

This presentation premiered at WaterSmart Innovations

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Performance of Weather- Based Irrigation Controllers in Santa Clarita Valley

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Castaic Lake Water Agency

- Formed: 1962
- Service Area: 195 square miles
- Population: 280,000
- Water Demand: 70,000 AF
- Imported Water Supply:
Half of SCV demand



Santa Clarita Valley Water Use Efficiency Strategic Plan

- Developed by the Santa Clarita Valley Family of Water Suppliers in 2008
 - Castaic Lake Water Agency – wholesaler
 - Los Angeles County Waterworks District #36
 - Newhall County Water District
 - Santa Clarita Water Division
 - Valencia Water Company
- Portfolio of programs to get to 10% by 2030, including residential and commercial programs

Residential Weather-Based Irrigation Controller Program

- Began in 2010
- Upon completion of a training course
 - Classroom
 - Online with test
- Provided 1,365 free Weathermatic Smartline 1600 controllers to:
 - Landscapers and gardeners
 - Homeowners



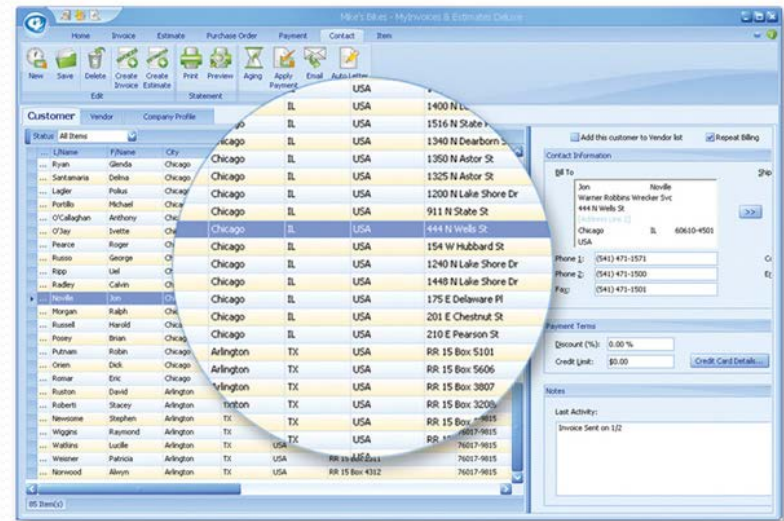
Project Goals

1. Determine the overall change in water use for the entire system
2. Determine the overall change in average household outdoor water use
3. Examine and compare the factors that affect changes in water use
4. Examine differences in water use between participating agencies
5. Provide recommendations for improvements to the existing programs



Data Collection

- Water billing data from each agency
- Type of instruction
 - Online
 - Face-to-face
- Type of installation
 - Homeowner
 - Contractor
- WBIC – year of installation
 - Pre/post analysis



Pre-Installation Period	Year of Installation	Post-Installation Period
2007, 2008, 2009	2010	2011, 2012, 2012
2009, 2010	2011	2012, 2012
2011	2012	2013
2012	2013 (addendum)	2014

Assembly of Billing & Weather Data

- Disaggregation of seasonal and non-seasonal water use
 - Initially used month with lowest consumption as proxy for indoor
 - Re-evaluated using 7.7 CCF per month based on data from the 2011 California Single Family Water Study
- Weather data obtained from CIMIS Station 204
 - Located on CLWA property
 - Maintained by CLWA staff
 - Active since December 2006



Test Group and Control Group

- Test group:
 - Combined set of single family homes from the utility databases that received a WBIC
 - Received WBIC between 2010-2013
 - Had to have complete billing data and identifiable landscape area
- Control group:
 - Combined set of single family homes from utility billing databases
 - Did not receive a WBIC
 - Located within 500 feet of a WBIC home
 - Outdoor use in 2007 (beginning of study) matched that of the Test group

Weather Normalization of Outdoor Water Use – Net ET_o

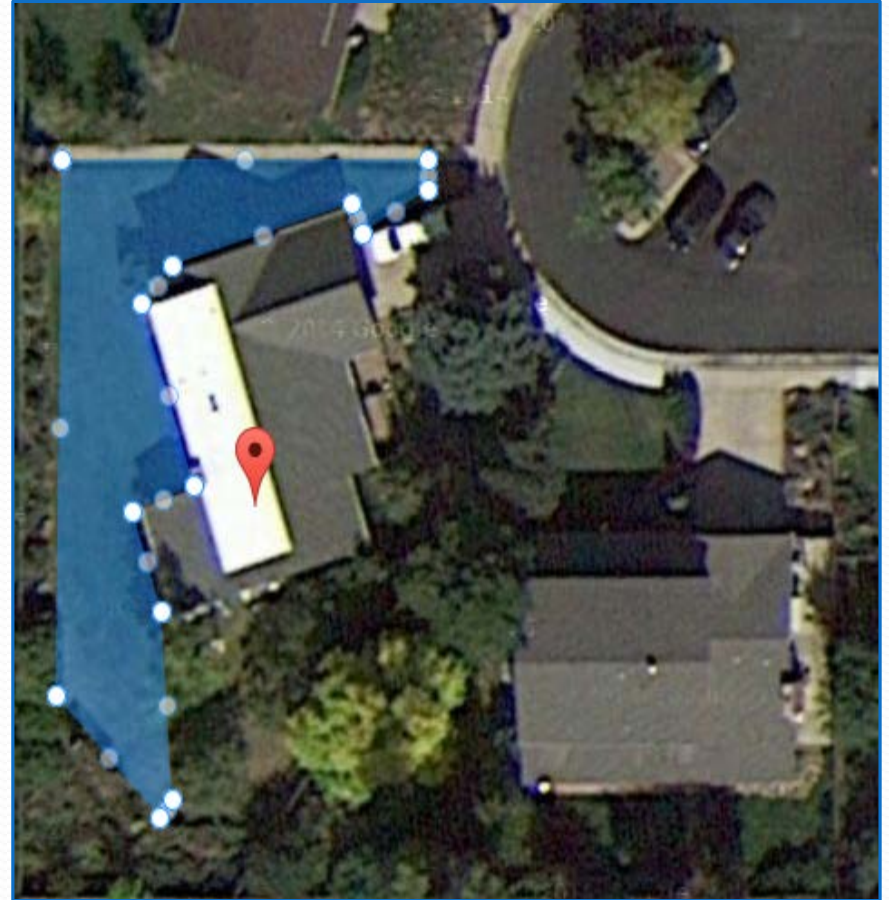
Measures the response of outdoor water use to changes in ET in Control group

	2007	2008	2009	2010	2011	2012	2013	Ave
Ave outdoor water use for control group (CCF)	194	180	150	124	125	142	140	151
OWU ratio	1.29	1.19	1.00	0.82	0.83	0.94	0.93	–
ET _o (in)	71.6	69.5	71.1	64.6	62.4	67.1	70.1	68.0
ET ratio	1.05	1.02	1.04	0.95	0.92	0.99	1.03	–

Year	2007	2008	2009	2010	2011	2012	2013
ET ratio	1.05	1.02	1.04	0.95	0.92	0.99	1.03
Normalization Factor	0.87	0.95	0.89	1.16	1.30	1.04	0.92

GIS Analysis

- Measured 115 sites
 - Lot size
 - Irrigated area
- Used to develop relationship between irrigated area and lot size where only lot size was provided
- Irrigated area ~ 30% of lot size in lots < 10,000 ft²



Determination of Application Ratios (AR) of Test Group

- AR is ratio of applied water to the theoretical irrigation requirement (TIR)
- TIR is function of:
 - Irrigated area
 - ET
 - Plant type
 - Irrigation efficiency
- WBICs designed to apply $AR = 1.0$
- $AR < 1.0$ indicates under-irrigation
- $AR > 1.0$ indicates over-irrigation



Create an Analytical Database

- Pseudonymous Customer ID
- Installation and training information
- Year of installation
- Ave pre-install OWU test and control
- Ave post-install OWU test and control
- Pre-install AR for test group
- Paired comparison of changes in OWU (before and after WBIC deployment)
- Analysis of impact of pre- install AR on change in water use

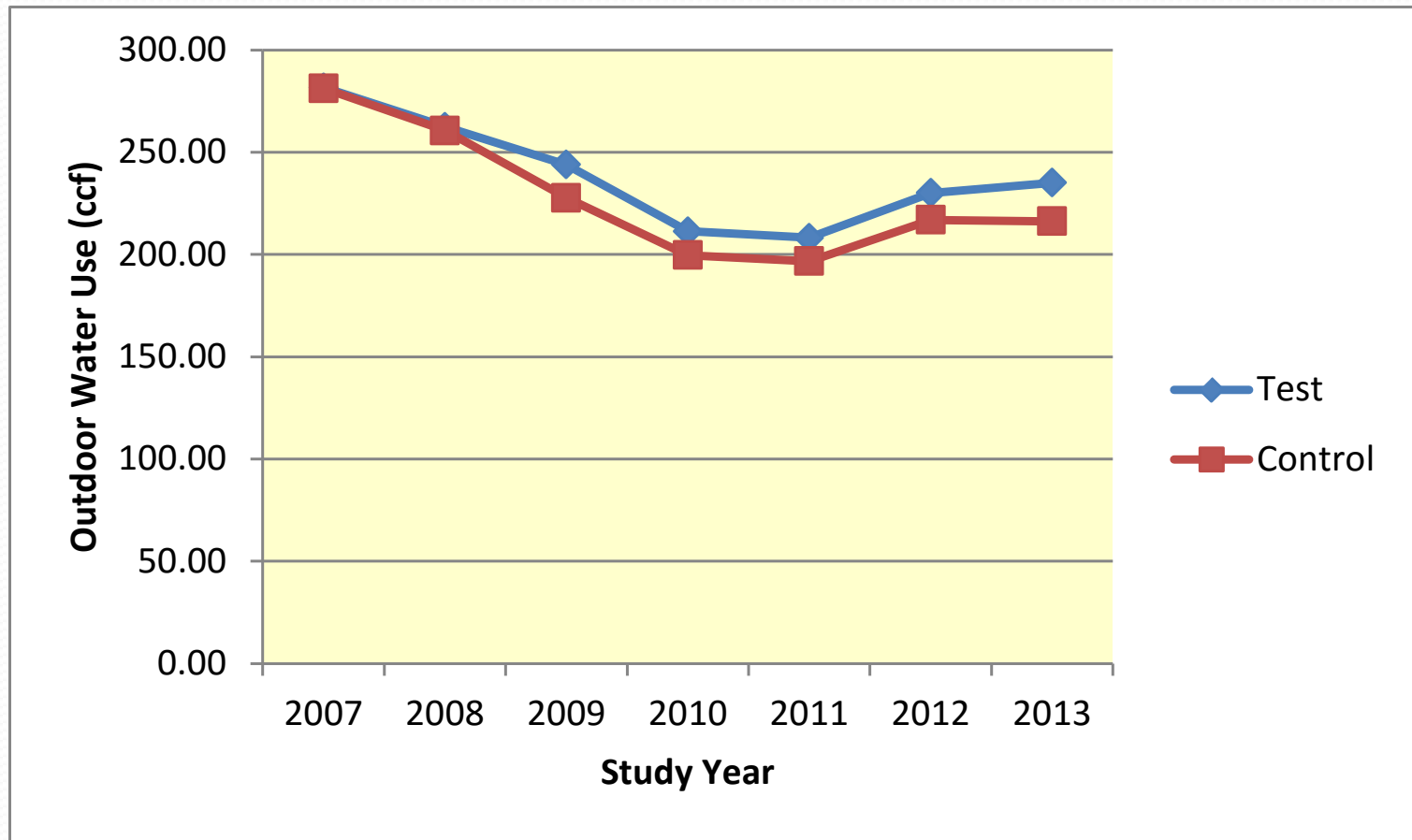
Perform Statistical Analysis

- Water use pre/post WBIC installation
 - Same homes before and after
 - Same pre and post-installation period
 - Negative change in outdoor use – reduction
 - Positive change in outdoor use – increase
- Similar factors affecting Control and Test groups
- The effect of the Application Ratio on changes in outdoor water use
- Change in water use of Test group vs Control group
 - Helps to account for factors such as economic downturn
 - Control group located within 500 feet of Test group

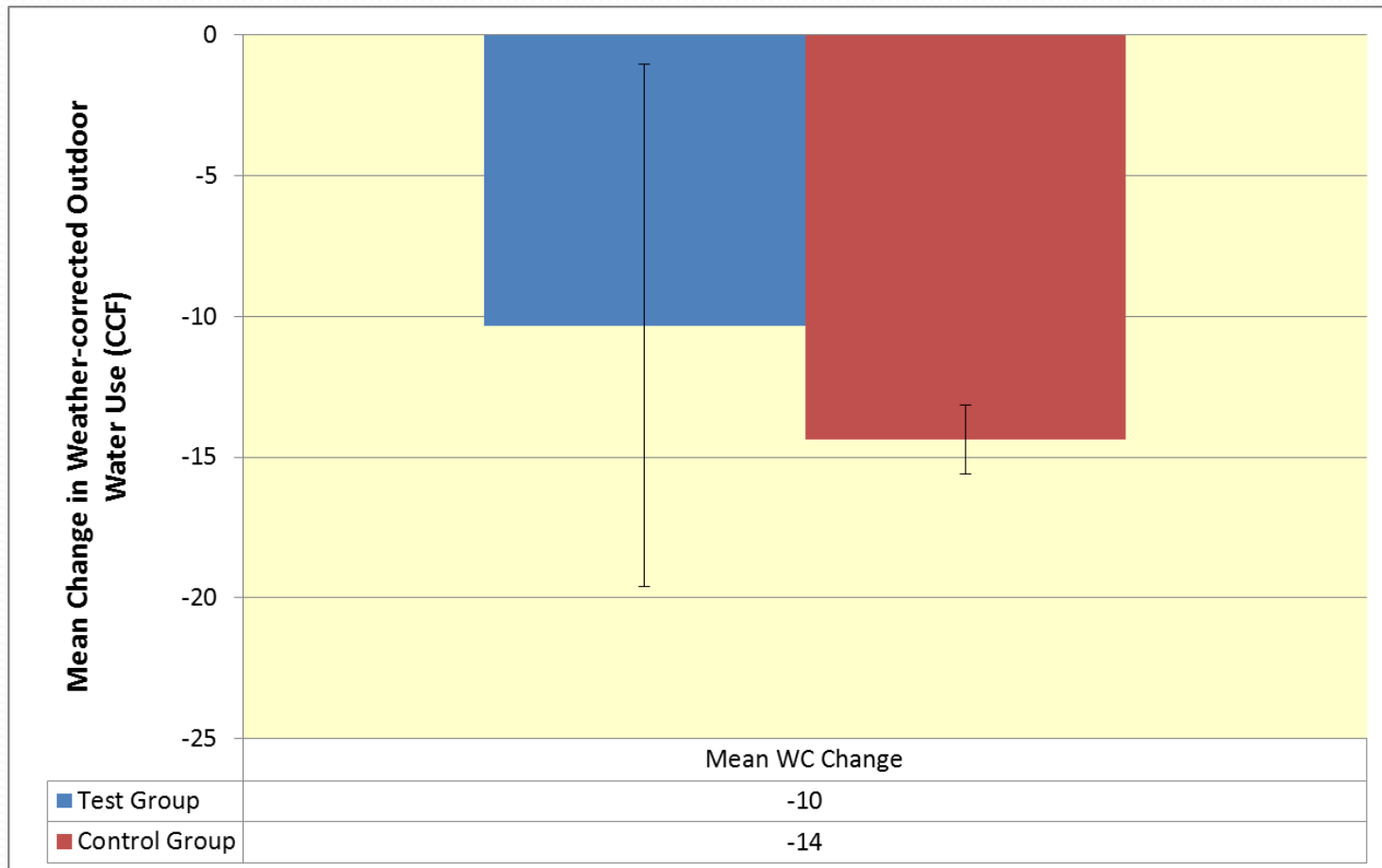
Statistical Analysis – Paired Comparisons

- Homes had to have complete water billing data
- Test homes had to have lot size data
- Homes missing these data were excluded from study
- Homes in Control group had to be located within 500 feet of Test home
- Ave outdoor use of Control group had to match that of Test group
- 892 homes in Test group & 33,149 in Control group

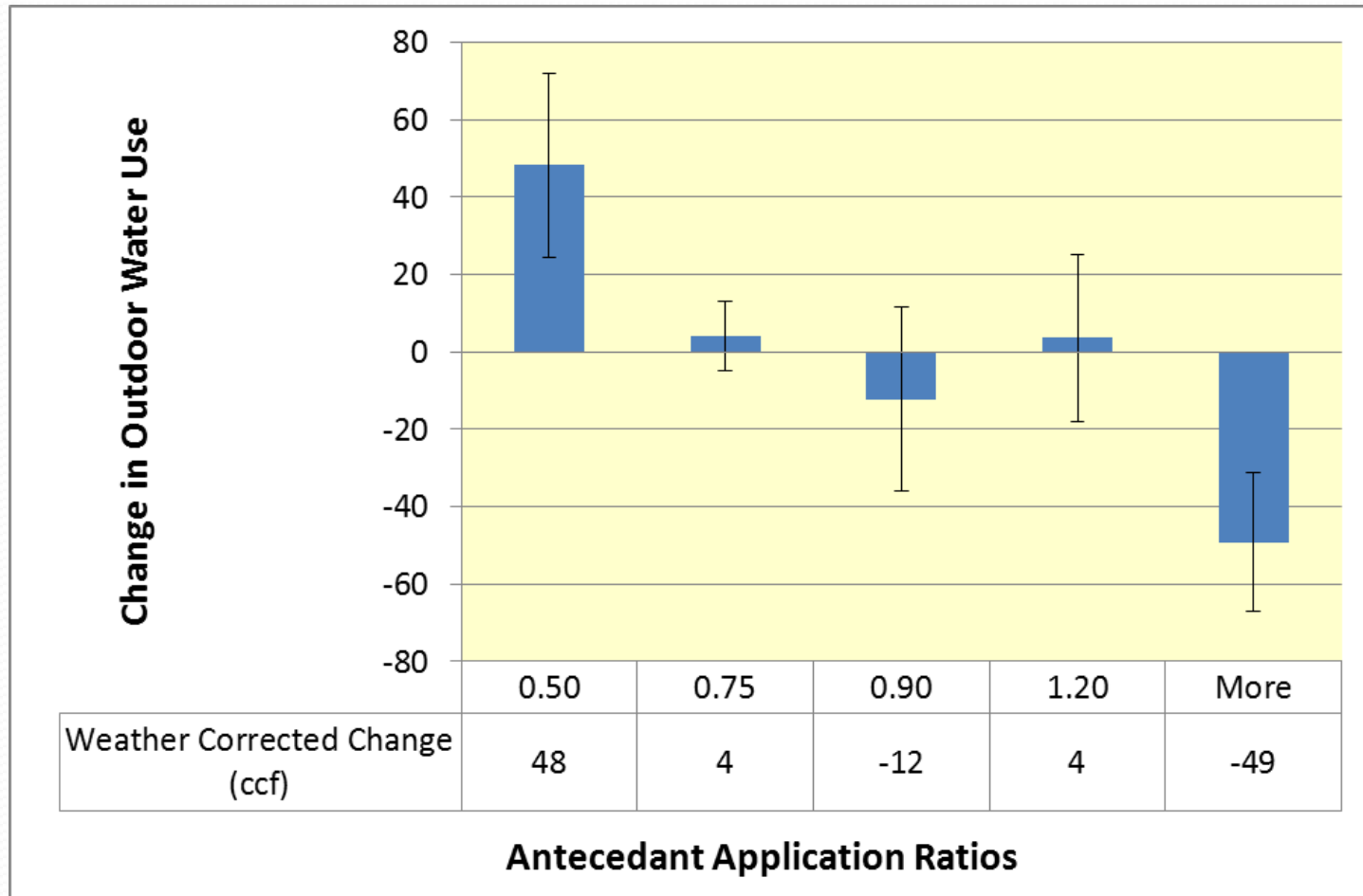
Changes in Outdoor Water Use for Test and Control Groups over Study



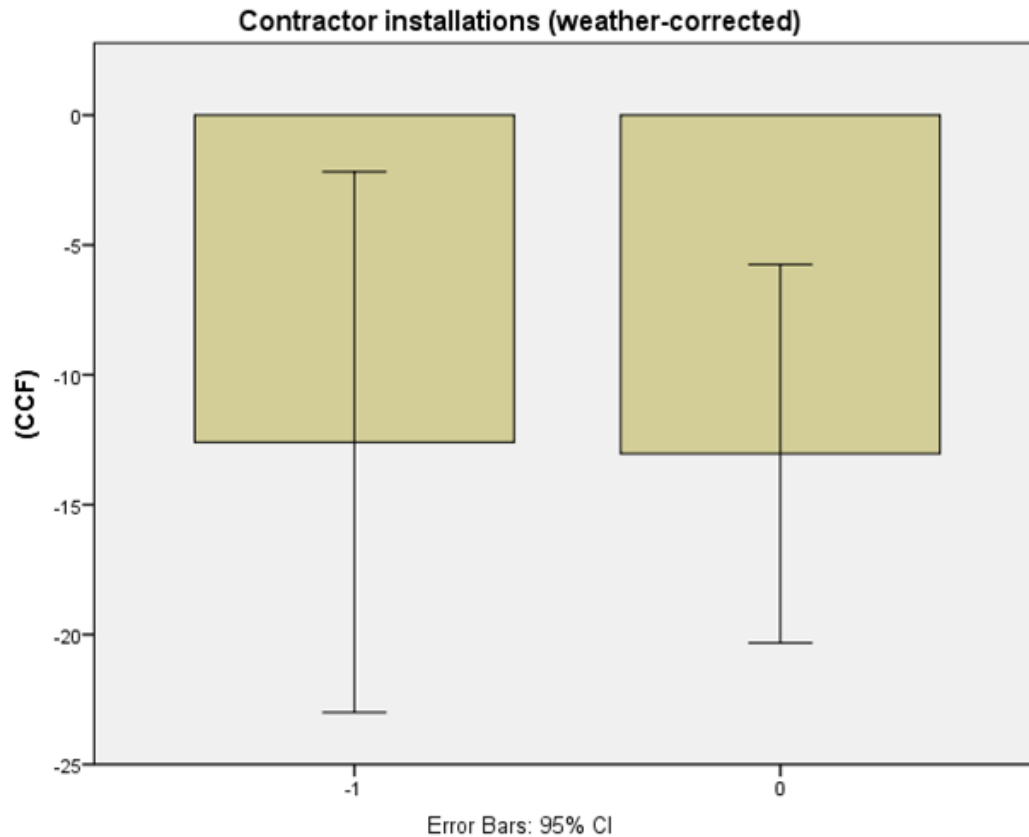
Mean Change in Weather-Corrected Outdoor Water Use



Change in Water Use vs Antecedent Application Ratio



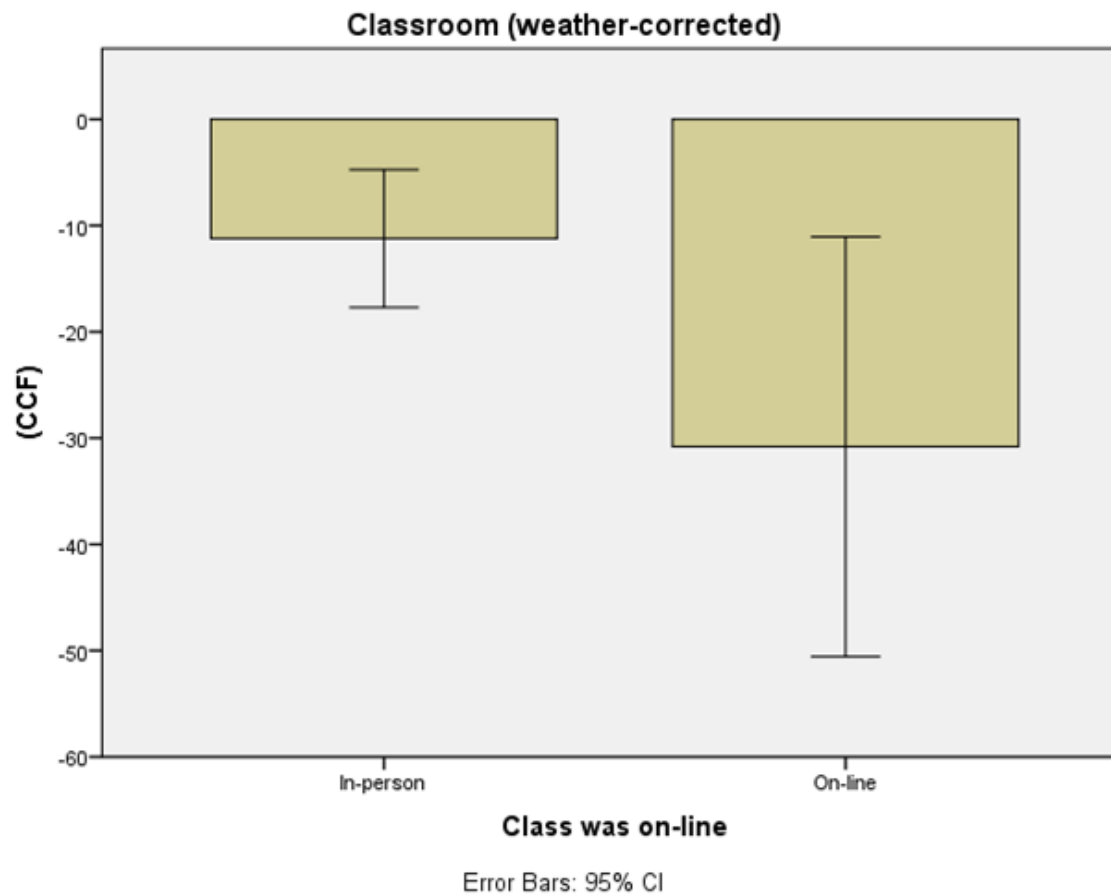
Comparison of Water Use by Installation Method



-1 = contractor

0 = homeowner

Comparison of Water Use by Method of Instruction



Conclusions about System Performance

- WBICs performed as expected by matching application ratio to theoretical irrigation requirement
- Increased water use in homes that were under-irrigating
- Decreased water use in homes that were over-irrigating
- Overall *increase* in water use due to the number of under-irrigating homes

Recommendations

- **WBIC retrofits should be directed at over-irrigators**
- Eliminate general rebate or give-away programs
 - Particularly for users with traditional landscapes that are under-irrigating
- WBICs can be used effectively in *new* landscapes to prevent over-irrigation.



2014 Update

- Added data from 2013 and repeated the analysis
- Reduction in water use in both the Test group and the Control group
- Greater reduction in the Control group than Test group
- Greatest reduction in group with Application Ratio greater than 1.20
- Confirms the conclusions of the original study including the importance of targeting WBIC programs to highest over-irrigators based on AR



AMA

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