



# IRWD's Water Loss Control Programs and Cost-Effectiveness

Amy McNulty  
September 17, 2018



# Presentation Agenda

- IRWD's Water Loss Program Development
- Program Cost-Effectiveness
- Lessons Learned
- Conclusions



# Irvine Ranch Water District Service Area



## 20% of Orange County

IRWD covers a large portion of central Orange County

Serve 6 cities and unincorporated County

## 181 Square Miles

One of top ten largest retail agencies in California

## Newer Community

Newer infrastructure

Elevations from 0 to 1960 ft

Average pressure 84 PSI

# Water Loss Program Development



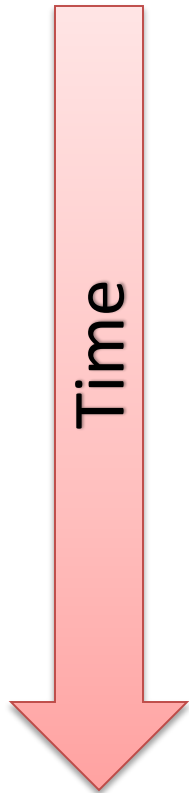
# IRWD Leak Detection Program

Water Loss Program established in 1991

- Proactive Leak Detection
  - Annual average of 55 system & 60 customer side leaks
  - Cost-effective based on:
    - Avoided cost of imported water purchases
    - Cost of program implementation
- 2009 Training on AWWA water loss audit process



# The Road to Real Loss Reduction



Step 1 – identify the team

Step 2 – conduct the audit

Step 3 – source meter testing

Step 4 – identify preliminary target

Step 5 – component analysis

Step 6 – assign costs

Step 7 – compile short term plan

Step 8 – implement short term plan

Step 9 – review results and revise the plan

Step 10 – recalculate component analysis w/new data

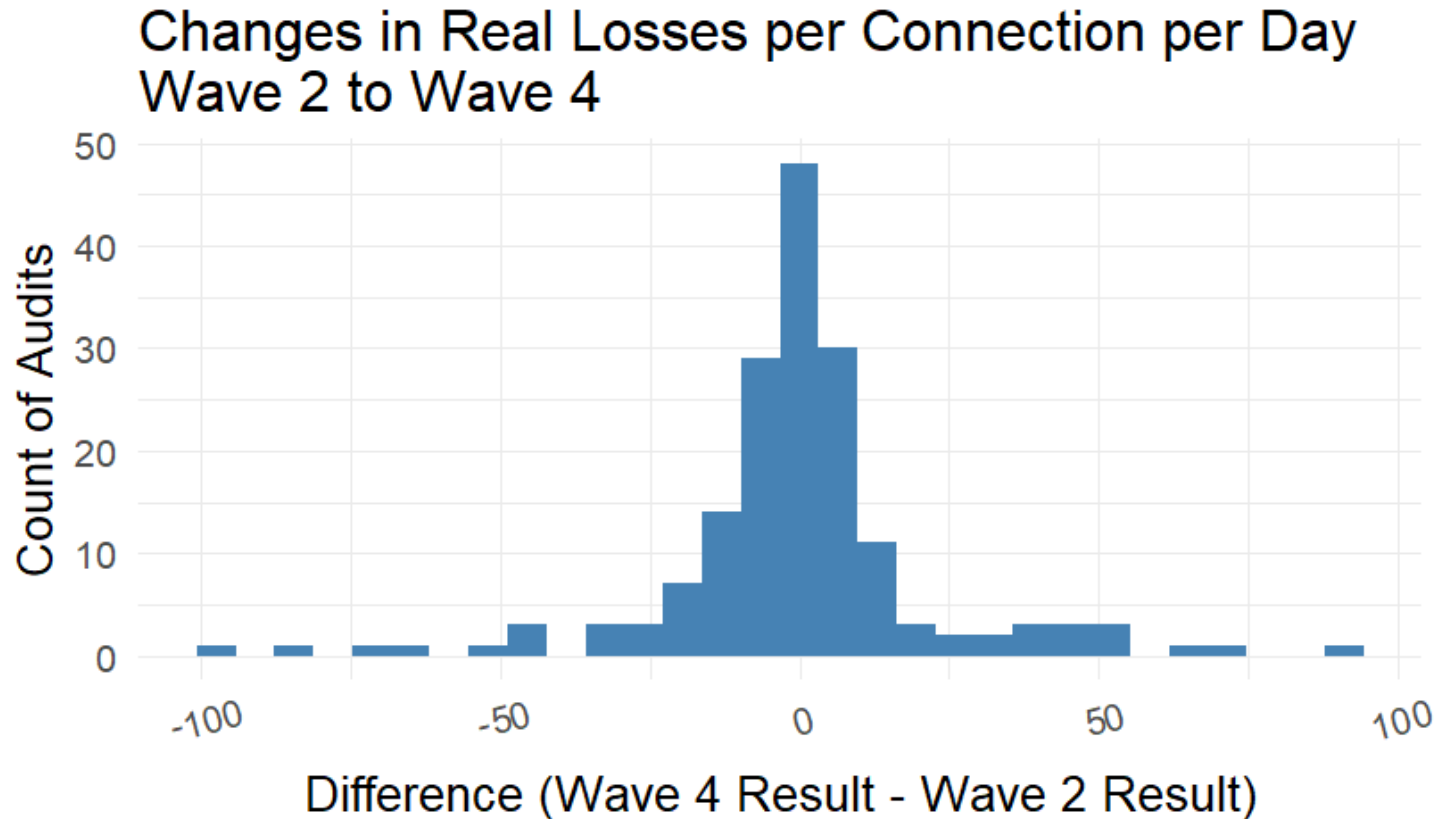
Step 11 – set goals for medium & long term reduction

- “11 steps to prepare for a leakage management program” – AWWA M36 Table 5-1

# Data Improvements Can Change Results

	INDICATOR	FY 13-14	FY 14-15	FY 16-17	UNITS
	<b>FINANCIAL PERFORMANCE INDICATORS</b>				
1	Non-Revenue as % by volume of Water Supplied	10.7%	7.1%	6.8%	
2	Non-Revenue as percent by cost of operating system	14.7%	15.1%	17.1%	
3	Annual cost of Apparent Losses	\$1,275,162	\$714,816	\$828,315	Customer retail unit cost
4	Annual cost of Real Losses	\$3,756,605	\$3,672,216	\$3,200,547	Variable prod. cost
	<b>OPERATIONAL EFFICIENCY PERFORMANCE INDICATORS</b>				
5	Apparent Losses per service connection per day	12.7	7.4	6.8	gal /conn/day
6	Real Losses per service connection per day	38.1	28.3	20.8	gal /conn/day
7	Real Losses per service connection per day per PSI	0.5	0.3	0.3	gal/conn/day/PSI
8	Unavoidable Annual Real Losses (UARL)	2,037	2,270	2,501	AF / yr
9	Current Annual Real Losses (CARL)	4,404	3,241	2,579	AF / yr
10	Infrastructure Leakage Index (CARL/UARL)	2.2	1.4	1.03	
	<b>DATA VALIDITY PERFORMANCE INDICATOR</b>				
11	Data Validity Score	75	78	76	scale 1- 100
		IRWD Staff	Technical Assistance	Data Validated	

# Statewide Impacts of Data Improvements



- Approximately 1/3 of utilities had a significant shift.
- 62 audits changed by more than 10 gallons per connection per day between Wave 2 validated and Wave 4 validated.



# IRWD's Water Loss Audit Recommendations

	Recommendation	IRWD Implemented	Real Water Loss Reduction
1	Subtract well wastewater from production totals	YES	NO (only on paper)
2	Apply production meter calibration and test results on a meter-by-meter basis	YES	NO
3	Incorporate the change in stored volume in determining Water Supplied.	YES	NO (only on paper)
4	Pro-rate raw billing data	YES	NO
5	Determine Unbilled Unmetered Authorized Consumption	YES	NO
6	Incorporate all customer rate tiers to calculate a weighted Customer Retail Unit Cost	YES	NO
7	Calculate average system pressure using a weighted average	YES	NO
8	Confirm the inclusion of relevant costs in the Total Annual Operating Cost	YES	NO

# Component Analysis

	Recommendation	IRWD Implemented	Real Water Loss Reduction
1	Establish a system for tracking and incorporating estimates of development and coliform bacteria test flushing in Unbilled Unmetered Authorized Consumption.	YES	NO
2	Track leaks discovered through proactive leak detection in aggregate tabular format, rather than in entries that must be individually and manually extracted. In future proactive leak detection assessments, IRWD will save significant time if data is collected in a single spreadsheet.	YES	NO
3	Continue proactive leak detection survey of the potable distribution system at the current pace.	YES	NO
4	Update the leak detection cost-benefit analysis to incorporate IRWD's actual cost of leak detection and any changes in the value of leakage.	PLANNED	NO
5	Update proactive leak detection and repair records to include precise timestamps capturing leak discovery and leak containment.	EVALUATION PLANNED	NO
6	Consider the installation and management of pilot District Metered Areas (DMAs) to target proactive leak detection, optimize pressure, and monitor water losses more locally.	NO	NOT FOR IRWD

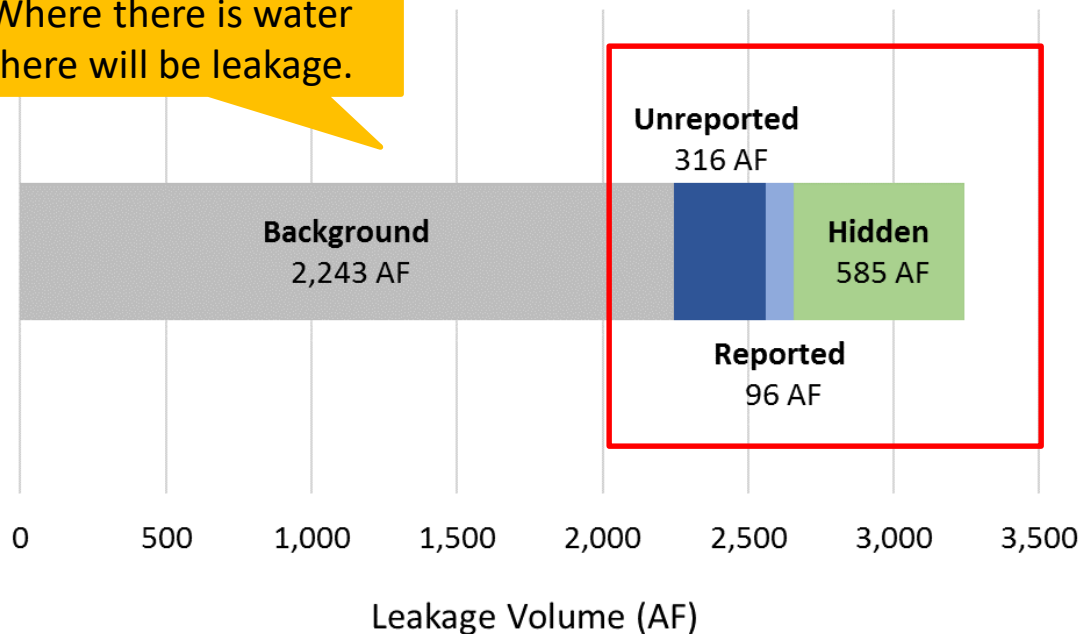
# Program Cost-Effectiveness



# Component Analysis of Real Losses

## FY 14-15 Leakage Profile

Where there is water there will be leakage.



**Background leakage** – modeled with infrastructure and pressure information

**Unreported leakage** – estimated with proactive leak detection and repair records

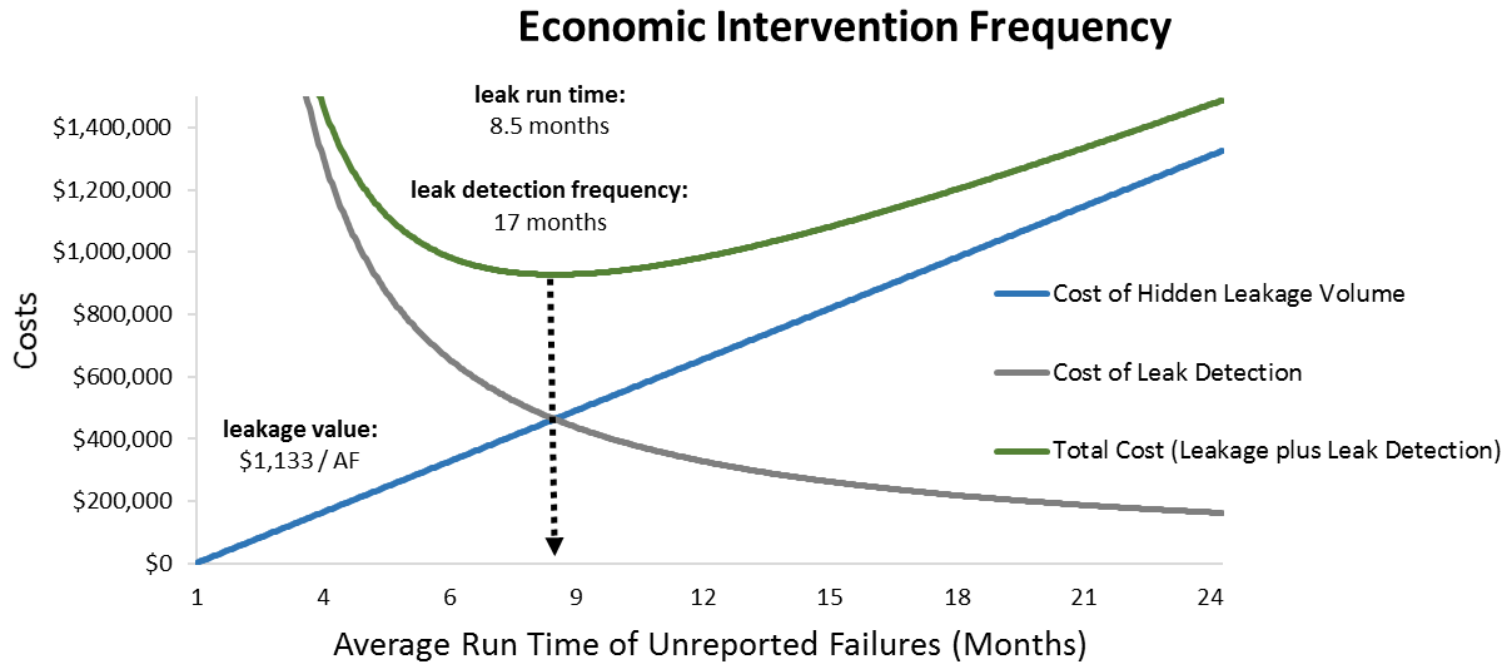
**Reported leakage** – estimated with reported leak repair records

**Hidden leakage** – leftover volume running unsurfaced and undiscovered

**Total leakage is equal to 5.6% of total potable supply.**

**Recoverable through leak detection is 1.7%.**

# Leak Detection Cost Effectiveness for IRWD



Economic Intervention Frequency (how often leak detection is performed) minimizes the combined cost of leakage and leak detection

# Getting from Detection to Water Savings

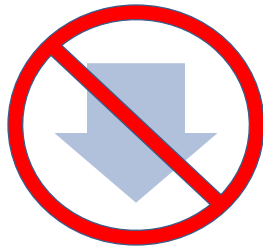
## Leak Detection

- Acoustic (IRWD)
- In-pipe
- Remote



## Identify Potential Leak

- Walk 4-6 miles per day
- Drive main arterials
- Pipelines, hydrants, valves, angle stops, air vacs, meters



## Repair

- Scheduled within 48 hours
- Customers notified
- Record estimated water loss



## Pinpoint Leak

- Listen at contact point
- Turn off water
- Pull meter and listen again

# Cost Effective Programs for IRWD

- Proactive leak detection – acoustic method

Recoverable Leakage (Based on FY 14/15)	Variable Production Cost	Total Value of Leakage
997 AF	\$1,133/AF	\$1.1 Million

Recovered Leakage	Variable Production Cost	Value of Recovered Leakage	Annual Program Cost
316 AF	\$1,133	\$358,028	\$257,595

- AMI \$40 million – not cost effective
- DMAs – not cost effective
- New focus is on Apparent Losses
  - Revenue recovery not real water loss
  - Over \$500,000 recovered in less than a year

# Statewide Variable Production Costs

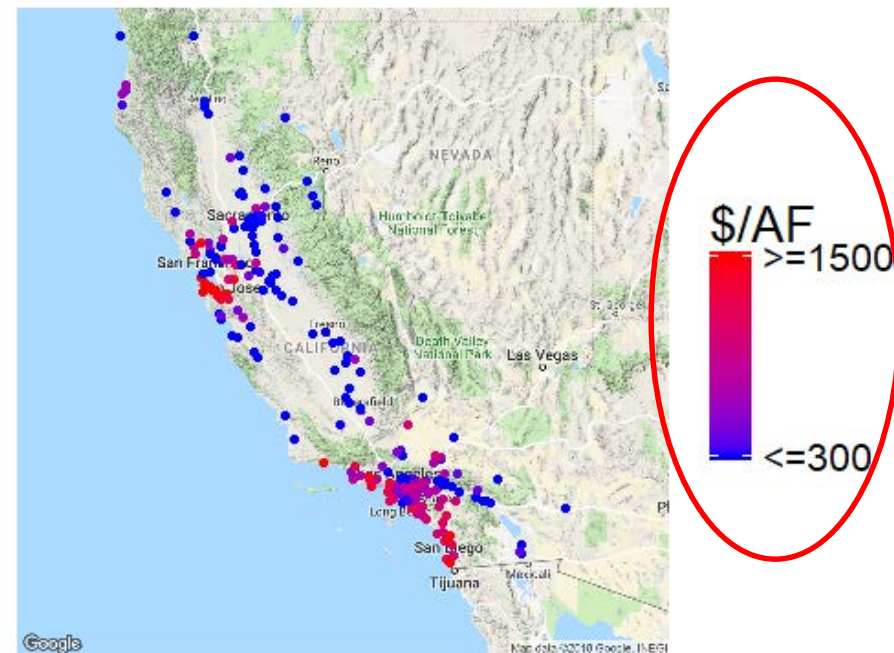
## Significant Variability

### 1. Cost Structure

- Cost of water
- System infrastructure
- Data collection
- Data analysis
- Program implementation

### 2. What Costs Are Included

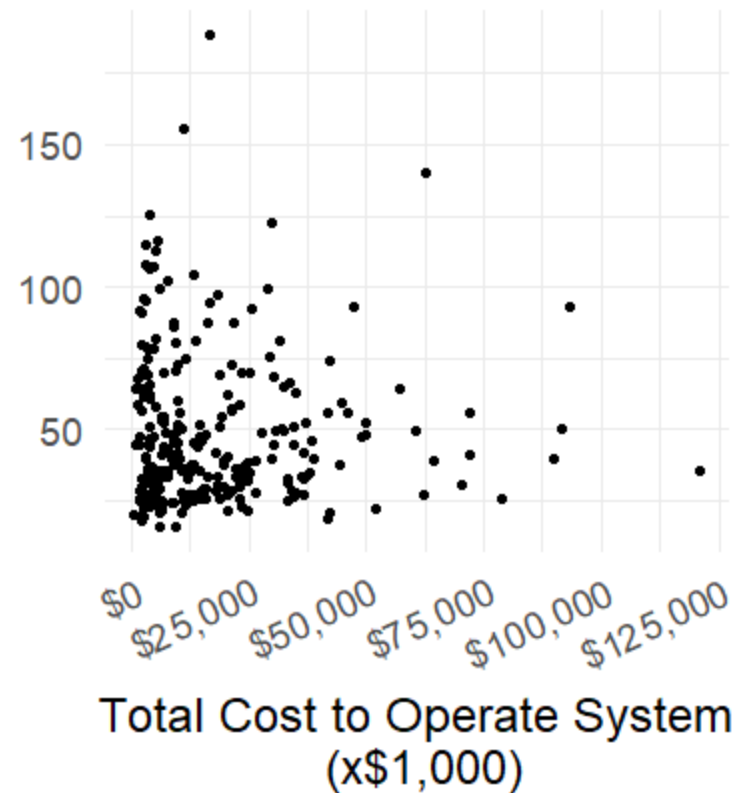
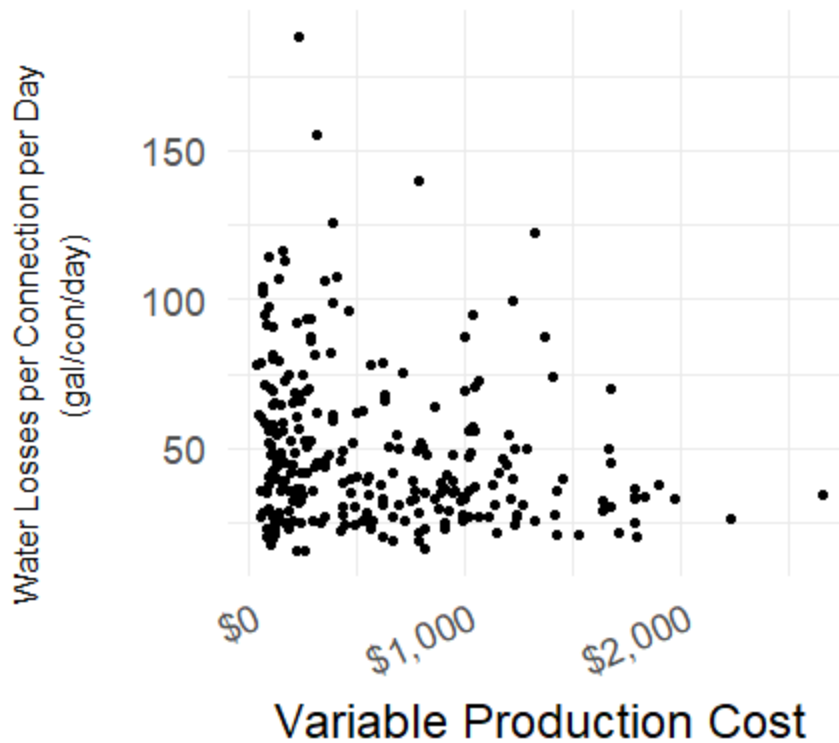
## Variable Production Cost (\$/AF)





# Correlations?

## Financial Characteristics and Normalized Water Losses

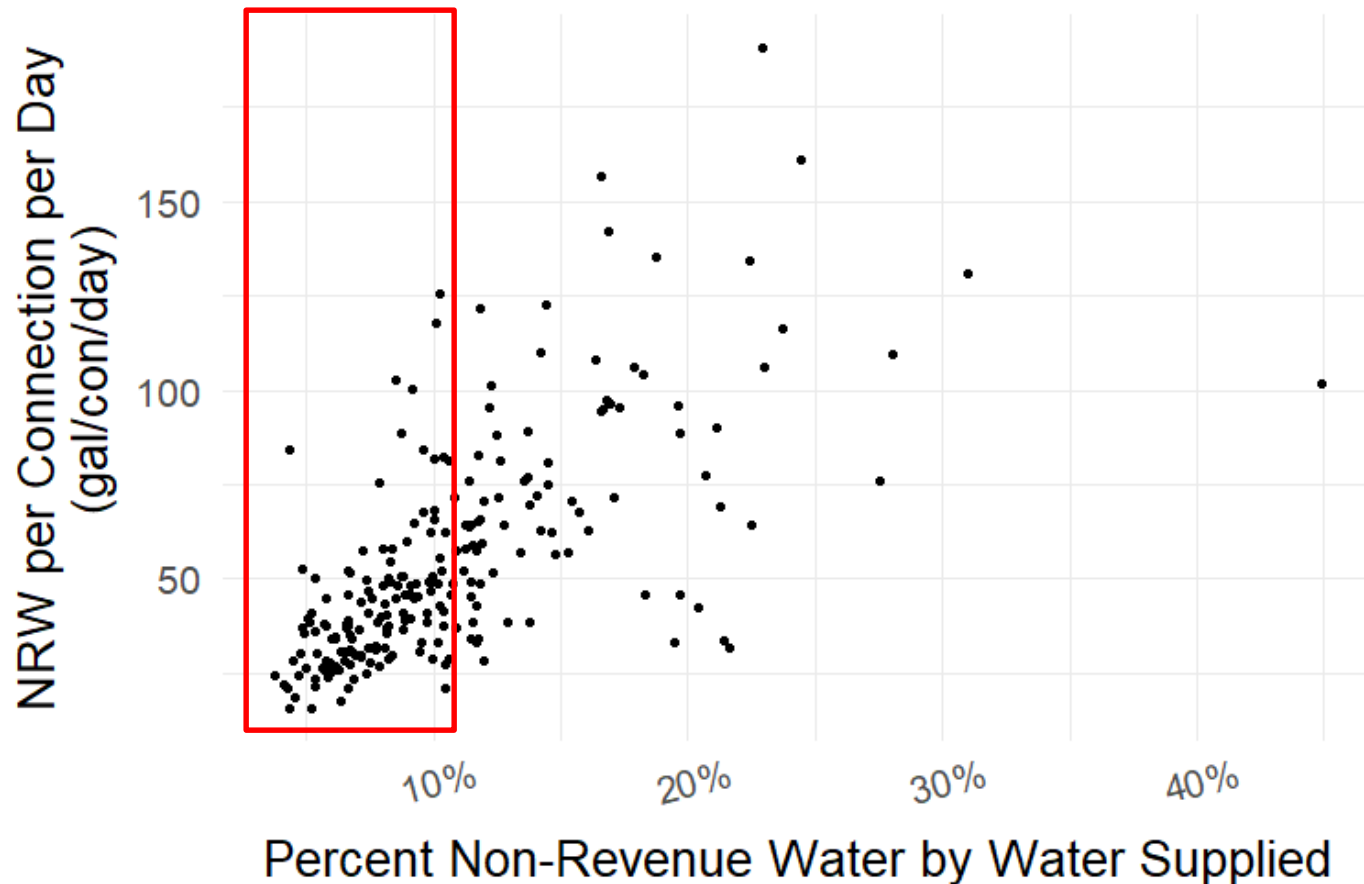


# Volumetric Water Loss

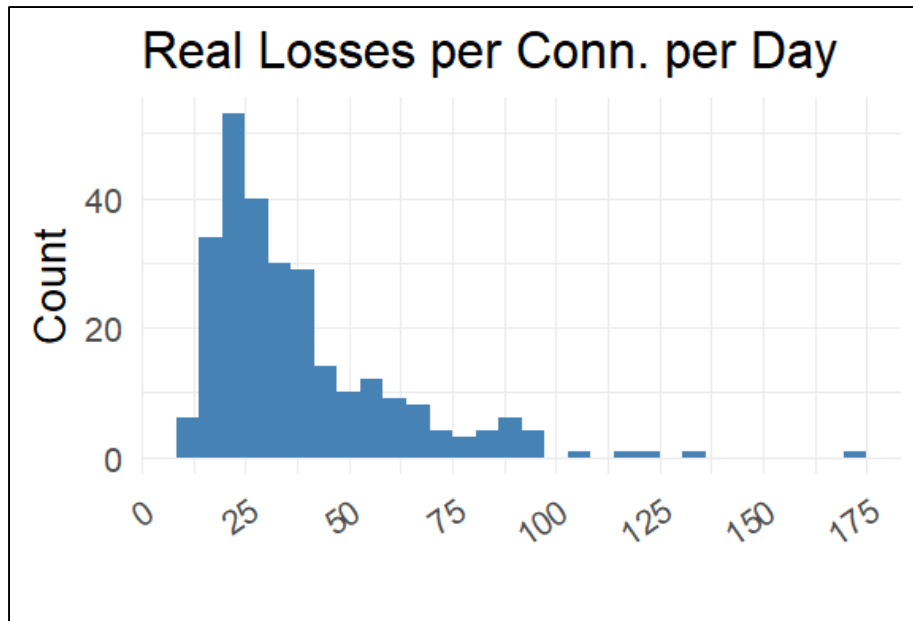
	Volume of Loss	Pros	Cons (assumes good data)
1	Non-revenue as percentage by volume of Water Supplied	<ul style="list-style-type: none"> <li>• Relatively Simple</li> </ul>	<ul style="list-style-type: none"> <li>• Volatile, subject to change based on supply changes</li> </ul>
2	Total volume of Real Losses	<ul style="list-style-type: none"> <li>• Relatively Simple</li> </ul>	<ul style="list-style-type: none"> <li>• Not a comparable metric.</li> <li>• Does not account for differences in systems/ infrastructure/costs</li> </ul>
3	Real losses by connection per day (gal/conn/day)	<ul style="list-style-type: none"> <li>• Relatively Simple, accounts for some agency variability</li> </ul>	<ul style="list-style-type: none"> <li>• Not a comparable metric.</li> <li>• Does not account for differences in systems/ infrastructure/costs</li> </ul>
4	Real losses by connection per day per psi (gal/conn/day/psi)	<ul style="list-style-type: none"> <li>• Relatively Simple, accounts for some agency variability,</li> <li>• Normalizes data</li> </ul>	<ul style="list-style-type: none"> <li>• Pressure can be a complicated calculation</li> </ul>

# Problems with Percentages

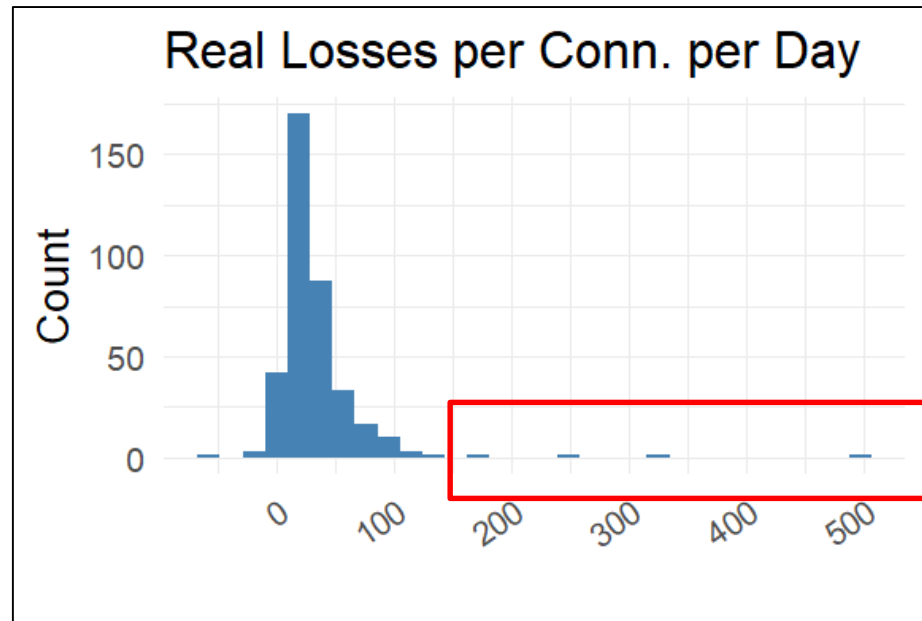
Comparison Between Normalized and Percentage Performance Indicators



# California Real Losses

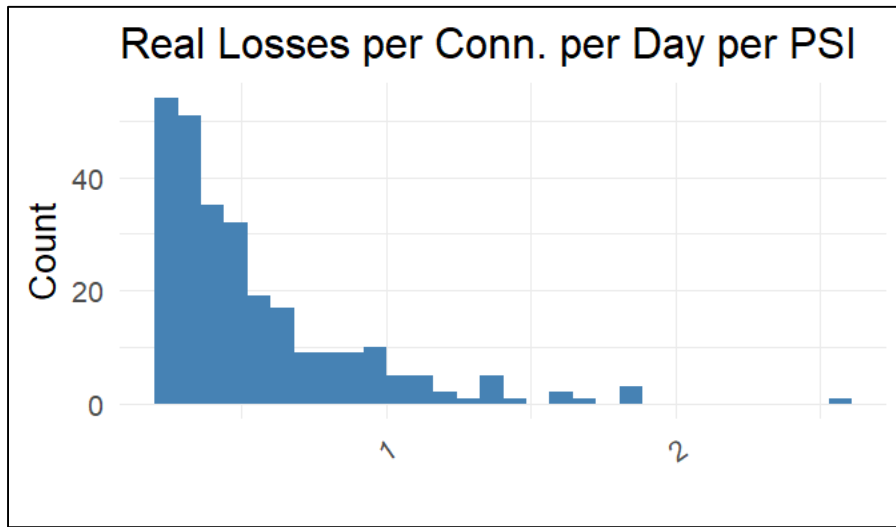


Agencies with only “realistic” results

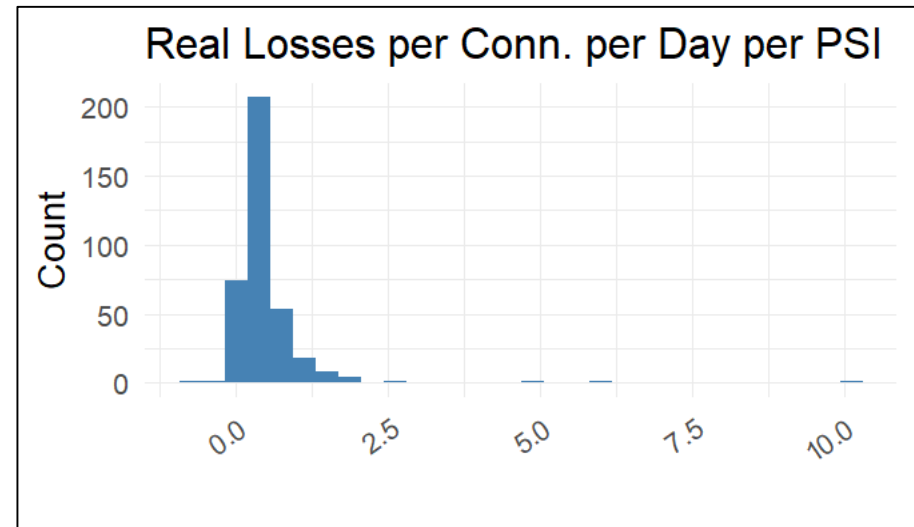


All Agencies

# Real Loss Per PSI

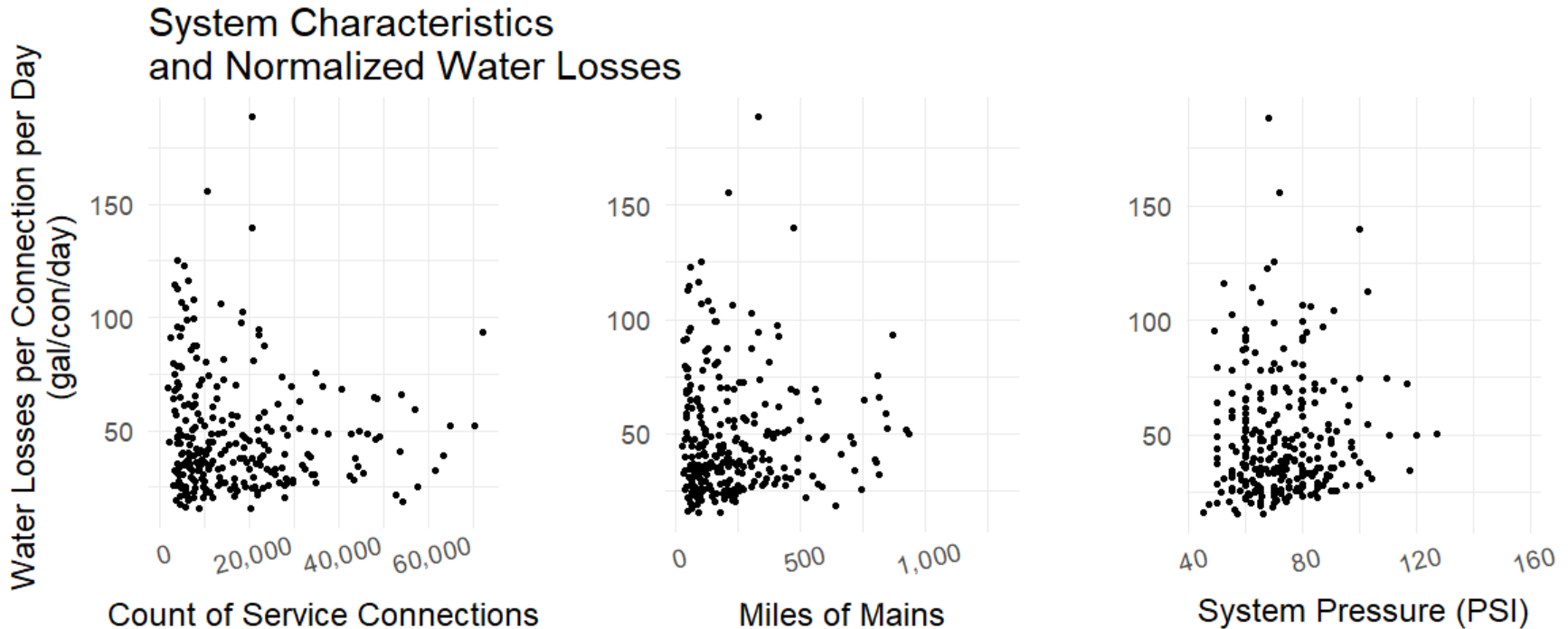


Agencies with only “realistic” results



All Agencies

# Correlations?



*Analysis shows no correlations based on system characteristics*

# IRWD Lessons Learned

- Water loss program implementation is a process and needs to be phased in
  - Component Analysis critical step in the process to understand where to target
- Data quality improvements can change results with no change in real water loss
  - Training and technical assistance are key
- Agency cost-effectiveness determines which aspect of water loss should be pursued
  - Continue leak detection program
  - New focus on apparent loss reduction

# Conclusions

- Significant variability in agencies statewide
  - Systems, infrastructure, costs, etc.
  - Resources, starting point
- Cost-effectiveness is unique to each agency
- Data quality will improve over time
- Potential metrics for volumetric standard
  - Example: 75% of median gal/conn/day/psi
  - Example: % of non-revenue water
- Phased approach to standards
  - Start simple with a cyclical review process



# Questions

Amy McNulty  
Water Efficiency Manager  
Irvine Ranch Water District  
[mcnulty@irwd.com](mailto:mcnulty@irwd.com)  
949-453-5634

