The Reality Of Leaks: Cost-Effective Strategies For Real Water Loss Recovery

Reducing water loss starts with proper perspective. In distribution systems that do not yet have permanent infrastructure monitoring for active leaks, even the approach to evaluating such infrastructure requires a new perspective. Here is how different technical approaches can make a difference, regardless of the age of the system or the pipe materials it uses.

The Economics Of Leak Detection And Prioritization

For operations management and C-level decision-makers at water distribution systems experiencing high water costs, real and apparent non-revenue water (NRW) losses, water scarcity, or rapid growth, the need for change is obvious but the cost of it raises concerns.

Fortunately, affordable strategies for leak detection and repair do not necessarily require all-or-nothing capital investments. Utilities can take a tiered approach to investing in solutions that will help them identify and remediate their most egregious risks for real water loss first. Whatever the approach, a fundamental aspect of cost-effective leak detection and prioritization is having low-cost, permanent sensing capabilities to focus attention on key factors:

- **The majority of leaks (70 percent) occur on service lines.** Even at less than 1 gpm, that can add up to a lot of real losses if those leaks go undetected for years.
- **Increasing pressure to satisfy customer complaints is not the solution.** It only forces more water through those leaks and endangers other areas of weakness in adjacent infrastructure.
- **Leaks change over time.** Not all leaks deteriorate at the same pace. Good tracking systems can identify when they cross the threshold to a higher level of concern.
- **A holistic approach can save more than just the cost of water.** A comprehensive approach to water operations management should improve infrastructure management and reduce the risk of liability for damage caused by leaks.

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Figure 1. Affordable acoustic sensors that provide up to 20 years of field life for leak detection on metal and plastic pipe are just the first aspect of a comprehensive water operations management solution.

The Mechanics Of Leak Detection

Getting to the root of the problem involves both structural and logistical considerations related to aging infrastructure, population growth, mixed pipeline materials, and other operating conditions. Technology options include acoustic, pressure, optical, and ultrasound monitoring — each with its associated advantages, operating requirements, and costs.

For example, non-invasive acoustic sensing can pinpoint leak locations accurately (Figure 1), but because sound does not transmit through plastic the same as metal, using it for standard correlation techniques on plastic pipe requires closely spaced extra sensors. Alternately, using a temporary 'lift and shift' approach to limit the number of acoustic sensors required can drive up labor costs and provide only a snapshot of system leaks at a point in time, not a continuous view.

By contrast, a low-cost pressure and triangulation approach can make permanent sensor installation more affordable for continuous monitoring at numerous service line locations — including segments served by plastic pipe. It can blanket a distribution system well enough to narrow down leak locations to the point where repair crews can confirm the exact location cost effectively by using a second technology such as a ground microphone. While district metered areas (DMAs) are not yet widely used in the U.S., utilities are starting to recognize their value associated with pressure-based leak monitoring solutions.

Pressure monitoring can also highlight sudden starts and stops of flow at high-volume industrial accounts that can introduce water hammer and cause leaks by placing added stress on nearby weak spots. And it can identify increased pressures at low points in hilly terrain that can exacerbate leak rates unless managed by pressure control valves.

What Makes Leak Monitoring Cost-Effective?

Using affordable sensor and transmitter units, networks, and analytical systems (Figure 2) that make it more practical to collect and analyze leak detection data as a proactive solution improves short-term and long-term decisions for infrastructure repair and replacement. That approach makes it easier to establish Infrastructure Leakage Index (ILI) and Loss Cost Rate (LCR) key performance indicators (KPIs). It also enhances operational visibility, operational efficiency, event management, and real loss leak management.

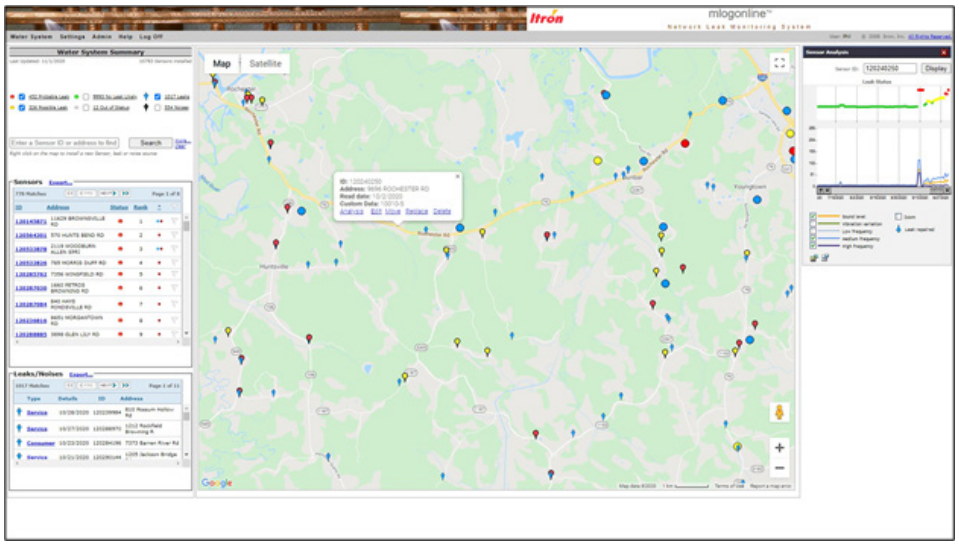

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Figure 2. Continuous monitoring of signals from acoustic and pressure sensors can help water distribution utilities map newly emerging leaks and deteriorating existing leaks by service location, with added insight to make optimal decisions about repair efforts.

Best of all, water operations management solutions that integrate multiple sources of pressure, flow, acoustical, GIS, hydraulic modeling, and even billing data into one platform (Figure 3) — instead of tracking them through different departments — support a more holistic approach to decision-making in order to:

- **Identify Emerging Problems.** Permanent pipeline monitoring can identify anomalies in operating patterns, quantify emerging leak issues as soon as they occur, and track their progress over time better than intermittent pipeline inspections.

- **Establish Leak Patterns For Better Decision-Making.** Whatever a water utility's priorities — water scarcity, cutting real losses, forestalling capital investments in new water treatment capabilities, etc. — better leak detection and documentation provide greater insight for cost-effective decision-making:

    - **Repair vs. Replace.** Better analysis of leak frequency and severity patterns in a segment of the distribution system or by a given type or age of pipe material can support better repair/replacement decisions.

    - **Now vs. Later.** Certain small leaks can be repaired affordably before they grow to the point of requiring large equipment and road infrastructure repairs, but not every leak necessarily demands immediate repair. Continuously monitoring for sudden changes in water loss rates can help to determine the optimal repair time based on a utility's unique circumstances of water availability, treatment-plant costs, and capital/operating budgets.

- **Prioritize High-Value/High-Volume Leaks.** Integrated solutions help users prioritize leak repairs by volume of loss, ease/cost of repair, risk of critical infrastructure failure, risk of ancillary damage, etc.

- **Protect Critical Resources/ Services.** Continuous leak monitoring makes it easier to manage concerns about

potential service disruptions to critical customer locations, such as hospitals, large industrial users, and high-rise buildings.

Finally, Extrapolate Success From The Experience Of Others

As utilities look to the future and consider how to combat NRW losses, one of the best ways to appreciate the value of cost-effective, permanent leak monitoring is to compare the experiences of other utilities that have already embraced the concept. Here are examples of how one utility used district metering analysis to effect an average 33 percent reduction in monthly NRW losses — and occasionally up to 50 percent — while another used comprehensive water analytics to cut its real losses from 22 percent to just 5 percent of treated water.

With that insight, affordable sensing technology, and targeted use of analytical software, every utility is capable of crafting its own most cost-effective strategy for real water loss recovery — regardless of the age or makeup of its infrastructure. ■

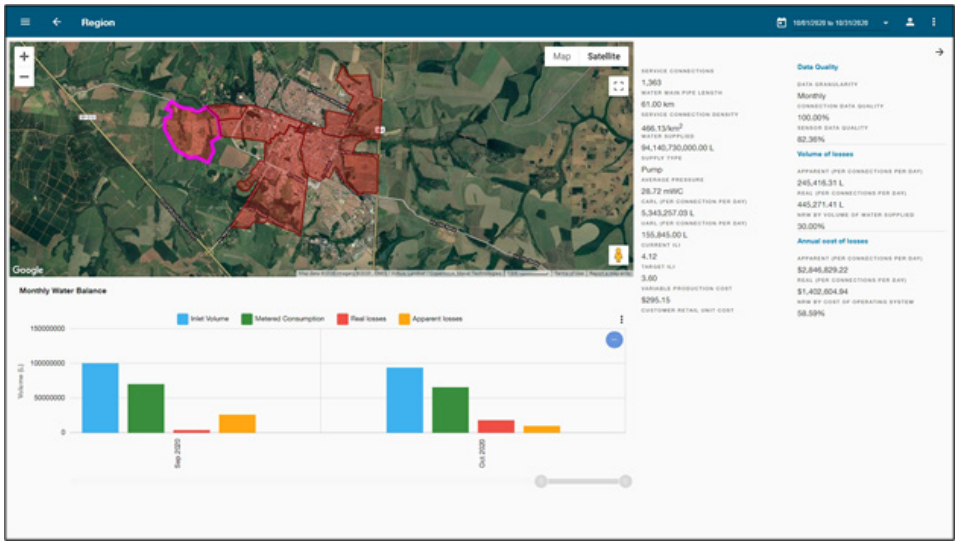

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Figure 3. Water operations management solutions that integrate multiple capabilities in one system — e.g., distribution infrastructure performance, GIS-indicated repair locations, performance analytics, etc. — can have positive impacts on improving overall efficiency while reducing real and apparent losses.

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