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MOVING FROM “X-RAY” TO “MRI”

Many of the pipes in Racine's pilot area often surcharged during dry or wet-weather events, while some only surcharged during wet-weather events. As a result, CCTV observations were often inconclusive or unable to locate specific sources of active infiltration.

While metered flows at pump stations could identify peak flows, entry paths for water entering the network at specific joints, bad service connections, defective manholes or internal cracks in the wall of the pipe, were not apparent.

A new level of diagnostic tool, akin to what can be found in modern day MRI readings, compared to old style X-Ray, was about to be put to the test. Working with the only ASTM-compliant supplier of low voltage conductivity,
Sacramento-based Electro Scan Inc. was contracted to locate and measure all of the potential leak sources, before and after CIPP. Using the same coax cable and reel typically used for a high-resolution CCTV camera, a focused array of low voltage electric current (i.e. 40 milli-amps or 5AA batteries) measured the variation of electricity that escaped through openings (i.e. defects) in a pipe’s wall.

Given a surface located grounding stake, any opening in a pipe means that electric current inside the pipe would always take “the path of least resistance” to seek out the above-ground stake to complete its circuit. And, since a common footage reading is available using the same footage en-coder, defect locations could be easily compared between CCTV & Electro Scanning Inspection.

In contrast to CCTV inspection, the new approach would be able to locate and measure defects inside the bell and spigot of each joint, defects at lateral connections, cracks often hidden by fats, oil and grease (FOG), and defects beneath silt — not typically visible by CCTV operators.

More importantly, the technology would also be able to identify leaks in CIPP liners, such as accidental cuts, accelerant burns, bad resin mixtures, degraded epoxy, fins and folds, poor service reinstatements, overcooking, ridges, and wrinkles.

### PRE-REHABILITATION DIAGNOSIS

On Nov. 11 and 12, 2015, Electro Scan Inc. completed the pre-rehabilitation portion of the assessment on approximately 5,550 ft of sanitary sewer mains. The diameters ranged from 8 to 10 in. and pipe material was primarily concrete. The results of pre-CIPP Electro Scanning Inspection include:

- 28 pipe segments were assessed to have an estimated infiltration rate of 1,186 gpm or 1,707,840 gpd, (+/- 40 percent), with 133 gpm from “severe” flows (4.0 gpm to 10.0 gpm).
- 1,286 leak locations were detected, with 180 rated as “large” (700 to 4,000 mA).

### POST-REHABILITATION DIAGNOSIS

On April 5 and 6, 2016, Electro Scan completed the post-rehabilitation assessment on the same pipes, after CIPP liners were installed. The results of the post-CIPP Electro Scanning Inspection include:

- 28 CIPP pipes assessed have a potential to infiltrate 301.96 gpm or 434,823 gpd, (+/- 40 percent); 230 gpm came from “severe” flows (4.0 gpm to 10.0 gpm).
- 96 potential leak locations were detected, with 40 rated as “large” (700 to 4,000 mA).

When SEH compared the pre-rehabilitation scans to the post-rehabilitation scans, the total potential infiltration was reduced by an estimated 75 percent or 1.273 million gpd and defects were reduced by 93 percent. While 24 of the 28 pipes had defects, there were four of the 28 pipes, or 19 percent of total linear feet, showed minor increases in defect flow. The Electro Scan results of these four pipes corresponded with the post-lining videos which showed significant interstitial flow, which was now concentrated at the lateral reinstatements.

### GOING FORWARD

The City of Racine is continually monitoring I/I reductions using flow monitoring and comparing to the estimated reduction provided by the low voltage conductivity results. Thus far, it is showing promising results. The reduction in I/I will be used to help in decision-making on the most cost effective rehabilitation strategies in the future. Additionally, the data gathered will be used to make judgments on lateral rehabilitation strategies, so flows will not be higher after a pipe has a CIPP liner installed. Racine can use the information to repair lateral reinstatements which leak the most, and avoid rehabilitating lateral reinstatements that are leak-free. Lastly, Racine intends to use results from its project as a measure of effectiveness (MOE) when reporting I/I reductions in its annual CMOM report and to demonstrate I/I reduction to Racine’s sanitary sewer treatment provider.

Carissa Boudwin is director of marketing at Electro Scan.