PUBLIC SECTOR DIGEST
INTELLIGENCE FOR THE PUBLIC SECTOR.

THE NEXT BIG THING FOR PUBLIC WORKS: NEW WATER TECHNOLOGY FOR MORE LIVEABLE CITIES

ANNE KERSHAW, ONTARIO CENTRES OF EXCELLENCE

Asset Management

FEBRUARY 2014
www.publicsectordigest.com

ASSET MANAGEMENT

THE NEXT BIG THING FOR PUBLIC WORKS: NEW WATER TECHNOLOGY FOR MORE LIVEABLE CITIES

ANNE KERSHAW, ONTARIO CENTRES OF EXCELLENCE

This summer, the City of Waterloo set out to rehabilitate about four kilometres of cast iron pipes within their water distribution system with a structural liner. Like aging infrastructure in most cities and towns across North America, Waterloo is experiencing iron pipe corrosion and associated discolored water and structural concerns. Another worrisome problem was biofilm growth in the iron pipes creating the potential for water quality to be compromised.

"Budget-conscious government officials and environmentalists are becoming increasingly concerned about what has been identified as the water-energy nexus. Pumping water through clogged, narrowed pipes requires more pressure and therefore more energy."

In keeping with conventional approaches, Waterloo constructed a provisional bypass pipeline system to keep water flowing to households while the main line was being renovated. The bypass installation took more than two months to install due to difficulties commissioning the temporary system to ensure that it met strict water quality standards, significantly increasing the cost of the overall project. "This is the kind of expense and frustration that many municipalities are experiencing when undertaking water main rehabilitation work," says Denise McGoldrick, Director of Water Services for the City of Waterloo.

I. THE PROBLEM

Canada's pipeline infrastructure is primarily made up of ductile iron, which is prone to corrosion and breakage. One way to extend the life of pipes and improve water quality is to clean them and then apply an inner coating or cured in place lining. So far there has been a dearth of technology development in this area. One approach is the application of spray lining techniques. This requires several components of specialized equipment to clean the pipe and then coat it. Achieving consistency coatings has been an industry problem. A more conventional approach has been to dig up old pipes and replace them, an extremely time-consuming expensive option.

The price tag for building a new system? That's not even within the realm of possibility. Just keeping up with repairs is daunting enough. According to the Water Quality and Health Council (WQHC), Canadian taxpayers spend about $82 million a year to repair broken water mains. The 2013 Royal Bank Canadian Water Attitudes study says it would cost $80 billion to replace drinking water, wastewater, and storm water infrastructure in "fair to very poor" condition across Canada.

"The dollar figures are pretty frightening. And the problems aren't going away," says Jonathan Pearce at the City of Waterloo. "A lot of people are overwhelmed by the magnitude of the problem but we have to be creative in finding solutions and developing the financial models that will make the system sustainable."

In its own search for solutions, Waterloo has partnered with the University of Waterloo and an innovative Ontario company called Envirologics Engineering to explore the potential of a ground breaking new technology that would largely do away with lengthy service interruptions to residents, traffic gridlock, and cost overruns.

Budget-conscious government officials and environmentalists are becoming increasingly concerned about what has been identified as the water-energy nexus. Pumping water through clogged, narrowed pipes requires more pressure and therefore more energy. Close to 30 percent of Ontario's total electrical energy usage in urban areas is consumed by pushing water through defective infrastructure and leaky pipes.

"Just as a heart works harder to pump blood through clogged arteries, so too do the pumps that provide potable water. When blockages become too constrictive in aging arteries, we have heart attacks. In water main systems, we have main bursts," says Randy Cooper, President of Envirologics.

Water loss due to cracked leaking pipes (up to 20 percent of treated water) also results in increased energy needs and higher water treatment costs. According to the Residential and Civil Construction Alliance of Ontario, a minimum of 327 million cubic metres of water are being leaked from the province's corroded and cracked pipes every year or "enough to fill more than 50,000 Olympic-sized swimming pools." The WQHC estimates that a single pipe leaking just one gallon of water per minute, for example, equals more than 500,000 gallons of water loss each year.

The overall hit to a city's energy bill can be harsh, with energy consumption growing to more than 50 percent of operation costs, says Dr. Mark Knight, Principal Investigator at the University of Waterloo and Executive Director of the Centre for Advancement of Trenchless Technologies (CATT).

II. THE SOLUTION

The gravity of deteriorating infrastructure and the daunting financial challenge facing towns and cities is being driven home. This fall, Ontario Centres of Excellence (OCE) and the Natural Sciences and Engineering Research Council (NSERC) approved funding for the Waterloo-based collaborative industry-academic project, entitled Novel Water Technology for Liveable Cities.

The project has a value of more than $500,000 (cash and in kind) and includes matching contributions from the company, Envirologics.

"The urgent need for solutions is growing with the increasing population growth in urban areas, aging infrastructure, and impacts of climate change," says Leanne Gelsthorpe, OCE's Business Development Manager with expertise in water issues. "We work with industry, academia, and all levels of government to build communities of interest in every aspect of environmental technology, including drinking water, wastewater, and source water protection."

Under the OCE-supported industry-academic partnership, the City of Waterloo will be testing new technology developed by the Bracebridge-based company Envirologics with the expertise of researchers at the University of Waterloo. Called the Tomahawk Mark 1, the technology uses crushed stones with a high velocity air stream to clean and ready the pipe to be lined. Accessing buried water pipes through small 'surgical' pits dug into the ground, the system can quickly eradicate the rust build-up and corrosive ridges that narrow a pipe's passageway. And employing expertly engineered deflectors, the abrasive material can be directed with precision to target a troubled area. The low cost, efficient energy system operates without water or chemicals, causes no damage to pipes, and avoids fouling fresh water supplies.

Once pipes are cleaned out, inspected, and dried, a special Ministry of the Environment approved coating is applied. Using the Tomahawk technology, the coating is injected into the air stream and down the pipe to quickly cover interior surfaces, adding decades of additional lifespan. Conventional approaches to repairing water pipe systems take about a week to do a street. Using the Envirologic's technology, the job can be done in a day, making it the fastest customer service model.

First piloted in Napanee, the novel cleaning technology has also been employed in Peterborough, Cambridge, St. John, New Brunswick, and Illinois.

III. THE A-TEAM

Each of the three partners in this unique collaboration plays a critical role. The City of Waterloo is providing the testing environment for the new technology. The municipality will be providing iron pipe samples taken during water main breaks or pipeline replacement programs and offering comments on the pilot study findings.

"Our philosophy at the city is very supportive of embracing new technological developments to help them advance. They have to be put into use before they can move forward," says Jonathan Pearce, the City of Waterloo's Construction Inspector. "If the City of Waterloo can show value from the new technology and how it works in a real environment, it will go a long way toward making other municipalities more comfortable in adopting it."

Along with the National Research Council, the City of Waterloo is a founding partner in CATT. Serving Canada and the northern United States, CATT helps municipalities address their buried infrastructure challenges through the use of innovative, low cost trenchless technologies. With extensive industry support, CATT has become recognized as an international leader on this research front.

Through its role with CATT, the City of Waterloo signaled its intent to ensure its residents benefit from innovations in delivery of municipal services. "Our relationship with the University of Waterloo and in particular CATT has positioned us to be at the forefront of new technology and to be part of a network that enables us to learn from others," says McGoldrick. "We have benefitted greatly from that partnership. It puts us at the table in testing and developing new technology and ensures that we have the comfort level needed to adopt it in our municipality."

Mark Knight, Director of CATT and the principal investigator on the project, says the role of the research team is to help the company further develop and optimize the effectiveness of the technology. "A lot of the work carried out to date has been done on a trial-and-error basis. By applying engineering research, we can improve the efficiency and productivity of the system."

The Waterloo engineering researchers will undertake lab testing and computer modelling to optimize all aspects of the system, including stone selection and the application and durability performance of the pipe coating, which will be NSF 61 approved to meet international safety standards for drinking water. They will also examine and review the airborne camera design to ensure optimal inspection and cleaning operations.

For the most part, Canadians remain blissfully unaware of the precarious situation beneath their feet. More than 80 percent believe their drinking water and wastewater facilities are in good condition and in no need of major or immediate investment, says the RBC study.

In reality, water distribution and sewage pipes in many municipalities are at the end of their projected service lifespan, about 50 years according to industry standards. The average age of Toronto's pipes is 54 years. Seventeen percent of its water distribution network has been in service for 80 to 100 years, and some parts for more than 100 years. This exceeds the accepted industry standard by more than 30 years.

Waterloo has about 800 kilometres of water and wastewater pipes in their asset inventory. The city would need to replace eight kilometres of pipe every year to have every pipe renewed in 100 years. The inconvenience to households, traffic delays, and labour costs make this prohibitive.

IV. THE DISRUPTIVE TECHNOLOGY

In the parlance of the innovation industry, the Tomahawk product is seen as having the potential to be 'disruptive technology'. "This technology has the potential to become a new tool in the tool box that can be used to extend the life of iron water piping at a lower cost than existing technology, with significantly lower disruption to its customers and traffic," says Knight. "Once proven, this technology will meet a market gap that currently exists in North America, provided it is cost effective and meeting performance requirements."

The technology, protected under patent applications now being filed in the province and worldwide, could become a global seller and success story for Ontario. Along with municipalities across Canada, U.S. and European cities are also grappling with the scourge of decaying pipes and the daunting budgetary implications. The latest American Water Works study in 2012 put the value of the market for water infrastructure renewal in North American alone at $500 billion over the next 24 years.

"As more cities become built up they do not have the space to rip up roads or the ability to have them lay open for months and months. So this technology will be very attractive to them, "says Gelsthorpe. "This completely changes the game as we know it," says Cooper of Envirologics. "There is nothing out there that can compete with us at this time. We are occupying a totally different place in the spectrum of the market."

"This is a win-win for taxpayers and municipalities," says Brian Thorogood, Program Manager of Envirologics. "And we get to be a part of bringing our solution to taxpayers across Ontario and around the world. It's great that a small company from a small town like Bracebridge would be able to have this impact around the world."

In recent years, OCE has been developing a holistic framework that recognizes the inter-relationship of energy, water, climate change, effective use of resources, and land use for food and agriculture, says Carole Champion, OCE's Director, Industrial Engagement and Sector Lead, Energy and Environment. "We strongly support efforts to better manage and support asset management and develop smarter cities and communities."

"I get very excited thinking about how greatly municipalities can benefit and industry can benefit as new ideas move forward. It's exciting to see new developments, new ideas, and new ways of looking at things," says Pearce from the City of Waterloo.

ANNE KERSHAW is Communications Manager for Ontario Centres of Excellence and a multiple national award-winning writer and author. She has extensive communications and journalism experience. This includes her previous work as Director of Marketing and Communications at Queen's University; City Editor and Editorial Page Editor at the Kingston Whig-Standard; and contributor to numerous national publications.