Phocus® on Leakage

Anglian adopts new acoustic noise loggers for more efficient leak location

The recent advances in the new technology of acoustic noise logging and the operational benefits it can bring have been recognised by many of the major water companies as they look carefully at how this new technology can be deployed to further reduce their leakage levels.

Figure 1 Phocus noise logger installation

Anglian Water at Norwich decided upon the use of Phocus noise loggers to further reduce their leakage - aiming to employ the latest techniques which improve the effectiveness and efficiency of leak location. Phocus is produced by Primayer, one of the UK's top hi tech manufacturers of data monitoring and leak location systems, who are recognised for their innovative approach to new aqua technology and design, while maintaining a reputation of proven reliability in the field.

In principle acoustic noise is recorded at one-second intervals for two hours during the night, when background noise is likely to be lower. Noise amplitude (or loudness) will vary due to random effects, but there will always be a consistent minimum due to any noise that is always present - for example leakage. Furthermore, noise generated by a leak tends to have reasonably consistent amplitude.

Acoustic noise logging involves identification of recorded noise generated from a leak, followed by a comparison of noise amplitude information at different locations to determine the location of the leak.

Primayer's Phocus incorporates a high sensitivity accelerometer into a rugged, submersible, mechanical enclosure. This, combined with very low-noise electronics, gives improved sensitivity for detecting low amplitude leak noise. The result is improved performance on difficult leaks, including those on plastic pipes.

Phocus also includes other design innovations to enable improved performance in the field, these include being "powered for life" - effectively meaning no battery charging, and a large memory. The small size also reflects the practical need for the noise logger to fit into the smallest chambers and onto valve spindles where the covers can then be closed. Phocus is also submersible to IP68, to allow data to still be collected from flooded chambers.

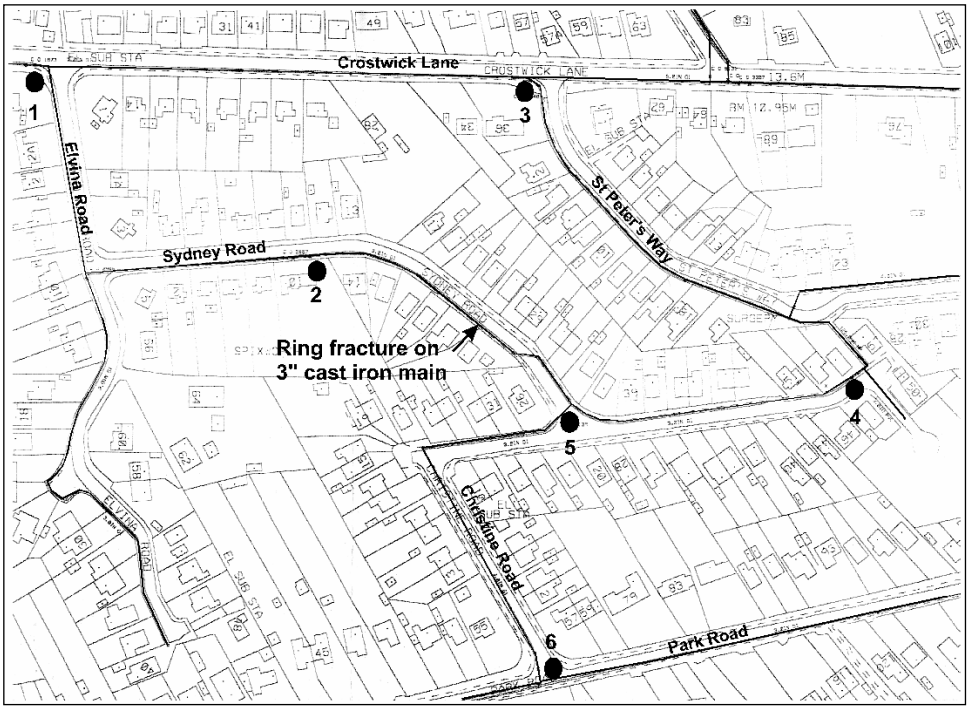

Figure 2 Map showing noise logger location

Anglian recognised that the combination of two of these features greatly increased the operational usefulness of the noise loggers. Since Phocus is powered-for-life and this is combined with a large, flexible, memory - there is a choice of conventional, short term deployment or, alternatively, much longer term or permanent deployment, to investigate difficult, ongoing, problems. This opens the possibility to compare, the most recent 'night' with one several months previous, to ascertain how acoustic noise, and thus leakage, might have changed over a period of time.

The deployment of Phocus in Norwich typifies the

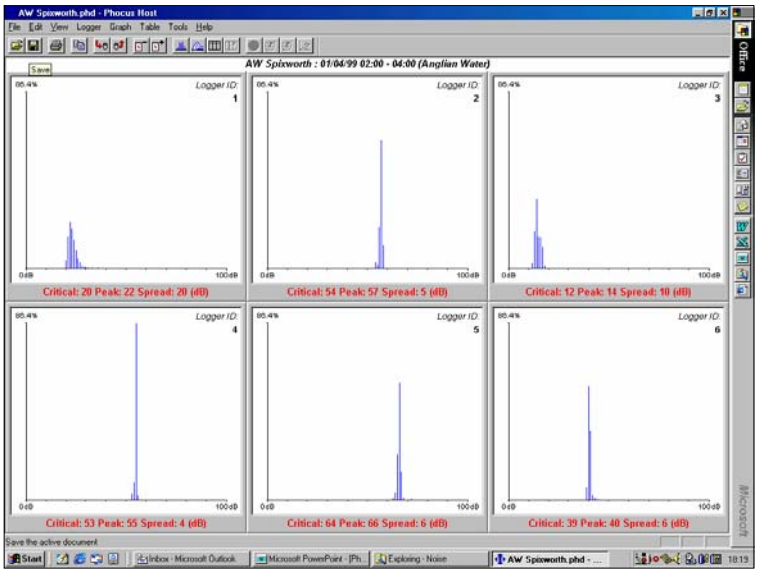

Figure 3 2D graphs indicate leak noises at loggers 2, 4, 5, and 6

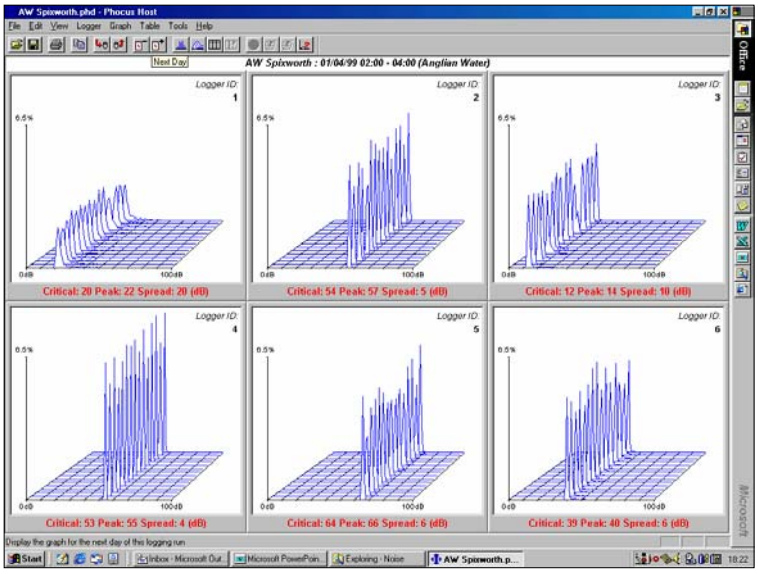

Figure 4 3D graphs show noise variation with time

results that have been achieved using this new technology.

The area has ageing cast iron pipes and was known to have leakage problems from a high night-line. A set of six noise loggers were deployed throughout the DMA. They were positioned at selected locations and set to log from 0200 - 0400 hours. They were moved to a new location each day. All loggers were fitted on the top of valve spindles with the small size of Phocus allowing the chamber covers to be closed. The distance between loggers varied between 50 metres and 250 metres.

Figures 3 and 4 show graphical representation of the variation of noise obtained from the six locations. The graphs indicate noise amplitude measured in dB on the x-axis, number of samples (e.g. how often measured at one-second intervals) on the y-axis and time (through the two-hour window) on the z-axis. Leak noise is characterised by little change in loudness (narrow spread in dB) which is measured frequently (high on the y-axis). When other, parasitic, noises are present then skewing of the characteristic occurs.

Phocus employs further statistical analysis, similar to the methodology developed for the Socrates Leakage Analyser, to produce a ranking table of results (Figure 5). This shows logger positioned closest to a leak at the top of the table and the others in descending order of distance from the leak. Here loggers 2, 4, 5 and 6 all show typical leak noise characteristics, with loggers 2, 4 and 5 having the highest critical noise amplitude (the consistent minimum noise), at 54dB, 53dB and 64dB respectively. This indicates the leak is likely to be between loggers 2 and 5, or possibly 4 and 5, but closer to 5. The table shows the result of the statistical analysis indicating a leak between loggers 2 and 5.

Subsequent leak noise correlation between loggers 2 and 5 produced a clear peak at 43 metres from logger 5. This, upon excavation, was found to be a ring fracture of the 3 inch cast iron main, in exactly the correlated position.

There is little doubt that noise logging forms a valuable link between leakage determination (via DMA flow-metering) and leak pinpointing (via correlation or listening). It is a non-intrusive technique where the cost of deployment is minimal.

Following the deployment of the Phocus noise loggers in Norwich, it was possible to move through the DMA efficiently and focus location effort in the area where the leak was situated.

Phocus noise loggers are now used routinely within the Anglian Water region, reflecting their ease of use and rapid achievement of results. There is little doubt that leading edge products like Phocus will continue to assist Anglian Water in achieving their leakage targets.

Metering Area	Supply Area	Order of Log	Logger ID	Location of Fitting	GPS Ref. N	GPS Ref W	Notes	Leak Confidence	Critical (dB)	Peak (dB)	Spread (dB)	Counts (%)
CM342		5	5	Christine Road / Sydney Road				4	64	66	6	57
CM342		2	2	Sydney Road				3	54	57	5	62
CM342		4	4	Playing Field				4	53	55	4	86
CM342		6	6	Park Road				4	39	40	6	55
CM342		1	1	Elvina Road				1	20	22	20	22
CM342		3	3	Crostwick Lane				1	12	14	10	34

Figure 5 Ranking Table – logger proximity to leak (closest at the top, furthest at the bottom)