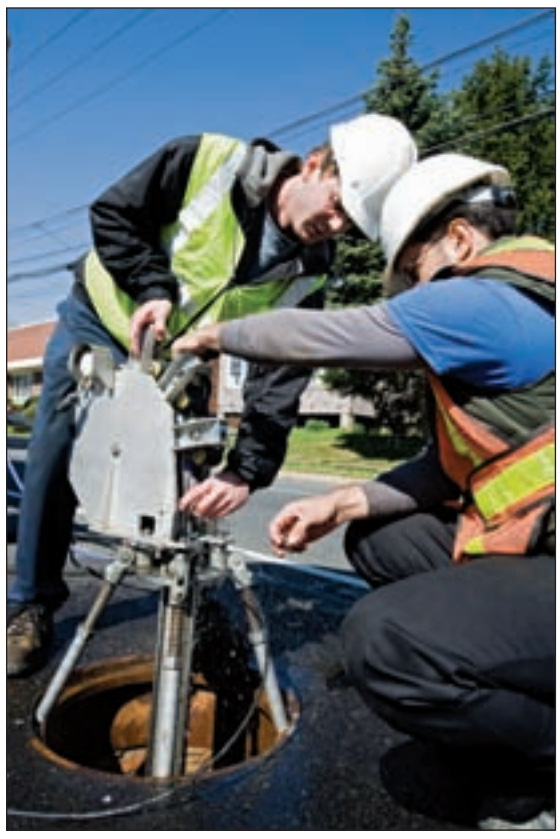
By David S. Jones



PWD staff tried unsuccessfully to locate the leak with above-ground technology before turning to Sahara, a leak detection tool designed for live inspection of large-diamater water mains.

Large-diameter pipeline leak detection provides less rupture risk

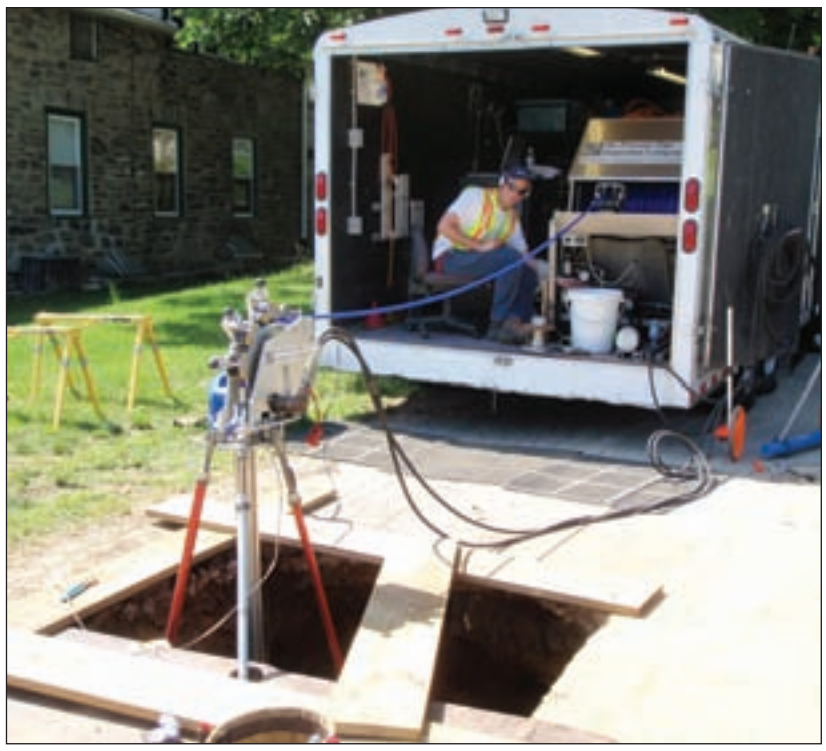
The water utility crew crowded behind the field technician monitoring the incoming data, jostling to get a better look at the small computer screen. The crew had just finished helping field technicians set up a special apparatus attached to a 48-in.-diameter transmission water main pipe located under a street in downtown Philadelphia. They watched as a small rod-like acoustic hydrophone sensor device about a foot long and an inch in diameter was tethered to a 6,000-ft spool of special fiber-optic cable driven by a powerful truck-mounted electric winch. The acoustic sensor was inserted into a cylindrical launch tube on top of the pipe, a ball valve was opened and the sensor device and cable were inserted into the "live" water main pipe pressurized at more than 70 psi.

Locating Leaks

It was the moment of truth for the Philadelphia Water Department (PWD), which was experiencing a critical deployment of Sahara, a leak detection tool designed for live inspection of large-diameter water mains, at an elusive leak site. Inserted directly into a live pressurized water pipe, the tool detects the location of water leaks while pulled through pipeline by a small water-driven parachute and transmits an acoustic signal to the surface through the attached cable.

A busy interstate highway carrying tens of thousands of daily commuters in the heart of downtown Philadelphia follows a route that dives underground in a depressed section of highway cutting across the city. Built 50 years earlier, a pair of large-diameter water mains were rerouted to run deep beneath the highway. The steel pipes used were excellent for handling the stress of high-pressure water mains, but very susceptible to corrosion. Water drained from this depressed highway after a heavy rainfall goes to a nearby storm water pump station, where it is pumped up to a sewer at street level. The water drainage system worked for decades without incident, until the pump station technicians reported that their storm water pumps had begun operating continuously—even during long periods of dry weather.

Water leaking from many nearby distribution pipelines might account for the continuously operating pumps, but engineers worried that the source might be the water mains running underneath the depressed highway. A pipeline failure there could cause the highway road surface to collapse, releasing vast amounts of water, threatening public safety and causing widespread property damage. It could mean costly repairs, lengthy traffic interruptions and a legal liability nightmare for the city. With millions of dollars at stake, PWD engineers turned to Sahara.



Rupture Risk

As soon as the Sahara leak detection sensor entered the water pipe running under the highway, the surface operator detected a large water leak about 20 ft down. The device used in Philadelphia was deployed by the Pressure Pipe Inspection Co. (PPIC). The location technology pinpoints leaks within a foot of accuracy, using a sophisticated acoustic sensor that detects sound created by water escaping from pressurized pipe.

The device quickly found a second, bigger leak in the water main underneath the highway.

"The leak was taking water out of the pipe so fast that it literally sucked the sensor through the hole in the pipe wall," said PWD engineer George Kunkel.

In contrast to free swimming-ball leak detection solutions, the cable-tethered Sahara device is designed to cope with this situation. Its surface operators moved quickly to extract the sensor from the gushing hole, engaging the truck-mounted electric winch to pull the sensor out and rapidly retrieve it to the surface.

PWD technicians had tried to find the source of the leak using traditional surface acoustical detection methods, but the pipes running underneath the highway were too deep and inaccessible to survey as such.

"I would say we spent $100,000 over 10 years in unsuccessful attempts to locate this downtown leak using traditional above-ground detection technology," Kunkel said. "Sahara found it within minutes, and at a fraction of the cost." Also, the utility avoided taking pipeline out of service, dewatering the line and manually inspecting it.

Delivering Results

Philadelphia has the oldest pipes in continuous service in the U.S., with some segments of its water system going back to the 1820s. The city suffers an average water leakage loss of more than 50 million gal per day (gpd). Philadelphia has used Sahara to survey 22 miles of pipelines. To date, it has found 45 leaks, with an average daily savings of roughly 6,000 gpd.

Since the mid-1990s, Sahara has found more than 2,000 leaks in more than 1,000 miles of pipeline. PPIC's ongoing research and development is expanding the tool's capabilities; adding an onboard video and lighting system to visually inspect interior pipe walls while still in service; and promising new acoustic technology for measuring wall thickness of metallic pipes to gauge the strength of corroded pipe walls and estimate their remaining service life. WWD

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