

This presentation premiered at WaterSmart Innovations

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Irrigation Detection Algorithms and Customer Compliance

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Context

- Mixed findings in literature on effectiveness of irrigation restrictions
- Almost impossible to run controlled experiments (usually implemented with other drought measures and outreach)
- AMI data offers new way to assess compliance and effectiveness (which may not be the same thing)

Kinds of Irrigation Restrictions

- Time of Day (eg 8pm-6am)
- Day of Week (T, Th, Sat)
- Day of Week by Address (Evens – T, Th, Sat / Odds – M, W, Sun)
- Weather Contingent (No watering after rain)

Meet the IDA

- Model Inputs:
 - Hourly Customer Water Use Data
- Purpose
 - Detect pattern-based water ‘events’ that imply that the household is using a time-regulated irrigation system.
 - Minimize the number of false positives (e.g. classifying indoor use as irrigation)
 - Capture the maximum amount of timed irrigation for each household



Meet the IDA

- Algorithm:
 - Compare a given hour's water use to hourly use at same time on other days within a rolling month time-frame
 - Based on the strength of the pattern signal, classify the hour as irrigation or not.
- Verified by rigorous testing:
 - Using hourly data for a Mountain West utility in the winter months provided a way to check for false positives.
 - Tuned the model to capture the maximum amount of timed irrigation, with acceptable false positives (<0.1%)

Algorithm In Practice

History

BILLING

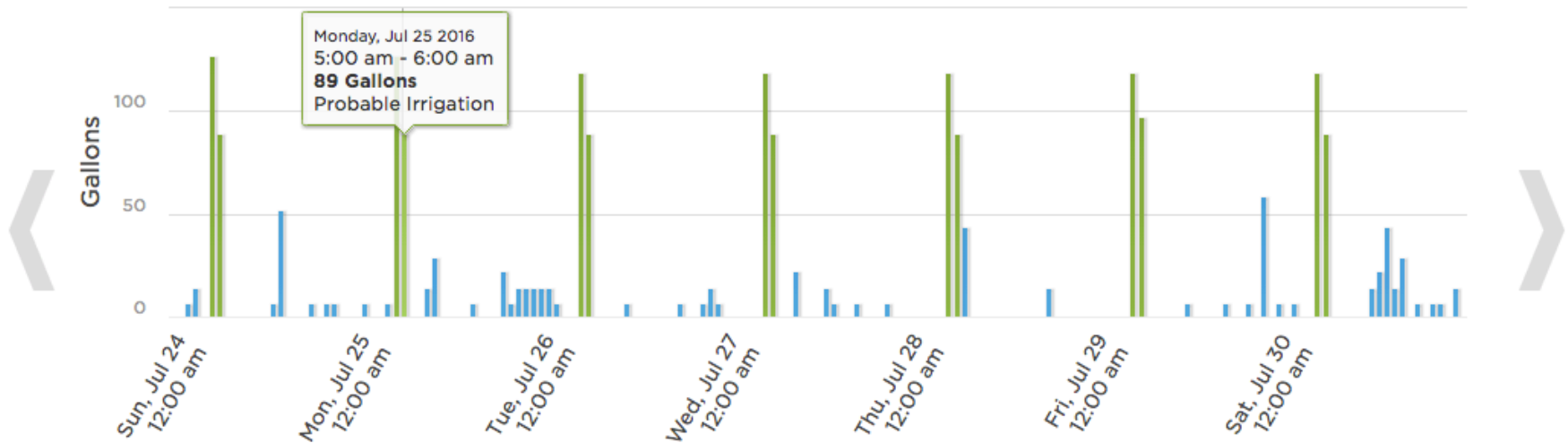
AMI

LEAKS

Jul 23, 2016 — Jul 30, 2016

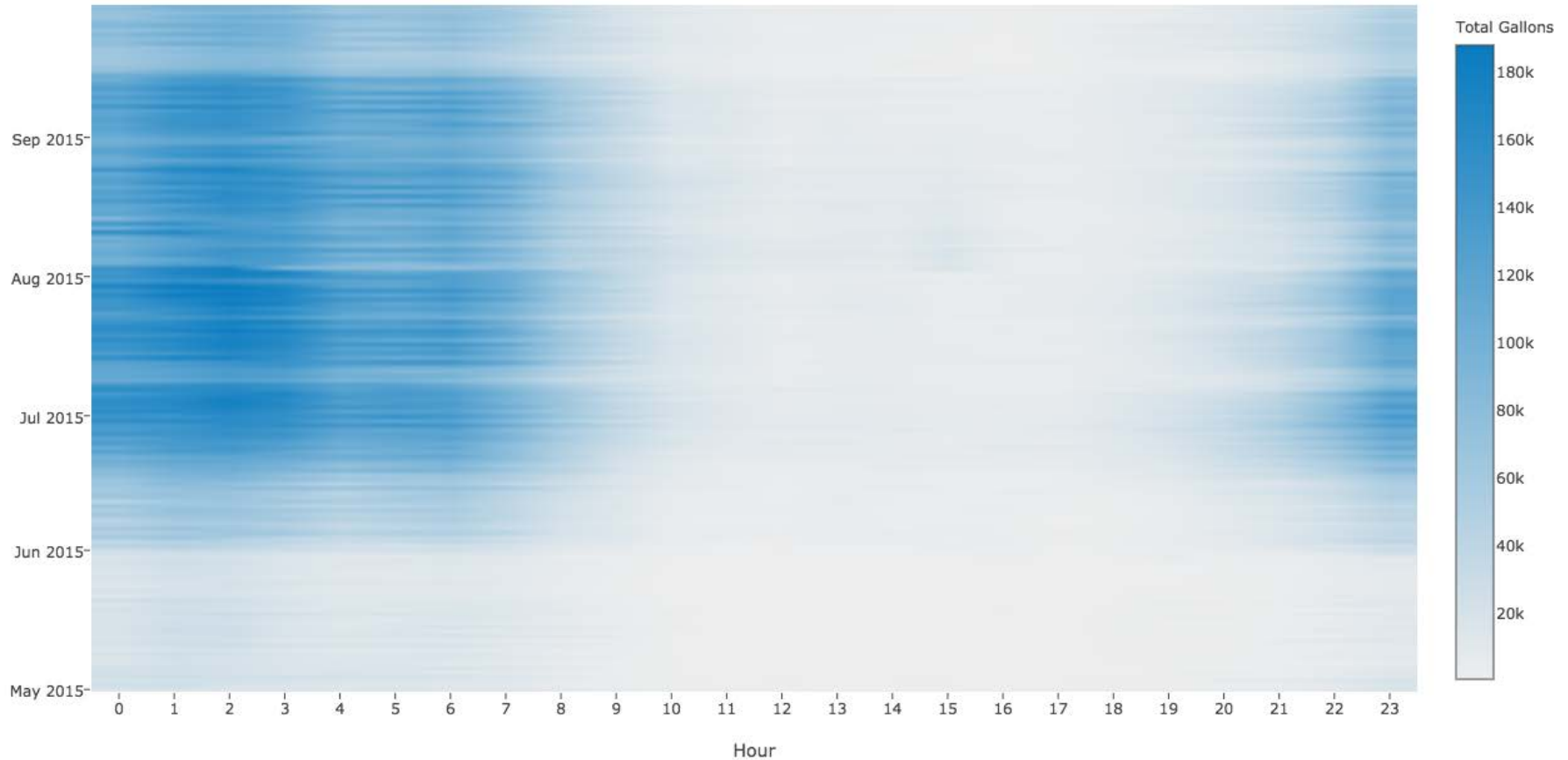
DAY WEEK 2 WEEKS 2 MONTHS YEAR

● Normal use ● Possible leak ● Probable irrigation

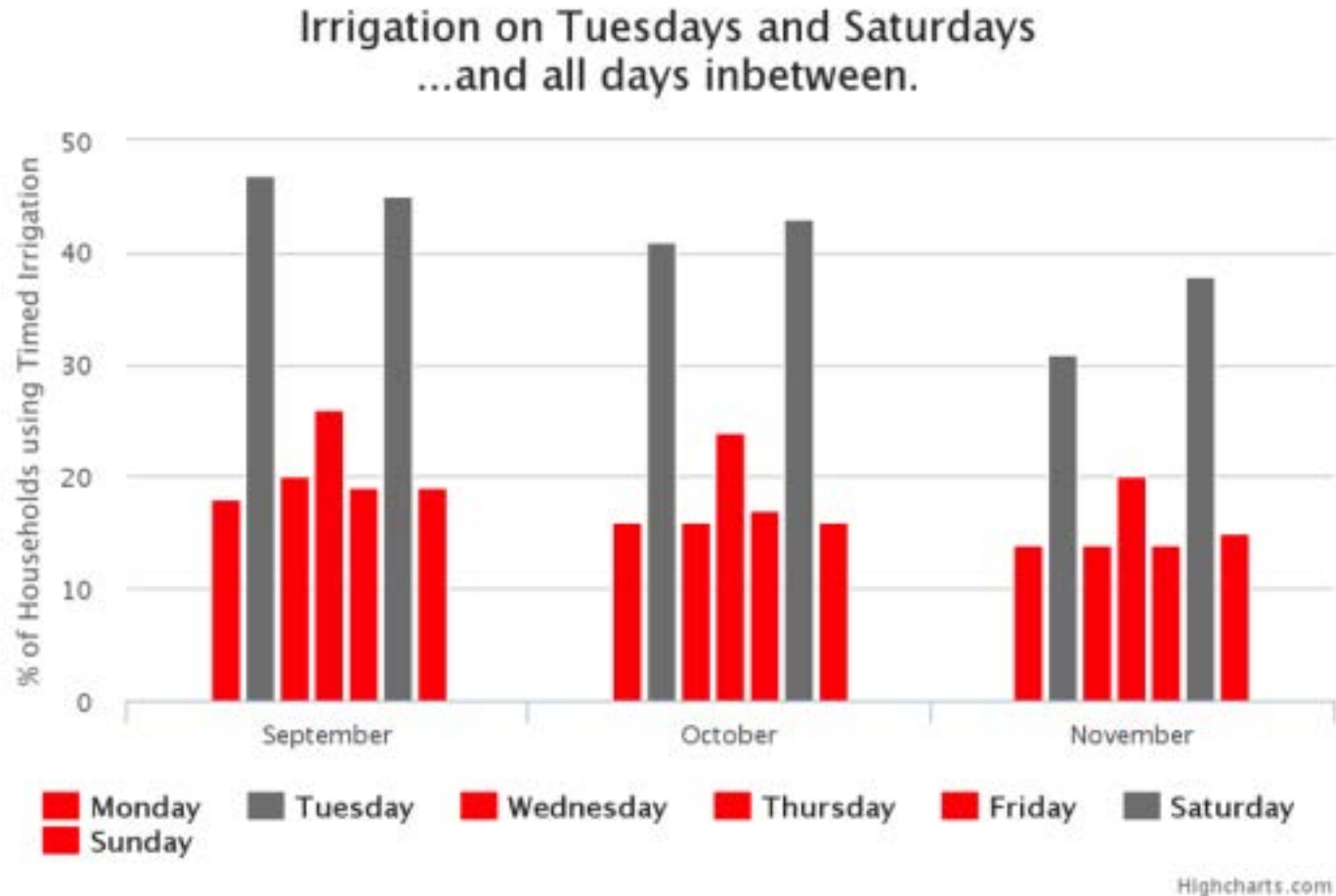


Compliance: Time of Day

83.3% of Irrigation During Proper Hours (10PM – 7AM)



Compliance: Day of Week

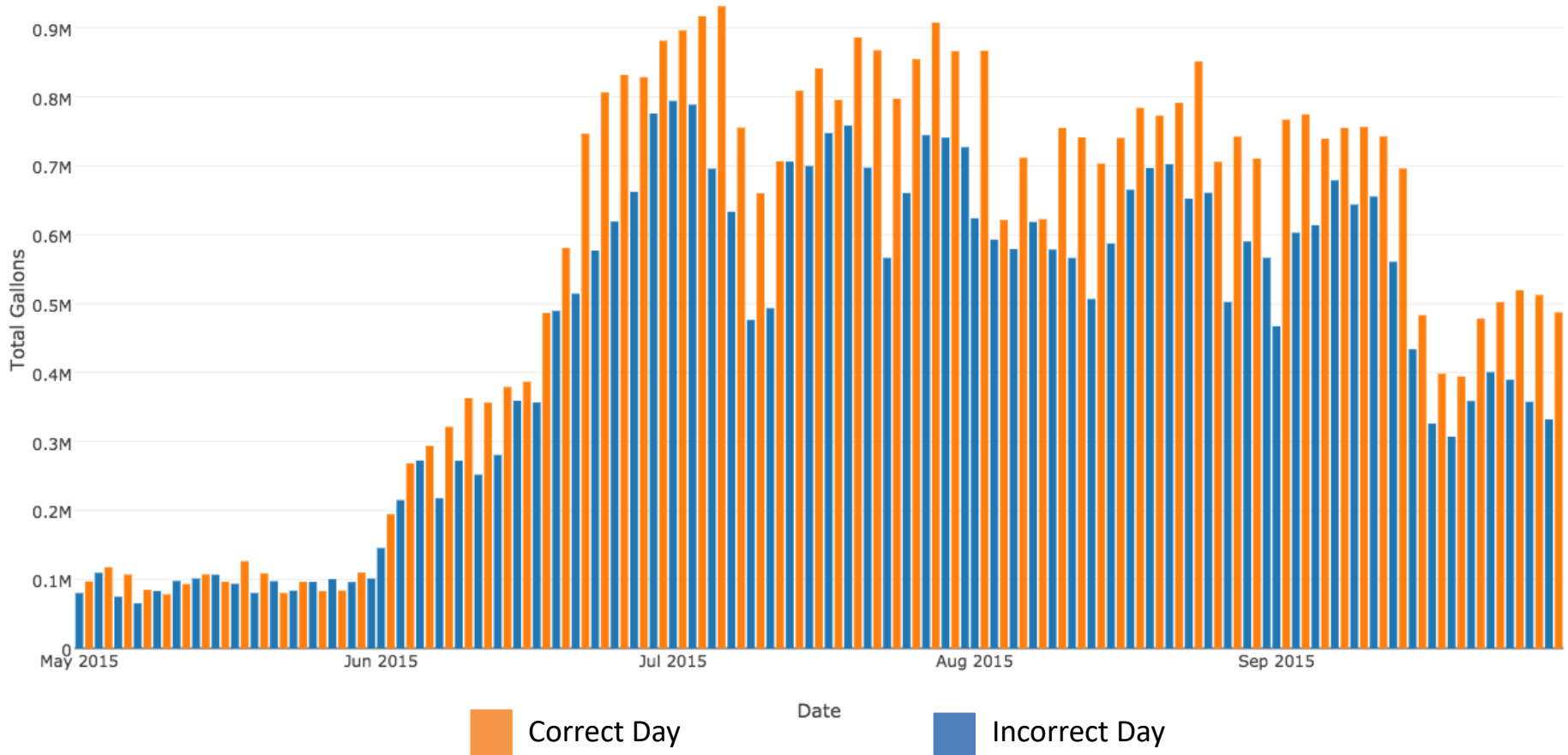


15 – 20% of households do not water within irrigation day regulations

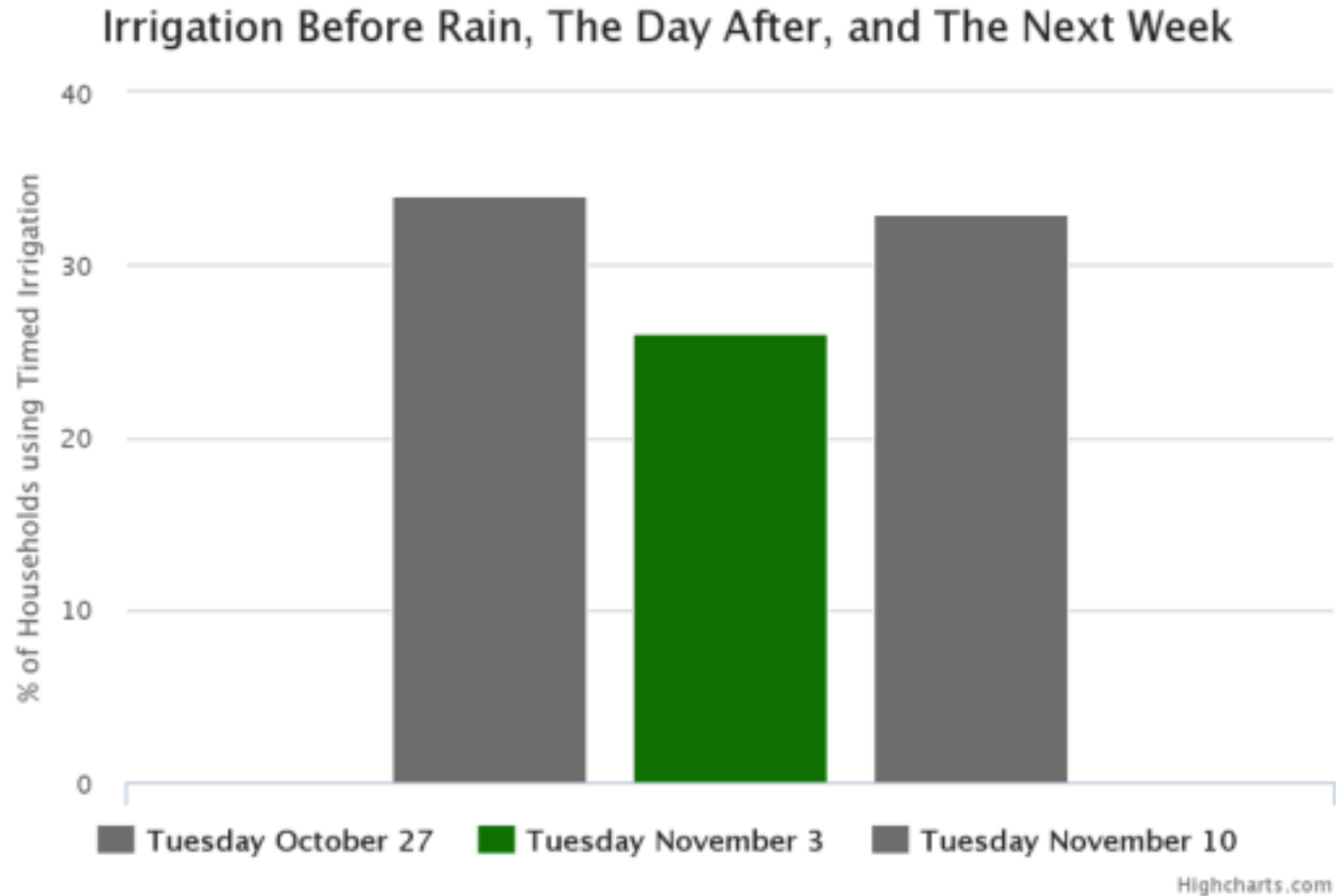
Tested in medium-sized Southern California community with watering allowed on Tuesdays and Saturdays

Compliance: Day of Week by Address

50-54% of households comply with even/odd day of week



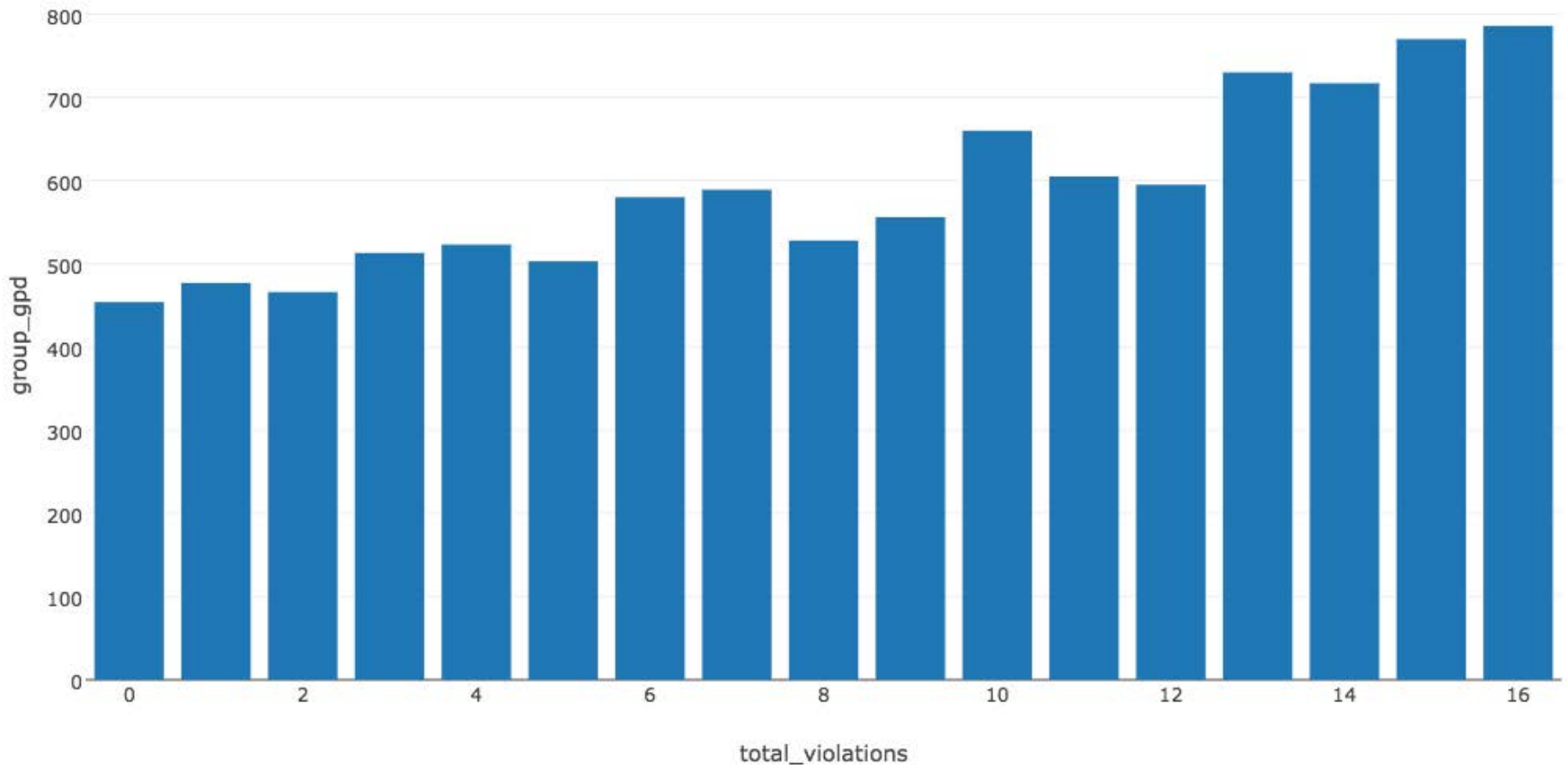
Compliance: Weather Based



Tested in medium-sized Southern California community with watering allowed on Tuesdays and Saturdays

Violation vs Total Water Use

Avg GPD by Violation Group Aug 2016



Use your Time Wisely...

Irrigators 1,231 results							TABLE VIEW	MAP VIEW
Likely irrigators are those with a consistent pattern of high water use, which is most likely timed irrigation. A green check ✓ indicates irrigation on the right day and a red X indicates irrigation on the wrong day. Days without detected irrigation have neither symbol.								
AMI Data through Wednesday, September 7 at 11:00 pm.								
SEARCH ACCOUNT	METER CLASS	IRRIGATION IN LAST 7 DAYS	SHOW	UPDATE				
<input type="text"/>	SFR	1 or more	Only non-compliant					
ACCOUNT	IRRIGATION DAYS BY WEEKDAY	IRRIGATION DAYS IN LAST 7 DAYS	GPD	WATER REPORT RECIPIENT	MOST RECENT NOTE	CONTACT	MORE COLL	
Alphonso Sella 9417 Dagmar Ave 203977786003	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	2,081	Y		demo-inbox+394709@wa		
Ashlynn Strathman 1497 Timmy Dr 702216095402	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	921	Y				
Alessandra Sturm 2561 Giuliana St 608185557202	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	689	N				
Aine Scipione 8901 Veta Blvd 607013720302	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	576	Y		demo-inbox+2022@water		
Antonio Seymour 8454 Melaine Ln 503299052704	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	569	Y		demo-inbox+user78049		
Allison Staines	Su X M X Tu ✓ W X Th ✓ F X Sa ✓	7	550	Y		demo-inbox+316701@water		

Use your Time Wisely...

Irrigators **1,231 results**

TABLE VIEW MAP VIEW

Likely irrigators are those with a consistent pattern of high water use, which is most likely timed irrigation. A green check  indicates irrigation on the right day and a red  indicates irrigation on the wrong day. Days without detected irrigation have neither symbol.

AMI Data through Wednesday, September 7 at 11:00 pm.

SEARCH ACCOUNT

METER CLASS

SFR













IRRIGATION IN LAST 7 DAYS

1 or more

SHOW

Only non-compliant

UPDATE

ACCOUNT	IRRIGATION DAYS BY WEEKDAY	IRRIGATION DAYS IN LAST 7 DAYS ▲	GPD	WATER REPORT RECIPIENT	MOST RECENT NOTE	CONTACT	MORE COLL
 Ayana Ruskowski 4788 Masako Ave 908553849104	Su M Tu W Th  F Sa	1	233	Y		demo-inbox+502@waters	
 Allena Patzner 9797 Ta Ave 309920569201	 Su M Tu W Th F Sa	1	233	Y			
 Alfie Buanno 5356 Danika Ave 903274519407	 Su M Tu W Th F Sa	1	241	Y			
 Arline Schreifels 7523 Adina Ct 206912168802	 Su M Tu W Th F Sa	1	245	Y		demo-inbox+user169752	
 Ayaan Asmus 6733 Kenda Ln 208508727004	Su M Tu W Th  F Sa	1	245	N			
 Adalsh Soudski	Su M Tu  W Th F Sa	1	228	Y			

What about Non-AMI?

Top SFR Consumers by Irrigable Area

100

results

TABLE VIEW

MAP VIEW

The accounts consuming the most per square foot of irrigable area.

SEARCH ACCOUNT

x









READING PERIOD

2016-4

INCLUDE

☐ Suspect Data ☐ Inactive Accounts

UPDATE

ACCOUNT	CCF	GPD	IRRIGABLE AREA	GPD PER SQUARE FOOT ▼	LOT SIZE	POOL	MORE COLUMNS
 Shary Melchior 527 Lynwood Ln 108301382705	72	885	61	14.51	2,800	No	
 Sherley Luco 9741 Katherine Ave 106917404005	53	666	100	6.67	1,202	No	
 Shameka Meason 7458 Lory Ct 206892803507	31	359	100	3.59	1,171	No	
 Camellia Vandermark 7278 Birdie St 902077673603	29	338	100	3.38	1,714	No	
 Sherly Refsell 5691 Curtis Ln 303384821600	29	392	120	3.27	728	No	
 Martha Gruber 829 Ronna Ln 205958615702	24	315	100	3.16	859	No	
 Walter Messman 5348 Jessie St 905559443602	44	578	200	2.89	975	No	
 Jonah Pawluch	21	285	100	2.86	672	No	

Initial findings

- Algorithm accurately captures probable hours of patterned irrigation
- Without finer-grain data, actual observation of irrigation can be difficult based on a timing period that would need to be observed
- An actual predictive model would be useful to generate probabilities for irrigation flags
- Model could be fine tuned with weather data and current restrictions

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- Easily exclude customers who shouldn't receive a message



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- Open and click rates
- Customer interactions

Unlimited emails and contacts

Thank you!



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