

ADOPTING SMART WATER NETWORKS AND DRIVING SMART CITY SOLUTIONS ACROSS THE UK WATER INDUSTRY

An ageing water infrastructure and the associated repair and replacement costs that go with that are top of the agenda for water utilities. Specifically, as water mains and pipes become more susceptible to the wear and tear over time, increasingly this is where we suffer our greatest loss...water.



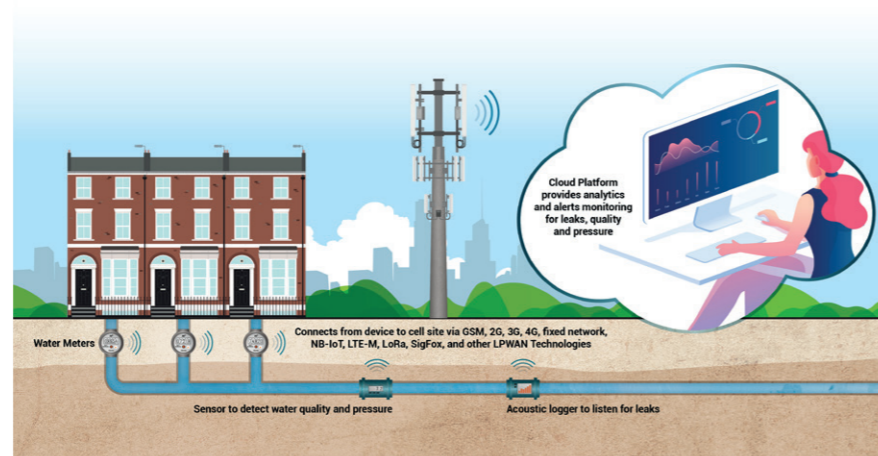
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Through applying digital technology and expertise we can create smart water network solutions that improve the efficiency, longevity, and reliability of the underlying physical water network by better measuring, collecting, analysing, and acting upon a wide range of network events.

This can take shape in different phases of the utility process, such as real-time monitoring and automation, operational readiness, or network planning. The availability of cheap, easy-to-use data technologies, as well as external pressures on the water industry, means that water networks will see much greater sensor and controller density, and inevitably a more central role for all the data systems built on top of them as part of holistic system thinking.

Smart water networks can prevent the significant (20% on average) network

Fig.1 Smart networks allowing multiple sensor types to be correlated and visualised on one cloud-based platform.



pressurisation and chemical costs lost due to leakage. Smart water networks can also reduce the cost of field operations and maintenance, leakage detection, quality monitoring and repair.

This year Yorkshire Water and Stantec embarked on the largest and most extensive smart water network pilot in the UK - the Hadfield Smart Network. With seventeen companies in the digital water space, a collaboration was formed which included Stantec, BT, Xylem, Itron, ATi, Inflowmatix, HWM, Gutermann, Technolog, Servelec/Primayer, Connexin, Arqiva/Sensus, Invenio, MUS and Syrinix to further improve the essential water supply service provided to Sheffield.

The scope of the ambitious industry-wide collaboration is to test the latest cutting-edge digital water meters, sensors, advanced analytics and telecommunications channels.

The smart water network pilot integrates the data from multiple new and existing sources, including acoustic, flow, pressure and water quality monitors, and presents it in a single visualisation platform. This will provide a virtual model of the physical assets across the network referred to as a digital twin.

The smart network will use data received at near real time from across its network and through the use of machine learning and artificial intelligence, clustering data sets and removing false positives, it will revolutionise the way Yorkshire Water manages leaks and interruptions to supply in the future and therefore reduce the amount of water taken from the environment.

Sheffield was chosen as a location for the four-year innovation pilot for geographical reasons. The hills in the city will test the capability of the wireless solutions for transferring flow data. Also, its elevation

Fig.2 Five layers of smart architecture



and closeness to the Peak District means the area faces harsh winters and the associated challenges with leakage during freeze-thaw events. The pilot area covers 23 network zones to the west of Sheffield, called DMAs (District Metered Areas), which monitor water flow into and out of areas of the network. Approximately 2,200 smart advanced metering infrastructure customer meters are being fitted in this area and will remotely send 15-minute water flow information back to Yorkshire Water Services up to every 4 hours.

Using this data Yorkshire Water Services can identify when increases in demand are due to leakage and respond quickly as well as advising customers on water conservation measures. In addition, over 1,300 acoustic, pressure and water quality monitors have been deployed to provide a full picture of what is happening across the network.

The digital twin will ultimately have live hydraulic modelling capability, integrated to sensor data in the field which will be used in real-time to assess the impact of an incident or network anomaly and to provide an informed operational decision support tool for situational awareness. As a result, analysts in Yorkshire Water will be able to prioritise repairs instantly, enabling leaks to be repaired quicker and reducing water lost.

The project has utilised state-of-the-art technologies including BT's NB-IoT network, which is being used commercially in the

area as part of this initiative for the first time. BT's NB-IoT solution has the potential to deliver significant improvements in data quality and battery life, enabling Yorkshire Water to identify and prevent leaks and network incidents more accurately than ever before.

The smart water networks analytics system being used in the pilot is cloud based and will support delivery of Yorkshire Water targets for reduction in leakage, bursts, and supply interruptions.

In this pilot, network asset health utilising hydraulic modelling is being analysed, along with field-collected pressure transient and water quality data and non-evasive pipe condition analysis. This analysis is being carried out to understand the health of the network and also whether there is an underlying reason causing bursts, pressure irregularities or water quality incidents.

This information is being used to inform an intervention strategy to optimise and calm the network. The focus is on removing harmful pressure transients caused by pumping, pressure reducing or sustaining valves, network restrictions or large users. Ultimately it will be used to introduce advanced pressure management and network reconfiguration to improve reticulation or targeted mains replacement.

Yorkshire Water's innovation programme manager, Sam Bright, said: "Technology has

progressed so much over the past few years that we are now able to really start to push the boundaries of what is possible, using artificial intelligence, to make our networks smarter than ever before. Bringing in the expertise of Stantec and the supply chain has helped us to accelerate this process and quickly translate these developments into real value for our customers."

The Hadfield Smart Network Pilot is the first step to becoming data-rich and knowledge-smart and will be pivotal in achieving outcome delivery incentives for AMP7 and beyond. The water industry needs to system-think differently; to think smarter with the early focus being on network asset health, customer side leakage management and smart water networks. Eventually the goal is a holistic end to end integrated infra and non-infra view of the network and how the asset base connects together to drive automation and better customer outcomes.

Stantec is supporting Yorkshire Water's ambition to deliver more than just the deployment of ICT solutions and collecting and analysing data to improve decision-making. For the Hadfield Smart Network, the core enabler of the strategy is an innovation ecosystem. The aim is to create a city with a thriving innovation ecosystem and to promote and drive the adoption of smart city solutions across the UK water industry. The smart city concept, in this context, is a signal of the aspiration to leap to the cutting edge of modernity.