TECHNICAL MEMORANDUM

To:	Greg Johnson, P.E.
From:	Uma Vempati, P.E.; Bailey Hadnott Taylor, P.E.; Molly Cyr
	Kimley-Horn and Associates, Inc.
Date:	June 11, 2026
Subject:	White Bear Lake Comprehensive Plan: Study No. 12 – Tiered Increasing Block Water Utility Rates

Executive Summary

The Metropolitan Council Environmental Services, in coordination with 14 communities connected to White Bear Lake, is evaluating strategies to ensure sustainable drinking water supplies while supporting long-term growth. This study (Study No. 12) assesses the effectiveness of tiered increasing block water utility rates as a tool to reduce groundwater use and promote residential water conservation.

Tiered rate structures are already widely used across the study area and are designed to incentivize conservation by charging higher rates for higher volumes of water use. Evidence from national case studies indicates that implementing these rate structures can aid in reducing water demand, although results vary depending on local conditions and supporting conservation measures.

Analysis of historical data from the 14 communities shows that cities with tiered rate structures have generally experienced measurable reductions in residential water use, with reductions ranging from 12% to 45%. Water reductions in these communities could also be attributed to other factors such as high efficiency appliances, public education programs, or changes in habits of individuals. The extent of water savings is influenced by several factors, including the length of time since implementation of tiered increasing block water rate structures, median household income, and local weather conditions such as drought. Higher income communities tend to be less responsive to price increases, while lower income communities demonstrate greater sensitivity to water rate changes. Across the study area, reductions in water were observed when water bills were between 0.15-0.46% of median household income depending on the city, suggesting a potential “tipping point” for behavioral change. However, achieving this tipping point does not consistently produce water savings.

In summary, tiered increasing block water utility rates are an effective and flexible tool for reducing residential water consumption in the White Bear Lake area. While not solely responsible for conservation outcomes, they play a key role and communities that do implement them should evaluate affordability when adjusting rates.

Purpose and Scope

Purpose of the Study

The Minnesota legislature has funded the Metropolitan Council to work with the 14 communities in the White Bear Lake area to develop a comprehensive plan that ensures sufficient access to drinking water while supporting municipal growth. The plan will identify strategies to maintain the long-term sustainability of both surface water and groundwater resources for future generations. Study 12 evaluates the potential water savings that can be achieved through tiered increasing block water utility rates within the 14 White Bear Lake area communities.

Scope of the Study

The scope of the study has the following requirements:

- Review of Case Studies and Best Practices
    - Research regional and national data and case studies for public water systems that implemented tiered increasing block water utility rates and water savings achieved.
    - Review case studies focused on water savings in western and southern states.
- Existing Tiered Increasing Block Water Utility Rates
    - Identify and summarize exiting tiered increasing block water utility rates and related city codes or ordinances for the 14 White Bear Lake communities.
- Historical Water Use Analysis
    - Review historical municipal well pumping data from the Minnesota Department of Natural Resources (DNR) Permitting and Reporting System (MPARS) database.
    - Compare water use both before and after implementing tiered increasing block water utility rates.
    - Calculate and estimate annual water use savings achieved from implementing tiered increasing block water utility rates for these communities based on the average total gallons consumed per capita per day data.
- Estimated Water Savings from Tiered Increasing Block Water Utility Rates
    - Estimate water savings achieved by the White Bear Lake area communities with existing tiered increasing block water utility rates and the additional potential water savings that could be achieved based on regional and national case studies.
    - Estimate the potential water savings of implementing tiered increasing block water utility rates for the communities without tiered increasing block water utility rates.
    - Estimate the potential water savings of modifying the rates for the communities with existing tiered increasing block water utility rates.
    - Estimate the expected tipping point in a tiered rate structure with respect to minimum cost per volume that would need to be charged by the water utility to provide a significant and noticeable reduction in high water used. This tipping point will be based on national case studies for public water systems that implemented tiered increasing block water utility rates and data from 14 White Bear Lake Area communities.

- Future Water Demand
    - The potential water savings from tiered increasing block water utility rates shall be calculated and based on data obtained from the regional/national case studies for current water use, the projected water demands for year 2050, and the projected water demands for ultimate development for each of the 14 White Bear Lake area communities.

Work Performed

Data Collection and Review

The data for this study was obtained from the following sources:

- Minnesota DNR Permitting and Reporting System (MPARS)
- Metropolitan Council
- ESPWater database, provided by the Metropolitan Council
- 14 White Bear Lake communities

MPARS permit records related to municipal water supply systems were requested for each of the 14 White Bear Lake area communities. Data was available for most communities and was used to determine total municipal groundwater pumping volumes from 1988 through 2025.

In addition to the MPARS data, the Metropolitan Council provided annual total gallons pumped for each city from the ESPWater database for the years 2014 through 2023. This dataset had been previously reviewed and validated by a Metropolitan Council consultant, making it more reliable than the raw data entries available in MPARS. Accordingly:

- ESPWater data was used for the years 2014 to 2023.
- MPARS data was used for the years 1988 to 2013 and 2024 to 2025.

The primary dataset used in this study consisted of Metropolitan Council data for:

- Residential gallons sold per year,
- total water service population per city, and
- projected water demands for the year 2050 and ultimate development scenarios.

As some datasets were not available for all years, interpolation and estimation methods were applied to address these data gaps

Data Processing and Estimation Methods

Residential Water Use

Metropolitan Council provided data on residential gallons sold per city per year for the

periods 1990 to 2012 and 2012 to 2022. The identical values for 2012 allowed the datasets to be merged into a single continuous record. To estimate residential water use for 2023-2025, the percentage of residential water use relative to total city water use was calculated for available years, and the average percentage was applied to total water consumption.

City and Household Data

Annual water use per capita, total city population, historic and existing tiered rates, and median household income were obtained from Metropolitan Council population projections, the United States Census Bureau and requested city records.

Case Studies Research

The team conducted a review of available case studies on tiered increasing block water utility rates using the following sources:

- United States Environmental Protection Agency (EPA)
- Environmental Defense Fund (EDF)
- Peer-reviewed scientific research journals

The project team reviewed available case studies published by the Water Research Foundation and AWWA but did not identify any documented case studies evaluating tiered increasing block utility rates.

Effectiveness of Tiered Increasing Block Utility Rates

To date, the available research that quantifies water savings attributed to tiered increasing block utility rates focuses on regions where drought conditions are more severe such as California, Utah, and Texas. The team was unable to find case studies specific to the Midwest region.

Published studies report anecdotal evidence that suggest implementing tiered increasing block utility rates can have a large effect on water demand.

Irvine Water District, California[1][2]

- Reported that in the 13 years after introducing allocation-based tier rates, the average outdoor water demand fell by 61 percent per acre.

Eastern Municipal Water District, California[1]

- Saw a reduction in water demand between 10 to 15 percent after introducing tiered pricing.
- Reported that the demand for efficient users reduced by 5 percent while demand for inefficient users reduced by 25 percent due to the tiered pricing structure.

Saratoga Springs, Utah[3]

- Implemented an allotment tiered water utility rate for the irrigation season in 2022 during a drought.

- Residential customers used 22% less in July, 19% less in August and 10% less in September than the previous year.
- While the irrigation area in Saratoga Springs grew by 17% from 2021 to 2022, the total water used for irrigation only increased by 6% so the city saw a reduction in water use per unit area

Blanding, Utah[3]

- Implemented an allotment tiered rate that helped them reduce water use by 14% in 2022 during drought conditions compared to the previous year.

San Antonio Water System (SAWS), Texas[4]

- Implemented increasing block rates in the 1980s to incentivize conservation and they have made modifications to the rates throughout the years including seasonal variations to the inclining block rate structure.
- Since the implementation of increasing block rates, the city has grown by 80 percent, but the amount of water needed to sustain the population has only grown by 20 percent.

Table 1 summarizes the case studies listed above.

Table 1 Summary of Communities in Case Studies

Community	Water Savings	Comments
Irvine Water District, California[1][2]	Outdoor water demand fell by 61% per acre.	13 years after the introduction of allocation-based tiered rates.
Eastern Municipal Water District, California[1]	Water demand fell by 10% to 15%.	Demand for efficient users fell by 5 percent while demand for inefficient users fell by 25 percent.
Saratoga Springs, Utah[3]	Water demand fell by 22% in July, 19% in August, and 10% in September compared to the previous year.	Implemented an allotment tiered water utility rate for the irrigation season during drought conditions.
Blanding, Utah[3]	Water demand fell by 14%	Implemented an allotment tiered water utility rate during drought conditions.
San Antonio Water System (SAWS), Texas[4]	City has grown by 80% while water used to sustain the city has only increased by 20%.	Implemented increasing block rates in the 1980s to incentivize conservation.

Cost-Effectiveness

Tiered increasing block utility rates are a good way to accommodate equity concerns by charging lower rates for essential uses such as drinking, cooking, and cleaning.[2] Using pricing as an incentive for conservation allows households to choose how they respond to increased prices which does not require installing new technology and requires less monitoring or enforcement than nonprice approaches.[1]

Other Factors Impacting Water Use in Households

The reported water savings cannot exclusively be attributed to tiered increasing block utility rates. Other factors influencing water savings include:

- Economy: Changes in the broader economy such as fluctuations in income and prices can drive per-capita water demand up or down.[2]
- Nonprice Water Conservation Policies: Nonprice demand management policies are also used to encourage residents to conserve water. These policies include watering restrictions, information and education campaigns, and low-flow fixtures. These policies can vary widely in effectiveness as they are dependent on behavioral changes. [1]
- Public Education Programs: Utility conservation programs that include outreach and education components such as informing the public on actions needed to reach conservation goals, how water utility rates work, and how to interpret bills are more effective in encouraging residents to conserve water.[4]
- Price Information: Water utilities that include price information on the bill can increase residents' responsiveness to price signals.[5]
- Local Weather Patterns: Changes in regional temperature and changes in cyclical precipitation patterns can have a large impact on outdoor water use. [2]
- Population Growth: Population growth can reduce per-capita water demand when new homes must be built with water-efficient technologies.[2]
- Irrigable Lot Size: Households with larger lawns or gardens are more likely to have higher water consumption to maintain lawn and garden health.
- Home Age: Older homes are more likely to have leaky fixtures or pipes and less efficient appliances leading to higher water consumption.
- Irrigation Systems: Preferences for water conserving technologies such as weather-based irrigation systems can reduce water demand.[2]
- Individual Habits: Individual personal habits, such as taking longer, running water while washing dishes or brushing teeth, running the dishwasher with only partially full loads and running partially full loads of laundry can lead to variable household water use.[6]

Key Factors Affecting Effectiveness

- Combined Conservation Measures: Many of these studies evaluate increasing tiered block utility rates alongside other measures such as public education programs, lawn watering restrictions, appliance rebate programs, drought messaging, drought pricing, allocation based tiered increasing block rates, or seasonal variations to rates.
- Drought vs. Non-Drought Conditions: Restrictions were implemented during drought conditions in many of these case studies, when drought messaging and water conservation awareness is higher.

Applicability to White Bear Lake Area

Based on the available research, tiered increasing block water utility rates are widely used and are shown to contribute to reductions in water use per capita. Due to the lack of Midwest specific data about tiered increasing block utility rates, reliance on case studies from outside of the region is required. The reported water savings from these case studies should be interpreted cautiously due to the regions these case studies are taken from having a different climate than the Midwest.

Potential Water Savings from Tiered Increasing Block Water Utility Rates

Metropolitan Council provided data including residential water usage, residential population, water service population, and water pumped from existing wells. Each city provided information related to their residential water use. Based on historical data and water service population, residential water use was calculated. Commercial water use was calculated by subtracting residential water use from total water use for each city. Table 2 shows these volumes for 2024 for each city.

Table 2 2024 Residential and Commercial use for White Bear Lake communities

City	2024 Total Water Use (gal/year)	2024 Annual Residential Water Use (gal/year)	Estimated Commercial Water Use (gal/year)
Hugo	392,816,000	286,977,013	105,838,987
Lake Elmo	364,031,000	272,345,774	91,685,226
Lino Lakes	536,434,500	450,414,213	86,020,287
Mahtomedi	207,499,000	170,593,528	36,905,472
New Brighton	1,177,022,000	673,528,144	503,493,856
North St. Paul	345,389,000	235,238,017	110,150,983
Oakdale	837,290,000	616,828,899	220,461,101
Shoreview	813,347,800	528,028,302	285,319,498
Stillwater	602,597,000	438,041,285	164,555,715
Vadnais Heights	443,669,000	333,276,224	110,329,776
White Bear Lake	685,297,238	421,997,962	263,299,276
White Bear Township	368,780,700	288,212,477	80,411,156
Woodbury	2,436,540,000	1,894,605,403	541,934,597

Additional data was collected from each city with respect to existing tiered rate structures and historical tiered rates as well as implementation dates for tiered rates. Table 3 shows each city, their respective implementation date for tiered rate structures and their current tiers and rates. This data was evaluated to understand how tiered rate structures impact water usage.

Kimley»Horn

Table 3 Residential rate structure overview for White Bear Lake Communities

Residential Rate Structure Overview							
City	**Year Tiered Rates were Implemented**	**Current Base Rate**	**Tier 1 (gal)**	**Tier 2 (gal)**	**Tier 3 (gal)**	**Tier 4 (gal)**	**Tier 5 (gal)**
Hugo[1]	2010	$44.50	0 – 11,000	11,001 – 20,000	20,001 – 29,000	29,001+	--
		Rate	$1.15	$2.30	$3.45	$6.45	--
Lake Elmo	2012	$27.02	0 – 15,000	15,001 – 30,000	30,001 – 50,000	50,001 – 80,000	80,001+
		Rate	$2.70	$3.25	$3.89	$4.68	$5.59
Lino Lakes	2023	$25.00	0 – 20,000	20,001 – 40,000	40,001 – 80,000	80,001 – 120,000	120,001+
		Rate	$2.28	$2.53	$2.86	$3.80	$4.43
Mahtomedi	2010	$24.34	0 – 14,960	14,961 – 24,684	24,685 – 33,660	33,661+	--
		Rate	$3.73	$3.89	$4.71	$6.59	--
New Brighton	N/A	$36.56	0 – 8,000	8,001+	--	--	--
		Rate	$0.00	$4.57	--	--	--
North Oaks – West[2]	2017	$48.24	0 – 5,000	5,001 – 10,000	10,001 – 30,000	30,000+	--
		Rate	$2.69	$4.33	$5.99	$9.85	--
North Oaks – East[3]	2012	$58.94	0 – 10,000	10,001 – 20,000	20,001 – 30,000	30,001+	--
		Rate	$2.68	$2.94	$3.97	$6.90	--
North Saint Paul	1998	11.92	0 – 7,000	7,001 – 20,000	20,001+	--	--
		Rate	$3.49	$4.57	$6.64	--	--
Oakdale	1997	$15.84	0 – 25,000	25,001 – 50,000	50,001+	--	--
		Rate	$2.60	$2.89	$3.10	--	--
Shoreview	1992	$37.47	0 – 5,000	5,001 – 10,000	10,001 – 30,000	30,001+	--
		Rate	$2.09	$3.36	$4.65	$7.65	--
Stillwater	2021	10	0 – 8,000	8,001 – 18,000	18,001 – 28,000	28,001+	--
		Rate	$1.75	$2.29	$2.84	$4.48	--
Vadnais Heights	2007	$15.28	0 – 6,000	6,001 – 20,000	20,001 – 50,000	50,001+	--
		Rate	$2.00	$3.21	$5.39	$6.99	--
White Bear Lake	2026	$39.23	0 – 6,000	6,001 – 20,250	20,251 – 56,250	56,251+	--
		Rate	$0.67	$2.99	$3.33	$3.49	--
White Bear Township	2012	$45.50	0 – 10,000	10,001 – 20,000	20,001 – 30,000	30,001+	--
		Rate	$2.60	$2.85	$3.85	$6.70	--
Woodbury	2001	$9.40	1,000 – 25,000	25,001 – 50,000	50,001 – 75,000	75,001 – 100,000	100,000+
		Rate	$2.50	$3.85	$5.20	$6.45	$7.80

Notes:
[1] Data only available from 2010 for Hugo.
[2] Includes one neighborhood served by Shoreview.
[3] Includes one neighborhood served by White Bear Township.

The following sections summarize how cities were categorized to better understand water savings achieved since implementing tiered rate structures for water users.

Regression Analysis

Using the coding language R and statistical analysis software based on it, R Studio, a multivariable regression analysis was completed for each city. The calculation determined an estimate of the dependent variable of total residential water usage for a given city as a function of the following independent variables:

- Base rate
- Rate (per 1,000 gallons) charged for each tier
- Median household income

Due to varying data availability by city, the exact numbers that result from completing this regression analysis cannot confidently predict exactly how much water will be in demand each year or what rates should be charged to achieve that level of demand. However, general trends can be observed across each city's calculations as follows:

- Based on individual correlation coefficient calculations for each variable, almost all the variables considered (base rate and each tier's rate) have a relatively strong negative correlation with total residential water demand; that is, as the base rate or tier rates increase, the total residential water demand will decrease.
- Median Household Income (MHI) has a moderately strong positive correlation; that is, as MHI increases, the total residential water demand will increase.
- No clear pattern emerges across cities regarding how much each tier's rate contributes to the regression analysis' ability to predict water usage. In some cities, a change in the highest tier's rate has more impact on demand than increasing the lowest tier's rate, and vice-versa. However, increasing any individual tier's rate will likely cause some decrease in overall water usage.

Implementation Date

One case study showed that in the 13 years after implementing a tiered rate structure for water, outdoor water usage was reduced by over 50%. This indicates that there is a lag period between implementation date and water reduction. Therefore, cities were categorized by years since implementation. Cities that have implemented a tiered rate structure in the last five years are unlikely to see a significant reduction in water usage but could see reduction in water usage in 2050 and ultimate development. This information is summarized in Table 4.

Table 4 Summary of Water Reduction Based on Years since Implementation of Rate Structure

Years since Implementation	Cities	Average Residential Water Use per Capita Before Implementation (gal/year)	Average Residential Water Use per Capita 2024 (gal/year)	% Reduction
No Tiered Rates	New Brighton[1]	28,515	28,166	1%
No Tiers Until 2026	White Bear Lake[2]	22,996	16,397	29%
Less than 10 Years	Stillwater	30,970	22,586	27%
	Lino Lakes	29,104	24,605	15%
Less than 20 Years	Vadnais Heights	29,008	25,587	12%
	Mahtomedi	32,856	18,156	45%
	Hugo	26,825	20,008	25%
	White Bear Township	35,617	24,014	33%
	Lake Elmo	35,379	24,808	30%
More than 20 Years	Shoreview	25,036	20,160	19%
	Oakdale	25,974	20,825	20%
	North St. Paul	23,340	14,936	36%
	Woodbury	36,851	22,626	39%

Notes:
[1] New Brighton does not have a tiered rate structure. Therefore, the average residential water use per capita from 1990-2023 was compared to the residential water use per capita from 2024 to determine water reduction without a rate structure.
[2] White Bear Lake did not implement a tiered rate structure until 2026. Therefore, the average residential water use per capita from 1990-2023 was compared to the residential water use per capita from 2024 to determine water reduction without a rate structure.

Based on review of existing data, cities with tiered structures for less than 10 years, less than 20 years and more than 20 years have seen an average reduction of 21%, 29%, and 28.5%, respectively.

Estimating savings for commercial water use is more complex than residential water use. Although the estimated commercial water use was calculated for each year, the variability in commercial developments makes it difficult to attribute water savings to all developments. For example, water reduction for a warehouse is different than water reduction from a food manufacturing process. Businesses/commercial users also have more consistent use of water that does not vary as much as residential users. And although commercial users have assigned tiered rates, it is unlikely that an increase in rates would cause a significant decrease in water use.

Household Income

As stated in the regression analysis section, median household income (MHI) was seen as a strong predictor for water usage. Figure 1 shows how water use increases as household income increases.

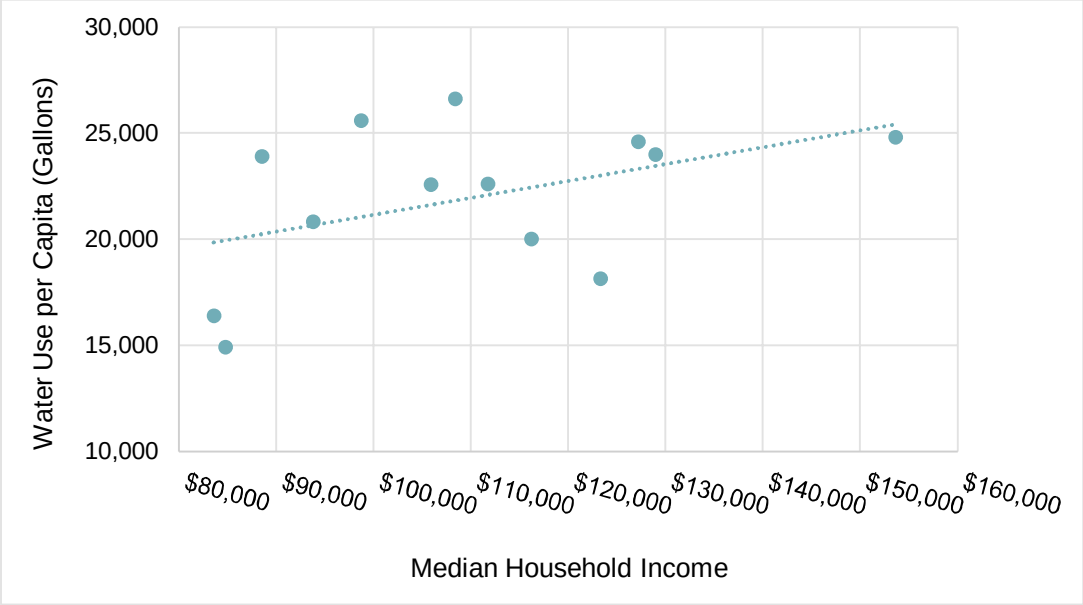


Figure 1 Median Household Income (MHI) vs Water Use

There is a stronger correlation, however, with cities that have a median household income of less than $100K. Cities with median incomes lower than $100,000 seem to lower their water use when the percentage of their income contributed to their water bill increases (See Figure 3). Cities with median incomes higher than $100,000 maintain water usage as water bills increase (See Figure 2).

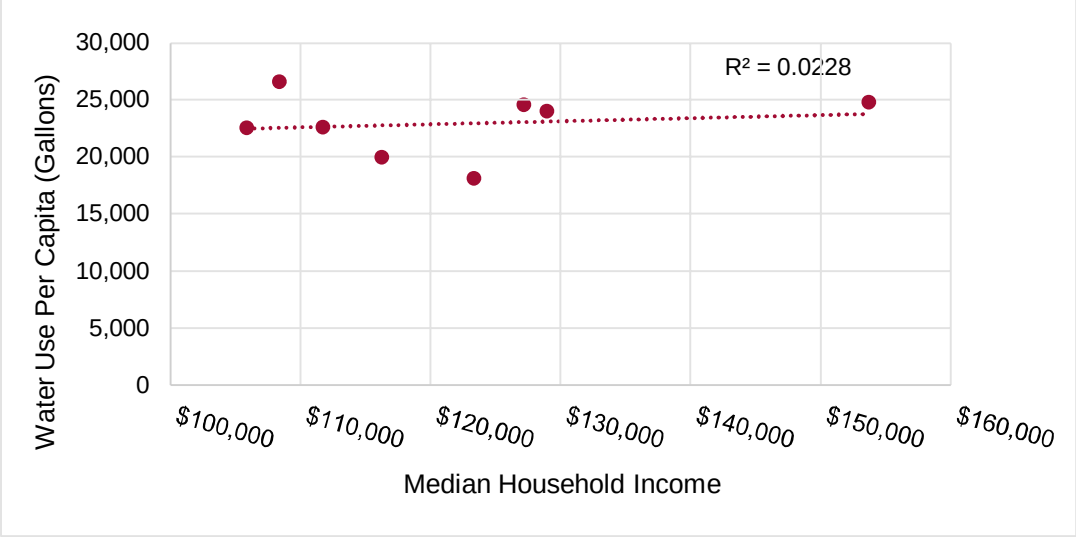


Figure 2 Water use per capita vs median income greater than $100K

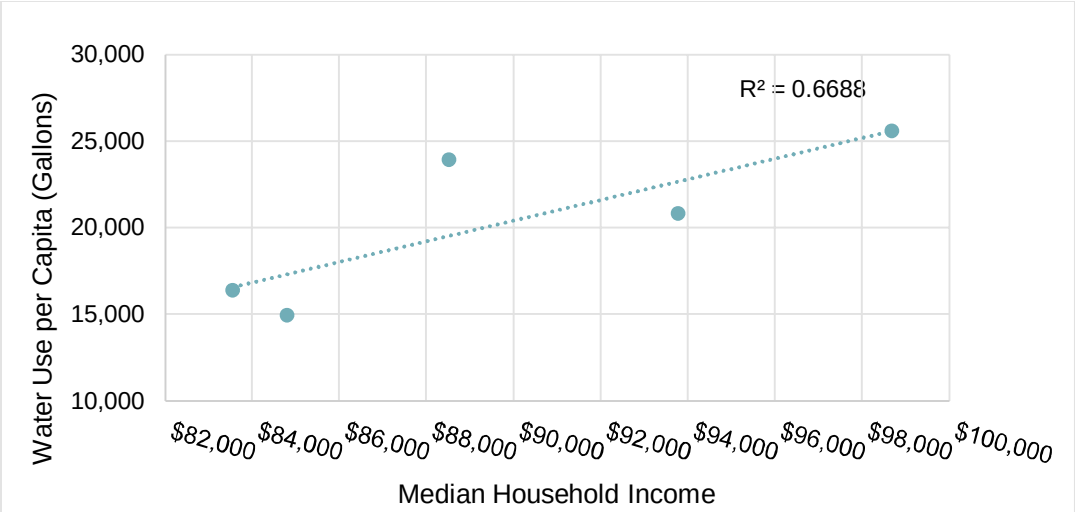


Figure 3 Water use per capita vs median income less than $100K

To better understand how percent of median income affects water usage, figures were created showing residential gallons used per year and % of median income going to a quarterly water bill. Figure 4 demonstrates the City of Hugo's water use between 2010 and 2024 and compares it to percent of median income going to a water bill. It appears the residential gallons of water used decreased significantly after the maximum percentage of income of 0.23% was achieved in 2012. However, the peak in water usage also occurred during a drought period of 2010-2013 which likely contributed to the increase in water demand at that time. Therefore, the decline cannot be fully attributed to the increase in percentage of median income.

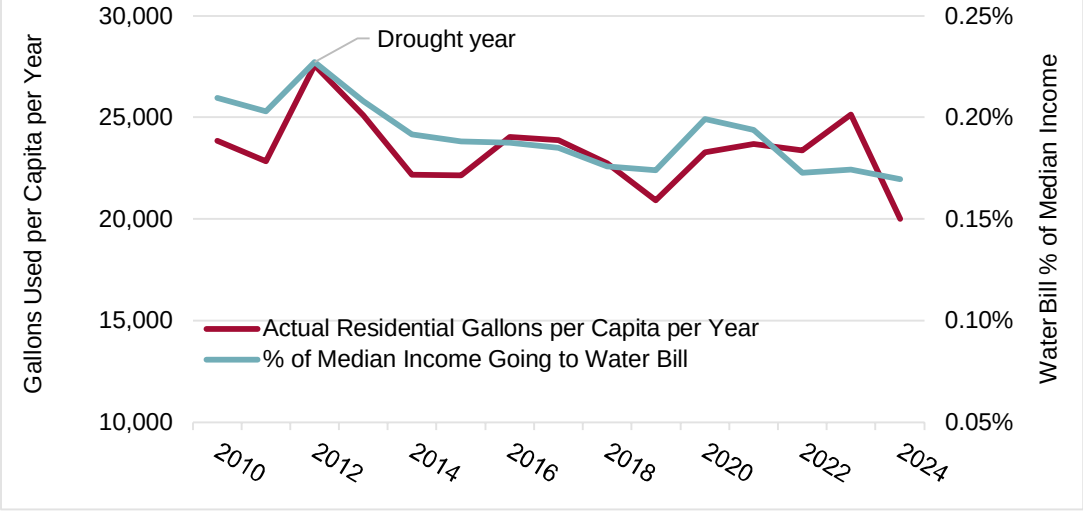


Figure 4 Hugo water use vs water bill % of median income

To estimate the tipping point for behavioral change in a tiered rate structure, the average yearly water bill as a percentage of median income was calculated for each city using data from 2010 to 2024. Table 5 shows each city's highest percentage reached or expected tipping point. Many of the cities saw a decrease in water demand per capita after reaching the highest water bill as a percentage of median income. Therefore, this study shows that achieving a tipping point could be a factor in achieving decreased water usage.

It is important to note that cities with lower median household incomes are more sensitive to price increase. For example, North St. Paul achieved water savings after increasing water bills to 0.46% of median household income. That additional cost could put strain on households. Therefore, a more detailed affordability analysis should be conducted by individual cities before implementing or increasing water tier rates to ensure residents can still afford water bills while achieving water savings.

Table 5 Water use and median household income - 2024

City	Median Household Income (MHI)	2024 Average Water Bill as a Percentage of MHI	Highest Water Bill as a percentage of MHI	Year Highest Average Water Bill Occurred
White Bear Lake[1][2]	$ 83,554	0.19%	0.22%	2023
North St. Paul[1]	$ 84,797	0.32%	0.46%	2018
New Brighton	$ 88,521	0.32%	0.32%	2024
Oakdale	$ 93,772	0.19%	0.19%	2018, 2019, & 2024
Vadnais Heights[1]	$ 98,685	0.18%	0.22%	2012
Stillwater[1][2]	$ 105,853	0.14%	0.16%	2023
Shoreview[1]	$ 108,370	0.24%	0.28%	2021
Woodbury[1]	$ 111,734	0.15%	0.15%	2022 & 2024
Hugo[1]	$ 116,228	0.17%	0.23%	2012
Mahtomedi[1]	$ 123,318	0.20%	0.25%	2012
Lino Lakes[1][2]	$ 127,181	0.18%	0.25%	2023
White Bear Township[1][2]	$ 128,963	0.25%	0.30%	2023
Lake Elmo[1]	$ 153,669	0.16%	0.36%	2012

Notes:
[1] Water use decreased in the following years after city reached the highest average water bill as a percentage of median income.
[2] Highest average water bill seen during drought year and there is not enough data following that year to indicate a trend.

Case studies showed that introducing tiered rate structures could contribute to reduced water use. The White Bear Lake study showed that water usage decreased differently by city but generally, the city with no tiered rate structure (New Brighton) saw a 1% decrease in water usage which could be attributed to a variety of other factors such as high efficiency appliances or public education programs. Cities that have had tiered rates have experienced a 12-45% decrease in water usage

since implementation. Accurately estimating potential water savings solely from tiered increasing block water utility rates is not possible since the decrease in average historical water usage over time can also be attributed to other factors such as high efficiency appliances and public awareness. Although it is not possible to accurately estimate the additional potential water savings from increasing existing tiered increasing block water utility rates, it is likely that communities would achieve additional water savings by increasing their existing tiered rates.

Findings and Implications

Case studies have shown that implementing a tiered rate structure for water can produce water savings. Tiered increasing block water utility rates are currently in place for all the White Bear Lake communities aside from New Brighton. The White Bear Lake Study 12 shows that cities that have implemented a tiered rate structure have seen water savings ranging from 12-45%, while New Brighton has seen minimal water savings. There is a strong correlation between household income and water use. The majority of cities in the study saw a decrease in water use after implementing tiered rates that resulted in a water bill that was anywhere from 0.15% to 0.46% of that city's median income. Cities with median incomes less than $100,000 are more sensitive to tiered rate changes and increasing rates for these cities would likely result in a reduction in water usage. It is likely that communities would continue to achieve additional water savings by increasing their existing tiered rates. However, affordability is a large factor and should be considered when planning tier rate increases.

Risks & Data Needs

- Gaps in data availability required significant amounts of estimation in calculations, introducing uncertainty into final estimates.
- Limited published research exists in the Midwest, and existing research from the Western United States may not be broadly applicable to the Twin Cities Metropolitan Area due to varying climatic conditions.
- Insufficient data is available on post-policy-implementation water use trends in cities that implemented tiered rates in the past 1-5 years. Additional estimates of water savings can be calculated once sufficient data is available.

Recommendations

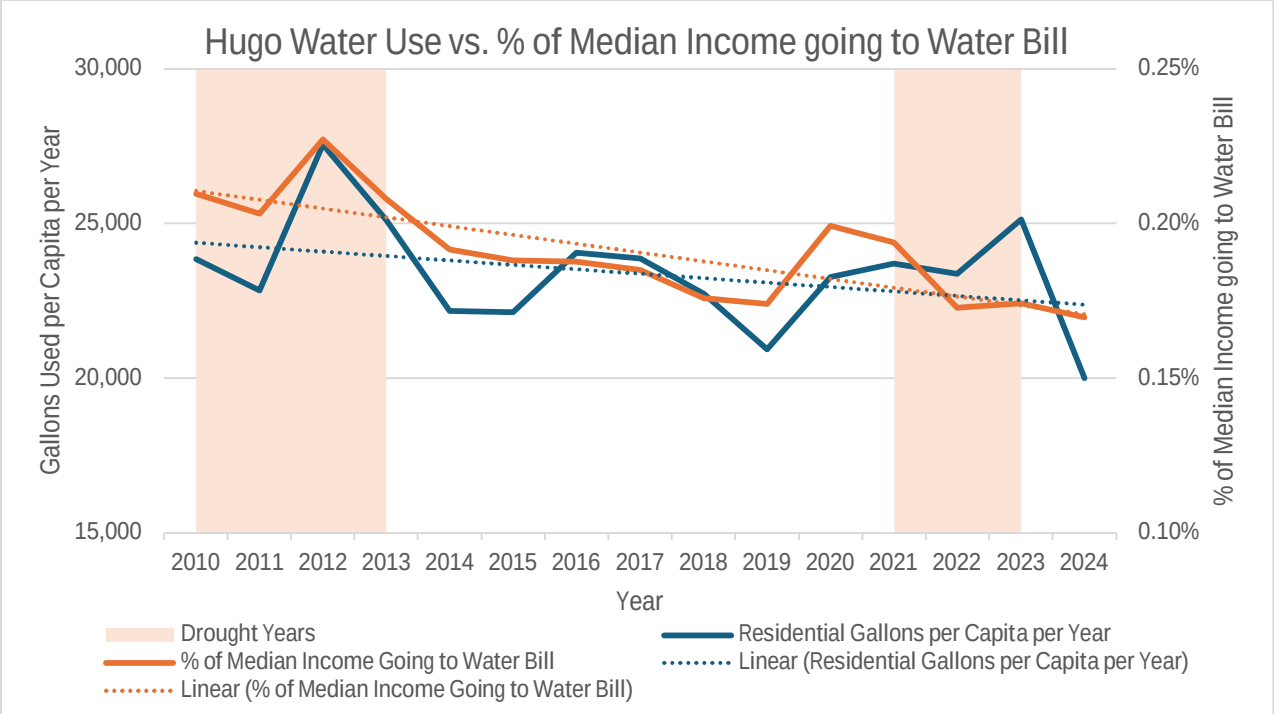
- It is likely that additional water savings can be achieved by increasing tiered rates. Communities should consider these potential savings when studying and adjusting their water rates.
- Individual cities should implement tiered rate structures if they do not currently have tiers in place.
- Although there is a relationship between household income and water usage, it is important to consider affordability as a factor when estimating tipping points for tiered rates to achieve water savings.

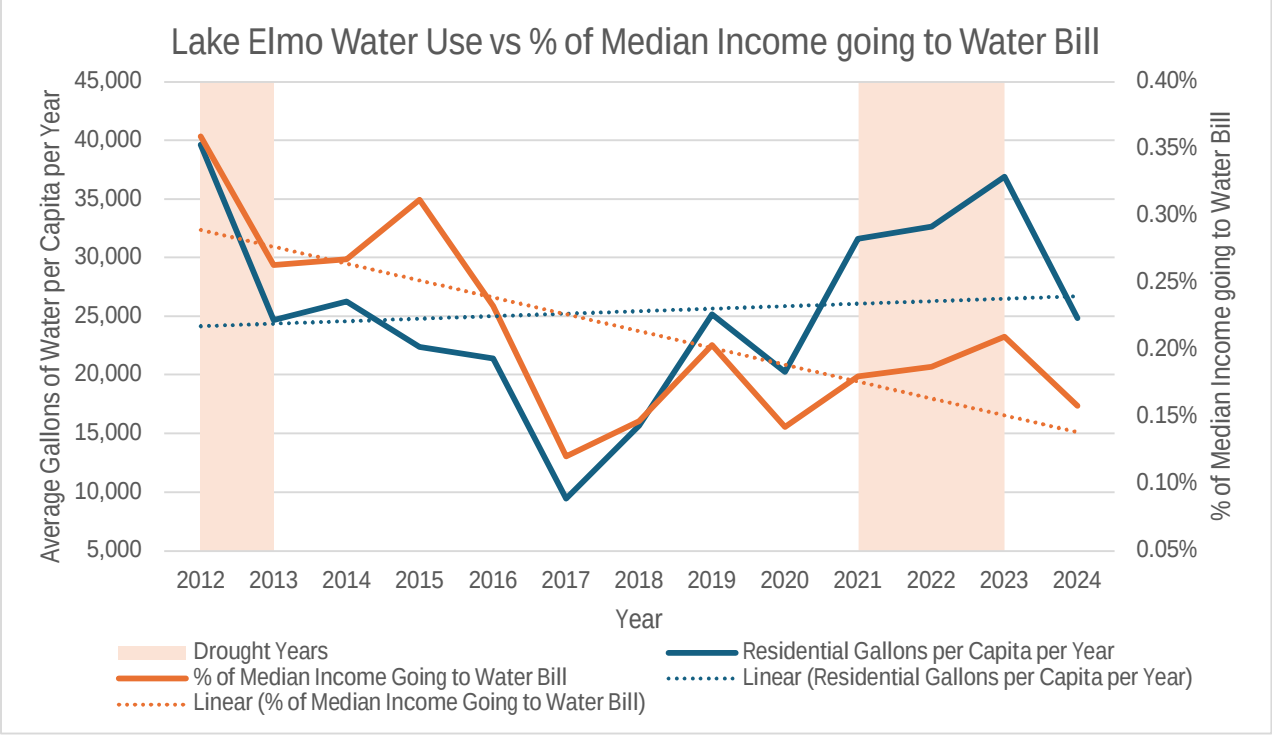
Appendices

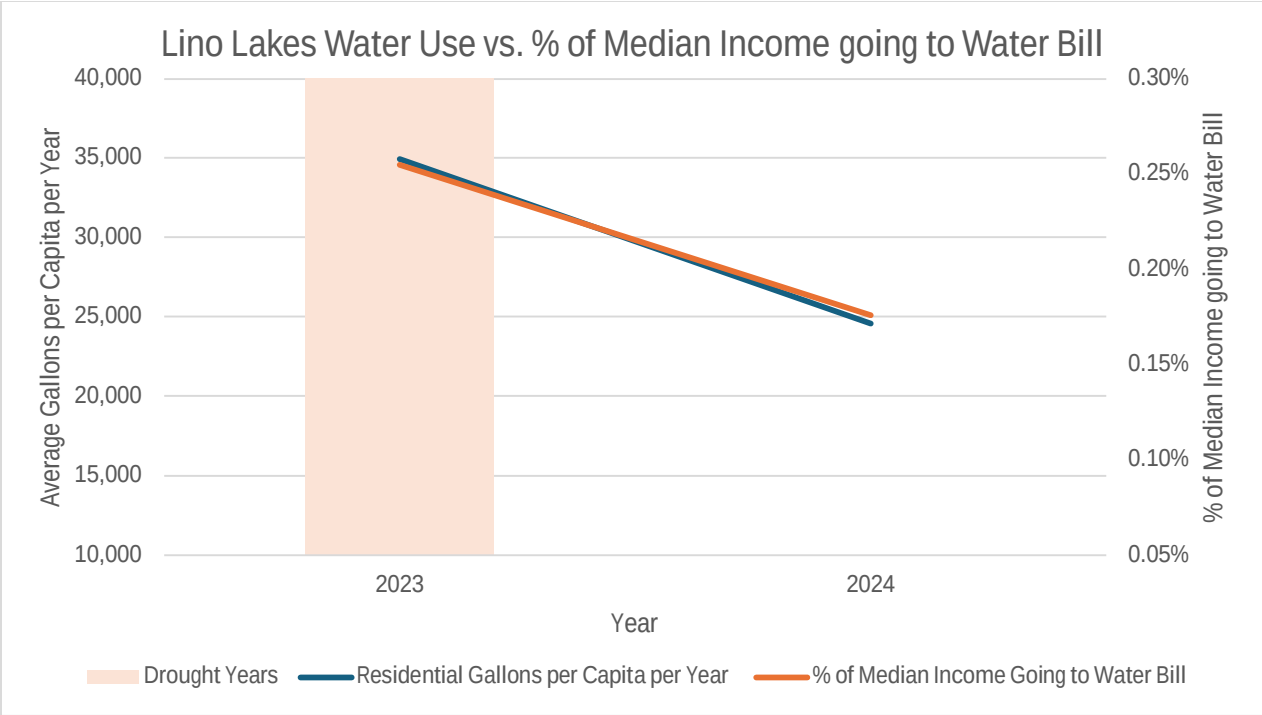
Appendix A – Water use vs. % median income

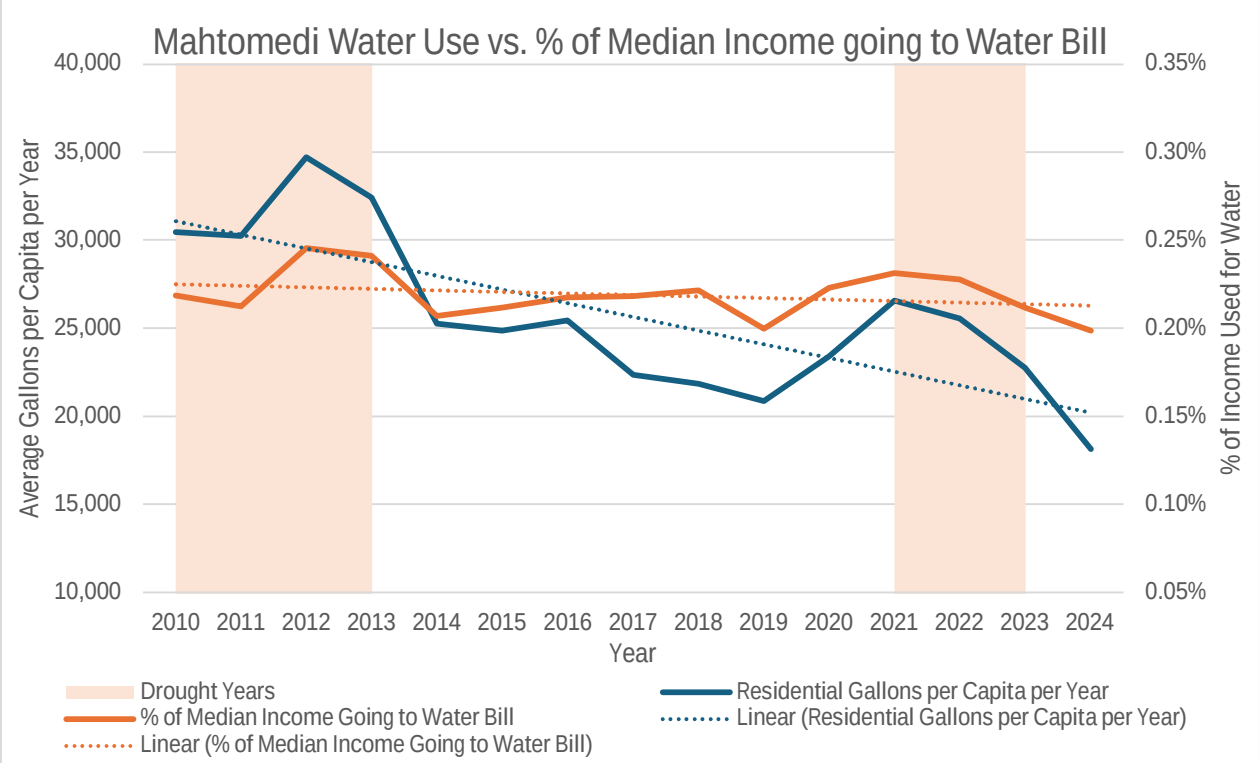
Appendix B – Water use before and after implementation of tiered increasing block utility rates

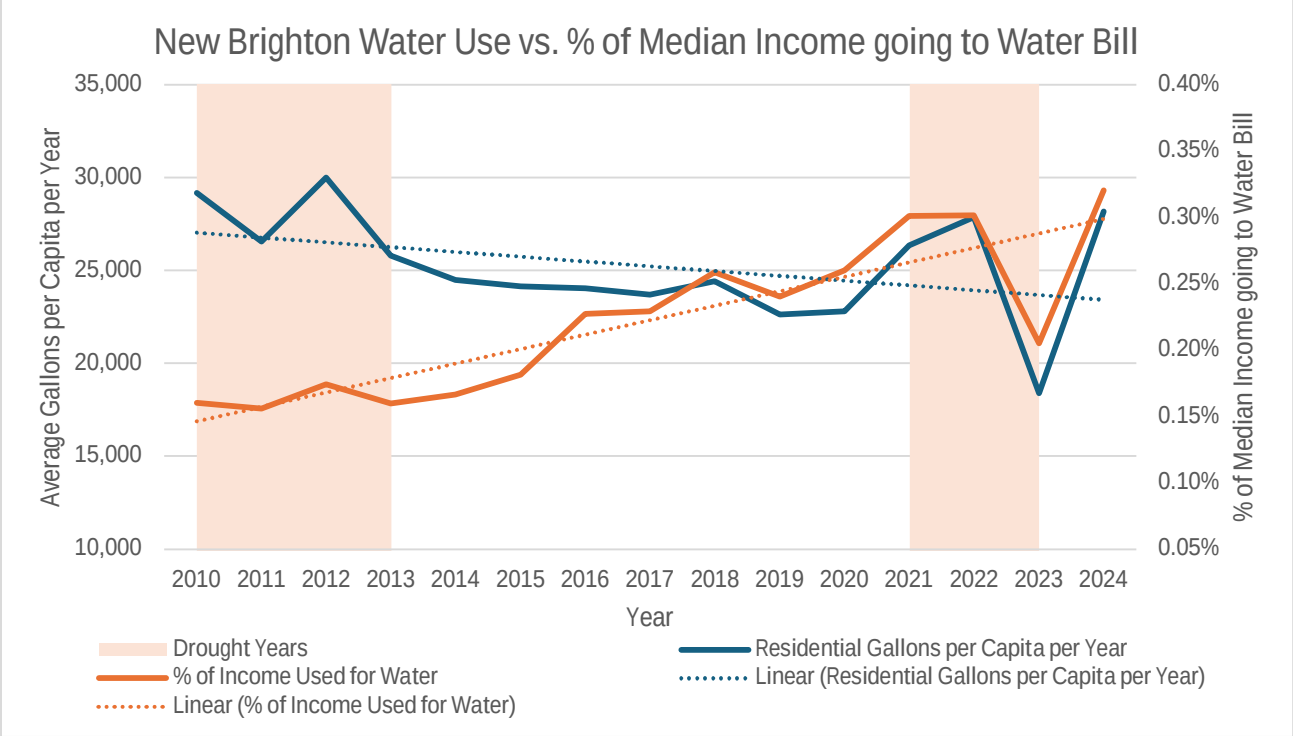
Appendix A: Water Use vs. % Median Income Used on Water Bill

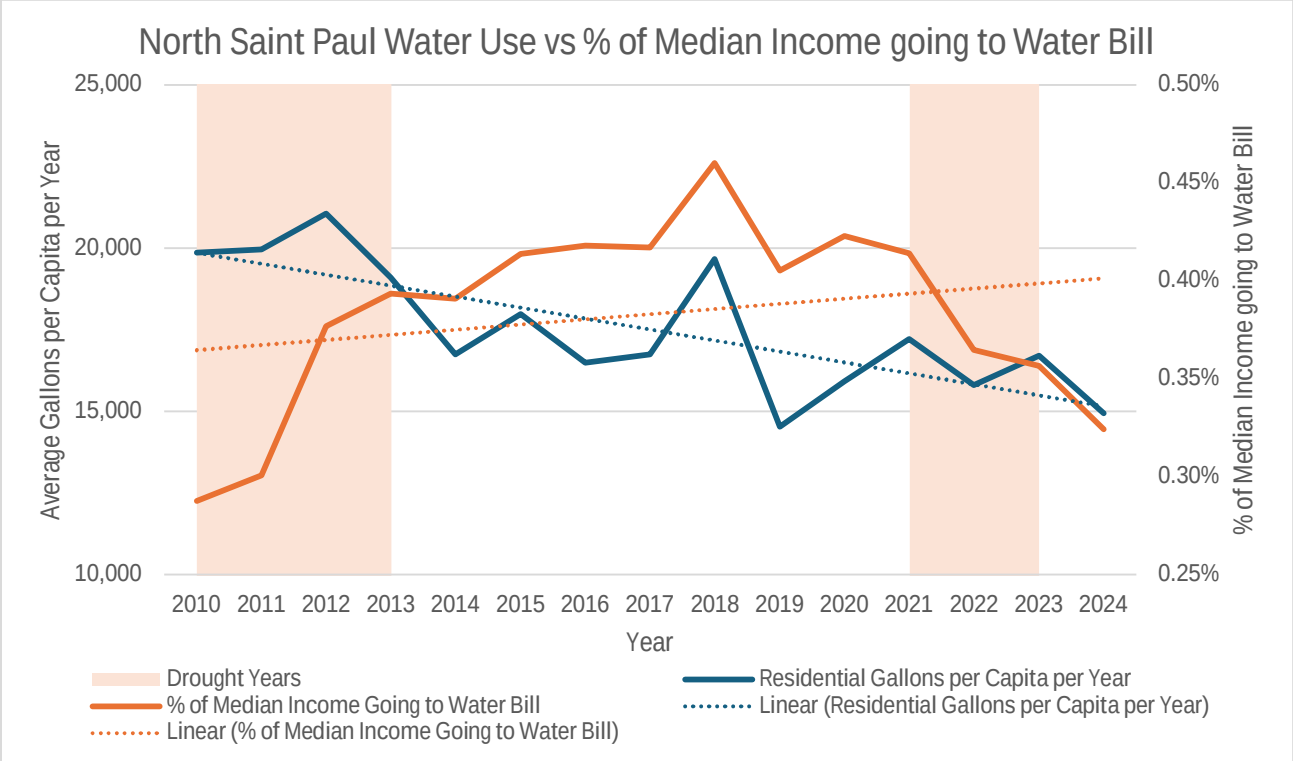


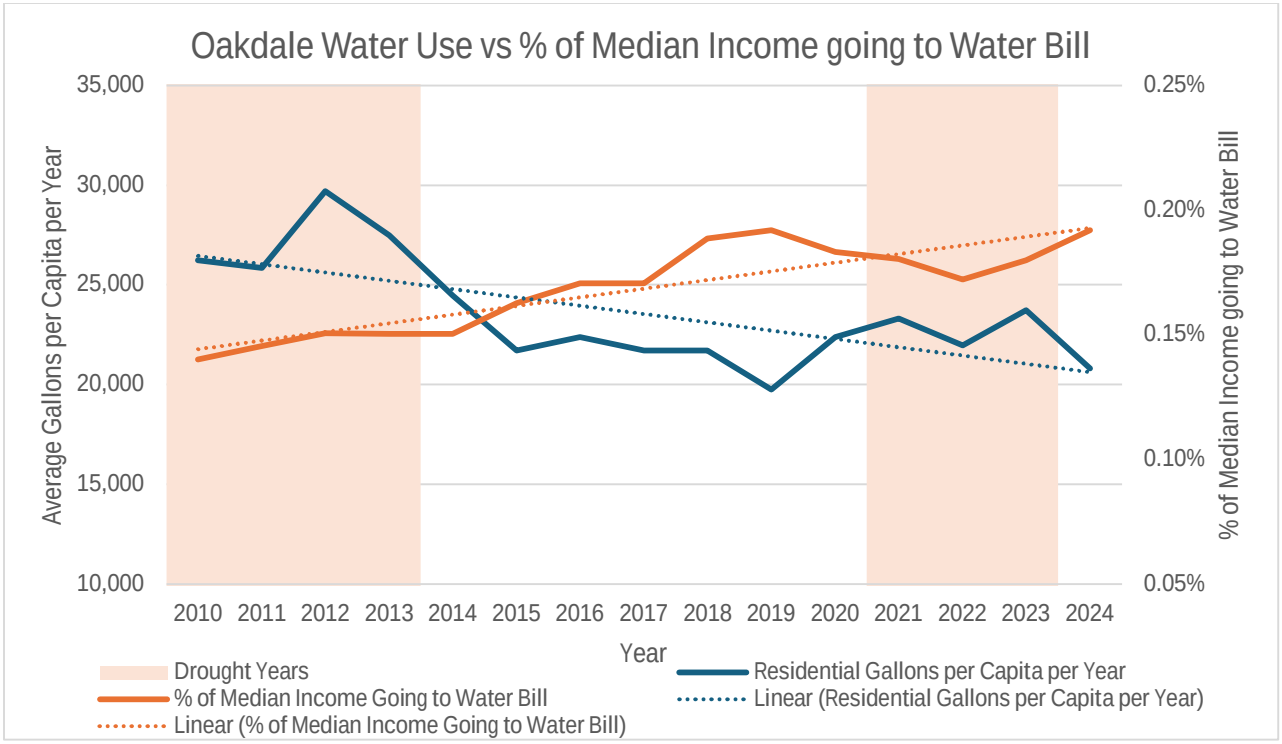


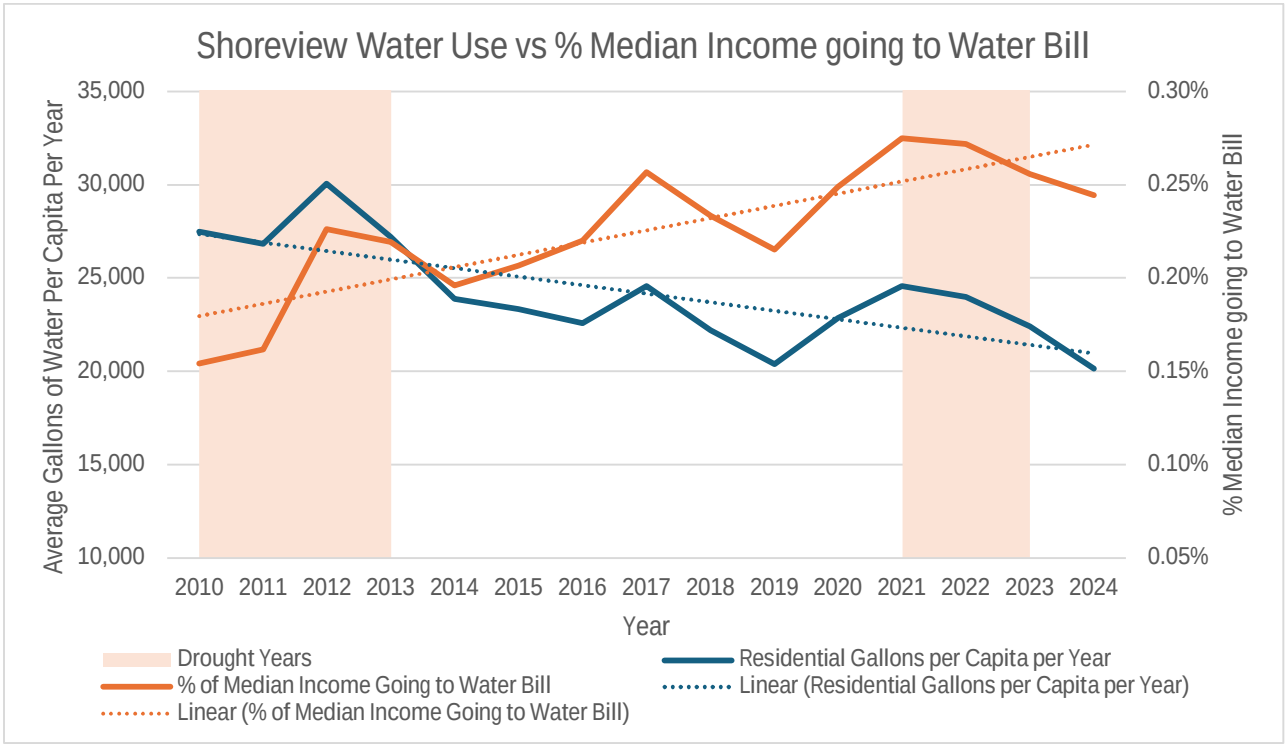

Lino Lakes Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
40,000
35,000
30,000
25,000
20,000
15,000
10,000
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
% of Median Income going to Water Bill
2023
2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Median Income Going to Water Bill

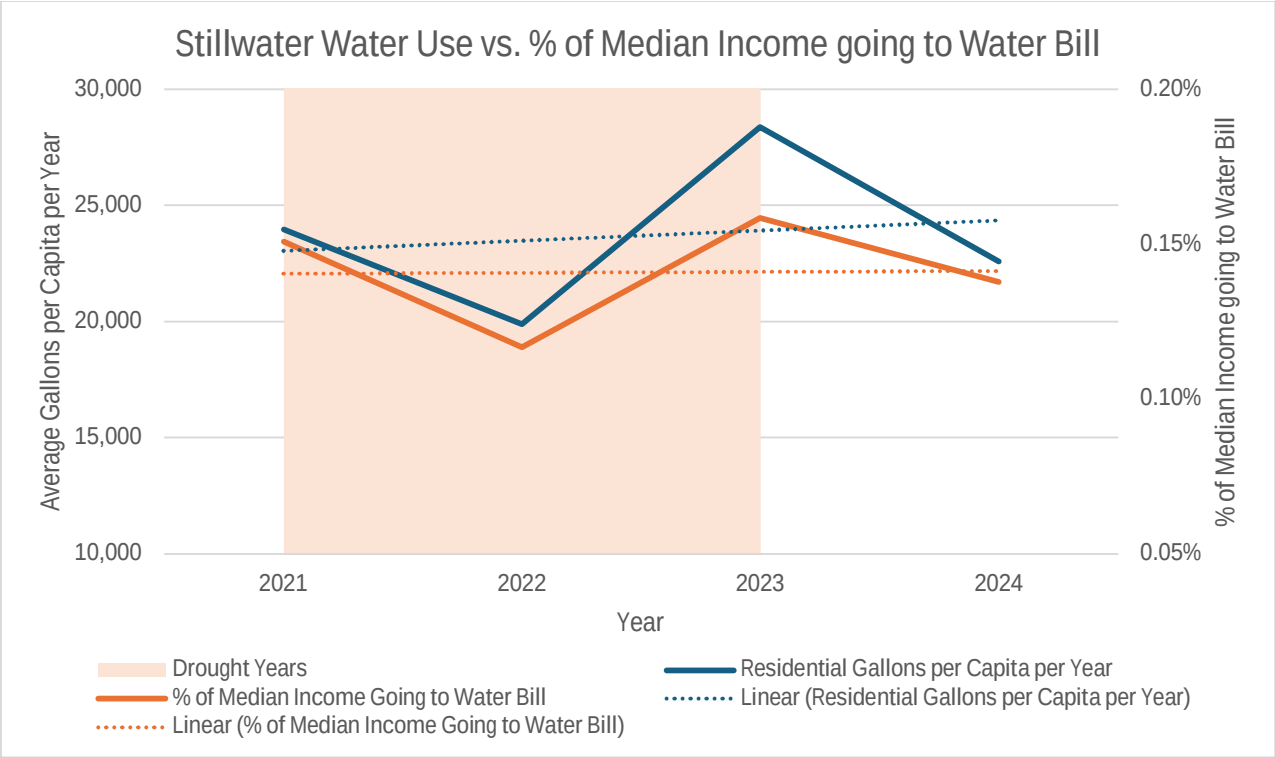

Mahtomedi Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
40,000
35,000
30,000
25,000
20,000
15,000
10,000
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
% of Income Used for Water
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
% of Median Income Going to Water Bill
Linear (% of Median Income Going to Water Bill)
Residential Gallons per Capita per Year
Linear (Residential Gallons per Capita per Year)

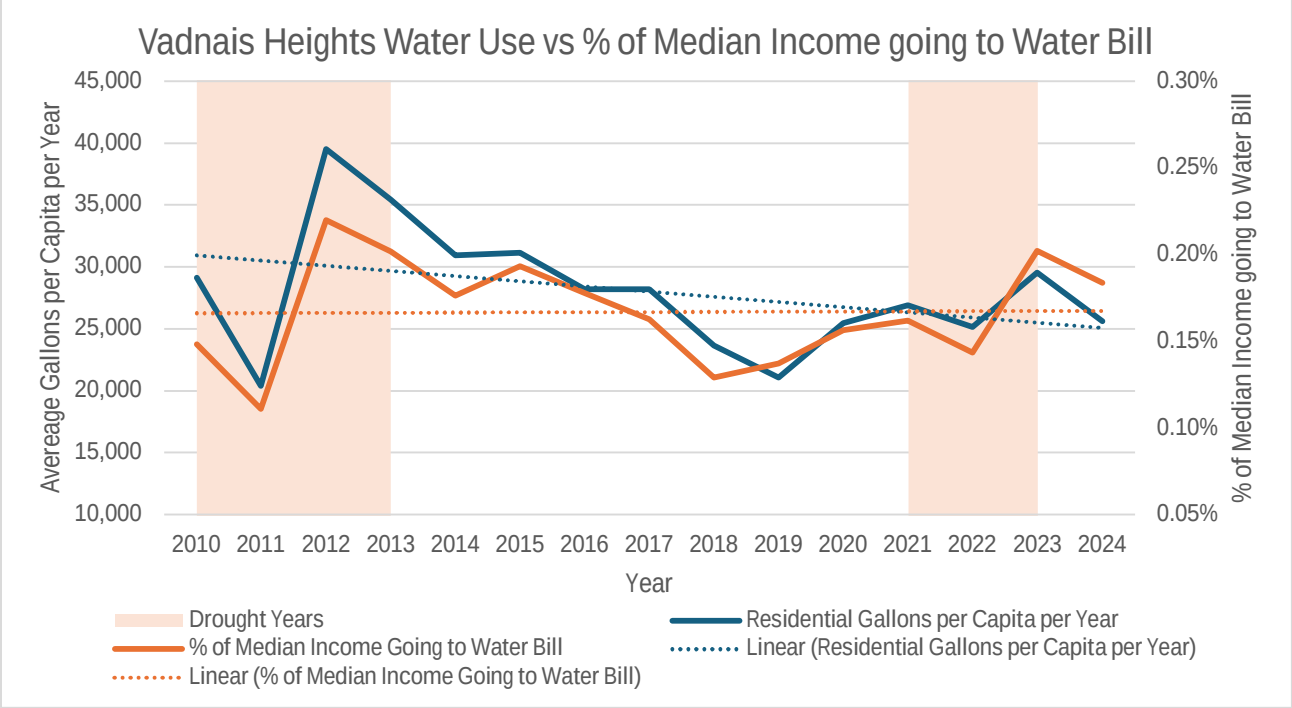

New Brighton Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
% of Median Income going to Water Bill
35,000
30,000
25,000
20,000
15,000
10,000
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Income Used for Water
Linear (Residential Gallons per Capita per Year)
Linear (% of Income Used for Water)

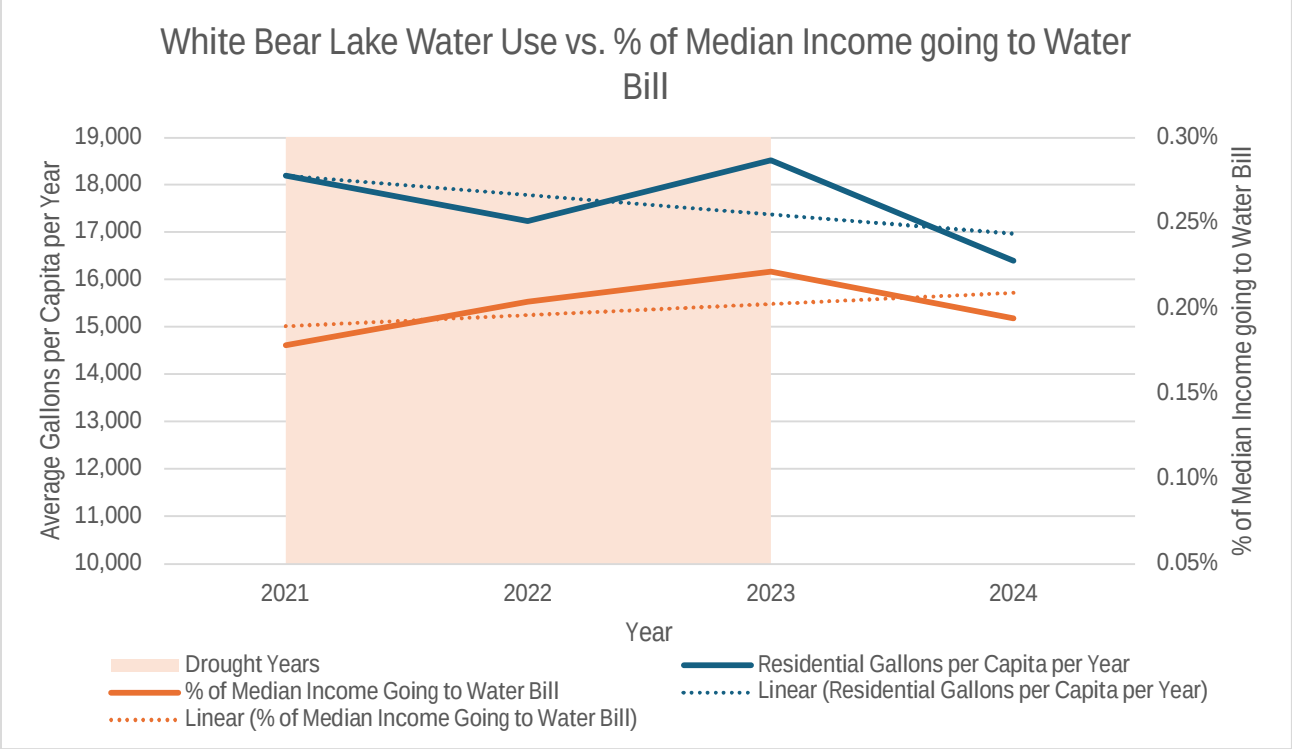

North Saint Paul Water Use vs % of Median Income going to Water Bill
Average Gallons per Capita per Year
% of Median Income going to Water Bill
25,000
20,000
15,000
10,000
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Median Income Going to Water Bill
Linear (Residential Gallons per Capita per Year)
Linear (% of Median Income Going to Water Bill)

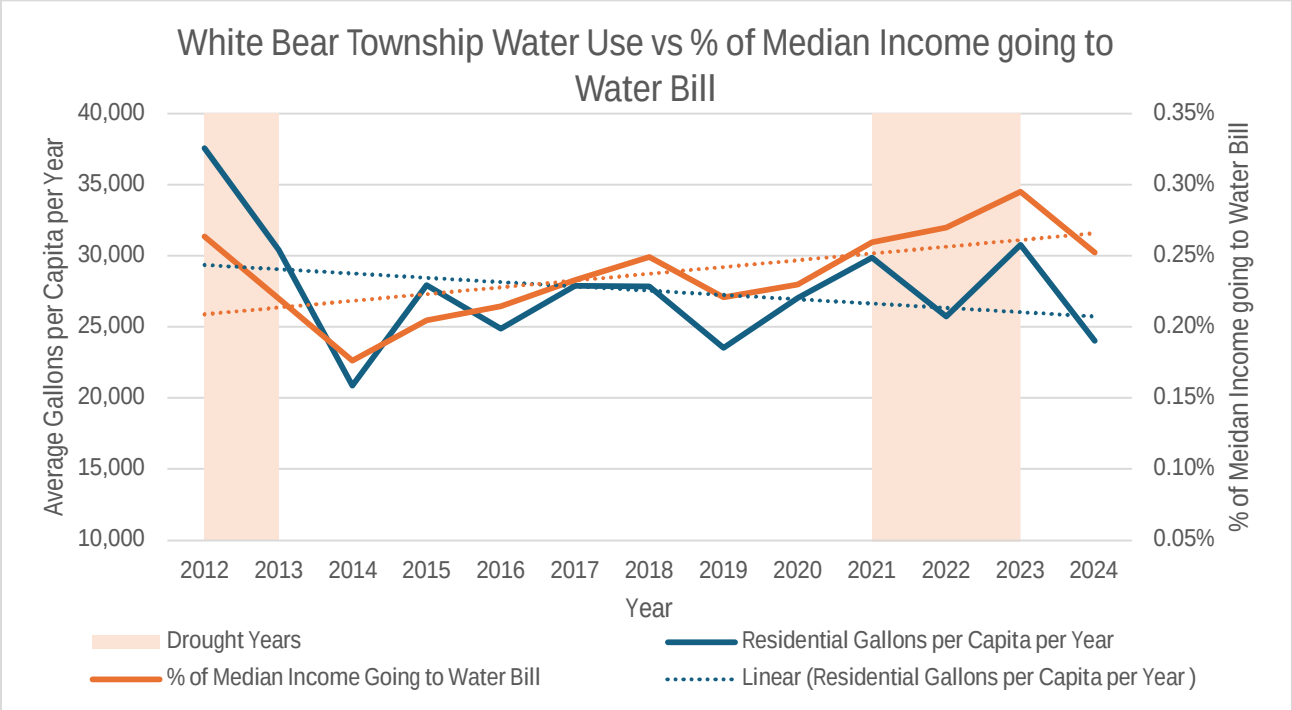

Oakdale Water Use vs % of Median Income going to Water Bill
Average Gallons per Capita per Year
% of Median Income going to Water Bill
35,000
30,000
25,000
20,000
15,000
10,000
0.25%
0.20%
0.15%
0.10%
0.05%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
% of Median Income Going to Water Bill
Linear (% of Median Income Going to Water Bill)
Residential Gallons per Capita per Year
Linear (Residential Gallons per Capita per Year)

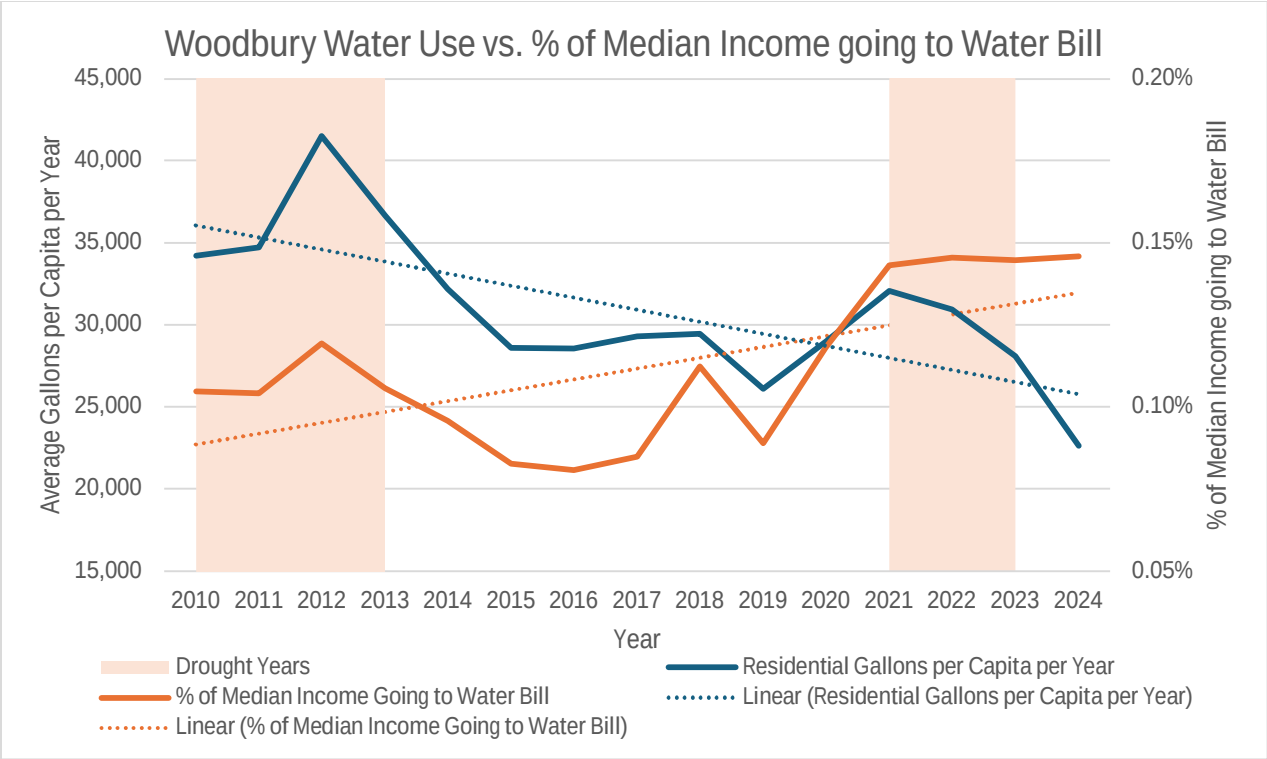

Shoreview Water Use vs % Median Income going to Water Bill
Average Gallons of Water Per Capita Per Year
% Median Income going to Water Bill
35,000
30,000
25,000
20,000
15,000
10,000
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
% of Median Income Going to Water Bill
Linear (% of Median Income Going to Water Bill)
Residential Gallons per Capita per Year
Linear (Residential Gallons per Capita per Year)


Stillwater Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
30,000
25,000
20,000
15,000
10,000
0.20%
0.15%
0.10%
0.05%
% of Median Income going to Water Bill
2021
2022
2023
2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Median Income Going to Water Bill
Linear (Residential Gallons per Capita per Year)
Linear (% of Median Income Going to Water Bill)

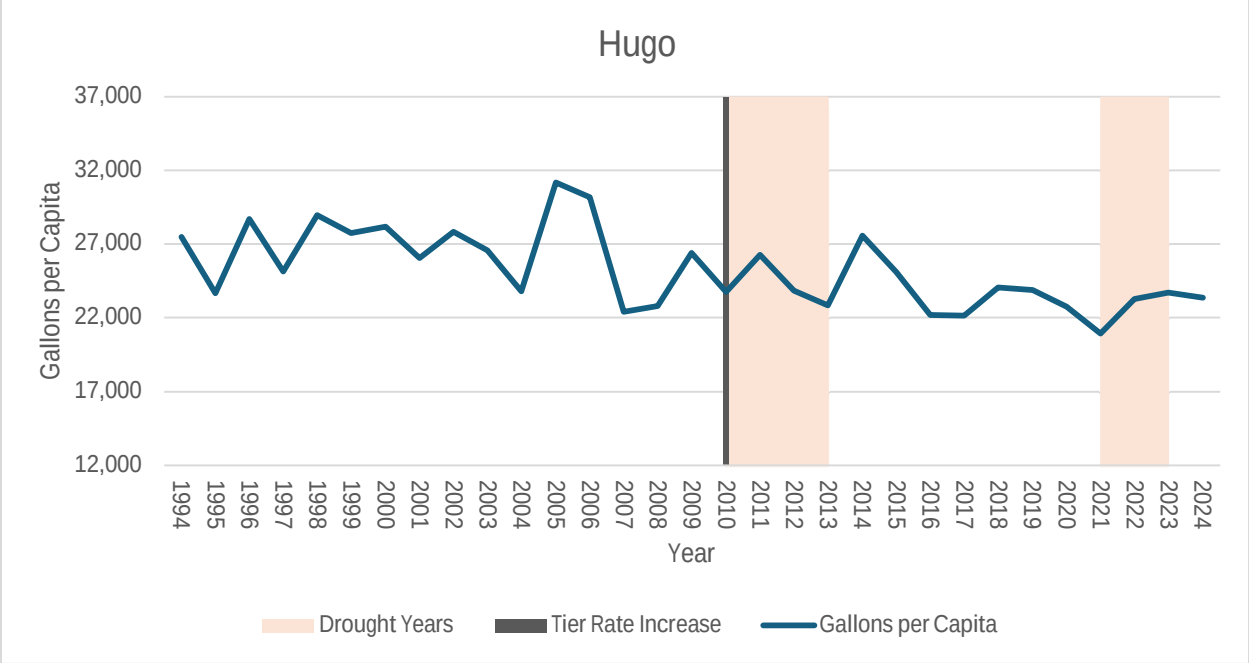

Vadnais Heights Water Use vs % of Median Income going to Water Bill
Average Gallons per Capita per Year
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
% of Median Income going to Water Bill
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Median Income Going to Water Bill
Linear (Residential Gallons per Capita per Year)
Linear (% of Median Income Going to Water Bill)

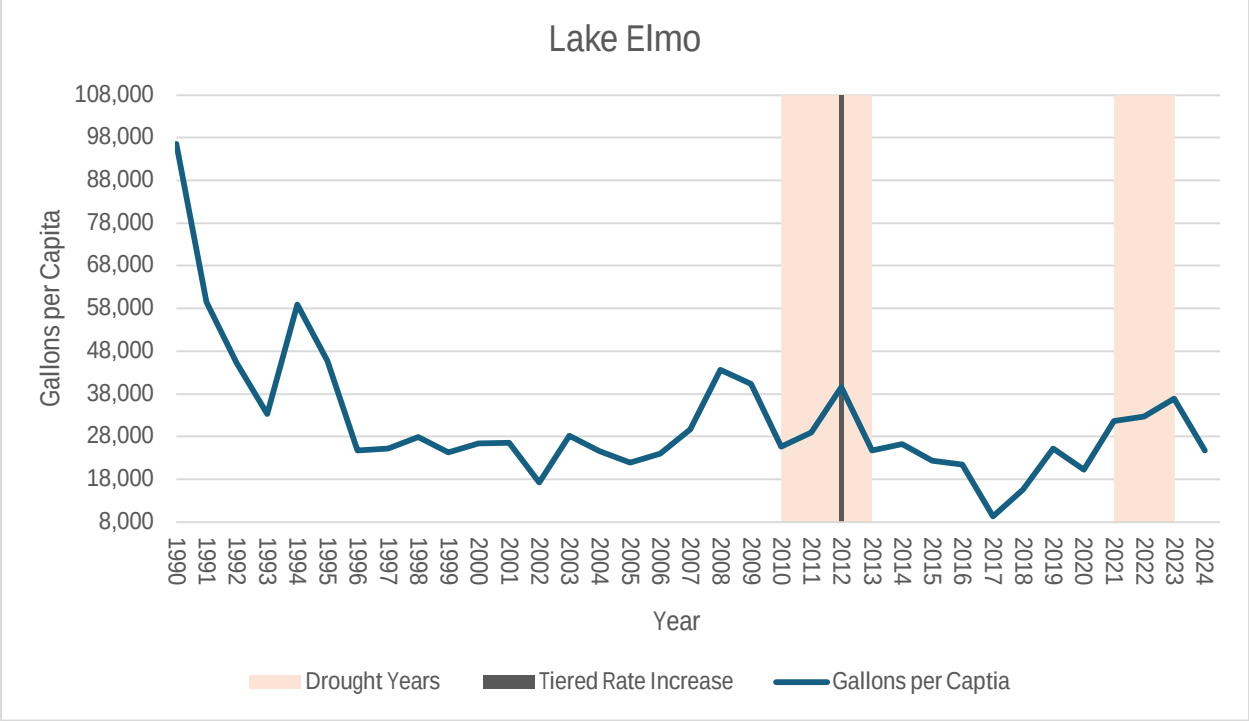

White Bear Lake Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
% of Median Income going to Water Bill
2021
2022
2023
2024
Year
Drought Years
% of Median Income Going to Water Bill
Linear (% of Median Income Going to Water Bill)
Residential Gallons per Capita per Year
Linear (Residential Gallons per Capita per Year)

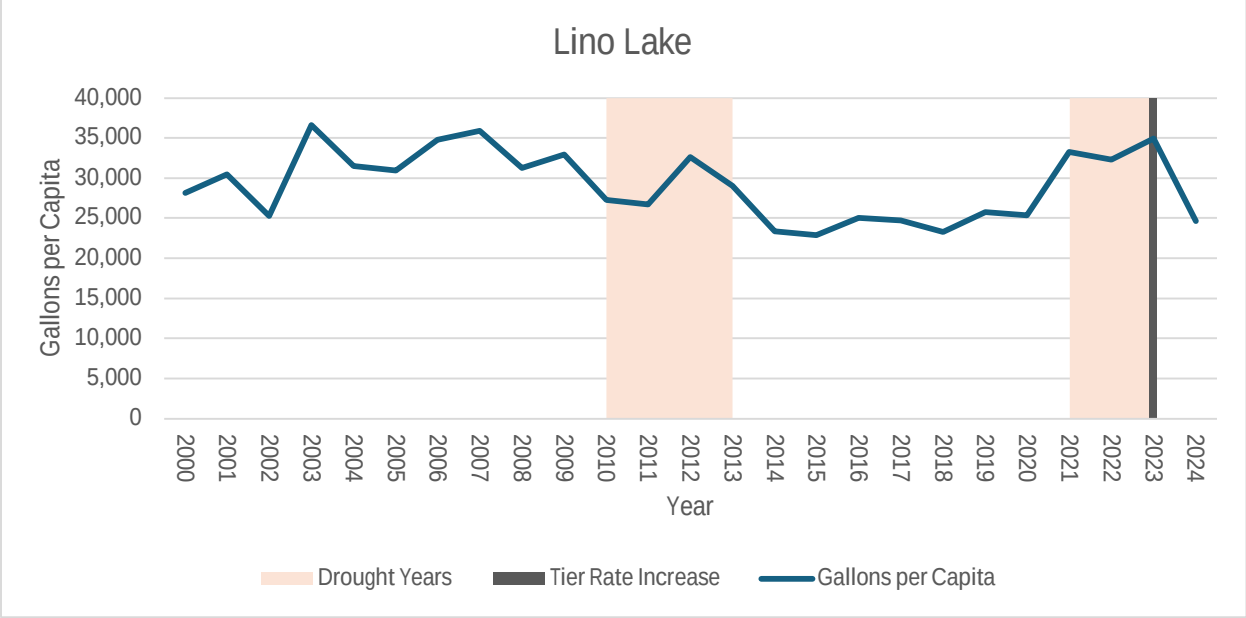

White Bear Township Water Use vs % of Median Income going to Water Bill
Average Gallons per Capita per Year
40,000
35,000
30,000
25,000
20,000
15,000
10,000
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
% of Meidan Income going to Water Bill
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
Drought Years
% of Median Income Going to Water Bill
Residential Gallons per Capita per Year
Linear (Residential Gallons per Capita per Year)

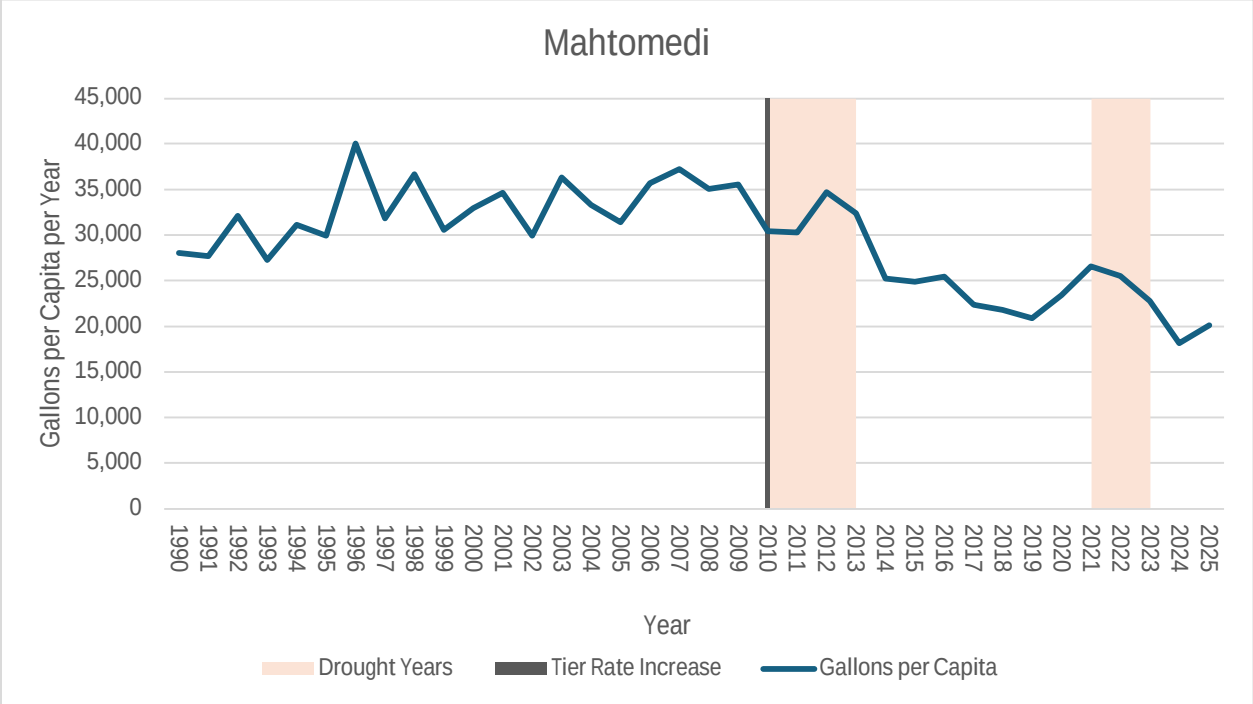

Woodbury Water Use vs. % of Median Income going to Water Bill
Average Gallons per Capita per Year
% of Median Income going to Water Bill
45,000
40,000
35,000
30,000
25,000
20,000
15,000
0.20%
0.15%
0.10%
0.05%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Residential Gallons per Capita per Year
% of Median Income Going to Water Bill
Linear (Residential Gallons per Capita per Year)
Linear (% of Median Income Going to Water Bill)

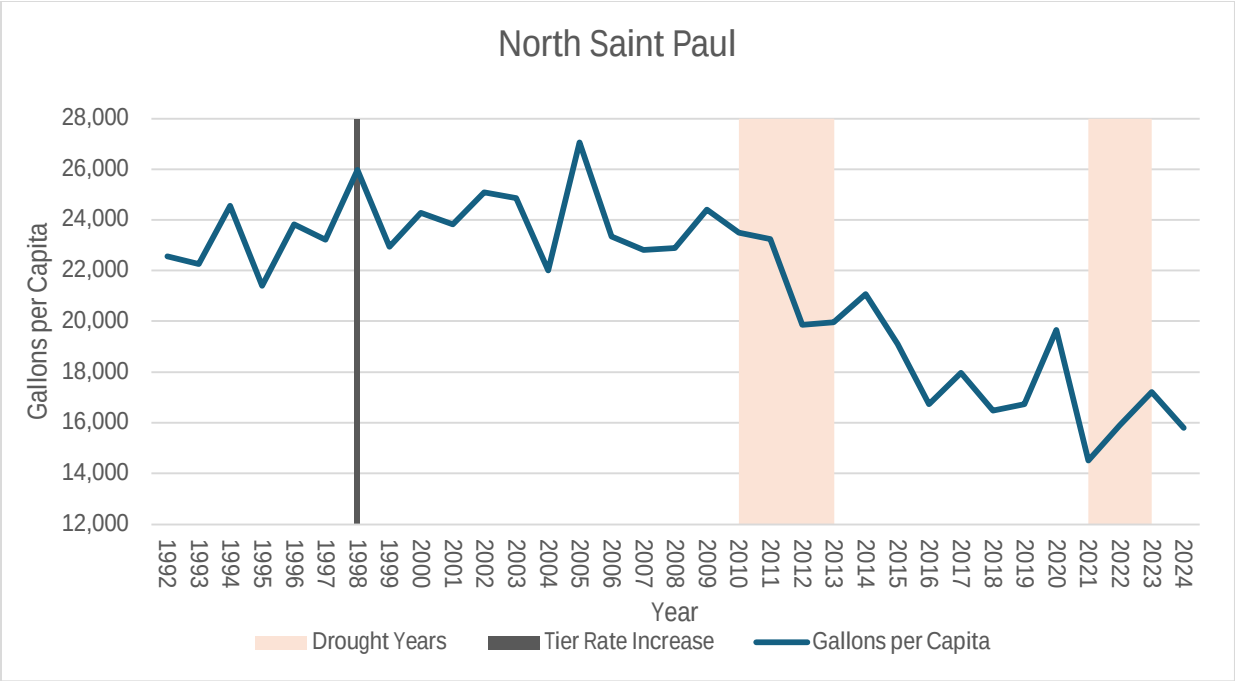
Appendix B - Water Use Before and After Implementation of Tiered Increasing Block Utility Rates

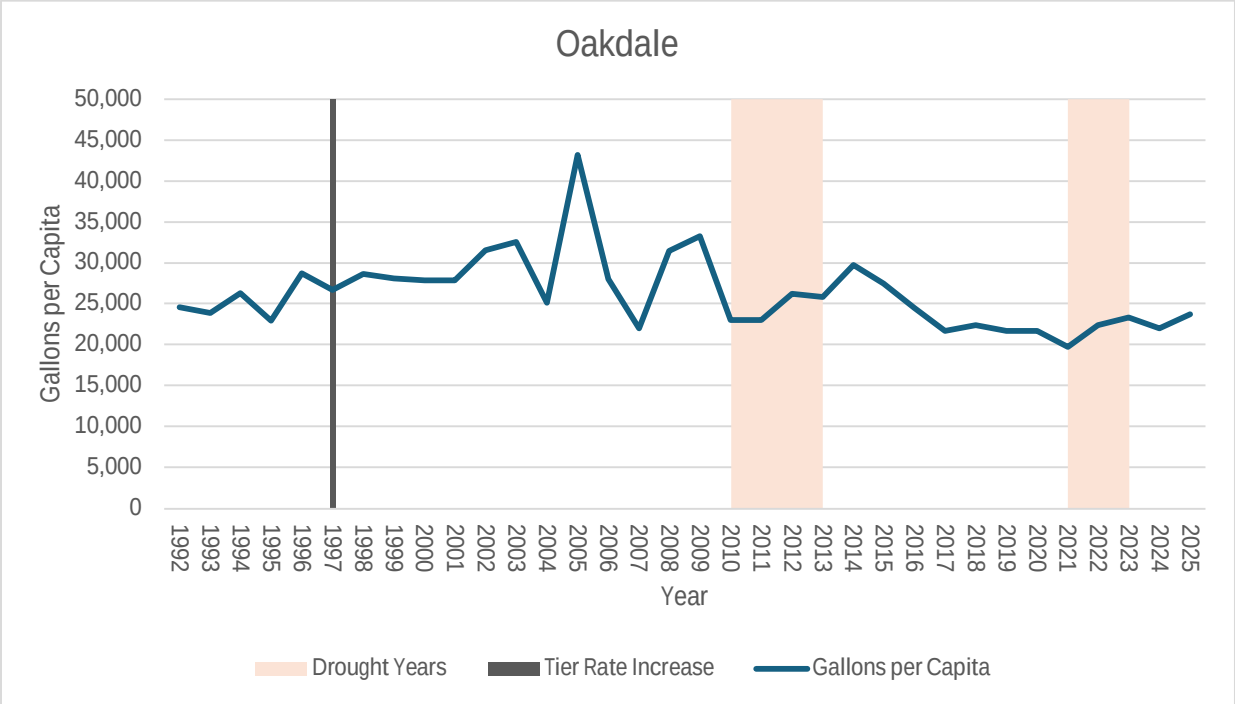


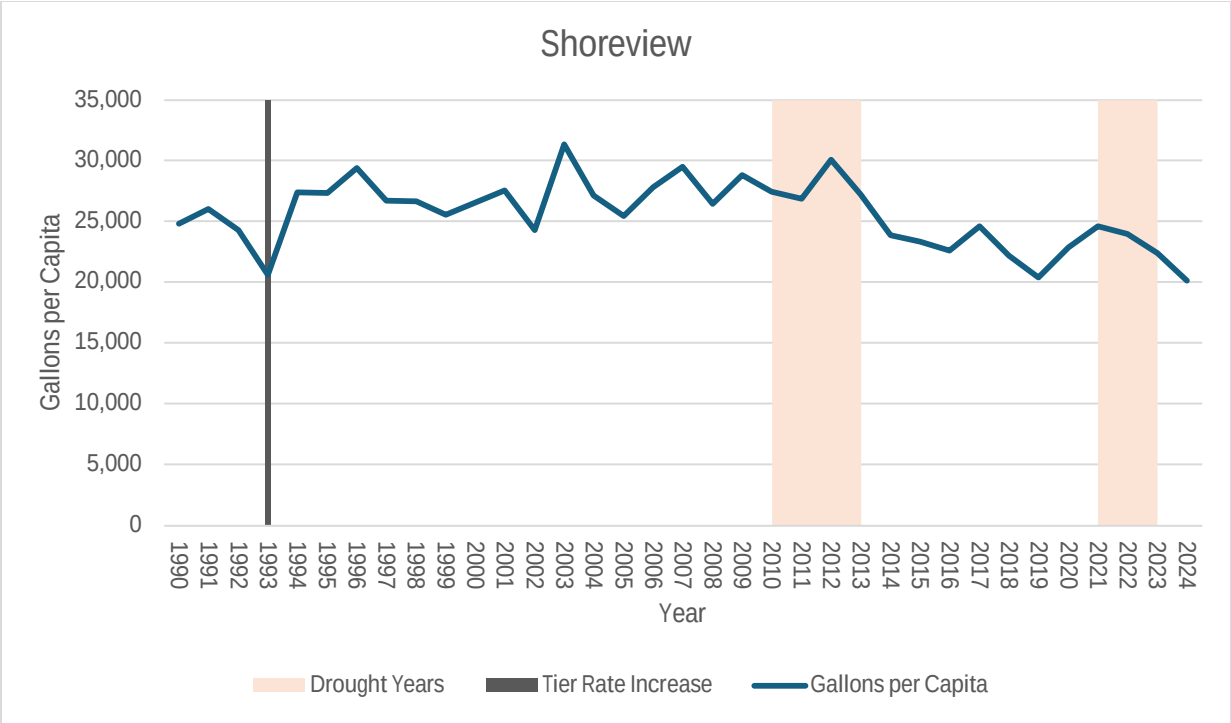


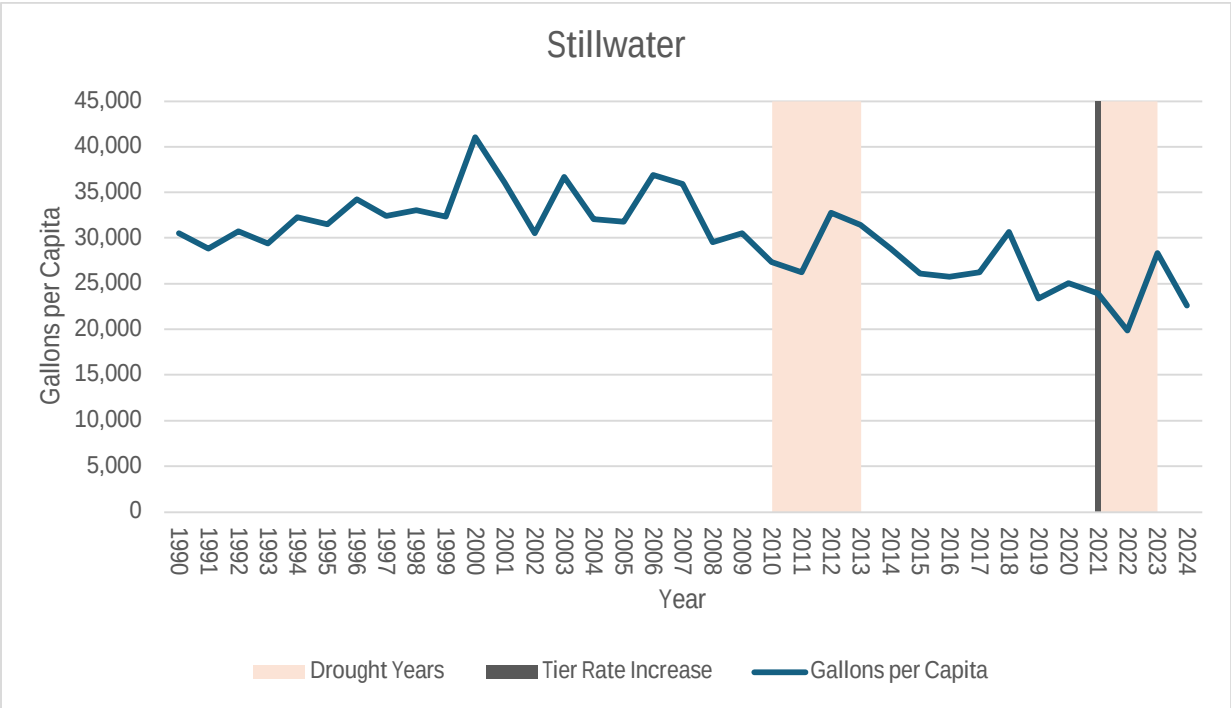

Lino Lake
Gallons per Capita
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita

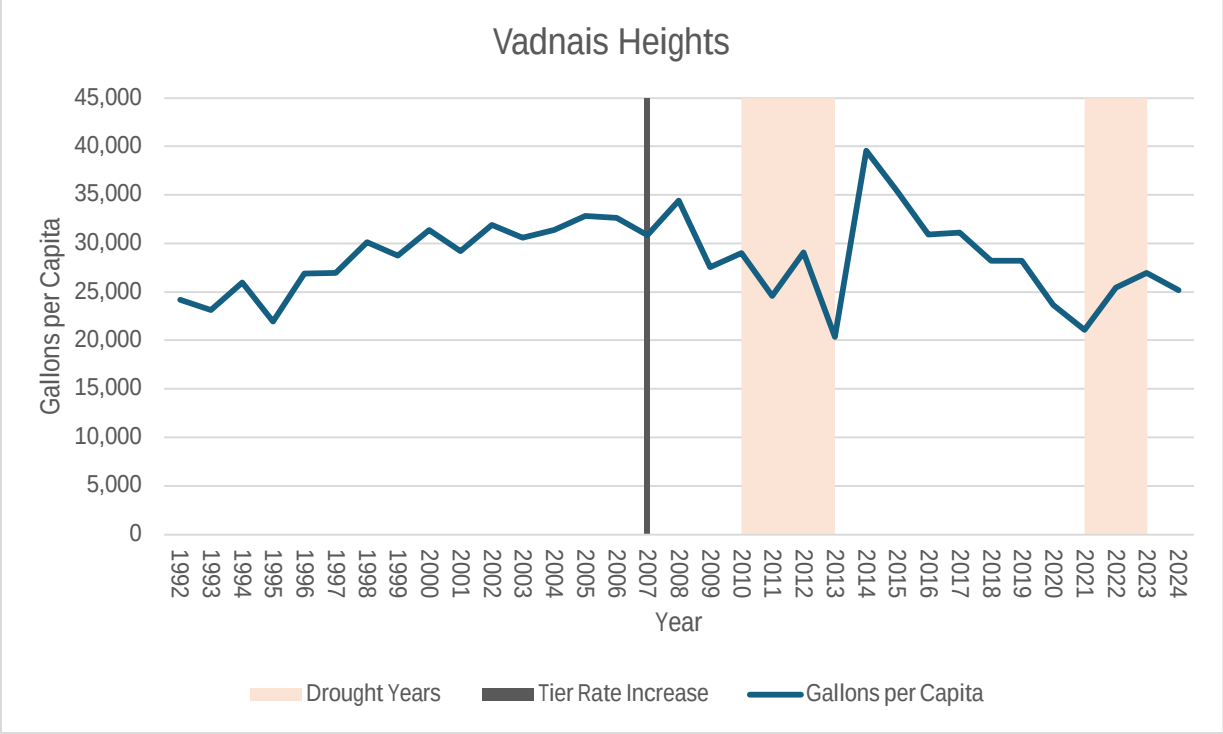

Mahtomedi
Gallons per Capita per Year
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Year
Drought Years
Tier Rate Increase
Gallons per Capita

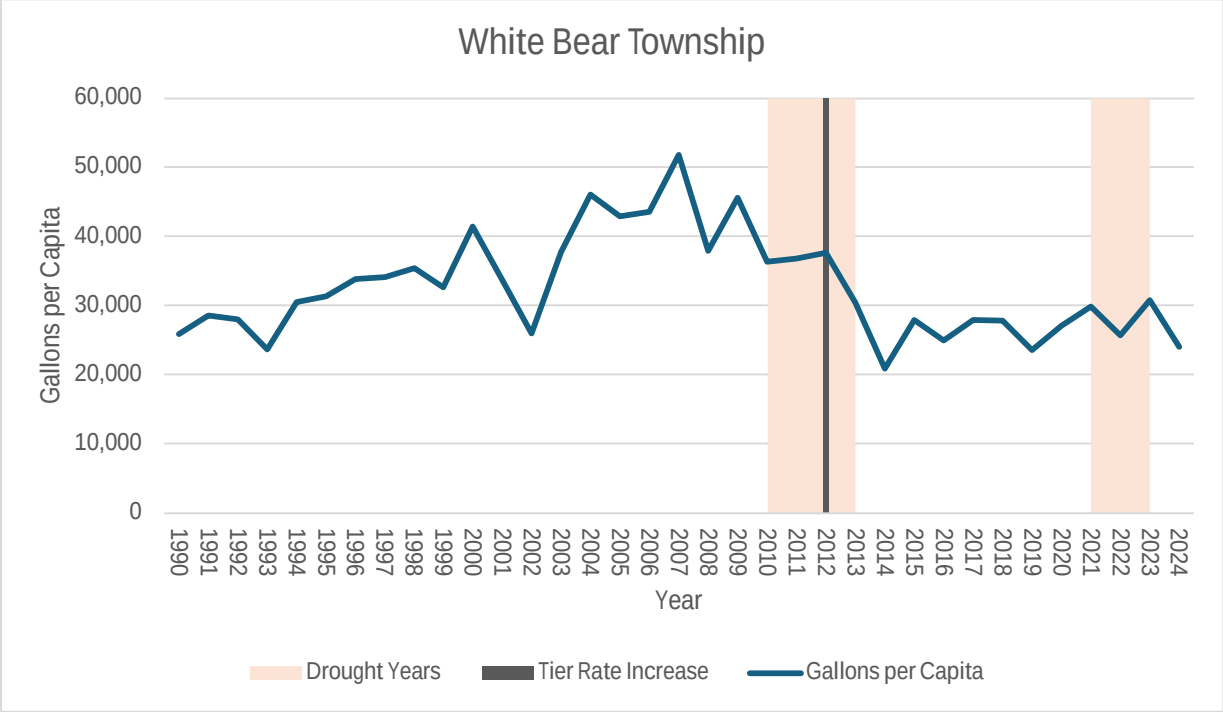

North Saint Paul
Gallons per Capita
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita

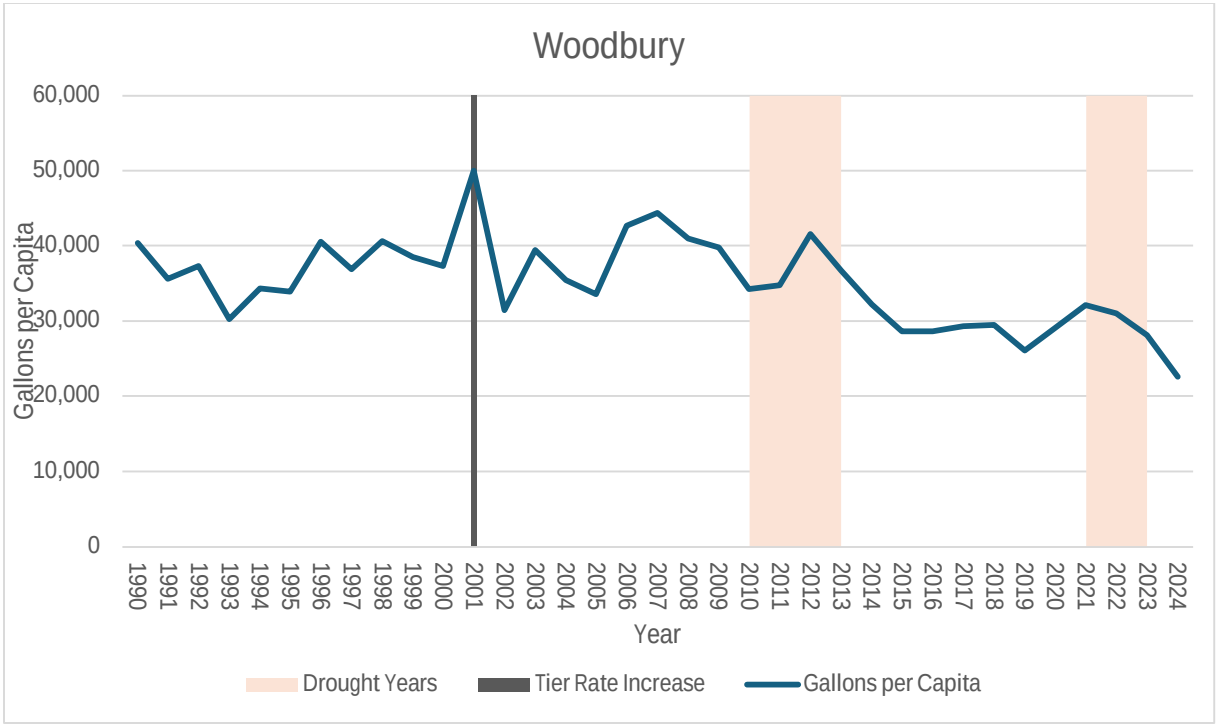

Oakdale
Gallons per Capita
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Year
Drought Years
Tier Rate Increase
Gallons per Capita


Shoreview
Gallons per Capita
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita


Stillwater
Gallons per Capita
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita


Vadnais Heights
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Gallons per Capita
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita


White Bear Township
60,000
50,000
40,000
30,000
20,000
10,000
0
Gallons per Capita
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita


Woodbury
60,000
50,000
40,000
30,000
20,000
10,000
0
Gallons per Capita
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
Drought Years
Tier Rate Increase
Gallons per Capita

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