

## Is hydraulic modelling in the midst of an evolution?



Digitalisation is changing the way we understand how wastewater systems operate and how they can be improved. Water and sewerage companies have access to immense levels of network data due to the widespread uptake of smart monitoring devices. Thousands of event duration and sewer level monitors installed across networks have led to a shift in visibility of asset performance.



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If we can understand the implications of this, then we can potentially explore new ways of designing and maintaining assets, better monitor operational and environmental performance, support regulatory compliance from the outset of a scheme, and enable important decisions to be made on schemes in minutes when these may have taken weeks otherwise.

The wastewater network hydraulic modelling industry has benefitted from this data overload. Traditionally, approaches to hydraulic modelling – while robust – can arguably be too slow in our

urgency to make real improvements. Conventional approaches rely on running simulations in a numeric but physical representation of sewer networks. These are computationally intense and require frequent manual interventions which can make it difficult to get the answers needed quickly.

Currently, regulatory requirements mandate the use of CIWEM Urban Drainage Group Code of Practice for compliant-verified hydraulic network models. These standards do not yet formally recognise machine learning models and the use of new forms of

data, unintentionally creating a barrier to adopting new techniques and methods.

As it stands, the use of more novel, machine learning techniques is seen as unproven and untested in the field. But to meet increasing public and regulatory expectations, the water industry needs to adopt new ways of working.

At Stantec, we supported a UKWIR (United Kingdom Water Industry Research) project, alongside partners, StormHarvester, to understand what role new statistical models (based on the new live network data) have in the future, and compare these against more traditional deterministic, hydraulic models.

### Working together with industry

This research, 'Understanding the possibilities of new approaches and standards from a data rich sewer network', looks at how statistical, mathematical, and machine learning techniques can provide deeper insights, improve efficiency, and support data-centric asset management. Hopefully, having a greater level of understanding will prove to be a key mechanism when unlocking important doors on our industry's innovation journey.

In the project, we centred around several key elements. This included understanding when and for what purpose we use hydraulic network models, understanding the potential alternative approaches and applications that could be used to support these endeavours, and engaging with the CIWEM Urban Drainage Group (UDG) community to understand the readiness of the sector to embrace new ways of working.

The project steering group included representatives from various water companies and CIWEM's UDG.

### Harnessing innovation

By gathering thoughts and insights, we identified sector priorities, gauged the industry's readiness for adopting new methods, and created a list of frequently asked questions around sewer network performance. This list was formatted as use cases. These spanned asset planning, creation, operation, and

maintenance, and were then prioritised for further investigation.

We organised sprint workshops bringing together subject matter experts, statisticians, machine learning specialists, and hydraulic modellers. These evaluated the potential of alternative approaches, such as statistical modelling and machine learning, when applied to the use cases. Case studies were developed using real network data from water companies.

Our work focused on critical areas like reducing spill frequency, assessing water quality impacts, and tracking the effectiveness of interventions. The team tested various modelling techniques and compared outputs to traditional hydraulic models, assessing both scalability and accuracy.

By taking advantage of more data-rich approaches and alternative modelling techniques, we found that water and drainage sectors can significantly improve their understanding of sewer networks and the assets within them. By combining traditional hydraulic model outputs with statistical and machine learning methods, the sector may be able to achieve much faster and potentially more accurate calculations of spill volumes, storage requirements, and water quality impacts. The speed element also addresses industry needs to make significant productivity improvements.

### Efficiency and productivity gains

Interestingly, these more innovative approaches also enable real-time analysis and scenario testing, such as evaluating the effectiveness of interventions or predicting future performance under climate change scenarios. Our findings highlight that machine learning models offer the ability to rapidly assess asset performance and support operational decision-making without the lengthy processes required by conventional modelling. With so much pressure on increasing efficiency and productivity within the water sector, the significance of these potential benefits is magnified.

However, the research also emphasised the success of these new approaches is dependent on the quality and frequency of data. Poor data quality, inconsistent asset records, and coarse time intervals in monitoring equipment remain significant barriers to reliability. But, even with current limitations, valuable insights can be gained.

The report, published in November, and available to download from UKWIR, encourages further investment in better data collection and governance, as well as the building of capacity in data science, to fully realise the benefits of data-driven asset management.

The findings are also being used to inform practical guidance for the sector, including the potential creation of an addendum to CIWEM's UDG Hydraulic Modelling Code of Practice. This addition outlines how water companies can adopt alternative modelling approaches and support a shift towards more efficient, data-driven asset management.

### Evidence driven improvements

Ultimately, the UKWIR research has shown through evidence that non-traditional modelling approaches, like statistical methods and machine learning, can result in significantly faster, more detailed, and less labour-intensive insights when compared to traditional hydraulic modelling.

By taking advantage of this invaluable long-term network data and using strategies that support alternative modelling, water companies and the wider environmental sector at large will be better informed and positioned when facing future challenges.

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