This presentation premiered at WaterSmart Innovations

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Reduction of Hot Water Line Flushing; Testing the Technology

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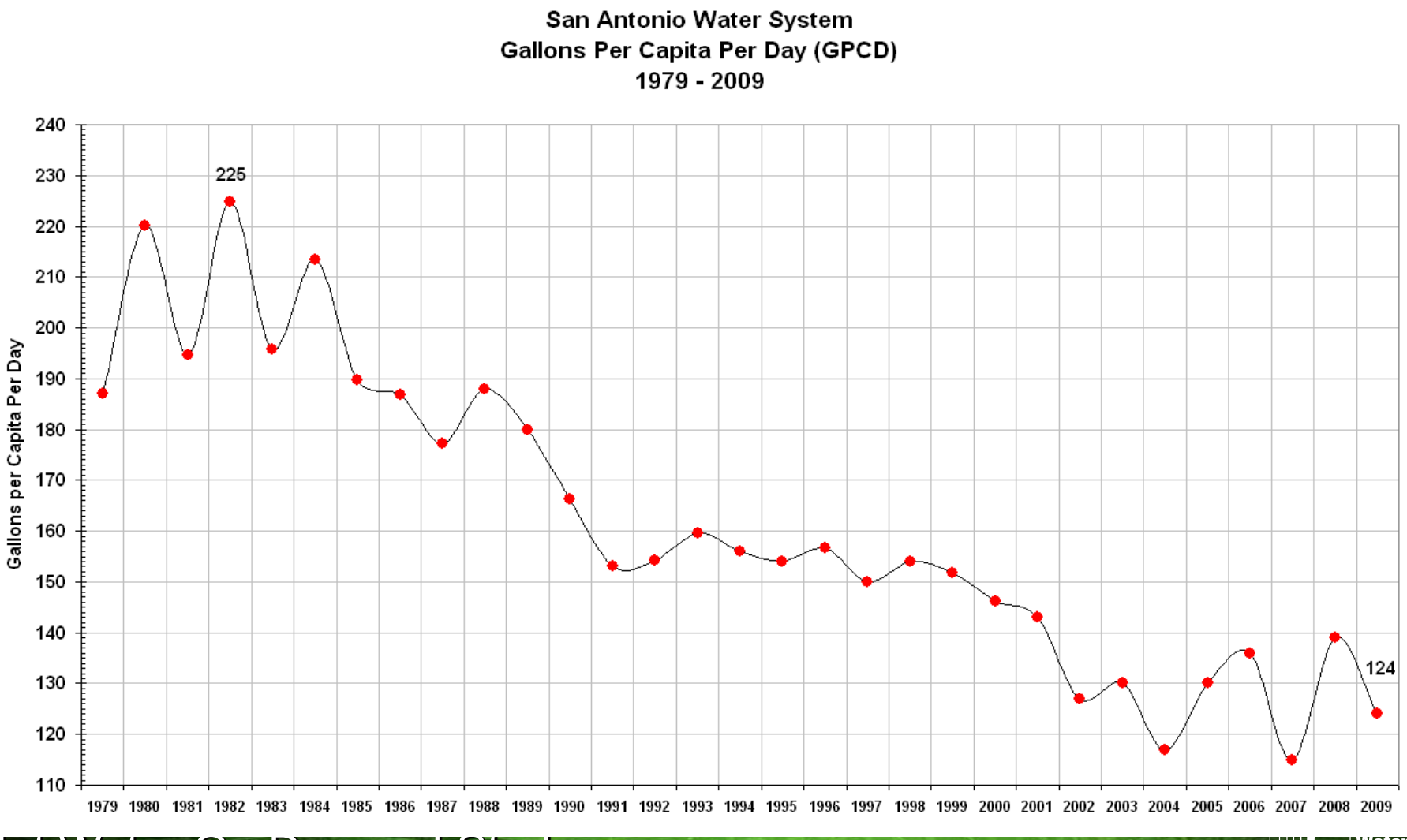
San Antonio Water System

Background: San Antonio

- **San Antonio is America's 7th largest city and growing fast**
- **SAWS is largest local provider of water and wastewater services provided for over 1.3 million people**
- **Primary supply is an aquifer which also feeds springs and rivers key to sustaining endangered species, aquatic habitats and estuaries**
- **All new supply options are expensive and politically controversial**
- **Region is drought prone with extreme precipitation fluctuations**

San Antonio GPCD



Program Goal: 1 billion gallons/year

Kick the Can
FREE Toilets

Watersaver Landscape
Rebates

Wash Right
Washing Machine Rebate

Hot Water
On Demand Rebate

Home Water
Conservation Audits

San Antonio
Landscape Care Guide

E-Newsletter with
Irrigation Advice

Drought Restriction
Enforcement

Reporting Water Waste

Large-Scale Retrofit
Rebate Program

Toilet
Retrofit Program

Commercial Cooling
Tower Audits

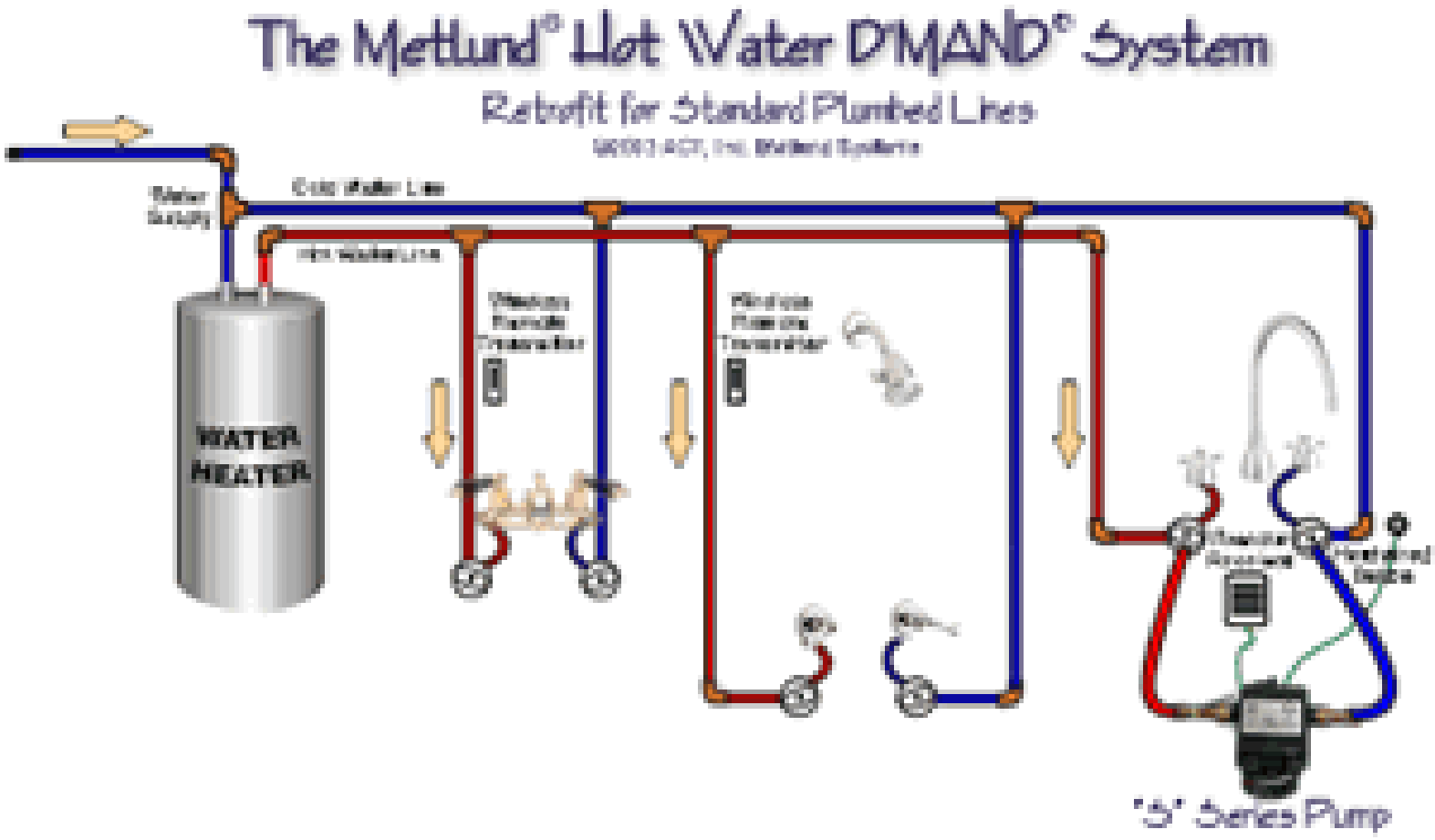
Restaurant Certified
WaterSaver Program

On-Site Cooling
Water Reclamation

Why Hot Water On Demand

- Line flushing to obtain hot water is a usage that should be eliminated
  - Larger homes may have up to 5 min wait for hot water; up to 6 gallons of flush per usage
  - Users dislike the wait and waste
- New home construction is addressed with:
  - R-4 insulation to reduce cooled water problem
  - Circulation pumps with dedicated return lines
  - Improved hot water location/plumbing layout
- Program addresses retrofit of older homes

What is HWOD?


The Metlund® Hot Water DMAND® System
Retrofit for Standard Plumbed Lines
WATER HEATER
"S" Series Pump

Hot Water On Demand - Background

- The San Antonio Water System (SAWS) wanted to evaluate the effectiveness of our Hot Water on Demand (HWOD) rebate program
- SAWS Staff proposed an analysis of water use on households both pre and post installation of a HWOD system

Hot Water On Demand – Volunteer Homes

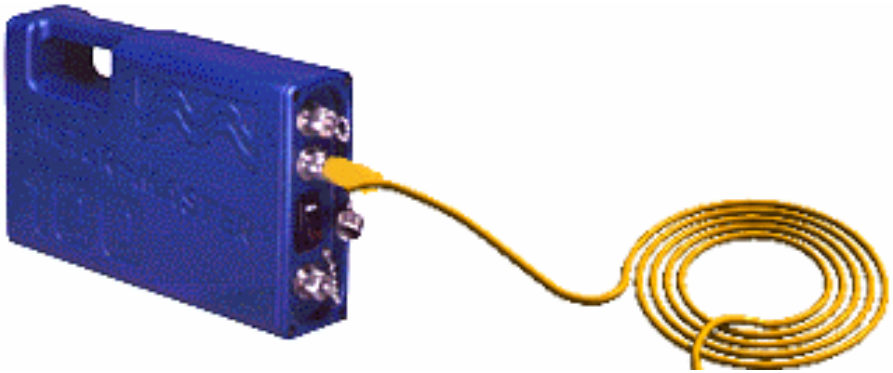
- SAWS brought the concept of the study to its Community Conservation Committee (CCC) for discussion
- The CCC is an advisory group made up of citizens from within the SAWS service area
- The CCC members were asked if they would like to participate in a study of their home water use for this project

Hot Water On Demand – Small Analysis

- 9 CCC members responded positively to the request
- The study ended up with 7 households after 2 members withdrew

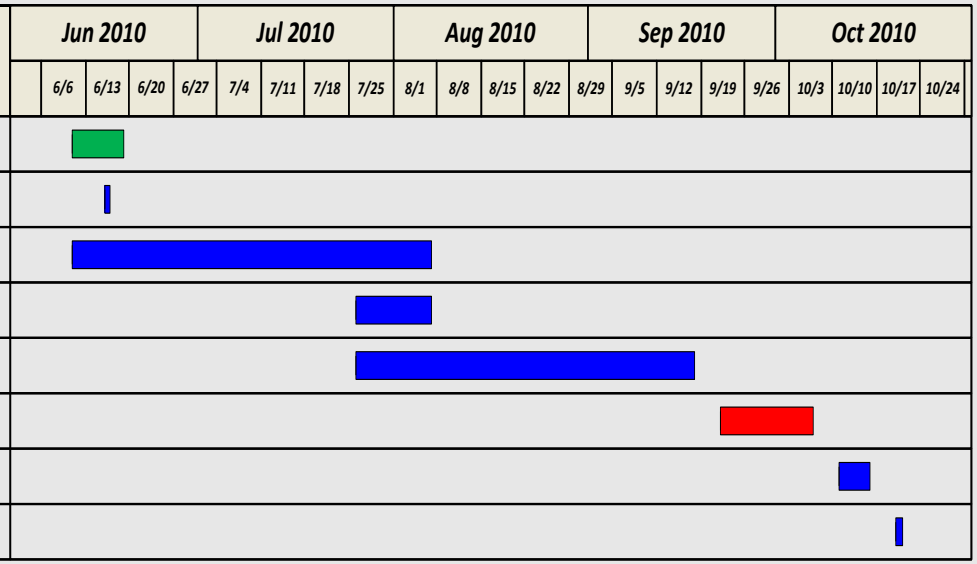
Hot Water On Demand – Study Method

- Data collection began in June of 2010 and is currently still being collected
- SAWS chose to use the Meter Master 100 EL as it's tool of choice for data collection



Project Timeline

ID	Task Name	Start	Finish	Duration
1	Install Meter Masters	6/11/2010	6/18/2010	6d
2	CCC Meeting	6/16/2010	6/16/2010	1d
3	Pre-Install Readings	6/11/2010	8/6/2010	41d
4	Hot Water Install	7/26/2010	8/6/2010	10d
5	Post-Install Readings	7/26/2010	9/17/2010	40d
6	Elliott Out	9/22/2010	10/6/2010	11d
7	Analyze Results	10/11/2010	10/15/2010	5d
8	Present to CCC	10/20/2010	10/20/2010	1d



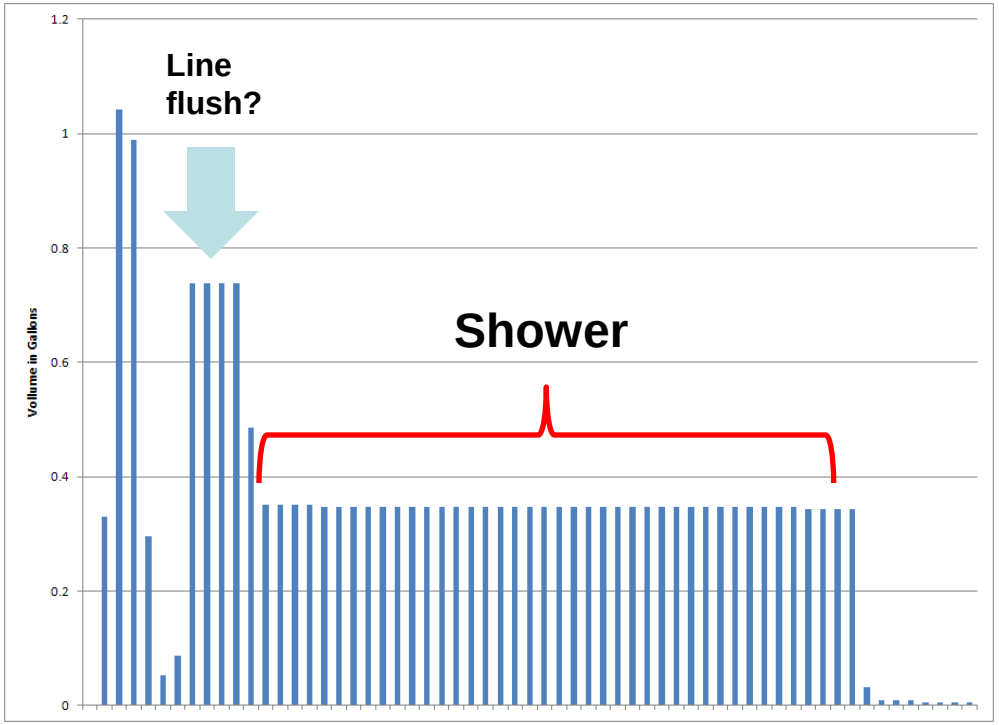
Hot Water On Demand - Background

- The Meter Master 100 EL allowed SAWS to gather data at 10 second intervals for up to 15 days in a row
- The ability to collect data at this resolution was important for a couple of reasons
  - The amount of flow that SAWS was attempting to trace was small in comparison to all of the flows in the house
  - 10 second intervals is a “standard” in the conservation community as it formed the basis for the Residential End Uses of Water Study (REUWS) in 1999

What Are We Looking For?

Theory vs. Practice

- Reductions in hot water consumption; how much is there to save?
- Looking for patterns in hot water usage to identify “line flushing”
- How much water is actually saved by eliminating line flushing?



Hot Water On Demand - Method

- Data was collected roughly every 2 weeks from June through September 2010
- Data was downloaded to a laptop in the field and meter reading were taken at the same time

Hot Water On Demand – Volunteer Effort

- As the Meter Masters were collecting data, study participants were asked to keep a journal of their hot water use
- The purpose of the journal entries was to help identify specific hot water use events in the data

Hot Water On Demand; Data Challenges

- Specific to this study example:
  - No backflow preventers installed
  - Water seeping in to meter box
  - Sensor movement on the meter
- Each of these issue can lead to data inaccuracies over time
- Volunteers may alter water use behavior due to logging hot water usage

Hot Water On Demand – Hot Water Journal

- Sample journal page

Hot Water on Demand Study
Journal Entry Sheet

Date	Time			Hot Water Activity (Shower, dishes, etc)	Location in House	Duration	Used Hot Water On Demand?	
	Hour : Min	AM	PM				Yes	No
___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐
___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐
___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐
___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐
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___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐
___/___/10	__ __:__ __	☐	☐			____ min.	☐	☐

Participant Name: «First_Name» «Last_Name»	Notes:
Tap #: «Tap_Num»	
Address: «St_Num» «St_Name»	

Hot Water On Demand - Background

- Study participants were asked to return their journals in September
- At the same time, data that was collected over the summer was analyzed and reformatted for analysis

Hot Water On Demand – Journal Results

- 3 of the participants had usable journal entries to help identify when hot water was being used in the home
- 3 of the homes did not have journal entries available and/or will require some additional analysis
- 1 home did not have a journal but only collected some data as part of a post study effort

Hot Water On Demand – Analysis Method

- Data collected with the Meter Master units was processed with Microsoft Access and prepared for analysis use Trace Wizard software from Aquacraft, Inc.
  - Trace Wizard helps identify types of flow (e.g. shower vs. washing machine) in a set of data based on a fixture use profile
  - The profile can be modified in multiple ways by the user
  - The journal entries were used to help modify profiles in order to find specific uses

Hot Water On Demand – Main Participants

- Summary of households that ended up with data
  - Each participant had a distinct profile of family living in the house.
    - Household A – Multi-generational family
    - Household B – Older couple
    - Household C – Single younger female
  - Households A and C had a traditional hot water on demand system installed
  - Household B had a system with a timer installed

Hot Water On Demand – Household A

- House built in 1984
- Living area of 1,582 square feet
- Lot size of 0.1749 acres

Hot Water On Demand – Household B

- House built in 1958
- Living area of 1,176 square feet
- Lot size of 0.1848 acres

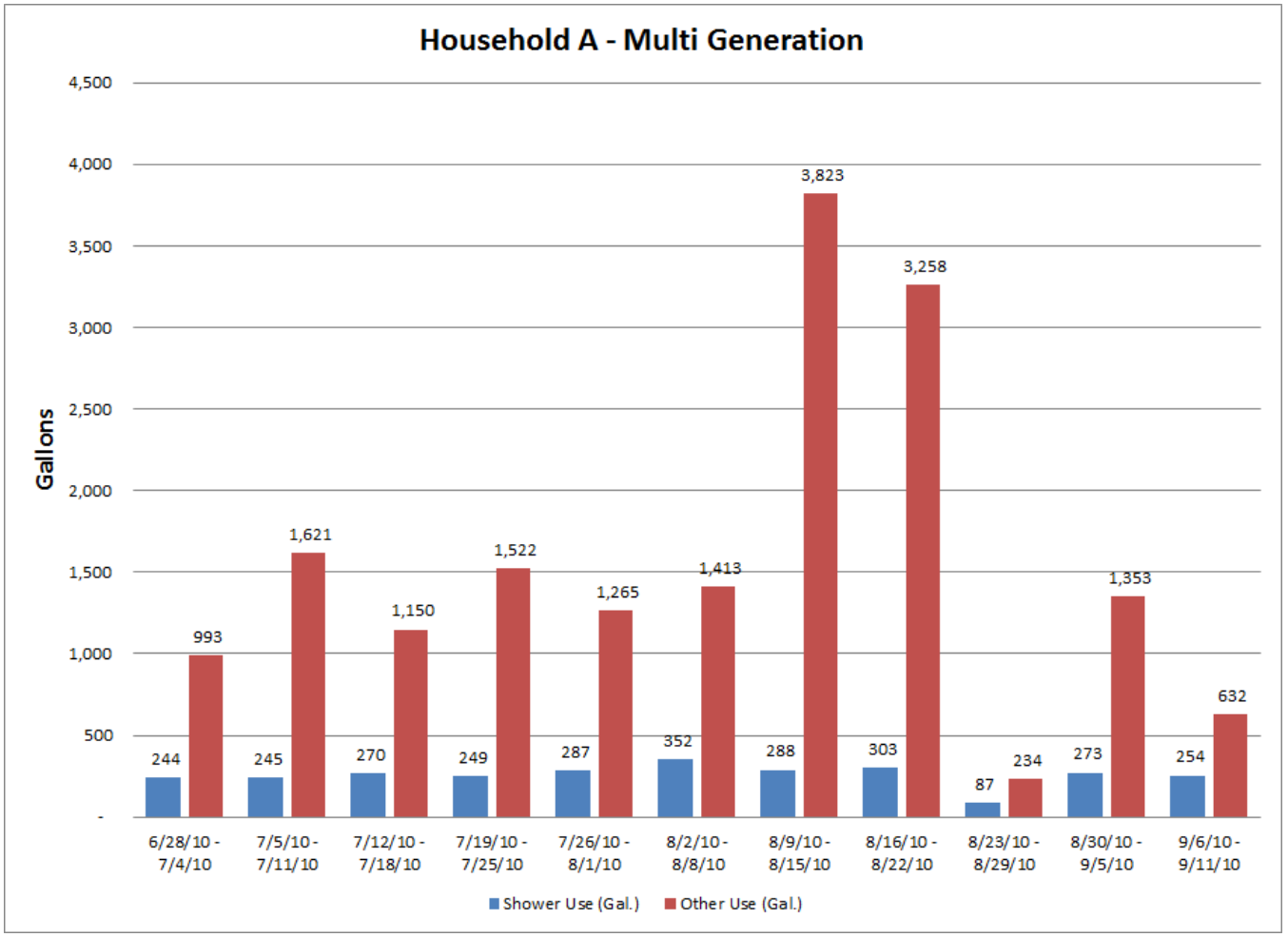
Hot Water On Demand – Household C

- House built in 2000
- Living area of 1,704 square feet
- Lot size of 0.2787 acres

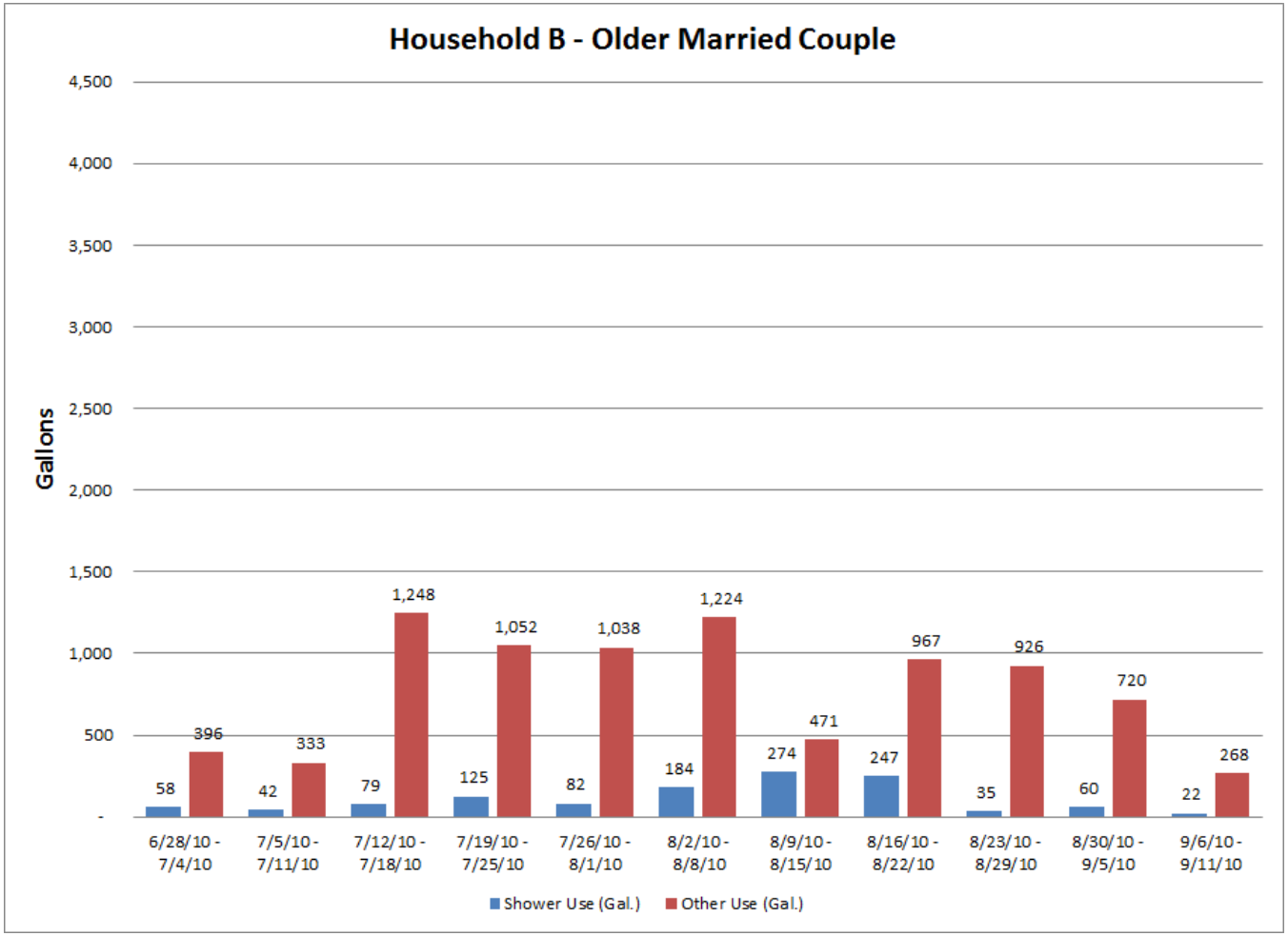
Hot Water On Demand – Preliminary Results

Dates	6/28/10 - 7/4/10	7/5/10 - 7/11/10	7/12/10 - 7/18/10	7/19/10 - 7/25/10	7/26/10 - 8/1/10	8/2/10 - 8/8/10	8/9/10 - 8/15/10	8/16/10 - 8/22/10	8/23/10 - 8/29/10	8/30/10 - 9/5/10	9/6/10 - 9/11/10		Composite
Household A													
Shower Use (Gal.)	244	245	270	249	287	352	288	303	87	273	254		2,851
Other Use (Gal.)	993	1,621	1,150	1,522	1,265	1,413	3,823	3,258	234	1,353	632		17,265
Total Use (Gal.)	1,237	1,866	1,420	1,771	1,553	1,765	4,111	3,562	321	1,626	885		20,116
Percent Shower Use	19.7%	13.1%	19.0%	14.0%	18.5%	19.9%	7.0%	8.5%	27.1%	16.8%	28.7%		14.2%
Percent Other Use	80.3%	86.9%	81.0%	86.0%	81.5%	80.1%	93.0%	91.5%	72.9%	83.2%	71.3%		85.8%
Household B													
Shower Use (Gal.)	58	42	79	125	82	184	274	247	35	60	22		1,209
Other Use (Gal.)	396	333	1,248	1,052	1,038	1,224	471	967	926	720	268		8,643
Total Use (Gal.)	454	375	1,327	1,177	1,120	1,408	745	1,214	961	780	290		9,851
Percent Shower Use	12.9%	11.3%	6.0%	10.6%	7.3%	13.1%	36.7%	20.3%	3.6%	7.7%	7.6%		12.3%
Percent Other Use	87.1%	88.7%	94.0%	89.4%	92.7%	86.9%	63.3%	79.7%	96.4%	92.3%	92.4%		87.7%
Household C													
Shower Use (Gal.)	52	67	27	19	56	46	47	51	34	12	55		467
Other Use (Gal.)	361	666	436	560	431	600	426	521	230	338	666		5,235
Total Use (Gal.)	413	733	463	579	487	646	473	572	264	350	721		5,702
Percent Shower Use	12.7%	9.2%	5.8%	3.3%	11.5%	7.1%	9.9%	9.0%	12.9%	3.4%	7.7%		8.2%
Percent Other Use	87.3%	90.8%	94.2%	96.7%	88.5%	92.9%	90.1%	91.0%	87.1%	96.6%	92.3%		91.8%

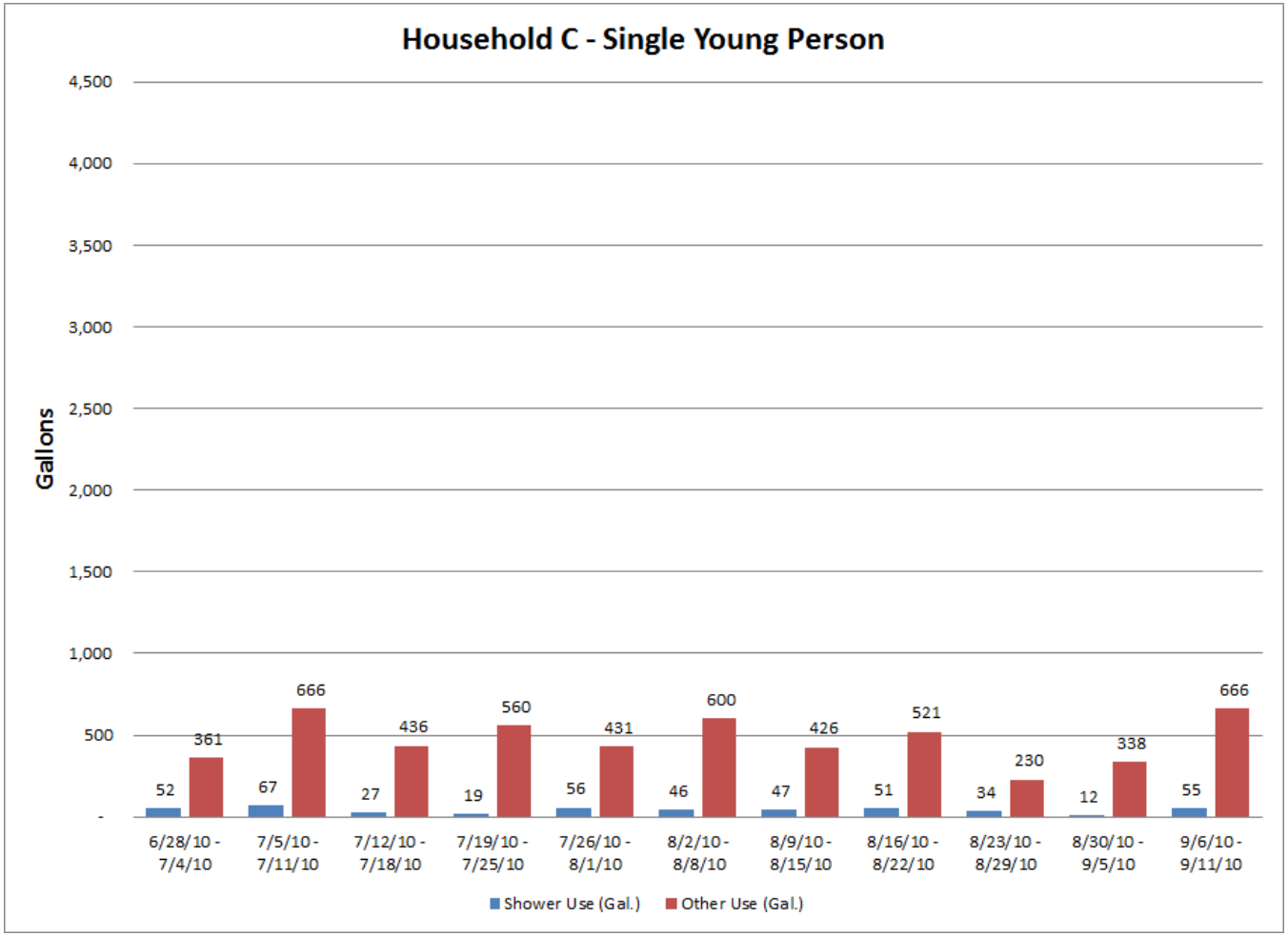
Household A - Gallons



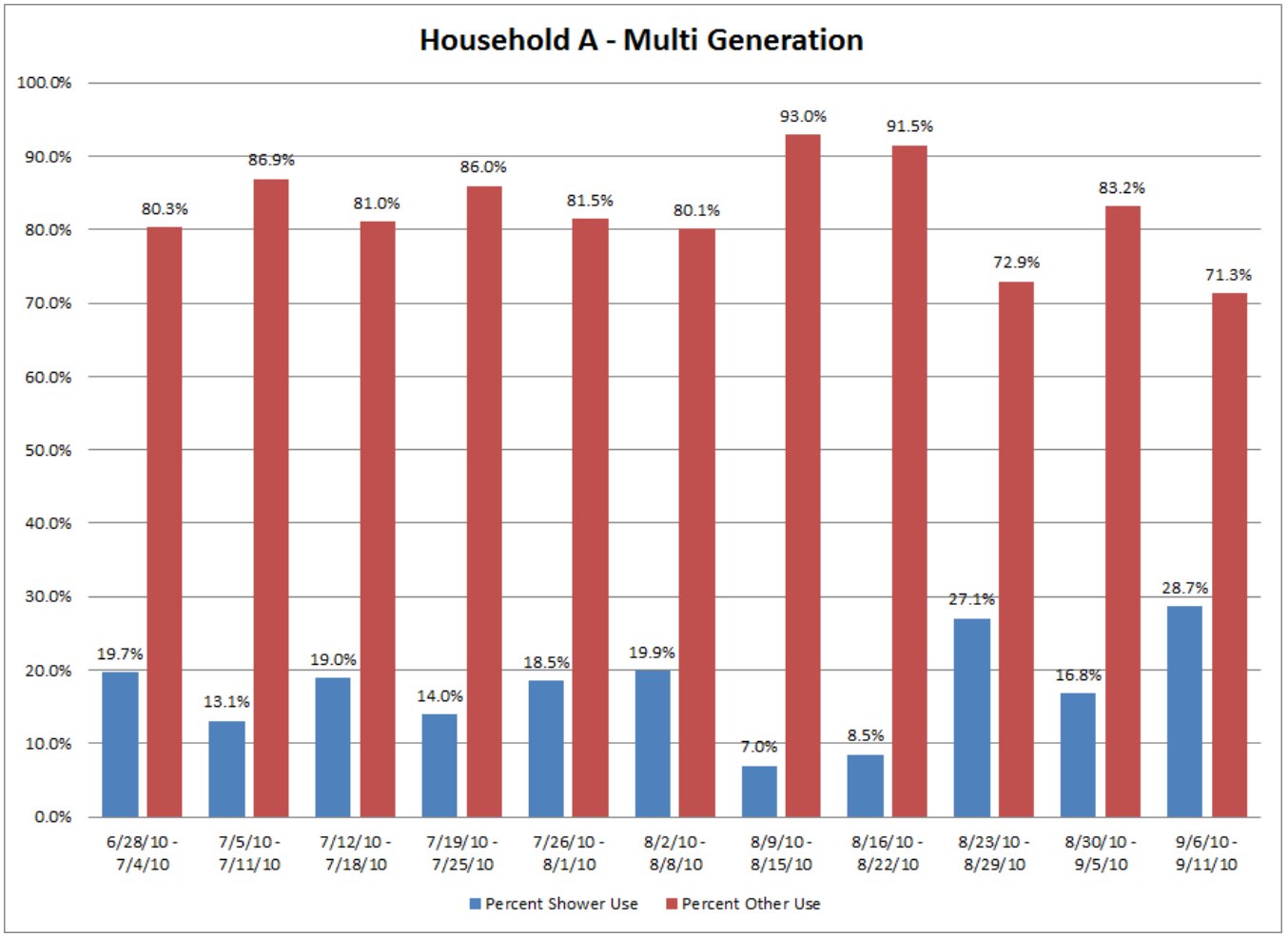
Household B - Gallons



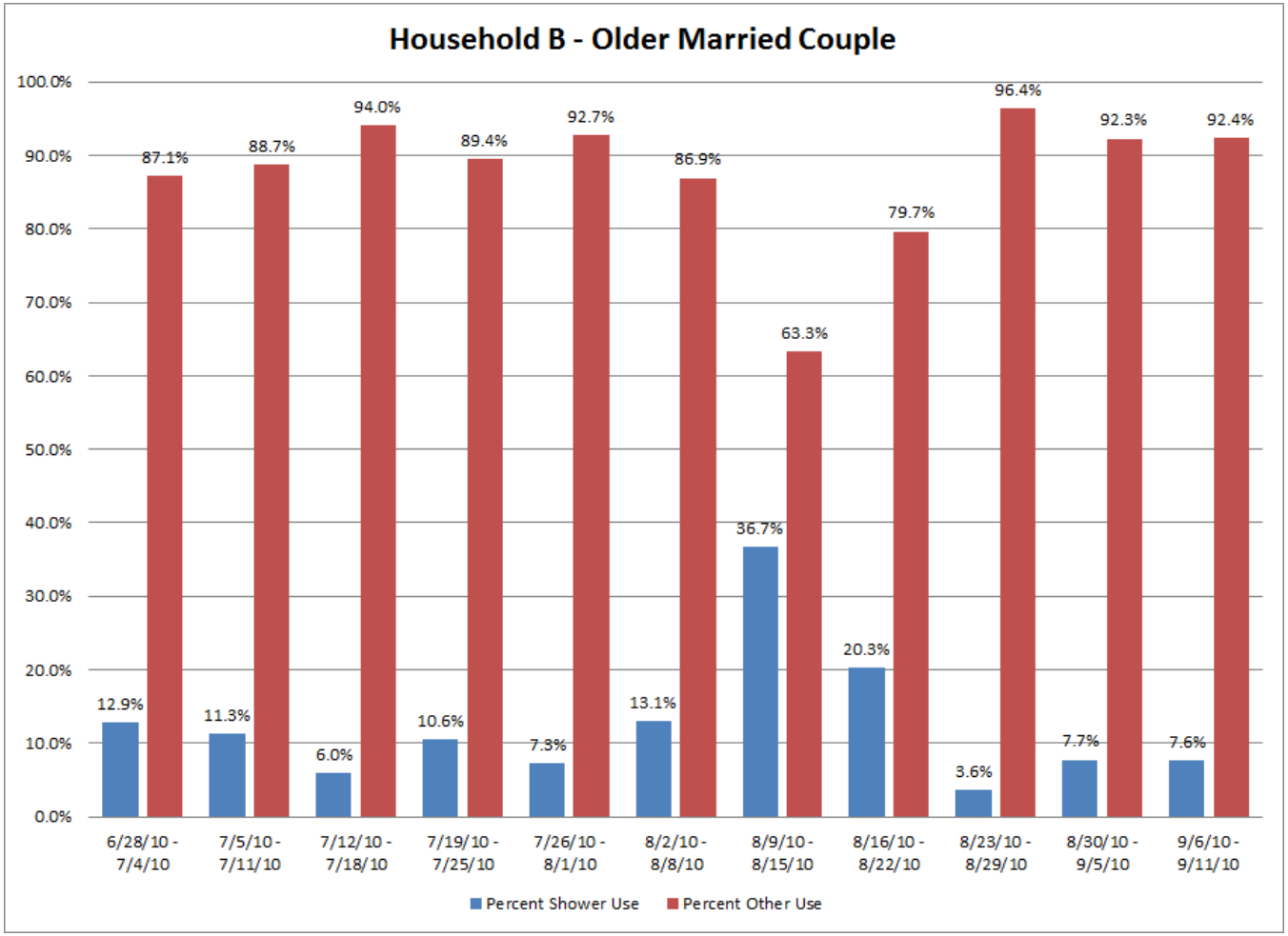
Household C - Gallons



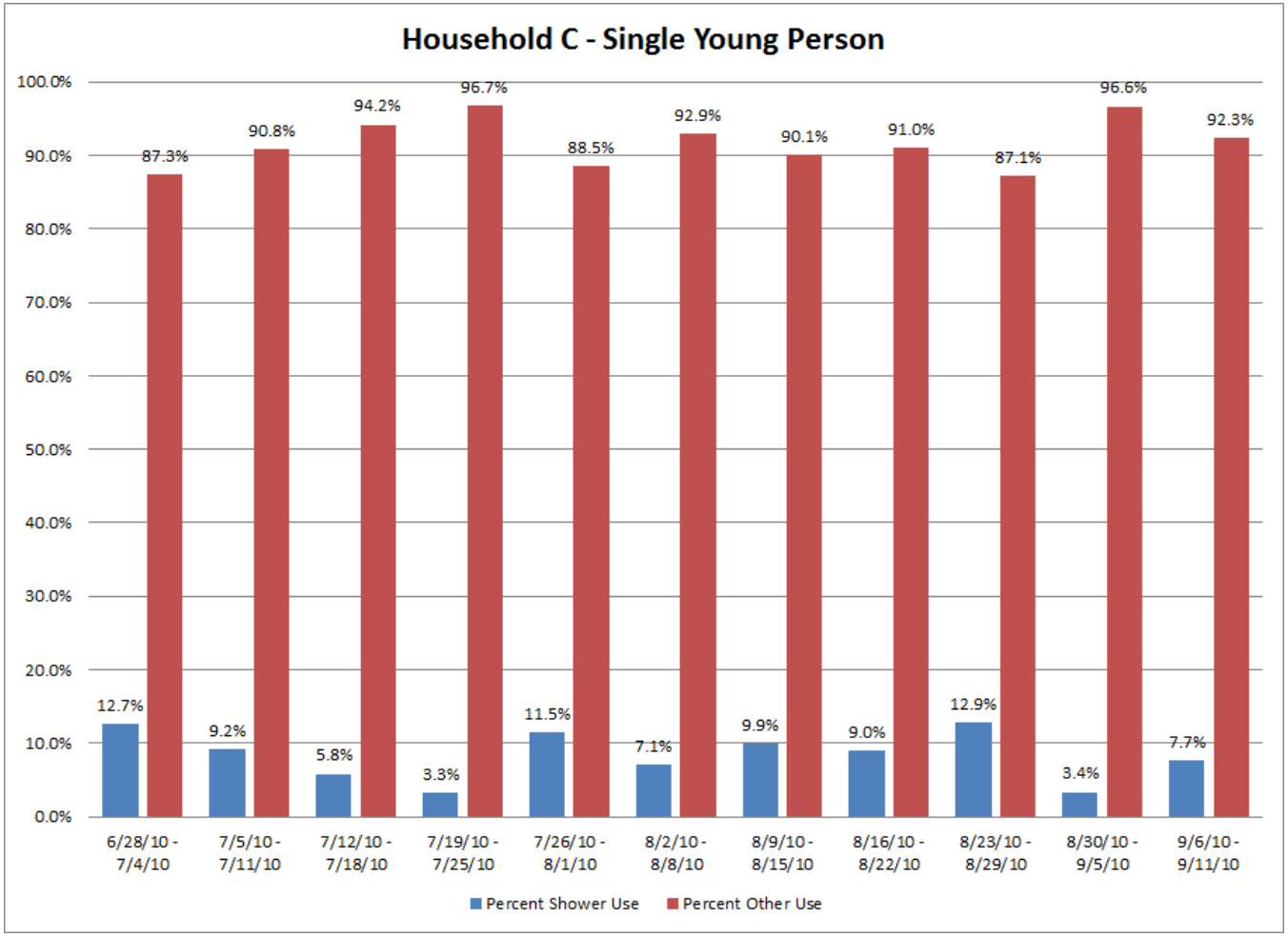
Household A – Percent of Use



Household B – Percent of Use



Household C – Percent of Use



Hot Water On Demand – Data Challenges

There were some data collection challenges in this process

- The absence of a backflow preventer on each house may have cause additional data to be collected
- Water and dirt did find it's way into each of the boxes at some point
  - This can cause the Meter Master to stop recording and even, if submerged, cause a reset
  - The reset did not happen
- Sensor connections were generally good over the summer

Hot Water On Demand – Preliminary Conclusions

- Based on analysis of shower use, Household A may show the beginnings of a pattern of lower usage
  - It looks like there may be a drop of about 2 to 3 gallons per day/ person on the shower usage
- All three households need additional time for data collection and analysis of flows before any solid conclusions can be set

Hot Water On Demand – Savings Potential?

- Initial conclusions show shower water consumption to be lower as a percentage than averages from Residential End Use Study
  - Small sample with conservation minded volunteers
- Initial savings of 2-3 gallons/day/person significantly lower than theoretical
- Still analysis of other homes coming

What We Learned?

- Our staff have become more experienced with recognizing water specific usage patterns from data loggers
- Our initial findings support shower consumption representing a lower overall usage than previously thought
- Hot water pumps to eliminate line flushing will not likely yield payback unless in a very large home
  - VERY preliminary and soft conclusion

Next Steps?

- Complete analysis of other homes and more detailed look at water usage in study homes
- Estimate savings in larger homes on per person basis
- Review characteristics of program users to date
- Determine if savings can justify $150 rebate at $400/acre foot investment requirement