

DAY ONE PROJECT

Establishing a National Water
Technology Pipeline

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Summary

The next administration should establish a National Water Technology Pipeline (Pipeline) to spur the innovation and commercialization of water technologies. The Pipeline should be designed to:

- (1) Proactively deploy monitoring and treatment technologies nationwide to avoid the devastating societal impacts of water contaminants.
- (2) End significant sanitary sewer overflows that pose risks to human and environmental health.
- (3) Ensure that every community in America has access to affordable and safe drinking water.

A National Water Technology Pipeline would mobilize American entrepreneurs and manufacturers to develop the next generation of solutions in water treatment, monitoring, and data management. The Pipeline would facilitate commercialization of later-stage water technologies by identifying innovative next-to-market technologies, proving technology through competitive demonstration projects, and deploying market-ready technology at full scale with federal funding support. An underlying objective of the Pipeline would be to improve water quality and access in the United States while addressing mounting infrastructure and maintenance costs. The Pipeline would also place an emphasis on training the next generation of technology-focused water professionals and strengthening community engagement and customer service.

Modernizing the water sector will require the federal government to renew its commitment to investing in water. The water sector currently receives only 4% of its funding from the federal government: a far lower fraction than other infrastructure sectors, such as highways (25%), mass transit and rail (23%), and aviation (45%).¹ Increasing federal funding for water even by a few percentage points would have hugely beneficial impacts. By dedicating 5% of projected water infrastructure costs—an estimated \$6 billion per year over the next 10 years—the next administration can build a robust National Water Technology Pipeline, ushering in a new era of water and sanitation technologies.²

Challenge and Opportunity

The next administration will inherit water and wastewater infrastructure that the American Society of Civil Engineers has given a D and D+ rating, respectively.³ Much water and wastewater

¹ Congressional Budget Office. (2018). "Public Spending on Transportation and Water Infrastructure, 1956 to 2017". Available at <https://www.cbo.gov/system/files/2018-10/54539-Infrastructure.pdf>.

² Value of Water Campaign, "The Economic Benefits of Investing in Water Infrastructure", 2020. Available at http://www.uswateralliance.org/sites/uswateralliance.org/files/publications/The%20Economic%20Benefits%20of%20Investing%20in%20Water%20Infrastructure_final.pdf.

³ American Society of Civil Engineers. (2020). "Infrastructure Report Card". Available at <https://www.infrastructurereportcard.org/>.

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infrastructure across the United States is more than half a century old. These infrastructure assets are showing signs of significant deterioration and displaying strong risks of failure as they approach the end of their service lives. Moreover, many U.S. water systems are simply not equipped to handle emerging treatment requirements and severe weather challenges.

We cannot address our nation's water infrastructure crisis without addressing water infrastructure funding for modern systems. One problem is that federal water infrastructure funding has simply dried up. In the 1970s and early 1980s, federal funding accounted for 15–30% of water infrastructure funding nationwide. This fraction has since declined to only 4%, far lower than other infrastructure sectors.⁴ Municipalities have been forced to raise water rates to cover the funding gap. Access to adequate supplies of clean water is quickly becoming unaffordable for many Americans as a result.

A second problem is the growing cost of operating and maintaining water infrastructure. Nearly three-quarters of public spending in the water sector supports operations and maintenance water systems, which are often legacy facilities. Estimated expenditures of \$1 trillion over the next 25 years are needed just to maintain legacy systems at current levels of service, without any modernization.⁵ Moreover, the U.S. water sector is large and complex, including over 50,000 community water systems and 16,000 sanitary sewer systems nationwide. Such a balkanized system makes it difficult to transfer innovative experiences and funding strategies across jurisdictional boundaries.

These challenges have recently been exacerbated by the financial stresses that the COVID-19 pandemic is placing on municipalities and individuals alike. COVID-19 has highlighted water treatment as an essential service. As one of the most important tools we have for reducing the spread of infectious disease, clean water merits robust federal investment.⁶ The water industry is also vital to operations of other sectors essential to human health, environmental health, energy production, and transportation. Every dollar invested in drinking water and wastewater infrastructure increases GDP by \$6.35, creates 1.6 new jobs, and provides \$23 in public health-related benefits.⁷ Investing in the water sector is investing in the U.S. economy. The United States is lagging behind many other countries in dealing with issues as wide-ranging as water-loss reduction, asset management, customer engagement, and customer service. It is past time to catch up.

The next administration should view these challenges as opportunities. Instead of propping up aging facilities, the next administration can incentivize investment into—and demonstration of—the most advanced and efficient water systems. Moreover, the next administration can incentivize the deployment of advanced monitoring and analytic technologies to proactively evaluate asset

⁴ Congressional Budget Office. (2018). "Public Spending on Transportation and Water Infrastructure, 1956 to 2017".

⁵ American Water Works Association. (2012). "Buried No Longer: Confronting America's Water Infrastructure Challenge."

⁶ Plotkin, S.L. (2004). "A Short History of Vaccination", Vaccines, 4th edn.

⁷ Multiple authors. (2019). "Water Infrastructure Investment Needs". Letter to Congressional Leaders. Available at https://www.rcap.org/wp-content/uploads/2019/01/Water-Sector-Ltr-to-Congress-on-Infrastrucure-Package_Jan.-2019.pdf.

health and develop a data-driven schedule for infrastructure replacement instead of *ad hoc* upgrades. Establishing a National Water Technology Pipeline will help unify our nation's water sector and create pathways to expedite the installation of modern systems instead of maintaining outdated legacy technologies.

The next administration should empower the National Institute of Standards and Technology (NIST) in the Department of Commerce to lead Pipeline development. NIST would facilitate validation of new breakthroughs in low-cost sensors, data management and analytics, internet of things (IOT), predictive analysis, and machine learning and other technologies that are proving capable of significant productivity gains for water utilities and can prevent catastrophic system failures. These solutions have been demonstrated to reduce sanitary sewer overflows by optimizing existing sewer networks.⁸ Further advances could enable real-time monitoring of lead and other contaminants. Operational and maintenance savings realized from these technological solutions can be directly reinvested into infrastructure needs and/or used to subsidize water costs for low-income customers.

Plan of Action

The next administration should set the United States on a path to build the most advanced water systems in the world by launching a new National Water Technology Pipeline initiative. The Pipeline would accelerate adoption of existing "off-the-shelf" solutions from around the world while also fostering development of next-generation technologies by American innovators. The Pipeline should be structured around three main goals:

- (1) Proactively deploying monitoring and treatment technologies nationwide to avoid the devastating societal impacts of water contaminants.
- (2) Ending significant sanitary sewer overflows that pose risks to human and environmental health.
- (3) Ensuring that every community in America has access to affordable and safe drinking water.

Achieving these goals will require a multi-pronged approach, as described below.

New Public-Private Frameworks to Enable Innovation

NIST should lead a new collaborative effort aligned with the Department of Commerce's mission to "promote U.S. innovation and industrial competitiveness" in the water sector. Specifically, NIST should partner with industry leaders from utilities, vendors, equipment manufacturers, and system designers to develop a unified framework for deploying new technologies in the water sector. The framework would include verification and provisional standards to allow utilities to more easily adopt new technologies and to open the market for private investment in public

⁸ See [South Bend, Indiana](#), for example.

water infrastructure. These efforts could be modeled after NIST's efforts on the Manufacturing USA program and the Smart Grid Framework.⁹

Technology Demonstration and Deployment Network

Congress should appropriate 5% of total water infrastructure costs each year to support water innovation. Specifically, these monies would be used for competitive grants (administered by NIST) to assist "early adopter" water utilities in deploying improved technologies, to fund state-based water innovation councils, and to support small manufacturers innovating in the water sector. NIST would coordinate with state, county, and local utilities, industry associations and professionals, and manufacturers to facilitate identification, testing, validation, and adoption of viable technology solutions. A similar development and dissemination strategy has successfully accelerated innovation in the transportation sector.¹⁰

Education, Workforce, and Community Engagement

Innovation in theory cannot become innovation in practice without a well-trained, certified workforce to implement new solutions. Now more than ever, Americans need well-paying jobs. A new water workforce will provide job opportunities in every county in the nation. The next administration can begin retraining workers into tech-savvy water professionals immediately through programs like the National Science Foundation's Advanced Technological Education program and the Department of Defense's SkillBridge program.

Over the last three decades, the federal government has abdicated its responsibility for funding the water sector, leaving states and local utilities to tackle new treatment challenges, deal with the impacts of climate change, and overcome catastrophic events including the ongoing COVID-19 pandemic. The next Administration can reinvest in U.S. water systems and bolster our economy by empowering NIST to spearhead a Pipeline to deliver modern solutions for modern water obstacles.

⁹ National Institute of Standards and Technology. (2020). "Smart Grid Framework". Available at <https://www.nist.gov/el/smart-grid/smart-grid-framework>.

¹⁰ U.S. Department of Transportation. (n.d.). "Center for Accelerating Innovation". Available at <https://www.fhwa.dot.gov/innovation/>.

Frequently Asked Questions

How much would a National Water Technology Pipeline cost?

To meaningfully modernize U.S. water systems, the federal government should directly invest 5% of projected water infrastructure funding needs (about \$6 billion per year) over the next 10 years into innovative water technology solutions.² For comparison, federal expenditures in 2014 included only \$4 billion per year to support water utilities, but \$15 billion for mass transit and rail, \$16 billion for aviation, and \$46 billion for highways. Federal spending on water infrastructure is an order of magnitude lower than it is for the transportation sector.

What is preventing technological progress in the water sector?

The water sector is strongly influenced by federal regulations that maintain minimum drinking-water and wastewater treatment standards. Where existing treatment standards can be met with legacy technologies, there is little incentive for utilities to invest in newer, advanced systems. Furthermore, the evaluation of new technologies typically occurs on a state-by-state basis. Differing state regulatory requirements inhibit the dissemination of successful solutions across jurisdictional boundaries. These barriers mean that useful new technologies can take as long as a decade to see widespread deployment in the water sector.

How will an influx of federal funding for a National Water Technology Pipeline impact businesses in the water sector?

Funding support allocated through the Pipeline will enable water utilities to adopt new technologies and upgrade to newer systems more easily and efficiently. The uptake of new technologies will in turn increase demand for new water innovations, creating market opportunities for U.S. start-ups and entrepreneurs. Overall, the Pipeline will increase public health protections through deployment of advanced treatment systems and monitoring solutions and drive private investment in the water sector.

How will this effort ensure safe drinking water for all Americans, especially underserved communities?

The Pipeline will expedite development of new treatment technologies, monitoring systems, and cost-saving strategies, and will ensure that these solutions are deployed at local utilities much more quickly. The Pipeline will support promising innovations and fund demonstration projects to increase the availability and visibility of vetted technology solutions for large and small utilities alike. Emphasis could and should be placed on accelerating technologies that solve challenges in rural communities, overburdened communities, communities with declining populations, and other underserved communities.

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Isn't the Environmental Protection Agency (EPA) in charge of water quality for the United States? Why have the Department of Commerce (DOC) serve as the lead federal agency for a National Water Technology Pipeline instead of EPA?

The Pipeline will require leadership and expertise from an agency focused on public-private partnerships and job creation. The DOC's mission is "to promote job creation, economic growth, sustainable development, and improved living standards for all Americans by working in partnership with businesses, universities, communities, and workers." NIST, within the DOC, is well positioned to support standards development, fund technology evaluations, support small manufacturers, and develop public-private partnership consortia. DOC would coordinate with EPA experts as needed to evaluate public health impacts and/or environmental compliance.

EPA funds some water infrastructure projects through State Revolving Funds. Why not include this initiative in those programs?

The Clean Water and Drinking Water State Revolving Funds (SRF) are designed to provide some funding to states to support local infrastructure projects through loans and sometimes grants. The purpose of the Pipeline, by contrast, would be to identify new technologies that solve immediate and emerging broad challenges facing utilities across the nation, with an emphasis on sharing solutions regionally and nationally. Technologies identified through the Pipeline could be incorporated into SRF projects where appropriate.



About the Author

Marc Santos is a Senior Consultant at Isle Utilities. He served as a 2018–2019 ASME Congressional Engineering and Science Fellow in the Office of Senator Chris Coons, where he managed the manufacturing, innovation, and small business portfolio. Marc is a licensed professional engineer in Texas and California. He has served as the Engineer of Record on numerous water treatment system designs and has successfully supported municipal water utilities through emergency-response scenarios. Marc holds a master's degree in Environmental Engineering from Manhattan College and a bachelor's degree in Mechanical Engineering from The University of Massachusetts Amherst.



About the Day One Project

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