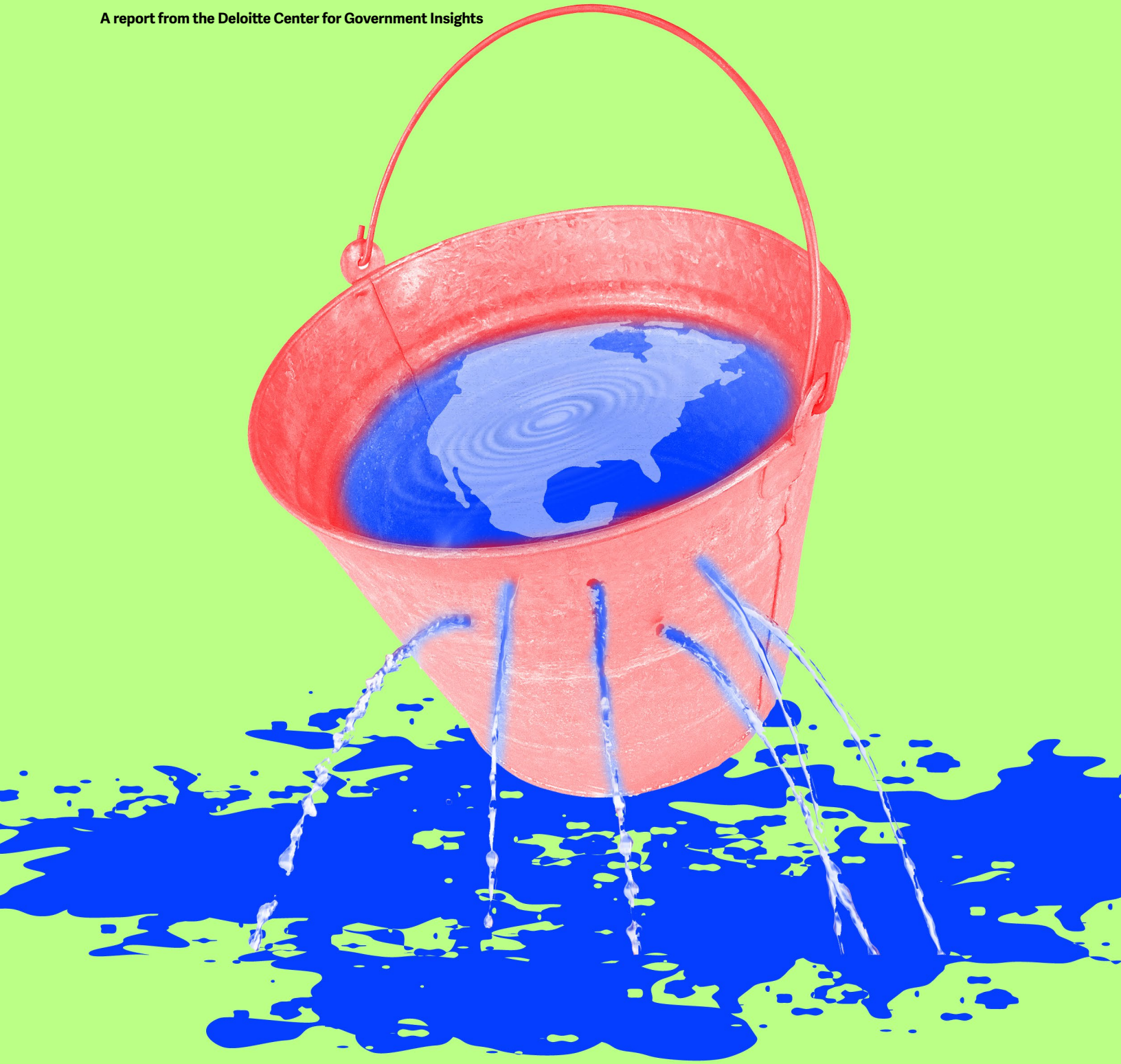
Tackling America's water crisis: A cross-sector approach

Collaboration strategies for sustainable water resource management

A report from the Deloitte Center for Government Insights



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Introduction

Abundant and diverse water resources exist in the United States, from complex river systems and wetlands to coastal waters. The country is endowed with some of the world's largest freshwater and marine reserves.[1] Yet, under severe pressures from climate change and accelerating land use demands, the nation is facing major water challenges. We interviewed 54 water specialists across the public and private sectors (figure 1) who experience relevant issues. We then captured the pain points and discussed new ways to encourage cross-sector collaboration and better manage our water resources. Our analysis suggests that to succeed, public-private partnerships must acknowledge inherent challenges in managing complex water systems while working to align values, set mutually beneficial objectives, prioritize projects that meet these objectives, and effectively leverage the partnership's combined resources. These collaborations are more likely to lead to long-term, sustainable, and equitable solutions for managing our national water supply.

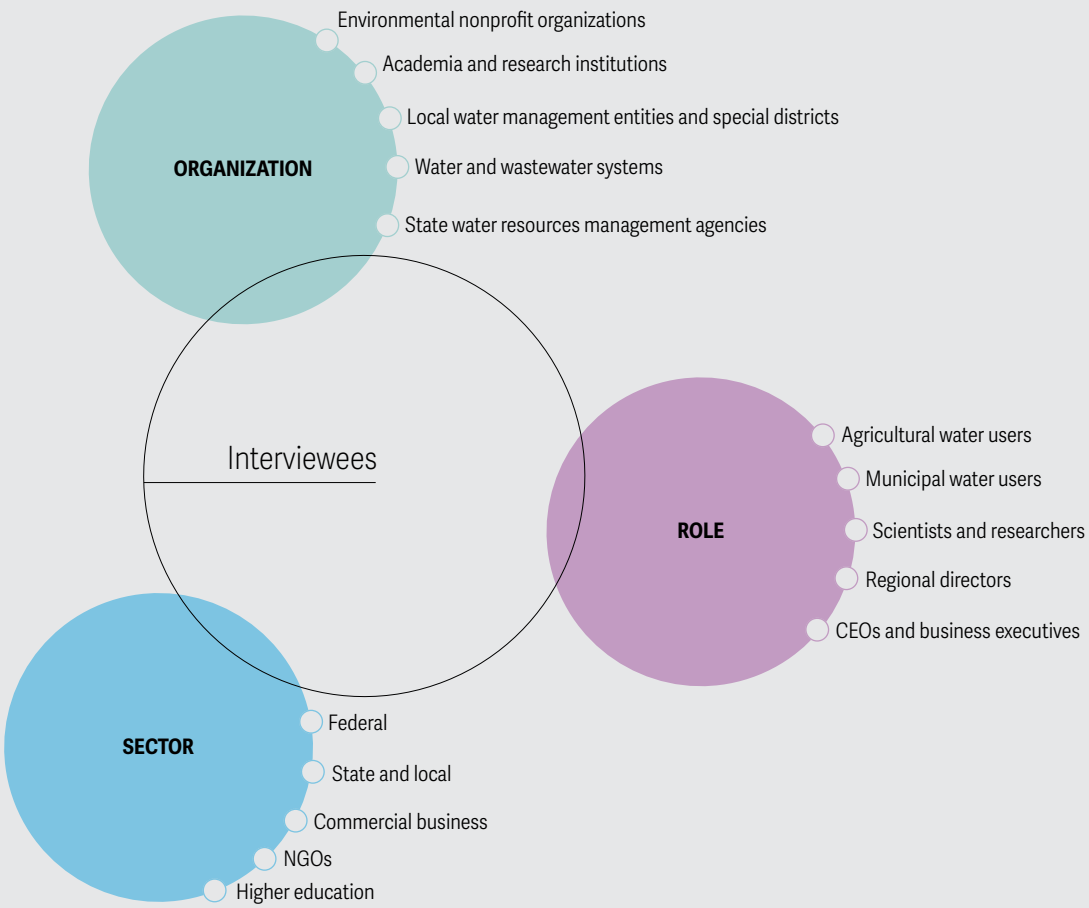
Managing water resources in the United States: Challenges and fragmented approaches

Water use challenges across the country vary by geography and depend on factors such as population density, climate, industrial activities, agricultural practices, and water availability.[2] Much of the United States is facing drought conditions, particularly in areas where the population relies on the agrarian economy, and some regions are known for their high water consumption due to specific demands and resource availability.

Figure 1

Interviewees at a glance

Varied attributes of more than 50 specialists we interviewed



Source: Deloitte analysis.

Water scarcity is most acute in the arid western United States due to conflicts between states over agricultural irrigation and urban consumption within the Colorado River watershed. In the central plains states, irrigation is crucial for growing crops like corn, soybeans, and wheat, which contributes to the nation's agricultural output and export. As a result, the Ogallala Aquifer, the largest aquifer in the country that spans eight central states, has been under constant depletion for decades.[3] Similarly, water demand is high for major urban centers and agricultural uses in the Mississippi River basin and southeastern states. As episodic flooding increases due to climate change, these strained water resources are becoming increasingly polluted, threatening the viability of critical water supply in these watersheds.[4]

These unique environments produce highly localized water challenges and require relevant and focused solutions. But water transcends borders and county lines, and we often manage, protect, and govern our water resources in fragmented ways that conflict with natural water landscapes and the water cycle.

American water tales

Our interviews with public and private sector water specialists highlight a few examples of the diverse and complex water problems across different ecologies in the United States. These illustrative tales provide a glimpse into the very real economic, cultural, historical, political, and environmental phenomena that shape our connections to water.

- On the outskirts of Phoenix, Arizona, a fourth-generation producer looks out over his once-green cropland. Previously irrigated with water from Lake Mead, his alfalfa fields now lie fallow.[5] The Colorado River, a power and water source for more than 40 million people, is drying up; and this Arizonian grower, among hundreds of others, is fighting to keep his family farm afloat amid a 50% cut to his agricultural water supply.[6]

- Further upstream, a member of the Navajo Nation also contends with the dwindling supply of the Colorado River. Her people have been stewards of its tributaries for centuries, and the river is central to their cultural and spiritual identity. In this time of scarcity, she reflects on the injustices of the past and fears for the nation's water future. Today, nearly one-third of her reservation lacks running water, and water often costs her family 15 times more than it does for those living in the nearby town.[7]

- Meanwhile, a water system manager on the East Coast struggles to deliver clean drinking water to her community. Her town is routinely flooded from heavy rainfall. And sewer overflows driven by failing stormwater infrastructure have only compounded contamination of freshwater resources.[8] Though historically compliant, the community water system has amassed violations due to adverse reactions between new pollutants and treatment chemicals.[9] The water system manager has limited staff and funding, making it difficult to improve and manage the town's water and wastewater infrastructure.

Our environment is changing, so why aren't we?

Climate change significantly contributes to challenges in water systems. However, the lack of adaptation in the water ecosystem stems not only from environmental issues but also from social and other constraints. Water usage is closely linked to various societal challenges, including food security, human health, and disaster prevention. Managing water requires consideration of multiple interests and dealing with complex factors beyond water use. Public-private partnerships can help address these challenges by bringing together people from diverse backgrounds, interests, and motivations.

Insights from specialists on effective water management

Our interviewees agreed that new collaboration methods are needed to recognize and integrate these societal challenges into impactful, long-lasting solutions for our watersheds. The 54 specialists we interviewed span the United States and include leaders from federal agencies, state departments, water-focused nonprofit organizations, research institutions, and private industry companies such as utilities, environmental commodity traders, water-related technology businesses, and water preservation consulting firms. Our interviews sought to uncover the ongoing issues in managing the country's water infrastructure and freshwater bodies and the underlying challenges impeding water management and cross-scale collaboration.

To meet these objectives, we focused our discussions on identifying pain points that hinder a program's progress, barriers to adopting innovative solutions and processes, and solutions that address programmatic needs. Various themes emerged through our conversations, from environmental to social and historical to economic. Interviewees also identified data and technology as crucial for cross-sector collaboration.

Environmental factors

Water experts identified two leading environmental concerns in the emerging water crisis: the complexity of natural and built environments and the issue of aging infrastructure. The former affects our ability to understand the exact science driving different landscapes, and the latter impinges on developing effective solutions to address unique environmental challenges.

Hydrologists, economists, and policymakers have found that there is no panacea to address emerging water issues across different environments. Solutions developed for one region are not effective out-of-the-box interventions for water issues in another region. The complex relationships between natural and built landscapes further compound these water-related issues. Ecological processes depend on factors like biodiversity and the availability of natural resources across multiple domains and respond to stressors specific to each domain, impacting the benefits provided by ecosystems.

Additionally, aging infrastructure poses a serious threat to water quality. Many of the pipes used in the United States were laid in the early to mid-20th century and have already exceeded their lifespan, making them prone to breaks and leaks. Such infrastructural failures would inevitably lead to the loss of our access to water.

Social and historical factors

Water has long been considered an unlimited resource from individual, community, regional, and national perspectives. As water availability decreases across regions of the country, methods of sustainable management are met with resistance from those who undervalue water. This resistance to change impacts the ability of scientists, legislators, and water experts to draft policies, enforce regulations, adopt technologies, and form public and private organizations dedicated to effectively managing water resources.

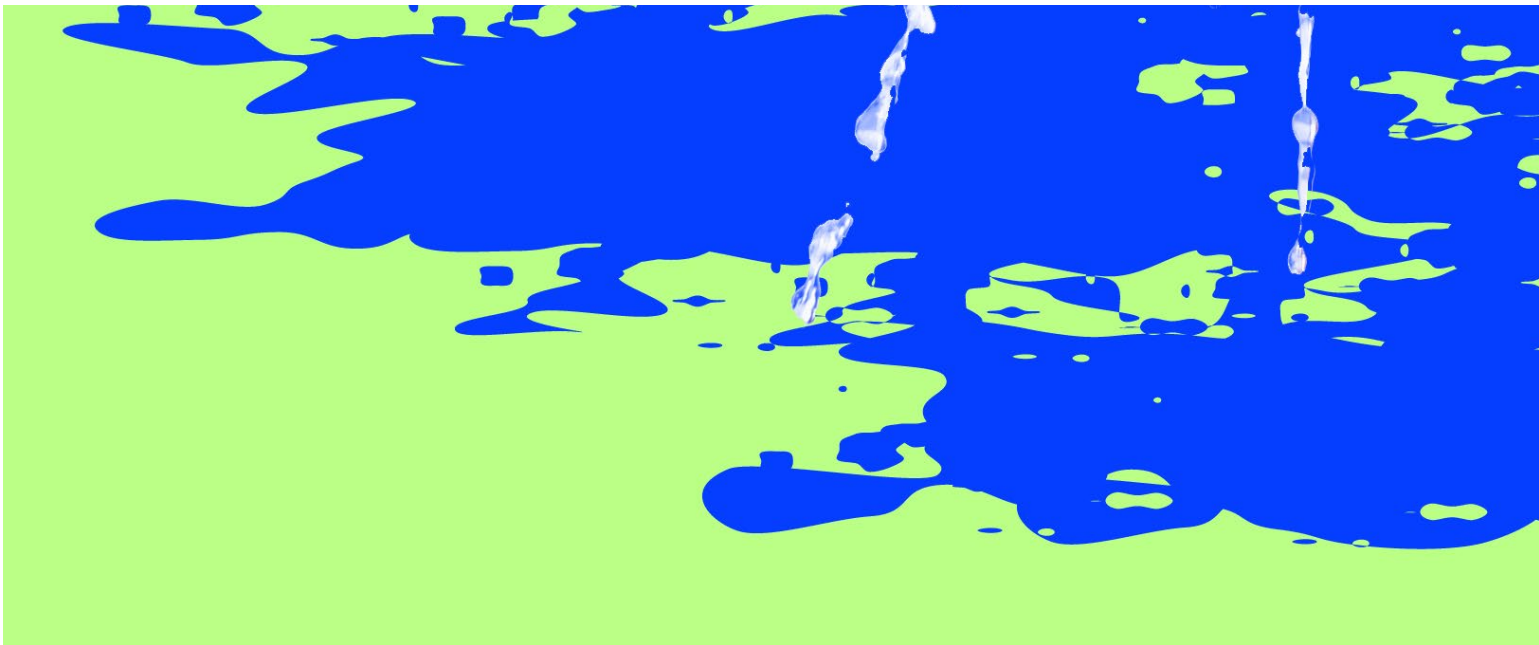
Humans rely on finite natural resources, and their activity is projected to be the dominant driver of future water scarcity on a global scale.[10] One expert noted that easy access to water has created a misalignment between public perception and the actual cost of managing water systems.

Policy and regulatory factors

In our conversations, experts emphasized the distinction between politics and regulations. Although they expressed concerns about the politicization of water issues, they also discussed the impact of regulatory structures, laws, and other policies that influence and govern the actions of people, communities, institutions, markets, and systems as barriers to making progress on water issues.

A series of laws and regulations govern US water management, including the Clean Water Act, which sets the standards for water quality and management.[11] In many cases, changes to water management require complex reviews to move forward.

With the complexity of existing legislation and implementation requirements, multiple groups have found



executing innovations or acting on market opportunities challenging. Innovators often enter the market to build solutions for emerging water issues without an adequate understanding of policy and regulatory constraints, and later, some find that their solutions conflict with existing legislation and regulation. According to an expert, government involvement from the outset is crucial in the intersection of technology, engineering, and politics to drive water crisis mitigation projects forward.

Economic factors

Experts identified several economic pain points, including budgetary constraints, lack of funding opportunities, and functional incentive programs.

Recent laws, including the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, make significant new funding available for certain drinking water, wastewater, drought mitigation, and other climate resilience projects.[12] However, interviewees explained that agencies are still struggling to secure enough funding to manage and monitor their water resources and operations effectively.[13] A lack of funding also limits agencies' abilities to access and nurture nascent, innovative technologies in the water space.

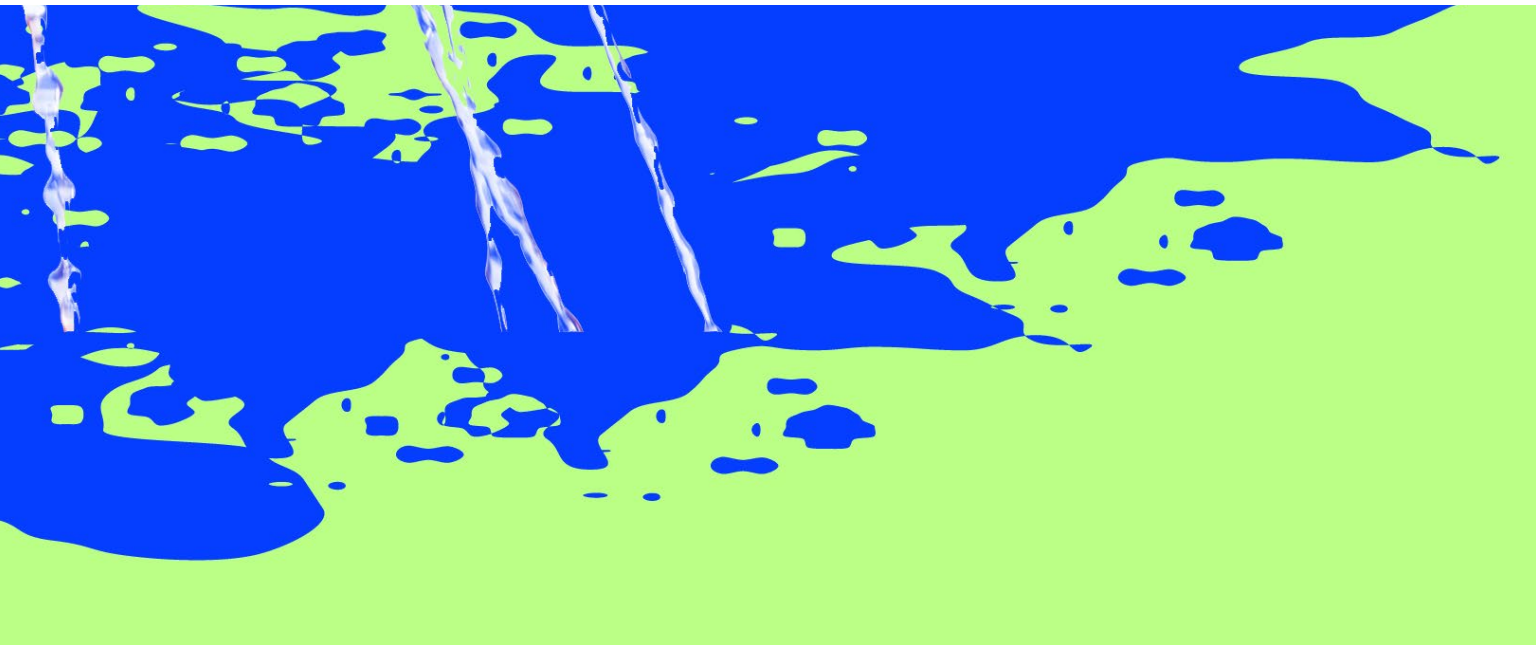
To rectify economic pain points, one state department natural resources expert stressed the importance of agency engagement with legislative bodies to set a strategy for how the department would lead on water resource management. Collaborating with legislative experts to access funding mechanisms (e.g., grants) and implementing institutional incentive systems for finding solutions to water crises can benefit all parties involved.

Organizational factors

Political boundaries can make it difficult for local, regional, and national entities to manage free-flowing water. This challenge, as described by water experts, impacts both governmental bodies and private actors. Although states and state agencies are responsible for the allocation and administration of water rights, water issues are multisectoral and cross-boundary, encompassing numerous communities, private and public sector interests, and levels of government. The flow of information and funding from one level of government to the next can hinder the progress of solving water crisis issues.

Our interviewees indicated that private sector players across industries, from agriculture to natural resource management to wastewater and utilities, are generally concerned about water as it relates to their specific businesses. Since different industries use and value water differently, there are often conflicting opinions when it comes to managing water across industries and sectors.

As a result of geographic separation and different operational spheres, collaboration amongst the numerous players across the public and private sectors can be challenging. Experts indicated that water solutions require both public and private actors to break down siloes, approach water solutions with an interdisciplinary lens, and increase involvement across all players. Strategies that encourage coordination—whether incorporated into program requirements, emerging from established partnerships, or brought about through other modes of engagement—can foster an "all-hands-on-deck" mentality to tackle existing and future water crises.



Data and technology

Data allows agencies and companies to understand their water usage and quality, creating workplace efficiencies and providing opportunities to forecast water scenarios better. The volume and types of water data, however, are often complex and collected by different actors across state agencies, federal and local governmental agencies, utilities, and nongovernmental organizations.[14]

Understanding how or why data was collected and how to best manage and use it is not straightforward. We repeatedly heard that water data is plentiful, but users are unsure how best to analyze it, especially regarding forecasting water usage and availability. New technology to collect water data is also being developed rapidly (figure 2). However, its adoption can be slow due to the lack of funding and training required to identify the best technology needed to perform the job. Skills gaps in collecting, processing, and analyzing data further delay adoption.

Figure 2

Sample technologies in use to address corresponding water management issues

Name	Technology type	Description
Community earth system model	Global climate model	Provides computer simulations of the Earth's past, present, and future climate states
Arkansas river colors of water forecasting tool	Water analysis and decision-making	Assists with the administration of water rights and provides information regarding administrative decision-making to water users and the public
ParFlow	Hydrologic model	Simulates spatially-distributed surface and subsurface flow, as well as land surface processes, including evapotranspiration and snow
WRI aqueduct	Suite of tools	Maps and analyzes current and future water risks across locations and identifies coastal and riverine flood risks to explore the costs and benefits of investing in flood protection
Drought resilience self-assessment tool (DR.SAT)	Resilience modeling tool	Allows farmers to complete a personalized self-assessment of farm resilience
WaterSignal	IoT sensor	Provides real-time monitoring of water use connected to mobile SMS alerts
Water compass	Water management software	Offers cloud-based water use analytics and dashboarding
MasterPlan	AI-enabled GIS pipe deficiency analysis	Uses GIS Data and AI to measure soil moisture to determine where pipes are degrading
Optiqua	AI water quality analysis	Provides an early warning system by integrating AI to detect real-time water quality events
SWAN	AI water management software for agriculture	Offers data-driven configurable water and nutrient management software

Source: Deloitte analysis.

While technologies like remote sensing, satellite imagery, Internet of Things, sensors, AI, machine learning, and blockchain are generating more data than imaginable, there remains a need for:

1. Additional computing power
2. Better approaches to analyzing the data
3. Adequate training for analyzers and users
4. Improved interoperability between data structures and technologies

Coordination between the public and private sectors, as well as direct paths between research and its implementation, are required to bring together the necessary resources and knowledge to use water data most effectively.

How to address the water ecosystem's collective action problem

The importance of cross-sector collaboration was highlighted in most of our interviews and confirmed across all governance levels and industries. To address the water crisis and capture the true scale of action required, our understanding of the water ecosystem must extend beyond governmental water agencies and water/wastewater systems. It must encompass the complex and interconnected network of water ecosystems, as well as the individuals and organizations involved in the use, management, and governance of their surrounding water and wastewater systems. It must also include an interdisciplinary approach to understand the complex drivers relevant to water use, such as socio-economic context and climatic effects.[15]

Decision-makers in the water ecosystem should come together to:

1. Define the problems impacting the watershed and all communities affected by these problems.
2. Understand the values landscape and scope of action for each affected community.
3. Set common objectives, targets, value drivers, and metrics.
4. Prioritize and operationalize collaborative solutions.

After consulting with water specialists, we created a guide for collaborative water management at the watershed level. The guide offers pathways for decision-makers to improve solutions, rather than being prescriptive. Each watershed requires unique management according to its communities, relevant laws, regional interests, and resource and financial constraints.

Developing a community, multisectoral approach to water management

Our guide to multisector water action (figure 3) outlines a partners-based ecosystem approach that can help leaders address transboundary water challenges, improve regional policy and planning efforts, and build local capacity to manage freshwater resources sustainably, effectively, and equitably. Each step is grounded in recommendations suggested by specialists from our interviews and scientific studies spanning behavioral economics, common pool resources management, and social psychology.

The foundation of the guide rests on a strong problem statement and a robust understanding of the impacted parties. Before pursuing these activities, groups must clearly define the problem they are trying to solve, and organizations, groups, and individuals who could potentially be affected by these decisions should be engaged in the process.

Step 1: Understand the values landscape and scope of action

To cultivate an environment conducive to cross-industry and cross-scale collaboration, the water ecosystem should first establish an approach to identifying ecosystem collaborators and players. As highlighted by one interviewee, there is tension in addressing environmental problems because people value the same things differently. To address this disconnect, we suggest water leaders connect with local and regional water players—such as government agencies, businesses, nonprofit organizations, local community leaders, and tribal communities—to discuss the similarities and differences in how people use and value water across localities and interdependent watersheds and water resources.

As a part of this discussion, there are various values to consider, both monetary and nonfinancial, such as municipal use, biodiversity, cultural traditions, aesthetics, etc.

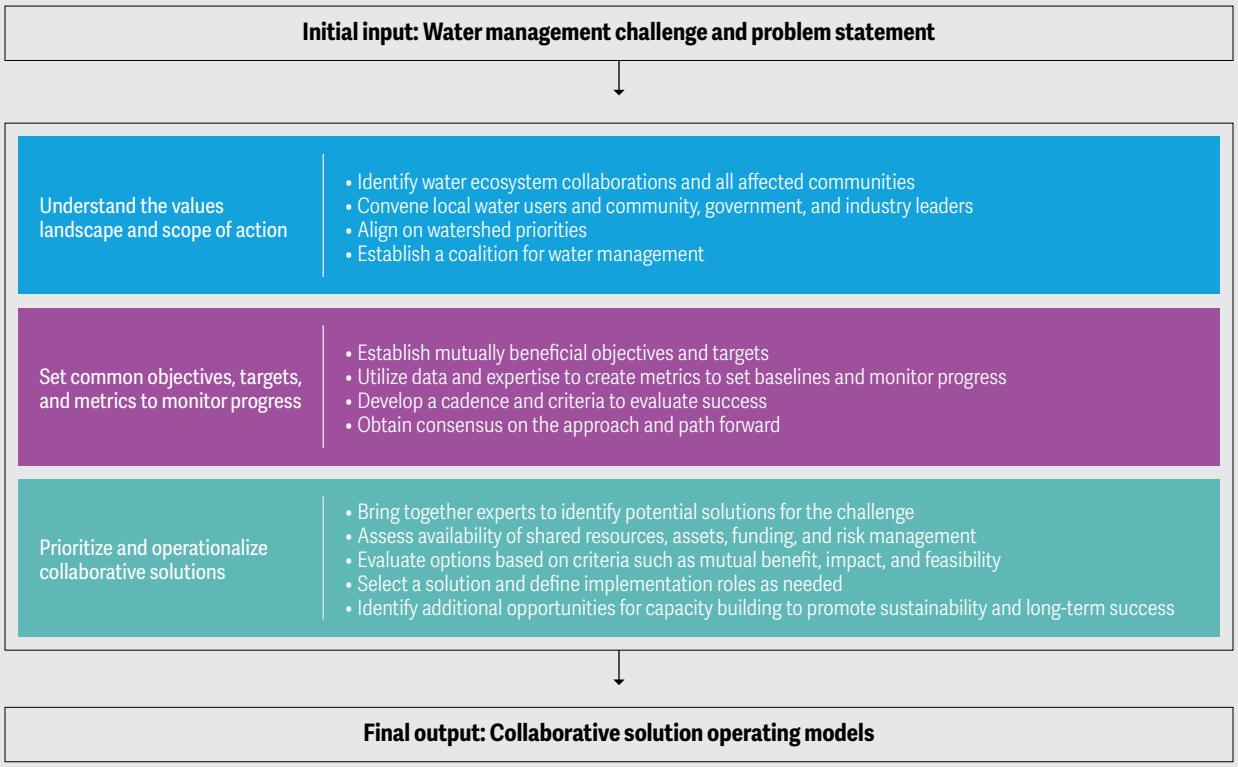
REAL-WORLD EXAMPLE IN ACTION | CHESAPEAKE BAY PROGRAM

Background: The Chesapeake Bay Program[16] is a prominent public-private partnership focused on safeguarding and restoring the Chesapeake Bay watershed—the largest, once most productive estuary in the United States and the third largest in the world. The Chesapeake Bay watershed spans six states and is home to more than 18 million people and 3,600 species of plants and animals. The watershed has been adversely affected by diverse land uses impacting the industries and communities that rely on the watershed for everyday life.

Understanding the values landscape and scope of action: Founded in 1983, the Chesapeake Bay Program is centered around creating a collaborative water management strategy to accelerate restoration and align federal directives with state and local goals to protect the watershed. The Chesapeake Bay Program uses written agreements that include collective value principles to align its members, with the agreements periodically updated to reflect changing priorities and objectives. By engaging federal and state agencies, local governments, NGOs, businesses, academic institutions, and local communities, the coalition has established a holistic approach that addresses water quality and habitat restoration while facilitating community engagement and improving industries around the Chesapeake.

Figure 3

Guide to multisectoral water action: Strategy for collaborative water governance at the watershed level



Source: Deloitte analysis.

Once a baseline understanding of the values landscape is established, a water coalition should be formed with members from various sectors who accurately represent these values. It's essential to establish private and public sector partnerships during this step to increase collaboration amongst water ecosystem players. These partnerships are also helpful because they assume shared risk and can balance the risk of innovation with the risk of compliance and regulatory requirements. The established water coalition can then set a scope of action for addressing transboundary water challenges and building water ecosystems to support collaborative, community-led water resources management.

Step 2: Set common objectives, targets, and metrics

According to one of our specialists, large organizations investing in the environment and water resources are doing so reactively. Setting objectives aims to collectively define strategic outcomes based on group values. Targets quantify goals aligned with objectives, while metrics measure progress toward those objectives.

First, water coalitions should set strategic objectives and targets, collaborating closely with researchers and knowledge holders. Some water-related considerations for setting objectives include water quality, water availability, water accessibility, water equity, and/or water acceptability.

Next, water coalitions should utilize data and expertise to identify the appropriate set of metrics for setting baselines for these objectives and monitoring progress toward goals. These metrics may be primarily quantitative, but qualitative criteria may be appropriate for a watershed's unique situation. While data is useful for establishing metrics and measuring progress, data rights, privacy, and sharing protocols must be considered, recognizing that some data should not be shared.

After establishing objectives, targets, metrics, and data protocols, water coalitions should validate the same with all community members to establish a consensus on a path forward. The methodology will only be useful if it accurately captures the community's values, water uses, and environmental challenges. Through consensus-based deliberation, participants are more inclined to abide by the rules of collaboration and feel ownership over solutions.

REAL-WORLD EXAMPLE IN ACTION | CALIFORNIA WATER ACTION COLLABORATIVE

Background: The California Water Action Collaborative (CWAC)[17] is a public-private partnership of diverse groups working to pursue collective action projects to ensure sustainable water management in California. The CWAC aims to improve water security in California for its people, businesses, agriculture, and nature. The CWAC comprises governmental agencies, environmental organizations, and major companies, including the United Nations' Global Compact CEO Water Mandate, the Environmental Defense Fund, and the Nature Conservancy.

Setting common objectives, targets, and metrics: The CWAC recognizes that setting common objectives, targets, and metrics is imperative to align diverse collaborators toward the shared goal of addressing water scarcity challenges in the state. By aligning with the United Nations' Sustainable Development Goals, the CWAC helps its coalition establish specific and measurable objectives to guide its collective efforts.

Some of the CWAC's current priorities include:

- Building social capital for improved local water management
- Returning water to natural systems—both surface water and groundwater
- Driving corporate water stewardship aligned with state and global water stewardship goals

Setting these objectives helps all members to have a shared understanding of the purpose of their work, aligns disparate roles, resources, and activities toward a mutual cause, and drives toward tangible outcomes of the coalition's efforts.

Step 3: Prioritize and operationalize collaborative solutions

Only after aligning on values and objectives can private-public partnerships begin to identify potential solutions that will align with all members of their collaboration, improving the chances for sustainability and success. Leveraging group expertise, we suggest the coalition create a list of potential solutions that meet its objective(s) and consider each component required for success—people, processes, technology, communities, policies, and data. For example, if a community wants to conserve 10% of the water used for agriculture, they should consider these components: Which crops use the most water, and how much water do they use? Who relies on these crops, and how will changes in water conservation impact them? What can my group and others change? Where are there gaps in resources to make this happen?

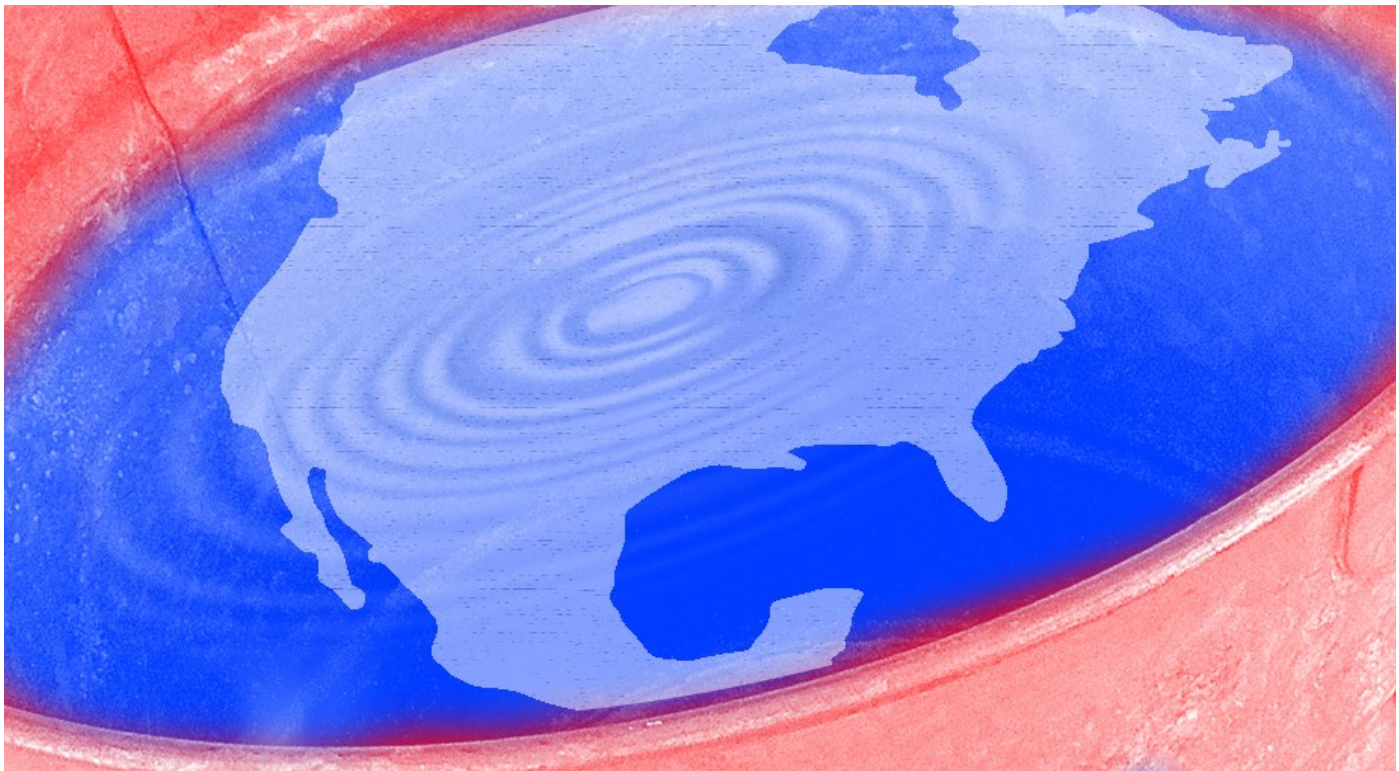
Once potential solutions are established, water coalitions can create criteria to weigh each solution's suitability, with higher weights for areas of greater group priority. These criteria may include:

1. Ability to meet shared objectives
2. Ability to produce equitable trade-offs
3. Impact
4. Feasibility

The coalitions can then evaluate the solutions and select the best option based on these criteria. It is vital to recognize that circumstances, including resource access and priority, may change, and having a list of potential solutions may be beneficial if the group needs to pivot to new ideas that better reflect their current situation.

After selecting a path forward, water coalitions should define group roles and capabilities necessary to perform the work and match these amongst collaborators and water ecosystem players. If gaps appear, this can identify what additional roles or capabilities are needed to execute the objectives. Individuals may need to receive training or supporting partners may need to be identified. Some examples of roles in the water coalition may include innovators, developers, funders, regulators, operators, motivators, and integrators. One interviewee also stressed that without an internal champion behind an innovation, momentum fades, and projects are quickly deprioritized.

To have long-term success, communities should set a cadence for regularly updating on solution implementation and its progress toward objectives, as well as protocols for how challenges will be identified and addressed. Additional capability training should be considered to continue increasing the group's shared knowledge and capacity for sustainable action.



REAL-WORLD EXAMPLE IN ACTION | OHIO RIVER BASIN ALLIANCE

Background: The Ohio River Basin Alliance (ORBA)[18] is a collaborative coalition of partners that provides a "unified voice of [collaborators] for water resource priorities of the Ohio River Basin striving to sustain healthy ecosystems and river communities and vibrant water-dependent economies." The Ohio River Basin encompasses six states within which more than 25 million people live (almost 10% of the US population), and it directly supplies drinking water for more than 5 million people. ORBA began in 2009 as a byproduct of the Ohio River Valley Basin Summit, co-led by the Ohio River Valley Water Sanitation Commission, the US Army Corps of Engineers, and the US Environmental Protection Agency. Today, the alliance has grown to include federal and state agencies, environmental organizations, industry players, and academia to create solutions for the Ohio River Basin Strategic Plan developed in 2019 and 2020.

Prioritize and operationalize collaborative solutions: ORBA aligned on six objectives set out in the Ohio River Basin Strategic Plan, including[19]:

- *Healthy and productive ecosystems:* Conserve, enhance, and restore ecosystems within the Ohio River Basin to support natural habitats and the fish and wildlife resources that depend upon them.
- *Nation's most valuable river transportation and commerce corridor:* Provide for safe, efficient, and dependable commercial navigation within the Ohio River Basin to ensure a competitive advantage for our goods in global and regional markets; sustain a water use system to efficiently and effectively support agricultural, industrial, and energy productivity.
- *Reliable flood risk management:* Provide reliable flood risk management through well-managed and maintained infrastructure, including appropriate flood plain connections for water conveyance and ecosystem benefits and management of surface and stormwater runoff to protect life, property, and economies better.

ORBA created six working groups to develop solutions for these objectives and, as an outcome, formed a team to secure federal funding to restore, protect, and enhance ecosystems in the river basin as aligned with its "Healthy and productive ecosystems" objective. This is an emerging new strategy for the region, which has not historically received extensive federal funding to support its watershed. The plan offers a "blueprint" for increased federal support, including the designation of the Ohio River as a protected water system eligible for additional funding.

Conclusion

Tackling the nation's water crisis requires new approaches and enhanced collaboration strategies. We must use our diverse perspectives to generate new ideas and work together to address water challenges. Public-private partnerships and cross-sector collaboration are crucial in solving water-related challenges. Our guide to cross-sector action is founded on these insights, supported by literature, and demonstrated in successful water coalitions across the country. The core principle is to bring all communities to the table, align on shared values, and establish consensus to build lasting results. Successful water management programs combine all constituents to create solutions greater than any single part, like a watershed assembled from all its components. By collectively acting on diverse interests, we can address our water crisis and ensure that every section of our communities, businesses, and governments have the amount of water they need.

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Acknowledgments

The authors would like to extend their thanks to the following Deloitte colleagues for their support with the research, writing, and development of this report: **Katherine Demaree**, **Harper Drake**, **Adam Samazin**, **Matt Stephens**, **Zach East**, **Jake Hanssen**, **Jennie Zhu**, **Marika Schulhof**, and T**iffany Dovey Fishman**.

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Published in collaboration with Deloitte Insights.