

Nitrate Treatment Affordability in California:

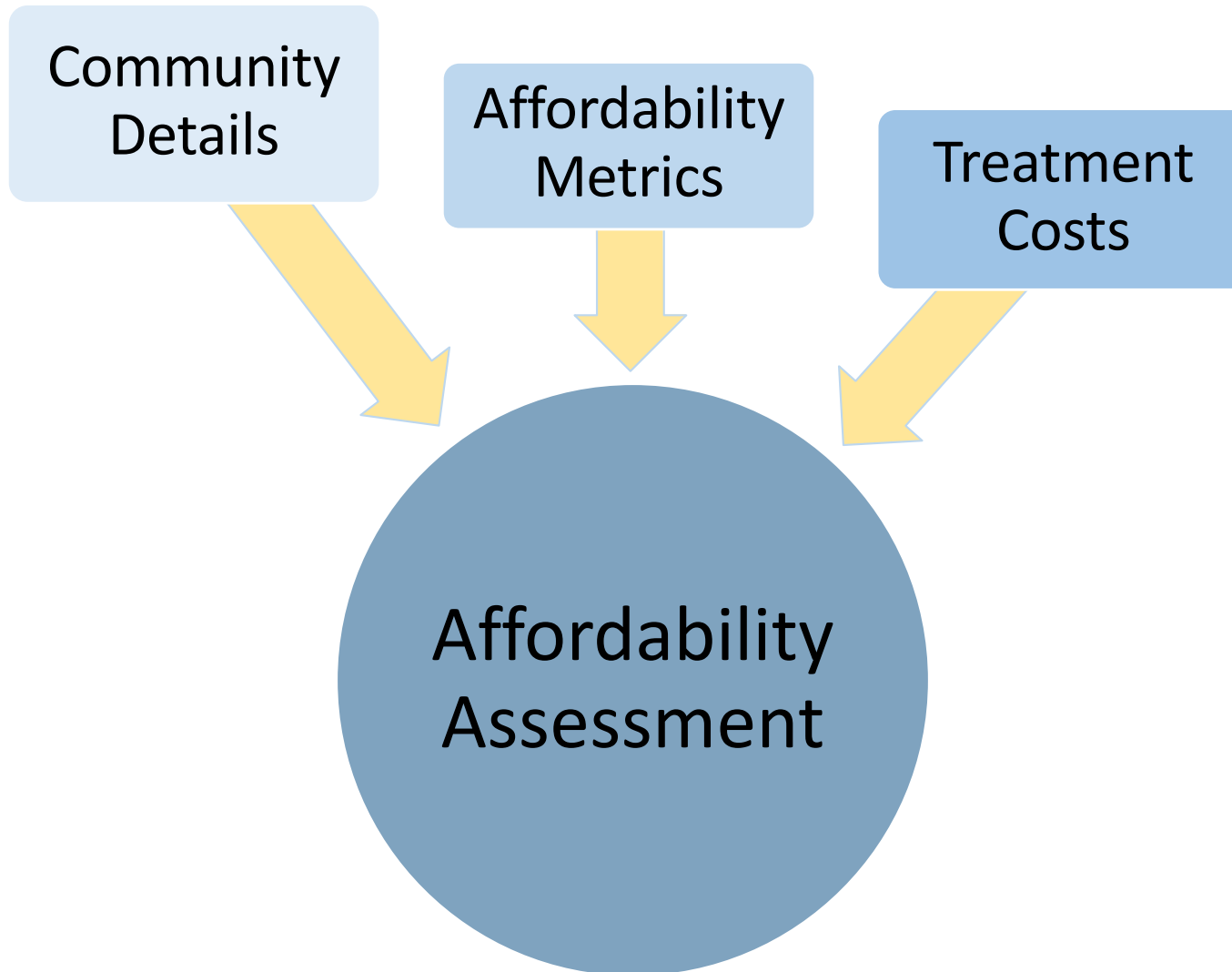
- Three Case Studies

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A decorative graphic at the bottom of the slide featuring a dynamic splash of water with numerous bubbles and droplets, set against a white background with a blue wavy line at the very bottom.

Affordability Considerations



Affordability Metrics

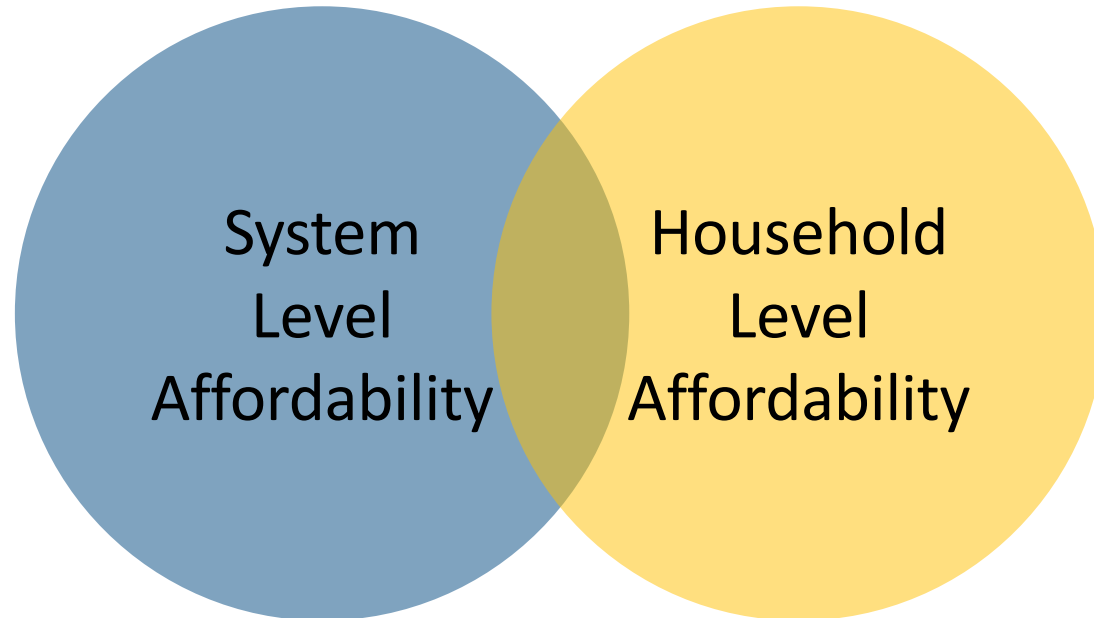


System
Level
Affordability



Household
Level
Affordability

Affordability Metrics



Examination of affordability at the household level informs assessment of system level affordability

Affordability Metrics

Important Factors:

- Easy to understand
- Straightforward calculation
- Accessible data
- Assessment of low-income households
- Local/regional context
- Informative

Affordability Metrics

Threshold	Water Services	Organization
1.5% of MHI	Drinking Water	CA SWRCB (SWRCB 2016)
2.5% of MHI	Drinking Water	US EPA (US EPA 2002)
3% of MHI	Drinking Water	United Nations (UNDP 2014)
2% of MHI	Wastewater	US EPA (US EPA 1997)
4.5% of MHI	Drinking Water and Wastewater	US EPA (US EPA 2002) US EPA (US EPA 1997)
7% – 10% of LQI	Drinking Water and Wastewater	AWWA, NACWA, WEF (Draft Report 2019)

Affordability Metrics

AR Name	Abbr.	Equation	Affordability Threshold	Reference
Residential Indicator	RI =	$\frac{\text{Average wastewater } \$/\text{hhld}}{\text{MHI}}$	2%	(US EPA 1997)
Percentage of MHI	$PI_{\text{MHI}} =$	$\frac{\text{Average drinking water bill}}{\text{MHI of water system}}$	1.5% CA SWRCB 2.5% US EPA	(SWRCB 2016) (US EPA 2002)
Percentage of LQI	$PI_{\text{LQI}} =$	$\frac{\text{Average drinking water bill}}{\text{LQI of water system}}$	TBD	
Household Burden Indicator¹	HBI=	$\frac{\text{Basic water service costs for 50 gallons per capita per day (gpcd)}}{\text{LQI of water system}}$	7% – 10%	(AWWA, NACWA, WEF Draft Report 2019)
Poverty Prevalence Indicator	PPI=	$\frac{\text{\# of households } < 200\% \text{ FPL}}{\text{\# of households}}$	20% – 35% ≥ 35%	

¹ The numeric values shown for the HBI benchmark levels are preliminary, and subject to revision based on future empirical investigation.

Affordability Metrics

AR Name	Abbr.	Equation	Affordability Threshold	Reference
Teodoro AR	$AR_{20} =$	$\frac{\text{Average water and sewer bill for 50 gpcd}^2}{\text{Discretionary income}^3}$	10% for customers at the 20 th percentile income	(Teodoro 2018a)
Pacific Institute AR	$AR_{PI} =$	$\frac{\text{Average water and wastewater bill for 43 gpcd}}{\text{Discretionary income}^4}$	> 50% of customers spend 10% or more on drinking water	(Feinstein 2018)
AR at the Median Household Income	$AR_{MHI} =$	$\frac{\text{Average bill for 50 gpcp}^5}{\text{MHI of water system}}$	None provided	(Balazs et al. 2019)
AR at the County Poverty Threshold	$AR_{CPT} =$	$\frac{\text{Average bill for 50 gpcp}^5}{\text{County Poverty Threshold (CPT)}^6}$	None provided	(Balazs et al. 2019)
AR at the Deep Poverty Threshold	$AR_{DP} =$	$\frac{\text{Average bill for 50 gpcp}^5}{\frac{1}{2} \text{ times the CPT}^6}$	None provided	(Balazs et al. 2019)

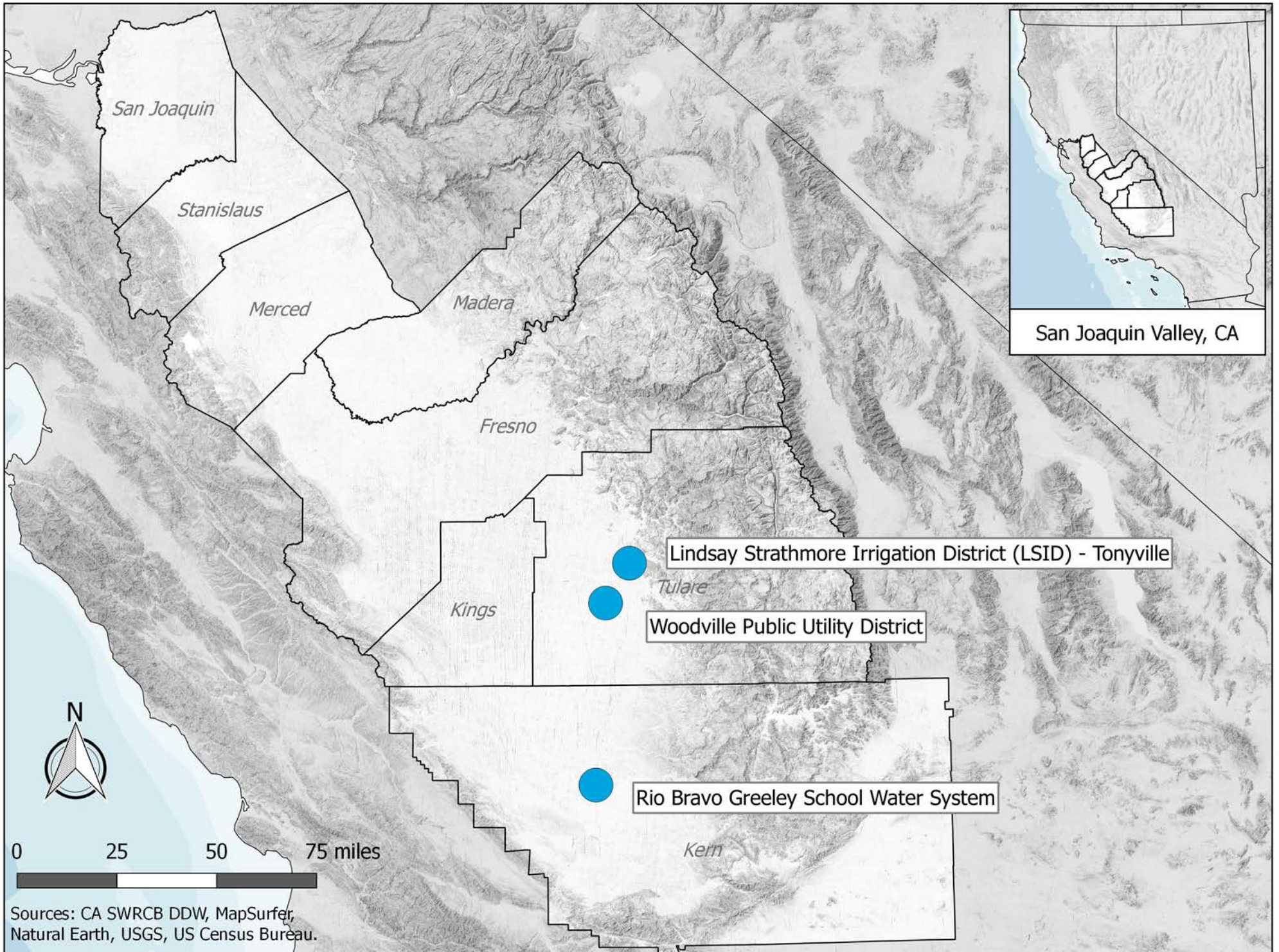
² Teodoro (2018) assumes 50 gpcd as a reasonable level of use to support health, sanitation, and basic household uses.

³ Where discretionary income is after-tax household income minus essential costs including: shelter, health care, food, and home energy. The ratio is typically applied to the upper limit of the lowest income quintile but can also be applied at various income levels.

⁴ Where discretionary income is household gross income minus expenses on shelter, health care, food, **transportation, telephone, laundry and cleaning**, home energy, and taxes. Items in bold were not included in the AR_{20} .

⁵ Note that 50 gpcd for a household of 3 is 6 hundred cubic feet (HCF), which is used in the paper and converted here for consistency.

⁶ CPT is a previously published value (Bohn et al. 2013, Public Policy Institute of California 2016).



Sources: CA SWRCB DDW, MapSurfer, Natural Earth, USGS, US Census Bureau.

Affordability Metrics

Participating Systems

	Rio Bravo	Tonyville	Woodville	CA
County	KERN	TULARE	TULARE	-
Population Served	887	500	1673	-
Connections	16	50	467	-
Households	N/A	100	446	-
Census Data				
Census Data Basis	School district	Tonyville CDP	Woodville CDP	State
Census CDP Population	4,451	684	1,770	38,982,847
# Housing Units	1,466	121	453	12,888,128
MHI	\$94,048	\$48,859	\$28,508	\$67,169
20th Percentile Household Income ²	\$34,702	\$24,920	\$15,191	\$26,498
Unemployment Rate	9.8% +/- 5.6	10.4% +/- 12.0	12.7% +/- 5.0	7.7% +/- 0.1
% below FPL³				
– All Families	5.4% +/- 4.3	27.3% +/- 32.4	45.4% +/- 9.8	11.1 +/- 0.1
– All Individuals	10.8% +/- 6.6	35.4% +/- 29.8	49.7% +/- 9.9	15.1 +/- 0.1
% below 200% FPL³				
– All Families	17.5% +/- 8.8	65.3% +/- 47.9	65.8% +/- 14.1	27.7% +/- 0.1
– All Individuals	23.3% +/- 9.7	66.7% +/- 51.2	70.3% +/- 13.9	33.9% +/- 0.2

¹ Data sources: ACS 2017 5 YR (2013 - 2017), DDW Database, and contact with water system representatives.

² Upper limit of lower quintile (LQI).

³ Error values included following percent values as +/- percent value. Margin of error values were included in or calculated from US Census Data. Note the higher margin of error for the smaller datasets, particularly Tonyville.

Affordability Metrics

Participating Systems

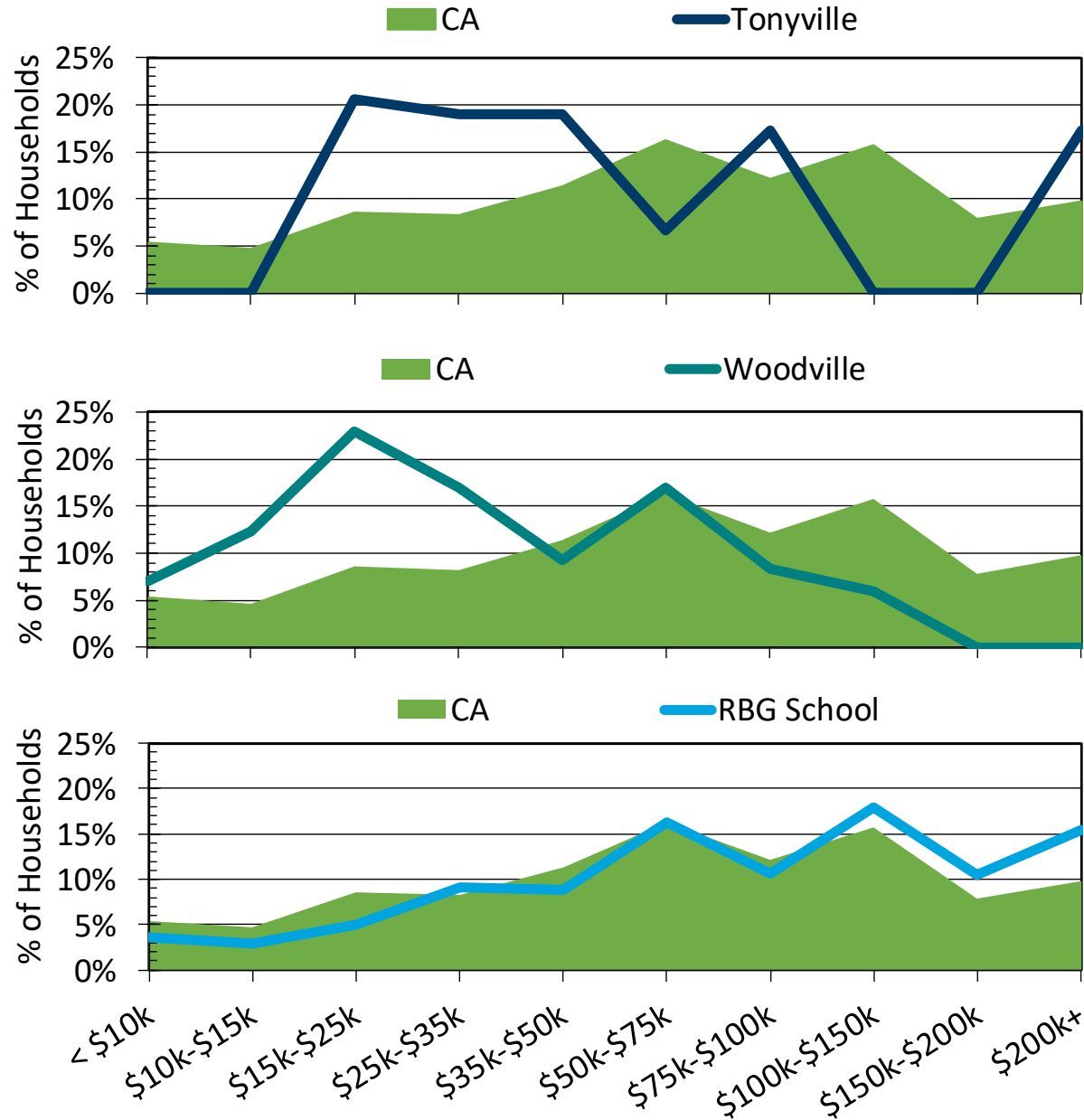
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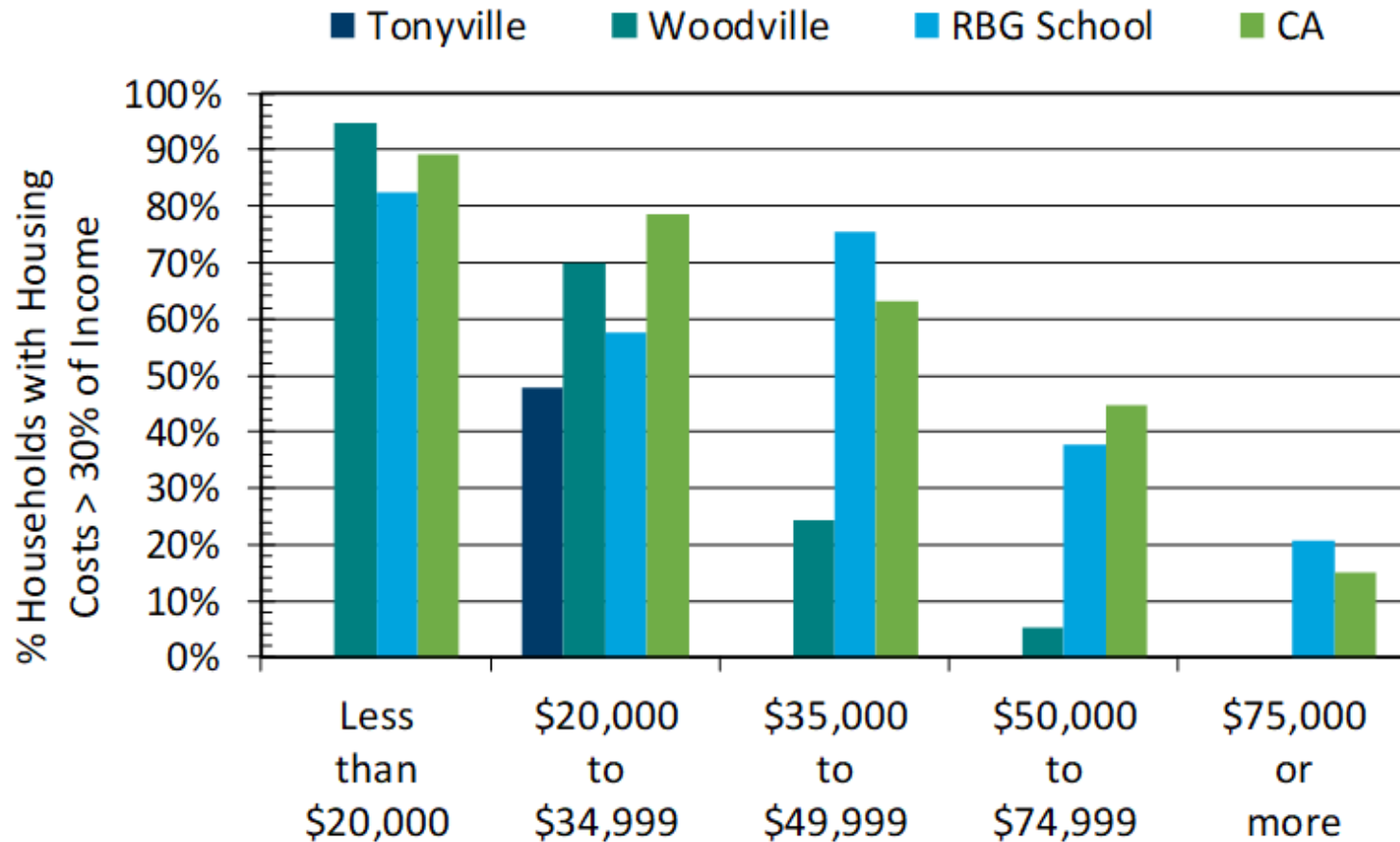
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Income distribution of participating utilities compared with that of California (2017 U.S. Census ACS 5 Yr (2013 – 2017)).



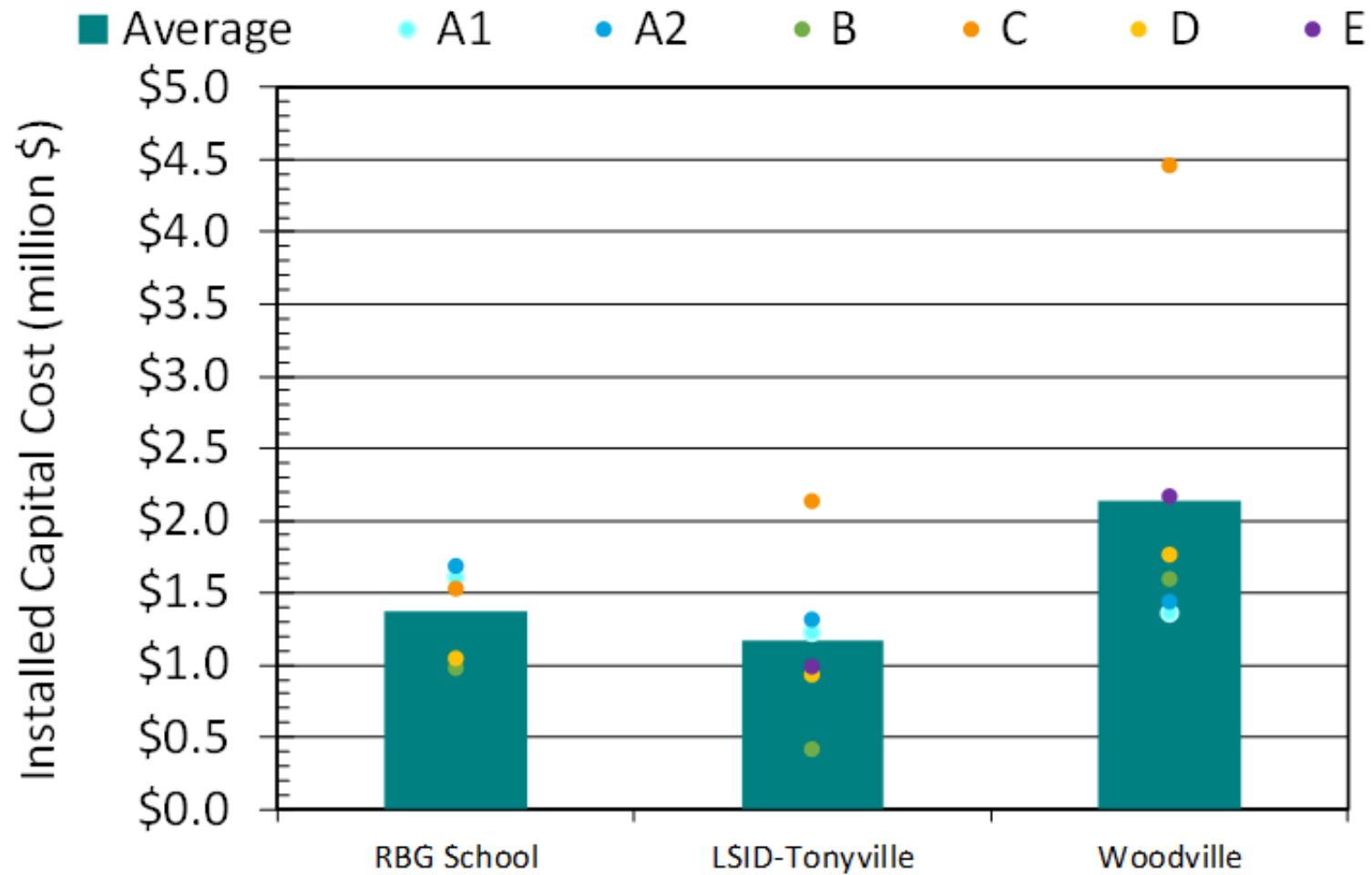
Affordability Metrics

Participating Systems



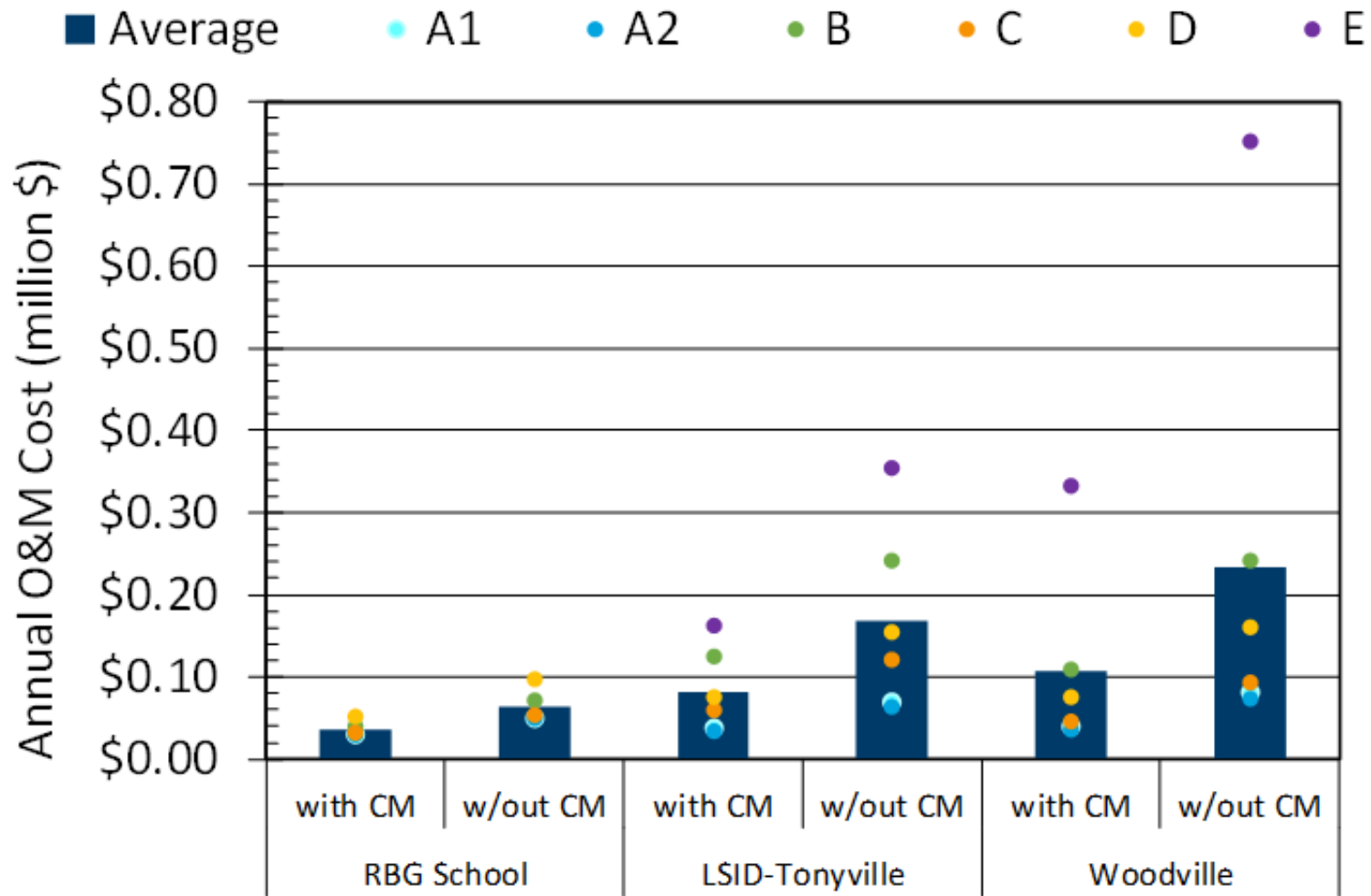
Treatment Costs

Participating Systems



Treatment Costs

Participating Systems



Treatment Costs

Participating Systems

	Tonyville	Woodville
Current water and sewer rates per household		
Average current water bill, \$/month	\$12.19²	\$25.75
Water rate information (residential)	Fixed meter fee: \$7.50/month Usage rate: \$0.58/HCF	Flat rate: \$17.25/month Usage rate: \$0.50/HCF
Fixed water cost, \$/month (per household)	\$3.75	\$17.25
Variable water cost, \$/kgal	\$0.78	\$0.67
Average current sewer bill, \$/month	\$26.92³	\$19.75
Wastewater rate information	Flat rate: \$36.88/connection	Flat rate: \$19.75
Average current sewer + water bill, \$/month	\$39.11	\$45.50
Estimated future water rates per household¹		
New treatment O&M bill increase, \$/month	\$68.68 (\$29 – \$135)	\$17.92 (\$6 – \$56)
Average current water bill, \$/month	\$12.19	\$25.75
Average future water bill, \$/month	\$80.87 (\$41 - \$148)	\$43.67 (\$32 – \$82)
Average future sewer + water bill, \$/month	\$107.80	\$63.42

¹ Assumes consolidated management. Average across all vendors provided, with range in parentheses. Includes only the increase in the water bill associated with O&M costs. Capital costs associated with treatment are not included here as they are paid for by the Prop 50 grant.

² The average current monthly water bill reported for Tonyville was \$24.38 per connection (Edwards 2018); assuming two households per connection as noted previously, the corresponding average current monthly water bill per household is \$12.19. Similarly, the fixed water rate for Tonyville was reported as \$7.50/month per connection resulting in a fixed water rate of \$3.75/month per household.

³ The average current monthly sewer bill reported by the City of Lindsay for Tonyville sewer service was \$36.88/connections with 73 connections reported (City of Lindsay 2019). This cost was adjusted to be distributed over the assumed 100 households of Tonyville, resulting in an estimated 1.37 households per sewer connection and an average monthly sewer bill of \$26.92/household.

Treatment Costs

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Treatment Costs

Participating Systems

	Tonyville		Woodville	
MHI	\$48,859		\$28,508	
20 th Percentile Income	\$24,920		\$15,191	
Avg Current Annual Water Bill (1)	\$146		\$309	
As a % of MHI	0.3%		1.1%	
As a % of 20 th percentile income	0.6%		2.0%	
	With CM	Without CM	With CM	Without CM
New Treatment O&M Water Bill Annual Increase (2)	\$824	\$1,676	\$215	\$472
As a % of MHI	1.7%	3.4%	0.8%	1.7%
As a % of 20 th percentile income	3.3%	6.7%	1.4%	3.1%
Avg Current Bill plus New Treatment O&M Increase (3)	\$970	\$1,823	\$524	\$781
As a % of MHI	2.0%	3.7%	1.8%	2.7%
As a % of 20 th percentile income	3.9%	7.3%	3.4%	5.1%
Current plus New Treatment O&M and Capital (4)	\$1,909	\$2,762	\$908	\$1,164
As a % of MHI	3.9%	5.7%	3.2%	4.1%
As a % of 20 th percentile income	7.7%	11.1%	6.0%	7.7%

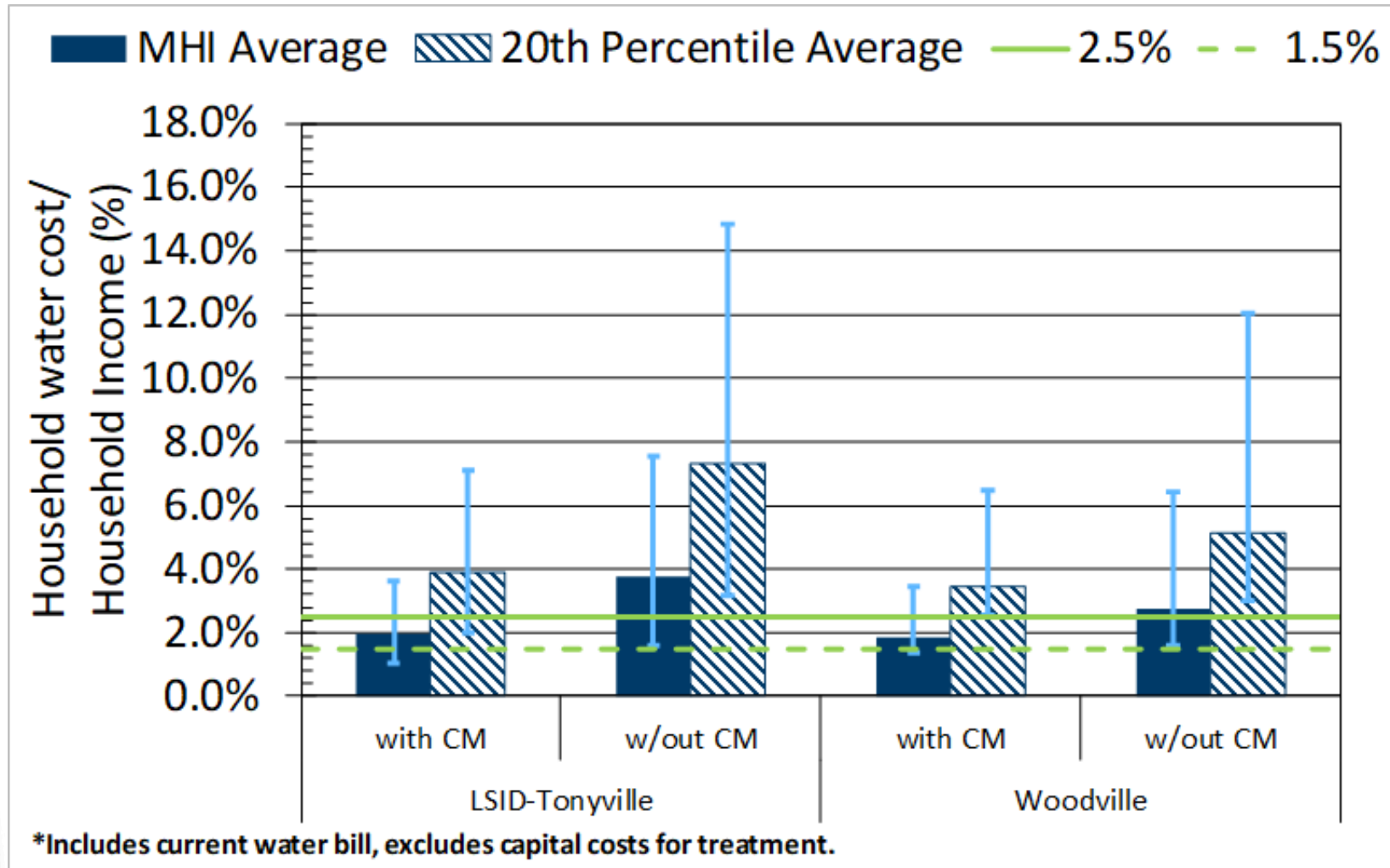
Treatment Costs

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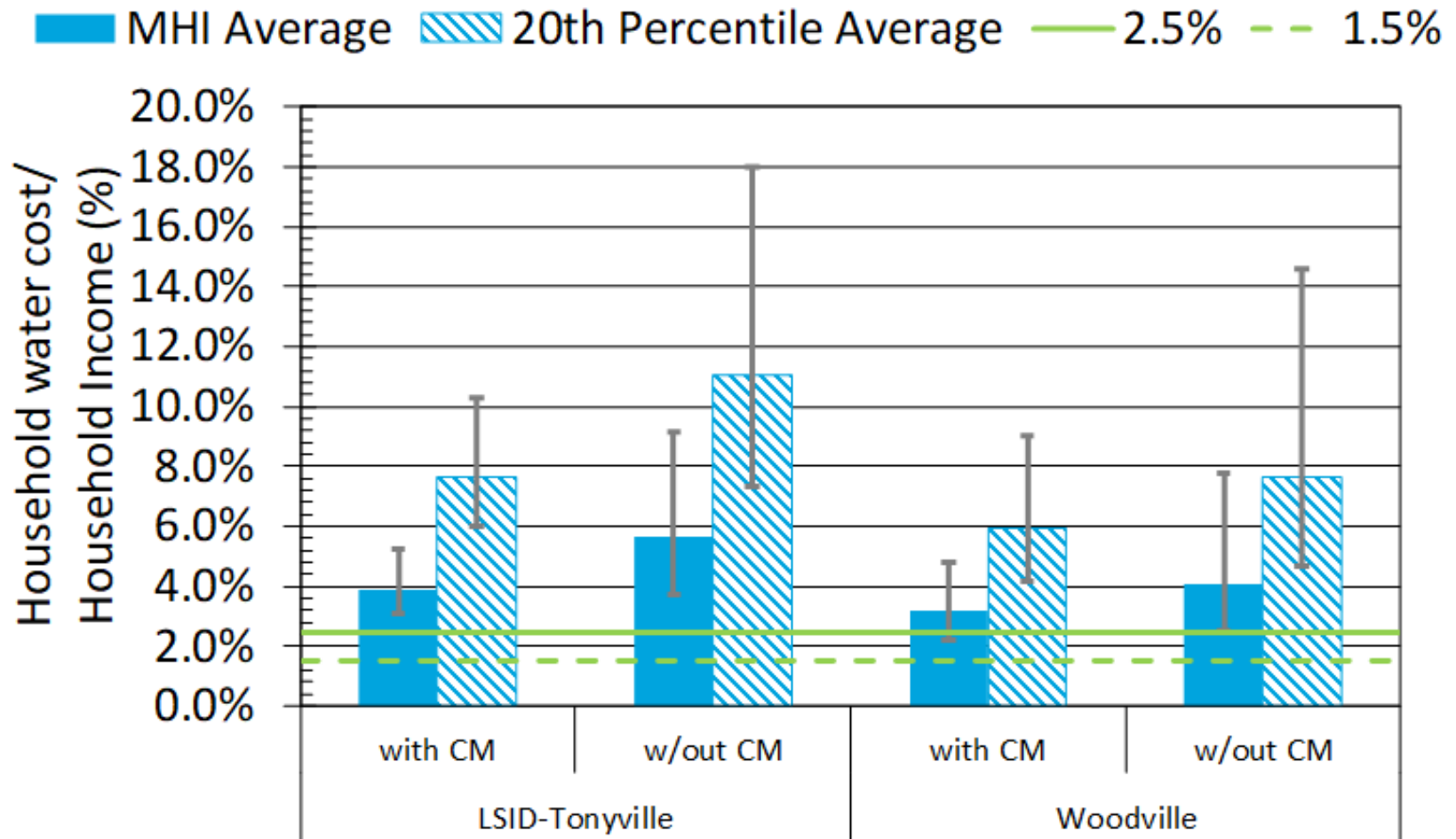
Affordability Metrics

Participating Systems



Affordability Metrics

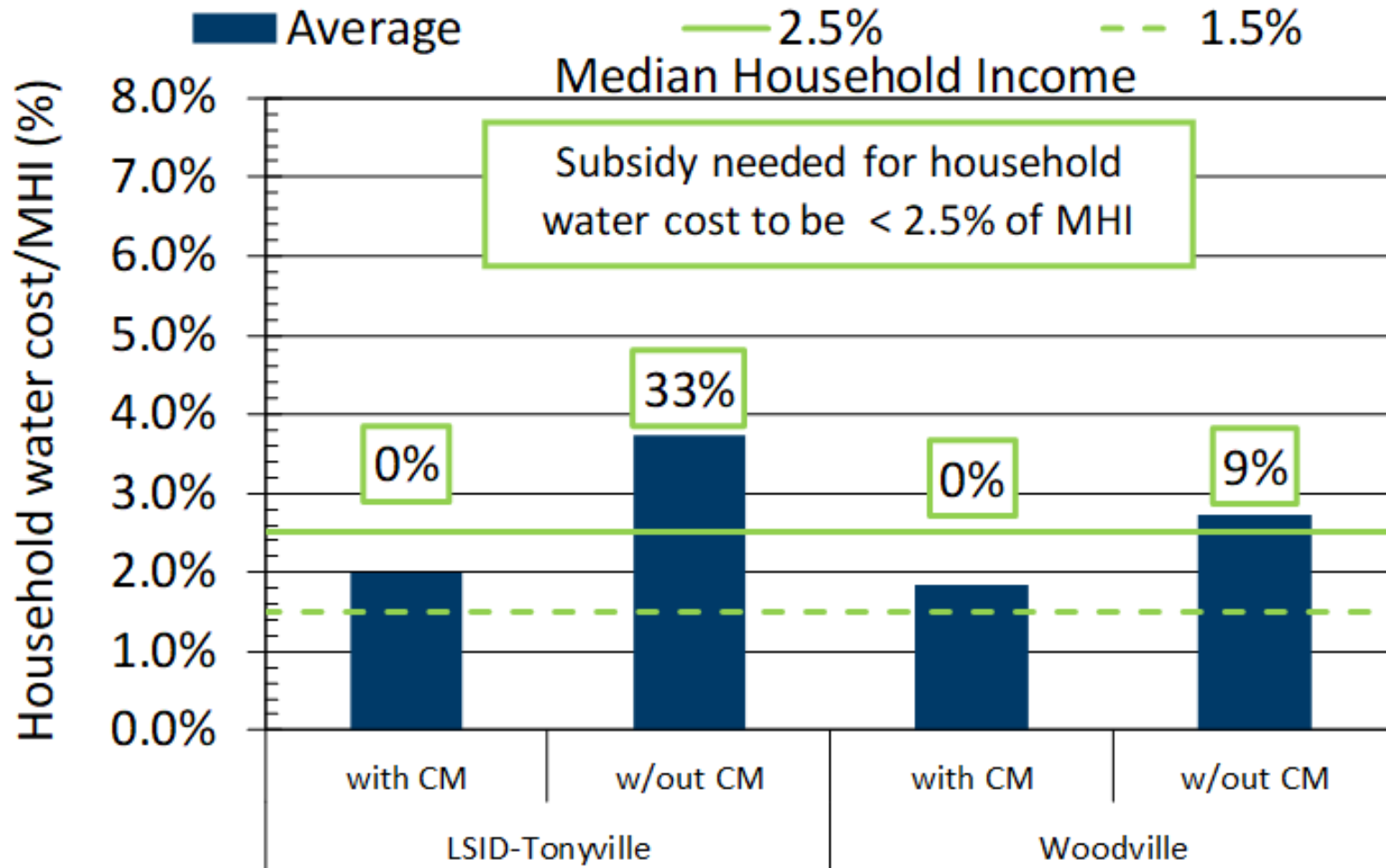
Participating Systems



*Includes current water bill, includes capital costs for treatment.

Affordability Metrics

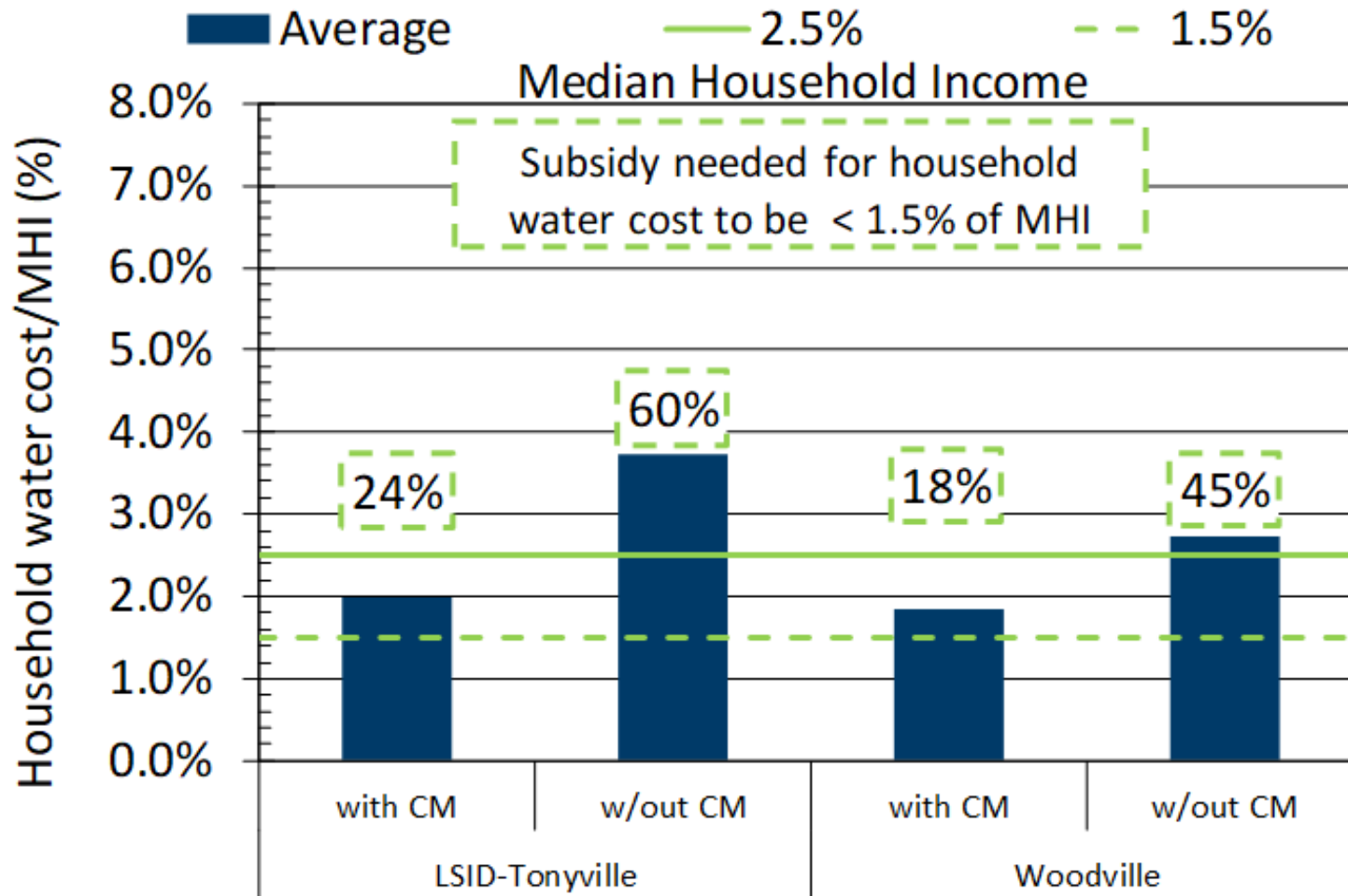
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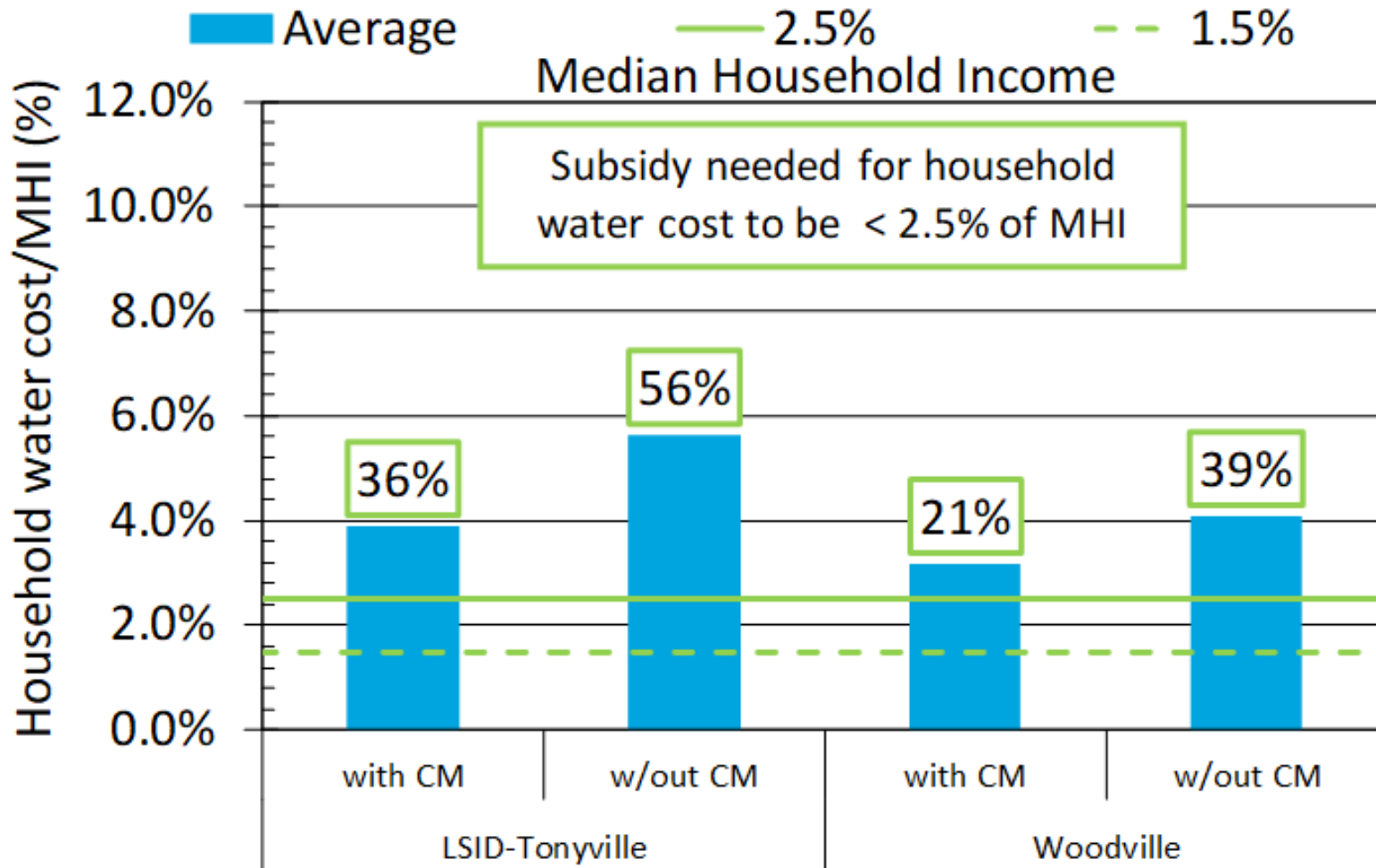
Participating Systems



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Affordability Metrics

Participating Systems



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Affordability Metrics

Participating Systems

	(1) AR _{T-20}	(2) HM	(3) AR _{PI}	(4) AR _{PI-20}	(5) AR _{B-MHI}	(6) AR _{CPT}	(7) AR _{DP}
Reference	Teodoro	Teodoro	Feinstein	Feinstein	Balazs et al.	Balazs et al.	Balazs et al.
Threshold	10%	8 hr/month	10%	10%	None	None	None
Tonyville	Average Household Size:		5				
Income, \$/year	\$24,920	N/A	\$26,900	\$24,920	\$48,859	\$24,021	\$12,011
Essential Expenditures, \$/yr	\$18,437	N/A	\$23,678	\$24,050	N/A	N/A	N/A
Discretionary Income, \$/yr	\$6,483	N/A	\$3,222	\$870	N/A	N/A	N/A
Household cost for basic water and sewer service:							
Current \$/yr (\$/mo)	\$439 (\$37)	\$439 (\$37)	\$429 (\$36)	\$429 (\$36)	\$439 (\$37)	\$439 (\$37)	\$439 (\$37)
With CM \$/yr (\$/mo)	\$1,063 (\$89)	\$1,063 (\$89)	\$966 (\$80)	966 (\$80)	\$1,063 (\$89)	\$1,063 (\$89)	\$1,063 (\$89)
Metric - Current	7%	3.32	13%	49%	0.90%	1.83%	3.65%
Metric - With CM	16%	8.06	30%	111%	2.18%	4.43%	8.85%

Affordability Metrics

Participating Systems

	(1) AR _{T-20}	(2) HM	(3) AR _{PI}	(4) AR _{PI-20}	(5) AR _{B-MHI}	(6) AR _{CPT}	(7) AR _{DP}
Reference	Teodoro	Teodoro	Feinstein	Feinstein	Balazs et al.	Balazs et al.	Balazs et al.
Threshold	10%	8 hr/month	10%	10%	None	None	None
Woodville	Average Household Size:		3.8				
Income, \$/year	\$15,191	N/A	\$26,900	\$15,191	\$28,508	\$24,021	\$12,011
Essential Expenditures, \$/yr	\$16,608	N/A	\$20,329	\$18,535	N/A	N/A	N/A
Discretionary Income, \$/yr	-\$1,417	N/A	\$6,571	-\$3,344	N/A	N/A	N/A
Household cost for basic water and sewer service:							
Current \$/yr (\$/mo)	\$490 (\$41)	\$490 (\$41)	\$483 (\$40)	\$483 (\$40)	\$490 (\$41)	\$490 (\$41)	\$490 (\$41)
With CM \$/yr (\$/mo)	\$562 (\$47)	\$562 (\$47)	\$546 (\$45)	\$546 (\$45)	\$562 (\$47)	\$562 (\$47)	\$562 (\$47)
Metric - Current	-35%	3.71	7%	-14%	1.72%	2.04%	4.08%
Metric - With CM	-40%	4.26	8%	-16%	1.97%	2.34%	4.68%

Affordability Metrics

Participating Systems

	LSID-Tonyville			Woodville		
	Serving 500 people, 100 households			Serving 1,673 people, 446 households		
	Current	with CM	without CM	Current	with CM	without CM
MHI	\$48,859	\$48,859	\$48,859	\$28,508	\$28,508	\$28,508
LQI	\$24,920	\$24,920	\$24,920	\$15,191	\$15,191	\$15,191
Annual Water Cost, DW only	\$146	\$970	\$1,823	\$309	\$524	\$781
Annual Water Cost, All	\$469	\$1,294	\$2,146	\$546	\$761	\$1,018
Annual Water Cost, All Basic	\$439	\$1,063	\$1,709	\$490	\$562	\$648
PI_{MHI}, 1.5% and 2.5%	0.3%	2.0%	3.7%	1.1%	1.8%	2.7%
PI_{LQI}, 3.5% and 5.5%	0.6%	3.9%	7.3%	2.0%	3.4%	5.1%
2.5% and 4%	0.6%	3.9%	7.3%	2.0%	3.4%	5.1%
HBI, 7%-10%, All	1.9%	5.2%	8.6%	3.6%	5.0%	6.7%
HBI, TBD¹, All Basic	1.8%	4.3%	6.9%	3.2%	3.7%	4.3%
PPI, 35%	65.3%	65.3%	65.3%	65.8%	65.8%	65.8%

¹ Threshold range for HBI based on basic water only to be determined from further empirical data.

