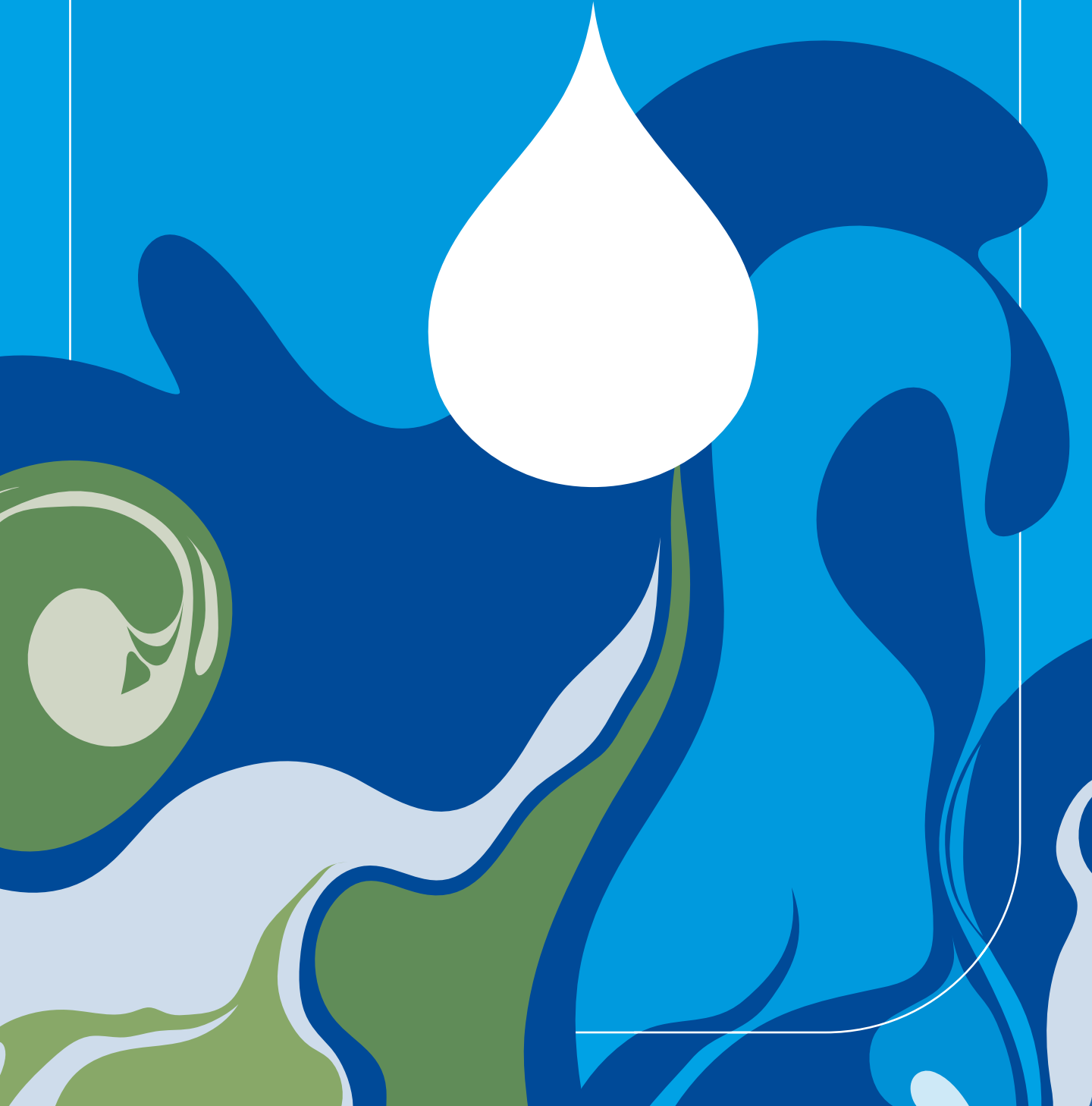




BLACK & VEATCH

2024

Water Report





About This Report

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A dozen years since Black & Veatch first launched its annual analysis of the U.S. water sector, the industry's complexities have grown more profound with challenges intensifying by the day.

Unsurprisingly, the industry's aging infrastructure remains the preeminent headache, as it has been for decades. Regulations relating to contaminants — often so-called “forever chemicals” — and the lead-and-copper rules continue to evolve and stoke uncertainty. Blamed for more frequent and severe weather events, climate change more than ever is testing the resilience of water infrastructure — and with droughts, impacting water supply. Cyber threats are on the rise, pressing the need for utilities to bolster their defensive postures. What are utilities doing in the face of the “silver tsunami,” the rising tide of retirements in the industry?

All of it provides the backdrop to Black & Veatch's *2024 Water Report*, a deep dive into many of the industry's top issues, based on expert analyses of our survey of roughly 630 U.S. water industry stakeholders.

Amid all the headwinds, opportunity still abounds. While still not used to its full potential in heightening resilience and sustainability, data continues to hold great promise in helping utilities do more with less with infrastructure well past its prime. Sustainability — what we define as the ability to meet the needs of the current generation without compromising the needs of future ones — is taking deeper root as a critical strategic focus.

The *2024 Water Report* offers a comprehensive overview of what's changed — and what has not — in an industry with enormous potential to accelerate innovation in strategy, operations and funding. 💧

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Executive Summary

A Rising Tide of Change: U.S. Water Sector Navigating Challenges, Opportunities as Sustainability, Resilience Drive Discussion

About the Author

Mike Orth is president of Black & Veatch's governments and communities business. Before that 2021 appointment, Orth served as executive vice president and managing director of Black & Veatch's water business in the Americas. He has guided the company's growth efforts in supply, storage, treatment and conveyance by delivering projects for clients through both traditional methods and alternative solutions such as design-build, performance contracting and public-private partnerships.

Anyone unversed in the rapid torrent of change in the U.S. water sector needs to only appreciate what the industry's stakeholders considered their top headaches a few short years ago. Cited in [2019 by eight of 10 respondents to Black & Veatch's survey](#) for its assessment of the sector, aging infrastructure overwhelmingly ruled the roost, as it has in virtually all of the 13 editions of this yearly report. Justifying capital improvement plans and rate requirements, managing capital costs, system resilience, and data collection and management followed, none getting more than 26 percent of the vote.

Flash forward to these times, and the tide dramatically has turned.

Aging infrastructure in dire need of upgrades and investment remains the biggest headwind among nearly 630 survey respondents in this Black & Veatch 2024 Water Report. Then there's the aging workforce and the hiring of qualified staff — what's being dubbed an unfolding "silver tsunami" of retirements expected to deepen over the next 10 years. Throw in the uncertainty of an evolving, shifting regulatory landscape involving contaminants such as "forever chemicals," lead and copper rules, the surge of cybersecurity threats, funding constraints, high energy costs, and the pressures for more sustainability and resilience in the face of growing climate change impacts.

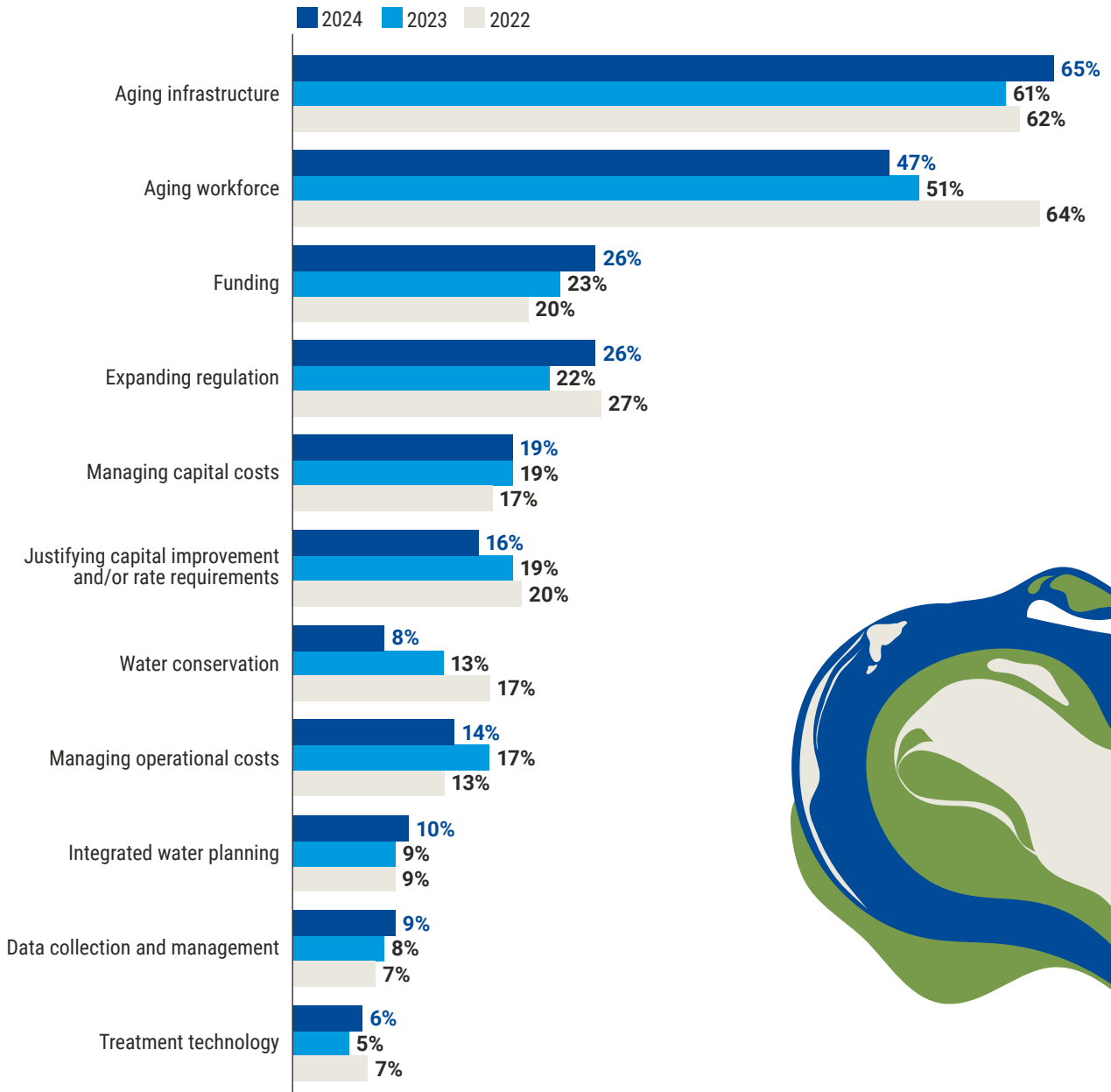
While the already complex U.S. water, wastewater and stormwater sectors try to muscle through a tug of war of conflicting priorities, a pipeline of opportunity exists, with the promise of digital technologies and innovations leading the list of ways in which operators can make better decisions and get the most of their graying assets and limited resources.

Integrated water solutions — with a "One Water" understanding that all forms of water are a singular resource to be managed sustainably — hold growing influence in helping reshape the water sector eager to achieve enhanced sustainability and system resilience.

Figure 1

What are the most challenging issues facing the water, wastewater and stormwater industry today? (Select up to three issues)

Source: Black & Veatch



Aging Infrastructure, Other Challenges Abound

In a fragmented industry with more than 50,000 water utilities and 16,000 wastewater utilities in the United States, there may be a time when aging infrastructure doesn't top the list of headaches, but it's unlikely to come soon. Roughly two-thirds of survey respondents (65 percent) cited that issue as their foremost challenge, a few percentage points higher than the previous two years but still easily at the top of the heap (Figure 1).

The matter of the aging workforce and the challenge of hiring qualified staff remains in the top two for the third consecutive year at 47 percent, down from 51 percent in 2023. This is a dramatic improvement from 2022 (64 percent), when COVID-19's impact included forcing droves of workers to go remote or, in scores of cases, retire altogether as increased adoption of automation and outsourcing filled

some of the gaps. That exodus is expected to worsen, with [federal estimates](#) that one-third of water utility workers could call it a career in the next decade.

When it comes to hiring staff in a sector where trained operators are crucial in satisfying the mission of capturing, treating and delivering water, the dilemma remains: qualified candidates have more options and bargaining power in an intensely competitive job market. That's putting a strain on utilities with limited financial resources, especially the smaller ones. Hoping to assist, the U.S. Environmental Protection Agency last year announced the availability of more than \$20 million in grants to support training and career opportunities for water and wastewater workers nationwide.

Money matters naturally never stray from being close to top of mind. Funding or availability of capital – along with growing regulation – tied at 26 percent for third place on the dreaded headache list, with managing capital costs (19 percent), justifying capital improvement programs and rate requirements (16 percent), and managing operational costs (14 percent) also all among the list's top 10.

Respectively, four in 10 respondents don't expect funding for capital infrastructure projects over the next five to 10 years to be enough; roughly a quarter said it'll just meet the requirement (27 percent) or that funding will be sufficient (24 percent). Nearly half (45 percent) said they've pursued state and federal funding (including the Bipartisan Infrastructure Law), with an additional 39 percent saying they plan to do so.

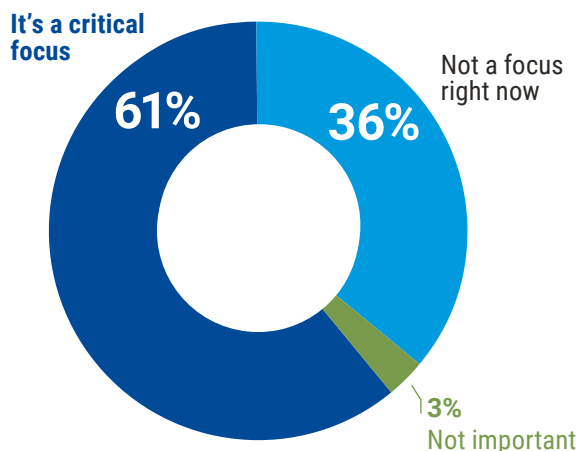
Sustainability

While sustainability means different things to different people, we see it as the need to serve the current generation while safeguarding the needs of future generations. And U.S. water utilities appear to be holistically embracing its importance, with six in 10 respondents casting

Figure 2

What is the importance of sustainability within the water utility industry? (Select one)

Source: Black & Veatch



it as a critical strategic focus, a slight drop from the previous two years but promising, nonetheless (Figure 2). Three-quarters of larger utilities – those serving a population of more than half a million – hold that view.

About half of respondents report that their utility has sustainability goals and the means to measure them, in line with last year (51 percent). Three-quarters of larger utilities – those with at least 500,000 customers – say they've got such targets and the related metrics, up from 67 percent just a year ago. By comparison, just 40 percent of smaller utilities say they have a sustainability game plan.

Components of those goals and metrics have shuffled a bit over the past year. While energy efficiency (89 percent) leads the way, renewable energy has surged to second (72 percent), overtaking water recycling (64 percent, up from 56 percent in 2023) and water reclamation (relatively unchanged at 63 percent). None of the other survey options – net zero carbon or GHG emissions, decarbonization, solid waste diversion or sea level rise adaptation – drew more than 50 percent.

Wondering about the time horizon for those with sustainability goals to achieve them? Quick answer: it won't be soon, with one-third of respondents giving an outlook of six to 10 years, with just 13 percent saying it'll happen within the next half decade. One-quarter (26 percent) don't know.

Digital Water

For years, these Black & Veatch reports have evangelized all that data can do through next-generation collection devices and predictive analytics. So-called “digital water” boasts the ability to funnel disparate data into a single, meaningful snapshot of the entire water ecosystem, giving insight into the system’s connectivity and synergies to drive operational efficiency, performance predictability and maintenance planning while optimizing workforce needs.

Simply put, data in a sector where many utilities grapple with trying to do more with less has the power to understand, manage and guide reliability and optimize asset performance, with smart infrastructure the key to overcoming the many threats to our water supply. Other benefits include precise reads of consumption and customer engagement and leak detection.

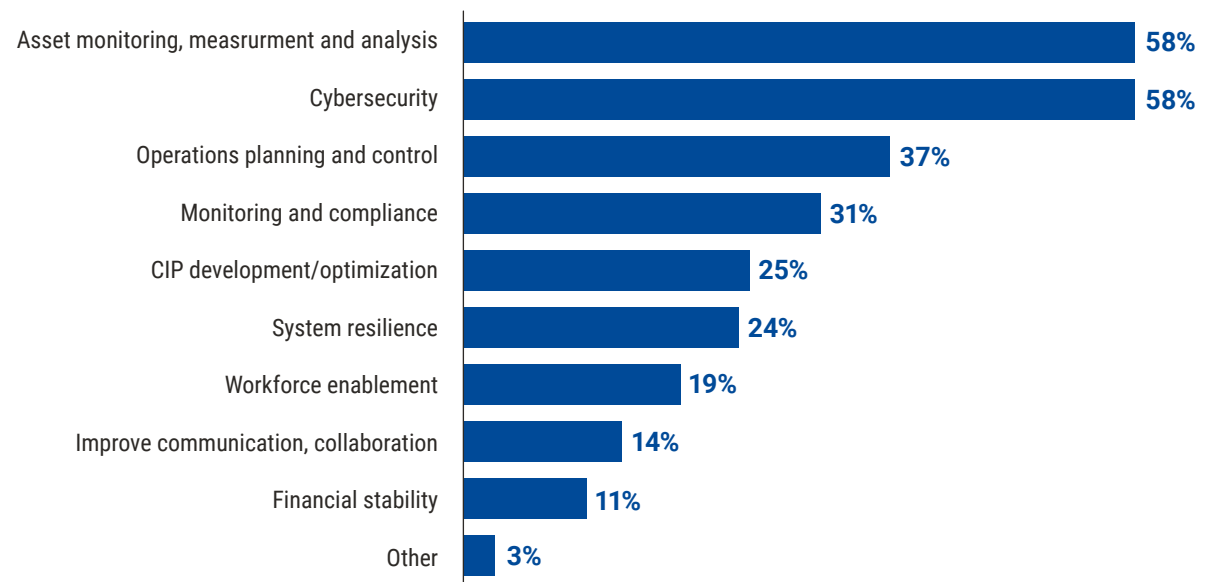
So where are today’s U.S. water utilities on the data journey? Not where they need to be, and for that they’re missing out. Six in 10 respondents say they’re collecting lots of or some data but not leveraging it effectively. And just 4 percent of respondents say their data or digital solutions are achieving all of their strategic objectives; 18 percent say they’re hitting most of their targets, while one in four say they’re achieving some.

While funding issues lead the list of reasons why respondents haven’t adopted digital solutions, a majority of those with a data-related gameplan say asset monitoring, measurement and analysis – along with cybersecurity – are their top objectives, followed distantly by operations planning and control, then monitoring and compliance (Figure 3).

Figure 3

What are the top objectives for your data or digital solutions strategy? (Select up to three)

Source: Black & Veatch



Cybersecurity

In a March 2024 letter, the Biden administration asked all governors to bolster security in their states for water and wastewater systems, warning that “disabling cyberattacks” are targeting utilities across the country, with the trend threatening to “impose significant costs on affected communities.”

“Drinking water and wastewater systems are an attractive target for cyberattacks because they are a lifeline critical infrastructure sector but often lack the resources and technical capacity to adopt rigorous cybersecurity practices,” [reads the letter signed by EPA Administrator Michael Regan](#), whose agency also has formed a task force to identify vulnerabilities in the water sector.

Water utilities understand the gravity, with more than eight of 10 respondents to Black & Veatch’s survey casting cybersecurity investment as “very important” in safeguarding their assets. Yet nearly 40 percent say they have cyber protocols in place but recognize gaps may exist with field devices and hosted solutions.

What’s more, two-thirds of respondents prefer that they govern their cybersecurity themselves, down from more than 70 percent over the previous two years.

As increasingly connected, digitized infrastructure presents new openings to cyber attackers while spurring utility stakeholders to reassess their security needs, decision-makers are well-served

seeking outside guidance and [solutions from such experts as Black & Veatch](#), which recently launched its global industrial cybersecurity business that the times demand.

The Pressing Need for Action, Change

As the headwinds whirl, the industry on many metrics appears to be better positioning itself against the challenges of the times, either independently or with outside guidance. Central to it all is addressing the need for infrastructure and technology investments while unleashing digital solutions that help abate water waste from aging, leaky pipelines, mitigate climate change fallout and pesky contaminants, and bolster water reuse while maneuvering the confines of rates and regulation.

Slowly but surely, U.S. water utilities are discovering and pursuing new ways of doing business by leveraging integrated approaches to both planning and delivering strategic, financial and operational resilience.

With innovation knocking, the sector has an opportunity to be an agent of change. Because this age of rapid change demands it. 💧

Elsewhere in This Report

Contaminants

From federal rules for lead service lines and efforts to mitigate contamination from so-called, high-profile “forever chemicals,” U.S. utilities in the business of providing clean, reliable drinking water are reflecting tension and anxiety about ever-evolving regulations related to contaminants.

Climate Change

As extreme weather events in the form of flooding, droughts and wind-fanned wildfires increasingly stress and test the resilience of their aging infrastructures, U.S. water utilities are pursuing nature-based solutions and other mitigation efforts but not meaningfully turning to the promise of predictive climate analytics platforms.



Cybersecurity

Growing Concern About Cyberattacks Calls for Additional Guidance



As the federal government investigates multiple cyberattacks, it's becoming abundantly clear that water utilities are a particularly vulnerable part of the nation's critical infrastructure.

Last November, [as reported by Politico](#), politically motivated hackers breached a Pennsylvania water utility's booster station. While that attack was diverted before any major impacts were made on water quality or availability, U.S. lawmakers have demanded more proactive cybersecurity measures. Last year, the Environmental Protection Agency (EPA) unveiled (and later rescinded) new federal mandates requiring water system inspections to include assessments of cybersecurity threats. While emerging standards are a step forward, there are worries about whether basic observance would give water utilities a false sense of security; compliance often does not necessarily equal a robust cybersecurity program.

Based on expert analyses of data from nearly 630 survey respondents, Black & Veatch's *2024 Water Report* illustrates a water sector navigating the challenges of cybersecurity, confidence in their current cybersecurity strategies, proactivity in financing upgrades and willingness to seek expert guidance.

Utilities Acknowledge that Cybersecurity is Essential

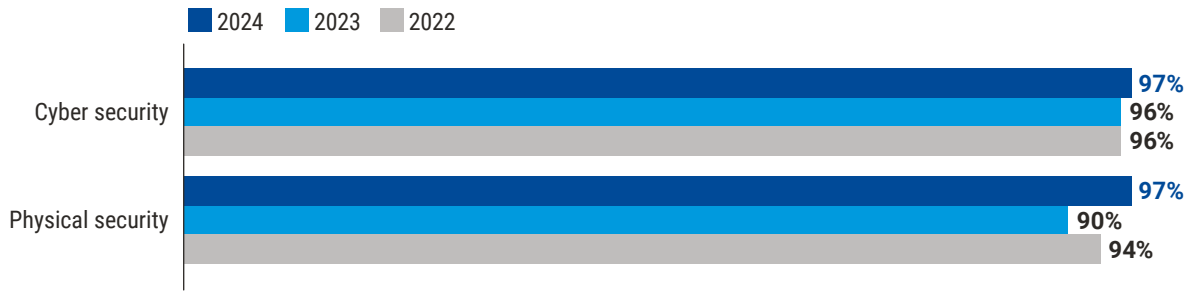
Eighty-six percent of respondents reported that cybersecurity is "very important," while 73 percent categorized physical security in that way. Utilities are recognizing that cyberthreats have an exponentially growing reach, with even greater potential compromise than physical threats.

For example, if a whole network system is compromised in a cyberattack, it could impact the entire utility; if just a single pump station is physically vandalized, the effects might be limited and addressed without a widespread service outage.

Figure 4

How important is the investment in the security of your assets? (Select one for each)

Source: Black & Veatch



Note: These responses are just the 'very important and important' answers.

If the data for “very important” and “important” are combined, 97 percent of respondents believe that both cybersecurity and physical security are essential to the security of their assets (Figure 4). While there were no significant changes in the data regarding cybersecurity from 2022 to 2024, it’s worth noting that physical security had a 7 percentage point increase in “very important” and “important” responses from 2023 to this year. Respondents correctly may be recalling the increase in physical attacks on electrical substations in the Pacific Northwest in November 2022 that caused significant customer outages.

These observations are further validated in the [digital water section, page 41](#) of the 2024 Water Report; cybersecurity and asset management were tied at 58 percent among top objectives in the utilities’ digital solutions strategy.

As promising as that sounds, utilities cannot have robust cybersecurity without equally robust physical security, and vice versa. Here’s why: network devices and endpoints need physical protection to prevent unauthorized *electronic* access by an adversary. Conversely, the technology that supports physical security needs cybersecurity protection to prevent unauthorized *physical* access by an adversary. Utilities should consider having their cybersecurity and physical security professionals collaborate to strategically align efforts. For example, if an adversary were to access a computer physically, they are more easily able to hack into the computer, affecting the utility’s cybersecurity as well.

Hinderances Include Lack of Personnel Training, Funding

When asked what is preventing utilities most from advancing the cybersecurity of their control systems, staff resources (47 percent) and budget or funding (37 percent) led the way (Figure 5). In the past year, it appears that staff resources became slightly less of a concern, decreasing from 51 percent in 2023. Budgeting became more of a hindrance, increasing from 33 percent in 2023. Respondents who selected cyber expertise slid from 33 percent in 2023 to 23 percent in

2024; this reveals that although there still are knowledge gaps within their organizations when it comes to cybersecurity, utilities are beginning to feel more confident in their abilities to address it.

A takeaway: utilities should provide their control systems' engineers with additional cybersecurity training to work toward closing this knowledge gap completely while simultaneously mitigating their staff resource obstacles.

Figure 5

What is preventing you most from advancing the cybersecurity of your control system(s)? (Select up to three)

Source: Black & Veatch

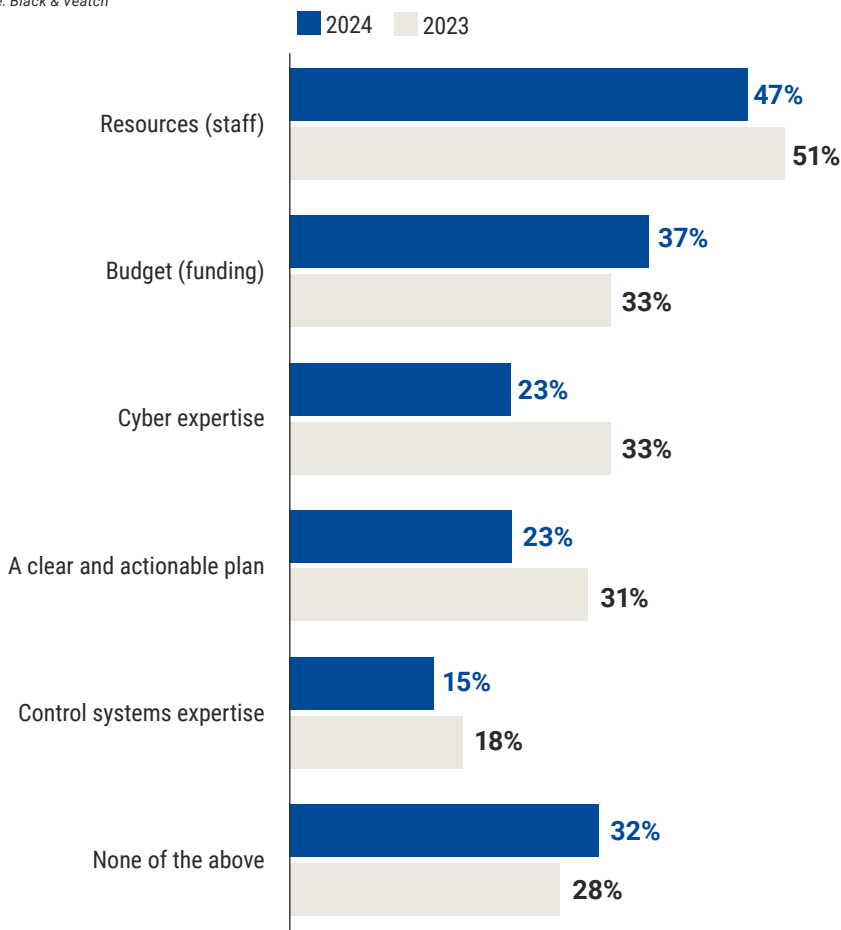
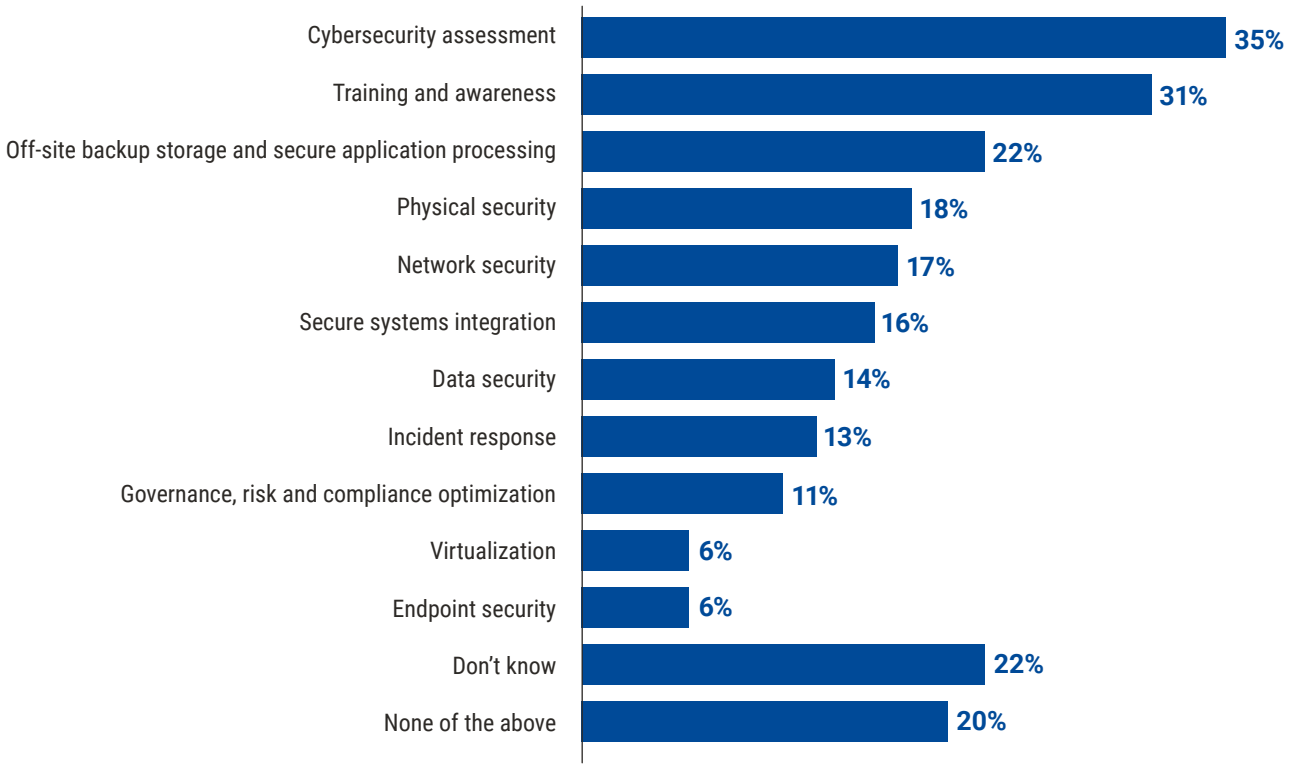


Figure 6

Which of the following areas, if any, would your organization prefer to outsource?

(Select all that apply)

Source: Black & Veatch



Utilities Seek External Support to Address Cyber Challenges

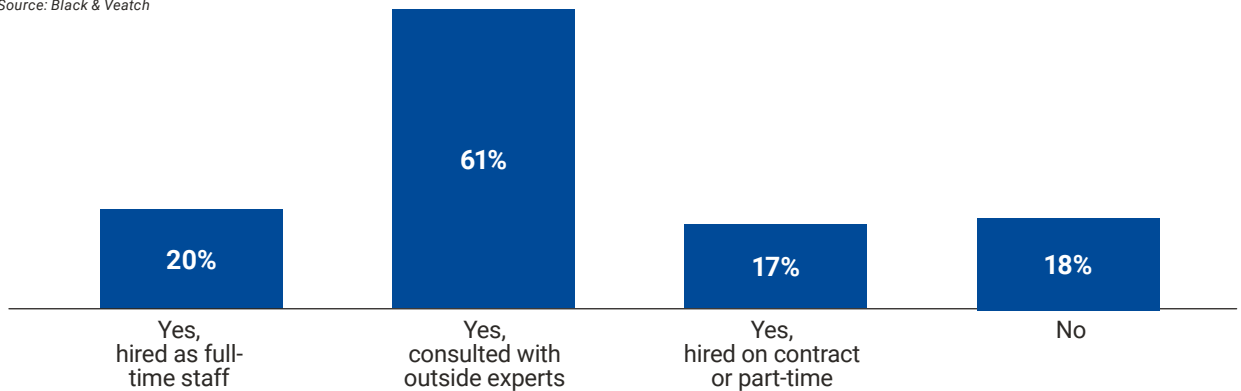
Without question, utilities agree that cybersecurity is a growing concern – but a few key obstacles stand in their way. Black & Veatch’s survey found that utilities may be struggling to determine the best path forward and are seeking external support to address it. Of all the areas that can be outsourced, 35 percent of respondents reported a preference to do so with cybersecurity assessments, closely followed by personnel training (31 percent) (Figure 6). There’s a correlation between these two majority selections, in that utilities need assessments to embark on their cybersecurity journey and need training to maintain the strategies implemented.

Figure 7

Has your utility hired or consulted with cybersecurity experts or information security engineers?

(Select all that apply)

Source: Black & Veatch



Sixty-one percent of utilities reported that they already have consulted with outside cybersecurity experts; an additional 37 percent hired cybersecurity experts as either part-time or full-time permanent staff (Figure 7). Only 18 percent hadn't consulted with external experts at all – an encouraging showing of the willingness of utilities to seek external expertise to protect their assets in the most strategic way possible. It could also mean that in that 18 percent, utilities may have internal IT and SCADA departments, with experienced resources and the ability to take on cybersecurity without external consultants.

Next Steps: Connecting the 'Why' to the 'How'

Given the proliferation of digital attacks and growing vulnerabilities, it's more important than ever to take cybersecurity seriously. Black & Veatch's survey demonstrates that utilities agree on the "why" behind cybersecurity, but not all are confident on the "how." When it comes to cybersecurity, the areas where utilities need the most support are training, technical design and funding. Regarding technical design, utilities are seeking alignment for their people, processes and technology in addition to ongoing management, with a growing chorus among utilities of "help me build it, then help me run it."

Funding remains a hindrance; due to inflation, costs for utilities are rising across the board – not just for cybersecurity services. This makes

it challenging to make impactful progress when fewer "real" dollars are available to be applied to these initiatives. Underfunded utilities also are more likely to be using outdated equipment that isn't protected from modern cyberattacks.

The bottom line: utilities should consider a holistic approach to cybersecurity, understanding that it's not just about addressing vulnerabilities but about how cybersecurity fits into the overall modernization strategy and existing system of operations. It's also about balancing multiple priorities that shouldn't have to compete. Many utilities are doing a great job of bolstering resiliency in the face of climate change but are lacking in cybersecurity. These don't have to be competing priorities, and it's essential to find ways to address both.

Following the data trend of seeking external consultants, utilities benefit from collaborating with expert advisory partners such as Black & Veatch who can provide an [overall cybersecurity roadmap](#) that considers initial costs, lifecycle costs and process integrations to best fit their unique needs. 💧

Contaminants



Modular Solutions, Predictive Modeling Good Steps Toward Managing Drinking Water Contamination

While drinking water safety typically is drowned out by more controversial political issues in an election cycle, public awareness of emerging waterborne contaminants – and the newly established federal regulations – should make the calls for improved water treatment infrastructure loud and clear across both sides of the aisle in 2024.

In April, the [federal government announced a regulatory limit for all municipal water systems](#) for six perfluoroalkyl and polyfluoroalkyl substances, known collectively as PFAS or “forever chemicals.” At the same time, utilities are still weighing options for complying with the EPA’s Lead and Copper Rule Revisions that, by October 2024, would require establishing and maintaining an inventory of water service line materials.

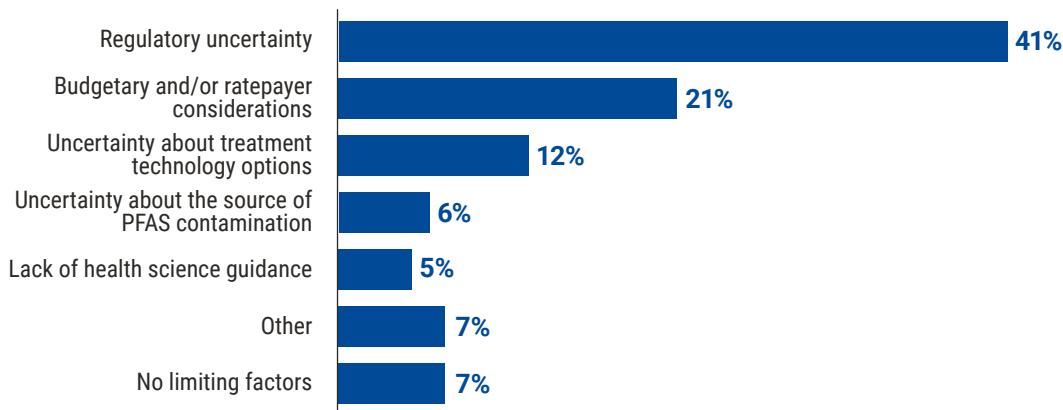
Black & Veatch’s *2024 Water Report* – based on a survey of nearly 630 U.S. water sector stakeholders – showed that for the third year in a row, respondents reported regulatory uncertainty as the greatest limiting factor for addressing PFAS in water. But that survey was conducted from mid-February through early March, before the EPA’s April announcement about the new regulations. At 41 percent, though, that concern was down 7 percentage points from 2023 (*Figure 8*).

Given the release of the final drinking water regulation this year, it remains to be seen if utilities will be confident in their regulatory requirements going forward, or if uncertainty will continue due to other evolving regulations such as proposed changes under the Resource Conservation and Recovery Act (RCRA).

Figure 8

What’s the greatest limiting factor for your utility addressing PFAS in your water? (Select one)

Source: Black & Veatch

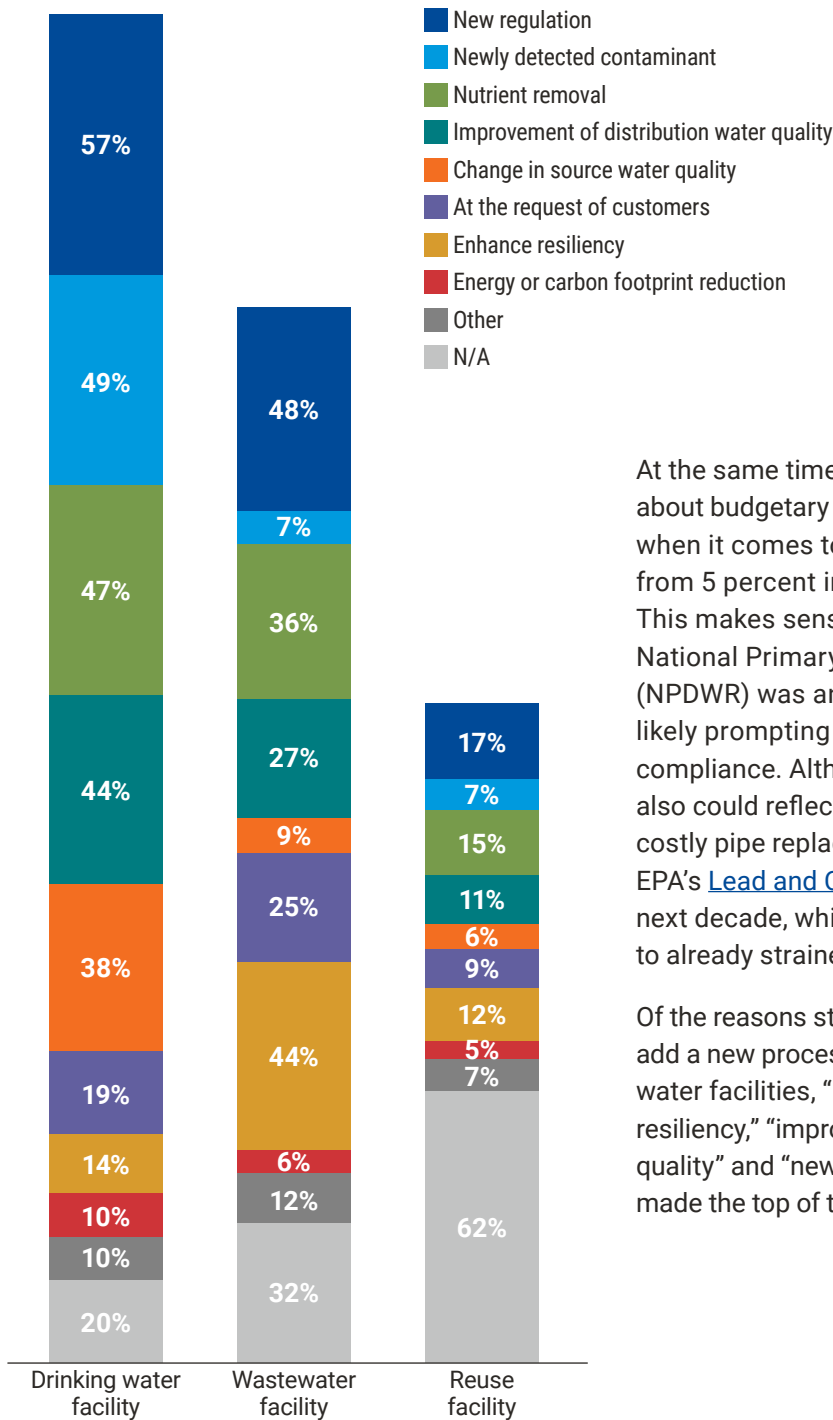


Note: The survey was conducted online Feb 12 - March 15, 2024.

Figure 9

What reason(s) do you expect to add a new process or technology to each facility? (Select all that apply for each)

Source: Black & Veatch



At the same time, water stakeholders’ worries about budgetary and/or ratepayer considerations when it comes to PFAS jumped significantly from 5 percent in 2023 to 21 percent in 2024. This makes sense, as the U.S. EPA’s proposed National Primary Drinking Water Regulation (NPDWR) was announced in March of 2023, likely prompting concerns about the cost of compliance. Although different contaminants, it also could reflect burgeoning knowledge about costly pipe replacements necessary to meet the EPA’s [Lead and Copper Rule Revisions](#) over the next decade, which would certainly add pressure to already strained budgets.

Of the reasons stakeholders said they expected to add a new process or technology to their drinking water facilities, “new regulation,” “enhance resiliency,” “improvement of distribution water quality” and “newly detected contaminant” again made the top of the water survey’s list (Figure 9).

Waterborne Disease

The increase in responses about newly detected contaminants largely could be attributed to more awareness of potential PFAS and lead contamination; however, that response, along with the rise in concern over distribution water quality, might reflect a [March report from the Centers for Disease Control and Prevention](#). Of U.S. waterborne disease outbreaks from 2015 to 2020, the report found that drinking water exposures caused 2,140 illnesses, 563 hospitalizations and 88 deaths. Legionella, which causes potentially fatal Legionnaires' disease, was the leading cause of outbreaks. That bacteria can grow in piping systems of office buildings, hospitals and cruise ships, and they affect people through inhalation of aerosolized water droplets.

At a time when aging water infrastructure is causing more illness and resulting in the lack of our most basic, life-sustaining necessity — for example, a water treatment plant failure in summer 2022 that left more than 150,000 people without safe drinking water for weeks — ratepayers and politicians seem just as focused on headline-grabbing PFAS regulations. Along with the Lead and Copper Rule, the final national primary drinking water regulation for PFAS is the biggest drinking water regulation of the past decade.

It also could be the costliest, with PFAS treatment solutions in the United States potentially exceeding \$3 billion annually, according to a [Black & Veatch study conducted for the American Water Works Association](#). The costs could be a major hurdle for water utilities and ratepayers across most states and municipalities, which already are struggling with funding uncertainties, staff shortages and other headwinds facing the nation's aging water systems. While compliance could be difficult, the dangers to public health could come at much higher costs.

Water Treatment Solutions

PFAS treatment investments should balance several factors, including treatment goals, water quality and how PFAS treatment technologies could complement existing infrastructure and operational needs. Remediation in drinking

water can be accomplished through ion exchange, granular activated carbon adsorption, nanofiltration and reverse osmosis. A bench scale test or pilot test helps determine which treatment technology is best.

With today's technology, it shouldn't take one to three years to bring safe drinking water to communities across the country. [Modular treatment solutions](#) also have emerged as a viable short-term option for complying with PFAS regulations in time-sensitive or emergency situations. Following upfront testing and assessments, modular units can be delivered by vehicle and deployed in compact configurations. Each can treat up to 4 million gallons of water per day, and multiple units can be deployed at the same time for higher treatment flows. The temporary solutions are relocatable once water utilities have permanent PFAS remediation technologies in place.

PFAS in Wastewater, Biosolids

Although PFAS treatment options are available for drinking water, the industry should brace for yet another challenge on the horizon: PFAS in wastewater. One potentially overlooked aspect of PFAS contamination that could make solutions for future drinking water treatment and regulation murkier is the release of PFAS chemicals into waterways following wastewater treatment processes and biosolids production. By the end of 2024, the EPA is expected to release the results of a biosolids risk assessment for two PFAS compounds, after which it plans to decide whether PFAS management in biosolids is necessary.

Although there are no regulations limiting PFAS release from wastewater treatment facilities, lawsuits throughout the country could further bring wastewater treatment operations under the EPA's microscope. In Georgia, a federal lawsuit alleges that one city allowed a land company and water control plant to release PFAS into a river's watershed, contaminating the county's drinking water through sludge disposal operations, [according to several reports](#). Similarly, farmers are suing a biosolids management company for

allegedly high levels of PFAS in the fertilizers it produces from sewage sludge; that lawsuit claims contaminated water killed livestock and decreased property values. Maine has banned land applications of biosolids. Regardless of regulation status, individuals and businesses are demanding action around keeping their waterways clean.

Lead and Copper Rule

Finally, when it comes to the biggest challenges water stakeholders said they were facing related to the Lead and Copper Rule Revisions, service line inventory mapping (47 percent) took the top spot this year over staffing availability (43 percent), which was the biggest concern in 2023 (*Figure 10*). The result suggests water utilities are most concerned about how they're going to meet the EPA's deadline for establishing and maintaining an inventory of lead water service lines by October 2024. Some of this worry

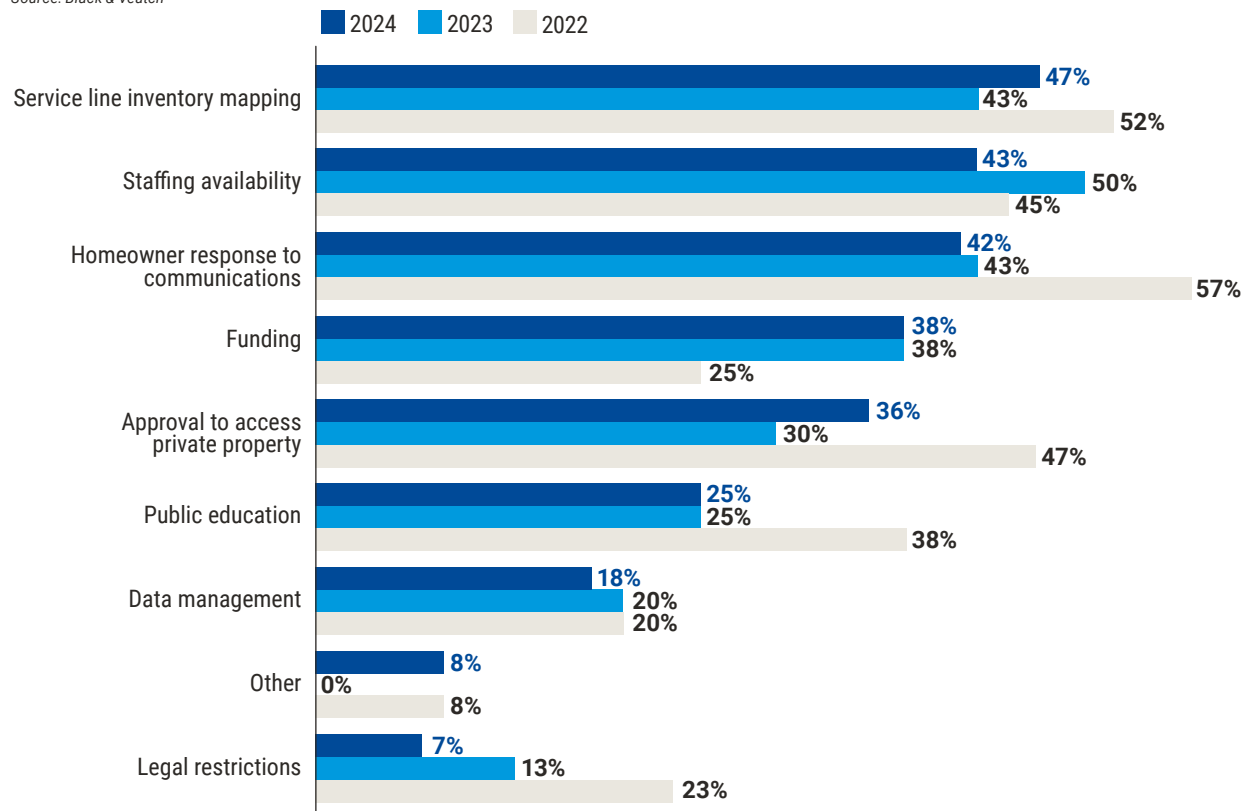
could be attributed to unknowns existing on the customers' side of water meters as there was an increase in the difficulty to gain approval to access private property (up to 36 percent from 30 percent in 2023) as the inventory deadline approaches.

Although there has been uncertainty about whether state regulators will accept statistical processes that estimate inventory materials, predictive modeling could help utilities minimize the amount of unknown service line materials in their systems. It's an especially efficient data collection mechanism for utilities faced with gathering hundreds of thousands of data points. 💧

Figure 10

What are your biggest challenges related to lead/copper rule compliance? (Select all that apply)

Source: Black & Veatch



Environmental and Treatment





Managing Current, Emerging Regulations in Wastewater

Over the past three decades, nutrient regulations have driven utilities to implement nutrient removal at their facilities in different watersheds across the United States and Canada, including most notably the Chesapeake Bay area around Washington D.C. and Long Island Sound in New York. Currently, nutrient regulations are being implemented in multiple states with waterways that feed into the Mississippi River, aiming to reduce the incidence of hypoxia in the Gulf of Mexico, impacting by U.S. Environmental Protection Agency's (EPA) estimates 1,232 publicly owned treatment facilities across 31 U.S. states and two Canadian provinces.

In addition, regulations are being developed on per- and polyfluoroalkyl substances (PFAS) — so-called “forever chemicals.” While drinking water is an immediate focus, wastewater and effluent quality needs retain some of the spotlight as regulation sets its sights on the pressing issue.

Per the [EPA's 2023 effluent guidelines plan](#), a nationwide study will be conducted this year to collect and analyze nationwide data on industrial discharges of PFAS into publicly owned treatment works (POTWs) influent, effluent and sewage sludge. The study inevitably will steer the conversation about continued regulations and future practices while driving utilities to better plan their operations to meet the needs of the EPA guidelines.

Along with PFAS guidelines, nutrient removal remains in play. While in some areas, nutrient removal regulations are in place for some nutrients, there remains uncertainty in future direction of those limits and for other nutrients. Highly populated states such as California, Texas and Florida are rolling out nutrient limits to reduce eutrophication — an excess of nutrients in bodies of water. The San Francisco Bay is looking to implement strict nutrient limits, and in Texas, nutrient limits are starting to be issued to facilities discharging into pristine waters. Florida also recently signed legislation that eliminates direct discharges to the ocean driven by severe algal blooms, resulting in increased reuse efforts.

Black & Veatch's *2024 Water Report* — based on expert analysis of survey results from about 630 U.S. water sector stakeholders — highlights an industry on the cusp of change, waiting for the next regulation to take the wheel of their operations and steer them in the right direction while continuing to manage the changes needed to meet existing challenges.

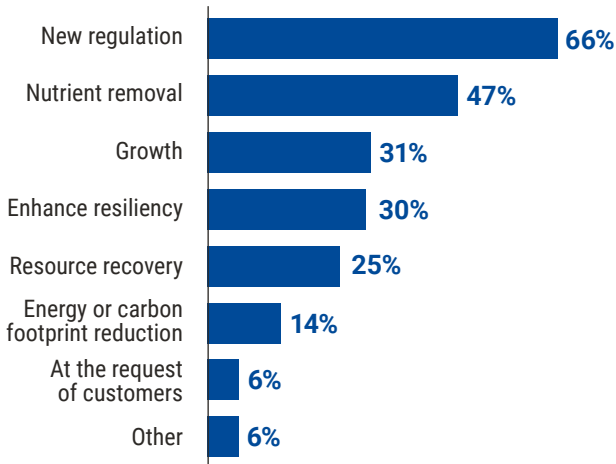
Regulation as a Reason

Are new regulations a significant factor in moving the needle on improving wastewater treatment to protect human health and the environment? According to survey respondents, notably two-thirds of them, that answer is yes.

Figure 11

What reasons do you expect to add a new process or technology? (Select all that apply)

Source: Black & Veatch



When asked what reasons they expect to add a new process or technology, two-thirds of respondents noted “new regulation” as their top choice, followed by “nutrient removal” (47 percent) and “growth” (31 percent) (Figure 11).

New technology can address PFAS removal and nutrient removal such as nitrogen and phosphorous, support asset management and more. In an age of increased extreme weather events attributed to climate change testing community water systems, one might think that “enhancing resiliency” – or even “resource

recovery” – might score more highly in relation to the others, but our survey results showed otherwise. Regulations are the main drivers.

As new regulation provides the push utilities need to get moving on their plans, the EPA is working to survey water stakeholders and provide updated guidelines, and the Clean Water Act from more than a half century ago remains the law of the land.

Sixty percent have tested for PFAS at their water resource recovery facility (WRRF), and many respondents suggest that new regulations will be the driver in implementing enhancements. The prospect of an election year brings about uncertainties, especially when it could mean major changes in the EPA. But there is silver lining: many already are thinking about addressing this challenge at their utility and what it means for their communities and the environment.

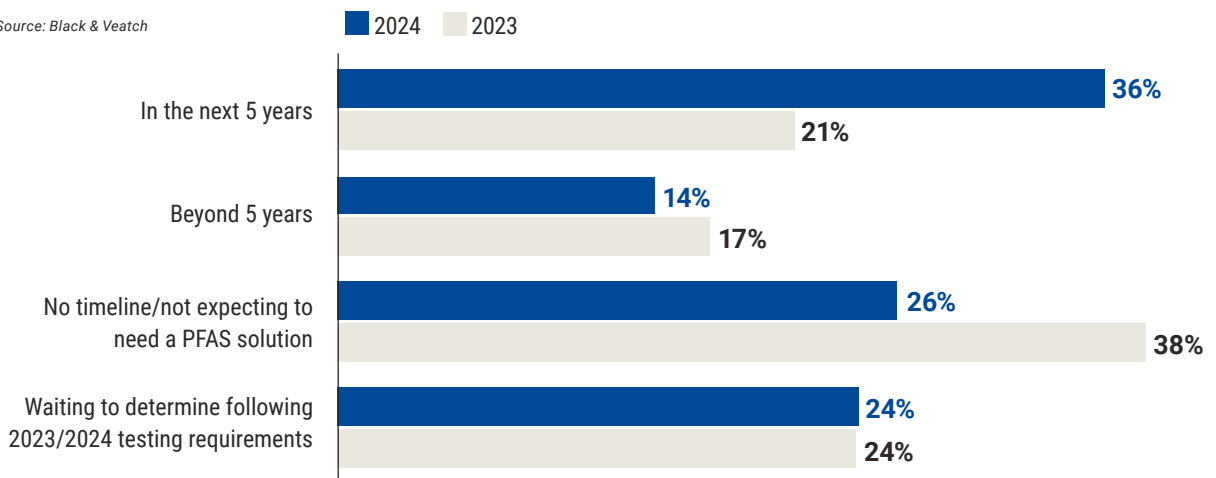
Wastewater Treatment: An Industry in Limbo

Encountering uncertainty, wastewater treatment plants are looking ahead to PFAS mitigation strategies, and it may be sooner rather than later. When survey respondents were asked when they foresee the need to provide a PFAS management/treatment solution, 36 percent responded “in the next five years,” a 15 percent jump from 2023. The number of respondents with no timeline decreased from 38 percent to 26 percent (Figure 12).

Figure 12

When do you foresee that you may need to provide a PFAS management/treatment solution? (Select one)

Source: Black & Veatch



Notably, one in four (24 percent) of respondents remained consistent in their stance to wait until 2023/2024 testing requirements. About one-quarter of utilities seem to be in limbo, ensuring their efforts to manage and treat PFAS are worthwhile. And while almost 40 percent know they will be dealing with it in the next five years, the uncertainty remains steady for the other 50 percent, with no timeline or plans to wait.

When uncertainty abounds regarding PFAS, the rumor mill begins turning, leaving utilities asking when the regulations will be at play and exactly how low the limit will be. Without definite numbers and concrete regulation, wastewater treatment facilities are left in the dark about future regulations, operating without knowing what plans to make, and creating uncertainty on the funding required to make any changes.

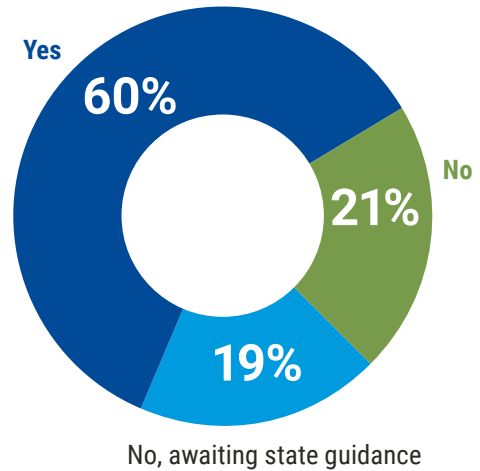
When survey respondents were asked if they have tested their WRRF influent, effluent or biosolids for PFAS content, a strong 60 percent said yes, leaving the remaining 40 percent responding no and/or that they are “awaiting state guidance before they sample” (Figure 13). Without the data, plans for removal and treatment cannot be made.

Wastewater facilities may be stuck between a rock and a hard place. The EPA’s 50-year-old Clean Water Act seeks to regulate and ensure healthy effluent water guidelines, but without the proper updates to limitations and treatment, utilities are tasked with managing their own treatment plants and hoping for the best – or they are stuck in limbo, awaiting an uncertain future. 💧

Figure 13

Have you tested your Water Resource Recovery Facility (WRRF) influent, effluent or biosolids for PFAS content? (Select one)

Source: Black & Veatch



Rates



Growing Needs for Infrastructure Investment, Ratepayer Education

At a very basic level in the water sector, it's all about money: How much, where to get it and who will pay for it.

The industry's notoriously aging infrastructure demands the infusion of historic investment for long-overdue upgrades. The quest by drinking water utilities for sustainability – by our definition, the ability to meet the current generation's needs without compromising the needs of future ones – doesn't happen for free. With so many utilities grappling with competing interests, including hardening assets and networks against cyberattacks and climate change, budgets are tight.

On the water treatment side, the federal government announced in April [a regulatory limit for all](#) municipal water systems for six per- and polyfluoroalkyl substances on utilities and those they serve.

It brings us all to the issue of rates, the heavily scrutinized lifeblood of utilities tasked with providing clean, affordable drinking water to often cost-conscious consumers – especially the economically disadvantaged – with little appetite for higher monthly bills.

According to a survey of nearly 630 U.S. water sector stakeholders for Black & Veatch's *2024 Water Report*, six in 10 respondents deem sustainability as a critical strategic focus. But only about half – 49 percent – have sustainability goals and the metrics to measure them. Therein lies the push/pull of balancing the utility's basic needs versus investments in sustainability – however the utility defines it – and perhaps some evidence that utilities traditionally pull back on discretionary activities such as sustainability when dollars are tight.

The Divide Over the Value of Water

Too often, consumers don't fully understand water's value and true cost. Consumers believe this vital resource is seemingly endless and are oblivious to the investment-starved, decaying assets they can't see. That disconnect appears to be worsening; some 61 percent of respondents believe consumers have "little understanding" of the gap between the cost of producing safe water and the current rates they pay, up from 50 percent each of the previous two years. Consistent with the previous two surveys, just 3 percent have a "full understanding."

That shortcoming in perceived understanding comes as four in 10 respondents say funding for their capital infrastructure projects won't be enough in the next five to 10 years, an uptick from the 36 percent in 2023. Roughly half of respondents say such funding will either meet the requirement or be sufficient, almost identical to last year's feedback.

Billions of dollars available in federal funding from the Bipartisan Infrastructure Law — also known as the Infrastructure Investment and Jobs Act — may be enticing to utilities, though many utilities still view such programs as too administratively burdensome or restrictive — again, the top two reasons respondents say they haven't taken advantage of that funding infusion. The slowness of such federal monies making their way through the pipeline — and the fact that they don't address operations and maintenance concerns that continue to rise in cost — haven't helped.

Enter rates again. When it comes to addressing their utility's financial resilience, 73 percent of respondents say their strategy includes annual or multi-year rate adjustments, just edging

out the 72 percent who cited capital program prioritization. Capital program prioritization had held a 3 percent point lead over rate increases in 2023's survey.

Long story short, this backdrop amplifies the need for utilities to communicate sustainability efforts to consumers better — unquestionably a formidable challenge, given that pressing rate increases at levels that outpace inflation is a heavy lift.

In the end, financial resilience depends on a proactive strategy for addressing customer affordability — especially in an inflationary environment — with the understanding that ignoring the economically disadvantaged ratepayer could give those deciding your next rate increase request the grist to deny it.

The key is a holistic approach toward building rate resilience and an amplified engagement and education of ratepayers to promote the true value of their water and the pressing need to invest in it. 💧



Sustainability and Decarbonization

Water Conservation, Loss Mitigation Emerge as Top Tactics for Sustainability, Decarbonization

Sustainability programs are embracing a spectrum of topics – from conservation and resilience to reuse, better efficiencies and new technologies – all integral to water stewardship. All of it is punctuated by the fact that water is a finite resource and an increasingly pressing global concern.

A legion of variables are complicating matters. The ever-aging infrastructure of the U.S. water and wastewater sectors is strained through more frequent extreme weather events such as droughts and floods. The unabated growth of urbanization with more development, along with digitization leading to the development of water-intensive data centers, is stoking rising demand for reliable water supplies.

The critical question: Where are water utilities in their sustainability and decarbonization journeys? Black & Veatch’s 2024 Water Report, with expert analyses of survey responses from nearly 630 U.S. water sector stakeholders, offers answers about how the complex water industry perceives sustainability and tracks its progress in a world eager to dramatically reduce carbon emissions.

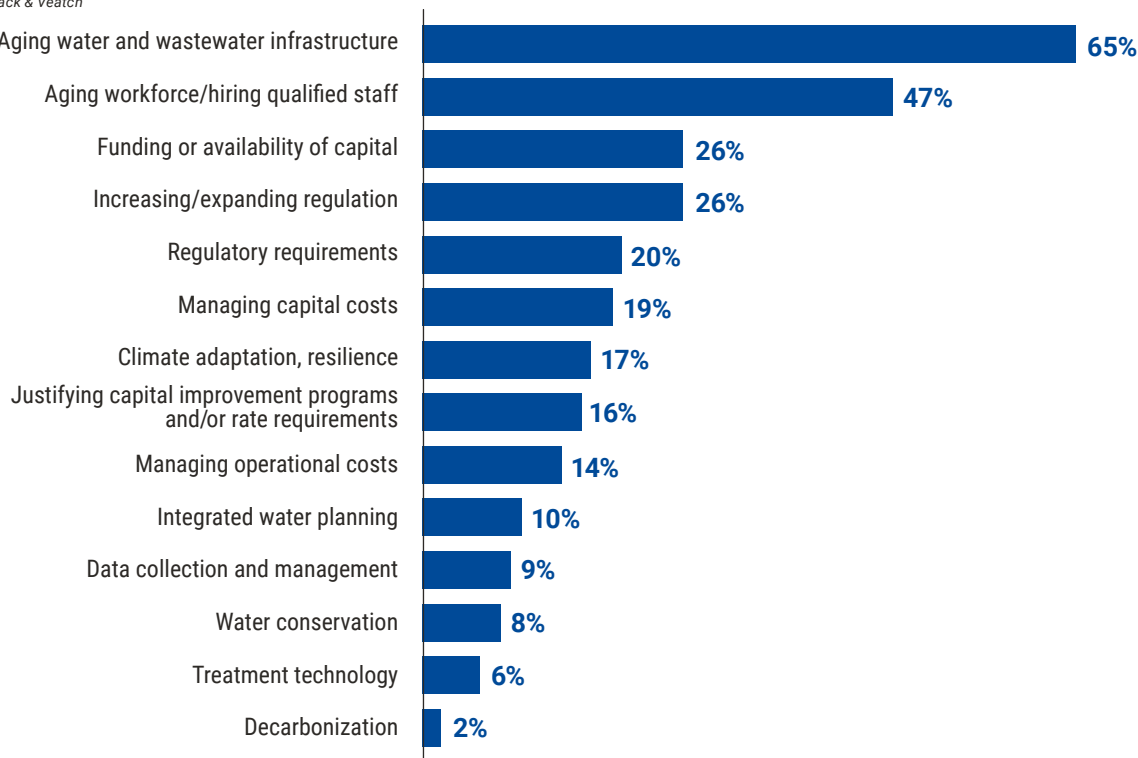
To little surprise, aging infrastructure again tops the list of challenges cited by more than six in 10 respondents, followed by an aging workforce and the hiring of qualified staff (47 percent, down from 51 percent last year and 64 percent in 2022, when the COVID-19 exacerbated the issue in prompting retirements) (Figure 14).

Figure 14

What are the most challenging issues facing the water, wastewater and stormwater industry today?

(Select top three)

Source: Black & Veatch



Advancing sustainability and decarbonization initiatives often is a matter of money — or the relative lack thereof. Respondents cited funding or availability of capital as their third largest concern, at 26 percent tied with increasing or expanding regulation. Managing capital costs (19 percent), justifying capital improvement programs or rate requirements (16 percent) and managing operational costs (14 percent) rounded out the top nine.

Amid the global worries and vigilance about climate change and its impacts on water supplies, climate adaptation and resilience —

a new response choice in this year’s survey — found itself in the middle of the pack (17 percent), illustrating its ascension in the consciousness of U.S. water sector stakeholders.

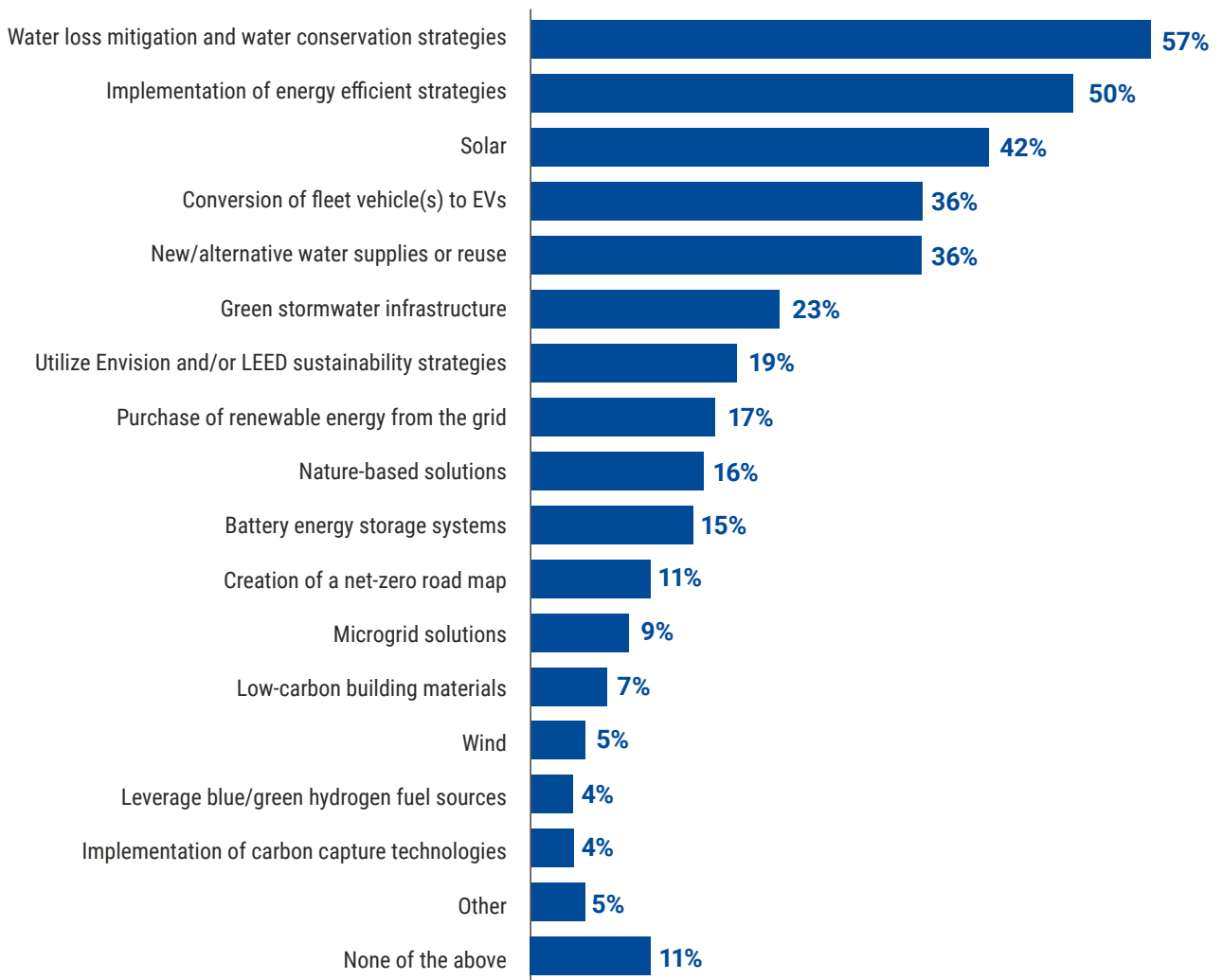
When asked what type of climate mitigation or adaptation strategies they have pursued or planned to initiate, water loss mitigation and water conservation strategies emerged as the top choice (57 percent). Only 11 percent said they are not pursuing any of the more than a dozen possible responses from which to choose (*Figure 15*).

Figure 15

What climate mitigation or adaptation strategies is your utility pursuing or planning to pursue?

(Select all that apply)

Source: Black & Veatch



Given that water infrastructure is energy intensive, utilities must ensure a reliable power supply that also is more efficient and renewable to bolster resilience and sustainability. Water utilities appear to understand that, explaining why implementation of energy efficient strategies (50 percent) remained the second ranked climate-related strategy on utilities' radar, followed by use of solar power (42 percent); the decarbonization play of converting fleet vehicles to electric vehicles (EV) (36 percent) and new or alternative water supplies and water reuse (36 percent).

As an example for converting fleet vehicles to EVs, [Black & Veatch recently was selected by Helix Water District in San Diego County, California](#), to perform design and engineering services for the district's EV charging infrastructure project that will allow Helix to convert its fleet of utility vehicles to EVs in the coming years with a reliable, resilient charging solution. California's Advanced Clean Fleets regulation related to EVs is among the country's most aggressive, requiring half of all state and local government fleet purchases of medium- and heavy-duty vehicles to be zero-emissions or near-zero-emissions by the end of 2024 – and 100 percent by 2027.

Sustainability Protects Future Generations

More than six in 10 respondents (61 percent) consider sustainability to be a critical strategic focus, with nearly half (49 percent) highlighting that their organization has specific sustainability goals and performance metrics.

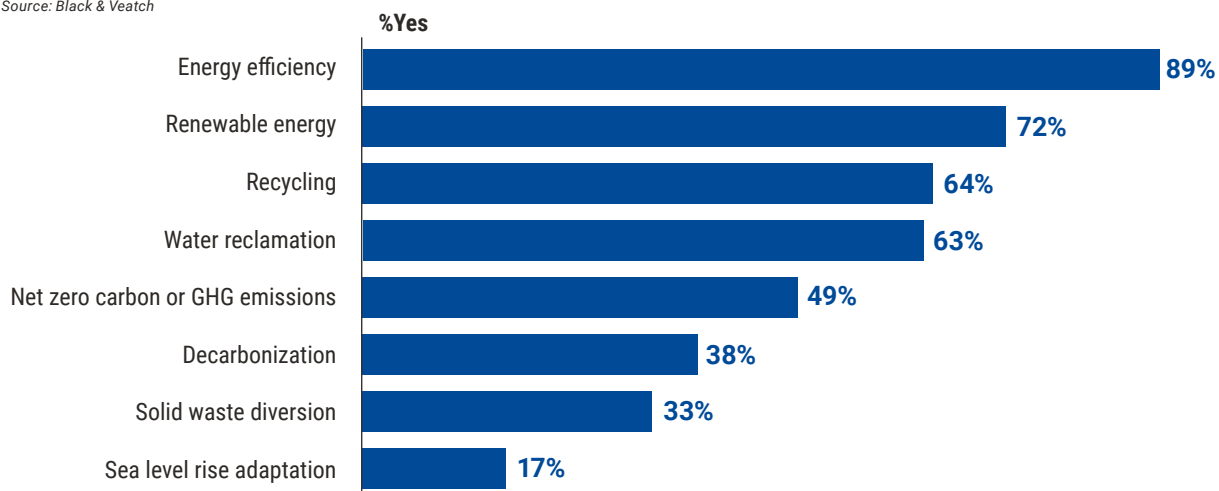
Three-quarters of larger water enterprises – those serving more than 500,000 people – reported having sustainability goals and metrics, nearly twice the rate of their smaller counterparts (40 percent). For those enterprises with sustainability targets and measurements, respondents overwhelmingly said those initiatives included energy efficiency (89 percent) and renewable energy (72 percent), followed by recycling, water reclamation, net zero emissions and decarbonization (*Figure 16*).

Most of these objectives note a target completion date of six to 10 years down the road (33 percent), while 13 percent envision that timeframe as being within five years. From a regulatory standpoint, this falls within many governmental parameters; entities required to make major changes often are given a 10-, 15- or 20-year lead time to get funding and infrastructure improvements in place.

Figure 16

Do those goals and metrics include the following? (Select yes or no)

Source: Black & Veatch



When asked what sustainability-enhancing tactics utilities are practicing, asset management led the way at 65 percent, followed by water conservation initiatives, operational efficiency, proactive replacement of infrastructure, energy efficiency initiatives and nutrient removal.

Decarbonization Still Lags

Decarbonization — ostensibly any approach that directly cuts greenhouse gas (GHG) emissions — still has hurdles to overcome to gain traction in the water industry. While nearly half (47 percent) of respondents said they have no decarbonization plan, that doesn't mean they won't be cutting GHG emissions or energy use. For instance, they may be putting solar power to use, just not under the auspices of a formal decarbonization plan.

When asked about the biggest drivers for their decarbonization plan, one-third of respondents listed environmental benefits, while other categories such as resilience, cost savings, regulation, community and the desire to be a good citizen registered about half that response.

Hurdles to Sustainability

As the drive towards more sustainable practices accelerates, challenges to achieving those goals remain. The biggest: affordability, listed by three-quarters (76 percent) of respondents, followed by the availability of resources and capacity (49 percent).

It's worth noting that the Internal Revenue Service in recent months has issued tax guidelines and clarifications surrounding the Bipartisan Infrastructure Law enacted in late 2021.

As signaled by affordability concerns, access to federal, state and local funding becomes critical to furthering sustainability goals. Given the complex and evolving nature of these funding options, and the resource and capacity constraints within utilities, partnering with outside experts can be a game changer to secure a utility's share of funding.

A Measured Approach

Utilities are navigating a period of significant investments to address rapidly growing demand and aging water infrastructure. The megatrend around sustainability creates both complexity as well as opportunity for utility leaders.

Utilities are responsibly starting with a focus on managing existing assets and operations to maximize efficiency and sustainability as indicated by our respondents. They also are considering new investments in solar, electric vehicles and charging infrastructure, and other sustainable infrastructure as climate mitigation strategies.

By working with experts such as Black & Veatch, they can develop an effective strategy and roadmap that enhances utility operations, promotes sustainability and resilience, and maximizes affordability for customers that includes leveraging the generational public funding opportunities that are available. As they consider these investments, it is imperative to future-proof in a way that supports achieving multiple objectives of reliability, efficiency and affordability through resilient, sustainable infrastructure. 💧

Climate Change



Climate Change: An Evolving Paradigm for Sustainable Infrastructure

As climate change brings profound change to the world's water cycle, U.S. water utilities are being compelled to rapidly adapt to the ever-evolving conditions to better prepare for threats and hazards and withstand and rapidly recover from adverse climatic events.

The need for responsiveness, planning and investment has been promoted for decades, notably since the U.S. Global Change Research Program was established by Congress in 1990 to coordinate federal research and investment to advance understanding of climate change. In 2023, it published its fifth National Climate Assessment, providing an accounting of climate change's impact on Earth's systems and processes — its interconnected land, water and atmosphere. Backed by scientific observation, that assessment details extreme variability in climate-related events, notably the rise in their severity, extent and/or frequency.

Clearly, it's a complex issue with no simple solutions, no silver bullet. But Black & Veatch's *2024 Water Report*, based on expert analyses of a survey of roughly 630 U.S. water sector stakeholders, brings it all into focus.

The key: Planning, preparedness and a focus on adaptation enables effective response and prevents costly and less effective reactive measures.

Extreme Variability

If necessity is the mother of invention, as the age-old proverb suggests, then performance is the mother of resilience for those in the water industry.

Consider this: Because of the dynamic relationship between people and nature, climate variability is putting lives and livelihoods at grave risk. Inequities are worsening within underserved and marginalized communities. Networks of industry, infrastructure, commodities, goods and services are increasingly vulnerable. And the global financial toll from disasters driven by climate change is astounding; [A study published in October 2023 by the journal Nature Communications](#) estimated that such events between 2000 and 2010 have caused damages equivalent to \$391 million a day, with researchers determining that droughts and heat waves contributed to about \$143 billion of damage annually.

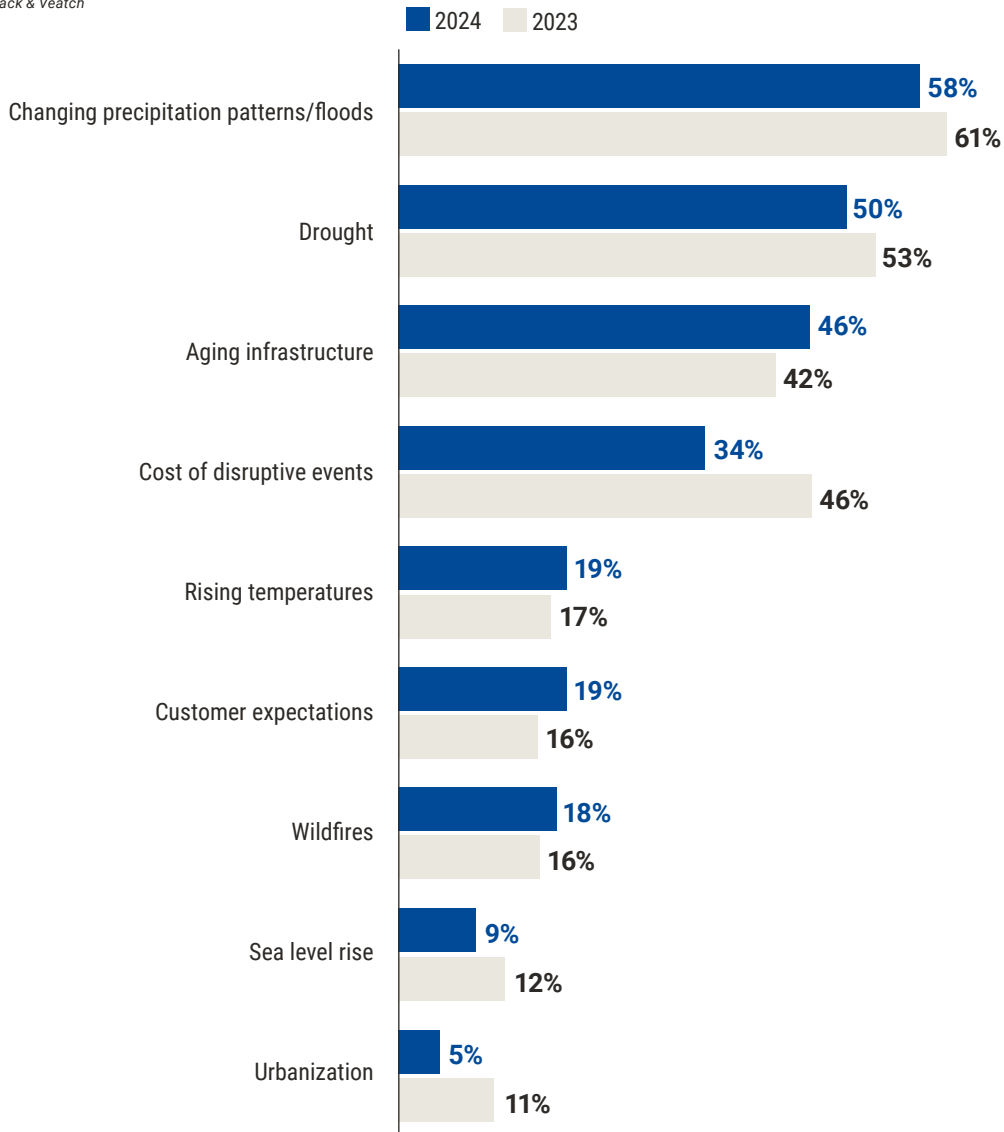
To put a finer point on it, the National Centers for Environmental Information — an arm of the National Oceanic and Atmospheric Administration — has reported that the United States experienced a billion-dollar disaster, adjusted for inflation, on average every 82 days in the 1980s; now, there is one on average every 18 days.

Shifting weather patterns, devastating storms and warming average temperatures bring significant threat and damage to the nation's water resources and infrastructure. Altogether, it is compounding the challenge of water sustainability and resilience.

Figure 17

What are your top three concerns about the impact of climate change? (Select up to three)

Source: Black & Veatch



Impacts and Concerns

There was not a significant change in feedback from last year in response to Black & Veatch’s survey question regarding respondents’ concerns about the impacts of climate change. Changing precipitation patterns resulting in flooding and drought is of greatest concern to respondents, with rising temperatures, wildfires and sea level rise lower on the list. When it comes to their enterprise’s ability to handle such events, respondents pointed to aging infrastructure — perennially, the sector’s top concern — and the cost of disruptive events as their primary worries. However, and perhaps optimistically, respondents who cited the cost of disruptive events as a top

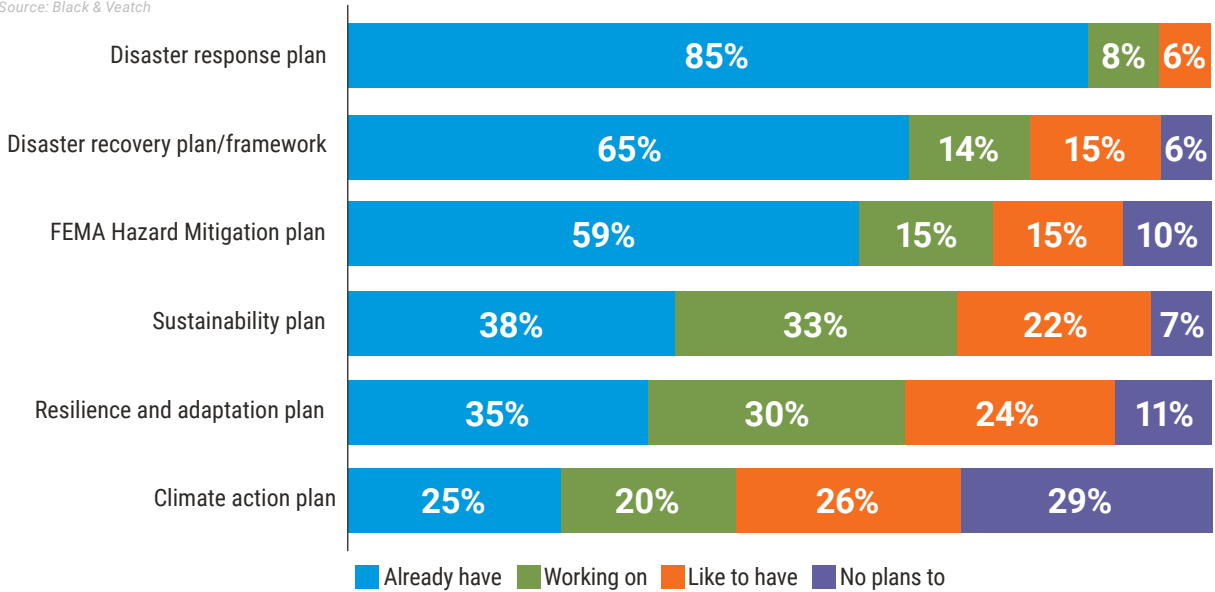
concern fell by 10 percent from 2023; This could be due to the work utilities have done to harden their facilities, with another possible explanation being the access to unprecedented federal funding (Figure 17).

In any case, the most-cited concerns from Black & Veatch’s survey align with the most significant climate-change impacts cited in the U.S. Global Change Research Program’s Fifth National Climate Assessment — water scarcity, damage to critical infrastructure, harm to human well-being and disruption to business.

Figure 18

How would you describe the quality of the information that your utility has on the assets it owns and operates? (Select one for each)

Source: Black & Veatch



Hazard Mitigation Planning

The existential threat to their year-round, 24/7 service has spurred utilities to understand and mitigate the climate-related shifts to their water resources and risks to their infrastructure and operations. As such, they are embracing planning for climate change adaptation and community, infrastructure and ecosystem resilience. Eighty-five percent of respondents report having a disaster response plan, 65 percent have a disaster recovery roadmap or framework, and nine in 10 respondents have, are working on or would like to have a resilience and adaptation plan (Figure 18).

Given ample evidence that severe weather events are becoming more unpredictable and costly, a hazard-mitigation plan (HMP) developed under Federal Emergency Management Agency (FEMA) requirements can be well worth the effort. [The National Institute of Building Sciences has documented that mitigation can reduce future disaster costs up to \\$13 for every \\$1 invested.](#)

An HMP identifies natural risks and vulnerabilities in a utility’s planning area and provides short- and long-term strategies for reducing loss of life, destruction of property, and interruption of services from the hazards. HMPs help utilities break the cycle of disaster damage

and reconstruction. They create eligibility for FEMA mitigation grant funding opportunities such as the Building Resilient Infrastructure and Communities (BRIC) program, which has awarded more than \$1 billion for water infrastructure projects nationwide.

HMPs also can be integrated with capital improvement programs, climate action and adaptation plans, water loss management analysis, water resource management plans, America’s Water Infrastructure Act (AWIA) risk and resilience assessment and risk mitigation plans, and many others. Such progressive planning promotes holistic management of water resources and infrastructure, increasing efficiency and funding eligibility while promoting resilience.

In last year’s Black & Veatch survey, four in 10 respondents said they were part of their local FEMA HMP; that number is trending up, reaching 53 percent now, indicating the sector is managing climate change impacts more proactively. However, 11 percent still say they are not part of a HMP and more than one-third (36 percent) remain unsure — all missing a potentially significant opportunity.

Nature-based Solutions

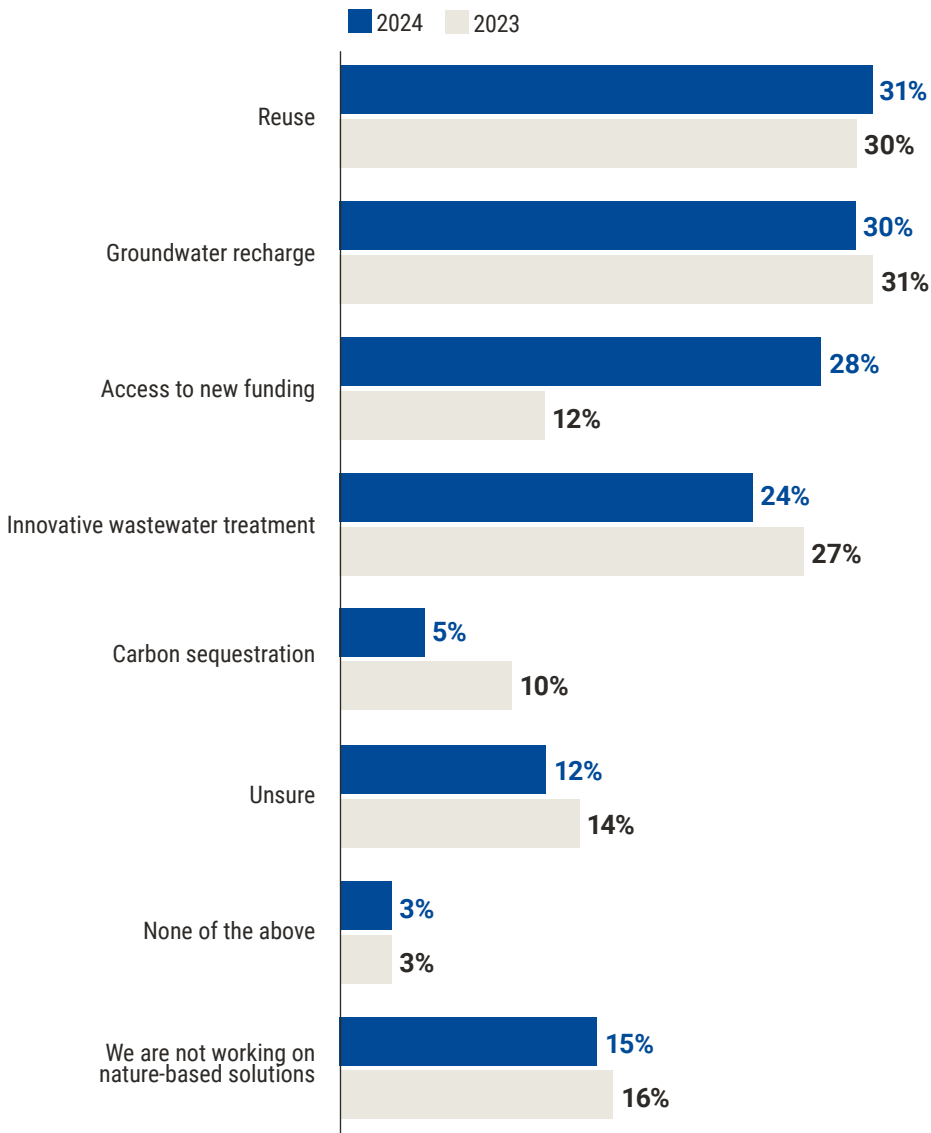
Nature-based solutions are a “One Water” approach that survey respondents also are deploying to manage impacts from climate change. Such solutions use, manage, protect and restore natural features and processes to promote adaptation and resilience; and these solutions involve managing, protecting, and restoring natural features and processes, and can be integrated into hazard mitigation and asset management frameworks.

Top priorities cited by respondents as drivers of integration of these solutions include groundwater recharge, reuse and innovative wastewater treatment. That nearly mirrors last year’s responses with a significant exception: Respondents identified access to funding as a major factor in 2024, as important as any other and much higher than in 2023. (Figure 19).

Figure 19

What priorities are driving integration of nature-based solutions? (Select all that apply)

Source: Black & Veatch



Note: Only options shown in both 2023 and 2024 are shown here

The reason begins with the benefits of integrating nature-based solutions, which help utilities restore the integrity of natural systems, comply with regulatory requirements, mitigate climate risk and deliver community-centered amenities — all potentially at a lower cost than stand-alone traditional infrastructure. This has opened the door to a myriad of funding opportunities. Hundreds of federal and state grants, loans, rebates, tax credits and other programs are designed for or can be used to fund nature-based solutions projects. An estimated 70 to 80 programs were created, enhanced, or received funding for nature-based solutions under the Inflation Reduction Act of 2022 (IRA) and Bipartisan Infrastructure Law (BIL) alone.

Climate Analytics

In a somewhat telling finding from this year's survey, just 11 percent said they use a climate analytics platform for future predictions, while those who said they do not total 61 percent. One in four respondents didn't know.

Sure, utilities don't face regulatory compliance requirements to compel them to examine climate analytics, and some might not see the value or may view the technology as expensive. But it's an opportunity the water sector might be overlooking.

Planning and design criteria depend heavily on historical data, which does not help with the extreme climate variability the world is experiencing. Modeling — coupled with analytics — is a proven tool for minimizing future damage and outages from weather-related disasters. For example, Black & Veatch helped a client develop a projected storm reserve basis for the next 20 years, including inflation, by matching storm events and damage data against storm costs suffered by the client. Black & Veatch effectively developed a new way to calculate risk based on specific storm types, providing analysis that is now a key piece of the client's climate change risk management profile.

Make no mistake, climate change impacts are expected to continue, perhaps change, become more frequent and expensive, and so on. But climate change's fallout already is evident, pressing the urgency to do something to analyze the impacts and adapt to them now, knowing it'll likely be more costly and punishing to those who take their chances by waiting. 💧

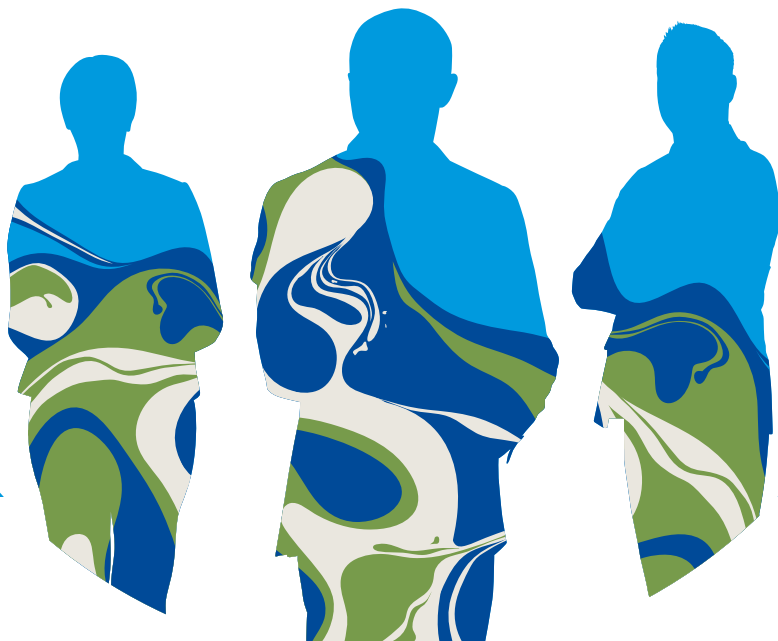
Case Study

Flood mitigation became a top public works priority for Apache Junction, Arizona, as traditional storms in the region became more severe and frequent with climate change, bringing cascades of water, sediment and debris out of the Superstition Mountains to the growing city east of metropolitan Phoenix. Needing to protect lives and property, [Apache Junction is building a new multi-use detention facility that features nature-based solutions.](#)

Designed by the team of Black & Veatch and Dibble with strong community engagement, the facility will extend more than 12,000 feet along Weekes Wash, a dry watercourse that quickly fills when heavy storms hit. A 34-foot-high earthen embankment will impound floodwater, providing storage for 100-year storm events and an alternative supply to be used to augment groundwater resources via permitted rainwater harvesting and groundwater recharge. Yet the design allows flows from smaller storms to pass through, to preserve the wash's hydrological and ecological functions. The project also includes recreational and public amenities.

With its nature-based features and integrated water resources management approach, the project qualified for funding from FEMA's Flood Mitigation Assistance Program. Black & Veatch helped Apache Junction realize the project by proactively securing approximately half the funding for the \$90 million legacy project via \$44 million in competitive grants, the most that FEMA has ever awarded in Arizona.

Workforce



The ‘Silver Tsunami’: Surging Retirements Stoke Workplace Challenges for U.S. Water Utilities

Transformative digital technologies have long been recognized as a solution to the U.S. water industry’s pressing workforce challenges, increasing efficiency and mitigating problems created by what has become known as the “silver tsunami.” That’s the tide of veteran, aging workers launching into retirement, taking their deep operational knowledge with them.

It’s a growing headache for the sector, as Black & Veatch’s *2024 Water Report* makes clear: Nearly half – 47 percent – of the nearly 630 U.S. water industry stakeholders who responded to the report’s survey cited the aging workforce and hiring of qualified staff their top challenge. That’s second only to aging water and wastewater infrastructure – a chronic issue for decades.

Putting a finer point on the matter, eight in 10 respondents report that their utility is experiencing “an increase of retirements or people leaving,” consistent with the responses from the past two years. The transitory nature of some roles today requires utility leadership to engage in how digital technology can make the onboarding and staff transitions much easier.

While an aging workforce has remained a consistent challenge over time, this year’s survey revealed changes to which job categories are most affected. Eighty-six percent of respondents

cited management or supervisors as the most impacted job category, up 9 percentage points over last year in overtaking last year’s No. 1 answer – operators, at 82 percent. It seems in 2024, therefore, that water utilities are experiencing the most impact when it comes to the retirements or departures of their management or supervisory staff.

Another pain point was engineers. Sixty percent of respondents stated that engineer job functions are most impacted by retirements or people leaving, compared to 53 percent in 2023. This tracks with another survey question, in which six of 10 respondents said they are outsourcing engineering or technical work, with outsourcing of information technology (IT) staff a distant second at 28 percent.


So, with utilities increasingly outsourcing engineering staff, will digital tools bridge the gap? The answer is yes, but for these tools to be useful to users, change management must improve with new ways of working with digital technology support. Half of the respondents said that they have experienced resistance to technology adoption from their staff, an answer consistent with 2023’s 49 percent and 2022’s 51 percent.

It remains clear, therefore, that as digital solutions offer exciting new transformative abilities and efficiencies, water utilities will continue to have to tend to the “human” side of things as well through training and change management. 💧

An abstract graphic featuring a central water droplet filled with a blue network diagram of interconnected nodes and lines. The droplet is surrounded by flowing, organic shapes in shades of blue and green, set against a light blue background. The overall composition is dynamic and modern, suggesting the integration of digital technology with water management.

Asset Management, Digital Water

As Data Maturity Levels Rise, Digital Water Strategies are Revisited



If ever there was a time for the U.S. water and wastewater sector to embrace data, it's now as challenges mount: an ever-aging infrastructure in need of upgrades, increasing retirements in the workforce, heightened demand for water and a shifting regulatory environment.

Data – or in today's parlance, “digital water” – holds the key to unlocking a trove of promise and rewards in its power and potential to deliver actionable information, get higher investment returns and, perhaps most importantly, bolster resiliency by getting the most out of aging assets.

Yet a survey of nearly 630 respondents for Black & Veatch's *2024 Water Report* continues to show missed opportunity, with lagging adoption of digital solutions keeping utilities from the multiple benefits that can come from the vast amount of data generated but not leveraged.

This is illustrated by respondents of our survey who were asked whether the use of their utility’s data and digital solutions strategies are achieving the intended objectives (*Figure 20*). Only 4 percent said they were achieving all their objectives, while 18 percent believed most of their targets were being realized.

While 22 percent of respondents consider they are meeting most of their objectives from these strategies, 25 percent stated they are only meeting some of their objectives. There has, however, been an increase in the number of respondents who are in the process of actively defining these objectives, up to 21 percent from last year’s 14 percent. Yet strikingly, one in four respondents say they’re only meeting “some” of the objectives – a slide from last year’s 42 percent.

The takeaway: some utility leaders are finding that even though they thought they were on their way with a solid set of strategic objectives, that’s not the case, and they’re now reassessing and perhaps even going back to the drawing board.

When asked to identify the top objectives for data and digital solutions strategies, asset management – listed as asset monitoring, measurement and analysis – and cybersecurity drew an equal share of attention, at 58 percent. Operations planning and control (37 percent) and monitoring and compliance (31 percent) round out the top four responses.

Figure 20

To what extent is your company’s data or digital solutions strategy achieving objectives? (Select one)

Source: Black & Veatch

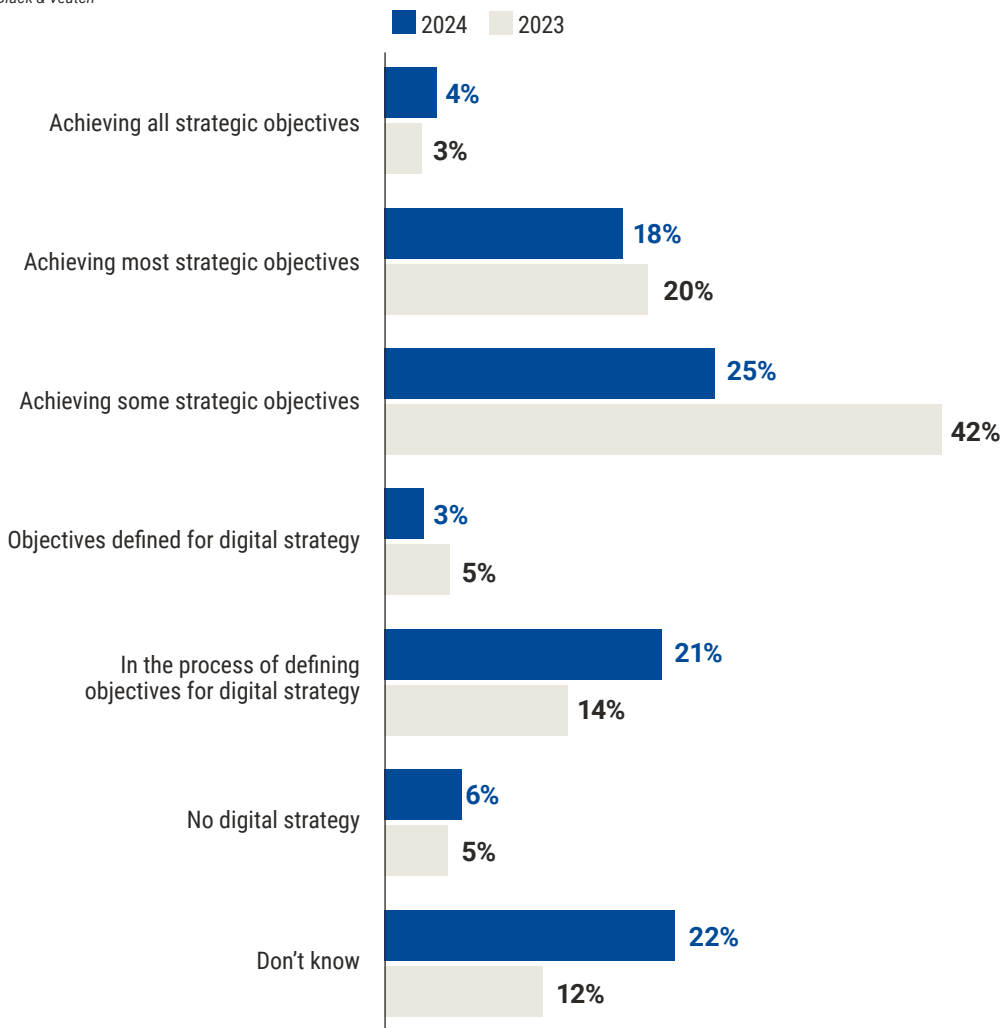
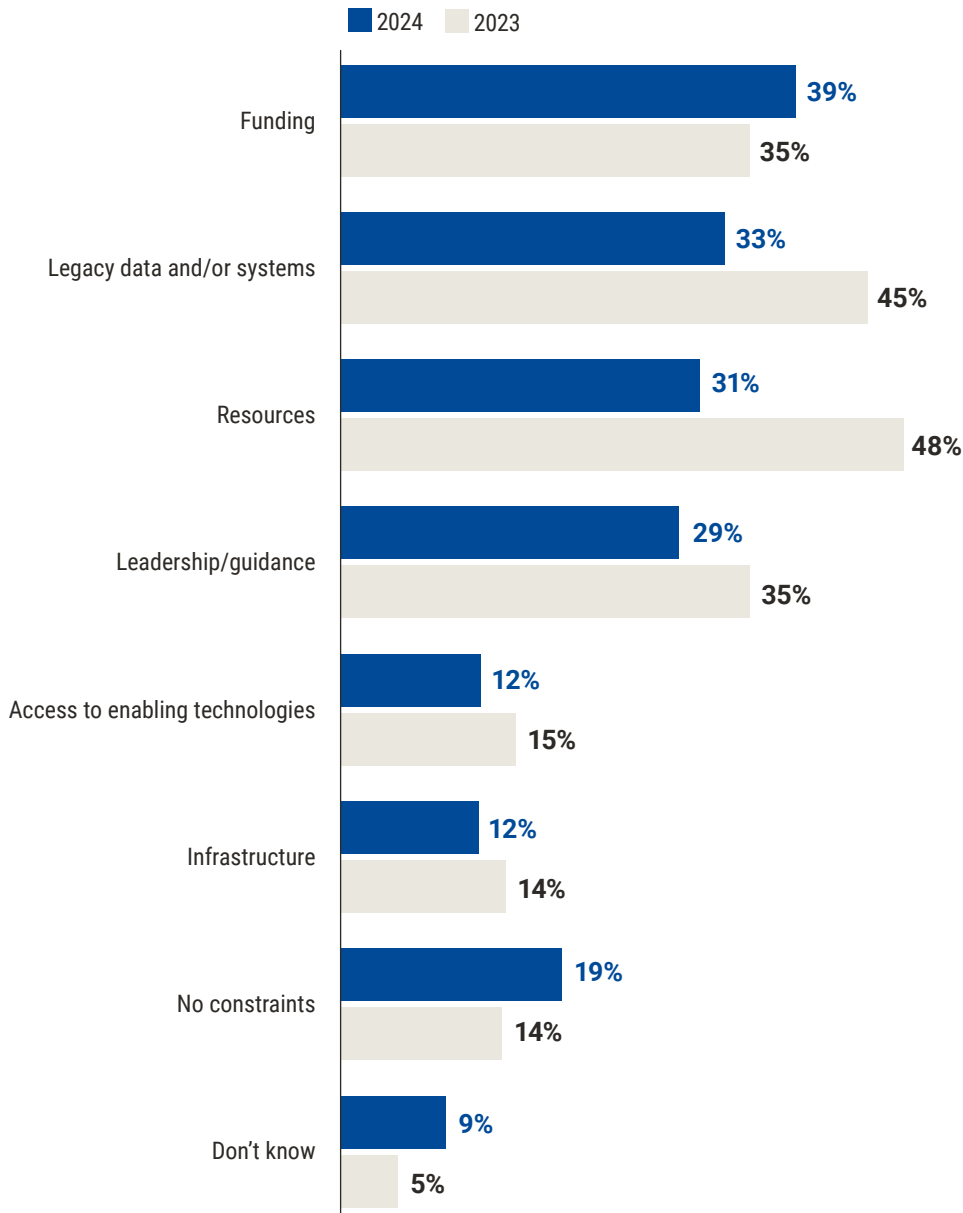


Figure 21

Which of the following constraints impair or preclude your utility from adopting digital solutions? (Select up to three)

Source: Black & Veatch



Data Maturity Levels on the Rise

When it comes to data or digital solutions, survey results suggest that digital strategies certainly are being reassessed, with the maturity levels of those roadmaps within the organizations rising. For instance, operations, maintenance and asset management all rose at least 10 points in 2024 compared with the previous year, suggesting that utilities have recognized the need for and are implementing their improvement strategies to keep pace with the changing needs of the water

industry. One notable exception is training, which as a category dropped about 8 percentage points over 2023. This could be attributed to a move back to normalcy since the COVID-19 pandemic prompted a flood of training in virtual control and monitoring.

Constraints to progress in digital water always seem to be prominent, but this year's survey actually showed a sizable drop in some categories compared with 2023 (Figure 21).

Perhaps not surprisingly, funding — or lack thereof — led the way with 39 percent of respondents listing it as an impairment to digital adaptation. But other categories declined year over year: legacy systems fell to 33 percent from 45 percent; resources were listed by 31 percent of respondents, down 17 percentage points; and leadership guidance drew 29 percent as a constraint, compared with 35 percent in 2023.

Nearly one in five (19 percent) said they had no constraints at all, up from 14 percent in 2023. This points to some progress being made in eliminating the barriers to harnessing the benefits of data — and perhaps suggests more funds and resources are being allocated for software systems.

Producing Good Data

The survey appeared to show that respondents are learning to discern what’s good data and what isn’t. When it came to rating the effectiveness of the current data being collected, one in five said they were collecting some data but not leveraging it effectively, while 42 percent said they were collecting a lot of data but not putting it to best use. In either case, 62 percent felt they were falling short of being effective with the current data they had, up 7 percentage points from 2023. Only 38 percent felt they effectively were using their current data (*Figure 22*).

Figure 22

Which of the following statements best describe the current data management practice at your organization? (Select one)

Source: Black & Veatch

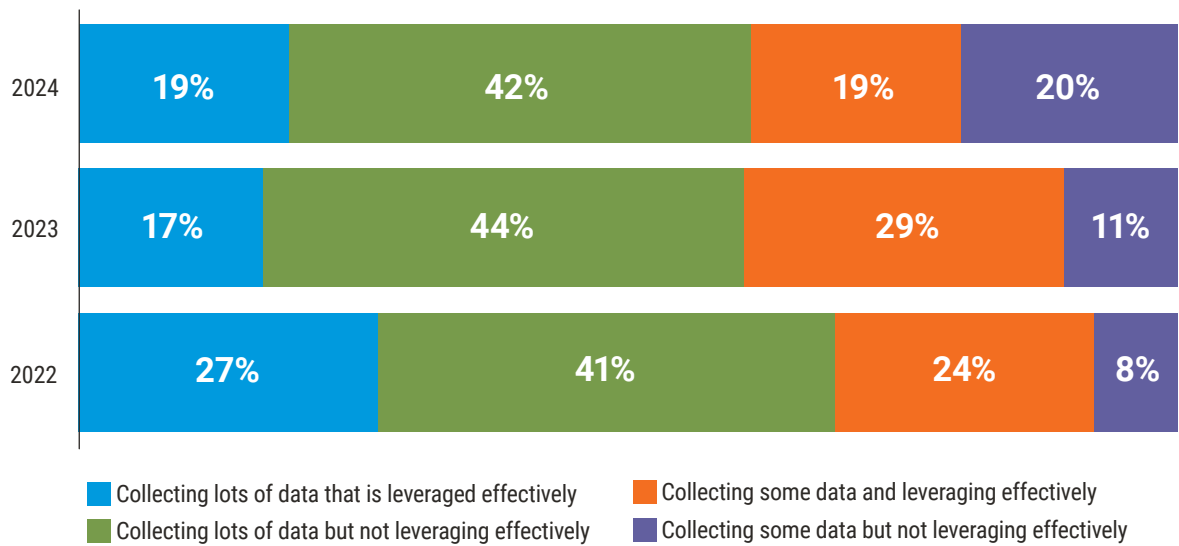
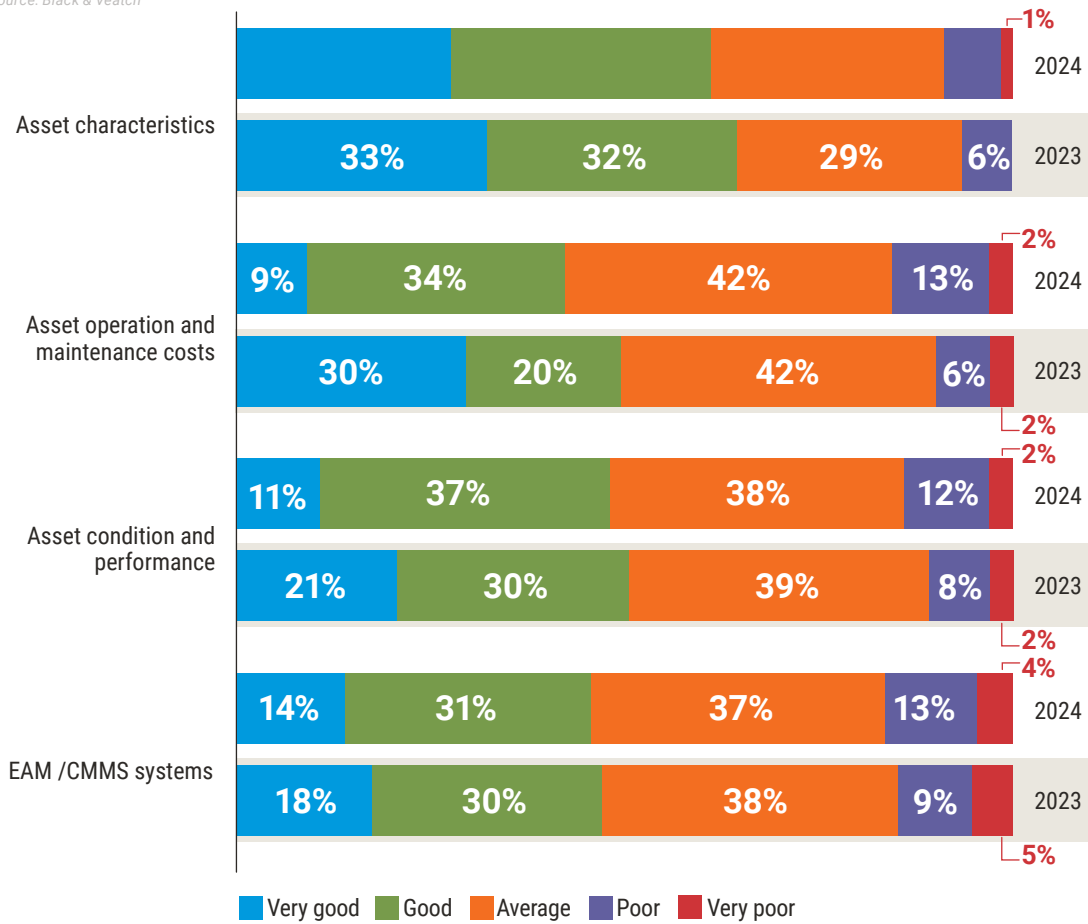


Figure 23

How would you describe the quality of the information that your utility has on the assets it owns and operates? (Select one for each row)

Source: Black & Veatch



When asked to describe the quality of information their organization has on the assets it owns and operates, about 43 percent rated it as very good or good for asset operations and maintenance costs, a decline from 50 percent in 2023. Likewise, almost half rated information for asset condition and performance as very good or good, about the same as 2023's 51 percent. (Figure23).

Respondents appear more aware of what's good data, and many realize they simply don't have it. Utilities need to focus on solid processes for the data they collect. Governing and managing the data are paramount to ensuring the quality is high.

Overall, when looking at the quality of information that utilities have on the assets they own and operate, there are not drastic changes from 2023, but the data instead paints a picture of an industry with work to be done progressing the information from "average" or "poor" to "good" or "very good."

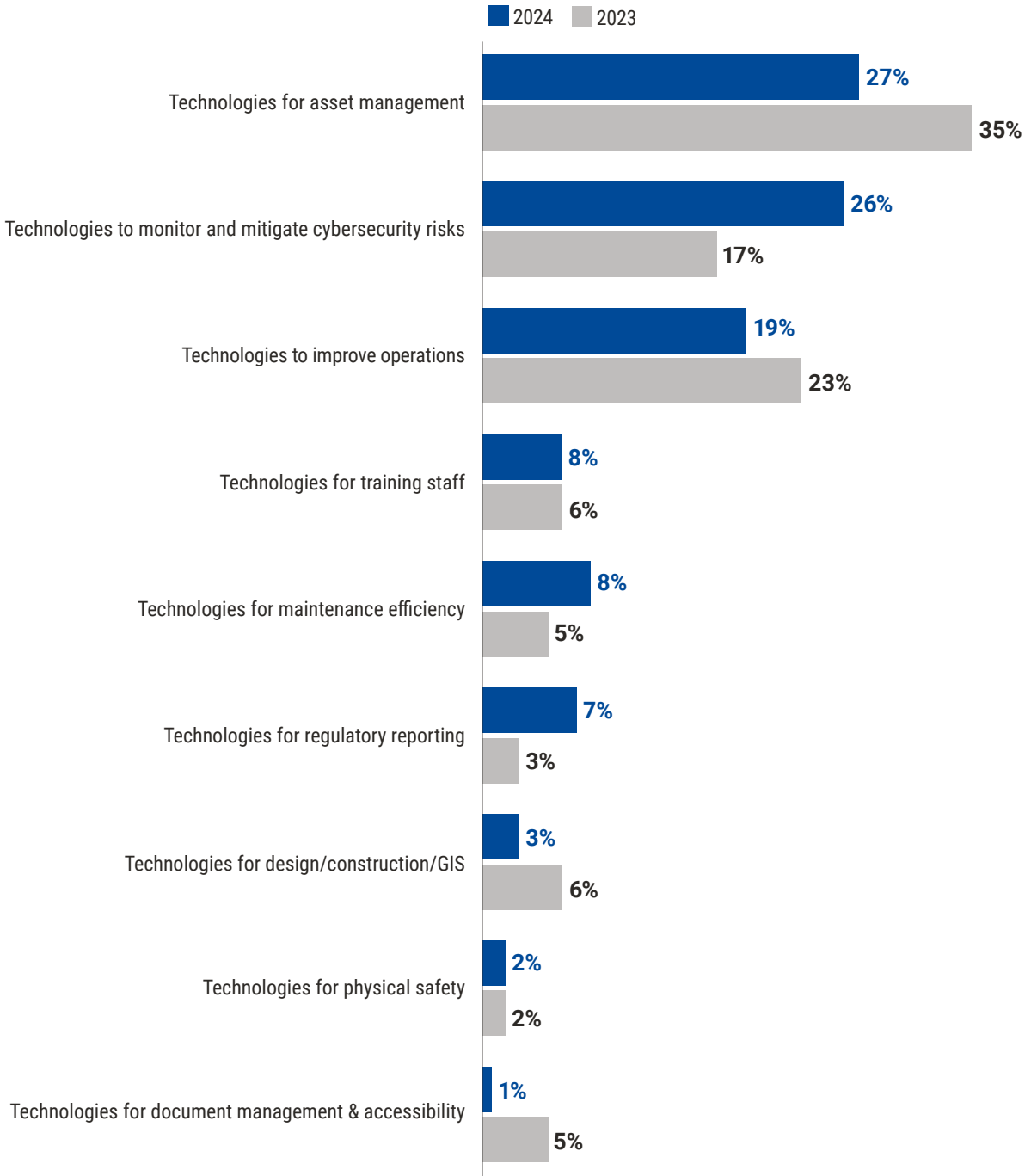
Looking ahead, when asked which types of technology water utilities should most emphasize, respondents cited asset management, cybersecurity and operations as the top three, in congruence with the top objectives for a digital strategy (Figure 24). However, the change was

noticed when comparing the response to last year; both asset management and operations declined several percentage points from 2023, while cybersecurity jumped 9 points. Again, this reinforces the importance that water utilities are beginning to place in this vital risk area.

Figure 24

Which type of new technology should water utilities emphasize most? (Select one)

Source: Black & Veatch



Cybersecurity's continued rise in prominence (see this report's cybersecurity section) comes as the industry works to fortify itself against the growing threat of cyberattacks. The U.S. Environmental Protection Agency (EPA) has pushed hard to get water utilities large and small to beef up their defenses, recently announcing its formation of a water sector cybersecurity task force to combat threats faced by water systems nationwide.

When asked to rate their organization's level of expertise in a variety of technologies, geographic information systems (GIS) — the original digital model more than two decades ago — topped the list, followed by advanced metering infrastructure (AMI), another well-trusted and mature technology solutions making up the lower half of the list included mobile workforce technology, enterprise resource management systems (ERM), data visualization and energy management systems. These are tools that utilities will eventually need to reduce maintenance, energy and labor costs, meaning a pathway has been mapped out for them as to where expertise gaps exist, which utilities should be attempting to fill the pathway to better secure their future.

Some such future solutions are now appearing over the horizon — things like artificial intelligence (AI), machine learning (ML), computerized maintenance management systems (CMMS) and building information modeling (BIM). These technologies will take time; there is no "flipping the switch" to solve issues here, though the time invested now will pay huge dividends later.

The majority of utilities are working on how these technologies can be used to solve business problems. The key being to move away from what is possible and instead focus on practical solutions where AI/ML and other advanced technologies can show a clear return on investment (ROI). Utilities that have been successful in the deployment of these solutions typically have started small, clearly defined the business problem and then shared the results of successful pilot applications to gain the alignment and buy in of the organization through demonstrating value.

Pursuing a Digital Water World

A move forward toward a true digital water world begins with having a vision for where each utility wants to be as a digital entity, and there's palpable signs of progress. For instance, our clients are reporting significant success with their water-loss campaigns, given that data helps pinpoint water loss issues and enables them to resolve the issue in a cost-effective way. GIS and AMI also are mature strategies that have proven successful, serving as further inspiration for emerging technologies.

Leaders who are innovative in managing their operations will be called upon to spearhead the path to a more robust digital water world. Technologies now commonplace once were frontiers, and if viewed from that perspective, it is only a matter of time before we'll see giant leaps and greater benefits in the use of digital water. 💧



About the Authors

Laura Adams is Black & Veatch's community and ecosystem solution lead. A 17-year veteran of the company, Adams leads a multi-disciplinary team with deep experience in program development and planning, design and construction, and the maintenance of nature-based solutions. The team is creating innovative solutions to revitalize communities, restore natural resources and address climate resilience.

Mike Borchers is a solutions director for strategic growth initiatives for Black & Veatch's governments and communities business sector. In this role he is responsible for developing and implementing strategies and solutions for water, wastewater and other governmental clients to increase their overall resilience and become more sustainable through renewable energy sources, zero-emission vehicles and other technologies that balance operational performance with reduced carbon impact. Borchers has more than 20 years of experience in the water industry, including time in utility management, as well as management consulting where he has focused on helping clients develop and implement business strategies to provide quality water service to customers in an affordable manner.

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Ann Bui is a senior managing director who leads Black & Veatch's global strategic advisory rates and regulatory market business. Besides providing clients with strategic financial management strategies, her responsibilities include driving growth and innovation to water, electric and gas utilities in financial and advisory planning, advanced metering, sustainability issues, asset integrity and enterprise risk management services. Bui has more than 30 years of experience with clients in North and South America, Europe and Asia.

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Zeynep Erdal is the director of integrated water solutions, overseeing the development and deployment of holistic solutions that include planning, asset management, treatment and digital transformation. She drives solutions to public and private sectors with a goal of achieving resilient and sustainable communities. Erdal serves on the board of directors of the Water Research Foundation, working with utilities to set strategies and develop solutions for future-ready communities.

Adam Feffer has 19 years of drinking water experience focusing on surface water treatment optimization, disinfectant byproduct management, treatment of emerging contaminants (including PFAS), drinking water compliance, and distribution system monitoring. He is skilled in process design and project management and is a proven leader of teams and champion of new ideas. Feffer has become one of Black & Veatch subject matter specialists for PFAS.

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Rick Kaiser is Black & Veatch's federal market leader, president of BV Special Projects Corp. and a retired U.S. Army major general. Kaiser's 36-year career in the military and engineering and construction fields included Army service as the deputy chief of the U.S. Army Corps of Engineers executing a \$46-billion construction portfolio, with prior duty commanding USACE's Mississippi Valley and earlier the Great Lakes/Ohio River division. Kaiser joined Black & Veatch in 2020 and served as the federal growth officer with a focus on expanding cybersecurity, master planning and resilience offerings for clients.

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Jim Schultz is a senior operational technology cybersecurity consultant with Black & Veatch and has more than 30 years of experience with utility and federal projects aimed at improving operational technology and reducing cybersecurity risk to critical infrastructure. Throughout his career, Schultz has been engaged in the planning, design, implementation and support of operational technology and information technology projects in the water, wastewater, manufacturing, electric utilities and federal sectors.

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