Case study:

Intelligent sewers: understanding our EDM alarms

September 2021

Marketplace

Background

The reduction of pollution incidents is a key target for sewerage companies to improve their service to the environment. In recent years companies have installed large amounts of event duration monitoring (EDM) equipment at the storm overflows which prevent properties from flooding in heavy rain. These devices tell us the level of sewage in the pipe, trigger an alarm when they are discharging and measure the duration of the overflow.

The problem is that they are designed to go into high level and discharge and so the alarms generated when they do operate can hide information about overflows operating when they shouldn't be. We wanted to be able to use this data more intelligently. Rather than muting alarms over a wide area during a rainfall event, could we locally identify sites that are exhibiting depths that are outside the expected operating parameters for the weather conditions at the time? In other words, is there a problem we should know about? Furthermore, are we able to use the data to give early warnings of blockages, enabling us to proactively intervene to minimise the likelihood of incidents occurring? Using this information, can we move from a time-based maintenance approach to more of a condition-based approach for these assets?

Approach

The Wessex Water Marketplace platform is the hub of our open systems approach. From the platform we share business challenges as open questions, aiming to reach the full breadth of the supply chain and beyond, sharing our data where appropriate.

We decided to use the Marketplace platform to pose this challenge to the market. Why? A more traditional procurement exercise would have been challenging to design as our internal knowledge in this area was still in early stages of development. Furthermore, with the number of potential smart algorithm products already out there, but with limited case studies of implementation in the UK, a Marketplace challenge offered the chance to reach a large audience and review a wide range of options, testing them out on real data, warts and all, to understand which was the best fit for us.

Launching the challenge

We launched the challenge in October 2019, focussing on the Bath catchment. As part of this we shared around two years of historical data for 89 EDM locations, as well as the associated sewage pumping station (SPS) run-stop data (ie, when the pumps turn on and off). We asked interested parties to process our data in their systems (whether newly developed, repurposed or existing systems) to demonstrate their abilities. We were particularly interested in how the systems coped with real operational data that may have gaps or 'blips' in level readings, rather than theoretical system capabilities using cleansed data.

A three-stage shortlisting process then commenced:

1 A high-level review by our business lead looking at core capability.
2 A detailed review by a small team of business experts.
3 Face-to-face meetings with shortlisted suppliers to understand their products further.

From the sixteen companies that responded to the challenge, we selected three to proceed to the next stage – a live proof of concept trial. The three companies – in no particular order – were Detectronic (partnering with Royal Haskoning DHV), Meniscus and StormHarvester.

The trial

We kicked off the trial in Summer 2020 and it ran for around three months.

We set up a near real-time feed of the data from our sites into their products, comparing the alarms each company generated with those generated by our current systems. Over the course of the trial, we worked closely with the three companies to fine-tune their systems to give the best possible results.

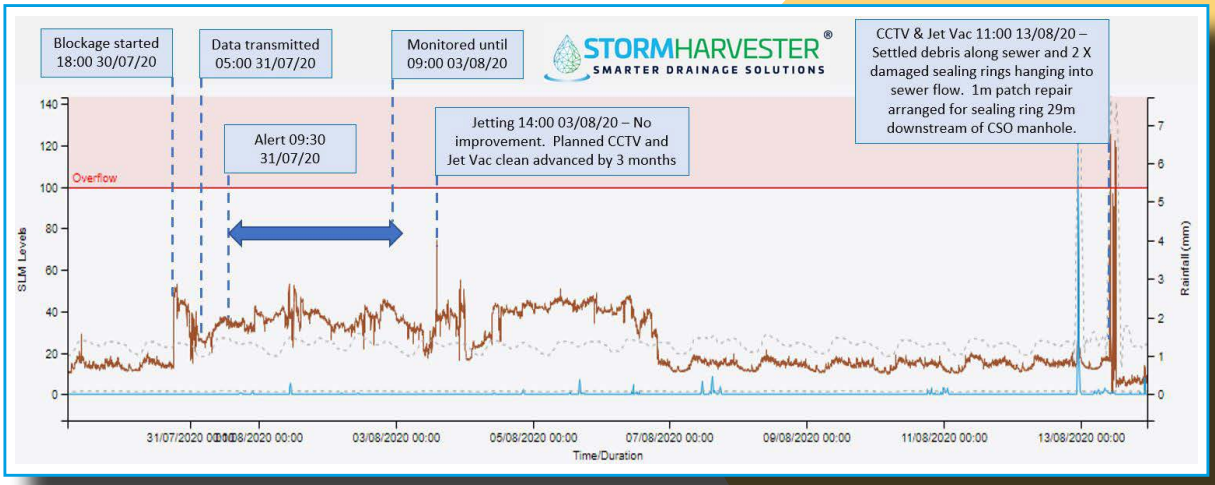
But how did we assess the calibre of the products? The key criteria were:

- Alarm reduction during a rainfall event
- The average number of alerts during wet weather
- Accuracy of alerts when compared to network performance
- Number of missed spill events
- Ease of use and application functionality

Even during the relatively short trial period, we saw some clear 'successes' in the systems that gave an early indication of the potential power of these products.

- A partial blockage was detected resulting in a low level at an EDM site
  - A flap valve that had broken away from its fixings was obstructing the sewer flow, this was removed

- An intermittent blockage was detected that didn't respond to traditional jetting
  - Following a CCTV survey two sealing rings were found to be obstructing flow, a patch repair was carried out to resolve the issue



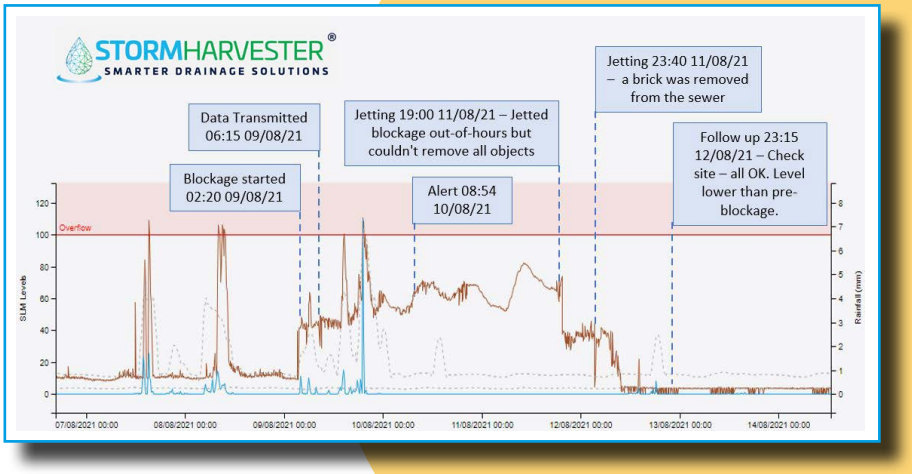
During the trial, some of the systems demonstrated an impressive 97% reduction in the number of alarms that would have reached our control room.

Challenge outcome

Following on from the trial and the subsequent tender process, we are pleased to announce that we have recently signed a contract with StormHarvester. StormHarvester will be supporting us over the coming three years and will be monitoring up to 1,700 devices across our network.

The system has already demonstrated its value as shown by the previous examples, and it continues to do so. By using the data and analysis provided, we are approaching management of the sewer network in Bath in a more proactive way. We have been alerted to a number of blockages since the end of the trial and the system has identified many sensor issues.

The operational teams have responded to these before they have caused any issues in the network or affected our regulatory standard for event duration monitor data collection. The image to the right shows how better data is driving better knowledge and performance.



The image shows identification of a downstream blockage when the sewage depth (brown line) exceeds the normal expected operating envelope (dashed grey lines) for the rainfall conditions at the time (blue line) which is subsequently cleared.

This Marketplace challenge has shown us that the use of artificial intelligence and machine learning tools to analyse a limited data set can provide real value to our business.

Another aim of this trial was to provide evidence that fully calibrated hydraulic models are not necessary to provide value to operational teams. None of the trialists were provided with any data on the sewer network capacity or wet well sizes yet were still able to identify network issues.

We're looking forward to seeing how the StormHarvester system will continue to transform the use of our EDM data and future in-sewer monitors.