

# Are There Savings in Lower GPM Showerheads?

Session 2C.

Changes in Residential Hot Water Use and Opportunities for Savings

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# Shower Standards Should Save Water

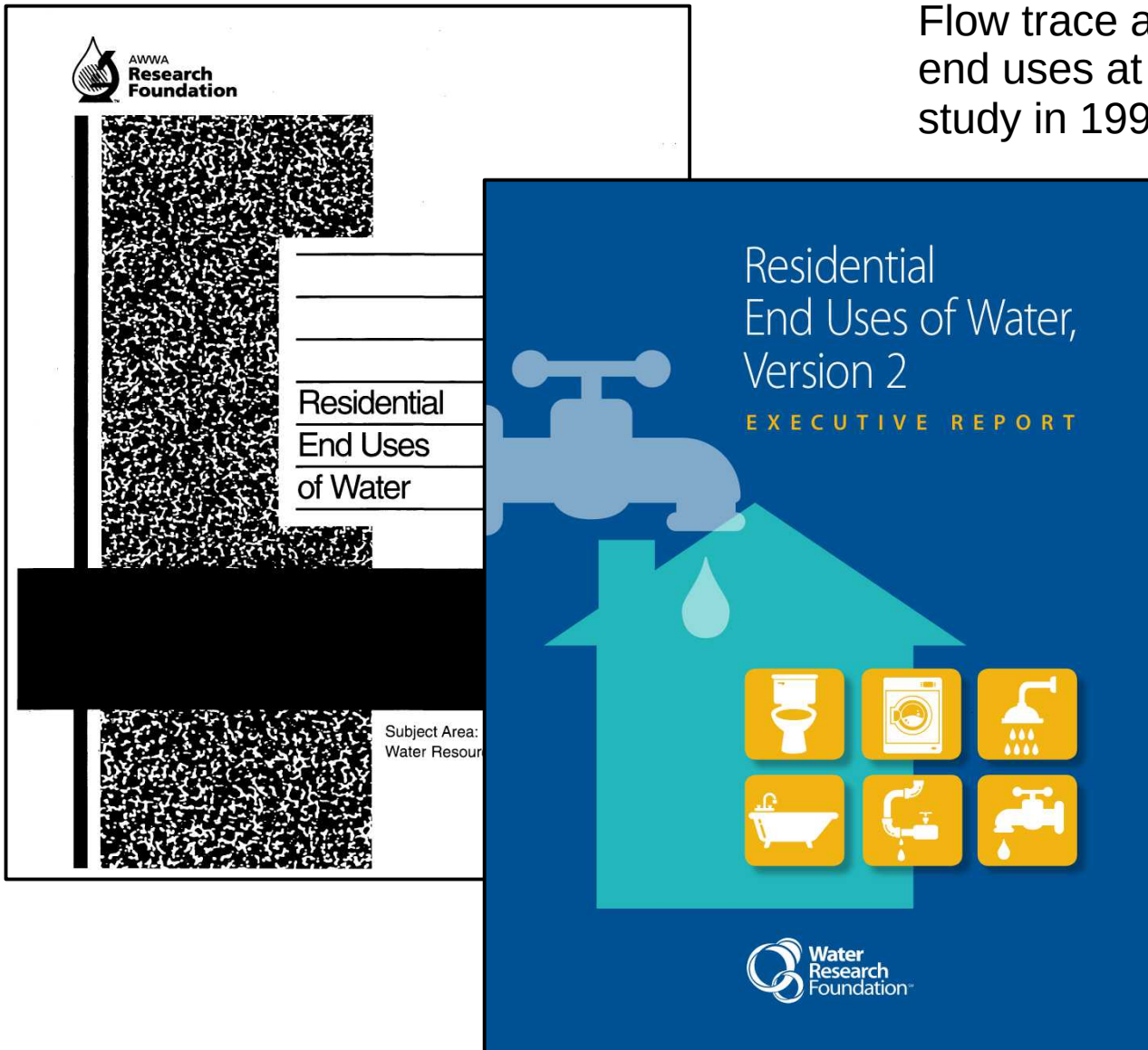
- first standards effective nationally 1994
- more stringent standards followed
- more likely to come

< 1994	~ 5.5 GPM	historical
1994	2.5 GPM	Energy Policy Act 1992
2010 2012 2014 2016	2.0 GPM	EPA WaterSense, New York City, Colorado, California,
July 2018	1.8 GPM	California
...	?	...

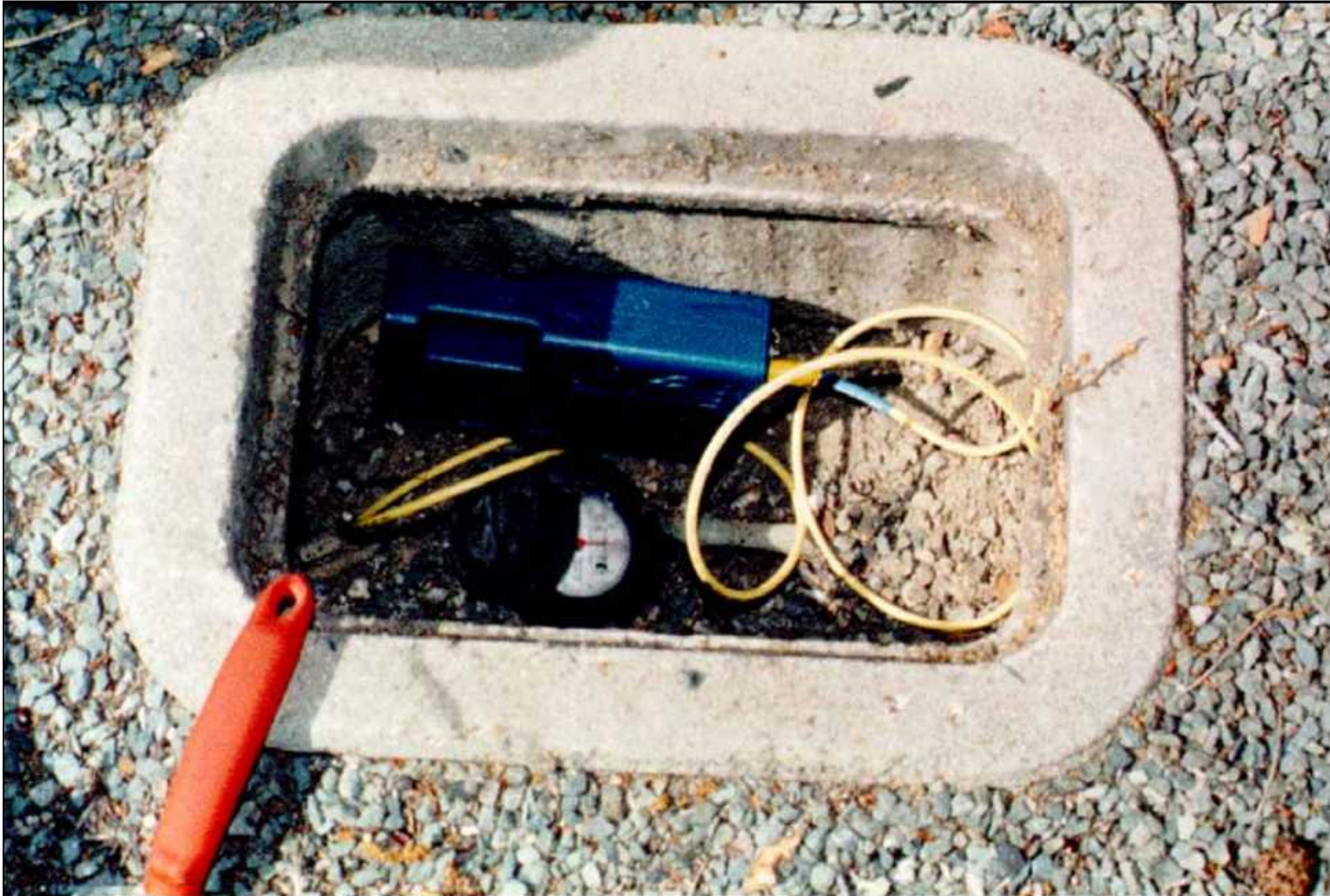
# Residential End Uses of Water

## Water Research Foundation

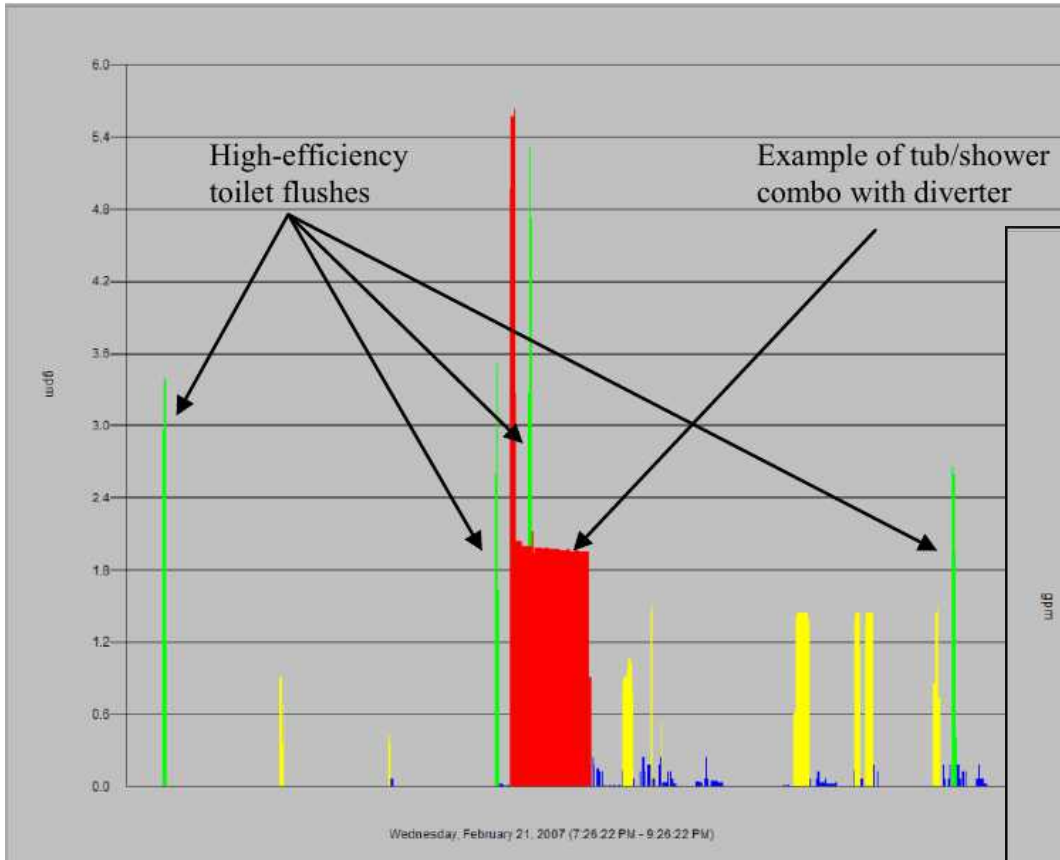
Flow trace analysis of whole house water end uses at several hundred homes. First study in 1999 and 2<sup>nd</sup> in 2011.



# Data Logger in Meter Pit

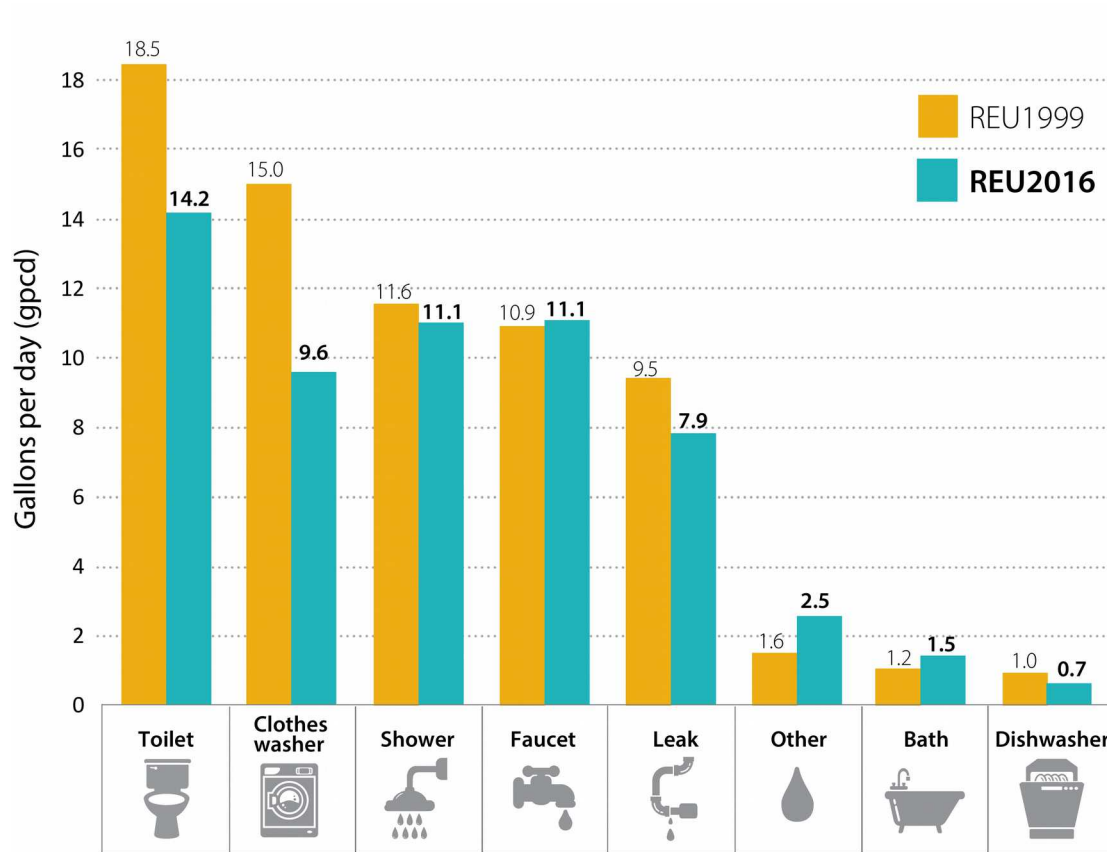


# Flow Trace Analysis



# Average Daily Indoor Per Capita Water Use

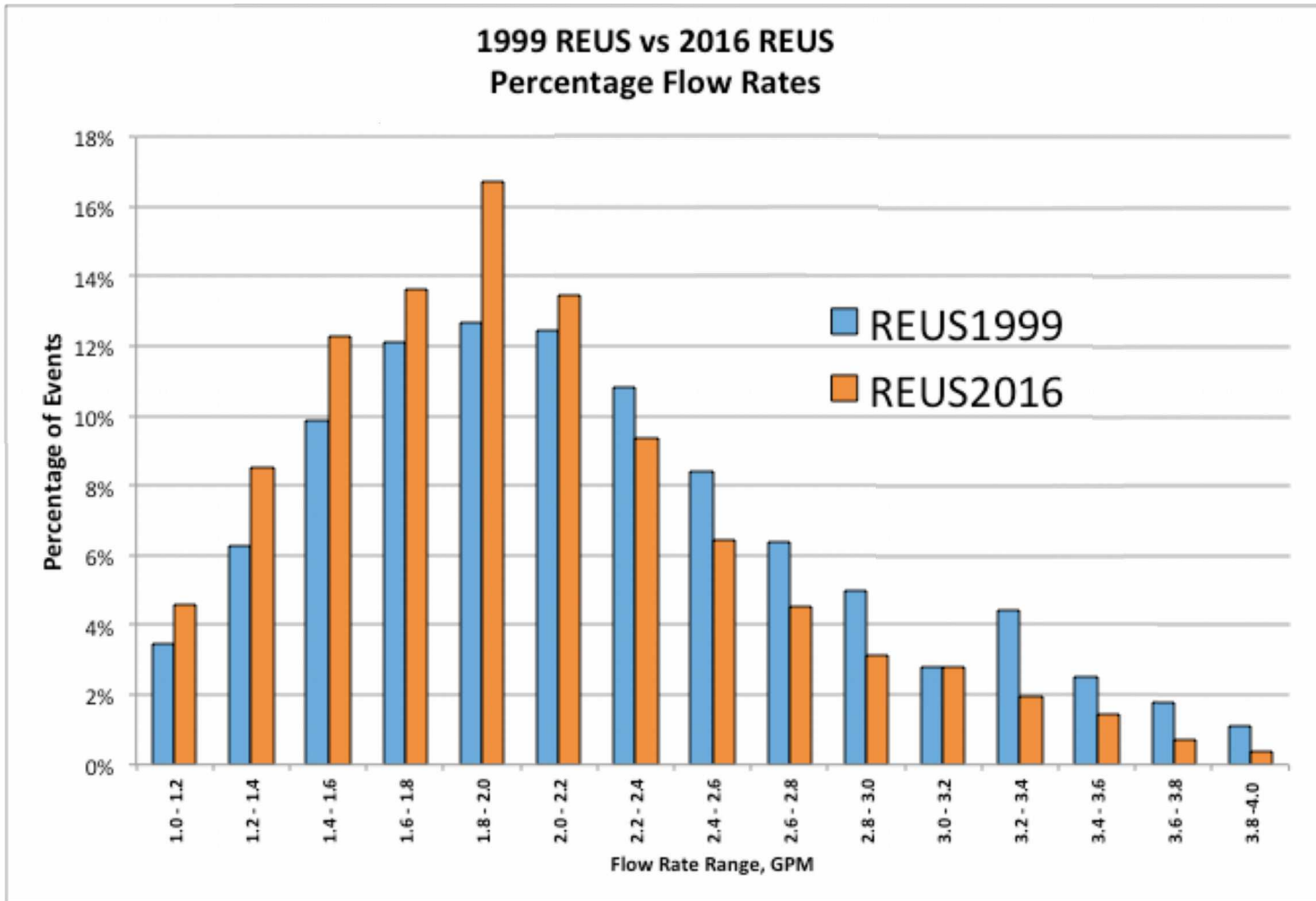
## REUWS 1999 and REUWS 2016



- 21% reduction in indoor use
- number of persons per home has not changed significantly
- reductions due mainly to better efficiency toilets and clothes washers
- only small reduction in shower use

# Why So Little Savings for Showers?

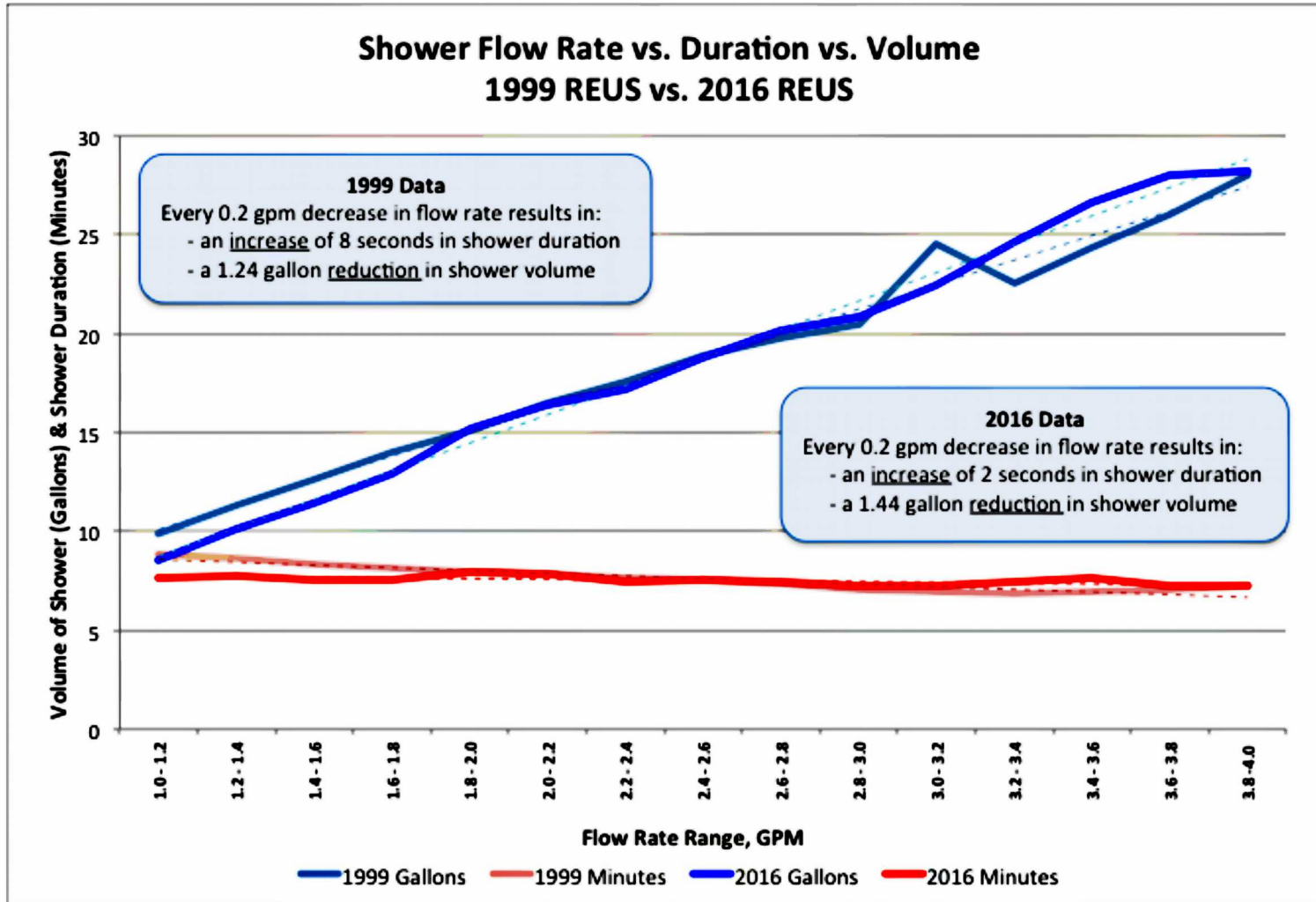
## Is it Flowrate?



Analysis  
from event  
data.

# Why So Little Savings for Showers?

## Is it Duration?



Analysis from event data.



# Water Conservation Pilot Studies

- Seattle and EBMUD water conservation studies
- pre and post-retrofit conservation measures
- total water and hot water both logged
- working with detailed flow data

**SEATTLE HOME WATER  
CONSERVATION STUDY**  
**THE IMPACTS OF HIGH EFFICIENCY  
PLUMBING FIXTURE RETROFITS IN  
SINGLE-FAMILY HOMES**

December 2000

Submitted to:  
Seattle Public Utilities  
and  
The United States Environmental Protection Agency

Prepared by:  
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[www.aquacraft.com](http://www.aquacraft.com)

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**RESIDENTIAL INDOOR WATER  
CONSERVATION STUDY:**  
**EVALUATION OF HIGH EFFICIENCY INDOOR  
PLUMBING FIXTURE RETROFITS IN  
SINGLE-FAMILY HOMES IN THE EAST BAY  
MUNICIPAL UTILITY DISTRICT SERVICE AREA**

July 2003

Prepared for and submitted to:  
East Bay Municipal Utility District  
and  
The United States Environmental Protection Agency

Prepared by:  
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# EBMUD Water Conservation Study

**Table 4.6 Comparison of baseline and post-retrofit per capita daily use – excluding leaks**

Category	Baseline (gcd)	Post-Retrofit (gcd)	Difference in Means (gcd)	% Change	t-Value	P-Value	Statistically significant difference?*
Bath	3.0	2.8	-0.2	-6.60%	0.578	0.5674	No
Clothes washer	13.9	8.8	-5.1	-36.70%	4.762	<0.0001	Yes
Dishwasher	1.0	0.9	-0.1	-10.00%	1.86	0.072	No
Faucet	10.5	10.5	0	0.00%	0.03	0.9759	No
Shower	12.0	10.7	-1.3	-10.80%	1.959	0.0589	No
Toilet	19.9	9.8	-10.1	-50.80%	9.129	<0.0001	Yes
<b>Indoor</b>	60.3	43.5	-16.8	-27.86%	7.631	<0.0001	Yes
Other/Unknown	0.1	0.4	0.3	75.00%	-2.614	0.0004	Yes
<b>Total</b>	60.4	43.9	-16.5	-27.32%	7.471	<0.0001	Yes
Avg. # of Residents per household	2.56	2.52					

\*95 percent confidence level

source: Mayer, Peter W., William B. DeOreo, Erin Towler, and David M. Lewis. "Residential Indoor Water Conservation Study: Evaluation of High Efficiency Indoor Plumbing Fixture Retrofits in Single-Family Homes in the East Bay Municipal Utility District Service Area." Aquacraft, Inc. Water Engineering and Management, July 2003.

# Seattle Water Conservation Study

**Table 3.3 Mean indoor per capita water use, baseline and post-retrofit**

<b>Category</b>	<b>Baseline (gcd)</b>	<b>Post- Retrofit (gcd)</b>	<b>Difference in Means (gcd)</b>	<b>% Change</b>	<b>t-Value</b>	<b>P-Value</b>	<b>Statistically significant difference?*</b>
Bath	3.7	2.7	-1.0	-27.9%	2.443	0.0147	No
Clothes Washer	14.8	9.2	-5.6	-37.7%	5.157	<0.0001	Yes
Dishwasher	1.4	1.2	-0.2	-13.6%	1.460	0.1446	No
Faucet	9.2	8.0	-1.2	-13.1%	3.310	0.0010	Yes
Leak	6.5	2.2	-4.3	-66.0%	9.891	<0.0001	Yes
<b>Shower</b>	<b>9.0</b>	<b>8.7</b>	<b>-0.3</b>	<b>-3.8%</b>	<b>0.740</b>	<b>0.4596</b>	<b>No</b>
Toilet	18.8	7.9	-10.9	-58.1%	25.29	<0.0001	Yes
<b>Indoor</b>	<b>63.4</b>	<b>39.8</b>	<b>-23.6</b>	<b>-37.2%</b>	<b>13.935</b>	<b>&lt;0.0001</b>	<b>Yes</b>
Other/Unknown	0.2	0.1	-0.1	-46.9%	1.570	0.1166	No
<b>Total</b>	<b>63.6</b>	<b>39.9</b>	<b>-23.7</b>	<b>-37.2%</b>	<b>13.927</b>	<b>&lt;0.0001</b>	<b>Yes</b>
Avg. # of Residents per household	2.54	2.51					

\*99 percent confidence level

source: Mayer, Peter W., William B. DeOreo, and David M. Lewis. "Seattle Home Water Conservation Study: The Impacts of High Efficiency Plumbing Fixture Retrofits in Single-Family Homes." Aquacraft, Inc. Water Engineering and Management, December 2000.

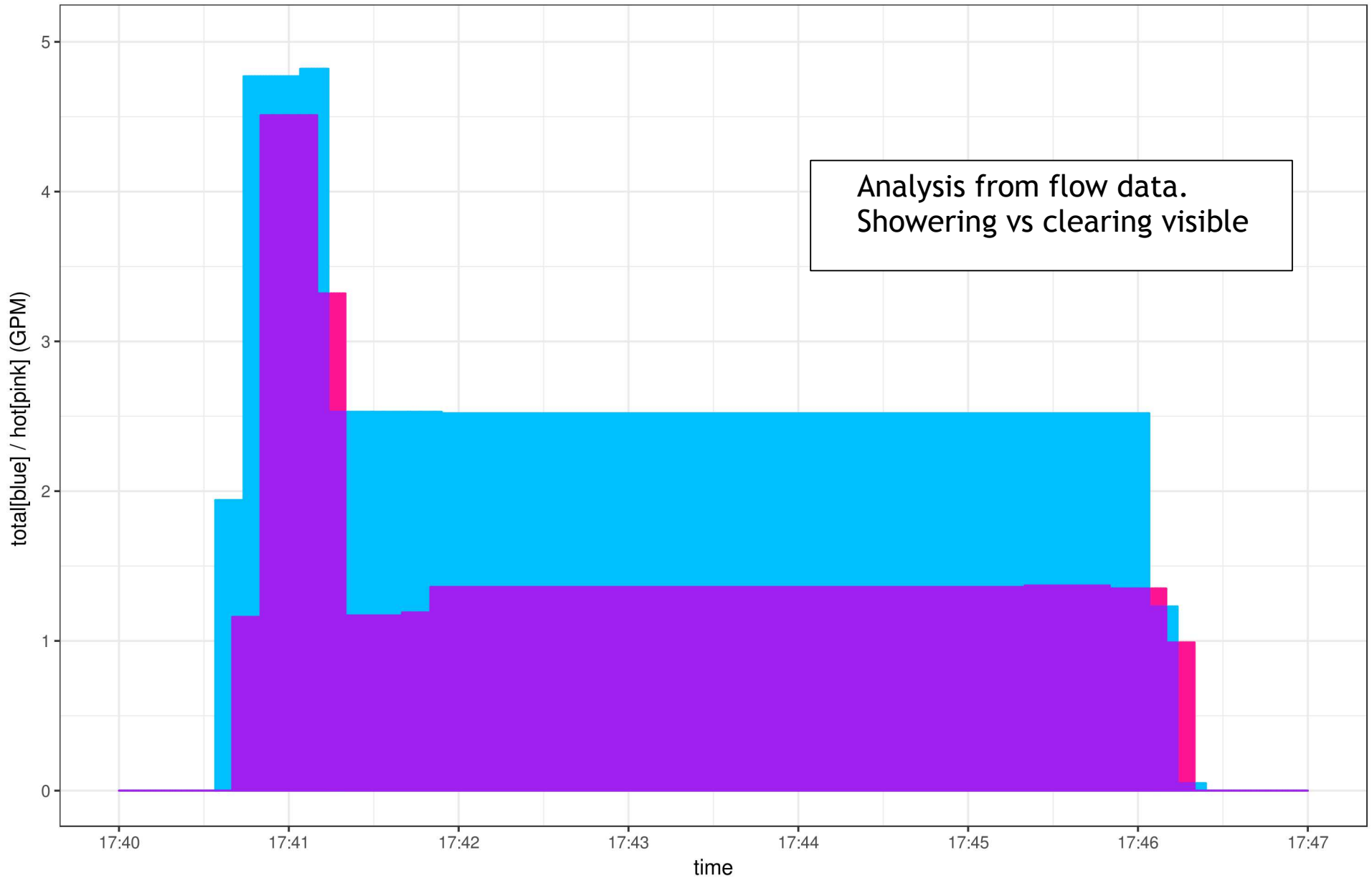
# Using Flow Data to Examine Showering

- developing algorithm to separate clearing and showering draws
- pre-retrofit to post-retrofit changes?
- showering draws
  - duration
  - flow rate
- clearing draws
  - volume

# Example Shower Interval Data

shower water flows for house 13431

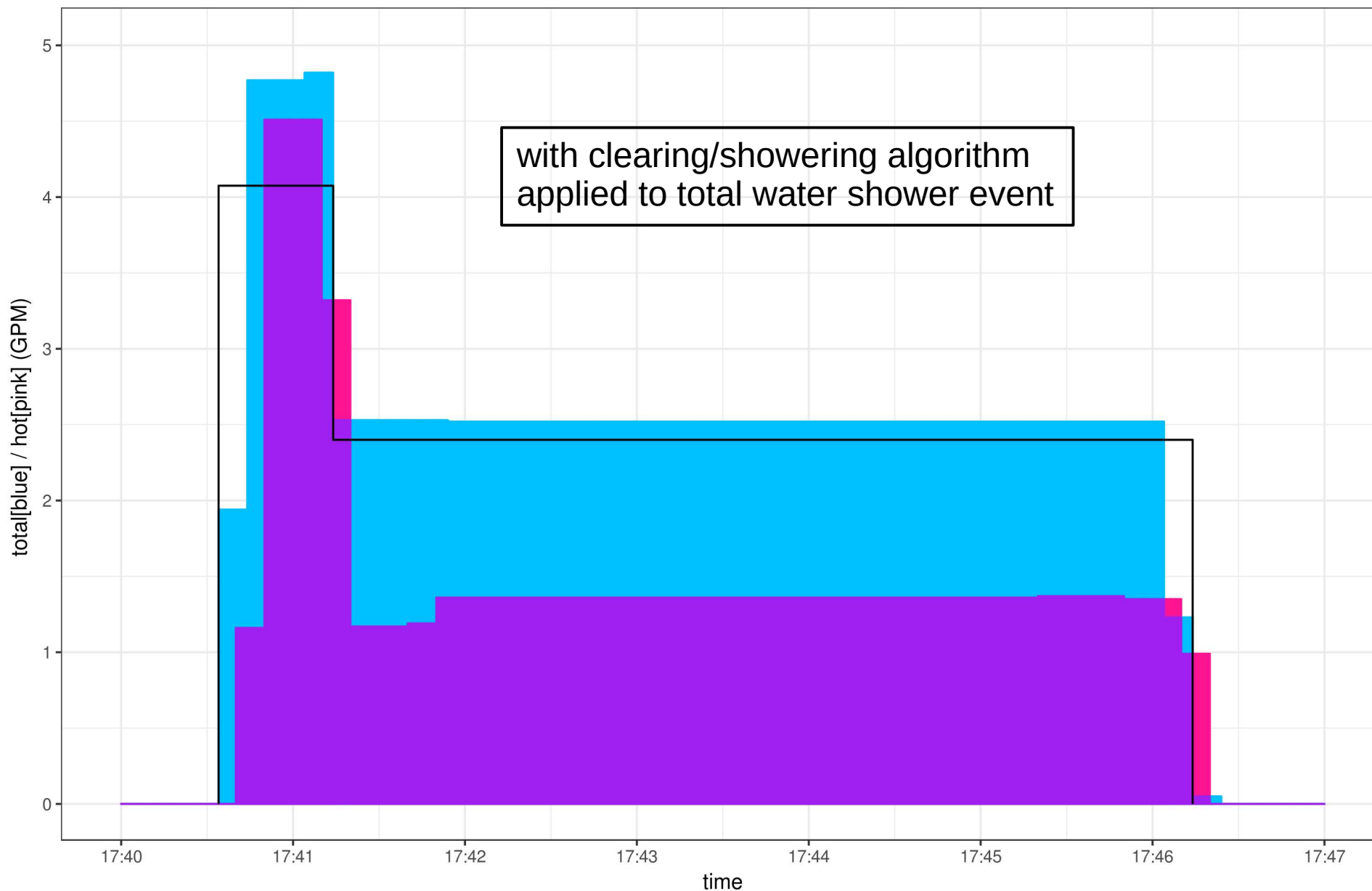
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# Example Shower Interval Data

shower water flows for house 13431

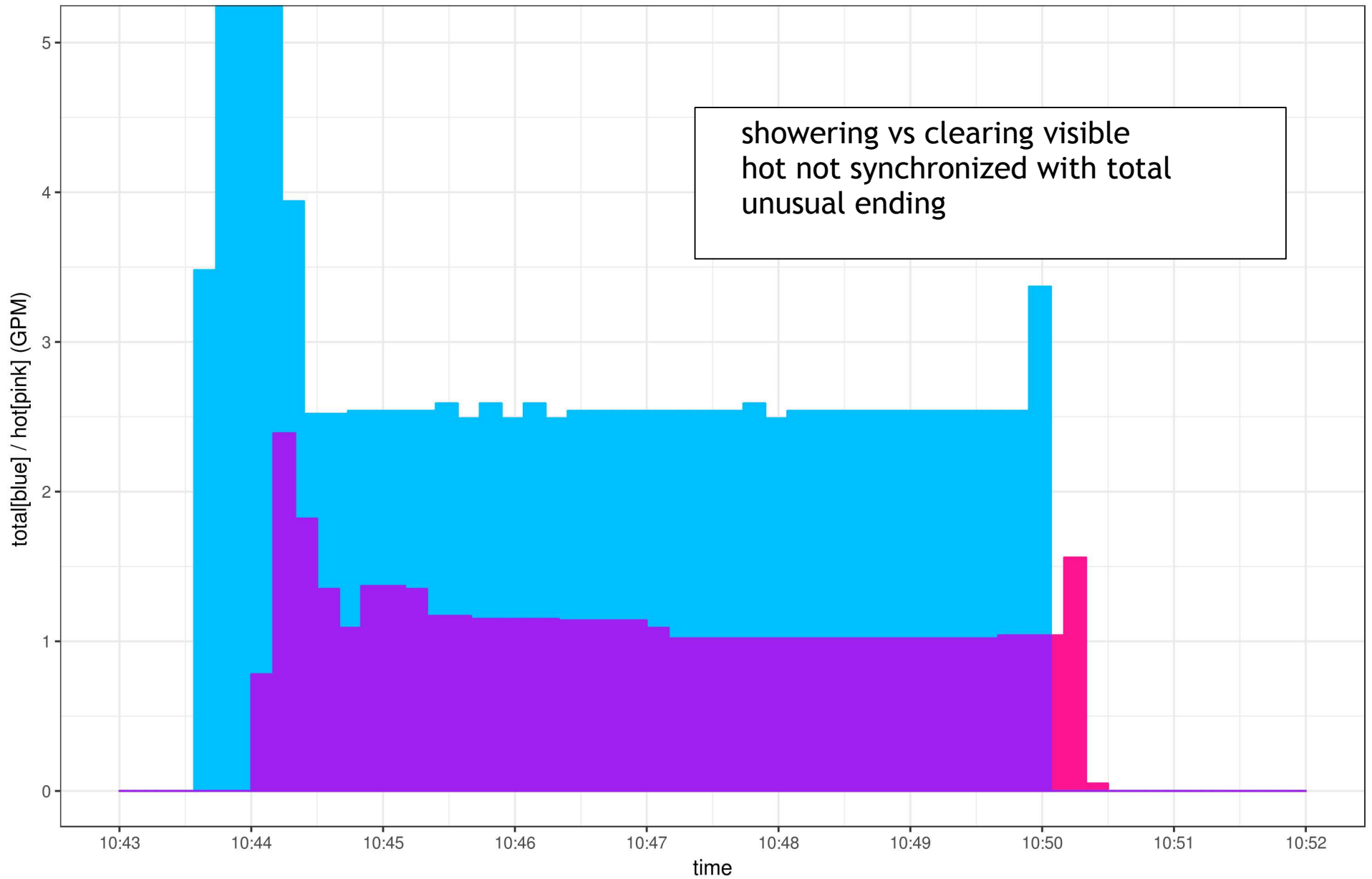
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# Devilish Details

shower water flows for house 13431

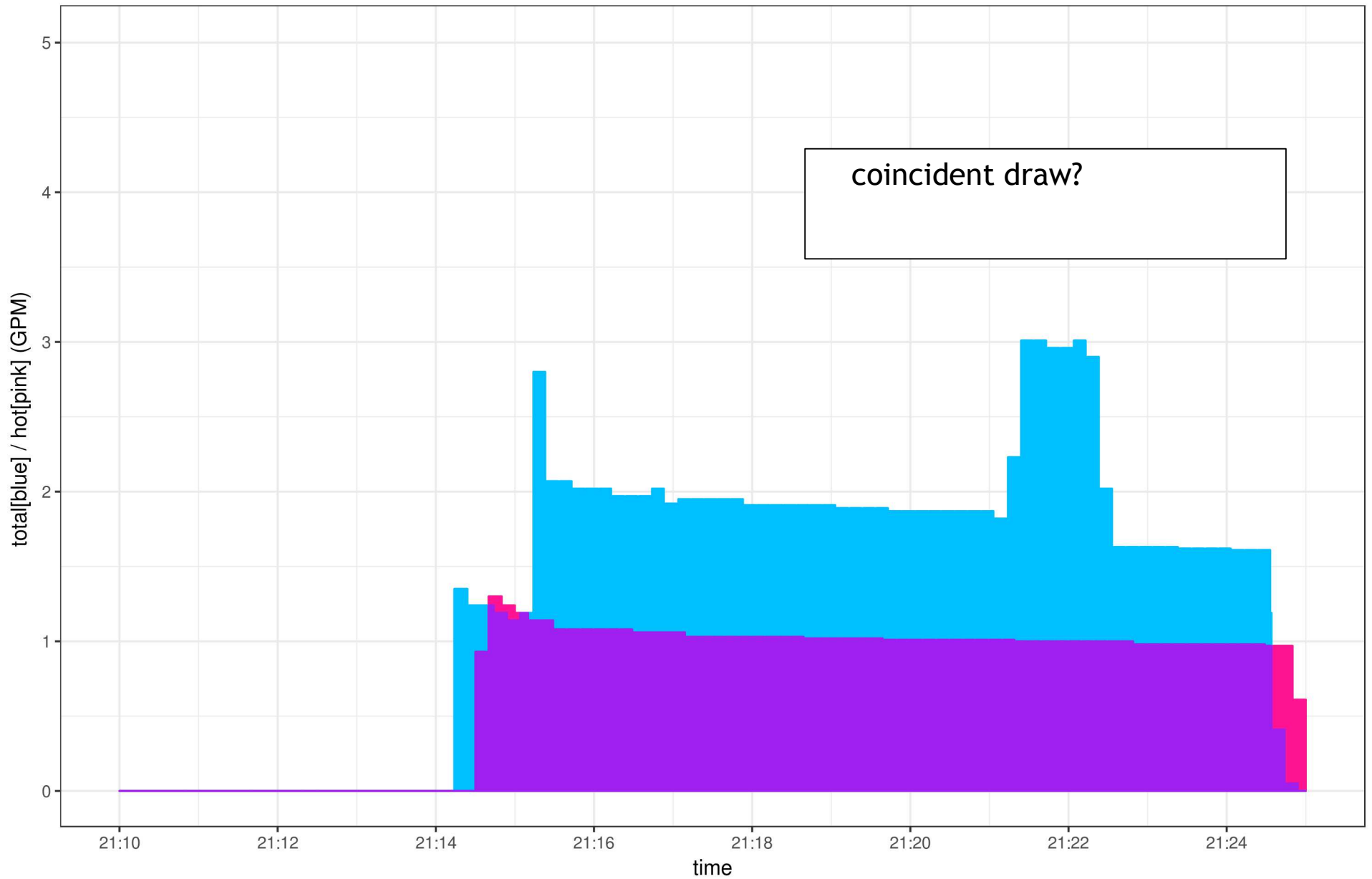
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# Devilish Details

shower water flows for house 13431

date = Mon 1999-11-08

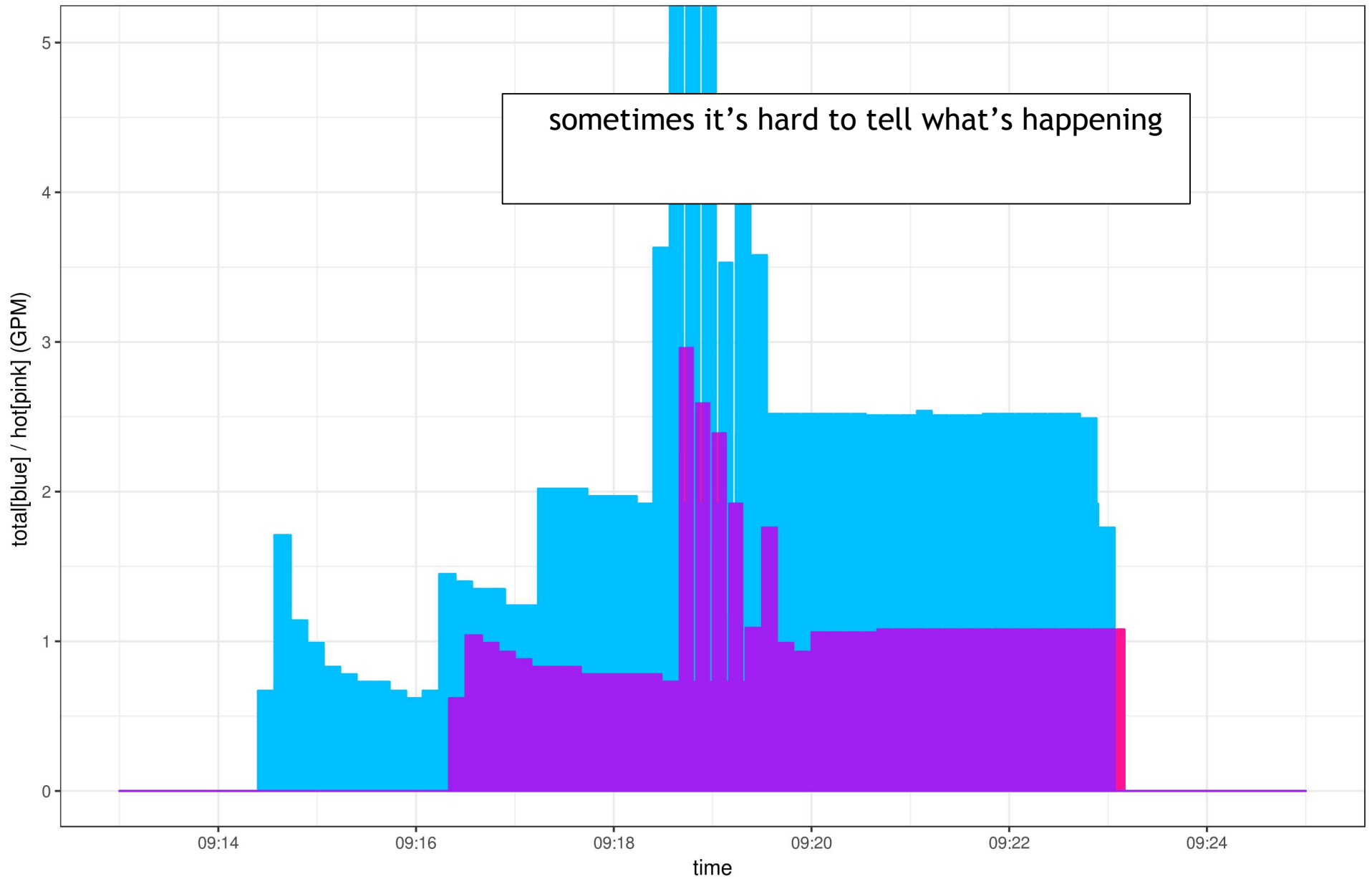




# Devilish Details

shower water flows for house 13431

date = Sun 1999-10-31



# Next Steps

- Refine algorithm to calculate
  - showering duration and flow rate
  - clearing duration and volume
- Apply to as many shower events as possible
- Compare pre- and post-retrofit
  - in aggregate
  - by household
- Apply to REUWS datasets?
- Other?