

TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING OF MAY 29, 2012
FROM:	JOHN BRAAM, P. ENG. ACTING EXECUTIVE DIRECTOR PLANNING AND ENVIRONMENTAL AND ENGINEERING SERVICES & CITY ENGINEER
SUBJECT:	EW3717 - CONCRETE PRESSURE PIPE INSPECTION FIBRE OPTIC INSTALLATION – AMENDMENT OF EXISTING CONTRACT

RECOMMENDATION

That, on the recommendation of the Acting Executive Director Planning and Environmental and Engineering Services and City Engineer, the following actions **BE TAKEN** with respect to amendment of contract for EW3717 Concrete Pressure Pipe Inspection – Fibre Optic Installation:

- (a) The contract value for Pure Technologies Inc., 3rd Floor, 705-11 Avenue SW, Calgary, Alberta, T2R 0E3, **BE AMENDED**
 - i. in the amount of \$336,382.00 from \$1,263,520.00 (excluding H.S.T.), to a revised total of \$1,599,902.00. (excluding H.S.T.),
 - ii. for annual monitoring costs at an upset limit of \$152,165 to pay for the long term acoustical monitoring of the pipeline as part of the installation of the fibre optic cable and computerized laser monitoring system,
 - iii. noting that this request for increase in funds is within the existing funding allocation for the project;
- (b) the financing for this project **BE APPROVED** as set out in the Sources of Financing Report attached hereto as Appendix "A";
- (c) the Civic Administration **BE AUTHORIZED** to undertake all the administrative acts that are necessary in connection with this project, and
- (d) the approval given herein **BE CONDITIONAL** upon the Corporation adjusting the existing purchase order for the work to be done and the materials to be supplied on this project.
- (e) the contract amendment **BE AUTHORIZED** in accordance with section 20.3(c) of the Corporation of the City of London's Procurement of Goods and Services Policy;
- (f) **IT BE NOTED** that the Corporation previously entered into a formal contract with Pure Technologies Inc. to undertake the installation of the fibre optic cable and acoustic monitoring system, and this work is an amendment of that contract.

PREVIOUS REPORTS PERTINENT TO THIS MATTER
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The reports noted below can be found at <http://www.london.ca/d.aspx?s=/Meetings/Default/meetingpackages.htm>:

- EW3717 Concrete Pressure Pipe Inspection – Fibre Optic Installation, April 14, 2010, Board of Control, Agenda Item #27
- Water Distribution System Needs Update/Final Report – Project EW 3802, August 30, 2004, Environment and Transportation Committee, Agenda Item #4
- Concrete Pressure Pipe Leakage Survey and Inspection EW3715 / RFP 06-32, January 31, 2007, Board of Control, Agenda Item #1
- Water System Risk Management Exercise and Evaluation, April 23, 2007, Environment and Transportation Committee, Agenda Item #3.

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BACKGROUND

Purpose

This report recommends the amendment of a previous project award to Pure Technologies to complete the fibre optic installation for acoustical monitoring of the large diameter concrete pressure pipe watermain between the Arva Pumping Station and the Springbank Reservoir (approx. 20km).

Background

The large diameter concrete watermain that connects the Arva Pump Station with Springbank Reservoir is one of the most critical links in our system and serves the majority of homes and businesses in London. The partial installation of the fibre optic line already in place is providing the City with real time acoustic data of any wire breaks that occur on the pipe. Information received from the fibre gives the City the ability to react immediately to prevent a possible break similar in scope and magnitude to the March 2010 Mt. Carmel watermain break on the Huron pipeline that feeds the Arva Reservoir. The section of pipe that is currently monitored and will be completed through the amendment of this award, is of the same vintage (1965) and was installed under the same provincial grant funding as the pipe that broke in Mt. Carmel in 2010.

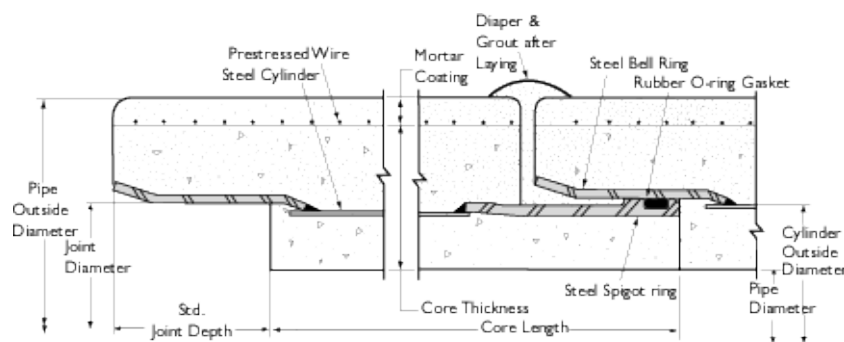
Discussion

Water is delivered to customers within the City of London by 1600 kilometers of pipe. Approximately 115 kilometers of pipe is Concrete Pressure Pipes (CPP), some of which are over 40 years old. These pipes are typically large diameter (450mm to 1350mm) and are some of the most important links in our distribution system with an asset value of approximately \$300 million. While it is anticipated that the life expectancy of these pipes may be in the range of 75 to 100 years, experience has shown that some individual CPP may fail at an earlier age. The Lake Huron Pipeline had two failures in 1983 and 1988 after approximately 20 years of services, but has not had any recent failures until the one in March 2010. These failures occurred in unpopulated areas and were repaired in a timely manner with minimal affect to City water supply.

Several municipalities in Canada and the US have experienced CPP failures resulting in an average repair cost of \$1.7 million (AWWA Research Foundation 2007 Study <http://www.awwarf.org/research/TopicsAndProjects/Resources/SpecialReports/2607/SupplementalReport.pdf>). These costs include direct costs to the utility to repair the pipe, account for lost water, claims settlement, business loss, and social impact. Compounding the risk equation for these critical infrastructure links is that they are sometimes in close proximity to residential and commercial properties. The most public and costly local example of a watermain failure in an urban area occurred on a 300mm in diameter pipe in 2007 and is now known as “The Dundas/Wellington Sinkhole.”

Discussion – Previous Work

Concrete Pressure Pipe (CPP) is a composite pipe manufactured using a thin steel cylinder with an inner liner of concrete a few centimetres thick. After the initial curing of the inner liner a high strength prestressed wire is spirally wound around the outer steel cylinder. A mortar liner is then placed on the outside of the steel cylinder which encases the prestressed wire and the steel cylinder providing a protective outer layer of cement mortar. The integrity of the composite pipe construction is highly dependent on the prestressed wire keeping the concrete core in compression.



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Over time the protective mortar can breakdown and expose the steel cylinder and the prestressed wires to corrosion. As the prestress wires corrode, some may break. If enough wires break, the pipe section may fail. Due to the age of these pipes, it is possible that there are some broken wires. Since the summer and fall of 2007, Pure Technologies have carried out four different inspections on our 1965 CPP that links the Arva Reservoir to the Springbank Reservoir:

1. Leak Detection – provides a current condition of the pipe by determining if there are any leaks in the system. This inspection was carried out in the section from the Arva Reservoir to Huron St.
2. Electromagnetic Inspection – provides a scientific analysis of the internal condition of the prestressed wires. This tool was used on the section of pipe between Arva Reservoir and Fanshawe Park Road.
3. Visual Internal Inspection – determines if there is any breakdown in the internal concrete layer. The inspection was carried out during the electromagnetic inspection.
4. Installation of Acoustic Fibre Optic Monitoring cable (AFO) – provides real time, GPS located information on when and where a wire break occurs. The City currently has 13km installed and active between Arva Pump Station and Whetter Ave.

Each inspection has been carried out inside the pipe. The leak detection was completed using a proprietary tool called the SmartBall that rolled down the pipe from Arva Pumping Station and listened for any leaks and found no leaks. The visual and electromagnetic inspections were carried out by members of Pure Technologies by draining the watermain and physically entering the pipe to do the work. The overall results were excellent. Pure found less than five wire breaks on a few different sections of pipe, they also noted that internally it was one of the best pipes they had every inspected for condition.

Since the AFO system has been installed and activated, the City has received 8 wire break alerts. It has not raised any alarms as none have been on the same section of pipe, and are scattered throughout the 13km length of monitored pipe. The prestressed wire spirally winds around the pipe over 100 times without a series of wires breaks on the same pipe, the individual alerts do not require immediate intervention. What is apparent, however, is that the pipeline is experiencing a level of distress and should continue to be monitored to allow water staff to react before a catastrophic failure of this concrete watermain.

Figure 1 Screen shot of wire break website noting location, number of breaks on an individual pipe in the monitored length .

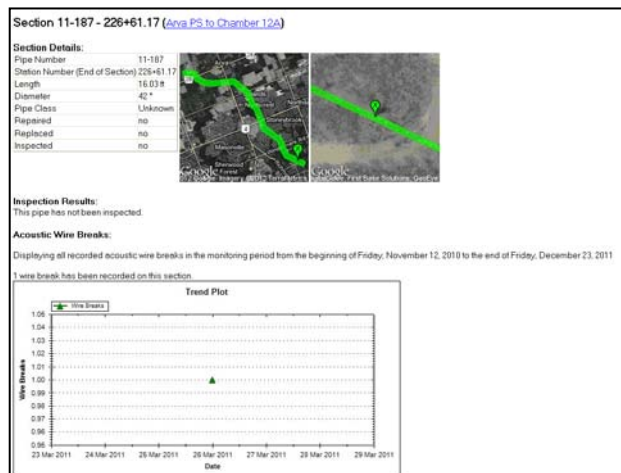


Figure 2 Photo of Pure staff installing the fibre optic cable just south of the intersection of Trevithen and Weston St.

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In Washington, DC where Pure Technologies has an extended service contract with the Washington Suburban Sanitary Commission (WSSC), the acoustic fibre optic monitoring system (AFO) that London is installing prevented a catastrophic break on the July 4th long weekend in 2010. A series of wire breaks were heard a few days prior to Independence Day in the US which led WSSC to shut down a 1650mm diameter watermain which put 1.8 million people on water use restrictions over the July 4th weekend. WSSC staff were able to confirm severe corrosion when they removed and repaired the pipeline.

The City of Ottawa has now installed the same AFO system on the Woodroffe watermain that broke last spring and led to severe water use restrictions affecting over 60,000 residents of Barhaven in the southwest Ottawa area last summer. The resulting costs have led the City of Ottawa to approve a 70%+ water rate increase over the next 10 years in order to pay for the emergency repair work and various inspections of their aging infrastructure.

Discussion – Fibre Optic Installation – Amendment of Award:

Due to the complex nature of retrofitting our system to accommodate the fibre optic installation in the pipe, the project has been broken into 3 phase from the original single phase installation to allow appropriate time to complete the various chamber modifications noting that the original bid price was based on doing the installation in one phase. The total increase to Pure Technology’s original budget will be **\$336,382** for a total project value of **\$1,599,902**.

Staff are requesting the addition of the following items in order to complete the project this fall:

Description	Cost
Supply of new 6 strand fibre between Arva PS and CH9	\$58,500
Credit for pre-purchased 4 strand fibre in 2007 and return to Pure Technologies	(\$68,753)
Upgrade of the fibre optic from a 4 strand cable to a 6 strand to allow for a direct SCADA connection of the Arva PS to the Springbank PS to act as a back up to the current communication system	\$118,800
Installation of a temporary access road across a farm field in order to access valve chamber	\$22,335
Costs for mobilization as a result of splitting the project into 3 phases which include costs for traffic control by Pure Technologies during the fibre install on Commissioners Rd.	\$78,500
Costs for electromagnetic inspection of the pipe between Whetter Ave. and Commissioners Rd. while the pipeline is shut down to facilitate the AFO installation	\$92,000
Addition of a contingency to deal with any unexpected costs in Phase 3 of the installation	\$35,000
Total Additional One Time Cost	\$336,382

Discussion – Monitoring Costs and Warranty:

To date, eight (8) different wire break alerts have been communicated with staff including one construction impact alert. With the construction impact alert, Pure’s system identified a series of impacts in a specific location where a contractor was installing a new private sewer across the easement and pipeline. The City’s Water Operations staff were notified and they were able to investigate and confirm no damage was done to the watermain.

As part of Pures Technology’s original bid, there is an annual monitoring cost that includes data storage, software upgrades, and the monitoring and analysis of acoustic events in the monitored pipe. Pure’s staff receives data from the monitoring computer located at Arva Pump Station 24 hours a day and is analyzing the acoustic signature for wire breaks and pipe impacts. The total monitoring cost when the full system is installed will be \$152,165.05 which has been prorated appropriately for the length of fibre currently installed.

Year	Billing Period	Installed Fibre Length	Billing Period Cost
1	January 1, 2011 to November 16, 2011	7,145m	\$49,323.58

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	November 17, 2011 to December 31, 2011	12,328m	\$11,967.65
2	January 1, 2012 to October 1, 2012	12,328m	\$76,592.74
	October 16, 2012 to December 31, 2012	19,325m	\$32,100.59
3	January 1, 2013 to December 31, 2013	19,325m	\$152,165.05

An option exists to apply an extended warranty of \$25,000 which is recommended to start in 2014 that would bring annual monitoring costs to a total of \$177,165.05. The warranty would cover the costs to maintain the monitoring computer and the various fixtures and fittings that allow the fibre to enter and exit the pipe.

Conclusions:

1. Staff recommends the increase of fees to the original contract with Pure Technologies to install a fibre optic monitoring system inside one of the most critical pipes in the City’s water distribution system. The total increase will be in the amount of \$336,382 which will cover costs for electromagnetic inspection, mobilization, traffic control, upgrades to the fibre optic cable, and miscellaneous project costs.
2. Staff recommends the authorization of annual monitoring fees paid to Pure Technologies to the annual upset limit amount of \$152,165.05.

Acknowledgements:

This report was prepared with the assistance of Matt Feldberg, Water Demand Manager.

PREPARED BY:	RECOMMENDED BY:
ROLAND WELKER, P.ENG. MANAGER WATER ENGINEERING	JOHN BRAAM, P.ENG. ACTING EXECUTIVE DIRECTOR PLANNING AND ENVIRONMENTAL AND ENGINEERING SERVICES & CITY ENGINEER

May 24, 2012
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Attachments: