MOONSHOT MISSIONS

WATER AFFORDABILITY ANALYSES FOR SIX MICHIGAN COMMUNITIES

This affordability analysis was conducted by Moonshot Missions, with funding from a partnership of, We the People of Detroit, Freshwater Future, and the National Wildlife Federation.

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EXECUTIVE SUMMARY

In response to growing concern about the affordability of water services in the state of Michigan, Moonshot Missions has prepared an analysis to evaluate the feasibility of potential affordability programs in six diverse communities. Feasibility is measured by whether a proposed affordability program can reduce the rates charged to qualified households without creating significant impacts on the community's revenue requirements or for other customers.

Six communities from around Michigan were chosen for their characteristics. The communities are Grand Rapids, Flint, East Lansing, Benton Harbor, Houghton, and Ishpeming.

These communities range in population from just over 6,400 to 200,000, with a median household income between $21,916 and $50,103. Poverty rates vary from 14.7% to 45.4%. Three communities are classified as severely disadvantaged, one as disadvantaged, and two as not disadvantaged. The monthly combined (water and sewer) cost for 3,000 gallons ranged from $44.76 to $127.38. Four communities are in the lower peninsula and two communities are in the upper peninsula.

Benton Harbor had the highest poverty rate of any of the communities analyzed. To offer further support to similar communities, the report offers a list of options covering both cost reduction and revenue enhancements. These options include reducing energy and chemical costs, as well as reduction of non-revenue water and implementing stormwater charges. Utilizing one or more of these tools will reduce the revenue target for user charges. For smaller communities with high poverty rates, it may be worthwhile to explore significant changes such as community-led regionalization or consolidation.

The Research Question is: For these six communities, can drinking water rates be structured to promote affordability without causing financial hardship to the utility and its customers, using one or more of the following methods: 1) a fixed discount program, 2) an income threshold program or 3) a water burden program?

The Research Answer is: In nearly all circumstances, some form of affordability program could be applied that would benefit qualified households in a meaningful way, without significantly impacting revenue requirements or other ratepayers.

Recommendations stemming from the analysis include:

1. Communities should evaluate an affordability program for their customers for equity and financial reasons, on a case-by-case basis.
2. Communities considering an affordability program should utilize financial tools such as those available through Environment Finance Centers to test effects on the financial health of the organization and residents' bills.

3. In addition, communities should consider additional cost reduction and revenue enhancement strategies to reduce the overall revenue requirements and thereby benefit all ratepayers, including but not limited to, qualified customers. Several examples of cost reduction and revenue enhancement opportunities are provided in this report.

It is our hope that this analysis contributes to the conversation around water affordability by showing that in the majority of communities studied, affordability programs can be implemented to benefit qualifying customers without significantly impacting the utility's operations or other customers.

INTRODUCTION AND BACKGROUND

Problem Definition

Water is essential for health and sanitation. The United Nations declared in Resolution 64/292 that the "General Assembly recognizes the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights."

There is widespread concern about the affordability of water. Among the findings of a recent-published study by the University of Michigan and its partners entitled "Water Service Affordability in Michigan: A Statewide Assessment" are that:

1. "Households in large Michigan cities have annual water bills that are, on average, $124 higher than households not located in large cities, while those in poverty pay, on average, $9 more than those who are not in poverty.
2. The inflation-adjusted average cost of water across Michigan has increased 188% since 1980 and up to 320% in individual cities.
3. Between 6.59% and 10.75% of households across Michigan struggle with water bills.
4. While households from all demographics and geographies struggle with water costs, almost all are below the poverty line and have above average water costs.
5. Unaffordable water affects individual, household, and societal physical and mental health well beyond the immediate lack of water." (Read et. al, 2021, p. 15-33)

These findings paint a grim picture of water affordability across the state of Michigan. Water is unaffordable for a significant portion of the population and as water rates continue to rise faster than income, more households will be faced with unaffordable water bills.

The effect of this lack of affordability on families and communities is captured in the study. Through the course of this work, the stakeholders we interviewed agreed on the following concepts:

- All Michiganders need available and affordable, safe, and sustainable drinking water and sanitation services.

- Economic stability is a necessity, and it requires appropriate supplementation from state and federal entities.
- At the household level, economic stability provides for health, family stability, and human dignity.
- At the water utility level, economic stability provides for technical, managerial, and financial capacity.
- When a household is unable to pay its water bills (i.e., the water is shut off), there are impacts to the household (damage to health and dignity), the water utility (operational costs and unreliable revenue), and society (public health and collective well-being)." (Read et al., 2021, p. 6)

Another major factor in the discussion is utilities' responsibility to deliver clean water now and in the future. One aspect of that responsibility is to invest appropriately in utility infrastructure. By planning, designing, and constructing improvements to treatment and distribution facilities, water utilities can prepare for continuing service, future needs, and upcoming regulatory changes. The recent University of Michigan study found that addressing the Michigan water infrastructure investment gap will require $19.8 billion in the next 20 years (Read et al., 2021, p. 25). So, while it is important for water utilities to invest so that clean water can continue to be delivered into the future, this need to invest creates further pressure to raise water rates.

It should be noted that this study does not consider the issue of trust around the quality of the drinking water. Some residents of communities such as Flint, and most recently Benton Harbor, are choosing to purchase bottled water rather than drink municipal water because of ongoing concerns about contamination. This increases their cost of drinking water substantially. The issue of trust must be addressed by the utility before it can be assumed that all customers are using the municipal drinking water.

If a community has rates that are unaffordable to a significant portion of the population and still needs to invest in a system to provide clean water – what then? There are at least four ways to address this challenge: 1) obtain outside funding, 2) reduce operating costs through additional efficiencies, 3) increase revenues via reduction of non-revenue water and 4) look at ways to redistribute the cost of water service delivery to those who can afford it. This analysis will discuss all four of these options, beginning with an analysis of the impacts of rate redistribution in six Michigan communities with varying characteristics.

Definition of Affordability

What affordability means has been long discussed and debated. There are numerous ways to look at the definition of affordability from a technical perspective, many of which are discussed in a University of Illinois study (Schneemann, 2019). The U.S. Environmental Protection Agency (EPA) has set affordability thresholds over the years using the combined annual cost of water, wastewater, and stormwater as a percentage of median household income. The Safe Drinking Water Act set the affordability threshold at 2.5%. However, EPA "notes that any number of justifiable variations of this ratio are possible,

such as including both the water and wastewater charge in the numerator, and using alternate income measures (mean income, poverty level income) in the denominator" (Schneemann, 2019, p. 5). This kind of flexibility in the variables included does not lend itself to precise analysis. Read et al. (2021) perform a more intricate analysis using Teodoro's calculation of affordability AR20 = Basic Water and Sewer Costs ÷ Disposable Income for Consumers at 20th percentile (p. 11). This in-depth analysis exceeds the capacity of this current study. For the purposes of this study, Moonshot Missions will be using 2% of household income as the measure of affordability, also called water burden. This is the EPA threshold set in 2014.

$$\frac{\text{Combined Drinking Water and Wastewater Bill}}{\text{Household Income}} \times 100 < 2$$

The authors acknowledge, however that this measure is imperfect as it does not capture the more individual aspects of a household's specific circumstances. "Specifically, the binary nature of these conventional approaches—either "affordable" or "unaffordable"—is problematic because affordability is rarely a strictly either/or phenomenon; water is affordable relative to the costs of other things and the household's total economic resources (cash and noncash)." (Wutich et al., 2017, p. 3)

Goal

The key question here is: Can utilities offer affordability while still providing water service and investing appropriately in infrastructure? The goal of this study is to demonstrate whether affordability programs are feasible in a range of community types and structures.

Deciding on the best type of affordability program is not an easy question to address given issues of fairness and possible barriers to customers accessing that program. This analysis explores several different types of programs to show the effects of each type and provide a menu of possible options for utilities.

It is important to pause and note that this report is analyzing for the worst-case scenario. The assumptions about data parameters are conservative, as detailed below. Therefore, the resulting calculations are also conservative with respect to the potential rate burden. However, as discussed in this report, there are many opportunities to reduce budget requirements and enhance revenue received to reduce the potential rate burden. In addition, charging an affordable rate can result in increased revenues from households currently not paying at all.

Research Question

The Research Question for this analysis is: For these six communities, can drinking water rates be structured to promote affordability without causing

financial hardship to the utility and its customers, using one or more of the following methods: 1) a fixed discount program, 2) an income threshold program or 3) a water burden program?

METHODOLOGY

Data Collection Plan

The goal of this analysis is to conduct case studies on six Michigan communities to demonstrate whether drinking water rates that promote affordability are feasible in a range of community types and structures.

Six communities throughout Michigan were chosen for their variety of characteristics, including:

1) Population;
2) Range of median household income;
3) Range of poverty level; and
4) Locations in both the upper and lower peninsula.

Table 1. Communities Analyzed, in Order of Population

Community	Population	MHI	Poverty Rate	Disadvantaged/Severely Disadvantaged?*	Combined Cost for 3,000 gal
Grand Rapids	201,013	$50,103	20.4%	Neither	$52.60
Flint	95,538	$28,834	38.8%	Severely Disadvantaged	$74.18
E. Lansing	48,145	$39,867	41.0%	Disadvantaged	$67.06
Benton Harbor	9,741	$21,916	45.4%	Severely Disadvantaged	$46.93
Houghton	7,754	$23,135	38.8%	Severely Disadvantaged	$44.76
Ishpeming	6,416	$46,299	14.7%	Neither	$127.38

*As compared to state Median Household Income of $57,144. Disadvantaged equals 80% of state MHI ($45,715) and severely disadvantaged equals 60% of state MHI ($34,286).

Demographic data was collected from the 2019 census data as not all community-specific data has been released for the 2020 census at the time of this analysis. This included population, median household income, and poverty rate.

Municipal budgets and Comprehensive Financial Annual Reports were collected from the municipality's website. Current rate structures were collected from the municipality's website or by contacting customer service. For financial information, Moonshot Missions chose to use 2019 data because communities were so dramatically affected by the COVID-19 pandemic in 2020 and 2021 and because 2019 matched the timeframe of the census data.

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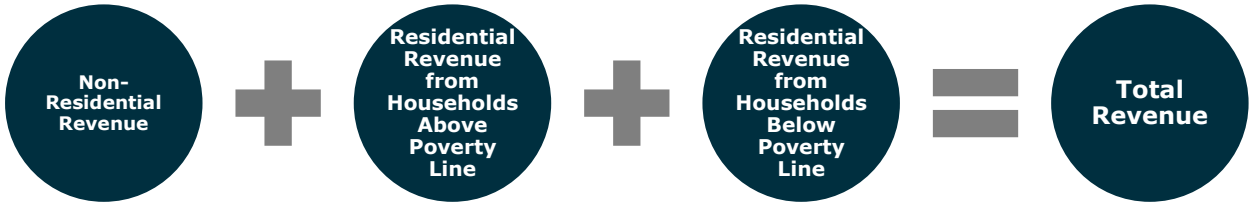
Data Analysis Plan

Using the Fiscal Year 2019 (FY19) budgets, Moonshot Missions chose revenue targets for each community that matched budgeted revenues for user charges. One change to the revenue target was made in the City of Flint. The FY19 budget included revenues that were lower than expenditures, and therefore required using some of the fund balance. There are several reasons that this would be the case, but for the purpose of this analysis, the revenue target was increased by the amount that was being used from fund balance so that the fund breaks even.

This study assumes that the municipality's utility expenditure estimates accurately reflects the cost of providing service and repairing or replacing infrastructure. There is a separate body of literature on whether and by how much a utility's revenue needs are underestimated. This analysis did not include a review of each utility's budget to ensure that it is accurate in planning for current and future needs.

Fixed Discount Program

The first analysis conducted was the effect of providing discounts of different levels to households below the poverty line and measuring the increase on the other categories of customers that is needed to attain the revenue target.



A key data point in this analysis is what portions of the revenue comes from residential and non-residential customers. Where data about this split was not available, the model was run with three different percentages of residential revenue, 60%, 75% and 90%, for each community. These percentages represent a wide range of community profiles, from a robust non-residential sector to a mostly bedroom community.

To calculate the residential revenue from households below the poverty line, the total residential revenue was multiplied by the poverty rate.

To calculate the needed revenue redistribution, Moonshot Missions applied different levels of discounts from 10% to 40% to households below the poverty line and calculated the deficit those levels caused. Moonshot Missions then measured the effect of eliminating that deficit by increasing rates on the non-residential and residential households above the poverty line.

To show whether the discounts are sufficient, the 2% affordability breakpoint was calculated for the median household income in each community. This was then compared to the statewide average water bill to determine how much of a discount was needed in each community to reach the 2% breakpoint.

An example analysis is as follows: East Lansing has a poverty rate of 41% and a revenue target for FY19 of $18,678,205. If it is assumed that 60% of the revenue comes from residential customers, then the non-residential portion is $7,471,282 and the residential portion is $11,206,923. Using the poverty rate, the amount of revenue from residential customers below the poverty line is $4,594,838 and the amount of revenue from residential customers above the poverty line is $6,612,085. If households below the poverty line are given a 20% discount, it creates a revenue gap of $918,968. If divided proportionally, this revenue gap creates a share of $487,516 from non-residential customers and a share of $431,452 from residential customers above the poverty line, a 7% increase for both categories. For East Lansing, a 20% discount is enough to bring the statewide average bill to 2% of the community median household income.

Income Threshold Program

The second analysis conducted utilized the Bill Payment Assistance Program Cost Estimation for Water Utilities ("Cost Estimation Tool") from the Environmental Finance Center at the University of North Carolina. This tool is available at efc.sog.unc.edu and is free to use.

The Cost Estimation Tool uses data from the census along with information about the community, entered by the user, to estimate a range for how much an affordability program will cost.

This analysis uses an eligibility threshold of below 125% of the Federal Poverty Level. This means that all households below this threshold would be eligible to participate. While this scenario means every community is measured with the same yardstick, it does not account for differences in median household income between communities.

Several assumptions were used for this analysis, detailed below:

1. Maximum annual assistance: In communities where summary customer data was not available, the maximum annual assistance was set at $1,002, which is the average water bill for a family of four in the state of Michigan (Read et al., 2021, p. 15).
2. Percentage of eligible customers who will likely participate: The percentage of eligible customers who will likely participate was set at 15%, 37.5%, and 60%. Sixty percent is in the range of the higher-participation in-kind social safety net programs, many of which are long-standing (Macartney and Ghertner, 2021, p. 2). In discussion with the staff of the Environment Finance Center at University of North Carolina, it was decided that the lowest probable participation would likely be around 15%. In addition, Moonshot Missions chose to also set a midpoint between 15% and 60%, which is 37.5%.
3. Program Costs: Administrative costs were set at $25,000 and marketing costs were set at $10,000. This reflects a portion of staff time to administer the program and additional marketing costs for bill inserts, advertising, and community outreach. These amounts are conservative estimates and could be partially offset by fewer resources spent on shutting off customers for lack of payment.
4. Annual budget for uncollectable revenue from residential customers: In communities where summary customer data was not available, uncollectable revenue was estimated $1,002 (the average water bill for a family of four in Michigan) multiplied by the

number of households below the federal poverty level was used. It should be noted that is uncommon for utilities to have a budget for this item. It is more common that the utility can report this data after all revenues are received for the year. See further discussion below regarding effect on the revenue picture.

5. Percentage of customers responsible for uncollectable revenue: In communities where summary customer data was not available, the percentage of customers responsible for uncollectable revenue was estimated to match the community's poverty rate.

This analysis includes differences from the Cost Estimation Tool as originally constructed. The first difference is that the cost of the program was divided over both non-residential customers and non-qualifying residential customers rather than including qualifying residential customers. This analysis presumes that those customers benefitting from the program cannot afford to contribute to its cost. The second difference is the addition of a mid-point between the minimum and maximum. This allows a more nuanced analysis as it is believed at least some of the uncollectable revenue will be offset using the affordability program.

Water Burden Program

The third analysis uses the Cost Estimation Tool with a user-defined threshold that is a percentage of the household's monthly income at a user-defined consumption rate. This can measure, for example, how much an affordability program would cost if households were spending $75 dollars per month on 3,000 gallons of water and associated wastewater services, against a threshold of 2% of the household's monthly income. Each community's actual cost of water was used in the calculation. These scenarios, run with different participation rates, get to the heart of the affordability question because they are measuring water burden by household.

This analysis uses the same assumptions as the Income Threshold Program, except for maximum annual assistance. The maximum annual assistance was set at the amount of the bill for 3,000 gallons for water and wastewater services, which differed by community.

The Water Burden Program analysis includes both differences from the Cost Estimation Tool, as well as one additional. The additional difference is that the cost per 3,000 gallons is altered to include both drinking water and wastewater costs to align with the amounts included in the EPA water burden calculation.

The authors would like to note that a lack of public data may make it difficult for community members or other interested parties to run this analysis for their own communities. Transparency of data would allow a broader understanding of both the complexities of the problem and the details of possible solutions, as well as contributing to increased trust of the utility.

Effect on Revenue Picture

The Cost Estimation Tool includes an item for bad debt, which Moonshot Missions prefers to call uncollectable revenue. The concept is that the amount of collected revenue will increase as the ability to pay due to increased affordability increases. This study does not

speculate on the magnitude of that increase in collected revenues, but it can be said which direction that effect goes.

In summary, a total of six scenarios were created for each of the communities: 15%, 37.5% and 60% participation for both 125% of FPL and household water burden.

Again, this analysis accounts for the worst-case scenario, resulting in the most conservative calculation of the theoretical rate impact on the other categories of customers. Any efforts to reduce the utility's budgeted expenditures, obtain outside funding or augment its revenues, would correspondingly reduce the cost impact of the affordability program upon other customers. In addition, charging a reduced, affordable, rate for all customers would result in additional revenue from customers currently not paying at all, thereby further reducing the revenue requirements from other categories of customers.

FINDINGS

Moonshot Missions now presents the findings of the analysis of these six case studies around the state of Michigan, examining four different types of methods to address household water affordability.

Fixed Discount Program

The first step in looking at affordability discounts is calculating what the breakpoint is in each community to provide an average bill that is 2% of the median household income (MHI). This is meant to calculate what level of discount is enough to meet that 2%, given an average annual bill of $1,002.

Table 2. Discount Breakpoints by Community

Community	MHI	2% of MHI	Needed Discount on MI Average Bill
Ishpeming	$46,299	$925.98	8%
Grand Rapids	$50,103	$1,002.06	0%
Flint	$28,834	$576.68	42%
Houghton	$23,135	$462.70	54%
East Lansing	$39,867	$797.34	20%
Benton Harbor	$21,916	$438.32	56%

This table represents those breakpoints by community. For Ishpeming, a household representing the median would require a maximum annual bill of $925.98, which represents a discount of 8% on the average bill. For Benton Harbor, a household representing the median would require a maximum bill of $462.70, which represents a discount of 56% on the average bill. Of note is that Grand Rapids' affordability threshold already matches the state's average annual bill. For the remaining communities, these are the target discounts needed to make a difference in bill affordability.

The analysis of affordability discounts reveals how different levels of discounts to residential customers below the poverty line would affect rates for non-residential customers and residential customers above the poverty line. The threshold for acceptable increases for these categories of customers was set at 10% or below. The three tables below represent the three different assumptions about the mix of residential and non-residential customers in a community.

Table 3. Effect of Fixed Discounts by Community with 60% Residential Assumption

	Ishpeming	Grand Rapids	Flint	Houghton	East Lansing	Benton Harbor
Poverty Rate	14.7%	20.4%	38.8%	38.8%	41%	45.4%
Percent Discount	Percent Increase to Non-Residential Customers and Residential Customers Above the Poverty Line					
10%	1%	1%	3%	3%	3%	4%
20%	2%	3%	6%	6%	7%	7%
30%	3%	4%	9%	9%	10%	11%
40%	4%	6%	12%	12%	13%	15%

This table represents the effect of a discount in a community with a 60% residential and 40% non-residential customer split. In communities with lower poverty rates such as Ishpeming and Grand Rapids, discounts of up to 40% are possible without exceeding the 10% increase threshold. In Flint, Houghton, and East Lansing, discounts of up to 30% are possible without exceeding the 10% increase threshold. Benton Harbor could offer a 20% discount but not higher.

Table 4. Effect of Fixed Discounts by Community with 75% Residential Assumption

	Ishpeming	Grand Rapids	Flint	Houghton	East Lansing	Benton Harbor
Poverty Rate	14.7%	20.4%	38.8%	38.8%	41%	45.4%
Percent Discount	Percent Increase to Non-Residential Customers and Residential Customers Above the Poverty Line					
10%	1%	2%	4%	4%	4%	5%
20%	2%	4%	8%	8%	9%	10%
30%	4%	5%	12%	12%	13%	15%
40%	5%	7%	16%	16%	18%	21%

This table represents the effect of a discount in a community with a 75% residential and 25% non-residential customer split. In communities with lower poverty rates such as Ishpeming and Grand Rapids, discounts of up to 40% are possible without exceeding the 10% increase threshold. In Flint, Houghton, East Lansing, and Benton Harbor discounts of up to 20% are possible without exceeding the 10% increase threshold.

Table 5. Effect of Fixed Discounts by Community with 90% Residential Assumption

	Ishpeming	Grand Rapids	Flint	Houghton	East Lansing	Benton Harbor
Poverty Rate	14.7%	20.4%	38.8%	38.8%	41%	45.4%
Percent Discount	Percent Increase to Non-Residential Customers and Residential Customers Above the Poverty Line					
10%	2%	2%	5%	5%	6%	7%
20%	3%	4%	11%	11%	12%	14%
30%	5%	7%	16%	16%	18%	21%
40%	6%	9%	21%	21%	23%	28%

This table represents the effect of a discount in a community with a 90% residential and 10% non-residential customer split. In communities with lower poverty rates such as Ishpeming and Grand Rapids, discounts of up to 40% are possible without exceeding the

10% increase threshold. In Flint, Houghton, and East Lansing, discounts of up to 10% are possible without exceeding the 10% increase threshold.

All three of these scenarios assume the discount would be applied to all households below the poverty line, meaning 100% participation. This would depend on the program's design. Participation clearly affects the amount of revenue that is redistributed to other customers, so these amounts are the maximum increases in rates to non-residential customers and residential customers above the poverty line.

Table 6. Breakpoint Discount Success with 75% Residential Assumption

Community	Needed Discount on MI Average Bill	Achievable Discount Tier
Ishpeming	8%	40%
Grand Rapids	0%	40%
Flint	42%	20%
Houghton	54%	20%
East Lansing	20%	20%
Benton Harbor	56%	20%

Half of the communities are able to offer discounts that reduced the annual water burden to 2% or below. The communities in which such discounts are not possible include all the severely disadvantaged communities included in this analysis.

Income Threshold Program

The analysis of the income threshold program costs reveals how offering a program with differing levels of participation affects rates for remaining residential customers. The table below three different levels of participation by eligible households. This analysis assumes that the communities are 75% residential. The 25% non-residential accounts will also contribute to covering the cost of the program.

Table 7. Range of Monthly Cost for Income Threshold Program with Different Participation Levels as Expressed in Cost per Non-Qualifying Household, using 125% of the Federal Poverty Level

Community	Program Cost	Program Participation		
		Low (15%)	Medium (37.5%)	High (60%)
Ishpeming	Min	$0.79	$0.81	$0.83
	Mid	$1.52	$2.67	$3.88
	Max	$2.25	$4.52	$6.93
Grand Rapids	Min	$0.03	$0.03	$0.03
	Mid	$0.87	$2.21	$3.62
	Max	$1.71	$4.38	$7.21
Flint	Min	$0.06	$0.06	$0.06
	Mid	$1.79	$4.68	$7.98
	Max	$3.52	$9.29	$15.89
Houghton	Min	$0.88	$0.92	$0.95
	Mid	$1.86	$3.42	$5.10
	Max	$2.83	$5.92	$9.24
East Lansing	Min	$0.17	$0.19	$0.21
	Mid	$2.22	$5.83	$10.24
	Max	$4.27	$11.46	$20.27
Benton Harbor	Min	$0.56	$0.61	$0.66
	Mid	$2.81	$6.71	$11.37
	Max	$5.05	$12.80	$22.07

This table shows the increase in monthly costs to non-qualifying households in a scenario using 125% Federal Poverty Level as the threshold for participation. The minimum represents the cost of an affordability program, including administrative costs, marketing costs, and program costs, less the amount of uncollectable revenue eliminated by the program. The maximum includes the same elements but assumes no recovery of uncollectable revenue. Uncollectable revenue is unpaid bills that the utility cannot collect on, commonly called bad debt.

Using Flint as the example, the lowest monthly cost estimate for the program (across all participation levels) per non-qualifying household is $0.06. With a low rate of program participation and no recovery of uncollectable revenue, the highest monthly cost estimate per non-qualifying household is $3.52. With a high rate of program participation and no recovery of uncollectable revenue, the highest monthly cost estimate per non-qualifying household is $15.89.

Water Burden Program

The analysis of the water burden program costs reveals how offering a program with differing levels of participation affects rates for remaining residential customers. The table below three different levels of participation by eligible households. This analysis assumes that the communities are 75% residential. The 25% non-residential accounts will also contribute to covering the cost of the program.

Table 8. Range of Monthly Cost for a Water Burden Program with Different Participation Levels as Expressed in Cost per Non-Qualifying Household

Community	Program Cost	Program Participation		
		Low (15%)	Medium (37.5%)	High (60%)
Ishpeming	Min	$0.81	$0.87	$0.97
	Mid	$3.83	$8.97	$14.97
	Max	$6.85	$17.07	$28.97
Grand Rapids	Min	$0.03	$0.03	$0.03
	Mid	$0.85	$2.17	$3.61
	Max	$1.67	$4.31	$7.19
Flint	Min	$0.06	$0.07	$0.08
	Mid	$2.97	$8.32	$15.30
	Max	$5.88	$16.56	$30.52
Houghton	Min	$0.92	$1.01	$1.12
	Mid	$2.24	$4.75	$7.77
	Max	$3.56	$8.48	$14.41
East Lansing	Min	$0.17	$0.20	$0.22
	Mid	$0.86	$2.12	$3.73
	Max	$1.54	$4.03	$7.24
Benton Harbor	Min	$0.58	$0.67	$0.80
	Mid	$2.19	$5.46	$9.95
	Max	$3.79	$10.25	$19.10

This table shows the increase in monthly costs to non-qualifying households in a scenario using a household water burden of 2% as the threshold for participation. The minimum represents the cost of an affordability program, including administrative costs, marketing costs, and program costs, less the amount of uncollectable revenue eliminated by the program. The mid-point is the midway point between minimum and maximum cost. The maximum includes the same elements but assumes no recovery of uncollectable revenue.

Using Houghton as the example, the lowest monthly cost estimate for the program per non-qualifying household is $0.92. The mid-point estimate ranges from $2.24 to $7.77. With a low rate of program participation and no recovery of uncollectable revenue, the highest monthly cost estimate per non-qualifying household is $3.56. With a high rate of program participation and no recovery of uncollectable revenue, the highest monthly cost estimate per non-qualifying household is $14.41.

It should be noted that Ishpeming is an outlier in this group as its combined water bill of $127.38 per 3,000 gallons is 225% of the average bill of these six communities. Therefore, despite the relative affluence of Ishpeming, the high cost of water translates to a larger amount for the affordability program to cover, and the gap is too great.

All communities can afford the minimum affordability program cost. Four communities can afford the maximum program cost for the lowest level of participation. Three can afford the mid-point cost for mid-level participation. Two communities can afford the maximum program cost for mid-level participation. In the next section, we will discuss more thoroughly uncollectable revenue and the likely scenarios for household water burden.

DISCUSSION

Answers to Research Question

Research Question: For these six communities, can drinking water rates be structured to promote affordability without causing financial hardship to the utility and its customers, using one or more of the following methods: 1) a fixed discount program, 2) an income threshold program or 3) a water burden program?

In nearly all circumstances, some form of affordability program could be applied that would benefit qualified households in a meaningful way, without significantly impacting revenue requirements or other ratepayers.

Table 9. Affordability Program Outcomes, in Increasing Order of Poverty Rate

	Fixed Discount Program: Do fixed discounts meet 2% water burden breakpoint?	Income Threshold Program – 125% Federal Poverty Level: Increase for Non-Qualifying Customer per Month is Under $5 at Medium Participation Level and Medium Uncollectable Revenue Recovery	Water Burden Program – Household Water Burden of 2%: Increase for Non-Qualifying Customer per Month is Under $5 at Medium Participation and Medium Uncollectable Revenue Recovery
Ishpeming	Yes	Yes	No
Grand Rapids	Yes	Yes	Yes
Flint	No	Yes	No
Houghton	No	Yes	Yes
East Lansing	Yes	No	Yes
Benton Harbor	No	No	No

This table represents the outcomes of the various analyzes performed for each community. Five communities are able to offer one or more type of affordability program. Benton Harbor, which has the highest poverty rate of any of the communities analyzed in this study, is unable to use these types of affordability programs on their own, meaning any program of this type would need additional measures to achieve significant results. However, these types of programs combined with costs reduction and revenue enhancement tools may be able to shrink the pie of revenue needed as well as redistribute it in a more equitable way. More information on cost reduction and revenue enhancement tools is discussed below.

Fixed Discount Program

For all communities studied, some level of discount is possible but not all discounts provide sufficient relief. Discounts that provide sufficient relief to households below the poverty line were possible only in communities with low poverty rates. In these communities with low poverty rates, affordability discounts of up to 40% do not result in increases to other customers above the set threshold of 10%. In communities with medium to high poverty rates, only smaller discounts are possible, and these discounts are below the threshold of providing sufficient relief to households below the poverty line. Again, cost reduction and revenue enhancement tools may enable full utilization of these affordability options.

Income Threshold and Water Burden Programs

The income threshold and water burden programs were successful in communities with sufficiently low poverty rates and relatively low combined water bills. In communities with higher monthly bills and/or relatively high combined water bills, these programs were not achievable without exceeding the $5 per month threshold.

Uncollectable Revenue

To explore the possible effect of an affordability program on uncollectable revenue, it is helpful to walk through an example. If a household has a water bill totaling $100 but can only afford $75, the household may choose not to pay anything towards the bill because it will not prevent the bill being overdue and may or may not prevent the water being shut off. If through an affordability program the bill is reduced to $75, the household will be able to afford the full bill and may prevent shut off. This scenario means both that the household will preserve their access to water and that the utility will receive the $75 in revenue and avoid the expense of shutting off the water.

Therefore, in regard to the wide range of costs predicted by the model, it is much more likely that a portion of uncollectable revenue will be obtained through an affordability program (meaning a minimum or mid-point cost) than not obtaining any uncollectable revenue at all (maximum cost). That is, more revenue will be realized from households paying an affordable rate, as compared to nonpayment of the current, unadjusted, rate.

Impact on Other Ratepayers

The rate increases required for these types of affordability programs are modest in comparison to the significant increases of between 188% and 320% since 1980 (Read et. al, 2021, p. 16). Communities will need to weigh the rate increase against the affordability program's benefits to the community, but the magnitude of the increase needed is indeed small.

Cost Reduction and Revenue Enhancement Toolbox

Overall, affordability measures are feasible and reasonable to implement, but they are not a silver bullet to solving the entire affordability issue. These measures need to be combined with other cost reduction and revenue enhancement measures to reduce the total revenue pie needed in addition to redistributing revenue. Smaller communities with high poverty rates may even require more drastic solutions such as public to public, community-led regionalization, consolidation, or federal/state financial assistance.

Cost Reduction and Revenue Enhancement Opportunities

Affordability programs seek to more equitably distribute the total amount of revenue needed by a water utility to sustain its operations. In addition, and in parallel, water utilities can, and should, also seek to reduce the total revenue requirement through cost saving and revenue enhancements. Ideally, a water utility should seek to minimize the total revenue pie needed, which benefits all ratepayers, and then also implement programs, to the extent legally permitted, to equitably apportion the remaining revenue requirements.

Cost saving initiatives that water utilities can implement include:

1. Reduction of total maintenance costs by improving preventive to reactive maintenance ratio. Specifically, reactive and emergency maintenance is significantly more costly than predictive/preventive maintenance. As a result, performing more preventive maintenance will reduce overall maintenance costs.
2. Reduction of energy costs via energy consumption efficiency initiatives. Such initiatives include upgrades to newer equipment that is more energy efficient, using variable frequency drives on pumping stations to reduce total energy consumption and making use of gravity driven processes in conveyance and treatment facilities wherever possible. In addition, since energy costs are often driven by both consumption and peak demand, total energy costs can be reduced by peak shaving, a process in which the utility avoids doing high energy activities that can be scheduled in a flexible manner during peak consumption periods. For example, processes that can be done on a weekly basis can be done in the middle of the night when consumption, and corresponding energy demands, are at their lowest.
3. Reduction of energy costs via implementation of green energy alternatives. Examples include solar panel arrays used at water or wastewater treatment plants in lieu of electricity, and conversion of digested biogas in wastewater treatment plants into electricity via use of a turbine. These projects can be funded through State Revolving Fund loans and/or FEMA resiliency grants or through power purchase arrangements. They can not only reduce energy costs but also reduce vulnerability to power outages by increasing resiliency.
4. Reduction of biosolids costs through operational efficiencies, such as improved dewatering. Biosolids are usually disposed of either in bulk, on a weight basis, or by reduction through heat processes such as drying or incineration. So, in either case, reducing the weight of water, via improved dewatering, will reduce disposal and energy costs associated with biosolids handling.
5. Reduction of staffing costs through cross training and automation. By implementing cross training, the utility can reduce its overtime costs and, in some cases, reduce overall staffing requirements. Automation in key areas, such as chemical dosing, pumping station monitoring via annunciators, etc., can also reduce staffing requirements without impacting efficiency.
6. Reduction of chemical costs through automation. Specifically, automation can practically eliminate the cost impacts of overdosing chemical usage manually, and also the performance impacts of underdosing chemical usage.
7. General reduction of costs through capital improvements that reduce operations and maintenance costs through lower maintenance and energy costs. Specifically, selective replacement of older equipment with newer, more energy efficient equipment can reduce both maintenance and energy costs. If funding can be

procured to pay for this new equipment, such that the annual debt service is less than the annual operations and maintenance savings, then the utility can realize positive cash flow as well as improved performance from newer equipment.

8. General reduction of costs through improved procurement processes. Specifically, improved procurement can result in receiving more bids which significantly increases the probability of receiving lower, more competitive, pricing. In addition, improved procurement can, by eliminating potential loopholes, reduce the probability of costly change orders to construction and design vendors.
9. General reduction of costs through procurement of outside funding, such as the Federal State Revolving Fund, WIFIA and FEMA's BRIC resiliency grants. By obtaining outside funding for capital improvements, the utility can improve performance, lower operations, and maintenance costs without increasing rate burden on ratepayers.

Revenue enhancement initiatives can include:

1. Reduction of non-revenue water on the drinking water side. Specifically, reduction of leaks results in lower operations and maintenance costs at the water treatment plant and lower pumping costs as less total water is needed to provide full service. In addition, ensuring that all customers pay for the water used, through accurate metering, results in increased revenue at the same level of service.
2. Implementation of connection fees and hookup fees for new customers. Connection fees and hookup fees for new customers provide additional revenue to the utility and create an equity for long standing customers who have been paying for the water and wastewater infrastructure as a component of their regular user fees.
3. Implementation of stormwater fees, especially in combined sewer communities. In combined sewer communities, the amount of additional combined sewage generated from large areas of impervious surface, like parking garages and parking lots, can be significant. Unless the owners of these large areas of impervious surface pay a stormwater fee, then all the other ratepayers in the user system must pay for the costs associated with conveyance and treatment of the combined sewage generated.

Implementation of these cost saving, and revenue enhancement initiatives can reduce the total amount of revenue needed by a water utility, benefiting all ratepayers, regardless of income. In addition, implementation of such initiatives also makes it easier to implement affordability programs as the necessary revenue gap is reduced correspondingly. Because each community is different, the tools for a community will vary.

Community-Led Regionalization, Consolidation, and Shared Services

Community-led regionalization and consolidation can be helpful governance models when there are several smaller utilities within a relatively short geographic radius. The two main examples are:

1. Smaller communities are connected into an existing larger treatment plant. In such cases, the smaller treatment plants are abandoned and flow from these communities are conveyed, either by gravity and/or pumping stations to the large treatment plant. The smaller communities realize a significant savings in operations, maintenance, and capital costs as they no longer have a treatment plant to operate. The marginal cost of adding the additional flow to the larger, now regional, treatment plant is significantly less than the ongoing cost of operations, maintenance, and capital of the smaller plants, due to greater economies of scale.

   For example, in Camden County, NJ, the regional wastewater utility eliminated 52 smaller wastewater treatment plants and conveyed the flow from these communities to the expanded regional wastewater treatment plant. Because of economies of scale, the total wastewater treatment costs for the residents of Camden County were significantly reduced. In addition, the regional wastewater system was designed to eliminate sewage discharges to the tributaries, which have lower assimilative capacity, and convey all the flow for treatment and discharge into the largest waterbody associated with the County. As a result, not only were total costs reduced but also the water quality of the tributaries improved significantly.

2. Smaller communities agree to combine to form a regional utility and a new regional wastewater treatment plant is constructed that services all of the member communities, allowing for elimination of their individual treatment plants. The annual debt service associated with the capital cost of the new treatment plant must be compared to the ongoing operations and maintenance costs of each of the existing community treatment plants.

In addition to these community-led regionalization and consolidation models, which require capital improvements to be placed into effect, there is also the option of shared services in which smaller utilities within a reasonably close geographic radius work together to lower collective costs while still maintaining their legal identities and independence.

Examples of shared service opportunities include:

1. Combined procurement of goods and services to gain lower unit prices through economies of scale;
2. Combined procurement of electricity and gas services in order to reduce costs through economies of scale;
3. Sharing of emergency equipment and personnel where possible in order to reduce costs and risk;
4. Use of spare treatment capacity where available; and
5. Sharing of knowledge, best practices, procurement documents, design documents, etc. among the members of the shared service community.

Potential Opportunities for a Host Community Benefit

In the case of a regional wastewater utility that services several municipalities, there is the opportunity to achieve a greater degree of equity by providing the community that hosts the regional wastewater treatment plant with a host community benefit. The economic rationale for this is that while all members of the regional utility benefit from the regional wastewater treatment plant, the host community does not benefit from the regional interceptor system that conveys flows from the satellite municipalities into the host community. Therefore, an equitable approach would be to calculate the operations, maintenance and capital costs associated with the regional interceptor system, and the same costs associated with the regional wastewater treatment plant, and then calculate the ratio associated with the treatment plant (treatment plant costs divided by treatment plant costs plus interceptor system costs). This ratio could be applied to the host community for a host community rate benefit, recognizing that the host community does not benefit from the regional interceptor system and therefore should not participate in the costs associated with same.

In addition to these economic equities, there are also ancillary equities such as the potential for odor impacts and truck traffic impacts on the host community, and the potential loss of a tax revenue generating structure on the footprint of the regional treatment plant.

For example, the Camden County Municipal Utilities Authority, located in Camden, NJ, did implement a host community benefit in this manner. It calculated that the treatment costs accounted for approximately 5/8 of the total operations, maintenance, and capital costs, while the interceptor system accounted for approximately 3/8 of the costs. As a result, the host community paid $220 per household per year, while the satellite communities paid $352 per household per year.

A similar approach can be taken for a regional drinking water system in which the drinking water treatment plant is in the host community and water transmission mains convey drinking water to satellite communities. As with the wastewater treatment example above, while all municipalities, host community and satellite communities alike, benefit from the regional drinking water plant, the host community does not benefit from the mains emanating out from the host community and conveying drinking water to the suburban communities.

Therefore, the cost associated with capital debt service, operations and maintenance of the regional water transmission mains can be calculated as a percentage of the total cost of the entire system and that percentage could be offered as a host community benefit accordingly.

Collectively, implementation of these cost efficiencies, revenue enhancements, plus procurement of outside Federal or State funding can reduce the total net revenue needed thereby reducing the amount needed for the affordability program and the corresponding rate burden from the other categories of customers.

RECOMMENDATIONS

1. Communities should consider an affordability program for their customers for equity and financial reasons, on a case-by-case basis.
2. Communities considering an affordability program should utilize financial tools such as the ones available through Environment Finance Centers to test effects on the financial health of the organization and residents' bills.
3. In addition, communities should consider additional strategies from the cost reduction and revenue enhancement toolbox, to reduce the overall revenue requirements and thereby benefit all ratepayers, including but not limited to, qualified customers.

CONCLUSION

In summary, this analysis looked at six communities, all significantly below the national average for median household income, and found that an affordability program was feasible and reasonable, in nearly all circumstances, which would allow nearly all households to have an affordable rate without impacting the community's water revenue requirements. And, in nearly all circumstances, an affordability program could be implemented to make a meaningful improvement in affordability for all households studied, without impact to total water revenue requirements. Naturally, communities with higher median household income would have even better results.

In addition, the implementation of cost efficiencies, revenue enhancement and the procurement of additional Federal and State funding, as discussed in this report, would reduce the total revenue requirements from the ratepayer base and thereby have a correspondingly beneficial impact on the efficacy of affordability programs.

Therefore, affordability programs are definitely a viable option for all communities and should be evaluated as an equitable alternative to ensure affordability of water, one of the most essential services for reasonable quality of life.

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DEFINITION OF TERMS

Affordable: For this study, a combined drinking water and sewer utility bill is defined as affordable if it is below 2% of the household's income. As discussed in the background section, there are several different definitions of affordability and much discussion around the subject.

Disadvantaged Community: For this study, a community with an annual median household income that is less than 80 percent of the statewide annual median household income.

Household Water Burden: A measure of affordability that divides the combined cost of water and wastewater services by the household income.

Median household income(MHI): A calculation computed by the U.S. Census Bureau - Income of Households which includes the income of the householder and all other individuals 15 years old and over in the household, whether they are related to the householder or not. Because many households consist of only one-person, average household income is usually less than average family income. The median divides the income distribution into two equal parts: one-half of the cases falling below the median income and one-half above the median. Median income for households, families, and individuals is computed based on a standard distribution. https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html

Poverty Line: A measure of poverty calculated at half the median household income of the total population. https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html

Poverty Rate: The ratio of the number of people (in a given age group) whose income falls below the poverty line; taken as half the median household income of the total population. https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html

Severely Disadvantaged Community: For this study, a community with a median household income of less than 60 percent of the statewide annual median household income.

ABOUT THE AUTHORS

Andy Kricun, P.E.
Managing Director, Moonshot Missions
andy@moonshotmissions.org

Andy Kricun is a Managing Director with Moonshot Missions, a non-profit focused on providing technical assistance to water utilities in underserved communities. He is also a Senior Fellow with the US Water Alliance working on their national water equity initiative. He also serves as a Senior Advisor to the Water Center at the University of Pennsylvania on various projects related to the Delaware River watershed. He serves on the National Environmental Justice Advisory Council and serves as the chair of the New Jersey Environmental Justice Advisory Council's water equity committee. He is also the co-chair of the Jersey Water Works water equity initiative and is a trustee of the New Jersey Conservation Foundation. He previously served on the board of the National Association of Clean Water Agencies for seven years.

Mr. Kricun has over 35 years of wastewater and biosolids management experience. He graduated with honors from Princeton University with a degree in chemical engineering. He also holds a professional engineer's license in civil engineering and is a board-certified environmental engineer as well.

Lydia Rossiter, MPA
Senior Utility Consultant, Moonshot Missions
lydia@moonshotmissions.org

Lydia Rossiter is a Senior Utility Consultant with Moonshot Missions, conducting utility assessments and researching and implementing solutions. Lydia has spent the last 20 years in state and local government, including the last ten in water utilities at the City of Santa Cruz and Santa Clara Valley Water District. She has performed complex financial and operational analysis, leading to staffing plans, capital improvement plans, and organizational change. Lydia was most recently a Program Administrator for Santa Clara Valley Water District, where her role included projects affecting the $8 billion capital improvement program, operating budget, project management, and financial modeling.

Lydia holds certifications in water treatment and water distribution from the State of California, wastewater treatment from the State of Arizona, and utility management from the National Rural Water Association. She graduated from Stanford University with a Bachelor of Arts in Political Science with a focus in statistics and from Golden Gate University with a Masters in Public Administration. She is originally from Ann Arbor, Michigan.

MOONSHOT

George S. Hawkins, Esq.
202-770-7632
george@moonshotmissions.org
5207 Portsmouth Road
Bethesda, MD 20816