WWT Case study

In association with Syrinix Intelligent Pipeline Monitoring

ACTIONABLE DATA OUTCOMES FROM A RISING MAIN MONITORING PROGRAMME

Following successful learnings from monitoring transients on water distribution networks, Anglian Water and Syrinix looked to see if there was an opportunity to transfer this knowledge across to wastewater 'rising mains.'

Across the UK water industry monitoring of rising mains is limited and even less common is a partnership approach to analysing and developing the data. Pressure monitoring offered a whole new angle on providing data which could inform and influence working practice and ultimately be beneficial from both an environmental and cost saving perspective.

The key driver from Anglian Water was to first off explore the capability of pressure monitoring to identify bursts on rising mains.

A burst on a wastewater network and the impact of its pollution is a problem with significant consequence for both customers and the environment and therefore increasing resilience by improving visibility and the time to respond is imperative, with obvious all-round benefits.

Secondly, there was the issue of generally having a better understanding about the state of their assets. Could Anglian Water get more out of existing assets? Could they last longer? A richer data set and the information it provided would lead to smarter investment decisions on assets and ultimately a reduction in the need to deliver huge capital solutions, (like mains replacement, etc).

Thirdly there was an efficiency point to make, considering both financial and operational efficiency.

The identification of failing assets such as non-return valves, air valves, degradation of pumps and in general, assets which start to cost more than they should do, brings back some efficiency and by default aids carbon and energy reduction, all of which are key priorities within the next AMP cycle.

Finally, geography plays its part for this utility and the topographical make-up of the Anglian Water area means before the sensors were installed, bursts could occur in rural areas and remote farmland that could lead to catastrophic pollution. Having the technology enables Anglian Water to manage those areas better and reduce the overall impact on the environment.

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How the partnership works

The rising main monitoring and analysis service from Syrinix combines a high-resolution pressure sensor, deployed at a pumping station outlet and the retrieved network data which via diagnostic tools, analyse the rising main system's operation and performance.

Pipeminder, Syrinix's high resolution pressure monitor, collects and analyses 128 samples per second and provides one-minute summary data intervals.

The data is sent every six hours to RADAR, Syrinix's cloud-based platform, where it is analysed against set performance parameters, which determine the system operating state. This enables the identification of asset issues such as blockages, sticking/passing non-return valves, worn pumps and burst mains.

Syrinix provide a monitoring service and have automated alerts for burst main identification, which can be integrated with existing software.

This project had been truly ground-breaking in its ability to deliver early value to a wide range of stakeholders within the utility. Asset planners can now look at the effects of design on rising main performance and inform future standards and operational teams can do greater amounts of fault diagnostics remotely, for example identifying poor performing NRVs which previously may have gone undetected until costs increased or performance was significantly impeded.

Anglian Water installed over 120 Syrinix Pipeminder devices.

Left and centre: Installation of the Pipeminder sensors at Anglian Water.

A sensor head in a non-return valve.

As the project took form, objectives were defined which took the scope beyond a simple alert system to a more sophisticated performance and diagnostic tool.

These objectives included -

- Asset performance monitoring
- NRV operation
- Rising main failure/ burst
- Air valve operation
- Asset condition monitoring
- Rising main deterioration
- Pump efficiency
- Impact of pump operation on rising main life.

For the solution to be effectively utilised as 'Business as Usual' (BAU) the following elements regarding integration were also considered:

- Business/stakeholder buy-in
- Education and learning
- Integration with existing systems
- Dashboards
- Effective presentation of data
- Contextualised information
- Intuitive GUI.

Initially sensors were placed on poor performing assets which were known to be at higher risk of failure. The intention behind monitoring these assets was to generate reference data which would allow an understanding of the patterns associated with bursts and poor performance.

In doing so Anglian Water would be able to roll out a broader programme of 'condition monitoring' to proactively monitor for events and deteriorating performance with greater confidence.

Via analysis techniques and work undertaken within specific pressure 'zones' it became possible to spot blockages and sticking non-return valves, giving predictive capabilities to asset owners and proven ability to address underperformance before failure.

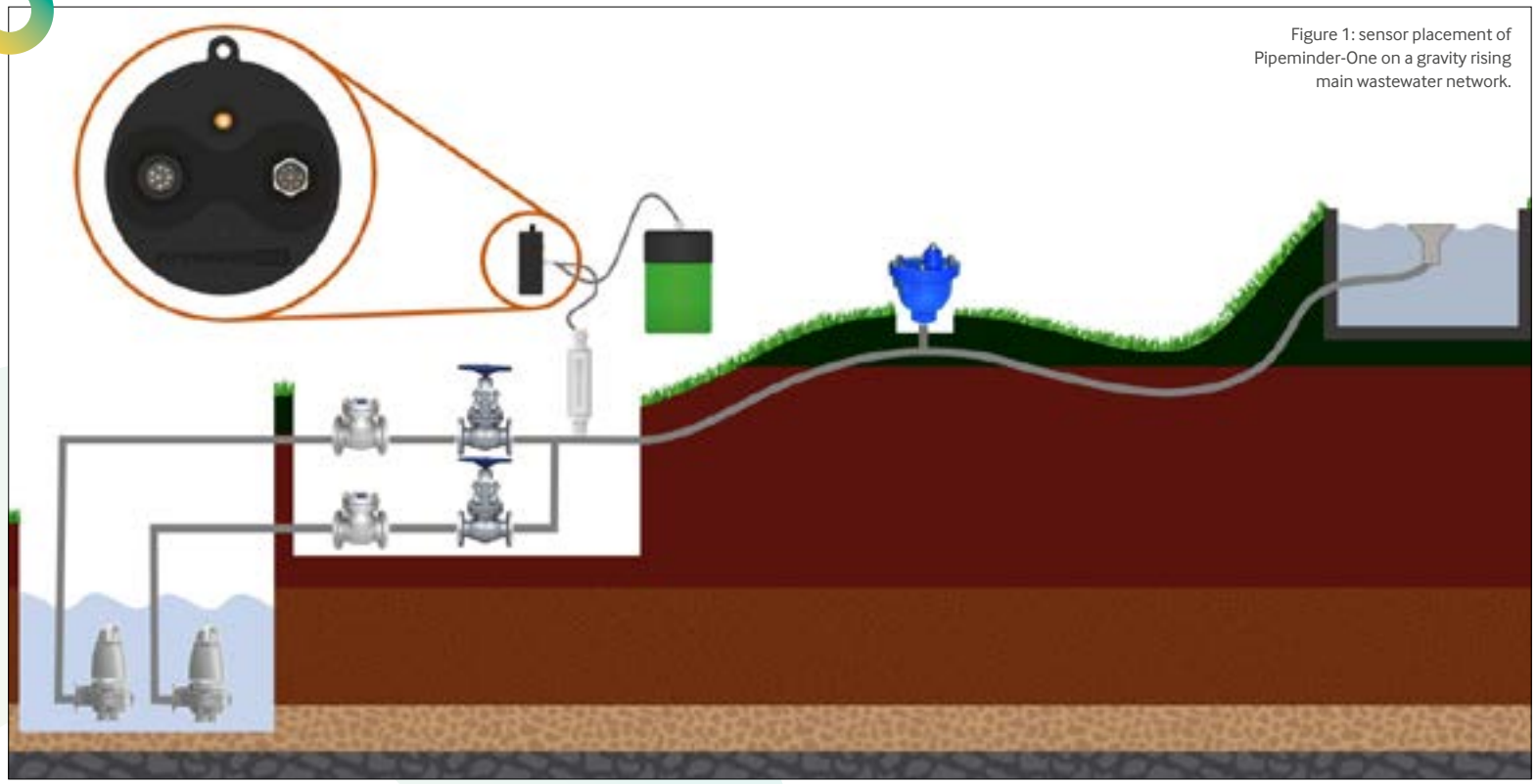


Figure 1: sensor placement of Pipeminder-One on a gravity rising main wastewater network.

Collecting and analysing data

Data collected from Pipeminder devices deployed at the pump station outlet was used to analyse the operation of the complete pipeline system. This translated to a visual representation of what good, bad and indifferent performance looks like. Syrinix could advise upon how a system was currently operating, compared to what optimum performance should be.

By analysing the one-minute summary data stream, the automated analysis methodology extracts numbers of minutes of time spent in the following categorised pressure zones:

- Low static head
- Normal static head
- Low delivery pressure
- Normal delivery pressure
- High delivery pressure
- Excessive transient activity.

A burst alert can now be raised in the operational control centre, a review and response to this failure can be planned and the time to respond and reduce environmental impact reduces significantly.

By looking at analysis of time spent in these zones it became possible to determine the system operating state.

Data tracked over time shows system issues (raised in red) and an accompanying state counter is used to indicate the asset issue (see figure 3). This better use of data gives a complete understanding of system performance which can then feed a predictive maintenance plan.

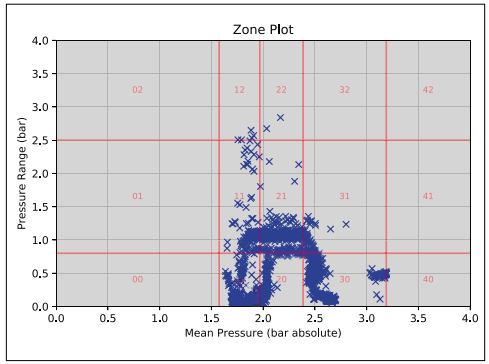
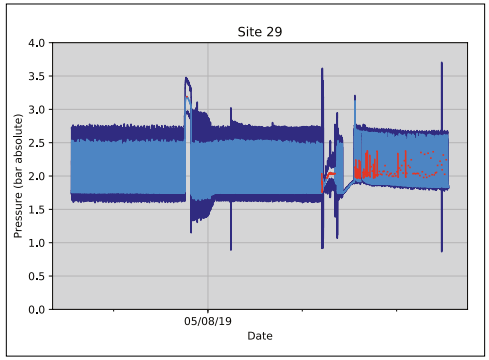
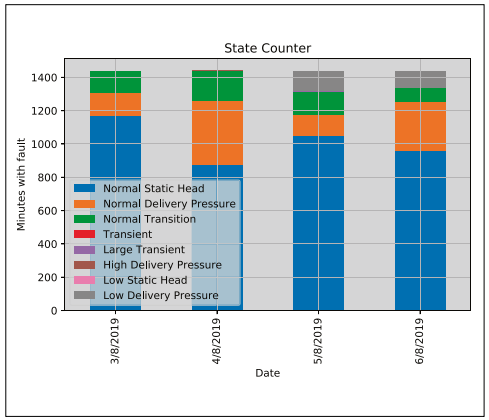


Figure 2: a graphical representation of these zones.



Middle and bottom: Figure 3.



Examples of monetary savings

Example one

In May 2019 early detection of a burst rising main meant a repair bill of £1,100 as opposed to the £25,000 repair bill received in December 2018, prior to the burst alert.

Early detection meant Anglian Water could minimise the impact on the environment, whilst lessening any customer impact and company reputation.

Example two

Data from RADAR overlaid with hydraulic analysis showed a series of examples where non-return valves (NRV's) were draining back. This information could potentially save over £1000's per year, simply by unblocking NRV's.

Drain down is when the non-return valve (two of which can be seen to the left of the Pipeminder-One monitoring device in figure 1) which follows a pump does not close fully and allows for some of the fluid to pass despite being closed. The static head begins to fall as the fluid begins to flow back into the well.

This means that the well will begin to fill not only from its source, but also from the rising main itself. Subsequently, money is wasted in not only pumping this fluid back up the pipe but also pumping more often as the well fills more quickly.
Using the Zone Plot, Syrinix has the capability to provide an alert when a rising main is draining down by looking for the presence of the highlighted section. This can provide an alert when the NRV needs maintenance and will help save money in the long run.

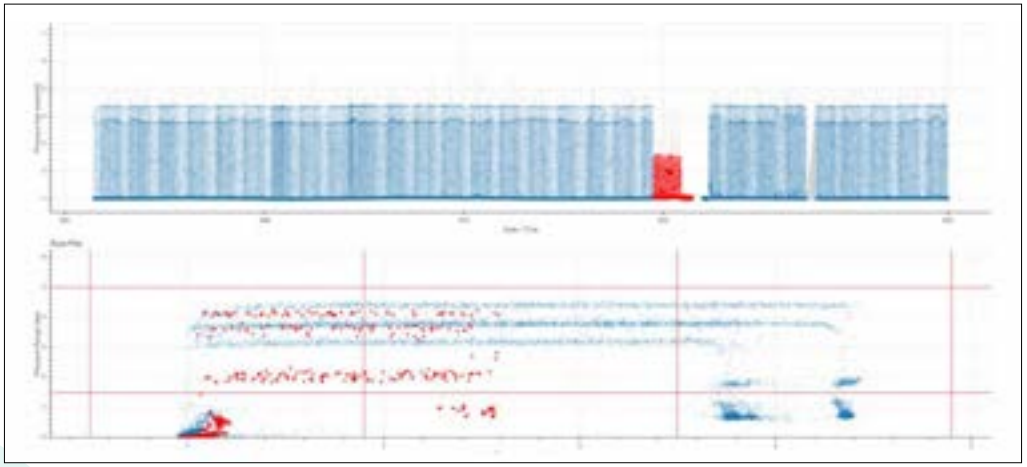


Figure 4: Shown here is the zone plot from one of the events captured – a pressure drop from ~4.4 Bar to ~2.5 Bar which tripped the zone alarm.

Example three

By using the extracted data, Anglian Water were able to reduce the burst frequency on a site from 19 bursts in 2018 to zero for 2019

Below are some examples chosen randomly from the site:

Date:	Pump surge	Pump stop to return to steady static pressure
December 2018	1.233 Bar	6.15 Minutes
April 2019	0.712 Bar	3.87 Minutes
July 2019	0.312 Bar	2.63 Minutes
November 2019	0.313 Bar	2.71 Minutes

This data shows that as time has gone on, the aggressiveness of the pumps has decreased. The overpressure due to pump surge and oscillations after the pump have stopped, have been significantly reduced.

WATER COMPANY VIEW

"This new level of monitoring has allowed Anglian Water to deploy strategies aimed at extending the life of the rising main (such as soft starts on pumps and improved air valve maintenance) of which early results have suggested it will allow for deferral of capital investment by extending asset life. This enhanced understanding of performance also provides an essential targeting tool for the optimisation team."

Rebecca Harrison - optimisation strategy manager, **Anglian Water.**

EXPERT'S VIEW

"This collaboration project has delivered real insight into how rising mains operate and defined the typical failures that occur. The data collected led to newly developed analysis methods which deliver both maintenance alerts and early warning of asset failures. The automated insights made viable savings for utility companies whilst also benefiting the environment."

Mark Hendy – VP sales EMEA, **Syrinix.**