American Water Works Association

Beyond the Replacement Era:

Balancing Compounding Infrastructure Needs With Household Affordability

ONEWATER ECON

RAFTELIS

FOREWORD

Beyond the Replacement Era

Strong, reliable drinking water infrastructure underpins the health and economic vitality of our communities—but the cost of sustaining it is rising rapidly and straining household affordability. Over the past quarter-century, the American Water Works Association (AWWA) has actively raised the conversation about buried water infrastructure above ground, defining the challenge, informing policymakers, and advancing solutions to assist communities and address affordability. Still, respondents to AWWA's 2026 State of the Water Industry survey name water infrastructure renewal and replacement as the top concern in the sector – as they do most every year -- followed closely behind by how to finance those improvements.

This new report verifies their deep-seated concerns. *Beyond the Replacement Era* provides an unprecedented assessment of the headwinds facing communities as they seek to provide robust, sustainable water services through the year 2050.

Key Takeaways from *Beyond the Replacement Era* include:

1. The Water Sector Has Entered a New Cost Era

Drinking water utilities are no longer facing just an asset-replacement challenge; they are confronting a compounding set of cost drivers that include regulatory compliance, climate resilience, cybersecurity, and treating more complex sources. Over the next 25 years (2026–2050), total drinking water infrastructure needs are projected at $2.1–$2.4 trillion (2025 dollars), far exceeding earlier estimates tied solely to buried infrastructure. These pressures signal a structural shift in the cost of providing safe drinking water, not a temporary spike.

2. There Is a Persistent and Growing Funding Gap

Current capital spending by drinking water utilities averages about $33.6 billion per year, while the annual investment needed to meet projected requirements is approximately $90.2 billion. This leaves an annual funding gap of roughly $56.6 billion, requiring a 168% increase in capital investment to close it. With a few exceptions (such as the Infrastructure Investment & Jobs Act (IIJA)), federal contributions have been limited — about 3.9% of total public infrastructure sector spending is on all water sector utilities, far below levels provided to other infrastructure sectors.

3. Household Drinking Water Bills Are Likely to More Than Double

If communities rely exclusively on revenue from water bills to close the funding gap, average annual household drinking water bills would rise from $429 in 2025 to $969 by 2050 (2025 dollars) — more than doubling in real terms. Even under a baseline spending scenario, bills are projected to increase to $685, reflecting rising operating and maintenance costs.

4. Affordability is at a Tipping Point

If the funding gap is addressed entirely through increases in household water rates, an estimated 30.4 million households (21.5%) would spend more than 2.5% of their income on drinking water, and 53.5 million households (37.8%) would exceed a 1.5% income threshold. The report estimates that $13.6 billion per year in assistance by 2050 would be needed to keep water bills below commonly cited affordability benchmarks. These impacts would disproportionately affect low-income households and small-system communities.

5. Core Federal Infrastructure Loan Programs are Critical

The IIJA provided a historic and much needed infusion of funding that expires after FY2026. However, it cannot fully solve the long-term gap. With total annual capital and O&M needs projected to reach $200.3 billion by 2050, temporary programs will not fully stabilize the sector. Core funding programs like the State Revolving Loan Funds (SRF) and the Water Infrastructure Finance and Innovation Act (WIFIA) remain critical, helping water utilities access low-cost loans with extended repayment periods and customizable terms. Reductions in financing costs can moderate rate increases and help keep water affordable.

AWWA's Infrastructure and Affordability Work in the 21st Century

Beyond the Replacement Era extends a series of AWWA reports that have characterized the U.S. water infrastructure challenge over the past 25 years. *Dawn of the Replacement Era* in 2001 introduced the reality that buried infrastructure, primarily the millions of miles of water mains across the United States, was entering a time where increased investment would be critical. Many of the findings from that report ring true today:

Pipes are expensive, but invisible
Pipes are hearty, but ultimately mortal
Increased expenditure is needed to climb the ramp and avoid a gap
Addressing affordability is at the heart of the challenge

In 2006, AWWA published *Water Infrastructure at a Turning Point*, which encouraged utilities to adopt asset management strategies to drive the systematic renewal of our water infrastructure. Using the metaphor of a well-maintained car to explain the need for proactive investment, the guide explained that utilities face a choice — the turning point—to either to adopt strategies that will lead to the systematic renewal of our water infrastructure or accept the erosion over time of reliable water service, public health, and environmental quality.

Buried No Longer: Confronting America's Water Infrastructure Challenge (2012) explored the drinking water infrastructure challenge in unprecedented depth, revealing the timing of water main installation and life expectancy, materials used, replacement costs and shifting demographics. It found investment needs for buried drinking water infrastructure alone would total more than $1 trillion nationwide over the 25 years (between 2011 and 2035). It determined needs would exceed $1.7 trillion through 2050, split roughly between replacement and expansion. The report noted the cost of these investments would be borne mostly by consumers through higher water rates.

Concurrently, AWWA advocated for a new federal loan program, culminating in 2014 with the passage of WIFIA. WIFIA has since served as an important complement to the critical SRF loans, which help water systems reduce the cost of infrastructure projects and moderate rate increases for consumers.

The Ides of Affordability

Throughout the infrastructure conversation, affordability concerns have steadily risen. In 2004, AWWA published the first of three editions of *Thinking Outside the Bill*, elevating the fact that water and wastewater rates in many communities were rising faster than inflation and low-income wages, leading households to spend an increasing percentage of their income on water and wastewater bills. The third edition (2022) provided new metrics for assessing affordability and an actionable guide to walk utility leaders through diagnosing the problem and identifying solutions.

As affordability concerns swelled, AWWA advocated for increased federal support through the Low-Income Water Assistance Program (LIHWAP). At the same time, it partnered with the National Association of Clean Water Agencies (NACWA) and the Water Environment Federation (WEF) on *Developing a Water and Wastewater Utility Assistance Program* to help utilities design comprehensive assistance programs for households struggling to meet essential needs.

Recognizing the potential for a significant affordability challenge related to federal regulations, AWWA organized an expert panel that created a report in 2021 titled *Improving the Evaluation of Household-Level Affordability in SDWA Rulemaking: New Approaches.* The project aimed to help regulators better understand affordability at a household level. As communities work to replace lead service lines and address PFAS contamination under new regulations, rising water rates will further stress households with lower incomes.

A Water 2050 Challenge

Beyond the Replacement Era for the first time captures the scope of the drinking water infrastructure alongside other critical pressure points impacting affordability. Its reckonings extend to the year 2050, providing a timely challenge for AWWA's Water 2050 visioning initiative. The Water 2050 vision strives for a secure, sustainable, affordable, resilient, and innovative water future.

One of the core principles of Water 2050 is that just waiting for change is not a strategy. *Beyond the Replacement Era* lays out the realities confronting our water systems, and it also makes clear that the future is not predetermined. If we move forward collaboratively and with clear intent, we can transform today's realities into a stronger, more resilient water future.

Sincerely,

Heather Collins

President
American Water Works Association

David B. LaFrance

CEO
American Water Works Association

Acknowledgements
Many people were involved in the development of this report. In addition to the Raftelis and One Water Econ teams named in the main text, the following members and staff provided substantial contributions to its development.

Project steering committee
Colleen Arnold, Aqua America
Clayton Freed, City of Phoenix, AZ
Monica Hoyt, Carollo Engineers
Matt Junker, Municipal Authority of Westmoreland County, PA
Martin Tower, City of Austin, Texas

Project management
Adam Carpenter, PhD, AWWA

Reviewing and expert support
Rachel Gonsenhauser, AWWA
Kevin Morley, PhD, AWWA
Jay Tanner, AWWA
Steve Via, AWWA

Communications, editing, and graphics support
Derek Fisch, AWWA
Greg Kail, AWWA
Carita Parks, AWWA

Front Page Photo Credits
Large image: AU USAnakul/Shutterstock.com
Top inset image: PeopleImages/Shutterstock.com
Middle inset image: Beaver Water District
Bottom inset image: Orange County Water District

Prepared for

The American Water Works Association

by

J. Mastracchio, CFA, Z. Green, B. Kirsch, B. Vatter, P. Purdy
Raftelis

J. Clements and Claire Sheridan
One Water Econ

March 2026

Contents

Tables

Figures

List of Acronyms

ACS	American Community Survey
ALICE	Asset Limited, Income Constrained, Employed
ASCE	American Society of Civil Engineers
AWIA	America's Water Infrastructure Act
AWWA	American Water Works Association
BLS	Bureau of Labor Statistics
CBO	Congressional Budget Office
CDBG	Community Development Block Grant
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEX	Consumer Expenditure Survey
CPI	Consumer Price Index
CWS	Community Water Systems
DWINSA	Drinking Water Infrastructure Needs Survey and Assessment
DWSRF	Drinking Water State Revolving Loan Fund
FPL	Federal Poverty Level
FRED	Federal Reserve Economic Data
GAC	Granular Activated Carbon
GASB	Governmental Accounting Standards Board
GPCD	Gallons per Capita per Day
HBI	Household Burden Indicator
IIJA	Infrastructure Investment and Jobs Act
IOU	Investor-Owned Utility
IPR	Indirect Potable Reuse
IT	Information Technology
IX	Ion Exchange
LACSD	Los Angeles County Sanitation Districts
LCR	Lead and Copper Rule
LIHWAP	Low Income Household Water Assistance Program
LIWCAP	Low Income Water Customer Assistance Program
LQI	Lowest Quintile Income
LQPI	Lowest Quintile Poverty Indicator
LRP	Lead Reduction Program
LSLs	Lead Service Lines
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
MHI	Median Household Income
MWD	Metropolitan Water District of Southern California
NACWA	National Association of Clean Water Agencies
NCEI	National Centers for Environmental Information
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration

NPDWR	National Primary Drinking Water Regulation
NRW	Non-Revenue Water
O&M	Operations and Maintenance
OBMUA	Old Bridge Municipal Utilities Authority
OCCT	Optimal Corrosion Control Treatment
OT	Operational Technology
PFAS	Perfluoroalkyl and poly fluoroalkyl substances
PPI	Poverty Prevalence Indicator
PUMS	Public Use Microdata Sample
PWSC	Pure Water Southern California
R&R	Rehabilitation and Replacement
RI	Residential Indicator
RPPs	Regional Price Parities
SDWA	Safe Drinking Water Act
TOC	Total Organic Carbon
U.S.	United States
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WEP	Rural Development Water and Environmental Programs
WIFIA	Water Infrastructure Finance and Innovation Act
WPAFB	Wright-Patterson Air Force Base
ZLD	Zero-Liquid Discharge

Executive Summary

The American Water Works Association ("AWWA") has repeatedly highlighted the critical need for investment in drinking water system infrastructure, with prior assessments estimating more than $1 trillion nationwide over 25 years (2011-2035) to replace and expand aging drinking water systems.[1] Yet, these needs continue to escalate nationally as significant challenges and obligations on drinking water utilities compound. Beyond the ongoing costs to replace, repair, and expand infrastructure, drinking water utilities now face additional cost drivers associated with compliance with major federal regulations, the treatment of complex water sources, and essential resilience measures to protect against natural hazards and other threats. The research team evaluated projected capital and operating costs required to meet new regulatory requirements and to maintain and expand the nation's drinking water infrastructure.

This assessment examined existing data sources and recent regulatory impact analyses which contained cost data associated with these stressors and compared these against the current drinking water utility funding levels and household income trends. Based on this analysis, several key findings emerged regarding the drinking water utility funding gap and resulting affordability implications.

Infrastructure Investment Needs and Costs are Growing

The total cost to address the need for investment in drinking water infrastructure over the next 25 years (2026–2050) is estimated to be between $2.1 trillion and $2.4 trillion (in 2025 dollars). Replacement and rehabilitation of existing assets account for a significant portion of this total, but new cost drivers add hundreds of billions of dollars to the national tab of drinking water utility investment needs. These drivers include regulatory compliance for perfluoroalkyl and polyfluoroalkyl substances ("PFAS") treatment, lead service line replacement, and hardening systems against natural hazards. Still other drivers, such as the need to address cybersecurity and to develop alternative water supplies to improve resiliency and accommodate growth are known but do not currently have data to fully quantify.

Water Utility Capital Infrastructure Needs – 25-Year Costs

Cost Driver	25-Year Cost (in 2025 $ Billions)
Infrastructure Replacement, Rehabilitation, and Expansion	$1,728.4 - $1,757.1
Regulatory Compliance (PFAS and Lead Service Lines)	$94.1 - $105.8
Risk and Resilience	$263.6 - $561.1
Total	**$2,086.1 - $2,424.0**

[1] American Water Works Association, *Buried No Longer: Confronting America's Water Infrastructure Challenge*, Denver, CO, 2012; https://www.awwa.org/wp-content/uploads/Buried-No-Longer-Report.pdf.

Infrastructure Funding Gap

Current capital spending by drinking water utilities averages approximately $33.6 billion annually whereas the identified need averages $90.2 billion per year. To meet the identified needs, capital investment must increase by approximately 168%, corresponding to an annual infrastructure funding gap of $56.6 billion. Under current funding models, the federal government provides approximately 3.9% of total public spending on drinking water utilities, a significantly lower federal contribution than those to other infrastructure sectors such as highways (22.5%). Furthermore, while the Infrastructure Investment and Jobs Act ("IIJA") provided a temporary influx of capital funding support, these funds are scheduled to expire after FY2026 and prior appropriations will be expended over a few years, while drinking water utility operations and maintenance ("O&M") costs continue to rise at a rate exceeding inflation.

Projected Impact on Household Costs

If the identified funding gap is addressed entirely through increases in local household water rates, the financial burden on households will increase substantially. Under a baseline scenario, comprised of continued historical national spending trends, the average annual household drinking water bill is projected to rise from $429 in 2025 to $685 by 2050 (in 2025 dollars). However, if the entire funding gap is met by increasing local utility rates the average annual bill would then be projected to reach $969 by 2050. This represents an increase of roughly 126% - more than doubling the average household bill - over current levels (in 2025 dollars).

Affordability Analysis

The projected increase in water service costs significantly expands the segment of the population facing water affordability challenges. If the identified funding gap is closed entirely by increases in utility rates:

- Approximately 30.4 million households (21.5% of the U.S. total) would spend more than 2.5% of their income on drinking water services.
- Approximately 53.5 million households (37.8% of the U.S. total) would spend more than 1.5% of their income on drinking water services.

An estimated $13.6 billion in annual assistance from federal, state, or other sources (in 2025 dollars) would be required by 2050 to support these households to ensure water bills remain below the 2.5% affordability threshold. Recognizing that 2.5% of household income is not a perfect threshold for gauging affordability, its use allows us to quantify the scope of the affordability challenge. These projected impacts on affordability pertain only to drinking water. In many cases, the same water utility ratepayer will also need to absorb the escalating cost of other water sector utilities, such as wastewater and stormwater.

Conclusion

The investment needs for drinking water infrastructure are estimated to exceed $2.1-2.4 trillion for 2026-2050. If drinking water infrastructure needs are met through local rates alone, drinking water bills will more than double by 2050, posing much greater water affordability challenges and impacting many more households than today. Recognizing the need for utilities and the local communities they serve to do their part to invest towards addressing these challenges, the size of the challenge to close the infrastructure gap while maintaining affordability, will also require a significant, sustained federal investment in infrastructure and affordability.

1. Introduction

The American Water Works Association ("AWWA") has been a leader in highlighting the critical need for investment in drinking water infrastructure in the United States ("U.S.") and throughout North America. The *Dawn of the Replacement Era* (2001)[2] demonstrated that large portions of water mains were aging and in need of replacement; *Buried No Longer: Confronting America's Water Infrastructure Challenge* (2012)[3] revealed that more than $1 trillion would be required over 25 years to replace and expand drinking water infrastructure. However, drinking water utilities are now entering a new era where these foundational needs are no longer the primary drivers of investment.

Today's drinking water utilities face compounding challenges that extend beyond the traditional repair of aging assets and new construction to accommodate growth. While the need to replace, rehabilitate, and expand infrastructure remains critical, utilities must also contend with an additional set of financial stressors that were not fully captured in previous eras. These pressures are driving up costs at an unprecedented rate and include the following:

- Major changes to regulatory landscape: Simultaneous compliance with existing, along with new and evolving, federal and state regulations, particularly those requiring advanced treatment for per- and polyfluoroalkyl substances ("PFAS") and the replacement of lead service lines.
- Source water complexity: The need to develop and utilize alternative water supplies that are more difficult and costly to treat as population growth and climate stressors limit the availability of existing, high-quality sources of water.
- Risk and Resilience: Urgent requirements to harden infrastructure against observed and reasonably anticipated natural and manmade hazards, along with the critical need to implement robust cybersecurity measures to protect essential systems.
- Operational Realities: Escalating costs associated with complex waste disposal requirements, advanced drinking water treatment, and inflationary pressures on utility operations and maintenance ("O&M") costs. Although beyond the scope of this report to fully assess, operational considerations may necessitate greater cooperation and economy of scale amongst utilities in the future.

This report brings together these interconnected stressors to update and reframe AWWA's previous estimate of the total investment required to sustain the nation's drinking water systems. It aims to provide policy makers and stakeholders with a clear understanding of the scope of necessary investment and the cumulative financial impact these drivers will have on households and communities.

Furthermore, this analysis addresses the growing affordability challenge. As costs rise to meet these needs, the financial burden on customers increases, necessitating a re-evaluation of how these needs are funded. This report highlights that while recent federal funding measures like the Infrastructure Investment and Jobs Act ("IIJA") provide a welcome funding source, they are time-limited and insufficient to close the widening gap. By estimating the costs of these drivers, this report underscores the risks of inaction: delaying these investments or forgoing necessary maintenance will stifle economic growth and could lead to compliance failures and compromise public health protections that remain drinking water utilities' highest priority.

---

[2] American Water Works Association. *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure*, Denver, CO, May 2001.

[3] American Water Works Association. *Buried No Longer: Confronting America's Water Infrastructure Challenge*, https://www.awwa.org/resource/water-infrastructure-funding/.

2. Cost Drivers of Infrastructure Needs

The total investment required to sustain the nation's drinking water infrastructure in the future is driven by aging assets, expansion needs, and emerging financial stressors. To capture the full scope of this challenge, this analysis aggregates projected expenditure needs across three primary categories: the replacement and expansion of physical assets, the compliance with evolving federal regulations, and the critical hardening of facilities against natural hazards. These estimates reflect the cumulative investment necessary to help ensure the long-term service reliability and public health protection over the 25-year period spanning from 2026 through 2050.

Major cost drivers were segregated into the following categories and evaluated based on existing federal data, regulatory impact analyses, and supplemental industry research:

1. Infrastructure Replacement, Rehabilitation, and Expansion
2. Regulatory Compliance
3. System Resilience and Operational Risk

Other drivers, such as the need to address cybersecurity threats and the need to treat more challenging water supplies to meet demand growth, will further increase costs but do not currently have robust data to fully quantify, and are discussed separately.

2.1. Infrastructure Replacement, Rehabilitation, and Expansion

U.S. drinking water utilities are inherently capital intensive, relying heavily on physical infrastructure to provide their service, requiring significant and sustained investment, which is a baseline financial requirement. This category includes the costs associated with rehabilitation and replacement of aging infrastructure, as well as necessary capacity expansion to support growth.

2.1.1. Infrastructure Replacement and Rehabilitation

There is already a well-established understanding of the need for significant investment in water infrastructure throughout the U.S. The U.S. Environmental Protection Agency ("USEPA") regularly surveys drinking water utilities nationwide to assess the capital costs they anticipate over the next 20 years. The USEPA released The *Drinking Water Infrastructure Needs Survey and Assessment, Seventh Report to Congress* ("DWINSA") in 2023, demonstrating the scale of the reinvestment needs facing water systems.[4] USEPA indicates that "comprehensive infrastructure costs, including engineering and design, raw materials and equipment purchases, and construction labor" are captured in the DWINSA. This widely accepted, though inherently conservative, assessment estimated that drinking water systems will need more than $625 billion in investment between 2021 and 2040 (in 2021 dollars). This figure includes costs associated with infrastructure replacement and rehabilitation of sources of supply infrastructure, water transmission and distribution mains, water treatment plants, and storage facilities.

[4] USEPA. *Drinking Water Infrastructure Needs Survey and Assessment: Seventh Report to Congress*. EPA 816-R-23-001, March 2023. 2023. *EPA;* https://www.epa.gov/dwsrf/epas-7th-drinking-water-infrastructure-needs-survey-and-assessment.

We aligned this estimate with the scope of this study, which estimates the need over a 25-year period from 2026 to 2050. We adjusted the DWINSA estimate for inflation[5] and extended the estimate over the 25-year period. This calculation results in an estimated replacement and rehabilitation need of $960.2 billion over the forecast period. The DWINSA estimate, combined with our inflation and temporal adjustment, is summarized in Table 1.

Table 1. Infrastructure Replacement and Rehabilitation Needs – USEPA DWINSA Estimate

Category	USEPA Estimated Costs in 2021$ (20-Year Need)	Updated Estimated Costs in 2021$ (20-Year Need)
Transmission/Distribution	$420.8B	$646.4B
Treatment	$106.4B	$163.4B
Storage	$55.3B	$85.0B
Source	$24.9B	$38.3B
Other	$17.6B	$27.1B
Total	**$625.0B**	**$960.2B**

It is important to note that the DWINSA assessment contains inherent limitations that are likely to result in underestimating the total infrastructure replacement and rehabilitation requirements:

- *Documentation Requirement:* Utilities can only respond with projects that have been documented, have at least begun the planning phase, and have cost estimates. Consequently, if a utility lacks at least a planning phase estimate of project costs, need is not accurately reflected and as such, a significant portion of its actual requirements will remain unquantified and excluded from the survey.
- *Eligibility Constraints:* Only projects eligible for the Drinking Water State Revolving Loan Fund ("DWSRF") can be submitted. While this restriction is useful to the government in determining DWSRF funding allocations to states, it renders many necessary projects ineligible for inclusion in the survey data.
- *Short Planning Horizon:* Utility responses were likely constrained by short-term planning cycles (e.g., five years), significantly distorting the aggregate documented need over a 25-year assessment period. For example, the utility costs for potential future population growth or major regulations are not included in the estimate if utilities have not planned for these costs within their current planning horizon.

[5] U.S. Bureau of Labor Statistics. (2025). Consumer Price Index for All Urban Consumers (CPI-U). Accessed at: https://www.bls.gov/cpi/data.htm.

Utilizing Water Loss Data to Help Justify Infrastructure Rehabilitation Needs

Physical water losses from water distribution systems, often termed Non-Revenue Water ("NRW"), serve as an ongoing critical indicator of distribution system degradation and help validate the urgent need for comprehensive infrastructure rehabilitation and replacement ("R&R") programs.

Quantification of the Results of Underinvestment
Water loss data support the significant ongoing scope of the water infrastructure rehabilitation challenges across the U.S. National studies cited by the USEPA indicate that, on average, 14% of treated water is lost to leaks within distribution systems. In some areas, reported loss rates can exceed 60%.[6] The American Society of Civil Engineers ("ASCE") reports that across the nation's 2.2 million miles of water pipes, a water main breaks approximately every two minutes.[7] This results in an estimated aggregate loss of 6 billion gallons of treated drinking water daily in the U.S. This volume is sufficient to meet the daily consumption needs of approximately 75 million people.

Financial Consequences
The economic consequences of high NRW rates reinforce the justification for R&R investment. Losses are not uniformly distributed. Bluefield Research reports that five high-density states, California, Texas, Florida, New York, and Illinois, account for over one-third of national losses, collectively losing 2.44 billion gallons daily. In these five states alone, the lost water translates to roughly $6.3 million in uncaptured daily utility revenue.[8]

Continued Need for Reinvestment
The high incidence and volume of water loss from leaky water distribution systems demonstrate that current infrastructure rehabilitation continues to be a significant challenge. Sustained investment in aging water utility infrastructure is not merely a discretionary capital expenditure but a critical requirement for improving the condition of water utility infrastructure, and to help ensure the long-term reliability and economic stability of the nation's water supply systems.

To provide an example of how the DWINSA needs estimate may be conservative, we examined national-level data regarding pipeline inventories, typical pipeline replacement cycles and unit costs, and prepared a bottom-up estimate of the replacement and rehabilitation needs for transmission/distribution pipelines. The *ASCE Report Card for America's Infrastructure (2025)* indicates the nation has about 2.2 million miles of water pipes and a water main break occurs on average every two minutes.[9] A typical replacement rate for water mains is approximately 1% per year (based on a 100-year lifespan), which means that every 100 years, all mains would be replaced.[10] Given the age of the nation's infrastructure, drinking water utilities should be targeting renewing and replacing at least 1% of their distribution/transmission pipelines each year in order to meet that long-term target. Some systems, facing age- and risk-related vulnerabilities, may require even higher annual rates (e.g., 2% or greater) of infrastructure renewal/replacement to achieve long-term stability if they have not kept up with the renewal/replacement needs in the past.[11]

Current planning level cost estimates for drinking water pipeline renewal are based on a cost estimate of $500 - $600 per linear foot (in 2025 dollars). This value is drawn from the literature and our recent project experience.[12] When applying a 1% annual renewal rate to the country's 2.2 million miles of pipeline

---

[6] "US water infrastructure: Making funding count," McKinsey & Company, November 24, 2021; https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count.

[7] American Society of Civil Engineers, 2021 Report Card for America's Infrastructure – Drinking Water; https://2021.infrastructurereportcard.org/cat-item/drinking-water-infrastructure/.

[8] "Water Losses Cost U.S. Utilities US$6.4 Billion Annually." Bluefield Research, April 28, 2025; https://www.bluefieldresearch.com/ns/water-losses-cost-u-s-utilities-us6-4-billion-annually/.

[9] American Society of Civil Engineers, A Comprehensive Assessment of America's Infrastructure, 2025 Report card for America's Infrastructure; https://infrastructurereportcard.org/.

[10] American Water Works Association. *Buried No Longer: Confronting America's Water Infrastructure Challenge*.

[11] American Society of Civil Engineers, *Breaking water mains present US, Canada with $452B problem,* April 22, 2024; https://www.asce.org/publications-and-news/civil-engineering-source/civil-engineering-magazine/article/2024/04/breaking-water-mains-present-us-canada-with-$452b-problem.

[12] "Estimation of Water Pipe Installation Construction Cost," Chee, Lansey, Chee, American Society of Civil Engineers, 2018; https://ascelibrary.org/doi/10.1061/%28ASCE%29PS.1949-1204.0000323.

(equivalent to 22,000 miles per year), the resulting annual need is estimated to cost $58 billion to $70 billion for pipeline renewal/replacement.

Extending this estimate over the 25-year forecast period, and excluding future inflation, the total capital need for distribution and transmission pipelines is projected to range from $1.45 trillion to $1.74 trillion in 2025 dollars, which is approximately 50% to 80% higher than the transmission/distribution estimate included in the DWINSA shown in Table 1. This projected need provides another reference point using recent data of the magnitude of the challenge, demonstrating that the DWINSA estimate is likely conservative. Even the documented DWINSA drinking water infrastructure replacement and rehabilitation need, though estimated at only $960 billion for the 2026 to 2050 period, underscores a financial challenge of staggering proportions for the nation's drinking water utilities.

2.1.2. Infrastructure Service Expansion

The DWINSA estimate explicitly excludes expansion or growth-related capital projects. However, these expenditures represent a major cost driver for many water systems across the U.S that are experiencing population growth. These expenditures must be financed either by new development, by existing rate payers, or both in some combination. Although new expansion often helps fund growth-related infrastructure through system development fees and the addition of revenue from new customers, those contributions are not guaranteed. As a result, existing customers may still be responsible for paying for part or all of the costs associated with these growth-related projects. We estimated the growth-related drinking water distribution/transmission system and treatment capacity costs over the 2026-2050 period using readily available data, as described below.

2.1.2.1. Distribution/Transmission Systems

Expansion-related capital expenditure needs for conveyance infrastructure, pipelines connecting treatment facilities to new service areas and to new customers, were estimated using prior AWWA research. The 2012 *Buried No Longer* report[13] estimated expansion-related distribution and transmission pipeline costs at $802.2 billion over a 40-year period (2011 – 2050). Taking the annual cost need for the 40-year period, adjusting this figure to the current 25-year timeframe (2026-2050), and inflating to 2025 dollars, yields an aggregate cost need for expansion-related water mains of $739.2 billion for the 2026 – 2050 period.

2.1.2.2. Treatment Capacity

A three-part methodology was employed to quantify the cost associated with augmenting treatment capacity for population expansion and to bridge the existing national data gap:

- Projected Population Growth. We based our calculation on the 2023 U.S. Census Bureau projection for national population growth of approximately 22 million people from 2026 to 2050.[14]
- Demand Modeling. We used an average water use of 82 gallons per capita per day ("gpcd"),[15] and applied a peaking factor of 1.6. This figure is drawn partially from the National Research Council[16]

---

[13] American Water Works Association. *Buried No Longer: Confronting America's Water Infrastructure Challenge*.

[14] U.S. Census Bureau. National Population Projections: 2017–2060. U.S. Department of Commerce, 2017; https://www.census.gov/data/datasets/2017/demo/popproj/2017-popproj.html.

[15] Dieter, C.A., Maupin, M.A., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2018, Estimated use of water in the United States in 2015: U.S. Geological Survey Circular 1441, https://doi.org/10.3133/cir1441.

[16] National Research Council. 2006. *Drinking Water Distribution Systems: Assessing and Reducing Risks*. Washington, DC: The National Academies Press. https://www.nationalacademies.org/projects/WSTB-U-04-06-A.

and from data from our recent rate studies to forecast maximum to average day usage and for long-term capital needs.

- Cost Estimate: We used an industry-based cost range of $10 to $20 per gallon for new treatment capacity. Current drinking water utility planning estimates for drinking water treatment capacity are generally in the range of $10 to $20 per gallon of treatment capacity. This figure is drawn from recent water treatment plant projects, and our recent project experience.[17]

Based on these parameters, the projected cost for growth-related treatment capacity for 2026-2050 ranges from $29.0 billion to $57.7 billion.[18]

2.2. Regulatory Compliance

Costs associated with compliance with existing regulations are in many instances addressed in the existing cost estimates. However, certain regulatory requirements represent critical, non-discretionary cost drivers that are largely excluded from previous infrastructure needs surveys because those surveys pre-date the finalization. Regulations addressing PFAS and lead service line replacement, as described below, fall into this category and therefore are additional costs beyond those captured in prior assessments. These costs must be incurred over compressed compliance timelines, placing immediate pressure on utility finances.

2.2.1. Per- and Polyfluoroalkyl Substances (PFAS) Treatment

The finalization of the USEPA's National Primary Drinking Water Regulation ("NPDWR") for PFAS in 2024 set new, enforceable standards for six types of PFAS to achieve new Maximum Contaminant Levels ("MCLs") in drinking water systems.[19] The NPDWR will, in many cases, require water systems across the country to install advanced treatment to reduce PFAS concentrations to below the new regulatory standards in compliance with the MCLs. Based on a 2023 industry cost model, the annualized costs associated with capital improvements and O&M expenses for PFAS treatment were estimated to be $5.21 billion per year.[20] Approximately 66% of these costs were estimated to be capital costs for new and advanced equipment added to treatment facilities. The remaining 34% of the estimated PFAS treatment costs were for ongoing annual operations costs for materials, maintenance, testing, disposal of removed PFAS, reporting, etc. This estimate was further updated in 2024 to account for the MCLs set by the USEPA in the final NPDWR.[21] Based on the updated 2024 cost model, and adjusting for inflation, the annualized costs associated with capital and O&M expenses for PFAS treatment over the 25-year timeframe (2026-2050) was estimated to be between $59.2 billion and $77.6 billion. This estimate is summarized in Table 2.

---

[17] For example, recent water treatment plant expansion projects in Austin, TX, Columbus, OH, and Tampa, FL were estimated to cost $12 per gallon, $17-28 per gallon, and $15 per gallon, respectively. The Austin estimate is from email from Martin Tower, Infrastructure Management Division Manager at Austin Water, City of Austin 2025. The Columbus estimate from: https://cbuswater.com/wp-content/uploads/2024/08/Contractor-Open-House-Update-08022024.pdf. The Tampa estimate is from: https://www.tampabaywater.org/supply/projects/surface-water-plant-expansion/.

[18] Per input from professionals with experience in these states.

[19] USEPA. PFAS National Primary Drinking Water Regulation. Federal Register 89, (April 26, 2024): 2024-07773. https://www.federalregister.gov/documents/2024/04/26/2024-07773/pfas-national-primary-drinking-water-regulation.

[20] WITAF 56 Technical Memorandum, PFAS National Cost Model Report, Prepared by Black & Veatch for AWWA, March 7, 2023; https://awwa.org/wp-content/uploads/AWWA-Comments-on-Proposed-NPDWR-for-PFAS-excl-AppendixE.pdf.

[21] Estimating the National Cost to Remove PFAS from Drinking Water using UCMR 5 Data, Prepared by Black & Veatch and Corona Environmental Consulting for AWWA, July 11, 2024; https://www.awwa.org/wp-content/uploads/Final-Technical-Memorandum-Updating-National-Cost-Estimate-for-PFAS-Standards-using-UCMR-5.pdf.

Table 2. PFAS Treatment Cost Needs

Description	Low-End Estimate (2025$)	High-End Estimate (2025$)
Annual O&M	$0.8B	$1.1B
Total Capital Costs	**$39.2B**	**$50.9B**

The majority of the cost burden to address PFAS is concentrated in near-term capital costs, since the current PFAS MCL compliance deadline is set for April 26, 2029.[22] With this compliance deadline, drinking water utilities are projected to incur substantial capital expenses (estimated at $39.2 billion to $50.9 billion) within the first five years of this report's forecast period. Annual O&M costs are projected to range from $0.8 billion to $1.1 billion. We included the O&M and capital cost estimates for PFAS treatment in our 25-year estimate. In May 2025, Administrator Zeldin publicly announced USEPA's intention to extend the MCL compliance deadline to 2031,[23] but that is not yet effective at the time of this report.

2.2.2. Lead Service Line Replacement

In the wake of the Flint, Michigan water crisis, additional regulations were created that required removal of all lead pipes from drinking water systems by 2037.[24] The Lead and Copper Rule Improvements also require more rigorous testing of drinking water and a lower threshold requiring communities to take action to protect people from lead exposure in water. In addition, the rule requires improvements in communication within communities so that families are better informed about the risk of lead in drinking water, the location of lead pipes, and plans for replacing them. USEPA estimates there are 4.0 million lead service lines ("LSLs") that will require replacement.[25] This estimate is based on the November 2025 LSLs estimate from USEPA.

Cost estimates associated with the replacement of all LSLs vary greatly between sources. One estimate prepared by the USEPA in 2019 estimated the average cost to replace LSLs to be $4,700 per line.[26] In 2022, the AWWA commissioned a report prepared by CDM Smith to refine the estimate of the cost of full LSL replacements in the U.S.[27] The CDM Smith report estimates an average cost of $12,500 (in 2022 dollars) per LSL. This higher estimate is based on costs from four different surveys and used updated actual identification, engineering, replacement, and customer outreach costs from the surveyed utilities.

Using the information contained in the above-referenced reports, we estimated the total cost of LSL replacement by multiplying the estimated average replacement unit cost of $12,500 per line by the number of estimated LSLs (4.0 million). Adjusting for inflation, we calculated a cost of $54.9 billion over the 25-year timeframe (2026-2050). This regulatory-driven cost has a compliance deadline of 2037, meaning these costs will likely be incurred by drinking water utilities over a compressed timeframe of 13 years.

---

[22] USEPA. PFAS National Primary Drinking Water Regulation.
[23] *U.S. EPA Announces It Will Keep Maximum Contaminant Levels for PFOA/PFOS*EPA Press Office, May 14, 2025; https://www.epa.gov/newsreleases/epa-announces-it-will-keep-maximum-contaminant-levels-pfoa-pfos.
[24] USEPA. Lead and Copper Rule Improvements; https://www.epa.gov/ground-water-and-drinking-water/lead-and-copper-rule-improvements.
[25] USEPA. 2025 Update to the 7th Drinking Water Infrastructure Needs Survey and Assessment November 2025. https://www.epa.gov/system/files/documents/2025-11/fact-sheet-2025-7th-dwinsa-update.pdf.
[26] USEPA. "National Primary Drinking Water Regulations: Proposed Lead and Copper Rule Revisions." Proposed Rule. Federal Register 84, no. 219 (November 13, 2019): 61684–61774. https://www.federalregister.gov/documents/2019/11/13/2019-22705/national-primary-drinking-water-regulations-proposed-lead-and-copper-rule-revisions.
[27] "*Considerations when Costing Lead Service Line. Identification and Replacement*" prepared by CDM Smith for AWWA, 2022. https://www.awwa.org/wp-content/uploads/CDM-Considerations-when-costing-lead-service-line-ident-replacement.pdf.

2.3. Risk and Resilience

Beyond asset replacement, rehabilitation and regulatory compliance, utilities face increasingly volatile operational cost risks stemming from natural hazards. Drinking water utilities must be prepared for a range of contingencies, and while this is not a new concept, the challenges are evolving. America's Water Infrastructure Act ("AWIA") of 2018 amended SDWA §1433 by mandating a process for evaluating risk and resiliency at community water systems serving over 3,300 people. AWIA required these systems to develop and routinely update robust risk and resilience assessments and emergency response plans.[28] Investment in hardening systems against these risks is essential for maintaining supply security and continuity of service.

Sustaining water service in the face of natural hazards requires preparing for drought, wildfires, extreme precipitation, and shifting weather patterns, necessitating substantial preemptive investment in system hardening and capacity expansion (e.g., source water diversification, advanced treatment for saline or challenging to treat drinking water sources, and physical flood protection). The National Oceanic and Atmospheric Administration ("NOAA") National Centers for Environmental Information ("NCEI") indicated the U.S. sustained 403 weather and climate disasters from 1980–2024 where overall damages/costs reached or exceeded $1 billion (including inflation) for each disaster. The total cost of these 403 events exceeds $2.915 trillion.[29] Increasing weather volatility is creating significant uncertainty that drinking water utilities must account for when planning future projects. These disasters, including drought frequency and intensity as well as severe precipitation events that threaten water supplies, facilities, and water systems nationwide.

Estimates prepared by the National Association of Clean Water Agencies ("NACWA") in 2009 and 2023 quantified the total cost of addressing these natural hazard impacts for drinking water and wastewater utilities.[30,31] The 2023 NACWA estimate separated drinking water costs from wastewater costs and include the capital and O&M costs of interventions taken by drinking water utilities to respond to the impacts of natural hazards, such as reverse osmosis treatment systems, potable reuse systems, and seawater desalination projects. NACWA's estimate included 10% for annual O&M costs. Using the NACWA cost estimates and adjusting the estimates for inflation to reflect 2025 dollars, we estimated the combined capital and O&M expenditures required for climate adaptation and mitigation by drinking water utilities to range from $289.9 billion to $617.2 billion over the 25-year timeframe (2026–2050) in 2025 dollars. This includes implementing technologies such as reverse osmosis and potable reuse systems. The drinking water utility O&M expenses included in the estimate range between $26.3 billion and $56.1 billion and the capital costs included in the estimate range between $263.6 billion and $561.1 billion. We included the drinking water utility O&M and capital cost estimates for natural hazards in our 25-year estimate.

---

[28] America's Water Infrastructure Act of 2018. P.L. 115-270. Enacted October 23, 2018. https://www.govinfo.gov/content/pkg/PLAW-115publ270/pdf/PLAW-115publ270.pdf.

[29] National Centers for Environmental Information (NCEI) Billion-Dollar Weather and Climate Disasters December 8, 2025; https://www.ncei.noaa.gov/access/billions/.

[30] National Association of Clean Water Agencies (NACWA). Confronting Climate Change: an Early Analysis of Water and Wastewater Adaptation Costs. Washington, D.C.: NACWA, October 2009. https://www.nacwa.org/docs/default-source/news-publications/White-Papers/2009-10-28ccreport.pdf.

[31] National Association of Clean Water Agencies (NACWA). Resiliency in the Balance: Funding Challenges for Clean Water Utilities in Addressing Climate Adaptation. Washington, D.C.: NACWA, December 2023. https://www.nacwa.org/docs/default-source/resources---public/nacwa-climate-resiliency-report.pdf.

Enhancing Water Supply Resiliency Through Local Resource Development – Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (“MWD”) is the primary water wholesaler serving over 19 million people across 5,200 square miles. MWD’s service area encompasses portions of six counties and relies heavily on imported water from two climate-sensitive sources: the Colorado River Aqueduct and the State Water Project (via the California Aqueduct). [32] [33]

Climate and Supply Vulnerability

MWD’s long-term water security is severely challenged by climate volatility. The region’s imported supply, derived from annual Sierra Nevada snowpack and the highly constrained Colorado River Basin, is increasingly unreliable due to persistent, historically extreme drought conditions. As of late 2025, significant portions of both the Colorado River Basin and California remain in severe or extreme drought, underscoring the long-term impacts on both surface and groundwater reserves.[34] This dependence on climate-vulnerable external sources mandates a strategic shift toward developing stable, local, and drought-proof supplies.

Strategic Solution: Pure Water Southern California (PWSC)

To achieve greater self-sufficiency and supply resiliency, MWD is planning to construct the Pure Water Southern California (PWSC) project in partnership with the Los Angeles County Sanitation Districts (LACSD). PWSC represents a major investment in Indirect Potable Reuse (IPR), decoupling a significant portion of the region's drinking water supply from volatile weather patterns. PWSC could produce up to 150 MGD of purified water using an advanced water treatment process including membranes, reverse osmosis, and ultraviolet light disinfection, to transform recycled water into a safe, high-quality supply. A new 60-mile regional conveyance system will deliver this reliable water source to recharge four critical regional groundwater basins.

Resiliency Benefits

The PWSC project is a component of MWD’s climate adaptation strategy. By maximizing the reuse of local resources, it mitigates the risk associated with diminishing imported supplies and fluctuating snowpack, ensuring a supplemental supply for the region’s growing population, regardless of external drought conditions.

The project is projected for completion by 2032 and carries an estimated cost of $9 billion, demonstrating the critical strategic importance placed on enhancing regional water security. To date, PWSC has received some federal support, including $125 million from the Bureau of Reclamation and the Department of the Interior.[35]

In addition to providing a new, efficient, and reliable water source, the project is also projected to fuel job creation and the local economy. A 2025 study, conducted by the Los Angeles Economic Development Corporation, found the construction of Pure Water Southern California facilities is expected to generate over $15.1 billion in total economic output and support approximately 75,660 job-years, including 43,700 project-related job-years and another 31,960 job-years across Southern California through indirect and induced effects. The project’s total supported labor income in Southern California is estimated to be about $6 billion. Moreover, it will contribute $719.4 million in state and local taxes and $1.4 billion in federal tax revenue.[36]

---

[32] Information from the Metropolitan Water District of Southern California website. Accessed at: https://www.mwdh2o.com/how-we-get-our-water/.

[33] Information from the Metropolitan Water District of Southern California website. Accessed at: https://www.mwdh2o.com/our-story/.

[34] CPR News. Colorado’s 2025 ‘Water Year’ was abnormally hot and dry. Ishan Thakore, December 1, 2025. https://www.cpr.org/2025/12/01/colorado-2025-water-report-hot-dry/.

[35] Information from the Metropolitan Water District of Southern California website. Accessed at: https://www.mwdh2o.com/building-local-supplies/pure-water-southern-california/.

[36] Institute for Applied Economics. *Metropolitan Water District: Pure Water Southern California, An Updated Economic Impact Study*, Los Angeles County Economic Development Corporation, 2025; https://bda.mwdh2o.com/CEQA%20Record%20of%20Proceeding/D.%20Environmental%20Impact%20Report%20and%20Notices/Draft%20EIR%20Documents%20Cited/13%20-%205.9%20Land%20Use%20and%20Planning/4_LAEDC%20Updated%20Economic%20Impact%20Study_2025.pdf.

2.4. Other Drinking Water Utility Stressors

2.4.1. Hard-to-Treat Water Supplies

Local cost drivers related to drinking water source complexity are increasing due to population strain and diminishing high-quality resources. Communities across the country are currently utilizing water sources that are at or near capacity and many of these communities cannot accommodate the level of growth necessitated by their projected population increases or other drivers of demand, such as data centers. This forces communities to utilize hard-to-treat sources, such as brackish water, reclaimed wastewater, or highly salinized ground or surface water.

Since hard-to-treat water supply costs are highly localized, national aggregate cost estimates have not been compiled. However, there are many published examples of utilities expanding capacity through harder to treat sources, which will likely increase the overall infrastructure costs compared to traditional sources. Recognizing there is no national compilation, examples include:

- ***Source Water Diversification (California):*** Projects using indirect potable reuse and brackish water desalination often carry price tags exceeding $100 million for medium-sized municipalities. For example, the Ventura WaterPure project in California is an indirect potable reuse project that will reduce the discharge into the Santa Clara River Estuary and will eventually provide 4.7 million gallons per day ("MGD") of recycled water, up to 20% of the city's future water supply. It is estimated that the new water purification facility will cost approximately $420 million and improving treatment processes at the existing wastewater treatment plant will cost $254 million, totaling $674 million for one community with a current population of about 110,000.[37] [38]

  Another example is the Antioch Brackish Water Desalination Plant in California (population 117,000). This is a new facility designed to treat brackish surface water from the San Joaquin River, which has experienced rising salinity, and will produce up to 6.0 MGD of potable water. The total projected cost is estimated at approximately $116 million. The plant is intended to supply 30 to 40% of the city's annual drinking water demand, thereby reducing dependence on purchased water and improving resilience to drought and salinity intrusion.[39]

- ***Water Supply Expansion (Florida):*** Some drinking water utilities in Florida are facing water shortage challenges. The shallow surface water and groundwater aquifers currently used for drinking water supplies are increasingly having to be supplemented by other sources. Often, this includes deeper groundwater, which can be more saline and contain contaminants of concern, requiring more advanced (and expensive) treatment technologies. The resulting brine has to be disposed of, often through deep injection. Riviera Beach, with a population of about 40,000, is spending at least $406 million in a Phase 1 treatment facility project to produce 7.5 MGD of additional treated drinking water.[40] Collier County with a population of about 422,000 is spending at least $438 million on a new

[37] Information from the City of Ventura website. Accessed at: https://www.cityofventura.ca.gov/1650/About-VenturaWaterPure.

[38] "Ventura planned water treatment project now tops $674M." Wes Woods II, VC Star. June 26, 2025; https://www.vcstar.com/story/news/2025/06/26/ventura-planned-water-treatment-project-now-tops-674m/84294261007/.

[39] "California opens $116 million Antioch Brackish Water Desalination Plant." Smart Water Magazine. July 10, 2025; https://smartwatermagazine.com/news/smart-water-magazine/california-opens-116-million-antioch-brackish-water-desalination-plant.

[40] "Riviera Beach launches $400 million water plant." WLRN Public Media, Carolyn DiPaulo, September 9, 2025. https://www.wlrn.org/development/2025-09-09/riviera-beach-launches-400-million-water-plant.

treatment facility to produce 10 MGD of additional treated drinking water and 6 MGD of wastewater reclamation capacity.[41]

- ***Alternative Water Supply Needs (Western Region):*** Utilities dependent on the Colorado River and its tributaries face escalating costs due to drought and water quality degradation. The nearly 25-year drought, coupled with long-term climate variability, has severely compromised the area's water supply reliability. As of November 2025, approximately 57% of the basin remains under severe or extreme drought conditions.[42] Water resource managers face critical uncertainty regarding future yields, as concerns persist that a series of below-average snowpack years followed by dry springs could lead to critically low runoff and record-low reservoir elevations. Major reservoirs across the American West are currently at historically low capacities. Projections indicate that if current trends continue, water levels could eventually dip below the thresholds required for consistent hydropower generation.[43]

  Compounding the issue is the long-term depletion of regional groundwater, which has lost a volume of water comparable to the storage capacity of the nation's largest reservoirs over the last two decades. While the impact is most acute in the Lower Basin, prolonged drought conditions have also become a persistent reality for states across the Pacific Northwest and the Northern Rockies. This instability drives several compounding financial burdens:

  - **Declining water quality**: As the Colorado River's flow decreases, the concentration of dissolved salts and other contaminants increases. This necessitates a shift toward more advanced and costly treatment processes, such as membrane filtration, to maintain potable water standards.
  - **Cost of alternative sources**: Water managers are increasingly forced to explore supplemental sources to offset shrinking surface water supplies. While options like desalination or large-scale recycling offer reliability, they are significantly more energy-intensive and expensive than traditional surface water systems.
  - **Utility Rate Impacts**: The rising costs of advanced treatment and the procurement of new water sources are inevitably passed on to consumers. Municipalities across the region are already implementing or planning significant rate increases to maintain infrastructure and secure future supply.

These specific examples underscore a broader challenge. Regions across the country are facing analogous issues where traditional hydrological assumptions no longer hold, forcing a transition toward more resilient, but more expensive, water management strategies.

The shift toward utilizing increasingly complex and lower quality drinking water sources imposes significant financial burdens on water systems. Although we know that these alternative water supplies are more expensive than more traditional sources, the differences in costs are based on too many localized variables to be able to generalize how much more. These localized expenses are excluded from our aggregate 25-year infrastructure needs estimates because national level data is not yet available. However, hard-to-treat water

[41] "Collier NE wastewater, water treatment plants proceed", The Naples Press, Aisling Swift, July 4, 2025. https://www.naplespress.com/local-news/collier-ne-wastewater-water-treatment-plants-proceed/article_2862c39c-ba99-5172-a872-a406643979dd.html..

[42] "Rainfall brings #ColoradoRiver drought relief, but concerns for next year's water supply remain," WaterDesk.org, Cassie Sherwood, November 4, 2025; https://coyotegulch.blog/2025/11/06/rainfall-brings-coloradoriver-drought-relief-but-concerns-for-next-years-water-supply-remain.

[43] "Alarming drought outlook threatens the West," Western-Water.com, September 8, 2025; https://www.western-water.com/2025/09/08/alarming-drought-outlook-threatens-the-west.

supplies represent a future financial cost to utilities that will inevitably expand the total national investment requirement.

2.4.2. Emerging Contaminants

Although not able to be quantified, drinking water utilities will likely encounter future expenditures related to future regulation of currently unregulated contaminants and/or other regulatory changes. The ability to identify and reliably quantify many contaminants to very low levels has greatly increased over time. Although it is difficult to predict what contaminants will go through the regulatory process in the future, the contaminant candidate list (CCL) offers clues on what contaminants need additional research and analysis to either rule out as a national concern or further evaluate for potential regulation.[44] The Safe Drinking Water Act establishes a process to nominate contaminants for research and evaluation (the CCL), and when sufficient information about health effects, occurrence, and risk is known, to periodically issue Regulatory Determinations to either proceed with developing a regulation or determine that no national regulation is necessary.[45] For those proceeding to regulation, it takes years to develop a proposal, take comments, develop a final regulation, and then phase in requirements over several additional years. For those found not to warrant a national regulation, non-regulatory health advisories or other guidance may be issued by EPA, which does not directly mandate costs but may still spur action and lead to additional spending. In some cases where a contaminant is mostly found in certain geographic areas, a state-level regulation may also be made by state primacy agencies. Likewise, every six years, the Safe Drinking Water Act requires EPA to evaluate existing regulations for potential improvements, providing another reference point for potential future regulatory activity.[46]

Addressing future contaminants will likely require a combination of advanced treatment technologies, distribution system upgrades, and/or the implementation of operational changes that will impose additional costs on drinking water utilities, but the extent and costs of these potential future regulations cannot be known with sufficient precision to include in this report.

2.4.3. Complex Waste Disposal Requirements

The deployment of advanced treatment technologies to remove contaminants from increasingly complex and lower quality drinking water sources, including brackish water, reclaimed wastewater, or highly salinized ground or surface waters, transfers these contaminants into concentrated residual streams, creating new long-term financial burdens for drinking water utilities. Unlike conventional water treatment residuals, the waste products generated from removing these contaminants are subject to more expensive management and disposal. Costs for disposal can include specialized treatment, transportation, and landfill fees, which vary significantly by location and volume.

Although some complex waste disposal activities may already be captured in infrastructure needs estimate when the need for it is well established, the emerging example of the removal of spent filtration media for PFAS likely is not. The interplay amongst various environmental laws and the status of PFAS compounds within them poses a significant challenge, both in terms of potential liability and in terms of direct costs. How these residuals end up being regulated in the long-term is not clear, but costs could be extensive. As one example, if PFAS-containing water treatment residuals are regulated as hazardous waste under the Resource

[44] USEPA. Drinking Water Contaminant Candidate List (CCL) and Regulatory Determination; https://www.epa.gov/ccl.
[45] USEPA SDWA Evaluation and Rulemaking Process. https://www.epa.gov/sdwa/sdwa-evaluation-and-rulemaking-process.
[46] USEPA. Six Year Review. https://www.epa.gov/dwsixyearreview.

Conservation and Recovery Act ("RCRA"), they would require disposal in a Subtitle C hazardous waste facility. A recent report calculated a unit cost for disposal at a hazardous waste facility at nearly $2,500 per ton.[47] This report found the cost to be roughly $1,000 per ton more than the nonhazardous alternative and more than $2,400 more per ton for the land application of biosolids or lagoon settling of lime softening sludge. Nationally, this could amount to $3.6 billion annually for PFAS treatment and conventional treatment residuals (e.g., spent GAC, biosolids, coagulant and softening sludge). However, this estimate is not included in the total spending need estimate as very few studies have investigated PFAS in water treatment residuals and their potential to leach, and the ultimate disposal options and requirements over the long-term are not certain.[48]

Beyond PFAS, the expansion of the use of hard-to-treat water supplies for inland communities utilizing brackish water or potable reuse supplies, results in high-salinity brine that must then be managed and disposed. This management often necessitates the construction of zero-liquid discharge ("ZLD") systems that crystalize the brine, which can more than double the capital and operational costs of treatment plants even before the disposal of the crystalized brine.[49]

Given the highly site-specific nature of utility disposal requirements and the lack of standardized national data, these substantial future costs are not currently included in our aggregate 25-year infrastructure needs estimate presented in this report, contributing to the conservativeness of our aggregate estimate.

2.4.4. Cybersecurity

The threat of a cybersecurity incident represents a clear danger not only to drinking water utilities but also to the integrity of national security. Cybersecurity is the top threat facing business and critical infrastructure in the U.S., according to reports and testimony from the Director of National Intelligence, the Federal Bureau of Investigation and the Department of Homeland Security.[50] Since cybersecurity measures are highly localized, national aggregate cost estimates for utilities to implement appropriate and protective cybersecurity measures have not been compiled to-date. A cyber attack could disable water supply and distribution, disrupt billing operations, and more. The potential impact on public health and reputational damage outweighs the cost for implementing basic cybersecurity practices. In response to this risk, Congress enhanced SDWA §1433, as amended by AWIA, to direct drinking water utilities to assess cyber threats and sets an expectation for systems to mitigate risks.[51] While drinking water utilities are working to implement more robust cybersecurity practices in what will likely be continuous iterative process as threats and technology evolve, many have indicated that limitations in technical capacity and resources remain a challenge.[52,53]

Implementing and maintaining adequate cybersecurity measures requires sufficient staffing and resources. . A 2021 Water Sector Coordinating Council survey found that limitation on workforce and technical capacity were challenges in supporting cybersecurity. Nearly half of the utilities surveyed spend less than 2% of their

[47] "Water Systems Could Face Costly PFAS Waste Rules", Chris Moody and Connor Murray, Journal AWWA, November 2023; https://awwa.onlinelibrary.wiley.com/doi/pdfdirect/10.1002/awwa.2174.

[48] AWWA. Comments submitted by AWWA to EPA. Posted November 10, 2022; https://www.regulations.gov/comment/EPA-HQ-OLEM-2019-0341-0543.

[49] National Alliance for Water Innovation. Technology Roadmap: Municipal Sector., DOE/GO-102021-5565, July 2021. https://docs.nlr.gov/docs/fy21osti/79889.pdf.

[50] American Water Works Association. Cybersecurity & Guidance. https://www.awwa.org/resource/cybersecurity-guidance/.

[51] USEPA. AWIA Section 2013/SDWA Section 1433: Risk and Resilience Assessments and Emergency Response Plans; https://www.epa.gov/waterresilience/awia-section-2013.

[52] AWWA. 2025 State of the Water Industry Report, https://www.awwa.org/state-of-the-water-industry/.

[53] Water ISAC. Cybersecurity: 2021 State of the Sector. Charles Egli, June 17, 2021. https://www.waterisac.org/2021survey.

annual budgets on Information Technology ("IT") and/or Operational Technology ("OT") security.[54] This metric may be misleading, as total spending is not a reliable indicator of improved security or the implementation of baseline cybersecurity controls.IT security focuses on protecting data and digital systems, prioritizing confidentiality, integrity, and availability. OT security protects systems that control physical machinery and equipment processes, prioritizing availability, safety, and operational continuity because disruptions can lead to physical damage or injury.

A key risk with cybersecurity is interruption to continuity of service and the drinking water utilities' responsibility to manage that threat. Water systems are resource stressed for workforce and budget, which includes capacity to support implementation of various cybersecurity controls and transitioning from legacy technology.

A review of data associated with the State & Local Cybersecurity Grant program found the average award to water systems was $150,000. These funds are specifically designated for building cybersecurity resilience and risk mitigation. For illustration purposes, if the $150,000 average award was limited to 10,000 drinking water utilities to address cybersecurity under SDWA § 1433, the investment need would be $1.5 billion. If all 50,000 community water systems were included, the baseline investment need would be $7.5 billion. As these values are based on existing awards and not on total need, they likely represent only a fraction of the total need to address transitions from legacy technology, staffing and implementation of controls to mitigate the dynamic nature of cyber threats. These expenses are not included in the 2026-2050 infrastructure needs estimates because robust national level data are not yet available.

2.5. Infrastructure Needs Summary

Based on the summation of infrastructure replacement, rehabilitation, expansion, regulatory compliance, and risk and resiliency cost drivers, the total infrastructure need from 2026 through 2050 is projected to range between $2.1 trillion and $2.4 trillion (in 2025 dollars), as shown in Table 3. This estimate reflects the baseline requirement to rehabilitate aging transmission and treatment assets, as identified in USEPA's DWINSA, updated with cost escalation and augmented by the substantial costs associated with PFAS treatment, LSL replacement, and measures of natural hazards.

---

[54] Ibid.

Table 3. Water Utility Capital Infrastructure Needs – 25-Year Costs

Cost Driver	25-Year Cost (in 2025 $ Billions)
Infrastructure Replacement, Rehabilitation, and Expansion	**$1,728.4 - $1,757.1**
Replacement and Rehabilitation	$960.2
Distribution System Expansion	$739.2
Treatment Capacity Expansion	$29.0 - $57.7
Regulatory Compliance	**$94.1 - $105.8**
PFAS Treatment	$39.2 - $50.9
Lead Service Line Replacement	$54.9
Risk and Resilience	**$263.6 - $561.1**
Natural Hazards	$263.6 - $561.1
Total	**$2,086.1 - $2,424.0**

Note that this projection represents a conservative baseline estimate. As detailed in this Section, reliable national-level cost data are not yet available for several emerging cost drivers, specifically addressing cybersecurity, the treatment of hard-to-treat water supplies, the remediation of currently unregulated emerging contaminants, and the complex disposal requirements for treatment residuals. Consequently, costs associated with these specific drivers are excluded from the aggregate national estimate provided herein. The actual national investment requirement will likely exceed our projections as these localized challenges become more widespread and as regulatory frameworks evolve.

3. Funding Availability

3.1. Review of Key Funding Sources

Drinking water utility user fees and rate revenues serve as the primary funding sources to pay for the identified water utility capital and O&M expenses, placing the primary financial obligation on the ratepayer. Consequently, the decision to advance a capital project or program is driven by a balance of technical necessity, competing infrastructure priorities, and the capacity of the customer base to absorb rate increases. Federal programs that help fund or subsidize capital projects can lessen this burden. For drinking water utilities, the primary federal program is the Drinking Water State Revolving Loan Fund ("DWSRF"). Under the DWSRF, the USEPA provides capitalization grants to states, which then administer subsidized loans, some with partial principal forgiveness and most with below market interest rates, to eligible projects.

A variety of other federal programs also provide assistance for water infrastructure projects. For example, in addition to the DWSRF, the USEPA also administers the Water Infrastructure Finance and Innovation Act ("WIFIA"), which assists larger water infrastructure projects that have historically been difficult to fund through DWSRF. The Department of Housing and Urban Development's Community Development Block Grant ("CDBG") program provides funding for economically disadvantaged urban communities, while the Department of Agriculture's Rural Development Water and Environmental Programs ("WEP") serves similar communities in rural areas. Water infrastructure is just one of many project types eligible under CDBG, whereas WEP is limited to water and wastewater infrastructure projects that protect human health. In other words, while many federal programs support water infrastructure projects, eligibility, priorities, and the type of assistance will vary by funding source.[55]

3.2. Trends in Federal/State Spending Data

Funding for drinking water utilities is periodically summarized by the Congressional Budget Office ("CBO").[56] The most recent report, released in February 2025, quantifies state, local and federal spending between 1956 and 2023 utilizing data from the U.S. Census Bureau, State and Local Government Finance Series, and from the Office of Management and Budget.[57] While the CBO reports historical expenditures in 2023 dollars (adjusted herein to 2025 dollars), its dataset aggregates spending related to both drinking water and wastewater utilities. To isolate drinking water infrastructure spending, we applied a 56% allocation factor, based on a U.S. Conference of Mayors publication that reports that 56% of combined water utility expenditures from 1993 to 2020 were for drinking water needs.[58]

---

[55] National Association of Clean Water Agencies (NACWA). "Water Infrastructure Funding Parity Report," prepared by Raftelis and Tetra Tech for NACWA, July 21, 2022. https://www.nacwa.org/docs/default-source/resources---public/water-sector-funding-parity-whitepaper-final-(7-21-22).pdf?sfvrsn=63a5c461_2.

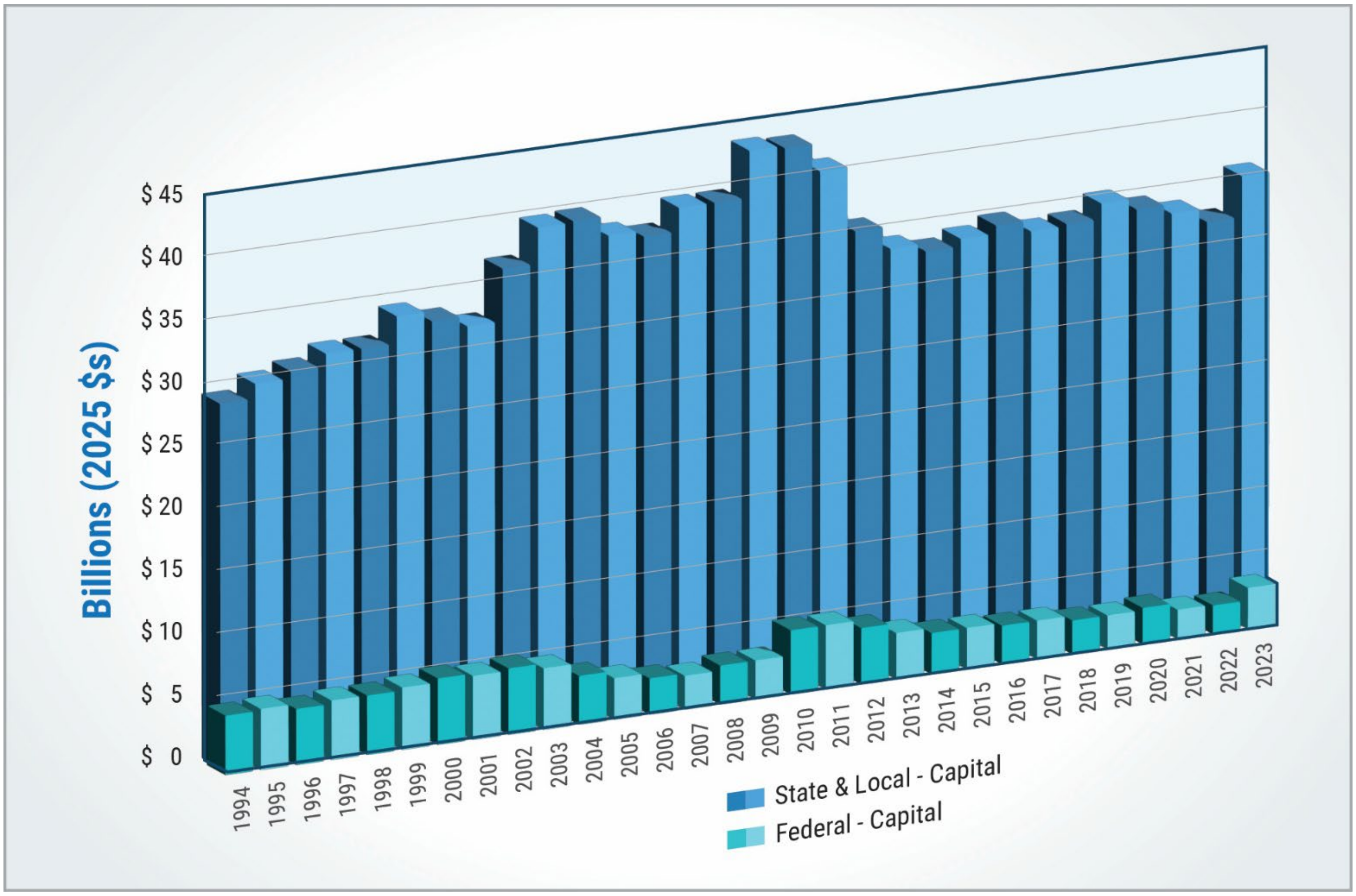
[56] U.S. Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 2023", Report 60874, February 2025. https://www.cbo.gov/publication/60874.

[57] Ibid.

[58] U.S. Conference of Mayors Water Council, "$144.6 Billion All-Time High Local Spending on Water and Sewer Utilities in 2020 – CARES Act Fiscal Stimulus Makes an Impact", October 2022. https://www.usmayors.org/2022/12/12/144-6-billion-all-time-high-local-spending-on-water-and-sewer-utilities-in-2020/.

Figure 1 illustrates the estimated capital infrastructure spending for drinking water utilities from 1994 to 2023, distinguishing between federal spending and state and local spending. All past investment figures were converted to 2025 dollars, meaning they were adjusted for inflation to represent the same purchasing power as money spent today. The data shows that throughout this entire timeframe, the vast majority of the capital spending on drinking water utilities was incurred and paid for at the state and local level (84% or more since 1994 and 90% or more since 2014), while the federal contribution to capital infrastructure has remained a minor component of the total investment (16% or less since 1994 and 10% or less since 2014).

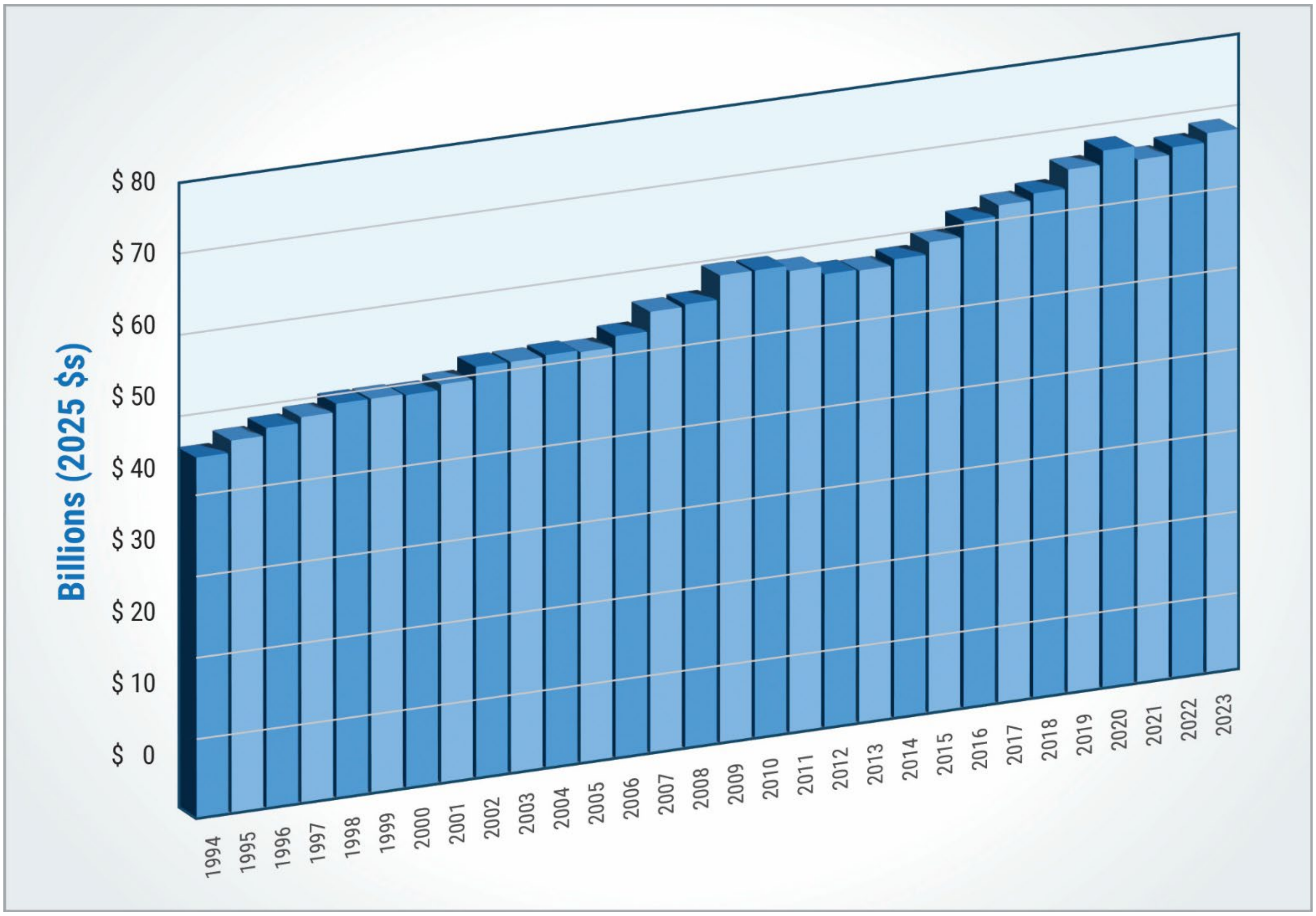
Figure 1: Estimated Capital Spending on Drinking Water Utilities by Source



The annual O&M expenses incurred by drinking water utilities (in constant 2025 dollars) was estimated from U.S. Congressional Budget Office estimates of total water sector annual O&M expenses.[59] Similar to above, we applied a 56% allocation factor, to isolate drinking water infrastructure spending, based on a U.S. Conference of Mayors publication that reports that 56% of combined water utility expenditures from 1993 to 2020 were for drinking water needs. The estimate, shown graphically in Figure 2, reveals a distinct trend of steadily increasing O&M costs. Expressing these costs in 2025 dollars allows us to distinguish between price increases caused by normal economic inflation and the specific rising costs of operating water infrastructure. Focusing on the latest 10 years of data (2013 through 2023), capital spending (as shown in Figure 1) was relatively stable, whereas O&M costs grew at an average annual rate of 1.8% after adjusting for inflation, as shown in Figure 2.

[59] U.S. Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 2023", Report 60874, February 2025. https://www.cbo.gov/publication/60874. Spending data in report adjusted from constant 2023 dollars to constant 2025 dollars.

Figure 2: Estimated Aggregate O&M Expenses by Drinking Water Utilities



Drinking water utilities face inflationary pressures related to specific operating expenses, such as power, chemicals, and labor costs. These categories of expenses often rise at rates exceeding the Consumer Price Index (CPI-U) used to adjust the data. While the precise contribution of each factor cannot be isolated within the aggregate national data, the trend indicates that the baseline cost of delivering water service is rising faster than general inflation.

3.3. Infrastructure Investment and Jobs Act

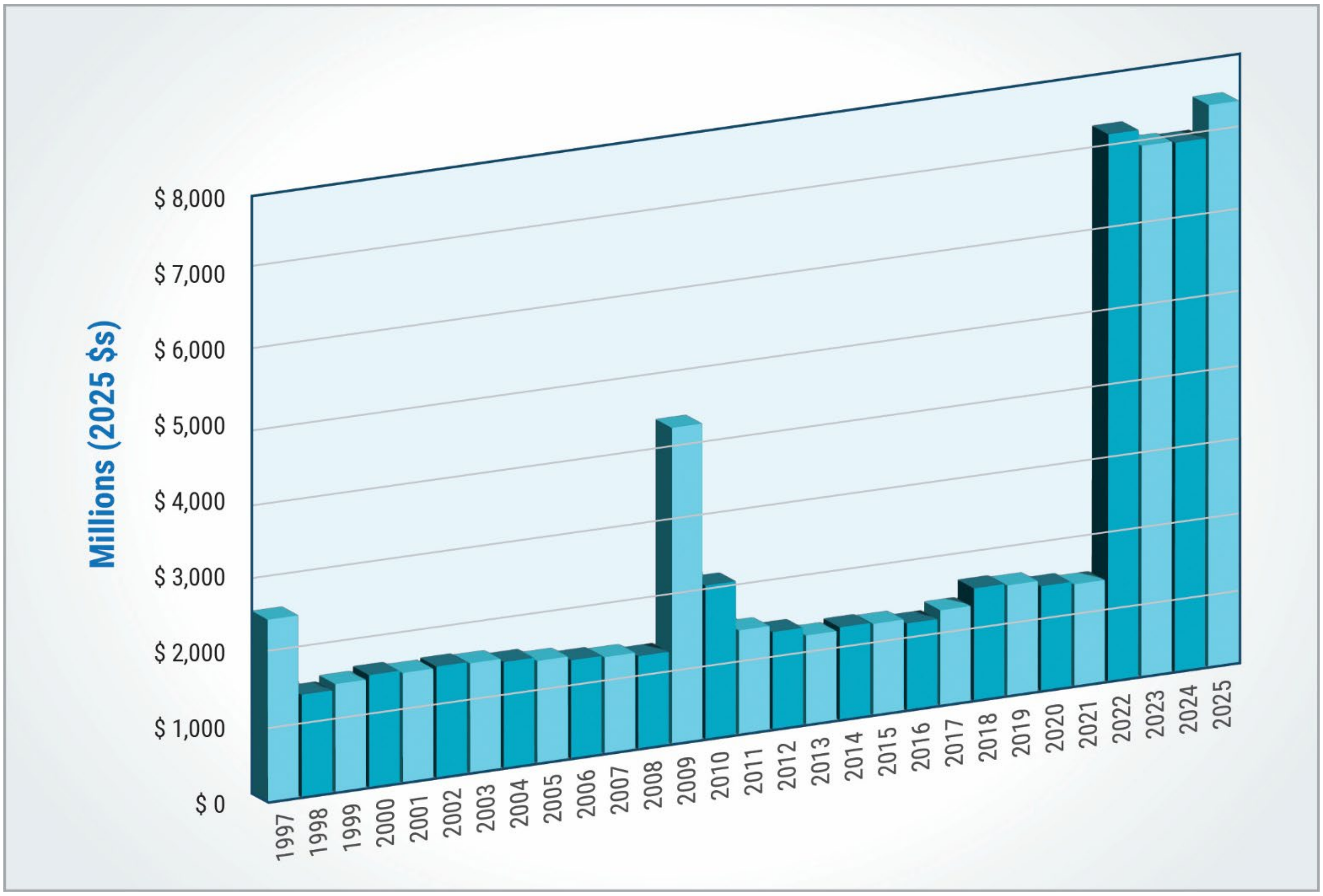
The IIJA, enacted in 2021, included nearly $55 billion for broad water infrastructure for five years. For context, recent annual congressional appropriations to the DWSRF and congressionally directed spending (i.e., earmarks) have averaged approximately $1.1 billion.

The DWSRF program was introduced in 1997 and has become the primary federal funding mechanism directed solely toward drinking water infrastructure. Throughout its nearly 30-year history, the DWSRF program has enjoyed relatively stable funding levels in constant dollar terms.[60] Figure 3 shows the annual funds made available for DWSRF capitalization grants over the life of the program, and with three areas of exception, the available funding has ranged between $1.2 billion - $1.5 billion per year in 2025 dollars. The first exception is the inaugural year in 1997, when nearly $2.4 billion in 2025 dollars was made available. The

[60] U.S. Congressional Research Service, "The Role of Earmarks in SRF Appropriations in the 118th Congress", Report R48066, 2024. https://www.congress.gov/crs-product/R48066.

second exception is in 2009 and 2010 when approximately $4.1 billion and $2.0 billion in 2025 dollars, respectively, were made available. This surge in funding arose from the American Recovery and Reinvestment Act ("ARRA"),[61] which was passed in response to the Great Recession of the late 2000's. The third exception to the baseline level of funding begins in 2022, with the passage of the IIJA in 2021. The IIJA includes the single largest federal investment in water infrastructure in U.S. history. The bill funded a five year-period (2022 – 2026) for three categories of drinking water infrastructure: $15 billion for LSL replacement, $9 billion to address emerging contaminants (including PFAS), and $11.7 billion for the DWSRF in addition to annual appropriations.

Figure 3: Appropriated Funds for DWSRF Capitalization Grants



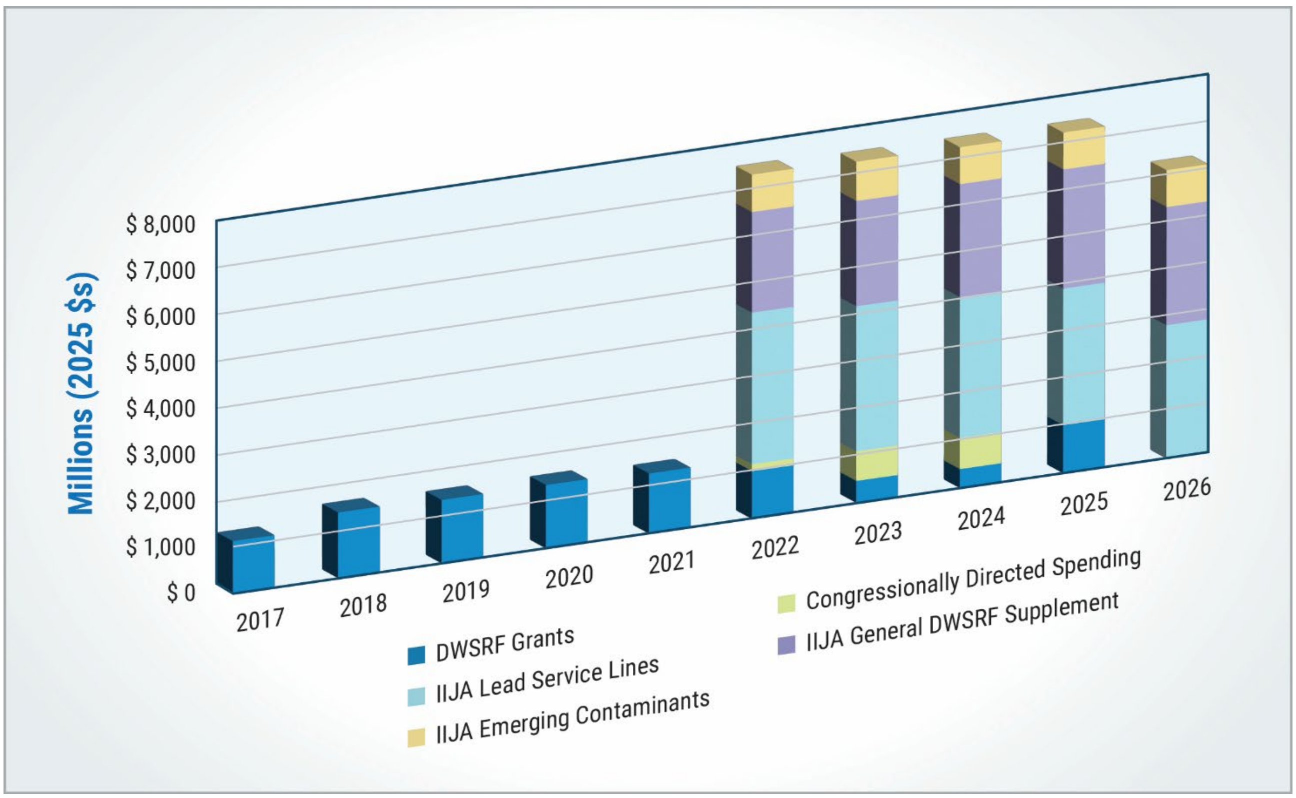
[61] American Recovery and Reinvestment Act of 2009. Pub. L. No. 111-5. https://www.govinfo.gov/content/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf.

Despite the enactment of the IIJA in 2021 providing enhanced funding beginning in 2022, the data in Figure 1 reflects only a modest increase in federal capital spending in 2022 and 2023. The dollar amounts in Figure 1 depict federal outlays (actual cash disbursements to states) rather than authorizations, whereas Figure 3 reports authorizations. The administrative process required to obligate and disburse federal funds often spans months or years. Consequently, the full financial impact of the IIJA is expected to appear in spending data over the coming years.

Figure 4 shows the DWSRF and IIJA authorization amounts in 2017 through 2026 in constant 2025 dollars. The spending authorization in 2017-2021 predates the IIJA; the subsequent years show the scale of the increase in funding provided by the IIJA.[62] However, this influx of capital into the water sector is temporary. IIJA funds are scheduled to expire at the end of 2026, and congressional debates regarding potential reductions to core federal water infrastructure programs, such as the DWSRF, have created significant uncertainty about future federal funding levels.[63]

Note that the Congressionally Directed Spending shown in Figure 4 began in 2022, are currently drawn out of the DWSRF capitalization grant appropriations. These amounts are included in Figure 3 above. There is no Congressionally Directed Spending in 2025 due to the use of continuing resolutions to fund federal spending.

Figure 4: DWSRF and IIJA Authorization Amounts



)

[62] USEPA. Annual Allotment of Federal Funds to States, Tribes, and Territories; https://www.epa.gov/dwsrf/annual-allotment-federal-funds-states-tribes-and-territories.

[63] At the time the analysis was completed, Congress had not yet authorized DWSRF capitalization grants for 2026 outside of previously authorized IIJA funds.

Ways Federal Support Can Help Address Challenges

The City of Baltimore has leveraged the Water Infrastructure Finance and Innovation Act ("WIFIA") program and State Revolving Loan Fund ("SRF") program several times. One WIFIA loan they received was for $193 million in 2021 to cover water infrastructure rehabilitation, estimated to save $40.4 million to the City and supporting 1,313 jobs.[64] The City also received a WIFIA loan in 2019 for $202 million ($40 million in savings[65]) and another in 2021 for $160.8 million ($51.2 million in savings[66]) to cover their wastewater repair, rehabilitation, and replacement program. In addition, since 2015 the City has received $393.3 million from the SRF as a combination of loans and grants (about $106 million in grants) for their water and wastewater infrastructure.[67]

The Pittsburgh Water and Sewer Authority ("PWSA") received a WIFIA loan in 2023 for $52.5 million to cover their Water Reliability Plan, saving $20 million over other financing and supporting 534 jobs.[68] In addition, PWSA since 2018 has received $795.8 million in Pennsylvania Infrastructure Investment Authority ("PENNVEST") loans and $116 million in PENNVEST grants for water infrastructure rehabilitation, including lead service line replacements.[69] PENNVEST is a financing authority in Pennsylvania that manages the distribution of WIFIA, SRF and other funds to provide low-cost financial assistance to address water, wastewater, stormwater, and non-point source pollution problems that impact public health, safety, the environment, regulatory compliance, and economic development.[70]

The PENNVEST grants and low-cost loans represent significant savings to PWSA in funding their water infrastructure needs and helped to allow lead service line replacements and water main replacement projects to move forward. The benefit of WIFIA to Baltimore and PWSA was the significant flexibility in shaping the debt repayment to match the utility's cash flow needs and to better match the repayment of the debt with the useful lives of the assets that the loans were used to pay for. This helped them smooth out the ratepayer impacts in the near term to help allow the projects to move forward.

[64] USEPA. 2021. Water Infrastructure Rehabilitation Project. https://www.epa.gov/system/files/documents/2022-01/factsheet-baltimore-water.pdf.

[65] USEPA. 2019. Comprehensive Wastewater Repair, Rehabilitation and Replacement Program. https://www.epa.gov/sites/default/files/2019-02/documents/baltimore_wifiaprojectfactsheet_loanclose.pdf.

[66] USEPA. 2022. Wastewater Infrastructure Rehabilitation. https://www.epa.gov/system/files/documents/2022-01/fact-sheet-baltimore-wastewater.pdf.

[67] Conversation with Garret Halbach, Chief of Budget and Financial Planning, Baltimore DPW, November 17, 2025.

[68] USEPA. 2023. Water Reliability Plan. https://www.epa.gov/system/files/documents/2023-06/Factsheet_Pittsburgh.pdf.

[69] Information obtained in an email from Ed Barca, Director of Finance, PWSA, December 2, 2025.

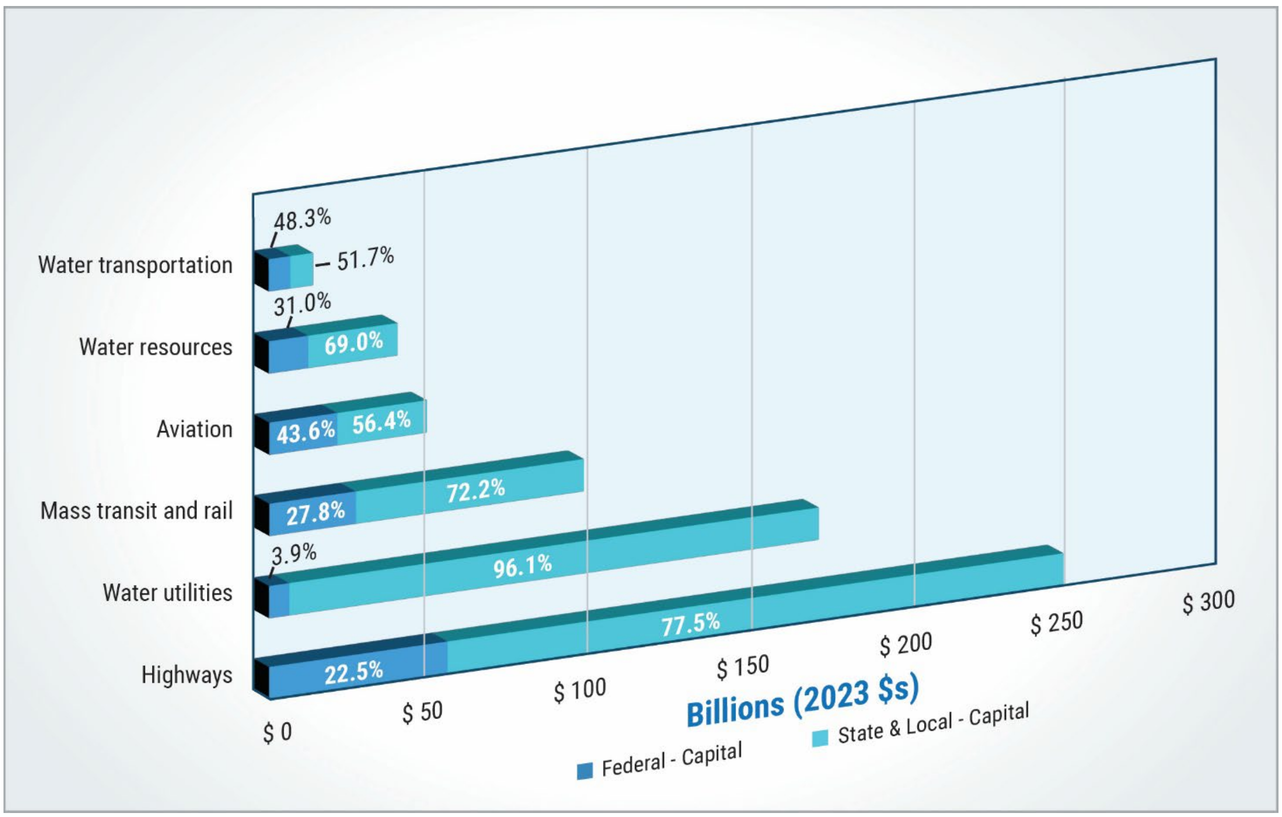
[70] Financial Assistance for Water Quality Improvement Projects in Pennsylvania: Pennsylvania Infrastructure Investment Authority – PENNVEST; https://www.pa.gov/agencies/pennvest.

3.4. Comparison of Federal Funding Support to Other Sectors

Historically, the federal government has provided varying levels of financial support to major infrastructure sectors, including the water sector. However, drinking water utilities have consistently received significantly less federal aid than other major classes of infrastructure. This disparity was comprehensively documented in the 2022 *Water Infrastructure Parity Report*.[71] This report benchmarked federal support for water sector utilities relative to other infrastructure sectors, such as water transportation (i.e., ports), water resources,[72] highways, mass transit and rail, or aviation.

Figure 5 illustrates the total public spending in 2023 across these sectors.[73] In this comparison, "water utilities" aggregates drinking water, wastewater, and storm water utilities. The data reveals a striking imbalance. Despite being the second largest infrastructure sector by total expenditures, water utilities receive the lowest level of federal support, both in absolute dollars and as a percentage of total spending. Specifically, federal sources contribute just 3.9% of total public spending on water sector utilities.[74] In contrast, the next lowest federally subsidized sector (highways), received 22.5% of their funding from the federal government.

Figure 5: 2023 Public Spending on Transportation and Water Infrastructure



[71] National Association of Clean Water Agencies (NACWA). "Water Infrastructure Funding Parity Report".

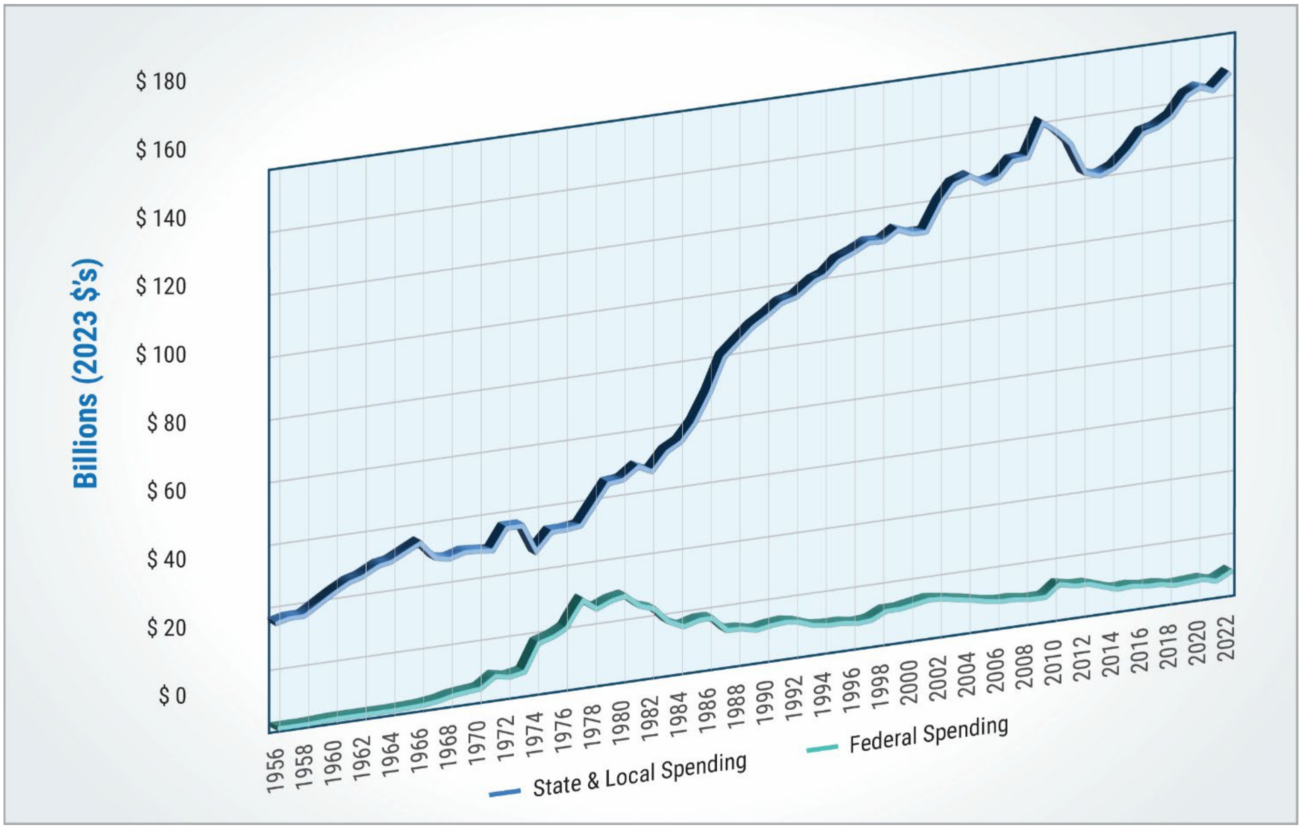
[72] Water resources include water containment facilities (e.g., dams, levees, reservoirs, and watersheds), sources of fresh water (e.g., lakes and rivers), and outlays for navigation by the U.S. Army Corps of Engineers.

[7373] U.S. Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 2023", Report 60874, February 2025. https://www.cbo.gov/publication/60874.

[74] Note that this information presented by the CBO compares the total spending on water infrastructure, including O&M and capital spending, and water infrastructure here represents both water and wastewater utility spending. This differs from Figure 1 above that isolates the federal support for drinking water utilities and compares the total federal support to water utility capital spending, which excludes O&M spending.

Figure 6 illustrates the historical divergence in federal funding compared to local spending in the water sector.[75] Over the past 60 years, state and local spending on water sector utilities has roughly quadrupled in real terms (i.e., in addition to increase in spending due to general economic inflation). The data highlights a widening gap where the increasing financial burden of water sector infrastructure has fallen almost exclusively on states and local utilities.

Figure 6: Public Spending on Water Sector Utilities by Source



3.5. Characterization of Investment Gap

The drinking water utility infrastructure gap can be characterized by the difference in current spending levels and the estimated future needed spending levels. As detailed in Table 3, the total capital needs in 2026-2050 were estimated to be between $2,086.1 billion and $2,424.2 billion. To provide a consistent annual benchmark, total capital needs of drinking water utilities were amortized evenly across the 25-year time horizon. Furthermore, since rising operating costs significantly influence household affordability, this analysis also incorporates projected O&M expenses, which continue to outpace general inflation.

Using the midpoint of the projected total capital needs estimate ($2,255.2 billion), we estimate that drinking water utilities in aggregate require an average annual capital investment of roughly $90.2 billion per year through 2050. In comparison, the current baseline for capital spending, calculated as the inflation-adjusted average from 2013 to 2023, is $33.6 billion per year.[76] Comparing the required annual investment ($90.2

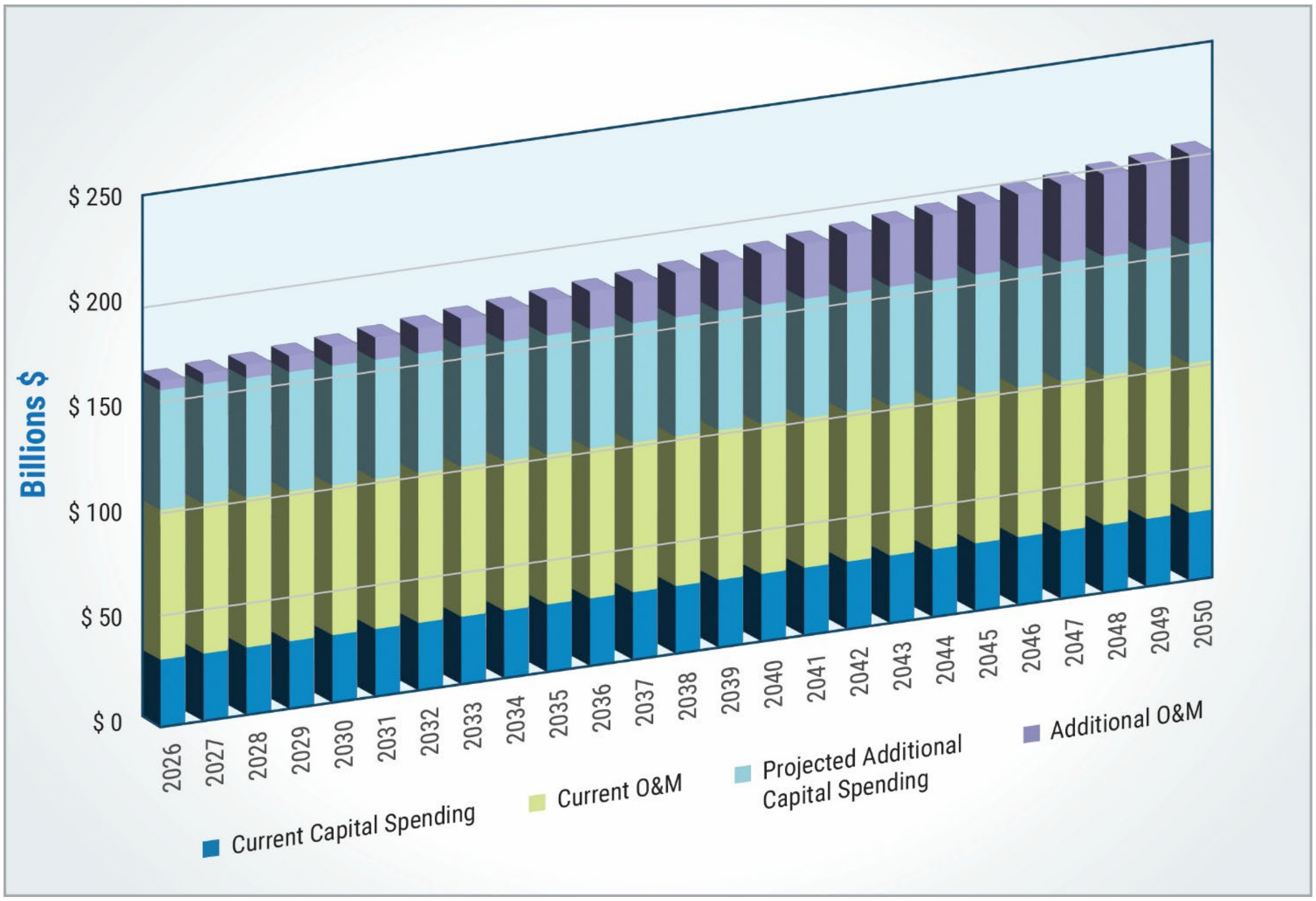
[75] U.S. Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 2023", Report 60874, February 2025. https://www.cbo.gov/publication/60874.

[76] The average capital spending over 2013 – 2023 was selected to represent current baseline capital spending for water utilities. Capital spending rates prior to 2013 were elevated, elevated partly due to post-Great Recession stimulus spending and do not reflect the current business environment. Within the period 2013 – 2023, spending rates have little variation, with the low in 2022 at $32.1 billion and the high in 2023 at $35.2 billion.

billion) against the current baseline ($33.6 billion) reveals a substantial annual infrastructure spending gap of approximately $56.6 billion per year.

Regarding operating costs, historical data indicates a consistent growth rate above normal economic inflation of 1.8% per year between 2013 and 2023. Consequently, this analysis projects future O&M requirements in two components: "Current O&M expenses," which were held constant at 2023 levels, and "Additional O&M expenses," which represent the cumulative cost of O&M expenses growing at 1.8% above the normal annual inflation rate. Figure 7 presents the aggregate of these projections to illustrate the total spending requirement over the 25-year period (2026 – 2050), categorized by current capital spending, additional needed capital spending (i.e., the capital funding gap), current O&M spending, and additional O&M spending.

Figure 7: Projected Water Utility Spending



Our analysis estimates that the current spending by drinking water utilities, including annual capital and O&M spending of approximately $101.6 billion in 2025 dollars, is insufficient to meet future needs. Closing the funding gap requires adding $56.6 billion in capital investment each year, while rising operational costs are projected to add an additional $42.1 billion in annual need by 2050 in 2025 dollars. This brings the total annual need to $200.3 billion by 2050 in 2025 dollars. The projected total represents a doubling of the necessary financial resources and purchasing power, rather than simply a higher price tag caused by general economic inflation. This additional $98.7 billion of annual capital and O&M spending by 2050 will be a burden borne by ratepayers if additional support from federal or state sources are not realized. Between 2012 and 2021 the annual capitalization grants to the DWSRF program averaged just $1.3 billion in 2025 dollars, representing just 1.4% of capital spending needs. In other words, the projected additional drinking water utility spending by 2050 will be 76 times the recent baseline DWSRF funding levels.

4. Affordability Impacts of Needed Investments

The widening disparity between water utility infrastructure investment needs and available federal funding creates an inevitable pressure on local water rates. As utilities move to address the projected 25-year needs, the financial burden will increasingly fall upon ratepayers. To understand the magnitude of the future drinking water utility customer financial burden, the following analysis quantifies the current baseline of water affordability in the U.S. and projects how the burden on low-income households will intensify if local ratepayers are forced to fully finance the nation's infrastructure needs without increased federal support.

4.1. Introduction to Water Affordability

4.1.1. Water Affordability Background and Context

Water affordability is a pressing issue in many communities across the U.S. The USEPA recently estimated that between 12.1 and 19.2 million households nationwide (approximately 9% to 15% of all households) meet thresholds that indicate they may struggle to afford basic water services.[77] For some, water affordability is a chronic issue; others have unexpected crises that affect their ability to pay. Low-income households who do pay their water bill are often forced to make trade-offs that affect their health and well-being.[78]

At the same time, as described throughout this report, the cost of providing clean, safe, and reliable water services is growing. Cities, towns, and utilities nationwide will continue to require higher levels of investment to address aging infrastructure, regulatory requirements, climate change impacts, emerging contaminants, lead service line replacements, and other issues. With limited external funding, water and sewer utility rates will necessarily increase, exacerbating affordability challenges for low-income households.

Drinking water utilities have historically examined affordability within the context of nationally mandated regulatory requirements and utility financial capability to deliver water services in full compliance with applicable laws and regulations. Traditional affordability metrics, such as USEPA's Residential Indicator ("RI"), were initially developed with this lens. Over the past decade, practitioners have developed more robust approaches and methods for better examining affordability at the household level. This report applies these approaches, and examines additional metrics and data, to quantify the scale and depth of affordability challenges for households within the U.S., both now and into the future, as funding needs continue to grow. Specifically, the following sections examine affordability challenges as follows:

- Characterizing current affordability challenges for U.S. households, with a focus on low-income households and their ability to meet basic needs.
- Applying established water affordability metrics to quantify the burden of water service costs and estimate the number of households facing affordability challenges.

[77] USEPA. 2024. *Water Affordability Needs Assessment: Report to Congress.* EPA 830-R-24-015. Accessed on September 2, 2025: https://www.epa.gov/system/files/documents/2024-12/water-affordability-needs-assessment.pdf.

[78] Environmental Financial Advisory Board. 2025. *Advancing Water Affordability Nationwide: A Framework for Action.* USEPA. Accessed on November 11, 2025: https://www.epa.gov/system/files/documents/2025-07/efab-fact-sheet.pdf.

- Examining the impact of future water bill increases on low-income households to understand how rising water bills may exacerbate affordability risks.

4.1.2. Defining Drinking Water Affordability

While there is no universally accepted definition of household water affordability, it is commonly described as the ability of households to pay for water services without experiencing undue economic hardship.[79] Such hardship occurs when financially constrained households must sacrifice other essential goods and services to cover their water bills. Examples include forgoing medical care or prescriptions, skipping nutritious meals, or struggling to pay for childcare, transportation, or home energy services. Households facing water shutoffs also experience economic hardship, as the loss of water service can render a home uninhabitable.

These concepts are reflected in the definition of household affordability developed by a panel convened by the AWWA in 2021 to explore alternative approaches for evaluating affordability as part of rulemaking under the SDWA.[80] For the purposes of this report, we adopt the panel's definition of affordability as:

> *". . . . the ability of a customer to pay the water bill in full and on time without jeopardizing their ability to pay for other essential expenses."*

While this definition is conceptually sound, affordability remains a subjective and context-dependent issue. How much is "too much" for a low-income household to pay? In most cases, it is not the water bill alone that pushes households into financial distress, it is the cumulative burden of meeting basic needs.

4.1.3. Origins of the 2.5% Threshold

A commonly cited benchmark for drinking water affordability is 2.5% of median household income ("MHI"). This figure stems from historical USEPA policy, which the agency developed to assess the national-level affordability of regulatory options for small communities. Specifically, in the past, USEPA stated that it would consider a NPDWR to be unaffordable for small systems (serving populations under 10,000) if compliance would result in a household water bill exceeding 2.5% of the MHI for those communities.

Importantly, this threshold was intended for application to small systems in aggregate, not to individual utilities or households. Despite its narrow regulatory origin, the 2.5% threshold has taken on outsized influence in broader affordability discussions. It is often inferred that a combined annual water and wastewater bill of less than 4.5% of community MHI is affordable, allocating 2.5% for drinking water and 2% for wastewater and combined sewer overflow controls.[81] This inference, while widespread, lacks a formal basis and does not necessarily reflect the lived realities of low-income households facing layered cost burdens.

---

[79] Raucher, R., J. Clements, E. Rothstein, J. Mastracchio, and Z. Green. 2019. *Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector*. Prepared for AWWA, NACWA, and WEF. Accessed November 25, 2025: https://www.awwa.org/wp-content/uploads/Developing-New-Framework-For-Affordability.pdf.

[80] American Water Works Association (AWWA). 2021. *Improving the Evaluation of Household-Level Affordability in SDWA Rulemaking: New Approaches*. Accessed November 25, 2025: https://www.awwa.org/wp-content/uploads/Improving-Evaluation-Household-Level-Affordability-SDW-Rulemaking.pdf.

[81] See USEPA (2024), *Water Affordability Needs Assessment: Report to Congress.* EPA 830-R-24-015, for additional background on affordability thresholds for water, wastewater, and stormwater costs.

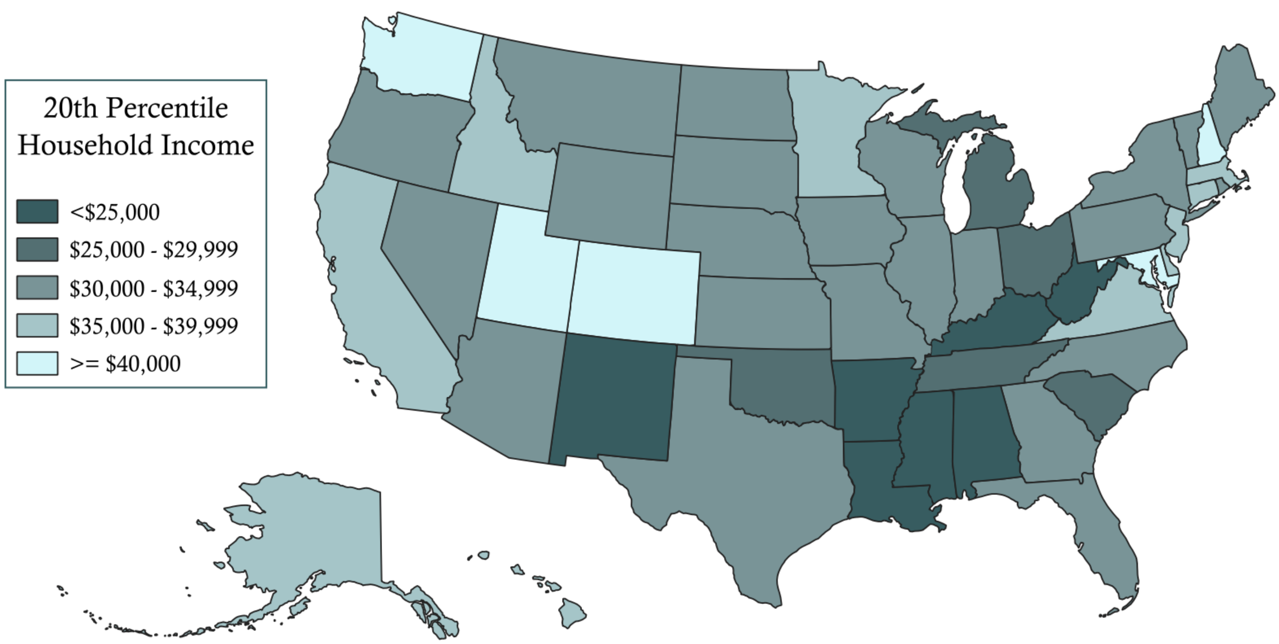
4.2. Household Affordability Challenges: A National Overview

Quantifying the scope of financial hardship requires a robust analysis of the economic realities currently facing households across the U.S. To conduct this analysis, we relied primarily on federally available data sources, including the 2023 U.S. Census American Community Survey ("ACS") and Public Use Microdata Sample ("PUMS") one-year datasets, Bureau of Labor Statistics ("BLS") Consumer Expenditure Survey ("CEX"), and Federal Reserve Economic Data ("FRED"), unless otherwise noted.

4.2.1. Income Levels and Non-Discretionary Spending

The MHI in the U.S. is currently \$81,600; this varies significantly at the state level – ranging from \$56,800 in Mississippi to \$106,100 in Massachusetts. Based on data from the ACS, 20% of U.S. households earn less than \$31,800 per year. Like MHI, the 20th percentile income (also referred to as the upper limit of the lowest quintile income, "LQI") also varies by state - from \$22,100 in Mississippi to \$46,100 in Utah. As shown in Figure 8, the 20th percentile income is generally lower in the Southeastern U.S. and some more central eastern states and is higher in the west. The 20th percentile income is often used to represent low-income populations because it captures a broader segment of economic vulnerability than traditional poverty measures, as is explained in more detail below.

Figure 8: Upper Limit of Lowest Quintile Income by State

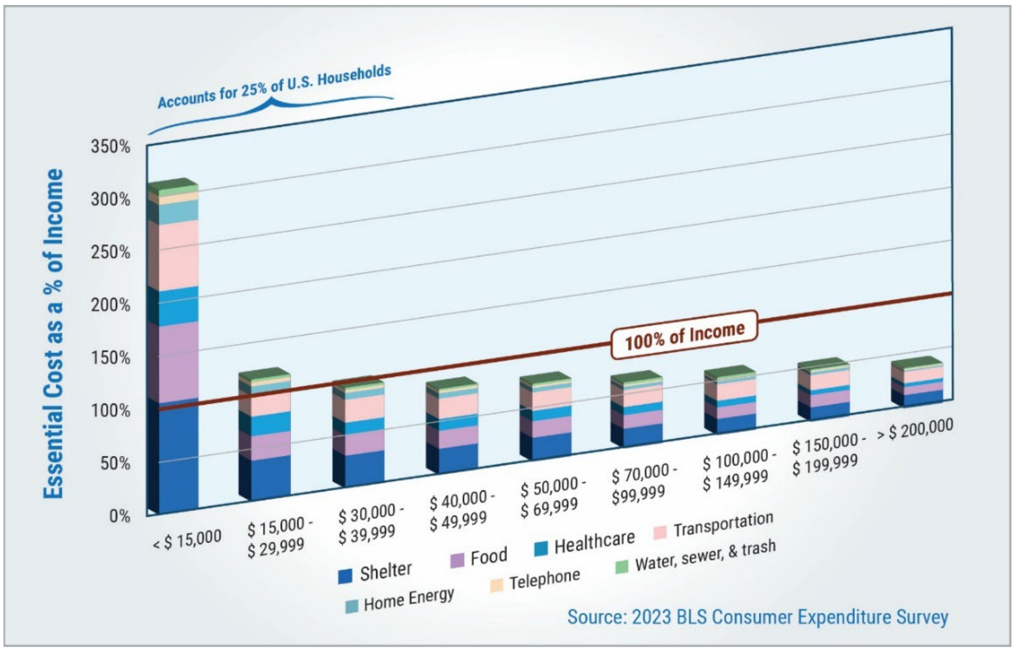


Source: ACS PUMS 2023 single-year estimates

It is not sufficient to examine income alone to fully understand household affordability challenges at the national scale; we must also consider the extent to which income levels enable households to meet their basic needs. This depends not only on earnings, but on the cost of essential goods and services, such as housing, medical care, food, and all forms of utilities. Essential goods and services are those that are required for a household to meet their most basic needs and maintain health, hygiene, and employment.

Figure 9 and Table 4 present data from the BLS CEX, showing the amount that households spend on select essential items, including shelter, food, healthcare, transportation, home energy, phones, and water, sewer, and trash collection services, as a percentage of their after-tax income, by income category. These data indicate that for up to one quarter of U.S. households, these expenditures account for 95% or more of their income. Even households earning between $50,000 and $70,000 per year spend an average of 74% of their income on these non-discretionary items. This leaves little room for other important needs, such as childcare, clothing, and household emergencies. Notably, across all income categories, water, sewer, and trash services (combined) make up a small portion of household costs; however, the CEX data indicate that households in lower income categories do not have capacity to absorb even a small increase in their expenses.

Figure 9: Essential Household Expenditures as a Percentage of Household After-Tax Income, by Income Category



Source: 2023 BLS Consumer Expenditure Survey

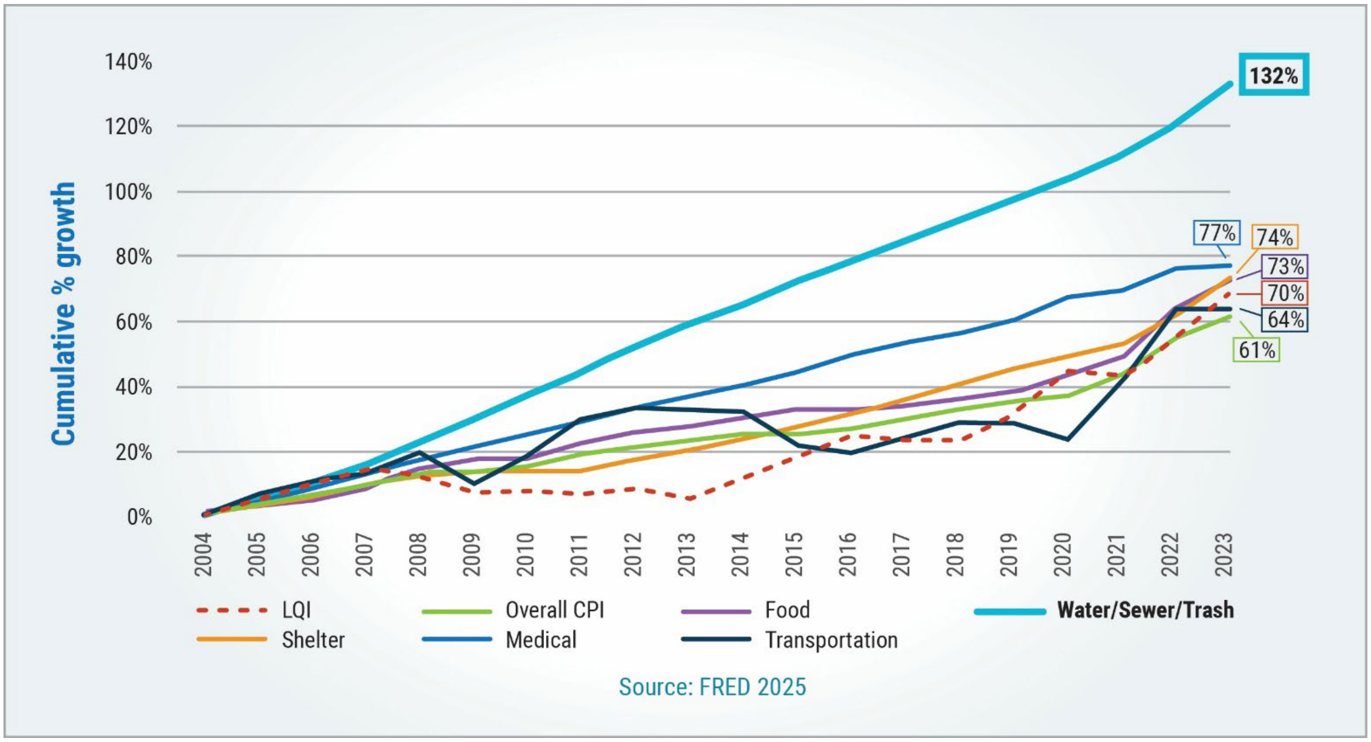
Table 4: Select Household Essential Expenditures as a Percentage of Household Income, by Income Category

Household Income Category (before tax)	Average Annual Income (after tax)	Cost of essential expenses as % of household income	% of U.S. households (Cumulative %)
< $15,000	$7,880	308%	9% (9%)
$15,000 - $29,999	$23,211	115%	10% (18%)
$30,000 - $39,999	$35,538	95%	7% (25%)
$40,000 - $49,999	$44,292	81%	7% (32%)
$50,000 - $69,999	$56,491	74%	13% (45%)
$70,000 - $99,999	$77,472	61%	16% (61%)
$100,000 - $149,999	$108,701	53%	17% (78%)
$150,000 - $199,999	$147,286	48%	9% (87%)
> $200,000	$259,392	37%	13% (100%)

Source: 2023 BLS Consumer Expenditure Survey, U.S. Census 2023 PUMS single year estimates

At the same time, the costs for essential goods and services are rising, and in some cases, outpacing growth in incomes for the lowest income earners. Figure 10 presents the nominal increase in the CPI for the four largest household cost categories reported above (shelter, food, healthcare, and transportation), as well as for water, sewer, and trash costs (combined), compared to growth in the upper limit of the LQI over the last 20 years (2004 – 2023). As shown, the upper limit of the LQI increased by 70% over this period, while costs for shelter, healthcare, and food grew by 74%, 77%, and 73%, respectively. Overall, transportation has experienced a lower increase, although this has varied considerably over time. The CPI for water, sewer, and trash experienced a significantly greater increase than other categories – growing 132% in nominal terms.

Figure 10: Increase in LQI and CPI for shelter, medical, transportation, and food cost categories



4.2.2. Federal Poverty Level

Approximately 10.6% of the U.S. population is living in poverty (2024 estimate), down from 14.7% in 2015.[82] Historically, U.S. poverty thresholds have been used as a benchmark for identifying households struggling to meet basic needs and determining eligibility for certain public assistance programs. However, this metric has significant limitations, as it is based on outdated assumptions about household spending and consumption patterns and does not account for regional differences in cost of living.[83]

Many households earning well above the federal poverty level ("FPL") have trouble paying for basic expenses.[84] Federal, state, and local governments frequently set eligibility for social assistance programs at 150% or even 200% of the FPL. The 200% FPL threshold has been used as a general rule of thumb for

[82] Shrider, E, and C. Bijou. 2025 September 9. Poverty in the United States: 2024. U.S. Census Bureau. https://www.census.gov/library/publications/2025/demo/p60-287.html.

[83] Stratus Consulting. 2013. Affordability Assessment Tool for Federal Water Mandates. Prepared for U.S. Conference of Mayors, AWWA, and Water Environment Federation. Available: https://www.awwa.org/wp-content/uploads/affordability-assessment-tool-for-federal-water-mandates.pdf.

[84] The United Way. 2025. The State of Alice in the United States. Available: https://www.unitedforalice.org/national-overview#4.5/36.316/-95.842.

defining economically vulnerable populations.[85] Currently, approximately 28% of the U.S. population live in households earning less than 200% of the FPL (2024).

Established measures of income adequacy indicate that the scope of affordability challenges is much greater than indicated by poverty thresholds, including even 200% of the FPL. For example, United Way's Asset Limited, Income Constrained, and Employed ("ALICE") Project continues to provide critical insights into the scale of financial hardship across the U.S. ALICE refers to households who have incomes above the FPL but who still struggle to afford basic necessities.[86] A cornerstone of the project is the Household Survival Budget, which estimates the minimum cost of five essentials (housing, childcare, food, transportation, and health care) tailored to household type and county-level costs. According to the 2025 national report, 42% of U.S. households fall below the ALICE threshold: 13% in poverty and an additional 29% classified as above the ALICE threshold. This means over 55 million households are unable to meet basic needs, despite many having steady employment. This is in line with the BLS CEX data presented above.

4.2.3. Geographic Variations in the Cost of Living

The cost of living varies widely across the U.S. An income that affords a comfortable lifestyle in the Southeast may fall short of covering basic expenses in major West Coast cities. To examine these geographic differences, this analysis uses Regional Price Parities ("RPPs")—a metric published by the Bureau of Economic Analysis (BEA) that measures state-level price differences relative to the national average. RPPs express cost-of-living variations as percentage deviations from national price levels. By adjusting household incomes using RPPs, we can better compare incomes and household water burdens across states.

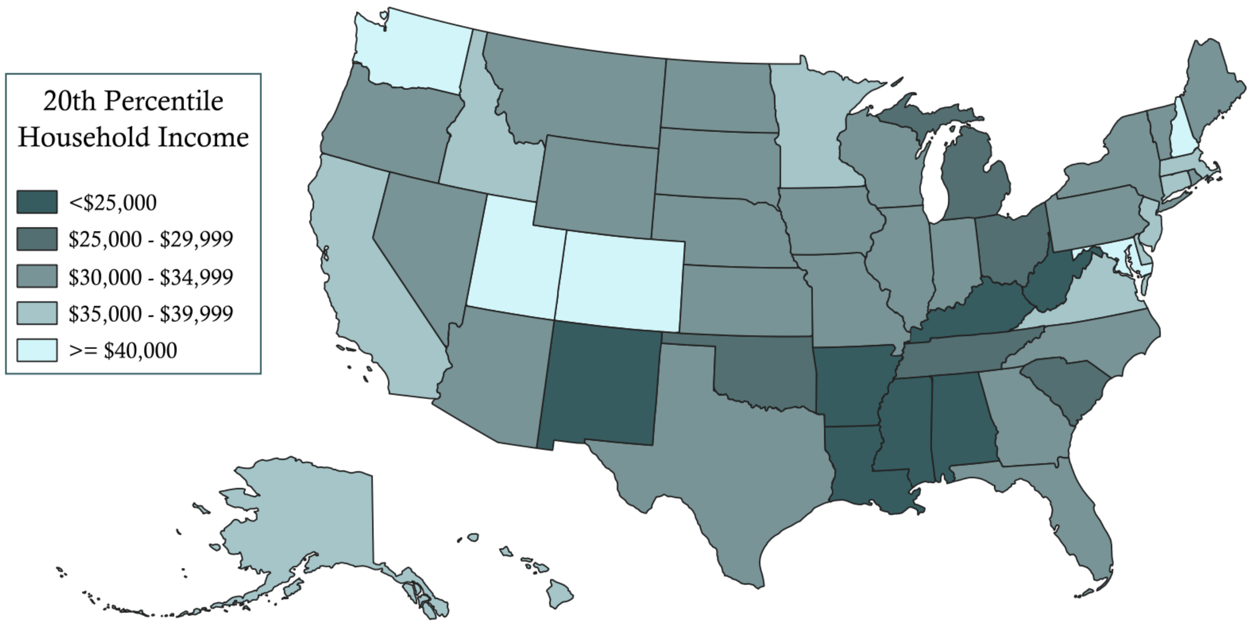
Figure 11 illustrates the 20th percentile income by state, both unadjusted (published data that does not account for cost-of living differences) and adjusted (standardized according to the RPPs). Adjusted incomes are benchmarked to the national average, providing a proxy for buying power among low-income households. As shown, several Southern states—such as New Mexico, Arkansas, Alabama, Tennessee, and South Carolina—shift into higher income categories when adjusted for cost of living (as indicated by lighter shading). This reflects the fact that while incomes are lower, so are local prices. Conversely, states like New York, California, and Washington shift downward, revealing that relatively high incomes are offset by elevated living costs, meaning households in these states have less purchasing power to meet basic needs.

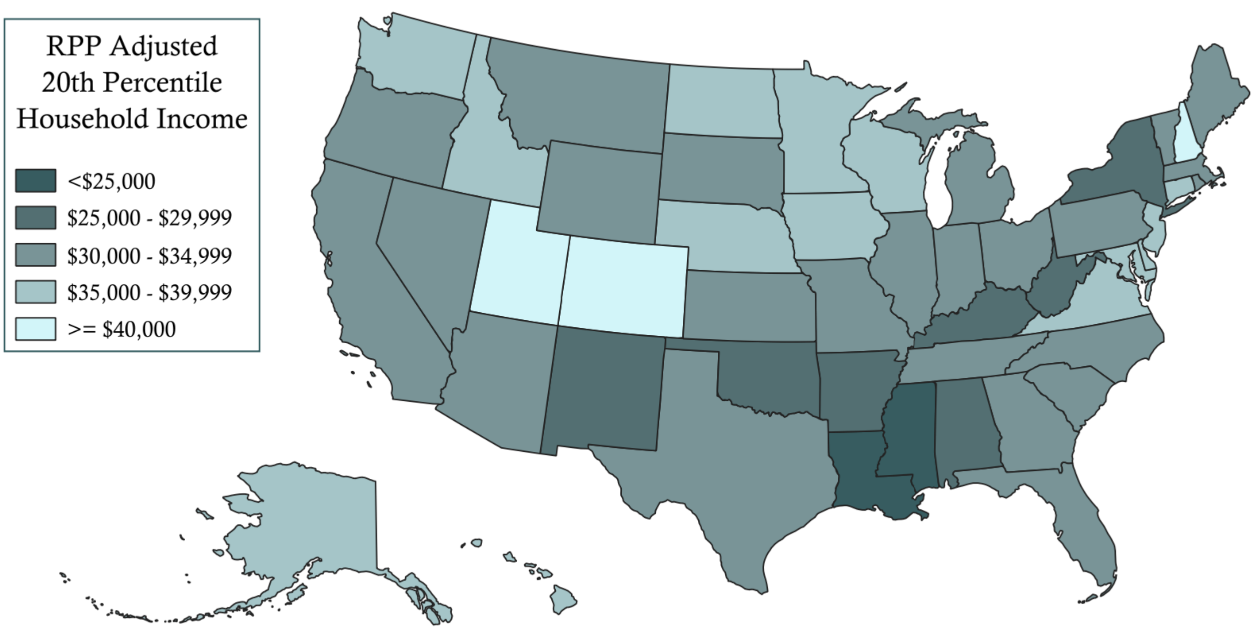
---

[85] Glicksman, A. and L. Ring. 2021. Defining Poverty as an Eligibility Requirement for Supportive Services. Innov Aging. Dec 17;5(Suppl 1):426–7. https://doi.org/10.1093/geroni/igab046.1656. PMCID: PMC8969935.

[86] As of 2023, the ALICE Project has expanded its reach to cover all 50 states, Washington D.C., and Puerto Rico, offering a standardized methodology to assess local cost-of-living pressures.

Figure 11: Upper Limit of the Lowest Quintile Income by State (above) and RPP adjusted Upper Limit of Lowest Quintile Income by State (below)





4.3. Current Water Affordability Challenges

Moving from broad economic indicators to sector-specific impacts, the following analysis examines the cost of water services for low-income households. By applying established affordability thresholds, we identify how water bills interact with other essential expenses to create cumulative affordability challenges for vulnerable populations.

Water Supply Issues Drive Funding Gap for Old Bridge Municipal Utilities Authority

The experience of the Old Bridge Municipal Utilities Authority ("OBMUA") in New Jersey illustrates the compounding financial gap created when utilities face significant infrastructure needs that are not supported by existing utility rates. Following New Jersey Department of Environmental Protection ("NJDEP") mandates in the 1980s to combat seawater intrusion, OBMUA was compelled to reduce local groundwater withdrawals from 8 MGD to 4 MGD.[87] While the original regulatory framework anticipated a 25-year aquifer recovery period, the coastal well rights have not been restored, rendering a permanent loss of low-cost local supply.

Financial Impacts of Water Supply Issues

To bridge the supply deficit, OBMUA entered into a purchase agreement with a private investor-owned utility ("IOU") for up to 9 MGD of source water. This shift in water supply has exposed the Authority to escalating operational costs that consistently outpace inflation. The shift to purchased water has resulted in source water cost premiums of over 30% compared to continuing to use local groundwater sources. Wholesale rates from the supplier increased by an average of 8% annually through 2017.[88] This trend has continued since then, with the OBMUA 2025 Budget Workshop citing a 6.3% year-over-year increase in purchased water expenses.[89]

With the supplier filing a new two-year rate case with the New Jersey Board of Public Utilities (NJBPU) in 2025 and seawater intrusion projected to worsen, OBMUA faces a widening divergence between its revenue requirements and the escalating cost of bulk water imports, placing additional pressure on water rates and customer bills. This case underscores the long-term economic vulnerability introduced when environmental factors strand local infrastructure assets and render local water supplies unusable.

4.3.1. Household Water and Sewer Costs

There is no comprehensive national database that reports drinking water service costs or utility-specific water rates for residential customers. Several sources do report average household costs or costs associated with a specific level of use, although some of these sources combine drinking water costs with the costs of other utilities. For example, the 2023 BLS CEX survey estimates the average annual household cost of water, sewer, and trash services to be approximately $850 nationally (when adjusted to 2025 dollars). The CEX reports differences across income categories, with bills ranging from an average of $434 (5.1% of income) for households earning less than $15,000 to $1,347 (0.5% of income) for households earning greater than $200,000. The U.S. Census PUMS also reports data from households on the cost of water service; however, it is not clear whether (or how many) households may be including sewer and/or stormwater services in their responses.

A 2024 survey administered by the U.S. Department of Health and Human Services to examine the effectiveness of the temporary Low-Income Household Water Assistance Program ("LIHWAP") asked utilities to report water and sewer bills for residential customers using 5,000 gallons per month.[90] For a 2.5-person household, this amounts to approximately 65 gallons per person per day, with bills amounting to $1,258 per year. Finally, for a study commissioned by AWWA and several other water industry organizations

[87] Information from Old Bridge Municipal Utilities Authority website, accessed at: https://obmua.com/about-us/.

[88] "OBMUA groundwater cutbacks mandated by the NJDEP" presentation accessed at: https://www.facebook.com/OldBridgeMUA/videos/395055017589932/.

[89] Middlesex Water Files for Rate Request, Middlesex Water, June 30, 2025; https://investors.middlesexwater.com/news-releases/news-release-details/middlesex-water-files-rate-request.

[90] U.S. Department of Health and Human Services, Office of Community Services. 2024. *LIHWAP Water Utility Affordability Survey Report: Understanding Water Affordability Across Contexts*. Accessed on November 25, 2025: https://acf.gov/sites/default/files/documents/ocs/lihwap-survey-report-03-14-24.pdf.

to examine the potential for a Federal Low-Income Water Customer Assistance Program Assessment ("LIWCAP"), researchers estimated average household water and sewer costs (separately) by state based on multiple drinking water utility surveys and available utility data.[91] This report assumed a use of 50 gallons per person per day for the average household size of 2.5 people, approximately 3,750 gallons per month with a resulting average annual household cost of $954. Table 5 compares water and sewer cost estimates across these various sources.

Table 5: Comparison of Water and Wastewater Costs by Source (2025 USD)

Source	Average Annual Household Cost for Water and Sewer Services	Key Assumptions
BLS CEX	$850	Reports survey responses of urban consumers for water, sewer and trash services; average respondent household size is 2.5 people.
ACS PUMS	$766	Reports weighted household survey responses from Census; applies to households who pay for water directly; asks households to report household water costs. Likely that some/many household water costs also include sewer services.
LIWHAP survey	$1,258	Survey of utilities by Department of Health and Human Services; based on use of 5,000 gal/month.
LIWCAP report	$954	Estimates based on multiple drinking water utility surveys and utility-specific data; reflects basic use of 50 gpcd for the average U.S. household size (2.5 people), equal to 3,750 gal/month. Broken out by water and sewer costs (costs for water alone average $429 per year nationally).

*Estimates updated using CPI for water, sewer, and trash from dollar year in which they were reported.

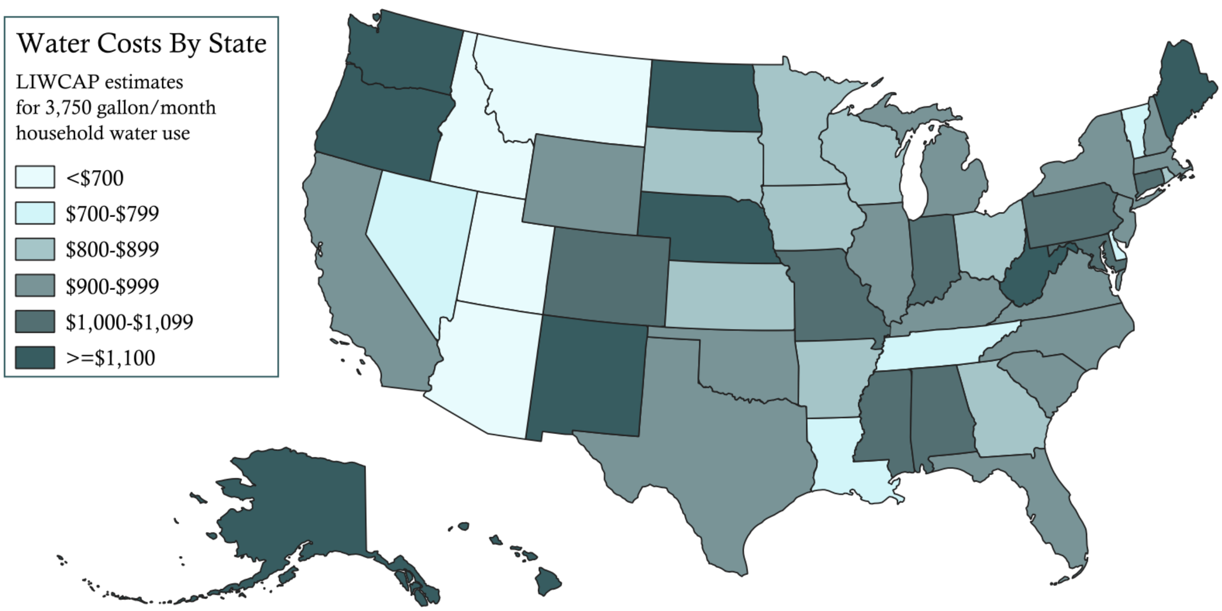
Each data source described above offers distinct strengths and limitations. The BLS and ACS datasets are consistently collected and updated, making them valuable for tracking changes in household costs over time. The ACS PUMS data enables deeper analysis of water bills by household characteristics such as size, income, and age. However, neither BLS nor ACS data isolate drinking water costs from sewer and/or trash collection costs.

Estimates from the LIHWAP survey reflect water consumption levels that exceed those typically used in affordability analyses, potentially overstating household costs for many low-income households. In contrast, the LIWCAP report provides disaggregated estimates for water and wastewater charges, by state, calibrated to reflect a level of use of 50 gpcd for the average household size. For the remainder of this analysis, we therefore rely on the estimates from the LIWCAP report—both state-level and national—as the baseline for household water costs.

[91] Berahzer, S. I., J. Clements, Z. Green, J. Mastracchio, R. Raucher, E. Rothstein, and M. Teodoro. 2023. *Low-Income Customer Assistance Program Assessment.* Prepared for American Water Works Association, Association of Metropolitan Water Agencies, National Association of Clean Water Agencies, National Association of Water Companies, and the Water Environment Federation. Accessed on November 25, 2025: https://www.awwa.org/wp-content/uploads/low-income-water-customer-assistance-program-assessment-report.pdf.

Figure 12 shows household drinking water and sewer costs based on the estimates from the LIWCAP report, again, assuming an average household use of 3,750 gallons per month. Costs vary significantly by state, with several states in the Rocky Mountain region showing costs of less than $700 per year. The lowest bill is in Arizona, where the annual cost amounts to $607 for the average household size. A handful of states (e.g., Alaska, Hawaii, Oregon) have costs estimated to be more than twice that amount.

Figure 12: Estimated Annual Household Drinking Water Costs by State, Assuming 50 gpcd for Average Household Size

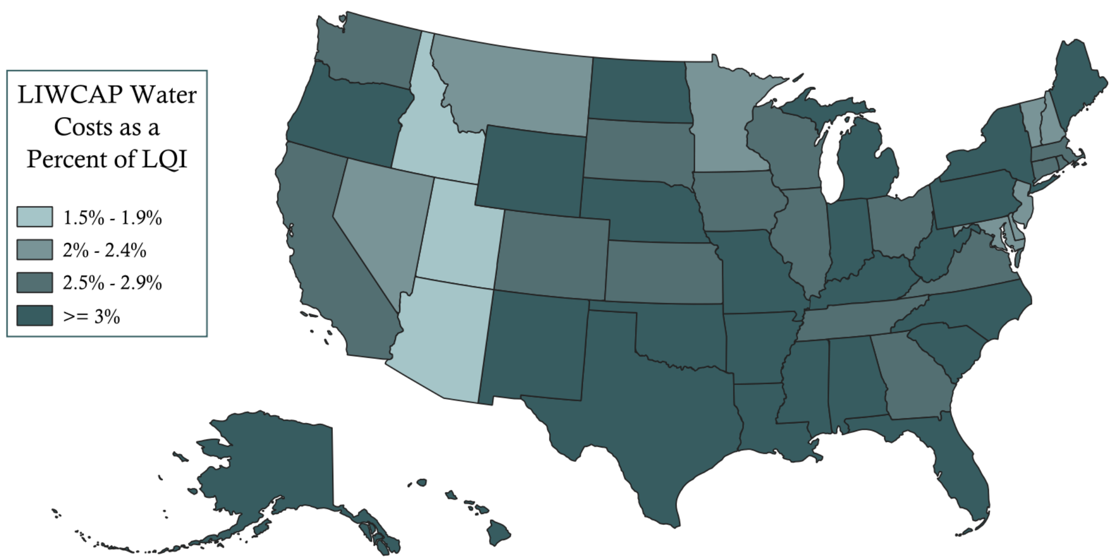


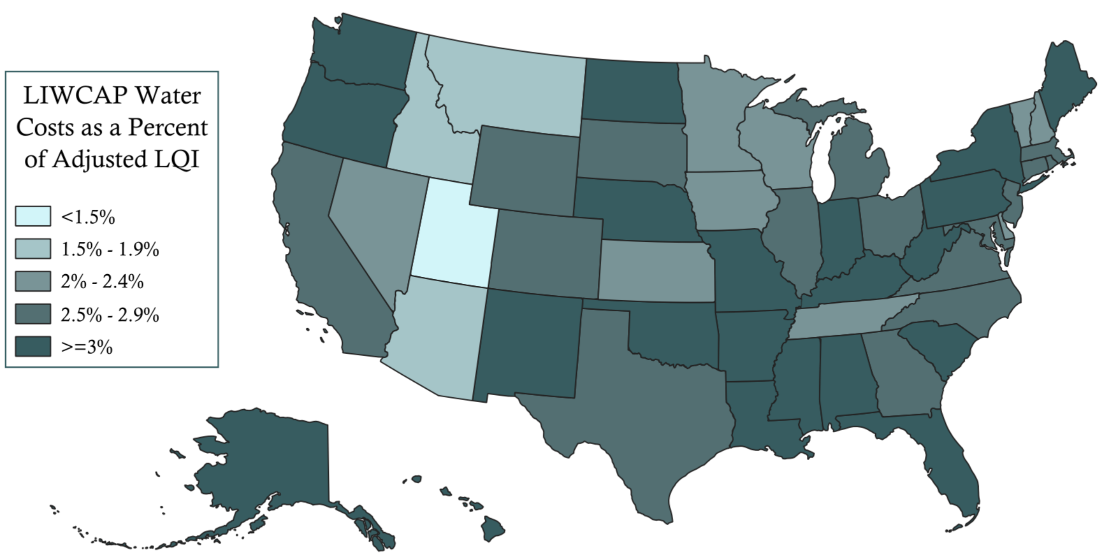
Source: LIWCAP Assessment, 2025 dollars

Note: Water and sewer costs reflect water use of 3,750 gallons per month, 50 gpcd for a 2.5-person household

Figure 13 shows how estimated household water and sewer costs compare to the upper limit of the LQI, both unadjusted (a) and adjusted (b) with regional price parities, in each state. As shown, water and sewer costs currently exceed 3% of the 20th percentile income in many states, although fewer states exceed this threshold when incomes are adjusted to reflect differences in the cost of living.

Figure 13: LIWCAP Water and Sewer Costs as a Percent of Lowest Quintile Income by State (above) and as a Percent of Lowest Quintile Income adjusted with RPPs (below)





Note: Water and sewer costs reflect water use of 3,750 gallons per month, 50 gpcd for a 2.5-person household

4.3.2. Overview of Common Water Affordability Metrics

Historically, USEPA evaluated affordability within a regulatory context by comparing household water and sewer costs to a community's MHI. Although not originally intended to assess household-level affordability, this approach gave rise to widely cited affordability benchmarks: 2.5% of income for water and 2.0% for wastewater have long been considered as thresholds for community level affordability. Despite longstanding critiques, particularly around its limitations for assessing affordability among low-income households and/or in economically diverse communities, these thresholds have persisted and continue to influence sector discourse and policy framing.

Over the past decade, practitioners have developed alternative metrics and approaches intended to better capture the burden of household water costs on low-income households. These include household-level burden indicators that account for regional cost-of-living differences and focus explicitly on income-constrained households. Table 6 summarizes the most used household burden metrics in current practice.

Table 6: Summary of Household Burden Affordability Metrics

Metric Name	Equation	Affordability Threshold
EPA-based metrics [a]	Wastewater (WW) + drinking water (DW) cost per household	4.5% (2% WW/SW, 2.5% water)
	MHI of service area	
Household Burden Indicator ("HBI")[b]	Basic water service costs (50 gpcd)	7% – 10% (high burden) >10% (very high burden)
	LQI of service area	
Teodoro Affordability Ratio (AR)[c]	Basic water service costs (50 gpcd)	10% for customers at 20th percentile income
	Discretionary income of LQI	
Cost of Living Adjusted (COLA) HBI	Basic water service costs (50 gpcd)	None established
	LQI of service area adjusted for cost of living	

[a] EPA 1996

[b] HBI calculated for average household size; water service costs include costs for water, WW, and SW, assuming basic level of water use of 50 gallons per capita per day (gpcd, Raucher et al. 2019).

[c] Basic water service costs include water/WW; discretionary income is defined as after-tax household income minus essential costs including shelter, health care, food and home energy (Teodoro 2018).

Other metrics are designed to capture the prevalence of affordability challenges within a community through socioeconomic data. For example, the team of researchers who developed the HBI proposed that it be applied along with the Poverty Prevalence Indicator ("PPI"), which reflects the percentage of households within a community earning less than 200% of the FPL. Together, the HBI and PPI are designed to assess both the depth and breadth of affordability challenges within a community.

Likewise, the USEPA introduced the Lowest Quintile Poverty Indicator ("LQPI") as part of its updated Financial Capability Assessment Guidance[92]. The LQPI is intended to help assess the financial burden of Clean Water Act requirements based on six community socioeconomic indicators and how they compare to national averages or established values. The first indicator compares the upper limit of the LQI in a

[92] U.S. EPA. 2024. *Water Affordability Needs Assessment: Report to Congress*. EPA 830-R-24-015.

community to the national upper limit of the LQI, while others benchmark the percentage of the population living below 200% FPL, percentage of households receiving SNAP benefits, percentage housing units that are vacant, unemployment levels, and trends in household growth. These indicators reflect the prevalence of affordability challenges, as well as a community's ability to pay for infrastructure improvements necessary to meet regulatory requirements.

4.3.3. Households Facing Water Affordability Challenges

This report focuses on quantifying the number of households likely facing affordability challenges. Specifically, we use data from the U.S. Census PUMS to compare water costs (i.e., state level estimates from the LIWCAP report) to individual household incomes. PUMS provides anonymized, household-level data drawn from the ACS, allowing researchers to analyse income, housing costs, and demographic characteristics with greater flexibility than pre-tabulated Census products. Using PUMS data allows us to estimate the number of households, by state, for which water and sewer costs exceed specific income thresholds.

In a 2024 assessment, the USEPA considered two affordability threshold values, 3% and 4.5% of household income spent on drinking water and wastewater bills combined.[93] Applying these same benchmarks, we estimate the following:[94]

- 13.1 million households (10.0% of total households) pay more than 4.5% of their income for water and sewer services.
- 21.5 million households (16.4% of total households) pay more than 3.0% of their income for water and sewer services.
- It would cost $5.42 to $8.96 billion in 2025 to make water services affordable to these households, e.g., by providing a subsidy or reducing costs to ensure that all households paid less than 4.5% and 3.0% of their income, respectively, for basic water and sewer services.

Examining drinking water costs alone, and applying the EPA-based 2.5% threshold, we estimate that approximately 10.2 million households (7.8% of total households) are water burdened (i.e., they pay more than 2.5% of their income for water). It would cost $1.94 billion in 2025 to make drinking water affordable for these households. This cost is expected to grow over time as household water costs continue to outpace inflation.

---

[93] Ibid.

[94] To be consistent with the way the U.S. Census calculates housing burden and related metrics, our estimate of the number of households facing affordability challenges excludes households reporting zero or negative incomes.

Small Systems Affordability Challenges

There are nearly 40,000 small community water systems in the U.S. that serve 3,300 or fewer people (EPA SDWIS 2025). Many of these systems face urgent investment needs to maintain and modernize their drinking water infrastructure. With costs recovered from a limited number of households and businesses, many of these small systems - and the communities they serve - are at heightened risk of affordability challenges.

The Drinking Water Infrastructure Needs Assessment Survey (DWINSA, EPA 2023) reports infrastructure needs by system size. We paired this information with data from EPA's Safe Drinking Water Information System (SDWIS) to examine how costs are distributed across affected populations (see table below). This analysis indicates that small systems will need to shoulder a significant burden to maintain access to clean and reliable drinking water. As shown in the table below, while small water systems in the U.S. serve 7% of the population, they account for 16% of the annual $38.4 billion investment need derived from the DWINSA (See Section 2.1).

Drinking Water Infrastructure Need by System Size and Population Served

System size category	% of population served[a]	% of need
Small (<=3,300)	7%	16%
Medium (3,301 – 100,000)	45%	45%
Large (>100,000)	48%	39%

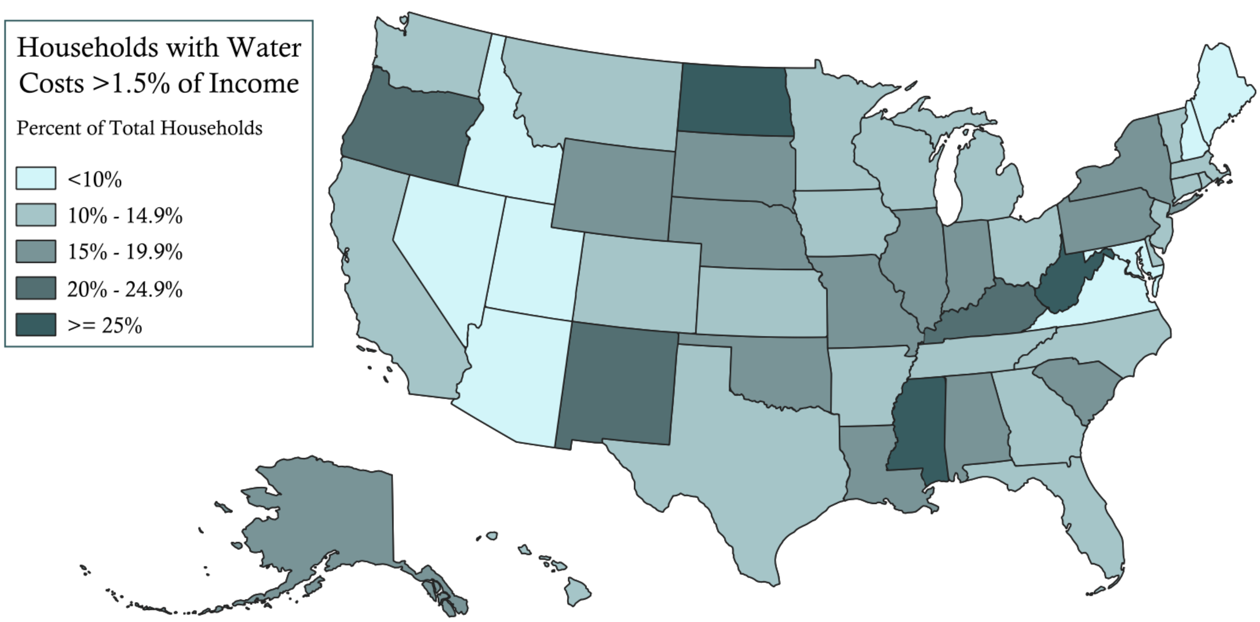
a. Excludes households not served by a community water system.

Based on the DWINSA-related costs alone, we estimate that the annual per capita need for large systems is approximately $96 ($240 per year for an average household), while for medium systems, per capita needs amount to $117 per year ($234 for an average household). Small systems face the largest challenge, with annual per capita needs of $267 ($534 per household). This is 180% higher than the estimated per capita needs for large systems. Again, these estimates represent only those needs reported in the DWINSA; they do not include the additional important investment needs discussed in this report, such as related to those related to PFAS, lead service line replacement, and natural hazards.

The 2.5% cost as a percentage of income threshold for drinking water is greater than the 2.0% threshold typically applied to wastewater; however, average household sewer costs exceed those for drinking water in most states (all but nine based on the LIWCAP report data). Thus, examining drinking water costs in isolation while relying on the traditional 2.5% threshold underestimates the number of households struggling to pay for overall water service. An alternative approach is to examine water and sewer costs using proportional thresholds. For example, nationwide, drinking water costs account for 45% of the total estimated water and sewer bill (drinking water accounts for $429 while sewer costs amount to $525). If we assume the traditional 2.0% threshold for wastewater, a proportional threshold for drinking water would be close to 1.5%. We estimate that currently, 19.0 million households (14.5% of all households) pay more than 1.5% of their income for drinking water. It would cost $3.65 billion to ensure water affordability for these households.

Figure 14 shows the percentage of households in each state that currently pay more than 1.5% of their income for basic drinking water services.

Figure 14. Percentage of Households Paying More than 1.5% of their Income for Basic Drinking Water Services



Source: LIWCAP Assessment, 2025 dollars

Note: Water and sewer costs reflect water use of 3,750 gallons per month, 50 gpcd for a 2.5-person household

Finally, as noted throughout this report, affordability challenges rarely stem from a single household bill. Instead, they emerge cumulatively, reflecting the combined cost pressures faced by low-income households across essential needs. In this context, examining total housing costs provides critical insight into broader affordability risks. Researchers have established thresholds to assess housing cost burden. A severe housing burden typically refers to households spending more than 50% of their income on housing, leaving limited resources for necessities such as food, healthcare, and transportation. A moderate housing burden applies to households spending between 30% and 50% of their income on housing.

Based on ACS 2023 single year data, approximately 15% and 16% of all U.S. households currently have a severe (> 50%) and moderate (between 30% and 50%) housing burden, respectively. Housing costs are defined as gross rent for renters and selected monthly owner costs for homeowners. Gross rent includes contract rent plus the estimated monthly cost of utilities and fuels, if paid separately by the renter. Selected monthly owner costs include mortgage payments (if applicable), property taxes, insurance, utilities (electricity, gas, water, sewer, and other fuels), and any homeowners association or condominium fees.

4.4. Affordability Assessment: Impacts of Closing the Funding Gap

Limited federal funding for drinking water utilities means that a significant portion of increased investments in drinking water infrastructure and rising O&M costs will likely be borne by residential water utility customers. This section estimates changes in household water costs through 2050 under two spending scenarios:

1. Continued baseline levels of capital spending per household (no real increases) with a small real increase in O&M spending, consistent with spending patterns over the past 20 years.
2. Capital spending per household increases consistent with the identified funding need in order to close the funding gap identified in this report without federal support.

For both scenarios, we consider relevant affordability metrics and estimate the number of households that will likely face affordability challenges. This analysis compares the years 2026 to 2050, in alignment with the preceding sections of this report.

4.4.1. Key Assumptions and Methods

As described previously, this analysis relies on average household water and sewer costs by state, calibrated to reflect a basic level of water use—defined as 50 gpcd for a 2.5-person household. We updated these costs from 2019 to 2025 dollars using the CPI for water, sewer, and trash, as published by BLS.

- Under the 2050 baseline spending scenario, we assumed that household water costs would continue to grow following historical trends. Specifically, we applied the BLS-reported average annual real increase in the cost of water, sewer, and trash services over the last 20 years (1.89% increase above inflation).
- For the second scenario, under which ratepayers bear the costs of meeting the funding gap, we assumed household bills would increase from the baseline scenario based on the projected percentage increase in spending on capital and O&M, including historical increased O&M spending per household.

We applied a real annual growth rate of 0.20% to project incomes beyond 2023, which reflects the real increase in incomes for households in the lowest income quintile from 2006 through 2023 based on data from the Federal Reserve.[95] We also assumed that income distribution will remain the same through 2050 and that the number of households will grow by 0.27% per year, again based on historical trends.[96] To estimate future housing burden, we incorporated historical changes in housing costs from the ACS.

---

[95] Federal Reserve Economic Data. 2024. Income Before Taxes: Income Before Taxes by Quintiles of Income Before Taxes: Lowest 20 Percent (1st to 20th Percentile), U.S. Dollars, Annual, Not Seasonally Adjusted. Available: https://fred.stlouisfed.org/.

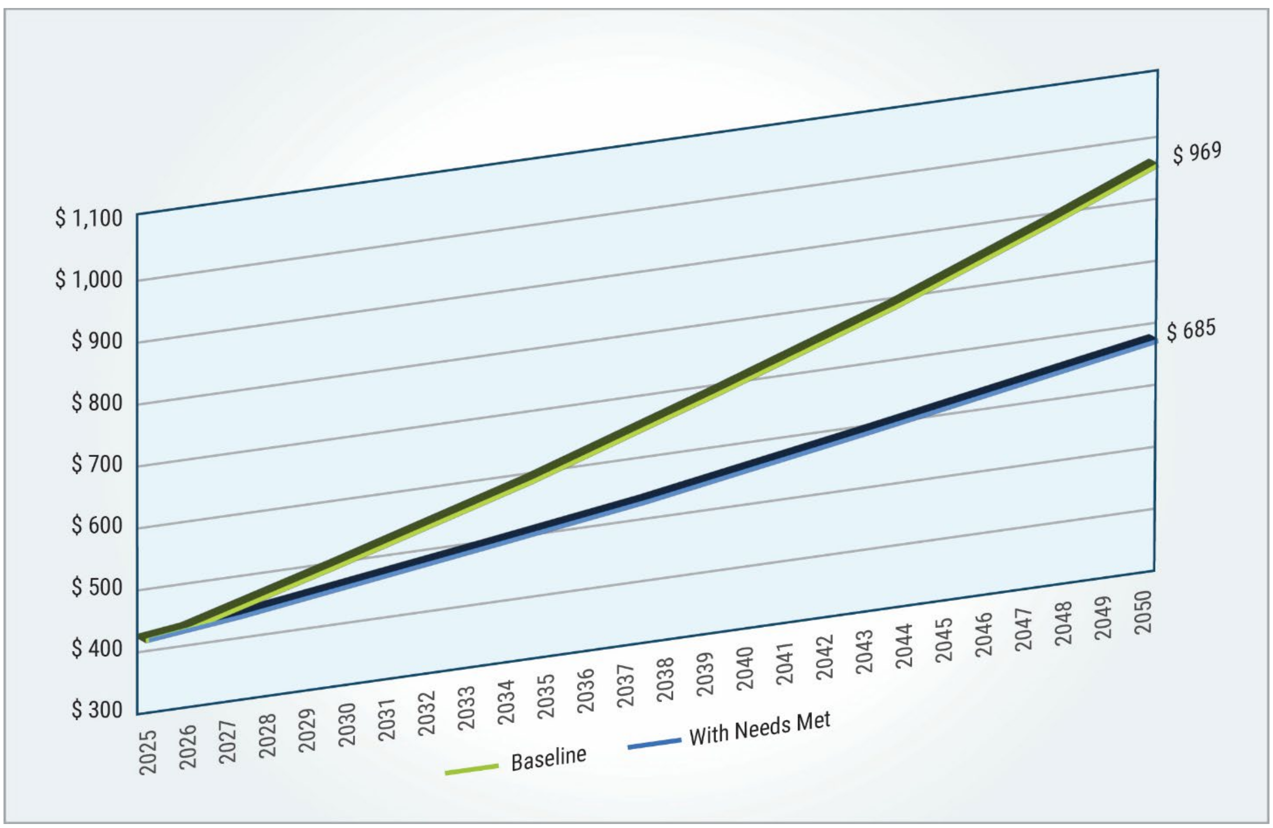
[96] Statista. 2025. Number of households in the U.S. from 1960 to 2025. https://www.statista.com/statistics/183635/number-of-households-in-the-us/?srsltid=AfmBOorT7CXcd5nwFW1gave2T6eYUtqPtWQnmw6NxsGjseAv-4wCQ4bR.

We assumed 50% of future investments are financed and 50% are cash-funded (referred to as PAYGO) to reflect the reality that for most drinking water utilities, a portion of capital infrastructure projects are debt financed. O&M costs for PFAS are phased in over time to reflect full implementation by 2029, per the final rule. This affordability analysis relies on the same assumptions put forth in the funding gap analysis with regards to projected capital and O&M needs. However, the affordability analysis assumes that growth will pay for itself, so costs for growth/expansion are assumed not to impact household bills. Finally, because future investment/spending needs are not allocated across states, we assume the same percentage increase in household bills for all U.S. households.

4.4.2. Growing Water Affordability Challenges

Under the baseline spending scenario, the average household drinking water bill would increase from $429 in 2025 (in 2025 dollars) to approximately $685 (in 2025 dollars) in 2050, representing a 60% real increase. If the gap in infrastructure funding is entirely borne by ratepayers, household drinking water bills could rise to $969 in 2050 (in 2025 dollars), a 41% increase over the 2050 baseline spending scenario and a 126% increase over 2025 baseline levels (Figure 15). This is reflective of the average increase for all households; it will vary based on several factors, including household water use, system size, and utility needs, among others.

Figure 15 Projected Real Increase in Annual Household Water Bills (2025$) under Baseline and Increased Spending to Meet Need



Based on the estimated increase in household water bills and income growth, we determined the number of households who would likely face drinking water affordability challenges under both 2050 scenarios, applying the 1.5% and 2.5% thresholds. We also estimated the costs (in the applicable year) associated with making drinking water affordable for the fiscally challenged households. Sewer costs (and associated thresholds) are not included in this analysis because we did not project the full funding need for the wastewater sector.

As summarized in Table 7, the projected increase in water service costs significantly expands the segment of the population facing water affordability challenges. If the identified funding cap is closed by increases in utility rates, the analysis indicates the following impacts:

- Approximately 30.4 million households (21.5% of the U.S. total) would spend more than 2.5% of their income on drinking water services.
- Approximately 53.5 million households (37.8% of the U.S. total) would spend more than 1.5% of their income on drinking water services.

An estimated $13.6 billion in annual federal assistance would be required by 2050 to subsidize these households to the point where their water bills remain below the 2.5% affordability threshold. Furthermore, we estimate that 19.0 million households (14.5% of all households) currently pay more than 1.5% of their income for drinking water. We estimate that it would cost $3.65 billion to ensure water affordability for these households.

Table 7: Drinking Water Affordability 2025, 2050 Scenarios

Source	2025 Current Baseline	2050 Baseline	2050 Full Burden
Average annual drinking water bill (50 gpcd for 2.5-person household, 2025 $s)	$429	$685	$969
Average annual drinking water bill (as a percentage of LQI)	1.24%	1.89%	2.67%
Number (and %) of households paying more for water than specified income threshold			
2.5% of income threshold	10.2 M (7.8%)	20.2 M (14.3%)	30.4 M (21.5%)
1.5% of income threshold	19.0 M (14.5%)	36.9 M (26.1%)	53.5 (37.8%)
Annual cost to make bills affordable in 2050 (i.e., less than specified threshold, 2025 $s)			
2.5% threshold	$1.94 B	$6.31 B	$13.6 B
1.5% threshold	$3.65 B	$11.6 B	$24.5 B

[1]The 2050 Baseline Scenario assumes current levels of capital spending per household would continue (no real increases) with a small real increase in O&M spending, consistent with spending patterns over the past 20 years.

[2]The 2050 Full Burden Scenario assumes capital spending per household increases consistent with the identified funding need in order to close the funding gap identified in this report without federal support. It also includes a small real increase in O&M spending, consistent with spending patterns over the past 20 years.

4.5. The Importance of Federal Funding Support

The analysis presented in this section demonstrates that the convergence of aging infrastructure replacement, strict regulatory compliance for contaminants, such as PFAS and LSL replacement, and necessary resilience upgrades has created a financial requirement that far exceeds the capacity of the traditional rate-based funding model. With total annual spending needs projected to reach $200.3 billion by 2050, relying exclusively on local rate increases to close the annual infrastructure gap would place an unsustainable burden on ratepayers, potentially resulting in 53.5 million households paying more than 1.5% of their household income for drinking water, and 30.4 million of those households paying more than 2.5%. Recognizing the conservative assumptions of this analysis and additional cost drivers that could not be nationally quantified, the costs and thus the affordability impacts are likely to be even greater.

Currently, the federal share of public spending on water sector utilities sits at approximately 3.9%, an amount disproportionately low compared to other critical infrastructure sectors. If this trend continues, states and communities will continue to stretch limited budgets while trying to maintain adequate levels of service and balance affordability challenges. Necessary investments may be deferred, likely resulting in more costly fixes over the long term and potentially public health challenges.

To ensure that safe, reliable drinking water remains accessible without driving millions of households into economic hardship, it is imperative that federal investment in the water sector evolves into a more significant, sustained long-term commitment that supports the sector's growing financial reality.

5. Summary of Findings and Conclusions

By analyzing existing data sources and recent regulatory impact analyses and comparing these against the current drinking water utility funding levels and household income trends, several key findings emerged regarding the drinking water utility funding gap and resulting affordability implications:

5.1. Report Findings

Infrastructure Needs Cost Projections. The total cost to address drinking water infrastructure needs over the next 25 years (2026–2050) is estimated to fall between $2.1 trillion and $2.4 trillion (in 2025 dollars). While the replacement and rehabilitation of existing assets accounts for a significant portion of this total, new cost drivers, specifically regulatory compliance for PFAS and LSL replacement, as well as hardening systems against natural hazards, add hundreds of billions of dollars to the national tab.

Infrastructure Funding Gap. Current capital spending by drinking water utilities averages approximately $33.6 billion annually. Capital investment would need to increase by approximately 168% to an average of $90.2 billion per year to address the need, resulting in an annual infrastructure funding gap of $56.6 billion. Under current funding models, the federal government only provides approximately 3.9% of total public spending on water sector utilities, significantly lower than the federal contribution to other infrastructure sectors such as highways (22.5%). Furthermore, while the IIJA provided a temporary influx of capital, these funds are scheduled to expire after FY2026, while O&M costs continue to rise at a rate exceeding inflation.

Projected Impact on Household Costs. If the identified funding gap is closed entirely through increases in local utility rates, the financial burden on households will increase substantially. Under a "Baseline" scenario, comprised of continued historical spending trends, the average annual household drinking water bill is projected to rise from $429 in 2025 to $685 by 2050 (in 2025 dollars). However, if drinking water utility spending increases to fully address the funding gap, and the spending is paid for through increases in local utility rates, the average annual water utility bill is projected to reach $969 by 2050 (in 2025 dollars). This represents an increase of roughly 126% over current levels before factoring in cost inflation.

Affordability Analysis. The projected increase in water service costs significantly expands the segment of the population facing water affordability challenges. If the identified funding gap is closed by increases in utility rates, the analysis indicates the following impacts:

- Approximately 30.4 million households (21.5% of the U.S. total) would spend more than 2.5% of their income on drinking water services.
- Approximately 53.5 million households (37.8% of the U.S. total) would spend more than 1.5% of their income on drinking water services.

An estimated $13.6 billion in annual assistance would be required by 2050 to subsidize these households to the point where their water bills remain below the 2.5% affordability threshold. Furthermore, we estimate that currently, 19.0 million households (14.5% of all households) pay more than 1.5% of their income for drinking water. It would cost an estimated $3.65 billion to ensure water affordability for these households today.

5.2. Conclusion

The analysis demonstrates that the cost to maintain regulatory compliance, ensure system resilience, and support population growth exceeds the current financial capacity of drinking water utilities' traditional rate-based funding model alone. With total annual spending needs (capital plus O&M) projected to reach $200.3 billion by 2050, relying solely on local rate increases will place a measurable portion of the U.S. population into a status of water unaffordability. Water utilities will need access to a suite of tools in order to meet the challenges presented by aging infrastructure, new regulations, hazards, and ensuring affordable rates. Closing the infrastructure gap will likely require a combination of rate adjustments, customer assistance programs, and significant federal investment to soften affordability impacts on communities.

American Water Works Association

AWWA Headquarters
6666 West Quincy Avenue
Denver, CO 80235-3098 USA
Phone: 303.794.7711
Fax: 303.347.0804
Toll-free: 800.926.7337
service@awwa.org

AWWA Government Affairs
1300 Eye Street, NW
Suite 701 W
Washington, D.C. 20005 USA
Phone: 202.628.8303
Fax: 202.628.2846

AWWAIndia Association
New Delhi, India
awwa-india.org

CONTACT US
awwa.org
303.794.7711 or
800.926.7337

A Better World
Through Better Water