Reducing Long-term Rate Impacts through Water Conservation and Lessons Learned from Tucson's Conservation Program

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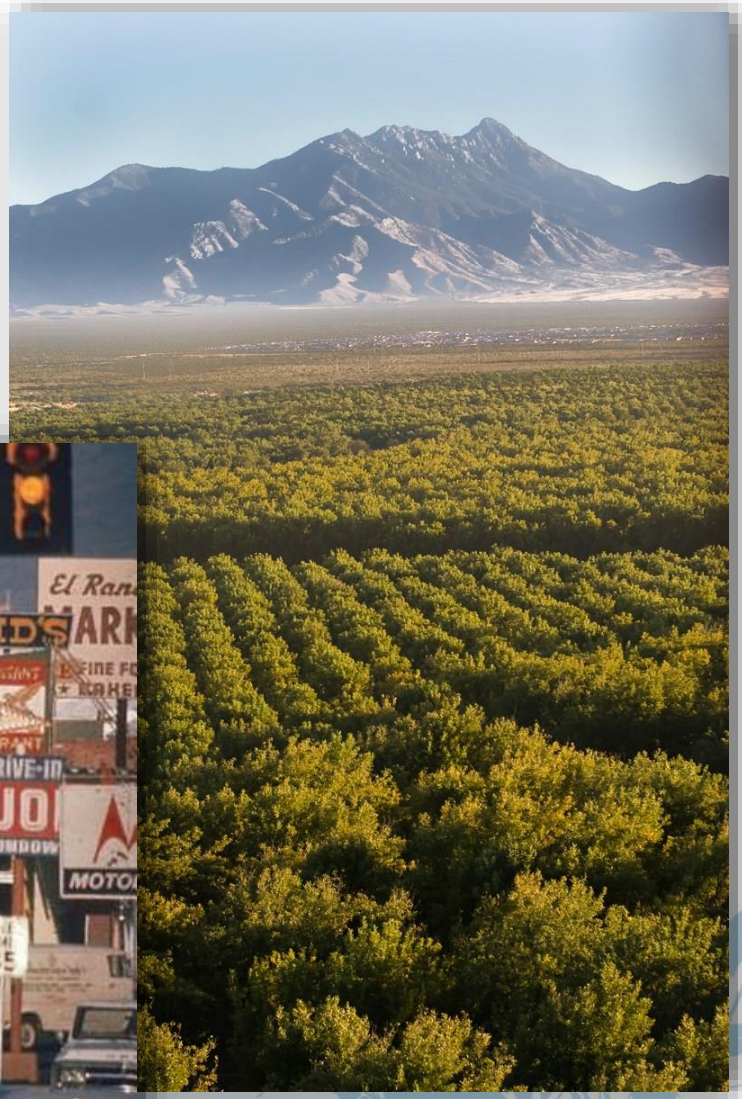
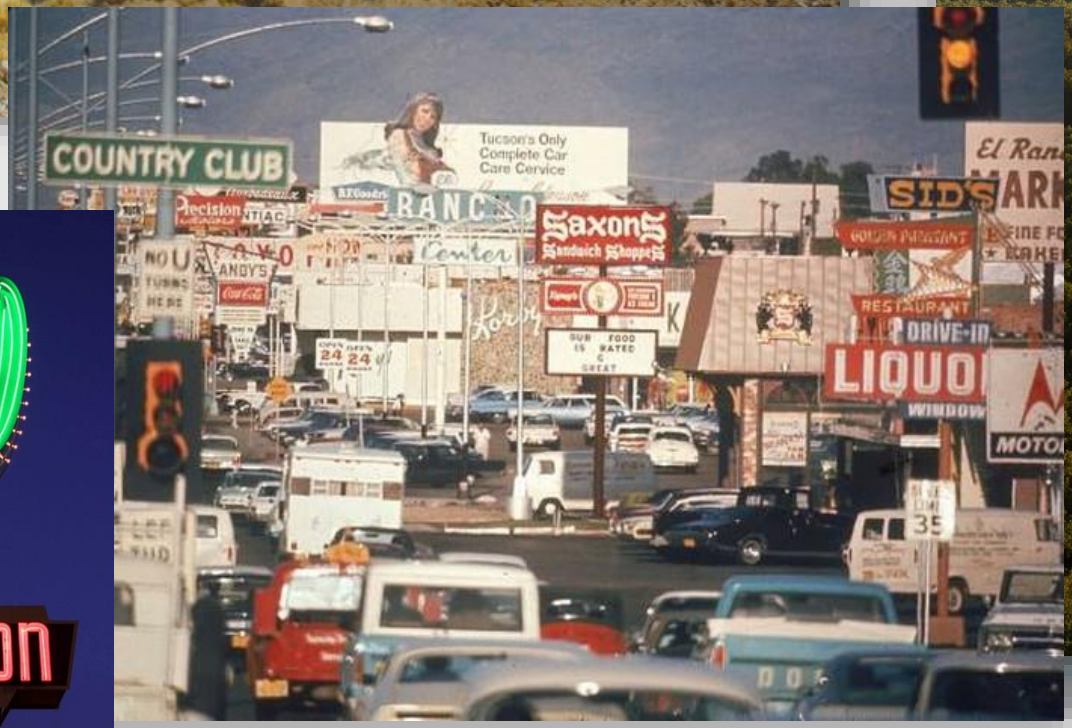
Central Texas Water Efficiency Network
February 1, 2018

Water Reliability

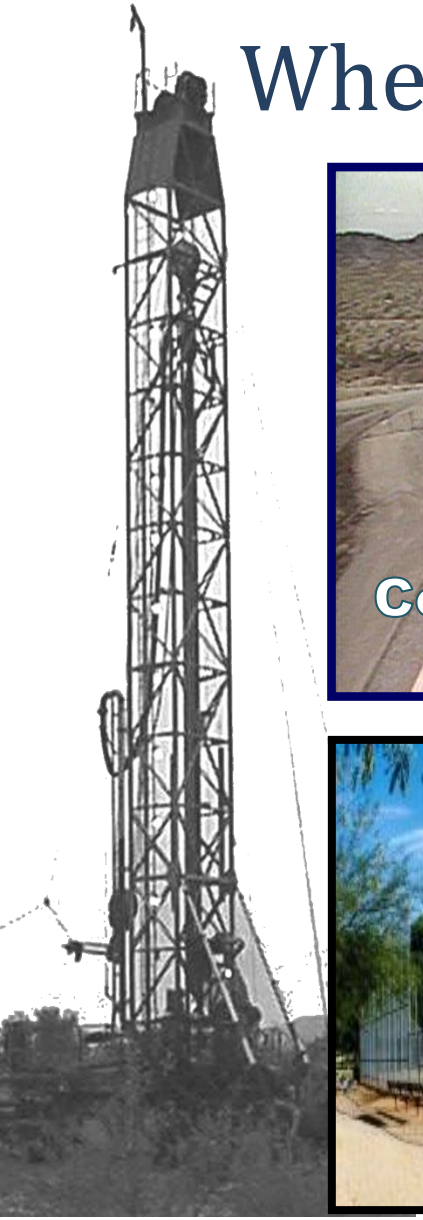
TUCSON WATER

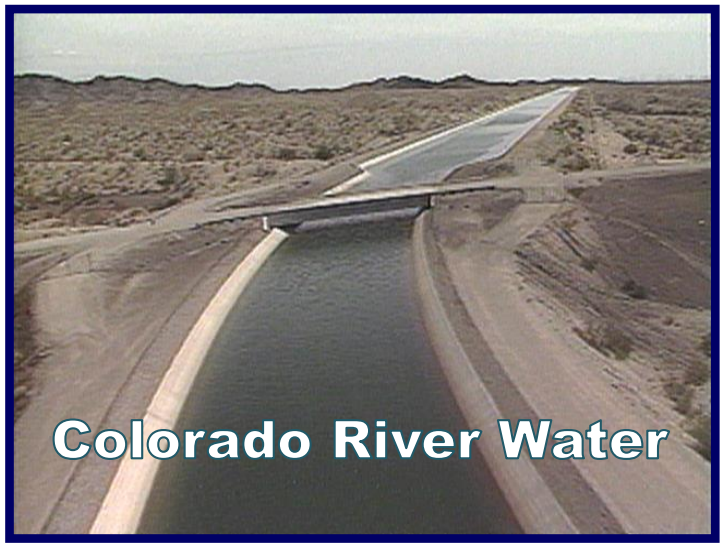
Welcome to Tucson, Arizona





Where does Tucson's Water come from?



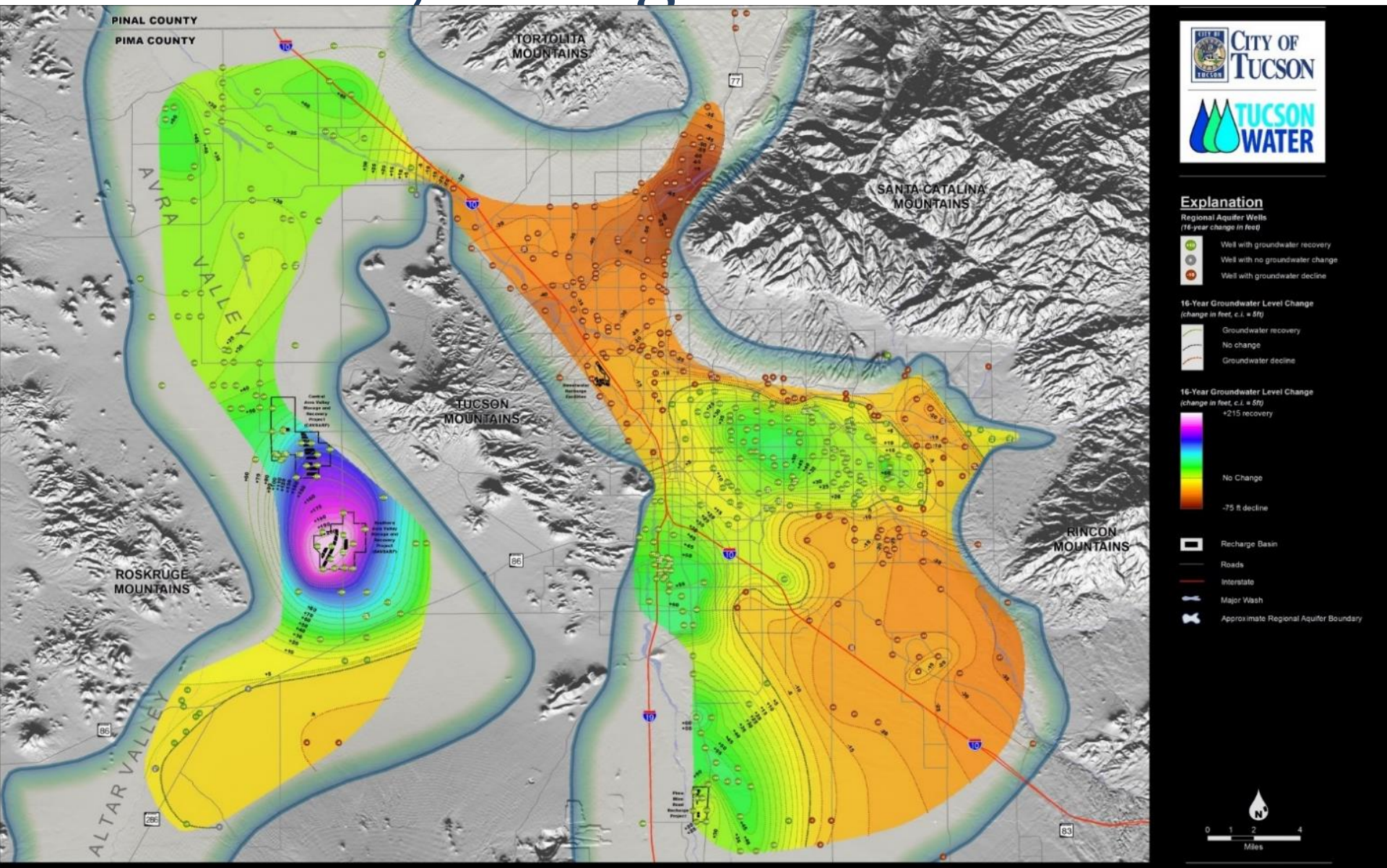


Is the Rain Bucket Our "Next Bucket"?

Hydrologic Outlook

- We store over 1/3 of our CO River allocation each year
- In 2016, we left 26,500 af in Lake Mead
- On track to have over 1,000,000 af in storage by 2030

Hydrologic Outlook



16-YEAR GROUNDWATER LEVEL CHANGE (2000 - 2016)

EVER WONDER WHY

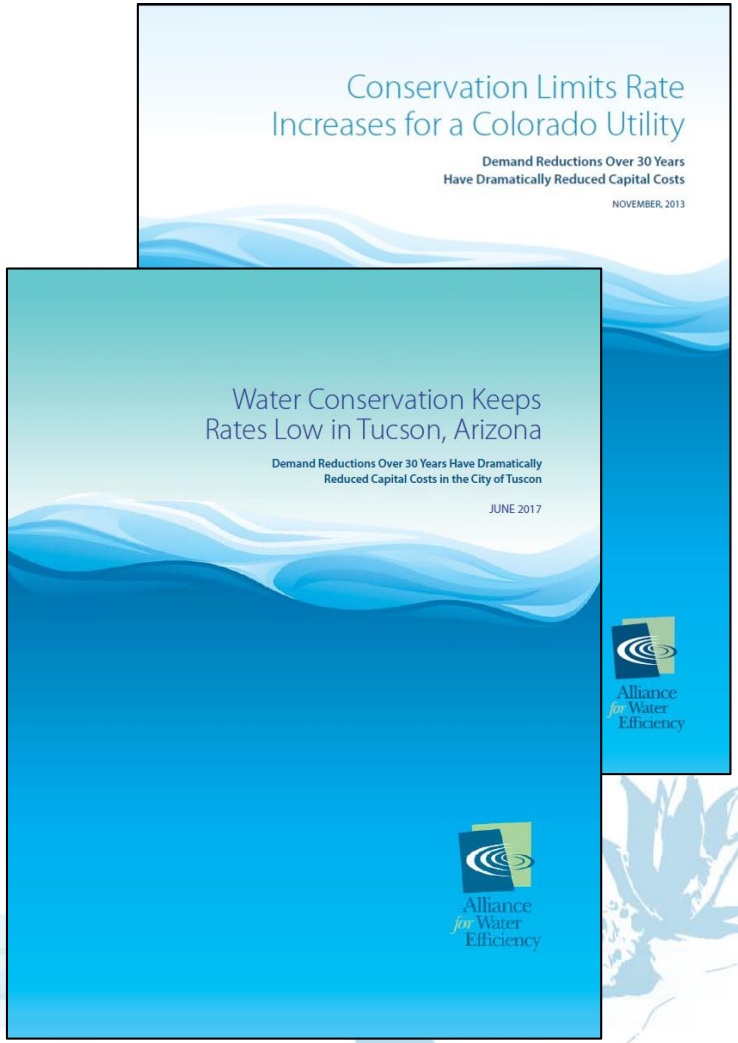
your water rates are going up,
even though

YOU'RE USING LESS?

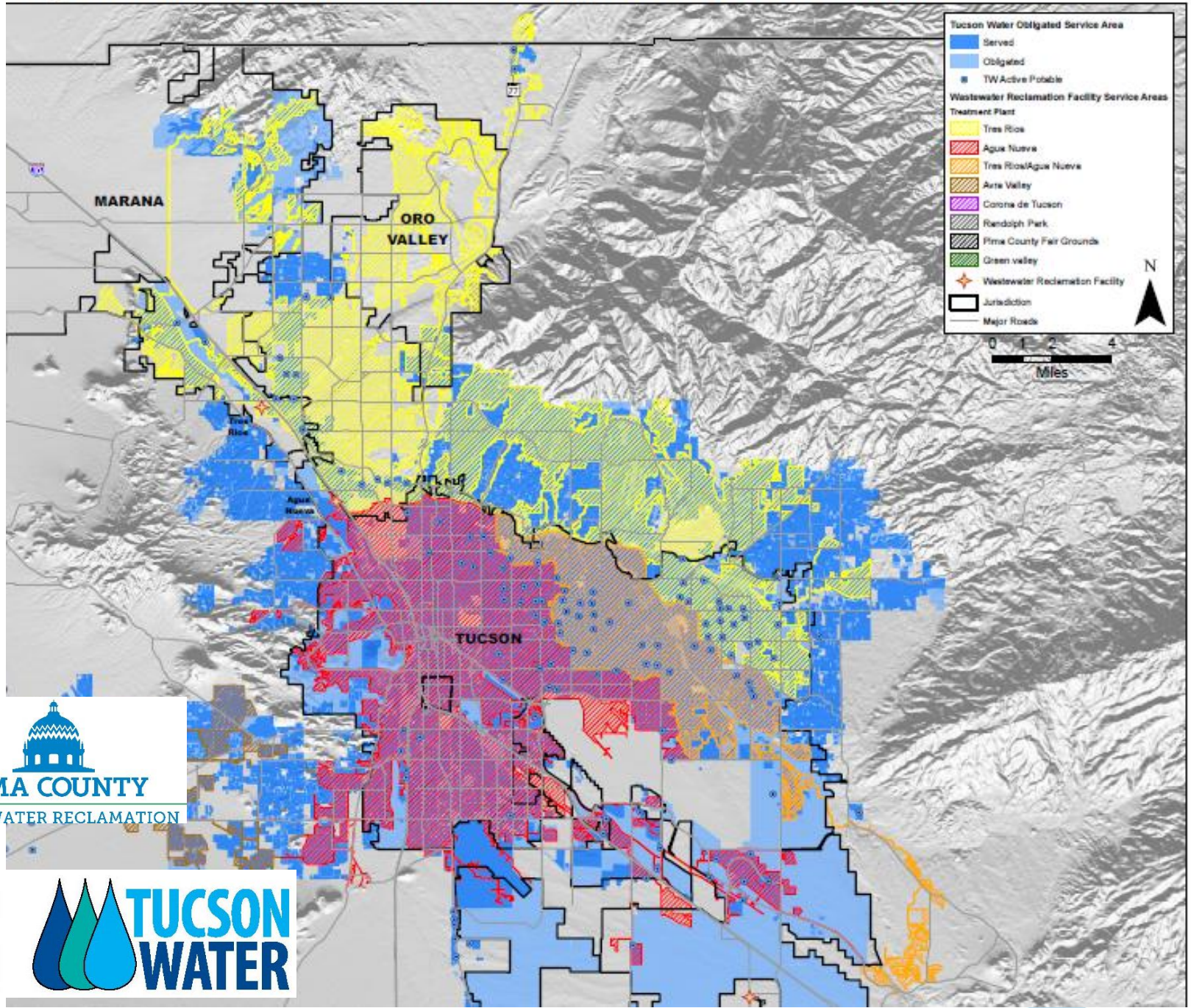
TUCSON WATER

AWE Avoided Cost Study

- Alliance for Water Efficiency grant funds from Walton Family Foundation focused on Colorado River Basin
- Building on previous work by WaterDM and City of Westminster Study in 2013
- Tucson, AZ and Gilbert, AZ selected to participate
- **Goal: Examine the impact of increased water use efficiency on customer rates**



Regional Wastewater Reclamation Department Service Areas

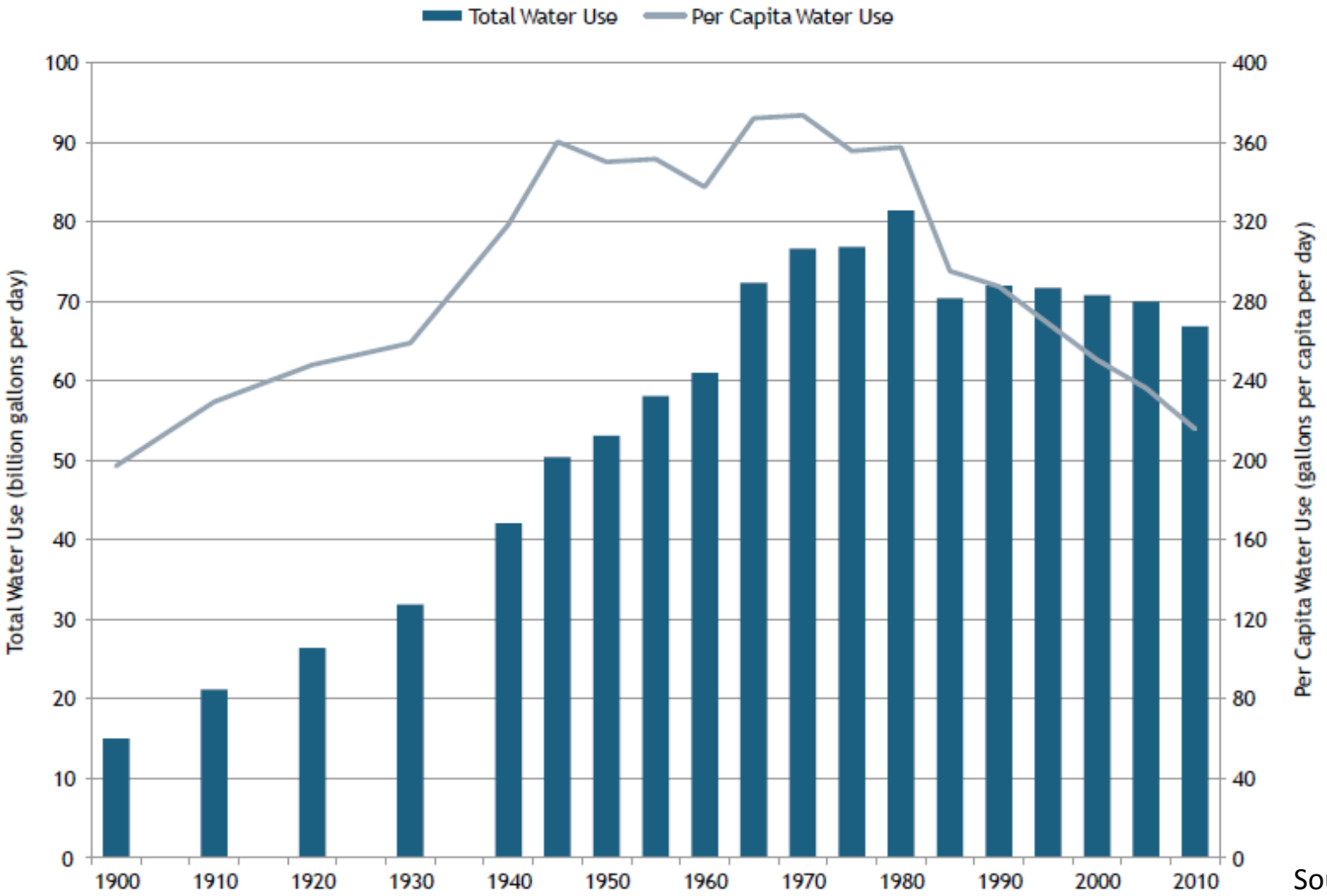


PIMA COUNTY
WASTEWATER RECLAMATION

CITY OF TUCSON

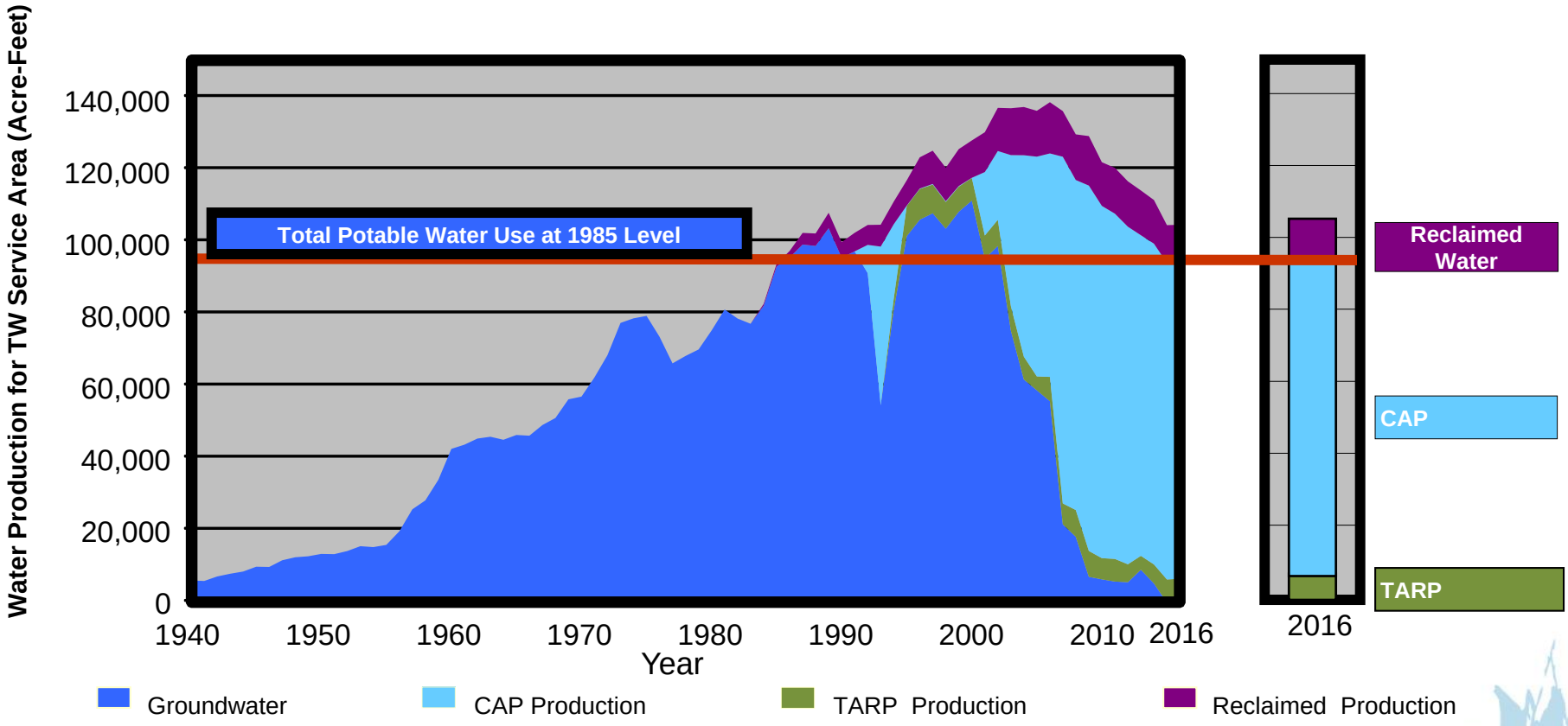
TUCSON WATER

M&I Water Use in the US, 1900 - 2010

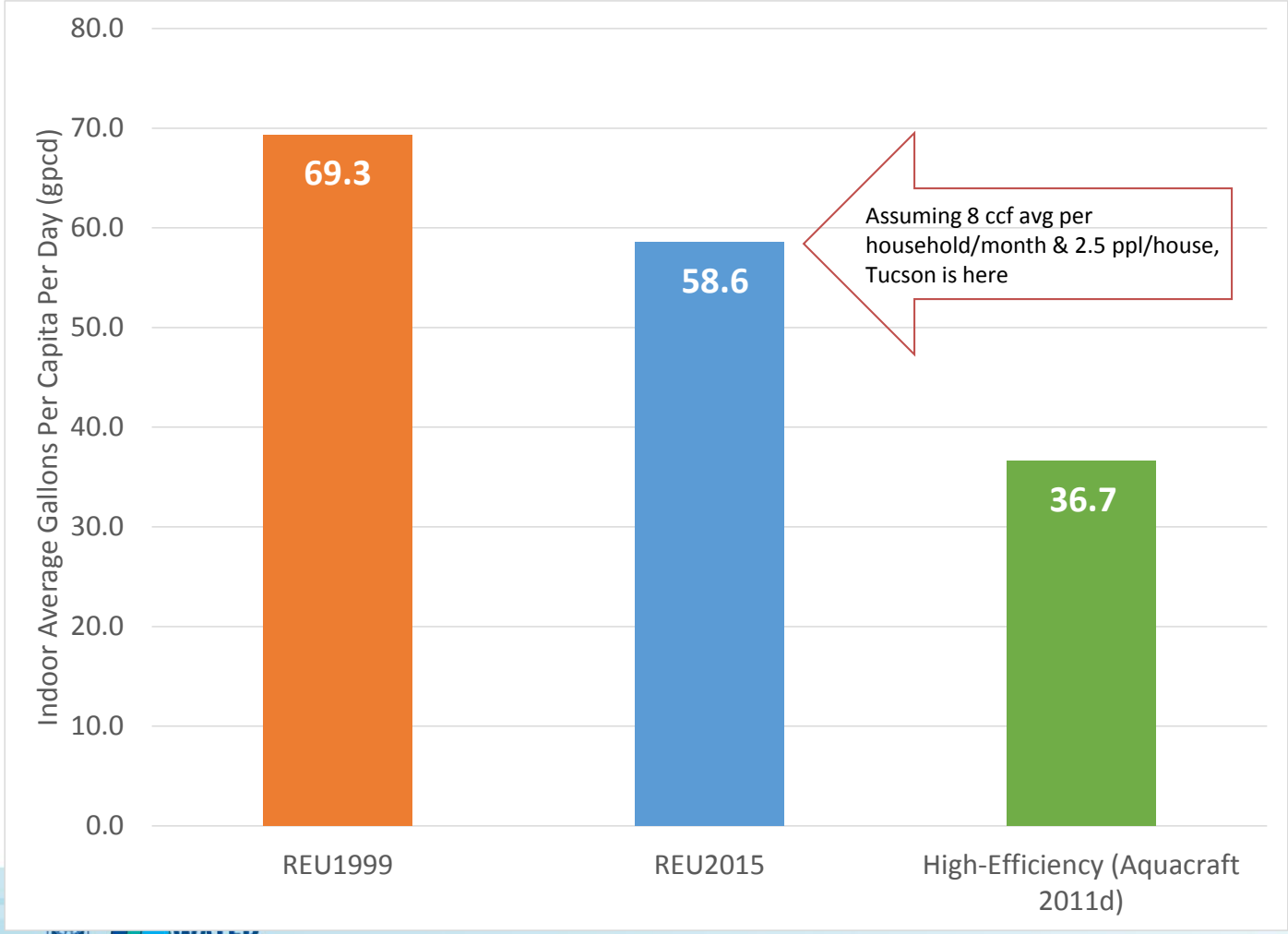


Source USGS and Pacif
Institute 2015

Tucson Water
Annual Production (1940-2016)



National Residential Indoor GPCD

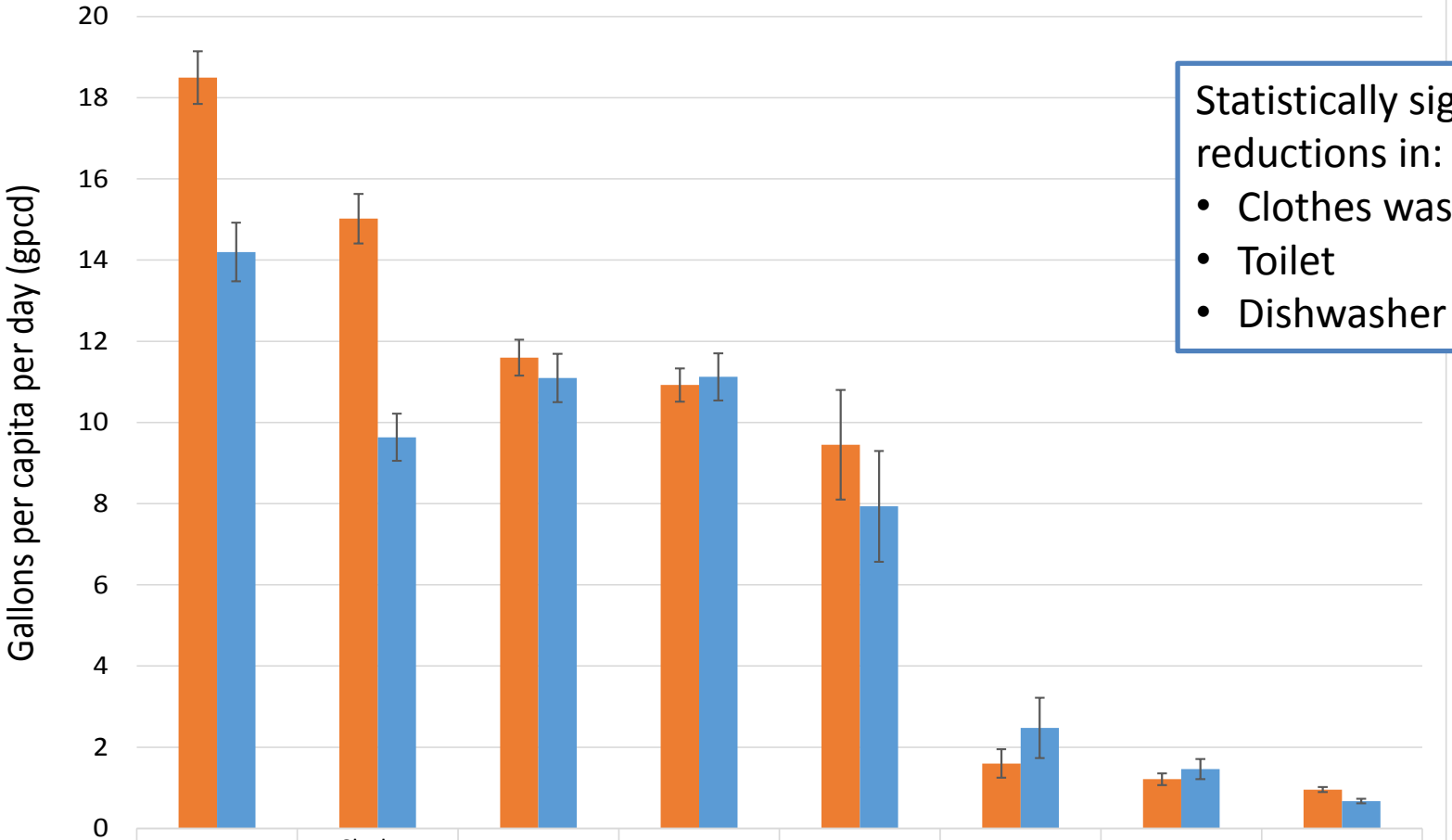


1999 vs. 2016 = 15.4% reduction

2016 vs. HE = 37.4% reduction

Source: Water Research Foundation (2016) Residential End Uses of Water Update – #4309. Denver, CO.

Indoor GPCD Comparison



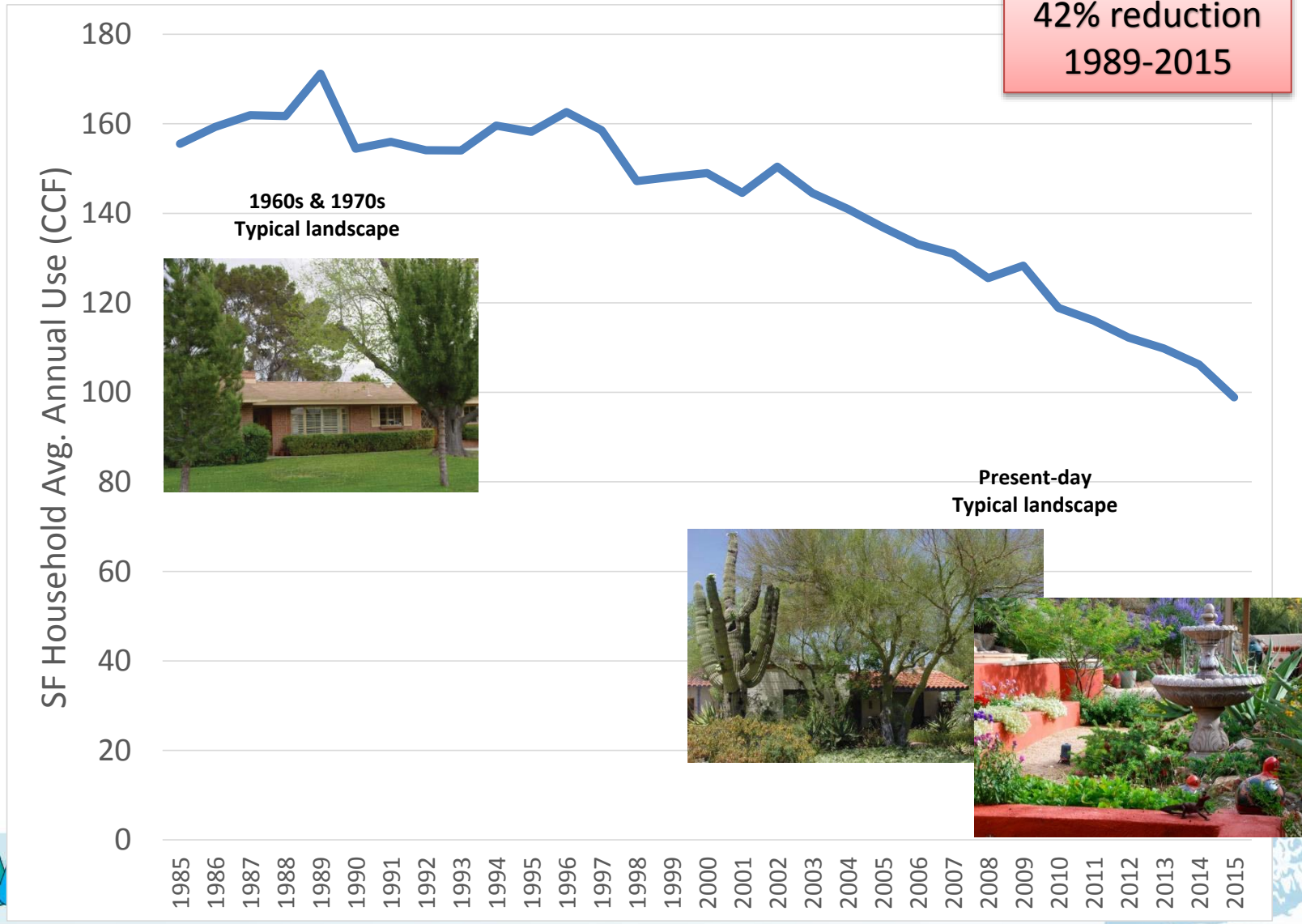
	Toilet	Clothes washer	Shower	Faucet	Leak	Other	Bath	Dishwasher
REU1999	18.5	15.0	11.6	10.9	9.5	1.6	1.2	1.0
REU2015	14.2	9.6	11.1	11.1	7.9	2.5	1.5	0.7

Statistically significant reductions in:

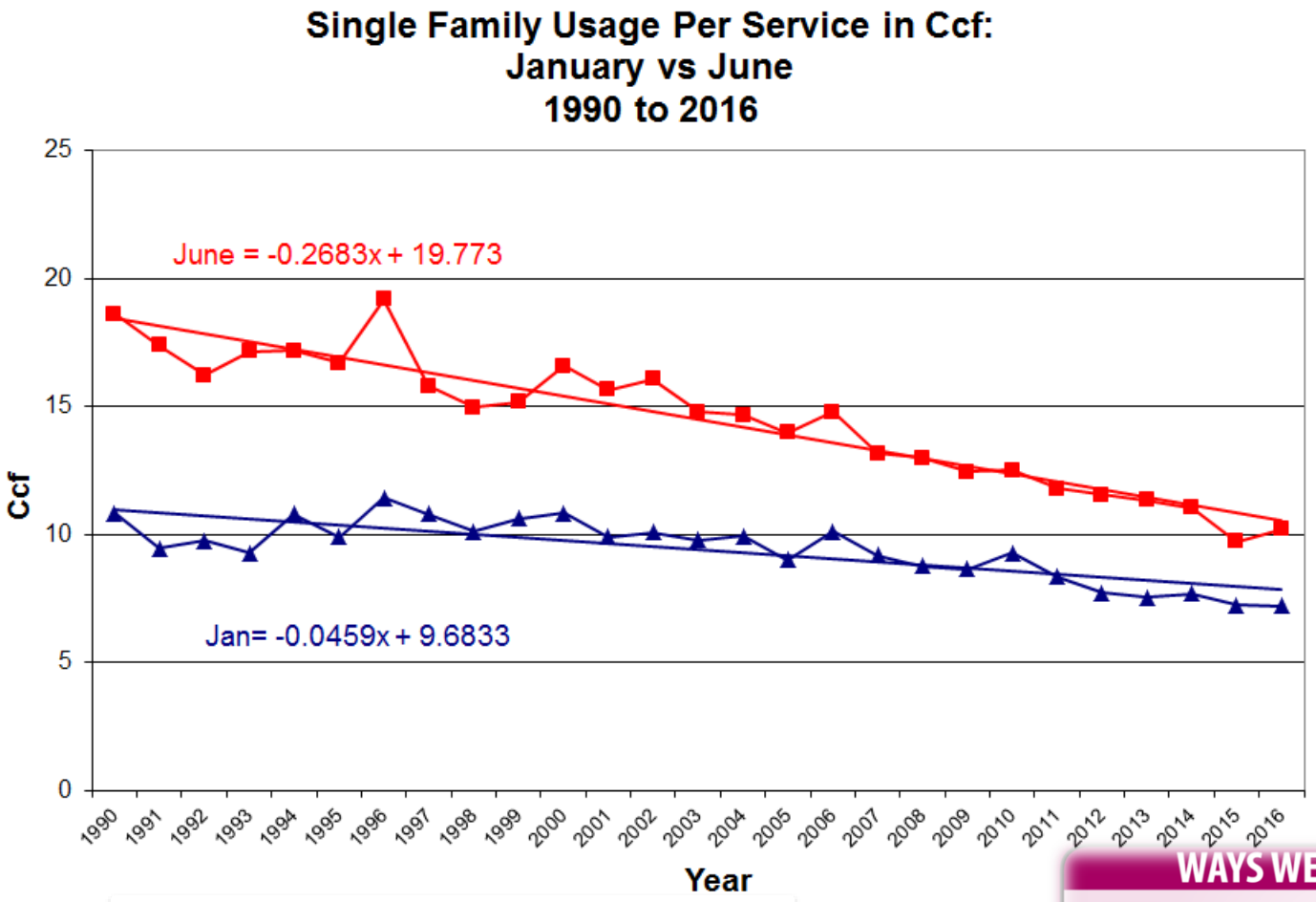
- Clothes washer
- Toilet
- Dishwasher

Source: Water Research Foundation (2015) Residential End Uses of Water Update – #4309. Denver, CO.

Single family avg. annual water use 1985 - 2015



Indoor v. Outdoor Use



Exterior use has decreased 53%

Interior use has decreased 23%

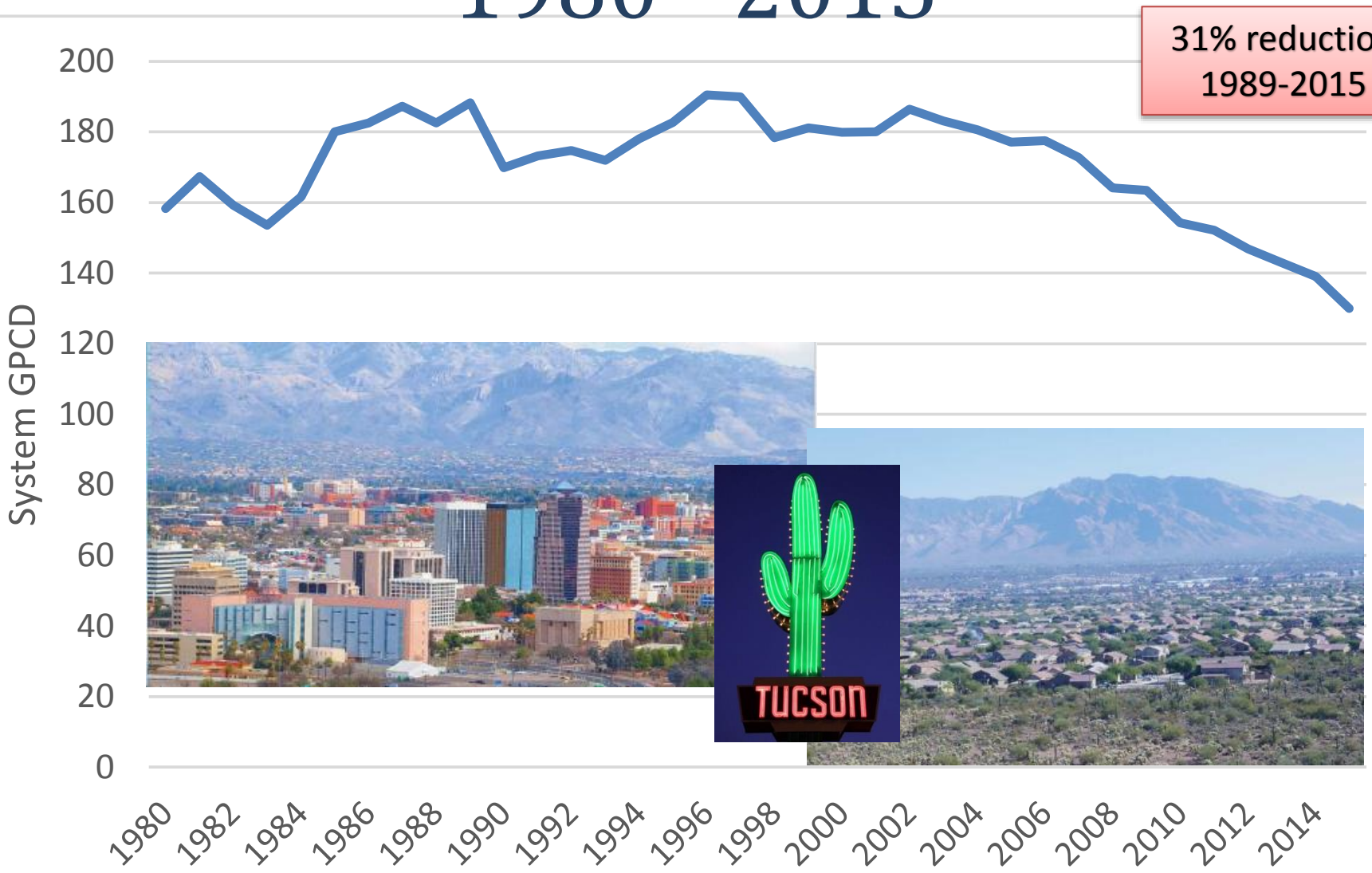
Historically, outdoor water use was 45% of single-family use

TUCSON WATER

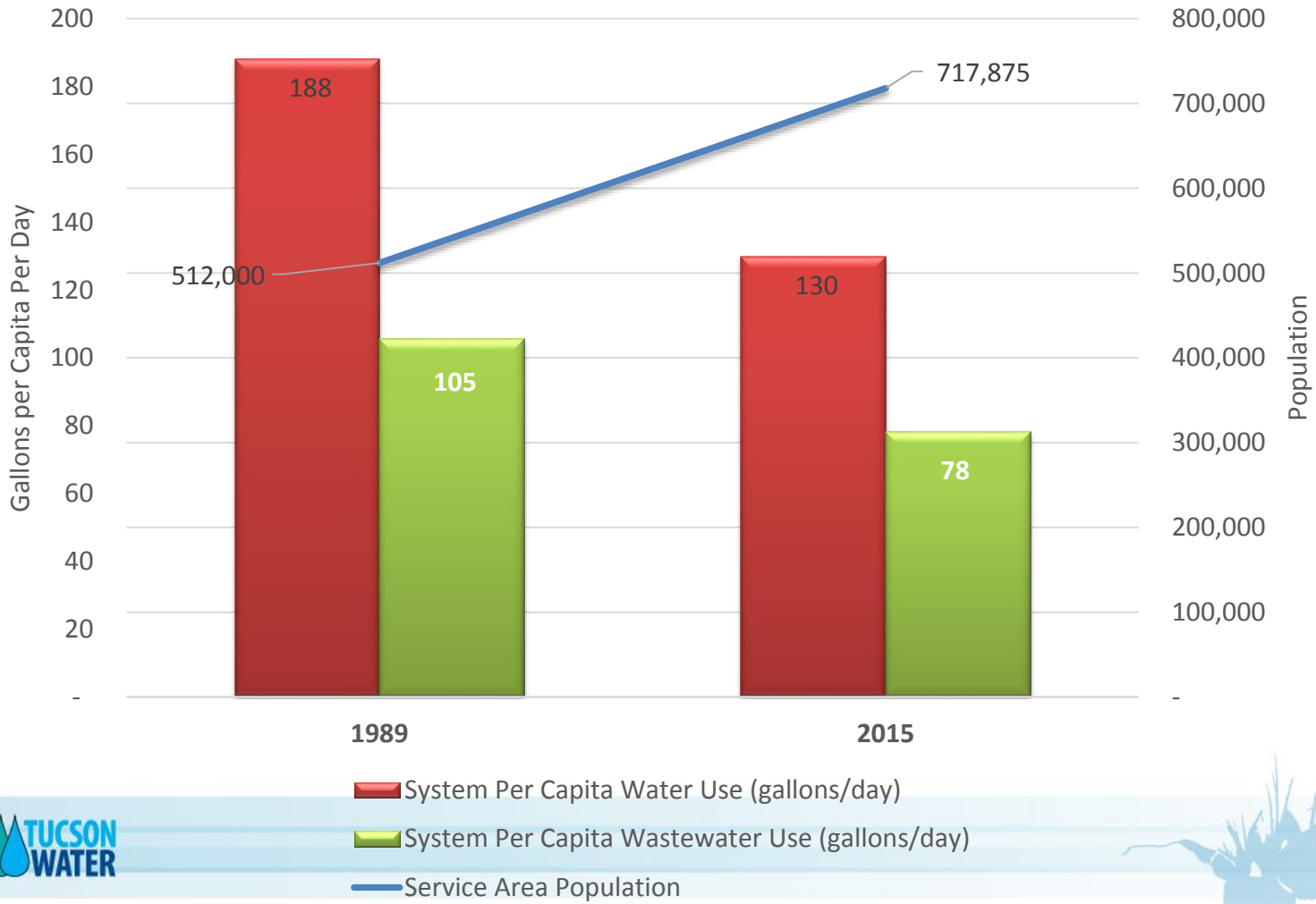
Water efficiency is not one, but many approaches

1. Utility-sponsored conservation & education programs
   - Rebates, Youth & Professional Education
2. Community outreach campaigns: Pete the Beak; Water Reliability
3. Increasing block rate structures
   - 4-Tier structure: $1.73,1-7 ccf; $3.32, 8-15 ccf; $7.73, 16-30 ccf; $12.00 > 30 ccf
4. Local ordinances: Xeriscape Landscaping (1991), Water Waste (1984) & Comm. Rainwater Harvesting (2008)
5. International Plumbing Code → Tucson Plumbing Code
6. National Policy that drives Innovation & technology improvements
   - Energy Star (2002) & WaterSense (2006)

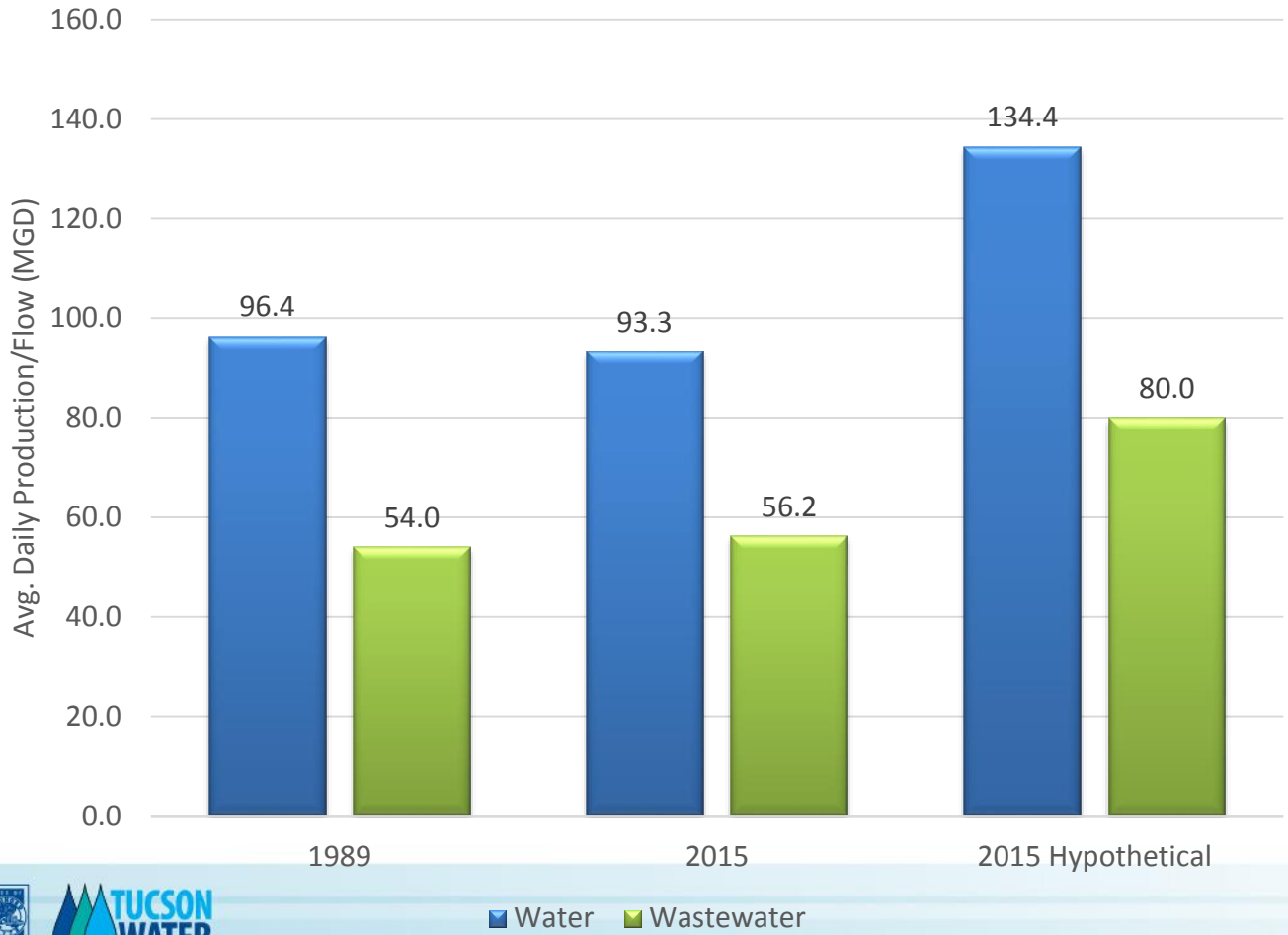
Total Water system GPCD 1980 - 2015



Population and Per Capita Water and Wastewater Use



Hypothetical, non-conserving Water & Wastewater demands



Daily Water Production & Wastewater Flows:
-1989 actual
- 2015 actual
- 2015 hypothetical

1989: 188 / 105 gpcd
Pop. 512,000

2015: 130 / 78 gpcd
Pop. 717,875

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Population & Water Demand

From 1989 to 2015

Service Area population grew by 70%

GPCD decreased by 31%

For the average single-family customer:

Actual 2015 usage: 74,000 gallons

Hypothetical 2015 usage: 97,200 gallons

Customer: *"Why are my rates going up again when I keep conserving water?!"*

Utility Rep: *"It's complicated. Costs of operating our water and wastewater system have increased, yet our community's conservation efforts have helped. Without conservation we'd need to produce more water, which means more infrastructure, more employees, more chemicals to treat the water, more energy to move the water and plainly, more water. All of these costs would add up to higher water bills than you have today."*

Customers are confused and frustrated.

So what are the impacts of delivering less water?

- Can we quantify them?
- Do we know what additional investments have been avoided because we haven't needed that hypothetical, additional water?
  - Transmission/conveyance
  - Water/wastewater treatment
  - Operations
  - Debt service
  - New infrastructure

WATER SYSTEM AVOIDED COSTS

How much additional cost to meet the non-conserving, hypothetical demand of 134 mgd? Or an extra 41.1 mgd?

- Water Treatment Infrastructure
  - $140,000,000 for new Avra Valley Transmission Main CIP
  - $15,400,000 for new 7 MGD recycled water facility
- Operating Costs
  - Additional $22 million per year for water system O&M
- Water Resources
  - None because of CAP supply

WASTEWATER SYSTEM AVOIDED COSTS

What additional wastewater system infrastructure and costs to meet 80 mgd avg. daily flow?

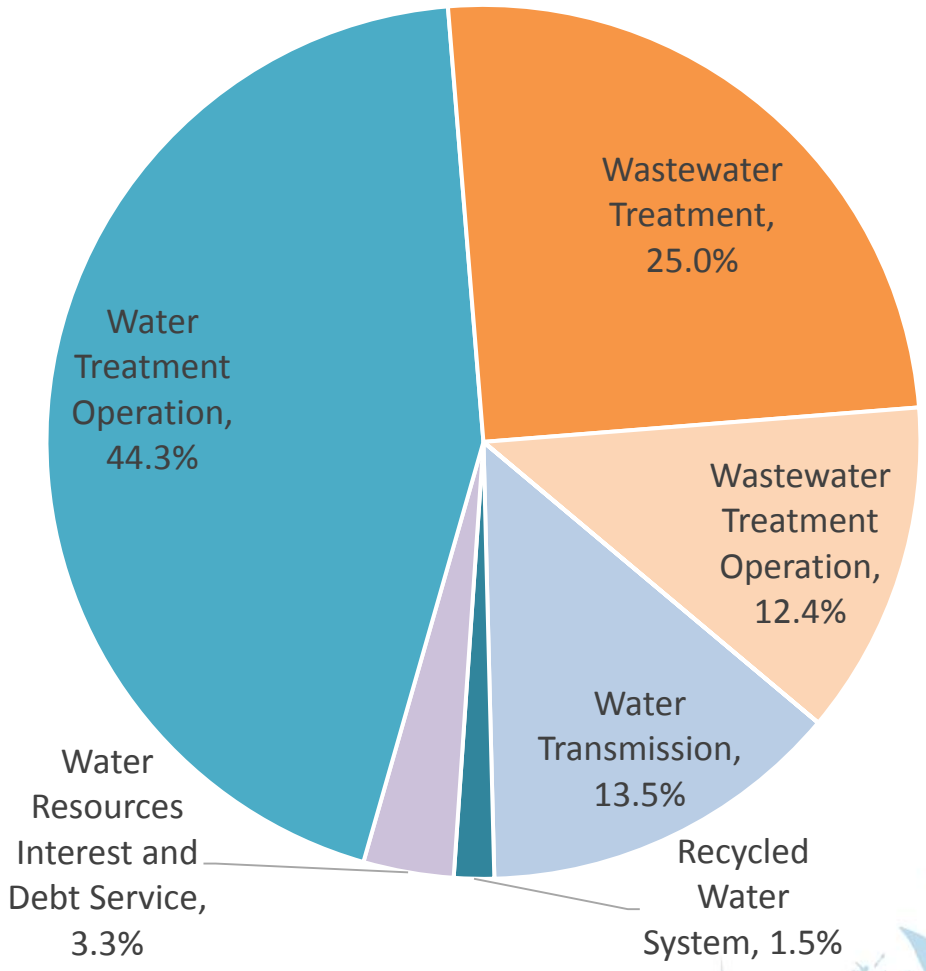
- Wastewater Treatment Infrastructure
  - Current System Max. Treatment Ability ~ 95 MGD
  - Capacity increased to 107 MGD to meet Hypothetical Non-Conserving Daily Flow
  - $195,000,000 for additional 12 MGD of wastewater capacity, financed over time
- Operating Costs
  - Additional $6,400,000 per year for wastewater treatment O&M

$4,066 single-family connection fee or $16.02 million/MGD

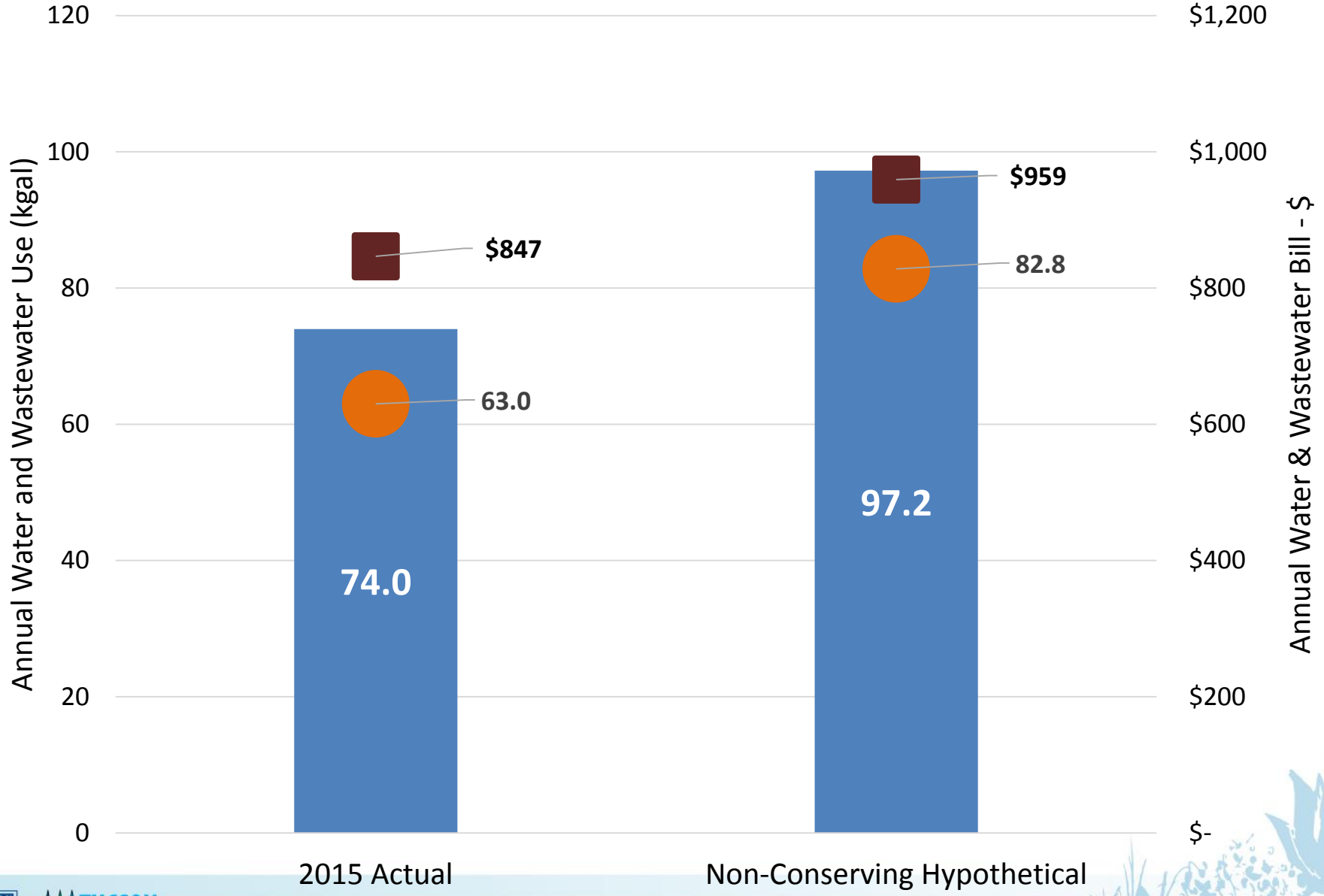
Breakdown of avoided costs

Total avoided costs:
$415,000,000

$351,000,000
In infrastructure alone



How are Customer rates affected?



How are Customer rates affected?

Tucson Water bills are **15% lower**

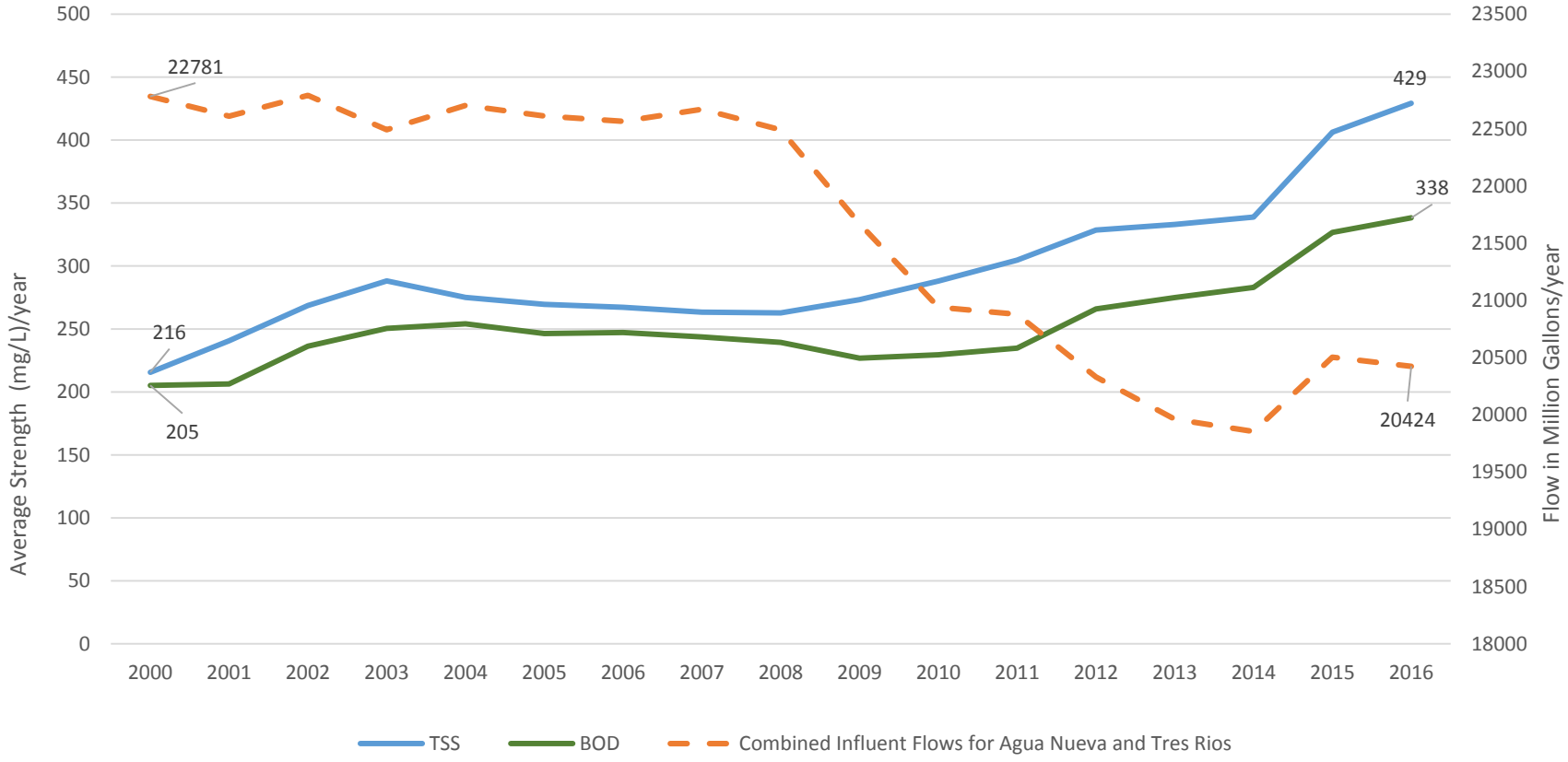
Pima County RWRD bills are **8.6% lower**

Than otherwise necessary if per capita water demand had not been reduced.

Due to water efficiency, combined bills today are at least 11.7% LOWER than otherwise necessary.

TUCSON WATER

System Impacts: Strength of Sewer Flows



System Impacts: Lower Wastewater Flows

- Scour velocities may take longer to attain in newer developments with lower flows
- Flushing of pipes may be required (Yes)
- Potential for more odors in pipes
- Potential for corrosion in pipes
- Terminal ends may require steeper slopes (Yes)
- Cost goes up for deeper sewers (Yes)

Higher population with historic demands would have required…

- 40 mgd more water
- $351 million in infrastructure costs
- $30 million more in O&M – less delivery & treatment costs

Tucson Water didn't build a $15M 7 mgd recycled water facility or a $140M transmission main to Avra Valley

Pima County didn't build additional 12 mgd of capacity in their regional plants @ $190M

To date, we have avoided these costs due to conservation & decreasing demand!

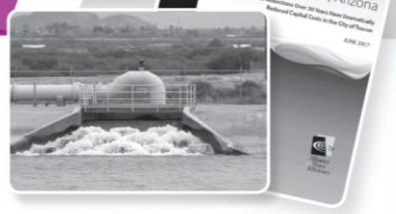
Bottom Line: When Everyone Conserves, Everyone Saves

- Water and wastewater rates have increased because of the increasing costs of providing 24/365 service, while maintaining and improving infrastructure to meet regulatory treatment requirements.
- Planned, long-term conservation is not why rates are increasing.
- The "**answer**" (of a customer paying 11.7% less for water and wastewater service in Tucson today) provides an entry point to talk about the value of our water systems and their ability to provide safe, reliable water service to our community, now and in the future.

Who's hearing the message?

WORKING WITH WATER

Ward 2 Council Member Paul Cunningham provides a perspective on water rates, usage and the long term benefits of conservation and using water efficiently. He explains how conservation has helped to temper utility capital and operating costs and to keep rates low, as detailed in an independent study by the Alliance for Water Efficiency released in June.



Back in Tucson's territorial days, water could be hard to come by. If you lived in town in the 1870s, chances are you didn't have a well and you had to buy water from someone who would bring it up in a wagon from springs in the Santa Cruz Valley south of town. You'd be charged a penny a gallon.

In today's dollars, that comes out to twenty-one cents a gallon. Tucson Water doesn't bill by the gallon, but by the Ccf, which is 100 cubic feet of water or nearly 750 gallons. You'd be paying the equivalent of $158.97 per Ccf in the 1870s.

Which brings me to present time: as of July 3, we are paying a bit more for water.

The average single family household that uses 8 Ccfs per month will see an increase of $2.84 or about $35 per year. I have a young family myself, so I know what even a modest price increase can mean for a tight budget. Still, I supported the rate increase.

Despite the fact that it is a part of city government, Tucson Water is self-funded and receives no money from taxpayers. Tucson Water is a public utility meaning it is owned by you and other citizens. The utility runs safely, efficiently, and in the public interest and, even with this rate increase, at rates below the average for other water utilities in Arizona.

Tucson Water has done a good job keeping costs low while maintaining council-mandated conservation and low-income programs. Still, the reality is that many of the utility's expenses continue to increase.

Which leads to a question that I get from constituents: Why am I going out of my way to cut down on water use if you are going to raise my rates anyway?

It's a valid question. Community members have done a lot to save water and use it more efficiently than many other southwest towns and cities. After hitting its peak last decade, total water use by Tucson Water customers is now at the same level it was in 1985 when we had 200,000 fewer people. But what's the reward if water bills keep going up? Well, there is something called avoided costs.

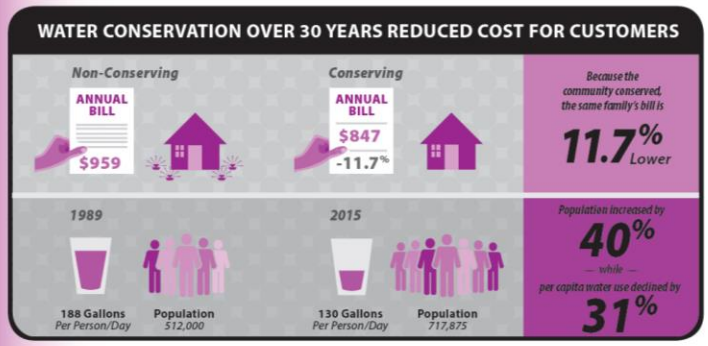
There are expansions that Tucson Water has avoided because of lower water use, efficiency and conservation. A study by the Alliance for Water Efficiency estimates that Tucson Water's maintenance and operation costs would be 30% higher than they are now if old usage trends had continued. That's almost $23 million.

Tucson Water has also managed to avoid having to build some expensive new infrastructure. Plans for an Avra Valley transmission facility were shelved because of the lack of need. That is $140 million that Tucson Water didn't spend because use is down so much. Pima County Regional Wastewater Reclamation Department collaborated on this study. Lower water use has helped avoid nearly $200 million in wastewater system expansion costs.

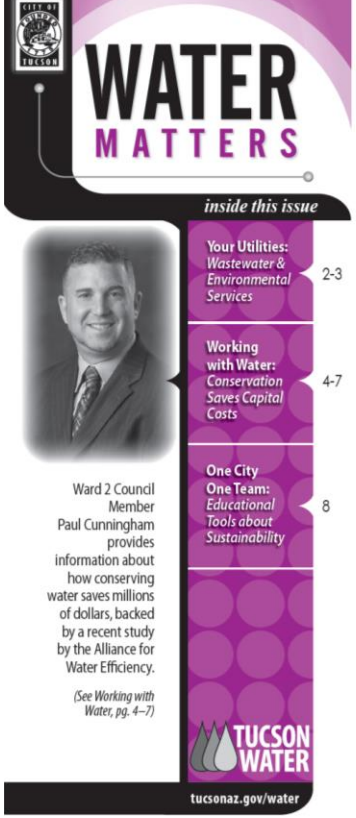
These savings are passed on to customers through lower water and wastewater rates. In all, your bill is 11.7% lower than it would be had we not been conserving.

The reality is that the cost of everything is going up, and that's reflected in our water bill. Still, much of what you've done as conscientious and efficient water users has kept those costs from increasing even more.

Go to **tucsonaz.gov/water** *for the June 2017 Alliance for Water Efficiency Study,* ***"Water Conservation Keeps Rates Low in Tucson, Arizona."***



CALL	CLICK	SOCIAL	TDD	WATCH
Public Information English & Español: (520) 791-4331	tucsonaz.gov/water		(520) 791-2639	tucsonwater



Conservation Program Lessons from Tucson

Conservation Program Lessons

1. Know your community
2. Know your customers
3. Have a marketing/outreach plan
4. Have an evaluation plan
5. Share successes with your customers

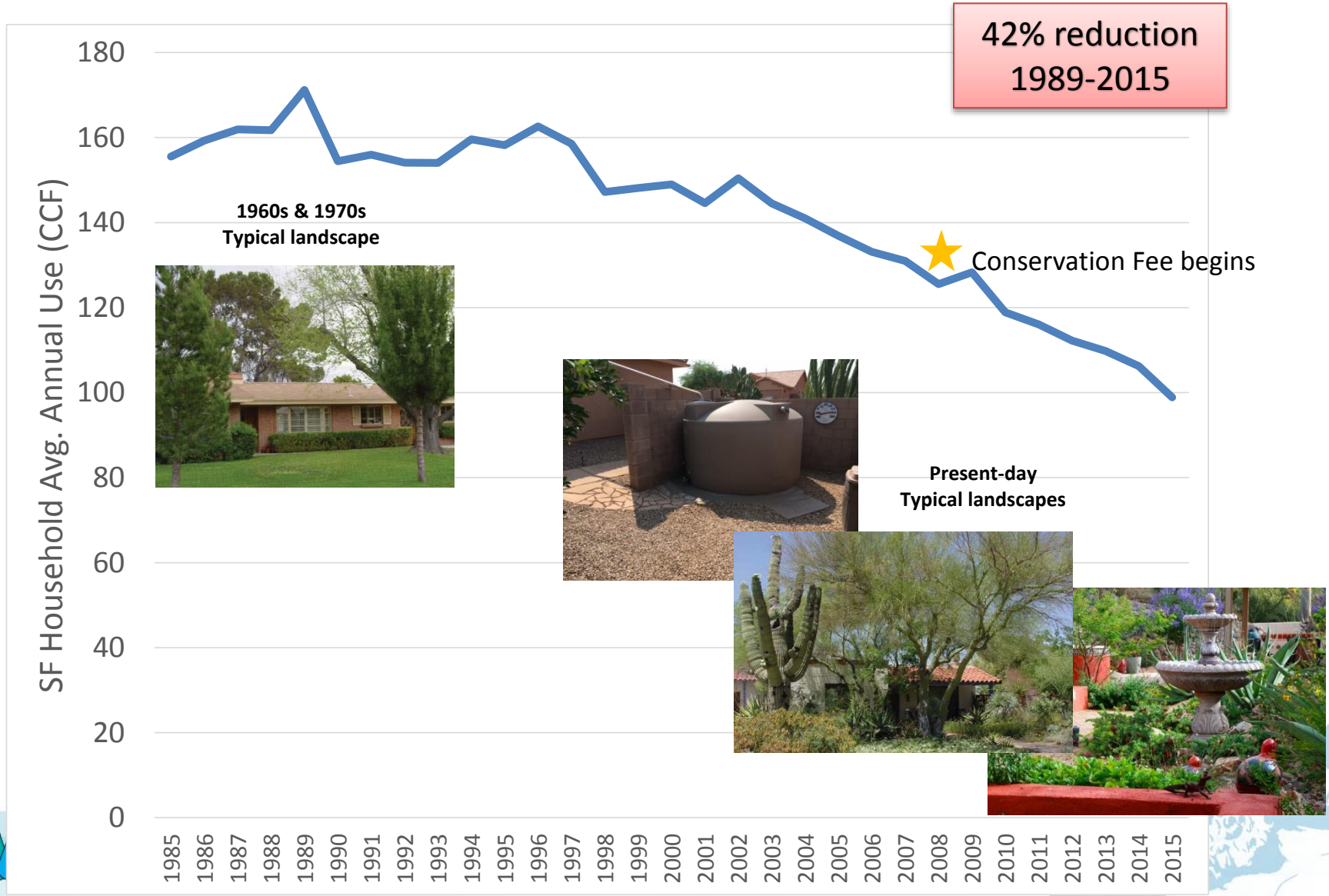
TW Conservation Programs

- Rebates & Incentives for residential, MF & commercial customers
- Water Waste enforcement of Ordinance (27-15)
- Education:
  - K-12 education programs - 50,000 students annually
  - Free Smartscape landscape classes: homeowners & professionals
- Free Water Audits

Residential Conservation Programs

- Rebates for:
  - Indoor Savings: high-efficiency toilets ($75) & high-efficiency clothes washers ($200)
  - Outdoor Savings: gray water systems (up to $1,000) & water harvesting (up to $2,000)

Tucson responds to Xeriscape push



The Conservation Ethic Sticks

And begins to drive new approach to resiliency…

2012: Rebate Program

2017: Neighborhood Grant Program & Low-income RWH program

Commercial Rainwater Harvesting

Residential Rainwater Harvesting

Green Streets Policy

Neighborhood-Scale Rainwater Harvesting

One Watershed Solutions

2010: Ordinance

2013: New const. policy

One Water solutions involve Individuals, neighborhoods, non-profits, city & county

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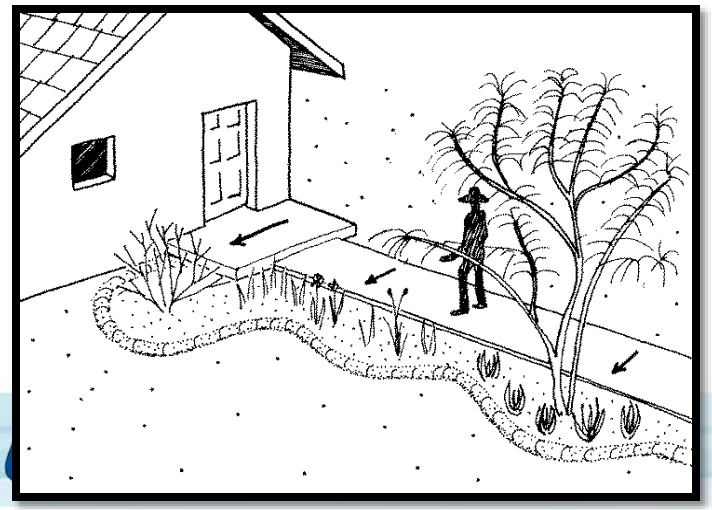
Rainwater Harvesting Rebate

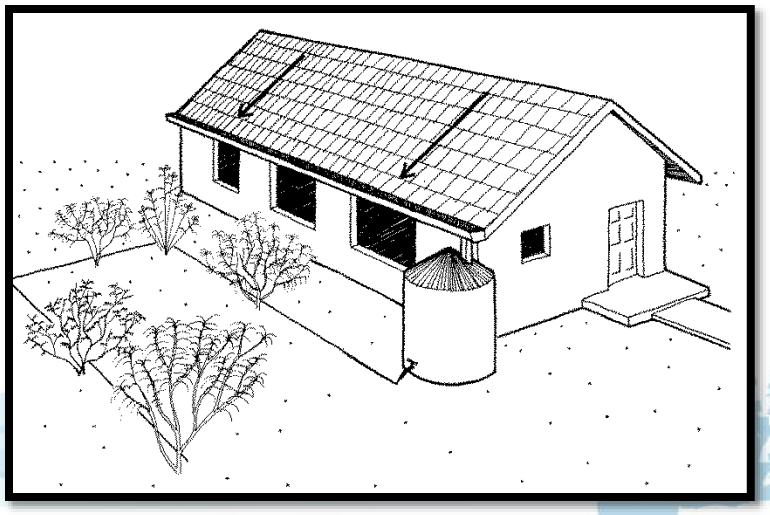
Level 1 - Passive

- Incentive:
  - 50% of the costs of eligible materials and labor up to $500 including excavation, rocks and mulch



Level 2 - Active

- Incentive:
  - up to $2,000 based on gallon capacity of cistern
  - $0.25 per gallon capacity of 50-799 gallon cistern
  - $1.00 per gallon capacity of 800 gallon and larger cistern



"I want to harvest water because... _____"

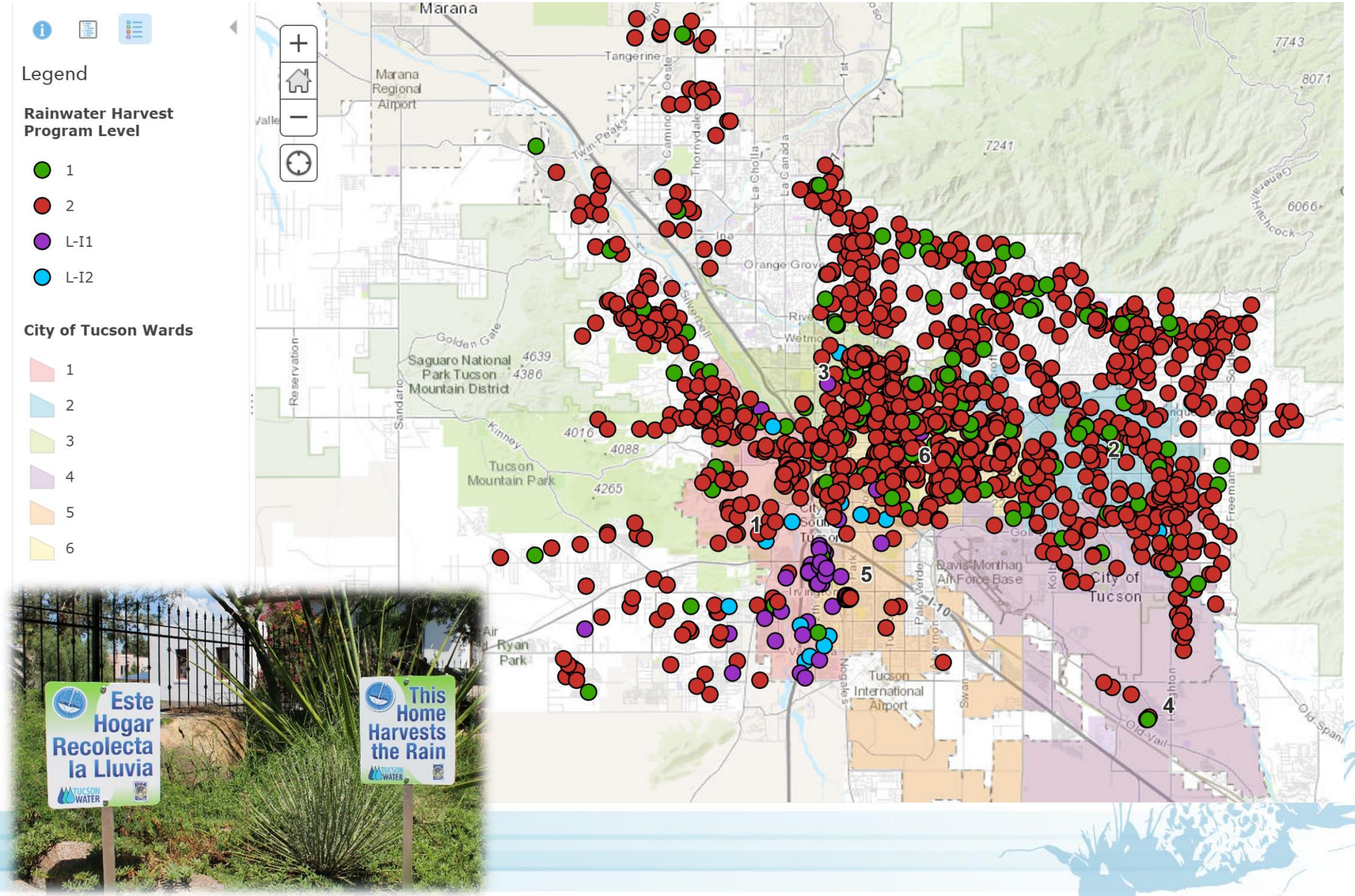
- The water is free.
- The water is better for my plants.
- I need to deal with a flooding problem.
- I want more shade & animal habitat.
- I want a garden.
- I'm tired of my water bills going up.
- It will slow traffic on my street.
- It makes my neighborhood look nicer.
- I think it's the "right" thing to do.
- I don't think we should depend on water from faraway rivers.

Additional benefits like:

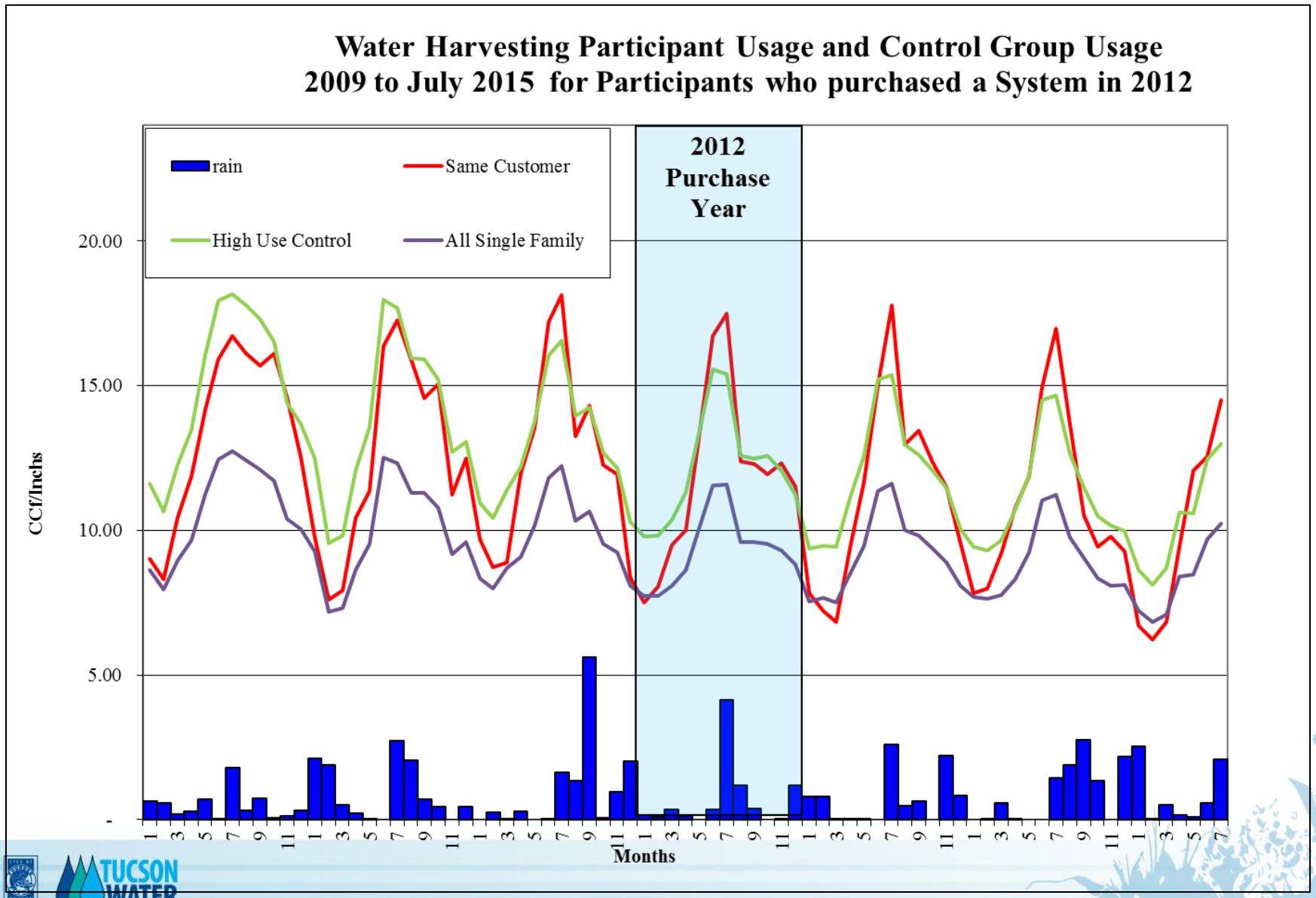
- Beautification/aesthetics
- Flood reduction
- Increased habitat
- Pollution control
- Traffic calming
- Increased tree canopy
- UHI mitigation

Quality of Life & Community Ethic

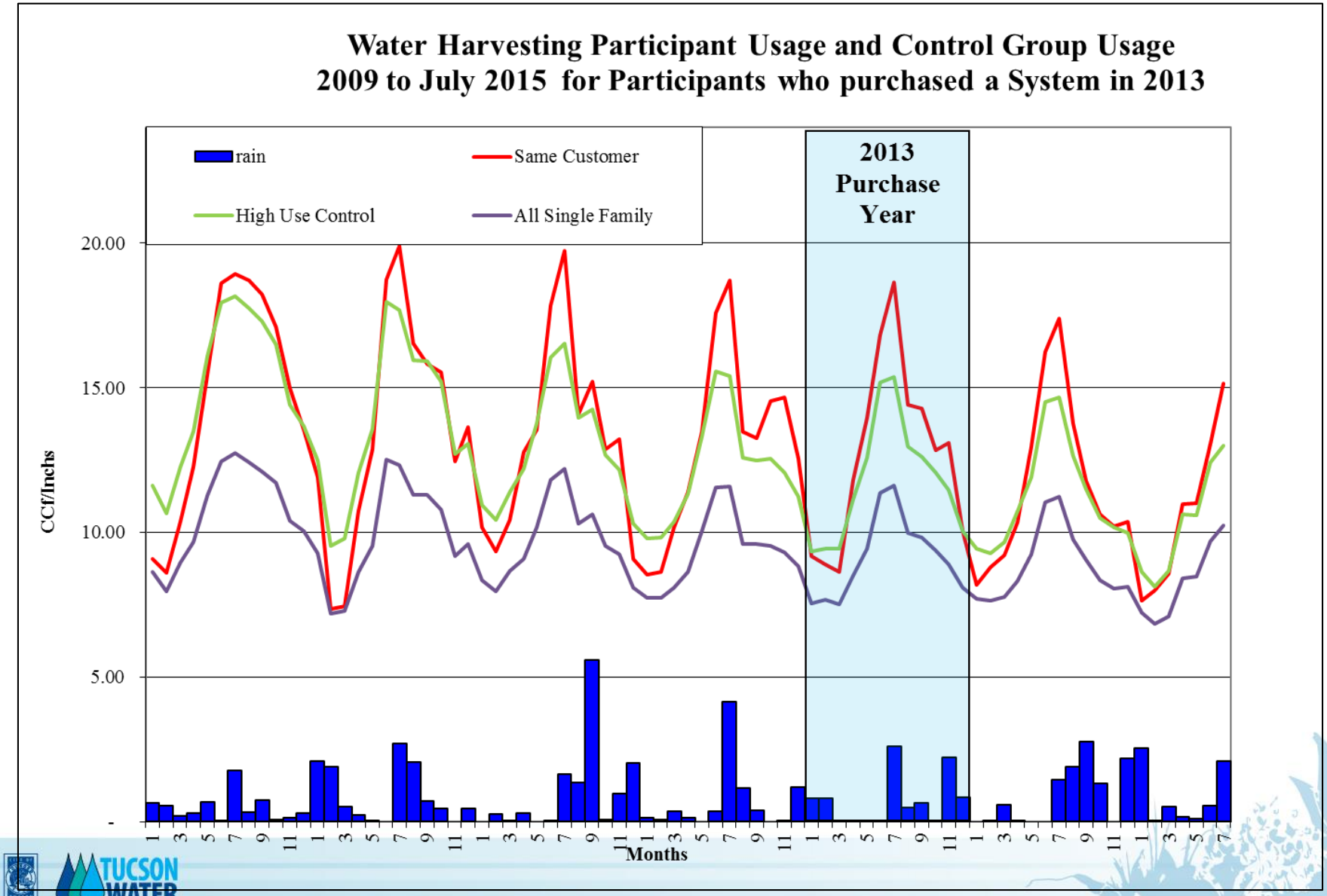
Residential Water Harvesting



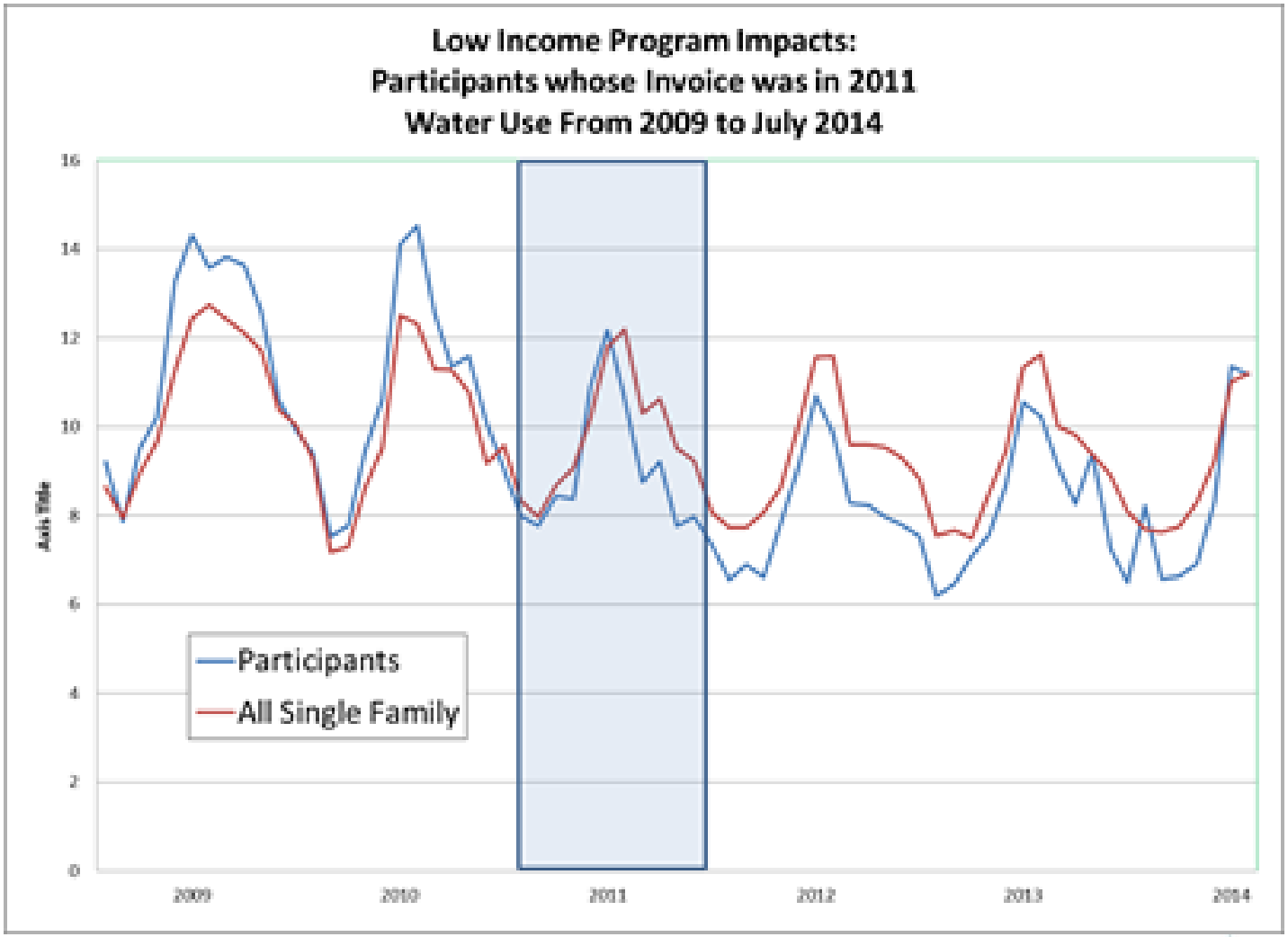
Early Findings



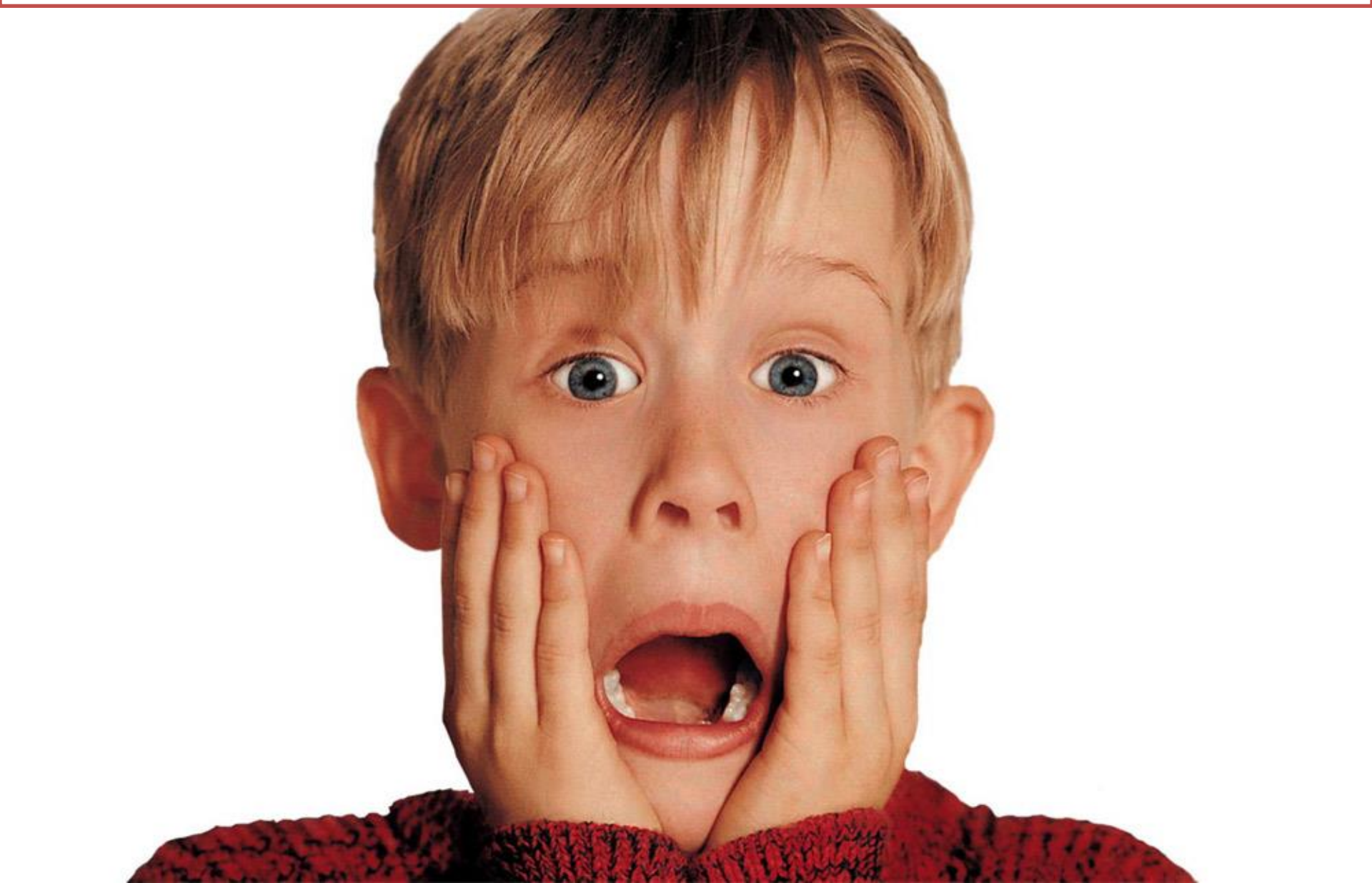
Early Findings



Compared to Limited-income HETs



When City Council heard we (the Utility) were saying Rainwater Harvesting didn't save water…



Let's understand what's going on

What about this program is different than more traditional, demand management conservation programs?

Remotely

1. Maintenance Survey
2. NDVI (Greenness) remote sensing analysis

Directly

3. Participant motivation study
4. Cistern monitoring study

And finally…

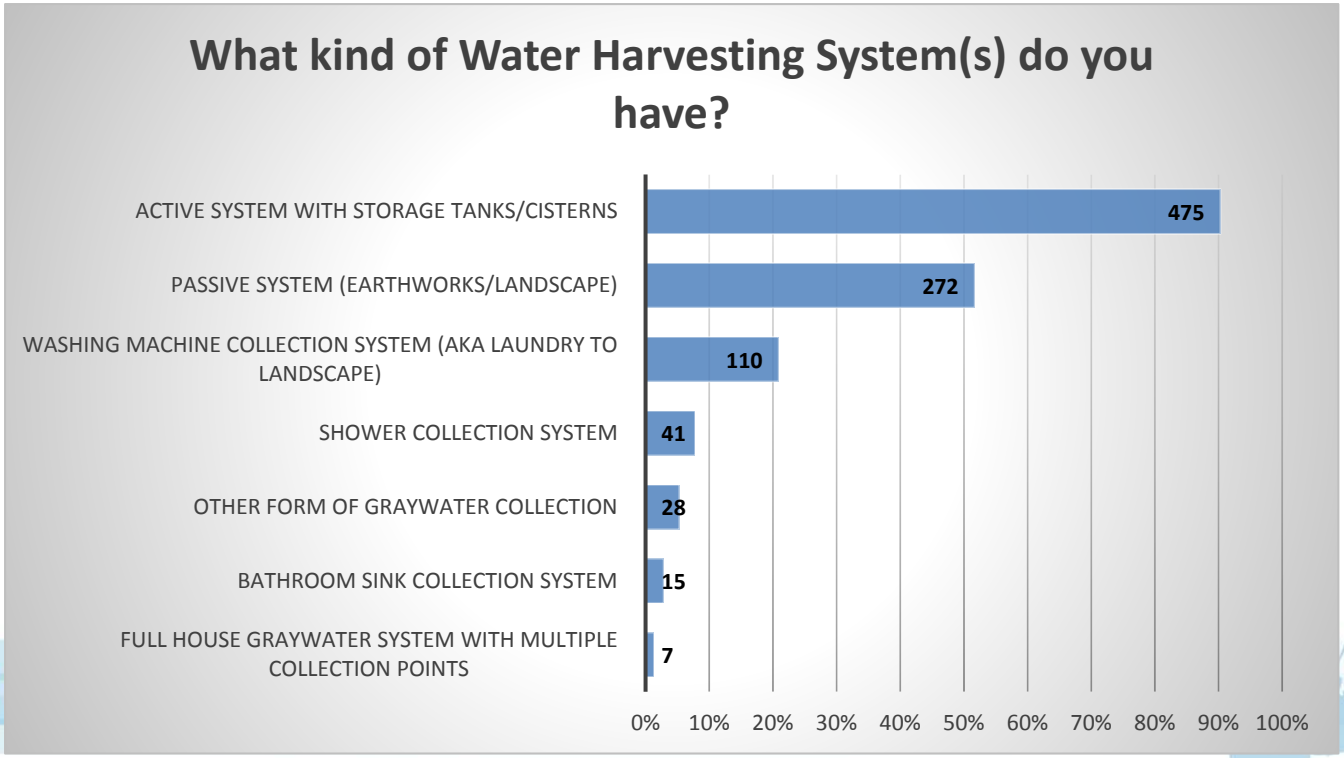
5. Ongoing monthly water use analysis

We find ourselves with an opportunity to re-think how we manage rainwater…

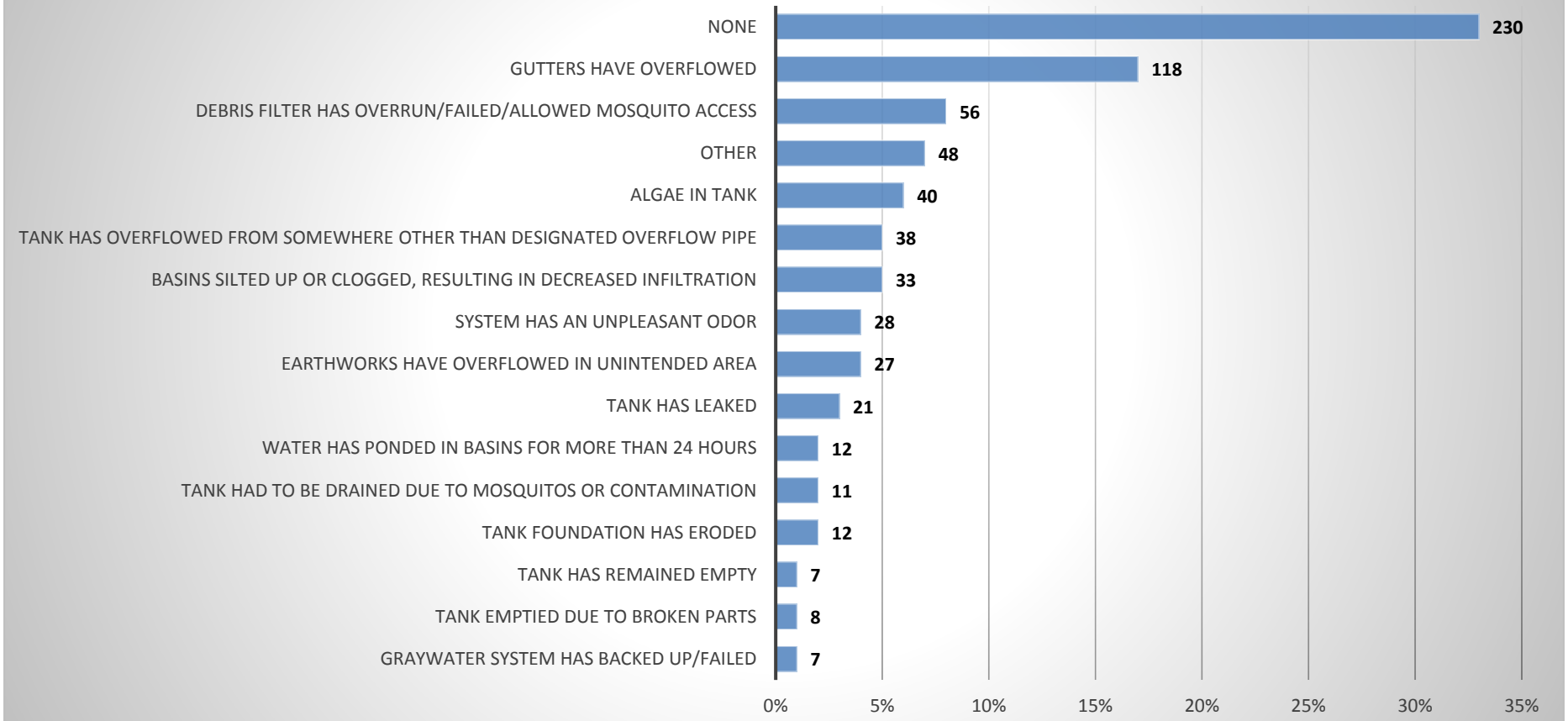
TUCSON WATER

Maintenance Survey

- Goal: ID barriers to effective use of water harvesting systems & recommend best practices



Maintenance Issues that have Occurred



Of the respondents who indicated they had experienced issues, 62% indicated the issues were expected and 38% indicated they were not expected (N=501).

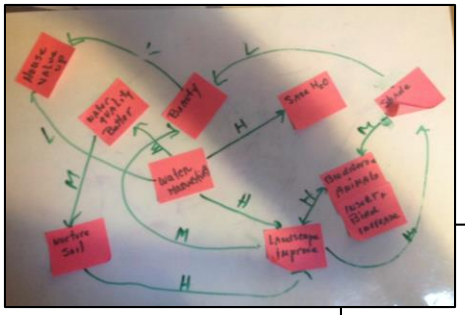
RWH Participant Motivation Study

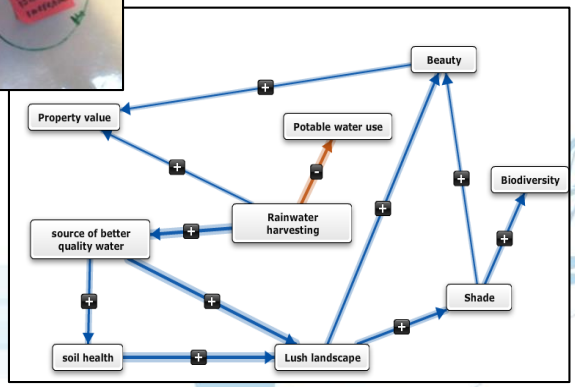
Study Goals – "What we want to learn"

1. To understand **why** people decided to do rainwater harvesting and **how** they are doing it?
2. To identify the **additional benefits** of water harvesting that individuals and the community incur.
3. To prepare **recommendations** on how to use best practices and maximize the benefits of rainwater harvesting.

Research Design - "How to collect info"

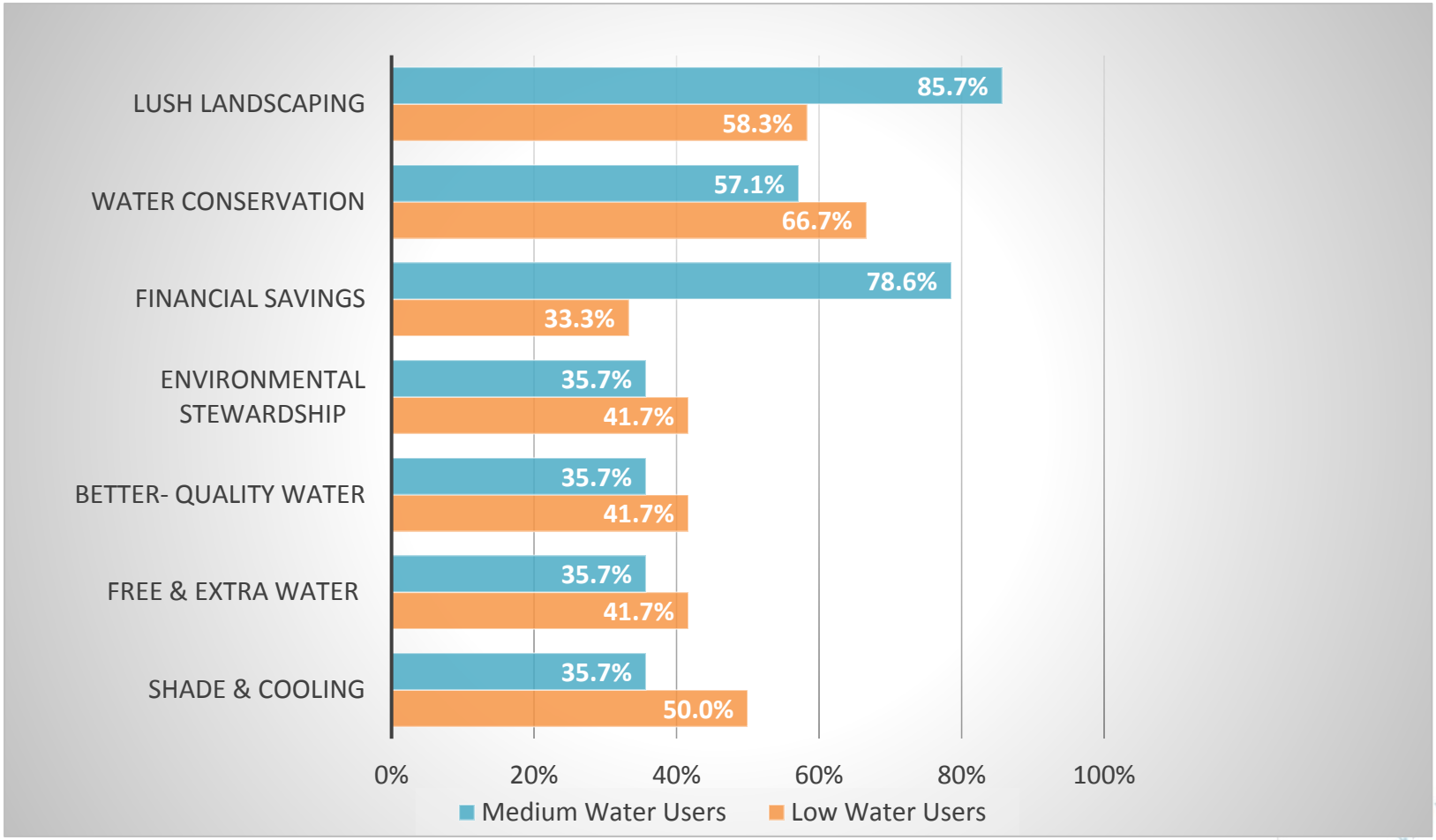
- Interviews
- Landscape surveys
- Monthly surveys
- Fuzzy Cognitive Maps





TUCSON WATER

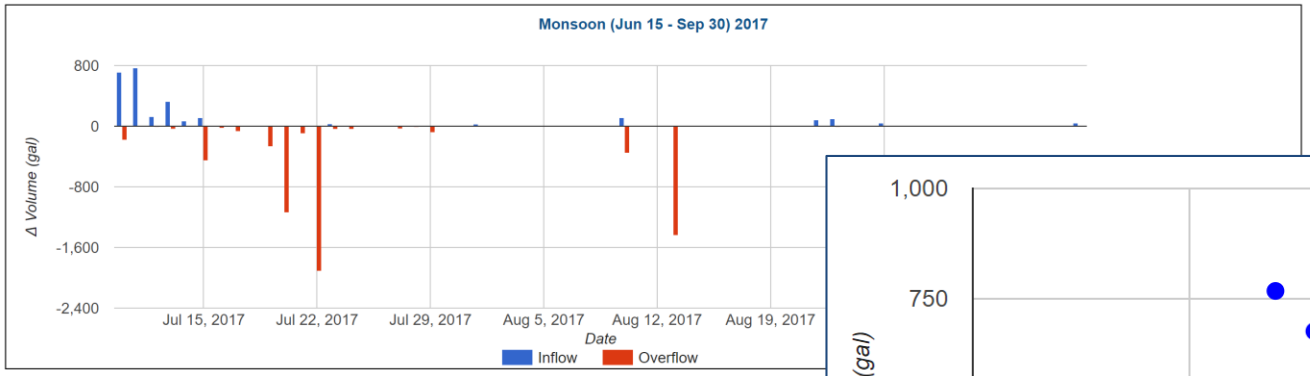
RWH Participant Perceived Benefits

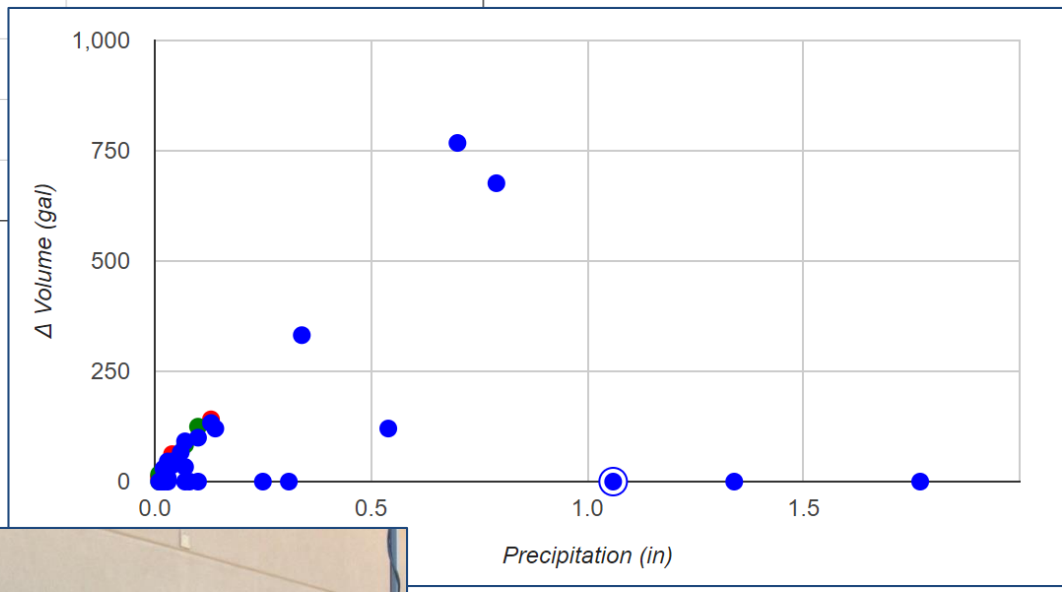


Cistern-level Monitoring

- Goal: Determine frequency & duration of cistern inflows, outflows & overflows to improve sizing & savings estimates
- 15 sites with weather stations & pressure transducers on their tanks
- Water used for: pools, winter gardens, citrus, xeriscapes, mesquite bosques

Data logging cisterns



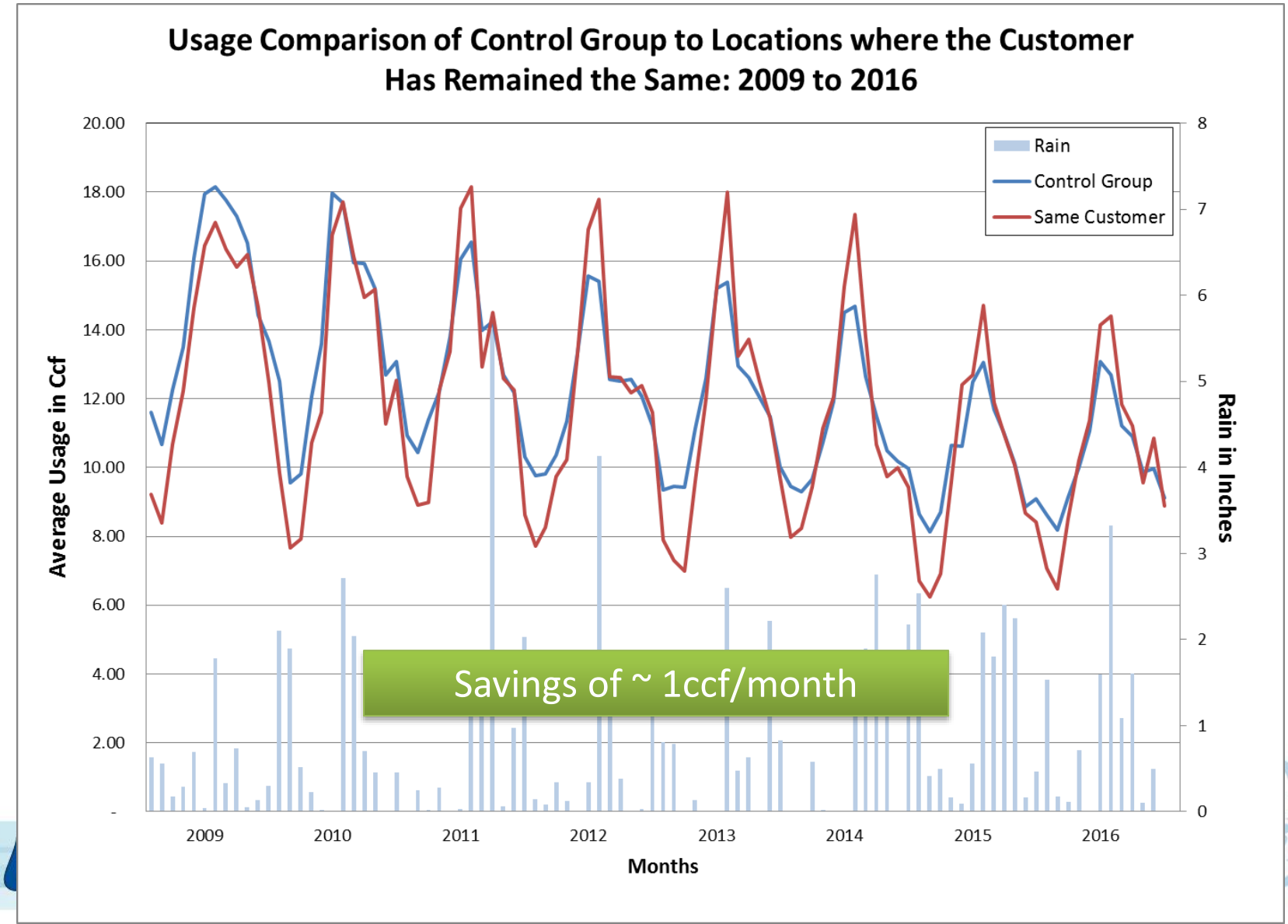


Limited-income RWH Program

RWH Program Lessons

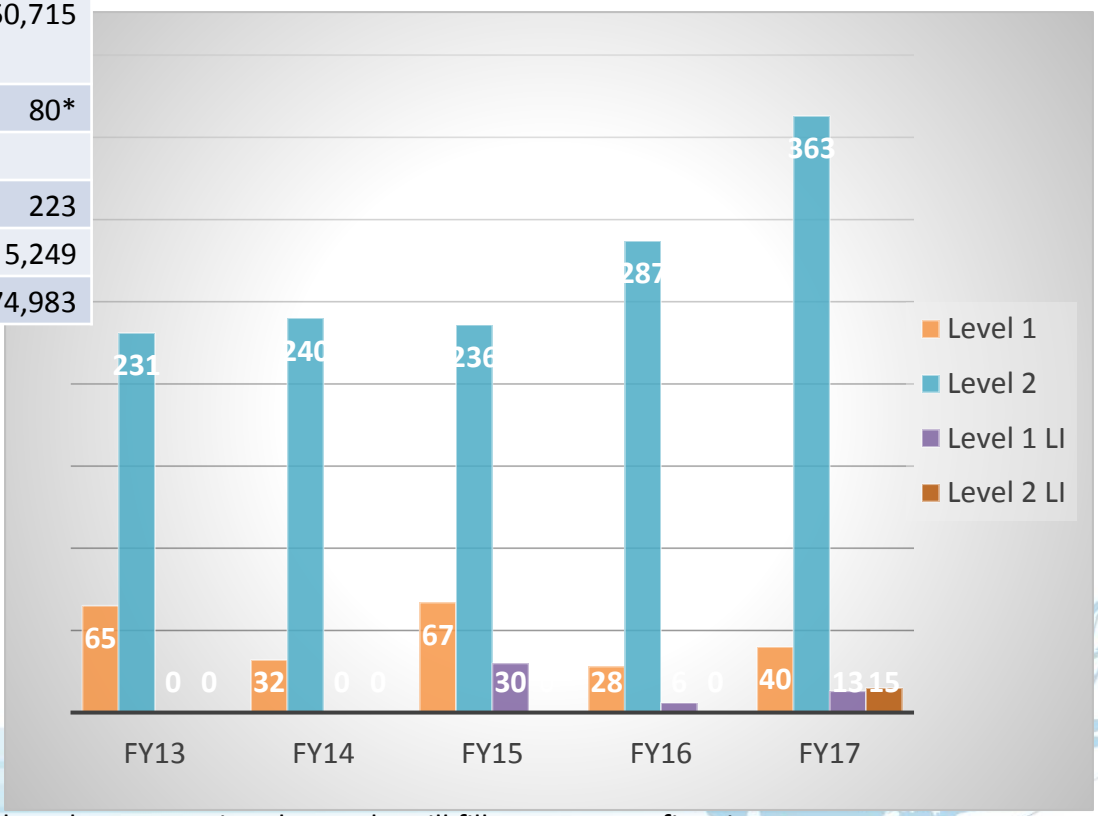
1. Know your community ✓
2. Know your customers ✓ *(after awhile)*
3. Have a marketing/outreach plan
4. Have an evaluation plan ✓ *(has evolved)*
5. Share successes with your customers ✓
   (can do more & better)

More Recent Findings



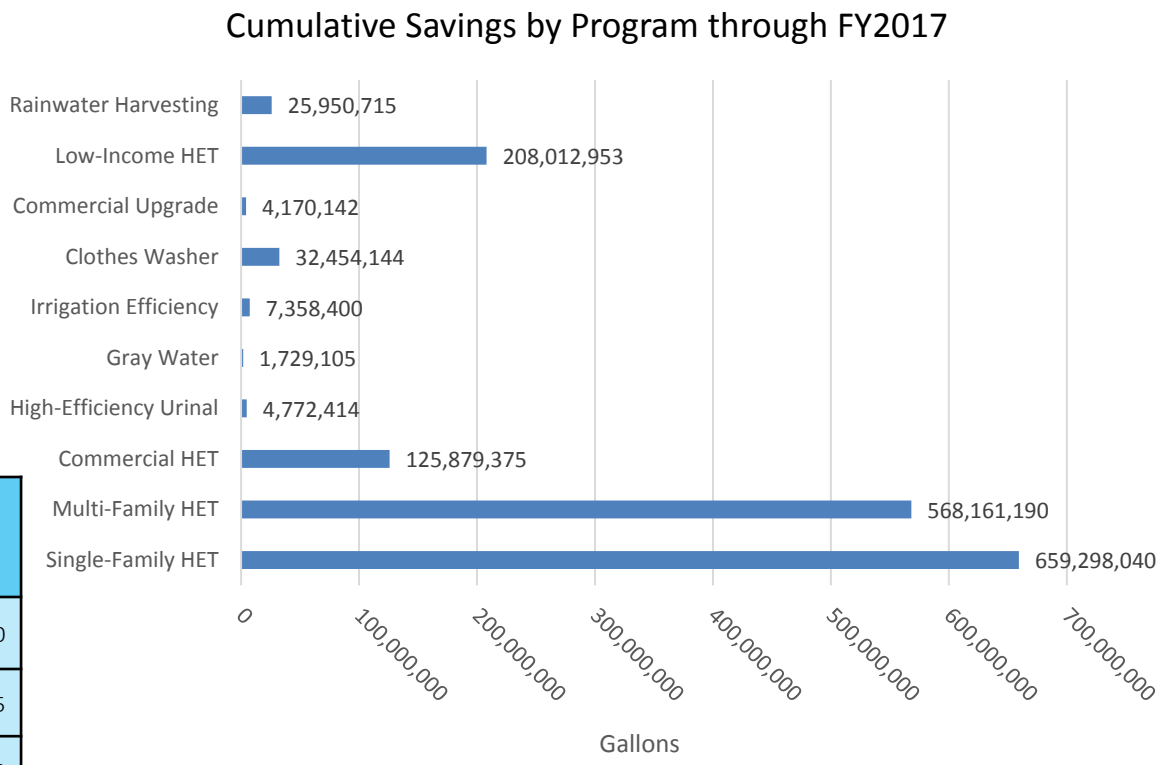
RWH Program Activity

	FY 2016-17 Activity:	Cumulative:
Approved Applications:	438	1,697
Expenditure Level 1:	$118,531	$88,578
Expenditure Level 2:	$395,899	$1,835,361
Expenditure L-I Level 1:	$4,853	$21,910
Expenditure L-I Level 2:	$19,570	$22,210
Estimated Gallons Saved:	2,134,225	25,950,715
Estimated AF Saved:	7*	80*
Staff Labor Hours:	340	
Workshops:	54	223
Workshop Attendees:	1,132	5,249
Gallons of Storage	426,845	1,874,983



*The current estimated savings is based on the assumption that tanks will fill, on average, five times per year.

Conservation Program Metrics



Program	Expenditure	Saved Water (Ccf)	Cost per Ccf
Single-Family HET	$ 139,980	18,916	$ 7.40
Low-Income HET	$ 246,970	8,245	$ 29.95
Multi-Family HET	$ 226,780	30,250	$ 7.50
Commercial HET	$ 18,225	2,774	$ 6.57
High-Efficiency Urinal	$ 2,800	116	$ 24.11
Clothes Washer	$ 389,400	18,342	$ 21.23
Gray Water	$ 12,742	419	$ 30.44
Commercial Upgrade	$ 23,718	4,056	$ 5.85
Rainwater Harvesting	$ 419,959	2,853	$ 147.19

To date, programs funded by the conservation fee have resulted in:

- More than 1.6 billion gallons (5,026 acre-feet) conserved
- More than 8.8 million dollars invested in rebates and incentives
- Nearly 50,000 HET and urinal installations
- Over 1,700 rainwater harvesting and gray water installations

Questions?
Thank you!

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