NIAC The President's National Infrastructure Advisory Council

Preparing United States Critical Infrastructure for Today's Evolving Water Crises

June 2023

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About the NIAC

The President's National Infrastructure Advisory Council (NIAC) is composed of senior executives from industry and state and local government who own and operate the critical infrastructure essential to modern life. The Council was established by executive order in October 2001 to advise the President on practical strategies for industry and government to reduce complex risks to the designated critical infrastructure sectors.

At the President's request, NIAC members conduct in-depth studies on physical and cyber risks to critical infrastructure and recommend solutions that reduce risks and improve security and resilience. Members draw upon their deep experience, engage national experts, and conduct extensive research to discern the key insights that lead to practical federal solutions to complex problems.

For more information on the NIAC and its work, please visit: https://www.cisa.gov/niac.

Executive Summary

Water crises threaten the security and resilience of our nation's critical infrastructure. This report identifies the challenges we are confronted with and provides recommendations to address them.

The NIAC's **recommendations** include the following:

Aid Infrastructure Owners and Operators

1. Create, incentivize, and enforce standards for water use and quality.
2. Remove barriers to new ways of funding water projects.
3. Invest in innovation.
4. Assist low-income and vulnerable populations.
5. Increase national resiliency to drought, floods, and other water-related crises.
6. Invest in the water infrastructure workforce.

Mitigate Cross-Sector Impacts

1. Invest in reliable infrastructure in U.S. river systems to provide for energy generation needs.
2. Modernize and make flood resilient the inland waterways transportation system.
3. Support adaptive practices and promote smarter irrigation technology so farmers, ranchers, and forest landowners can better deal with climate variability.

Create a National Water Strategy

1. Elevate the importance of water in the national consciousness through a public awareness program.
2. Institute either a Department of Water or some other entity that stewards water at the Cabinet level.

The NIAC concludes that successful mitigation of the risks water crises presents requires a coordinated effort between owners, operators, and the federal government. The response must be nuanced, timely and intent on delivering results that strengthen the security and resilience of our nation's critical infrastructure. To achieve the desired outcomes, the NIAC recognizes that innovation, investment, and incentives play a pivotal role in creating long-term gains. This report explores where we are and a better way forward in the form of recommendations and a federal-level water strategy.

Introduction

On December 27, 2022, The National Security Council (NSC) tasked the NIAC to answer the following questions:

How should the Federal government help critical infrastructure owners and operators prepare for the rapidly evolving water crisis (including the Colorado River Basin) and what actions should we take now to minimize cross-sector impacts?

As a result of its deliberations, the NIAC:

- Identified eight main areas in which the federal government can aid owners and operators of critical infrastructure prepare for the evolving water crisis and six major categories of recommendations associated with them;
- Focused on four critical sectors that are strongly connected to water and provided four recommendations to minimize cross-sector impacts of the evolving water crisis; and
- Proposed the creation of a national water strategy stewarded by a new Department of Water or Cabinet-level entity.

Our nation's water infrastructure and the reliance of water on other critical infrastructure is extremely complex. It is acknowledged that the topics and recommendations in this report are not exhaustive in nature. The NIAC, in its deliberations, focused on limited critical issues.

1. The NIAC's Charge

The NSC tasked the NIAC with the following:

> *How should the Federal government help critical infrastructure owners and operators prepare for the rapidly evolving water crisis (including the Colorado River Basin) and what actions should we take now to minimize cross-sector impacts?*

2. Subcommittee Activities

The Subcommittee held the following meetings and received the following briefings from Water Agencies, Water Organizations, Water Utility Owners and Operators, Research Centers, and Members of Academia:

February 23, 2023 – Kickoff meeting for the Subcommittee.

March 2, 2023 – Subcommittee meeting focusing on the study topic question. The Subcommittee Chair asked subcommittee members the following questions:

- *Identify a list of issues related to water crisis and water security including the Colorado River Basin.*
- *Provide recommendations on how the federal government can help critical infrastructure owners and operators prepare for the rapidly evolving water crisis including the Colorado River Basin.*
- *Identify actions to minimize cross-sector impacts.*

March 9, 2023 – Subcommittee meeting focused on subcommittee member discussion of cross-sector issues related to water supply and potential briefers.

March 16, 2023 – Subcommittee meeting focused on discussion of water supply, water moving and water conserving issues, and potential briefers on these issues.

March 23, 2023 – Subcommittee meeting focused on discussion of water supply issues pertinent to actionable recommendations.

March 30, 2023 – Subcommittee meeting focused on water supply issues pertinent to actionable recommendations. The Subcommittee Chair asked members to provide three names for briefers or three major areas of expertise related to the issue.

April 6, 2023 – Subcommittee briefing from Mr. Del Shannon, President of the United States (U.S.) Society of Dams and Chief Dam Engineer at Kiewit, followed by a question-and-answer session.

April 13, 2023 – Subcommittee briefing from Mr. Michael Lee Connor, Assistant Secretary of the Army for Civil Works, followed by a question-and-answer session.

April 20, 2023 – Subcommittee briefing from Mr. Eddie Belk, Director of Civil Works, U.S. Army Corps of Engineers; and Dr. Robert Webb, Director of the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory, followed by a question-and-answer session.

April 27, 2023 – Subcommittee briefing from Dr. Seth Meyer, Chief Economist, and Mr. Brad Rippey, Meteorologist, U.S. Department of Agriculture (USDA), followed by a question-and-answer session.

May 4, 2023 – Subcommittee briefing from Ms. Leslie Meyers, Associate General Manager and Chief Water Resources Executive of the Salt River Project in Arizona, followed by a question-and-answer session.

May 11, 2023 – Subcommittee briefing from Mr. Andrew Lee, General Manager and CEO, Seattle Public Utilities (SPU); Mr. Corey Williams, Member of the Board of Trustees, Water Environment Federation (WEF); Mr. Calvin Farr, General Manager and CEO, Prince William County Service Authority (PWCSA); and Mr. Michael Johnson, General Manager, Birmingham Water Works Board, followed by a question-and-answer session.

May 18, 2023 - Subcommittee briefing from Mr. Ken Jenkins, Chief Water Resource Sustainability Officer, California Water Service (Cal Water); Mr. Scott Wagner, Director Water Resource Manager, Cal Water; Mr. Lester Snow, Chair, Emergency Preparedness Safety & Security Committee, Cal Water; Ms. Erica Brown, Chief Policy and Strategy Officer, Association of Metropolitan Water Agencies (AMWA); Mr. Dale Pierson, Executive Director, Rural Water Association of Utah (RWAU); and Mr. Kurt Pfeifle, Executive Director, South Dakota Association of Rural Water Systems (SDARWS), followed by question-and-answer sessions after each briefer.

May 25, 2023 - Subcommittee briefing from Mr. Jared Mitchem, Regional Vice President, Tennessee Valley Authority (TVA); Mr. James Everett, Manager of the River Forecast Center, River Management, TVA; Mr. Alex Sadler, Training and Development Consultant, TVA Economic Development's Community Development Team; Mr. Wes Kelley, President and Chief Executive Officer, Huntsville Utilities (HSVUTIL); and Mr. Frederick Mucke, Director of Water Operations, HSVUTIL. A question-and-answer session followed, and then the subcommittee met separately to work on report recommendations.

June 1, 2023 – The Subcommittee met to discuss their draft report and recommendations.

June 2, 2023 – The Subcommittee invited the full NIAC to attend a Subcommittee meeting to hear initial details of the draft Water Security Report.

June 7, 2023 – The Subcommittee Chair met with U.S. Bureau of Reclamation Commissioner Camille Touton to discuss the Department of Interior's "Watermaster" role and the Colorado River Basin.

June 8, 2023 – The Subcommittee met to discuss their draft report and recommendations.

3. Organization of this Report

This report is organized as follows:

Aid Infrastructure Owners and Operators

1. *Challenges in the Evolving Water Crisis for Critical Infrastructure Owners and Operators* details eight problem areas for critical water infrastructure owners and operators.
2. *Recommendations to Aid Infrastructure Owners and Operators* details six recommendations for how the government can help prepare water infrastructure owners and operators for the evolving water crisis.

Mitigate Cross-Sector Impacts

1. *Mitigation of Cross-Sector Impacts Due to the Water Crisis* details five sectors that are impacted by the water crisis.
2. *Recommendations to Mitigate Cross-Sector Impacts* details three ways that the government can help with cross-sector water challenges.

Create a National Water Strategy

1. *Need for a National Water Strategy* describes why a national water strategy is needed.
2. *Recommendations for a National Water Strategy* provides two elements necessary in a national water strategy.

Challenges in the Evolving Water Crisis for Critical Infrastructure Owners and Operators

Water access is central to every aspect of the U.S. economy. Per the USDA, power generation is the biggest user of our nation's water at 41%; irrigation, at 37%, is the next largest user; public consumption is at 12%; and mining/industrial/technology/manufacturing use composes another 6%. Surface water provides roughly 60% of the public water supply, with the remaining 40% coming from groundwater aquifers.

Delivering water to communities, business and industry in the U.S. is complex. As a member of the subcommittee has said, "all water is local." Especially in the arid western U.S., however, water is not often located where it is ultimately needed. Large water supply infrastructure such as dams and reservoirs capture precipitation and store water until it is used. Dams and reservoirs also often play a role in flood control and navigation on inland waterways. Canals and other conveyances distribute raw water to where it is treated. Water infrastructure at the local level consists of treatment plants, distribution pipes, pumps, and other drinking water facilities. Federal, state, tribal, county, and municipal governments as well as private entities and public/private partnerships own and/or operate parts of this critical infrastructure.

The NIAC identified the following eight themes in discussions of how to help owners and operators of critical water infrastructure prepare for the rapidly evolving water crisis:

1. Unsustainable Use of Water

The nation's current use of water is unsustainable, in part due to unsustained investment. Decades of chronic underfunding and underinvestment have impacted the condition, reliability, and resiliency of the nation's critical water infrastructure. The U.S. government's share of capital costs on water infrastructure fell from around 60% in 1977 to below 10% in 2020.

The American Society of Civil Engineers' (ASCE) *Failure to Act: The Economic Benefits of Investing in Water Infrastructure* 2020 report analyzed the impact of not investing in drinking water and wastewater infrastructure on the gross domestic product, businesses, households, and public health. The report predates the current federal investment in water infrastructure, namely the Infrastructure Investment and Jobs Act (IIJA)[1]. The ASCE report[2] states that in 2019, the total capital spending on drinking water and wastewater infrastructure at the local, state, and federal levels was approximately $48 billion, while investment needs totaled $129 billion, creating an $81 billion gap for just that year. The IIJA appropriated to the Environmental Protection Agency (EPA) roughly $50 billion on drinking water and wastewater infrastructure improvements over five years (or $10 billion per year). This investment by the federal government and the American people clearly helps to close the gap in annual water infrastructure investment but does not cover all of the nation's drinking water and wastewater infrastructure investment needs. Sustainable water systems should provide adequate water quantity and appropriate water quality for

[1] IIJA investments include $11.7 billion to the Drinking Water State Revolving Fund (DWSRF) and $11.7 billion to the Clean Water State Revolving Fund (CWSRF) to improve water infrastructure, $15 billion to replace lead pipes, and $5 billion to DWSRF and CWSRF, and $5 billion to Water Infrastructure Improvements for the Nation (WIIN) Act grant programs to assist in the removal of emerging contaminates (PFAS) from 2022 to 2026. Other water related IIJA investments include $17.1 billion to the U.S. Army Corps of Engineers (USACE) for inland waterway infrastructure construction, repair, and operations and maintenance and $16.8 billion to the Bureau of Reclamation for repair of aging water infrastructure and drought resilience.

[2] The remainder of this report does not cover on the nation's wastewater treatment needs but instead focuses on drinking water and water supply.

a given need, without compromising the future ability to provide the required capacity and quality. Attaining a sustainable water supply requires sustained investment at all levels of government.

U.S. water is still among the safest and most reliable in the world. The great majority of Americans have the benefit of clean, inexpensive water on demand. But most of our water supply infrastructure is at or nearing the end of its design life. Extreme weather events prompt more frequent boil orders due to failure of stressed aged water infrastructure. The American Water Works Association (AWWA) estimates that most of the nation's existing drinking water pipes must be repaired or replaced before 2040, necessitating a "replacement era" that will dramatically increase costs to utilities and their customers. ASCE's 2021 *Report Card for America's Infrastructure* gave U.S. dams a "D" grade, and the Association of State Dam Safety Officials (ASDSO) has identified over 15,000 dams that pose a high hazard of failure. The ASDSO also estimated in 2022 that the cost of rehabilitation of non-federal dams is $75 billion due to decades of deferred maintenance and repair.

The true costs of supplying and treating water are often not reflected in the price the consumer pays. Water utilities have resisted increasing the price of water until recently, and instead covered the cost through reductions in operations and maintenance (O&M). Due to deferred maintenance, about one-sixth of finished water in the U.S. never reaches customers but leaks out of storage and distribution systems. This loss of revenue is borne by the utilities because leaked water cannot be billed since it never reached the user.

The other reason that our nation's current use of water is unsustainable is overreliance on stored surface water and groundwater, particularly in the arid western states. Groundwater can be a sustainable water supply source if the total water entering, exiting, and being stored in the aquifer is conserved at sustainable levels. Similarly, surface water captured from rain and snowmelt and water stored in dammed reservoirs can be used sustainably if the water levels in the reservoirs are maintained at viable levels.

In the West, population growth and rampant development, decades of drought, overuse of stored surface water, and over pumping of groundwater have created a critically unsustainable situation. The water levels of the nation's two largest reservoirs, Lakes Mead and Powell, are at record low levels, impacting hydropower production and the ability to operate the associated dams. The Colorado River is a case in point, and its water issues are exacerbated by several factors. The total amount of water that the century-old Colorado River Compact uses as a base amount is more than the Colorado River can supply. The area is in its 23rd year of drought so the river's flow is down by about 20% when compared to flows in the 1900s. Yet water usage has dramatically increased over the years and has not been significantly scaled back until the 2023 Colorado River agreement. In this deal, the three Lower Basin states will cut 1 million acre-feet of consumption each year for the next three years. About 75% of the cuts will be compensated for through IRA funds,[3] mostly by paying farmers to reduce irrigation. Although this agreement will significantly increase water levels in Lake Powell, it is temporary and does not bring the reservoir's water level up to sustainable levels. If the megadrought continues, a more sustainable solution must be reached.

Other areas are taking unprecedented steps to solve water scarcity. Arizona is now limiting future development, mostly in the Phoenix area, by denying new Certificates of Assured Water Supply required for new construction in locations that rely on groundwater for water supply. In California, the State Water

[3] These include water-related IRA investments in the creation of a Lower Colorado River Basin Conservation and Efficiency Program

Resources Board is accelerating permitting of projects that recharge aquifers in order to capture and beneficially use floodwaters from recent atmospheric river weather events.

Ways to Increase Water Supply Sustainability

Aquifer recharge can return overprescribed aquifers back to health, if they have not been pumped below unrecoverable levels, by injecting water into wells. This can prevent salt-water intrusion into a freshwater aquifer or reduce land subsidence. Aquifer storage is used to store water for later retrieval and beneficial use, much like storage of surface water in dam reservoirs but without losses associated with evaporation.

Dams, reservoirs, underground storage containments, and canals are used in storing and moving surface water. Lining and covering canals in dry regions can minimize water loss through seepage and evaporation, respectively.

Harvested rainwater and greywater can be used for non-potable purposes such as for landscape use. Reclaimed water (both greywater and blackwater) can be treated to the appropriate quality and used for drinking, irrigation, industrial purposes. Desalination, because of its expense and high energy use, is not yet considered sustainable, although use of renewable energy and development of technologies to increase its efficiency will eventually increase desalination's attractiveness. Water reuse (water recycling) is the use of municipal wastewater, industrial cooling or process water, agricultural runoff, or produced water from extraction activities such as fracking and mining as source water for potable and non-potable purposes.

An example of a country with a sustainable water program is Israel. To meet its water demands, Israel has a highly integrated water management system that combines desalination, recycling of wastewater, and stormwater capture for aquifer recharge. It is so successful that even in its arid climate, Israel is now a water exporter.

2. Issues with Water Quality

Raw water quality can be impacted at its source (groundwater, rivers, and reservoirs) and treated (finished) water can be contaminated during distribution from the treatment plant en route to the customer. Sources of contamination include fertilizers and pesticides applied to farmland, runoff from concentrated animal feeding operations, outflows from manufacturing operations, sewer overflows, storm water, the dissolving of chemicals found in rock and soil into groundwater, the dissolving of chemicals such as lead in pipes, pipe joints, and other fixtures into finished water during distribution, and seepage of contamination into leaks in distribution pipes if water pressure is lost. Climate change impacts source water quality because more intense rainfall can increase both the concentration of pollutants and sediment beyond those occurring during normal conditions.

Recent water quality issues of concern are lead in distribution piping and per- and polyfluoroalkyl substances (PFAS) in source water. The EPA estimates that there are over 9 million lead service lines that are known to be a significant source of lead contamination. According to AWWA, $60 billion is needed to replace lead pipes; the IIJA investment in lead pipe removal is $15 billion, leaving a gap of $45 billion to be paid by utilities and their customers. New EPA regulations setting limits on PFAS in drinking water have recently been proposed due to the impact of PFAS on public health. The proposed National Primary Drinking Water Regulations (NPDWR) will require public water systems to monitor for PFAS and reduce levels if they exceed the proposed limits. Costs for the monitoring, removal, and disposal of PFAS will exceed the additional EPA funding available, requiring utilities and their ratepayers to cover the rest. Such unfunded or underfunded mandates add additional stress to water providers who also must replace aging infrastructure and assure sustainable water supplies. It requires water providers to install new processes and equipment such as granular activated carbon filtration or reverse osmosis and ion exchange systems and to have the needed personnel to operate the new processes.

3. Water Inequity and Unaffordability

Water supply infrastructure in the U.S. ranges from large municipal systems serving millions of people to private wells serving a single family. The majority of U.S. residents have access to clean, reliable drinking water, but not everyone. An estimated 0.5% to 1% of U.S. residents do not have piped water; these instances often occur in low income and minority communities (colonias communities in Texas, tribal lands, and Alaskan Native villages). The United States Geological Survey (USGS) estimates that 15% of the U.S. population relies on individual or shared water systems. These systems are most often in rural areas where water quality testing is limited and are generally subject to few regulations. Most U.S. residents get their water from community water systems which does not guarantee the water quality or reliability of the system. Just 9% of the community water systems provided water to 80% of the country with the remaining 91% servicing small communities. Small water systems more often service low-income areas.

Ideally the price of water covers the cost of providing it. Many factors impact the ability of providers and their ratepayers to develop and maintain needed water supply capabilities. One factor is the age of the water infrastructure. Many jurisdictions do not account for the full lifecycle cost of building, maintaining, upgrading, and replacing systems. Often water utility owners and operators are unable or unwilling to raise rates to pay for needed investment. Rates can be based on the least cost, which relies on patching and repairing and ignores longer-term problems and consequences. This has negative impacts on water quality and reliability. Low-income and vulnerable communities are more likely to lack access to clean reliable water.

Climate change and water scarcity also impact marginalized and low-income communities disproportionally. In regions where drinking water is obtained from aquifers that are being depleted, large utilities are more likely to have the financial resources required to drill deeper water wells, but adjacent rural or low-income communities are challenged to do so.

4. Fragmentation of Water

Roughly 80% of all water utilities are publicly owned and operated by municipalities. Most are small with the great majority of publicly owned water systems serving populations of less than 3,300. Community water systems are not typically connected to adjacent systems, unlike electricity and transportation infrastructure which are interconnected into national networks. Small publicly owned water systems are less likely to have the resources to deal with short- or long-term water scarcity, to have access to diverse sources of raw water, and often have limited ability to store treated water for resiliency during short term outages.

Water service regionalization occurs when multiple individual water systems consolidate operations, maintenance, and/or financial management. This consolidation can be small scale, such as joint procurement, or complex and large in scope. The objective is to realize operational efficiencies and economies of scale. It can also provide greater financial stability and access to capital. Full scale consolidation requires complex coordination between municipalities, changes in the way water is managed, and often construction of new infrastructure.

Adjacent utility owners and operators can make simple regional agreements for water sharing, which would require interconnection of the utilities' systems. An example of this type of arrangement is TVA's interconnection with several neighboring rural systems (this agreement is limited to water transfer during emergencies). TVA has access to surface water, while the adjacent systems rely solely on groundwater for their raw water needs. Groundwater availability is diminished during times of extended drought, so TVA will transfer water to their neighbors in a drought emergency. This is not a one-way street: TVA has relied on the water from adjacent systems when either equipment failed or during extended electrical outages.

On a much grander scale, China and India (e.g. India's Dam Rehabilitation and Improvement Project [DRIP]) are creating large scale water grids, similar to electric grids and interconnected surface transportation systems, which allow transbasin transfer of raw water. California has invested in the California Aqueduct and other infrastructure that allows the intrastate transfer of water from the water-rich Sacramento-San Joaquin Delta in the northern part of the state to the communities in Southern California, while also providing flood control through water storage facilities such as Lake Oroville.

5. Climate Change

Operators of large water systems often have over one hundred years of historic record to aid them in their long-term operation and planning efforts. Research, using tree ring data, has backfilled past temperature and precipitation information predating the historic record. This has allowed water sector decision makers some degree of certainty in the past. Similarly, traditional hydrologic frequency analysis assumes that climate is stationary, meaning that the statistical properties of hydrologic variables in future time periods will be similar to those in the past time periods, which until recently was an easily defendable assumption.

Weather events over the last two decades indicate that weather has become much more erratic. Examples include last year's atmospheric rivers in California after a record 23-year period of drought and record water levels of the Mississippi River[4]. Hurricanes are becoming increasingly more intense and cause billions of dollars in flood damages. Extreme weather events, exacerbated by increasing temperatures, are contributing to failures of inadequate and poorly maintained water infrastructure, which disproportionately impact economically depressed communities including older adults, individuals with disabilities, and people of color. Water losses in the West due to evaporation will increase with rising temperatures. Raw water capture and storage systems must be altered in light of anticipated shifts in precipitation. Drinking water utilities often have 24 hours of water or less in storage, with longer outages leaving communities without potable water. An example is the long duration failure of the water system in Jackson, Mississippi, to provide potable water that was extended due to weather-related issues.

Projects that capture available precipitation, stormwater, or floodwater for aquifer recharge or for replenishing depleted surface water storage must be located where high flows exist. To meet the water-related challenges of climate change, accurate climate predictions and weather forecasting is necessary. NOAA is the federal agency tasked with providing weather forecasts, as well as severe weather information, aviation weather, historical weather, satellite imagery, coastal charts, and climate records. NOAA also provides tools and resources that engineers use to help make informed decisions about climate risks and vulnerabilities in the design, operation, and maintenance of critical water infrastructure. The Bureau of Reclamation uses NOAA's Water Supply Forecasts for short-term water release planning. NOAA Atlas 14 (and next generation Atlas 15, when published) provides precipitation frequency estimates used in the design and management of the nation's critical infrastructure.

[4] The Mississippi River saw record highs in 2011, 2018-2019 (extended duration of high water), and 2023, and record lows in 2012, and 2022.

To incorporate climate change into NOAA tools and to provide more accurate, reliable, and timely precipitation forecasts across timescales, from seasonal to decadal, NOAA has recently launched the Precipitation Prediction Grand Challenge Strategy.

6. Workforce Challenges

Water utilities face challenges in recruiting, training, and retaining their workers. About one-third of the current water sector workforce will be eligible to retire in the next ten years. Technologies used in the water sector are becoming more advanced. New water quality regulations such as the limits on forever chemicals and threats such as cybersecurity compromises will require a more specialized workforce. Workforce development will require upskilling and reskilling current employees, enabling re-entry of retirees, and ensuring skill enhancement is equitable. Attracting individuals from disadvantaged communities to a career in water will be key to creating the water utility workforce of the future.

The NIAC's 2023 *Cross-Sector Collaboration to Protect Critical Infrastructure* report noted that the ability to attract information technology (IT) talent varies significantly between industries. Specifically, it is easier for industries where IT is part of their core business to attract highly skilled talent compared to industries where it is a necessary component but not the core function of the business. Water utilities will be hard pressed to find talent to meet their cybersecurity needs, but utilities must protect customer data and maintain secure control of all processes within their systems. This problem is exacerbated for the public sector, which must compete for talent with the private sector.

7. Barriers to Innovation and Implementation of New Capabilities

There are barriers to the use of novel things in the water sector, not the least of which is the risk of regulatory noncompliance when trying something new. Other barriers include lack of personnel needed to institute new processes, equipment, and procedures; limited or no funds devoted to investment in new equipment; and hesitancy in adopting new things because of limited availability. There are issues in scaling from research quantities to production quantities of new materials and equipment. Some new technologies simply need to be proven and their efficacy validated through bench and full-scale studies.

Innovative digital water management includes artificial intelligence (AI), internet of things (IoT) sensors that detect leakage, and advanced meters that enable remote asset management and improve decision making. Precision farming practices conserve irrigation water by utilizing drones and sensors to monitor irrigation, water quality, and soil moisture. Innovative materials such as modular adsorbents, electrode-based reactors, photocatalysts and nanoparticles are being researched for water applications. Desalination research includes solar-powered reverse osmosis technology and floating wave-powered desalination plants. Ultraviolet (UV) disinfection, an innovation that can replace chlorine disinfection, can eliminate the risk to the public associated with the transport of chlorine on our transportation systems.

There have been significant advances in using AI, delivery methods, and water treatment technologies to address efficiency, energy usage, and structural delivery models (i.e., distributed water, which is similar to distributed energy). Through using AI or AI Markup Language (AIML), technologies receive financing to accelerate the creation of "actional information" so that water systems become more efficient and address the critical need for robustness. Currently these advances are mostly used in industrial, agricultural, and energy production where water is a raw material input.

New public-private partnership O&M services and financing models are emerging, such as integrated solutions or design-build-own-operate and maintain (DBOOM) services. Industrial users are embracing thirdparty investors for O&M as well as direct ownership of water assets. The trend is also accelerating for municipal systems. By entering long-term contracts with service providers, water facility operators can reduce costs and improve efficiencies. Industrial operators are also starting to change their mindset from viewing wastewater as a compliance cost to viewing it as a reliable and sustainable water source.

For instance, the 20,000 resident city of Alice, Texas, recently entered into a partnership with Seven Seas Water Group, a private company owned by Morgan Stanley Infrastructure Partners, to convert brackish groundwater into drinking water without taxpayers investing upfront capital. Ridgewood Infrastructure LLC and IDE Technologies Ltd. entered a unique public-private partnership project with the city of Fort Lauderdale, Florida to construct and operate a 50-million gallon-per-day water treatment plant using state-of-the-art technology to replace an aging facility built almost 70 years ago. The private parties will fund 25% of the project costs and assume all the risks of construction and O&M over a long-term contracted basis. Finally, as a measure of how water utilities can be combined into a more efficient and collaborative system akin to regionalization, Central States Water Resources Inc. (CSWR) has acquired water utilities in 12 states[5]. CSWR now services more than 300,000 customers in its network and is transforming how water utilities work by using technology and innovation to quickly assess and invest in infrastructure.

8. Emergency Management

Rising incidents of water crisis creates the need for holistic emergency management. Water is a lifeline sector that serves communities, industries, and businesses daily and has the power to bring them back to normal after a disaster, which makes quickly restoring water services highest priority.

As stated, community water systems are not typically connected to adjacent systems, unlike electricity and transportation infrastructure, which are interconnected into national networks. The connection of a water system to adjacent systems can allow for transfer of water during emergency situations. With climate change and increasing water scarcity as well as high intensity precipitation events, the number of significant water crises has dramatically increased. For example, Hurricanes Laura and Delta in 2020, both affecting Southeast Louisiana, impacted water supply for over 300 utilities. Hurricane Fiona in 2022 impacted the power grid in Puerto Rico and the lack of power made the water systems throughout the island inoperable. New Orleans lost power for 31 days in 2021 due to Hurricane Ida that had a cascading impact to the city's water system.

Recommendations to Aid Infrastructure Owners and Operators

Subcommittee members proposed a range of recommendations in six major categories where the federal government can help owners and operators of critical water infrastructure prepare for the water crisis:

1. Create, incentivize, and enforce standards for water use and quality.

- Set reasonable timelines for compliance with new regulations for water quality, particularly those new standards that require adding entirely new processes and equipment.

[5] Central States Water Resources Inc. is a portfolio company of Sciens Capital Management LLC, a private equity investor that views water as a sustainable investment opportunity.

- Streamline the permitting process, which can take eight to 10 years for complex projects.
- Incorporate regulatory "teeth" into source water protections as opposed to relying on water treatment at the backend.

2. Remove barriers to new ways of funding water projects.

- Incentivize sustainable investment strategies at the regional and local levels to diversify and have strong interconnectivity with adjacent districts.
- Remove barriers to privatization, concessions, and other nontraditional models of funding community water systems.
- Allow access of privately owned water providers to Water Infrastructure Finance and Innovation Act (WIFIA) and federal grant programs.
- Support regionalization of water systems.

3. Invest in innovation.

- Provide funding and construct infrastructure to retrieve water from underground storage.
- Fund NOAA's Precipitation Prediction Grand Challenge Strategy.
- Furnish high speed computational systems to allow for accurate decadal weather forecasting and related modeling that incorporate the effects of climate change
- Enable water suppliers to try innovative products and practices by minimizing the risk in innovation while maintaining compliance and capacity.
- Provide funding for research in AI and how it can be used as a tool in water resource management.

4. Assist low-income and vulnerable populations.

- Identify and assist at-risk communities where water security can be decimated by non-record weather events (e.g., Jackson, Mississippi's August 2022 extended loss of potable water)
- Expedite Native American water rights settlements in lieu of adjudication.
- Make permanent and increase the funding for programs that aid water customers with delinquent accounts and low-income assistance programs; provide the aid directly to water utilities.
- Assist low-income communities in preventing loss of treated water from leaking pipes and restoring efficiencies to at-risk water systems through federal investment.
- Address water over-allocation and inequities in water entitlements.

5. Increase national resiliency to drought, floods, and other water-related crises.

- Promote cooperation and transparency between government and non-government entities, including local authorities, and help states and cities adjust and adapt to extended drought conditions, intense precipitation, and flooding.
    a. Conduct cross-sector and regional water crises drills to ensure cooperation and response during extreme events.
    b. Eliminate silos between federal, state, and other agencies.

- Enable the ability to upgrade existing water infrastructure such as reservoirs to increase water storage capacity.
- Allow operational flexibility of federal water assets to take advantage of wet and dry years.
- Ensure that protocols and processes are in place to face natural and man-made disasters and disruptions in water supply.
    a. Create and implement a water industry national standard in cybersecurity that is affordable and attainable by all utilities.
        - Invest in cybersecurity systems at water plants and on military bases.
        - Regulate AI; this technology allows everyday hackers to write sophisticated code that can impact supervisory and control data acquisition (SCADA) systems.
    b. Facilitate connectivity of adjacent water systems for water sharing during emergency situations.
- Streamline the Federal Emergency Management Agency (FEMA) emergency process.
    a. Recommend that FEMA include the Water Sector as an Emergency Support Function under the National Response Framework.
    b. Encourage FEMA to allow post-disaster mitigation funding for nontraditional emergencies and to increase funding for the Disaster Relief Fund (DRF).
- Remove barriers to interbasin transfers of water.
- Leverage regional water systems.
    a. Provide interconnections to maximize use of available water – move water to where it is needed (regional systems act as raw water wholesalers to local water treatment facilities).
- Promote water reuse, the use of greywater, underground storage, and the recharge of aquifers through onsite retention of stormwater and other available water.
    a. Implement desalination projects (especially on the Gulf Coast).
- Organize large-scale conservation efforts.
- Incentivize homeowners to install water-saving fixtures and appliances by increasing the limit on federal tax credits.
    a. Increase the limit on tax-free "cash for grass" programs.

6. Invest in the water infrastructure workforce.

- Expand workforce development and training programs such as the EPA's Innovative Water Infrastructure Workforce Development Grant Program to find and train the next generation of water facility operators.
- Focus on diversity and inclusion to create a pipeline of workers. Half of all Americans do not have a post-high school credential, so remove barriers such as lack of access to funding (i.e., Pell Grants), childcare, transportation, and workforce housing.

Mitigation of Cross-Sector Impacts Due to the Water Crisis

The DHS OCIA Sector Resilience Report includes a measure of the dependency on water of U.S. critical infrastructure. It was determined that a four- to eight-hour loss of water substantially impacted the functioning of all other critical infrastructure. A graphical depiction of this interdependency is shown in Figure 1.[6]

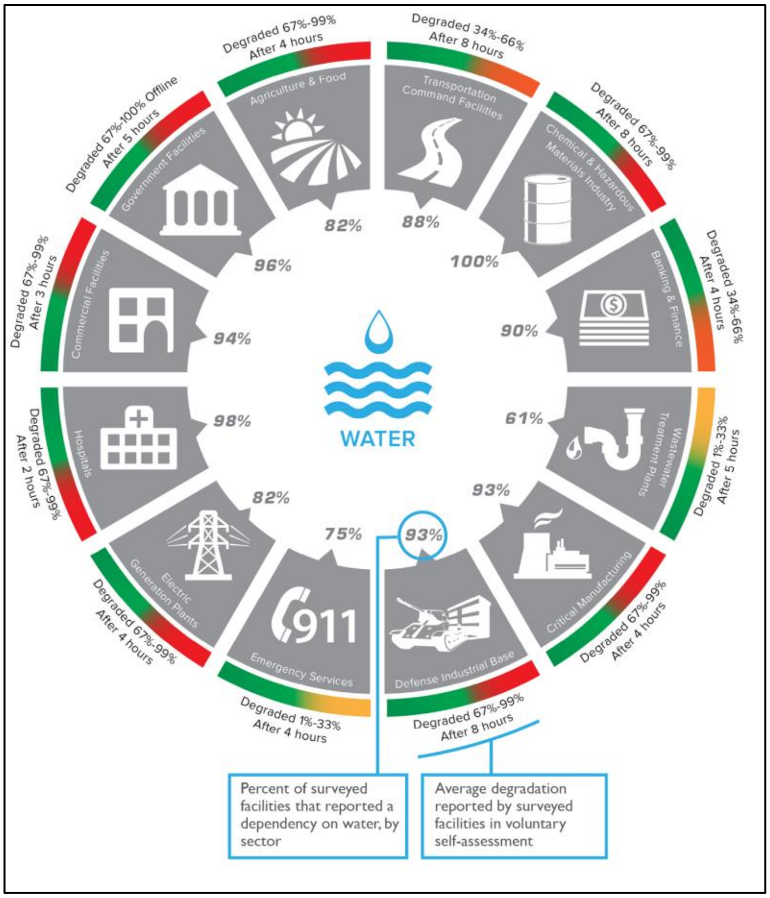

Figure 1: Critical Infrastructure Dependence on Water and Potential Function Degradation following Loss of Water Services (2016)

The ASCE's *Failure to Act: Economic Impacts of Status Quo Investment Across Infrastructure Systems* 2021 report assessed how the conditions of U.S. infrastructure systems affect the nation's economic performance. Our nation's economic health relies on reliable delivery of clean water and electricity and on low transportation costs to offset higher wages and production costs when compared to our international competitors. By 2039, water service disruptions are estimated to cost water-reliant businesses a cumulative $2.9 trillion decline in the gross domestic product (GDP) due to underinvestment, and failing drinking water infrastructure results in a cumulative $7.7 billion in associated health care costs. This analysis has not been adjusted for the impact of IIJA investments.

In this section, the NIAC focused on four sectors that depend on water: energy, agriculture, inland waterway transportation, and flood control.

[6] This figure was drawn from the NIAC's 2016 Water Sector Resilience report with the following explanation: The information provided in the graphic is based on a limited sample of 2,661 voluntary facility assessments conducted between January 2011 and April 2014 (DHS OCIA, *Sector Resilience Report*, 2014).

1. The Energy Sector

Energy production heavily relies on water for generating electricity and is the biggest user of water. However, the generation of electricity does not consume an appreciable amount of water but returns the vast majority to the system after use. In all thermal power plants, whether fueled by fossil, nuclear, or solar, boiled water turns a steam turbine that generates electricity. About 90% of all U.S. power plants are thermal, 6.2% are hydropower, and 3.4% are photovoltaic solar. A moderate amount of water used for cleaning reflective surfaces of solar panels, particularly if located in areas of little rain, is consumed. Thermal and hydropower plant efficiency and generation capacity is reduced by drought conditions. Drought or low water river conditions also impact the supply chain for fuel availability and delivery.

New sources of energy can also be big consumers of water. Green hydrogen uses clean energy to electrolyze water, thus consuming water in converting it to hydrogen and oxygen. The other types of hydrogen production are less green, but most use steam in the chemical process of creating hydrogen. Water will play a key role in attaining carbon neutrality, further increasing the strain on the nation's water resource infrastructure.

Conversely, as much as 40% of operating costs for drinking water systems can be for energy. The pumping of raw or finished water is energy intense.

2. The Agriculture Sector

The U.S. is a major agricultural producer and breadbasket for the world. The Midwest grows the majority of the nation's corn and soybeans. California is the "fruit and vegetable basket" of the country, growing nuts, seeds, citrus and other fruits, and vegetables. The U.S. produces about 30% of all corn and 35% of all soybeans grown globally, and it provides 55% of the world's almonds and 37% of its pistachios. It is not surprising that agriculture is the second biggest user of water and the biggest consumer of water. According to the USDA, the top five states ranked by irrigated acres are Nebraska (14.8%, increasing), California (13.5%, decreasing), Arkansas (8.4%, increasing), Texas (7.5%, decreasing), and Idaho (5.9%). The listed percentage is of the total irrigated land. The same USDA report indicates whether irrigated acreage is increasing or decreasing over the last decade. These regional trends reflect how changing water availability related to competing water demands, the effects of drought, and depletion of groundwater has influenced the distribution of irrigated farmland.

Corn and soybean yields have steadily increased over the last two decades, partially due to the increase in irrigation of these crops and despite being sensitive to extreme heat. Roughly 90% of corn and soybean acreage is insured, decreasing a farmer's financial risk. However insured farmers do not have the incentive to engage in costly climate adaptation as insurance compensates them for potential losses.

More than half of irrigation water (55%) comes from surface water, and 45% of irrigation water is from groundwater. Surface water irrigation is most common in the western states where federal reclamation policy and state investment in irrigation infrastructure make surface water accessible to irrigated land. The types of crops that are irrigated have shifted, with corn, soybeans, and alfalfa being increasingly irrigated. Groundwater withdrawal for irrigation is usually managed by local irrigation organizations. Irrigated agricultural production supported by groundwater use is concentrated over three aquifers, including the Central Valley, High Plains, and Mississippi Embayment, with unsustainable ground water depletion increasing over the last thirty years. Regions pumping at particularly unsustainable rates are the southern part of the Central Valley Aquifer (Tulare Basin) and the Southern High Plains in Texas. Irrigation withdrawals of surface water from Lake Mead and Lake Powell are major contributors to the depletion over the last two decades of these stored water assets.

3. The Inland Waterways: Transportation

The nation's inland transportation system relies on water. The Mississippi River's inland waterways overlay America's (and arguably the world's) most productive farmland, providing the U.S. an agricultural competitive edge. It is the only transportation system with the capacity to handle moving the projected increase in agricultural, energy, and manufacturing products to the coast for export. This is dependent on the reliability of the inland waterways transportation system to move bulk freight. Over 92% of the nation's agricultural exports and 78% of the world's feed grains and soybean move by barge on the inland waterways annually, often closing the gap between total U.S. imports and U.S. exports. Exported U.S. farm products play a vital role in global food security and stability.

The inland waterways system also supports industries that rely on rivers, indirectly contributing to job growth in the agriculture, manufacturing, and energy sectors, while directly supporting towboat operators and skilled labor trades. The inland waterways navigation system, along with railways and highways, provides a multimodal network that enables freight movement and reduces congestion along roadways and rail lines. This integrated transportation system enhances the overall efficiency and effectiveness of the nation's logistics infrastructure. In addition, barge transportation has a significantly lower carbon footprint than other modes of transportation and reduces highway congestion.

The Mississippi River and its tributaries connect inland ports that rely on barges to move freight to and from deep draft Gulf Coast ports. The system includes over 12,000 miles of navigable waters, made navigable by systems of locks and dams. Locks act as marine elevators, allowing barge traffic to move through a dam. Dams, often authorized for a single purpose (water supply) or a dual purpose (navigation and flood control), play an important role in managing both high and low water conditions. Other features include levees, floodwalls, channel stabilization, floodways, dikes, and other structures.

The average age of U.S. dams is 60 years, and many waterway assets have reached the end of their design life. Single locks present a single point of failure for movement of barge traffic and are not sized for today's barge tows so that tows must break into two parts to traverse locks on the system. The IIJA provided $2.5 billion for construction and major rehabilitation of inland water projects although there is a $6.8 billion backlog of construction projects and an estimated $13 billion funding needs for complete modernization. Projects along the inland waterways system yield a substantial return on investment due to the movement of bulk commodities and reduction in flood damages. The inland water system is managed by the U.S. Army Corps of Engineers.

4. The Inland Waterways: Flood Control

Climate change has challenged inland waterways. In the past twelve years, the Mississippi River system has seen several years of historic record flows alternating with record low water flows caused by climate variability. Low water flows threaten navigation, requiring releases from dam reservoirs, an increase in dredging due to sediment carried by the energy of the river at high discharge, and a reduction of freight loaded on barges to reduce barge draft. Record high discharge often causes riverine flooding of communities, industry, and farmland and causes economic damages associated with record flooding as well as damages to the system itself.

Enhancing the infrastructure of the inland waterways' navigation system improves natural disaster resilience. The waterways serve as alternative transportation routes should roads, railways, or pipelines become inaccessible or compromised. In natural disasters and major flood events, the system's levees and dams are used to manage floodwaters and are damaged in the process. Emergency Supplementals, appropriated by Congress, are used for recovering from major disasters such as major floods, wildfires, and hurricanes. The use of supplemental funds most often are limited to repair of damaged federal assets and measures to increase resiliency are not allowed. The exception was the Third Emergency Supplemental for damages from Hurricanes Irma, Harvey, and Maria and wildfires in the West which allowed funding of mitigation and resiliency projects.

5. Other Sectors

The communication and information and technology sectors rely on dependable supplies of freshwater for cooling data centers., Extractive industries, such as mining and fracking rely on water in extraction processes, and the manufacturing and chemical sectors rely on water for their system processes. The need for water requires the understanding of water-related risks. Most big corporations inadequately manage their water risks, but uncertainties related to climate change are driving industries to incorporate water risks into their valuation models and investment decisions. This can encourage sustainable practices such as using recycled greywater for cooling purposes by a corporation but can also lead to loss of business opportunities in a community because of water reliability issues. Investors now search for competitive advantages and may review corporate operations for water-related risks. Specialized tools are being used to help a company determine a location's true value for water as opposed to the price paid for water (which is often not reflective of actual costs of supplying clean water to a site). Investors want to determine how much they are underpaying for the risk that they are exposed to. An example is that California just passed climate risk disclosure legislation – the first in the nation – to help make water risks, and the steps being taken by stakeholders to minimize those risks, more transparent.

Recommendations to Mitigate Cross-Sector Impacts

Subcommittee members proposed a range of recommendations to mitigate cross sector impacts of the evolving water crisis:

1. Invest in reliable infrastructure in U.S. river systems to provide for energy generation needs.

- Rehabilitate dams and reservoirs.
- Monitor drought and river levels.
  - Increase the number of point measurement such as river gauges.
- Increase drought prediction and forecasting capabilities.
- Invest in interdisciplinary and applied research.
  - Promote the use of reclaimed wastewater for thermoelectric power cooling needs.
  - Increase efficiency of cooling technologies to offset energy demands from increasing temperatures because of climate change.

2. Modernize and make flood resilient the inland waterways transportation system.

- Integrate multiple benefits as opposed to a single benefit into feasibility studies and investigations for new inland waterways projects, and always address flood risk.

- Allow supplemental appropriations to be used to fund mitigation and resiliency post disaster.
  - Increase FEMA's Building Resilient Infrastructure and Communities (BRIC) funding.
- Use forecast-informed reservoir operations (FIRO) strategies to better respond to atmospheric episodes by either retaining or releasing water from reservoirs per forecasted weather.
- Incorporate modern information systems into flood control/risk management.
- Update water control manuals and operating rules of large inland waterway infrastructure to better handle climate variability.
- Replace aging locks with larger dual locks on the Mississippi and Ohio Rivers.
- Support dredging needs in the long term.
- Fund programs monitoring and forecasting snowpack related to potential flooding on the Mississippi and Missouri Rivers, Ohio Valley, and into the Great Lakes region.

3. Support adaptive practices and promote smarter irrigation technology so farmers, ranchers, and forest landowners can better deal with climate variability.

- Incentivize the planting of less water-intensive crops by farmers in areas of water scarcity.
- Support drip irrigation and other ways to apply irrigation of water efficiently.
- Promote USDA's Climate Hubs which, in conjunction with partner entities, offer strategies, management options, and technical support to farmers, ranchers, and forest landowners to help them adapt to climate change.
- Reform crop insurance to incentivize climate adaption by farmers.
- Develop a comprehensive, objective national drought index. Include reservoir levels, aquifer status, in-situ soil moisture measurements to validate model predictions, potential moisture stored in snowpack, and a measure of the temporal distribution of precipitation.
- Prioritize drinking water over agriculture water during drought emergencies; agriculture water used for drinking purposes should be compensated post-disaster.

Need for a National Water Strategy

Water is an essential and primary need of every American, yet most Americans take water for granted. Because water infrastructure and water suppliers have a long track record of reliable service with few major disruptions, the infrastructure that delivers water often goes unnoticed by the public and is undervalued by decision-makers. Local water suppliers are dealing with aging, obsolete infrastructure, a challenged and shrinking workforce, and compliance with regulations of increased scope. Existing water treatment processes cannot remove PFAS. These new regulations require upgrades to water treatment facilities, during a time of supply chain issues, regardless of whether the utility is large, well-managed, and financially secure or a small provider of water to a marginalized community. Our raw water supply is being threatened by changes in weather patterns. Erratic precipitation and the associated uncertainties in long- term forecasting and hydrologic modeling make the retrofitting and remodeling of major water supply infrastructure of federal interest a challenge. Access to water is crucial to energy production, food security, and bulk freight transportation, as well as to large domestic military bases (which impacts national security).

The regionalization of water will require federal action. We need to elevate water as a national priority. The People's Republic of China (PRC) has the Ministry of Water Resources as a department within China's Central People's Government responsible for managing water resources in PRC, an $800 billion annual water budget, and a Five-Year National Water Security Plan. The U.S. has an outward facing Global Water

Strategy, but no five-year or long-term national strategy. Water resources are managed by a variety of federal agencies, with little coordination among them. EPA enforces water quality requirements through the Clean Water Act and the Safe Drinking Water Act; the Department of Interior has oversight of the data-gathering U.S. Geological Survey and the Bureau of Reclamation, which is responsible for large water infrastructure and hydropower in the western U.S.; the Department of Defense, through the U.S. Army Corps of Engineers, manages the inland waterways east of the Rocky Mountains with a focus on flood control and navigation. The Departments of Energy (DOE), Transportation (DOT), and Commerce have varying water related programs and interests. Examples include DOE's Water Conservation Program and DOT's Water Management Policy. This fragmentation of responsibility at the federal level makes it difficult to ascertain the country's water needs and strategically prepare the nation for a water-secure future.

Recommendations to Create a National Water Strategy

Subcommittee members proposed two major recommendations regarding a National Water Strategy:

1. Elevate the importance of water in the national consciousness through a public awareness program.

- In the 1970s, the famous advertisement depicting a Native American crying because of pollution skyrocketed the environmental movement into public awareness. While this ad became controversial and has since been retired, at the time of its release, it was an influential advertisement campaign.

2. Institute either a Department of Water or some other entity that stewards water at the Cabinet level.

- Consider having a designated water advocate in every regulatory agency that interacts with water.
- Create and implement both a near-term and a long-term national strategic plan for water infrastructure.
    - Consider population shifts and its impact on the location and design of future water resource infrastructure.

Call to Action

Following receipt of the NSC's tasking, and over the course of three and a half months, the NIAC pulled its network of resources from across the critical water infrastructure industry to share challenges faced in the evolving water crisis. The result is this report's identification of **14 challenges** as well as **11 recommendations** which the federal government can use to help critical owners and operators prepare for the rapidly evolving water crisis. The NIAC urges the President to consider these recommendations for immediate and long-term implementation to improve the nation's critical water infrastructure resilience, security, and accessibility through increased investments, standards, and attention.

Appendix A: Water Missions of Federal Agencies Mentioned in this Report

The following agencies have been mentioned in this report due to their involvement in water interests.[7]

U.S. Federal Agencies	Missions Involving Water
Environmental Protection Agency	Enforces water quality requirements through the Clean Water Act and the Safe Drinking Water Act.
Department of Interior - U.S. Geological Survey	Collects and analyzes hydrologic data and information.
Department of Interior - Bureau of Reclamation	Responsible for large water infrastructure and hydropower in the Western United States.
Department of Defense - U.S. Army Corps of Engineers	Manages the inland waterways east of the Rocky Mountains with a focus on flood control and navigation.
Department of Energy	Has varying water-related programs and interests including the Water Conservation Program.
Department of Transportation	Has varying water-related programs and interests including the Water Management Policy.
Department of Commerce	Has varying water-related programs and interests.

[7] This table is not exhaustive but is meant to illustrate how many entities in the U.S. government have water-related responsibilities. A more expansive list of U.S. Federal agencies involved in water interests can be found on the Water Education Foundation's (WEF) website.

Appendix B: Acknowledgements

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Appendix C: Definitions

Term	Common Definition
Aquifer recharge	Water that moves from the surface or unsaturated zone into the saturated zone, which is an underground rock formation or sedimentary deposit that holds water.
Aquifer storage	Natural stores in the ground that can be positioned between less than 100 meters to many hundreds of meters deep, depending on the type of subsoil.
Blackwater	Wastewater from toilets.
Greywater	Household wastewater that does not contain serious or body or food wastes, such as from sinks, baths, or washing machines. It can be reused for some purposes without purification, such as watering plants or flushing toilets.
Rainwater harvesting	The collection and storage of rain for use. It can be collected on a small or large scale, from roofs, fields, rivers, or other sources.
Reclaimed water	The process of converting municipal wastewater (sewage) or industrial wastewater into water that can be reused for a variety of purposes.
Water reuse	Also known as water reclamation, water reuse is the process of converting municipal wastewater (sewage) or industrial wastewater into water that can be reused for a variety of purposes.

Appendix D: Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
AI	Artificial Intelligence
ASCE	American Society of Civil Engineers
ASDSO	Association of Dam Safety Officials
AWWA	American Water Works Association
BRIC	Building Resilient Infrastructure and Communities
CEO	Chief Executive Officer
CISA	Cybersecurity and Infrastructure Security Agency
CWSRF	Clean Water State Revolving Fund
DRIP	Dam Rehabilitation and Improvement Project
DWSRF	Drinking Water State Revolving Fund
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRO	Forecast-Informed Reservoir Operations
IIJA	Infrastructure Investment and Jobs Act
IoT	Internet of Things
IRA	Inflation Reduction Act
IT	Information Technology
NIAC	National Infrastructure Advisory Council
NOAA	National Oceanic Atmospheric Administration
NPDWR	National Primary Drinking Water Regulations
NSC	National Security Council
PFAS	Per – and Fluoroalkyl Substances
SCADA	Supervisory and Control Data Acquisition
Subcommittee	Water Security Subcommittee
TVA	Tennessee Valley Authority
U.S.	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WEF	Water Education Foundation
WIFIA	Water Infrastructure Finance and Innovation Act
WIIN	Water Infrastructure Improvements for the Nation Act

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