ALLIANCE FOR WATER EFFICIENCY

WATER EFFICIENCY & CONSERVATION SYMPOSIUM 2025

AUGUST 6-8, 2025 | CHICAGO, IL

The Big Reveal: First Insights from the Residential End Uses of Water Study and the 50L Home Pilot

Room 621 12:30 – 2:00pm

Building on the Foundation of Demand Management Research

Sydney Samples

Research Manager, Water Research Foundation

OUR PURPOSE

To advance the science of water to improve the quality of life for all communities.

THE Water Research FOUNDATION®

OUR MISSION

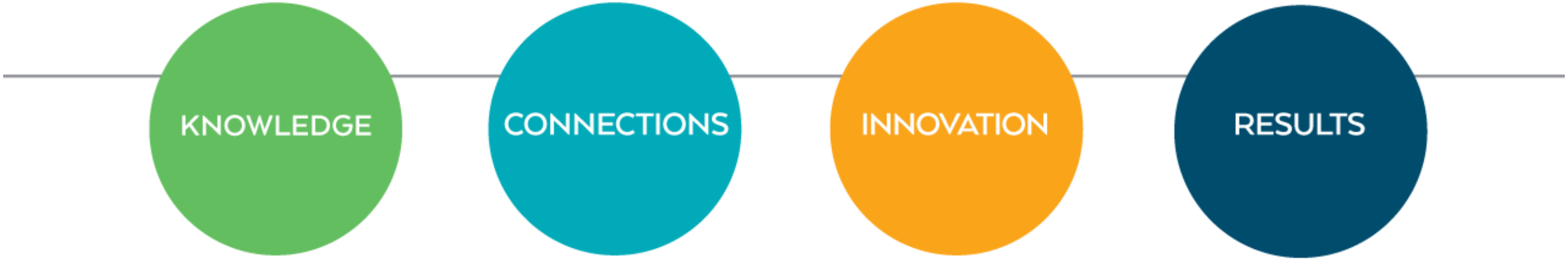
To help our subscribers discover opportunities and solve problems by delivering actionable water research to meet the needs of the communities they serve.

THE Water Research FOUNDATION®

How does WRF accomplish our mission?

Identify, prioritize and fund research for the water sector.

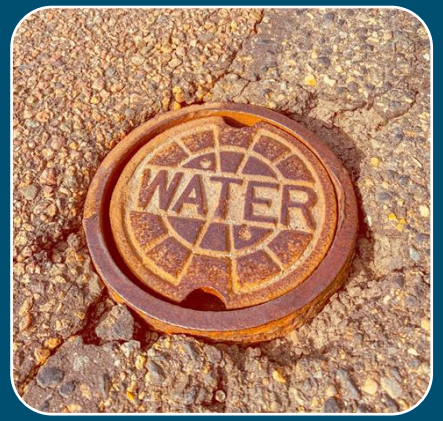
Accelerate the adoption of new technologies in the water sector.

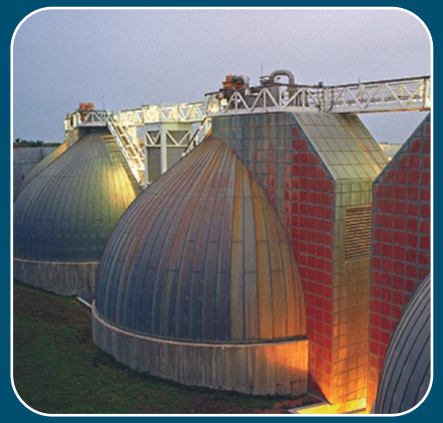


Convene experts and sector representatives to identify and collaborate on priority water research.

Educate decision-makers on the science of water.

advancing the science of water





Healthy Communities & Environment

- Holistic Watershed Management & Integrated Planning
- Monitoring Tools at Watershed & Sewershed Scale
- Receiving Water Quality Management

Treatment Innovation & Optimization

- Treatment & Process Optimization
- Nature-based Solutions
- Diversifying Water Systems

Efficient Resource Use & Recovery

- Energy Efficiency, Intensification & Resource Recovery
- Climate Change Mitigation
- Nutrient Removal & Recovery
- Solids Management

Resilient Infrastructure

- Asset Management
- Distribution System Integrity & Water Quality
- Collection Systems Integrity & Water Quality Impacts

Utility Operations & Management

- Water Resources Planning
- Workforce Management
- Financial Management

Climate Risk Assessment & Adaptation, Communication, Environmental Justice, Digital Transformation

Long History of WRF Subscriber Interest in Demand Mgmt.

4031

North America Residential Water Usage Trends Since 1992

4554

Water Use in the Multi-Family Housing Sector

4623

Integrating Land Use and Water Resources: Planning to Support Water Supply Diversification

4649

UKWIR

COLLABORATIVE, IMPARTIAL RESEARCH

INTEGRATION OF BEHAVIOURAL CHANGE INTO DEMAND FORECASTING AND WATER EFFICIENCY PRACTICES

PROJECT NO. 4495

Integrating Water Efficiency into Long-Term Demand Forecasting

4495

Uncertainty in Long-Term Water Demand Forecasts: A Primer on Concepts and Review of Water Industry Practices

Project #4558

4558

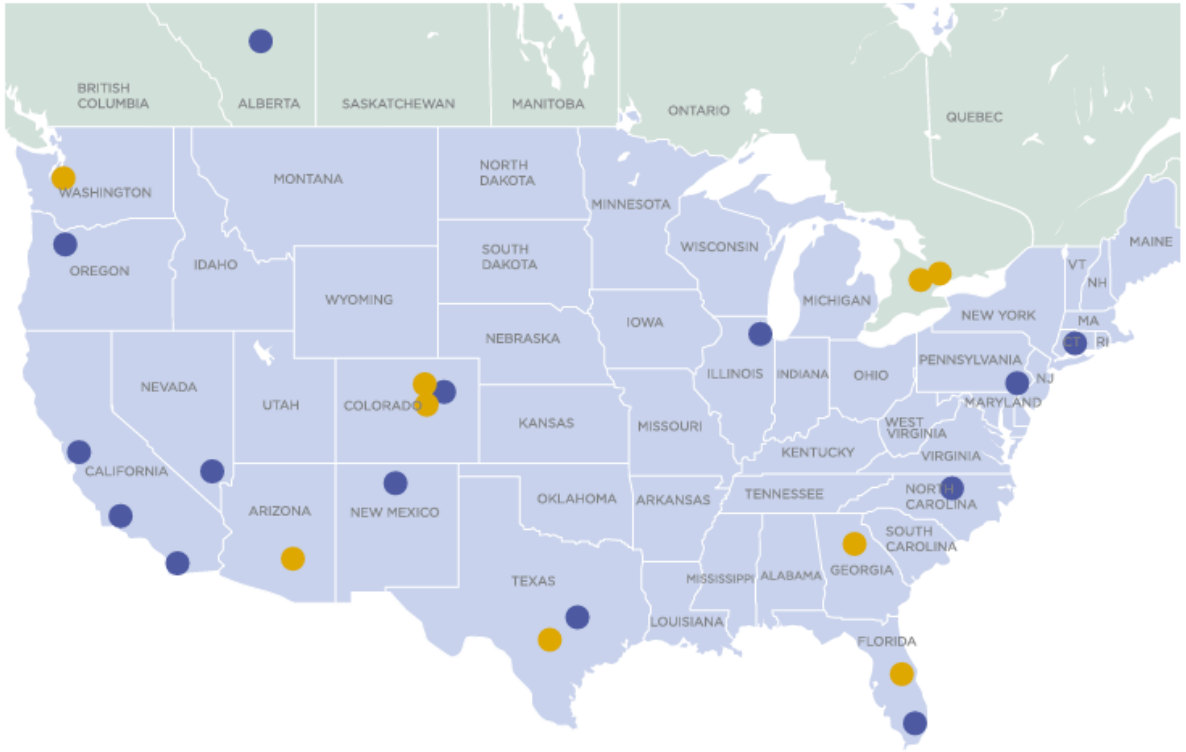
PROJECT NO. 4667A

Long-Term Water Demand Forecasting for Water Resources and Infrastructure Planning: A Review of Forecast Design Considerations and Typology of Practices

4667

WRF 4309: Residential End Uses of Water, Version 2

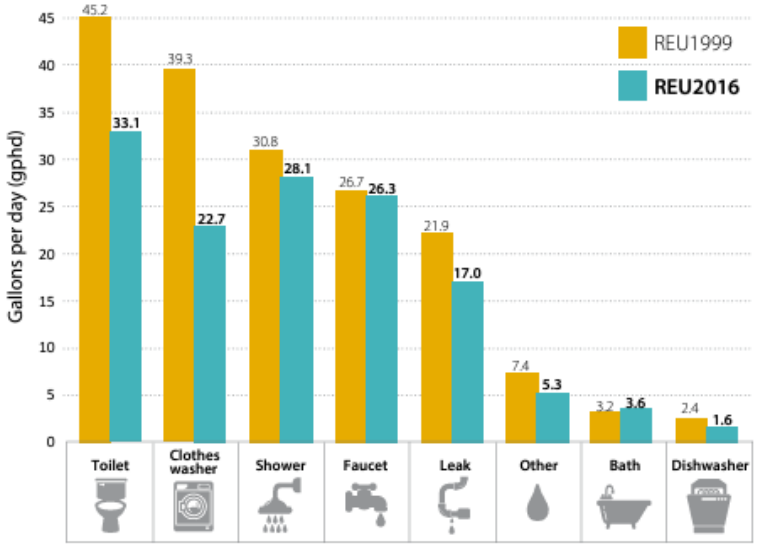
Figure 8. Diversity of the Level 1 and Level 2 study site locations



LEVEL 1 STUDY SITES: Clayton County, GA · Denver, CO · Fort Collins, CO · Peel, Ontario · San Antonio, TX Scottsdale, AZ · Tacoma, WA · Toho, FL · Waterloo, Ontario

LEVEL 2 STUDY SITES: Aurora, CO · Austin, TX · Cary, NC · Chicago, IL · Edmonton, Alberta Henderson, NV · Miami, FL · Mt. View, CA · New Haven, CT · Otay, CA · Philadelphia, PA · Portland, OR Santa Barbara, CA · Santa Fe, NM

Figure 4. Average daily indoor per household water use REU1999 and REU2016



22%
DECREASE PER HOUSEHOLD
DAILY WATER USE
1999 TO 2016

Figure 1. Indoor household use by fixture

Toilet	Shower	Faucet	Clothes washer	Leak	Other*	Bath	Dishwasher
24%	20%	19%	17%	12%	4%	3%	1%
33.1 gphd	28.1 gphd	26.3 gphd	22.7 gphd	17.0 gphd	5.3 gphd	3.6 gphd	1.6 gphd

* The "Other" category includes evaporative cooling, humidification, water softening, and other uncategorized indoor uses.

THE Water Research FOUNDATION®

MOTIVATION FOR V3

advancing the science of water®

Published in 2016 but still a top resource in the 2020's

Most Viewed Website Research Project Pages

1. Residential End Uses of Water, Version 2
2. Economic Framework and Tools for Quantifying and Monetizing the Triple Bottom Line Benefits of Green Stormwater Infrastructure
3. PFAS One Water Risk Communication Messaging for Water Sector Professionals
4. Determining the Fate and Major Removal of Mechanisms of Microplastics in Water and Resource Recovery Facilities
5. Demonstrating Virus Log Removal Credit for Wastewater Treatment and Reverse Osmosis for Potable Reuse at OCWD

2022 Q2

Most Visited Research Project Pages

1. PFAS One Water Risk Communication Messaging for Water
2. Residential End Uses of Water, Version 2 (4309)
3. Demonstration of Progressive Carbon Efficient Nitrogen with Biological Phosphorus Removal... (5071)
4. Advancement of Densification to Implement and Achieve More Efficient BNR Processes... (5130)
5. Long Term Water Demand Forecasting Practices for Water Resources and Infrastructure Planning (4667)

2023 Q2

Most Visited Research Project Pages

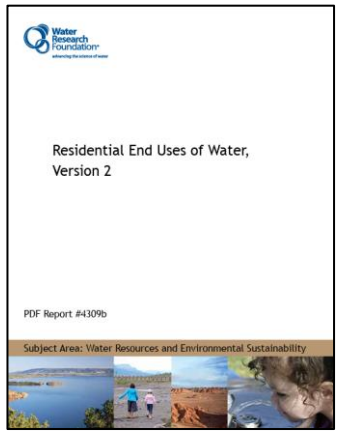
1. Developing Strategic Consumer Messaging for Microplastics in Drinking Water Supplies (5155)
2. Occurrence of PFAS Compounds in US Wastewater Treatment Plants (5031)
3. Guidance for Using Pipe Rigs to Inform Lead and Copper Corrosion Control Treatment Decisions (5081)
4. Residential End Uses of Water, Version 2 (4309)
5. Demonstrating the Effectiveness of Flushing for Reducing the Levels of Legionella in Service Lines and Premise Plumbing (5033)

2024 Q2

Evolution of Residential End Uses of Water

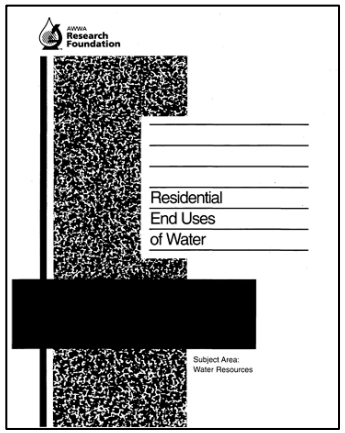
1999

Project 241



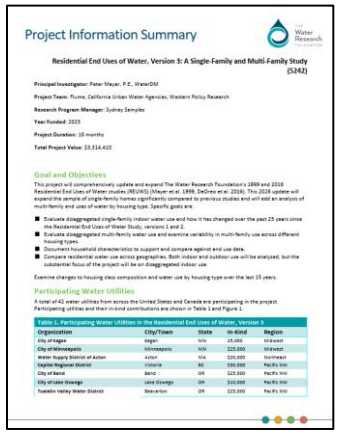
2024

Project 5242



2016

Project 4309



Project 241

- SF end use & billing analysis (14 utilities)
- Mailed survey (5,574 total)
- Utility specific analysis
- Included benchmarking & modeling

Project 4309

- SF end use & billing analysis (9 utilities fully participating, 15 supporting utilities)
- Mailed survey (5,574 total)
- Utility specific analysis
- Included hot water analysis, detailed landscape and outdoor use analysis, and modeling

Project 5242

- SF & MF end use & billing analysis (52 supporting utilities & 1,302 MF homes)
- Primarily electronic survey (over 49,000 total)
- Regional Analysis w/ focus on indoor use
- Includes seasonal analysis, a comparison of SF & MF, and housing composition analysis

2025 Search Results – Q1

Most Visited Research Project Pages
1. Residential End Uses of Water, Version 3: A Single-Family and Multi-Family Study (5242)
2. Autonomous in situ Monitoring of Harmful Algal Blooms (5154)
3. The Role of Generative AI (GenAI) for the Global Water Sector (5321)
4. Utility Field Guide for Developing a Cyanobacteria and Cyanotoxin Monitoring Program (5120)
5. Data-Driven Process Control for Maximizing Resource Efficiency (5141)

5242
Project Page

THE Water Research FOUNDATION®

WHERE DO WE GO NEXT?

advancing the science of water®

Publication of Residential End Uses of Water V3

Project Deliverables:

- Technical Report
- Executive Summary (Lay Audience)
- Data Dashboard
- Data Set

Anticipated Publication: Spring 2026

Potential areas for further residential end use research

Multi-Family Housing

Regional Differences

Seasonal Differences

Demand Trends

Impacts of New Fixtures & Technologies

Water & Wastewater Pricing

WRF 5265: Evaluating Changes in Peak Water Demand and How that May Affect the Choice, Design Management, and Evaluation of Demand Management

Project Objectives:

- **Identify peak demand definitions and use cases** that are relevant to water utility operations.
- **Document trends over time** across different geographies and contexts.
- **Document the drivers** of peak demand patterns.
- **Evaluate peak demand management strategies**, potential costs and benefits, which are effective, and why they are effective in the context of changing trends and drivers.
- **Assess how these and additional factors may influence peak demand in the future**.
- Cultivate conversations and develop shared understanding of how certain strategies affect other utility operations and costs.

Research Team:
Liesel Hans, Andrew Morris, Devin Smith, & Amanda Christophe (AWE)

Expected Deliverables:
Research Report & webcast

Key Chapters:
Literature review, case studies, & demand management strategies

Expected Publication:
Late 2025

WRF 5237: Utility Business Models for Managing Water Demand Reduction

Support Research

Scan the QR Code to receive a link to take the survey

Research Team:
Alliance for Water Efficiency & Pacific Institute

- Help identify effective, field-tested strategies in **rate design, financial planning, utility services, and demand management.**
- About the survey:
  - Seeking responses from water utilities
  - Complete in 10-15 minutes
  - Only aggregated or anonymized data will be published

WRF 5335: Per Capita Water Use

Project Objectives:

- **Understand how per capita water use is calculated and measured** throughout North America **and how it is used as a metric for comparison** and water resource planning.
- **Evaluate the risks and benefits associated with different methodologies** for per capita water calculations **and** the risks and benefits **of standardizing the calculation**.
- **Develop a framework, definitions, and standard methodology** for calculating per capita water use that can be used universally, allowing for effective comparisons and planning.
- **Apply this framework and methodology** to a set of water providers.

Funding Source:
WRF, Central Utah Water Conservancy District & City of Calgary

Expected Deliverables:
Research Report, Guidance Manual, Framework Tool, & Webcast

Anticipated Kickoff:
Late 2025

AWARD ANNOUNCEMENT COMING SOON

WRF 5359: Building Better Forecasts: Improving Utility Demand Models with Climate, Development, and Socio-Economic Insights

Project Objectives:

- **Investigate how residential demand models that incorporate** demand drivers such as **socio-economic factors, climate variables, and/or land use/development patterns and policies are used within utilities**, the assumptions they make, and if/how they are incorporated into scenario-based demand projections.
- **Investigate how different modeling tools and approaches can be used to meet different forecasting and scenario planning needs** to mitigate uncertainties related to the above key demand drivers.
- **Develop 3-5 case study examples** from different regions of the country that demonstrate the use of these methodologies, and identify gaps, new opportunities, and constraints.
- **Provide a set of recommendations and guidance to water utilities** on what factors could be included in water demand forecast models, what uncertainties remain, and the budgetary/resource requirements necessary to utilize the method.

WRF 5359: Building Better Forecasts: Improving Utility Demand Models with Climate, Development, and Socio-Economic Insights

Get Involved in Research

Utility Participation in Research

WRF invites subscribing utilities to participate as test facilities, provide water samples, respond to surveys, loan equipment, or share staff expertise on research projects. Participating utilities gain firsthand information on the study and benefit from working with researchers and others in the water community. Projects benefit from participation by a diverse group of utilities. Only subscribing utilities will be listed on Requests for Proposals. If you are interested in becoming a subscriber, please visit "Become a Subscriber."

UPIR INFORMATION SHEET

VOLUNTEER YOUR UTILITY

Subscribing members

THE Water Research FOUNDATION

Sydney Samples

Research Program Manager

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The Water Research Foundation

www.waterrf.org

Residential End Uses of Water, Version 3: A Single-Family and Multi-Family Study (5242)

Peter Mayer

Principal, WaterDM

Residential End Uses of Water, Version 3: A Single-Family and Multi-Family Study (5242)

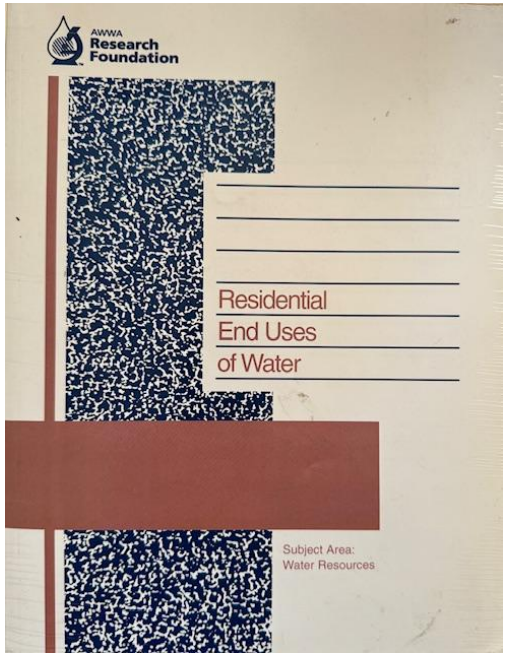
Alliance for Water Efficiency Symposium
August 8, 2025
Chicago, IL

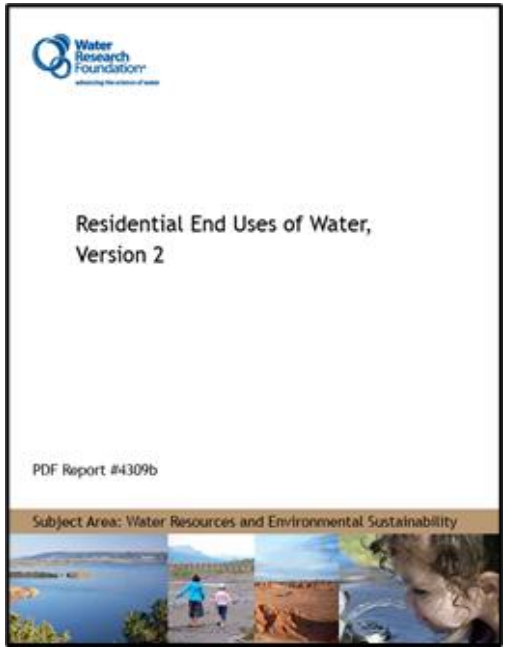
flume™

WaterDM
DEMAND MANAGEMENT

THE Water Research FOUNDATION

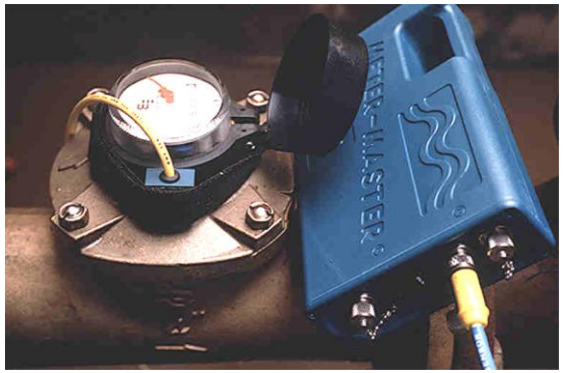
30 Years of Residential End Uses of Water Studies - Consistency and Innovation

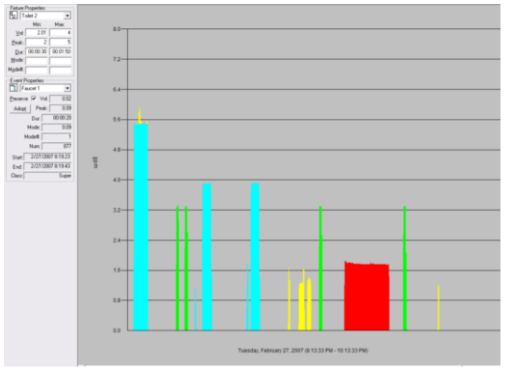




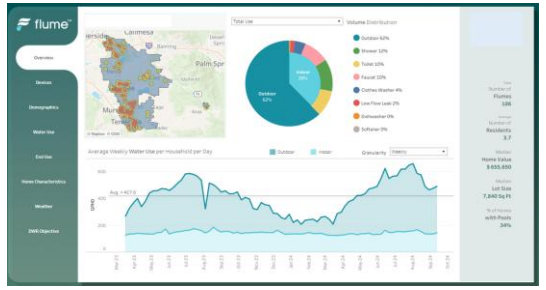
Residential End Uses of Water, Version 3

2026





Data loggers, Trace Wizard software



Flume

Project Approach

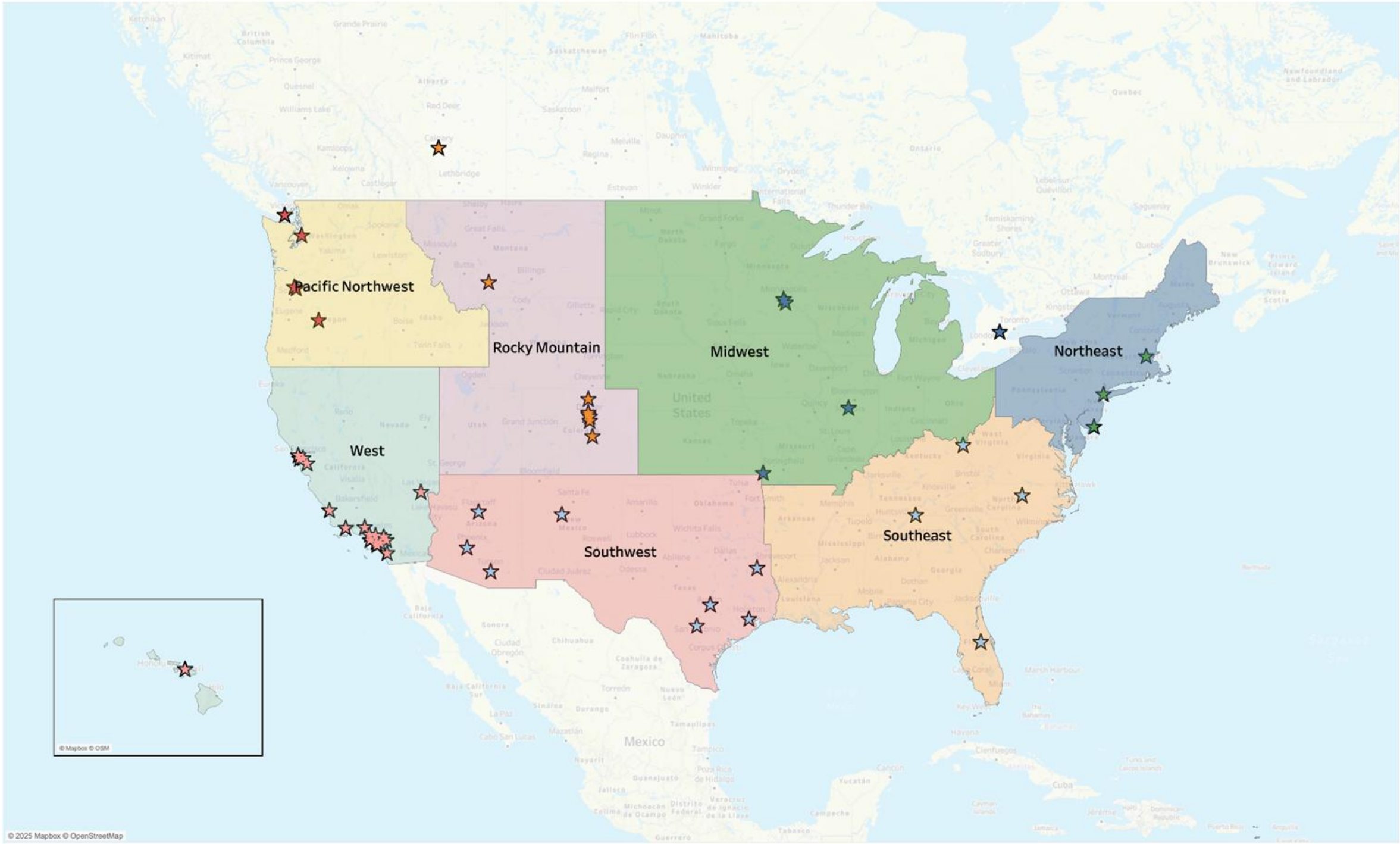
Regional Single-Family End Use Analysis - Flume data will be used to characterize and compare single-family residential water use across seven regions of the US and Canada.

Opportunistic Multi-Family End Use Analysis - The Flume team is using new and existing Flume data from Flume devices installed in multi-family apartments and condos

Utility Single-Family and Multi-Family Water Use Analysis - Utility billing data and Customer survey info.

- Annual, Indoor, Outdoor (seasonal/non-seasonal)
- minimum month, average of winter months, and a statistical approach leveraging Flume data (Butterfly).
- Customer survey with > 62,000 total responses


Pacific Northwest
Rocky Mountain
Midwest
Northeast
West
United States
Southwest
Southeast
Mexico
© 2025 Mapbox © OpenStreetMap


Pacific Northwest
Rocky Mountain
Midwest
Northeast
West
Southwest
Southeast
United States
Mexico
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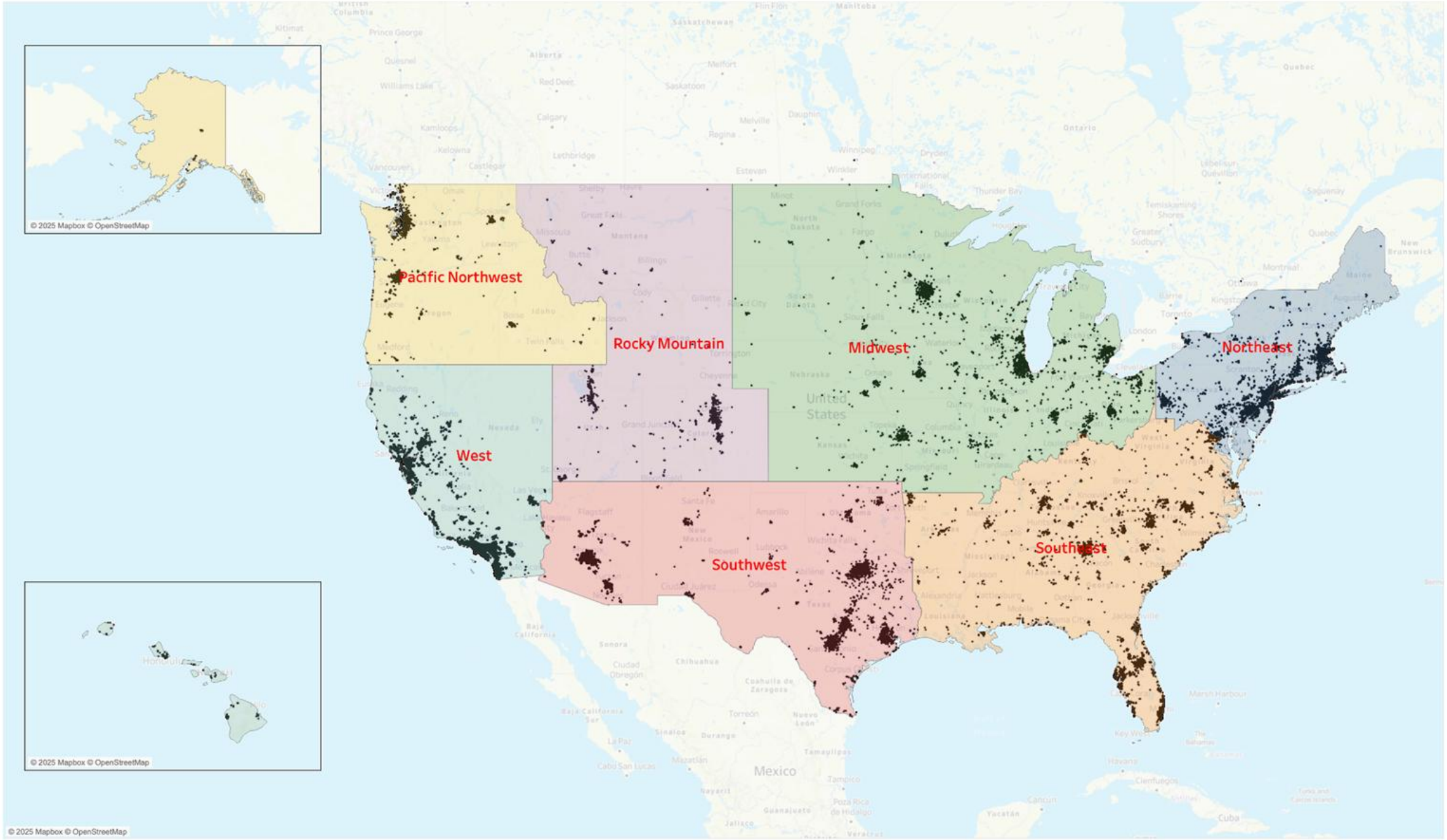
52 Participating North American Water Agencies

Alameda County Water District
Albuquerque Bernalillo County WUA
American Water - Chattanooga
American Water - Huntington
American Water - Joplin
American Water - Lincoln
American Water - Ocean City
Capital Regional District
Centennial Water and Sanitation District
City and County of Broomfield
City of Bend
City of Bozeman
City of Calgary
City of Durham
City of Eagan
City of Flagstaff
City of Fort Collins
City of Goodyear
City of Houston
City of Kilgore
City of Lake Oswego
City of Long Beach
City of Minneapolis
City of Round Rock
City of San Luis Obispo
City of Santa Barbara
City of Tucson
City of Westminster
Colorado Springs Utilities
County of Maui, Dept of Water Supply
Denver Water
East Bay Municipal Utility District
Eastern Municipal Water District
Guelph
Irvine Ranch Water District
Los Angeles Dept. of Water and Power
Marin Water
NYC Department of Environmental Protection
Orange County Utilities
Orlando Utilities Commission
San Antonio Water System
San Francisco Public Utilities Commission
Santa Clarita Valley Water Agency
Santa Margarita Water District
Seattle Public Utilities
South Coast Water District
Southern Nevada Water Authority
Tualatin Valley Water District
Vallecitos Water District
Walnut Valley Water District
Water Supply District of Acton
Western Water

Flume Locations



Number of Flumes in each region in 2024. Total number: 78,983

West	53,923
Southwest	8,955
Southeast	5,671
Northeast	3,805
Midwest	3,448
Pacific Northwest	2,087
Rocky Mountain	1,094

Let's Play Kahoot!

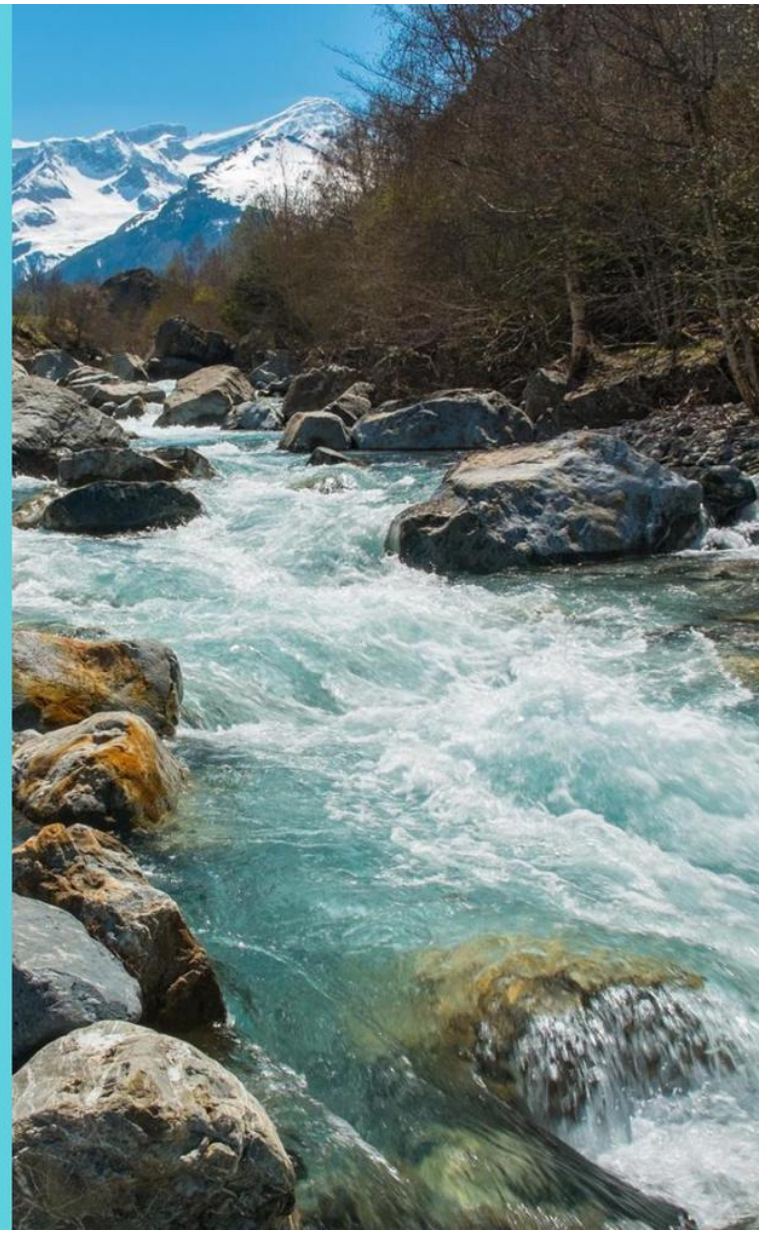
- What is Kahoot?
  - A very fun trivia game for us to learn about the REUWS studies
- How do we play?
  - Each table is a team
  - 1 person from each team will login to Kahoot on their phone to submit answers for the team
  - A question will appear on the screen and the team has 30 seconds to discuss and submit an answer
- How do we win?
  - By getting the question right!
  - Points are based on accuracy, not speed
  - But you must submit an answer within 30 seconds
- How do we start?
  - Navigate to the website and enter the game code (www.kahoot.it)

The Big Reveal:

First Insights* from the Residential End Uses of Water Study

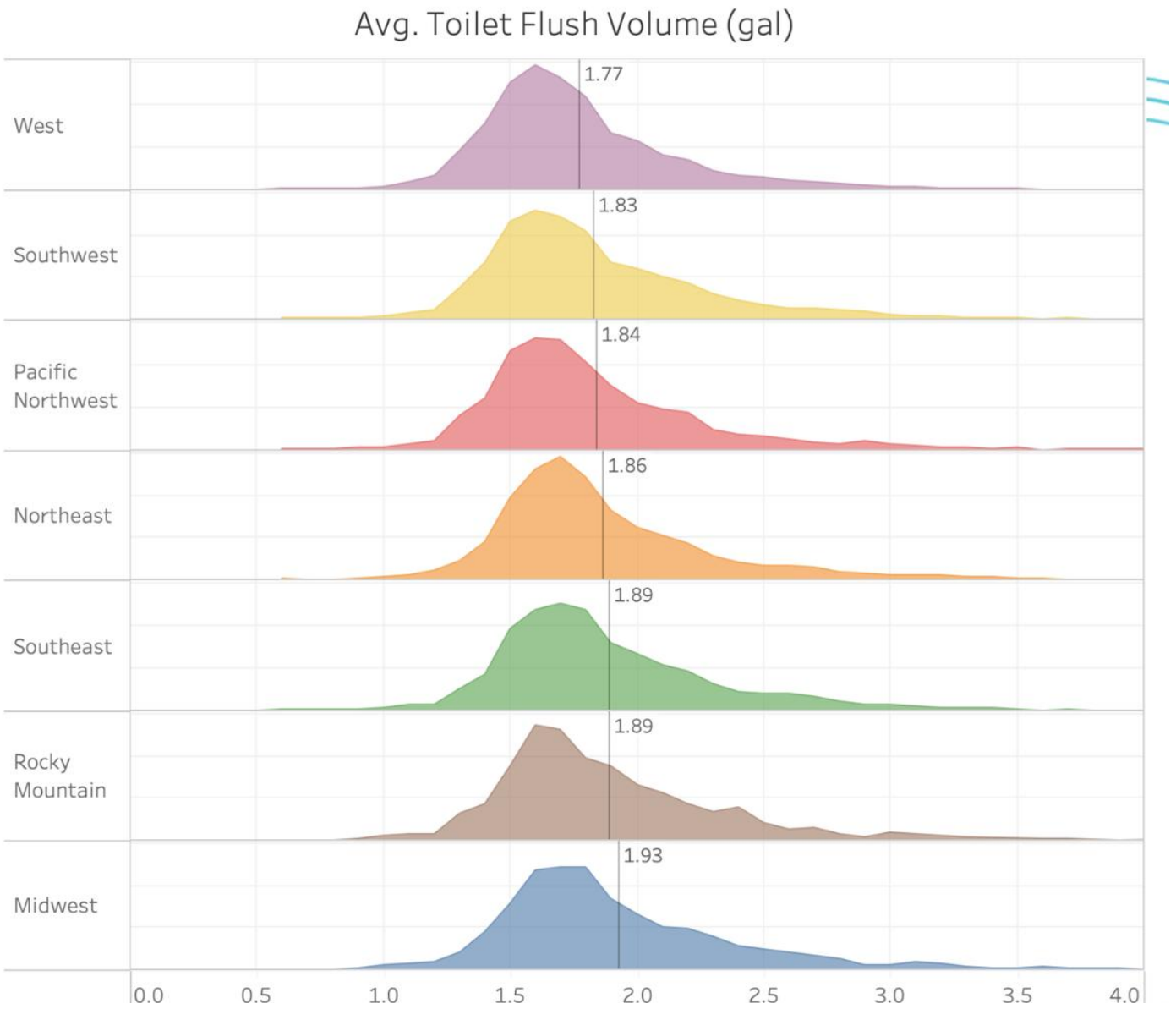
**Research in progress: results subject to change*

flume™ | August 8, 2025

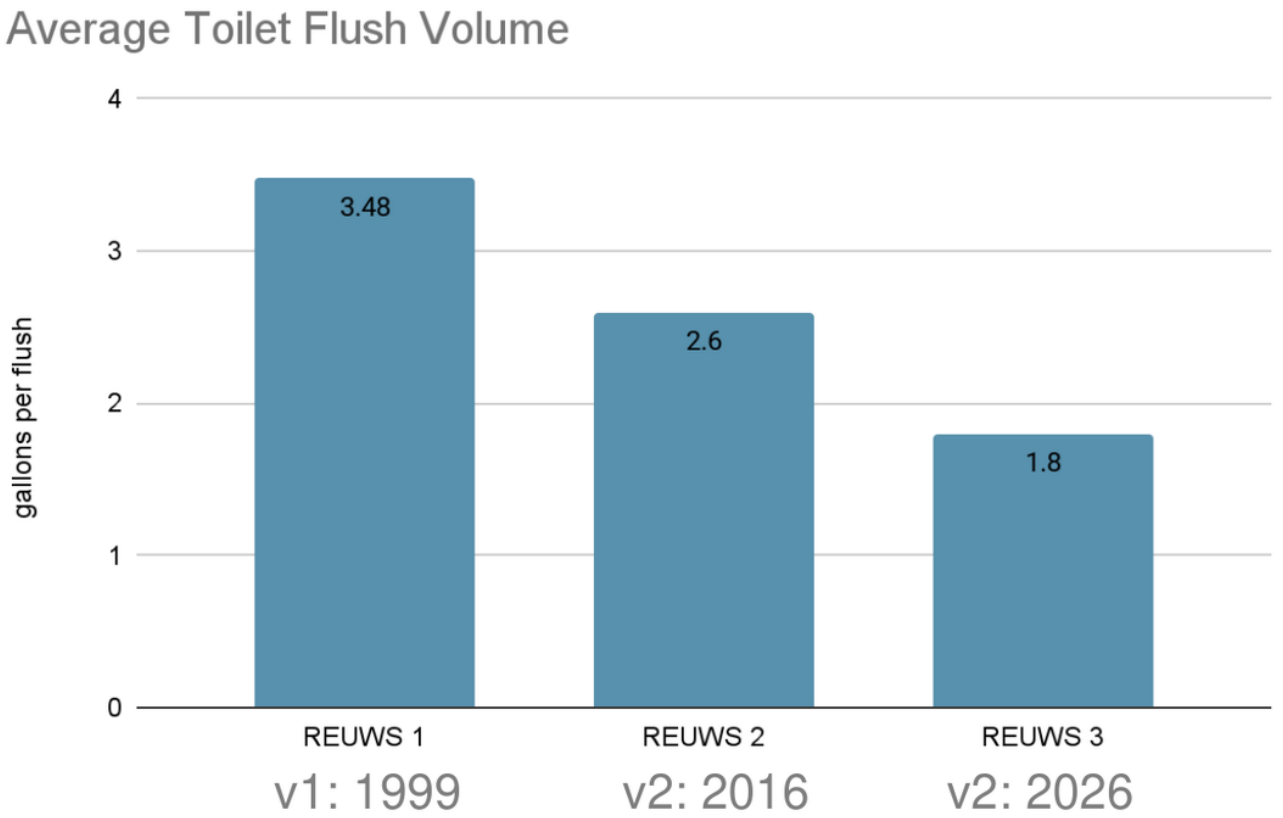


WATER EFFICIENCY & CONSERVATION SYMPOSIUM

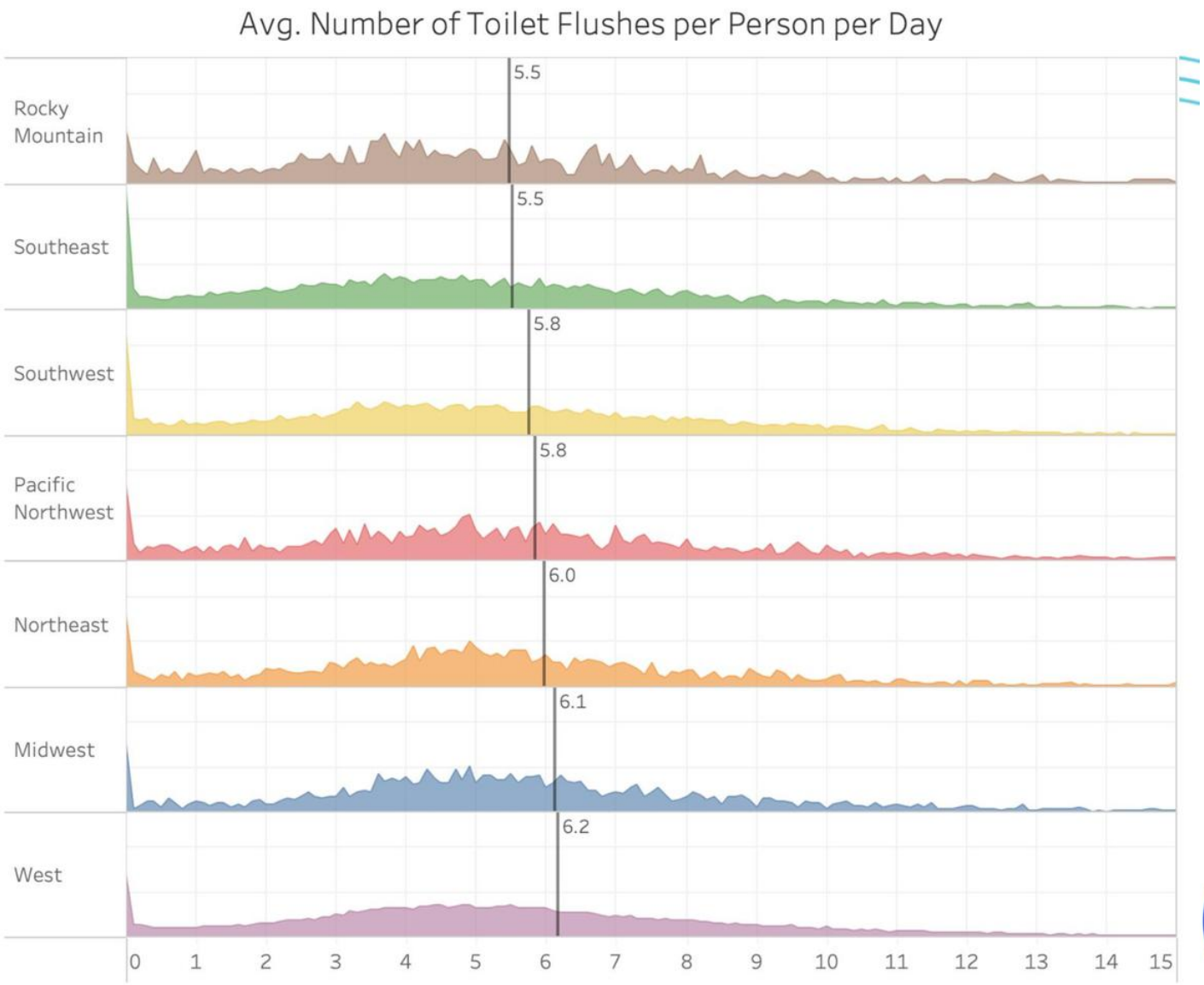
Toilet Flush Volume



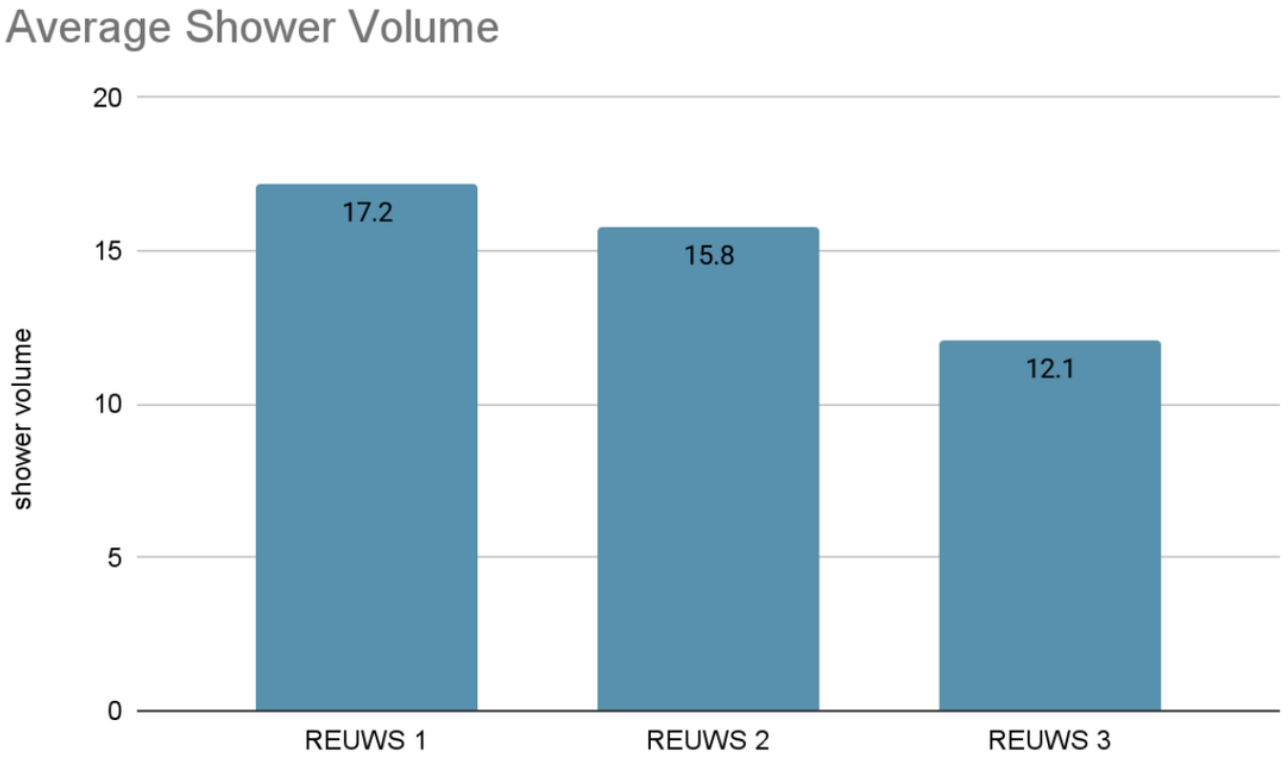
Toilet Flush Volume



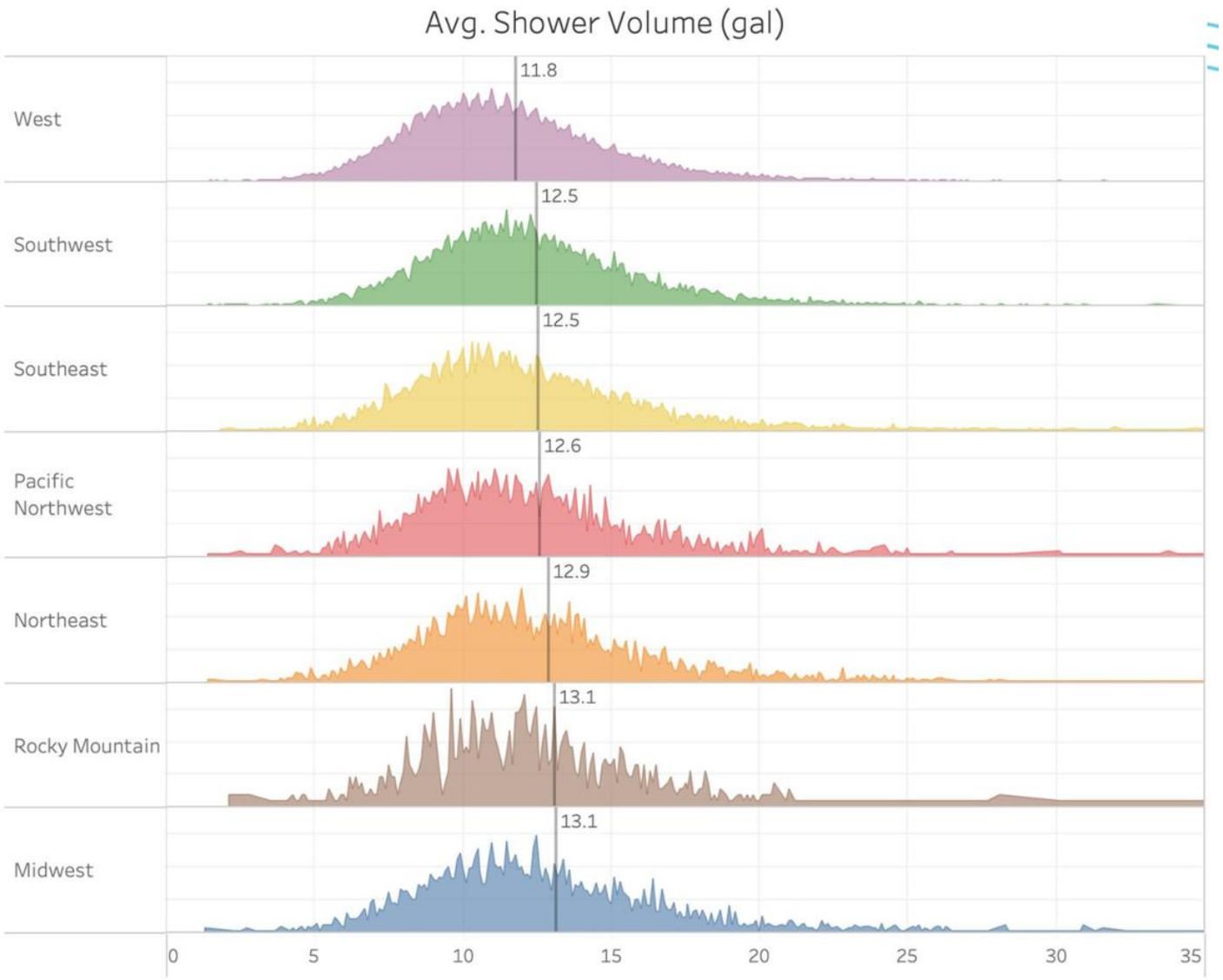
Toilet Flush Frequency



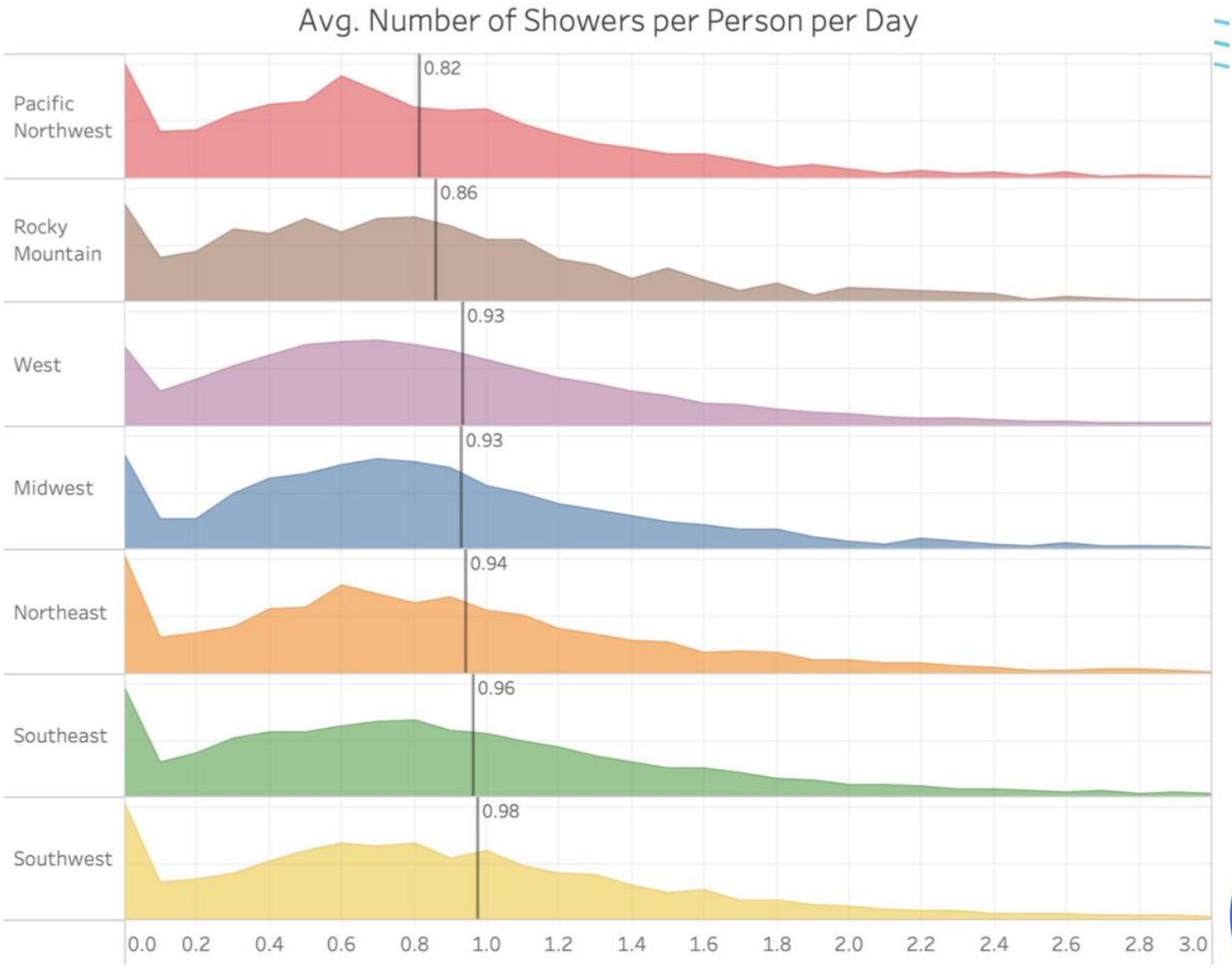
Shower Volume



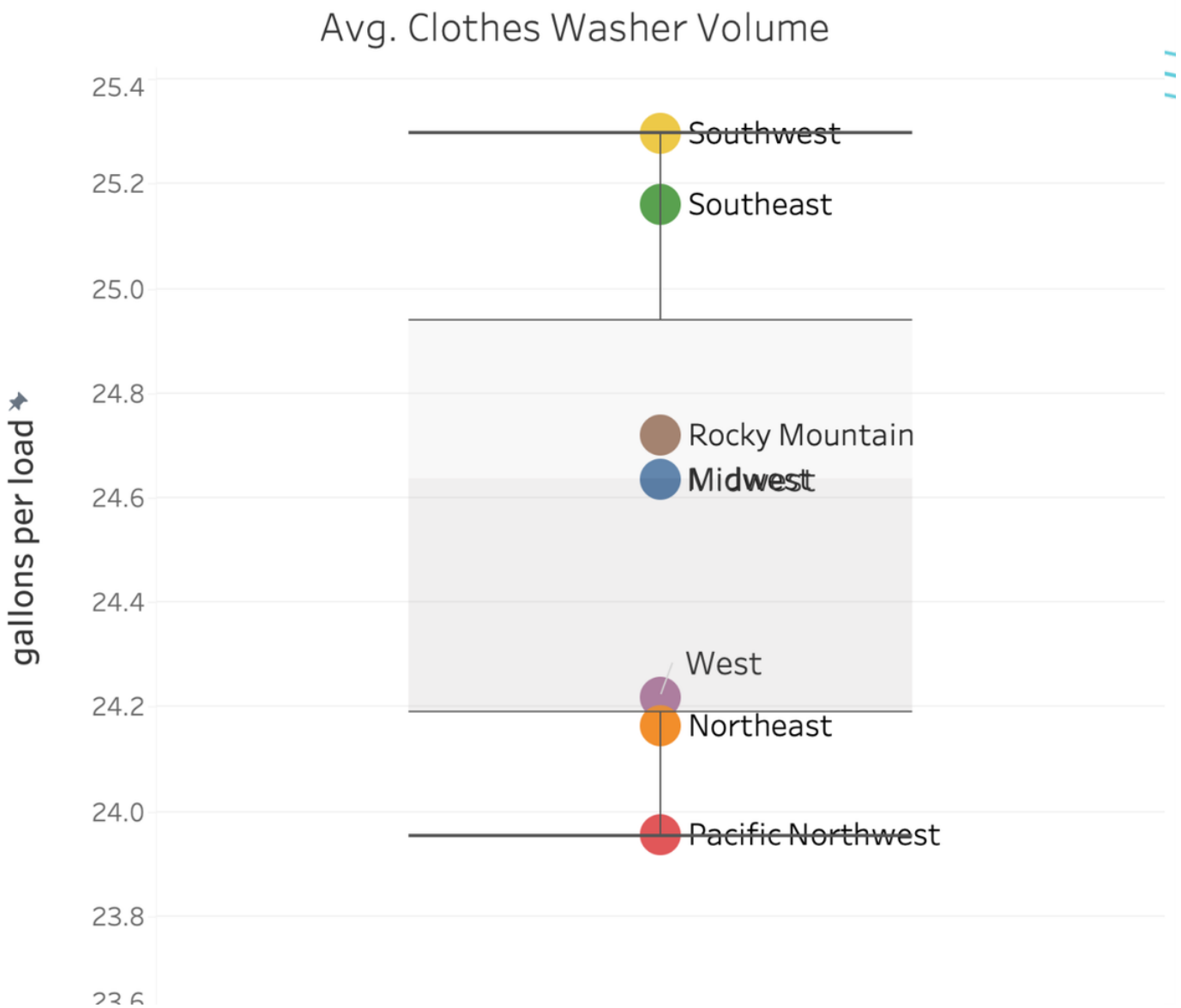
Shower Volume



Shower Frequency



Clothes Washer Volume



Project Team

- Sydney Samples, The Water Research Foundation - Research Manager
- Peter Mayer, WaterDM - Principal Investigator
- Joe Fazio, Flume - Project Manager
- Sarah Musiker, CWA - Asst. Project Manager
- James Fazio, Flume - Technical Team Manager
- Max Behrens, Flume - Data Analyst
- Katie Frick, Flume - Utility Liaison and Survey Lead
- Ralph Kaiser, Flume - Utility Coordinator
- Jeff Hufford, Flume - Data Scientist
- Aggrey Muhebwa, Flume - Data Scientist
- Grant Bernosky, Flume, - Data Scientist
- Christian Johanson, Flume - Software Engineer

REUWS 3 Data Sets

- Utility monthly/bi-monthly billed consumption data - 5 years, > 40,000,000 accounts
- Customer survey with > 62,000 total responses
- Weather data - NOAA and CIMIS - temp., precip., ET
- Property data - from assessor records, purchased from vendor
- Water and wastewater rates (2024) – all participating utilities
- US Census data – avg. persons per household
- Flume water use and demographic data ~ 78,000 devices (2024)
  - Regional single-family end use analysis
  - Multi-family end use analysis

What's in the Final Report?

- Detailed assessment of residential water use
- Range and variability across water providers
- Single-family and multi-family
- Comparisons over time - REUWS 1, 2, 3
  - Changes in use
  - Changes in water rates
  - Changes in fixtures and appliances
  - Changes in customer attitudes

Next Steps - Residential End Uses of Water, V3

- Data collection and ingestion
- Data analysis
- Prepare deliverables
  - Final report
  - Executive summary
  - Data dashboard
  - Data set

Draft report - Dec. 15, 2025

Final draft report - Mar. 15, 2026

THE Water Research FOUNDATION

Residential End Uses of Water, Version 3:
A Single-Family and Multi-Family Study (5242)

THANK YOU

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joe@flumewater.com

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WaterDM
DEMAND MANAGEMENT

THE
Water
Research
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50L Home Project

Maureen Erbeznik

Principal, Maureen Erbeznik & Associates

50L Home LA Pilot

AWE Symposium

August 8th, 2025

LA Pilot Overview

50L HOME

Our vision: Irresistible innovations that transform urban water and buildings into low-carbon, safe, and sustainable systems.

Drawing on its unique connection to private sector know-how and the innovations created in early city pilots and policy engagements, the 50L Home Coalition will **pioneer a movement** to mainstream disruptive, inclusive and responsible water access solutions, driving down energy consumption to deliver efficiency globally.

Supported by the Secretariat:
World Business Council for Sustainable Development and the World Economic Forum.

Members

GRUNDFOS
IKEA
P&G
Electrolux Group
KOHLER

Partners

City of Phoenix
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epiccleantec WATER SOLUTIONS FOR THE MODERN WORLD
flume™
WATEREUSE
IDRA
NWP Netherlands Water Partnership
waterwise
Scottish Water Always serving Scotland

Pilot Objectives

- **Develop and test integrated innovations** to achieve the 50-Liter goal (13 GPCD)
- **Enhance household experience** — less time, less effort, better performance
- **Define rebates and policies** to rapidly scale adoption

Phase 1: Baseline

Phase 2: Market Available

Phase 3: New Innovations

(Hot) Water Use Measurement

Sensors-based, Passive Monitoring

Flume:
Whole House Water
Every 5 seconds

Droople:
Points of Use
Hot & Cold Water
Every minute

50L HOME

LA Pilot Phase 2 Scope

50L HOME

KITCHEN

LAUNDRY

BATHROOM

Phase 2 Results

Retrofitted Homes Avg 87 LCPD (23 Gallons)

- **21% reduction** in total water use compared to the control group
- LA average indoor water use is 180L (per person per day

Hot water use decreased by 23%

- Translates into an 18% reduction in energy

Dish Cleaning – Less Resources, Time & Effort

- 34% Hot Water Use

- Less hand-washing
- No soaking, no scrubbing

-15% Less Sink Use

- Maximize use w/ superior cleaning
- No pre-rinsing, no rewashing

*"[P&G Dawn EZ Squeeze and Dawn Powerwash] are **less water consuming because they're more effective**."*

*"We used to do a lot of pre-rinsing…we don't do quite as much anymore because **the dishwasher is a little more efficient.**"*

Cold Water Laundry & More Efficient

*"I **don't have to think anymore about sorting clothes** before loading the machines… […] **I like doing laundry now!**"*

***-55%** hot water*
***-22%** water per washing machine cycle*

50L HOME

Showers – More Delightful Products and Efficient Fixtures

*"I **definitely cut the time**… I have thick hair… [the shampoo] does not stick in there, it takes less time."*

-20% water per shower
-6% time spent in shower

50L HOME

Toilets – Key Behavioral Observation

High Efficiency Single Flush vs. Dual Flush

1.0 gpf

1.6/1.1 gpf

-16% less water use

-23% water in a sub-group of homes with single flush

+35% water in a sub-group of homes with dual flush

50L HOME

Phase 3 Update

LA Pilot - Phase 3 Innovations

Phase 3 of the project features state-of-the-art water-saving showerheads, faucets, dual-flush toilets, next-gen washers, as well as eco-friendly consumable products and innovative water reuse solutions.

50L HOME

Kitchen

Ultra efficient kitchen faucet **1.0 gpm**

Dishwasher with Smart Boost and Lux Care

Bathroom

Ultra efficient showerhead **1.25 gpm**

Dual flush toilet **1.0/0.8 gpf**

Shower booster (on/off button)

Faucet mister

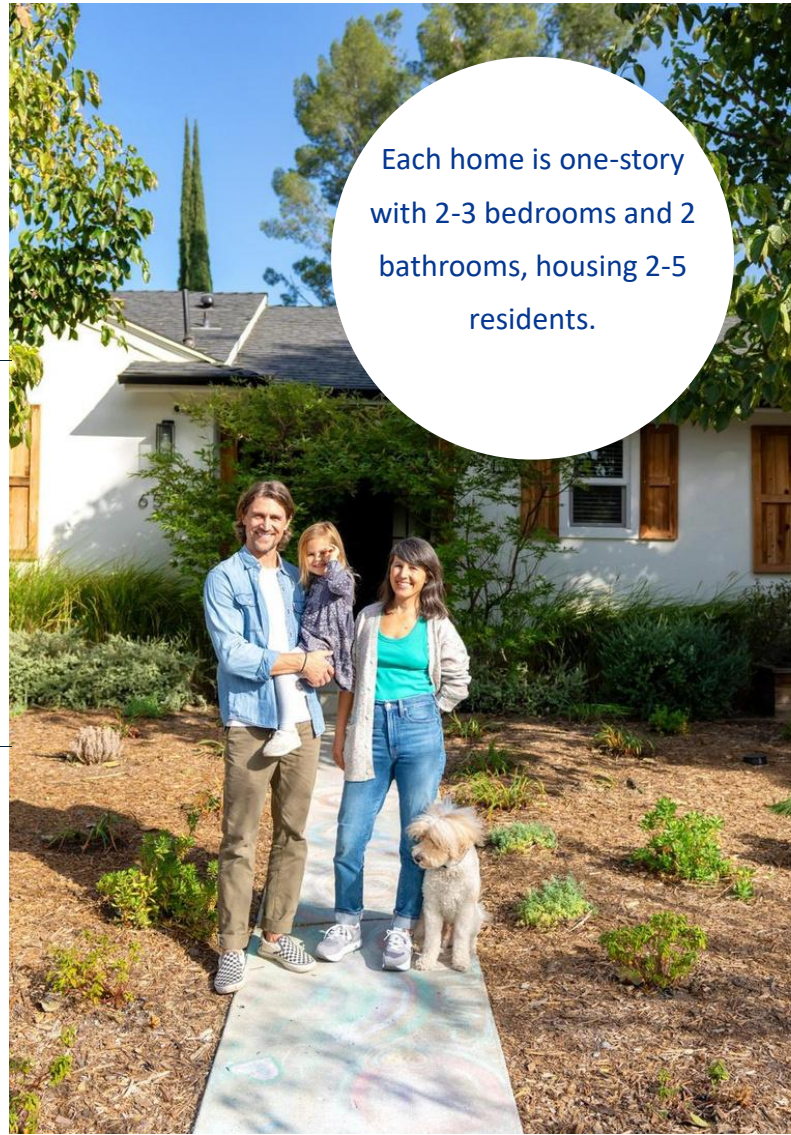
Ultra efficient faucet **0.5 gpm**

Water Reuse Solutions

Recirculating Shower and Auto Diverter

Laundry Room

Perfect Steam Washer and Dryer with LuxCare Plus Wash and SmartBoost

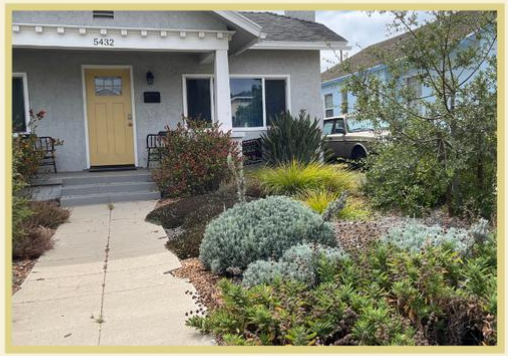


Each home is one-story with 2-3 bedrooms and 2 bathrooms, housing 2-5 residents.

Landscape Transformations

3 Homes

- Remove and dispose of turf using sod cutter (no chemicals)
- Convert overhead spray irrigation to drip
- Contour for rainwater capture
- Sheet mulch for soil health
- Plant native and climate appropriate plants - 80% coverage



Polyculture Lawns

2 Homes

- Scalp existing turf
- Dethatch existing turf
- Irrigation tune up
- Core aerate
- Contour for rainwater capture
- Overseed with Flower to the People Seed Mix

Comprehensive Monitoring - 2 Years

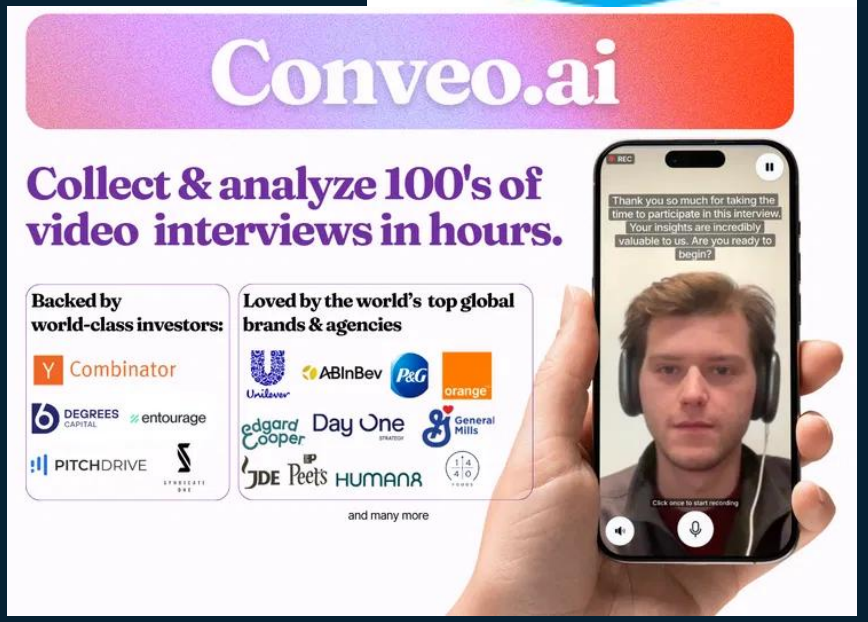
- Infiltration Rate
- Compaction and Root Depth
- Soil samples
  - Organic carbon & bulk density
  - Water holding capacity
  - Biological health assessment
- Brix Test (plant health)
- Water Use
- Above Ground Biodiversity Count

Recirculating Shower

- Bathroom remodel complete
- Installed floor receptor
- Passed City of LA inspection
- Ozone based treatment
- Inspection for compliance
    - IAPMO Interim Guide Criteria 330-2023

Behavioral Analysis

- Continue with behavioral analysis & gathering consumer insights
- AI monitored interviews



KEY DATES

Secure Title Sponsor (Complete)

Procter & Gamble ($50,000)

Secure Partner Sponsors

April 14, 2025

Start Date (Planned)

June 2, 2025

Judging (Planned)

November 15, 2025

Announce Winners (Planned)

December 1, 2025

TIMELINE

Development Phase (8 Weeks)

Build competition materials, recruit judges, and finalize framework.

Promotion Phase (4 Weeks)

Announce the challenge, attract participants, and drive registrations.

Design Challenge (10 Weeks)

Teams develop and submit their architectural solutions.

Judging Phase (2 Weeks)

Industry experts evaluate submissions – impact, feasibility, innovation.

Winner Announcement & Publication (2 Weeks) Showcase winning designs through digital publications and events.

Audience Q&A

Group Discussion

Sydney Samples, Peter Mayer, & Maureen Erbeznik

Moderated by Amy Talbot

Reminders & What's Next

Thank you all for participating in this session!

- **CEUs:** AWWA CA-NV Water Use Efficiency Practitioner and Irrigation Association

American Water Works Association California-Nevada Section

- **Next:** Track Sessions (2:15 – 3:10 pm)
  - The Illusion of Progress: Navigating Water Loss Reduction in an Era of Conservation **(Room 300)**
  - The Future of Demand Forecasting: Navigating Water Planning in a Changing World **(Room 400)**
  - From Root to Rise: The Growth of Residential Landscape Programs **(Room 621)**

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