This presentation premiered at WaterSmart Innovations

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INNOVATIONS

Metering Non-Potable Water: 5-Year Study of Urban Irrigation Efficiency

David Rice

Weber Basin Water Conservancy District

Joanna Endter-Wada

Diana Wuenschell

Christine Garrard

Center for Water Efficient Landscaping

USU Extension

Utah State University

Weber Basin Water Conservancy District

CWEL Center for Water-Efficient Landscaping

WaterMAPS™ Water Management Analysis and Planning Software

UtahState University

Presentation Overview

- **Context:** WBWCD and implementation of non-potable ("secondary" or "landscape") water metering
- **Project background and goals:** USBR grant and WBWCD-USU collaboration
- **Landscape irrigation conservation strategy:** parcel-level customer information feedback and monitoring
- **Results:** customer response (survey data); 5-year analysis of water reductions and efficiency gains (water use data)
- **Lessons learned:** analyzing appropriateness in landscape water use; communications with customers

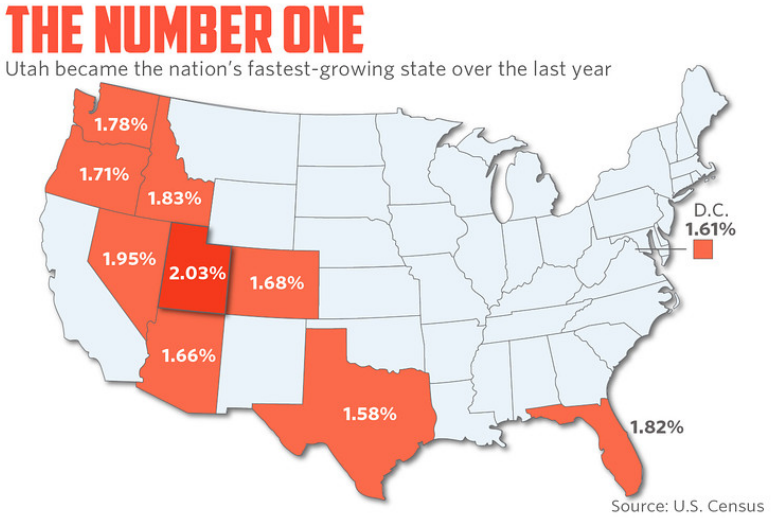
CONTEXT

Utah

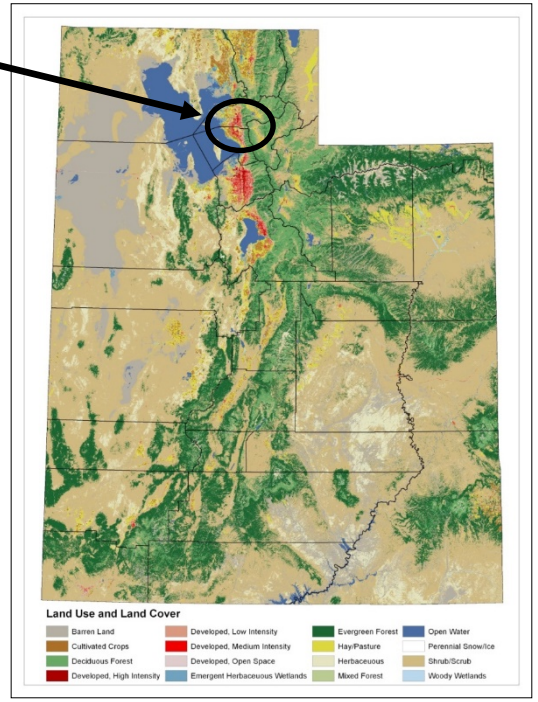
and

Non-potable (secondary or landscape) water metering

Utah is 2nd driest state in the USA



Rapid population growth



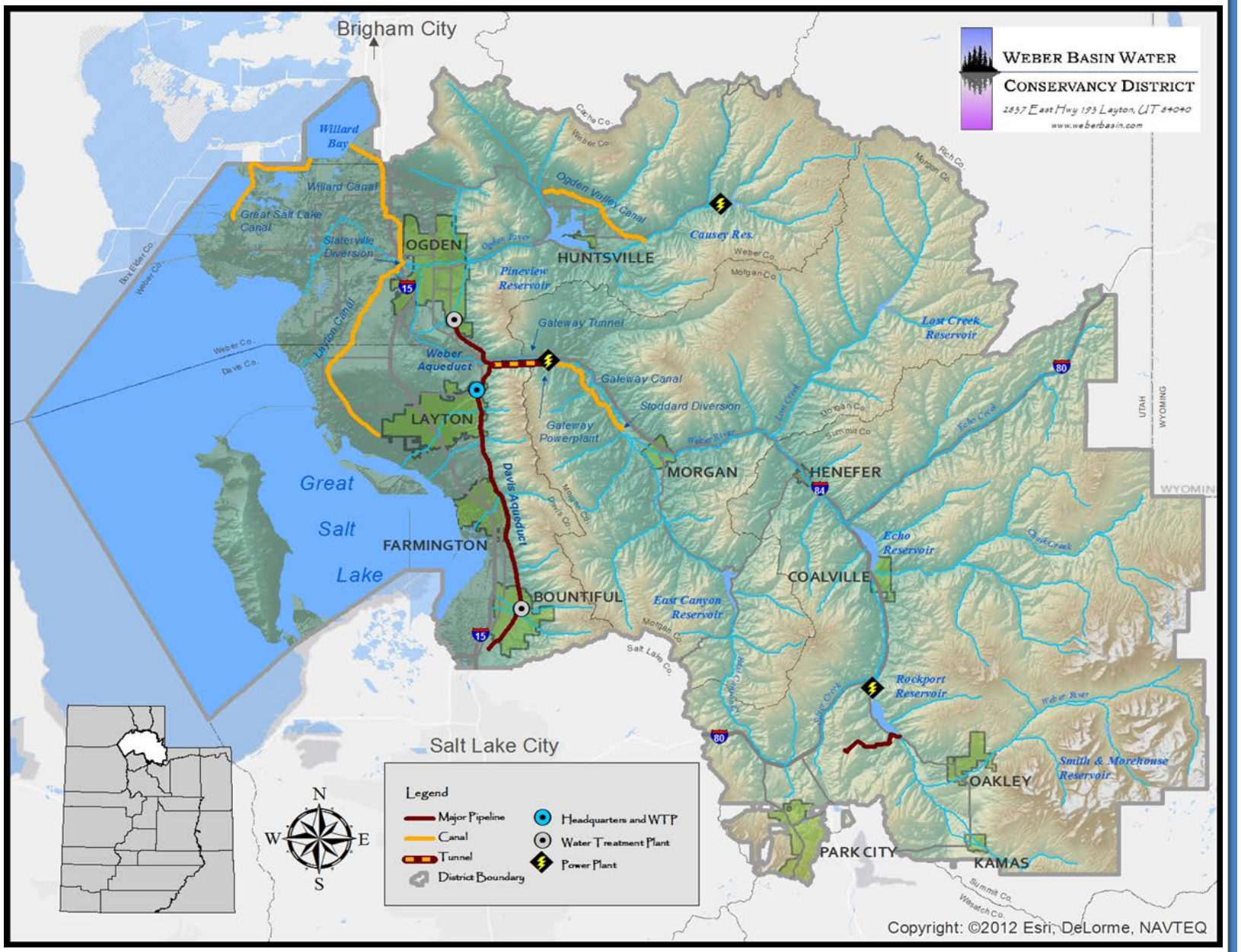
Map compliments of Shujuan Li

Concentrated urbanization

http://pics4.city-data.com/cpicc/cfiles7647.jpg

Major land use transitions

Water Supply From Weber Basin



- **Agricultural supplies**
  - 5 counties
- **Pressurized secondary systems**
  - wholesale
  - retail
- **Municipal**
  - 50 cities & districts
- **Industrial supplies**
  - minerals
  - refineries
  - manufacturers

Land Use Transitions

1958 2012

Clinton Utah

Syracuse Utah

Layton Utah

- **Pressurized secondary water systems**
  - agricultural-to-urban land use transitions
  - ≈ 100,000 connections
- **Water allocations or allotments**
  - attached to urban parcels that were agricultural lands
  - based on an agricultural duty of water – generally 3 af/acre in WBWCD

PROJECT

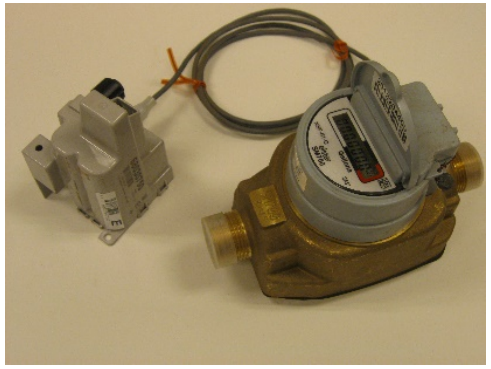
"Water user dimensions of meter implementation on secondary pressurized systems"

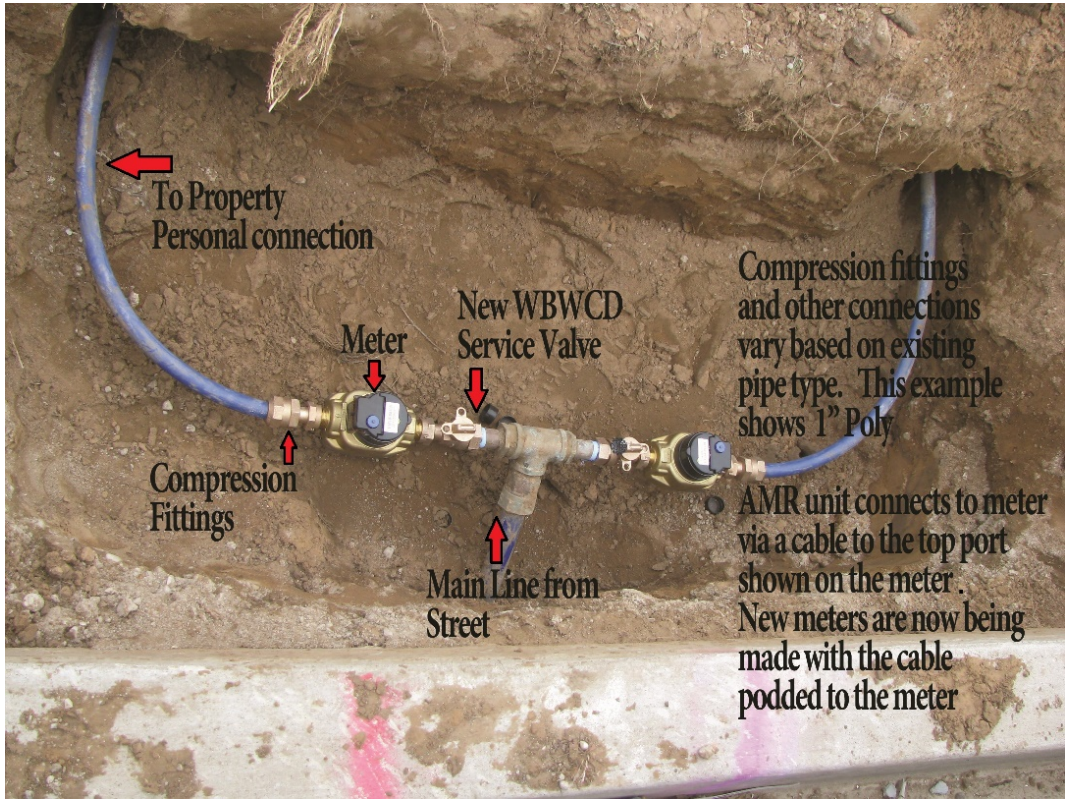
Weber Basin Water Conservancy District

Utah State University

Meter Transition Issues

- Meter & AMR compatibility
- Data reading and calibration
- Public relations





Project Goals

WBWCD Management Goals:

- Work to meet state and district water conservation goals
- Promote individual water use accountability
- Determine if secondary water use is within water allocations

USU Research Goals:

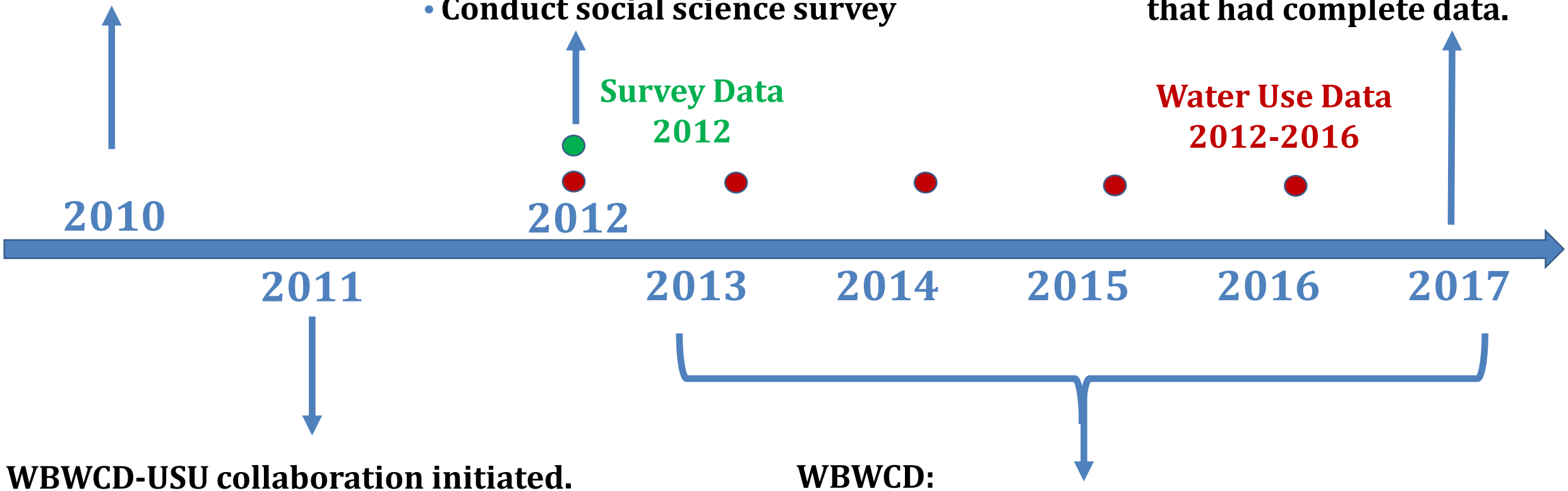
- Investigate human behaviors and perceptions related to meters
- Analyze urban landscape irrigation in relation to plant water need using USU WaterMAPS™ (software)
- Design innovative strategies for interpreting and sharing meter data with users to motivate conservation absent a price signal
- Encourage people to monitor their own water use by reinforcing conservation through information feedback mechanisms

Project Timeline and Continuation

- WBWCD implements district policy to meter secondary connections

WBWCD and USU:
- Utilize WaterMAPS™ analysis approach
- Design/send secondary water use reports
- Conduct social science survey

- WBWCD and USU analyze water use results for 2012-2016 using 842 locations from Phase 1 that had complete data.



- WBWCD-USU collaboration initiated.
- USBOR 2011-2012 Water Smart grant secured.
- Meter implementation begins.
- Users informed of gallons used.

WBWCD:
- Expands metering to more phases and locations.
- Continues sending slightly simplified secondary water use reports to all locations with meters.

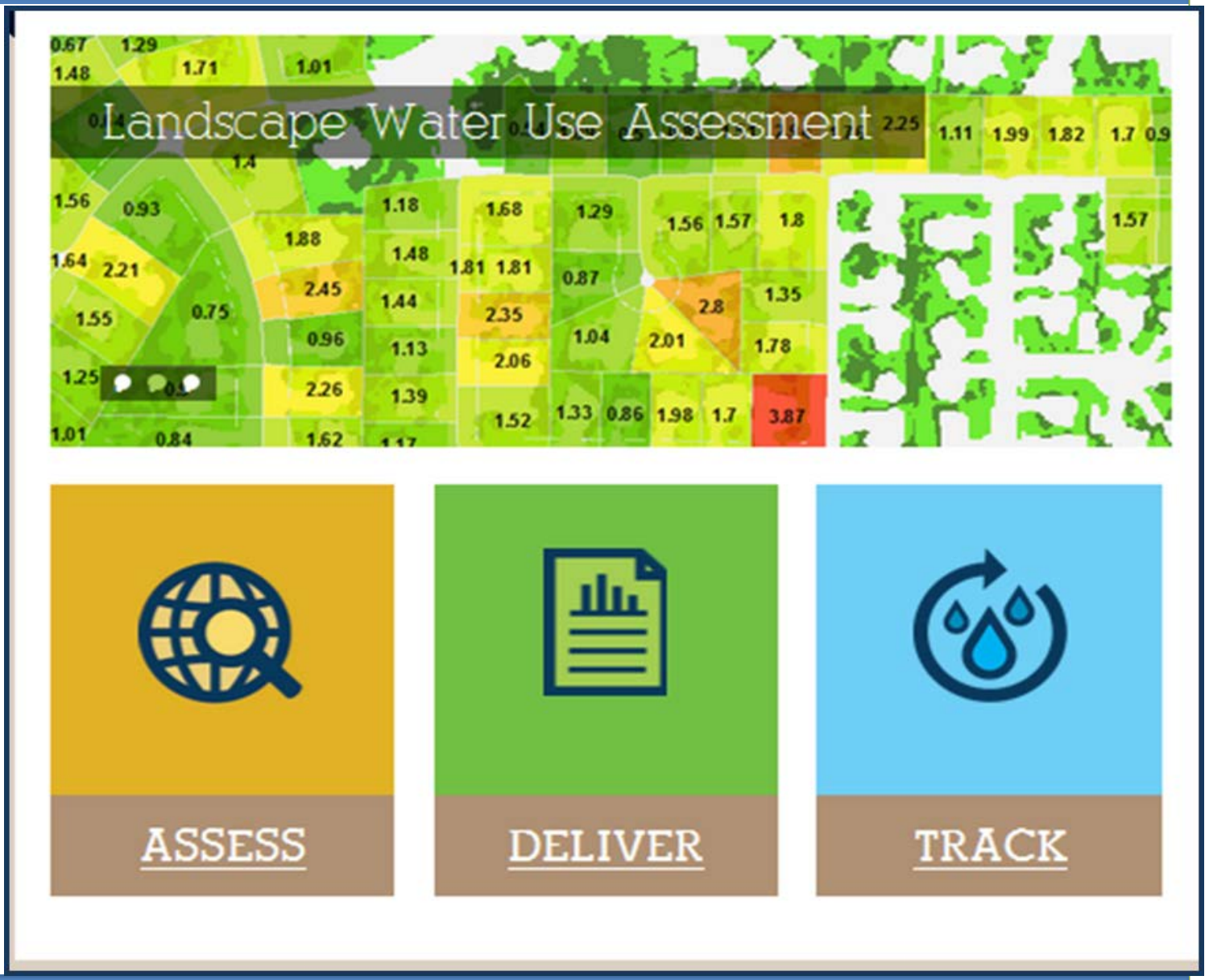
WATERMAPS™

Software application to analyze and manage urban landscape water use

ASSESS: identify locations with capacity to conserve

DELIVER: water use reports to help people conserve

TRACK: water use change over time; monitor conservation success



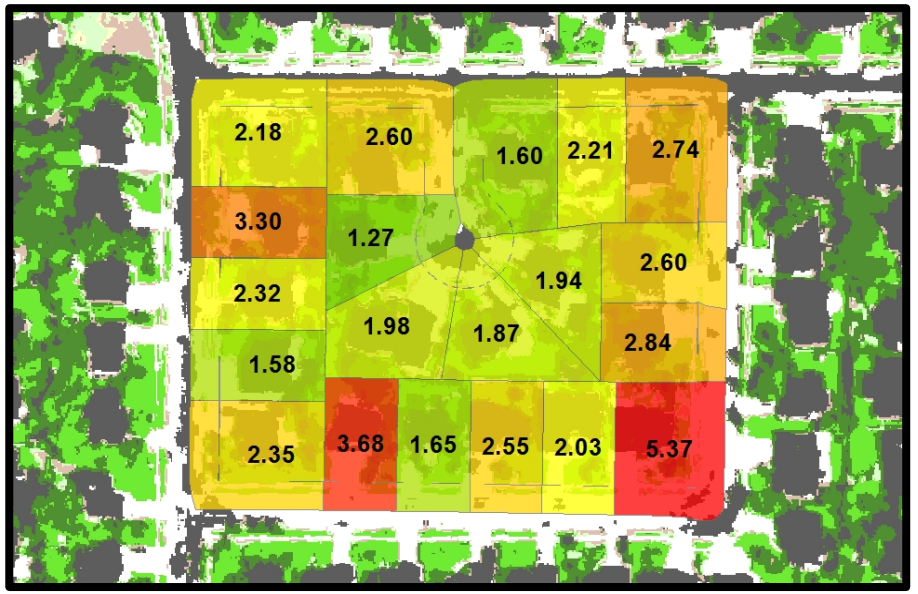
Identifying Capacity to Conserve Utilizing Landscape Irrigation Ratio (LIR)

$$LIR = \frac{\textbf{Landscape Water Use}_{\textit{estimated}}}{\textbf{Landscape Water Need}_{\textit{estimated}}}$$

Landscape Water Use *estimated*
(derived from analysis of municipal or water provider meter data)

Landscape Water Need *estimated*
(derived from the classification of remotely-sensed airborne multispectral imagery and localized reference ET_o rates)

(per unit of landscaped area)



LIR less than 1	=	Efficient
Between 1 and 2	=	Acceptable
Between 2 and 3	=	Inefficient
Greater than 3	=	Excessive

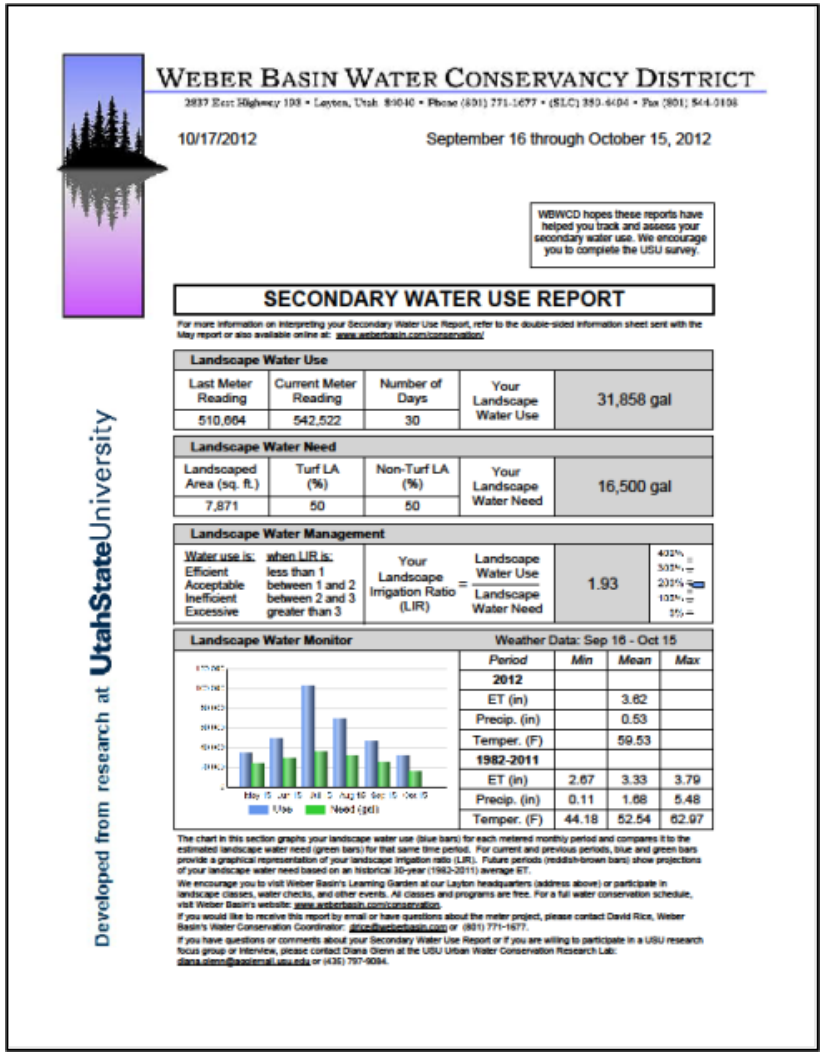
CONSERVATION STRATEGY

Water meter data interpretation and sharing through Secondary Water Use Reports

Not a bill.

People pay for secondary water in connection with property taxes.

Sample 2012 Secondary Water Use Report



WEBER BASIN WATER CONSERVANCY DISTRICT

2837 East Highway 193 • Layton, Utah 84040 • Phone (801) 771-1677 • (SLC) 359-4494 • Fax (801) 544-0103

10/17/2012 September 16 through October 15, 2012

WBWCD hopes these reports have helped you track and assess your secondary water use. We encourage you to complete the USU survey.

SECONDARY WATER USE REPORT

For more information on interpreting your Secondary Water Use Report, refer to the double-sided information sheet sent with the May report or also available online at: www.weberbasin.com/conservation/

Landscape Water Use

Last Meter Reading	Current Meter Reading	Number of Days	Your Landscape Water Use	31,858 gal
510,664	542,522	30		

Landscape Water Need

Landscaped Area (sq. ft.)	Turf LA (%)	Non-Turf LA (%)	Your Landscape Water Need	16,500 gal
7,871	50	50		

Landscape Water Management

Water use is:	when LIR is:
Efficient	less than 1
Acceptable	between 1 and 2
Inefficient	between 2 and 3
Excessive	greater than 3

Your Landscape Irrigation Ratio (LIR) = Landscape Water Use / Landscape Water Need = 1.93

Landscape Water Monitor — Weather Data: Sep 16 - Oct 15

Period	Min	Mean	Max
2012			
ET (in)		3.62	
Precip. (in)		0.53	
Temper. (F)		59.53	
1982-2011			
ET (in)	2.67	3.33	3.79
Precip. (in)	0.11	1.68	5.48
Temper. (F)	44.18	52.54	62.97

The chart in this section graphs your landscape water use (blue bars) for each metered monthly period and compares it to the estimated landscape water need (green bars) for that same time period. For current and previous periods, blue and green bars provide a graphical representation of your landscape irrigation ratio (LIR). Future periods (reddish-brown bars) show projections of your landscape water need based on an historical 30-year (1982-2011) average ET.

We encourage you to visit Weber Basin's Learning Garden at our Layton headquarters (address above) or participate in landscape classes, water checks, and other events. All classes and programs are free. For a full water conservation schedule, visit Weber Basin's website: www.weberbasin.com/conservation

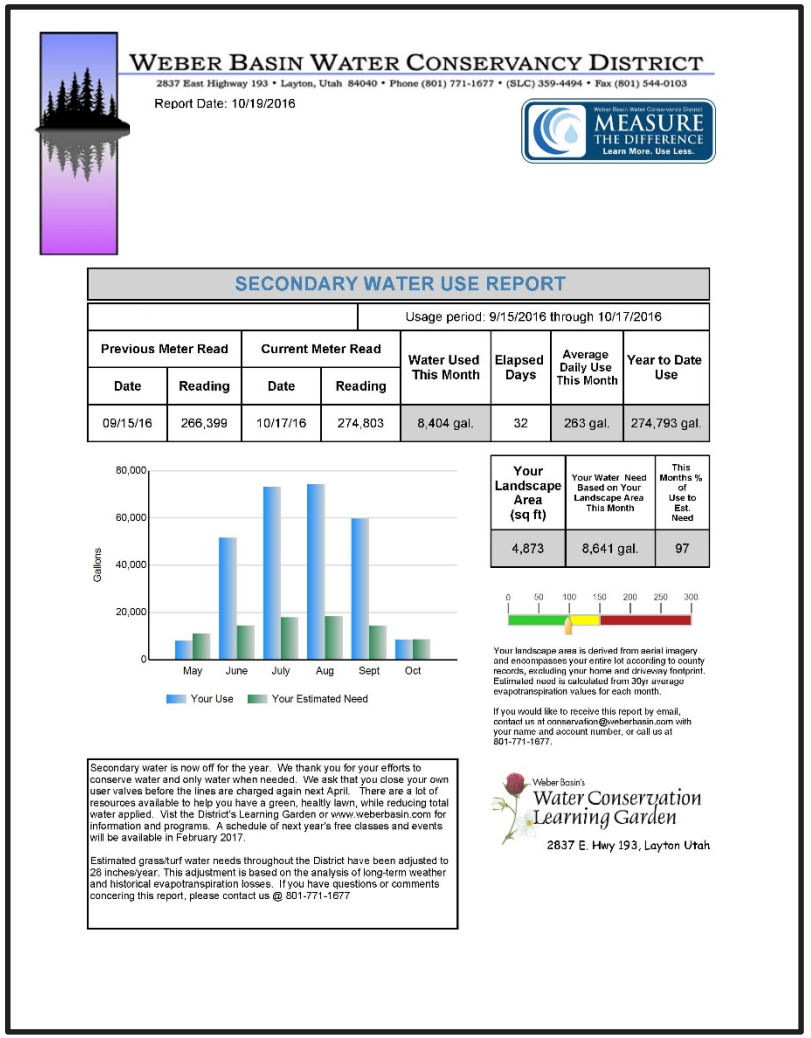
If you would like to receive this report by email or have questions about the meter project, please contact David Rice, Weber Basin's Water Conservation Coordinator: drice@weberbasin.com or (801) 771-1677.

If you have questions or comments about your Secondary Water Use Report or if you are willing to participate in a USU research focus group or interview, please contact Diana Glenn at the USU Urban Water Conservation Research Lab: diana.glenn@aggiemail.usu.edu or (435) 797-9084.

Developed from research at UtahStateUniversity

Reports are based on defining appropriateness of landscape water use relative to plant water need (landscape water budgeting)

Sample 2013-2016 Secondary Water Use Report



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Report Date: 10/19/2016

MEASURE THE DIFFERENCE Learn More. Use Less.

SECONDARY WATER USE REPORT

Usage period: 9/15/2016 through 10/17/2016

Previous Meter Read		Current Meter Read		Water Used This Month	Elapsed Days	Average Daily Use This Month	Year to Date Use
Date	Reading	Date	Reading				
09/15/16	266,399	10/17/16	274,803	8,404 gal.	32	263 gal.	274,793 gal.

Your Landscape Area (sq ft)	Your Water Need Based on Your Landscape Area This Month	This Months % of Use to Est. Need
4,873	8,641 gal.	97

Your landscape area is derived from aerial imagery and encompasses your entire lot according to county records, excluding your home and driveway footprint. Estimated need is calculated from 30yr average evapotranspiration values for each month.

If you would like to receive this report by email, contact us at conservation@weberbasin.com with your name and account number, or call us at 801-771-1677.

Secondary water is now off for the year. We thank you for your efforts to conserve water and only water when needed. We ask that you close your own user valves before the lines are charged again next April. There are a lot of resources available to help you have a green, healthy lawn, while reducing total water applied. Vist the District's Learning Garden or www.weberbasin.com for information and programs. A schedule of next year's free classes and events will be available in February 2017.

Estimated grass/turf water needs throughout the District have been adjusted to 28 inches/year. This adjustment is based on the analysis of long-term weather and historical evapotranspiration losses. If you have questions or comments concering this report, please contact us @ 801-771-1677

Weber Basin's Water Conservation Learning Garden

2837 E. Hwy 193, Layton Utah

Customer name, address, account (not shown)

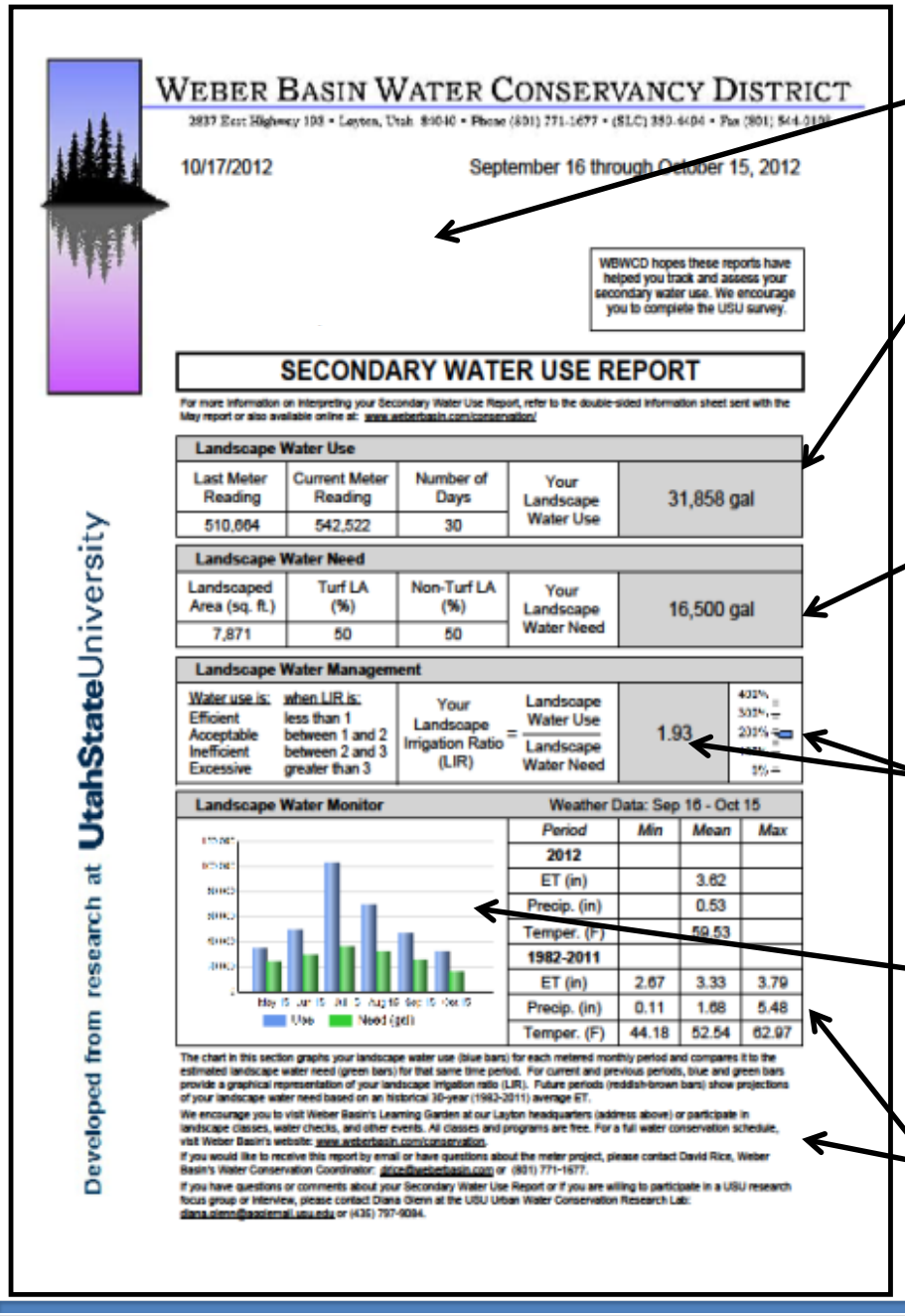
Landscape water use: secondary meter readings and landscape water use in gallons

Landscape water need: estimated landscape water need in gallons based on landscaped area and weather data

Watering appropriateness: reported as a landscape irrigation ratio (LIR) and/or a %

Landscape water monitor: graph of monthly landscape water use compared to need

Information & messaging: weather data, conservation programs, contact information



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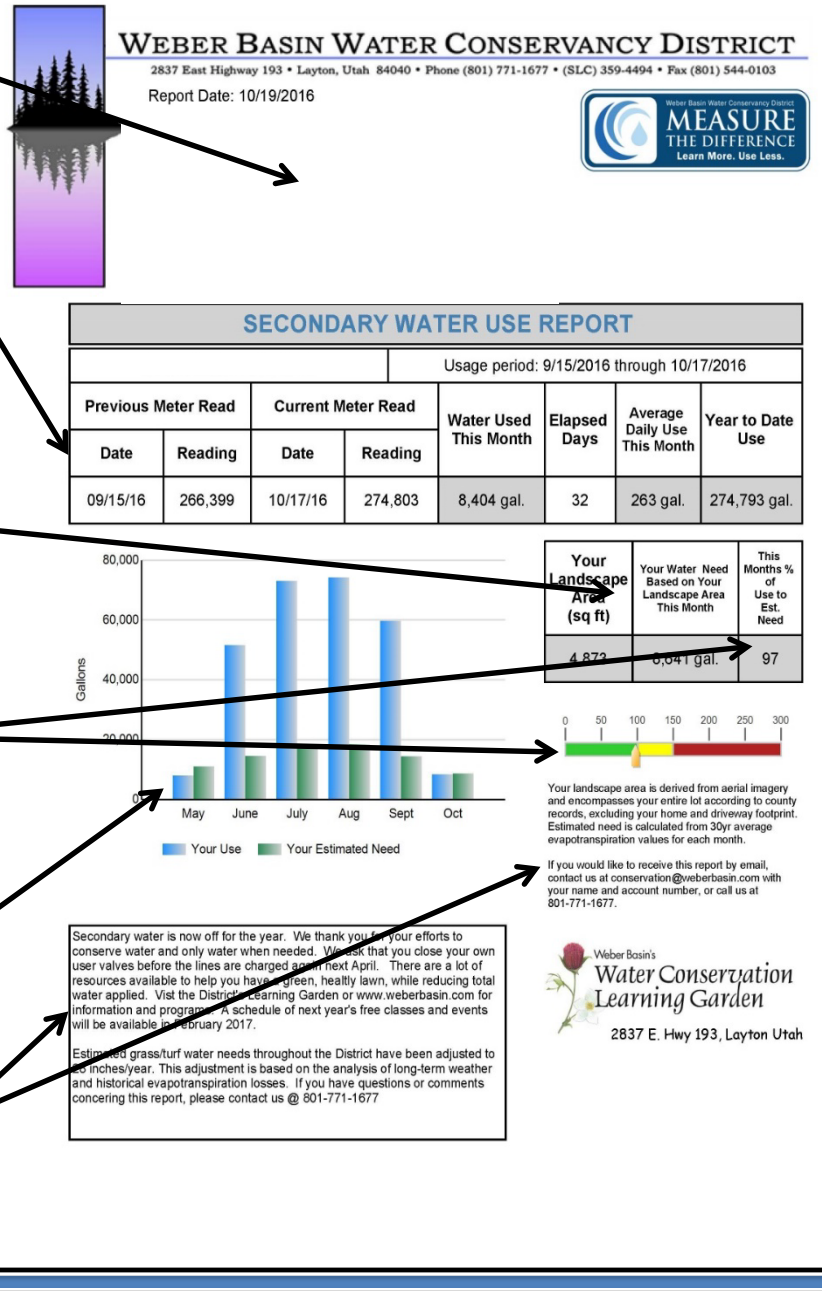

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2837 E. Hwy 193, Layton Utah

Elements of Secondary Water Use Reports

WEBER BASIN WATER CONSERVANCY DISTRICT

UtahStateUniversity

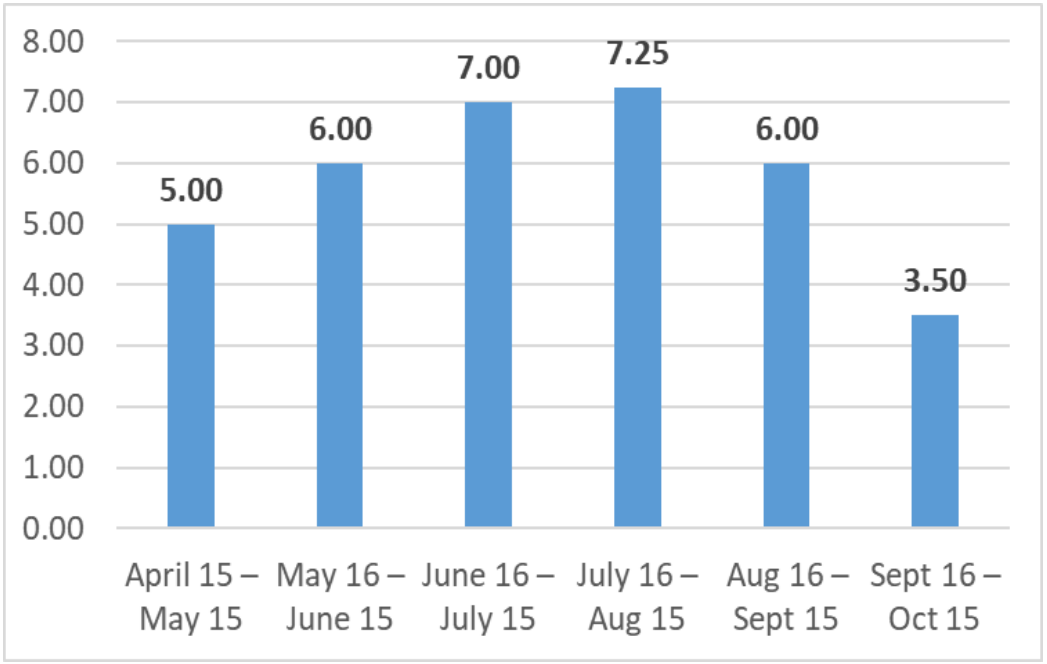
Project Landscape Water Budget Assumptions

- Irrigation season
  - *April 16 through October 15 for 2012 and 2016 (full season)*
  - *April 16 through October 1 for 2013, 2014, and 2015 (short season)*
- Landscaped area and water need
  - *Parcel + 10-foot buffer (to capture parking strip) minus hardscape* ***
  - *Turf plant factor applied to all landscaped area (.8)* ***
- Weather Data
  - *monthly ET_o values based on 30-year historical average - Ogden Airport*
  - *precipitation and soil moisture not subtracted (grants users "extra water")* ***
  - *34" seasonal water budget for analysis consistency (WBWCD reduced to 28" in 2016)*
- Irrigation system distribution uniformity
  - *assumed 100% (water budget not adjusted for poor irrigation practices)* **

*** *assumption makes landscape water budgets more generous for most users*
** *assumption makes landscape water budget less generous if people have poor irrigation systems*

KEY CONSERVATION MESSAGES:

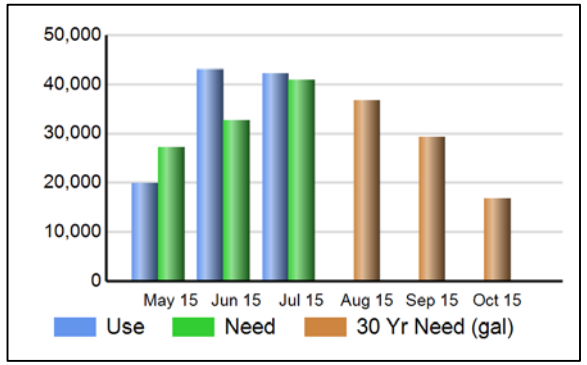
- ***Water to meet landscape need (or demand) over the irrigation season***
- ***Importance of irrigation scheduling***
- ***How to access additional information***

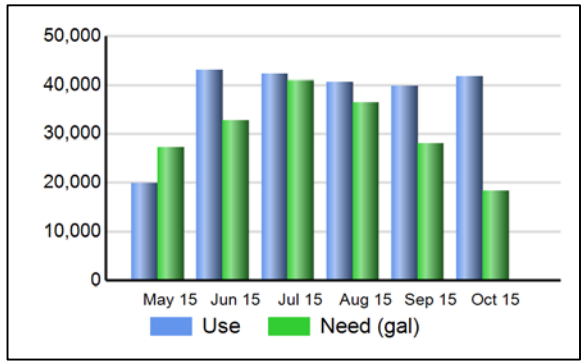


30 Year Average Monthly Reference ET (in.)

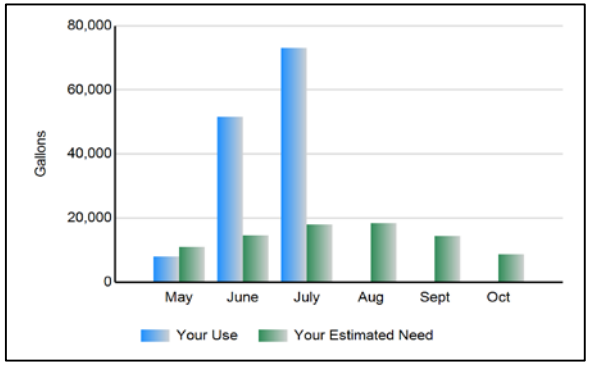
Landscape Water Monitor on Reports:

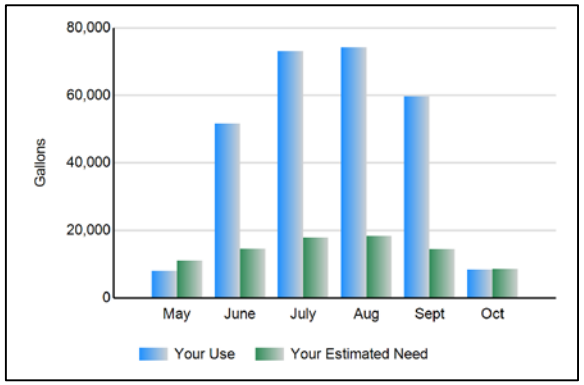
- predictive in advance to condition people to changing landscape water needs
- actual comparison with each monthly report





2012 EXAMPLES:
JULY REPORT
OCTOBER REPORT

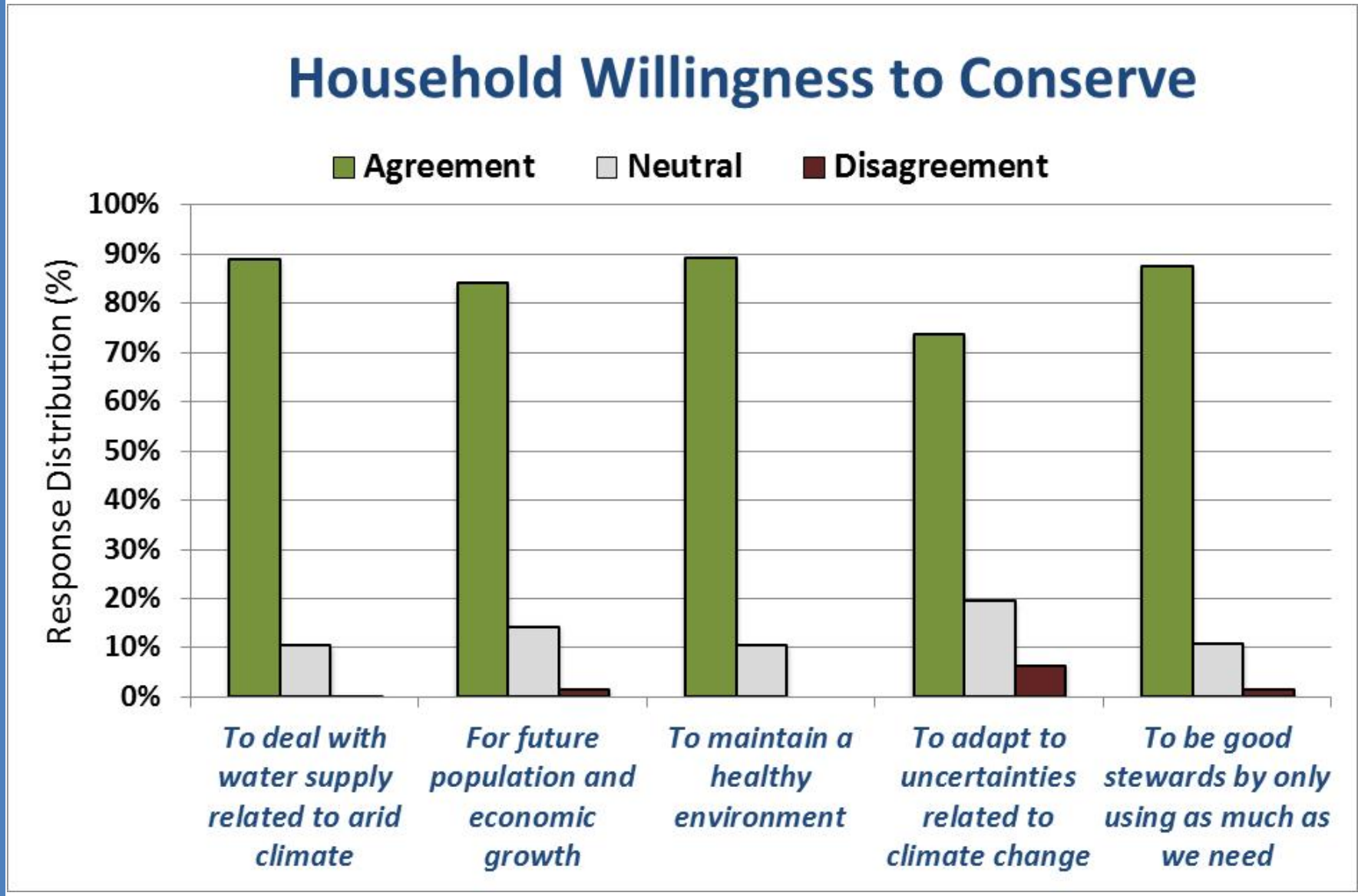




2013-2017 EXAMPLES:
JULY REPORT
OCTOBER REPORT

RESULTS:
Customer Response 2012 Survey

Participants indicated high willingness to conserve for a variety of reasons

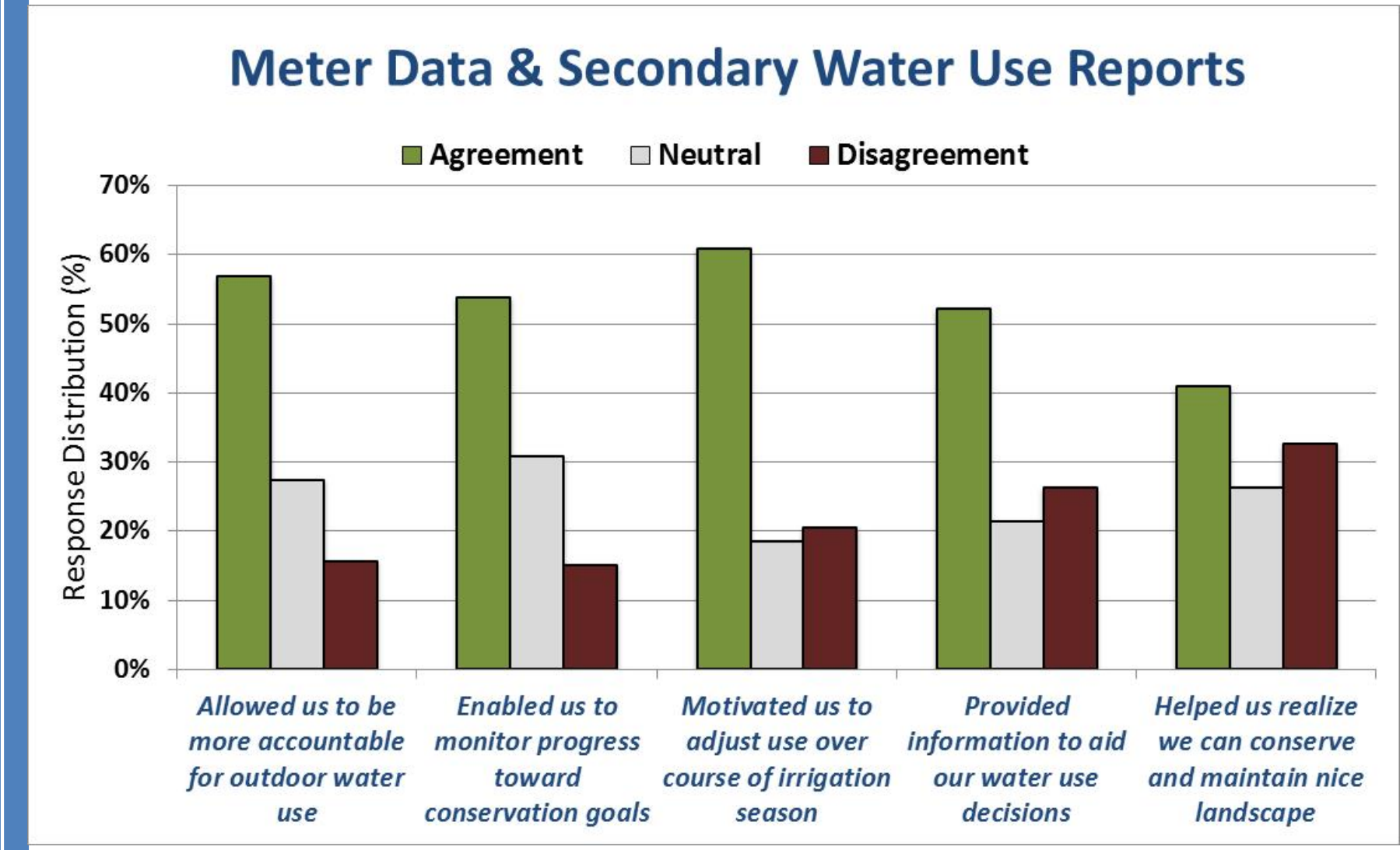


n=210 survey respondents

RESULTS:
Customer Response 2012 Survey

- *73% were surprised to learn the amount of water used on their landscape*
- *Reports sent the intended message to most users*
- *Reports provided actionable information to users*

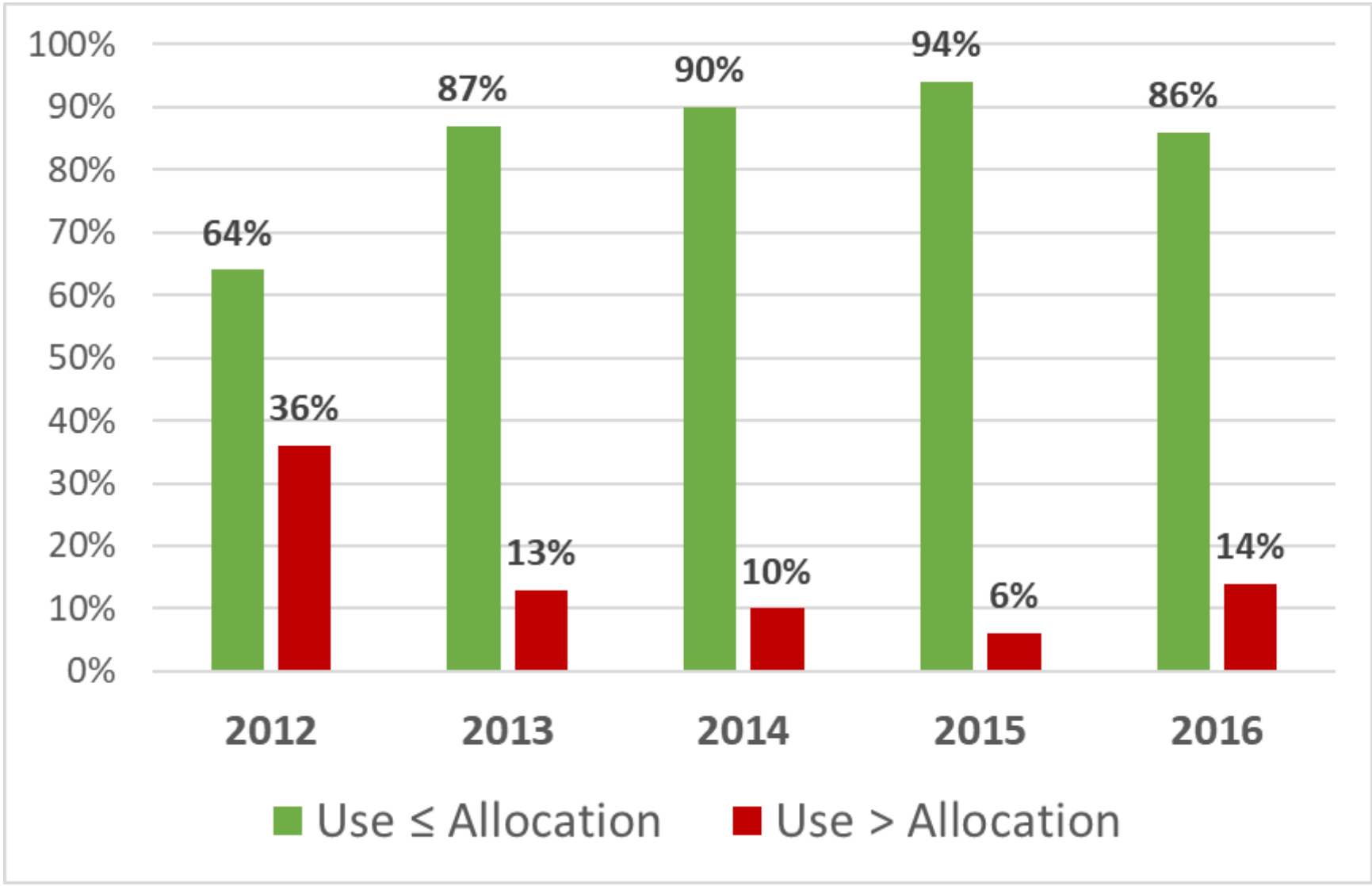
Actionable Information the Reports Provided



n=210 survey respondents

RESULTS:
Water Use Trends 2012-2016

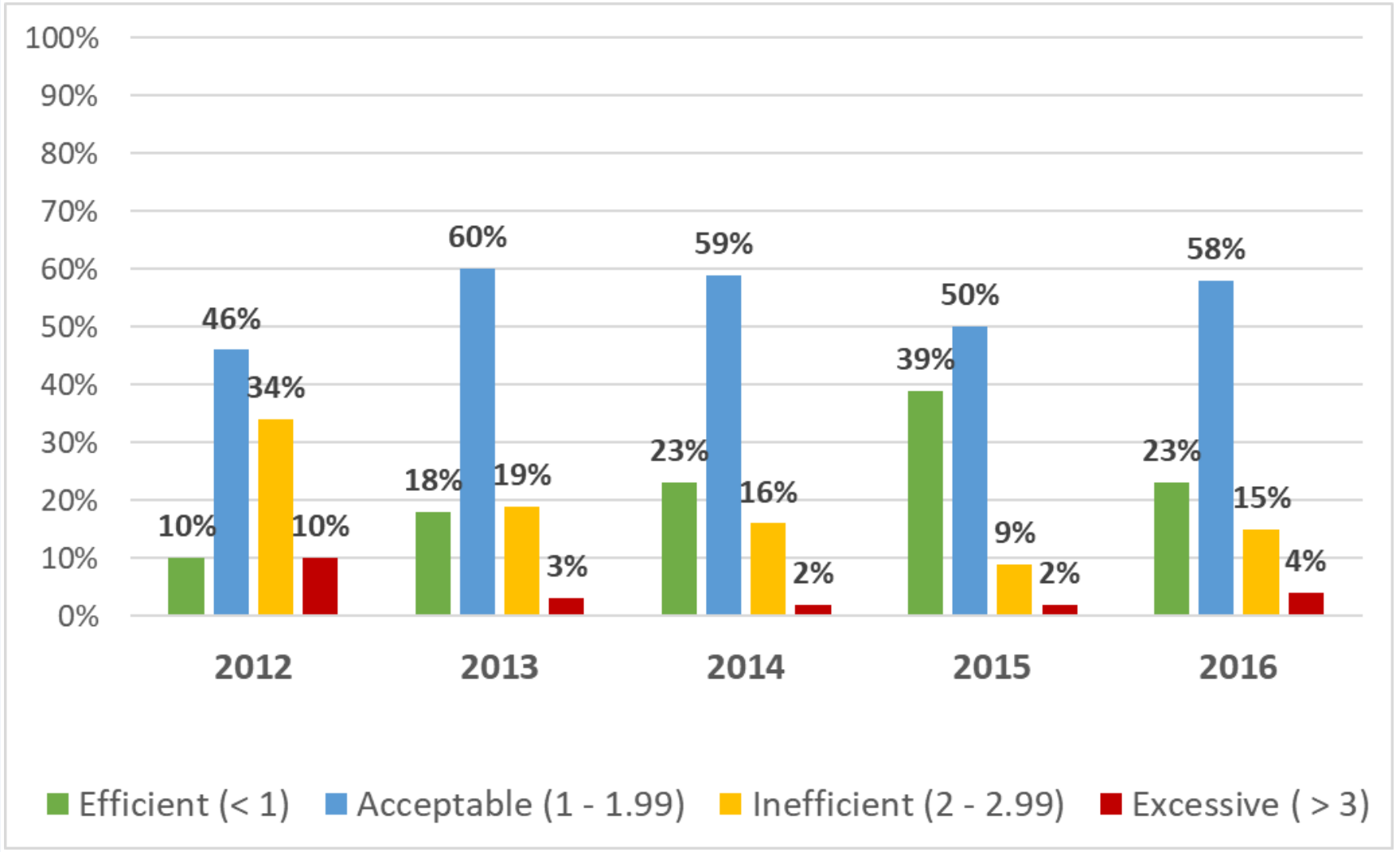
More households are staying within their property's water allocation



n=842 metered locations

RESULTS:
Water Use Trends 2012-2016

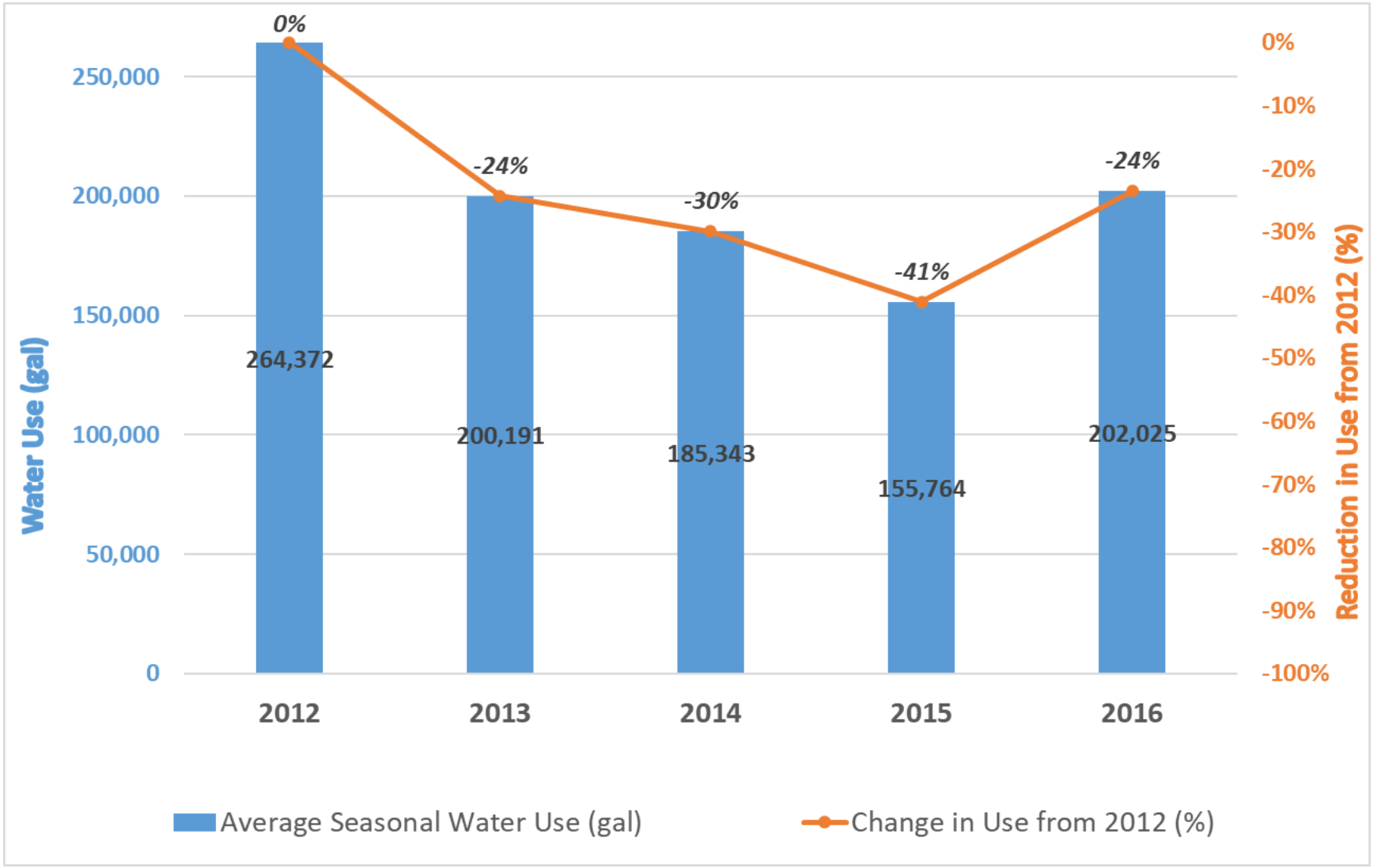
Households are generally becoming more efficient in their secondary landscape water use



n=842 metered locations

RESULTS:
Water Use Trends 2012-2016

Resulting in documented and durable landscape water savings in gallons



n=842 metered locations

RESULTS:
Water Use Trends 2012-2016

- *Households use, on average, 160% (LIR=1.6) of the water that their landscapes need*
- *Seasons unfold differently, requiring adaptability for maximum efficiency*
- *More overuse tends to occur later in the irrigation season*

Average LIRs for months and seasons by year

	2012	2013	2014	2015	2016	5-year average
April 15-May 15	1.2	1.0	0.5	0.5	0.3	**0.7**
May 16-June 15	1.9	1.5	1.8	0.7	1.2	**1.4**
June 16-July 15	2.2	1.9	1.6	1.6	1.9	**1.8**
July 16-Aug. 15	2.1	1.7	1.6	1.3	2.0	**1.7**
Aug. 16-Sept. 15	2.1	1.4	1.4	1.7	1.9	**1.7**
Sept. 16-Oct. 15	2.4				1.3	**1.9**
Sept. 16-Oct. 1		2.0	2.0	2.0		
Seasonal	**2.0**	**1.6**	**1.5**	**1.3**	**1.4**	**≈ 1.5**

LESSONS

Analyzing appropriateness in landscape water use

- Applied interdisciplinary sciences can help address management challenges (plant, climate, and social/policy sciences).
- Water budgeting approaches based on science and responsive to policy contexts are important conservation tools.
- Site-specific information in addition to more general conservation information motivates and helps people to conserve.
- Conservation education can be effective even absent economic incentives (prices).
- Reports reach all users with metered secondary water. The approach avoids conservation program recruitment issues.

LESSONS

Analyzing appropriateness in landscape water use

- **Metering secondary water is an effective tool to reduce outdoor water use by helping users to be accountable.**
- **Tools combined with appropriate education can change behavior by aiding people in their conservation efforts.**
- **Communication for any conservation effort is the key to success. Users need to know *why* and *how* to conserve.**
- **WBWCD will continue this project until all of its secondary connections are metered.**
- **Metering technologies will improve and help the District in providing accurate information to end users.**

PRESENTER CONTACT INFORMATION

David Rice

Conservation Manager
Weber Basin Water Conservancy District
2837 East Highway 193
Layton, Utah 84040
drice@weberbasin.com
(801) 771-1677

Dr. Joanna Endter-Wada

Professor of Policy and Social Science
Dept. of Environment & Society
Quinney College of Natural Resources
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(435) 797-2487