

Water Rates as a Driver of Residential Water Demand

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MOTIVATION

To improve the understanding and management of the impact of water rates on residential irrigation demand

- ◆ Applies high quality parcel-level water demand data
- ◆ Accounts for irrigable area of each parcel
- ◆ Employs an improved estimate of the landscape net irrigation demand

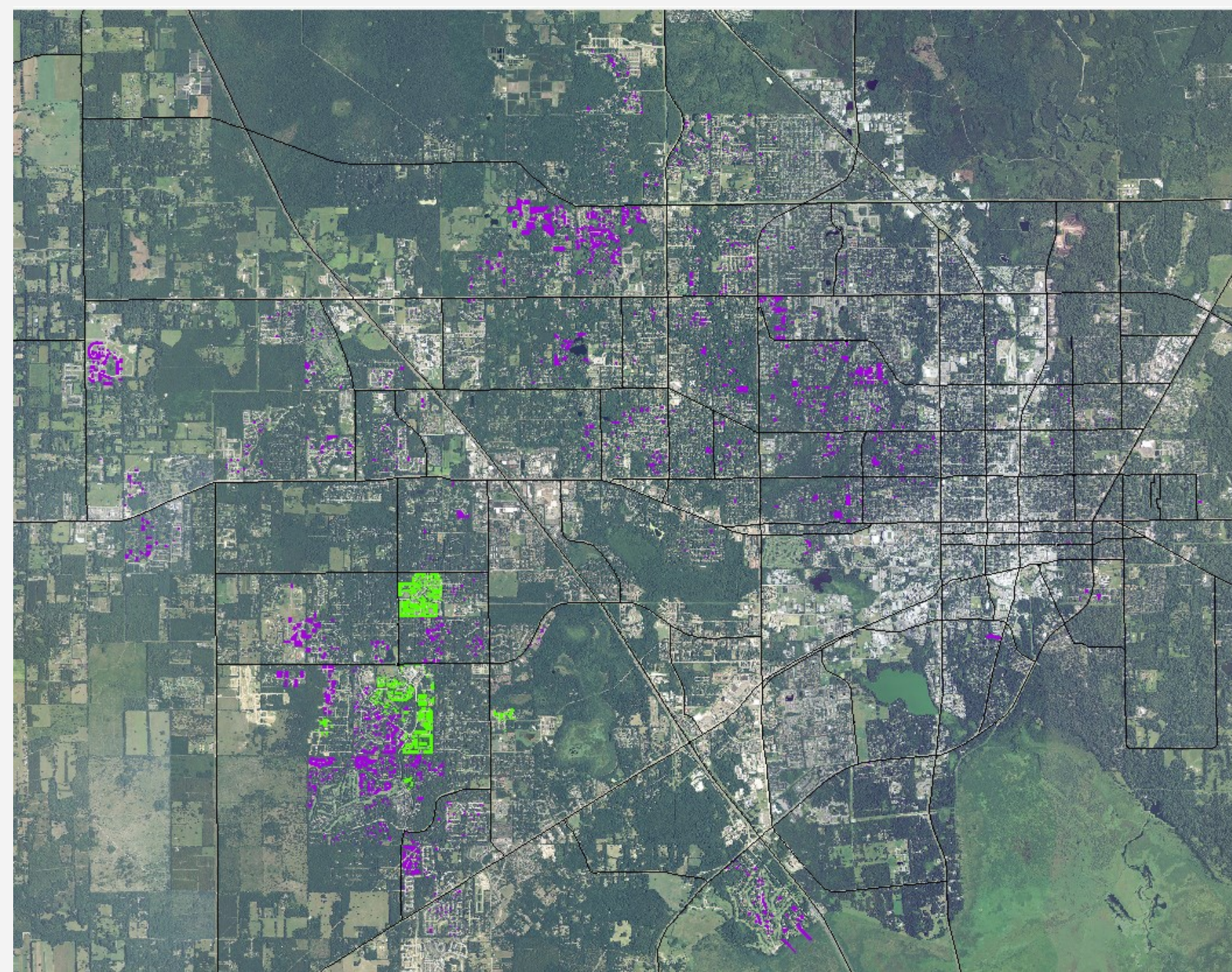
DATA SETS & METHODS

Water Demand Data (2008-14)

- ◆ 510 single family residential customers in Gainesville, Florida that received reclaimed water through a separate meter

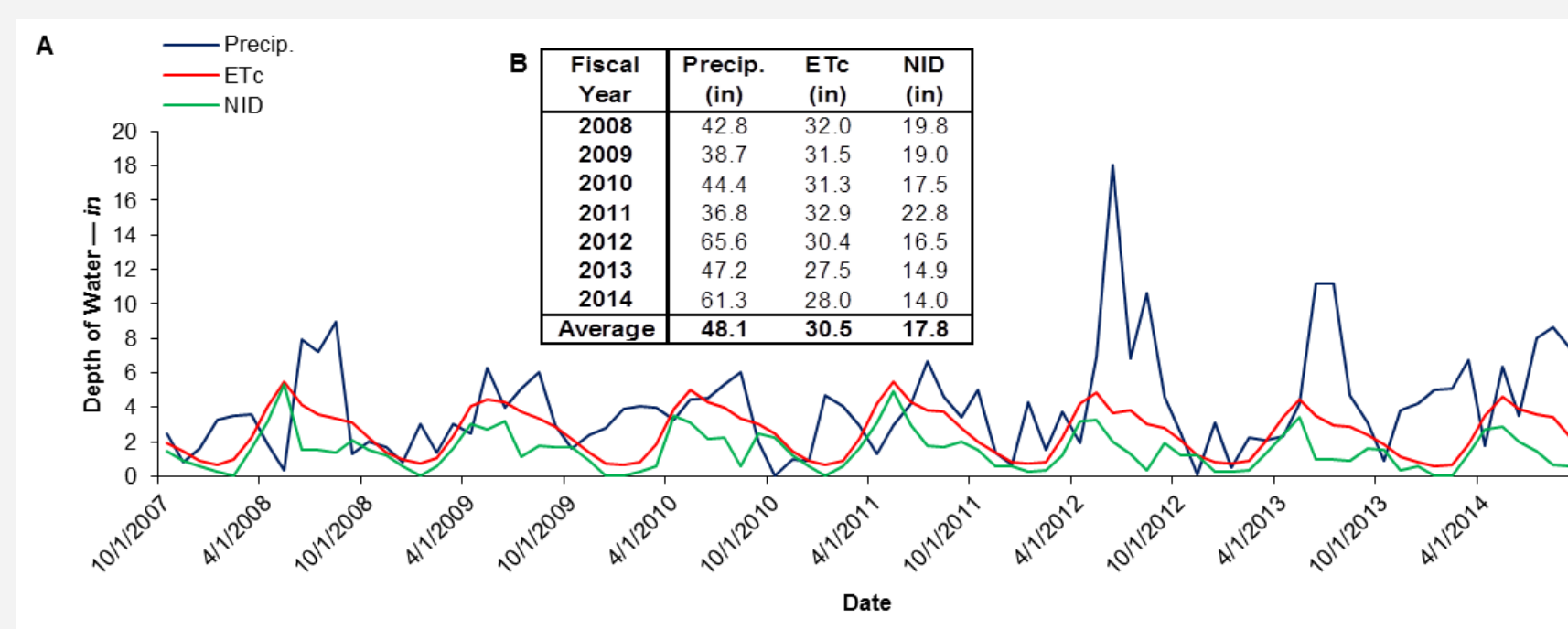
Type	Year	Account Charge (\$/month)	Commodity Charge (\$/kgal)	Type	Account Charge (\$/month)	Commodity Charge (\$/kgal) Tier 1	Commodity Charge (\$/kgal) Tier 2	Tier 1 Cutoff (kgal)
Reclaimed	2008	\$10.00	—	Dual Potable	\$5.35	\$2.82	\$4.93	15
	2009	\$6.00	\$0.60		\$7.00	\$3.11	\$5.50	15
	2010	\$6.00	\$0.60		\$7.30	\$3.30	\$6.00	15
	2011	\$6.50	\$0.60		\$7.75	\$3.65	\$6.00	15
	2012	\$7.40	\$0.60		\$8.65	\$3.65	\$6.00	13
	2013	\$7.40	\$0.63		\$8.70	\$3.75	\$6.00	13
	2014	\$7.85	\$0.65		\$9.00	\$3.75	\$6.00	14

- ◆ 610 single family residential potable water customers with dual meters in Gainesville, FL



Weather Data (2008-14)

- ◆ Florida Automated Weather Network daily data
- ◆ Daily soil water balance based on Dukes (2007)



ANALYSIS & RESULTS

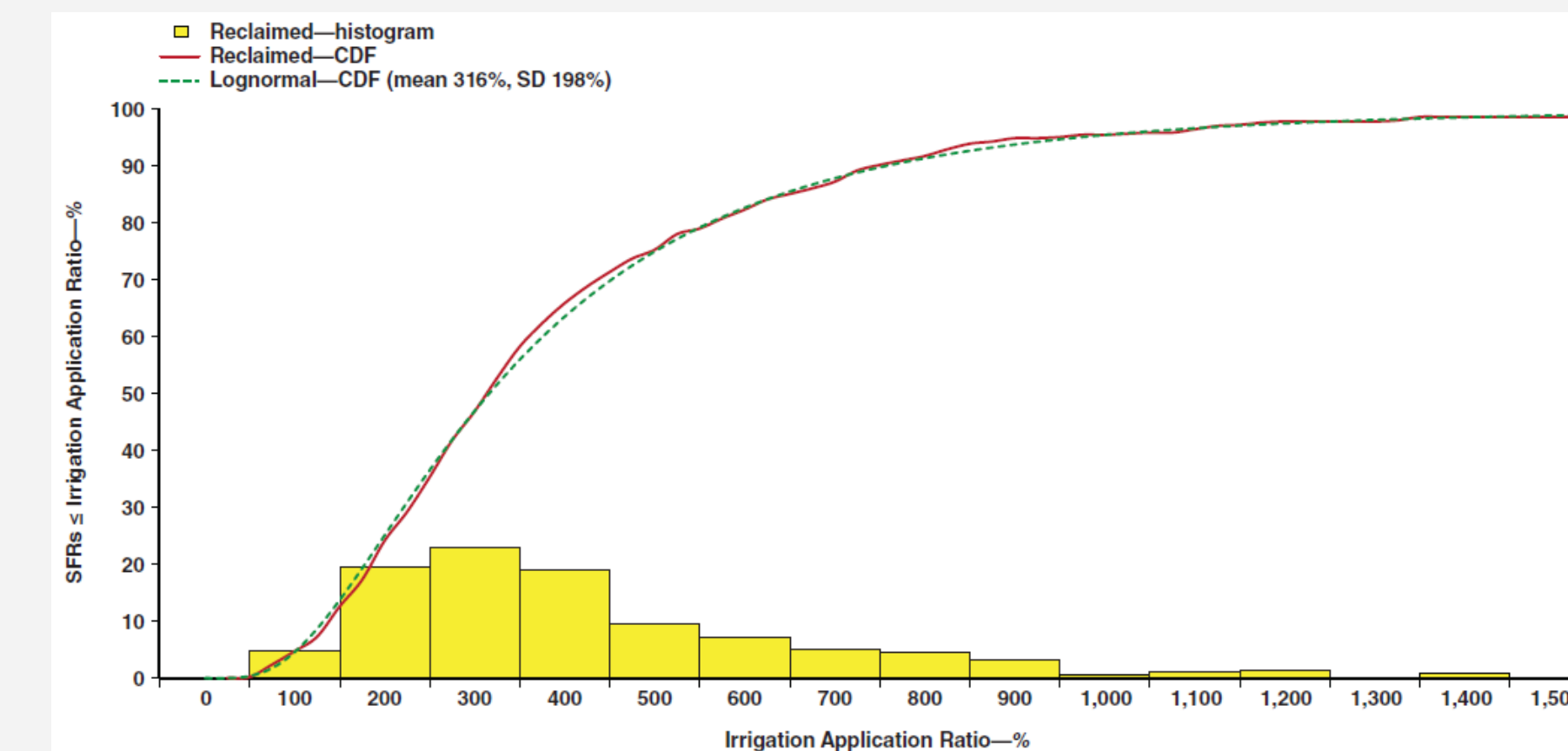
- ◆ The irrigation application ratio (IAR) for free reclaimed water averaged 328%

$$IAR_{ann} = \frac{\overline{AR}_{ann}}{NID_{ann}} \times 100\%$$

- ◆ Offset credits (OC) were used to compare potable to reclaimed demand; reclaimed customers had an OC of 20%

$$OC = \frac{\overline{AR}_{potable}}{\overline{AR}_{reclaimed}} \times 100\%$$

- ◆ Reclaimed customers compared before and after a small commodity charge was added showed large decreases in use in the aggregate, but between 14 and 27% of customers increased use in each post-rate year

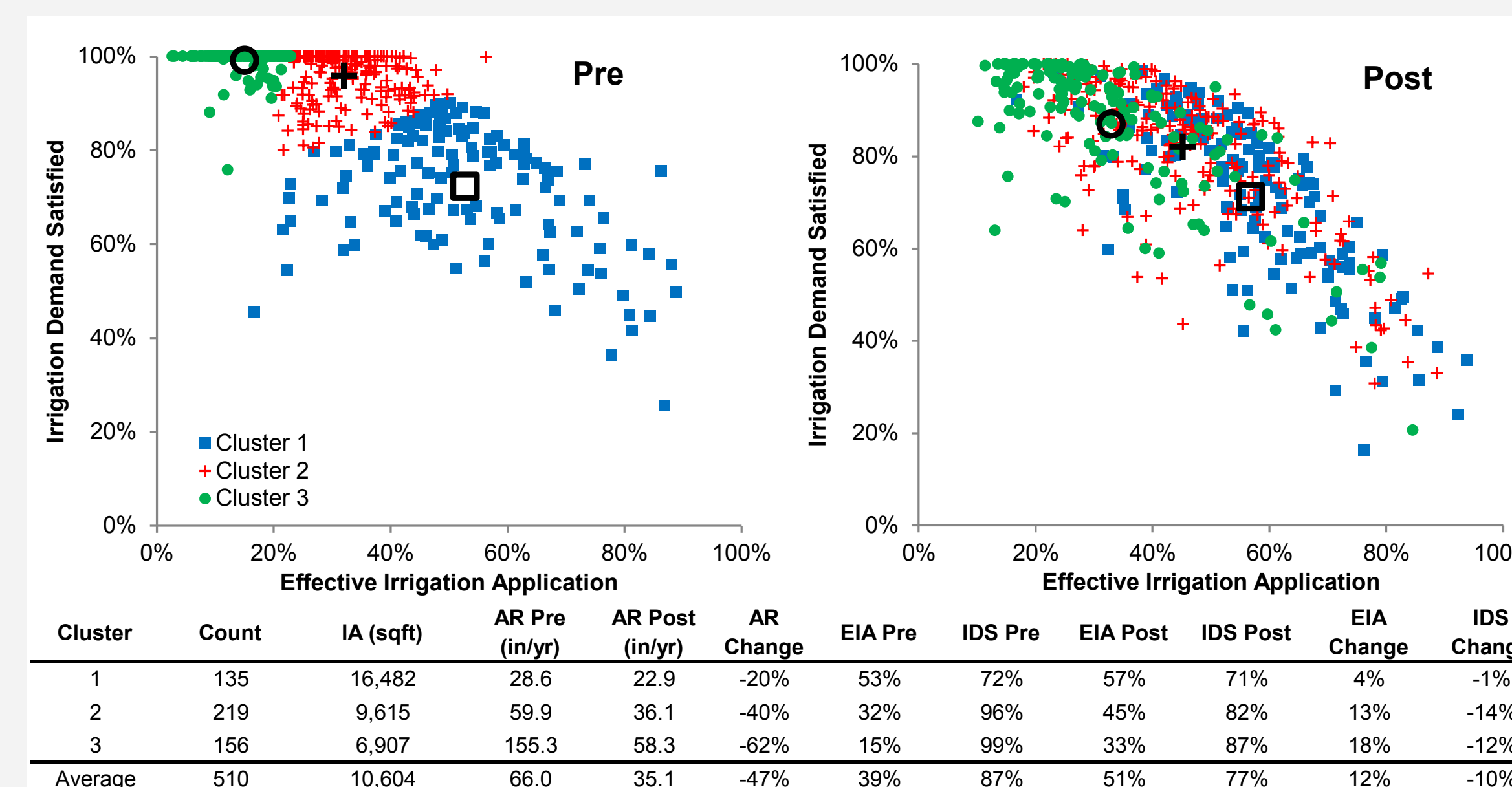


- ◆ Calculated the monthly net irrigation demand (NID) to determine the need for irrigation in each month

- ◆ Two annual efficiency metrics were applied: the irrigation demand satisfied (IDS) and effective irrigation application (EIA) using monthly demand data for each account

$$IDS_y = \frac{\sum_1^{12} (\min(NID_m, AR_m))}{\sum_1^{12} NID_m} \times 100\%$$

$$EIA_y = \frac{\sum_1^{12} (\min(NID_m, AR_m))}{\sum_1^{12} AR_m} \times 100\%$$

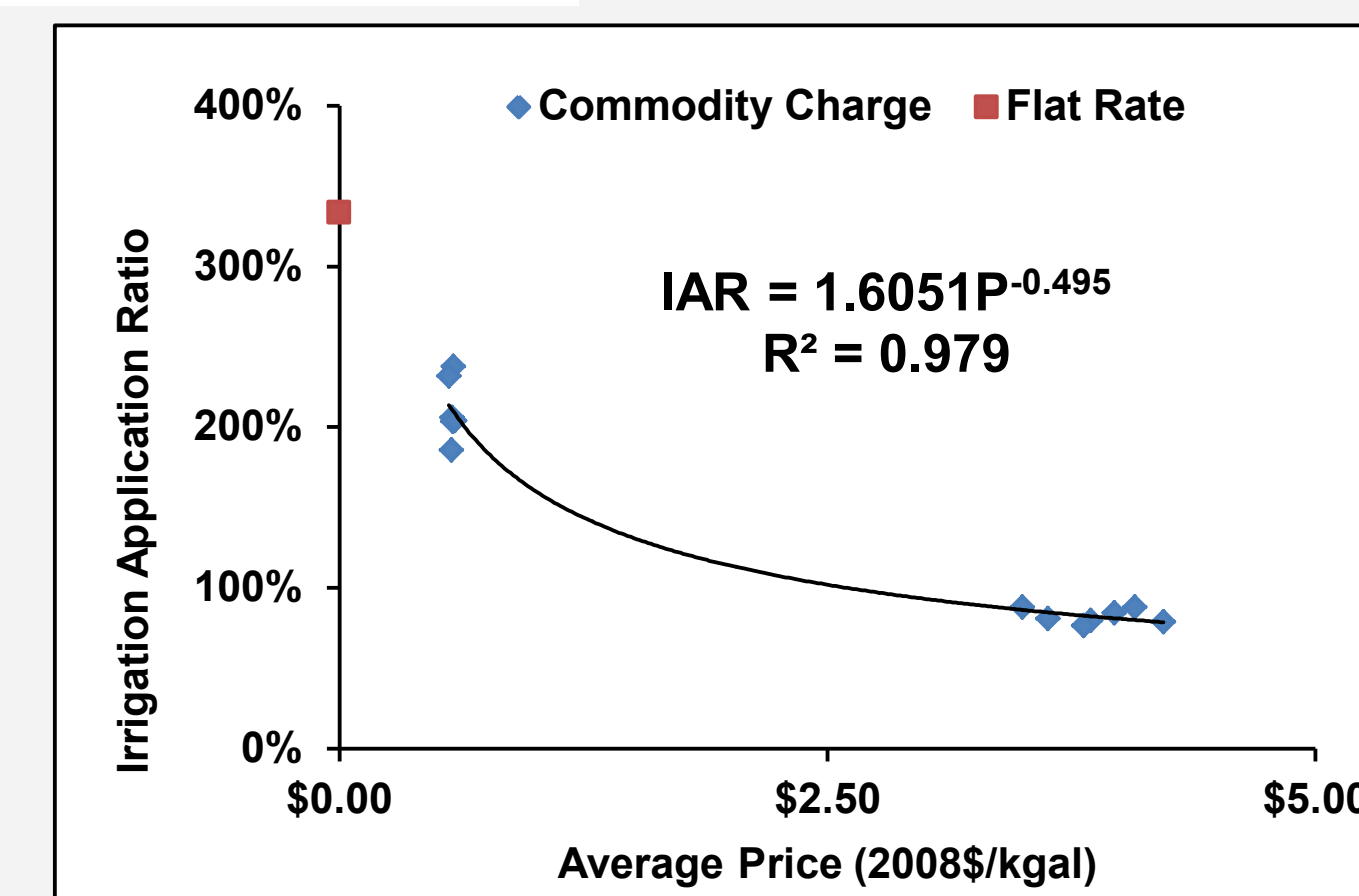


- ◆ Clustering was used to evaluate characteristics of groups of customers both for efficiency and for irrigable area

- ◆ Looked at the cumulative impact of the change from flat-rate to commodity charges

- ◆ By incorporating the potable dual meter customers, a model was developed to estimate the impact on demand as rates changed

- ◆ Estimated the normalized effect of a change in rates on the utility revenue generated



	Percentage Change in Price												
	-50%	-30%	-20%	-10%	-5%	0%	5%	10%	20%	30%	50%	75%	100%
Revenue	-30%	-16%	-11%	-5%	-3%	0%	2%	5%	10%	14%	23%	33%	42%
Demand	41%	19%	12%	5%	3%	0%	-2%	-5%	-9%	-12%	-18%	-24%	-29%

CONCLUSIONS

Changes in residential demand for irrigation do not occur in a vacuum, but rather are influenced by weather, customer preferences, and water rates.

- ◆ Knowing irrigable area and irrigation demand provides a better metric for determining irrigation efficiency

- ◆ Reclaimed customers improved efficiency with a small commodity charge

- ◆ Customers with smaller irrigable areas over-irrigated to a greater extent

- ◆ 14-27% of reclaimed customers in each year increased their use despite the additional cost

- ◆ Changes in water demand are predictable at the aggregate level and can be estimated under increased rates

- ◆ Before developing a reclaimed system, utilities should determine the desired blend of water offsets and wastewater disposal

- ◆ When combined with water conservation efforts water rates can be an effective tool to manage demand

FUTURE WORK

- ◆ Increase the data sets to include a wider range of rates

- ◆ Evaluate demands elsewhere to improve the model

- ◆ Consider other price elasticity model formulations

- ◆ Estimate the potential for customers to convert to other water sources (private wells) as rates are increased