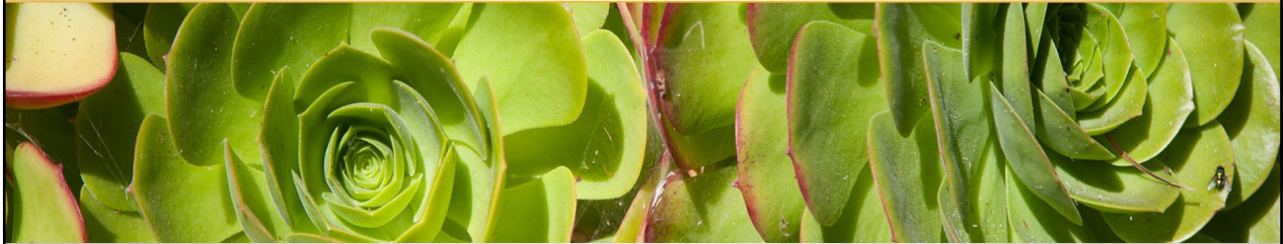


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What's Up with Indoor Residential Water Use Studies?

CALWEP P2P, December 9, 2020

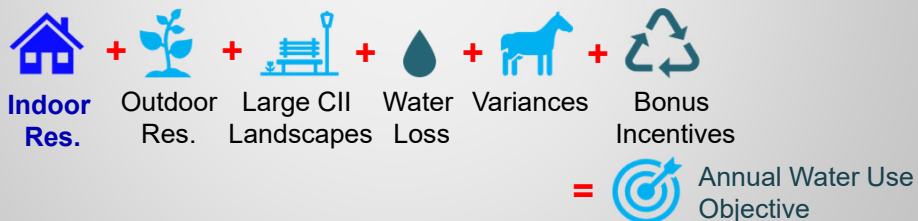


Shem Stygar, Project Manager
 Sabrina Cook, Water Use Efficiency Implementation Section Chief
 California Department of Water Resources

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Why Is The Indoor Residential Water Use Standard Important?

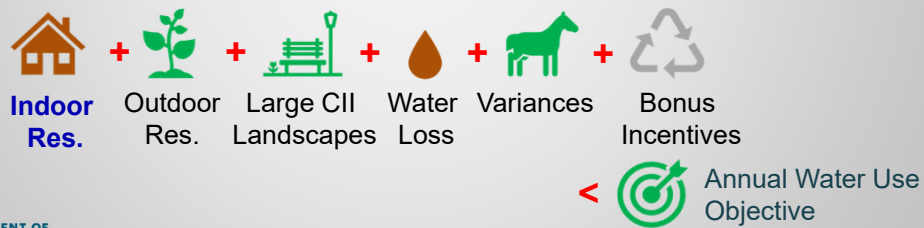
- 2018 Water Conservation Legislation – Annual Objectives
- Annual Objectives are set by sum of standards, variances, and bonus incentives



2

What the Standard Means

- The Indoor Residential Water Use Standard (RI-gpcd) is an annual average across a water supplier's district – **NOT** a *customer-level, nor daily standard*.
- RI-gpcd is not independently enforced - *Enforcement will be on the total Annual Water Use Objective*.



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Currently

- AB1668 and SB606 (Water Code Section 10609.4. (a)) set the **indoor residential water use standard (RI-gpcd)** as:
 - 2020-2025 – **55** RI-gpcd
 - 2025-2030 – **52.5** RI-gpcd
 - 2030 and beyond – **50** RI-gpcd
- Authority to reduce the **Indoor Standard** resides with the Legislature



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However....

Is Water Code 10609.4.(a) an appropriate standard?

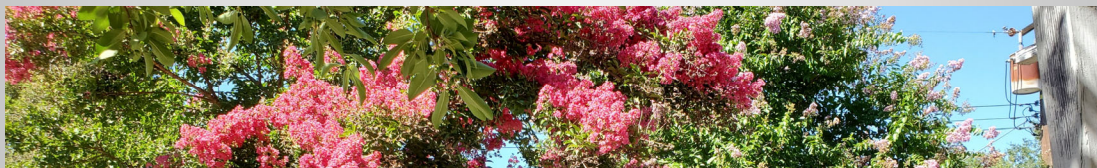
10609.4. (b) (1)

The department, in coordination with the board, shall conduct necessary studies and investigations and may jointly recommend to the Legislature a standard for indoor residential water use that more appropriately reflects best practices for indoor residential water use than the standard described in subdivision (a). A report on the results of the studies and investigations shall be made to the chairpersons of the relevant policy committees of each house of the Legislature by January 1, 2021, and shall include information necessary to support the recommended standard, if there is one. The studies and investigations shall also include an analysis of the benefits and impacts of how the changing standard for indoor residential water use will impact water and wastewater management, including potable water usage, wastewater, recycling and reuse systems, infrastructure, operations, and supplies.



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STUDY OVERVIEW

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Research Approach

1. What is current average RI-gpcd?
2. What is the supplier distribution of that water use?
3. What will RI-gpcd be in 2025 and 2030?
4. Who/how many suppliers would be affected by a changing standard?
5. What might the benefits and impacts be?



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Study Sampling Approach

- **Statewide sampling strategy:**
 - Customer level data from representative census tracts
 - Single-Family Residential (SFR), Multi-Family Residential (MFR), Dedicated Irrigation (DI) accounts
 - QA/QC the data
 - Cross-Check RI-gpcd estimates with other analysis methods
 - Understand sampling error
- **Sample Size:**
 - 18 suppliers, roughly 896,000 customer accounts
 - Approximately **6.7% of CA population**



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Statewide Estimates Census Tract Binning Into Strata

- Previous End Use Studies indicate that the drivers of Indoor Use include:
 - Persons Per Household
 - Dwelling Age
 - Socioeconomic Characteristics (i.e., MHI)
 - Employed/Retired
- Census Tracts were characterized on all four drivers
- Select suppliers to best represent those strata

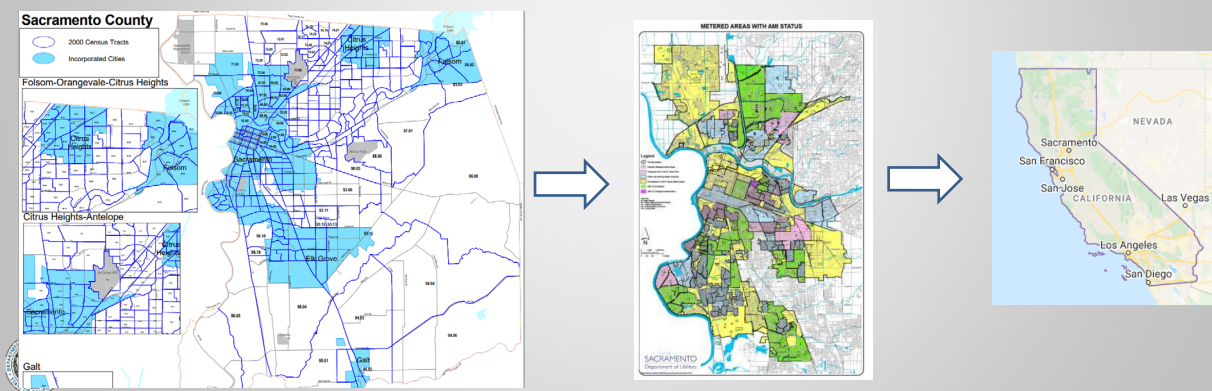


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From Sampled Data to Statewide Estimate

- Customer-level SFR analysis (and MFR, where possible)
- Aggregated to Census tract



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Two Ways to Get Statewide Estimates

- **Strata-Based**
 - Estimate RI-gpcd by census tract for the 18-Suppliers
 - Apply population weighted tract RI-gpcd to similar tracts
 - Aggregate to Statewide average
- **Model-Based**
 - Use tract characteristics to develop an RI-gpcd model [age of housing stock, % of population over 65, and Median Household Income (MHI)]
 - RI-gpcd model applied to each tract based on their characteristics
 - Aggregate to Statewide average



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Study Approach - Disaggregation

- **Monthly disaggregation**
 - 5 to 10 years per account plus QA/QC
- **Hourly disaggregation**
 - 1 year per account plus QA/QC
- **End-Use Analysis Pilot (Flume)**
 - Non-invasive & cost-effective
 - 5 to 10 second reads for 30 days with QA/QC
 - Explain high and low water use
- **eAR Data Monthly disaggregation**

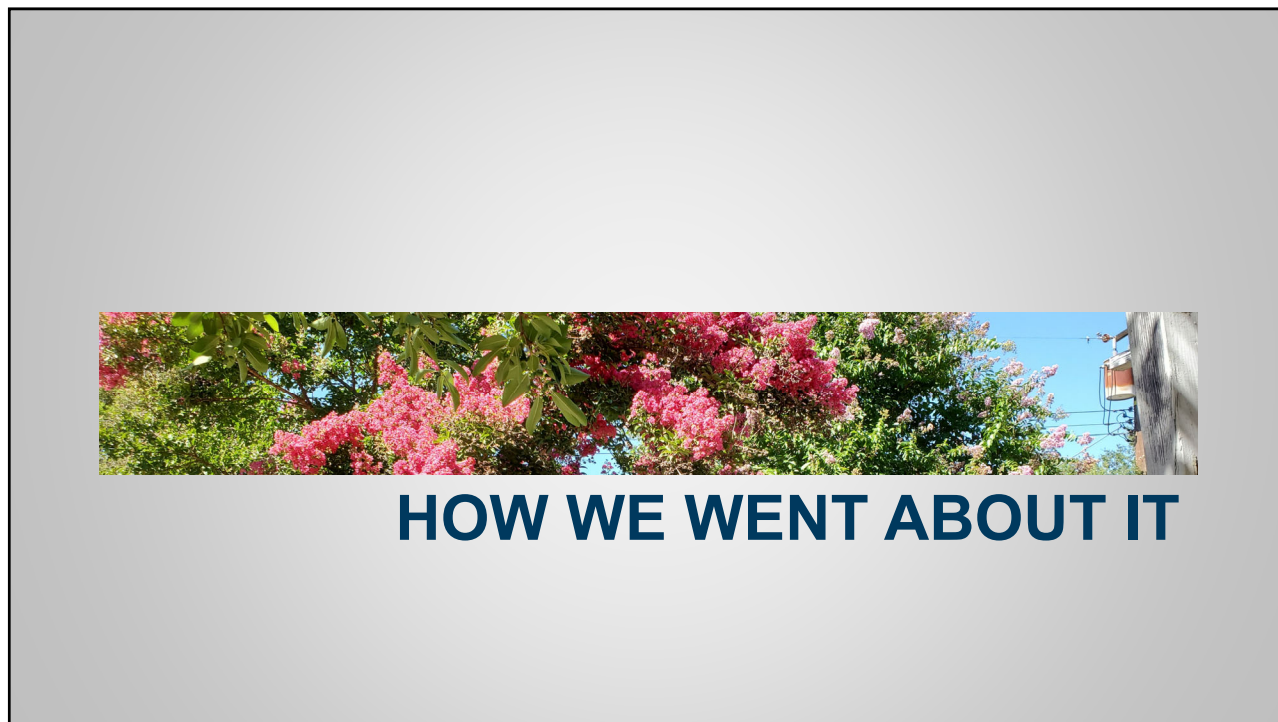


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Study Team

Monthly Analysis Team


Hourly Analysis Team

Technical Advisory Team

Water DM

Western Policy Research

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Study Participants

- City of Folsom*
- City of Sacramento*
- City of Santa Cruz
- Redwood City*
- Coachella Valley MWD
- Eastern MWD*
- Irvine Ranch WD
- Moulton Niguel WD
- California Water Service

Sample Coverage
 18 Urban Water Service Areas
 560 Census Tracts
 896,000 Residential Customers

Billing Data Span
 2011 – 2020 = Many millions of meter reads

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Monthly Data Processing

- **Phase 1: Data collection and cleaning**
 - Collect customer level data
 - Process / clean data (QA/QC)
- **Phase 2: Estimation – 3 Main Methods**
 1. Seasonal Adjustment Method (SAM)
 1. 3 Variations
 2. Landscape Adjustment Method (LAM)
 3. Rainfall Adjustment Method (RAM)



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Seasonal Adjustment Method (SAM)

Look at Dedicated Irrigation Meter Water Use

Example:

- Min Irr/Seasonal Range = 6.9%
- Residential Range (418 – 188) = 230 GPD
- Residential Outdoor Use (230) * 6.9% ≈ 15.9 GPD
- Residential Indoor Use 188 – 15.9 = 172.1 GPD

Method Assumes Same Relationship Applies to Residential Irrigation

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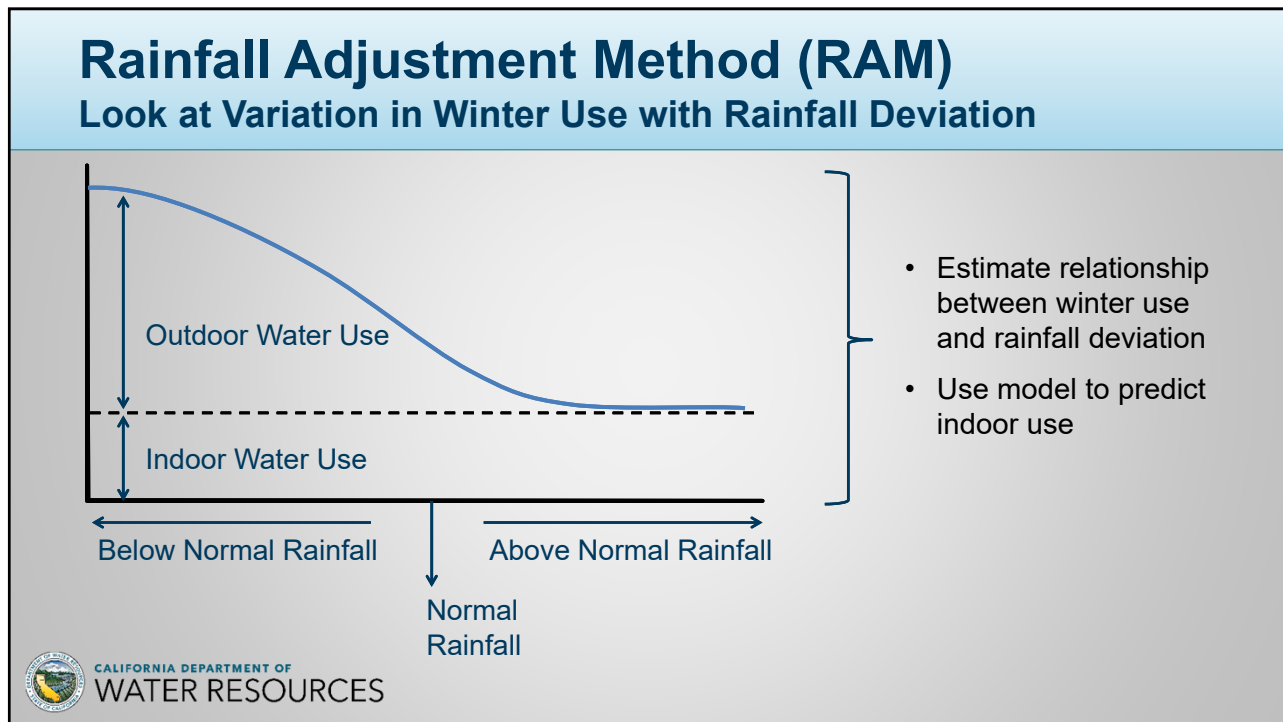
Landscape Adjustment Method (LAM)

Look at Variation in Winter Use with Landscape Area

- Estimate relationship between winter use and residential landscape area
- Use model to predict indoor use

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Strata Based Preliminary Monthly Results

18-Suppliers SFR RI-gpcd

Period	Sampled Census Tracts	Estimation Method					
		SAM		LAM		RAM	
		Mean	Median	Mean	Median	Mean	Median
Pre-Drought ('11-13)	340	54.0	49.0	64.9	62.1	63.2	57.9
Voluntary 20% ('14)	401	56.5	52.1	63.2	57.6	61.0	55.2
Mandate ('15-16)	508	47.4	44.3	54.6	46.4	52.4	46.0
Post-Drought ('17-19)	699	52.4	50.2	52.2	48.0	52.4	48.4
Grand Average		52.7	49.9	55.7	50.5	55.1	49.9

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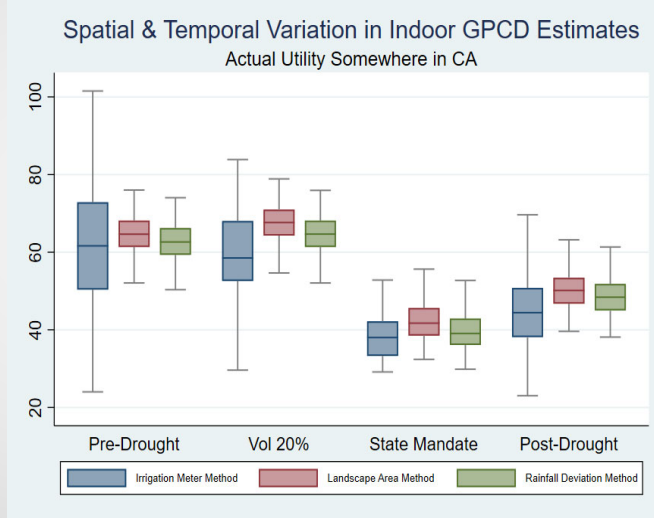
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Spatial & Temporal Variation in GPCD 18-Supplier Monthly Data

There is significant variation in RI-GPCD across:

- Census Tracts
- Time



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Preliminary Multi-Family Residential (MFR) Results

- MFR - NOT used in developing Statewide Estimates
- MFR Dwelling Unit counts from:
 - Sacramento, Santa Cruz, Eastern MWD, Irvine Ranch WD, & Redwood City
- SFR and MFR indoor use are similar at Census Tract Level

Estimation Method		SFR	MFR
SAM	Mean	52	49
	Median	50	48
LAM	Mean	52	50
	Median	48	48
RAM	Mean	52	49
	Median	48	46

- SFR from full 18 suppliers
- MFR from 6 suppliers



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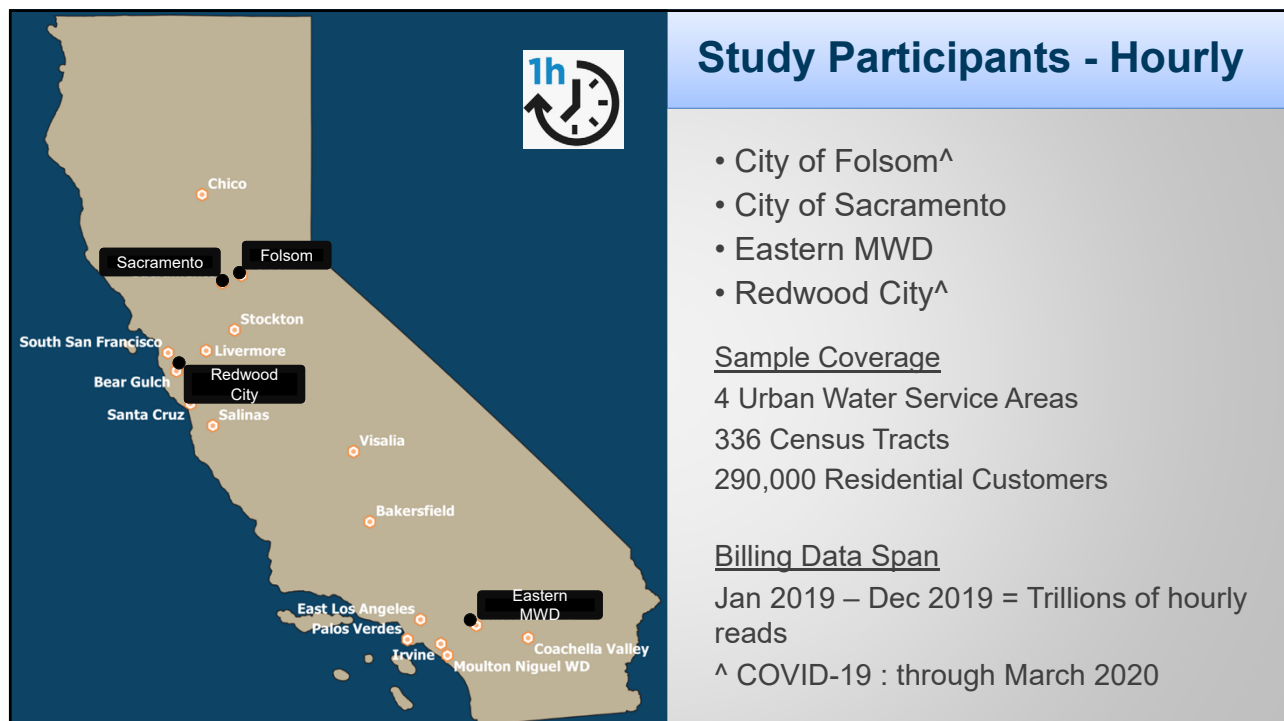
Hourly Analysis Process

- **Phase 1: Data collection and cleaning**
 - Collect hourly / AMI data
 - Process and clean data
 - Reconcile hourly data with monthly data
- **Phase 2: Estimation**
 - Develop methods to estimate indoor usage on subsample
 - Apply to entire sample
 - Estimate indoor water usage
- **Additional Area of Inquiry:**
 - What Effect is Pandemic Having on Residential Water Use?



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Phase 2 Estimation Methodology

Three approaches to infer indoor usage



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Numerical Approach



- Examine water usage at hourly level
- Yardstick for max amount of water used per hour based on:
 - Appliance end-use studies*
 - Average persons per household (Census Tract)
- Yardstick used to label indoor or outdoor water use



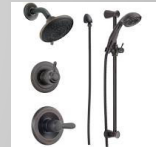
Washing machine
~ 30 gal per load



Dishwasher
~ 30 gal per wash



Shower
~ 18 gal per shower



Toilet flush
~ 2 gal per flush

100 gallons per hour is a reasonable yardstick for indoor water use.



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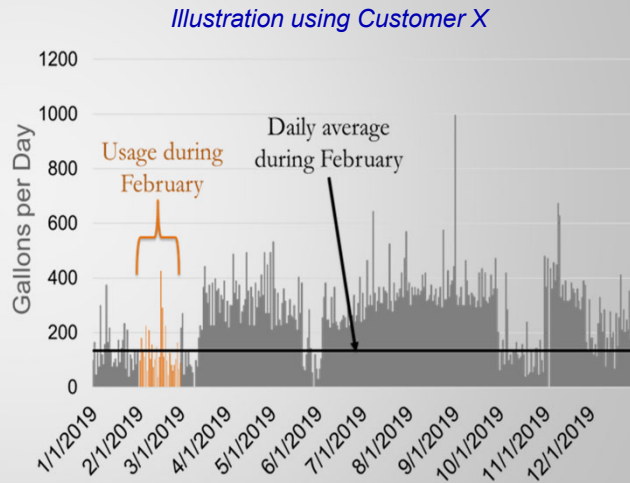
*Source for appliance estimates: DeOreo et al (2011)
California Single Family Water Use Efficiency Study.

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Hourly Minimum Month Approach



- Examine water usage at daily level – varies by customer
- Daily water use during expected min month outdoor usage (e.g., February)
- Indoor if daily total \leq min month daily average



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Clustering Approach



Assignment determined by rules in terms of frequency, typical seasonal water use, flow rates



- 1. Indoor Only Profile*
- 2. Indoor + Outdoor Profile
- 3. Outdoor only Profile
- 4. Atypical Profile

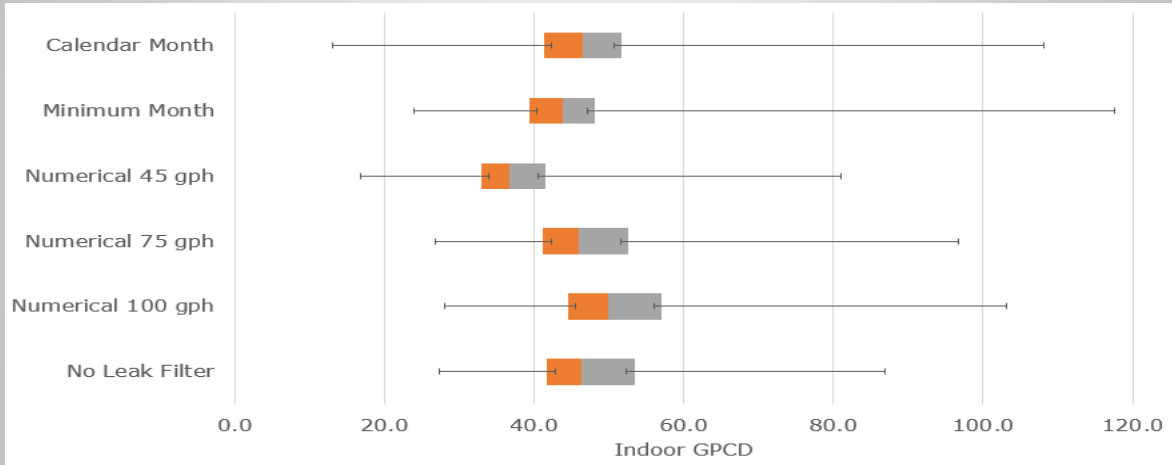


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*We also apply a filter for indoor leaks

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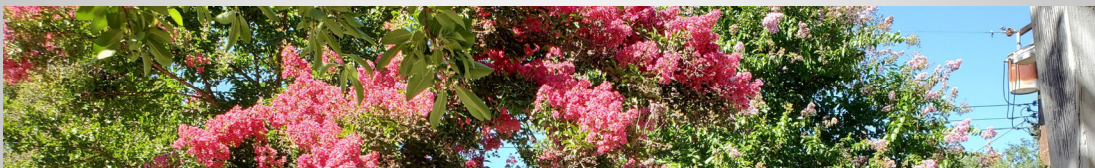
Summary of Preliminary SFR Hourly Analysis



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CURRENT WATER USE PRELIMINARY RESULTS

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Limitations of the Analyses

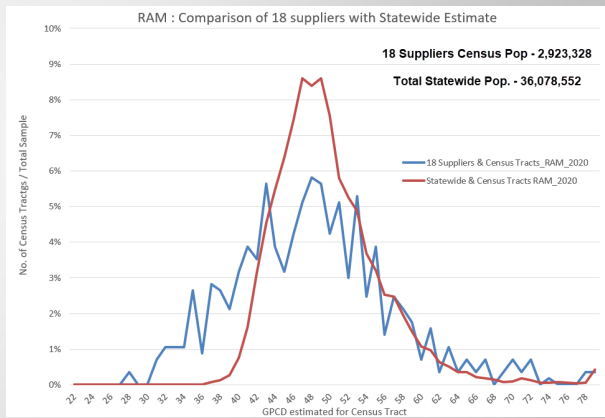
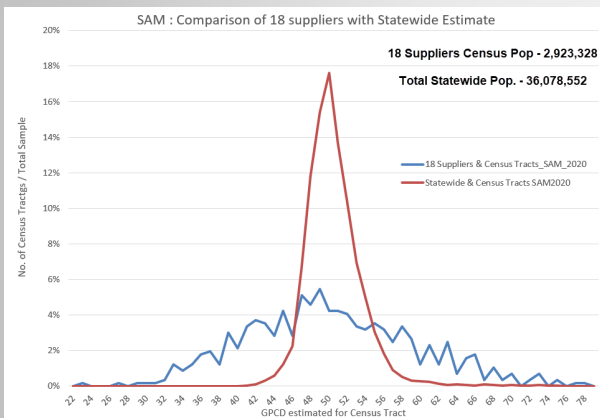
- SAM – simpler to apply and can use aggregated data, but less robust
- LAM & RAM – data intensive and need customer-level data
- All analyses methods (except End Use) assume winter outdoor use is minimal
- MFR needs number of dwelling units per meter + classification issues
- Indoor use variable over time + transitory external factors



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Tract RI-GPCD Distribution Preliminary Results for 18-Supplier SAM & RAM vs. DWR Modeled Statewide Estimates

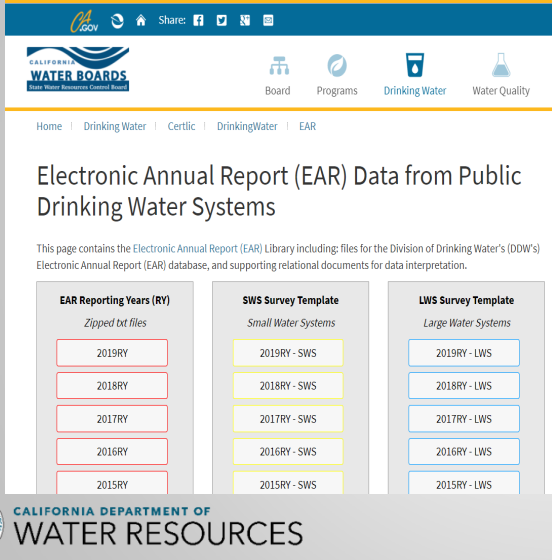


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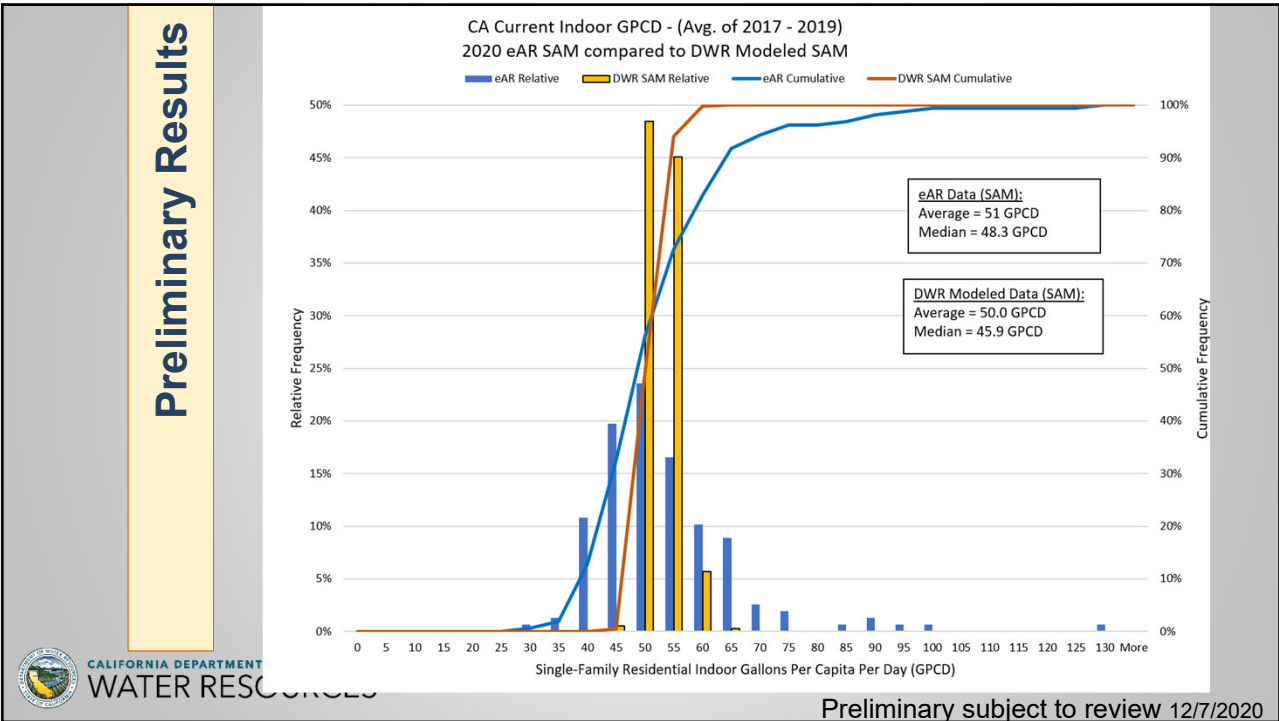
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Using eAR Data



- Monthly SAM analysis applied to eAR data – 3 variations
- Only for those suppliers that reported dedicated irrigation meter values
- eAR data is supplier reported data subject to reporting errors - QA-QC data
- Rules for exclusion = 157 suppliers with suitable data

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Preliminary Summary Statistics

Current (2020) Conditions

Current (2020)			
	eAR Data	DWR Modeled SAM	DWR Modeled RAM
Mean	51	50	49
Min	28	41	34
Max	129	75	96
Median	48	48	48



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Estimated Pandemic effects on RI-gpcd

- Monthly Analysis (4 suppliers)
 - RI-gpcd increase vs. pre-pandemic: 3 to 5 gpcd
- Hourly Analysis (2 suppliers)
 - RI-gpcd increase vs. pre-pandemic: 3 to 4.5 gpcd
- End Use Study (20 homes): June – August 2020
 - 30-day average of about 8 toilet flushes / day
 - Increase of about 3 flushes /day vs. previous end use studies
- Increase of about 2-3 extra toilet flushes per day (SF)



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Potential Benefits and Impacts

Qualitative Assessment

Potential Benefits:

- PW: Stretch resources & defer investment
- WW: Reduced energy usage & defer investment
- RW: Better steward of water & public perception

Potential Impacts:

- PW: Decreased water quality, reduced revenue,
- WW: higher contaminant load, odors, blockages
- RW: Offset less WW flow with PW, water quality



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Factors to Consider in Recommendations

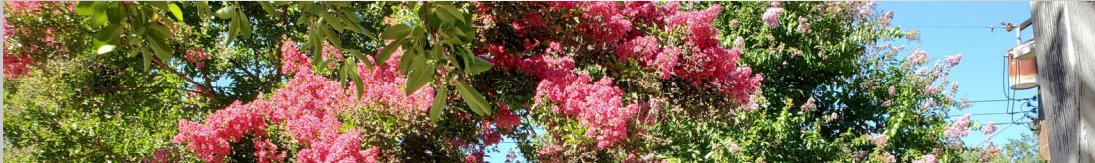
- Data quality and many assumptions used in the analyses
- 'Natural' reductions from appliance turnover & existing codes
- Affordability of water service & human right to water
- 'Best practices' suppliers can reasonably implement to accelerate efficiency
- Secondary effects on Suppliers' PW / WW / RW Systems
- Geographic variability and demographic effects



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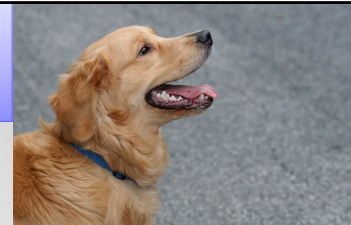


MOVING FORWARD

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Schedule & Next Steps

- Leg. report due – Jan 1, 2021
- Delays:
 - Included more QA/QC data in analysis
 - Joint recommendation with SWB
 - First standard of the Water Use Objective
- Preliminary draft ****coming soon!****



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To be added to the listserv for updates contact
wue@water.ca.gov



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Questions and Comments



For Questions contact Shem Stygar at: Shem.Stygar@water.ca.gov

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