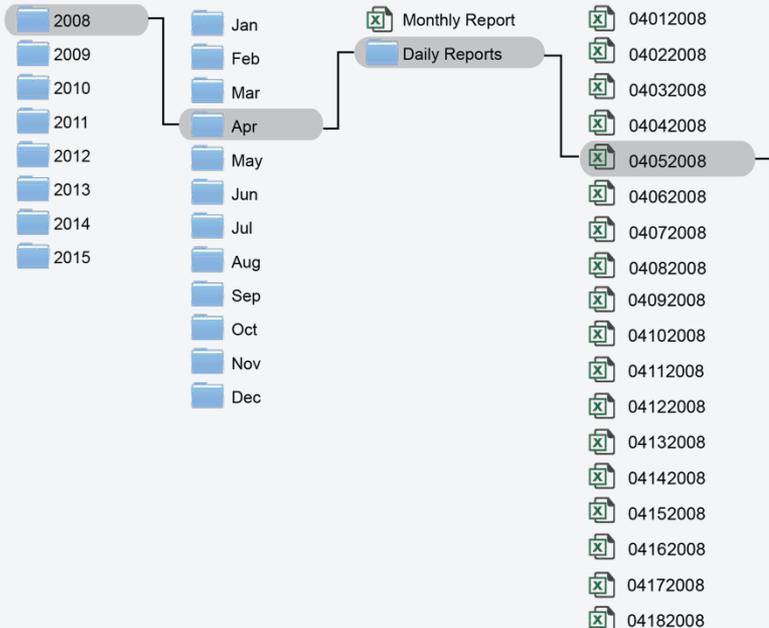


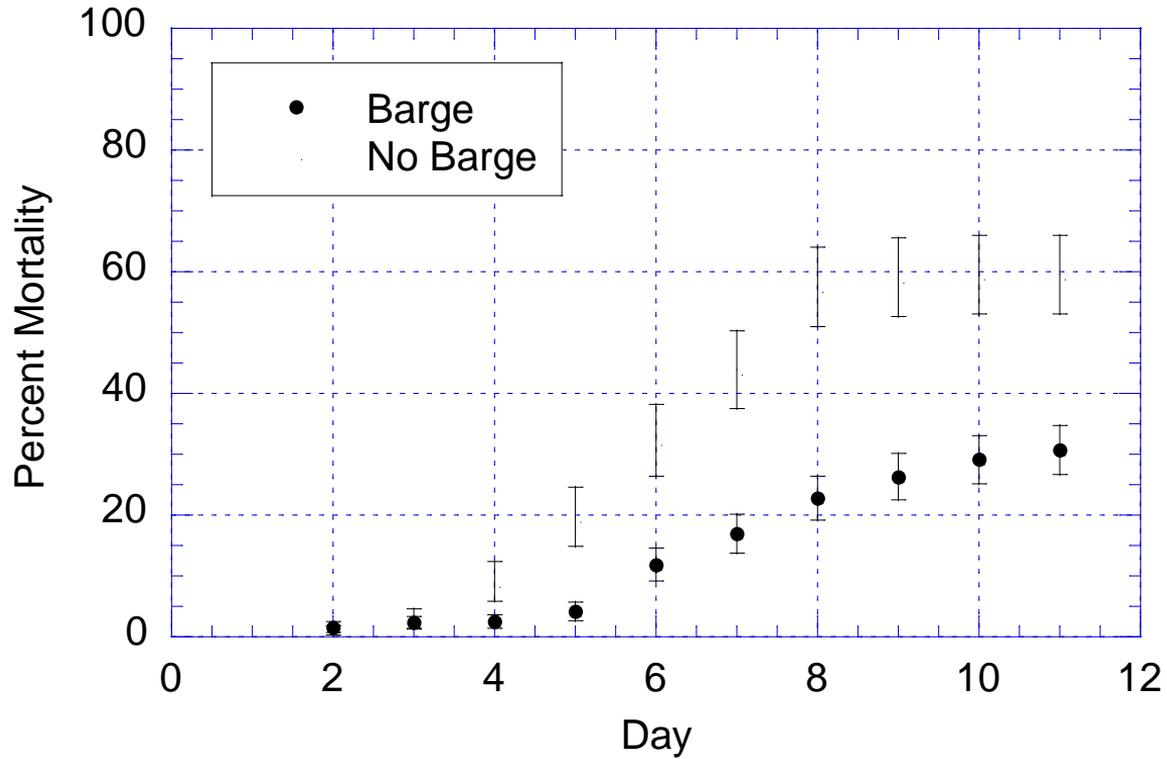
# Advancing Water and Energy Analytics: Perspectives on Information Technology

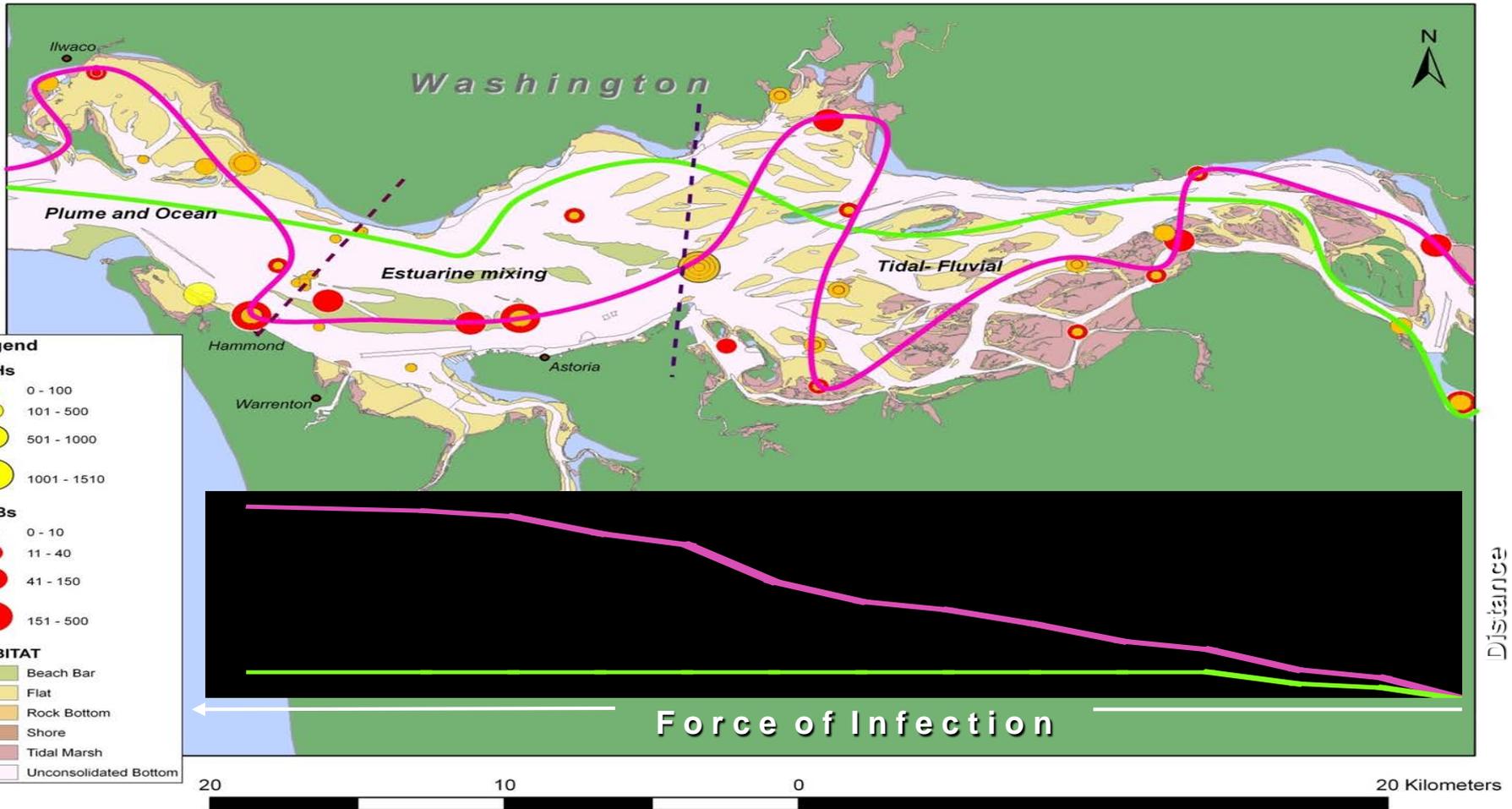
Frank Loge, Ph.D., P.E.

Dept. of Civil and Environmental Engineering  
Center for Water-Energy Efficiency  
University of California, Davis



RESERVOIR LEVELS (FT.)	12 M	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 N	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	12 M
NORTH AUSTIN	9.8	9.7	9.6	9.5	9.6	9.7	9.9	9.9	9.9	9.9	9.9	9.9	9.9	10.0	10.2	10.3	10.3	10.4	10.5	10.5	10.4	10.0	9.5	9.2	8.9
EAST AUSTIN	24.5	24.3	24.3	24.4	24.6	24.8	25.0	24.7	24.2	27.2	29.9	32.3	34.6	37.0	39.1	41.0	42.9	45.1	39.8	35.2	36.5	34.1	31.0	28.5	26.5
SPICEWOOD SPRINGS	11.0	10.7	10.6	10.5	10.5	10.5	10.5	10.3	10.2	9.9	9.7	9.5	9.3	9.0	8.8	8.6	8.8	9.2	8.9	8.7	8.5	8.5	8.4	8.3	8.4
HOWARD LANE #1	13.4	13.1	12.9	12.7	12.6	12.6	12.5	12.3	12.0	10.8	12.2	13.5	14.7	16.1	17.3	18.4	19.6	21.6	23.4	22.2	20.8	19.8	19.0	18.3	17.7
HOWARD LANE #2	13.5	13.2	13.0	12.8	12.7	12.7	12.6	12.4	12.1	11.0	12.3	13.6	14.9	16.2	17.4	18.6	19.7	21.7	23.5	22.4	20.9	19.9	19.1	18.4	17.8
MARTIN HILL	83.7	82.4	81.3	80.4	79.8	79.6	79.8	80.1	79.6	78.5	74.8	71.5	68.9	66.1	63.5	61.3	58.1	55.6	54.1	56.4	58.9	60.8	63.1	65.3	67.5
JOLLYVILLE	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
POND SPRINGS	27.7	29.3	30.8	32.6	34.7	37.0	38.8	38.6	38.0	37.6	37.5	37.8	38.1	38.2	38.1	38.1	38.2	38.3	38.4	38.1	37.3	36.5	35.8	35.7	36.0
ANDERSON MILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERY RANCH	21.5	22.7	24.4	27.0	28.4	30.5	32.3	31.3	31.2	30.4	30.8	31.0	31.0	31.4	31.0	31.3	31.5	31.5	31.9	31.2	30.4	29.4	28.8	28.9	28.9
FOREST RIDGE	54.3	57.9	60.7	57.4	54.8	53.1	51.7	50.8	50.0	49.2	47.6	46.2	45.3	44.3	43.4	42.6	40.3	38.5	38.8	39.1	39.5	39.8	40.1	40.5	40.9
FOUR POINTS GROUND	18.0	16.8	15.8	17.2	18.6	19.9	21.3	22.5	23.6	24.9	26.0	27.3	28.1	29.4	30.0	29.3	28.7	28.1	27.4	27.4	27.3	27.3	27.2	27.1	27.1
FOUR POINTS ELEVATED	28.8	31.3	33.9	31.3	28.8	27.1	24.6	22.3	20.5	18.3	16.8	15.0	13.1	11.8	11.8	18.6	25.2	31.7	32.7	31.2	28.5	26.1	23.3	21.1	19.1
CENTER STREET	47.3	44.7	42.6	40.4	38.6	37.2	35.7	35.5	36.7	38.1	39.4	40.6	41.7	42.9	43.9	44.9	45.8	46.8	47.6	48.2	48.4	48.1	47.5	47.2	46.9
PILOT KNOB	13.6	13.8	14.0	14.2	14.5	14.7	14.9	14.4	13.9	13.4	13.3	13.2	13.3	13.5	13.8	14.0	14.4	14.8	15.1	15.3	15.2	15.0	14.7	14.6	14.7
DAVIS LANE #1	30.9	31.5	32.2	33.2	34.1	35.0	36.1	36.1	35.4	34.8	34.4	33.8	34.0	34.6	35.3	36.0	36.7	38.6	40.1	41.2	42.8	45.2	45.0	44.6	44.6
DAVIS LANE #2	54.8	55.5	56.4	57.2	58.0	58.9	40.1	40.1	39.4	38.8	38.3	37.8	37.9	38.5	39.2	39.9	40.6	42.5	43.9	45.2	47.2	49.6	49.6	49.1	49.1
LEUTHAN LANE	25.0	25.2	25.5	26.0	26.5	27.1	27.9	28.2	28.3	29.4	31.4	32.9	33.4	33.4	33.5	33.6	32.6	29.8	27.3	24.8	21.5	19.3	21.9	25.2	28.6
SLEIGHTER LANE	27.4	27.7	28.0	28.5	28.9	29.5	30.1	30.2	30.4	30.9	31.9	33.4	33.5	33.6	33.7	33.9	30.4	27.9	25.6	22.6	20.4	23.2	26.3	26.3	29.5
LA CROSSE	24.3	25.5	26.6	28.0	29.4	30.8	32.2	33.1	34.0	34.7	33.7	32.6	31.8	30.8	29.9	29.0	28.2	27.1	26.1	25.0	23.2	21.7	19.9	18.2	16.6
THOMAS SPRINGS ELEVATED	22.1	21.1	20.4	19.5	18.7	18.0	17.0	15.7	14.6	13.4	12.6	11.6	10.9	9.9	8.8	8.4	14.5	19.9	24.2	28.0	32.2	33.7	32.7	31.8	31.2
GREEN WTP PUMPAGE RATE (MGD)	12M-1A	1A-2A	2A-3A	3A-4A	4A-5A	5A-6A	6A-7A	7A-8A	8A-9A	9A-10A	10A-11A	11A-12M	12M-1P	1P-2P	2P-3P	3P-4P	4P-5P	5P-6P	6P-7P	7P-8P	8P-9P	9P-10P	10P-11P	11P-12M	
PUMPS 32-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PUMPS 54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PUMPS 35-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PUMPS 57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL PUMP RATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAVIS WTP PUMPAGE RATE (MGD)	12M-1A	1A-2A	2A-3A	3A-4A	4A-5A	5A-6A	6A-7A	7A-8A	8A-9A	9A-10A	10A-11A	11A-12M	12M-1P	1P-2P	2P-3P	3P-4P	4P-5P	5P-6P	6P-7P	7P-8P	8P-9P	9P-10P	10P-11P	11P-12M	
MEDIUM SERVICE PUMP 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEDIUM SERVICE PUMP 12	0.0	0.0	8.8	17.5	17.4	17.5	17.4	17.5	17.5	17.5	17.3	17.2	17.1	17.2	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEDIUM SERVICE PUMP 13	10.6	10.6	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	10.2	10.3	10.3	10.3	10.6	10.6	10.6	10.6	10.6
MEDIUM SERVICE PUMP 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEDIUM SERVICE PUMP 15	18.8	18.9	18.4	18.1	17.7	17.8	17.8	17.8	17.9	17.6	17.6	17.7	17.5	17.4	17.5	18.2	18.0	18.1	18.1	18.3	18.7	18.8	18.9	18.9	18.9
MEDIUM SERVICE PUMP 16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEDIUM SERVICE PUMP 17	20.1	20.2	19.7	19.2	19.1	19.2	19.1	19.2	19.3	19.2	19.0	18.9	18.9	18.9	18.7	19.6	19.5	19.6	19.6	19.7	20.2	20.1	20.3	20.2	20.2
TOTAL MED. SERV. PUMPAGE RATE	49.5	49.7	52.2	54.8	54.2	54.5	54.3	54.5	54.7	54.3	53.9	53.8	53.5	53.5	53.2	48.1	47.7	48.0	48.0	48.3	49.5	49.5	49.8	49.7	49.7





# An Unintentional Collaboration: A Data Perspective

Substantial concentrations of immunosuppressive chemicals (e.g., PCB, DDT, PAH, or PBDEs) have been found in a range of animal populations.

- Killer whales
- Dolphin and porpoise
- Toads and frogs
- Albatross
- Fish
- Sea lions
- Seals
- Polar bears
- Foxes
- Seabirds
- Humans

## Commercial Data Practices

Intention: Privacy  
of data subject

Protects: **individual rights** to  
monitor and control

C&Os target: **entity**(ies)  
taking action or handling  
linkable personal data

## Internal Operational Practices

Intention: Confidentiality  
of proprietary or  
competitively sensitive  
information

Protects: **business** with fair  
information practices

C&Os: **carves out qualified  
business operations** (e.g.,  
exemption of choice  
requirements to individuals)

## Public or Nations

Intention: Secrecy

Protects: National  
Security, public health  
and safety

C&Os: **preempts**  
individual/business  
protections for qualified  
public works and national  
security functions

# System Architecture Based on a Trust Framework

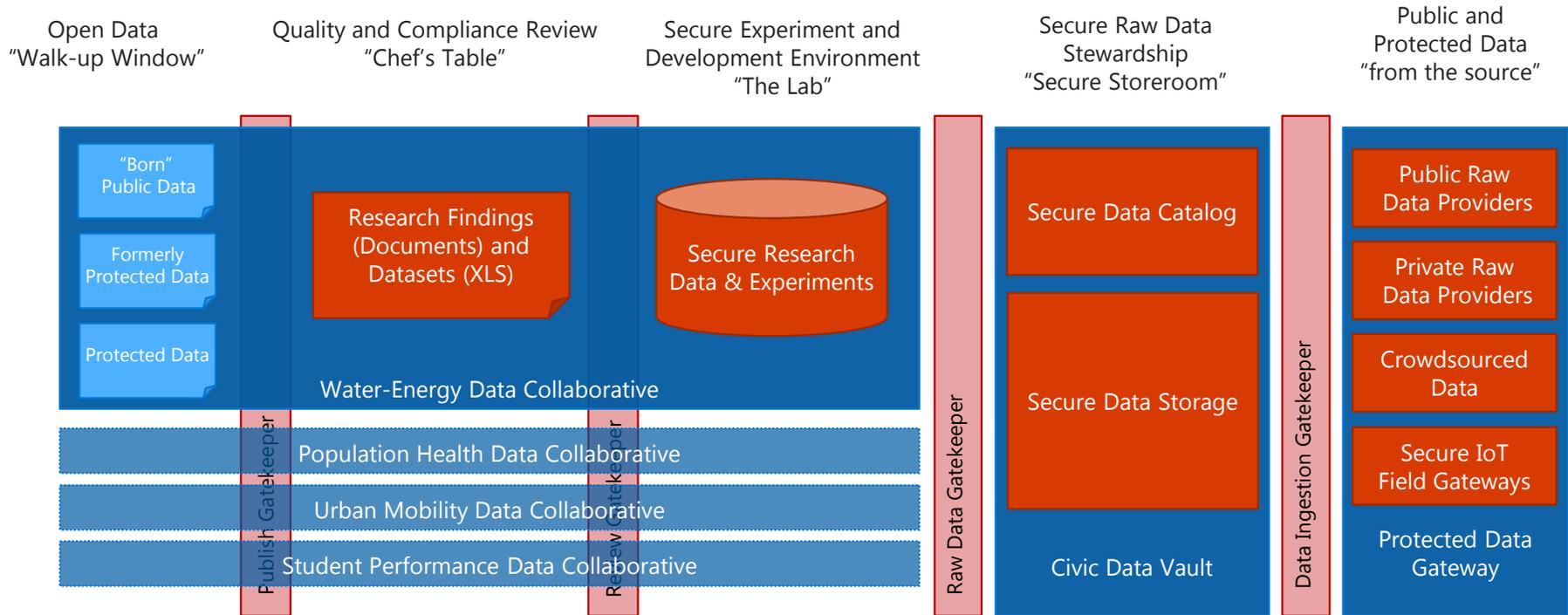




Photo by Philippa Willitts / CC BY

## Data Owner

Owner of data that has full rights to use or delegate access to data



Photo by Hector Parayuelos / CC BY

## Reviewer

Data owner or someone on behalf that ensures compliance with policies prior to publication



Photo by Carmen Jost / CC BY

## Data Steward

Person or organization entrusted to act on behalf of data owner



Photo by Lori Semprevio / CC BY

## Auditor

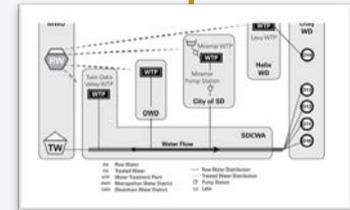
Parties interested in ensure data is handled according to policies



Photo by emdot / CC BY

## Cybrarian

Maintains catalog of all data on platform and ensures proper classification and use

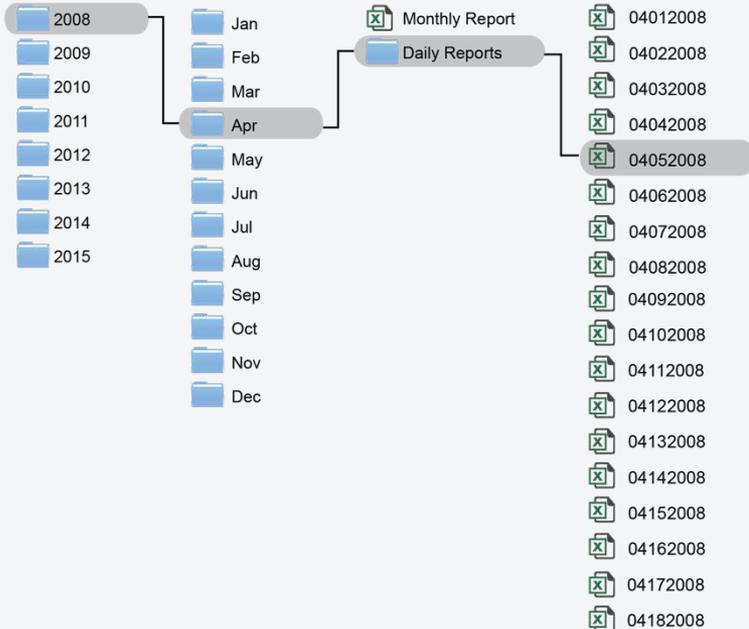


## Data Scientists

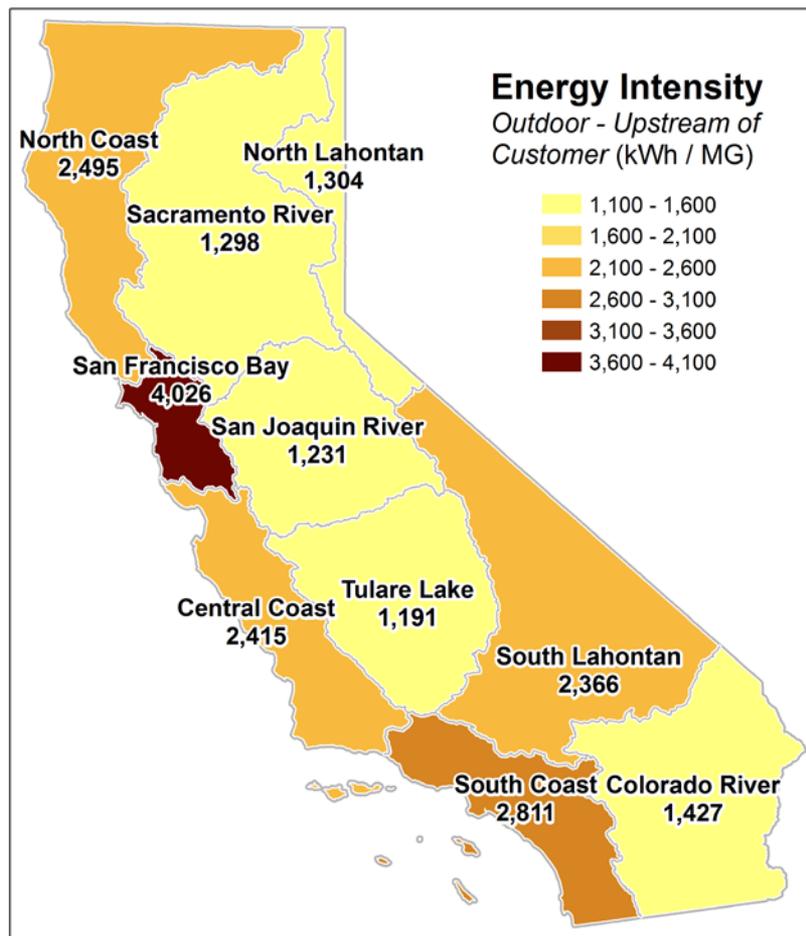
Individuals analyzing data

# Roles within a Trust Framework

- Databases are fragmented
  - GIS, Billing, SCADA, Asset, Conservation...
- Data is also cumbersome, incomplete, and underutilized



RESERVOIR LEVELS (FT.)	12 M	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 N	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	12 M	
NORTH AUSTIN	9.8	9.7	9.6	9.5	9.6	9.7	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	10.0	10.2	10.3	10.3	10.4	10.5	10.5	10.4	10.0	9.5	9.2	8.9
EAST AUSTIN	24.5	24.3	24.3	24.4	24.6	24.8	25.0	24.7	24.2	27.2	29.9	32.3	34.6	37.0	39.1	41.0	42.9	41.5	39.8	38.2	36.5	34.1	31.0	28.5	26.5	
SPICEWOOD SPRINGS	11.0	10.7	10.6	10.5	10.5	10.5	10.5	10.3	10.2	9.9	9.7	9.5	9.3	9.0	8.8	8.6	8.8	9.2	9.2	8.9	8.7	8.5	8.5	8.4	8.3	8.4
HOWARD LANE #1	13.4	13.1	12.9	12.7	12.6	12.6	12.5	12.5	12.0	10.8	12.2	13.5	14.7	16.1	17.3	18.4	19.6	21.6	23.4	22.2	20.8	19.8	19.0	18.3	17.7	
HOWARD LANE #2	13.5	13.2	13.0	12.8	12.7	12.7	12.6	12.4	12.1	11.0	12.3	13.6	14.9	16.2	17.4	18.6	19.7	21.7	23.5	22.4	20.9	19.9	19.1	18.4	17.8	
MARTIN HILL	83.7	82.4	81.3	80.4	79.8	79.6	79.8	80.1	79.6	78.5	74.8	71.5	68.9	66.1	63.5	61.3	58.1	55.6	54.6	56.4	58.9	60.8	63.1	65.3	67.5	
JOLLYVILLE	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
POND SPRINGS	27.7	29.3	30.8	32.6	34.7	37.0	38.8	38.6	38.0	37.6	37.5	37.8	38.1	38.2	38.1	38.1	38.2	38.3	38.4	38.1	37.3	36.5	35.8	35.7	36.0	
ANDERSON MILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERY RANCH	21.5	22.7	24.4	27.0	28.4	30.5	32.3	33.3	33.2	30.4	30.8	31.0	31.0	31.4	31.0	31.3	31.5	31.5	31.9	31.2	30.4	29.4	28.8	28.9	28.9	
FOREST RIDGE	54.3	57.9	60.7	57.4	54.8	53.1	51.7	50.8	50.0	49.2	47.6	46.2	45.3	44.3	43.4	42.6	40.3	38.5	38.8	39.1	39.5	39.8	40.1	40.5	40.9	
FOUR POINTS GROUND	18.0	16.8	15.8	17.2	18.6	19.9	21.3	22.5	23.6	24.9	26.0	27.3	28.1	29.4	30.0	29.3	28.7	28.1	27.4	27.4	27.3	27.3	27.2	27.1	27.1	
FOUR POINTS ELEVATED	28.8	31.3	33.9	31.3	28.8	27.1	24.6	22.3	20.5	18.3	16.8	15.0	13.1	11.8	11.8	18.6	25.2	31.7	32.7	31.2	28.5	26.1	23.3	21.1	19.1	
CENTER STREET	47.3	44.7	42.6	40.4	38.6	37.2	35.7	35.5	36.7	38.1	39.4	40.6	41.7	42.9	43.9	44.9	45.8	46.8	47.6	48.2	48.4	48.1	47.5	47.2	46.9	
PILOT KNOB	13.6	13.8	14.0	14.2	14.5	14.7	14.9	14.4	13.9	13.4	13.3	13.2	13.3	13.5	13.8	14.0	14.4	14.8	15.1	15.3	15.2	15.0	14.7	14.6	14.7	
DAVIS LANE #2	30.9	31.5	32.2	33.2	34.1	35.0	36.1	36.1	35.4	34.8	34.4	33.8	34.0	34.6	35.3	36.0	36.7	38.6	40.1	41.2	42.8	45.2	45.0	44.6	44.6	
DAVIS LANE #1	84.8	85.5	86.4	87.2	88.0	88.9	40.1	40.1	39.4	38.8	38.3	37.8	37.9	38.5	39.2	39.9	40.6	42.5	43.9	45.2	47.6	49.6	49.6	49.3	49.1	
LEUTHAN LANE	25.0	25.2	25.5	26.0	26.5	27.1	27.9	28.2	28.3	29.4	31.4	32.9	33.4	33.4	33.5	33.6	32.6	29.8	27.3	24.8	21.5	19.3	21.9	25.2	28.6	
SLAUGHTER LANE	27.4	27.7	28.0	28.5	28.9	29.5	30.1	30.2	30.4	30.9	31.9	33.4	33.5	33.6	33.7	33.7	32.9	30.4	27.9	25.6	22.6	20.4	23.2	26.3	29.5	
LA CROSSE	24.3	25.5	26.6	28.0	29.4	30.8	32.2	33.1	34.0	34.7	33.7	32.6	31.8	30.8	29.9	29.0	28.2	27.1	26.1	25.0	23.2	21.7	19.9	18.2	16.6	
THOMAS SPRINGS ELEVATED	22.1	21.1	20.4	19.5	18.7	18.0	17.0	15.7	14.6	13.4	12.6	11.6	10.9	9.9	8.8	8.4	14.5	19.9	24.0	30.0	32.2	33.7	32.7	31.8	31.2	
GREEN WTP PUMPAGE RATE (MGD)	12M-1A	1A-2A	2A-3A	3A-4A	4A-5A	5A-6A	6A-7A	7A-8A	8A-9A	9A-10A	10A-11A	11A-12N	12N-1P	1P-2P	2P-3P	3P-4P	4P-5P	5P-6P	6P-7P	7P-8P	8P-9P	9P-10P	10P-11P	11P-12M		
PUMPS 32-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PUMPS 34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PUMPS 33-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PUMPS 37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL PUMP RATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAVIS WTP PUMPAGE RATE (MGD)	12M-1A	1A-2A	2A-3A	3A-4A	4A-5A	5A-6A	6A-7A	7A-8A	8A-9A	9A-10A	10A-11A	11A-12N	12N-1P	1P-2P	2P-3P	3P-4P	4P-5P	5P-6P	6P-7P	7P-8P	8P-9P	9P-10P	10P-11P	11P-12M		
MEDIUM SERVICE PUMP 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MEDIUM SERVICE PUMP 12	0.0	0.0	8.8	17.5	17.4	17.5	17.4	17.5	17.5	17.5	17.5	17.3	17.2	17.1	17.2	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MEDIUM SERVICE PUMP 13	10.6	10.6	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	10.2	10.3	10.3	10.6	10.6	10.6	10.6	10.6	
MEDIUM SERVICE PUMP 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MEDIUM SERVICE PUMP 15	18.8	18.9	18.4	18.1	17.7	17.8	17.8	17.8	17.9	17.6	17.6	17.7	17.5	17.4	17.5	18.2	18.0	18.1	18.1	18.3	18.7	18.8	18.8	18.9	18.9	
MEDIUM SERVICE PUMP 16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MEDIUM SERVICE PUMP 17	20.1	20.2	19.7	19.2	19.1	19.2	19.1	19.2	19.3	19.2	19.0	18.9	18.9	18.9	18.7	19.6	19.5	19.6	19.6	19.7	20.2	20.1	20.3	20.2	20.2	
TOTAL MED. SERV. PUMPAGE RATE	49.5	49.7	52.2	54.8	54.2	54.5	54.3	54.5	54.7	54.3	53.9	53.8	53.5	53.5	53.2	48.1	47.7	48.0	48.0	48.3	49.5	49.5	49.8	49.7	49.7	



Statewide

Water utility

Date Range

Jun 2015

Feb 2016

Jun 2015 Jul 2015 Sep 2015 Nov 2015 Jan 2016 Feb 2016



**23.9% (goal: 25%)**

Water Savings

**-1.1%**

(Missed Target)

**922,543 MWh**

Resulting Electricity Savings

**219,653 MT CO<sub>2</sub>e**

Resulting GHG Savings

Estimated GHG emissions reduction equivalent to taking...

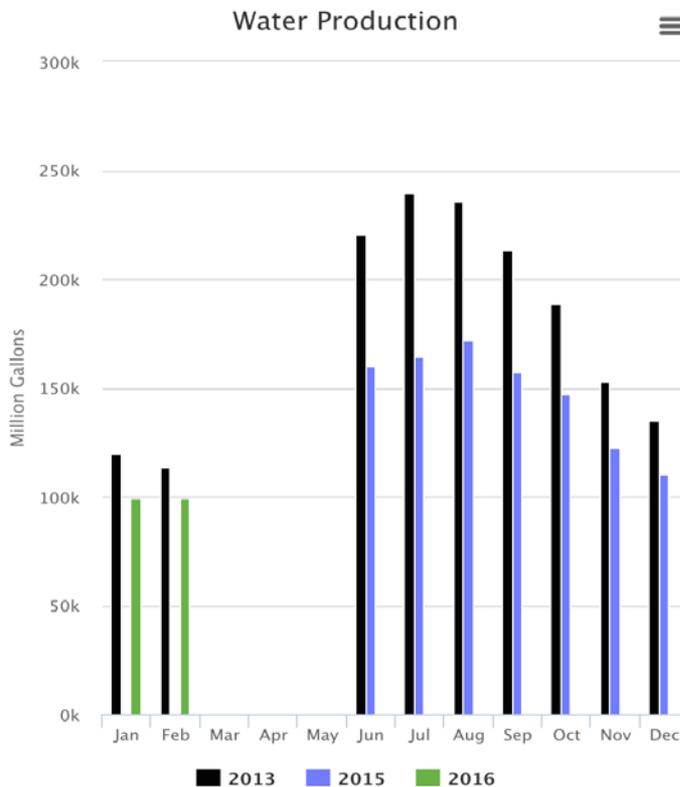
**49,731**

Cars Off the Road for a Year

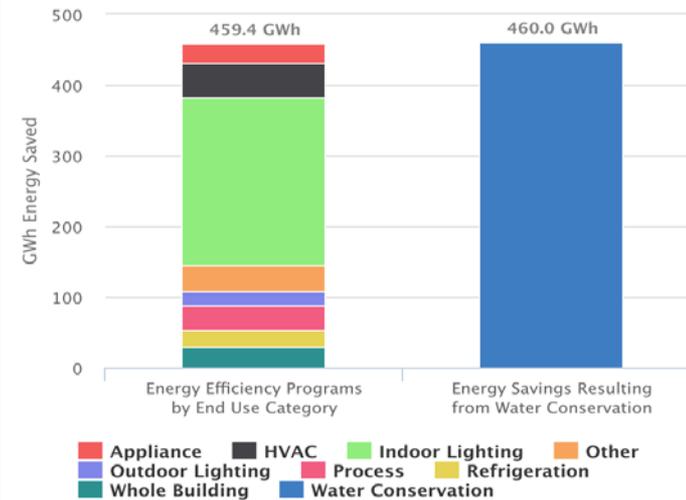
Energy

Cost

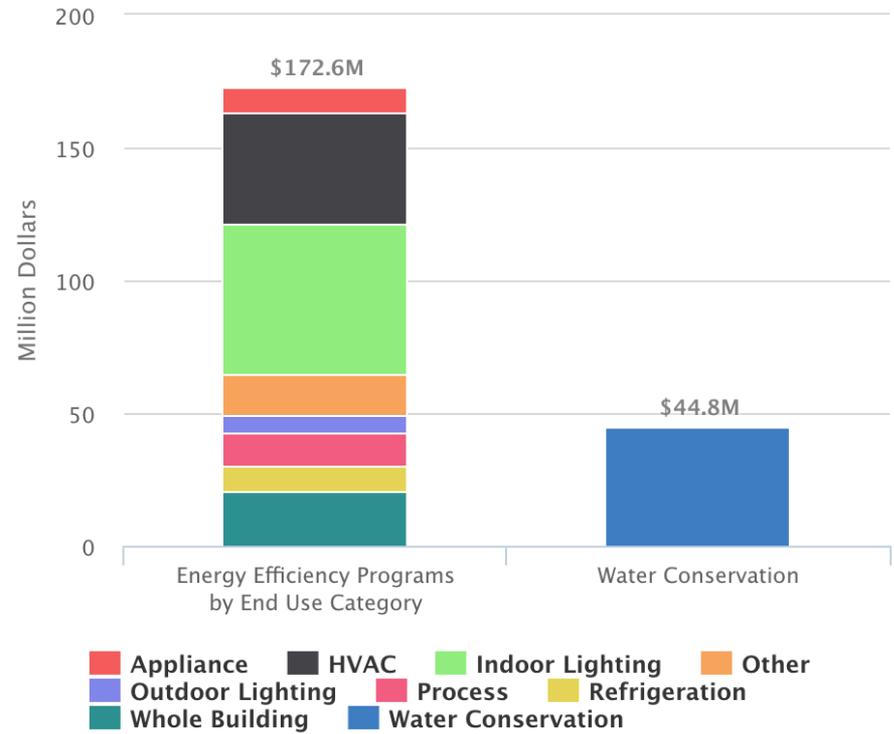
Cost per kWh



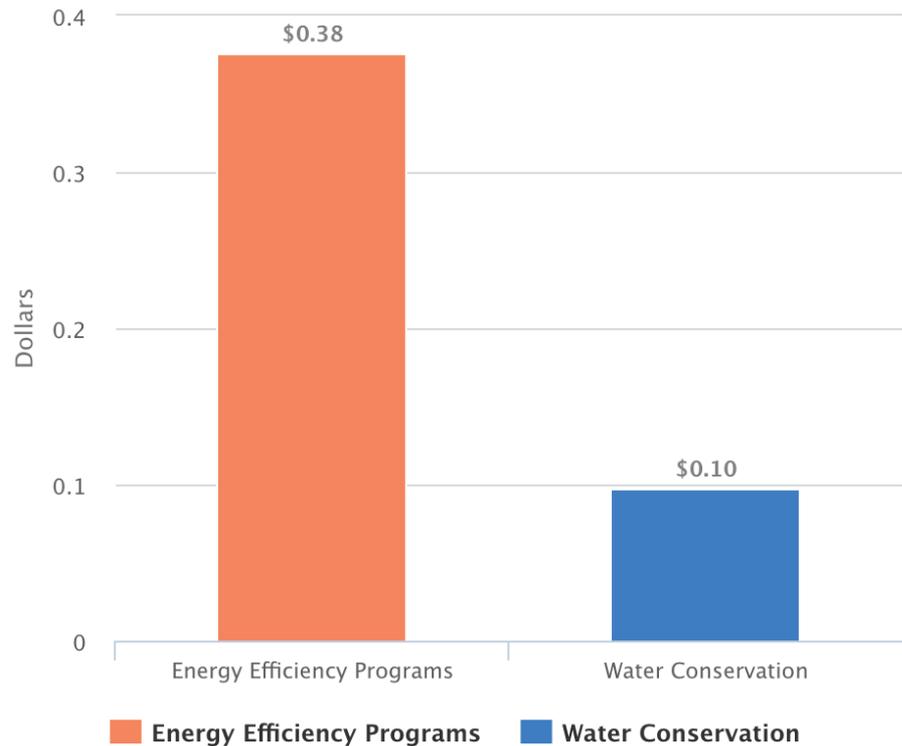
Electricity Savings from Statewide Water Conservation vs. Total First-Year Electricity Savings from Energy IOU Efficiency Programs (Jul - Sep 2015)



Cost of Statewide Water Conservation vs. Expenditures on Energy IOU Efficiency Programs (Jul - Sep 2015)



Cost per kWh of Statewide Water Conservation vs. Energy IOU Efficiency Programs (Jul - Sep 2015)



# Analysis of Public Data: Costs of Energy Savings

031

**UC DAVIS**  
**CENTER FOR WATER-ENERGY EFFICIENCY**

**Small Three-tier Rate**

% Fixed: 40

% Volumetric: 60

Fixed Charge (\$): \$234

Typical Tier (ccf)      Volumetric Charge (\$/ccf)

Tier 1	10	\$105
Tier 2	20	\$134
Tier 3	0	\$141

Monthly Consumption to Firmness (ccf): 159

Annual Consumption to Firmness (ccf): 1943

**Rate**

Adopted Rate: CBRF Rate

Small Three-tier Rate: Two-tier Rate

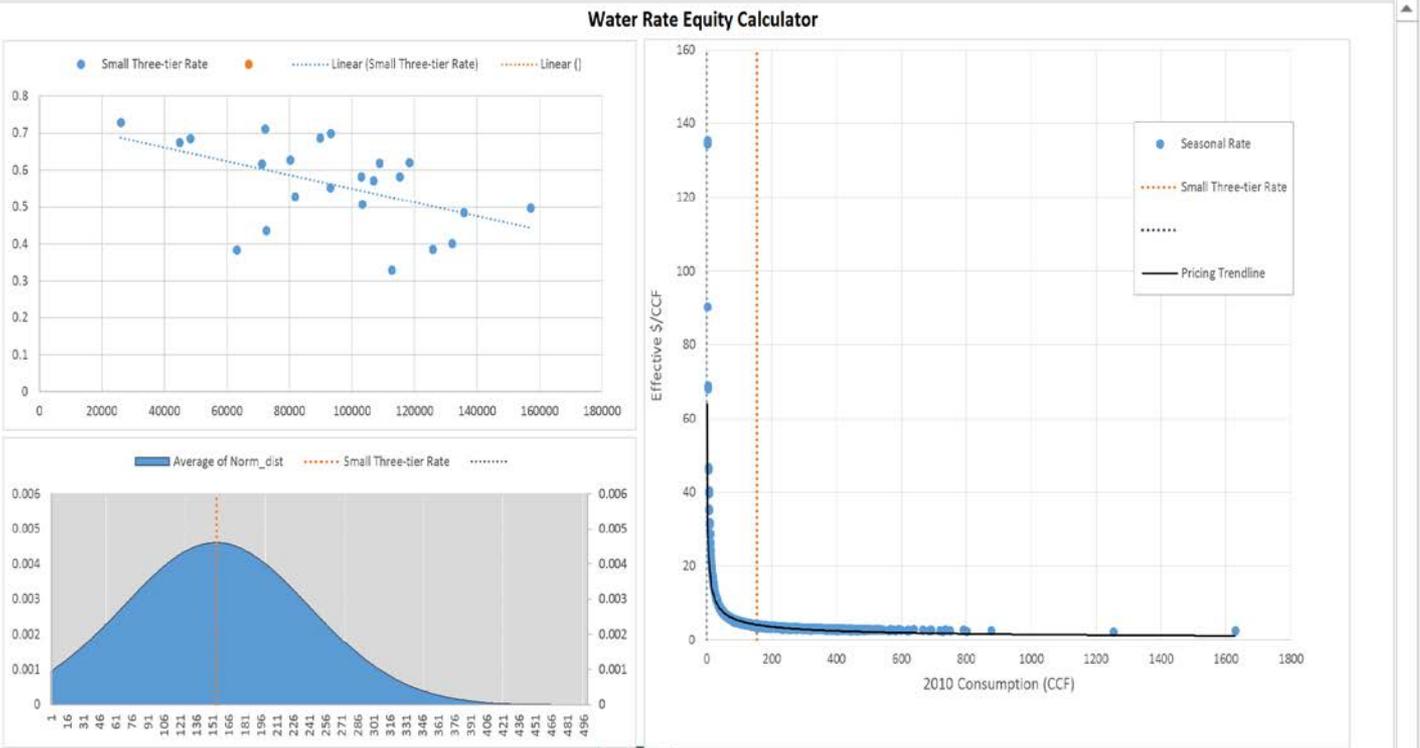
Uniform Rate ...

**measure**

Median Household Income

Median Value Of Owner Occupie...

Proportion of Population That Re...



# Analysis of Public-Private Data: Equity of Rate Structures

**Variable:**

- Energy Intensity (kWh/MG)
- Water Consumption (MG)
- Energy Consumption (kWh)

**Select Years:**

- 2009
- 2010
- 2011
- 2012
- 2013

Select All

Deselect All

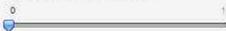
**Select Months:**

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

Select All

Deselect All

**Transparency:**



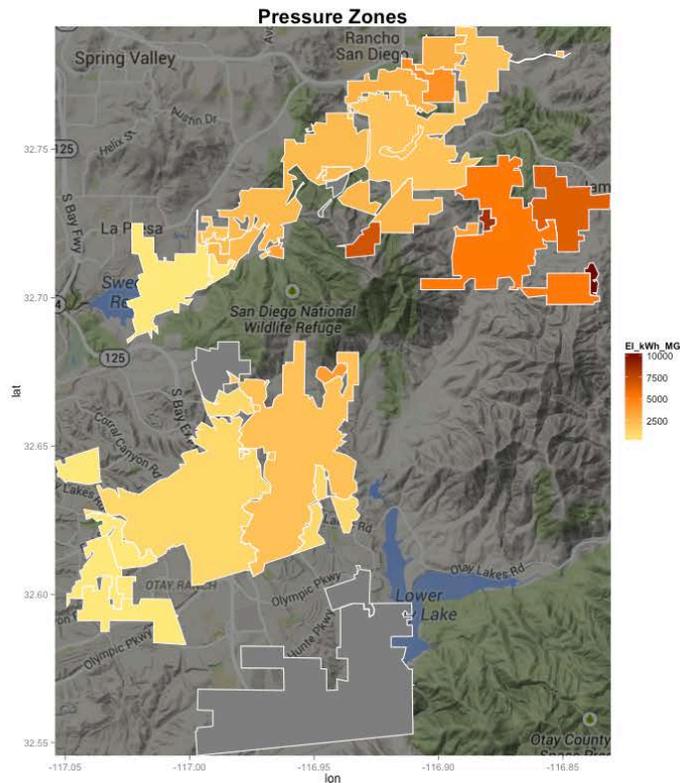
**Background Map Darkness:**

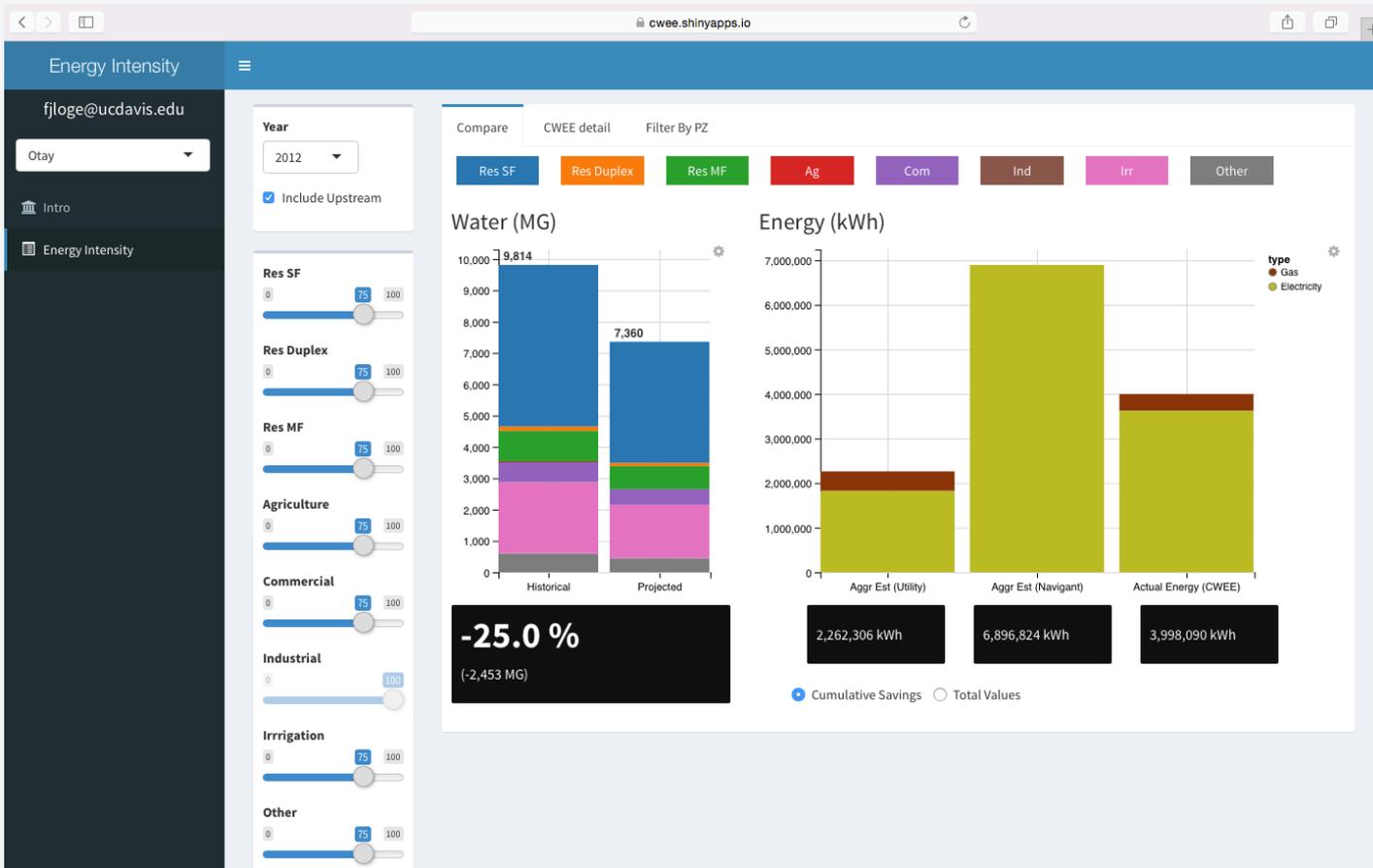


Update View



- By Hour
- By Day
- Heatmap
- Facility
- Geography





Enabling Investments from Energy Utilities and Carbon Cap and Trade Funds



Account ID#: 49697



**Water Use** ⚙️  
■ actual  
■ estimated

● Water ● Energy ● CO2 [help](#)

**Observed Consumption**

**393 ccf**

Annual Total



**+26.9%**

Compared to Similar Homes



Account Info

Indoor Water Use

Outdoor Water Use

Potential Reductions

**Address:** 123 Some Street  
**Building Floorspace:** 3,000 sq ft  
**Parcel Area:** 10,000 sqft

Account ID#: 49697



**Water Use**   
 actual  
 estimated

Water  Energy  CO2 [help](#)

**Observed Consumption**

**393 ccf**  
Annual Total



**+26.9%**  
Compared to Similar Homes



**58.5%**  
Water Accounted For

[Account Info](#) |
 [Indoor Water Use](#) |
 [Outdoor Water Use](#) |
 [Potential Reductions](#)

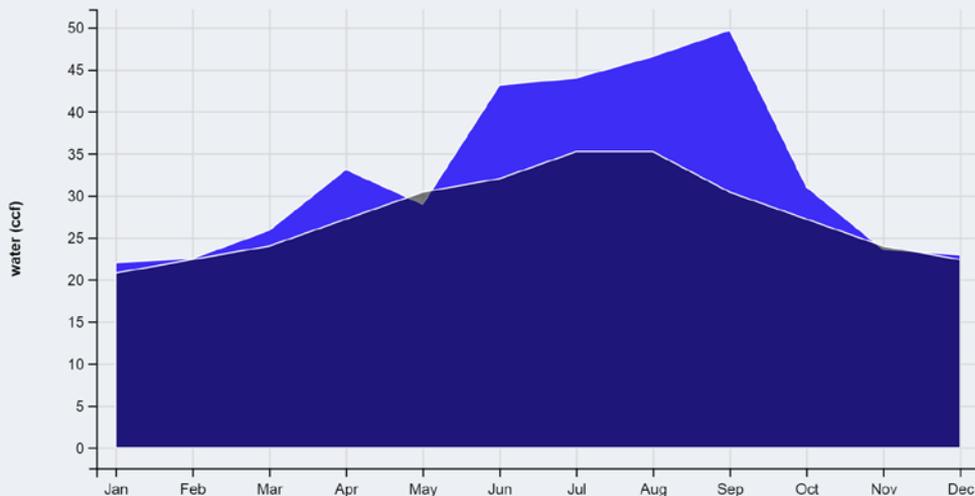
<b># of persons:</b>	<input type="text" value="5"/>	<b>Shower (gallons per minute):</b>	<input type="text" value="2.2"/>
<b>Toilet (gallons per flush):</b>	<input type="text" value="5"/>	<b>Dishwasher (gallons per load):</b>	<input type="text" value="20"/>
<b>Sinks (gallons per minute):</b>	<input type="text" value="2"/>	<b>Clothes Washer (gal per load):</b>	<input type="text" value="25"/>

**Other (unaccounted for) water: 163 ccf**



- Intro
- Utility Summary
- Utility Calculator
- Individual Accounts
- Water Use Calculator

Account ID#: 49697



**Water Use**

- actual
- estimated

Water  Energy  CO2 [help](#)

**Observed Consumption**

**393 ccf**

Annual Total

**+26.9%**

Compared to Similar Homes

**84.2%**

Water Accounted For

Account Info   Indoor Water Use   **Outdoor Water Use**   Potential Reductions

sq ft of turf/lawn:

1000

Sprinkler (gal per min):

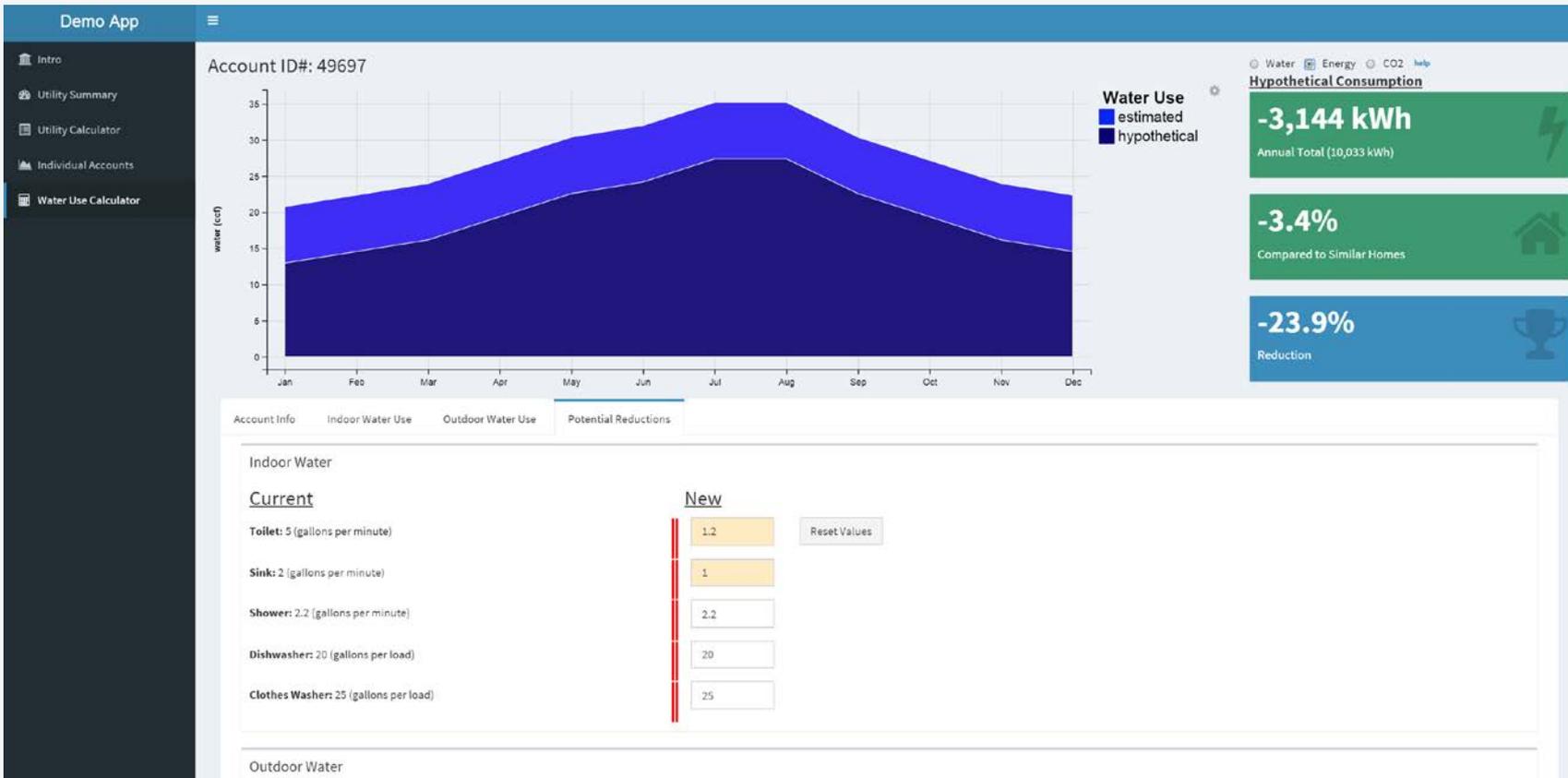
4

Swimming Pool:

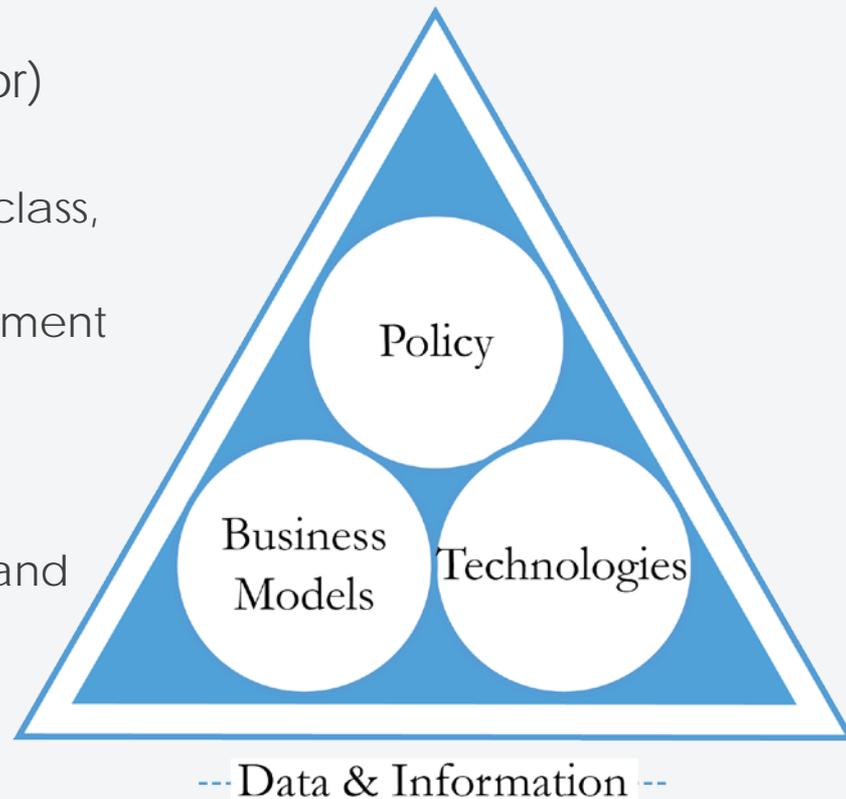
**Other (unaccounted for) water: 62 ccf**



Analysis of Private Data: Effectiveness of Demand Management



- High-resolution Data (Urban Water Sector)
  - Improve utility system performance
  - Benchmark water use across customers, class, and utilities
  - Assess effectiveness of demand management
  - Improve demand forecasts
  - Streamline and standardize reporting
  - Development of data enabled policy
  - Enables energy utilities and carbon cap and trade funds to invest in the water sector
  - Enables behavior modifications



- How do you combine multiple data classes with potentially multiple end-uses into an open platform?
  - Classes of Information
    - Protected Consumer Information
    - Protected Business Information
    - Controlled Unclassified Information
    - Public Information
  - End Uses (either internal or external to the utility)
    - Assess vulnerabilities and resiliency
    - Monitoring and verification
    - Academic research
    - Target markets for technologies – Commercialization
    - RD&D
    - Regulation

Contact info:

Frank Loge, Ph.D., P.E.

(530) 754-2297

[fjloge@ucdavis.edu](mailto:fjloge@ucdavis.edu)



Thank you