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Issue Brief, 2018

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Adapting to Change: Informing Water Use Efficiency and Adjusting to Declining Flows
This brief builds on CUWAâ€™s 2017 white paper to inform the stateâ€™s studies on a new indoor residential water use standard by analyzing the impacts of lower residential water use on water, wastewater, and recycled water
systems.

Additional submitted attachment is included below.

ISSUE BRIEF

Adapting to Change: Informing Water Use Efficiency and Adjusting to Declining Flows

While California's conservation and water use efficiency efforts support water supply reliability and resilience, declining flows have caused unintended consequences in water, wastewater, and recycled water systems. In 2018, the state enacted legislation that set a provisional standard for indoor residential water use of 55 gallons per capita day (R-GPCD), which will gradually decrease to the greater of 50 R-GPCD or a standard recommended by the California Department of Water Resources (DWR) and State Water Resources Control Board (State Board). Building on CUWA's 2017 white paper, "Adapting to Change: Utility Systems and Declining Flows," this issue brief helps to inform future standards, implications, and adaptions following the 2018 legislation.

Key Takeaways

During the period of mandated conservation, a wide range of water, wastewater, and recycled water systems experienced impacts from reduced flows.

In California Urban Water Agencies' (CUWA) 2017 survey, utilities representing a wide range of per capita residential water use reported impacts to water, wastewater, and recycled water systems due to reduced flows. The reported issues—such as treatment facility idling, odor complaints, and limited recycled water production—carry direct and indirect operational, financial, and physical consequences. Many of these challenges are caused or exacerbated by a combination of system-specific characteristics, such as water or wastewater quality, pipe material and size, and spatial topography, which makes it difficult to define a specific R-GPCD threshold that triggers adverse effects.

This brief builds on CUWA's 2017 white paper to inform the state's studies on a new indoor residential water use standard by analyzing the impacts of lower residential water use on water, wastewater, and recycled water systems.

Systems with large, unexpected flow reductions may experience significant operational challenges.

In the decades since most urban infrastructure was designed and built, water demands supporting the basis of designs have changed. Large reductions in flow may lead to systems operating well below design capacity, affecting system performance and operations. This effect will persist unless population growth moves service demand closer to planned capacity or agencies adapt. Systems designed with greater flexibility typically have more ability to adapt with operational adjustments.

Given time and resources, utilities can and will adapt to declining flows.

Declining flows are one example of many changes facing California utilities. Agencies need time, investment, and coordinated planning across the service area to adjust and maintain compliance with sometimes competing goals, including conservation standards, end user needs, and fire flow and public health requirements. The broad reach of impacts emphasizes the interconnected nature of infrastructure tying together water, wastewater, and recycled water systems and the benefits of a holistic, integrated, One Water planning and management approach.

Background and Methodology

In response to Governor's Brown's Executive Order in 2015, the State Board assigned over 400 urban water suppliers a conservation standard ranging between 4 and 36 percent based on R-GPCD for July through September 2014, recognizing utilities demonstrating proactive conservation with lower tiers. (Calculated using total potable water production and percent residential use, R-GPCD reflects both indoor and outdoor use.)[1] In November 2017, CUWA published the white paper "Adapting to Change: Utility Systems and Declining Flows,"[2] which examined the impacts of declining flows on California water, wastewater, and recycled water systems during this period of mandated water use reductions (2015-16).[3]

The 2018 legislation requires studies to analyze how the changing standard for indoor residential water use will impact water and wastewater management.

In 2018, the state enacted Assembly Bill 1668, which defines the current interim indoor residential water use standard as 55 R-GPCD and states that it will gradually reduce to 50 R-GPCD by 2030 unless a different (and higher) standard is deemed more appropriate. The legislation also requires DWR and the State Board to conduct studies to assess how the changing standard for indoor residential water use will benefit and/or impact water and wastewater management and, by January 1, 2021, report results to the Legislature.[4]

To inform the state's studies on a new indoor residential water use standard, CUWA revisited responses to the 2017 survey, in which 51 water, wastewater, and recycled water agencies reported impacts from declining flows and provided identifying contact information. To quantify the flows at which these impacts were observed, CUWA analyzed the 52 water suppliers that share service areas with these 51 agencies and were subject to the Governor's conservation mandate (Figure 1). The 52 water suppliers in CUWA's analysis serve one-third of the population affected by the emergency regulation, though they represent 13 percent of the agencies assigned a conservation target. While the 51 surveyed agencies are a relatively small sample of California utilities, their associated suppliers represent a range of R-GPCD values and lend insight on the impacts of declining flows across the spectrum of water use.

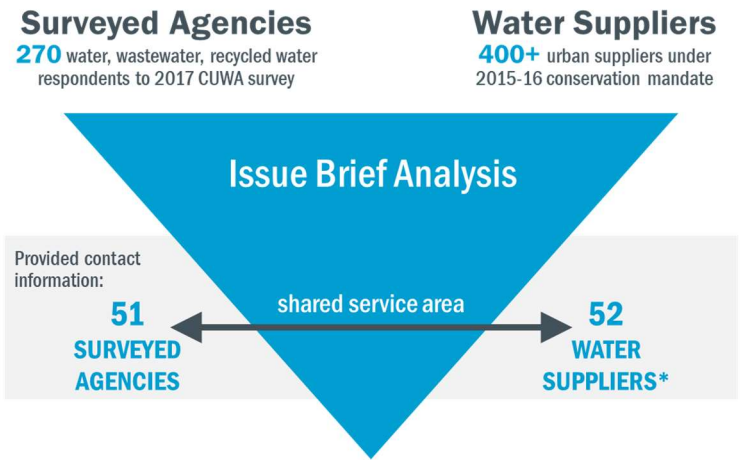


Figure 1. CUWA paired survey respondents with water suppliers based on shared service area.

*Some wastewater agencies are served by more than one water supplier.
The four water suppliers serving more than one agency are counted only once.

[1] State Board. *Urban Water Supplier Conservation Tiers* and *Instructions for Estimating Residential Gallons Per Capita-Day*.
[2] CUWA, 2017. *Adapting to Change: Utility Systems and Declining Flows*.
[3] State Board, 2015. *Emergency Regulation for Statewide Urban Water Conservation*.
[4] Friedman, 2018. *Assembly Bill No. 1668 - Water management planning*.

Water Use Aligned with State's Drought Emergency Goals

During 2015-16, all 52 water suppliers reduced their average monthly R-GPCD from their 2013 baseline, as shown in Figure 2. On average, these water suppliers achieved a 27 percent reduction in R-GPCD during the mandated conservation period, in alignment with Governor Brown's Executive Order imposing a 25 percent reduction in statewide urban water use. Furthermore, agencies with lower baseline R-GPCD values tended to reduce water use beyond mandated levels.

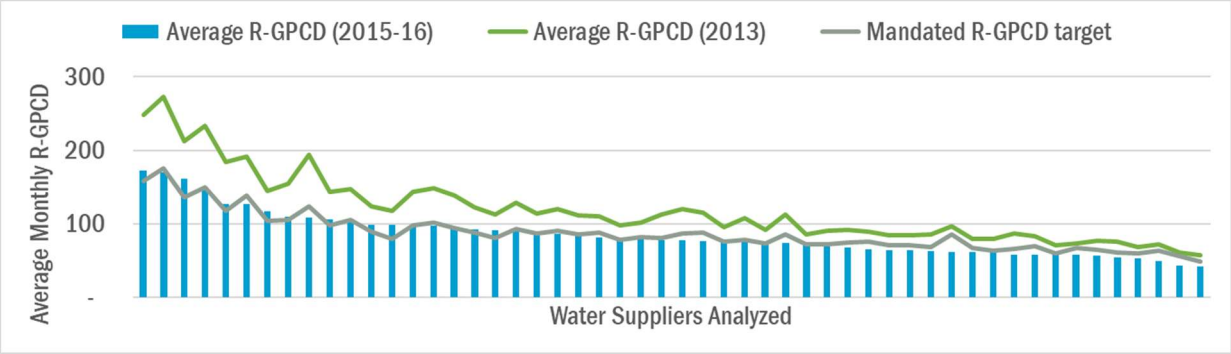


Figure 2. Water suppliers achieved an average 27% reduction, ranging from 17 to 44%.

The R-GPCD values represent the total residential water use in an urban water supplier's service area and do not distinguish between indoor and outdoor use. Because most residential customers do not have separate meters measuring indoor and outdoor use, actual indoor water use can be difficult to quantify. To estimate how total R-GPCD (including both indoor and outdoor use) may relate to a potential future indoor standard of 50 R-GPCD, Table 1 provides a cursory reference point. However, because the portion of indoor use varies widely between agencies due to many factors, this approach is not suitable for broad application.

Table 1. Cursory Reference Point Relating R-GPCD and Indoor Water Efficiency Standard

Future Indoor Residential Water Use Standard	Percent Indoor Use (Compared to Total Residential Use)	Resultant Total R-GPCD (Indoor + Outdoor Use)	Reference for Percentage Assumption
50 R-GPCD[a]	50%	100 R-GPCD	PPIC and DWR (for California urban water use)[b]
	70%	71 R-GPCD	EPA (for nationwide residential use)[c]

a. *Potential future standard in 2030, based on AB 1668. The current provisional standard is 55 R-GPCD.*
b. *Public Policy Institute of California, 2016. Water for Cities.*
c. *Environmental Protection Agency, 2008. Indoor Water Use in the United States.*

As a result of conservation efforts and investments in water use efficiency measures, residential water use for the majority of water suppliers assessed (79 percent) spanned between 41 and 101 R-GPCD during the conservation mandate. This range aligns with the 50 R-GPCD future indoor residential use standard under consideration by the state, assuming greater than 50 percent of residential water use is indoor.

Reduced Flows Led to Challenges Throughout Interconnected Urban Water Systems

Agencies observed impacts from declining flows throughout water, wastewater, and recycled water systems. Challenges in one part of the system often led to additional consequences downstream due to the interconnectedness of urban water infrastructure, highlighting the importance of coordinated planning.

Impacts to Water Distribution Systems

Of the 51 agencies surveyed, 37 provide water distribution services. As shown in Figure 3, there is no clear relationship between R-GPCD and reported impacts. However, CUWA observed common threads in the survey responses:

- **Water quality changes and operational challenges were the most commonly reported issues.** Reduced demand increases detention time and water age, causing nitrification. Some actions that agencies took to address reduced flows include the removal of storage tanks and reservoirs from service, increased flushing in the lines, and the operation of chloramination booster stations.
- **Few agencies reported the need to idle water treatment facilities,** demonstrating operational flexibility.
- **Other reported impacts reflect the financial implications of reduced flows.** Agencies reported a reduction in revenue due to decreasing water sales, which, for some agencies, translated to increased rates.

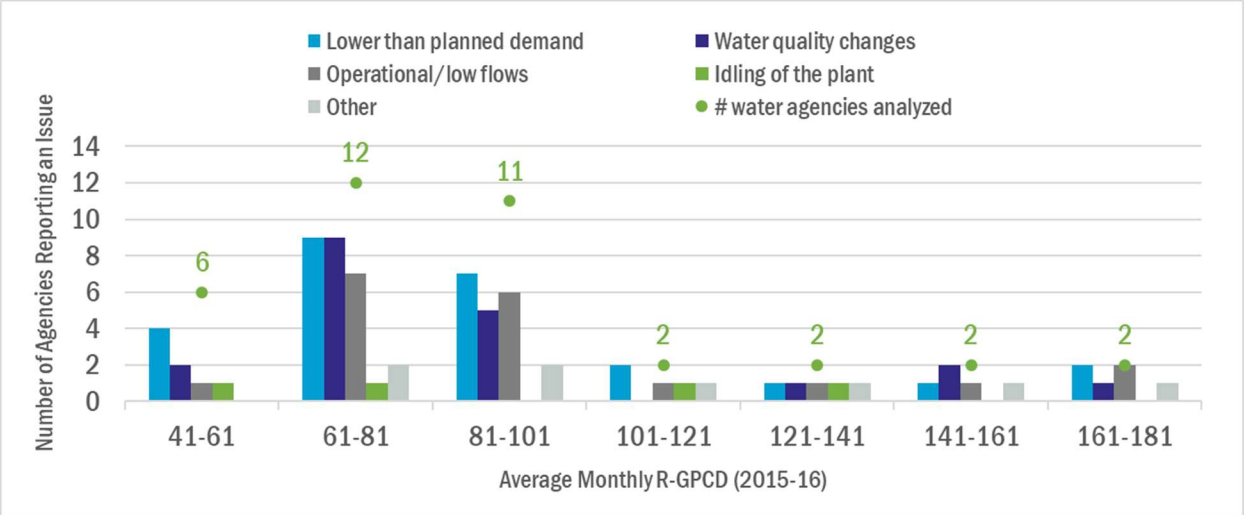


Figure 3. Water distribution systems observed impacts across a range of reduced flows.

Note: All charts in this issue brief with overlapping horizontal axis groups represent 41.00 to 60.99, 61.00 to 80.99, etc.

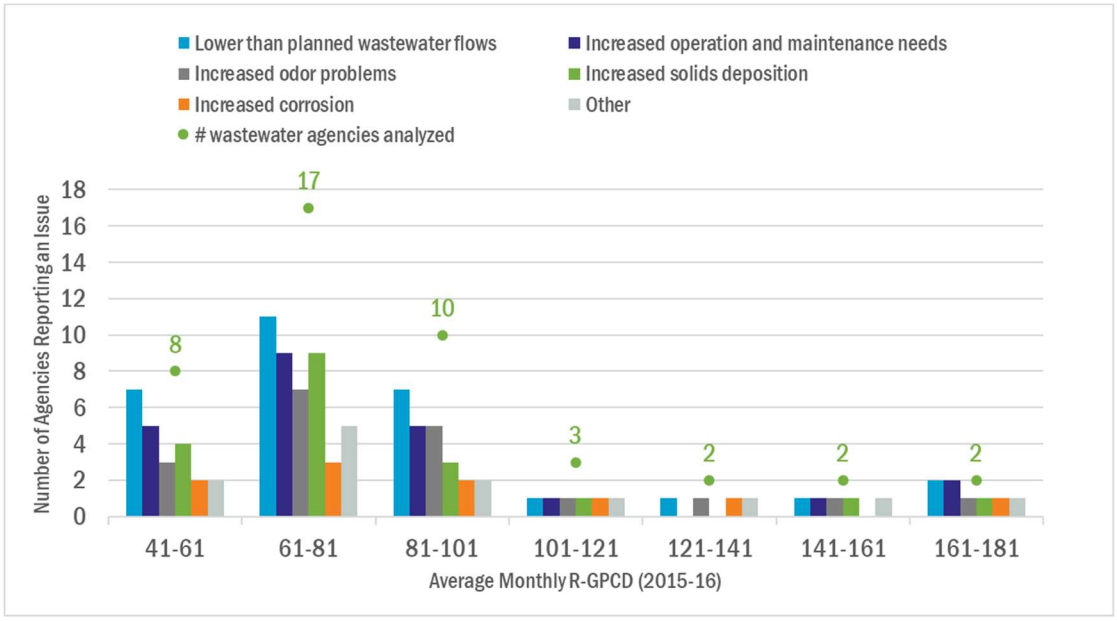
Case Study: San Diego County Water Authority (SDCWA)

Low flows in SDCWA's aqueducts increased detention time in their system, leading to increased water age and reduced disinfectant residuals within the conveyance system. To adapt, SDCWA increased their rate of flushing, which increased their maintenance costs, and invested in online monitoring equipment.

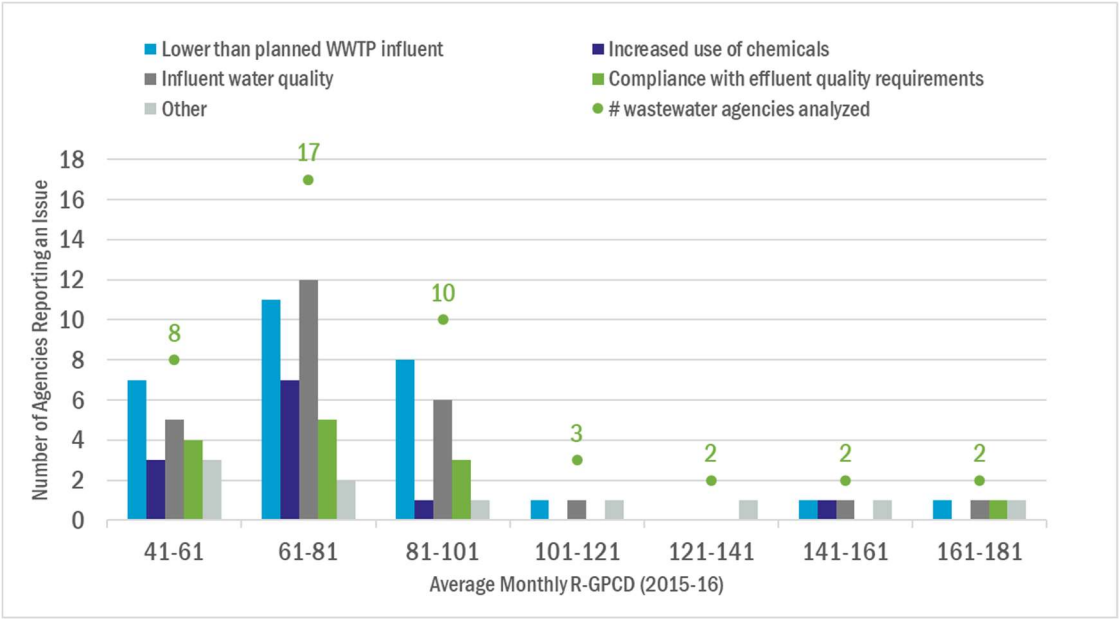
Source: CUWA, 2017. Adapting to Change: Utility Systems and Declining Flows.

Impacts to Wastewater Conveyance and Treatment Systems

Of the 51 surveyed agencies, 44 provide wastewater services. Approximately 55 percent of responding agencies reported impacts to both conveyance and treatment systems, as shown in Figure 4.



(4a)



(4b)

Figure 4. Wastewater conveyance issues (4a) have downstream effects at wastewater treatment facilities (4b).

Takeaways from the survey responses include the following:

- **Agencies across a range of reduced flows reported increased operation and maintenance needs on conveyance infrastructure.** This could be attributed to increased odor problems and solids deposition, which were reported at a similar frequency.
- **Many reported conveyance issues have downstream impacts on wastewater treatment.** Low flows lead to longer detention time in pipes, increasing biological degradation processes that result in emissions of greenhouse gases such as carbon dioxide and methane. Increased degradation also makes wastewater more difficult to treat downstream. One agency reported an upset to their treatment process, requiring the addition of alkalinity to control pH.
- **Agencies adjusted their treatment plant operations to address changing wastewater influent quality.** Wastewater agencies reported a need for operational changes to adapt to lower flows and higher ammonia, biological oxygen demand, and total suspended solids concentrations, which can increase the cost of treatment.
- **Increased corrosion was less commonly reported.** This may be a function of the time it takes for problems like corrosion to manifest.

Case Study: Los Angeles Bureau of Sanitation (LASAN)

LASAN reported that lower flows increased nitrogen concentrations, impacting both their wastewater treatment and conveyance system. While LASAN's Hyperion Wastewater Treatment Plant does not nitrify, it conveys 15 percent of its effluent to partner agencies, who subsequently treat the effluent to water quality standards based on application. Treating this increase in ammonia to meet end-use water quality has been a significant challenge to these partner agencies.

Source: CUWA, 2017. Adapting to Change: Utility Systems and Declining Flows.

Impacts to Recycled Water Systems

Of the total 51 agencies surveyed, 34 provide recycled water services. Impacts reported on recycled water systems—shown in Figure 5 and summarized below—highlight the need for increased planning and coordination among water and wastewater agencies.

- **70 percent of respondents reported a decrease in recycled water production.** This could be due to reduced demand for recycled water (largely for irrigation uses) and/or a lack of wastewater effluent available for reuse. To improve water supply reliability and resilience, many agencies have plans to increase water reuse. Declining wastewater flows will require effective planning and coordination among agencies to ensure sufficient source water to meet recycled and purified water production goals and maintain operable facilities.
- **Changes in influent water quality were prevalent under reduced flow conditions.** Wastewater quality challenges carry through to recycled water facilities and reduce the effectiveness of recycled water treatment processes. This has potential downstream impacts, as water quality changes—such as higher total dissolved solids—can negatively impact recycled water users.

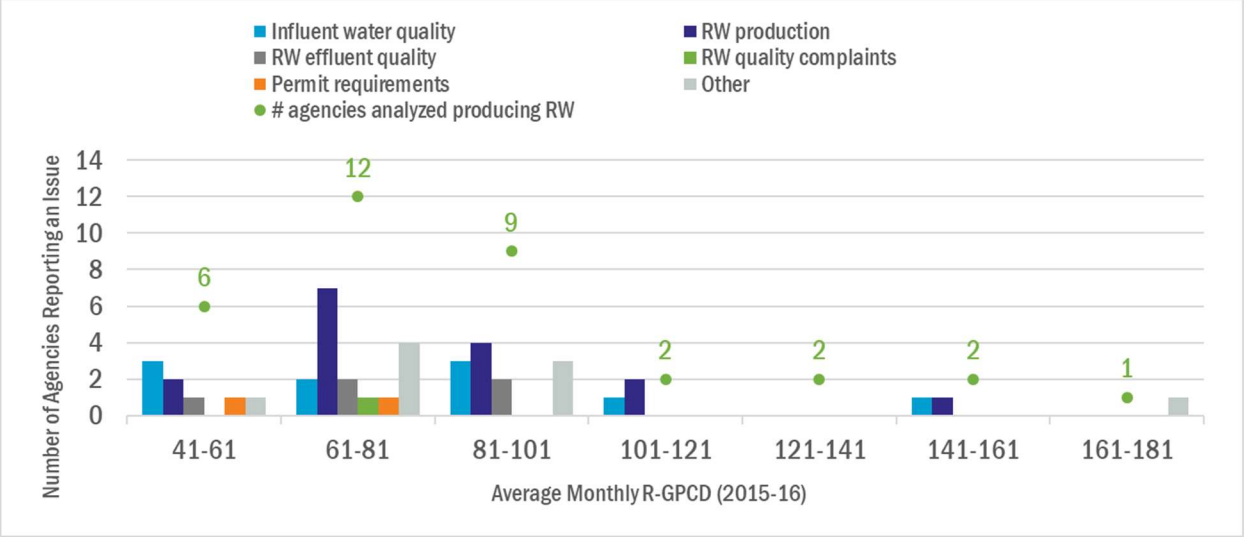


Figure 5. Recycled water facilities reported lower production and changes in water quality, which negatively affect downstream users.

Case Study: Victor Valley Water Reclamation Authority (VVWRA)

VVWRA reported that declines in wastewater influent subsequently reduced their recycled water production. Because VVWRA is required to discharge 8.2 million gallons per day to the river to meet California Fish and Wildlife requirements, the reduced wastewater flow compromised their ability to offset potable demand, requiring them to rely more heavily on groundwater.

Source: CUWA, 2017. Adapting to Change: Utility Systems and Declining Flows.

Recommendations

Based on this analysis, CUWA offers the following recommendations to inform indoor water use efficiency requirements.

For the State

Account for system-specific characteristics when evaluating appropriate indoor water use standards.

A variety of factors—such as pipe size and material and service area density—can contribute to or exacerbate impacts from reduced flows. CUWA's analysis did not indicate a single flow threshold below which agencies begin to experience adverse effects. A range of standards and/or phasing approaches may be warranted to account for system-specific characteristics and allow agencies time to adapt. Defining that range can be supported by analysis on a more substantial dataset that focuses on utilities experiencing impacts at R-GPCD values at or around the proposed indoor water use efficiency standard.

Ensure that state policies for water use efficiency and reuse are complementary.

California is developing and implementing multiple policies around water and wastewater management, ranging from defining water use efficiency standards to setting goals for recycled water production. Developing policies that are complementary in objective will better support utilities that are collectively working towards greater water resiliency. For example, limiting the amount of wastewater available for reuse may conflict with state objectives to advance recycled and purified water production.

For Utilities

Strengthen planning, coordination, and collaboration between water and wastewater agencies.

Many agencies responding to the survey reported "lower than planned" water or wastewater flows. Though water and wastewater agencies have historically operated separately, declining flows offer an opportunity to integrate planning. By jointly identifying implications to urban water infrastructure, such as more frequent droughts or lower demands, agencies may also collaborate on solutions, such as more flexible system designs to address variable flows.

Assess vulnerabilities and potential impacts throughout the system.

Most issues arising from declining flows result in specific "problem areas" within the system. For example, odors or blockages often occur in stretches of sewer with shallow slopes, and water quality challenges in distribution systems often occur at the edge of the system. Recognizing the new normal of reduced flows and proactively planning ahead to address specific system areas can mitigate future impacts.

For more information, visit www.cuwa.org.