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Issue Brief

Water and the COVID-19 Pandemic

Impacts on Municipal Water Demand

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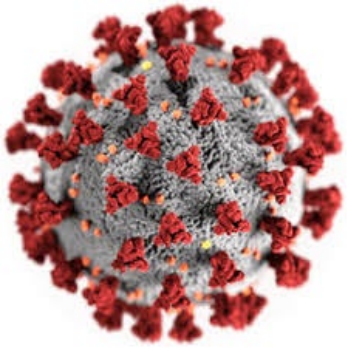

The sudden onset of the COVID-19 pandemic in early 2020 has imposed massive health and economic burdens on communities around the world. The full impact of the pandemic will not be tallied or understood for some time, after individual and governmental responses are implemented and evaluated. But no sector of society will be untouched, including the vitally important water sector.

This Issue Brief provides an early assessment of some of the critical impacts of the pandemic for municipal water demand. We find that stay-at-home orders and business shutdowns increased residential demand and decreased non-residential (i.e., commercial, industrial, and institutional) demand. The net effect of these changes varies from community to community, depending on the relative proportion of residential and non-residential water uses and the major economic sectors in the community.

Changes in demand have affected utility expenditures and revenue, customer water bills, water and wastewater operational conditions, and building water quality. Small systems are especially vulnerable to these impacts, as they have a smaller customer base to absorb revenue shortfalls and fewer operators. Some of these impacts will be short-lived, generally limited to the period when stay-at-home orders are in place and businesses closed. However, there could be longer-term impacts if, for example, unemployment remains high, people continue to work from home, or there are deeper changes to the economy. We do not yet know the extent or duration of these impacts. Immediate action is needed to ensure the safety of water during building reopening and improve the financial and operational resilience of utilities in the face of greater variability and uncertainty, and we offer recommendations on these issues in this Issue Brief.

IMPACTS ON WATER DEMAND

Stay-at-home orders and business shutdowns stemming from the early 2020 outbreak of COVID-19 have prompted changes in municipal water demand. Given lags in collecting and analyzing water-use data, details on these changes are limited. The available data suggest that, as intuition might suggest, residential water demand increased while non-residential demand decreased. In Portsmouth, England, for example, residential demand increased by 15 percent during the lockdown, while non-residential demand declined by 17 percent. By June, however, non-household water demand had returned to pre-COVID-19 levels (Portsmouth Water 2020). Likewise, residential demand in San Francisco, California increased by 10 percent, while non-residential demand declined by 32 percent (Kehoe 2020).

While non-residential demand has declined overall, there are significant differences from sector to sector. Based on a commercial sector risk assessment, AWWA and AMWA (2020) anticipated the pandemic would lead to "significant water demand reductions from industries in the leisure, hospitality, and transportation sectors, and moderate to significant reductions in water demands from other industries, such as retail and wholesale trade, manufacturing, and construction." Data for Portsmouth Water indicated the largest reductions in pubs, bars, and restaurants; big drops in schools, hotels, and real estate; and little to no changes in most other sectors, including high-demand sectors like agriculture, health care, and national defense (Portsmouth Water 2020).

The effect of the COVID-19 pandemic on total water demand varies from community to community. Key factors are both the relative proportion of residential and non-residential water uses and the makeup of the non-residential sectors in the community. Table 1 summarizes changes in total water demand in several U.S. communities during periods when shelter-in-place and business shutdowns were in effect. Most communities – including larger metropolitan systems in Boston (Massachusetts), Pittsburgh (Pennsylvania), and Austin (Texas) – experienced a reduction in total demand. However, more residential communities experienced either modest increases in total demand or the smallest decreases.

It is important to note that COVID-related impacts on water demand may be short-lived. As people return to work, residential and non-residential demands are likely to approach pre-COVID-19 levels. However, there could be longer-term impacts if, for example, unemployment remains high, people continue to work from home, or there are deeper changes to the economy.

Table 1. Changes in Total Water Demand During the COVID-19 Pandemic

Utility/Community	Demand Change	Time Period
Springfield and Ludlow, Massachusetts	-18%	Not specified
Boston, Massachusetts	-13.7%	March 18 to May 6
Waltham, Massachusetts	-13.1%	March 18 to May 6
Unspecified mid-sized utility in Pennsylvania	-10.0%	March 1 to 4
Pittsburgh Water and Sewer Authority	-12%	Not specified
Nahant, Massachusetts	-9.1%	March 18 to May 6
Milton, Massachusetts	-7.0%	March 18 to May 6
Unspecified large utility in Virginia	-6.7%	March 25 to 31
Norwood, Massachusetts	-6.7%	March 18 to May 6
Reading, Massachusetts	-6.1%	March 18 to May 6
South Central Connecticut Regional Water Authority	-6%	Not specified
CWTP, Massachusetts	-5.8%	March 18 to May 6
Austin Water	-5.5%	April
Framingham, Massachusetts	-5.4%	March 18 to May 6
Colorado Springs, Colorado	-5%	March
Arlington, Massachusetts	-4.8%	March 18 to May 6
Revere, Massachusetts	-3.6%	March 18 to May 6
Chicopee, Massachusetts	-3.3%	March 18 to May 6
Wilmington, North Carolina	-3%	April
Newton, Massachusetts	-2.8%	March 18 to May 6
Wilbraham, Massachusetts	-2.7%	March 18 to May 6
Weston, Massachusetts	-2.6%	March 18 to May 6
Brookline, Massachusetts	-2.6%	March 18 to May 6
Watertown, Massachusetts	-1.8%	March 18 to May 6
Belmont, Massachusetts	-1.1%	March 18 to May 6
Everett, Massachusetts	-1.1%	March 18 to May 6
Quincy, Massachusetts	-0.6%	March 18 to May 6
San Francisco, California	0.7%	March 15 to June 20
Chelsea, Massachusetts	0.8%	March 18 to May 6
Southborough, Massachusetts	1.1%	March 18 to May 6
Melrose, Massachusetts	2.5%	March 18 to May 6
Lexington, Massachusetts	2.9%	March 18 to May 6
Saugus, Massachusetts	3.2%	March 18 to May 6
Marblehead, Massachusetts	3.7%	March 18 to May 6
Somerville, Massachusetts	4.0%	March 18 to May 6
Malden, Massachusetts	4.1%	March 18 to May 6
Medford, Massachusetts	5.5%	March 18 to May 6
South Hadley, Massachusetts	6.2%	March 18 to May 6
Winthrop, Massachusetts	10.0%	March 18 to May 6
Swampscott, Massachusetts	12.7%	March 18 to May 6
Stoneham, Massachusetts	16.7%	March 18 to May 6

Data sources: AWWA and AMWA 2020, Clifton 2020, CSU 2020, Goonan 2020, Greaney 2020, Kehoe 2020, and Port City Daily 2020

IMPLICATIONS OF CHANGES IN WATER DEMAND

Sudden changes in the levels and patterns of water demands from quarantine and stay-at-home orders have a variety of consequences. In this section, we examine the financial implications for customers and utilities, as well as impacts on water and wastewater operational conditions and building water quality. There may also be implications for the environment, including from changes in water withdrawals from – and disposal of wastewater to – ecosystems and changes in energy use and the associated greenhouse gas emissions. These changes are likely to be short-term in nature and relatively modest and are best assessed at the local level when better data on water use are available.

Customer Water Bills and Utility Revenue

Changes in water use have financial implications for both the customer and the utility. Residential water use, and hence household costs, are likely to rise, while non-residential water use and costs are likely to decline. The effect on customer bills will depend on the change in usage and the utility's rate structure. A water bill typically has a fixed fee, as well as a variable fee that depends on the volume of water used. Because the fixed fee would remain unchanged, the change in the bill would be less than the change in water usage, i.e., the additional cost of a nine percent increase in household usage will often be less than nine percent.

For most utilities reporting data as of the date of publication, total water use has declined, and this means a drop in revenue. The Toho Water system in Florida, for example, projected an annual revenue loss of over nine percent because of an anticipated 52 percent drop in commercial water use and a 12.5 percent drop in sales of reclaimed water over a six-month period (AWWA and AMWA 2020). Notably, some utilities subsidize the cost of household water service with revenue from water sales to businesses. For these utilities, the financial impacts of reductions in non-residential demand would have a greater impact on their revenue stability and their ability to provide affordable water to residents.

The impacts of revenue shortfalls will vary from utility to utility, depending on the revenue losses incurred, the extent to which utility costs are fixed, as well as the funding sources used to pay for utility costs.[1] Revenue losses from reduced demand are compounded by likely increases in non-payment and higher costs, putting further pressures on water utilities. For example, many states have placed a temporary moratorium on customer disconnections due to non-payment. The economic downturn and high unemployment have also put added strain on low-income households, potentially increasing non-payment rates. Moreover, a questionnaire sent to U.S. water utilities suggested some

[1] Some utility costs, such as electricity and chemical costs, are variable, declining as water use declines. Others, like servicing debt, are fixed and would remain unchanged.

are offering hazard pay and overtime to essential workers, expanding training, and spending more on certain supplies (AWWA and AWMA 2020).

A recent analysis – based mostly on information from larger utilities – suggests that reductions in water demand will have a greater financial impact on U.S. drinking water utilities than the shutoff moratorium and other COVID-19 related impacts (AWWA and AMWA 2020). Impacts are likely to be more severe for small water and wastewater systems, as they have a smaller customer base to absorb revenue losses. A May survey of small rural and tribal systems serving 10,000 residents or fewer found that more than 31 percent of systems able to estimate their financial outlook would be unable to cover all costs for more than six months under current conditions (RCAP 2020).

Water utilities have several tools for addressing the short-term financial challenges associated with the COVID-19 pandemic. They can, for example, use cash reserves and/or cut spending, including by deferring capital and maintenance projects. Utilities can also raise rates, although few are likely to do so in the near term because of the time required to implement a rate increase and the potential impacts on customers experiencing financial hardships due to the pandemic and the associated economic downturn. Finally, national and international aid agencies and international lenders can provide financial assistance to address revenue shortfalls and maintain infrastructure investments. While larger water systems likely have greater access to these tools and can thus more easily absorb financial losses, small systems are likely to be more vulnerable the financial implications.

Water and Wastewater System Operations

Water and wastewater system operations are configured based on historical demands, and rapid changes in water use can strain these systems. While the net change in water demand has been relatively modest for most systems, changes within a water system can be much more dramatic. The Cape Fear Public Utility Authority in North Carolina reported that while demand across its service area was down only three percent in April compared to the previous year, impacts on its three major subsystems were much larger (Port City Daily 2020). Its Sweeney Treatment Plant – which provides much of the water to the community and serves a mix of residential, commercial, industrial, and institutional users – experienced a nine percent reduction in demand. By contrast, water demand in the two smaller systems that largely serve residential areas increased by 25 percent and 36 percent.

Moreover, as businesses reopen and implement best hygiene and disinfection practices, water use may rise dramatically. These changes can be worsened by unseasonably warm weather, which typically increases outdoor water use. Such rapid and dramatic changes in water use can exacerbate existing and reveal new system weaknesses. Management of these weaknesses is likely to be even more difficult as system operators are adjusting to reduced staffing, working remotely, and other changes in response to the COVID-19 pandemic. Here, too, small water systems are more vulnerable than large systems. In its May 2020 survey of COVID impacts, RCAP (2020) found that “43 percent

of respondents said they rely on one full-time employee or less to operate their systems, because many rely on a part-time or contract operators and even volunteers."

New technologies and approaches such as real-time monitoring of water demand and new forecasting models can help utilities respond to these changes. For example, the water utility Stadtwerke Karlsruhe (SWKA) provides water services for more than 400,000 inhabitants in the state of Baden-Württemberg, Germany. During the pandemic, SWKA integrated measured and simulated water demand using real-time information to evaluate variations in water use before and after lockdown measures were applied. They then used a demand forecasting system combined with an artificial intelligence/pattern recognition tool to analyze and adjust their operations to changes in demand (Aquatech 2020). Digital methods for remote monitoring and control of water systems are already high on the agenda of many utilities and the pandemic is likely to reinforce and accelerate the need to expand the application of smart metering, remote leak detection, and advanced modeling approaches as utilities seek to improve management and financial stability (Bindler 2020).

Building Operations and Water Quality

As society begins to slowly reemerge from quarantines, stay-at-home orders, and business shutdowns during the pandemic, water utilities must pay attention to unexpected, unknown, and often ignored risks. While the United States has some of the safest tap water in the world and a sophisticated, well-trained water services sector, the pandemic has raised some new water-quality concerns in need of special attention. One of these relevant to municipal water systems is the potential for health risks associated with stagnant water inside building plumbing (Gleick 2020).

Under normal conditions, the regular flow of safe disinfected municipal tap water keeps water and plumbing free of corrosion, leached minerals, and bacteria. When water systems are shut down or inactive for weeks or months, residual disinfectants in water, such as chlorine, can fade away. Several potential hazards must be considered before reopening buildings or water systems, including the risk of mold, *Legionella* (the cause of Legionnaires' disease) and other bacteria, corrosion of plumbing, leaching of lead and other metals, and the presence of disinfection by-products. More routine risks, such as contaminated surfaces in bathrooms, kitchens, and fountains, are also present but typically managed by well-understood cleaning and disinfection practices. The actual risks in any building will vary depending on a wide range of factors, including kind of water agency involved, the length of shutdown, specifics of local water chemistry and treatment, details of the building's plumbing systems and fixtures, and the skills of building maintenance staff.

Many building owners will be unaware of the risks and the actions they should take. To minimize these risks, building reopening must be carefully managed. There are no official national or industry regulations for reopening buildings after extended shutdowns, but extensive guidance on how to do this is available from water professionals, the U.S. Environmental Protection Agency, and health agencies like the Centers for Disease Control and Prevention. Key actions for building managers are

described in the Pacific Institute Fact Sheet "Reopening Buildings After Shutdowns: Reducing Water-Related Health Risks" and include:

- Contact your water utility to see if specific information is available for your system.
- Review how water moves through your building, from the street to each point of use.
- To prevent bacterial growth, particularly *Legionella*, heat hot water to at least 140 degrees F (60 degrees C), and make sure it stays hot, greater than 131 degrees F (55 degrees C) to points of use.
- In buildings where water was stagnant for an extended period, flush both the cold and hot water piping and water storage. First flush the cold water and then the hot water at all points of use (faucets, showers, toilets, etc.) and in all water-using devices (dishwashers, washing machine, ice makers, etc.), with special attention to water outlets where exposure to contaminants is likely (showerheads, spas, etc.). Be careful to bypass point-of-use treatment devices during flushing and maintain those devices per manufacturer instructions.
- Maintain devices that use water as per manufacturer's specifications (cooling systems, decorative fountains, pools, etc.).

CONCLUSIONS AND RECOMMENDATIONS

Unexpected events – from extreme droughts and floods to major infrastructure failures and social disruptions like the 2020 COVID-19 pandemic – highlight the need for water utilities to bolster their resilience so they can continue to provide critical water and wastewater services under more variable and uncertain conditions. The pandemic has led to changes in water demand, with effects on utility expenditures and revenue, customer bills, building water quality, and operational conditions. Small water systems are more vulnerable to these impacts than larger systems. We do not yet know the extent or duration of the pandemic, range of impacts on different water utilities, or effectiveness of efforts to mitigate these impacts. However, given the experiences to date, we recommend the following actions:

Enhance Water Utility Resilience

Water utilities should expand their efforts to develop more robust and sophisticated "resilience" plans. A variety of resilience frameworks are available, and these frameworks can help water utilities prepare for and mitigate a wider range of risks than traditional planning approaches have addressed, including extreme climatic conditions, health threats like the COVID-19 pandemic, and the failure of key infrastructure components.

Water utilities and municipalities should accelerate the pace and scale of digital monitoring and operational technologies. Digital technologies, such as advanced meters and sensors, improved demand forecasting tools, remote operating tools, and real-time water quality monitoring, can help provide real-time data and information on water demand and system performance, providing advance notice of

developing problems. Such technologies can also help allow the continued safe operation of critical systems even with reduced staffing and shelter-in-place orders.

Water utilities should periodically update rate structures. Periodic review (and adjustment, as needed) of rate structures can help utilities bolster their financial health and respond to changes in water use and operating costs. While it may not be feasible to change rates in response to the immediate impacts of the pandemic, changes may be needed to address the longer-term economic impacts and build resilience to future crises. Some may call for adopting high fixed fees to provide greater revenue stability in uncertain times; however, such fees can conflict with efforts to promote efficiency and equity and increase long-term costs. Other strategies should be evaluated, such as budget-based or inclining block rate structures, drought surcharges, cash reserves, and other financial policies.

Water utilities should maintain cash reserves and clear policies on their use. Reserves are funds set aside to buffer the impacts of occasional revenue shortfalls, including from reduced water sales or increased costs. Such funds are especially useful with rate structures that are more sensitive to changes in water demand. Finance policies can provide guidance necessary to respond to revenue shortfalls quickly and easily and should include quantitative targets for when to withdraw these funds and how to apply them. Regulatory and bond rating agencies should support water utilities that seek to boost emergency reserve funds.

Water utilities should consider purchasing commercial insurance products that provide coverage for business interruptions. While commercial products may not specifically address all the challenges posed by the pandemic, more general policy terms can be negotiated in case of future disruptions.

National governments and international aid agencies should increase financial assistance for water projects that improve utility resilience and accelerate the disbursement of this assistance. Financial assistance can help ensure that much-needed utility infrastructure investments are maintained and stimulate economic recovery. Such funding should be prioritized for small systems and for projects that (1) enhance sustainability and resilience outcomes and (2) serve disadvantaged communities that lack comprehensive access to safe water and sanitation.

Ensure Water Safety During Building Reopening

Building operators and managers should take immediate proactive steps to protect public health by addressing building water quality prior to reopening. Actions taken should be shared with building occupants. In the future, facilities should maintain a minimum flow of water through the system during a shutdown.

Water utilities should proactively reach out to commercial and industrial customers with information about safe reopening procedures. In North America, the American Water Works Association (AWWA), Canadian Water and Wastewater Association, CDC, U.S. EPA, and other public and private groups offer recommendations for both specific actions and community outreach.

Local, state, and federal agencies should make special efforts to reach out to groups with limited access to technical expertise and financial resources. This includes small rural water systems, disadvantaged communities, Native American communities, and other groups with special water supply and quality challenges.

Facilities with their own water systems must consider protective actions. Groups that maintain their own water supply, including some schools, restaurants, churches, and recreational facilities, should contact their primacy agencies with specific questions.

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