

Scottish Water deploy SoundPrint® Acoustic Fibre Optic System

IN PARTNERSHIP WITH WRC TO EXTEND THE ASSET LIFE OF BLAIRLINNANS WATER MAIN

The Blairlinnans water main, owned and operated by Scottish Water, is a 42-inch pre-stressed concrete pipeline that runs over 16 kilometres (10 miles) from the Blairlinnans Water Treatment Works to a service reservoir in West Dunbartonshire, Scotland. The pipeline was installed in 1974 and is integral to the ongoing operation of Scottish Water's water network.

The Challenge

Like many water utilities, Scottish Water consider trunk mains to be among their most critical assets. Due to the high consequence of failure, Scottish Water recognised that the Blairlinnans main required a complete engineering assessment to understand the true condition of the pipeline. Scottish Water partnered with WRC and Xylem to inspect the Blairlinnans water main using SmartBall® acoustic leak detection platform and PipeDiver™ electromagnetic condition assessment technology in combination with detailed engineering analysis. The inspection showed most of the pipeline to be in good condition, although some pipe sections (around 2%) were found to have broken pre-stressed wires that are critical to support the integrity of the pipeline. Replacement of major pipelines is often cost prohibitive, extremely complex and causes major disruption to customers while also creating significant carbon emissions. Furthermore, 2% of damaged pipes was not enough to warrant a complete replacement.

The Solution

To actively manage the integrity of Blairlinnans water main and extend the life of the asset, Scottish Water opted to install Xylem's SoundPrint® Acoustic Fibre Optic (AFO) system - **a first of its kind within Europe**. The SoundPrint® AFO system is an industry leading technology consisting of a fibre optic cable installed inside the length of the pipeline that, in conjunction with the data acquisition (DAQ) system, allows detection and identification of the precise location of any breaks in the pre-stressing wires as they occur. As the wires break, the structural integrity of the main is reduced. Once a critical number of wires have broken in an individual pipe section, the main is at risk of catastrophic failure with potentially devastating impacts.

Data from the AFO system is complemented by Xylem's engineering service which combines expertise in hydraulic modelling,



Figure 1. SoundPrint® AFO consisting of a fibre optic cable installed inside the length of the pipeline.

PROGRAM HIGHLIGHTS

- A first of its kind within Europe
- Over 16 kilometres of pipeline continuously monitored
- 2% of pipes found to have wire breaks

SERVICES PROVIDED

- SmartBall® leak and air pocket detection
- PipeDiver® condition assessment
- SoundPrint® Acoustic Fibre Optic monitoring
- Transient pressure monitoring
- Structural analysis

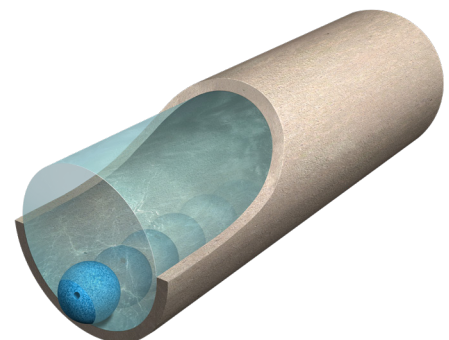


Figure 2. SmartBall® a free swimming tool to detect leaks and air pockets.

pressure testing and structural assessment to create valuable recommendations on how to manage the pipeline effectively. One engineering output includes Finite Element Analysis (FEA) curves which are used to determine if the number of wire breaks in a pipe section is cause for intervention or not.

It is only once a certain threshold of wire breaks have been detected that intervention is required to remediate the pipeline before it goes beyond its structural limits (as identified by the FEA curves). The combination of FEA curves and continuous wire break monitoring enables utilities to make smart, evidence-based decisions about which sections of pipe need immediate repair and which sections can be deferred until later.

The SoundPrint® AFO monitoring system was commissioned in June 2022 and enables Scottish Water to extend the life of their pipeline by monitoring its ongoing structural condition. A flow diagram for how asset owners manage their pre-stressed concrete pipelines using the AFO system is detailed in Figure 4.

The Results

Inspections and monitoring have provided the ability for Scottish Water to:

- Reduce the risk of failure by pre-emptively maintaining areas known to be in poor condition.
- Achieve cost savings by extending the life of remaining pipe sections that show either no damage or low-medium deterioration.
- Minimise water supply disruptions to customers.
- Maintain the utility's public reputation as a forward-thinking, reliable service provider.
- Reduce their CO2 footprint by offsetting emissions associated with pipeline renewal.

The Blairlinnans SoundPrint® Acoustic Fibre Optic system has proved to be a great success in remotely locating wire breaks which ultimately circumvent disastrous burst events. The AFO system not only equips Scottish Water with the data they need now, but it will also continue to support their future decision-making process.

“The SoundPrint® AFO system we have installed, in conjunction with the condition information from previous PipeDiver surveys, allows us to accurately monitor the condition of our trunk main and plan interventions to ensure the most resilient and reliable water supply to our customers. We made the decision as a company to create intervention points based on the Finite Element Analysis allowing us to create work packs to manage sections of pipework that are highlighted in the tool. A secondary benefit of this work means that we have more generic intervention work packs prepared for the functional sections of the pipe that can be accessed by our Intelligent Control Centre in the event of an incident allowing them to action any required intervention faster meaning less disruption to our customers.” Ian Dunsmore, Team Leader Strategic Water Infrastructure, Scottish Water

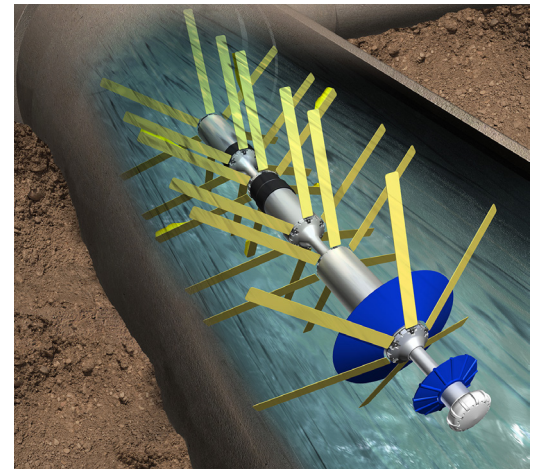


Figure 3. PipeDiver® inline free-swimming pipe condition assessment platform.

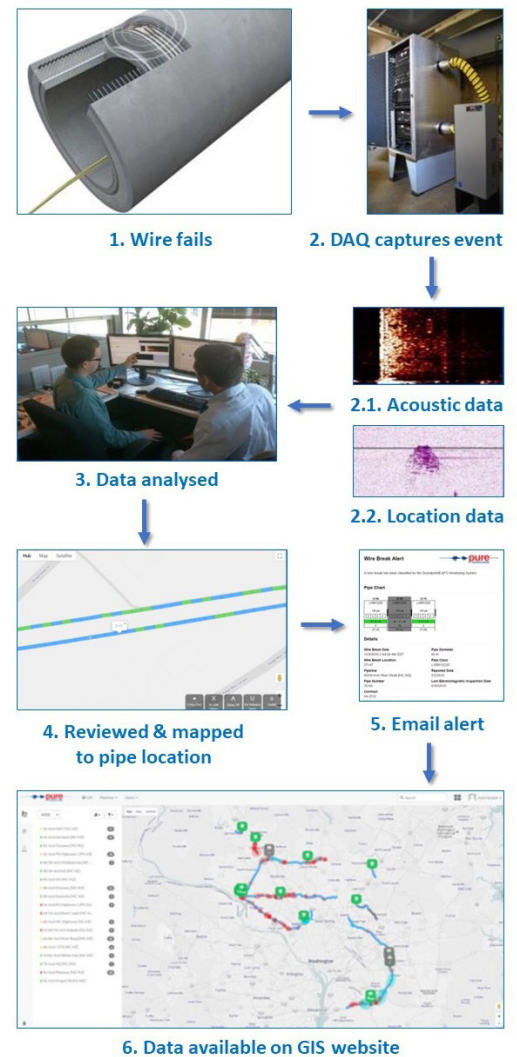


Figure 4. SoundPrint® AFO process from wire break to data visualised online.