unusable because there was incomplete consumption data for the period of analysis.

EMWD customers participating in the water budget program, excluding those charged with a surcharge for exceeding the water budget, were used as the control group. The control group for the 2001 surcharges consisted of 184 customers. The control group for the 2002 surcharges consisted of 217 customers. The average pre-measure water use of the participants (1,939,190 gallons) was higher than that of the control group (1,758,526 gallons).

ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The lifespan of a surcharge is 5 years; which was used as the period of analysis

Assumed EMWD spent $300,000 per year total on water conservation labor costs, 60% of which was due to Water Budget Program, 10% of which was due to enforcement of the Water Budget program ($18,000 per year).

Assumed the variable water rate for commercial customers was $1.46 per ccf in 2002, $1.46 per ccf in 2003, $1.47 per ccf in 2004, and $1.51 per ccf in 2005 and beyond.

The discount rate used in this analysis was 5.4%.

The CPI values that were used in this analysis were the 2004 value of 188.9 and the 2001 value of 177.1.

Participants who had two or more consecutive months of no water use were included in the study.

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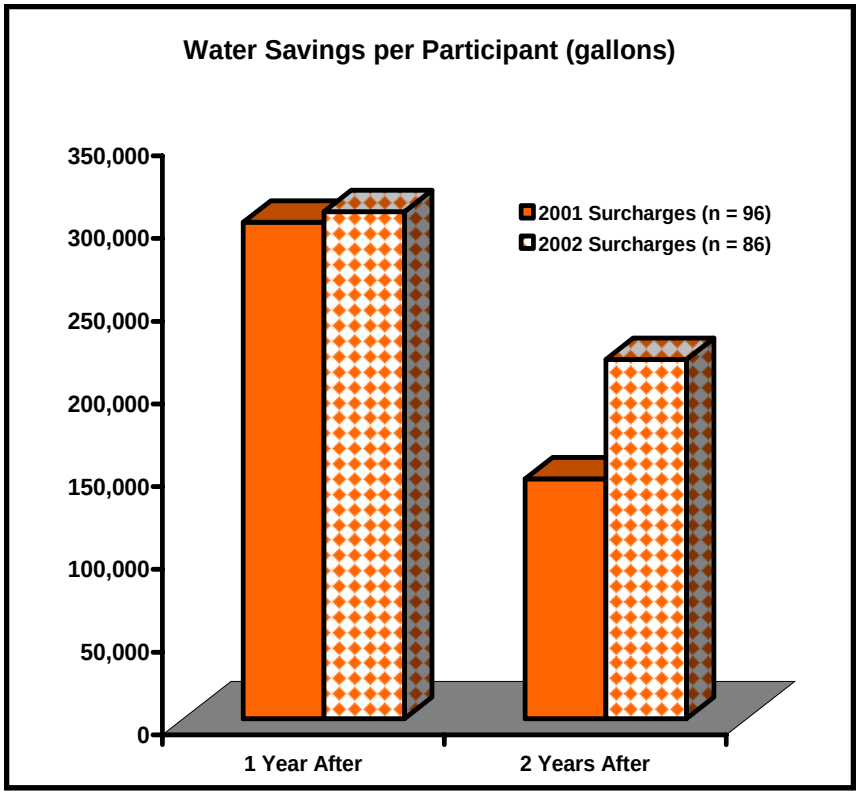
RESULTS - WATER SAVINGS

In the first year after the 2001 surcharges, the water savings amounted to 28,821,467 gallons, or 300,224 gallons per participant per year (gppy) (17.0% of pre-measure water use). The second year after, the water savings amounted to 13,919,048 gallons, or 144,990 gppy (8.2% of pre-measure water use). The average water savings per year was 21,370,257 gallons, or 222,607 gppy (12.6% of pre-measure water use). **The total water savings over the five year assumed lifespan of the surcharges was 106,851,285 gallons (327.9 AF), or 1,113,034 gallons per participant.**



The first year after the 2002 surcharges, there was a water savings of 26,362,743 gallons, or 306,544 gppy (14.4% of pre-measure water use). The second year after, the water savings amounted to 18,677,857 gallons, or 217,184 gppy (10.2% of pre-measure water use). The average savings per year was 22,520,300 gallons, or 261,864 gppy (12.3% of pre-measure water use). The total savings over the five year assumed lifespan was 112,601,500 gallons (345.6 AF), or 1,309,320 gallons per participant.

The total savings for the two years studied was 55,184,209 gallons, or 303,210 gppy (15.6% of pre-measure water use) during the first year after and 32,596,904 gallons, or 179,104 gppy (9.2% of pre-measure water use) during the second year after. The average savings per year was 43,890,557 gallons, or 241,157 gppy (12.4% of pre-measure water use). The total savings over the five year assumed lifespan was 219,452,785 gallons (673.5 AF), or 1,205,785 gallons per participant.

During the two years prior to being charged with the surcharges, participants' water use was 116.5% of the control group's use, on average. During the two years after, their water use was 102.4% of the control group's use, on average. The participants' water use decreased by 10.2% from pre-measure to post-measure, whereas the control group's use increased by 1.8%. **The resulting overall water savings attributed to this program was 12.0%.**

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RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

2001 SURCHARGES

- The quantified cost to the utility was $19,199 ($200 per participant), which includes the cost of labor.
- The quantified benefit to the utility was $35,412 ($369 per participant), which includes income from the surcharges.
- The quantified cost to the participants was $35,412 ($369 per participant), which includes the cost of the surcharges.
- The quantified benefit to the participants was $194,678 ($2,028 per participant), which includes the water bill savings.

2001	Quantified Costs and Benefits							
Utility					Participants			
Costs		Benefits			Costs		Benefits	
Labor	$19,199	Surcharges	$35,412		Surcharges	$35,412	Water Bill Savings	$194,678
Total	$19,199	Total	$35,412		Total	$35,412	Total	$194,678

UTILITY PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of $16,213 from the utility perspective. This is a net benefit of $169 per participant. The quantified costs to the utility were less than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $59.**

PARTICIPANT PERSPECTIVE- 2001

Results of cost benefit analysis show a net benefit (net present value) of $159,266 from the participant perspective. This is a net benefit of $1,659 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $108.**

OVERALL PERSPECTIVE - 2001

Results of cost benefit analysis show a net benefit (net present value) of $175,479 from an overall perspective. This is a net benefit of $1,828 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $167.**

2002 SURCHARGES

- The quantified cost to the utility was $16,011 ($186 per participant), which includes the cost of labor.
- The quantified benefit to the utility was $30,157 ($351 per participant), which includes income from the surcharges.
- The quantified cost to the participants was $30,157 ($351 per participant), which includes the cost of the surcharges.
- The quantified benefit to the participants was $195,519 ($2,273 per participant), which includes the water bill savings.

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2002	Quantified Costs and Benefits							
Utility					Participants			
Costs		Benefits			Costs		Benefits	
Labor	$16,011	Surcharges	$30,157		Surcharges	$30,157	Water Bill Savings	$195,519
Total	$16,011	Total	$30,157		Total	$30,157	Total	$195,519

UTILITY PERSPECTIVE - 2002
Results of cost benefit analysis show a net benefit (net present value) of $14,146 from the utility perspective. This is a net benefit of $164 per participant. The quantified costs to the utility were less than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $46.**

PARTICIPANT PERSPECTIVE - 2002
Results of cost benefit analysis show a net benefit (net present value) of $165,362 from the participant perspective. This is a net benefit of $1,932 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $87.**

OVERALL PERSPECTIVE - 2002
Results of cost benefit analysis show a net benefit (net present value) of $179,508 from an overall perspective. This is a net benefit of $2,087 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $134.**

ALL YEARS

- The quantified cost to the utility was $35,210 ($193 per participant), which includes the cost of labor.
- The quantified benefit to the utility was $65,569 ($360 per participant), which includes income from the surcharges.
- The quantified cost to the participants was $65,569 ($360 per participant), which includes the cost of the surcharges.
- The quantified benefit to the participants was $390,197 ($2,144 per participant), which includes the water bill savings.

ALL YEARS	Quantified Costs and Benefits							
Utility					Participants			
Costs		Benefits			Costs		Benefits	
Labor	$35,210	Surcharges	$65,569		Surcharges	$65,569	Water Bill Savings	$390,197
Total	$35,210	Total	$65,569		Total	$65,569	Total	$390,197

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UTILITY PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $30,359 from the utility perspective. This is a net benefit of $353 per participant. The quantified costs to the utility were less than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $52.**

PARTICIPANT PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $324,628 from the participant perspective. This is a net benefit of $3,775 per participant. The quantified costs to the participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $97.**

OVERALL PERSPECTIVE - ALL YEARS

Results of cost benefit analysis show a net benefit (net present value) of $354,987 from an overall perspective. This is a net benefit of $4,128 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $150.**

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **There were no unquantified costs.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness about water conservation.**
- **Water saved for future municipal use.**
- **Reduced groundwater depletion and surface water use.**

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Eastern Municipal Water Dist.

Surcharge Program

2001

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	19,199	NA	19,199
Costs to Participants	NA	35,412	35,412
Costs to Others	NA	NA	0
Total Costs	$19,199	$35,412	$54,611
Present Value Benefits			
Total Water Savings	327.91 AF	327.91 AF	327.91 AF
Benefits to Utility	35,412	NA	35,412
Benefits to Participants	NA	194,678	194,678
Benefits to Others	NA	NA	0
Total Benefits	$35,412	$194,678	$230,090
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$16,213	$159,266	$175,479
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$59 /AF	$108 /AF	$167 /AF

2002

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	16,011	NA	16,011
Costs to Participants	NA	30,157	30,157
Costs to Others	NA	NA	0
Total Costs	$16,011	$30,157	$46,168
Present Value Benefits			
Total Water Savings	345.56 AF	345.56 AF	345.56 AF
Benefits to Utility	30,157	NA	30,157
Benefits to Participants	NA	195,519	195,519
Benefits to Others	NA	NA	0
Total Benefits	$30,157	$195,519	$225,676
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$14,146	$165,362	$179,508
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$46 /AF	$87 /AF	$134 /AF

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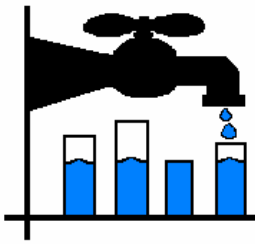

Eastern Municipal Water Dist.

Surcharge Program

ALL YEARS

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	35,210	NA	35,210
Costs to Participants	NA	65,569	65,569
Costs to Others	NA	NA	0
Total Costs	$35,210	$65,569	$100,779
Present Value Benefits			
Total Water Savings	673.47 AF	673.47 AF	673.47 AF
Benefits to Utility	65,569	NA	65,569
Benefits to Participants	NA	390,197	390,197
Benefits to Others	NA	NA	0
Total Benefits	$65,569	$390,197	$455,766
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	$30,359	$324,628	$354,987
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$52 /AF	$97 /AF	$150 /AF

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Castle Rock Utilities Dept.

Water Wiser Class Program

The Town of Castle Rock Utilities Department's (TCR) service area is in the town of Castle Rock, located in Douglas County, Colorado, midway between Denver and Colorado Springs. TCR serves a population of approximately 35,000 people. As of the 2000 census, the median household income for the town of Castle Rock was $64,138, which is higher than the statewide median of $47,203.[1]

UTILITY DEMOGRAPHICS

As of July 2005, TCR maintained 10,689 connections, of which 94% were residential. Of the total connections, 9,715 were single family residential, 292 were multifamily residential, 371 were commercial, 169 were irrigation, 30 were churches and schools, and 103 were municipal buildings and parks. TCR's total service area is approximately 33 square miles. As of 2004, average residential water use in gallons per capita per day (gpcd) was 168.4.

WATER WISER CLASSES

Eligible Customers:	**Single Family Residential**
Customers Analyzed:	**Single Family Residential**
Program Years:	**2002-present**

UTILITY RATE STRUCTURE AND PRICES

TCR has an increasing block rate structure. The monthly base rate for water service to a single family residential connection is $11.80 per month. The price per unit of water is as follows:

Usage	Price
0 - 5,000 gallons	$2.24/1,000g
5,001 - 15,000 gallons	$3.13/1,000g
Over 15,000 gallons	$5.01/1,000g

CURRENT CAPACITY AND WATER SOURCES

TCR has a water delivery system comprised of about 30 operational wells located throughout Castle Rock, which can produce a maximum of 13.2 million gallons per day at full pumping capacity. Additionally, there are 13 active reservoirs capable of storing more than 22 millions gallons of water.

About 96% of Castle Rock's water is pumped from the Denver Basin that contains four principal deep groundwater aquifers: the Arapahoe, Denver, Dawson, and Laramie-Fox Hills. The remaining 4% comes from shallow alluvial wells.[2]

FUTURE PLANS TO MEET DEMAND

TCR service area is growing at a rate of 12% per year. TCR plans to meet its future water needs by continuing the use of its deep ground aquifers, by exploring other surface water sources, by expanding facilities through increased well drilling, and through conservation.

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[1] US Census Bureau. FactFinder.
[2] Castle Rock's Water, Town of Castle Rock.

WATER WISER CLASSES - DESCRIPTION

Since 2002, TCR has offered Water Wiser water conservation classes to teach its customers how to irrigate efficiently, to share information on low water use plants, and to discuss the town's water situation. Residents who participate in the class are exempt from TCR's mandatory watering restrictions. They must take the class each year to be exempt from the watering restrictions and to be a part of the Water Wiser program.

OTHER CASTLE ROCK CONSERVATION PROGRAMS

Irrigation Timer Rebate Program, ***start date unknown***

Mandatory Water Restrictions, ***1985-present***

"every-third-day/specific hours" watering program, May 1 through September 30.

Landscape Regulations, ***July 2003-present***

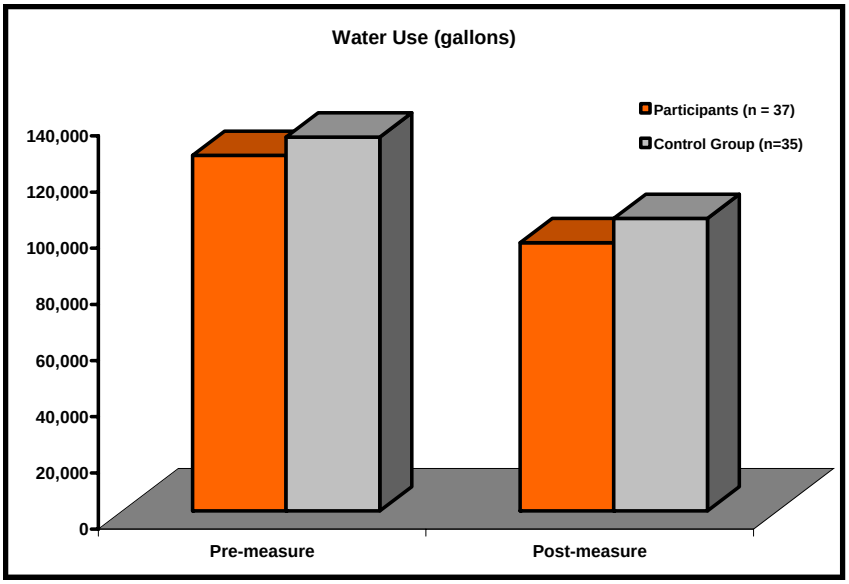
requires all non-residential, residential and multifamily building have landscape designs approved by the Town.

METHODOLOGY

Please see the General Methodology for the specific procedures and techniques used for all ECoBA analyses.

The analysis includes only single family customers that participated in the Water Wiser Classes during 2003, held on May 24 and July 19. The water savings were calculated and a cost benefit analysis was performed for 2003. The findings refer to 2003 only, not to the ongoing program. The lifespan of the conservation classes, which is used as the period of this analysis, was assumed to be five years.

All quantified costs and benefits have been discounted to the first year of the analysis (2003) and inflated to 2004 dollars. The 2003 discount rate used for this analysis was 3.6%. The Consumer Price Index values used in this analysis were the 2004 value of 188.9 and the 2003 value of 184.0.



The participant population studied for this analysis was comprised of customers who attended the Water Wiser classes in May and July of 2003. Fifty-five customers attended the class during this time period. Of those 55 participants, 37 customers were usable for this

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analysis. Sufficient raw data was not available for 18 program participants (33%).

The control group was comprised of Castle Rock single family residential households who lived nearby those customers participating in the Water Wiser classes, with similar lot sizes. The control group consisted of 35 households. The average pre-measure annual water use of the participants (126,568 gallons) was less than that of the control group (133,129 gallons).

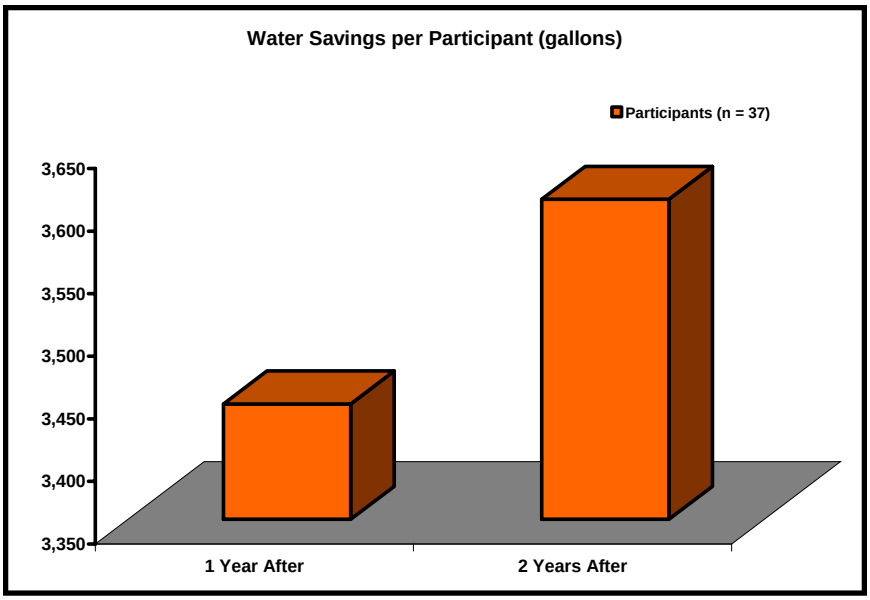
ASSUMPTIONS

Please see the General Assumptions for the specific conditions and rules underlying all ECoBA analyses.

The 2003 CPI value, 184.0, and the 2004 CPI value, 188.9, were used in this analysis.

The 2003 discount rate of 3.6% was used in this analysis.

The control group consisted of single family households located nearby those who participated in the Water Wiser classes.



The value of the water saved was calculated by multiplying the amount of water saved per fiscal year by the average the price of water from throughout the fiscal year, from the second tier ($2.86 per 1,000 gallons in 2002/2003, $2.97 per 1,000 gallons in 2003/2004, and $3.08 per 1,000 gallons in 2004/2005, and $3.19 per 1,000 gallons in 2005/2006 and beyond).

RESULTS - WATER SAVINGS

The first year after the Water Wiser classes, the water savings amounted to 127,360 gallons, or 3,442 gallons per participant per year (gppy) (2.7% of pre-measure water use). The second year after the classes, the water savings amounted to 133,411 gallons or 3,606 gppy (2.9% of pre-measure water use). Average savings per year was 130,386 gallons or 3,524 gppy (2.8% of pre-measure water use). **Total savings over the five year assumed lifespan was 651,930 gallons (2.0 AF) or about 17,620 gallons per participant.**

During the two years before the Water Wiser classes, the participant group's water usage was 95.1% of the control group's usage, on average. During the two years after the Water Wiser classes, the participant group's water usage was 91.7% of the control group's

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usage, on average. The participant group's water use decreased by 24.5%, whereas the control group's use decreased by 21.8%. **The resulting overall water savings attributed to this program was 2.7%.**

RESULTS - COST BENEFIT ANALYSIS

Costs and benefits listed below represent the entire lifespan of the program (five years).

- The quantified cost to the utility was $1,027 ($28 per participant), which includes printed materials, advertising, labor, and rain gauges.
- The quantified benefit to the utility was $0.
- The quantified cost to participants was $0.
- The quantified benefit to participants was $1,947 ($53 per participant), which includes water bill savings.

Quantified Costs and Benefits						
Utility				Participants		
Costs		Benefits		Costs	Benefits	
All Costs	$1,027	Not Quantified		Not Quantified	Water Bill Savings	$1,947
Total	$1,027				Total	$1,947

UTILITY PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of -$1,027 from the utility perspective. This is a net benefit of -$28 per participant. The quantified costs to the utility were greater than the quantified benefits to the utility. **The cost per acre-foot of water saved from the utility perspective was $513.**

PARTICIPANT PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $1,947 from the participant perspective. This is a net benefit of $53 per participant. The quantified costs to program participants were less than the quantified benefits to the participants. **The cost per acre-foot of water saved from the participant perspective was $0.**

OVERALL PERSPECTIVE

Results of cost benefit analysis show a net benefit (net present value) of $920 from an overall perspective. This is a net benefit of $25 per participant. The quantified costs to the participants and utility were less than the quantified benefits to the participants and utility. **The cost per acre-foot of water saved from an overall perspective was $513.**

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Castle Rock Utilities Dept.

Water Wiser Class Program

Results of Cost Benefit Analysis-Lifespan (5 Years)

	UTILITY	PARTICIPANT	OVERALL
Present Value Costs			
Costs to Utility	1,027	NA	1,027
Costs to Participants	NA	0	0
Costs to Others	NA	NA	0
Total Costs	$1,027	$0	$1,027
Present Value Benefits			
Total Water Savings	2.0 AF	2.0 AF	2.0 AF
Benefits to Utility	0	NA	0
Benefits to Participants	NA	1,947	1,947
Benefits to Others	NA	NA	0
Total Benefits	$0	$1,947	$1,947
Cost Benefit Calculations			
Net Present Value (NPV) (Total Benefits - Total Costs)	-$1,027	$1,947	$920
Cost Effectiveness Analysis (CEA) (Total Costs ÷ Total Water Savings)	$513 /AF	$0 /AF	$513 /AF

UNQUANTIFIED COSTS AND BENEFITS

Costs

- **Participant's time spent in classes.**

Benefits

- **Financial savings on sewer bills for participants.**
- **Avoided cost of acquisition and distribution of water saved.**
- **Environmental benefits of reduced water use.**
- **Increased public awareness about water conservation.**
- **Reinforces need to conserve water and desirability of conserving.**
- **Program participants were exempt from watering restrictions.**
- **Water saved for future municipal use.**

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ANNOTATED BIBLIOGRAPHY

A & N Technical Services, Inc. *BMP Costs & Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices, July 2000.* Santa Monica, CA: A & N Technical Services, Inc. for California Urban Water Conservation Council, 2000.

- These guidelines link conservation program costs and water savings to the Memorandum of Understanding Regarding Urban Water Conservation in California's set of Best Management Practices.
- This report identifies and summarizes the best available information about program costs and water savings.
- Assesses the reliability and generalizability of information currently available for quantifying and valuing conservation activity and for preparing cost-effectiveness exemption claims.
- Identifies the absences of, and notes critical deficiencies in, cost and savings estimates needed to quantify and measure the cost-effectiveness of specific BMPs.

Beecher, J.A., T.W. Chestnutt, and D.M. Pekelney. *Socioeconomic Impacts of Water Conservation*. Denver, CO: AWWA Research Foundation, 2001.

- This report explores the interrelationship between water conservation programs and socioeconomic characteristics and impacts.
- This report uses a simplified conceptual model to illustrate how socioeconomic characteristics and socioeconomic impact variables are related to water use and conservation on page 14.
- There is a table that provides a basic framework for understanding the connection between conservation and affordability on page 52.
- There is a list of the range of possible socioeconomic impacts that might result from conservation programs on pages 63-65.
- Page 71 has a benefit-cost assessment of Denver's low-income conservation program.
- There is a list of benefits from selected utility programs on page 89.
- Chapter 6 provides a planning and evaluation framework that water utilities can use for data collection and impact assessment. Includes a summary and various tables and descriptions of analytic tools such as cost-effectiveness analysis and net-benefit analysis (pp. 91-102).

California Department of Water Resources. *Sample 2000 Urban Water Management Plan.* California, 2000.

- The California Department of Water Resources prepared this 2000 sample urban water management plan for the imaginary City of New Albion. This sample plan is a guide, synthesized from local water supplier experiences, and is designed to

illustrate how to effectively prepare an urban water management plan.

California Urban Water Agencies with California Urban Water Conservation Council and United States Environmental Protection Agency. *A Guide to: Customer Incentives for Water Conservation.* California, 1994.

- This handbook is intended as a guide to help water agencies through the process of selecting incentives that are appropriate and cost-effective for their jurisdiction.
- Incentives are divided into four categories:
  - Information incentives
  - Access to conservation technologies
  - Cash transfers
  - Financing

California Urban Water Conservation Council. *Guidelines for Preparing Cost-Effectiveness Analyses of Urban Water Conservation Best Management Practices.* California, 1996.

- The purpose of this manual is to develop guidelines to conduct consistent cost-effectiveness analyses of Best Management Practices and Potential Best Management Practices based on sound economic principles

Campbell, H.E. and R.M. Johnson*. The Cookbook: Doing Multivariate Analysis of Residential Single-Family Water Conservation Programs*. Tempe, AZ: Morrison Institute for Public Policy, 1999.

- This book describes some basic rules of thumb for performing multivariate analysis of single family residential conservation programs. It is written so that water providers who may not have a strong background in statistics will be able to do a sound analysis of their programs. It includes:
  - How much and what kind of data you need ideally and as a bare minimum.
  - How to organize and clean your data for analysis.
  - How to perform different types of analyses and possible problems with each.
  - How to interpret the results from these analyses.

Campbell, H.E., R.M. Johnson, and E.H. Larson. *Prices, Devices, People, or Rules: The Relative Effectiveness of Policy Instruments in Water Conservation.* Tempe, AZ: Arizona State University, 2000.

- This paper presents results from a multivariate regression analysis incorporating variables controlling for several categories (forty-one variables were used to control for five categories).

Chestnutt, T.W. *Performance Standards for Demonstrating Urban Water Conservation*. California: A & N Technical Services, Inc. for California Urban Water Conservation Council, 1997.

- This book discusses the idea of performance standards, provides a description of alternative standards and describes measurement issues associated with each alternative.
- This book also discusses implementation issues related to compliance monitoring and provides a summary of the

advantages and disadvantages of each performance alternative.

- The alternative performance standards presented include percentage cutback, per capita targets, percentage reduction of forecast demand, and cost-effectiveness of conservation practices.

Dueker, L. and P. Regli. *Goal Billing: A Water Conservation Surcharge/Discounts System*. Scottsdale, AZ: City of Scottsdale Water Resources Department.

- This report discusses the goal billing system, which is a water conservation surcharge and discount rate system that is designed to encourage water conservation.

Gary Fiske & Associates. *California Urban Water Agencies Urban Water Conservation Potential Final Report.* Portland, OR: Gary Fiske & Associates, 2001.

- This study estimates potential savings for a subset of water conservation Best Management Practices assuming full implementation of the Memorandum of Understanding Regarding Urban Water Conservation in California.

Gerston, J., M. MacLeod, and C.A. Jones. *Efficient Water Use for Texas: Policies, Tools, and Management Strategies.* College Station, TX: Texas Agricultural Experiment Station and Texas A&M University, 2002.

- This paper presents alternative conservation and water management strategy options, the challenges of implementing them, and their overall costs and benefits.

Gleick, P. H., et al. *Waste Not, Want Not: The Potential for Urban Water Conservation in California.* Oakland, CA: The Pacific Institute, 2003.

- This report discusses the potential for urban water conservation in California, including how much can be saved and where it can be saved. They estimate that 1/3 of California's current use (more than 2.3 million AF) can be saved with existing technology. And 85% of this can be saved at less cost than developing new sources. The document estimates potential savings by sector and by end use.

Longsrtreth, M. and R.B. Billings. *Water Use and Conservation in Multiple Family Dwellings in Tucson, Arizona.* Tucson, AZ: University of Arizona, 1990.

- This report on the Tucson Water project studies water use and conservation in apartments that were randomly selected in Tucson.

Mayer, P.W., K.D. DiNatale, W.B. DeOreo, and D.M. Lewis. *Show me the savings! Do new homes use less water?* Westminister, CO: Aquacraft, Inc., 1999.

- This study examines water use in four samples of homes in the City of Westminster, Colorado:
    - Homes built prior to 1977
    - Homes built from 1984-1993
    - Homes built after 1997

    - Water Wise homes built in 1998 specifically to use less water
- The study disaggregates water use into component end uses such as toilets, faucets, clothes washers, showers, etc. and compares the use at the fixture level, on a daily per capita basis, and in terms of annual demand.
- Also examines irrigation water use.
- Research was carried out by conducting audits at the 40 homes selected for the study.
- Results were compiled completed using a combination of historic billing data, data provided by the City, the analyzed flow trace data, and the audit results.

Metropolitan Domestic Water Improvement District. ***Toilet Rebate Program and Toilet Leak Detection Program for Existing Residential Customers.*** **Tucson, AZ: Metro Water District, 2000.**

- This report summarizes Metro Water District's toilet rebate program including the cost of replacing the toilets and an estimate of how much water was saved.
- This report also includes a summary of the results of an outdoor water self-audit as well as the cost to implement the audit and a comparison of the water histories of the audits received.
- The report discusses the landscape water advice guide mailed to each District, the welcome packets given to new homeowners, ordinances, public information and education programs, etc.
- Includes a copy of Metro Water District's rate structure.

Michelsen, A.M., J.T. McGuckin, and D.M. Stumpf. ***Effectiveness of Residential Water Conservation Price and Non-price Programs*****. Denver, CO: AWWA Research Foundation, 1998.**

- The purpose of this study is to build upon and extend previous water conservation research efforts to evaluate the effects of price and non-price conservation programs on residential water demand in different urban areas of the southwestern United States.
- Three models of residential water demand were tested using maximum likelihood regression techniques.
- Analyzes data using statistical methods such as ANOVA and regression to identify trends water use, impacts of water conservation efforts, and socioeconomic and climatic-related parameter changes.
- Uses linear and multiplicative models.
- Uses the revenue-consumption model to analyze the effectiveness of alternative rate structures on residential water savings.

Montgomery Watson. ***City of Houston Water Conservation Plan*****. Houston, TX: Montgomery Watson, 1997.**

- This water conservation plan, prepared by Montgomery Watson, considers over 200 conservation measures and evaluates 20 conservation programs in order to provide the City of Texas with one recommended plan. The measures were evaluated using present value cost-benefit analysis, and water savings, benefits, and costs were estimated.

The Morrison Institute. ***Some Best Bets in Residential Water Conservation: Results of Multivariate Regression Analysis, City of Phoenix, 1990-1996 Final Report.*** **Tempe, AZ: Morrison Institute, 1999.**

- This report documents and analyzes the results of a multivariate regression analysis designed to estimate the effects on residential, single-family water consumption of a host of factors, particularly water conservation policies.

Moxley, M. A memo to Warren Tenney re: Analysis of Toilet Rebate Program. Tucson, AZ: Metropolitan Domestic Water Improvement District, 8 June 2001.

- This memo summarizes in a graph the conclusions made after evaluating the consumption records of the participants of the toilet rebate program for 1998-1999. Results show that there was a 9% reduction in total water use by participants and an 8% reduction in the average monthly water consumption of participants.

Pekelney, D.M. et al. ***Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation.*** **California, 1996.**

- Guidelines of the use of cost-effectiveness analysis in defining Best Management Practices (BMPs) for urban water conservation in California.
- Urban water suppliers, environmental organizations, and other interested parties signed a Memorandum of Understanding (MOU) to implement BMPs.
- The California Urban Water Conservation Council (CUWCC) was established to oversee the definition of BMPs and their implementation. The fundamental criterion, established in the MOU, for defining BMPs is cost- effectiveness. Hence, to implement the MOU, guidelines were needed to conduct and evaluate CEA studies.

Pekelney, D.M., T.W. Chestnutt, and D.L. Mitchell. ***Cost-Effective Cost-Effectiveness: Quantifying Conservation on the Cheap.***

- This paper presents concrete alternatives by which the results of a water conservation program can be quantified in a reliable and cost-effective manner.
- Gives recommendations for conducting a cost-effectiveness analysis and cost-benefit analysis and how to obtain NPV.
- Discusses avoided costs (avoided cost of wastewater treatment, avoided energy costs, etc.).
- Discusses discounting costs and benefits.

Planning and Management Consultants, Ltd. ***Evaluation of Urban Water Conservation Programs: A Procedures Manual.*** **Carbondale, IL: Planning and Management Consultants, Ltd., 1992.**

- This manual defines water conservation and then describes a procedure for a systematic analysis of water conservation alternatives divided into two parts: conservation planning and evaluation procedures.
- The purpose of the planning portion of the manual is to determine conservation potential and conservation opportunities

for a water service area and to conduct a preliminary evaluation of conservation measures with respect to their potential water Protection savings, costs, and benefits.
- The purpose of the program evaluation portion of the manual is to provide concepts and procedures for generating estimates of reliable water savings, program costs, and other conservation parameters that are used in the formulation and evaluation of demand reduction alternatives in the conservation planning process.

San Antonio Water System Conservation Division. ***2001 Water Conservation Report*****. San Antonio, TX: San Antonio Water System, 2001.**

- This report provides a record and analysis of conservation program results in San Antonio for 2001.
- Includes a section on "outcome measures" that describes a process of reviewing current and imminent programs in terms of water savings, cost for water saved and general budget.
- Includes a "per capita use water analysis" that relates water use to PET (Potential Evapotranspiration) to determine the effect of drought restrictions on water use.

Saving Water Partnership. ***Regional 1% Water Conservation Program 2002 Annual Report.*** **Seattle, WA, 2003.**

- This report reviews the annual progress of the 1% Program, a program aimed at helping customers served by the Seattle Public Utilities water supply implement conservation behaviors and equipment.
- Cost-effective conservation measures as well as short and long-term savings are illustrated in the report.

Sheikh, Bahman. ***Building Water Conservation into New Homes in Chula Vista, California.*** **San Francisco, CA: 2001.**

- An economic analysis was conducted comparing 14 specific water conservation options, their characteristics, costs, benefits, and feasibility of implementation during the construction state of new residential development.
- There is a Benefit/Cost Analysis of Water Conservation Measures.
- **Discount rate of 7% is mentioned on page 13.**

Southwest Florida Water Management District. ***Development of Water Conservation Options for Non-Agricultural Water Users.*** **Florida, 2000**.

- This study identifies, evaluates, and prioritizes non-agricultural water conservation measures in the Central and Southern region of Southwest Florida Water Management District.
- Includes an inventory and evaluation of the previous, existing, and future water conservation measures for the non-agricultural water uses (Appendix B-1 includes costs and savings of conservation measures and detailed lists of costs and benefits can be found throughout the report).
- Section 3 provides detailed descriptions of voluntary and mandatory conservation measures and evaluates them with

respect to water savings potential and cost-effectiveness (calculates total present worth of program costs using a discount rate of 8%).
- Section 4 provides detailed descriptions of the feasibility, implementation, and cost analysis of individual water conservation measures and includes water savings, program costs, and the cost-effectiveness ratio of selected programs.
- Concludes with the estimated total program costs, projected water savings, and the overall cost-effectiveness ratio.

Sovocool, K.A. and J.L. Rosales. *A Five-Year Investigation into the Potential Water and Monetary Savings of Residential Xeriscape in the Mojave Desert*. Las Vegas, NV: Southern Nevada Water Authority.

- This study quantifies the residential water and economic savings realized by converting from traditional turf grass to xeric landscaping in the Mojave Desert.
- Lists Best Management Practices, which provide the framework for implementing the water conservation plan.
- Data & Data Analyses included:
    - Datalogger analyses for quantification of outdoor irrigation
    - Pre/Post-Conversion Analysis using monthly consumption data from five years before conversion to as many years after conversion as records permitted.
    - Analysis of Economics (data on landscape maintenance economics was obtained via surveys sent to study participants)
    - Comparative Consumption Data (annual consumption on a per area basis)
    - Comparative Irrigation Cost Data (annual cost to irrigate a 100 square feet of xeric area and turf grass)
    - Xeric Area System Design and Consumption Data (flow rates for each irrigation station)
    - Xeric Area Canopy Coverage and Consumption Data (impact of coverage on mean annual consumption)

Tucker, Jeff. 2003. "Saving water isn't cheap." *Arizona Daily Sun* 6 July 2003.

- This article discusses the impact of water conservation on revenues in Flagstaff -- less water consumption means less revenue for the City utilities.
- In spite of conservation measures, the City uses more water due to growth, which offsets the loss in revenue from the conservation but does little to address the long range concern that more water is being used every year in Flagstaff.

U.S. Environmental Protection Agency. *Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs*. USEPA, 2002.

- This report illustrates how 17 different water utilities across the United States are saving water through strategic water-efficiency programs. (There's a concise summary table at the front of the report that lists each city's problem, approach, and results.)

U.S. Environmental Protection Agency. *Water Conservation Plan Guidelines*. Washington, D.C.: USEPA, 1998.

- These guidelines are for use by water utilities in preparing a water conservation plan.

Vickers, Amy. *Water Use and Conservation*. Amherst, MA: WaterPlow Press, 2001.

- This book responds to water needs by addressing where and how water is used and then applying effective efficiency technologies and practices that form the basis for water conservation.
- The book is divided into six chapters, most of which describe the costs and benefits of the efficiency measure being addressed in the chapter:
    - Planning a Successful Water Conservation Program
    - Residential and Domestic Water Use and Efficiency Measures
    - Landscape Water Use and Efficiency Measures
    - Industrial, Commercial, and Institutional Water Use and Efficiency Measures
    - Agricultural Water Use and Efficiency Measures
    - The Water Conservation Network
- Page 360 and others discuss evapotranspiration.

Western Resource Advocates. *"Smart Water: A Comparative Study of Urban Water Use Efficiency Across the Southwest."* Boulder, CO: Western Resource Advocates, 2003.

- The report offers detailed recommendations for addressing efficiency shortfalls, as well as providing substantial city-by-city data.
- It gives southwestern towns and cities a means of measuring their water efficiency against others in the region, inventories cutting-edge efficiency practices, and shows how they can be implemented.
- Variations in regional climate do not account for variations in metropolitan water use.

***Xeriscape Conversions Residential and Commercial Case Studies.* "Saving Money Through Xeriscape" Conference. Tucson, AZ: Sawara and Tucson Water, 1992.**

- This report summarizes costs and savings resulting from converting six lots to Xeriscape in Tucson.