

How Anglian Water predicts flooding incidents to reduce risk to public health and safety

Providing better information for operational decisions

In terms of geographic area, Anglian Water is the largest water and wastewater company in England and Wales, covering 20% of the land area. Some 112,833 kilometres of water and sewer pipes serve over six million customers and the company is committed to exploring new ways to operate more effectively and more sustainably. This commitment drives innovation at all levels within the business – from the strategic to operational.

New technologies are a feature of Anglian Water's 'Innovation Shop Window'. The real-world location in Newmarket, Suffolk acts as both a proof of concept and proving ground for the innovations the company believes will take its business forward to meet the demands of future generations. Sometimes, however, real-life presents the right conditions to test technologies in a live incident. As happened in May 2018.



The short read

- Hydraulic conditions triggered a structural manhole failure near a beach front.
- Anglian Water's Infrastructure Modelling team wanted a way to predict such incidents and reduce risk.
- ICMLive was set up to run the hydraulic model every three hours, or one hour when rain was forecast.
- Using information from previous incidents, tide and flow thresholds were set to create an alert.
- A forecast indicated concurrent high tide and heavy rainfall conditions, the predicted incident did not occur as the rainfall arrived two hours early.
- The modelling team set up a revised model with improved rainfall forecast data.
- ICMLive proved the importance of the reliability of the model and of having accurate data.





A flooding incident in May 2018 presented Jose Pereira and Debbie Bell from the Infrastructure Modelling team with an opportunity to explore the potential benefits of ICMLive. The live modelling technology from Innovyze would allow Anglian Water to predict such incidents and implement appropriate risk reduction measures.

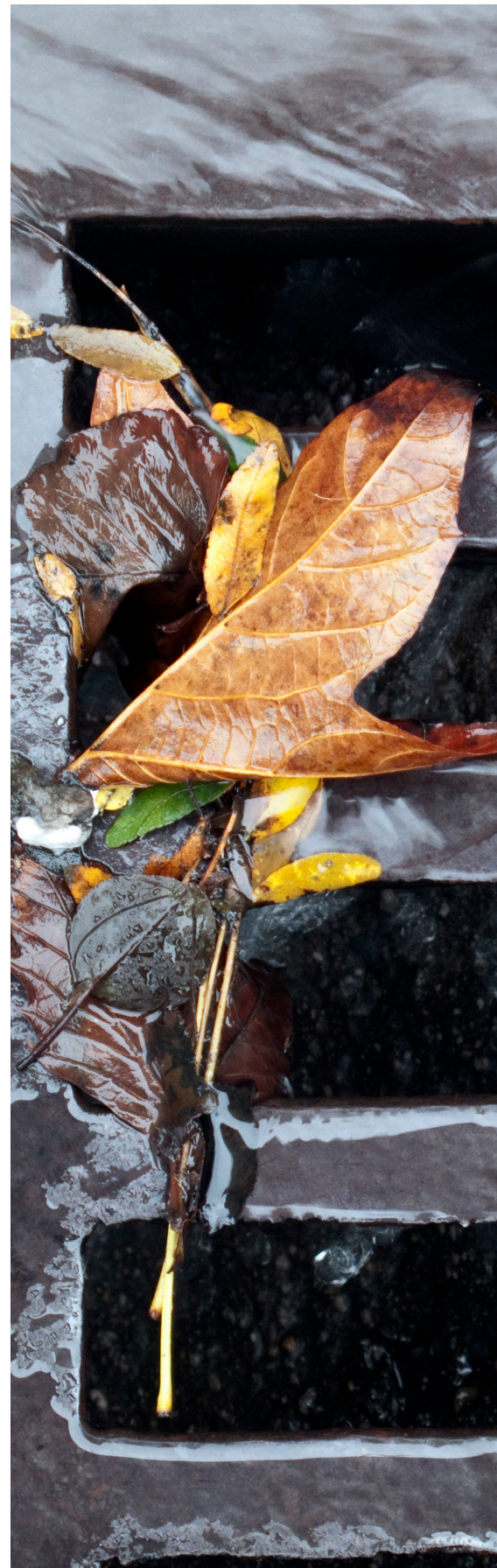
A manhole at the intersection of two roads near a tidal beach front suffered a structural failure. Heavy rainfall that day increased the volume of water being treated at the nearby water recycling centre. The final effluent would normally be taken out to sea by pipe, but a combination of a high tide conditions and increased flow rates from the sewage treatment works led the manhole to fail. As a result, a clean-up crew had to be mobilised and measures put in place to protect road users.

To try to prevent this from happening again, Anglian Water's Tactical Operations and Modelling teams worked together to identify the potential risks and prevent a recurrence, or mitigate health and safety risk, if prevention was not possible – as was the case in this instance.



The challenge was knowing where to set the thresholds to alert the teams to take action.

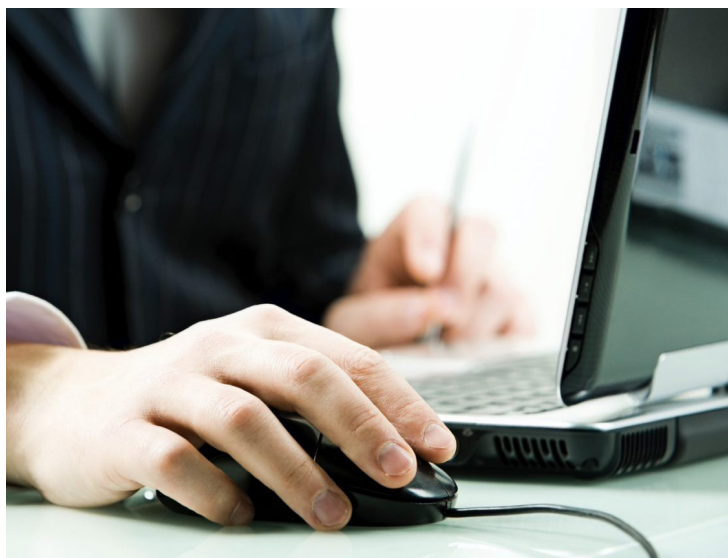
Infrastructure Modeller
Anglian Water



The Project

Anglian Water needed to develop a way to either prevent the flooding from recurring or at least mitigate the risk to public health and safety. The tactical operations team had previously relied on local knowledge, the weather forecast and a spreadsheet. Jose Pereira recognised the value of coupling live modelling technology with forecast rainfall and tidal information to trigger activity to mitigate the risk. "The challenge was knowing where to set the thresholds to alert the teams to take action," Jose explained. "We knew that when the tide is high, pressure in the manhole increases. That, coupled with heavy volumes of runoff flowing quickly through the drains, would potentially cause the manhole to fail again." He continued, "We also knew that this would be an iterative process. We planned to review the conditions after each incident and modify the thresholds as necessary."

ICMLive was set up to run the hydraulic model every three hours, the interval reduced to one hour when rain was forecast. Each run checked whether the thresholds were met. Using information from previous incidents, tide and flow, Jose modelled the thresholds and set the alert to happen when flow in the incoming sewer was greater than 1400 litres a second, and tide level at the final effluent was higher than 2.5 metres above ordinance datum.



The solution used at Anglian Water

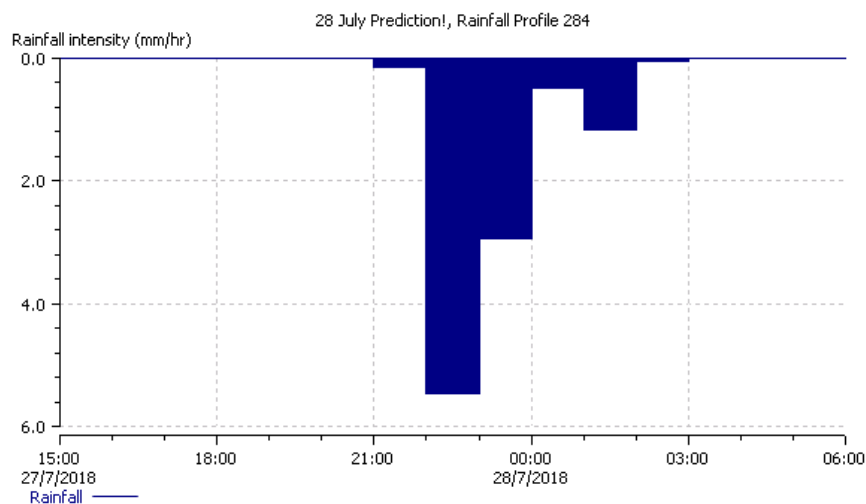
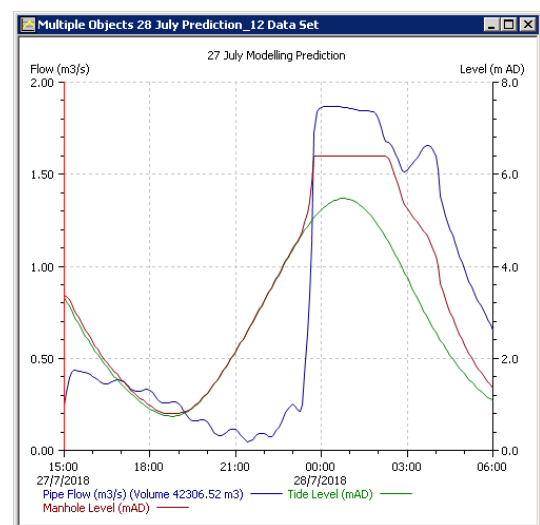
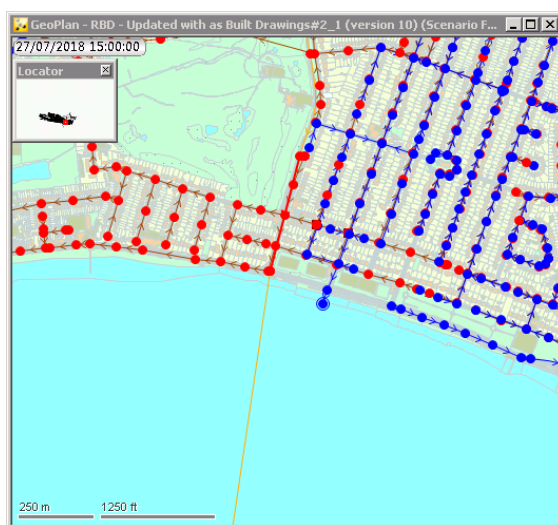


This is revolutionary within hydraulic modelling. By enabling proactive intelligent network modelling and predictive analysis, ICMLive will help Anglian Water remain a frontier performer.

Infrastructure Modeller
Anglian Water

Predicted Activity

The model was put to the test one night in July 2018. At the time the UK was experiencing a prolonged dry spell, but heavy rain was forecast. This coincided with a high tide and the model predicted a possible flooding incident for two hours from 11 p.m. The duty managers on call that evening received an email alert at 8:30 p.m. They reviewed the data and ran through pre-determined checks before sending an operations team to monitor the manhole. However, the predicted incident didn't happen.



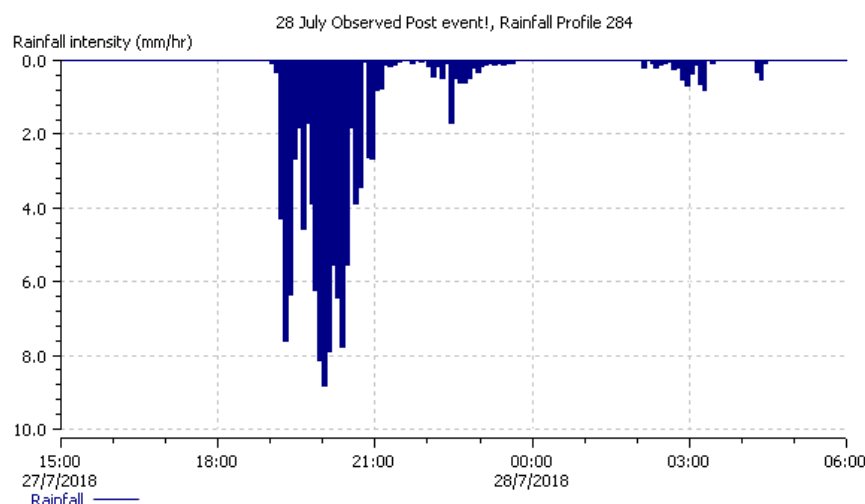
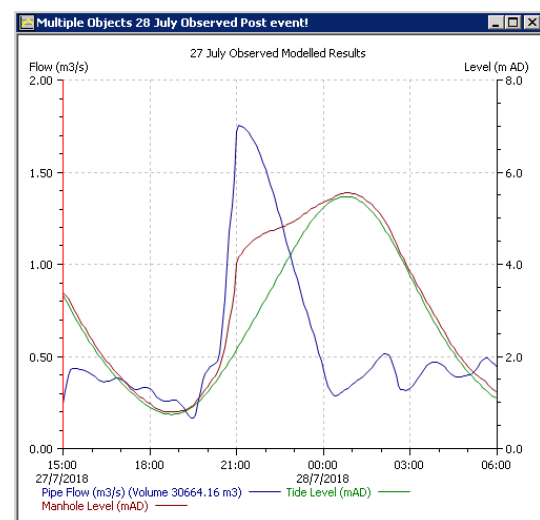
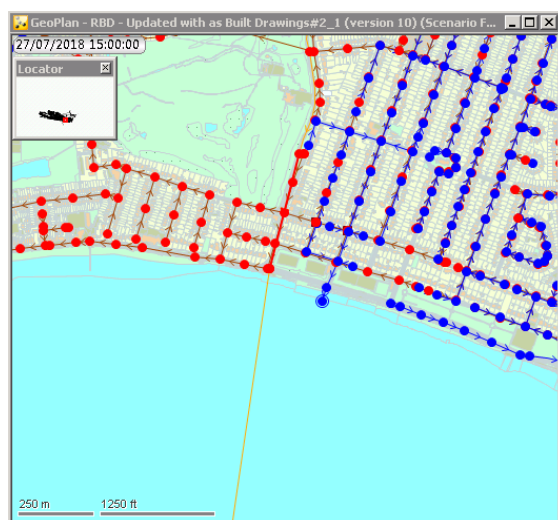
Observed Activity

Modelling the results using observed rainfall data – i.e. after the fact – the flow on the upstream pipe reached its peak more than two hours ahead of the peak tide. Rainfall forecasts and their variability will always be a consideration in operational response environments.

Rather than see this as a negative, the results proved the value of the model. If the thresholds were met, flooding was likely but as the rainfall data was two hours out, the model still stood up. The modelling team later set up a revised model with improved rainfall forecast data.

The following month ICMLive returned a 'false positive' based on initial conditions. In this case the observed data suggested that the condition was met but again, there was no flooding event. This helped the team review the threshold conditions and reset them to be less conservative.

"Our initial set up returned false positives," Jose said. "Based on those thresholds, which weren't met in reality, we could have sent out a crew unnecessarily – with all the cost that involves. By further narrowing down the conditions, we sharpen up our techniques and give our colleagues better information to base their decisions on."



The Result

The exercise presented Anglian Water with a really valuable lesson. It proved the importance of the reliability of the model and of having accurate data. As Debbie Bell explained, "Every day the business has to make decisions to send out crews. These are potentially made based on what these simulations tell us. Live modelling helps improve the effectiveness of our decisions. Using ICMLive, our colleagues are alerted to make decisions to take action or issue warnings with confidence that what is forecast is likely to happen."

The Future

As a proof of concept, Anglian Water's use of ICMLive to model manhole flooding in real-life has helped the company extend its coverage to other catchments beyond the Shop Window.

Innovyze and Anglian Water have worked collaboratively for many years on many projects. Innovyze has actively supported Anglian's work in hydraulic modelling and now ICMLive is enabling automated simulation controls in the company's existing hydraulic models.

"ICMLive has the potential to have a huge impact on our performance commitments, or ODIs, such as internal and external flooding, pollution incidents and sewer blockages," Debbie said. "It is already producing results in terms of the deployment of forecast issues."

She goes on, "This is revolutionary within hydraulic modelling. By enabling proactive intelligent network modelling and predictive analysis, ICMLive will help Anglian Water remain a frontier performer."



Among the future benefits that Anglian Water sees ICMLive helping to deliver are:

- Early warning of hydraulic flooding in order to take protective measures
- Automatically alerting tactical teams by email
- Analysis and comparison of telemetry feeds with modelled predictions and observed simulations after the effect, removing the forecast uncertainty
- Creating a 'digital twin' of the sewer infrastructure network for better asset management
- Reducing flooding issues by monitoring sewers for operational issues such as blockages and deploy resources before customers or the environment are affected



Get in touch

Our offices in the US, Australia, and the UK, plus our global network of partners, are here to help you get the most from your water systems.

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