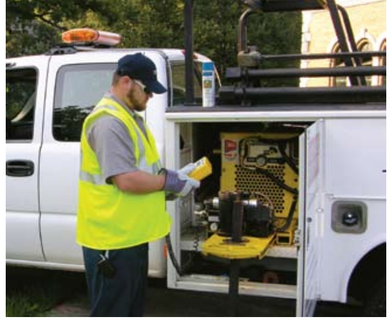

Wachs Water Services staff performing a valve assessment for the city of Baltimore.

A GIS field manager validating field-collected data.

TIME: the unforgiving enemy

Boosting emergency preparedness with GIS integration and valve management

By David Stewart Jones

Two days before Christmas in 2008, an aging 66-in. water main burst in a major eastern U.S. city, flooding the area with nearly 50 million gal of water at a rate of 150,000 gal per minute (gpm). Roads transformed into 4-ft-deep rivers, creating whitewater rapids that wrecked cars and smashed buildings. Helicopters, boats and fire trucks rescued trapped residents and transported them to safety, as utility crews struggled to shut down the ruptured main. As millions watched the dramatic footage on TV, the water distribution industry collectively winced.

Inspection of a 72-in. water main break in Baltimore.

Damage caused to a roadway by a 72-in. water main break in Baltimore.

With inevitable regularity, similar water main breaks over the past three years have devastated streets, businesses and homes in major cities across North America. In each case, utility crews responded almost instantly, deploying to the scene and attempting emergency procedures to shut down the broken water main. But the severity of flooding and property damage in each case dramatically increased because the responding utility workers lost the battle against their most unforgiving enemy: time. Locating, accessing and closing all the pipeline valves feeding the broken water main took almost eight hours in the 2008 incident. Why?

"It took hours and hours to shut down these broken mains because utility crews often didn't know which valves to open or close," said Dave Lewis, account manager for Wachs Water Services, who said another big problem faced was the lack of accurate asset location and operational status information. "The crews often couldn't find the right valves to shut off the flow of water to the broken main," he added. "And when they finally found the right valves, many just didn't work."

The rising number of significant pipeline failures is prompting many water utilities and municipalities to improve their emergency response efforts by leveraging GIS location-mapping technologies. GIS "smart maps" have become a necessary and indispensable tool for public utilities managing water, wastewater and storm water distribution systems. Merging cartography, statistical analysis and database technology, GIS accurately pinpoints locations of buried pipelines, valves, manhole access and other "out-of-sight" system equipment, and it enhances informed decision-making by storing, displaying and managing that asset data for analysis.

Water utilities also are turning to comprehensive valve management services. Valve management ensures utilities can find and operate pipeline valves quickly in response to a system event or catastrophic failure. Specialists in pipeline infrastructure assessment and rehabilitation services, Wachs Water Services helps utilities and municipalities precisely locate, assess and test the thousands of pipeline valves in their water distribution systems and record accurate valve location data, operational history and functional status into a utility's GIS system. Integrating field-verified valve management data into a powerful GIS system mitigates risk by delivering the operational intelligence that utilities need to accelerate emergency response to a major pipeline failure.

Operational Intelligence: The Best Defense

Just before rush hour in September 2009, a 72-in. prestressed concrete cylinder pipe water main suffered a catastrophic failure near a busy Baltimore street intersection. Gushing at 175,000 gpm, the broken main submerged residential areas in water 4 ft deep. More than 6,000 homes were impacted, and hundreds of emergency services employees were deployed. In contrast to the 2008 catastrophic failure during which municipal crews struggled with valves for eight hours, the Baltimore Department of Public Works (BDPW) field crews shut down all pipelines feeding this ruptured main in less than two hours.

"Having the operational intelligence from our GIS system saved the day," said Anthony Stevenson, water maintenance superintendent for BDPW. "Using our GIS system, we knew exactly where the key valves were located, whether they were in an open or closed position and whether or not they were currently operable," Stevenson said. "We even knew how many turns were required to operate the valve, when it was last operated and why."

Field crews from BDPW and Wachs Water Services converged on the scene of the water main break almost immediately. Providing valve management and GIS information integration services for the Baltimore utility, the Wachs Water Services team had helped locate and test thousands of valves in the city, and helped develop emergency response plans and special training specifically designed for this catastrophic failure scenario.

"You can't just go in and start shutting off stuff—you have to have a plan," Stevenson said. "Wachs gave us a detailed plan for how to shut down this main, including information needed on all valves involved and the specific pattern necessary to execute the shutdown in a manageable way. As a result, we knew exactly who to deploy, where to deploy them and what they needed when they got there."

The plan included alerting hospitals, churches, nursing homes and other places where people would be most vulnerable to the effects of the emergency. Utility officials updated the public in real time, explaining in detail exactly what to expect, how the utility is handling the situation and how the emergency will affect them. Prepared maps and graphics illustrated the areas involved, the critical facilities affected and the utility's plans for providing alternative sources of water for the duration.

"We were lucky to some degree, but primarily we were just very well prepared," Lewis said. "We knew exactly what to do, we did it and we did it as quickly as could be done under the circumstances—and having the key operational intelligence instantly accessible in the GIS system made all the difference."

Preserving Valuable Institutional Knowledge

The GIS system's key role in emergencies sometimes overshadows its less dramatic function in routine operational planning and daily management of a vast water distribution system that serves 1.8 million customers. The Baltimore Metropolitan Water System manages three reservoirs feeding 3,500 miles of pipeline, 64,000 valves and 22,000 hydrants. Engineers responsible for managing this vast water distribution system quickly recognized the inherent value of using geospatial asset data in their daily tasks.

"There is no difference between using a GIS system in an emergency or using it every day for operational planning purposes," said Opinder Singh, chief of water engineering with the BDPW. "The same capabilities help in the same ways. As a planning and reference tool, GIS is invaluable in understanding distances and locations when used along with traditional engineering tools."

Baltimore's GIS system also serves another key role: preserving and transferring the utility's valuable institutional knowledge. Field crew employees with BDPW average 10 to 15 years' experience, and about 15% of those highly experienced employees likely will retire in the near future.

"We are using the GIS system as part of a 'knowledge-base' tool for new employees," said August Severn, general superintendent for BDPW. "The idea is to electronically capture the accumulated expertise and experience of today's veteran field crews and transfer that hard-earned knowledge to the next generation."

According to recent American Water Works Assn. reports, almost 40% of a utility's pipeline valves are likely to be inoperable if they go untested or field-exercised beyond five years. Specialists with Wachs Water Services said their industry experience confirms this and that Baltimore had a similar high percentage of inoperable valves when the company began performing valve management services for the utility. Today, Baltimore's 64,000 pipeline valves approach about 94% operability—among the highest in the nation.

"Baltimore has been visionary in their integration of GIS and their asset data, and they are leading the country with their proactive management of their valves and their entire water distribution system," said Joe Scriptunas, Wachs Water Services project manager.

"In our business, your valves are your only defense and your only salvation when your pipes go," Severn said. "And all pipes are destined to go someday." WWD

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