Water Conservation Keeps Rates Low in Tucson, Arizona

Demand Reductions Over 30 Years Have Dramatically Reduced Capital Costs in the City of Tuscon

JUNE 2017

Alliance for Water Efficiency

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Acknowledgements

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Avoided Cost Overview

"Why do you ask me to conserve and then raise my rates?" asked a concerned Arizona customer at a public utility meeting. This is an important and reasonable question that customers across the U.S. are asking their water providers. The City of Tucson's Avoided Cost Analysis[1] answers this question through its rigorous review of the overall impact of water conservation on water and wastewater rates. Water and wastewater rates in Tucson are actually lower today than they would have been if the City had not implemented strong water conservation actions and policies.

Water conservation in Tucson has had a profound impact on the City, and on Pima County, by having reduced per capita demand thereby leveling off total production. This reduction in customer water use has extended the City's water supply decades into the future. This in turn helped Tucson avoid purchasing additional water supplies, defer investments in new large-scale infrastructure projects and system expansion projects, and has been able to scale down the size of new water and wastewater facilities.

In this study, two separate entities – the City of Tucson Water Department (Tucson Water) and Pima County Regional Wastewater Reclamation Department (PCRWRD) worked with Peter Mayer, P.E. and Principal of WaterDM, to carefully examine the impact of increased water conservation in Tucson on the City's rates. Staff from Tucson reviewed water demand records, water rates, connection fees, and capital project costs from the past 30 years with the following question in mind:

> ***What would water and wastewater rates be today if per-customer water demands had remained unchanged?***

The results of this study show that today Tucson customers pay water and wastewater rates that are at least 11.7% lower than they would have been if Tucson residents had not decreased per capita water use and lowered overall demand. Essentially, by conserving water each water and wastewater customer has avoided the costs of acquiring, delivering and treating additional water supplies that would have been necessary to provide a reliable water supply to a growing population.

The purpose of this avoided cost analysis is to quantify the impacts of water conservation and subsequent per capita demand reductions achieved in Tucson over the past 30 years on the City's water and wastewater rates.

1 This avoided cost analysis approach was originally developed by WaterDM and the City of Westminster, Colorado, and was published in the April 204 issue of the AWWA Journal. See Feinglas, S., C. Gray, and P. Mayer. 2014. Conservation efforts limit rate increases for Colorado utility. Journal AWWA, April 2014, 106:4, Denver, Co.

Changes in Water Use and Population

Despite a growing population, Tucson Water's potable production has declined steadily over the past ten years.

To explore the effects of increased conservation and demand management on water rates, the staff examined the historic water use patterns in Tucson. Figure 1 shows the entire history of potable water production in Tucson from 1899 to 2015. This figure charts the course of a desert city that exploded with growth starting in the 1950s and sharply increased groundwater pumping to meet population demands.

The most remarkable aspects of Figure 1 are the leveling off of water production around the year 2000 and the decline in water production measured in Tucson from 2005 to 2015. Despite a growing population, Tucson Water's potable production has declined steadily over the past ten years. It is this reduction in demand that spurred the avoided cost analysis presented in this report, which describes the impact of these changes on customer water and wastewater rates.

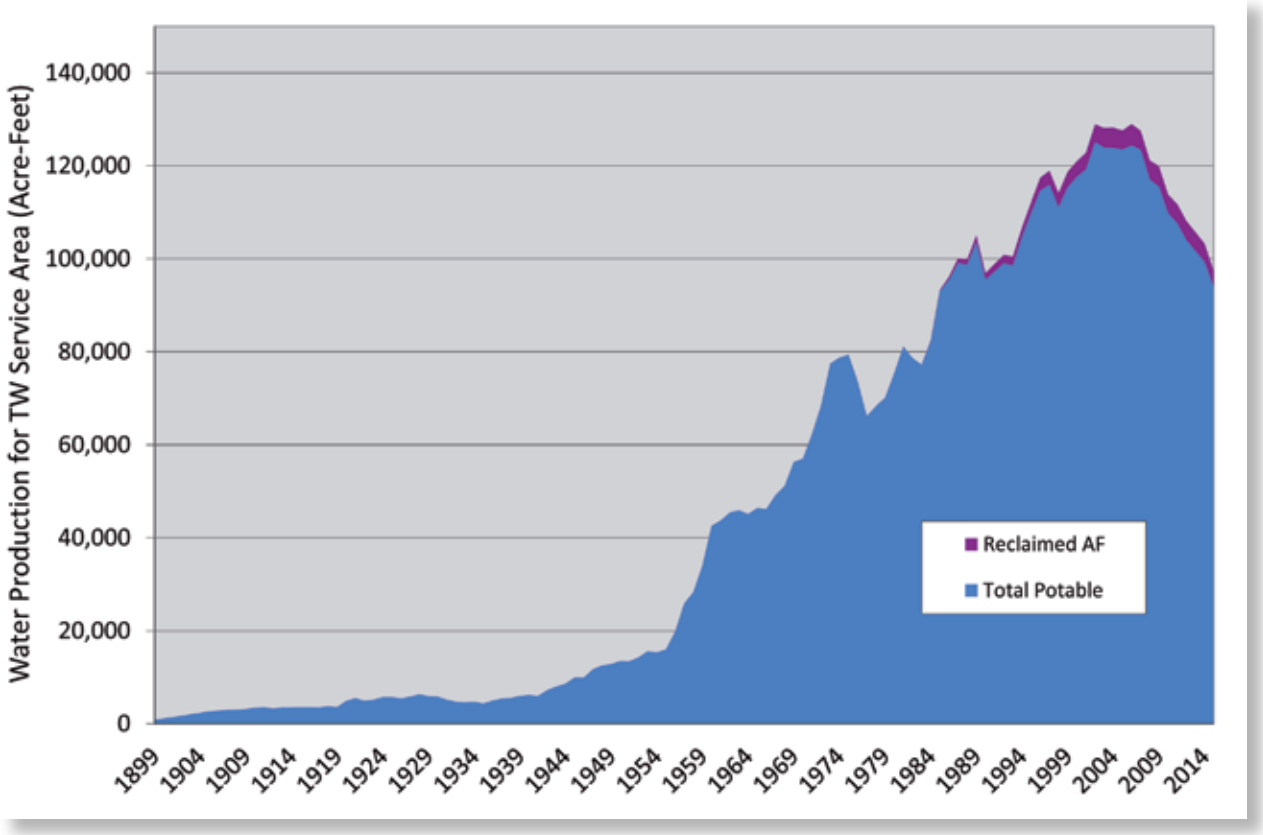


Figure 1: Water production by Tucson Water from 1899 - 2015 [2]

Figure 2 illustrates the same data as Figure 1, but provides a closer look at the last three decades from 1980 to 2015. Tucson Water's production in 2015 was about the same as it was 20 years earlier in 1985, when the population had about 200,000 fewer residents. From 2005 to 2015, annual water production in Tucson declined by 23.3%. These changes in water production are in fact the results of water conservation programs and policies put into place by Tucson Water and Pima County Wastewater Reclamation, as well as the state and federal government.

The water conservation achieved in Tucson resulted from a combination of utility-sponsored conservation programs, community outreach campaigns and tiered rate structures, as well as from national plumbing code changes and technological improvements that have helped reduce total and per capita demands.

2 Data Sources: 1899-1956: Typed Copy from Archives, 1957-1983: Sum of Total Annual Well Production from Hydro Database, 1984-2012: Annual Water Withdrawal and Use Reports. Special thanks to Michael Liberti and Jonathan Sax for Archives Discovery.

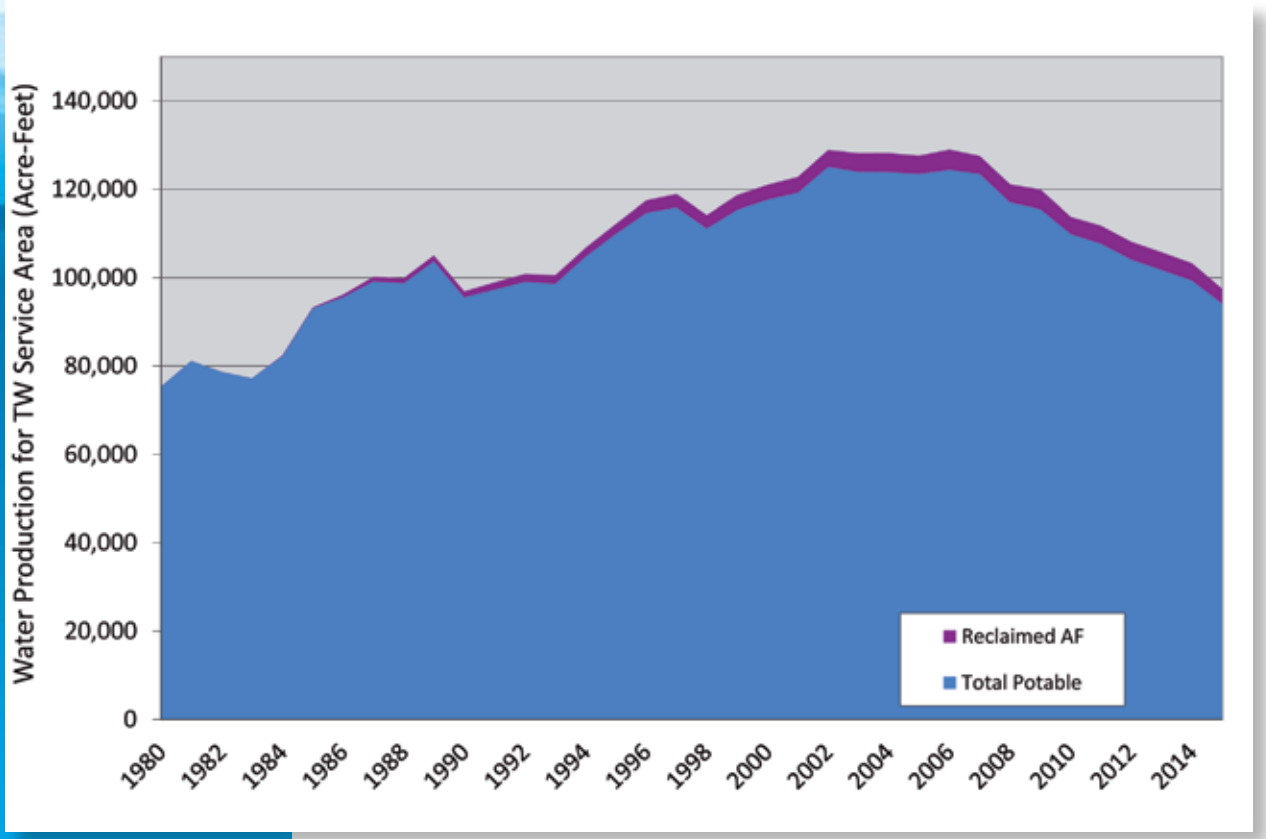


Figure 2: Water production by Tucson Water from 1980 – 2015

The demand reductions in Tucson shown in Figure 1 and Figure 2, have been caused in no small part by increased conservation in the single-family residential sector. Residential customers are the largest demand sector in Tucson and increased water conservation within this sector has helped drive down overall system demand down. Since 1985, Tucson's single-family sector has become substantially more efficient on average.

Over the same period of time from 2005 to 2015 Tucson Water's production declined by 23%, while the population was simultaneously increasined by more than 21,000 people (4.6%). Figure 3 shows the population of the Tucson Water service area from 1980 to 2015, a period which saw the population expand by 292,000 people (69.8%) from 425,000 to nearly 718,000. The substantial increases in population in the Tucson Water service area makes the reductions in water production all the more remarkable: in Tucson, water conservation gains have outpaced population gains over the last 10 years.

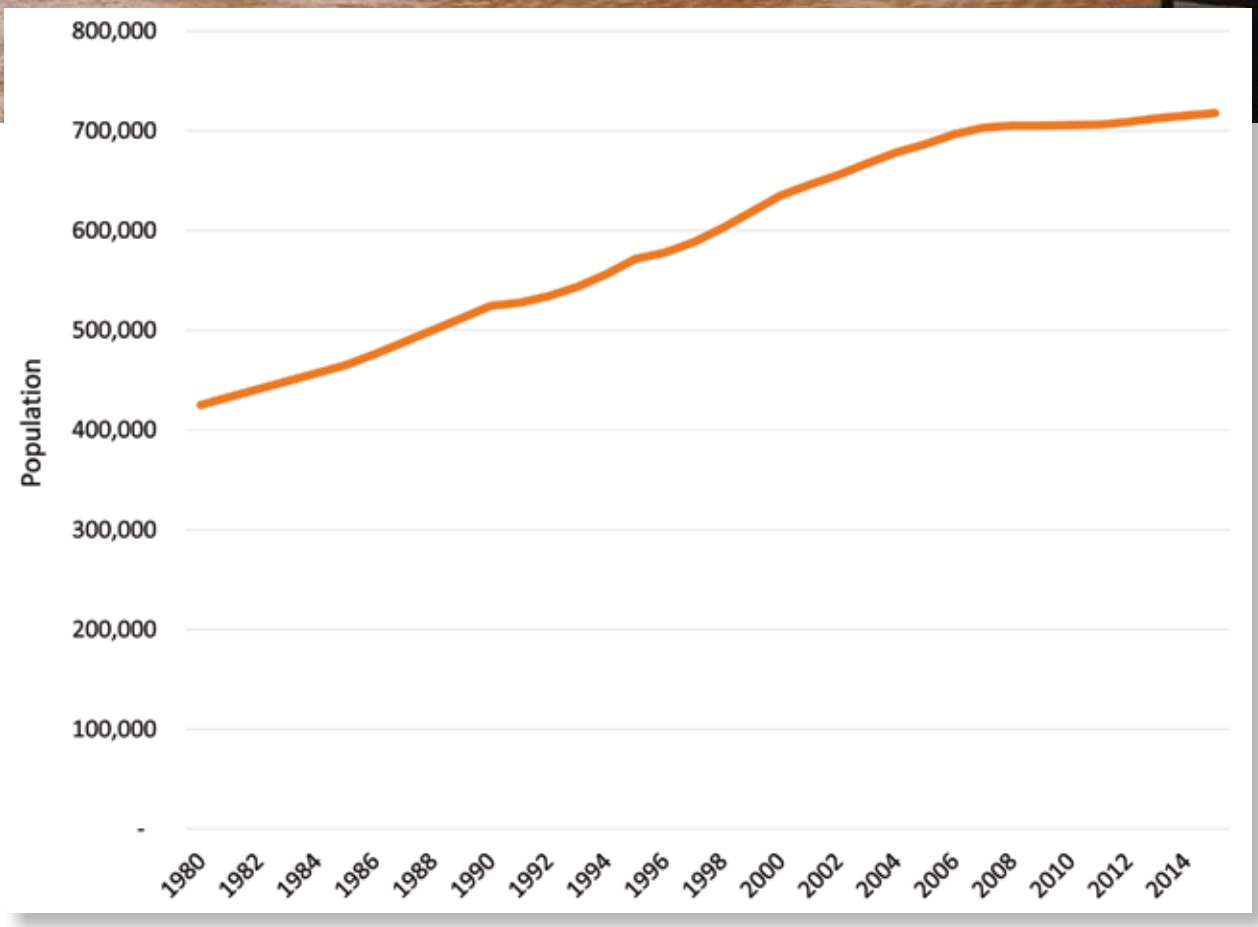


Figure 3: Tucson Water service area population, 1980 – 2015

Figure 4 shows the average annual water use of single-family homes in Tucson from 1985 to 2015 in gallons. Annual use for a single-family home in Tucson peaked in 1989 at 128,100 gallons and has declined to 74,000 gallons in 2015. This is a remarkable, 42% reduction in the average water use of single-family homes in Tucson.

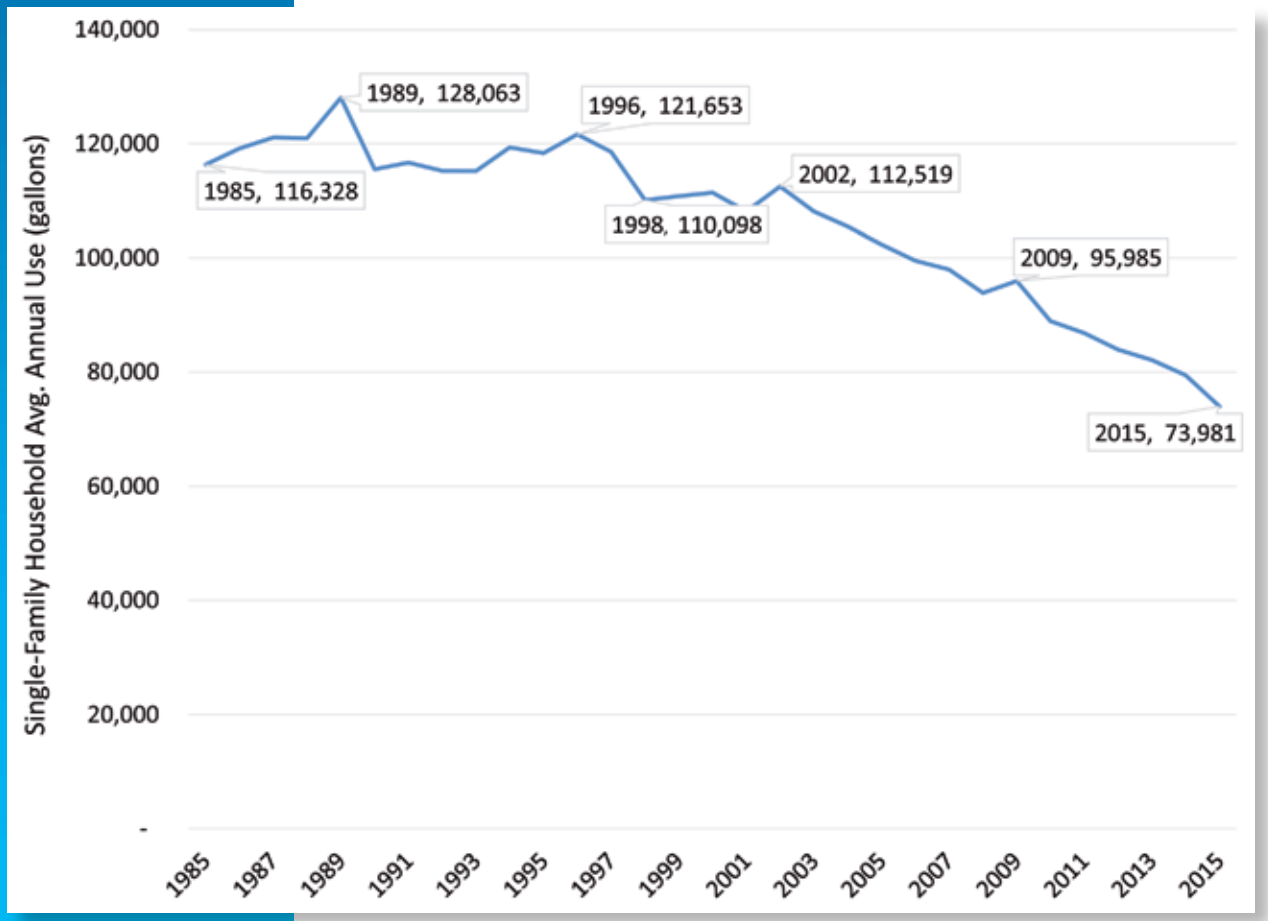


Figure 4: Average annual single-family water use in Tucson, AZ – 1985 – 2015

Following a similar trajectory as the residential sector water use, system-wide per capita water use has been declining in Tucson for nearly 20 years, as shown in Figure 5.[3] In 1989, the year chosen as the historic baseline in this study, the Tucson Water average was 188 gallons per capita per day (gpcd). In 2015, this had reduced by 31% to 130 gpcd.

3 System per capita water use is calculated as the total volume of water produced divided by the population served.

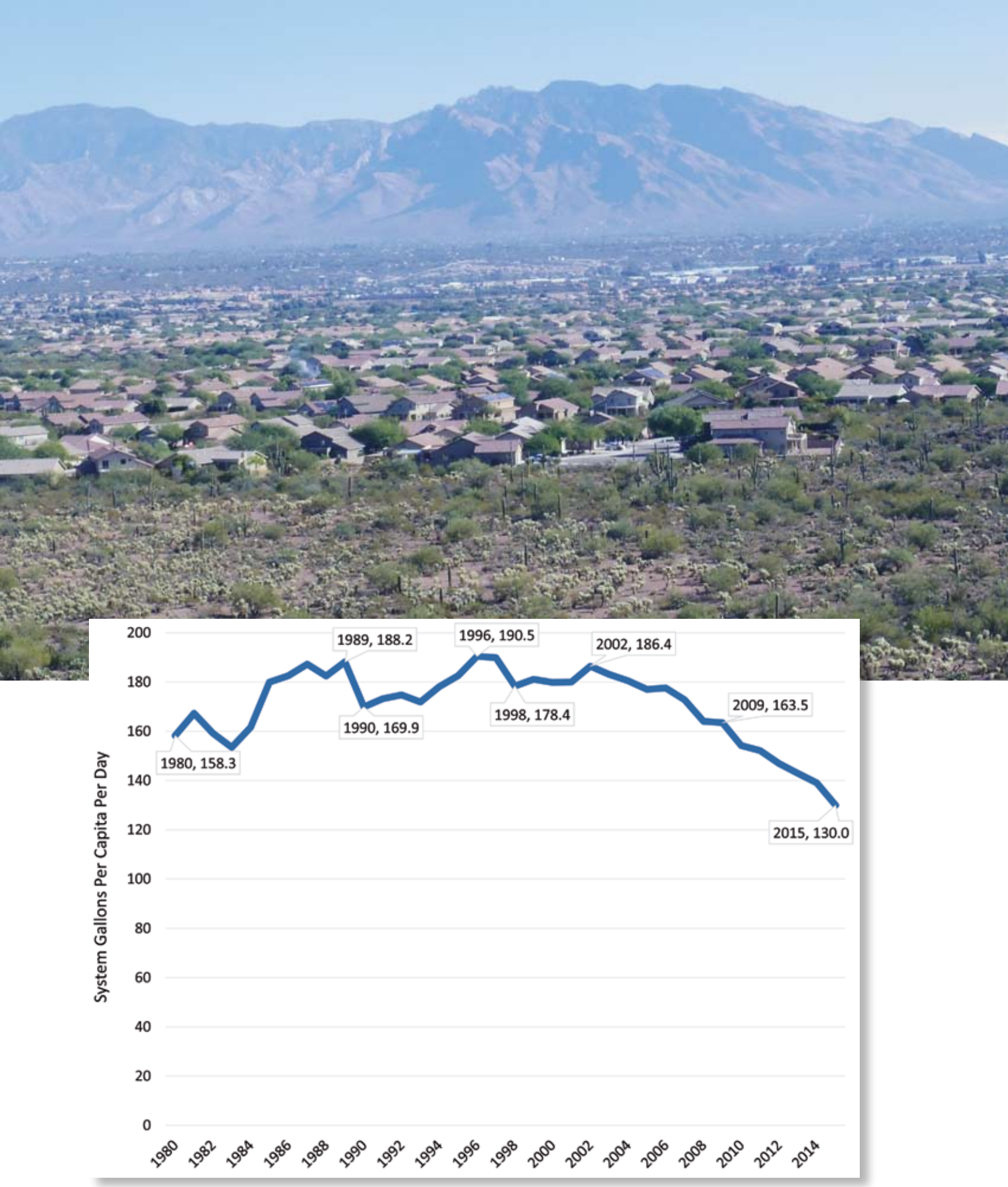


Figure 5: System per capita water use, Tucson, AZ – 1980 – 2015

Figure 6 summarizes two key points of consideration for this study: the change in per capita use and population in Tucson between 1989 and 2015. Over this time period, population grew by 205,875 people and per capita water use declined by 31%.

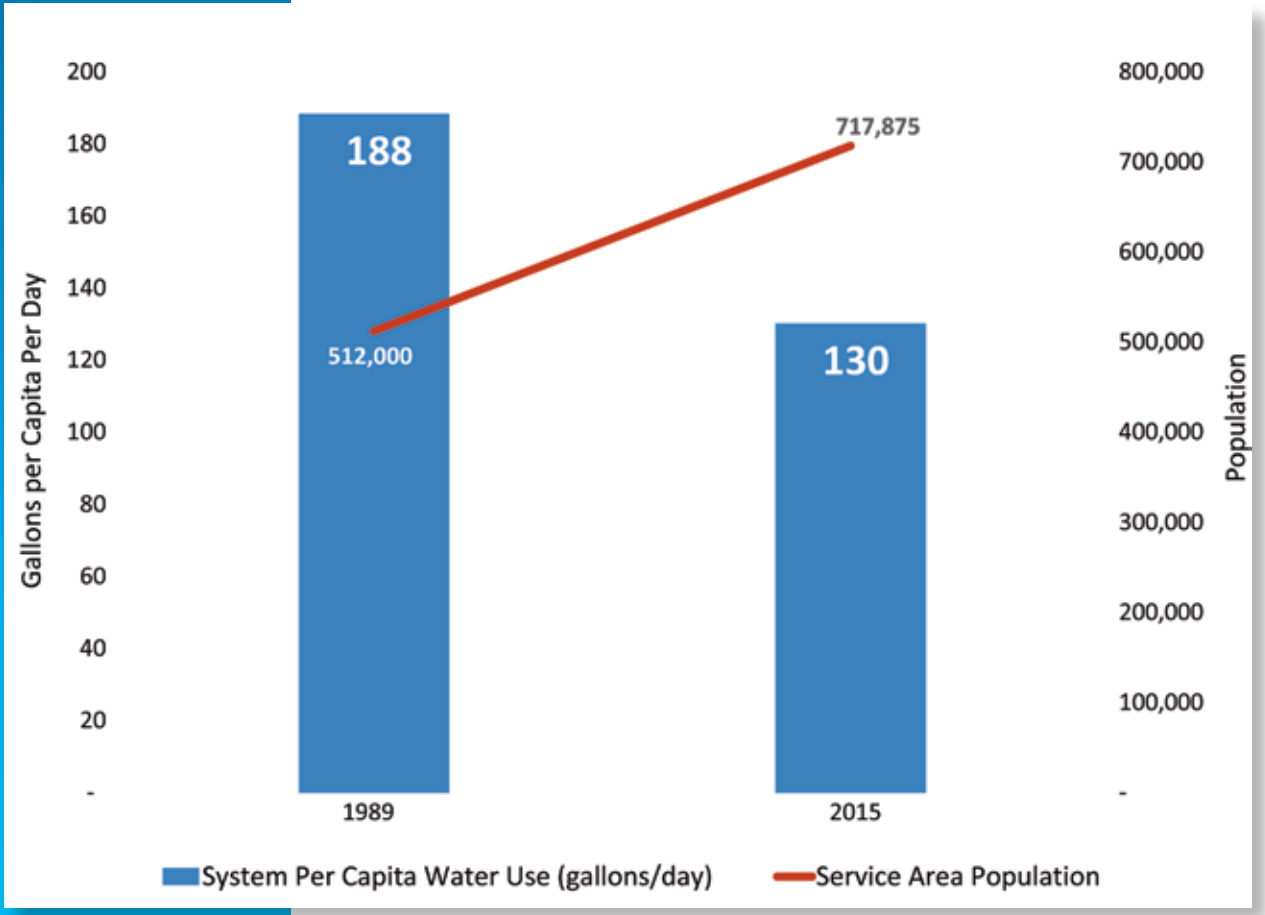


Figure 6: Per capita water use and service area population, 1989 and 2015

Wastewater Treatment

Over the same period of time, wastewater flows treated by PCRWRD have followed similar general trends as the water demand curves shown in Figure 2 (page 8) and Figure 3 (page 9). In 1989, PCRWRD treated an average of 54.0 million gallons of effluent per day at their Ina Road and Roger Road reclamation facilities. The population served in 1989 was 503,853. In 2015, with the population served at 717,875, PCRWRD treated an average of 56.2 million gallons per day (mgd) at their Agua Nueva and Tres Rios reclamation facilities.

In 1989, the per capita wastewater discharge is calculated to have been 107.3 gpcd. By 2015, this calculation has been reduced 27% to 77.9 gpcd as shown in Table 1 (page 14). Increased efficiency of indoor fixtures and appliances is the cause of this reduction. Combined PCRWRD influent from 1989 to 2016 is presented in Figure 7 along with the per capita wastewater influent. The impacts of water conservation and the resulting changes to wastewater flows shown in Figure 8 were also included in this avoided cost analysis. In addition, water conservation efforts continue to have an impact on the characteristics of wastewater influent. Levels of Total Suspended Solids and Chemical Oxygen Demand continue to rise as the dilution of wastewater decreases. Impacts on the sewer conveyance infrastructure, odors produced, corrosion, and additional maintenance required have yet to be studied.

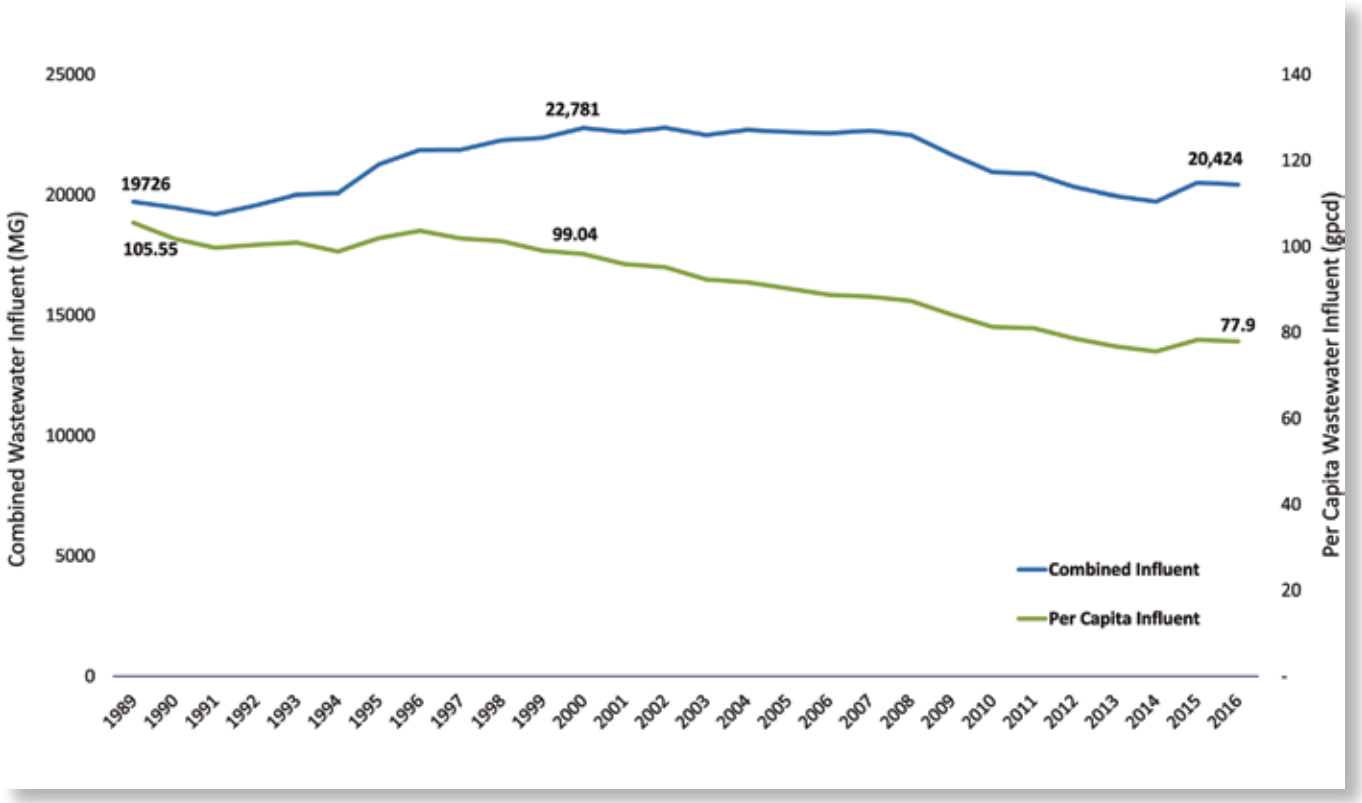


Figure 7: Combined metropolitan wastewater and per capita influent, 1989 - 2016

Tucson Avoided Cost Analysis

Step 1: Select Baseline

The avoided cost analysis starts with selecting a baseline year, in this case 1989, before demand management measures implemented in Tucson and nationally began reducing per capita water use. Wastewater flows from 1989 are used as the starting point for the analysis as well. Another reason 1989 was selected is that reliable data for both the water and wastewater systems were available going back to that year.

As shown in Table 1, in 1989, Tucson's system wide per capita use was 188 gpcd and in 2015 it was 130 gpcd.

Table 1: Statistical comparison of Tucson in 1989 and 2015

	1989	2015
Population	512,000	717,875
Water produced (kgal)	35,169,620	34,050,709
Water produced (AF)	107,932	104,498
Water produced (mgd)	96.4	93.3
Water system-wide gpcd	188	130
Wastewater treated (mgd)	54.0	56.2
Wastewater system-wide gpcd	107.3	77.9

With 1989 selected as the baseline year, the fundamental water use and population statistics could be established. The next steps of the avoided cost analysis envision water use in Tucson in the absence of water conservation.

What if water use patterns from 1989 had persisted and were unchanged today?

Step 2: Hypothetical Water Production and Wastewater Flow

In step 2 of the avoided cost analysis, a hypothetical, non-conserving water production is calculated using the 1989 baseline production of 188 gpcd. This non-conserving gpcd assumes that no conservation was implemented and the historic level of per capita consumption persisted up to 2015 as population increased. This is the key "what if" assumption in the analysis: *What if water use patterns from 1989 had persisted and were unchanged today?*

Total production for this hypothetical, non-conserving scenario is calculated by multiplying 188 gpcd by the population in 2015 and results in a hypothetical, daily water production for Tucson of 134.4 mgd.

The hypothetical, non-conserving wastewater production was calculated by applying the same ratio of water to wastewater flow found in 1989 and multiplying this ratio by the hypothetical, daily water production. This resulted in an estimated average daily wastewater flow of 80 mgd under the hypothetical, non-conserving scenario.

Figure 8 shows a comparison of the actual water production and wastewater flow in 1989 and 2015, compared with the hypothetical production and flow that would exist under the non-conserving scenario. These hypothetical demands shown in Figure 9 form the basis of the avoided cost analysis.

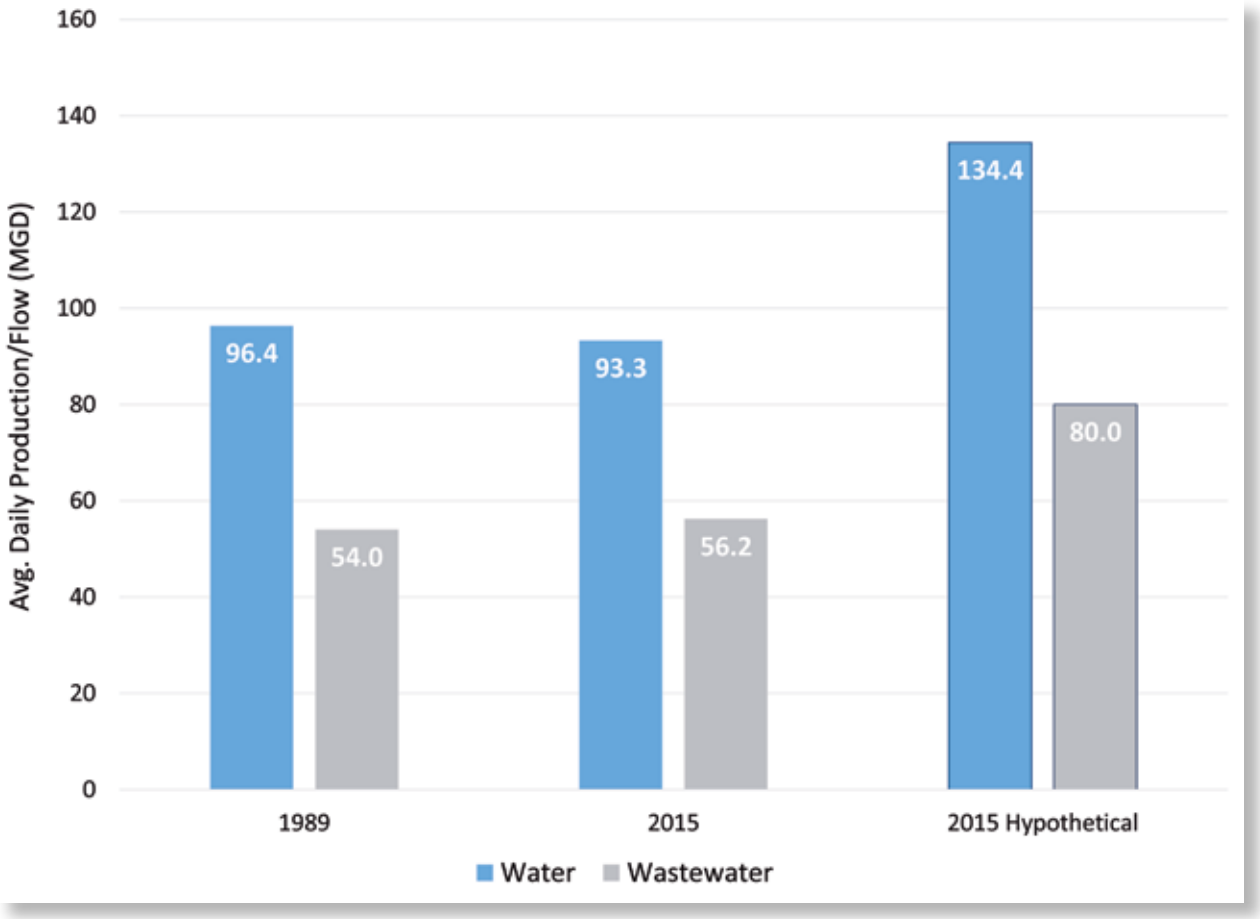


Figure 8: Daily production and flow – 1989, 2015, and hypothetical non-conserving

Step 3: Infrastructure and Operational Cost Assessments

The subsequent analysis steps answer the following questions:

1. What system capacity would be needed to produce and deliver an average of 134.4 mgd potable water and to treat 80 mgd of wastewater?

2. How much additional infrastructure would be required?

3. How much additional operational expense would be required?

In step 3, the additional water supply, treatment capacity, transmission capacity, and wastewater treatment and transmission capacity necessary to adequately serve the hypothetical non-conserving level of demand in Tucson was determined. The costs of expanding Tucson's infrastructure to deliver the water needed to meet the hypothetical additional demands were estimated using best available information from Tucson Water and Pima County Wastewater Reclamation staff and other experts on the cost of securing new supply and constructing new transmission and facilities.

The total estimated additional cost of water infrastructure required to meet the hypothetical, non-conserving demand was set at $155.4 million plus interest.

Water Infrastructure

Tucson's current peaking factor[4] is 1.4, but under the non-conserving scenario a slightly higher peaking factor of 1.6 was used to better represent increased outdoor use. The peaking factor of 1.6 was applied to the hypothetical average day demand of 134.4 mgd (Figure 8), to calculate a hypothetical peak day demand of 216 mgd.

The Tucson Water system, which primarily pumps recharged Central Arizona Project water from an extensive groundwater aquifer west of Tucson, currently has capacity to pump and treat about 240 mgd; sufficient enough capacity to meet the hypothetical peak day demand.[5] However, because a hypothetical demand of 216 mgd is very

4 Peaking factor for a utility is calculated annually as the peak daily production divided by the average daily production.

5 Tucson Water staff communication: We have a total production of 231.23 which includes 11.94 mgd of production from our hydraulically isolated systems plus the Santa Cruz well field which currently produces 9.0 mgd. Once the transmission main is re-rehabilitated and the additional wells are put in-service we are projected to be at 18-20 mgd from this source.

A SECTION OF THE CENTRAL ARIZONA PROJECT (CAP) NEAR TUCSON, ARIZONA.

close to maximum capacity, the Water System would need new expansion projects such as the Avra Valley Transmission Main Capital Improvement Project. This project would cost $140 million, provide an additional 40 mgd of capacity at an estimated $3.5 million per mgd.[6]

Additionally, under this hypothetical demand scenario, Tucson Water would have also moved forward to develop new recycled water supplies, specifically the North CAVSARP-3.[7] This 7 mgd project had an estimated cost of $2.2 million per mgd, for a total cost of $15.4 million.

Both of these projects were deferred and may be avoided entirely because of the impact of conservation on total supply.

The total estimated additional cost of water infrastructure required to meet the hypothetical, non-conserving demand was set at $155.4 million plus interest. It was assumed this infrastructure would be financed over 20 years at a 2% borrowing rate.

6 Tucson Water chose not to move forward with the Avra Valley Transmission Main CIP in response to the declining demands and pumping requirement shown in Figure 1 and Figure 2.

7 Tucson Water staff communication regarding the preferred option of the 2013 Recycled Water Master Plan.

Under this cost analysis, adding 12 mgd to treat flows under the non-conserving scenario would result in a total capital cost of $195 million including principal and interest.

Water Operations and Maintenance

The current variable costs in the water operations and maintenance budget is $51.3 million. Under the non-conserving scenario, it was estimated that Tucson Water's operations budget would be increased by about 30% to $73.8 million, an increase of $22.4 million.[8]

Wastewater Infrastructure

Under the hypothetical "non-conserving" scenario, Pima County Regional Wastewater Reclamation (PCRWRD) would be treating 80 mgd of effluent on average. The current conveyance and treatment capacity of the PCRWRD system is currently about 95 mgd. Under the non-conserving scenario it is assumed that an additional 12 mgd of capacity would be added to the system, bringing it up to 107 mgd, sufficient to handle the fluctuations of an 80 mgd average day demand.

PCRWRD's connection fee is $4,066 for a single-family residence, which is calculated based on a house producing 258 gallons of wastewater per day. This assumption includes inflow and infiltration into the system. PCRWRD calculates the total cost of capacity in the system to be $16.02 million per MGD which represents the comprehensive cost of adding wastewater capacity including: land purchase, engineering, conveyance, treatment, etc.

Under this cost analysis, adding 12 mgd to treat flows under the non-conserving scenario would result in a total capital cost of $195 million including principal and interest.

Wastewater Operations

The current variable costs in the PCWRD's operations and maintenance budget is $43.6 million. Under the non-conserving scenario, it was estimated that PCWRD's wastewater operations budget would be increased by about 15% to $49.9 million, an increase of $6.4 million.[9]

8 Operations and maintenance costs were prepared the Tucson Water Financial Services Team.

9 Operations and maintenance cost estimates were prepared by Raftellis assuming 85% fixed costs.

TUCSON FROM SPACE (NASA)

Step 4: Impact on Customer Rates

The goal of the final step in the analysis was to determine the impact the avoided costs discussed above have had on customer water and wastewater rates in Tucson.

In step 4, Tucson Water's current water rates and PCRWRD's wastewater rates were adjusted to determine what customer charges would be required to cover the additional costs brought about by the purchase and delivery of additional water supply and infrastructure and the treatment of additional wastewater flows in the hypothetical demand scenario. The final result is a reasonable estimate of the hypothetical Tucson water and wastewater rates and charges that would be necessary to cover all costs associated with a per capita water demand of 188 if it were unchanged from 1989.

Similarly, water conservation improvements have reduced per capita wastewater treatment and helped keep wastewater infrastructure and operating costs down through reduced need for expansion.

In 2015, the average single-family home in Tucson used 74,000 gallons of water per year, discharged 63,000 gallons of wastewater per year, and paid a total combined water and wastewater bill of $847 per year.[10] However, under the hypothetical non-conserving scenario the average single-family home in Tucson would have to pay $959 per year for the same service to cover all of the additional infrastructure, operations, and maintenance charges. This additional $133 per year represents a 13.3% increase over current water and wastewater rates.

Water conservation improvements have reduced per capita wastewater treatment and helped keep wastewater infrastructure and operating costs down.

10 As part of this analysis WaterDM prepared a water and wastewater rate calculator to develop these values using Tucson's current rates.

Figure 9 shows the change in annual water and wastewater rates that would be experienced under hypothetical, non-conserving scenerio.

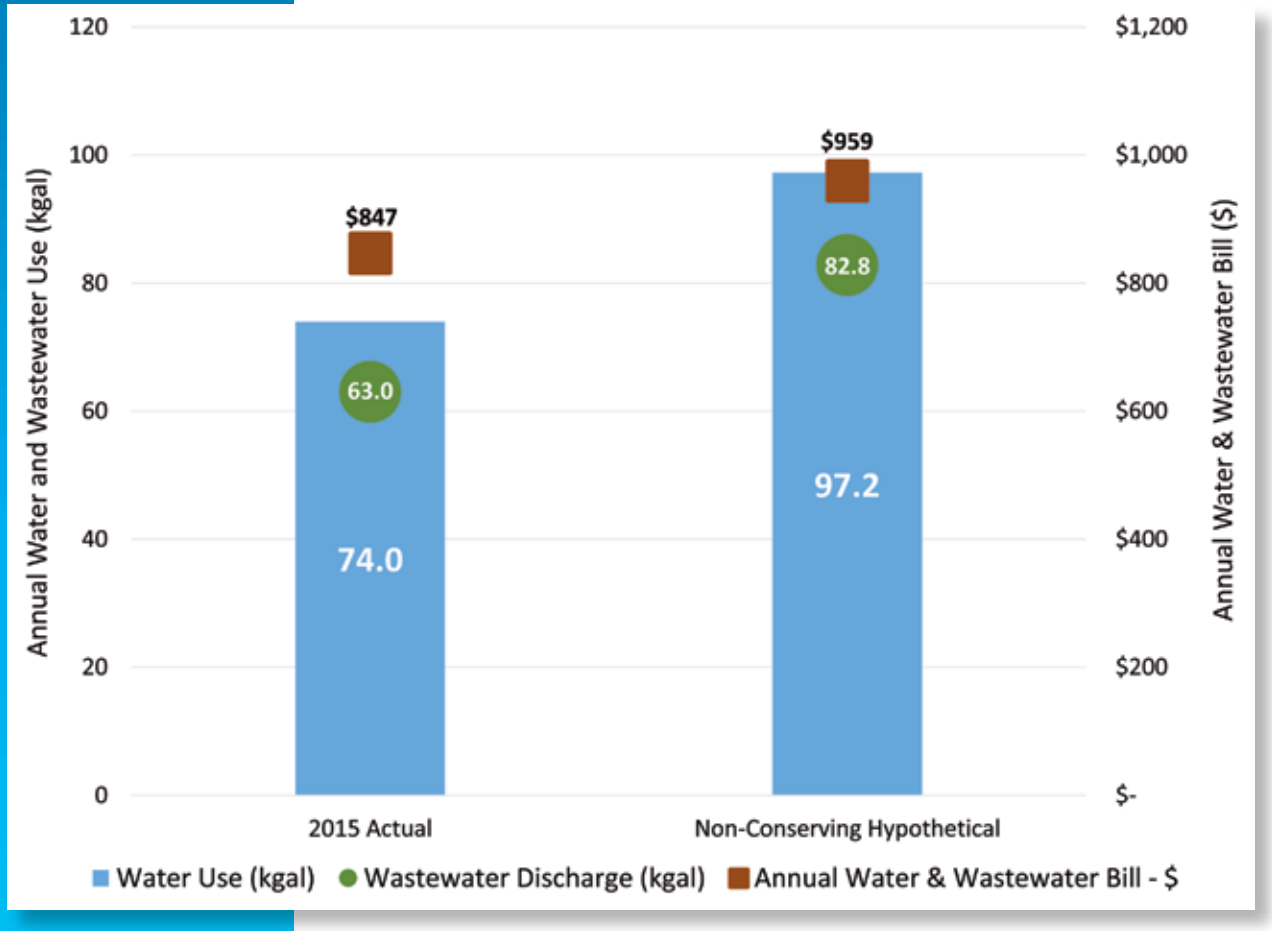


Figure 9: Average annual water use and wastewater production for a single-family customer and the resulting average annual costs for water and wastewater, comparing actual 2015 data to the 2015 non-conserving, hypothetical projection.

Figure 10 is a pie chart which shows the contribution of each of the various cost components to the avoided $133 annual rate increase. Water treatment infrastructure, operations, and interest and debt service account for 62.6% of the total rate increase. Wastewater treatment infrastructure, operations, and maintenance account for 37.4% of the total.

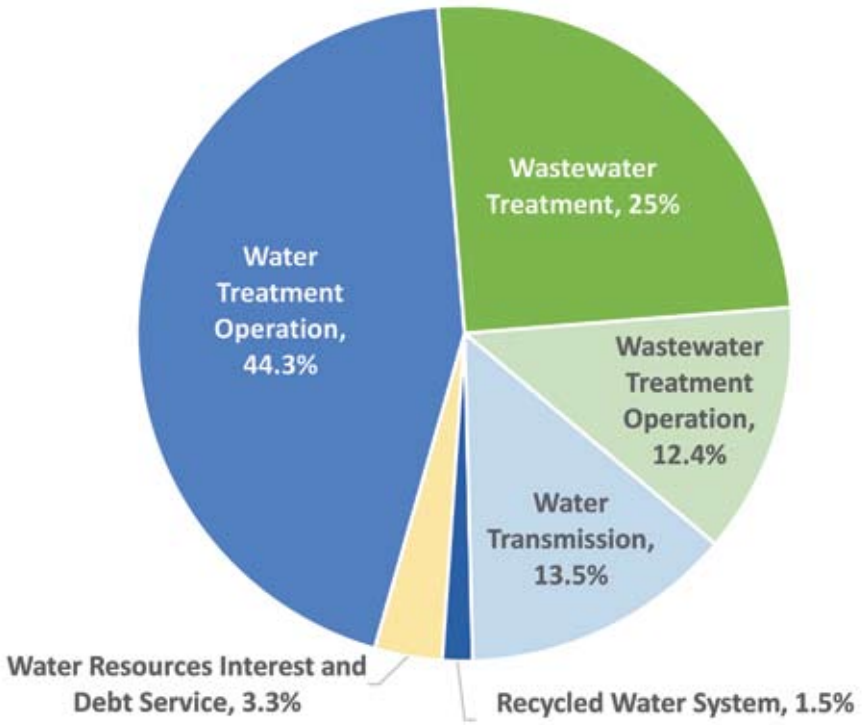


Figure 10: Summary of rate increase that would be necessitated by non-conserving scenario

Interest and debt service costs amount to nearly one-fifth of a rate increase that would occur under a non-conserving scenerio.

Key findings from this analysis:

1. Tucson's water conservation efforts have reduced per capita water demand from 188 gpcd in 1989 to 130 gpcd today.

2. The Tucson avoided cost analysis shows that water and wastewater rates and charges to customers are 11.7% lower today than they would have needed to be if per capita water demand had not been reduced.

3. Tucson Water rates are 15% lower today than they would have needed to be and PCRWRD's rates are 8.6% lower.

Tucson Water staff members noted that the findings are likely conservative and the community benefits of water efficiency are potentially even higher than reported.

After reviewing all of the underlying assumptions, Tucson Water staff members noted that the findings are likely conservative and the community benefits of water efficiency are potentially even higher than reported. This is because although this study found that even under the non-conserving scenario the City had adequate resources to meet its 2015 projected needs, Tucson's future needs beyond 2030 were less certain.

If future needs, driven by growth and higher demand had persisted, Tucson Water would have eventually needed to acquire additional water supplies. The hypothetical costs and timeline for acquiring additional water supplies are unknown and therefore did not enter into this study. For these reasons, many staff feel that the study findings are conservative and the community benefits of water efficiency are even higher than reported.

Summary of Findings

The findings of WaterDM's avoided cost analysis for the City of Tucson are revealing: Per capita water use has declined substantially, resulting in significant savings in both water and wastewater resource and infrastructure costs. If per capita water demand had not been reduced from 188 gpcd in 1989 to 130 gpcd, Tucson area residents would be paying rates that are 13.3% higher than what they are today for water and wastewater service.

Key findings from the City of Tucson avoided cost analysis are summarized below.[11]

- The Tucson service area population grew from 512,000 people in 1989 to 717,875,[12] today, a 40% increase.
- In 1989, Tucson Water produced 96.4 mgd of finished water and PCRWRD treated 54 mgd of wastewater. In 2015, Tucson produced 93.3 mgd of finished water and treated 56.2 mgd of wastewater.
- Tucson's per capita water use has reduced from 188 gpcd in 1989 to 130 gpcd today, a 30% decrease.
- If Tucson's current population used 188 gpcd (the amount used in 1989), the City would have needed to produce 134.4 mgd of water and the County would have needed to treat 80.0 mgd of wastewater in 2015 to meet demand.
- Tucson citizens have conserved 41.1 mgd of water through per capita use reductions from 188 gpcd in 1989 to 130 gpcd in 2015. In the absence of these reductions, Tucson rate payers would bear the cost of producing this additional, hypothetical 41.1 mgd of water demand.
- Hypothetical additional variable costs for water treatment would be $22,969,872.

If per capita water demand had not been reduced from 188 gpcd in 1989 to 130 gpcd, Tucson area residents would be paying rates that are 13.3% higher than what they are today for water and wastewater service.

11 All key data inputs and outputs from WaterDM's avoided cost model are presented in Appendix A.

12 Population numbers include inside and outside City water customers.

- Hypothetical additional water resources and wastewater treatment capital improvement costs would be $350,862,732.

- Hypothetical additional wastewater treatment and operation and maintenance costs would be $6,417,286.

- Current total annual water & wastewater service payment per single-family equivalent (1 SFE = 74,000 per year demand) would be $847.
    - $399.14 (47%) is the water component
    - $447.17 (53%) is the wastewater component

- Hypothetical, non-conserving total annual water and wastewater service payments per SFE (based on current SFE consumption) would be $959.
    - $469.69 (49%) is the water component
    - $489.66 (51%) is the wastewater component

- The increase in water and wastewater rates required to cover costs associated with hypothetical non-conserving water demand would be 13.3%.

APPENDIX A: Avoided Cost Model Inputs and Outputs

Fundamental data inputs and outputs to and from the WaterDM avoided cost model are presented here.

Population and Water Demand

Baseline-1989

Baseline Year – 1989[13]
Population – 512,000
Water Produced (kgal) – 35,169,620
Water Produced (AF) – 107,932
System wide GPCD – 188
Wastewater Treated – (mgd) – 54.0
Wastewater GPCD – 107.3

2015/Actual

Current Year – 2015
Population – 717,875
Water Produced (kgal) – 34,050,709
Water Produced (AF) – 104,498
System wide GPCD – 130
Wastewater Treated – (mgd) – 56.2
Wastewater GPCD – 79.1

Non-Conserving Forecast

Water Produced (kgal) – 49,311,310[14]
Water Produced (AF) – 151,331
Water conserved (kgal) – 15,260,601
Water conserved (AF) – 46,833

13 From City of Tucson TWServiceAreaHistorical.xls
14 Calculated as: 188 gpcd x 365 days x current population

Water Treatment Impacts

Water treatment capacity is not a limiting factor for Tucson Water.

Non-Conserving Forecast Avg Day (water system)	135.1	MGD
Non-Conserving Forecast Peak Day	216	MGD
Non-Conserving Peak Capacity Rqd. (includes growth capacity)	259	MGD
Peak Treatment Expansion Rqd. For Non-Conserving Peak	41	MGD
Estimated Unit Cost of Pumping & Transmission Expansion	$3,500,000	$/MGD
Estimated Cost of New Transmission Rqd.	**$140,000,000**	$

Water Resources	Additional Recycled Water Required[15]	7	MGD
	Unit Cost of Recycled Water Supply	$2,200,000	MGD
	Estimated Cost of New Recycled Water North CAVSARP-3	$15,400,000	$

Wastewater System	Wastewater Ratio of Avg. to Peak Day[16]	1.1	
	Current Avg. Day Design[17]	95	MGD
	Current Peak Day Design	95	MGD
	Current I & I Inflows (MG/year)[18]	17	MG/YR
	Non-Conserving Avg. Day Flow	80	MGD
	Non-Conserving Peak Day Flow	80	MGD
	Non-Conserving Peak Capacity Rqd. (90% rule)	89	MGD
	Estimated Required Capacity	107	MGD
	Expansion Rqd. For Non-Conserving Peak	22	MGD
	Unit Cost of Wastewater Plane Expansion	$16,000,000	$/MGD
	Estimated Cost of Wastewater Expansion	**$194,862,731**	$

Total cost of all additional water and wastewater infrastructure under the non-conserving scenario - $350,862,732

15 With avg. demand of 134 MGD it is assumed Tucson would move forward with more recycling, specifically the North CAVSARP-3 which is the first unit slated to be brought online in the Recycled Water Master Plan.

16 Calculated from 2013 Tucson treatment records.

17 2014 avg. day design.

18 Includes only City of Tucson (not outside customers).

Rate Impacts	1 Service Commitment Equivalent (SFE)[19]	74	kgal
	Current/Actual # of SFEs[20]	460,287	SFEs
	Hypothetical # of Non-Conserving SFEs	666,574	SFEs
	Additional SFEs Under Non-Conserving Scenario	205,288	SFEs

Capitol Rate Impacts	Loan Interest Rate	2.00%	%
	Loan Period	20	Years
	% of Expansion Cost Financed	100%	%
	Calculated Loan Interest	$34,675,080	$
	Total Loan Amount (P+I)	**$190,075,079**	$
	Loan Obligation Per Year	$9,503,754	$/Year
	Annual Rate Impact Per SFE	**$21**	**$/Year**

Water Treatment Portion	$-	$/Year
Transmission Portion	**$15**	$/Year
Recycled Water Portion	**$2-**	
Wastewater Treatment Portion	**$28**	$/Year
Interest Portion	**$4**	$/Year

19 1 SFE = average annual water use of 1 single-family home in Tucson
20 Calculated as: Total current demand divided by 1 SFE

Operational Rate Impacts

% Increase in Demand – Non-Conserving vs. Current	44.1%	%
Operational Budget Increase	44.1%	%
Current Water Treatment Budget	$51,252,270	$
Non-Conserving Water Treatment Budget	$74,222,142	$
Annual Rate Impact per SFE	**$50**	$
Current Wastewater Treatment Budget	$43,566,841	$
Non-Conserving Wastewater Treatment Budget	$49,984,127	&
Operational Budget Increase[21]	15%	%

Annual Rate Impact Per SFE	**$14**	$

Total Rate Impact Per SFE	**$113**	$

Current Annual Water and Wastewater Payments Per SFE	$847	$
Non-Conserving Annual Water and Wastewater Payments Per SFE	$959	$
% Increase in Total Rates Per SFE	**13.3%**	**Higher than w/o conservation**
	11.7%	**Lower than w/o conservation**

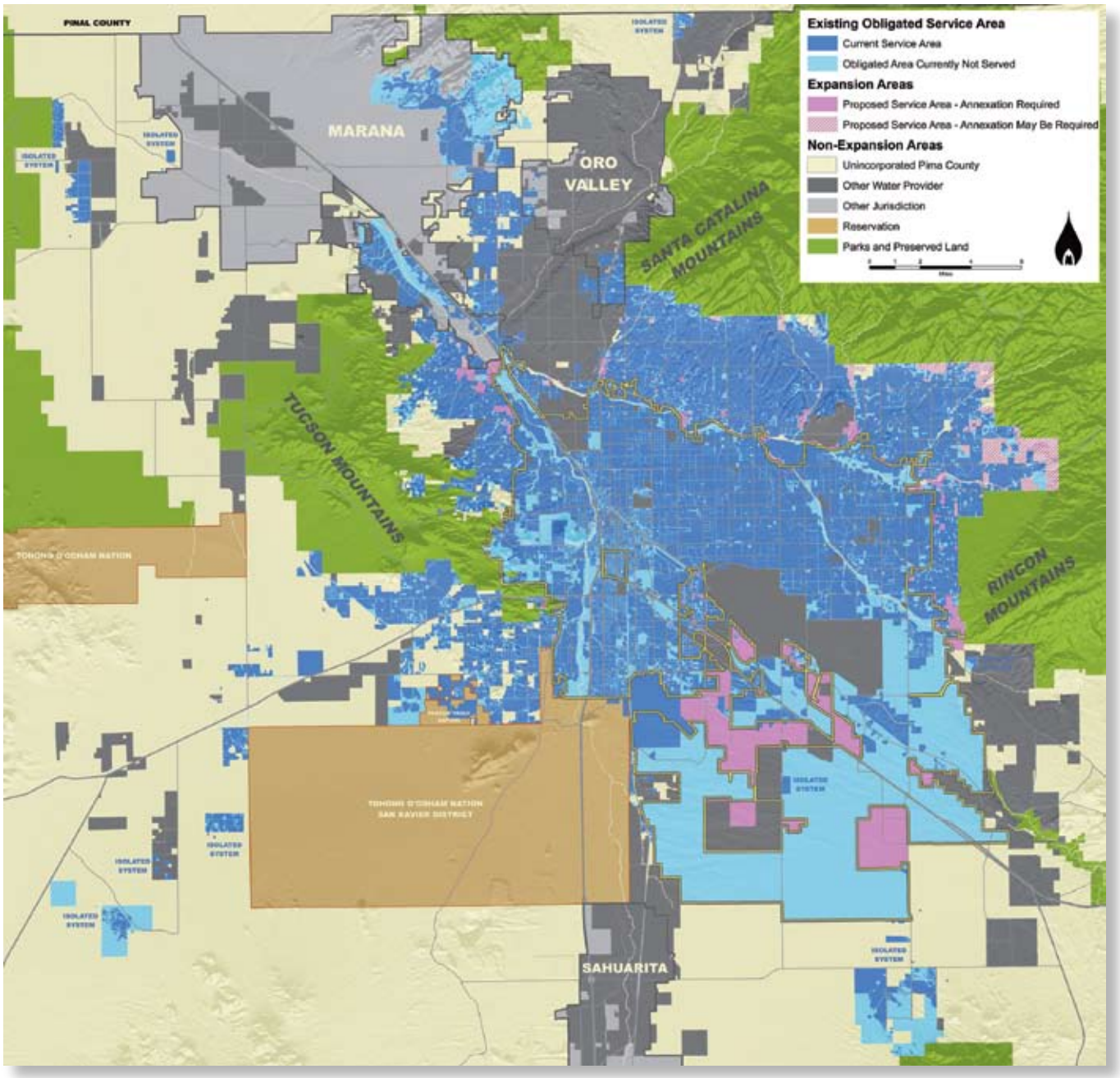
Capital Components of Rate Increase

Water Treatment	0%
Water Transmission	13.5%
Recycled Water System	1.5%
Interest and Debt Service	3.3%
Water Treatment Operation	44.3%
Wastewater Treatment	25%
Wastewater Treatment Operation	12.4%
Misc Operation	0%
Total	100%

21 From 2016 Raftellis analysis assuming 85% fixed costs

APPENDIX B: Service Area Map

Tucson Water and Pima County Regional Wastewater Reclamation Department Service Areas



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