# HOW
WATER INFRASTRUCTURE DIGITAL TWINS

ENHANCE UTILITY SERVICE BY UNCOVERING
NEW WAYS TO ANALYZE, PREDICT, AND SIMULATE
CURRENT SYSTEM CONDITIONS AND PERFORMANCE

Bentley®

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Image courtesy of Águas do Porto

TACKLING THE **DATA INFLUX**

Every day, water utilities make actionable decisions in an attempt to meet a high standard of service with minimal costs and disruption. It's a difficult, ongoing balancing act. As long as there is a population to serve, water, wastewater, and stormwater systems must be effective and efficient. Naturally, everyone wants to be smart about the choices and trade-offs they make. Infrastructure decisions have an impact that affect utilities' customers and their systems, both currently and for decades to come. Being smart about decisions can mean something different to large- and small-sized organizations. However, collecting data for its own sake isn't solely beneficial. If that data can be fed into a decision-support mechanism, like real-time simulation and predictive analytics software, utilities can confidently understand more about how their water distribution or sewer collection network is currently behaving, and how it will react under a wide range of what-if conditions.
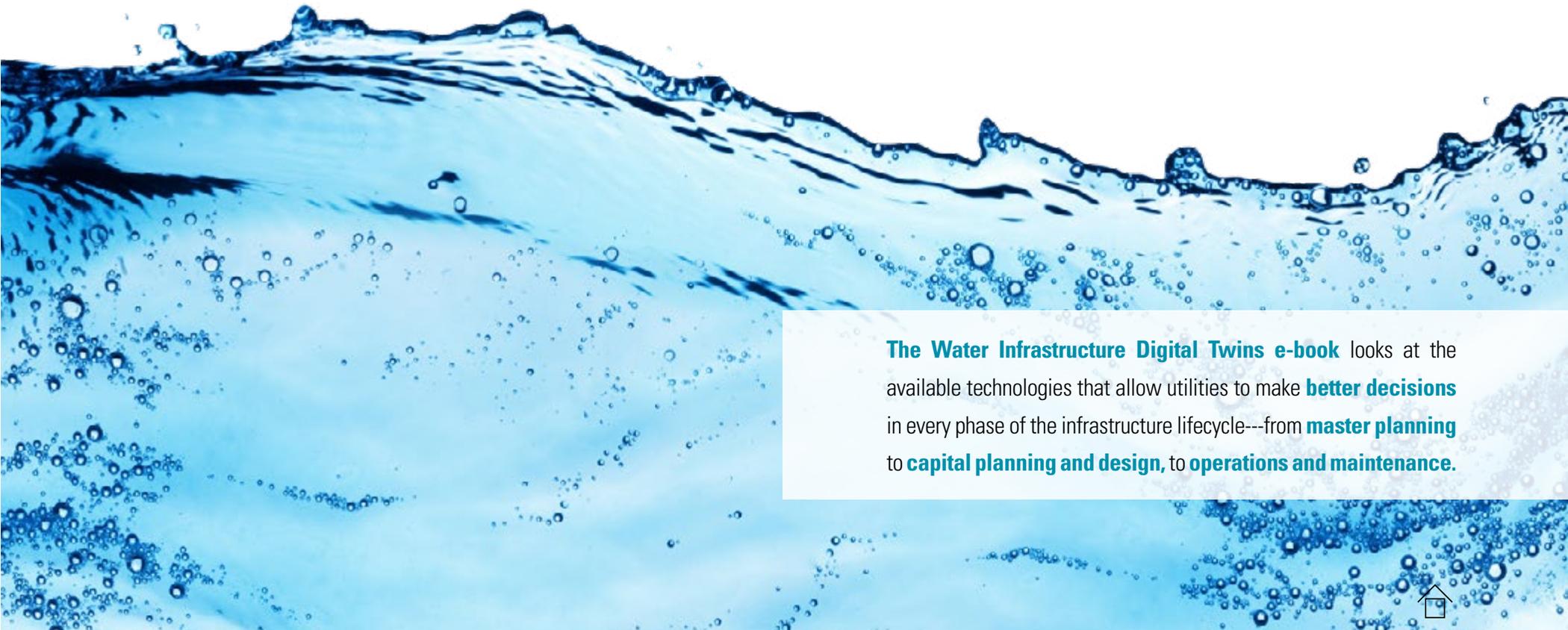
The Water Infrastructure Digital Twins e-book looks at the available technologies that allow utilities to make **better decisions** in every phase of the infrastructure lifecycle---from **master planning** to **capital planning and design,** to **operations and maintenance.**

WHAT PREVENTS UTILITIES FROM MAKING **DATA-DRIVEN DECISIONS**

Multidiscipline utility teams that comprise planners, engineers, GIS specialists, and operators among others, rarely leverage their data and insights outside of limited departmental roles. They might not realize how valuable their information would be if it were shared more effectively.

To understand how a utility's system functions and how their decisions might impact it, data sources such as asset management systems, GIS, CIS, and SCADA need to integrate with the power of real-time analysis. Connecting a SCADA system with hydraulic modeling and decision-support tools delivers new ways to virtually mirror and simulate your water system performance and condition in real time, enabling you to optimize it across the whole system lifecycle.

This real-time digital representation is called a water infrastructure digital twin, and it can provide real-world context about past and present data such as flows, pressures, and water quality, and the hydraulic model can fill in simulated data between measurement points. On their own, each system has useful but restricted applications. Together, their ability to enable smarter decision-making is unlimited.

✓ **AVAILABILITY**
Data to your problem simply doesn't exist.

✓ **ACCESSIBILITY**
"Dark data" exists beyond measured points in the system.

✓ **EFFECTIVENESS**
SCADA systems only provide a limited glimpse of current network performance, within a specific timeframe at specific locations.

✓ **SHAREABILITY**
Data is siloed, or exists in varying formats.

✓ **VOLUME**
Too much data without a proper method to visualize what is relevant.
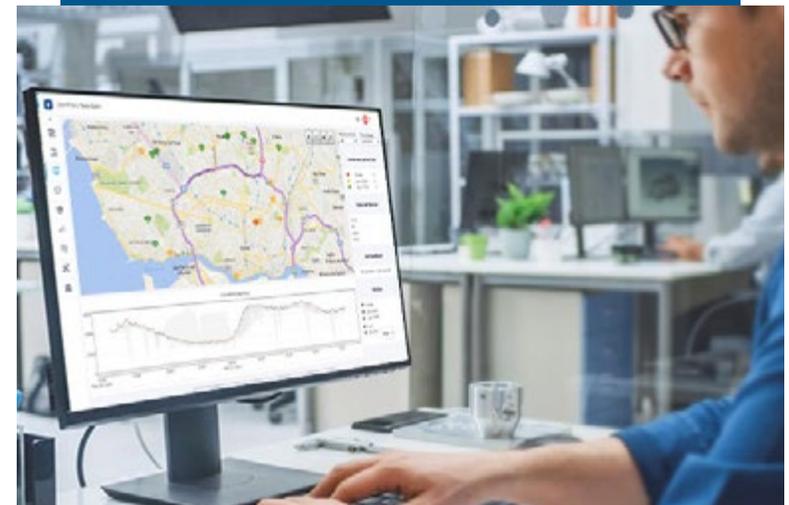
ADVANCING DIGITALIZATION WITH **DIGITAL TWINS**

Utilities that make effective and informed decisions are data driven. All the information in their system is monitored and connected. The knowledge gained by implementing a digital twin solution provides utilities with the ability to uncover critical information throughout the lifecycle of a water system. A digital twin is a digital representation of a physical asset, process, or system, as well as the engineering information that allows us to understand and model its performance. The concept of a digital twin can be used at different scales, from an individual component like a pump or valve, to a subsystem like a water treatment plant or other facility, to an entire utility network. The digitalization of data and its supported business processes can help you get the most out of your network information and improve service and efficiency by providing:

INTERNET OF THINGS CONNECTION

Use information from sensors and other data sources, as well as capabilities of hydraulic modeling, to fill in the gaps in between and beyond where sensors are located. Hydraulic modeling can also be used to simulate characteristics that are not directly measured, exposing network data that is otherwise hidden.

EMERGENCY RESPONSE MEASURES

Test variations in operational strategy, tactics, and emergency protocols in a risk-free way. Utilizing what-if simulations and identifying safe, reliable, and cost-effective options to improve the resilience and daily management of water distribution service.

PRESSURE ZONE AND DISTRICT METERED AREAS IDENTIFICATION

Utilize digital twins to automatically determine accurate pressure zones based on boundaries and large consumers. Identify potential areas to reduce pressures without disrupting service.

REAL-TIME INFORMATION

With a constant source of real-time data, you will always be up to date with asset performance across all aspects of the utility. No late reports. No unscheduled events.

ANOMALY DETECTION

Monitor SCADA sensors for early detection of anomalous behavior in the system. Protect against potential natural, accidental, or purposeful contamination that will compromise the system's ability to deliver safe potable water to customers.

ENERGY OPTIMIZATION

Model pumps accurately using hydraulic modeling to understand the impact that different pump operational strategies have on energy usage.

WHY **OPENFLOWS**

OpenFlows provides you with comprehensive solutions for creating water infrastructure digital twins, which allow you to:

MAKE REAL-TIME DECISIONS: Connect the varying interrelated assets that make up your water distribution, sewer collection, or stormwater network, and gain actionable insights into system performance to make timely operational decisions.

ANALYZE CURRENT SYSTEM RESILIENCY: Incorporate a hydraulic/water quality model to simulate events such as pipe failure, power outages, fires, and contamination.

SUPPORT RISK-BASED STRATEGIC LIFECYCLE ASSET MANAGEMENT: Leverage data from existing work management and asset management systems, as well as other enterprise systems. These benefits help utilities optimize lifecycle costs, extend the useful life of assets, and prioritize capital improvement projects.

INCREASE OPERATIONAL DATA EFFECTIVENESS: Continuously updating digital twins with measured operational data helps a utility determine the location of potential leaks as well as reduce water loss.

ANALYZE SYSTEM PROPERTIES THAT CANNOT BE DIRECTLY MEASURED: Integrating hydraulic models with data from SCADA, determine properties for system information such as water age or velocity—and realize a more comprehensive picture to increase physical safety and reduce pipeline breakages.

EXAMINE MULTIPLE WHAT-IF SCENARIOS: Simulate and test different ways that a water system could be operated to improve emergency response, increase efficiency, or save energy.

BRING IN **REAL-WORLD MEASUREMENTS**

EXAMINE AND PRIORITIZE **DEMAND INFORMATION**

SAFEGUARD **WATER QUALITY**

INTEGRATE WITH BENTLEY'S **REALITY MODELING SOLUTIONS**
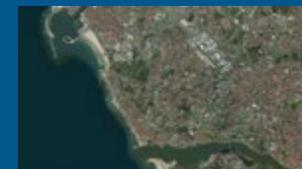
MANAGE ENTIRE CITIES **IN A SINGLE PLATFORM**

REAL-TIME OPERATIONAL DECISION SUPPORT WITH **OPENFLOWS WATEROPS**®

OpenFlows WaterOPS is a complete predictive modeling solution for real-time **water network operations, maintenance, and forecasting.** The application provides utilities with key advancements for operating a safe, sustainable water supply and distribution system. Extending the capabilities of the SCADA system and traditional hydraulic model functions, OpenFlows WaterOPS empowers network operators and operations engineers to update hydraulic models with live operational data.

The application helps users achieve target optimization for events associated with pressure, pump outage, fire, leakage, energy allocation, and water quality and demand management. OpenFlows WaterOPS **continually assesses system performance and alerts stakeholders of critical events before they occur,** allowing for smart response strategies that minimize ensuing effects for customers.
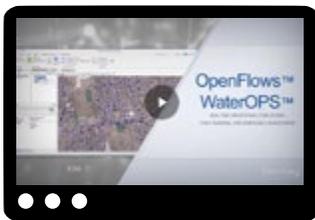
OpenFlows WaterOPS contains many capabilities found in OpenFlows WaterGEMS® CONNECT Edition, but is customized for operators with a **user-friendly interface to simplify model building and design workflows.**

**REVIEW PRODUCT CAPABILITIES »**   **REQUEST A TRIAL »**

PREDICTIVE BUSINESS INTELLIGENCE
WITH OPENFLOWS WATERSIGHT®

OpenFlows WaterSight connects SCADA, GIS, hydraulic modeling, and customer information into an interoperable dashboard. A scalable cloud-based environment provides your entire utility access into the detection of critical system and individual asset performance information, enhancing operations and maintenance planning decisions. Powered by a single water infrastructure digital twin, the application enables computation of present, historic, and forecasted performance for every asset within the system.

You can confidently share detailed graphics of current network performance, as well as the expected consequences and improvement for actions related to operational and maintenance activity. Moreover, OpenFlows WaterSight allows you to virtually test and simulate response measures for emergency situations, such fires, pipe breaks, pump outages, or other time-critical events.

REVIEW PRODUCT CAPABILITIES »
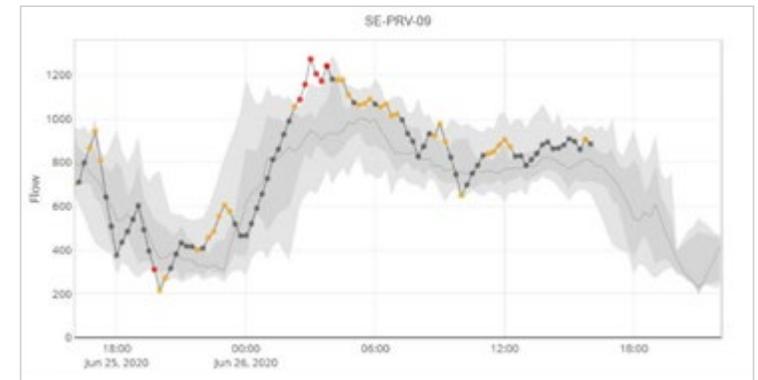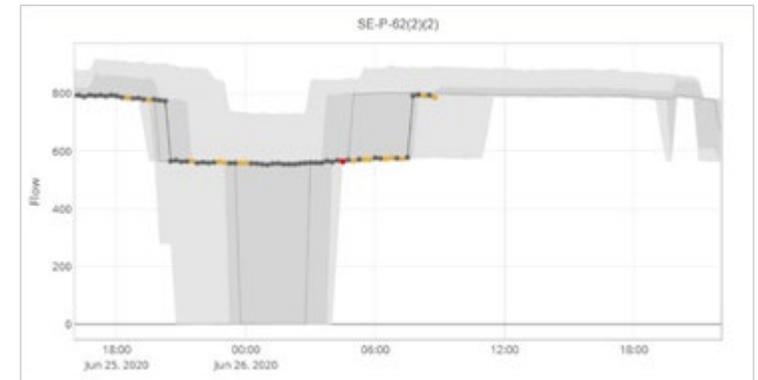
This graph shows recent historical SCADA data on a background based on 80-20 and 95-5 percent historical trends. Values outside of those trends would indicate anomalous behavior.

RISK-BASED PIPE RENEWAL
& CAPITAL PLANNING

OpenFlows digital twin solutions can help utilities take a data-driven approach to capital planning so that time is spent on preventative planning versus reacting to issues, and the decisions made yield the highest value for each dollar of investment. The capital planning process supports continual and iterative improvements and refinement. As a starting point, all available data can be easily accessible for the decision-support process. As decisions are made, data and the decision-support process can be easily audited for validation and continually improved through:

• Automated data connections and interoperability

• Objective, data-driven predictive learning and failure prediction

• Heuristic-based risk analysis and scenarios

• Cross-asset planning

• Advanced planning with monetized risk and lifecycle cost analysis

• Reach across departments with unified reporting

QUENCHING THE THIRST FOR INFORMATION

Water utilities have a long history of collecting data to monitor their systems. Most utilities also analyze and design their systems using hydraulic modeling software such as Bentley's OpenFlows WaterGEMS, but may not realize that they can combine these tools to make smarter decisions throughout the water infrastructure lifecycle. From planning and design to operation and maintenance, water networks become more reliable, efficient, and sustainable with digital twins.

Learn more about how water infrastructure digital twins can help you, your organization, and your projects.

1-800-BENTLEY (1 800 236 8539)

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