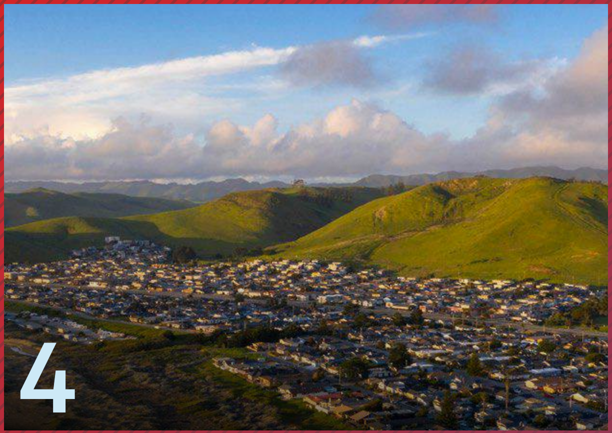
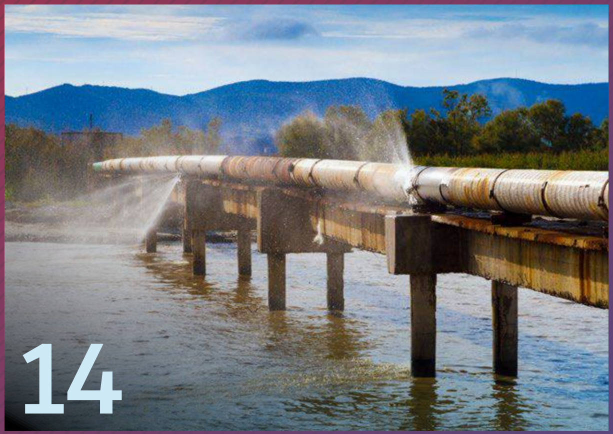
HOW TECHNOLOGY IS MAKING GLOBAL WATER INFRASTRUCTURE MORE RESILIENT

Redshift by AUTODESK





Cover: Transforming the global water supply system, including water treatment plants like this, requires a holistic approach.

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Introduction

In 2020, as the world began confronting the COVID-19 pandemic, one of the most important measures to prevent infection—the simple act of washing one's hands—highlighted another global crisis: water scarcity.

In many places, water is often polluted, unsustainably managed, or unevenly distributed, and climate change is altering its availability even further. A quarter of the global population lives in countries experiencing high water stress, and more than 2 billion lack access to safely managed drinking-water services. While getting water to those in need is crucial, nearly 9 trillion gallons are lost each year due to prolonged leaks and pipe breaks.

Improvements to the global water supply system—the infrastructure that collects, treats, stores, and distributes water to consumers—must be holistically addressed and will require a $1.9 trillion global investment by 2030. Technology will play a critical role in this effort. With Autodesk's recent acquisition of Innovyze, a developer of end-to-end solutions for the water industry, we can create a clearer path to more cost-effective and sustainably designed water infrastructure.

Back in my college days, I learned that civil engineers have an important social responsibility to the community: to plan, design, and build the assets that support the world's economic development. Years later, while completing my PhD in wastewater treatment, I realized they also need to be "technological thinkers" to drive the digital transformation of the world's water infrastructure.

Forward-thinking companies around the world are doing their part to transform the infrastructure. In these pages, learn how an engineering and construction consulting firm is using digital-water strategies to improve its clients' water operations, ensure greater sustainability, and reduce costs. Discover how organizations are using BIM (Building Information Modeling) and cloud technology to overhaul aging water-treatment plants from Ohio to Brazil—and clean up the local water supply in the process. And read about how city and local governments and industry advocates are seeking new ways to fund water-infrastructure upgrades.

Water is life. By developing and delivering technology that helps solve today's challenges, we can improve the lives of millions worldwide and build a better future for generations to come. I'm excited about the opportunities to create a more digitalized and sustainable water industry. It is time for the industry to drive change.

CAROLINA VENEGAS MARTINEZ, PhD
Water Industry Strategy Manager
Autodesk

Black & Veatch is designing a new water-reclamation facility for the coastal city of Morro Bay, CA.

As water-scarcity concerns loom, better solutions are needed. Smart-water technology uses data to better manage "digital-water" resources, improving efficiency and sustainability.

HOW SMART-WATER TECHNOLOGY IS HELPING SOLVE THE WATER CRISIS—ONE DROP AT A TIME

BY CHERYL GOLDBERG

Places all over the world are running out of water. Large swaths of South Africa, Brazil, India, and Australia—17 countries in all, representing a quarter of the world's people—face "extremely high" water stress. Growing populations, increased urbanization, and climate change have landed the water crisis in the top five global risks each year since 2012, according to a report by the World Economic Forum.

It's increasingly clear that water utilities must rethink the way they plan and maintain water infrastructure. Many are embracing digital water—a digital transformation toward smart-water technology, from big-data solutions to advanced management of distribution networks.

Black & Veatch of Overland Park, KS, is a major proponent of digital-water strategies. Founded in 1915, the engineering and construction consulting firm specializes in infrastructure development for water and other markets. The company supports every aspect of the water industry, helping clients collect, store, and treat water and wastewater; plan and manage watersheds; harness energy from water treatment; and improve sustainability.

Black & Veatch integrates sensor data from across plant infrastructure systems into a single version of "truth," then applies analytics and artificial intelligence to improve water operations, ensure greater sustainability, and rein in costs.

"Digital water lets us look at the infrastructure as a whole, not just individual assets," says Michael Etheridge, chief engineer for Black & Veatch's Water Group. "As the data becomes more integrated, plant operators can gain better insights into the relationships between data sets. This process helps identify correlation and causation between aspects of a system that humans can't easily spot, so we can optimize operations. We can also use the data as part of an integrated simulation system that shows the impact of decisions before they're implemented."

Optimizing Plant Efficiency

Black & Veatch is building a new water-reclamation facility in Morro Bay, CA, to replace the coastal city's aging wastewater-treatment plant. The new facility will help the city discontinue the discharge of treated wastewater to the ocean and create a new sustainable and local water resource. With the capacity to meet up to 80% of Morro Bay's water needs, the plant will include advanced treatment processes, allowing the use of treated water to replenish groundwater supplies while complying with stringent regulations.

In most plants, wastewater treatment begins when water flows from sewers and storm drains into a headworks facility, where it is filtered to remove stones and other inorganic matter. Chemicals and gravity precipitate suspended solids, which are pumped out and processed separately. The remaining water flows to a biological treatment plant that removes nitrogen phosphorus–related nutrients through aeration. Additional settling or filtration processes may be applied to remove other suspended solids.

The new facility will help Morro Bay discontinue the discharge of treated wastewater to the ocean and create a new sustainable and local water resource. Courtesy of City of Morro Bay.

“Digital water lets us look at the infrastructure as a whole, not just individual assets. As the data becomes more integrated, plant operators can gain better insights into the relationships between data sets.”

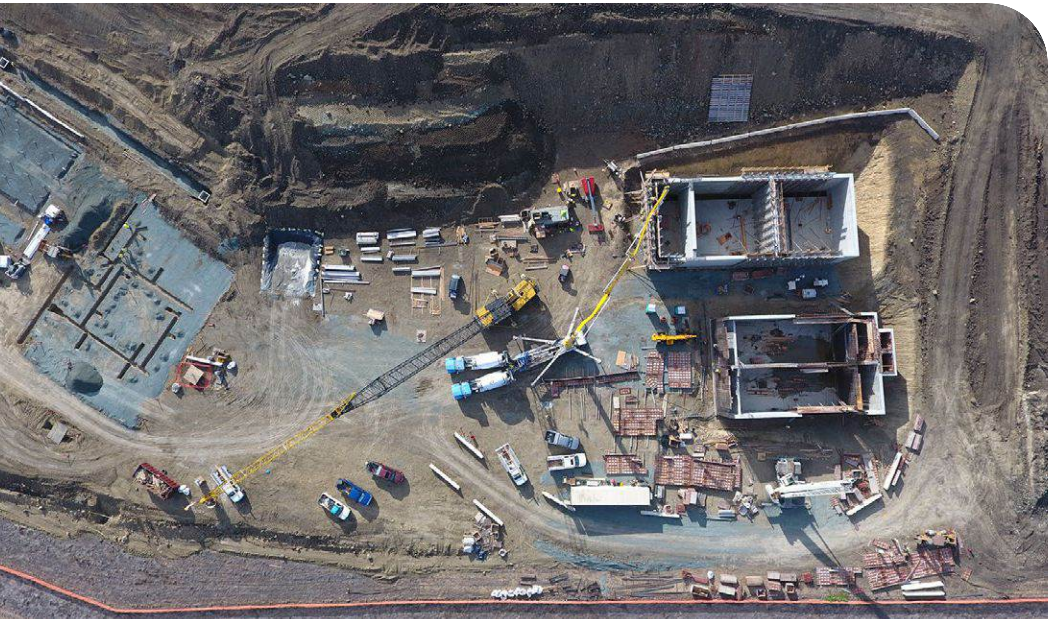
–Michael Etheridge,
Chief Engineer, Black & Veatch's Water Group

A rendering of the new Morro Bay plant. Courtesy of Black & Veatch.

Depending on regulatory requirements, the water might then be chlorinated or UV-disinfected, then released into a river or used for nonpotable services such as golf-course irrigation. In Morro Bay, additional filtration and treatment will make the water suitable for indirect potable use, where the treated water is returned to the water cycle through groundwater injection or pumped to a water-treatment plant to bring the water to potable-quality levels.

Plants have long used automation to streamline these water-treatment processes, eliminating manual data collection. Pressure sensors, flow meters, and other devices (used to measure chlorine, residual pH in the water, and more) feed automated plant-control systems that turn pumps on and off, filter backwash, and adjust chemical-feed rates. Digital-water concepts extend the use of that data to integrate it with related operational information and optimization algorithms to support improved operations from both quality and cost perspectives.

Using a cloud-based machine-learning technology called ASSET360 (developed by Black & Veatch subsidiary Atonix Digital), “Operators will be able to more quickly spot anomalies in operation,” Etheridge says. “They can also find less-obvious correlations that can lead to operational optimizations. For example, operators know that temperature impacts wastewater treatment, but machine learning might tell them that when the water temperature is below 50 degrees, using more of a particular chemical might increase the length of time before a filter requires cleaning, reducing labor and other costs.”



The construction of the plant in progress. Courtesy of City of Morro Bay.

Better Data Integration and Sharing

As the designer of the new Morro Bay plant, Black & Veatch is helping improve the project's operational and maintenance efficiency, as well as reducing costs. Unlike most construction projects where designers, contractors, and owners do not share data, Black & Veatch is working closely with all of the key players "to make data shareable and reusable at each stage across the project value chain, from planning to design to estimation, procurement, construction, safety, and quality assurance," Etheridge says. Black & Veatch is designing the project using Autodesk Revit and Forge, easing data exchange between the BIM model and other applications.

Etheridge says Autodesk BIM 360 and Forge allow better integration and help the team get more out of the data, including sharing it with external stakeholders. "Say we specify a pump," he says. "Previously, we would provide enough information so the contractor could buy it. The contractor would ask the supplier for information on how to install and start the pump. Then the owner would request preventative or predictive maintenance information and manually load that data into the computerized maintenance system to track maintenance requirements and raise work orders. Now, we pull data from the vendor as we're designing the pump and pass it along to the contractor and the owner. The deliverable is a BIM model that includes the physical representation and data for use in maintenance, eliminating manual data entry."

Using ASSET360, Black & Veatch can also combine design data with plant-control systems and Internet of Things (IoT) sensor data to supplement the vendor's preventative maintenance with predictive analysis. "The manual might say a pump doesn't need to be replaced, but vibration or heat might suggest it should be maintained sooner to avoid a costly failure," Etheridge says. "Data helps optimize operations and maintenance resources by reducing the time operators spend on mundane tasks or by extending equipment life through data-driven maintenance."

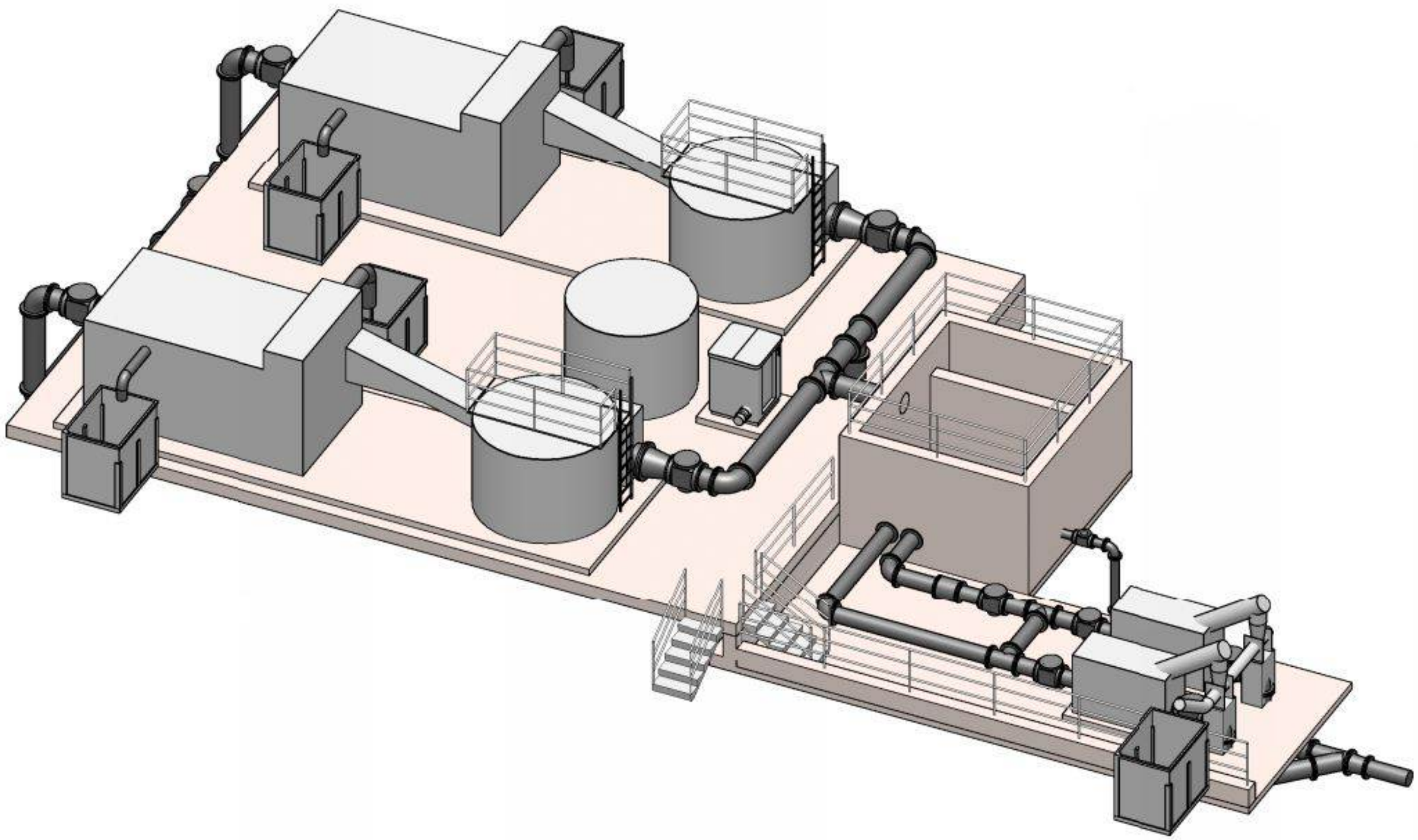
Security, Sustainability, Savings

As water plants become increasingly digitalized, concern about cybersecurity grows. Unless systems are properly secured, hackers could potentially wreak havoc, for example, by taking control of facilities and adjusting settings that impact water quality and safety. Etheridge suggests that water plants build cybersecurity protections into specs when building or upgrading facilities, segregate process-facing data on a private network, train staff about threats and best practices, and perform ongoing security audits.

But potential security threats are unlikely to stop the flow of digital water. Black & Veatch envisions a growing number of digital-water applications throughout the water value chain. Plants can improve environmental sustainability by turning waste into energy. Solids that settle out of wastewater can be treated to break down and produce methane gas. This gas can run generators that produce electricity, which can be sold back to the grid or used to power the plant. "Data can optimize energy production and help plant operators understand the best way to use that energy," Etheridge says.

Municipalities might also combine IoT data with population data to decide which capital projects provide the best return or to communicate with consumers in real time about water availability and quality. "Better data integration is really about enhancing visibility, optimizing operations, and having the data to back that up," Etheridge says. "And when we do make changes, we can see savings and actual cost benefits coming back."

A detail of the new headworks structure. Courtesy of Black & Veatch.



Rio de Janeiro's Guanabara Bay is famous for its beauty, depth—and toxic pollution, thanks in part to an aged wastewater system. The Brazilian Army aims to change that, with help from BIM.

BRAZILIAN ARMY BATTLES POLLUTION IN RIO'S TOXIC GUANABARA BAY USING BIM

BY MATT ALDERTON

There's something in the water in Brazil—lots of things, actually. In the Amazon River, pink dolphins, giant otters, electric eels, enormous anacondas, and knife-toothed piranhas are present. But the fauna's not all: Disease-causing microorganisms flourish in the rivers, basins, and bays of many Brazilian cities, including Rio de Janeiro.

Rio de Janeiro's heavily polluted Guanabara Bay is about to get a lot cleaner, thanks to efforts by the Brazilian Army.

Because it's home to the Amazon rainforest, Brazil is ground zero for environmental crusades, including clean-water campaigns. In Rio, however—some 2,000 miles east of the Amazon—it's not just stewards, scholars, and scientists leading environmental-cleanup efforts. The Brazilian Army is using an unexpected tool to catalyze environmental action in water-challenged Rio: BIM.

An Olympic-Size Problem

Rio de Janeiro was one of the first modern cities in the world to have a sewer system, which it began constructing in 1857. Back then, the city's population was just a fraction of its current 6 million-plus people, and the original engineers created a single system to convey wastewater and stormwater through the same pipes into Rio's rivers and, from there, Guanabara Bay.

After conducting a manual land survey, the team created a digital model of the military site. Courtesy of the Brazilian Army.

"In old times in Brazil, it was common to build sewers and drainage systems together," says Halan Oliveira, a civil engineer with the Brazilian Army. "It was easier to build and took less time. The population was smaller, so there was no problem if sewage went together with stormwater into the rivers. But then the city started to grow. The population exploded, and now we have a problem."

That problem is well-documented—most famously, perhaps, by the Associated Press (AP), which published a stunning rebuke of Rio's water in August 2016, just days before the start of the 2016 Summer Olympics. Viral levels were "up to 1.7 million times what would be considered worrisome in the United States or Europe," reported the AP after a 16-month study of water quality at Rio's Olympic and Paralympic venues. "At those concentrations, swimmers and athletes who ingest just three teaspoons of water are almost certain to be infected with viruses that can cause stomach and respiratory illnesses and, more rarely, heart and brain inflammation."

At fault: Rio's wastewater/stormwater drainage system, which not only releases 100 liters of raw sewage per second into the environment but also causes widespread flooding during large rain events due to its limited capacity.

As part of its winning Olympic bid, Rio pledged to invest $4 billion in wastewater treatment with the goal of decontaminating 80% of wastewater flowing into Guanabara Bay. Although it missed its target, Rio continues working toward its objectives thanks in part to the

Brazilian Army, which is modernizing the sewer system in the Rio neighborhood that it calls home: the 1,100-acre Military District. The four-year project, scheduled to be completed in 2020, was delayed by COVID-19. It is currently 70% complete.

Old Meets New

The underground sewage network in Rio's Military District was built before World War I (circa 1908). At the beginning of the 21st century, major sporting events in the neighborhood (2007 Pan American Games, 2011 Military World Games, and 2016 Summer Olympics) prompted the construction of the Deodoro Sports Complex. And in 2016, as part of Rio's Olympic cleanup commitment, the Brazilian Army commenced rebuilding the century-old system to separate wastewater from stormwater and route it to a new water-treatment plant instead of into the Marangá River—a major undertaking.

Rio's sewage network is not a simple rope of plumbing that can be unraveled: The task was to install new, dedicated systems for wastewater and stormwater in the same trenches as the previous dual-use system, to be completed in advance of the Games. "The Sports Minister always had this goal," says Colonel Francis Monteiro Gusmão. "So they knew if they separated two networks, the pluvial network from the wastewater network, they would have as a bonus to clean the bay area."

That complexity demanded an updated approach to construction; engineers turned to BIM to plan and optimize their designs.

Work must be executed without disturbing active military operations. Courtesy of the Brazilian Army.

"The population was smaller, so there was no problem if sewage went together with stormwater into the rivers. But then the city started to grow. The population exploded, and now we have a problem."

—Halan Oliveira,
Civil Engineer, Brazilian Army

The first challenge: Because the existing infrastructure was so old, there were no blueprints for it.

Working around four systems (drainage, sewers, electric, and gas) without a map, Oliveira says, "in some cases, we had to go to the site to do surveying to find old structures." The project team conducted a manual land survey, which produced thousands of geometric points that were then plotted on a map using Autodesk Civil 3D.

"Our site teams had to carry out the excavation works carefully because, in spite of all our efforts, clashes could happen during the excavation, and gas and electric structures can be affected," Oliveira says. In this case, it turned out the gas network was located higher than the 1.5 meters reported: "We almost hit it," he says. Compiling an accurate map of these utilities would help avoid these clashes, making things much safer for workers and the public.

From that map, the team created a digital terrain model for planning and design purposes. Armed with population data and other inputs, engineers used the Civil 3D Storm and Sanitary Analysis add-on to analyze water discharge points and flow rates to ensure proper system function. Likewise, the team performed interference checks to make sure new sewage and drainage pipes did not collide with each other, with the old pipes, or with proximal gas and electric lines.

Political complexities compounded this process. "We had a military government in Brazil for three decades, and by this time, the infrastructure was like a prison lot," Colonel Gusmão says. "And after that, we had a culture of a republic with four-year government, so every four years, everything changes; that's why this challenge exists."

Logistics also were a factor because work had to be executed without disturbing active military structures and operations. "We couldn't stop the troops; they needed a gas supply, water supply, and electric supply," says Oliveira, whose team divided the 43 buildings in the Military District into zones; while the team worked in one zone, military operations were uninterrupted in the others.

HDPE pipes are less expensive to install than standard concrete pipes. Courtesy of the Brazilian Army.

So Goes Rio

Although work is still underway, results already are apparent. Oliveira says the flooding once common in the Military District has stopped where work is complete. Those buildings are now conveying all wastewater to Rio's wastewater-treatment plant instead of natural waterways.

Arguably, the project's biggest impact will be as a case study for the rest of Rio—proving these necessary updates are also affordable. The project cost an estimated 40% less than a conventional project—a savings of roughly $15 million USD. Some of that savings comes from using lightweight HDPE (high-density polyethylene) pipes, which are more expensive than standard concrete pipes but less expensive to install. Much of the savings, though, is through BIM increasing precision and decreasing errors.

BIM will likely be woven into Brazil's broader infrastructure efforts. "Our federal infrastructure minister used to be military, so he will probably be very interested in applying BIM mandates in the near future," Colonel Gusmão says. "The government wants to apply BIM at a federal level, so it will happen in phases until 2028, and the first phase will be 2021."

The technology's economic benefits will make this project—and, by extension, its environmental impact—replicable for future projects. "If you can't deliver a cheaper result, the Brazilian government will not be interested," Oliveira says. "The Military District is just a small neighborhood. This project is a chance for other authorities to see it's possible to use BIM for large jobs across the city. If each neighborhood carries out the same job we are carrying out, we can have a better environment in the future."

Organizations around the world are working to improve the lives of women in developing countries through access to clean water.

LEARN MORE

Courtesy of Sanergy.

America's manufacturing economy depends on the increasingly leaky pipes undergirding the US water system. It's time to start funding water-infrastructure upgrades.

WATER INFRASTRUCTURE IS KEY TO A FAST-FLOWING INDUSTRIAL ECONOMY

BY PATRICK SISSON

The hubs of American manufacturing—from shop floors and assembly lines to high-tech labs and chemical facilities—are connected by webs of rail, roads, and electrical power. In the popular imagination, the creation of physical goods requires strength and heft, a bit of blue-collar can-do attitude, and innovative technological solutions.

What's rarely discussed, but equally important, is this sector's need for water and how the nation's aging network of pipes, treatment facilities, and wastewater plants provides a crucial component of the industrial economy.

“We typically think about highways and transit systems when we talk infrastructure, and those are very significant needs,” says Robyn M. Boerstling, vice president of infrastructure, innovation, and human resources policy for the National Association of Manufacturers (NAM), part of a coalition seeking to change public perception of essential infrastructure. “But it’s not just roads and bridges and hard assets. Water, like digital infrastructure, is key to production.”

This crucial need has led nonprofit United for Infrastructure (UFI), an industry partnership that includes NAM, to promote a focus on water as part of its annual “United for Infrastructure: A Week to Champion America’s Infrastructure” conference. Although energy and transportation typically get all the attention, water is vital to the manufacturing ecosystem. According to research from the Value of Water coalition, every day an average US business is without water, it loses $230 in sales per employee; that number skyrockets to $5,800 per employee in water-intensive industries.

Sadly, that’s an even bigger problem than it was a decade ago. The American Society for Civil Engineers (ASCE) found that there are roughly 240,000 water-main breaks across the United States every year, each with the potential to close a manufacturing or an industrial facility. In 2019, $7.6 billion of treated water was lost through the nation’s leaky pipes. “These businesses can’t exist without water,” says Greg DiLoreto, an engineer and former president of the ASCE, who gave the nation’s water infrastructure grades ranging from C- to D this year. “At places like Intel, water is a critical component to business.”

The United States has made big investments in water efficiency for homes and industrial sites, Boerstling says. But the pipes and systems that get water to those homes and businesses—the crucial infrastructure that’s underground and out of sight—receive inadequate support and need more robust and additional funding mechanisms.

Part of the strategy to rectify that shortage is avoiding waste and preserving this precious resource. Semiconductor manufacturers, data centers, and other high-tech manufacturing sites that are critical to the digital economy require ultrapurified water. A typical semiconductor plant may go through 2–4 million gallons of ultrapure water per day, according to CDP. A survey (p. 33) of manufacturers found that 45% cited physical water risks as key issues.

Robyn M. Boerstling, vice president of infrastructure, innovation, and human resources policy for the National Association of Manufacturers. Courtesy of Robin M. Boerstling.

Semiconductor manufacturing plants can use up to 4 million gallons of water every day.

The United States has made big investments in water efficiency for homes and industrial sites, but the pipes and systems that get water to those homes and businesses receive inadequate support.

Although these high-tech customers need large volumes of extremely pure water, they're not driving an increase in domestic water usage, DiLoreto says. If anything, by recycling and reusing water in increasingly sophisticated ways—data centers, for example, have experimented with evaporative cooling and building their own wastewater treatment plants to cool servers with recycled sewage—they're part of a general decline in water usage. The price of water has actually increased, he says, as local utilities struggle to meet the growing gap in funding required to bring systems back to a state of good repair. (DiLoreto estimates that gap to be $47 billion.)

The problem in patching pipes and upgrading infrastructure lies in funding. "No investor is interested in getting water pipes fixed; that's not how you typically get a good return on your investment," DiLoreto says. Water networks are also decentralized: The United States has more than 53,000 water systems, more than half of which are stand-alone operations serving fewer than 500 people—small players that struggle to raise money.

DiLoreto says that water utilities have typically focused on increasing access to clean water, a noble goal that also has historically prevented raising enough money to reinvest in long-term infrastructure. New funding programs can help bridge that gap and update long-serving pipes and plants.

"There are pipes in Washington, DC, that have been there since the Civil War," he says. "Nothing should be in the ground that long."

To close this funding gap, NAM and other industry advocates suggest creating more public-private partnerships to boost private-sector investment in water infrastructure.

Programs such as the 2014 Water Infrastructure Finance and Innovation Act can help government entities unlock additional funding for upgrades and investment.

Boerstling also suggests removing some federal limits on investment. For example, the Environmental Protection Agency provides limited federal resources through Clean Water State Revolving Funds, but the program limits private activity bonds. Lifting these caps could go a long way toward narrowing the funding gap; a PricewaterhouseCoopers study found that eliminating these caps and making other regulatory changes could bring up to $68 billion in incremental investment in water and wastewater infrastructure.

City and local governments have also increasingly taken it upon themselves to find new ways to raise funding—especially those that are prioritizing better infrastructure through the lens of a larger economic development strategy. CDP data found that 80 cities have reported at least $9.5 billion in water projects in recent years.

Water cools a rolling mill.

Phoenix issued $400 million in local bonds to support water-infrastructure projects as part of broader drought-resiliency measures and to help supply a plant that will make supplies for Apple. And Loudoun County, VA, home to one of Google's 13 North American data-processing centers, is looking at constructing a wastewater treatment center with funds from the county's Capital Improvement Program.

Inaction on the federal level is another reason to engage private funding sources. Congress, despite constant conversation about infrastructure investment, hasn't moved on a much-needed, comprehensive solution that could meet more than $1 trillion in infrastructure funding needs over a 10-year period. "Relying on the federal government for large sources of cash for infrastructure just isn't where we are now," Boerstling says. "It's disappointing that water is a lot harder to fund."

Industry leaders hope that in the way technological innovation has constantly created new manufacturing opportunities, new types of financial innovation can ensure that business doesn't suffer from insufficient water.

Courtesy of Gavin Gough.

When an aging water-treatment plant was overwhelmed by toxic algae, a design and engineering firm stepped in to upgrade the plant and ensure a safe water supply.

CLOUD TECHNOLOGY HELPS PROVIDE A RESILIENT WATER SYSTEM AMID PUBLIC HEALTH CRISES

BY CAROLINA VENEGAS MARTINEZ

A view of the Collins Park Water Treatment Plant in Toledo, OH, before the $50 million expansion and modernization project. Courtesy of Arcadis.

The architecture, engineering, and construction (AEC) industry is increasingly using cloud collaboration to power through challenges—those that can be anticipated and even those no one saw coming. The ability to design for and bounce back from disruption is the definition of resilience, a quality that has become essential as the world struggles to define a new normal in the wake of COVID-19.

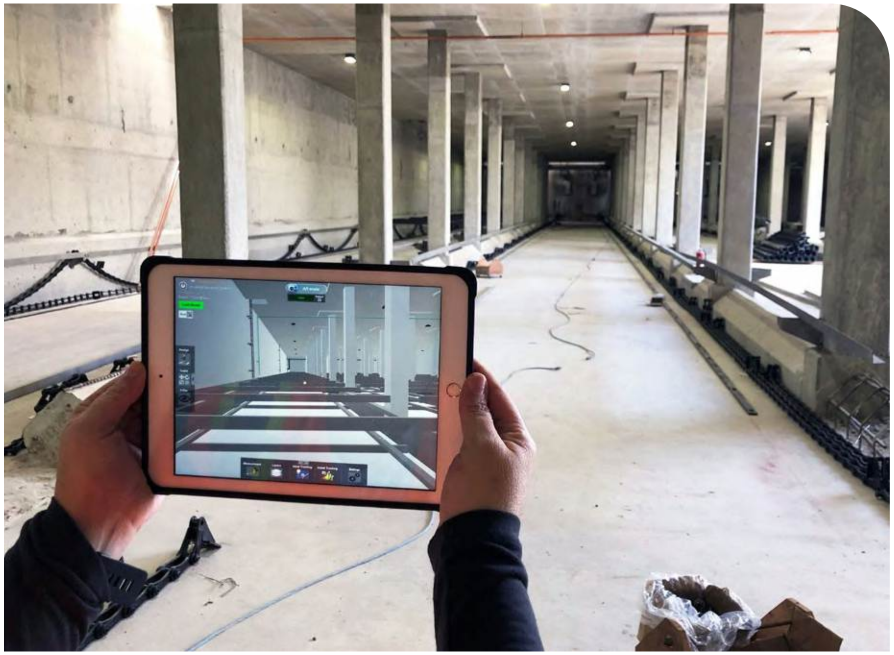
Take it from Arcadis, a leading global design, engineering, and management consultancy, which recently completed a $50 million infrastructure project that started with a toxic harmful algal bloom (HAB) in the US Midwest and ended with a pandemic that swept the world.

A 3D model of the Basin 7 main gallery shows a piping assembly connecting treatment trains. Courtesy of Arcadis.

The company met the challenge—and tight deadlines—by shaking up the way it works. Here's how Arcadis harnessed cloud collaboration and 3D modeling to provide a resilient water system for the city of Toledo, OH.

The story begins on August 2, 2014, when an HAB in Lake Erie turned the water into a thick green blanket of algae, leading to a "do not drink" advisory from the Ohio Environmental Protection Agency. The HAB produced a toxin called microcystin, which can cause stomach sickness; skin and eye irritation; respiratory issues; and, in a worst-case scenario, liver failure. The governor of Ohio declared a state of emergency, the National Guard and Red Cross set up water distribution centers, and the water system's half-million service population were under a "do not drink" advisory for three days. But even after the contamination cleared and the crisis waned, the threat of HABs remained an ongoing concern during hot and humid Ohio summers.

The city hired Arcadis to modernize and expand the aging system. Toledo's Collins Park Water Treatment Plant had six existing water basins at the time of the algal bloom. Built in the 1940s and '50s, the facilities needed more capacity to handle contamination and to remain operational during repairs and maintenance. Arcadis was charged with designing and overseeing the construction of two new water basins, adding 40 million gallons of capacity per day, while coordinating across other system upgrades and keeping the facility working during construction.



The timeline for the project was aggressive: Two years of design work starting in 2016, out for bid and construction beginning in 2018, and two new water basins up and running before summer 2020.

"We had five subconsultants on our team and a tight, mandated deadline set by the Ohio Environmental Protection Agency," says Kurt Smith, project manager for Arcadis. "We knew collaboration was essential to delivering an upgraded water system to Toledo's residents on schedule. It was time to rethink our processes and embrace every tool we could to be successful."

Cloud Collaboration Saves 1,000 Design Hours

During the design phase, Arcadis decided to use Autodesk BIM Collaborate Pro (formerly Autodesk BIM 360 Design) as a cloud collaboration tool for the entire project team, including subconsultants. The team represented a range of disciplines including architectural, structural, mechanical, HVAC, electrical, instrumentation and control, and civil site work, and members were spread out from Ohio to Florida. But with BIM Collaborate Pro, the data—13 Revit models of various parts of the project, plus project timelines and workflows—was all in one place, and everything came together in the cloud. All team members were trained on BIM Collaborate Pro so they could interact with the data in real time and see updates as they happened.

The impact of cloud collaboration was measurable. Project coordination was improved by eliminating email discussion threads and file downloads; the latter reduced lag time due to file transfers by 80%. Arcadis saved more than 1,000 design hours on the project and delivered the bid set on time in 2018.

Augmented reality (AR) overlays let the team cross-check models with the on-site environment. (top) Arcadis deployed reality-capture and visualization tools to create rich as-built models and enable AR and virtual-reality experiences. (bottom) Courtesy of Arcadis.

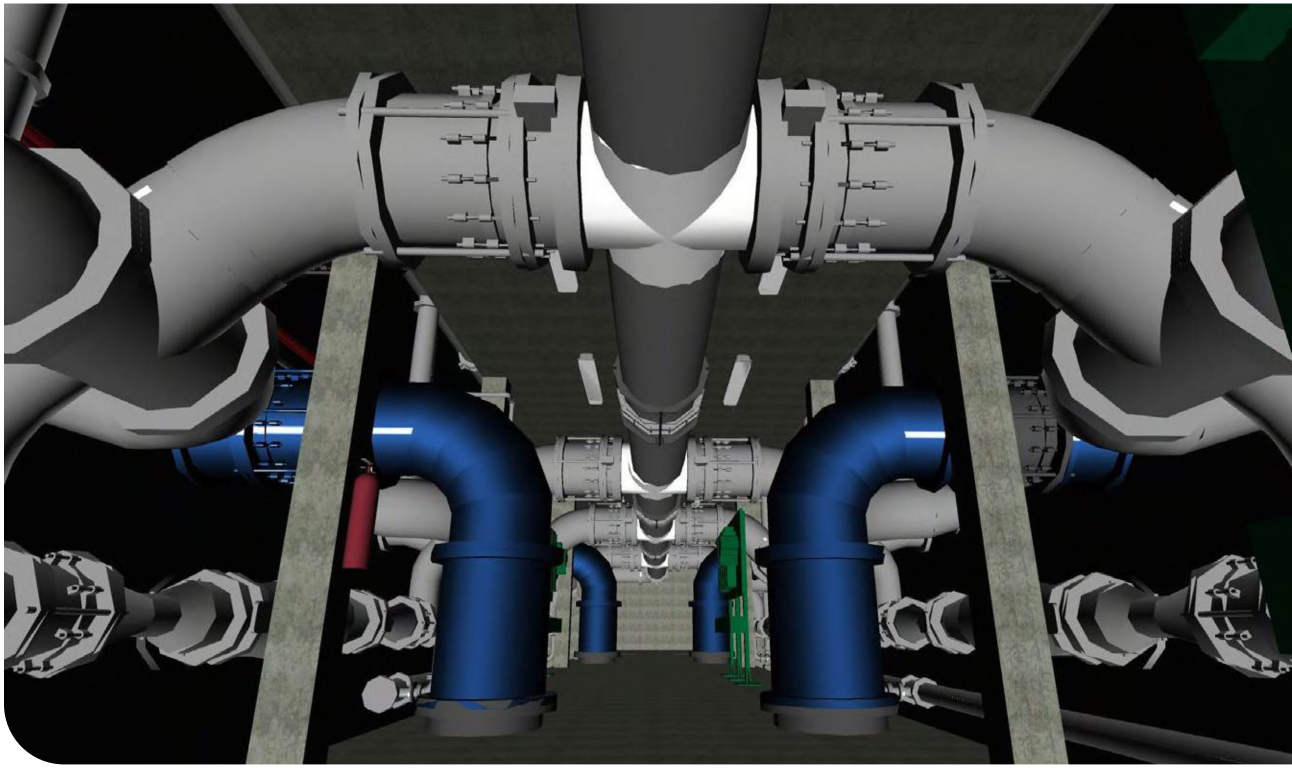
Reality Capture and AR Aid On-Time Project Delivery

In addition to collaboration tools, Arcadis embraced reality capture and augmented reality (AR) to improve designs and collaboration and prevent errors. The team used Autodesk ReCap to provide 3D scans of the site and Autodesk InfraWorks to layer in geographic information system data for the plant's surfaces and utilities. The results were rich 3D models that provided precise representations of conditions on the ground. Not only was the modeling critical to completing the design work, but it could be used and enhanced throughout construction. The Arcadis team was able to monitor the construction process with 360-degree photographs of active jobsites and integrate the data into the site model of record, where progress could be tracked and documented.

What's more, the models could be interacted with directly on the jobsite using AR. Wearing Microsoft HoloLens headsets, members of the construction team could virtually travel inside the 3D models while on the jobsite and see how the plans either aligned or conflicted with real-time conditions. The AR experience can help identify surface design problems and issues, so teams can refine models and workflows proactively and without unforeseen delay.

Remote Capabilities Keep Work Going Through COVID-19

Bringing two additional basins online was critical because the city needed the new capacity to begin upgrading and modernizing the other six aging basins. The culmination of four years of design work and construction paid off: The two new water basins were ready for action in the spring of 2020, with only finishing work stretching into the fall. Arcadis delivered on its efforts to prevent a public health crisis for the city, just as another one was emerging for the world.



Arcadis developed 13 models over two years to design the facility upgrades, including this model of the extensive underdrain system. Courtesy of Arcadis.

While COVID-19 caused new restrictions on crew sizes and disrupted supply chains, Arcadis didn't miss a beat. Using the remote capabilities of BIM Collaborate Pro, employees involved with the finishing work have continued to visit the jobsite virtually and maintain safe workplaces, reinforcing for Arcadis that cloud collaboration is vital to the future of a resilient AEC industry.

"We saw value in these collaboration tools throughout the lifecycle of the Collins Park project," says Smith. "The 3D models and AR devices are exciting and cool, but at the end of the day, they really are about delivering a better result for our customers. The winners here are the residents of Toledo, who now have a water treatment facility they can count on."

TAKEAWAYS

Transforming the global water supply system—the infrastructure that collects, treats, stores, and distributes water to consumers—requires a comprehensive approach that addresses its physical, tactical, and financial components. Here's how organizations around the world are helping to make water infrastructure more resilient.

New ways to fix old things

From BIM to cloud collaboration, innovative technology is being used to renovate aging pipes, treatment facilities, and wastewater plants—and create cleaner and more sustainable local water supplies.

Digital water offers clear benefits

Many water utilities are embracing a digital transformation toward smart-water technology, from big-data solutions to advanced management of distribution networks.

Funding for the unsung heroes

City and local governments and industry advocates are seeking more robust funding mechanisms for the critical underground systems that get water to homes and businesses.

From flood risk to water scarcity, see how technology helps improve the resilience of the world's most critical resource.

UNHCR Site Architects Use Technology to Help Rohingya Refugees in Bangladesh

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