Transformative Issues Symposium on Affordability: SPECIAL CONTENT COLLECTION
Greetings From AWWA and WEF

Dear Colleagues and Friends,

For many years, the water sector has emphasized that essential drinking water, wastewater, and stormwater services are undervalued—and too often underpriced—in our communities. With water systems facing an urgent need to reinvest in aging infrastructure and comply with stringent regulations to protect public health and the environment, the big question has been how to structure equitable and fair rate systems that reflect the full cost of providing these essential services.

Yet there’s also a growing awareness that even fair and equitable rates affect households differently. Water rate increases have outpaced the consumer price index for many years. While these increases are necessary, many families with low incomes struggle to pay for essential needs—including water services.

It’s against this backdrop that we gather this week to discuss the issue of affordability. As you will see inside this booklet, members of the American Water Works Association and Water Environment Federation have thought deeply about this topic from many perspectives. From better defining “affordability” to exploring customer assistance programs to posing important questions of environmental justice, water professionals are seeking solutions that keep water systems reliable and recognize the real financial challenges facing many of their customers.

With that in mind, we pulled together this short compendium of recent articles on the issue of affordability from AWWA and WEF publications and events. We are pleased to have many of the authors within these pages presenting at the inaugural Transformative Issues Symposium on Affordability.

Thank you for being here, and for helping build a future where all people enjoy reliable water services at a cost that is both fair and affordable.

Sincerely,

David B. LaFrance
AWWA Chief Executive Officer

Eileen J. O’Neill
WEF Executive Director
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Editor’s Note
Affordability Mega-steps

I have written and spoken about how to set fair and equitable water and wastewater rates for much of my professional career. I have also spent a great deal of time advocating for the importance of keeping water and wastewater rates affordable. The importance of and the interrelationships between both continue.

The cost-of-service methodology used to set cost-based utility rates results in the most widely accepted, defensible, and sound approach for establishing fair and equitable water and wastewater rates (see AWWA’s M1 manual, *Principles of Water Rates, Fees and Charges*). The water sector is facing a daunting cost profile with $1 trillion of buried infrastructure needs. Compounding the challenge is the fact that water usage is universally underpriced—sometimes below cost—the reality is that as rates go up, affordability challenges emerge for customers—perhaps not for everyone and not everywhere, but certainly for some in many places. It seems obvious that affordable water is good public policy, as are rates based on cost-of-service principles. The question becomes, then, can a utility square a rate-setting methodology based on cost of service with the goal of ensuring that water is affordable to all its customers?

At the core, there are two important issues when addressing affordability. The first is determining when a real affordability problem exists, and the second is how to successfully implement and pay for the solution. Neither are simple tasks.

Admittedly, the incidence of affordable-water problems is increasing. While some progress—baby steps, actually—has been made in addressing affordability, there are indications that we are on the verge of taking mega-steps toward addressing this important problem. Keeping this in mind, let’s look at the volume of new, present-day guidance that is being produced.

Last month (May 2017) in *Journal AWWA*, Mumm and Ciaccia published “Improving the Narrative on Affordability and the Measurements We Need to Take Us There.” The article addresses the issue of how to determine when affordability is a real problem by introducing a new methodology that more accurately measures affordability. The authors also offer preliminary findings that challenge the old threshold definitions of what is and is not affordable when it comes to utility bills.

This month, a study focused on the legal challenges of paying for affordability programs is expected to be released. The study was funded by six leading water sector organizations and conducted by the Environmental Finance Center at the University of North Carolina at Chapel Hill. The study report will be available at www.efc.sog.unc.edu. This is the first report to inventory legislation that enables, or does not enable, a utility to fund customer assistance programs from rate revenues. As it relates to solving affordability issues and balancing cost-of-service rate issues, Jeff Hughes, who is one of the principle investigators on the study, makes a significant point: “When customer assistance programs address their most vulnerable population through targeted affordability programs, utilities are more free to establish full cost of service rates.”

In August, *Journal AWWA* anticipates publishing an article by Blake, Brown, and Rothstein that offers pragmatic case studies of successful affordability programs in Portland, Ore., and Detroit, Mich. These studies show how utilities can develop programs to address a broad range of low-income customer needs, help utility customers stay current on their bills, and manage their water use. The solutions not only help define when affordability is a concern but also reflect how using revenue funds to pay for customer assistance programs helps enable more comprehensive approaches.

Then in September, an article by Switzer and Teodoro titled “The Color of Water: Class, Race, Ethnicity, and Safe Drinking Water Act Compliance” is scheduled to be published in *Journal AWWA*. This pioneering study puts a spotlight on an uncomfortable aspect of affordability by using national data to show that Safe Drinking Water Act violations are correlated with a community’s poverty rate—and the correlation is strongest in predominantly black and/or Hispanic communities. Teodoro says that “when it comes to affordability of water, we should be most worried about whether people can meet their basic health needs, and this article highlights this concern for low-income communities and minority populations.”

Addressing a community’s water-affordability concerns is complicated but solvable. While the affordability burden is ultimately felt “locally” by households and their water utilities, fully solving it will require the combined initiatives of technical, community, and policy leaders. It is gratifying that real, practical solutions that measurably move us forward are emerging and being implemented—a water and wastewater utility’s importance to society and the public health and environmental benefits it provides matter to all, irrespective of wealth.
The climbing cost of water
Michigan State researchers predict that water will no longer be affordable for as many as a third of American households

In the next 5 years, water may no longer be affordable for as many as 35.6% of American households, according to a research paper by researchers at Michigan State University (East Lansing).

The paper, “A Burgeoning Crisis? Nationwide Assessment of the Geography of Water Affordability in the United States,” appeared in the science journal PLOS One. The paper highlights that high-risk and at-risk households for water poverty often are clustered in urbanized, low-income areas (as defined by the U.S. Census). It also identified pressures that are influencing water affordability: climate change, suburbanization, shrinking populations in deindustrialized cities, and rising costs of infrastructure.

Elizabeth Mack, lead researcher, said the study seeks to “understand the extent that current and projections of future water/wastewater rates are affordable for U.S. households, based on the [U.S. Environmental Protection Agency (EPA)] criteria of 4.5% combined water services.” Mack is an assistant professor at the Department of Geography, Environment, and Spatial Science at Michigan State.

The team analyzed affordability by reviewing water and wastewater rates gathered by the American Water Works Association (Denver). They determined the average monthly water bill is $120 nationally. If that rises by almost $50 to $170 per month in the next 5 years — as is predicted — many Americans will no longer be able to afford water.

A national divide
The researchers pointed out that many areas already are experiencing an economic crunch when it comes to water affordability.

Atlanta and Seattle have some of the highest water rates in the country. The average monthly water bill for a family of four costs $325.52 in Atlanta and $309.72 in Seattle. Though the incomes in those cities can make these bills affordable for most of the population, that isn’t the case for everywhere.

The downtown areas of Detroit, Phoenix, and Philadelphia, for example, are filled with high-risk households for water poverty, according to the research. In fact, in Philadelphia, an estimated 227,000 customers or roughly 4 of 10 water accounts already are past due, the research found.

In general, Mack said Southern states dominate the “high-risk category” because of lower incomes. Mississippi, Louisiana, Alabama, and Kentucky topped the list of communities with future “high-risk” water poverty probability. New Hampshire, Wyoming, North Dakota, and Vermont ranked the lowest in this category.

Making water more affordable
The research says, “it is in the best interest of all people to work to resolve the rising costs of increasingly scarce water resources.”

Water and wastewater utilities can take some actions to help avert these increases, Mack said: “Lobby for subsidies to help pay for the cost of water infrastructure and/or lobby for local water affordability programs for low-income households.”

Many utilities and water and wastewater associations already seek this sort of funding. Mack also suggested utilities enact affordability programs for low-income families. For example, San Jose (Calif.) Water Rate Assistance Program provides a 15% discount on total water bills for eligible low-income customers. Likewise, the San Francisco Water, Power, and Sewer Community Assistance Program (CAP) offers qualifying residential single-family customers a 15% discount on water and a 35% discount on sewer charges. CAP applicants and re-enrollees are required to participate in a free water conservation home evaluation to participate in the program, according to the utility’s website.

Considering the research team’s initial findings, Mack said the next step in their research on water affordability is a “more fine-grained analyses of water poverty in metropolitan areas.”

— LaShell Stratton-Childers, WE&T

Originally published in WE&T (May 2017). © WEF 2017
During the first decade of the 21st century, local governments spent nearly $1 trillion on capital investments for water and wastewater infrastructure (USCM, 2013). The anticipated need during the next 25 years is projected to match this amount for drinking water alone, whereas the wastewater investment is projected to be even greater (Water Utility Council, 2012). These are staggering amounts, especially when considering that this investment will be passed on to rate payers as grant funding is no longer an option for most utilities. Reliable access to water and wastewater service is a critical component of every society; however, providing that access is becoming a contentious issue. During the last 20 years, the cost of clean water has developed from a minor issue affecting only a few isolated utilities into an industrywide challenge and area of focus.

Costs to provide safe drinking water and wastewater treatment are increasing. Since 1996, water and wastewater rates have increased at 4.9% annually, almost twice the rate of inflation as measured by the Consumer Price Index (AWWA & RFC, 2012). Fixed costs related to capital improvements are driving these rate increases. Regulatory compliance and infrastructure renewal are typically the fastest-growing pieces of the utility budget. The cost of these capital improvements will continue to spur rate increases and raise concerns about affordability.

Affordability can be thought of as a two-sided coin. One side relates to the capability of a utility and the community it serves to meet the costs of regulatory compliance and service delivery in a financially sustainable manner. The other side deals with addressing individual customers’ ability to pay their water and wastewater bills in full and on time. Although these issues cannot be totally separated, this article will focus on affordability as it relates to the financial capability of the utility as a whole.

The US Environmental Protection Agency (USEPA) published a series of documents in the mid- to late 1990s to provide context for the issue of financial capability and how it related to the agency’s determination of schedules for compliance with the Clean Water Act. The most-often quoted of these documents is the 1997 report titled Combined Sewer Overflows—Guidance for Financial Capability Assessment and Schedule Development (USEPA, 1997). The purpose of the report was to create a holistic approach that considered the community’s ability to comply with regulations.
The report identified a two-step financial capability approach to quantify the financial strength of a community and to learn whether a proposed compliance plan presented a significant burden.

The threshold for a significant burden identified in the USEPA guidance is typically crossed when the average cost of compliance (expressed on a per-household basis) exceeds 2% of the median household income (MHI) for the community (called the residential indicator). The report also identifies several community-related metrics (e.g., property tax collection rate, unemployment levels, bond ratings, overall debt levels) that are combined to develop a “permittee financial capability indicator,” but these have not generated the same level of attention as the residential indicator. The residential indicator with a threshold at 2% of MHI is the benchmark with which affordability of water service is most frequently compared.

The residential indicator was intended to be reviewed in conjunction with many other factors (the permittee indicator) when determining if compliance with environmental regulations presented substantial and widespread social and economic impacts on a community. As utilities actually began to incur the massive costs related to compliance and maintaining existing system assets, customer rates increased dramatically, and the 2% metric was the only available data point that could be used to substantiate an argument for longer compliance time frames.

This metric was developed to apply solely to wastewater systems and their ability to comply with regulatory mandates, but it has been adopted by the industry as a useful benchmark. Some guidance also indicates that 2.5% of MHI may be a guideline for water system affordability, but there is no clear consensus within the industry.

CHANGING THE DIALOGUE

The simplicity of the residential indicator is a major reason that it has become the de facto industry standard for determining customer affordability; this simplicity is also the reason it is an incomplete measure. Across very large, normal, and narrowly distributed sets of data, the median can be a useful statistic. Unfortunately, real-world income distributions do not follow a normal bell curve; when utilities apply them as a proxy for their customer base, they often result in overlooked affordability concerns for customers below the median. The MHI statistic also does not consider the composition and demographics of households below the median.

The USCM, AWWA, and the Water Environment Federation (WEF) published a white paper in 2013 declaring that “there are several critical limitations to how EPA defines affordability . . . EPA's reliance on metrics such as MHI is highly misleading as an indicator of a community’s ability to pay” (USCM et al, 2013).

Any one-size-fits-all guidance on what constitutes affordable water service is going to be inappropriate when applied to most local considerations. The income distribution for an actual US city is shown in Figure 1. The MHI for this city is approximately $40,000 but a significant portion of the population has annual income levels that place them below the poverty line.

Figure 1 illustrates the potential to miss significant impacts on economically disadvantaged customers. Although the impact on the median customer indicates that a compliance program may be affordable for the utility as a whole, the underlying data suggest that large segments of the customer base may already be struggling with the ability to afford service. The long-term sustainability of the water industry in the United States depends on finding ways to make the necessary improvements to its systems while understanding the impacts for all water customers, thus ensuring access to clean water for all.

The first step in this evolving discussion is the development of a system that provides an accurate and comprehensive determination of a utility’s financial capability. The existing USEPA methodology (2% of MHI) provides a starting point from which to work. One way to build on this commonly used approach is to break the community down into smaller and more meaningful parts. For example, using the MHI of a single census tract, zip code, or neighborhood will provide more

![Figure 1](image-url)
granular and customer-specific information without fundamentally altering the methodology. This type of information can also provide insights into the demographic composition of the customers being affected by increasing water and wastewater costs. The ultimate result of financial capability may not change, but understanding that many of the affected households are elderly consumers or single-parent families could change the conclusions drawn.

With the traditional approach, the entire service area flips from affordable to unaffordable in one dramatic swing. In reality, there are customers who are struggling to pay current bills, and more are added with each rate increase. Figure 2 is a visualization of real-life affordability for a US utility. Following the scale of green to yellow to orange, we can see the neighborhoods with residential indicators that are low, medium, or high burden, respectively.

On the whole, using 2% of MHI as the sole determinant may show no affordability issues. However, neighborhoods struggling with affordability appear in all areas of the map, showing evidence of widespread financial impacts within the community. The map shows where the most significant impacts occur geographically. Data from the census bureau or other sources can be used to identify the social demographics of these customers. Political districts can also be included to give political context to the discussion.

Census data provide a wealth of information that can be used to highlight many local affordability issues. A utility should also consider how various subgroups of the population will be affected (i.e., multifamily versus

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**FIGURE 2** Example of an affordability map

<table>
<thead>
<tr>
<th>Average change in stormwater fee</th>
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<tr>
<td>≤ –25%</td>
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<td>&gt; –25% and ≤ –15%</td>
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<tr>
<td>&gt; 15% and ≤ 25%</td>
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<tr>
<td>&gt; 25%</td>
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<tr>
<td>City council districts</td>
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Originally published in Journal AWWA (July 2014). © AWWA 2014
single-family households; renters versus owner-occupied; elderly versus families; households receiving public assistance; quartiles or quintiles of the income levels). These detailed data should be considered to provide a more comprehensive look at affordability risk across the utility.

Figure 3 shows the projected average customer bill during a long-term planning horizon as a percentage of MHI for varying percentages of the system's customers. The citywide MHI isn't exceeded until fiscal year 2025, but there are substantial impacts on large portions of households 10 years earlier. Similar graphs can effectively communicate the percentage of families or elderly households that are affected well before the universal residential indicator shows unaffordable service.

Integrated resource planning is a more recent approach that is endorsed by the USEPA to advance the traditional financial capability assessment. Integrated resource planning provides a vehicle for considering all of the water-related needs of a community and the combined impact on customers. The complete picture of the watershed (water, sewer, and storm) is considered, and the goal of integrated planning is to provide the maximum environmental benefit while being mindful of customer impacts.

The ongoing operations, repair and replacement, asset management, and compliance-related costs are all included in a comprehensive integrated plan. Capital financing and other local considerations for financial planning may alter the effect on different types of customers; it is important to look at the actual effect on water bills. Data from customer billing systems allow the analysis shown in Figure 2 to be performed on actual customer water use and bill statistics rather than on broad cost-sharing principles used in the traditional analysis.

Following these approaches can add depth and clarity to the uncertainty related to affordability, but one question is not often asked: If it is determined that a utility has significant affordability concerns, what should it do? When a utility crosses that threshold, will it

- be granted more time to comply with environmental regulations or be able to renegotiate its consent orders?
- be forced to delay reinvestment in existing assets?
- have special financing options opened to the utility, or is that utility then required to invest only the cash-funded capital that the current rates can support?
- be susceptible to default on its outstanding debt obligations?

The list of questions and concerns that accompany significant affordability challenges seems daunting. Unfortunately, little guidance has been provided by regulatory agencies to indicate what the answers to some of these questions will be.

**CONCLUSIONS**

There are many questions and few certainties when it comes to consumers' ability to afford water and wastewater service now and in the future. We can say that costs are going up and that they will be passed along to utility ratepayers. We can also say that there may never be universal agreement on what constitutes affordable pricing for an essential service. However, we can agree that rising costs present a problem that all utilities must eventually address. When that time comes, a more complete understanding of the issues
will allow the water industry to develop better solutions. We must understand the geographic and demographic characteristics of this service area and how the needs of drinking water, wastewater, and stormwater intermingle to ensure the health of communities and the environment. The analytical methods discussed here, coupled with an elevation of water issues in the public forum, can provide the answers we need to address affordability concerns.

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REFERENCES

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JOURNAL AWWA welcomes comments and feedback at journal@awwa.org.
If you’ve ever been so fortunate as to have a conversation with any of your elders, you will come to appreciate that things just cost more today than they did “back then.” All you have to do is ask. Back in 1975, you will be delighted to learn, a gallon of gas ran about 59 cents and you could go to a movie in a real theater for two bucks. You would be hard pressed to find data showing the cost of a month’s water or sewer service from back then, but you can safely bet it wasn’t very much. At least one researcher tells us that the price for these services was so low during the 1950s to the 1990s that any differences noted were statistically insignificant (Chermak 2005). Another thing your elders will tell you is that people didn’t make very much money back then. About $12,000/year, to be precise, so it was ideal that basic goods and services not be too expensive. Today, your results may vary.
MEASURING BURDENS IN AMERICA

For the past 15 years, at least, the financial burden imposed by the cost of water and sewer service has become a larger issue in America as household incomes have increased at a rate lower than inflation, and while water and sewer costs increased almost three times faster than inflation (Figure 1). During this same period, incomes have also become more disparate. This so-called erosion of the middle class can best be seen by comparing the percentage of households at various income levels in 2000 versus 2015 (Figure 2), where the percentage of households in the middle-income bands has decreased while that of both the lower and upper bands has increased. These things—rapidly increasing costs relative to inflation, decreasing real household income, and wider dispersion of income—have conspired to make the financial burden of water and sewer bills a much bigger issue than it was just 15 years ago, let alone back in the time of 59-cent gas.

The US Environmental Protection Agency (USEPA), since the inception of the Clean Water Act, has provided some guidance on how to measure financial burdens (USEPA 1997). Called the residential indicator (RI), the USEPA’s measure divides the annual residential cost of water or sewer service by the median household income (MHI) of the relevant community. The resulting value is the RI. A value of 2% or higher indicates a “high burden” based on USEPA standards concerning sewer utilities. A value of 2.5% applies for drinking water utilities. This simple measure has served as the industry standard for many years because the overall cost of water and sewer service remained relatively low compared with all other goods and services, and as income levels rose and income distribution held or improved.

FIGURE 1  Growth in key inflation and income measures, 2000–2015

CPI—consumer price index

FIGURE 2  Change in households by income level, 2000–2015

Source: US Census Bureau 2016
Normalized number of households in thousands.
Income in 2015 dollars.
However, with its strict focus on median, the USEPA RI cannot possibly capture or measure financial burdens robustly or, some would argue, fairly in today’s economic environment. By relying on only the population median as a reliable measure of central tendency despite evidence of widening income disparity, problems with the RI have been noted by those most affected by its impact on regulatory enforcement proceedings: utility providers in large urban cities. Indeed, the US Conference of Mayors recently adopted resolutions that, among other things, called for improved measurement of financial burdens (USCM 2016).

An alternative to the RI developed at MWH Global (now part of Stantec) is the Weighted Average Residential Index, or WARi™. The WARi methodology introduces measures that adjust for a community’s unique income distribution while also evaluating the burdens from real customer bills at the most granular level possible. (NEORSD) as an example. The maximum annual residential cost for NEORSD using the USEPA high-burden threshold as a guide would be $1,000 as of 2015, which is 2% of the MHI in the NEORSD service area. As a comparison, the MHI for the population of the United States is slightly higher, and the annual cost at 2% of MHI would be $60 greater for the US population than that for a resident of NEORSD. Under the USEPA methodology, these two costs—NEORSD at $1,000 annually, or $83.33/month, and the United States at $1,060 annually, or $88.33/month—are thought to quantify the same financial burdens. However, when quantifying the financial burdens by taking the differences in household income distribution into account, one can see that the financial burdens are quite different, 17.8% in this case (Table 1). Armed with this information, equalizing the two burdens is a matter of calculating the necessary reduction in annual cost for NEORSD to bring its burden down to the 3.9% level shown for the United States in Table 1. A reduction of 15.1% would reduce NEORSD’s annual cost from $1,000 to $849. At this level, NEORSD’s financial burden would be 3.9% based on WARi, the same as that for the US population used in the example. By implication, the $849 maximum annual cost is just 1.7% of MHI rather than the 2.0% value that USEPA currently includes in its guidance document (USEPA 1997). The WARi results suggest that these two annual costs produce equivalent financial burdens.

That two totally different populations with very different distributions of income may achieve equal financial burdens at different costs ought not be surprising. Still, the 2% threshold has been with us since the inception of the Clean Water Act, and its application in regulatory settings has not changed significantly. For populations with higher concentrations of low-income households, the high-burden threshold as measured by the RI should likely be adjusted down, as in the NEORSD example. For other populations, it could be adjusted up. As an alternative, an approach like that taken by WARi can provide a more equitable measurement of the burdens.

**A NEW EXPECTATION?**

All of this raises the question of what would be appropriate measures above which the burden would be considered to be “high” or otherwise unaffordable?

The USEPA RI threshold of 2% of MHI is a relic that appears to have some nexus in pre-1970s farm loan programs. Interestingly, the Federal Insurance Office (FIO) recently decided that automobile liability policy costs greater than 2% of MHI were “unaffordable” as well. Arguing against that decision, the Insurance Research Council told the FIO that “the 2% figure is arbitrary and that there is no external standard to support it” (Simpson 2016). Indeed, anyone who has researched the basis for USEPA’s 2% (or 2.5% for drinking water applications) may agree as to the seemingly arbitrary nature of the threshold (Davis & Teodoro 2015).

The lack of data and analysis supporting an approach based on a median-focused threshold of 2%...
leaves the water industry to wonder whether the implied cost of utility services at that level is too high or too low. Even if the burden is more accurately measured, the lack of meaningful guidance to inform policies around the affordability of basic utility services remains a significant shortfall. However, it is a shortfall that NEORSD’s leadership has attempted to address.

Facing a $3 billion capital program largely defined by an extensive consent decree, NEORSD’s current residential sewer costs already approach the 2% RI threshold. NEORSD sees its capital program as essential for meeting its strategic mission and vision for the Cleveland area, but the future costs will no doubt put the organization in new territory with respect to managing its financial burdens. The conundrum was enough to cause the agency to question whether the 2% threshold had any actual bearing, or whether customers could reasonably afford something more.

NEORSD decided to ask its customers what they valued. Given a limited budget, the question was, “Would you prioritize the bill for sewer service above or below other household expenditures?” Ask enough people the question the same way—where the sewer bill is compared against 16 other spending categories ranging from housing to health care to spending on entertainment—and the responses can be eye-opening. After asking those questions in six focus groups with

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Weighted average financial burdens in the United States versus NEORSDa</th>
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<tbody>
<tr>
<td><strong>United States ($1,060)</strong></td>
<td><strong>NEORSD ($1,000)</strong></td>
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<tr>
<td><strong>Income Bins—$</strong></td>
<td><strong>Population in Bin—%</strong></td>
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<td>&lt;10,000</td>
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<td>Weighted average burden (WARi)—%</td>
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<td>Skew—%</td>
<td>17.8</td>
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Source: US Census Bureau 2013

MHI—median household income, NEORSD—Northeast Ohio Regional Sewer District

aAs of 2015, assuming a $1,060 annual cost for the United States and a $1,000 annual cost for NEORSD. Both annual costs are at 2% of MHI for each respective population.

72 random respondents, NEORSD got the answers it needed:

- Customers ranked sewer utility service seventh out of 16 budget categories (drinking water service ranked sixth).
- Once responses were normalized and compared with government survey data on household spending, sewer service was valued at approximately $1,616 to $1,952/year, with an average of $1,784.
- On the basis of median household income in the NEORSD service area, these spending levels indicated a range of 3.2–3.9% of MHI, and an average of 3.6%.

Although the results are preliminary (they are being validated through a much larger survey as of the writing of this article), they suggest that the residents served by NEORSD may be willing to pay more for their sewer services than previously thought. If they are willing to pay more, the next question is how much. To answer that question, NEORSD evaluated the combined spending on categories that were less important than sewer services on the basis of the normalized importance scores from the respondents. Logically, if sewer service is more important, then substitution effect worked if customers were substituting the bottom 6.0 units of importance for the 6.0 units the respondents had assigned to sewer services. Following this logic, the substitute spending level was determined as being between the 4.9 cumulative importance (for

The lack of data and analysis supporting an approach based on a median-focused threshold of 2% leaves the water industry to wonder whether the implied cost of utility services at that level is too high or too low.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Budget Category</th>
<th>Normalized Importance Score</th>
<th>National Spending in Category—$/year</th>
<th>Cumulative Annual Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing</td>
<td>16.6</td>
<td>10,491</td>
<td>49,550</td>
</tr>
<tr>
<td>2</td>
<td>Food at home</td>
<td>11.8</td>
<td>3,971</td>
<td>39,059</td>
</tr>
<tr>
<td>3</td>
<td>Utilities—electricity and gas</td>
<td>9.2</td>
<td>1,933</td>
<td>35,088</td>
</tr>
<tr>
<td>4</td>
<td>Health and personal care</td>
<td>8.9</td>
<td>4,935</td>
<td>33,155</td>
</tr>
<tr>
<td>5</td>
<td>Transportation</td>
<td>7.7</td>
<td>9,073</td>
<td>28,220</td>
</tr>
<tr>
<td>6</td>
<td><strong>Utilities—drinking water</strong></td>
<td><strong>7.1</strong></td>
<td><strong>530</strong></td>
<td><strong>19,147</strong></td>
</tr>
<tr>
<td>7</td>
<td><strong>Utilities—sanitary sewer</strong></td>
<td><strong>6.0</strong></td>
<td><strong>NA</strong></td>
<td><strong>18,617</strong></td>
</tr>
<tr>
<td>8</td>
<td>Education/tuition/reading</td>
<td>5.5</td>
<td>1,339</td>
<td>18,617</td>
</tr>
<tr>
<td>9</td>
<td>Retirement savings and personal insurance</td>
<td>4.9</td>
<td>5,726</td>
<td>17,278</td>
</tr>
<tr>
<td>10</td>
<td>Clothing</td>
<td>4.2</td>
<td>1,786</td>
<td>11,552</td>
</tr>
<tr>
<td>11</td>
<td>Utilities—telephone service</td>
<td>3.8</td>
<td>1,315</td>
<td>9,766</td>
</tr>
<tr>
<td>12</td>
<td>Entertainment</td>
<td>3.3</td>
<td>2,728</td>
<td>8,451</td>
</tr>
<tr>
<td>13</td>
<td>Food away from home</td>
<td>3.1</td>
<td>2,787</td>
<td>5,723</td>
</tr>
<tr>
<td>14</td>
<td>Cash contributions</td>
<td>2.9</td>
<td>1,788</td>
<td>2,936</td>
</tr>
<tr>
<td>15</td>
<td>Alcohol and tobacco</td>
<td>2.6</td>
<td>782</td>
<td>1,148</td>
</tr>
<tr>
<td>16</td>
<td>Personal services</td>
<td>2.4</td>
<td>366</td>
<td>366</td>
</tr>
</tbody>
</table>

NA—not applicable, NEORSD—Northeast Ohio Regional Sewer District

aNational spending data are from the 2014 Consumer Expenditure Survey published by the US Census Bureau
bSewer service is combined with drinking water in the Consumer Expenditure Survey but separated in the NEORSD survey so that respondents could provide a relative importance rating.
personal services and alcohol and tobacco, combined), and 7.9 (for the first two, plus cash contributions). By interpolation, that point is approximately $1,784 (see Table 2 and Figure 3). Therefore, the preliminary focus group responses suggest that sewer service is more important than the first $1,784 of annual spending for the average customer. These results are open to further refinement, but this approach is currently being studied using a wider survey and more controlled techniques.

At $1,784 of annual spending ($148 per month), customers in NEORSD would be paying for sewer costs with a USEPA RI of 3.6% instead of 2.0%. The equivalent WARi values are 8.2% versus 3.9%, respectively.

**TARGETING FINANCIAL ASSISTANCE**

Even when equipped with better measurements of financial burden, and an improved understanding of how customers value their utilities, managers will still be left with some customers who cannot afford to pay for the services provided. As discussed earlier, the number of customers in this category has been increasing, especially in many urban areas. Addressing this issue has increasingly meant targeting financial assistance programs in one way or another, funded either directly or indirectly by the utility.

NEORSD has for many years funded a pair of financial assistance programs to help qualifying customers. As funds become scarcer against a growing need, targeting the assistance to achieve optimal outcomes has become more important. The question becomes how to best direct the assistance dollars for optimal results.

Because of the geospatial capabilities built into WARi, NEORSD is able to target assistance programs to (1) the specific areas where WARi is highest, and (2) to those addresses where the residents are actually paying the sewer bill (some residents never actually see a sewer bill if they are renting a property). One of the challenges that NEORSD has faced over the years has been getting more qualifying residents enrolled. The new information provided by using an approach like WARi allows NEORSD to target its marketing campaigns in the right places to produce maximum results.

![FIGURE 3](image)

**FIGURE 3** Estimated annual spending on wastewater services based on importance score signed by NEORSD survey respondents (preliminary results)


NEORSD—Northeast Ohio Regional Sewer District
NEORSD to target its marketing campaigns in the right places to produce maximum results.

CONCLUSIONS
There can be little doubt that the issue of affordability in the context of water and sewer costs has become a much more significant factor than it was in the previous era. Increasing costs, erosion of the middle class, and stagnant household earnings combine to make this issue a substantial one for utility managers and policymakers for the foreseeable future. These issues cannot be overcome by outdated measurements of financial burdens, nor by unsupported “thresholds” meant to warn us when costs are supposedly too high.

The informed utility leader would do well to adopt robust measures of financial burden that take more factors into account. The WARi approach offers a significant improvement in the way financial burdens are measured compared with the RI, and managers can use this kind of information to thoughtfully monitor financial burdens in their communities at a highly granular level.

Additionally, given the huge amount of investment expected in the water industry over the next 20 years, it seems reasonable to ask whether a cost of 2 or 2.5% of median income is really an effective indicator of affordability. As the industry looks to investing around $3 trillion (Anderson 2010), it would seem that it’s vital to answer the question of what is and what is not affordable.

Utilities need to ask the right questions, and answers like those developed by NEORSD may challenge the status quo. While preliminary at this point, the data collected by NEORSD may soon give the entire industry room for pause to consider anew the value of the service provided compared with the cost of providing it, especially for the increasing number of customers struggling to meet their obligations.

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https://dx.doi.org/10.5942/jawwa.2017.109.0060

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AWWA RESOURCES
• M1 Principles of Water Rates, Fees, and Charges, 7th ed. AWWA, 2017. Catalog No. 30001-7E-PDF.

These resources have been supplied by Journal AWWA staff. For information on these and other AWWA resources, visit www.awwa.org.
ABSTRACT

Rising costs and recent high-profile crises have brought renewed and increasing attention to the affordability of water and sewer service. Meaningful, accurate assessment of affordability is critical as utility leaders seek to serve low-income customers while simultaneously raising the revenue necessary to maintain and advance public health and conservation. Unfortunately, the predominant conventional method of measuring household affordability is fundamentally flawed and often misleading. This article advances a more accurate and meaningful methodology for measuring the affordability of water and sewer service for low-income households. The proposed method accounts for essential household water needs, income disparities, and core non-water/sewer costs. After detailing the method, the new approach is used to measure water and sewer service affordability in the 25 largest U.S. cities. The article concludes with a discussion of the new method’s limits and general guidelines for its use in policymaking and rate design.

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1 A full-length, detailed version of this work is available as:


Thanks to Jon Davis, Rick Giardina, Jason Mumm, anonymous reviewers from Journal AWWA, and several Twitter followers for useful discussion in the development of this paper. Errors remain the responsibility of the author. Comments and criticisms are welcome.
Rising costs and recent high-profile crises in Flint and Detroit, Michigan have brought renewed and increasing attention to the affordability of water and sewer service. Accurate assessment of affordability is critical as utility leaders seek to serve low-income customers while raising the revenue necessary to maintain and advance public health and conservation. Unfortunately, the predominant conventional method of measuring household affordability—combined average bill as a percentage of median household income (%MHI), with a value less than 4.0 or 4.5 designated as “affordable”—is fundamentally flawed and often misleading. Specifically, the %MHI method:

- Uses average water consumption as its basis for gauging affordability, rather than basic water consumption;
- Evaluates affordability based on a community’s median income, rather than on low-income households;
- Fails to account for essential non-water/sewer related costs, such as housing, food, health care, and home energy; and
- Applies an arbitrary affordability standard (typically 4.0%) that may not reflect community priorities.

A better method. A more meaningful and accurate methodology for measuring the affordability of water and sewer service at the household level is proposed here: the Affordability Ratio (AR) and Hours’ Labor at Minimum Wage (HM). Unlike the conventional approach, the proposed metrics account for basic household water needs (at 50 gallons per person per day) and essential non-utility costs:

\[
\text{Affordability Ratio} = \frac{\text{Cost of Basic Water + Sewer Service}}{\text{Household Income-Essential Costs}}
\]

This AR effectively captures basic water and sewer costs as a share of disposable income. With a concern for low-income households, the proposed method also assesses affordability at the 20th-income percentile (AR20), rather than at median income. Basic household water and sewer costs expressed in the number of hours worked at minimum wage (HM) is offered as useful complementary metric. Together these metrics offer a more defensible and practically useful way of assessing utility affordability for purposes of rate-setting and policy design.

Applications & limitations. The new metrics promise utility leaders, policy makers, and citizens more accurate information about the state of water and sewer affordability in their communities. Cross-utility comparison of AR20 and HM values is not recommended as a basis for policy for any specific utility. Rather, these metrics can help frame local discussions about affordability and serve as useful tools or reference points in rate-setting and the development of customer assistance programs. Instead of an arbitrary affordability standard, AR20 less than 10% and HM less than 8.0 are offered as “rules of thumb” to facilitate policy development.

A Big-City Snapshot. The new metrics are used to create an affordability profile for the largest 25 U.S. cities in the Spring of 2017. Household income at the 20th percentile and essential expenditures for each city were estimated using data on community demographics and
consumer expenditures. These estimates and minimum wage data were combined with water and sewer rates in place during the first half of 2017 to evaluate affordability for a hypothetical four-person household at the 20th income percentile and/or earning minimum wage.

The resulting AR20 values average 11.4% across the top-25 cities, ranging from a low of 4.8% in Phoenix to a high of 26.9% in San Francisco. In terms of labor, basic monthly water and sewer service in the top-25 cities average 9.0 HM, from a low of 4.0 (Phoenix) to a high of 13.6 (San Francisco). Not surprisingly, these results indicate substantial variation across large U.S. cities, and suggest that affordability challenges in some places are driven by rate structures, while in other places underlying economic conditions may play a greater role.

### Affordability in Largest 25 U.S. Cities in 2017

<table>
<thead>
<tr>
<th>Pop Rank</th>
<th>City</th>
<th>Monthly Basic Service Cost</th>
<th>Affordability Ratio, 4-Person Household</th>
<th>Minimum Wage</th>
<th>Hours at Min. Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New York, NY</td>
<td>$81.78</td>
<td>18,085 $</td>
<td>12.00</td>
<td>6.8</td>
</tr>
<tr>
<td>2</td>
<td>Los Angeles, CA</td>
<td>$73.11</td>
<td>19,063 $</td>
<td>15.00</td>
<td>7.0</td>
</tr>
<tr>
<td>3</td>
<td>Chicago, IL</td>
<td>$47.27</td>
<td>17,386 $</td>
<td>10.50</td>
<td>4.5</td>
</tr>
<tr>
<td>4</td>
<td>Houston, TX</td>
<td>$74.87</td>
<td>19,109 $</td>
<td>7.25</td>
<td>10.3</td>
</tr>
<tr>
<td>5</td>
<td>Phoenix, AZ</td>
<td>$39.68</td>
<td>21,401 $</td>
<td>10.00</td>
<td>4.0</td>
</tr>
<tr>
<td>6</td>
<td>Philadelphia, PA</td>
<td>$58.54</td>
<td>13,546 $</td>
<td>7.25</td>
<td>8.1</td>
</tr>
<tr>
<td>7</td>
<td>San Antonio, TX</td>
<td>$55.16</td>
<td>19,517 $</td>
<td>7.25</td>
<td>7.6</td>
</tr>
<tr>
<td>8</td>
<td>San Diego, CA</td>
<td>$108.71</td>
<td>26,381 $</td>
<td>11.50</td>
<td>9.5</td>
</tr>
<tr>
<td>9</td>
<td>Dallas, TX</td>
<td>$59.82</td>
<td>18,585 $</td>
<td>8.05</td>
<td>8.5</td>
</tr>
<tr>
<td>10</td>
<td>San Jose, CA</td>
<td>$104.47</td>
<td>33,342 $</td>
<td>10.50</td>
<td>9.9</td>
</tr>
<tr>
<td>11</td>
<td>Austin, TX</td>
<td>$91.20</td>
<td>24,438 $</td>
<td>7.25</td>
<td>12.6</td>
</tr>
<tr>
<td>12</td>
<td>Jacksonville, FL</td>
<td>$68.23</td>
<td>19,817 $</td>
<td>8.05</td>
<td>8.5</td>
</tr>
<tr>
<td>13</td>
<td>San Francisco, CA</td>
<td>$176.85</td>
<td>24,946 $</td>
<td>13.00</td>
<td>13.6</td>
</tr>
<tr>
<td>14</td>
<td>Columbus, OH</td>
<td>$106.36</td>
<td>18,784 $</td>
<td>8.15</td>
<td>13.1</td>
</tr>
<tr>
<td>15</td>
<td>Indianapolis, IN</td>
<td>$97.60</td>
<td>17,395 $</td>
<td>7.25</td>
<td>13.5</td>
</tr>
<tr>
<td>16</td>
<td>Fort Worth, TX</td>
<td>$66.67</td>
<td>21,817 $</td>
<td>7.25</td>
<td>9.2</td>
</tr>
<tr>
<td>17</td>
<td>Charlotte, NC</td>
<td>$68.84</td>
<td>23,135 $</td>
<td>7.25</td>
<td>9.5</td>
</tr>
<tr>
<td>18</td>
<td>Seattle, WA</td>
<td>$180.70</td>
<td>27,290 $</td>
<td>15.00</td>
<td>12.0</td>
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<tr>
<td>19</td>
<td>Denver, CO</td>
<td>$64.91</td>
<td>21,698 $</td>
<td>9.30</td>
<td>7.0</td>
</tr>
<tr>
<td>20</td>
<td>El Paso, TX</td>
<td>$54.45</td>
<td>17,879 $</td>
<td>7.25</td>
<td>7.5</td>
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<tr>
<td>21</td>
<td>Washington, DC</td>
<td>$112.51</td>
<td>22,526 $</td>
<td>11.50</td>
<td>9.8</td>
</tr>
<tr>
<td>22</td>
<td>Boston, MA</td>
<td>$99.51</td>
<td>15,625 $</td>
<td>11.00</td>
<td>9.0</td>
</tr>
<tr>
<td>23</td>
<td>Detroit, MI</td>
<td>$92.68</td>
<td>9,436 $</td>
<td>8.90</td>
<td>10.4</td>
</tr>
<tr>
<td>24</td>
<td>Nashville, TN</td>
<td>$65.95</td>
<td>21,153 $</td>
<td>7.25</td>
<td>9.1</td>
</tr>
<tr>
<td>25</td>
<td>Memphis, TN</td>
<td>$39.53</td>
<td>14,913 $</td>
<td>7.25</td>
<td>5.5</td>
</tr>
</tbody>
</table>

*Does not include low-income assistance programs.*

25-city Avg $83.58 $20,291 $780 11.4% 9.19 9.0
Communities are more frequently confronting water affordability issues at the utility and household levels, with multiple stakeholders working to balance affordable rates with the costs of service. For example, the City of Philadelphia, Pa., passed a progressive affordability program in 2017 that used household income as the basis for customer water rates (Nadolny 2017). Other recent municipal efforts in the United States include the work of the Baltimore, Md., city council to craft a water affordability package (expected this year), while in Chicago, Ill., aldermen have discussed ways to insulate low-income residents from water rate increases (Spielman 2017). In an example from Texas, concern over affordability led the City of Austin to explore rate reductions in 2018 for all classes of retail customers (Devenyns 2017). Given the widespread attention water affordability has recently received and the variety of approaches communities can consider, it’s not surprising that this local issue has caught the attention of some members of the US Congress.

2017 NAPA AFFORDABILITY FRAMEWORK

In the 2016 omnibus spending deal, Congress instructed the National Academy of Public Administration (NAPA) to study US Environmental Protection Agency (USEPA) water affordability guidance and provide a definition and framework for affordability of clean water for a community. NAPA assembled a panel of five academy fellows who directed the work of a study team to conduct a comprehensive literature review, survey, interviews, and a roundtable with stakeholders. The panel developed 21 recommendations for USEPA, summarized in its report, Developing a New Framework for Community Affordability of Clean Water Services (2017 NAPA Affordability Framework; NAPA 2017).

Although the congressional directive and many of USEPA’s existing policies and guidance focus on affordability of controlling combined sewer overflows (CSOs) and application under the Clean Water Act (CWA), the 2017 NAPA Affordability Framework panel widened the scope to look at affordability beyond the CWA. After all, the same ratepayer feels the burden alike for clean water, stormwater, and drinking water needs.

Many of the report’s recommendations are consistent with AWWA’s comments on and critiques of USEPA’s policies regarding affordability. The study focuses on how USEPA calculates the affordability of projects required to bring water systems into compliance with the CWA for CSOs. Ultimately, the report finds that median household income is not an effective indicator of community affordability. In addition, the metrics used by USEPA to address affordability in either the National Pollutant Discharge Elimination System permit process or an enforcement process (such as consent decrees) originating from the 1994 CSO Policy (USEPA 1994), and the subsequent 1997 Combined Sewer Overflows—Guidance for Financial Capability Assessment and Schedule Development (1997 FCA Guidance), need to be revised and improved.

THE FINANCIAL CAPABILITY METRIC

The 1997 FCA Guidance, used by USEPA to determine a community’s ability to pay for a project to reduce pollution of waterways by CSOs, relies on a residential indicator (RI)—based on the ratio of total annual wastewater and CSO control costs to the community’s median household income (MHI)—and a financial capability indicator—based on metrics that include bond rating, debt load, unemployment rates, MHI, and property tax revenues and collection rates. The RI uses a level of 2% of MHI to determine affordability for wastewater; in
other words, a project is affordable if it produces an average sewer bill less than 2% of MHI. AWWA and others have long criticized using this metric to gauge affordability because using MHI as a metric diminishes the impact of high water bills on the lowest-income customers (Teodoro 2018). Additionally, the RI only includes wastewater and CSO costs and does not evaluate all water costs, including drinking water, a metric that would reflect the full cost of water service to the customer. No explanation is provided in the 1997 FCA Guidance or in supporting materials for the choice of standards for the RI—namely, that costs exceeding 2% of household income constitute a high impact, and costs of less than 1% of household income constitute a low impact. In fact, the origination of this threshold is quite obscure.

The use of MHI as an economic indicator appears to have originated with the Farm Home Loan program in 1972 (NACWA 2005). This approach then spread to other programs, appearing in USEPA documents as early as 1984 (USEPA 1984). A 1998 USEPA document on variance technology for drinking water systems indicates the 2.5% threshold for drinking water affordability used by USEPA was derived in part from comparing Consumer Expenditure Survey data gathered by the Bureau of Labor Statistics; alcohol and tobacco, telephone, and energy and fuel expenditures are the reference data used in developing the affordability threshold (USEPA 1998).

In any case, the 2% threshold for wastewater and the 2.5% threshold for drinking water do not appear to be derived from an economic analysis, and further use of MHI as the standard metric for affordability deserves further study. Incorporating these recommendations from the report, and improving USEPA’s water affordability guidelines so that a community’s ability to pay for clean water projects required for federal compliance is more accurately captured, will ultimately benefit customers and the community by extending CSO enforcement deadlines and moving USEPA toward a more holistic view of affordability.

CONSUMER ASSISTANCE PROGRAMS

Another recommendation of the 2017 NAPA Affordability Framework urged USEPA to “work with local and state governments to eliminate barriers restricting utilities’ ability to develop more efficient and equitable water rate structures, including specific Consumer Assistance Plans (CAPs) for financially distressed low-income ratepayers” (NAPA 2017, 149). In 2017, the University of North Carolina Environmental Finance Center authored a report, funded in part by AWWA, exploring the legal framework, state policies, and barriers to rate-funded CAPs (UNC 2017).

Perhaps the most striking finding in this report is that only a few states have clear laws that specifically address the ability of water systems to establish CAPs from rate revenues. This is in stark contrast to state regulations addressing energy bills and affordability for low-income customers that exist in nearly every state (AWWA 2017). Although the lack of clear legal precedent in the water sector allows for ingenuity and innovative approaches, it also gives no assurance to a utility on whether a rate-funded CAP is permissible or prohibited. If states follow the recommendation put forth by the 2017 NAPA Affordability Framework, there could be an increase in states adopting more explicit language regarding how a water utility may legally address affordability and assist low-income customers in its service area.

ON CAPITOL HILL AND IN THE NATIONAL DIALOGUE

More recent activity on Capitol Hill could result in new legislation concerning water affordability. With an infrastructure package next in line on the congressional to-do list, we may see an increase in discussion and action around affordable water service and CAPs. In January 2018, the Senate Environment and Public Works Committee held a hearing on water infrastructure needs and challenges, marking the beginning of Senate focus on water infrastructure in the current session of Congress. Although affordability was not a main topic, an infrastructure bill would be a reasonable and compelling place to embed legislation on affordability issues for either water systems or households.

With an infrastructure package next in line on the congressional to-do list, we may see an increase in discussion and action around affordable water service and CAPs.

While members of the Trump Administration have talked more about process and permit streamlining, this cabinet has also promised to deliver a trillion-dollar infrastructure investment. The House Committee on Energy and Commerce has passed H.R. 3387, the Drinking Water System Improvement Act, a bill that would reauthorize the Drinking Water State Revolving Loan fund program and make some other changes to drinking water policy. This is intended to be the drinking water component of comprehensive infrastructure legislation in the House; however, it does not focus on affordability. Wastewater is under the jurisdiction of the House Committee on Transportation and Infrastructure,
and this committee is not as far along as the Energy and Commerce group in producing its infrastructure legislation (note that in the Senate, Environment and Public Works has jurisdiction over both drinking water and wastewater). Given these variables and the current political climate, it’s possible any meaningful legislation on water affordability will get lost in the chaos.

Although water service affordability is inherently a local challenge, the contribution of federal mandates to increasing water service costs and the national need for more investment in water infrastructure has set the stage for congressional action. In January 2017, the Problem Solvers Caucus, a bipartisan group of lawmakers, released a report on infrastructure policy solutions that recommends Congress “examine the growing affordability strain on ratepayers and its impact on water infrastructure maintenance and repair” (PSC 2017). The report also suggests that Congress develop a demonstration program to help states and cities address water affordability for ratepayers.

Along the same lines, draft legislation making its way around Capitol Hill proposes the creation of a new national grant program to help 20 water and wastewater systems address unaffordable water bills through CAPs. The cost of a grant program like this would be very high in comparison with the number of people it could ultimately serve, which will likely make such a program a tough sell for many members of Congress. By contrast, it’s surprising that enormous federal programs such as the Low Income Home Energy Assistance Program and Supplemental Nutrition Assistance Program exist to address affordability challenges now?

A new and upcoming symposium hosted by AWWA and the Water Environment Federation will attempt to address these issues head-on. The first annual Transformative Issues Symposium (www.awwa.org/affordability), scheduled for Aug. 6–7 in Washington, D.C., will focus on affordability, with topics such as utility rate setting, infrastructure financing, and legal and regulatory barriers around CAPs. The symposium is a chance for leaders in the water sector to work together on an important issue, identify new concerns, and collaborate to develop solutions. As water professionals come together at events like this to address pervasive affordability issues, their innovations and insights provide the guidance communities need to make water ultimately affordable for all.

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https://doi.org/10.1002/awwa.1100

REFERENCES


According to a 2016 forecast by Bluefield Research (Boston), California will need to invest more than $70 billion by 2025 to address current water and wastewater infrastructure needs. It has been shown, however, that ratepayers don’t see value in water compared to other things for which they pay. In general, ratepayers are disconnected from the real costs associated with maintaining our water infrastructure and often are reluctant to accept rate changes that pay for it.

The use of strategic communication methods before, during, and after rate changes can convey the benefits of clean and reliable water, the challenges of providing that water around the clock, and solutions and costs for ensuring sustained water and wastewater service. A better understanding of the returns ratepayers can receive through water infrastructure investment increases support for rate changes.

**Customer perceptions vs. financial realities**

- A 2016 Value of Water Coalition national poll highlighted several key gaps between customers’ engagement with clean water and their willingness to pay for it:
  - 71% of respondents said they deemed it very important to improve and modernize the water infrastructure system. However, only 38% said they would pay more to ensure safe and reliable water service.
  - 58% of respondents could not recall what they pay annually for water. When it is difficult for ratepayers to quantify the cost of water, it demonstrates that water (and even more so, wastewater) is clearly out of sight and out of mind for most people.
  - When asked about U.S. water infrastructure and the water infrastructure in their local community, 59% rated the nation’s infrastructure as “good” or “very good,” while 86% rated their local community’s infrastructure as “good” or “very good.”

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Raising awareness while raising rates

Targeted, ongoing, and sensitive communication strategies build customer acceptance of utility rate increases and infrastructure investments

Sara M. Katz, Karen Snyder, and Megan Drummy
This positive evaluation of the condition of water infrastructure nationally and locally is in stark contrast to the results of the American Society of Civil Engineers (Reston, Va.) 2017 Infrastructure Report Card, which gave drinking water infrastructure and wastewater infrastructure “D-” and “D+” grades respectively.

We know anecdotally that people also have misconceptions about the correlation between their water use and the costs they should pay for the service. During the recent and historic drought in California and the west, utilities set – and were required to achieve – ambitious conservation goals. As ratepayers answered the call and used less water, they believed that their bills would similarly decrease.

In fact, the opposite was true. As utilities received less revenue, the cost to pay for ongoing operations and maintenance, not to mention future capital improvement projects, had to be recovered, often resulting in rate increases or rate model modifications. This adds yet another layer to the communication challenges that utilities face.

**The need for effective communication**

Given the disconnect that community members have between the true costs and value of water, it is vital for utilities to engage in proactive and sustained communication with their ratepayers to prepare for future and ongoing rate increases.

Candidly, for too long many communities have relied on significant water consumption to disproportionately carry the actual costs to transport, treat, store and distribute the water. As we now struggle to address the unknowns of climate change and less reliable water sources, we must champion a conservation ethic as the new normal. As such, it will take a significant effort by utilities, not-for-profits, and government agencies to help advance this needed paradigm shift. It is safe to say it will not happen overnight.

With planning, solid communication in understandable terms, and continual reminders about the values of investments made, water providers can foster understanding in their communities, and rates can be supported. The Value of Water Coalition poll identified a clear shift in the perceived value of water once respondents were informed about the challenges and critical infrastructure upgrades needed – the percentage of respondents willing to pay more to ensure safe and reliable water rose from 38% to 60%. Agencies, including the San Francisco Public Utilities Commission (SFPUC) and the City of Fresno, Calif., continue to focus on closing the gap between public perception and the value of water and infrastructure through ongoing, strategic, and informed communication.

**San Francisco Public Utilities Commission leverages its reputation**

To pay off bonds secured to fund its $4.8 billion Water System Improvement Program and begin planning efforts for their Sewer System Improvement Program in 2013 and 2014, SFPUC completed a cost-of-service study, which determined that rate increases were necessary. Fortunately, based on years of community engagement and outreach, SFPUC has a strong history of trust and credibility within the community. This trust was confirmed through focus groups and survey work. This became foundational to the outreach and education campaign to help ratepayers understand the value of investing in water and wastewater infrastructure and the need for rate increases.

Branded the Infrastructure Investment Education Program, the program included developing and communicating key messages about San Francisco’s water and sewer system as well as the need to invest in this critical infrastructure. Information about 24/7 operations & maintenance, emergency repairs, and replacement of aging infrastructure were woven into messaging. A series of message trainings for various SFPUC departments and other program staff helped prepare the team with the skills and knowledge to speak with one voice, deliver a concise presentation, and answer tough questions.

Because the backbone of public outreach for the rate increase involved nearly 100 presentations to local community and key stakeholder groups, a series of practice sessions and individual coaching sessions helped prepare the speakers. There was no “winging it” when going to speak to stakeholders on this important topic.

The robust presentation program was supported by a full complement of digital and print collateral that reflected messages and provided additional details in understandable terms. Rates were not discussed as percentages, but in terms of a tangible dollar figures — $7 to $10 dollars per month, or one-and-a-half pennies per gallon over four years.

Information also focused on the use of ratepayer dollars, highlighting project milestones and successes in SFPUC’s Water System Improvement Program. Visual aids were used at every opportunity to underscore the “investments” being made. This framing helped demonstrate that SFPUC puts every dollar to work.

In addition to its many other efforts, SFPUC also focused on basic but key information in a fun and inviting way:

- **“We test your water 100,000 times a year!”** Through a variety of communication vehicles, SFPUC highlighted the high quality of the water delivered to customers around the clock. Simple but important information reminded water users about the people and activities behind making their water safe and reliable each and every day.

- **“You can’t live a day without me!”** SFPUC emphasized the importance of the invisible sewer system by profiling it with a “Get to Know Me” campaign. Slogans like “You can’t live a day without me!” were seen at bus stops throughout the city, making the wastewater story more “visible.” The campaign attracted local and national media coverage, which further spread the message about the value of the systems serving this large city.

Through dedication of time and attention, SFPUC was able to engage in meaningful discussions, make the case for needed investment, and successfully secure the rate increases needed to continue upgrading infrastructure. Ratepayers understood why funding was needed and where money was being spent.

**Fresno changes its image**

In 2013, after decades of planning and the critical overuse of groundwater coupled with severe drought conditions, the City of Fresno, Calif., was ready to proceed with its infrastructure program to capture, treat, and deliver surface water through a network of source water pipelines, a 364,000-m³/d (80-mgd) treatment facility, and miles of distribution pipelines. The system would diversify Fresno’s water portfolio and help ensure a sustainable water future.
The system also would require significant investment. A funding-and-rate plan was developed, a standard California Proposition 218 rate approval process solicited minimal community participation, and the Fresno City Council approved a 4-year rate plan to pay for the recommended projects. Securing Fresno’s water future was under way.

However, in 2014, a group of vocal individuals convinced elected officials to rescind rates after raising concerns that adequate public participation about the rate increases was not solicited. Once the rates were rescinded, the capital improvements program was no longer funded and current rates were insufficient to meet ongoing operational and debt obligations. Fresno had to start over.

City and utility administration committed to doing things differently. City water leaders understood that without knowledge of the dire water supply conditions facing Fresno, community members — including business and economic development interests — saw only dollar signs without corresponding values. No infrastructure program or rate process could be successful in that environment.

What followed was an intensive, tailored public participation process that invited community members to dive into Fresno’s water situation. Forums drew hundreds of people and were held throughout the city in sequence with facilitated discussions about:

- Fresno’s water situation – What are the challenges we’re trying to address?
- Water solutions – What are the things we’ve considered and should consider?
- Solution costs – What makes up Fresno’s water rates today and what are the cost effects of various alternatives?
- Findings and recommendations – What have we heard, what are we considering based on that input, what are the next steps, and what is behind rate development?

A panel of third-party experts was convened for each session, addressing questions and providing context. Informational displays and graphics (such as the figure below) were hosted by subject matter experts and were available for review before and after facilitated discussions. Meetings were live-streamed on the city’s government access channel, and experts were available for in-depth interviews before and after events. Simultaneously, an aggressive speakers’ bureau program was launched with trained presenters to speak to any and all interested groups.

Many more activities ensued, leading to approval of a 5-year rate increase, now in its third year. Pipelines are in construction, the treatment facility is nearly complete, and a sustainable water future is on its way to Fresno thanks to the city’s commitment to share a complicated story with an interested community.

### Improving your communication strategy

There are some essential elements that build understanding and foster community acceptance for rate changes. Of these, one of the most important elements is to make sure the community is aware of the water and wastewater services provided to them well before it is time to ask for a rate increase. With regular communication under way year-round, you can then lay out the investment and rate story. Useful communication strategies to consider include the following:

- **Focus on value and always be communicating.** Instead of talking about your utility’s many water and wastewater services only...

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### Fresno’s 2019 water rates are still lower than the average 2015 water rates in comparable California cities

<table>
<thead>
<tr>
<th>City</th>
<th>2019 Rate</th>
<th>2015 Rate</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>San Diego</td>
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<tr>
<td>Orange Cove</td>
<td>$48.17</td>
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**Rates are per 100ft³ = 748gal**

Without context, it can be difficult for water utility customers to know how the rates they pay for clean water services compare to those of other communities. Communicating contextual information well before asking for rate increases can help the public understand what they’re paying for and whether they’re getting a “good” deal. Data courtesy of Recharge Fresno (Calif.)
when it is time for a rate increase, you should always be talking about the value you provide for your customers. This means having a variety of materials (fact sheets, infographics, quick facts, etc.) that can be translated and tailored to different communities and interests. Information about the utility and its services should appear in many places throughout the community, and not just on the utility’s website. With a constant flow of bite-sized information, you aren’t just talking to community members when you want more money, but instead informing them every day what is being done to ensure these valuable services.

- **Speak with one unified, consistent voice.** Make sure water is always part of the conversation, not just in times of need, and that all spokespersons are using agreed-upon messages. Beyond messages, the devil is in the details. When we’re talking about miles of pipes, gallons of water, or percentages of increases, we need to be accurate and consistent. Inconsistency leads to confusion, and confusion leads to mistrust.

- **Know what your customers know.** Use formal or informal tools to gauge understanding and concerns. A range of options, from one-on-one discussions to surveys, are available to help you work within your community. Do not allow yourself to become isolated from your customers.

- **Demonstrate your expertise and consider branding.** Show your analyses and details looked at daily to ensure high-quality service at an affordable cost. Be proud of the long-range planning done to ensure you’re looking around the corner for your customers. If your program does not currently emphasize the importance of water in your community and the expertise of staff that work together to provide it, change your branding to highlight these things. Branding creates identity and persona and helps bring a focus to the conversation. Visuals, including videos and photos of completed projects or key facilities, are important to the effectiveness of this narrative. Put a face to your agency.

- **Go to your audience.** Don’t just expect customers to “come to you” and attend a meeting at your office – go to where they are already congregating and speak to them there. Instead of waiting for customers to ask questions or log a complaint or even commend your utility’s work, take pertinent information out to the community. Hold workshops to highlight issues, alternatives, and costs. Use technology to share information, gain input, and correct misinformation. Exhibit at community events to tell your customers how “we’re working for you.”

- **Regularly update community leaders.** Ratepayers will look to the leaders in their community to provide them information that they can trust. Activities that accomplish this include one-on-one meetings with community leaders and presentations to community organizations. As a voice to their neighbors and community, these leaders are also great resources for providing the utility with the best ways (be it events, the type of materials, etc.) to reach their community or neighborhood.

- **Use expert testimonials from third parties.** Sadly, most consumers won’t just take the utility’s judgment as the final opinion. However, people will pay attention when there is a critical mass of information that reflects views from diverse sources. A coalition of supporters who can emphasize the importance of water and infrastructure investments can create a powerful bandwagon that can attract members of their own circles of influence. Meeting with and recruiting supporters can add credibility and broaden your reach in the community.

- **Engage the media and industry organizations throughout the process.** Working with a newspaper reporter, blogger, and others to discuss what is going right with local infrastructure will help make the information about what your utility does for the community more widely accessible. Other information to share includes how well customers have done with water efficiency and conservation, as well as emphasizing how the water use efficiency has allowed your community to avoid some costly expansions of its system.

- **Show consequences of inaction.** Far too often, the “do nothing” alternative is far more frightening and expensive than the alternatives identified to solve real problems. Information can be provided factually, without scare tactics, to demonstrate the reality of the situation you are in.

- **Show return on investment.** Celebrate the investments that ratepayers make to ensure their community has clean and reliable water. Create pride in the facilities constructed on their behalf. Offer tours. Schedule ribbon cuttings. Find ways to show your utility goes far and deep beyond the invoice they receive every month. The days of flying under the radar screen are gone and it is time for utilities to pull back the curtain and show the real work and resources involved in providing clean, safe drinking water – and yes – this all costs money.

### Information is everything

Without context and understanding, rates are just rates. They don’t represent the people providing the service, the infrastructure and facilities in place, or the 24-hour efforts to keep services “invisible.” Comprehensive, intentional education helped the San Francisco and Fresno communities place a higher value on water and wastewater systems, and as a result, ratepayers were more willing to pay for those systems.

Changing and improving public understanding of the importance of water and the associated expenditures required will be key as cities across the nation struggle with ratepayer fatigue and a never-ending laundry list of projects that need to be funded. Regular, strategic communication helps utilities understand stakeholder perceptions and concerns, build ratepayer understanding of the role of safe, reliable water for their lives and community, and ultimately gain customer appreciation of the true value of water, bridging the gap between perceived value and willingness to pay.

Earning and maintaining your customers’ support takes time, resources, dedication, and commitment from every member of your organization. And as many water and wastewater service providers are learning, without this relationship it is becoming more and more difficult to raise rates, advance water and wastewater initiatives, and build the necessary infrastructure to support their communities.

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The issues of affordability and assistance for low-income customers are becoming a higher priority for the water industry as rates continue to rise in order to finance needed infrastructure investments. As one element of a proactive engagement strategy on this topic, AWWA’s Rates & Charges Committee formed an Affordability Sub-committee to focus on the emerging issues related to water affordability. This subcommittee has developed webcasts; updated chapter text for the 7th edition of AWWA’s manual of practice, M1, *Principles of Water Rates, Fees, and Charges*; and organized sessions at AWWA conferences, such as the session at AWWA’s 2016 Annual Conference & Exposition (ACE16) upon which this article is based (Matichich 2016).

The following two case studies—of Portland, Ore., and Detroit, Mich.—outline low-income assistance programs that may be particularly instructive for utilities as they address water affordability and potential programs for customer assistance. The first case study, showcasing the program run by the Portland Water Bureau, describes the origins of their program and how it has evolved in the face of changing needs and circumstances to become one of the most comprehensive in North America. The second case study illustrates a proactive program developed recently by the Detroit Water & Sewerage Department (DWSD) to address a significant need for low-income customer assistance and the need for different business processes based on a history of high delinquency rates and payment challenges.
PORTLAND’S APPROACH TO AFFORDABILITY PROGRAMS

Origins. The City of Portland has been specifically working on affordability issues for its low-income residential customers since the Portland City Council expressed concerns about the affordability of water and sewer services in the early 1990s. At the time, Portland was facing rapidly increasing costs as required federal compliance programs were implemented, and in December 1992, the Clean River Funding Task Force had some initial affordability concerns regarding the effect that rising sewer rates would have on ratepayers living on a limited or fixed income. They said the city should consider ways to reduce the impact on these ratepayers if significant sewer increases were involved in paying for combined sewer overflow improvements.

In 1993, the city council directed the Water Bureau and Bureau of Environmental Services (BES), which provides sewer services, to study the affordability issue. The council concluded that since water and sewer charges were based on the amount of water used, low-income customers with high usage should be targeted for conservation, and low-income households should be provided some ongoing sewer rate relief.

The bureaus prepared a report, Water/Sewer Bill Relief Program for Portland Low-Income Households, to provide the city council with several tools from which to choose to address the needs of fixed- and low-income customers of the Water and Environmental Services Bureaus. Program components for demand reduction included education services for conservation, home audit and fixture repair workshops, water conservation kits, and plumbing fixture repair up to $500 annually. To help make bills more manageable, the bureaus offered relief through payment extensions, budget or monthly billing, water block-tier pricing, a fixed bill discount based on 15% of a typical low-income bill, crisis assistance, and interest and penalty write-offs.

FIGURE 1 Monthly city utility bill for a typical Portland, Ore., household

The primary new element of the approved program was the fixed bill discount based on the typical bill for a low-income household. Eligibility was based on a household income equal to or less than 150% of the federal poverty level. Other important new elements were crisis assistance, plumbing fixture repair, and block-tier pricing. It was estimated on the basis of census data and other information that there would be 25,000 eligible households for the discount program, and it was estimated approximately 10,000 households would actually apply.

Program expansion. During fiscal year 1996–1997 (FY 96–97) budget discussions, the city council again expressed concern with the increasing cost of water and sewer service for residential customers (Figure 1). The city council believed that rate increases were growing faster than Portland household incomes and that those on a fixed or limited income could not afford to pay their bills. During the FY 96-97 budget discussions, the discount for qualified low-income customers was increased from 15 to 25% of the typical low-income bill, which is 5 ccf/mo. At that time, approximately 3,400 customers were receiving the bill discount, roughly 900 customers received crisis assistance, and the fixture repair program served approximately 20 low-income customers. With lower participation than anticipated, the city council directed the Portland Water Bureau and BES to reconsider the program in its entirety.

The 1996–1997 workgroup was made up of Water Bureau and BES representatives, nonprofit low-income assistance advocates, the general public, and the city’s financial administration. A review of literature, surveys, and interviews helped city staff in considering a variety of potential program elements. The essential and desirable criteria for this workgroup were as follows:

- Ease of understanding
- Minimization of rate impacts
- Revenue stability
- Public acceptance
- High participation rate
- Ease of administration
- Program flexibility
- Fair and equitable to ratepayers
- Measurable level of success
The workgroup’s goal was increased affordability of basic water and sewer service for the system’s low-income customers, with the ability to provide financial relief or affordability enhancements to low-income customers as rates increased or circumstances changed. Analysis of the essential criteria to look at both the existing program and possible new program features led to the enhanced assistance program adopted by the city council in 1997. The enhanced program, which included some elements of the previous low-income program, became effective during FY 97-98. The city continued with the bill discount and crisis assistance elements, expanded the fixture repair program to cover behind-the-wall and underground leaks, and added a waiver of penalty fees and payment arrangements without penalties.

Current program components. The city continues to make program improvements as it works to keep water and wastewater services accessible to low-income customers. The following components make up the bulk of the city’s current program.

Low-income discount. The discount continues to be a flat rate based on 50% of the typical low-income bill. In 2017, this provided a water and sewer discount of $144 per quarter to low-income single-family owners or renters responsible for this bill (i.e., water service not included in rent). For FY 15-16, an average of 7,322 customers per month received the bill discount. The highest participation rate occurred in December 2011 when 9,512 customers were enrolled in the discount program (Figure 2).

Crisis assistance program. Crisis assistance is available to low-income customers who are receiving the low-income discount and who are in a temporary crisis and unable to pay their water and sewer bill. The Water Bureau’s customer service staff members work with these customers and offer a crisis voucher up to $150, when appropriate, to avoid further collection fees and other associated issues. Customers may be eligible for a crisis voucher once every 12 months. For FY 15-16, the water bureau issued 2,220 crisis vouchers.

Fixture repair program. The fixture repair program was set up to assist low-income home owners who occupy their home and have plumbing fixtures that are leaking and causing an increase in the water/sewer bill. Currently the program covers material and labor up to $2,800 for each household per year. The program provides assistance to an average of 60 customers per year.

Monthly billing or monthly statements. Budget billing gives customers whose service is read and billed quarterly the option of receiving three statements each quarter and paying monthly. Even though this option is not limited to low-income customers, it has been found to especially benefit those on lower incomes, improving their ability to manage financial obligations. In January 2017, the city had 22,743 customers who had selected this billing option.

Payment extensions and penalty write-offs. For customers who are unable to pay their bill by the due date, this program allows them to extend the due date with no late fees or penalties added. Upon request, interest and penalty write-offs can be given one time per year. Eligible fees that can be reversed are a $5 reminder fee, $10 pre-shutoff fee, $20 “last chance” door hanger, $80 shutoff fee, and $75 lock or illegal use fee. These goodwill adjustments can be used by all customers, but they mainly benefit low-income customers.

Target conservation. The Water Bureau’s Water Efficiency program has served low-income customers since 1994. Initial programs focused on education and outreach through community partnerships and community centers. Many of these workshops and outreach efforts target low-income customers. Educational materials and conservation devices are provided at community fairs. The city has offered toilet rebates for customer purchasing WaterSense-labeled high-efficiency toilets, residential water assessments to measure existing conditions and flows from fixtures, and added conservation devices as needed.

The Water Efficiency program is currently undertaking a three-year outreach project using a software-based solution to strengthen communication paths and improve water efficiency for single-family residential, low-income customers. The program will target single-family residences enrolled in the city’s financial assistance program. The pilot study is designed to randomly divide low-income enrolled customers into a participant group and a control group. The program delivers quarterly digital or printed customized Home Water Reports to the participant group with information about their specific water use and tips for saving water. The remainder of customers in the control group do not receive Home Water Reports.

Eligibility and participation. To stay consistent with other low-income assistance programs in the Portland area, the city changed the income eligibility requirement to

![FIGURE 2 Discount program participants by month (July 2009–Oct. 2016)](image)
60% of statewide median income by household size. The program is open to single-family households that receive a bill from the City of Portland.

Unfortunately, participation levels have been below the city’s expectations. Experience has shown there are a number of barriers to participation, some of which include the following:

- Lack of program awareness
- Lack of access to program offices
- Misperceptions about eligibility
- Mistrust of utilities
- Lack of transportation
- Stigma of receiving public assistance

Some of which include the following: a number of barriers to participation, some of which include the following:

To help overcome some of these barriers and increase accessibility, the Water Bureau has posted an application on the bureau’s website so customers can apply directly for potential assistance. Two months before the end of an existing customer’s discount, the city mails an application packet to customers so they can reapply directly through the bureau.

The city continues to partner with Multnomah County and other service providers to build a referral network to automatically enroll customers who are receiving other benefits without sending them through the application process. These improvements continue to be developed and are designed to improve program accessibility.

Recently the city added an Honored Citizen feature for elderly customers on Social Security or those on permanent disability. Honored Citizens are given an extended termination date and are saved from having to apply for the program every two years.

**Safety Net program.** The BES and the Portland Water Bureau offer the Utility Safety Net program to provide emergency utility payments for ratepayers with temporary loss of employment, a medical emergency, or other personal emergencies. In July 2007, the city council authorized the Utility Safety Net program to help the city’s sewer and water customers avoid service shutoff if they have experienced a significant temporary change in household income. Safety Net is a last-resort solution for those qualified customers who are unable to achieve a solution through normal payment options.

The Safety Net program consists of four basic components:

- Deferred water shutoff
- Waiver of recent delinquency charges
- Interest-free payment plans
- Financial assistance, if applicable

When combined, these elements provide the time and means for customers to manage their way through a temporary crisis. The program is conditioned on responsible efforts by the customer to make regular, agreed-upon installment payments toward the payoff of past-due account balances.

Under this program, the city and the customer jointly determine the length of the deferral period and the number and amount of installment payments on the basis of the size of the account delinquency and the depth or severity of the hardship. The conditions of the assistance result in a signed agreement, reversal of penalty fees for the last three months, and an initial credit of $50 that is applied to the customer’s account. At the end of the agreement period, the city applies an additional credit of up to $300 to further help the customer bring the account up to date.

The customer returns to a normal billing cycle once the agreement ends and may work with the city to establish a new payment plan (outside of the Safety Net program) for any remaining outstanding account balance. The city may cancel the Safety Net agreement and revoke any financial assistance at any time if the customer fails to meet the terms of the signed agreement.

**To help overcome barriers and increase accessibility,** the Water Bureau has posted an application on the bureau’s website so customers can apply directly for potential assistance.

**Assistance for multi-family renters.** In light of high housing costs, the city council aims to provide assistance to low-income families living in multi-family dwellings; however, these families are not direct water/sewer customers, which creates an obstacle to providing these discounts equitably while meeting all legal requirements. The city studied this option and in 2007 approved a two-year pilot project to provide assistance to 300 multi-family units that were submetered. Unfortunately, this pilot project produced poor results that were determined to be caused by third-party billing issues, high administrative costs, and difficulty in getting accurate records from property managers and ensuring that discounts were passed on to the tenants through the third-party billing agent. Another workgroup reviewed this issue again in 2015, and their report is under review by the Portland Utility Board.

**Funding sources.** Determining who ultimately pays for these programs and how these funds are collected are sensitive policy issues. The City of Portland explored voluntary contributions, but ultimately didn’t want to compete with charitable organizations for public funding. The city also wanted to avoid the need for administration support for this type of funding, and it seemed unlikely that charitable giving alone would be enough to fund the majority of the program’s requirements. The city also
TABLE 1  Project costs  
2017–2018

<table>
<thead>
<tr>
<th>Assistance Program Element</th>
<th>Cost $</th>
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<tr>
<td>Bill discount</td>
<td>4,866,612</td>
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<tr>
<td>Crisis voucher</td>
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<td>Safety net</td>
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<td>Fixture repair</td>
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<td>Total</td>
<td>5,934,612</td>
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</table>

considered taxpayer support or use of the city’s general fund to finance the assistance program on the basis of the view that this was a social service and not a utility service. In the end, the city chose to fund these programs through utility rates because it is the utility costs that create the need for financial assistance.

The Water Bureau and BES have a combined projected revenue of $498 million for FY 17-18. The projected cost to fund the low-income assistance program for this same period is approximately 1.02% of annual revenues (Table 1).

**Lessons learned.** Participation in the affordability program has been lower than anticipated because reaching low-income households and effecting change have proved difficult. Marketing and education are considered the best methods of reaching these customers; however, this population is somewhat more transitory, making it difficult to reach and engage. Additionally, high housing costs are driving many low-income households out of Portland altogether.

The challenge for the city to minimize its water and sewer rates while providing high-quality service is made more difficult when trying to ensure these services are affordable for all. City leaders and administrative staff agree it is important to continue to provide financial assistance and to continuously improve the program with the intention that all households be able to afford water services.

**WATER AFFORDABILITY IN DETROIT**

Water affordability is a significant concern in Detroit, Mich., where water, sewer, and drainage charges are high and poverty is endemic. Almost 40% of the population, or more than 260,000 people, lives below the federal poverty line. The annual residential bill for 5 ccf of monthly water use, or ~45,000 gal/year, is just under $850 for water, sewer, and drainage services, which is almost 3.5% of the federal poverty level for a family of four (HHS 2016).

For decades, the DWSD has struggled with high bad-debt expenses and a high incidence of customers with unmanageable arrearages that resulted in their accounts becoming eligible for shutoff. In 2005, a Water Affordability Plan (Colton 2005) featuring an income-indexed rate structure was proposed but not implemented, in part because of concerns about potential challenges under Michigan law. In lieu of revenue-funded assistance, various volunteer-funded assistance programs were promoted but offered an inadequate patchwork of support. In 2014, extensive DWSD service disconnections prompted litigation against DWSD and street protests that gained international attention (Chapman 2014). In 2015, under the direction of Mayor Michael Duggan’s administration, payment plan options were greatly expanded to help water customers avoid water shutoffs and address their payment arrears (see sidebar, “Detroit’s 10/30/50 Plan”).

In 2016, however, the institutional landscape was changed in Detroit, laying the foundation for new approaches to address water affordability. In January 2016, the DWSD system's regional assets were leased to the newly created Great Lakes Water Authority (GLWA), which is now responsible for wholesale service delivery. DWSD’s scope was thereby limited to retail service delivery only, enabling a focus on financial solvency by balancing high-quality but affordable service with reliable and robust billing processes and policies.

**Compassionate customer service.** The new, retail DWSD has made compassionate customer service a center point of its strategic vision. Even before the Jan. 1, 2016, launch of the GLWA, DWSD leadership convened a Blue Ribbon Panel on Affordability (BRPA), supported by the Detroit City Council and composed of national experts and regional activists, to develop recommendations on how to address water affordability within Michigan’s restrictive legal framework (see sidebar, “Detroit’s 10/30/50 Plan”). The BRPA offered concrete, practical short- and long-term recommendations, as well as an overview of state and national advocacy (Detroit Blue Ribbon Panel on Affordability 2016). Perhaps more importantly, it
prescribed “compassion” as a fundamental tenet of service delivery.

Compassionate customer service is easier said than done—especially in a utility plagued by historical deficiencies in basic business practices, technology, and staff capabilities. The new, retail-focused, DWSD is attempting to effect dramatic improvements in basic utility operations and customer service functions while at the same time instilling internal culture and capacity improvements. Remedial measures include the following:

• Changing billings from properties, where bills were addressed to “Resident” to billing the financially responsible party for the customer account
• Training, monitoring, and assessing the performance of customer service personnel
• Enhancing billing system and business practices (e.g., interactive voice response system updates, smartphone-enabled customer service applications, new payment kiosks throughout the city)
• Adopting a new bill design that more effectively communicates the bill amount and basis for billing and provides measures customers can take to manage their usage and bills

Going further, DWSD is looking beyond the challenge of meeting industry-accepted customer service norms. DWSD is tailoring its affordability program to respond to the acute challenges of the population it serves through the following measures:

• WRAP. Under the lease terms, 0.5% of GLWA and Detroit retail system revenues (approximately $4.5 million in FY 2017) fund a Water Residential Assistance Program (WRAP) designed to provide eligible low-income customers in the GLWA service area with bill payment and conservation assistance (City of Detroit & Great Lakes Water Authority 2015a, 2015b) (see sidebar, “Water Residential Assistance Program”). As GLWA was a component of bankruptcy settlement agreements adjudicated under US federal court supervision, and its originating documents contemplated the WRAP, revenue funding of the program is insulated from a potential legal challenge under Michigan state law. DWSD worked with GLWA to ensure administration of the WRAP would complement its customer service initiatives and align with community-funded assistance efforts.

• Billing basis. DWSD is phasing in a change to the billing basis for its drainage charges from water meter sizes to measured impervious areas. In October 2017, the conversion will apply to residential properties such that bills will be reduced for smaller-sized lots.

• Collections. Perhaps most significant is that DWSD has modified its approach to collections to help customers avoid service disconnections. Water shutoffs are forestalled for those customers who enroll in payment plans and are faithful to their terms. Eligible low-income customers who apply for the WRAP are similarly not disconnected (see sidebar, “Helping Customers Avoid Water Shutoffs”).

Additional measures. Consistent with the BRPA’s recommendations, DWSD is planning a number of measures to provide more comprehensive and cohesive services for low-income residents in Detroit.

• To supplement the WRAP funding, DWSD is budgeting to provide additional assistance to help eligible low-income customers reduce water leaks and inefficient water usage. Given Michigan’s

Helping Customers Avoid Water Shutoffs

- New policies to enroll customers in payment plans and the Water Residential Assistance Program (WRAP) and avoid disconnection
- Enhanced customer outreach through advertising (radio and print), news media, social media, and e-newsletters
- A Water Assistance Fair for customers

Initial Results

- In the new Detroit Water & Sewerage Department’s first year, customers enrolled in payment plans have increased dramatically, reducing customers identified for service disconnection from 44,000 to 13,000 accounts.
- The WRAP program capacity has been expanded to reach as many as 6,000 customers previously identified for service disconnection.
restrictive legal framework, DWSD has developed a business case evidencing the positive economics of ensuring water affordability. DWSD’s revenue-funded assistance is anticipated to yield benefits to DWSD’s infrastructure systems by reducing flows and mitigating bad-debt expense.

- DWSD is planning to implement an inclining-block rate structure for both water and sewer services that will be designed to ensure that the cost of services are reasonable and fair for all.
- Recognizing that water affordability problems are often symptomatic of other acute poverty-related issues, DWSD is engaging with City of Detroit and Wayne County social service organizations to build a referral network for financially distressed customers. DWSD intends to train selected customer service representatives to not only help customers enroll in GLWA and DWSD programs to avoid shutoffs, but also to make sure customers are aware of other social services that can help them on the path to financial self-sustainability.

Advancing environmental justice. Beyond advancing new approaches to reduce shutoffs and expand assistance to low-income residents in Detroit, DWSD’s sole focus on Detroit residents enables it to potentially mitigate water utility-related environmental injustices. In order to address the large inventory of lead service lines, DWSD is implementing a Minimizing Lead in Drinking Water program that is changing how the utility approaches field operations, education and outreach, and capital program planning and implementation (Betanzo 2016, City of Detroit n.d.). Recognizing that incidences of sewer overflows, basement backups, and surface flooding primarily plague the economically disadvantaged sections of Detroit, DWSD has challenged traditional deflections of utility responsibility and sought quick resolution of customer’s damage claims.

Redefining utility service. DWSD, perhaps more than any other major metropolitan area, lives in the shadow of the recent Flint Water Crisis. Like Flint, Detroit’s residential population is challenged by acute poverty and economic dislocation. Its underground pipe networks are aged and require significant reinvestments, while its basic business processes and customer service culture require modernization and implementation of best management practices.

Looking to the future, DWSD is redefining its services not as simply the delivery of water but in terms of protecting public health. This redefinition prioritizes universal access to service and water affordability, changes the calculus of cost-of-service, and assumes a more customer-centric approach. In doing so, DWSD hopes to confirm the business case for compassion.

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https://doi.org/10.5942/jawwa.2017.109.0103
“All of the Above:” Moving from a Passive to an Active Stakeholder Engagement Culture

by

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ABSTRACT

Over the past ten years, news searches for the Mobile Area Water and Sewer System (MAWSS) would turn up results related to wet weather overflows and public health notices. With new leadership and an engaged Board of Directors, MAWSS has begun to turn towards a more proactive stakeholder engagement process. Serving the wettest city in the United States, MAWSS also faces many of the same aging infrastructure challenges as other older U.S. cities. In order to better communicate the value of services it provides, along with seeking out more actionable customer feedback, the utility has begun a number of initiatives, including:

- Web videos highlighting not only the challenges of aging infrastructure, but also the face of MAWSS employees as members of the community they serve
- Rebranded micro-site, promotional materials, and dedicated artwork to support educating the public on infrastructure needs and the value of water
- Project GIS maps showing the work in progress to address wet weather issues and renewal of aging infrastructure
- Affordability analysis as part of a long-term funding plan to increase and target investment in critical portions of the MAWSS system
- Engagement of the community through a speaker's bureau and participation in community events
- Paid advertising

MAWSS is essentially revamping its approach to customer relations: more hands-on, recognizable campaigns to educate the people and community it is responsible for serving. Through websites, social media efforts, paid advertising, and MAWSS-sponsored community events, it demonstrates the importance of public knowledge and comfort with the community's water and wastewater service provider.

By emphasizing infrastructure needs and the value of water to its customers, MAWSS makes a connection between the rates customers pay for water and sewer service and the benefits customers receive. For example, MAWSS is updating its ratepayer assistance program to address the needs of customers with financial challenges. The affordability analysis completed as part of MAWSS' comprehensive rate study evaluated the financial impact of annual water and sewer bills on residential customers. The analysis provided detailed information on total water and sewer bills as a function of household income for each census tract in MAWSS' service area. Current and projected rate increases were applied to determine the impact of proposed changes in
rates. MAWSS used the analysis to identify neighborhoods that may be more at risk for affordability issues and therefore in need of rate assistance.

This presentation will share lessons learned to date, discuss how smaller utilities like MAWSS can develop these capabilities with limited staff, identify benefits to both the utility and its customers, and share both quantitative and qualitative results from the effort. Many of these initiatives will have been completed at the time of the presentation. Each initiative furthers MAWSS' stakeholder engagement process and communicates the value of its services to its ratepayers.

KEYWORDS
Stakeholders, customer outreach, affordability, aging infrastructure, rate increases

INTRODUCTION
As part of its campaign to actively connect with its customers and educate them on the value of its services, the Mobile Area Water and Sewer System (MAWSS) is stepping up its game. The infrastructure campaign consists of a microsite, www.keepwaterworking.com, and is backed by social media posts, brochures and bill stuffers, speakers’ bureaus, signage familiarizing the community to the Keep Water Working logo, and public relations efforts including press events to highlight construction projects, community leadership briefings, and an op-ed piece in the local newspaper. The key focus of MAWSS’ Infrastructure Investment Public Awareness Campaign is the need to invest in renewal and replacement of water and wastewater infrastructure.

Such an assertive campaign comes with lessons learned to date, tips on how to develop these capabilities with limited staff, benefits to both the utility and its customers, and quantitative and qualitative results from the effort. Each initiative in the campaign furthers MAWSS' stakeholder engagement process and communicates the value of its services to its ratepayers. Finally, the increased attention to its community provides MAWSS staff with support by the Board of Directors for rate increases needed to maintain a sustainable utility.

METHODOLOGY
MAWSS’ infrastructure campaign consists of three general concepts:

1. Educate the community about MAWSS’ aging infrastructure
2. Highlight current activities to repair/replace capital improvement projects
3. Inform customers about the revenues required for renewal and replacement of infrastructure
Community Education

Negative publicity can hamper a utility’s ability to gain Board and public support for raising rates. MAWSS’ campaign highlights efforts to improve media and customer understanding about the status of its infrastructure to mitigate that bad press. Part of the education process is to emphasize MAWSS’ role in being a steward of clean water – whether that is safe drinking water or reliable wastewater service.

The public relations plan developed for MAWSS includes an assertive, multi-month public awareness process. Building truthful and transparent relationships with the media is a critical goal of MAWSS’ campaign.

Capital Improvement Projects

Customers want to trust MAWSS with how their rate revenues are being spent. MAWSS’ tactic for affirming responsible and effective use of funds consists of web videos demonstrating work in progress and a new microsite.

MAWSS’ microsite will show customers how their rates are funding recent capital improvement projects, as well as prepare them for future projects.

Rate Revenues and Infrastructure

MAWSS funds its capital improvements entirely from customer rate revenues. Rate increases may be needed for quite some time to continue funding a sustainably water and wastewater system. MAWSS’ campaign corroborates the findings of its recent cost-of-service rate study that projected a series of rate increases to support the infrastructure improvements. MAWSS’ current Master Planning process, scheduled to be complete in late 2018, will further inform the concrete needs in renewal and replacement.

To provide supporting information for the recommended rate increases, the rate study completed in 2017 included a detailed affordability analysis. Total water and sewer bills were presented as a function of household income for each census tract in MAWSS' service area. Current and projected rate increases were applied to determine the impact of proposed changes in rates. MAWSS used the analysis to not only provide the Board assurance that the proposed rate increases would not unduly affect its customers, but it also identified neighborhoods that may be more at risk for affordability issues and therefore in need of rate assistance.

RESULTS

Still in the midst of its infrastructure campaign at the time of this presentation, MAWSS can identify a few key outcomes to date.

KeepWaterWorking.com is a microsite designed to educate customers about the challenges MAWSS faces with aging infrastructure, the proactive response MAWSS is taking and ways the community can help. Utilizing short videos and strong visuals, it explains why the system experiences sanitary sewer overflows during heavy rains, how the size of the system makes it
difficult for any quick fix and the impact on the community and jobs if infrastructure needs are ignored. Infographics tell the story of the miles of pipe that have reached or exceeded their useful life, the amount of rainfall each year and the positive economic impact made by investment in renewal or replacement. A link lets visitors view ongoing projects, showing them how recent rate increases are being used. Illustrations show lateral problems that contribute to overflows, highlight ways customers can help like recycling cooking grease, making sure their cleanout caps are in place, not using their toilets as trashcans. Customers can also sign up to receive notices relating to construction projects, road closures and water outages.

To make this a branding effort, collateral material was developed including a brochure and stickers with the KeepWaterWorking logo that will be used on hardhats, signage and promotional items.

Figure 1 demonstrates one of several videos customers can watch to learn about water and the people in their community that help provide water and wastewater services.

Figure 1. Web video from MAWSS website

MAWSS completed a cost-of-service rate study in 2017 to determine the actual costs of providing water and wastewater service to its customers and measure the affordability of annual bills. The distribution of household income in the community is key to assessing affordability. The map below shows the median household income (MHI) by census tract.
Figure 2. Median Household Income (MHI) by Census Tract (2015)

Overall, the affordability analysis demonstrated the clear commitment of MAWSS to maintaining affordable utility service. As a result, both the current and proposed rates are affordable for more than 80% of the households served by MAWSS, despite significantly lower incomes than the national average. Going forward, MAWSS can monitor the households that have difficulty with water and sewer bills and target future assistance programs to mitigate the burden on those residents.

In December 2017, the Board approved two years of consecutive rate increases to allow funding for:

- repair and replacement of aging infrastructure,
- safe drinking water,
- sewer overflow prevention,
- high customer service levels,
- and meeting regulatory requirements that better protect public health and the environment.
DISCUSSION/CONCLUSIONS

By emphasizing infrastructure needs and the value of water to its customers, MAWSS makes a connection between the rates customers pay for water and sewer service and the benefits customers receive. Its infrastructure campaign includes plans for numerous initiatives, some of which have been implemented at the time of this presentation while others will occur in the months to come.

Several lessons/tips unfolded throughout the development and implementation of this campaign:

1. Engage outside public relations firm to provide a third-party point of view for strategy and tactics to accomplish stakeholder engagement goals
2. Use social media, websites, and printed material to reach largest customer base
3. Emphasize role of healthy infrastructure in delivering safe drinking water and sanitary sewer services
4. Communicate effects of rate increases on water and sewer bill affordability
5. Ensure all customers understand rate assistance is available for those who qualify

Overall, MAWSS’ campaign conveys the importance of its services to the community by providing reliable, safe, and affordable water while protecting the environment.

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In its most recent strategic assessment of the water industry, Black & Veatch (2016) observed that “those working in the water industry have realized a truth that is now reaching a broader audience: Water is woefully underpriced.” As readers of Journal AWWA will recall, AWWA published its report, *Buried No Longer: Confronting America’s Water Infrastructure Challenge* (AWWA Water Utility Council 2012), identifying a trillion dollars of investments needed for both replacement and expansion of drinking water infrastructure over two-and-a-half decades.

Yet the sector faces a paradox: water is underpriced, but it’s still expensive (Grigg 2016). As the Black & Veatch report (2016) notes, “issues of affordability” have made rate increases problematic in many communities, requiring water utilities to address “challenging social issues around this matter,” thrusting the issue into the political arena as well. This is entirely understandable given that, on average, water rates are increasing several times the rate of inflation, sometimes astronomically, especially in communities under a consent decree to compel an overhaul of their legacy combined sewer overflow systems. It does not matter if the cost drivers come from the wastewater,
drinking water, or stormwater side of the cycle—the ratepayers who bear these costs typically see them as a single water bill, and a rising one at that.

**STAGNANT PERSONAL INCOMES**

The challenge of affordability in the face of increasing water rates is even more compelling in light of overall macroeconomic trends in the United States. A recent article by William Galston in *The Wall Street Journal* (Galston 2017) noted that the acting commissioner of the Bureau of Labor Statistics issued a report with some disturbing news for workers: “Over the past year average hourly earnings have risen by 2.5%. Unfortunately, the consumer-price index, a standard measure of inflation, rose by 2.4%, meaning the average worker’s purchasing power hardly grew at all.”

This is no aberration but rather part of a disturbing trend. “Since 2010 hourly wages corrected for inflation have risen barely 0.5% a year,” writes Galston. “The official statistics back up reports that Americans are working harder than ever just to stay even.” While incomes have increased since the Great Recession, it is not due to rising wages. Americans are simply working more hours. “Nearly eight years after the official end of the recession, median household incomes aren’t much higher than they were when the recession began, and they remain a bit lower than in January 2000.” In sum, we are looking at a lost two decades. No wonder water customers, middle-income as well as lower-income, are edgy about the very necessary rate increases that they are experiencing.

The water and wastewater utility sector has realized the humanitarian and political consequences of the distributional impacts of inevitable price increases—i.e., the disproportionate impact on low-income customers, seniors or the disabled—so it must address affordability issues as a necessary component of its drive for more robust and fair rates. This is an important development, one that must be encouraged if utilities are to cope with a situation that has passed the Dawn of the Replacement Era and is now approaching high noon.

Fortunately, there is a movement in the water sector to adopt affordability or customer assistance programs (CAPs). Gas and electric utilities commonly solicit support for fuel or winter funds for low-income customers usually in partnership with other nonprofits (e.g., the Salvation Army) or other local businesses or media outlets. While perhaps not as common in the water industry, requests for customers to contribute to an equivalent fund for low-income water customers are gaining traction and will likely become more common.

**AFFORDABILITY PROGRAMS ADOPTED BY UTILITIES**

The literature provides some guidance to address affordability concerns. AWWA was out in front on affordability issues when it published *Thinking Outside the Bill: A Utility Manager’s Guide to Assisting Low-Income Water Customers* (AWWA Water Utility Council 2014), “a concise guide to affordability” and “a snapshot of tools that utilities may use to help lower-income customers afford their water bills.” In this same vein, a report from the University of North Carolina at Chapel Hill (UNC) describes barriers at the state level that may need to be overcome to establish sustainable and robust programs that fully meet the needs of struggling ratepayers (UNC 2017). (Note that AWWA, along with other water associations, contributed to the financing of the UNC study and report.)

Again from the Black & Veatch report (2016), “Water utilities . . . are leveraging a combination of payment and discount plan options.” Of the utilities included in this survey that have deployed programs “to help those in need,” 35.9% use short-term and long-term payment plan options, and 20.7% have adopted low-income programs with discounts on fixed charges. The rest pursue a variety of other programs such as joint efforts with nonprofits (8.7%) or payment plans with principal forgiveness (5.4%).

In its 2016 report, *Drinking Water and Wastewater Utility Customer Assistance Programs*, the US Environmental Protection Agency (USEPA) conducted a survey of 795 utilities, finding that nearly 30% had some form of CAP (USEPA 2016). The survey found that of 365 identified CAPs, low-income residents were the beneficiaries of the most programs, with seniors, disabled individuals, military, and individuals facing specific hardships also eligible for some programs.

USEPA identified five types of CAPs:

- **Bill discount**—provides continuous assistance by giving customers a discount on monthly, quarterly, or annual bills. This was the most common type of CAP in the survey.
- **Flexible terms**—relaxes requirements for bill payment, including waived penalties, lower interest, or more flexible payment timelines.
- **Lifeline rate**—offers a reduced rate for a set quantity of water per pay period. After that amount has been exceeded, rates increase.
- **Temporary assistance**—gives customers one-time assistance.

The sector faces a paradox: water is underpriced, but it’s still expensive.
to help with an unexpected difficulty. Sometimes a simple courtesy notice that a customer is nearing service termination is enough to avoid a shut-off.

• Water efficiency—helps homes save water by installing low-flow appliances or repairing leaky pipes, thereby reducing water use and saving money.

Funding is often the biggest challenge for a utility in setting up a CAP. The USEPA’s review found that nonprofit organizations were the most common source of funding for CAPs. USEPA recommends reaching out to nonprofit charities for utilities with tight budgets. As mentioned previously, some utilities ask customers directly for voluntary contributions, sometimes offering “round-up” programs, allowing customers to automatically round up their bill to the next dollar in order to make a donation. Soliciting donations through fundraising is also an option. Funding CAPs through the regular utility budget or adding a surcharge to customers not facing hardships are much less common funding mechanisms, often because of state-level limitations. Yet where they exist, they have generally been able to fund more comprehensive programs.

The USEPA report highlights several case studies of successful CAPs already in effect. The California Water Service Company (Cal Water), one of the largest private water service companies in the nation, created California’s first CAP in 2006. The utility’s Low Income Rate Assistance Program (LIRA) is a bill discount program that gives a 50% discount on the fixed portion of the customer’s bill. Any customers who qualify for assistance from their local electric utility are automatically enrolled in LIRA, which enrolls about 20% of Cal Water’s 478,000 customers. Cal Water also has a bathroom fixture replacement program, which provides new toilets, faucets, and showerheads for any customer enrolled in LIRA. About 1,500 customers took advantage of the fixture replacement program in 2015.

The San Antonio Water System (SAWS) offers an array of eight distinct CAPs. The largest of its programs is the Affordability Discount Program, which offers a discount of as much as $15/month to households under 120% of the federal poverty level. The program currently enrolls 18,000 of SAWS’s 500,000 account holders, although 42,000 are eligible but not enrolled. SAWS is working to provide additional outreach to eligible households to increase enrollment in the program. SAWS’s other programs include efforts to provide courtesy notifications and one-time assistance to customers close to having their service shut off, plumbing assistance to fix leaking pipes, and fee waivers for the elderly, disabled, and domestic violence survivors. The total cost of SAWS’s assistance programs was $3.2 million in 2016, almost 0.5% of its total revenue.

George Hawkins, chief executive officer and general manager of the District of Columbia Water and Sewer Authority, provided an overview of his utility’s affordability or customer assistance programs that put to use many tools in the customer assistance toolbox: the first 4 ccf (1 ccf = 748 gal) of water and sewer service free for qualified customers; 50% discounts on storm-water or impervious surface charges; voluntary donations from customers administered by the Urban League; lifeline rates; and lower fees for smaller meters (Hawkins 2017).

American Water, an investor-owned company that owns and manages water and wastewater utilities throughout the country, offers CAPs, where approved by state regulators, through emergency grants and discount payment programs. Again, where approved by state economic regulators (public utility commissions), American Water offers rebates for water-saving appliances, water audits, and even free water-saving devices to help customers reduce costs. It has seen a 349% increase in customer enrollment in its California CAP as the result of a ruling by the Utilities Commission. Enrollment has jumped from 5,477 to 19,130 (Duffy 2017).

**OVERCOMING LEGAL BARRIERS**

While there are many options to structure or finance a CAP, depending on the state, the legal barriers may be cumbersome. A new report by the Environmental Finance Center at UNC includes a snapshot summary of these barriers in every state and offers examples and strategies on how utilities can navigate this confusing framework (UNC 2017).

UNC found that states fit into four categories when it comes to statutes surrounding rate-revenue-funded CAPs. There are a small minority of states that either explicitly allow or explicitly prohibit utilities from setting up a CAP, while most states are more ambiguous. Some states have statutes that pose potential challenges to establishing a CAP without an explicit disallowance, while others do not explicitly forbid it but also have no language explicitly supporting it.

Unfortunately, there is little judicial interpretation to clarify this nebulous legal landscape. Many states’ statutes require water service rates to be “reasonable,” “uniform,”
“nondiscriminatory,” or “just.” Often the intent behind these terms is to require utilities to charge all customers the same rate rather than prohibiting the use of rate revenue to subsidize low-income customers; however, the latter is a side effect. In other cases, affordability programs may have to navigate rules that were established for entirely different purposes. For example, most state constitutions have “gift clauses” prohibiting government entities from giving grants, subsidies, or donations to specific individuals or corporations to ensure public funds are used only to promote public programs and public welfare. Some gift clauses are broad and may present an obstacle for CAPs, while others have exceptions for gifts that serve a public purpose, as CAPs certainly do.

Utilities interested in these programs should carefully review their state laws as they design their programs. National studies such as the UNC and USEPA affordability reports, while helpful in framing the major issues, are not a substitute for a utility seeking its own legal counsel in assessing its situation under relevant state law. Such reports should be used as a general introduction to the topic of legal barriers.

Utilities can argue that CAPs are necessary to run their operations when they are facing laws in the gray area. Frequent service shut-offs and resolving bad debt from customers who cannot afford their rates can be more expensive for a utility than instituting a CAP and assisting customers in paying their bills. One of the few cases providing legal precedent on this issue was heard by the Minnesota Court of Appeals. In state, advocates should work to clarify the statutes and regulations in their state to expressly authorize these programs. Second, stakeholders should carefully review the exact problematic language in their state law and make sure their programs are designed to overcome those limits. For example, in states where the limitation relates to requirements that all customers only pay rates linked to the cost of service, utilities could argue, through a business case, in court if necessary, that CAPs are an “essential cost of running a utility.” Third, if the first two options do not prove successful, utilities should create a CAP without using rate revenue. For example, funding can come through nonprofit partnerships, donations, or voluntary bill round-ups.

State laws disallowing or discouraging some types of CAP funding mechanisms may have been drafted with good intentions. Indeed, it seems fair that no one should have to pay more than anyone else for their water. In effect this principle means that too many people will be unable to afford safe water. In states that do not already allow or encourage CAPs, utilities could work with their state legislatures to convey the importance and successes of these programs.

CONCLUSION

Focusing on the distributional impacts of essential rate increases on ratepayers in need is both a humanitarian and a political imperative—the former because it is the right thing to do and the latter because ignoring these citizens’ concerns generates pushback from the community and elected officials. Affordability programs and CAPs must be viewed as an integral, even necessary, part of the financial plan for every water, wastewater, and stormwater utility. It is all the same ratepayer.

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Integrated Planning Meets Adaptive Management

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ABSTRACT

HRSD provides wastewater conveyance and treatment serving a population of 1.6 million people in Virginia. HRSD entered a Consent Decree (2010) with the U.S. Environmental Protection Agency (USEPA) to resolve wet weather sanitary sewer overflows (SSOs) through a wet weather program at a cost of $1.8 billion.

Virginia partially relies on groundwater from the Potomac aquifer for drinking water. Decades of overpumping led to depletion of the aquifer and proposals to restrict withdrawals, ground subsidence and potential for saltwater intrusion.

HRSD developed the Sustainable Water Initiative for Tomorrow (SWIFT) Program to mitigate the effects of aquifer depletion through the purification of effluent and injection of up to 120 million gallons per day of highly treated water at a capital cost of $1 billion.

HRSD is preparing an Integrated Plan that prioritizes SWIFT investments and high-priority wet weather projects ($200 million) for the initial period from 2020 to 2030. HRSD proposed an Adaptive Regional Plan that includes development of a Final Remedial Measures Plan in 2030 that would define system improvements in the context of the then current environmental priorities.

KEY WORDS: Integrated planning, adaptive management, wet weather, direct potable reuse, nutrients

INTRODUCTION

HRSD is a regional provider of wastewater conveyance and treatment serving a population of 1.6 million people in southeastern Virginia. In the Hampton Roads area, cities, counties and towns (Localities) own and operate the local collection system that conveys flows from homes and businesses to the HRSD system. Customers receive bills from Localities to cover the cost of owning and operating the local collection system and from HRSD for the regional conveyance and treatment system.

In 2007, HRSD and the Localities entered into a Special Order by Consent with the Virginia Department of Environmental Quality (DEQ) for wet weather issues and SSOs. In 2010, HRSD entered a Consent Decree with USEPA and DEQ to resolve wet weather SSOs. These enforcement actions required Localities to reduce infiltration and inflow (I/I) and resolve capacity problems in their systems and HRSD to increase the capacity of its regional conveyance and treatment system.
After several years of working together to collect flow and condition data and develop hydraulic models, Localities and HRSD decided to explore regionalization of the entire system under HRSD to reduce costs and solve issues of responsibility. A study showed that the region could reduce capital and operating costs of more than $1 billion. Despite the potential savings, the Localities could not agree with the complete transfer of assets and operational control due to challenges in governance and other issues. This gave rise to the hybrid approach whereby HRSD accepted responsibility for capacity in the entire regional sewer system including the Localities’ networks. This means that HRSD will be conducting rehabilitation in Localities’ networks to reduce I/I and building capacity enhancement projects to increase the current wet weather capability. The wet weather program is estimated to cost $1.8 billion.

Eastern Virginia partially relies on groundwater for drinking water through use of the Potomac aquifer. This confined aquifer covers an area from Richmond to the coast with a limited recharge area. In the 1920s, the aquifer was artesian and provided an ample supply. Decades of overpumping led to depletion of the aquifer and proposals to restrict withdrawals by DEQ, ground subsidence and the potential for saltwater intrusion.

**METHODOLOGY AND RESULTS**

HRSD began exploring aquifer replenishment to address multiple challenges including aquifer depletion, ground subsidence due to aquifer compression, reducing nutrient discharges to sensitive surface waters, ever-increasing regulations on wastewater discharges, and providing a buffer against saltwater intrusion into the aquifer. Treating this commodity (wastewater effluent) as a resource to be utilized rather than a waste product needing disposal opened up new possibilities. A schematic of SWIFT is shown in Figure 1.
Figure 1. Schematic of SWIFT

An early and important consideration for SWIFT was the level of treatment necessary to purify the water to suitable standards. HRSD looked at other reuse programs including a precedent-setting program at the Upper Occoquan Authority in northern Virginia and established programs in California and other places. This led HRSD to pilot test two treatment trains – membrane-based treatment and carbon-based treatment. After this testing, HRSD settled on the carbon-based treatment train due to lower costs and a product that is more compatible with the geochemistry of the aquifer.

Another aspect of the program that is fundamental to its long-term feasibility is the injection hydrogeology and aquifer geochemistry. HRSD has drilled test wells to define the aquifer stratigraphy and hydraulic properties. In addition, bench scale compatibility tests are being performed on purified water to identify interactions with the geological formation.

EPA has published their framework for Integrated Planning in 2011 with an objective of prioritizing the implementation of the most beneficial elements towards achieving the goals of the
Clean Water Act through reduction in risks to human health and the environment. Simply stated, the framework allowed communities to prioritize those investments that yielded the greatest benefits to human health and the environment. The Regional Wet Weather Management Program (RWWMP) will reduce sanitary sewer overflows and hence some discharge to the streams and the Chesapeake Bay. By contrast, SWIFT will reduce discharge of nutrients to the Bay by millions of pounds per year while providing additional benefits. Expected nitrogen reduction is 3.6 million pounds per year, solids reduction is 15.4 million pounds per year and phosphorus reduction is 300,000 pounds per year.

Reductions from SWIFT are much larger than the reductions called for in Localities’ MS4 stormwater TMDL obligations by orders of magnitude as seen in Table 1.

Table 1. SWIFT Nutrient Reduction vs. Localities’ MS4 TMDL Nutrient Reduction

<table>
<thead>
<tr>
<th></th>
<th>HRSD Bay TMDL Allocations</th>
<th>HRSD Post SWIFT Loads (2030)*</th>
<th>Available for other needs</th>
<th>Stormwater Reduction Needs**</th>
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<tbody>
<tr>
<td>Nitrogen</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>James</td>
<td>3,400,000</td>
<td>500,000</td>
<td>2,900,000</td>
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<tr>
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<td>275,927</td>
<td>25,000</td>
<td>250,927</td>
<td>19,114</td>
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<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>James</td>
<td>300,009</td>
<td>50,000</td>
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<td>York</td>
<td>18,395</td>
<td>2,000</td>
<td>16,395</td>
<td>3,887</td>
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<td>Sediment</td>
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<tr>
<td>James</td>
<td>14,000,000</td>
<td>700,000</td>
<td>13,300,000</td>
<td>5,269,142</td>
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<tr>
<td>York</td>
<td>1,400,000</td>
<td>98,000</td>
<td>1,302,000</td>
<td>1,413,762</td>
</tr>
</tbody>
</table>

*Preliminary subject to change
** VDEQ regulated stormwater without federal lands

HRSD gave nutrient credits generated by SWIFT to Localities without charge through a trading program that was established in Virginia several years ago. This trading is memorialized in a series of agreements between HRSD and the Localities.

HRSD is preparing an Integrated Plan that prioritizes SWIFT investments for the initial period from 2020 to 2030. Also during this period, HRSD will spend approximately $200 million on high-
priority wet weather projects. High-priority wet weather program projects will be those that have the highest potential water quality benefit. Additionally, HRSD has established a bacteria source tracking program that focuses efforts to find bacteria sources in local impaired waterways. This program will allow targeted efforts to address bacteria impairments as opposed to the broad “shotgun” approach of the RWWMP.

HRSD developed a set of criteria and process for identifying high-priority wet weather program projects that provided the greatest environmental and human health benefits. These criteria and their weights are as follows:

- SSO load reduction (50%)
- Location (30%)
  - Public beaches
  - Shellfish grounds
  - Drinking water sources
  - Bacteriologically impaired waters
- I/I reduction (20%)

These criteria were applied to wet weather program projects across the entire service area covered by the Consent Decree. A total of six project groupings comprising 35 elements were prioritized. These groupings together will cost approximately $200 million and will address approximately 40% of the SSOs at a 5-year level of service.

EPA has encouraged the use of adaptive management approaches in a wide variety of settings. Adaptive management features iterative decision making to manage uncertainty in addressing municipal environmental challenges. This approach has been particularly necessary with long-term community sewer rehabilitation and related programs. Almost every such program has needed multiple major modifications. In addition to responding to changing community circumstances, adaptive management also allows communities to continually prioritize the greatest public health and community benefits for the next public dollar invested. Given the scope, cost, complexity, and evolving nature of the challenges which HRSD and the Hampton Roads region face, the RWWMP necessarily features an adaptive management approach.

One of the most significant evolving integrated planning considerations which the Hampton Roads region faces is adaptation to rising sea level and increased frequency of recurrent flooding. The National Oceanic and Atmospheric Administration’s Office for Coastal Management has identified Hampton Roads as experiencing the highest rate of sea level rise along the entire Atlantic seaboard and that the region is the second largest population center in the United States at risk due to the impacts of sea level rise. Addressing sea level rise poses enormous challenges for HRSD and all of the Hampton Roads communities. We must balance further investments in regional wet weather capacity with investment in adaptation and resiliency strategies, which will likely necessitate utility relocation and/or floodproofing.

Rising sea levels and the grave implications for Hampton Roads have really come into focus over the past decade since EPA began discussions with HRSD about the RWWMP. As frequency, the level and amount of low lying lands impacted by sea level rise continue to increase, larger portions
of the regional sanitary sewer system are at risk. Traditional capacity management strategies may not be effective or appropriate in these areas and future investments may be needed to develop new systems that can function in areas frequently inundated until a managed infrastructure retreat/resiliency strategy is developed for coastal land.

Additionally, there are other adaptive management factors that create significant uncertainties (and opportunities) about any infrastructure investment plan that spans more than a decade. These uncertainties/opportunities include:

- The impact of sea level rise and recurrent flooding in the region’s infrastructure, land use patterns and economy;
- Understanding the system response to almost $700 million in wet weather capacity-related investments and evaluation over the past ten years;
- Magnitude and spatial patterns of community growth and redevelopment;
- Future of the extensive DoD facilities in the Hampton Roads region and HRSD priorities regarding these ubiquitous facilities throughout the service area;
- How effectively Locality and HRSD MOM programs will address sewer system degradation and I/I levels;
- Regional economic vitality and household income and employment levels;
- Changing regional environmental and public health priorities, specifically post-implementation evaluation of the Chesapeake Bay TMDL after the 2025 completion;
- Changing technologies and opportunities to achieve multiple benefits for public sewer-related investments; and,
- Levels of federal and state financial support for unfunded environmental mandates.

These uncertainties will have a profound effect on the location, volume, significance and priority of future wet weather capacity-related overflows.

Figure 2 depicts the sequencing of investments represented in the Adaptive Regional Plan.
CONCLUSIONS

EPA’s Integrated Planning framework is a sensible approach for communities to prioritize their Clean Water Act obligations. The mechanisms for making these obligations binding on both the government and the permittee can be less than obvious. In HRSD’s Integrated Plan, EPA was concerned about including SWIFT as a Consent Decree obligation.

Integrated Planning is highly effective for communities facing multiple Clean Water Act obligations. By prioritizing the highest impact activities first, both the environment and ratepayers benefit.

The Adaptive Regional Plan is an environmental and economic necessity and is consistent with EPA policy and guidance on adaptive management and integrated planning. In this plan, HRSD will have spent $2 billion by 2030, addressing the most pressing and important environmental challenges that the region faces. This spending will place a heavy burden on regional ratepayers. It is necessary to re-evaluate the needs and circumstances in 2030 to better identify the highest regional environmental and public health priorities at that time as well as an expeditious implementation schedule for additional sewer system investments.
Stormwater managers can apply economic instruments to address critical stormwater issues and meet stormwater program goals. Seth Brown of Storm and Stream Solutions, LLC and Carrie Sanneman of Willamette Partnership explain the use of incentive- and mitigation-based approaches to develop new cost-effective methods to reduce pollution and control stormwater volume.

Green Infrastructure
Working with the market to finance stormwater solutions

Urban stormwater runoff is one of the most significant environmental issues facing communities today. Flooding, water supply, water quality, habitat degradation, and other negative effects associated with stormwater runoff are increasing due to ongoing urbanization, more episodic climatic events, and rising global temperatures.

Communities are in need of cost-effective and innovative ways to drive investment and implementation of green infrastructure (GI) for stormwater management. Consequently, discussion about costs, funding, and financing stormwater-related projects often takes center stage. There is great need for investment in stormwater infrastructure and limited funds available to pay for it. Addressing this challenge requires a multifaceted approach. It is critical to find ways to decrease costs associated with stormwater investments and enhance the ability to fund and finance those investments. Additionally, there is a growing need to become more flexible and creative with investments, as the drive to locate stormwater infrastructure on private parcels is growing, which is less clearly done through traditional means.

The use of market-based forces is one tool that can affect all of these areas, which is why there is significant growth of interest in market-based approaches. They include the use of rebates, subsidies, trading, and mitigation.

In November 2016, a workshop hosted by the National Network on Water Quality Trading (NNWQT) and Storm and Stream Solutions LLC, in partnership with the Water Environment Federation’s Stormwater Institute, engaged more than 50 experts in stormwater management and trading to explore these nascent and evolving approaches. In May 2017, Willamette Partnership released a white paper, titled “Working With the Market: Economic Instruments to Support Investment in Green Stormwater Infrastructure,” that summarizes the key points raised during the event including the motivations that drive investment in stormwater infrastructure; program options that work with market forces for more effective and efficient investment in stormwater infrastructure; issues that limit these approaches; and ways to surpass these challenges.

If proven effective, these economic instruments could become more common in stormwater programs. The NNWQT is a group of 18 organizations representing agriculture, utilities, environmental groups, regulatory agencies, and others delivering programs. The NNWQT facilitates a national dialogue on how water quality trading can best contribute to clean water goals and works to improve consistency, innovation, and integrity in water quality trading. Willamette Partnership coordinates and facilitates the NNWQT dialogues through funding from the US Department of Agriculture – Natural Resources Conservation Services.

Evolving regulatory approach
Prior to the 1990 Clean Air Act Amendments, the approach to reducing air pollution was through traditional command-and-control methods, the traditional regulatory philosophy of setting rules and enforcing these rules in a strict and limited way. The 1990 amendments changed this approach by introducing market-based flexibility for emitters of pollution that drove down costs significantly through the use of a trading framework. While this was not the first example of a market-based flexibility for emitters of pollution, the 1990 amendments did provide a model for the approach that has been widely adopted.

Stormwater regulatory drivers and milestones in the United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Nationwide Urban Runoff Program launches</th>
<th>Clean Water Act amendments address nonpoint source pollution</th>
<th>Phase I Municipal Separate Storm Sewer permitting program established</th>
<th>Combined Sewer Overflow Policy established</th>
<th>Phase II Municipal Separate Storm Sewer permitting program established</th>
<th>National Research Council releases report on urban stormwater management</th>
<th>Integrated Planning Framework developed</th>
<th>Proposed national stormwater rule deferred</th>
<th>Green Infrastructure Collaborative formed</th>
<th>Memorandum on stormwater permits and total maximum daily loads revised</th>
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<td>1978</td>
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</table>
based approach in the environmental sector, this is certainly one of the most well known examples and is often seen as the catalyst for other environmental-focused, market-based frameworks, including water quality.

Since that time, trading policies have been developed at the federal, state, and local level to adapt these frameworks for water in pursuit of flexible and efficient improvements in water quality. More recently, we have seen a focus on these approaches in the stormwater and wet weather sectors, and this interest continues to grow.

Market drivers
Initial discussions on markets must focus on the question of supply and demand. In the stormwater context, the clearest drivers for infrastructure investment by communities and private entities are those associated with regulations, which take the form of Municipal Separate Storm Sewer Systems (MS4) permits and/or a consent decree or similar document in the context of combined sewer overflows (CSOs). Programs to address urban stormwater runoff are defined by MS4 and CSO dynamics, which are both associated with the National Pollution Discharge Elimination System (NPDES) program that has led to major reductions in point-source water pollution over the last four decades. Additionally, there is an increasing significance of the Total Maximum Daily Load (TMDL) program in the context of urban runoff. All of these programs help to define the demand for stormwater investments. While regulatory drivers typically provide the primary motivation for public and private entities to invest in stormwater management, it is important to note that municipal decision makers (e.g., city council members, city managers, mayors, etc.) are more apt to be motivated by the co-benefits associated with green stormwater infrastructure, which include climate resiliency, economic development, local job and business creation, enhanced property values, reduced urban heat-island effect, and even public health and safety. Several communities in the US are employing green stormwater infrastructure to meet local water quality regulations; however, the selling points start with social and economic benefits quite often. If green and gray solutions were mutually exclusive, it is the ancillary co-benefits associated with green stormwater infrastructure that can give the edge for using green over gray infrastructure to meet regulatory requirements. However, the reality is that green infrastructure is often used to enhance gray infrastructure, making this more than a zero-sum choice.

Economic instruments fall within the economic system to create action or investment that meets environmental goals. A credit is a currency representing units of environmental improvement, generated by a party going above and beyond its own regulatory obligations. Those credits are either saved for later use or sold to those for whom it is more expensive to generate environmental improvement and are therefore motivated to purchase credits as a means of regulatory compliance.

Economic instruments are a useful tool for stormwater managers because they can:
• Increase the coverage of green infrastructure on both public and private lands for new development and urban retrofits
• Provide flexibility for regulated entities trying to meet stormwater requirements
• Provide a vehicle for both public and private investments
• Enhance the efficiency of delivering benefits associated with stormwater infrastructure.

Incentive-based approaches
Traditional command-and-control regulatory frameworks are appropriate for many situations in the stormwater sector (municipal stormwater programs, development activities); however, a different approach is needed to drive stormwater infrastructure investments on private parcels or to increase the amount of innovative stormwater investments (green infrastructure). A compelling motivator for investments on private lands is based upon monetary and non-monetary incentives. Financial gains can be based upon...
Innovative Programs & Finance

Adoption of green stormwater infrastructure and relief for land developers who integrate green practices into development or redevelopment sites. Subsidies are often focused on specific practices such as rain barrels or rain gardens; however, one of the most unique programs based upon retention gained through employment of one of many green stormwater infrastructure options is a program of the Philadelphia Water Department (PWD), located in the US state of Pennsylvania. PWD is rewarding private parties that provide the most cost-efficient urban retrofit projects through a grant as well as a major reduction (80 percent) on stormwater fees to the property owner engaged in on-site retrofitting, which can be based upon a wide array of accepted practices, if the implementation of these practices is provided at a cost at or below a specified threshold. This program, known as the Greened Acres Retrofit Program (GARP), has already generated millions of US dollars of investment in Philadelphia focused on green stormwater infrastructure.

The City of New Orleans, Louisiana, USA, is a recent award winner in the National Disaster Resilience Competition (NDRC), led by the US Housing and Urban Development (HUD) department. The City has proposed the idea of reducing flood insurance premiums for private property owners who adopt on-site green stormwater infrastructure, which is an incentive to help reduce localized flooding impacts. While this idea has only been proposed at this time, the Federal Emergency Management Agency (FEMA) recognizes green stormwater infrastructure through the Community Rating Systems housed within the National Flood Insurance Program. In this program, communities who adopt retention-focused ordinances can receive reduced insurance rates for community homeowners. Land developers looking to adopt GI practices for new and redevelopment projects often face an inflexible regulatory permitting process at the local level or the challenge of regulatory staff that lack the technical knowledge to review and approve site designs incorporating GI. To overcome these barriers, state and local agencies can provide expedited plan reviews for proposed development that includes GI, reducing the time required to gain regulatory permits. Similarly, some communities have specialized staff members with a strong technical background that are dedicated to the review of GI-focused projects in order to enhance plan review services.

Mitigation and credit-based approaches

The second major category of economic instruments used to support effective and efficient stormwater management takes advantage of the variation in cost-to-compliance between different sites or parties. These approaches contain established rules for the generation, purchase, and use of stormwater benefits. Stormwater benefits, often quantified as a currency or credit, are tied to a pollutant of interest, such as nitrogen. Credits can be bought, sold, or traded to mitigate or offset regulatory requirements. The involved parties may be public or private. Transactions typically occur when one party can generate the desired outcome at a much lower cost than the other.

Permittee-responsible mitigation includes activities or projects undertaken by a permittee (e.g., developer, authorized agent, or contractor), to provide compensatory mitigation. Offset is another common term used to refer to a scenario in which the same party is responsible for both the impact and mitigation actions. Permittee-responsible mitigation tends to be associated with one-time actions, the benefits of which may or may not be quantified as credits. These programs typically allow a project or program owner to find another site, usually within a specific geographic area such as a watershed or jurisdiction, which can provide treatment equivalent with or greater than the impact of the permitted actions. The permittee retains responsibility for the maintenance and performance of the offset treatment for some discrete period of time, or in perpetuity.

Trading involves buyers and sellers transacting quantified and verified units of environmental benefit. Trading programs may use direct monitoring to determine the credits available from a given practice; others use data or modeling to set an assumed level of performance for each eligible practice type and then verify that it was implemented correctly. This category is further divided into water quality trading, in which credit transactions are used by an NPDES permittee to achieve compliance; and stormwater trading programs, which provide flexibility for those covered by the rules and local regulations that

NEARLY HALF OF THE 1500 STORMWATER UTILITY FEE PROGRAMS IN THE US OFFER SOME FORM OF FEE REDUCTION.
the permittee uses to implement its permit. The key difference is in whether or not credits are used by an NPDES permit holder to achieve compliance. If so, the program is subject to provisions of the US Clean Water Act (e.g., anti-degradation, anti-backsliding, no localized impacts, etc.) as described in 2003 US EPA Water Quality Trading Policy. If not, there may be considerably more flexibility in how the program can be implemented to achieve the desired environmental outcomes.

**Economic barriers**

Stormwater programs that feature economic instruments have many advantages. They can increase cost-efficiency in addressing environmental issues, draw new and non-traditional stakeholders into environmental investments, and engage with the private sector for needed treatment and project delivery support; however, they are the exception and not the rule. Multiple hurdles currently limit the application of economic instruments in the stormwater sector, but the Willamette Partnership white paper identifies potential solutions that can help communities and interested parties move past them. These include designing the right rebate or subsidy, maintenance responsibility, tax codes, and upfront capital.

For example, existing fee reduction and subsidy programs often struggle to gain participation from community members. In order to improve participation rates, the associated cost savings made possible by these programs need to provide a sufficiently attractive financial incentive. Participation struggles if the cost of stormwater infrastructure is higher than the stormwater fee, such that no amount of reduction could fully offset costs. Similarly, if the stormwater fee revenue cannot support subsidies that sufficiently cover the cost of GI installation, opportunity costs, and maintenance, they will be less attractive to property owners and developers.

For both fee reductions and subsidies, this problem stems from insufficient funding. Increasing user fees or establishing other dedicated funding streams are seemingly simple ways to address a funding gap, but these potential solutions almost always face political and statutory impediments. In this case, program managers should consider:

1. Layering other types of incentives
2. Reducing barriers to participation
3. Marketing the programs in a way that relates directly to property owner values
4. Supporting outreach that builds and awareness of stormwater impacts and a culture of stewardship

Another challenge is to address long-term maintenance of green infrastructure. Green roofs, bioswales, rain gardens, and many other stormwater best management practices (BMPs) need ongoing maintenance to continue providing the expected benefits. Due to the relatively young age of most stormwater programs and the lack of data on long-term BMP performance, it is difficult to develop a confident prediction of the effort and cost to maintain BMP function over the life of the practice. Property owners may not be willing to take on an uncertain, ongoing maintenance obligation, and public entities may be hesitant to pay upfront costs without any assurance that adequate maintenance will be provided to keep the practice functioning.

Stormwater program managers can address these issues through the development and application of robust maintenance agreements, providing incentives that respect whole lifecycle costs for onsite stormwater infrastructure and allowing for third-party agents to provide operations and maintenance services at a reasonable rate and at a high level of performance and accountability.

**Harnessing the power of incentives**

The challenges associated with stormwater are complex and require sophisticated solutions. Stormwater flows are chaotic and unpredictable because they are driven by weather and tied to land use. Management needs to operate across public and private properties. The current funding gap in this sector necessitates addressing these challenges in a highly cost-effective manner.

Daunting problems can force the development of innovative solutions. Economic instruments that harness the power of incentives and markets, such as rebates, trading, and offsets, are among these solutions. Economic instruments can incentivize GI on private land, create opportunities for private infrastructure investment, and drive innovation of more efficient and effective practices. Through programs that reward private property owners for onsite adoption of GI practices, stormwater managers may be able to greatly increase needed infrastructure in urban areas without the use of command-and-control methods. By providing flexible options to land developers and homeowners, such as the use of project offsets and in-lieu fees, infrastructure may be installed where it can have the greatest effect at the lowest cost. By allowing regulated entities to use trading programs to responsibly and more cost-effectively meet NPDES requirements, GI gives them the opportunity to save money and work within the holistic nature of watersheds.

The use of economic instruments for stormwater infrastructure investments are evolving, so many programmatic and policy challenges remain. Stormwater program managers are struggling to create a subsidy or fee reduction program that effectively incentivizes property owners to change their behavior while being financially sustainable, and trading programs developers struggle to define credit life and currencies that engage a sufficiently large market while protecting local water quality. These challenges highlight the need for ongoing efforts and research to refine these approaches and meet these challenges with clear and effective solutions. Collaborative groups, such as the National Network on Water Quality Trading, Water Environment Federation, and others in the water sector, will continue to explore these issues in order to highlight the technical and policy barriers that limit new and innovative approaches, discuss the potential benefits these approaches can provide, and generate ideas on how to best tap into the opportunities that emerging frameworks can provide.
The recent lead crisis in Flint, Mich., has brought the issue of environmental justice to the forefront of drinking water concerns in the United States. In 2014, under the direction of a state-appointed emergency manager, the city of Flint changed its primary source of drinking water from the Detroit water system to the Flint River. The switch in water source resulted in lead leaching from aging pipes into the drinking water of many city residents. Beyond the public health implications, the Flint lead crisis drew national attention that was due in part to the city’s demographic composition: Flint is approximately 55% black, with more than 40% of the population living below the poverty line. The demographic realities in Flint have made it emblematic of environmental injustice, a term that represents the possibility that poor and minority communities may be disproportionately exposed to environmental harms. In February 2017, the state of Michigan’s Civil Rights Commission (MCRC) declared that...
the water crisis in Flint was in part a consequence of “systemic racism” (MCRC 2017).

In December 2016, another major water contamination event occurred in Corpus Christi, Tex. A chemical leak in an industrial site led to the potential contamination of the drinking water, with residents being unable to use the water for almost four days. This incident was simply the latest in a series of drinking water problems in Corpus Christi, which has experienced repeated violations of the Safe Drinking Water Act (SDWA) over the past decade. While Corpus Christi is not as poor a city as Flint, with 17.5% of residents below the poverty line (about 2% above the national poverty level), it is about 60% Hispanic. The situation in Corpus Christi shows that Flint may not be alone and that drinking water safety may not be uniformly distributed across demographic lines.

Is community drinking water quality in the United States systematically correlated with class, race, and/or ethnicity? If so, the crises in Flint and Corpus Christi may represent a broader pattern of environmental injustice in drinking water across the United States. Since its emergence as an area of inquiry in the 1980s, the topic of environmental justice has received increased attention from politicians, scholars, journalists, and activists. The US Environmental Protection Agency (USEPA) recently focused on environmental justice as a point of emphasis, developing a strategic action plan called “EJ 2020,” which looks to confront environmental challenges in poor and minority communities (USEPA 2017).

This article analyzes class, race, and ethnicity as predictors of drinking water quality beyond isolated cases with a review of SDWA compliance across thousands of US utilities over a four-year period. Importantly, the analysis considers the effects of race and ethnicity in socioeconomic context. The goal of this analysis is to gauge the extent of demographic and economic disparity in drinking water quality in the United States, thus to open a broader conversation about class, race, and ethnicity among drinking water professionals and the communities they serve.

**ANALYSIS OF SDWA COMPLIANCE**

The present analysis investigates whether and how community demographics are related to utility violations of the SDWA. Violations of the SDWA provide a useful way of investigating environmental justice for a few reasons. First, utility goals are often ambiguous across settings, but regulatory compliance is regarded as a goal for all utilities. Regardless of personal opinions about regulations, all utility managers recognize the necessity of compliance with existing regulatory requirements. Also, all utilities are tasked with similar regulatory requirements under the SDWA, regardless of organizational characteristics. This common regulatory framework allows for a general comparability of utilities everywhere in the United States. Statistical regression allows analysis of the relationships between utilities’ SDWA compliance and their communities’ race, class, and socioeconomic characteristics, while accounting for other common factors that predict compliance.

**Data.** Data were drawn from a number of sources. Water utility and violations data were gathered from the Safe Drinking Water Information System (SDWIS). The SDWIS includes data on utility size, water source, and regulatory compliance for all public water utilities in the United States. The analysis here evaluates compliance for the years 2010–2013. The analysis includes 12,972 utilities over four years, representing all local government-owned utilities that serve populations of 10,000 or more. For ease of comparability, we exclude utilities owned by state or federal agencies, as well as private, investor-owned utilities. Demographic data were obtained from the US Census Bureau’s American Community Surveys from 2010 through 2013 (USCB 2014).

**SDWA violations.** Violations of the SDWA can be grouped into two distinct categories. “Health violations” relate to utilities’ ability to control the levels of contaminants in their water supply. Included in this category are maximum contaminant limit violations, which occur when the utility’s water contains contaminants above limits set by the state and USEPA, and treatment technique violations, which occur when a utility fails to follow mandated treatment methods. Second, the SDWA requires utilities to follow certain protocols for testing their water, filing reports, and communicating with the public; violations of these requirements are labeled “management violations.” These include what the USEPA calls “monitoring and reporting” violations and “other” violations; the precise requirements can differ depending on the size of the utility and the source of its water supply. Since this inquiry is

The goal of this analysis is to gauge the extent of demographic and economic disparity in drinking water quality in the United States, thus to open a broader conversation about class, race, and ethnicity among drinking water professionals and the communities they serve.
primarily concerned with public health, the analysis focuses on health violations, which the authors measure as a count of health violations committed by a given utility in a year. Health violations are relatively rare, with utilities committing an average of 0.19 violations per year. Table 1 summarizes the data used in the analysis.

**Demographics.** In order to investigate the relationship between race, ethnicity, socioeconomic status, and included percent Hispanic population and percent black population of the primary city served by the water utility, as identified in the SDWIS. Hispanic population ranges from 0 to 100%, with a mean of 11.6 and a standard deviation of 17.3. Black population also ranges from 0 to 100%, with a mean of 10.5 and a standard deviation of 16.9.

Also included in the analysis were a number of variables in the model meant to represent the socioeconomic status of the community served by the utility. Percent of the population that were high-school educated, percent of the population with a bachelor’s degree, percent of the population below the poverty line, and median household income were all included in the model. Of key interest here is the percent of the population below the poverty line. This analysis is concerned not just with the possibility that utility performance is worse in minority communities, but also whether poverty exacerbates the effects of race and ethnicity (or vice versa). In other words, it is possible that a community’s racial and ethnic composition predict its drinking water quality most where poverty is high. For this reason, the regression model linearly connects the interaction of the measure of percent of the population below the poverty line with the measures of race and ethnicity.

**Controls.** The analysis includes a number of control variables for utility characteristics that may also explain SDWA violations. First, the model includes a control for whether a utility’s primary source of water supply is groundwater or surface water, coded “1” if the primary water source is groundwater and “0” if the utility primarily uses surface water. Groundwater tends to have fewer contaminants than surface water. Groundwater tends to have fewer contaminants than surface water, so utilities that use surface water are expected to be more likely to commit health violations of the SDWA (Wallsten & Kosec 2008). Similarly, it is expected that utilities that purchase their wholesale water supplies will commit fewer violations since the wholesale provider is responsible for source quality and treatment processes (Teodoro 2014, Wallsten & Kosec 2008).

The age of a system could also be expected to influence SDWA violations are relatively rare, with utilities committing an average of 0.19 violations per year. Table 1 summarizes the data used in the analysis.

### TABLE 1 Descriptive statistics used in analysis of national water utility data from 2010 to 2013

<table>
<thead>
<tr>
<th>Binary variables</th>
<th>Percentage</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater supply</td>
<td>53.97</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchased water supply</td>
<td>28.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New system</td>
<td>11.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuous variables</th>
<th>Percentage</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health violations</td>
<td>0.19</td>
<td>1.11</td>
<td></td>
<td>0</td>
<td>75</td>
</tr>
<tr>
<td>Population with high school degree—%</td>
<td>83.44</td>
<td>9.62</td>
<td>19.1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Population with bachelor’s degree—%</td>
<td>21.44</td>
<td>13.09</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Population below poverty line—%</td>
<td>17.61</td>
<td>9.81</td>
<td>0</td>
<td>85.1</td>
<td></td>
</tr>
<tr>
<td>Median household income—$1,000</td>
<td>45.79</td>
<td>19.05</td>
<td>2.5</td>
<td>250,000</td>
<td></td>
</tr>
<tr>
<td>Hispanic population—%</td>
<td>11.64</td>
<td>17.28</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Black population—%</td>
<td>10.53</td>
<td>16.94</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Population served—1,000</td>
<td>17.99</td>
<td>109.96</td>
<td>10.01</td>
<td>8,271</td>
<td></td>
</tr>
</tbody>
</table>

Max—maximum, Min—minimum, SD—standard deviation
compliance since older systems may have antiquated technology and therefore may be more likely to commit health violations. Unfortunately, the SDWIS contains no information on the exact age of systems, and infrastructure can vary widely in age within any given system. As a next-best alternative, a new system variable was created that was coded “1” if the system existed in the SDWIS in 1981 (its first year) and “0” if it was entered into the SDWIS at a later date. Finally, system size may play an important role in SDWA compliance because smaller systems may lack the capacity to meet some of the more technically complex regulatory requirements (Switzer et al. 2016, Scheberle 2004). For this reason, the analysis also included a variable controlling for the size of the population served by the utility. It is likely that utility size does not have a linear effect on SDWA violations because the difference between utilities serving 5,000 and 10,000 customers should be more meaningful than the difference between utilities serving 100,000 and 105,000 customers. To control for this nonlinearity, the measure included in this analysis is the natural log of the population served.

**Model.** Because the dependent variable in the analysis is a count of the number of violations, a negative binomial estimator is appropriate for the analysis. The negative binomial model predicts the number of counts committed by a utility in a given year based on the independent variables included in the analysis. Additionally, since the SDWA is jointly administered by the USEPA and state governments, and regulatory requirements can vary across states, the model included a series of state dummy variables in order to control for state-level differences in regulatory regimes. Finally, a lagged dependent variable and year dummy variables were included in the model to control for potential biases that could result from the time series nature of the data.

**Results.** The results of the negative binomial regression are reported in Table 2; Figures 1 and 2 present the estimates graphically. In general, they show that race and ethnicity have a major impact on the number of violations committed by a utility, but the relationship is conditional on poverty. In relatively affluent communities, race and ethnicity have little effect on the number of violations. In relatively poor communities, however, race and ethnicity strongly predict the number of violations committed by a utility.

The finding that Hispanic population increases the number of violations committed by a utility is both statistically and substantively significant, indicating a serious potential concern over ethnic bias in drinking water quality.

<table>
<thead>
<tr>
<th>TABLE 2 Negative binomial predicting Safe Drinking Water Act violations between 2010 and 2013</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged violations</td>
<td>0.7969*</td>
<td>(0.0161)</td>
</tr>
<tr>
<td>Population below poverty line—%</td>
<td>-0.0067b</td>
<td>(0.0033)</td>
</tr>
<tr>
<td>Hispanic population—%</td>
<td>-0.0001</td>
<td>(0.0026)</td>
</tr>
<tr>
<td>Black population—%</td>
<td>-0.0058b</td>
<td>(0.0029)</td>
</tr>
<tr>
<td>Hispanic and poverty interaction</td>
<td>0.0002a</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>Black and poverty interaction</td>
<td>0.0003b</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>Population with bachelor's degree—%</td>
<td>-0.0099a</td>
<td>(0.0023)</td>
</tr>
<tr>
<td>Population with high school degree—%</td>
<td>0.0006</td>
<td>(0.0032)</td>
</tr>
<tr>
<td>Median household income</td>
<td></td>
<td>(0.0000)</td>
</tr>
<tr>
<td>Logged population served</td>
<td>-0.1069*</td>
<td>(0.0168)</td>
</tr>
<tr>
<td>Groundwater supply</td>
<td>-0.6686a</td>
<td>(0.0430)</td>
</tr>
<tr>
<td>Purchased water supply</td>
<td>-0.5783*</td>
<td>(0.0460)</td>
</tr>
<tr>
<td>New system</td>
<td>-0.2222a</td>
<td>(0.0586)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.8842</td>
<td>(0.3192)</td>
</tr>
<tr>
<td>Observations</td>
<td>51,889</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-18,334.239</td>
<td></td>
</tr>
</tbody>
</table>

*Significance level <0.01  
bSignificance level <0.05  
Models also include state and year fixed effects.
population on the number of violations committed by a utility. The y-axis in Figure 1 is the population below the poverty line, moving from a community where 0% of the population is below the poverty line to a community where 50% of the population is below the poverty line. The x-axis represents the Hispanic population of the community, moving from 0 to 100%. Red represents high numbers of predicted violations, while blue represents low numbers of health violations.

Figure 1 shows that the percent Hispanic population does not correlate with violations in the lower portion of the figure but strongly predicts violations in the upper-right quadrant. In a community with 10% of the population below the poverty line, a change in the Hispanic population has very little effect on the number of violations committed. Moving from a 0% Hispanic population to an 80% Hispanic population results in a statistically insignificant increase in the number of predicted health violations from 0.10 to 0.11. The same increase in percent Hispanic population in a community with 40% poverty results in an increase in the predicted number of health violations from 0.09 to 0.17, or almost double the predicted violations. In other words, ethnic disparities in SDWA compliance are most pronounced in poorer communities.

The results are similar for the effect of black population on health violations. The contour plot in Figure 2 is similar to Figure 1, but the horizontal axis now represents the relative share of a community’s black population. Percent black population does not correlate with the number of violations in the lower portion of the figure, where poverty is low. Where poverty is high, in the upper portion of the figure, moving from a low black population to a high black population greatly increases the number of violations. A move from 0% black population to 80% black population in a community with 40% of the population below the poverty line leads to a predicted increase in health violations from 0.09 to 0.13, equivalent to a 45% increase in the number of expected health violations.

Importantly, the effects of race and ethnicity in this statistical analysis cannot be dismissed as simply reflecting community socioeconomic conditions. The racial and ethnic disparities evident in the data persist after accounting for socioeconomic factors. Indeed, the interactive analysis indicates that the effects of race and ethnicity are amplified by poverty. Put

FIGURE 1 Effect of percent Hispanic population and poverty on Safe Drinking Water Act violations

FIGURE 2 Effect of percent black population and poverty on Safe Drinking Water Act violations
another way, poor communities that are predominantly Hispanic or black are likely to experience worse SDWA health compliance than similarly poor communities that are predominantly non-Hispanic and white.

CONCLUSION AND IMPLICATIONS

Analysis of national water utility data shows that Flint and Corpus Christi are not isolated cases where communities of color received low-quality water; the results here provide strong evidence that there is a systemic issue in utilities serving low-income communities of color across the United States. In communities with higher populations of black and Hispanic individuals, SDWA health violations are more common. Importantly, this effect is not homogeneous across all utilities: it is in the poorest of communities that race and ethnicity seem to matter most in determining drinking water quality. Notably, while percent black population significantly correlates with drinking water violations, the correlation with Hispanic population is markedly stronger.

The racial, ethnic, and socioeconomic disparities in drinking water safety identified in this study are acute challenges to the utility industry in the United States. Not only do such disparities represent failures of the water utilities’ core public health mission, they also threaten to undermine public trust and the legitimacy of utilities at a time when many utility leaders urgently need public support for capital replacement, improvement, and expansion. It is unlikely that the racial, ethnic, and socioeconomic disparities in American drinking water are due to conscious, overt bias; utility leaders and staff surely seek to provide the best service they can, regardless of their communities’ color. Nonetheless, structural conditions, organizational incentives, and political contexts may contribute to the kind of “systemic discrimination and racism” that the MCRC observed in Flint (2017).

As with any systemic problem, effective solutions to bias in drinking water quality will not be easy or immediate. In demonstrating racial, ethnic, and socioeconomic patterns of drinking water quality, this article seeks to open an industry-wide conversation on drinking water as a matter of environmental justice. Such conversations are never easy, and they are often uncomfortable. But AWWA’s core principles of protecting public health and fostering diversity and inclusion demand that its utility leaders take up the challenge of ensuring equally high water quality to all of the people they serve.

ABOUT THE AUTHORS

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https://doi.org/10.5942/jawwa.2017.109.0128

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University of North Carolina at Chapel Hill, 2017
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Editor’s Note

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