



Data & Technology Implementation with Bentley's OpenFlow Range

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About Bentley Systems, Inc

Who we are, what we do, and how we are advancing the Water Infrastructure of the world?

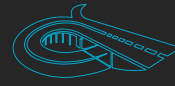
Bentley
Advancing Infrastructure

About Bentley:

Solutions for Project Delivery and Asset Performance

Bentley's mission is to provide *innovative software and services* for the enterprises and professionals who *design, build, and operate* the world's infrastructure – sustaining the global economy and environment for *improved quality of life*.

BENTLEY PROPRIETARY AND CONFIDENTIAL



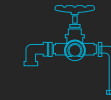
Road



Bridge



Rail Network



Pipe Network



Water Treatment Plant



Wind Turbine



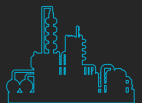
Cell Tower



Substation



Power Plant

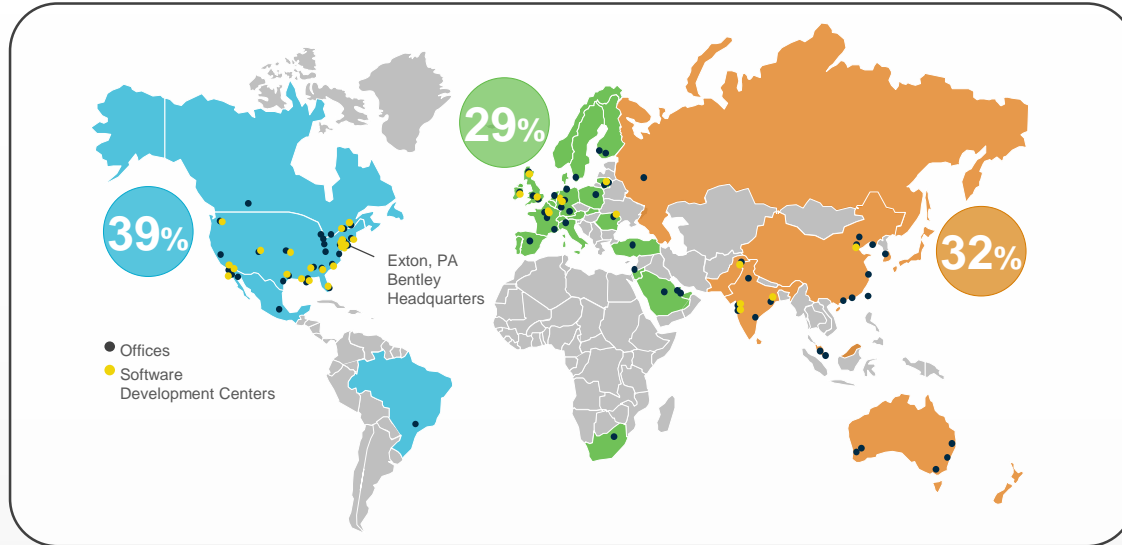


Digital Factory



Global Company with Rich Domain Experience


>4,500 colleagues worldwide




 **94**
Offices and
Development Centers

 **42**
Countries

 **64**
Languages

 **1532**
Engineering
Degrees

 **1026**
Master's
Degrees

 **87**
Doctoral
Degrees

Global Top 100 software company and the largest software company focused solely on infrastructure


India

5 offices/DC

Corporate office in Delhi

Development center in Pune

~700
colleagues

 2021 Revenues
> \$1bn

 R&D Investment
> \$1bn over past 5 years

Water Resource Management

Supply Side:

- **Natural Resources**
 - Ground Water
 - Surface Water
- **Non-Conventional Resources**
 - Brackish Water
 - Wastewater
 - Other Water Stream(Recycled, desalinated etc)

Demand Side:

- **High Consumption Resources**
 - Domestic Usage
 - Agricultural Usage
 - Industrial Usage
- **Low Consumption Resources**
 - Aquatic environment
 - Recreational Usage
 - Other Usage(hydropower generation)

Utilities on average loose 25-40 % of the drinking water in distribution, only <15% loss is a “world class”

Energy usage and costs are up to 30% of the Utilities operational budgets

Predicted costs for keeping the water infrastructure assets running is exceeding €65 billion per year worldwide

Water quality (safety) varies per season, and it is critical for the health of people !

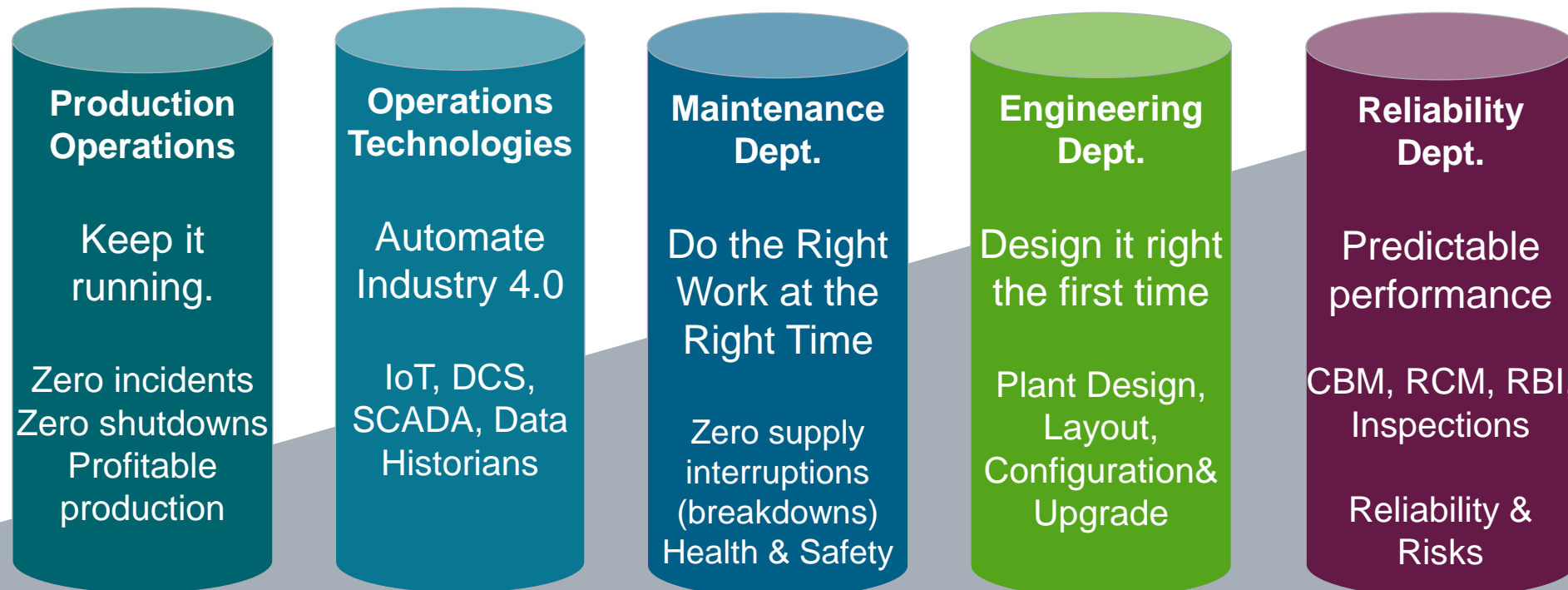
>2M m³ are discharged as sewerage and industrial wastewater into our environment daily

Stormwater and flood risk management, saving lives and critical infrastructure!

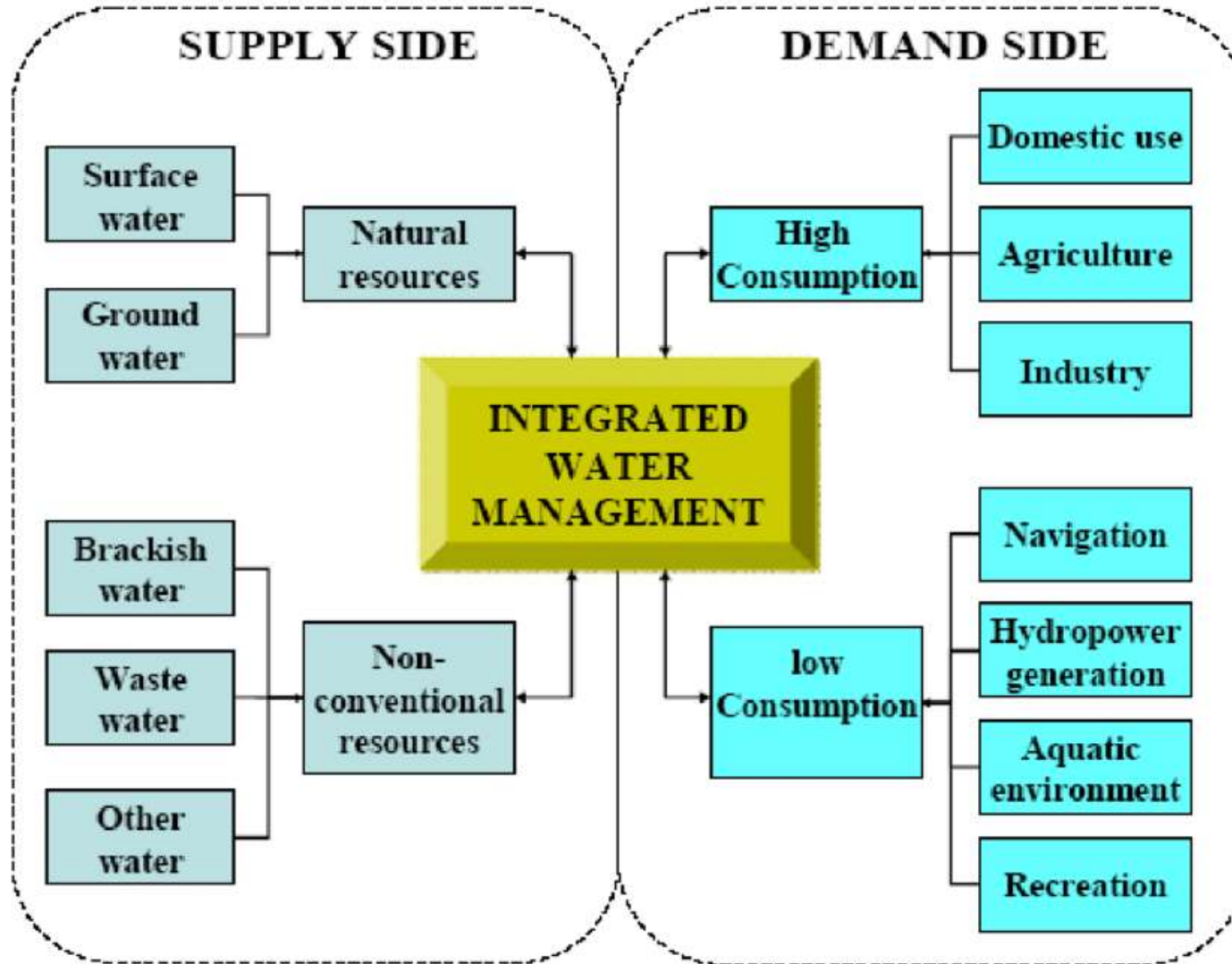
Imagine...
If we could solve some of the toughest problems?

Information Management Challenges - Water Infrastructure

- Silos of data, untrusted (quality) data
- Lack of collaboration between Engineering, Operations and Maintenance
- Outdated approaches to information management of the critical water infrastructure
- Productivity is far below what is possible
- Affects water asset reliability and performance




Need for Integrated Water Management



Ref: Integrated Water Resource Management (IWRM) mechanism based on integration of water demand and supply, Source: Ragab, 2004, p. 12

Water Industry Segments We Cover

	Lifecycle Phase	Treatment Plants	Water Distribution	Wastewater Collection	Stormwater Management	River and Coastal
Project Work 	Master Planning	Plant Design O&M	Urban Potable Water	Urban Drainage		Urban Flooding
	Planning & Analysis					
	Physical Design	Capturing reality, Geoinformation, Engineering Collaboration, Construction, Filed management				
	Construction					
Daily Work	Operations	Asset performance, Visibility & Insights, Reliability, Lifecycle Information Management				
	Maintenance					



OpenFlows Solutions

	Water	Sanitary	Storm	Flood
Engineering Analysis	WaterGEMS® WaterCAD® HAMMER®	SewerGEMS® SewerCAD® CivilStorm® StormCAD®		OpenFlows™ FLOOD™
Support Daily Operations	WaterSight™	SewerSight*		Flood Early Warning System*



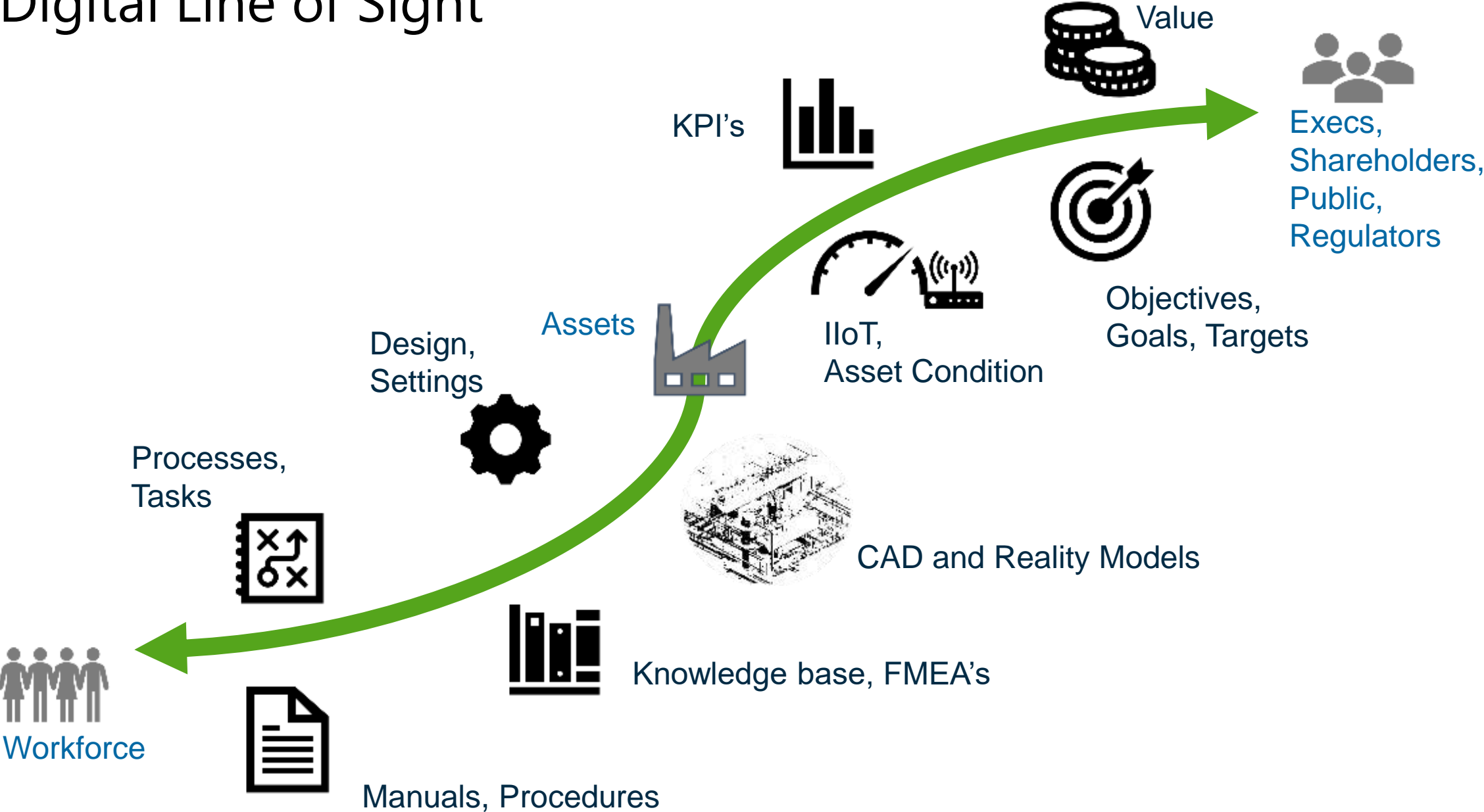
Bentley's Differentiating Value Proposition:

Digital Line of Sight

A digital connection (or thread) of data throughout an asset's lifecycle to ensure information integrity, accuracy, and timeliness to access.



Digital Line of Sight



Digital Twin | Unique Value Proposition addressing Water Assets Lifecycle





A digital twin is a digital representation of a physical asset, process or system.

Plus the engineering information that allows us to understand and model its performance.

Life Cycle Management Activities

Asset Inventory



*Know your assets
and their location*

Condition
Assessment



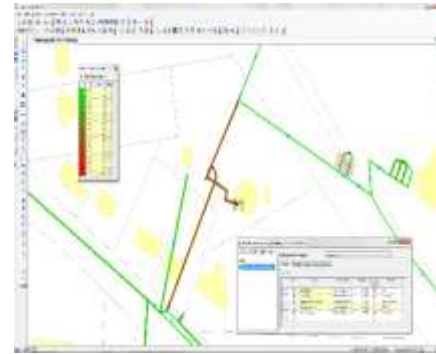
*Perform and
manage inspections*

Maintenance



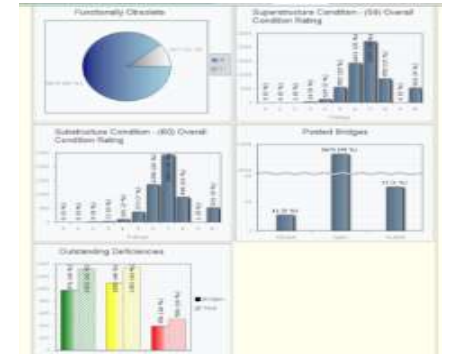
*Assign/Track
maintenance needs*

Planning &
Prioritization



*Use models and
data-driven
decisions on capital
plans*

Real-time Network
Management

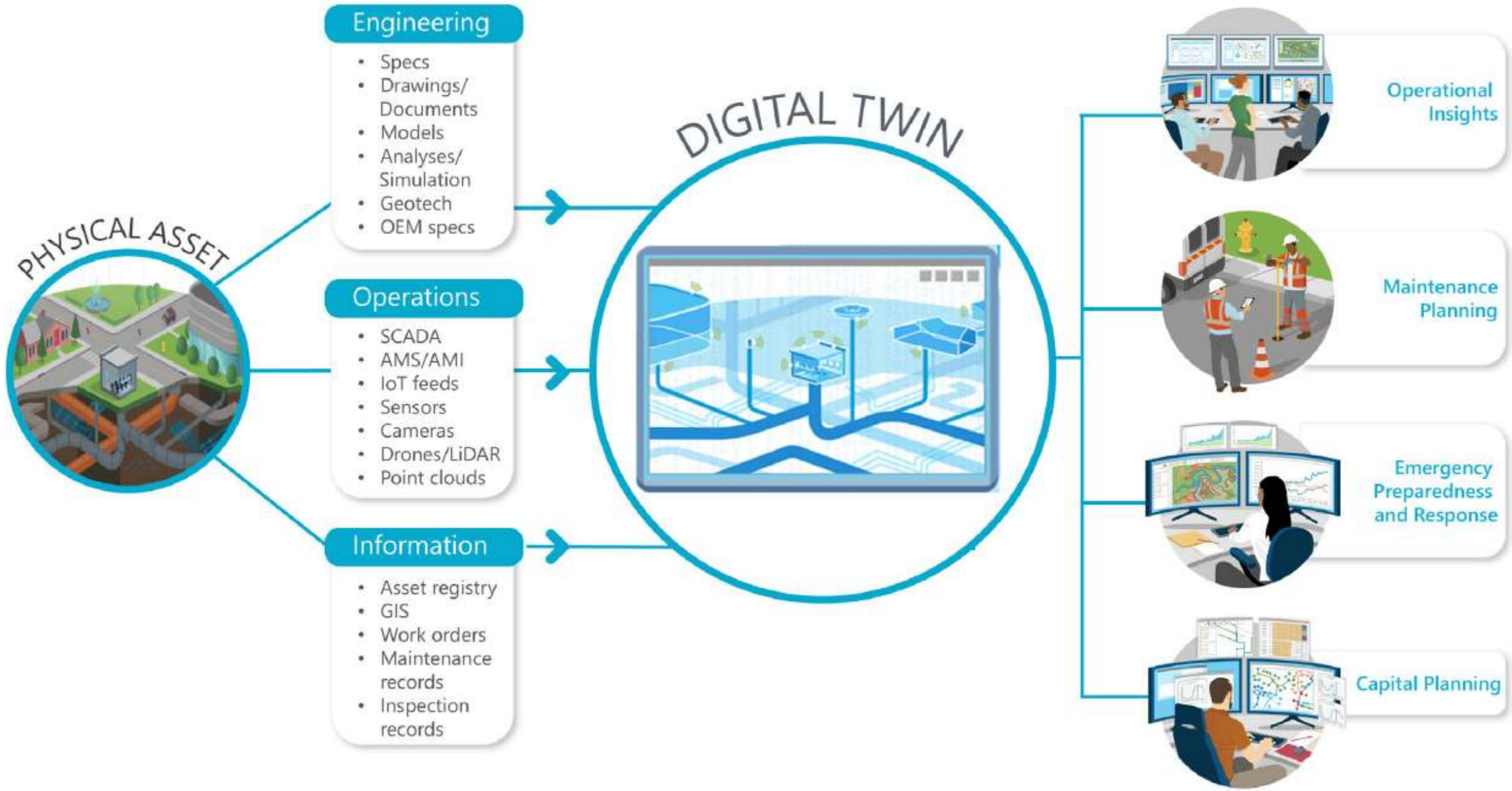


*Apply platform with
full visibility &
insights for real-time
performance*



Products & Solution for Water Resource Management

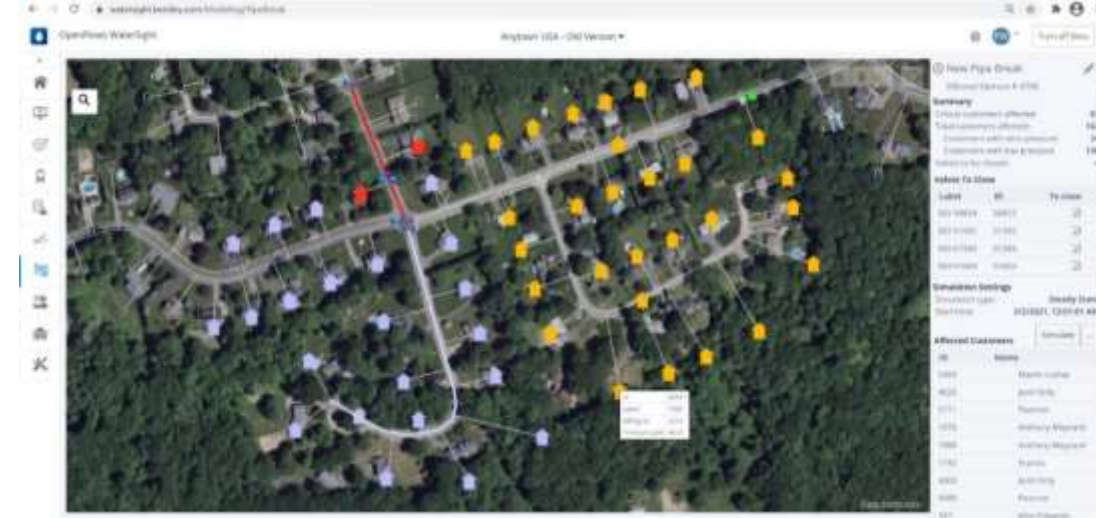
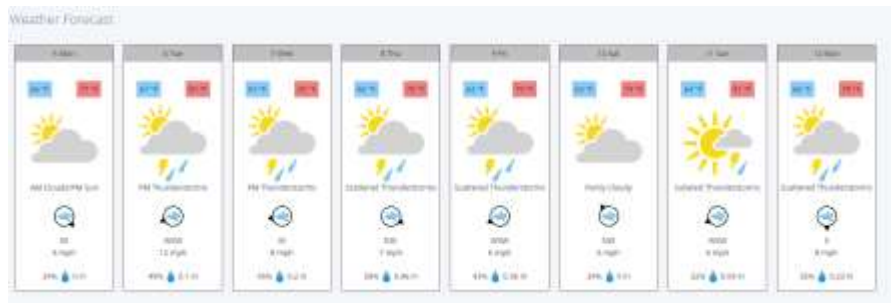
WaterSight: Digital Twin for Water Utilities Operations



WaterSight

Water Network Operation & Performance Improvement

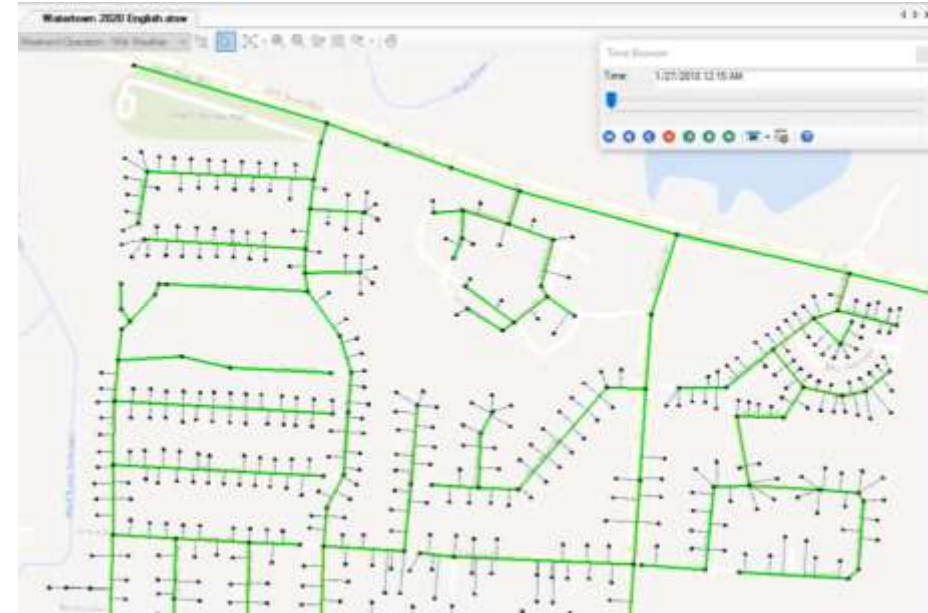
- Real-time SaaS
- Cloud based (Azure)
- Integrates:
 - Real-time & Historical data from Sensors
 - GIS data
 - Commercial Systems
 - Weather data
 - Machine Learning
 - Hydraulic model



WaterGEMS and SewerGEMS

Water Supply & Wastewater Collection Networks-Design/Plan/Analysis

- Understand system's current and projected conditions
- Discover system's bottlenecks
- "What if" scenarios
- Separate and Combined Systems
- Hydraulic solvers for Gravity and Pressure Networks
- Combined Sewer Outflow Analysis
- Optimized design for gravity conduits



Critical Storm Summary Results (Digital Twin Station) - Hydraulic Grade at Nodes (Maximum HGL)

ID	Status	Node	Element Type	Downstream Pipe	Critical Scenario	Critical Storm Event	Infl. Pipe (in)	Elevation (ft)	Freeboard (Required) (ft)	Freeboard (Actual) (ft)	Hydraulic Grade (ft)	Freeboard Height (Minimum) (ft)	Depth (Maximum Surface) (ft)
047531	HH-28	Sur/Ingrd	HH-20486	Manhole	20584(L)	Base	Time Depth	724.06	724.96	0.30	724.27	723.01	2.6
047581	HH-27	OK	HH-27723	Manhole	Sanitary	Base	Time Depth	725.06	724.33	0.30	724.64	718.60	4.7
048173	HH-28	Sur/Ingrd	HH-28412	Manhole	20183(L)	Base	Time Depth	724.13	725.13	0.30	724.83	724.47	0.7
028041	HH-28	OK	HH-28152	Manhole	20584(L)	Base	Time Depth	746.08	746.98	0.30	745.77	744.91	1.3
028291	HH-28	Sur/Ingrd	HH-28640	Manhole	20584(L)	Base	Time Depth	726.95	724.94	0.30	724.34	721.63	2.9
029331	HH-28	Sur/Ingrd	HH-28641	Manhole	20584(L)	Base	Time Depth	726.38	724.60	0.30	724.20	721.18	3.3
029251	HH-28	OK	HH-28642	Manhole	Barnes	Base	Time Depth	725.61	724.80	0.30	724.57	723.32	4.7
029381	HH-28	Sur/Ingrd	HH-28643	Manhole	20183(L)	Base	Time Depth	723.83	724.99	0.30	724.68	723.00	4.1
029481	HH-28	Overflow	HH-28644	Manhole	CO-1	Base	Time Depth	725.06	726.32	0.30	726.81	726.32	0.0
029491	HH-28	Overflow Risk	HH-28645	Manhole	Rogue F	Base	Time Depth	724.85	725.70	0.30	725.48	723.67	0.1
029211	HH-28	Overflow	HH-28646	Manhole	CO-3	Base	Time Depth	724.75	725.20	0.30	724.89	723.38	0.0
029231	HH-28	Sur/Ingrd	HH-28647	Manhole	CO-4	Base	Time Depth	724.30	725.54	0.30	725.23	724.95	0.6
029251	HH-28	Sur/Ingrd	HH-28648	Manhole	CO-5	Base	Time Depth	724.48	725.17	0.30	724.86	724.64	0.5
029291	HH-28	OK	HH-28657	Manhole	CO-6	Base	Time Depth	726.86	725.20	0.30	724.90	727.38	7.8


300 of 323 elements displayed




4D Construction Simulation: federated network and plant facilities



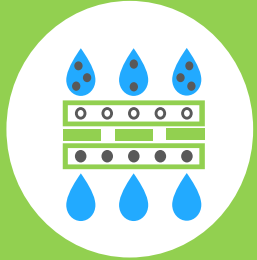
OpenFlows FLOOD



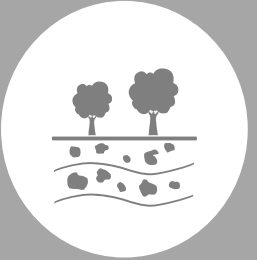
Flood Risk Assessment




Dam Break Scenarios



Impact of Discharge from WWTP



Impact of land use changes

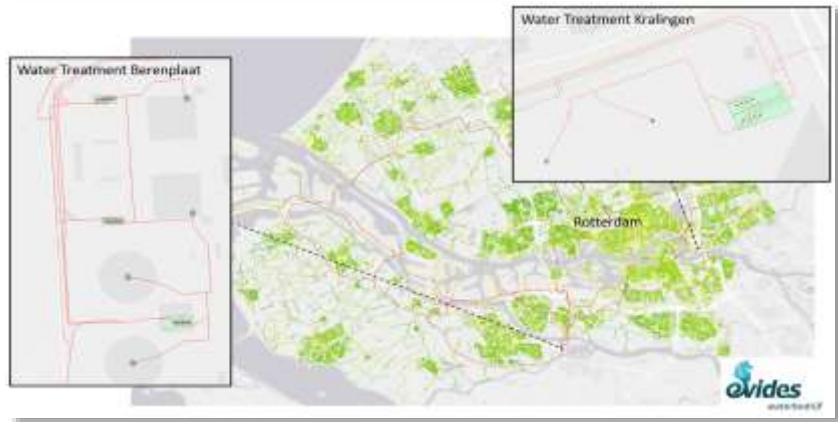


Groundwater Resources (Quantity & Quality)

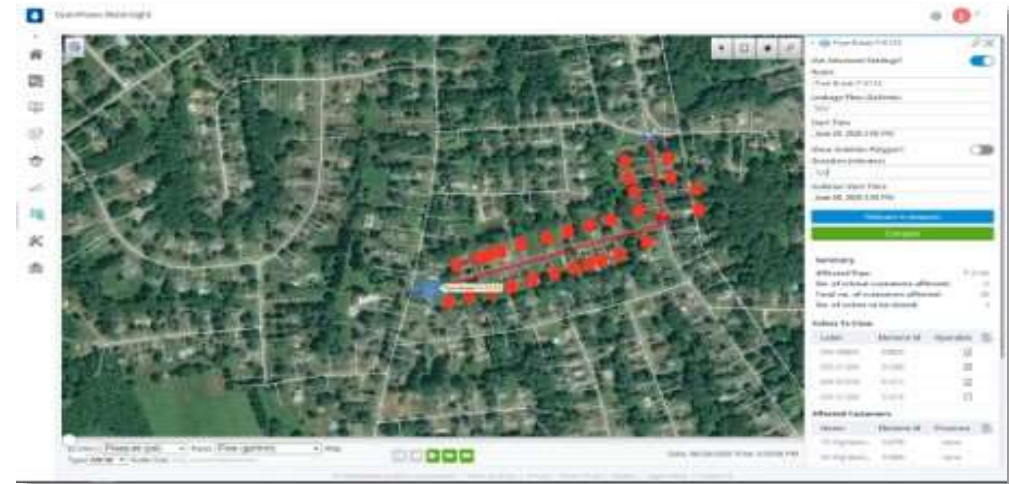
Simulate Climate Impact with Flood model - Helsinki, Finland



Example Outcomes



Evides saved 33% in energy costs and 942 tons per year in CO₂ emissions



AEGEA integrated data in different systems into one single platform, providing additional insights



DC Water is improving response to service disruptions and reducing NRW



Agua e Energia do Porto reduced supply interruptions by 22%

How to start your OpenFlows & Digital Twin journey?

Bentley Service Instruments

Play and Learn

- We can provide login to our digital twin demos (WTP or network DTs) to get hands on experience
- On-line training & certification opportunities

Digital Assessment Study

- Identify data gaps, understand internal SOPs
- Define near and long-term use cases / goals for each department persona
- Agnostic → provides value regardless of technology selection

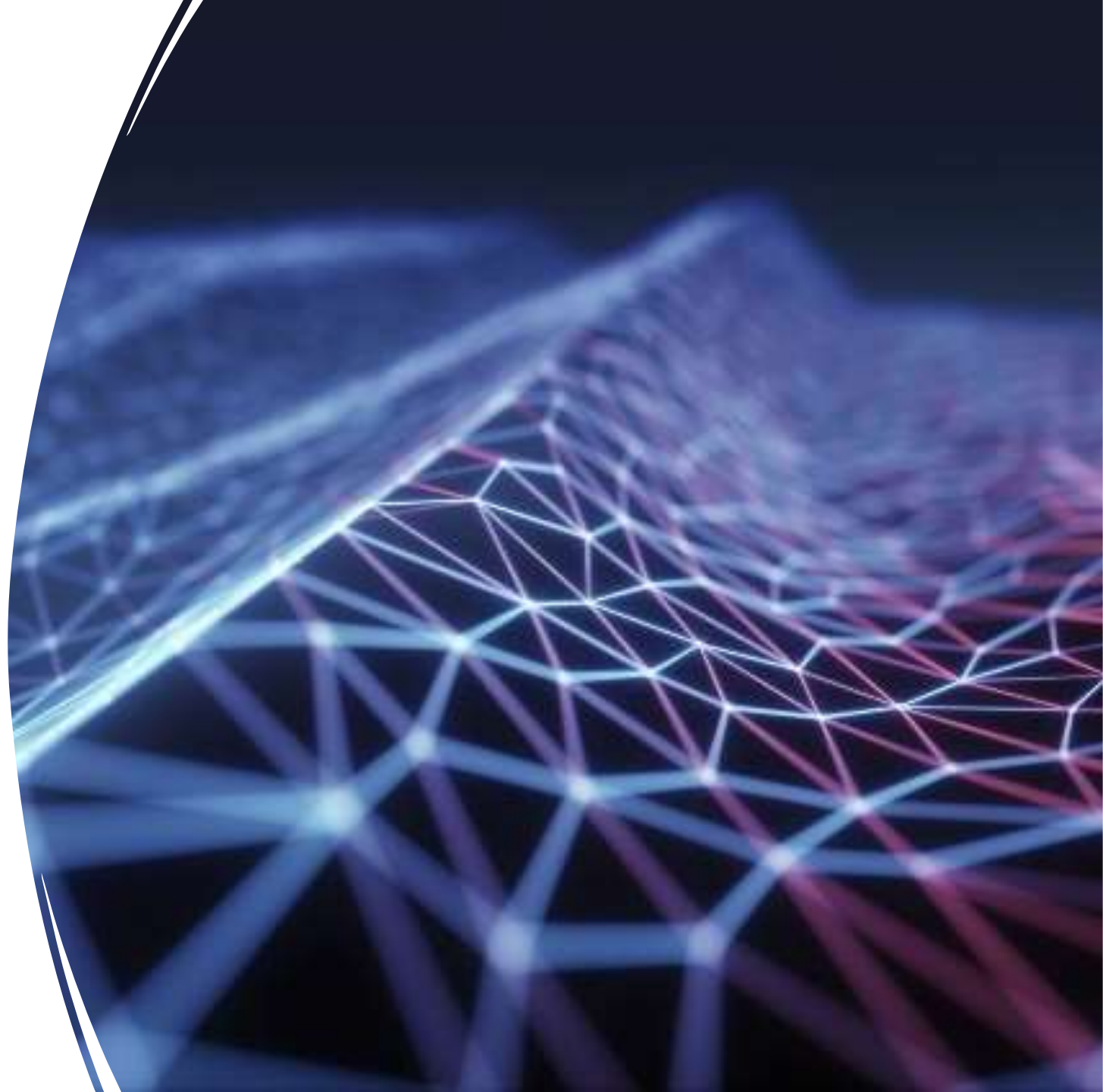
Pilot Study Deployment

- Start with 1 pressure zone or sub-catchment area
- Does not have to be live sensor data to achieve value



Call For Action

- Bentley is ready to host Executive Meeting and discuss the potential business outcomes from Digital Twin to get started quickly.
- We invite you to organize a Digital Twin workshop with the key Stakeholders in the organizations to develop Digital Implementation Roadmap.
- Based on our international experience, Bentley can prepare Use Cases aligned with the Business with a budgetary proposal to start immediate Proof of Value implementation.



Summary: Unique Solution and Value Proposition Covering the Lifecycle of Water & Wastewater

Meet
Capacity



Reduce
Leakage &
Maintain
Service



Safeguard
Quality



Ensure
Reliability



Handle
Emergencies



Control
Risks &
Costs



Advance with Bentley Digital Water Solution!



Thank you!