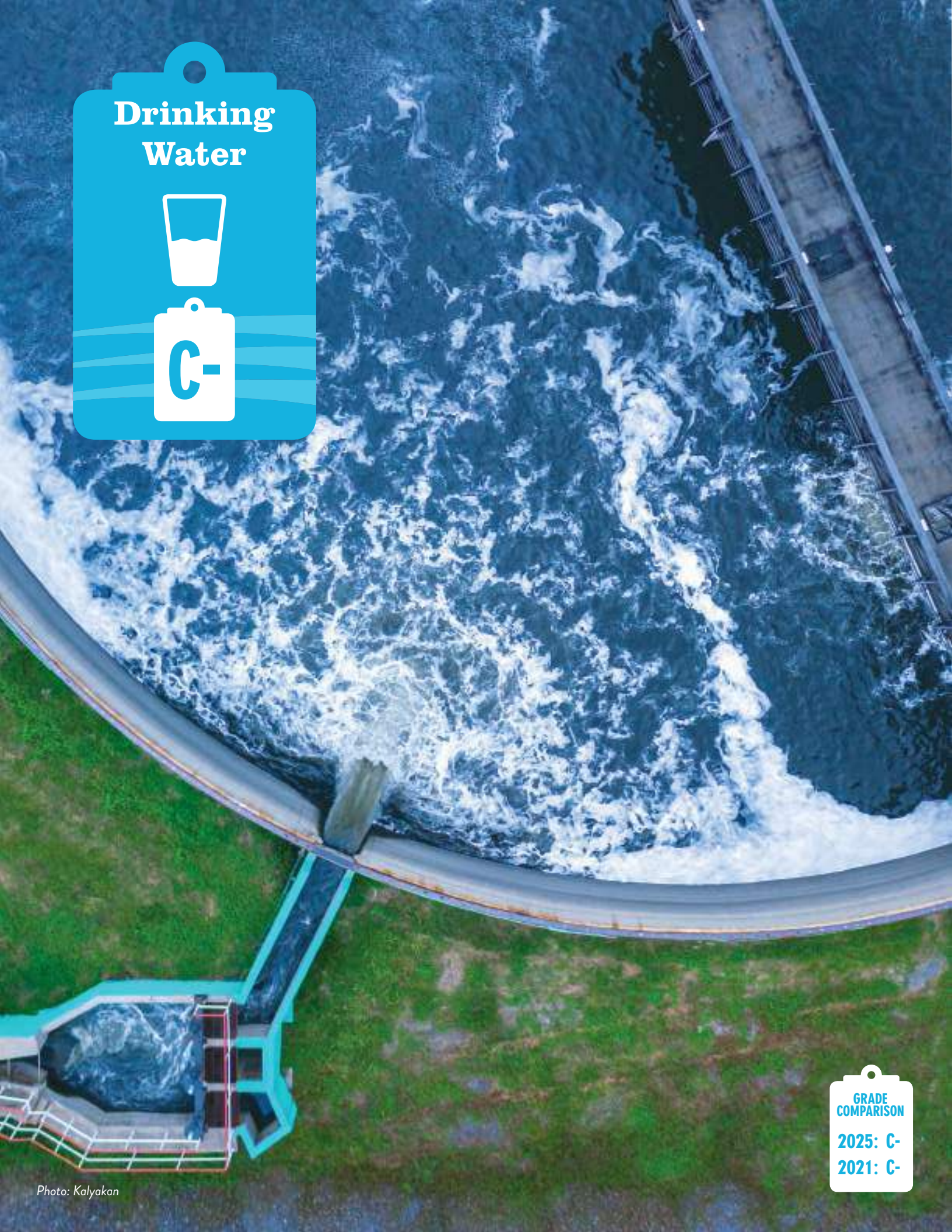
Drinking Water

C-



GRADE COMPARISON

2025: C-

2021: C-

Photo: Kalyakan

DRINKING WATER

EXECUTIVE SUMMARY

The nation's water infrastructure is aging and underfunded. More than 9 million existing lead service lines pose health concerns, and in 2023, the Environmental Protection Agency (EPA) determined that the nation's water infrastructure needs stand at $625 billion over 20 years. That exceeds EPA's 2018 assessment by more than $150 billion. The 2021 Infrastructure Investment and Jobs Act (IIJA) invested more than $30 billion for drinking water capital improvements, removal of lead service lines, and addressing emerging contaminants such as per- and polyfluoroalkyl substances (PFAS). However, funding shortfalls continue in state revolving funds that support drinking water. Challenges to utilities include aging infrastructure, emerging contaminants, and the increasingly severe effects of extreme weather. Many drinking water utilities are actively improving infrastructure through innovations such as asset failure prediction technologies, which improve the ability to identify issues before they become failures. Unfortunately, only about 30% of utilities have fully implemented an asset management plan, and just under half are in the process of implementing one. Federal agencies and programs are also able to provide financial and technical support to utilities meeting new regulations and replacing dangerous pipes, so the burden of rate increases does not fall too harshly on the public water systems of small communities.

BACKGROUND

The nation's drinking water infrastructure comprises more than 2 million miles of underground pipes and are operated by nearly 150,000 public water systems. These centralized systems provide service to 90% of the population, and half of these systems serve communities of fewer than 500 people.[1] Another 43 million people, approximately 15% of the population, rely on private wells as their primary source of drinking water.[2] However, because there is no federal regulation for private wells, data on water quality and performance is scarce. Utilities pay operation and maintenance expenses through user rates and rely on state and federal financing and grant programs to support infrastructure upgrades and maintain the safety of drinking water supplies. However, many of those programs are funded at flat or reduced levels annually. Large water utilities in thriving communities may also access the bond market for capital projects.

CAPACITY AND CONDITION

Drinking water infrastructure in the U.S. comprises more than 2 million miles of underground transmission and distribution lines. Some of the nation's oldest pipes were laid in the 19th century, and pipes laid post–World War II have an average lifespan of 75 to 100 years, meaning that many of even the newer pipe segments are reaching or have reached the end of their design life. As of 2023, the average life expectancy of these pipes is just over 78 years, which is 6 years less than in 2018.[3]

Access to clean, safe drinking water is essential to protecting public health and safety. This critical resource is provided by water systems of various sizes and drawn from different sources. Approximately 93% of systems serve communities under 10,000 people.[4] About 140 million people in the U.S. rely on groundwater sources for their drinking water, with 50% of that water coming from 68 regionally extensive aquifers.[5]

A 2018 study found that approximately 39 billion gallons of water per day were withdrawn from surface water or groundwater sources for public supply between 2000 and 2015. However, a 2024 reanalysis showed that initial estimates did not fully account for growing populations in urban centers served by public water systems. This new analysis reveals that total public-supply withdrawals grew by more than 7.5% between 2000 and 2020, indicating that estimates from the 2018 study should have been higher than reported.[6]

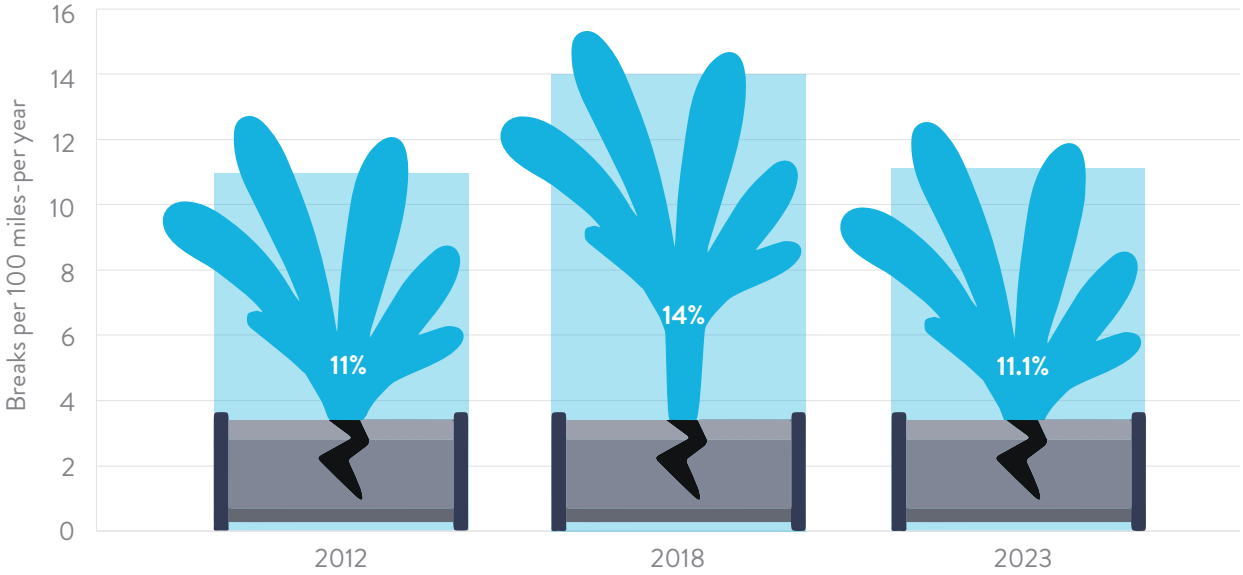
Aging infrastructure, extreme weather events, and costs associated with regulatory compliance place increased strain on the nation's water systems. Over half of the nation's public water systems have identified rehabilitation and replacement of aging infrastructure as their most critical challenge.[7] Aging infrastructure is also a leading contributor to water loss. Approximately 126 billion cubic meters of water (or approximately 33.3 trillion gallons) is lost annually, resulting in more than $187 billion in lost revenue.[8] Additionally, nearly 20% of installed water mains (a little more than 450,000 miles of pipe) were reported to have exceeded their useful lives but are still awaiting replacement due to inadequate funding.[9]

The 2022 rupture of a southeast Michigan drinking water pipeline brought attention to aging water infrastructure in the state; Great Lakes Water Authority

However, addressing aging or failing infrastructure is showing signs of progress. Since 2018, there has been a 20% annual reduction in water main breaks per 100 miles of pipe.[10] Much of this reduction resulted from a nearly 8% decrease in the use of cast iron and asbestos cement pipes, which are responsible for the highest rates of breakage across all pipe materials, between 2018 and 2023.[11] These pipes have been replaced by ductile iron and polyvinyl chloride (PVC), which are the most commonly used materials. However, ductile iron remains vulnerable to highly corrosive soil, with ductile iron pipes experiencing a break rate six times higher than when placed in less corrosive soil.[12] This could help explain why there are still approximately 240,000 water main breaks per year, resulting in roughly $2.6 billion in repair and maintenance costs. That does, however, represent an overall decrease in water main breaks, which was estimated to be between 250,000 and 300,000 per year in the U.S. in 2018.

Photo: Small Diameter Water Main Replacement—Washington DC.; DC Water

Water Main Break Rates Over Time



Source: Utah Water Research Laboratory, Utah State University

FUNDING

Water utilities primarily pay to operate and maintain water infrastructure through user rates. Utilities charge rates to cover the infrastructure and other operating expenses, including treatment plants, underground pipes, water storage, and the workforce that operates and maintains the system. Between 2012 and 2023, monthly household water bills increased by roughly 64%, standing at an average of $51, primarily due to increased labor costs and pressure from inflation.[13] Just over 47% of water utilities reported an increase in per-account water sales, significantly more than the 28% that reported increases in 2020, before the start of the COVID-19 pandemic.[14] Despite this, only 20% of water utilities reported being fully able to cover the cost of drinking water services.[15]

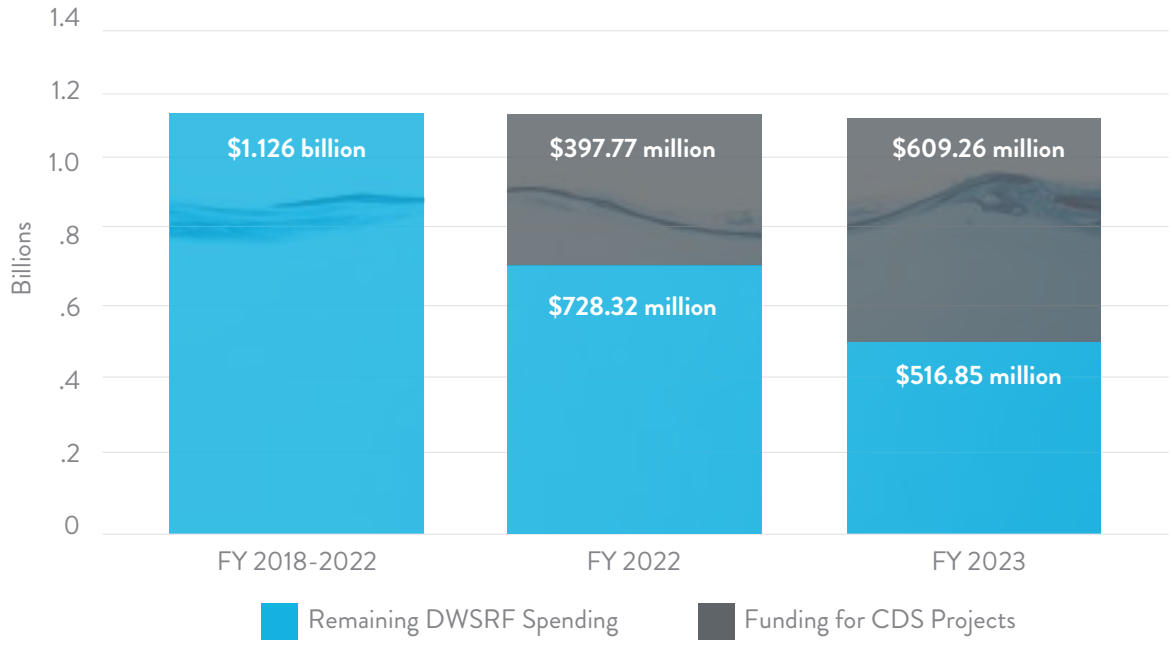
Smaller utilities often face more vexing challenges than larger utilities. Smaller, disadvantaged communities usually face water rates that exceed levels considered affordable because there is such a small base of ratepayers. Larger systems can spread costs over a larger population and provide lower costs per customer.[16]

At the federal level, the U.S. provides financing support through the Drinking Water State Revolving Fund (DWSRF) program. The DWSRF program provides states capitalization to finance low-interest loans for drinking water infrastructure projects. States are required to provide a 20% match of federal funds, and they may also set aside 31% of their capitalization grants for non-infrastructure needs. In 2021, the DWSRF was reauthorized under the IIJA at $15 billion over 5 years in federal appropriations over five years. Additionally, IIJA appropriated an additional $31 billion for the DWSRF to support additional capitalization, remove lead service lines, and address emerging contaminants over five years. The law also requires that states provide 49% of DWSRF general program funds and lead service line replacement funds to disadvantaged communities through grants or forgivable loans.

Although IIJA funds provide a needed boost for drinking water infrastructure, annual congressional appropriations for the DWSRF have fallen below the one-time investments in the infrastructure law. Since Fiscal Year 2022, the program has been appropriated at more than $1 billion below authorized funding levels. Additionally, DWSRF funding totals include designated Congressionally Directed Spending (CDS) for water infrastructure projects, colloquially referred to as earmarks, distributed essentially as grants. The practice reduces the total annual capitalization funds that go directly to states for their revolving fund programs, thus reducing funds available for state projects and taking decision-making away from the state entities that are most familiar with community needs. Between FY22 and FY23, more than $1 billion was taken from the DWSRF program for earmarks, resulting in a nearly 45% reduction in capitalization grants for states and an almost 45% reduction in set-asides.[17]

Some large water utilities with strong financial positions choose to access bond financing for large infrastructure projects. This is a viable option for a very small portion of total utilities and offers some benefits over the compliance necessary to access DWSRF.

DWSRF Funds Redirected to Congressionally Directed Spending (in billions)



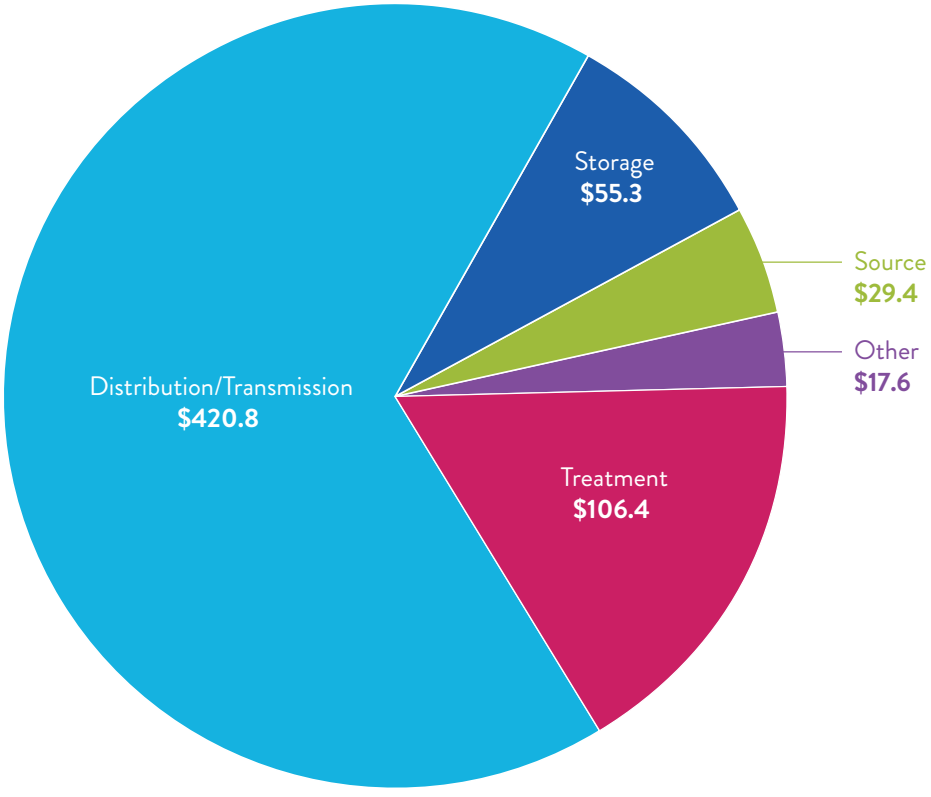
Source: Association of State Drinking Water Administrators

Another financing tool used by the EPA to support drinking water projects is the Water Infrastructure Finance and Innovation Act (WIFIA) program, which provides sponsors of large projects (generally over $20 million) with financing. Like the DWSRF, WIFIA was reauthorized under IIJA. Unlike the DWSRF, however, WIFIA has received more funding from Congress than its authorized levels. WIFIA received $69 million in FY22, $76 million in FY23, and $72 million in FY24. Even with the slight decrease in FY24, federal appropriations were significantly higher than the authorized annual level of $50 million. As of December 2023, the WIFIA program supported $43 billion in total water infrastructure investments, including $840 million to address lead in drinking water, and eliminated 100 water main breaks annually.[18]

FUTURE NEED

ASCE's 2024 *Bridging the Gap* economic study found that the projected gap between drinking water infrastructure needs and investments in 2024 stood at $309 billion and is expected to grow to $620 billion by 2043.[19] According to the EPA's 2023 national needs assessment, America needs $625 billion over the next 20 years to reach a state of good repair. That is 30% more than its previous assessment in 2018.[20] While this provides a snapshot of the nation's needs and does not contain data from every public water system in the country, the most recent assessment had a response rate of 97% of utilities from whom data was requested.[21] Water distribution and transmission infrastructure accounts for $421 billion (67%) of total future needs, followed by treatment needs accounting for 55.3 billion (17%).[22]

Total 20-Year State Need by Infrastructure Project Category *(in billions; January 2021 dollars)*



Source: U.S. Environmental Protection Agency

OPERATION AND MAINTENANCE

Water utilities are taking steps to improve responsiveness to maintenance challenges. The sector is using industry-related expertise, data, and predictive technologies to streamline the process of defect detection and asset failure prediction. These efforts are reducing reactive replacements and improving proactive, planned maintenance. Industry guidelines encourage 65% scheduled to 35% reactive maintenance. From 2015 to 2023, the portion of utilities that have improved their ability to track the planned-to-reactive maintenance ratio has increased from 37% to 42%. Furthermore, of the utilities tracking this ratio, more are seeing improvements in their ratio: 21% growing to 27% over the same period.[23] Finally, approximately 70% of water utilities have a pipe replacement program, indicating that utilities are taking a proactive approach to replacing aging and failing infrastructure.[24]

Despite some progress, workforce challenges remain an issue. In 2020, EPA found that approximately one-third of the nation's drinking water and wastewater workforce will become eligible to retire over the decade.[25] The median age of the water workforce is 48 years old, slightly older than the national average across occupations, whereas only 10% of the water workforce is under the age of 24.[26] Efforts have been made in recent years to address these challenges. At the federal level, in 2024, EPA made $20 million available to 13 workforce development organizations in 11 states and the District of Columbia through its Innovative Water Infrastructure Workforce Development Program that supports activities such as internship and apprenticeship programs, K-12 higher education programs, and other activities to help address water utility employment needs. States are also taking on the challenge of building their water workforce pipeline. In 2023, Texas passed a law allowing high school students who meet training and testing requirements to obtain provisional water or wastewater operator licenses while still in school, followed by obtaining a permanent license when they turn 18 and graduate from high school.[27]

Additionally, asset management serves as a valuable tool to minimize the costs of owning and operating infrastructure systems while meeting customer needs. Asset management plans can help improve decision-making to benefit ratepayers and communities.[28] Many states require utilities to implement asset management plans as a condition of receiving public funds, but no such federal requirement exists. In 2024, 13 states required some form of asset management for drinking water utilities, whereas 22 states provided financial assistance to support the development of asset management plans either through DWSRFs or other state funding mechanisms.[29] Overall, just over 30% of utilities have fully implemented an asset management plan, and just under half are in the process of implementing one.[30]

PUBLIC SAFETY

Since 1974, the EPA has regulated the nation's public drinking water supply through the Safe Drinking Water Act (SDWA). In 2022, only 4% of public water systems reported violations of a health-based drinking water standard where a contaminant was detected that exceeded allowable limits or water treatment requirements were not met, roughly equal to 2020 and 2021.[31]

In 2023, the EPA found that 9.2 million lead service lines are in operation across the country, and the following year the federal government set a goal to remove all lead service lines within 10 years.[32] In recent years, several U.S. cities have used federal funds and are taking a proactive approach to lead service line replacement. Since 2016, Pittsburgh, Denver, and Detroit have removed more than 45,000 lead service lines from their systems. According to a recent survey, 68% of utilities implement lead service line replacement programs, and 38% reported that planned capital improvement projects include lead service line replacement.[33] However, many utilities across the nation, typically those with younger systems, do not have lead service lines.

EPA estimates that removing all lead service lines would cost $45 billion, and removing lead service lines connected to private residences often falls to the homeowner, with an average cost of about $10,000.[34] Some cities, such as Milwaukee, WI, have implemented programs to cover the costs of lead service line removal for homeowners. At the same time, many cities have held off on similar programs

U.S. CITIES LEAD THE WAY ON LEAD SERVICE LINE REMOVAL

According to a recent survey, just over 66% of water utilities are implementing lead service line replacement programs.

PITTSBURGH, PA

Since 2016, Pittsburgh has replaced more than 11,000 lead service lines from its water system. The city has set a goal of removing all lead service lines by 2026.

DETROIT, MI

Detroit has replaced nearly 9,500 lead service lines since 2018, including more than 5,000 in 2024 alone. Detroit's lead service line replacement program prioritizes removal in neighborhoods populated by vulnerable communities such as children, the elderly, and low income earners.

DENVER, CO

Denver has replaced more than 25,000 lead service lines since 2020. In addition, the city provides free water filters for residents to use for the first 6 months after a lead service line is removed, and has expanded public outreach and communication to provide guidance about the program.

because such assistance can be deemed taxable income, which significantly increases tax burdens on families.[35] Removal is further complicated because there is no database of homes with lead service lines. A few cities, including Washington, DC, and Cleveland and Cincinnati, OH, have more detailed maps of lead service lines within their network. Free lead testing kits also increase surveillance ability, such as those provided by Cincinnati.[36]

Utilities also face ongoing challenges addressing emerging contaminants, such as per- and polyfluoroalkyl substances (PFAS), and the regulatory requirements needed to remain in compliance with SDWA. These substances, which have been widely used in the manufacture of many everyday products, have been shown to pose significant health risks and can easily contaminate water supplies, soil, and air. A recent study found that at least one PFAS can be detected in 45% of all U.S. drinking water.[37] It is estimated that water supplies at nearly 7,500 locations nationwide contain PFAS, affecting more than 130 million people.[38] IIJA appropriated $9 billion to address challenges posed by PFAS and other contaminants, and EPA has announced new enforcement thresholds for certain PFAS to be removed from drinking water under SDWA as part of the first-ever National Drinking Water Standard for PFAS. A key challenge, however, is that monitoring and eliminating these substances will likely fall to utilities. Many utilities may be unable to take on this financial burden because the estimated annual cost to install treatment systems to remove these substances is more than $3.8 billion.[39] Although federal funds are available, a larger and more sustained federal effort to assist utilities with PFAS clean-up may be required.

Drinking water systems are also becoming a more frequent target of cyberattacks. Cyber threats pose risks of treatment, distribution, and storage disruptions; damage to critical components such as pumps and valves; and altering levels of chemicals in water supplies to dangerous amounts.[40] Water systems nationwide have experienced attempts to breach their cyber defenses. In response, 82% of water utilities have developed and, in many cases, fully incorporated cybersecurity plans.[41] However, since September 2023, EPA has reported that more than 70% of water systems that have been inspected violate SDWA Risk and Resilience Assessment requirements.[42]

RESILIENCE AND INNOVATION

The effects of more extreme and frequent weather events continue to place stress on the nation's water systems, making resilience key. Increasingly powerful hurricanes, high winds, and more frequent flooding can lead to pipe breakage, can cause poor water quality, and can impede the efficient operation of water systems. Drought conditions that produce more frequent wildfires can impact physical infrastructure and water quality.[43] In 2018, Congress passed the America's Water Infrastructure Act, which required drinking water utilities to complete risk and resilience assessments of their systems. Utilities serving populations with at least 50,000 people were required to certify completion of these assessments by 2020; utilities serving 3,300 to 50,000 people were required to certify by 2021. However, by 2023 only 72% of utilities had implemented or were in the process of preparing risk and resilience assessments.[44] Utilities are required to complete these assessments every five years and will be required to submit their latest assessments by 2025 (2026 for smaller utilities). Despite this, in 2024, utilities ranked increasing their systems' resilience to climate extremes and other uncertainties as a top priority.[45]

Nationwide, utilities are embracing the greater use of digital technology and data-driven decision-making. In 2023, 43% of utilities planned to install new IT systems for water treatment or update existing systems, and 46% planned to install or update digital meter reading systems.[46] These innovations support greater efficiency of water utilities and can help improve water quality, keep rates low, and reduce a utility's carbon footprint.

Photo: chekart

RECOMMENDATIONS TO RAISE THE GRADE

- Direct an annual appropriation of $3.4 billion to the DWSRF program and ensure congressionally directed spending for community projects does not reduce the amounts made available to states.
- Increase federal and local support to recruit, train, and retain the next generation of the drinking water sector workforce to help offset expected retirements.
- Develop and fund affordability programs to ensure low-income and vulnerable communities do not bear a disproportionate burden of rate increases.
- Provide federal support for monitoring and removal of PFAS from public water systems, especially for smaller systems serving low-income communities.
- Continue to prioritize funding and assistance for removing and replacing lead service lines to improve public health and safety.
- Enforce the requirement that all drinking water utilities complete risk and resilience assessments of their systems per the America's Water Infrastructure Act.
- Increase the number of utilities updating or installing digital technologies to improve system operations and efficiency.
- Where possible and feasible, efforts should be made to merge smaller public water systems to expand ratepayer bases, thereby providing a greater ability to meet water utility demands.
- Provide expanded and more sustained grant funding for public water utilities to cover the cost of monitoring and removing PFAS from drinking water.
- Increase the number of states that require asset management plans for drinking water utilities and create or expand state funding mechanisms to support the development and implementation of asset management plans.

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