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IIJA to Ignite Long-term Changes in Water Infrastructure

The Infrastructure Investment and Jobs Act is a likely catalyst for a huge shift in how water infrastructure assets are managed and maintained in the United States.

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President Joe Biden's Infrastructure Investment and Jobs Act (IIJA) seeks to provide much-needed federal funding to improve water infrastructure in the country. In the United States, citizens expect that when they turn on the tap, clean, safe water will flow out.

Americans don't question whether the water coming into their house will make them sick. Unfortunately, clean, safe water is not always that easy to provide, even in the wealthiest nation in the world. Remember the water crisis in Flint, Mich., where thousands of children were exposed to lead leached out of aging pipes due to high levels of chloride in the city's water supply from the polluted Flint River?

Decades of water infrastructure neglect, coupled with the collapse of the once-proud home of General Motors, led to the catastrophe that left Flint residents drinking bottled water for several years. But this story is hardly unique. In America, both rural and urban communities have struggled to upgrade their aging water infrastructure. The networks that carry drinking water and sewers that divert stormwater are woefully deteriorated and their care underfunded. In the latest ASCE report card, America's drinking water infrastructure received a C-, while stormwater infrastructure got an abysmal D.

Contaminated drinking water on the level of the crisis in Flint might be rare in the United States. Lead pipes are not an immediate hazard as long as chemical pollutants in the water source do not leak the heavy metal into the water supply. Rather, the more pressing concern with the nation's drinking water infrastructure is the billions of gallons of water wasted each day due to water main breaks and undetected leaks. Water shortages due to severe drought conditions in some regions and contaminated source water in others also puts a strain on treatment plants. This goes in tandem with stormwater infrastructure pushed to its breaking point as runoff increases due to continued expansion of impervious surfaces and more frequent and heavy rains that come with climate change.

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A further complication is that, unlike roads and bridges, America's water infrastructure of pipes and sewers is not centrally maintained and overseen at a federal or state level. Instead, drinking water and stormwater runoff are managed by a loose network of municipal agencies, each with its own budgets and difficulties. In addition, bridges and roads are aboveground and fully visible, whereas most water infrastructure, comprised of miles of pipes and conduits, is buried. The condition of these underground, 100-plus year-old systems can be difficult to assess – until something goes wrong.

Water authorities operate in a grey zone between government agencies with a large budget and for-profit entities. The amount of profit is limited. As such a necessary resource as water is, it tends to be regulated. All of this leaves the state of water infrastructure in the United States very much in flux.

Operational intelligence. Water utility managers, operators, and engineers can now seamlessly integrate disparate systems and see all enterprise system data in one common dashboard environment. Image courtesy of Bentley Systems.

David Lieberman serves as Bentley Systems U.S. government relations director and has seen firsthand the continual lack of resources directed toward water infrastructure in his time working on infrastructure policy as counsel in the U.S. Senate and House of Representatives.

"It was pretty clear to me that we had under-invested in our water infrastructure during my time in government and, in my opinion, for a lot longer. One of the central tenants that I think the IIJA, in combination with ARPA, addresses is a reversal of that. Through those two bills, and, hopefully, going into the future, we have really spotlighted some of the problems that we've seen in our cities and towns throughout the country over the last decade," Lieberman explained.

FUNDING ON ITS WAY, TIME TO GET READY

As funding from the IIJA works its way through the system, the water industry needs to work on getting all of its ducks in a row by prioritizing projects and upgrades. The majority of the funding being released to the states is through the Clean Water and Drinking Water State Revolving Funds. State and local agencies must prepare now so that they can hit the ground running when they receive their federal dollars.

That process must involve embracing a shift from reactive capital deployment and maintenance to being proactive, such as investing in technology. It is the lack of technology to carefully monitor the condition of their systems that forces municipalities to be reactive, having to make hasty decisions when things fail.

At times, the water industry has been slow to embrace technology solutions due to lack of funding. The federal money from the IIJA is an opportunity to begin deploying technology solutions that make systems more resilient and allow for advanced planning of capital projects driven by monitoring, real-time data and machine learning. Adoption of smart water technology enabled by this new funding will improve decision-making and make water systems more efficient and resilient.

The key to improving resiliency of the nation's water infrastructure will be addressing the widening gap between the water quality and service between wealthy areas and disadvantaged communities. "Throughout the guidance and memorandum put out by the Biden administration and the Environmental Protection Agency, there is a major focus and a major prioritization on projects involving disadvantaged and underserved communities," said Lieberman.

"That's where the business issues are and that's where projects most likely will be addressed first," Lieberman continued. "The EPA has made targeting these disadvantaged and underserved communities a central tenet in the material that it has put out and it strongly encourages the states to maximize the potential to remove barriers and prioritize the distribution of grant funds to disadvantaged communities. Communities like Flint have been neglected for far too long and the funding here simply aims to reverse this unfortunate trend."

One of the reasons for this prioritization is that these underserved communities are most likely to have aging water infrastructure and minimal digital technology at their disposal to manage their assets.

Upgrading the physical assets, such as pipes and water treatment plants, is certainly a concern (and addressed as such in the IIJA). But the IIJA funding that is being spent in these parts of the country must also work to bridge the technology gap that will continue to hold them back if not addressed.

REAL-TIME DATA, ACTIONABLE RESULTS AND DIGITAL TWINS

Bentley Systems has been a leading provider of technology solutions for the infrastructure community since its founding nearly 40 years ago. The company's offerings span every corner of infrastructure management and civil engineering, including water infrastructure. Bentley is at the forefront of transforming how infrastructure is managed in the United States and digital water infrastructure solutions are very important to achieving this lofty goal.

OpenFlows™ WaterSight® is Bentley's digital twin solution for the water infrastructure industry. The software allows users to build cloud-managed digital twins of their system complete with real-time data, GIS, SCADA, hydraulic modeling, and individual customer data into a single location.

Bentley highlights four key aspects of water management that OpenFlows helps users address.

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1. Operational Intelligence

Real-time IoT sensors bring hydraulic modeling and customer information up a notch and allow users to track and share water system data efficiently. This data can then be used to improve decision-making across departments, leading to fewer service interruptions and less wasted water.

2. Reliability and Resilience

Through use of hydraulic modeling, artificial intelligence, and advanced analytics, OpenFlows helps water systems to predict trends and typical behaviors. This technology helps balance system pressures and detects anomalous behaviors and events that might impact service quality, avoiding disruptions.

3. Emergency Preparedness and Response

OpenFlows network models can be utilized to test variations in strategic response to emergencies so that users have a better idea of how their system should be operated for optimal emergency response to events such as power outages, fires, and burst pipes. Sustainability goals and benchmarks can also be met by using the technology to identify ways to reduce energy consumption.

4. Capital Planning and Risk Management

If capital-intensive projects are going to be completed using taxpayer dollars, there must be a tangible benefit. OpenFlows brings a data-driven approach to laying out capital spending programs with visualization and communication tools to drive decision-making in the right direction.

All told, utilizing OpenFlows to improve water systems operations could lead to huge returns for the water infrastructure industry. For example, Bentley's OpenFlows users, including Águas e Energia do Porto in Portugal and AEGEA, one of Brazil's largest private sanitation companies, have seen as much as a 20% reduction in nonrevenue water loss and operational costs, a 10% increase in water network availability, a 20% increase in pump energy efficiency, and a 25% reduction in service interruptions.

Early adopters of Bentley's WaterSight, such as DC Water in the U.S., implemented a water infrastructure digital twin to improve its operational resilience by establishing connectivity among all data sources and to simulate what-if scenarios to make informed decisions. These would be hugely impactful changes and help justify the increased utilization of digital solutions, which would then lead to a massive improvement in the functionality of America's water infrastructure.

BENTLEY SYSTEMS: WE ARE HERE TO HELP

Water providers have lagged behind other infrastructure, notably transportation and construction, for many reasons – funding chief among them. Operating and maintaining water infrastructure is capital and labor intensive and does not leave behind many spare dollars for computer software. When municipalities and water agencies do manage to acquire modern software, it is often scattered across projects, leading to siloed data and poor communication.

Bentley is advocating to drive funding for digitization and innovation in the water sector through both formula and discretionary grants coming from the U.S. Environmental Protection Agency. Similar to the Advanced Digital Construction Management Systems program in IIJA, which funds new technology in the planning, construction, and maintenance of roads, bridges, and transit systems, Bentley hopes to see dedicated funding and grants for adoption of cutting-edge technology and software in water infrastructure.

As with other disciplines of civil engineering, water grant winners are determined based on their proposed usage of innovative and new technology. "Every water company, along with their technology providers and consultants, needs to find a way to balance day-to-day operations with capital improvement projects and priorities for preparation of grant proposals. That can be a challenge. I think the key is efficient use of existing data sources. Many water companies we see have a mixed bag of systems," said Slavco Velickov, Bentley's advancement director for water infrastructure.

"But it's establishing this connected data environment and breaking the information silos, so that every department can view the data and can turn that data into information to make better informed decisions. This will enable them to understand how the assets are currently performing, analyze different scenarios, and understand the impact of this capital investment. That's how we can get the biggest bang for the buck," Velickov said.

Also included in the Biden administration's American Rescue Plan Act, an earlier effort to reignite the economy during the COVID-19 pandemic, were buckets of money to drive innovation and create new jobs. Much of this federal stimulus funding remains unallocated. Any municipality or entity seeking ARPA funds must go through a competitive application process. Bentley offers to help the water industry by getting involved in the grant-writing process.

"We know that you are stretched for time," Lieberman said, addressing municipalities and entities seeking funding. "We know that you are doing all you can, both in your normal day jobs, and then also applying for grants, and we really want to help you. We also know that there is a lot of paper and guidance coming out of Washington these days – it almost takes a full-time job to manage and review it all. This is where I believe Bentley can help the most: we are constantly putting out thought leadership in the form of funding and grant synopses and tips on what to include for discretionary grant applications to make it easier for applicants. We are adding experts for water projects that can help with the more technical aspects of a grant application. We have seen what a successful application looks like at the local and state level, the technical aspects and expertise required, the innovative projects. We can give you that insight so you can plug it into your grant.

"Just as important, we really want to understand what funding stream makes sense for you and your community," Lieberman said. "With hundreds of different IIJA funding streams, knowing which grants are relevant is paramount. You can't boil the ocean – being informed here is key. We can help guide you through which programs are available and may be of interest."

Sifting through the maze of federal rules and regulations to deliver IIJA funding for water infrastructure capital projects may be as difficult as actually delivering the completed projects. Having Bentley's experience could prove to be a huge benefit to the industry. Bentley is willing to put in the effort and legwork to help bring critical funding to water infrastructure, this oft-overlooked part of America's total infrastructure. Bentley has the technology, and the water infrastructure is certainly in need of technology.

All that remains is an alignment between Bentley and the water agencies to ignite significant improvement and upgrades in water infrastructure.

To learn more, visit the Bentley website.