

TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING OF MONDAY, JULY 21, 2014
FROM:	JOHN BRAAM, P.ENG. MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES AND CITY ENGINEER
SUBJECT	LONG-TERM LARGE DIAMETER PIPE INSPECTION STRATEGY AND SINGLE SOURCE PROCUREMENT EW3717-13, EW3717-14

RECOMMENDATION

That, on the recommendation of the Managing Director, Environmental & Engineering Services and City Engineer and on the advice of the Director of Water and Wastewater, with respect to a Long-Term Pipeline Inspection Strategy and the award of single source contracts for the inspection and condition assessment of pipelines:

- (a) The Long-Term Pipeline Inspection Strategy **BE APPROVED** as outlined in the Executive Summary dated June 26, 2014 and titled City of London, Trunk Water Main Management Plan;
- (b) The contract value for Pure Technologies Ltd., 3rd Floor, 705-11 Avenue SW, Calgary, Alberta, T2R 0E3, **BE APPROVED**, in accordance with section 14.4(e) of the Corporation of the City of London's Procurement of Goods and Services Policy, in the amount of \$1,076,660.00 (excluding H.S.T.) and including a \$50,000.00 contingency, to inspect and provide a condition assessment for the Arva-Huron pipeline in 2014;
- (c) The contract value for Pure Technologies Ltd., 3rd Floor, 705-11 Avenue SW, Calgary, Alberta, T2R 0E3, **BE APPROVED**, in accordance with section 14.4(e) of the Corporation of the City of London's Procurement of Goods and Services Policy, in the amount of \$904,900.00 (excluding H.S.T.) and including a \$50,000.00 contingency, to inspect and provide a condition assessment for the Elgin pipeline in 2015;
- (d) the financing for these projects **BE APPROVED** from current budget as set out in the Sources of Financing Report attached hereto as Appendix "A";
- (e) the Civic Administration **BE AUTHORIZED** to undertake all the administrative acts that are necessary in connection with these projects.

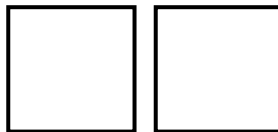
PREVIOUS REPORTS PERTINENT TO THIS MATTER
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- [EW3717 - Concrete Pressure Pipe Inspection Fiber Optic Installation – Amendment of Existing Contract, May 29, 2012, Civic Works Committee, Agenda Item #10](#)
- [Sole Source: EW3717 Concrete Pressure Pipe Inspection – Fiber Optic Installation, April 14, 2010, Board of Control, Agenda Item #27](#)
- [Water System Risk Management Exercise and Evaluation, April 23, 2007, Environment and Transportation Committee, Agenda Item #3.](#)

BACKGROUND

Purpose

This report recommends the acceptance of the R.V. Anderson's Ltd. (RVA) proposed Trunk Watermain Management Plan as the basis for selecting, procuring, and inspecting the large diameter (450mm to 1350mm) drinking water pipelines within the City of London. The Executive Summary from the report is attached in Appendix 'B'.



This report also identifies two projects (Appendices ‘C’ and ‘D’) to be undertaken in 2014 and 2015 using funds in the current capital budget (EW3717-14). The first of which will provide condition information on a section of pipe along Commissioners Road where a road widening is scheduled for 2015. By inspecting the pipe prior to construction and design, remediation strategies can be developed and carried out during the construction period.

Background

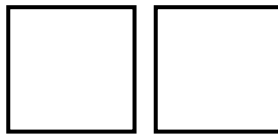
Water is delivered to customers within the city of London by more than 1,600 kilometers of watermain pipe. Approximately 200 kilometers of this pipe is considered large diameter (450mm to 1350mm) and is made up of various materials including PVC, ductile iron, cast iron, transite, and steel, but the majority is concrete pressure pipe. These large diameter pipes are some of the most important links in our distribution system with an asset value of approximately \$300 million ranging in age from 5 years to over 100 years old. London increased large diameter pipe installations in the 1950’s and 1960’s when the connection to Lake Huron system was made. A second period of increased large diameter watermain construction followed in the 1990’s partly attributed to the connection to the Elgin system. The anticipated life expectancy of these pipes is in the range of 75 to 100 years, but experience has shown that some individual sections of pipe may fail at an earlier age.

The Lake Huron pipeline that connects the treatment plant in Grand Bend with the Arva Reservoir has had two failures in 1983 and 1988 after approximately 20 years of service along with two recent failures in March 2010 and May 2012. These failures occurred in rural areas and were repaired in a timely manner with minimal affect to City water supply. There was a significant cost paid out following the rupture, even though it occurred in a rural land setting.

The following table summarizes the approximate costs incurred as a result of the 2012 rupture and can be found in further detail in the *May 2012 Pipeline Break – Remediation* report tabled at the Lake Huron Primary Water Supply System Board of Management on October 3, 2013:

Major Cost Item	\$	General Description
Emergency Rupture Repair	\$140,000	Costs for staff, contractor, equipment and materials to make the repairs
Remediation Activities	\$263,000	Charges incurred on remediation of private land where water damage occurred
Engineering Specialist Consultants and Survey	\$188,000	Pure Technologies hired to perform emergency condition assessment of pipe sections either side of the rupture
Legal	\$81,000	Legal fees
Landowner Compensation	\$595,000	Compensation paid to landowners for the destruction of property, degradation of farm land, etc.
Cost of 2012 Rupture	\$1,267,000	

The experience of the Lake Huron Water Supply System is shared by many municipalities in Canada and the United States who use concrete pressure pipe. Unlike the Lake Huron system, however, many failures are in urban settings. According to an American Water Works Association (AWWA) Research foundation report in 2007, the average cost of these urban failures is \$1.7 million (USD). Similar to the table above, this includes 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. Given that the 2012 rupture occurred on a 1200mm diameter concrete pressure pipe in a rural setting and the cost was approaching the \$1.3 Million mark, it would be appropriate to increase that value if it occurred in an urban setting. In London’s case, the most public and costly local example of a watermain failure in an urban area occurred on a 300mm diameter pipe in 2007 and is now known as “The Dundas/Wellington Sinkhole.”



Discussion

London's Water Service area has been embracing more trenchless technology tools that reduce the need for full replacement of pipelines. This was evident in the late 1980's when the first cement mortar lining project was undertaken and with various leak detection programs since the 1960's when the City connected to the Lake Huron Primary Water Supply System (LHPWSS). In 2006, a request for proposal was posted that built on the success of the small diameter watermain rehabilitation programs. The RFP invited companies to submit a proposal that utilized innovative technology to determine the current condition of the large diameter watermains within the city so that long term engineering planning decisions could be made. The pilot project examined the pipeline connecting the Arva Pumping Station to the Springbank Reservoir and assessed its current condition and installed long term monitoring. Starting in 2007, the inspections were completed in 3 phases and included leak detection, electromagnetic and visual inspection, and acoustic fiber optic installation for long term monitoring. The project proved to be successful and found that the 48 year old pipeline had high structural integrity. We are now receiving monitoring reports on wire breaks for specific pipe sections as they occur as a means of monitoring this pipeline as it ages. This allows us to more accurately predict the life span of one of the most critical pipelines inside the City and avoid a potential failure.

Condition assessment technology continues to make progress as a new method of managing piped infrastructure within the municipal right-of-way. These technologies provide utilities with the ability to make surgical repairs to individual pipes or pipe sections within watermains that distribute large quantities of water through the system. This is an advantageous position for a utility to be in as the cost of replacing these pipelines can be in the range of \$2,000 to \$4,000 per metre depending on diameter. To give perspective, if London were to replace the entire length of the Elgin Pipeline which connects the Elgin Middlesex Pumping Station to Commissioners Rd. east of Highbury Ave, the total project cost could exceed \$65 Million. Based on a proposal (Appendix 'D'), from Pure Technologies Ltd. to inspect this section of the system would cost \$904,900 representing approximately 2% of the replacement value.

Long-term Pipeline Inspection Strategy

Following the previous pilot project success, a long term strategy on the inspection and preventative maintenance for large diameter watermains has been reviewed by RVA. The first step was to develop a risk score for the entire large diameter watermain system which was undertaken in-house by the Water Services area. The assessment examined various factors and grouped them into likelihood and consequence of failure. Based on the internal analysis, RVA set-out to develop a full-scale strategy for the City to help establish which pipelines required inspection and the best technology with which to undertake the assessment. The report:

- Identifies the preferred renewal strategy for the water main, such as full/partial replacement or rehabilitation and a timeline for renewal;
- Provides additional information that can be used to adjust the probability of failure of the water mains based on the current condition observed through the inspections;
- Establishes a baseline for comparison purposes with future inspections so that the deterioration for each section can be estimated over time.

The proposed assessment program from RVA has been designed to inspect every trunk water main in the city over a period of 20 years. The City maintains approximately 200 km of trunk water mains, and therefore a target of 10 km per year should be inspected. The annual cost of the program has been estimated at \$750,000 excluding one-time costs associated with modifications to existing infrastructure to accommodate the inspections or internal City costs. This is an increase of \$130,000 per year that will be accounted for in the 2015 Water Capital Budget preparation.

Engineering staff have undertaken a review of capital works projects where major corridors within the City's right-of-way boundaries will be improved over the next few years. The intent of the review is to determine where the trunk watermains may be impacted by construction and if sections of pipeline can be repaired, as opposed to full replacement. RVA's report also provides a more in-depth five year trunk water main assessment program that will result in the inspection of approximately 50 km of trunk water mains. The trunk water mains that are on the first five years of the assessment program are in two general categories:



1. The most critical trunk water mains in the city with the highest consequence of failure. The assessments of these sections will support a proactive approach to risk management of the trunk water mains – Appendix 'C' and 'D' outline projects to inspect the Elgin pipeline and the twinned section of the Arva-Huron line through to the Springbank Reservoir.
2. Old trunk water mains that are assumed to be past their useful life but have not exhibited any signs of a decrease in the service that they are providing. The assessments of these sections will be used to identify if there is the opportunity to defer the replacement of some portions of the water main based on their current condition.

Limited Number of Qualified Bidders

The large diameter pipe condition assessment industry is small both in North America and worldwide. There are currently only a handful of companies that provide this type of non-destructive inspection and even fewer that have a full suite of inspection technologies available for all pipe materials. As a result it would be common for staff to submit a pipeline inspection report recommending approval of a contract under *14.3 Sole Source* or *14.4 Single Source* sections of the City's *Procurement of Goods and Services Policy*.

RVA also looked at potential ways to mitigate the lack of competition in the industry by bundling or separating out components of the program. The report makes specific recommendations on strategies to increase the number of bidders. Although the recommendations could attract more proponents, these recommendations may not be suited to all situations:

- Depending on the type of inspection and preparatory work required the contract could be split into sections to allow for civil works to be undertaken by local excavating contractors;
- Work with industry partners to pilot the use of new technologies in the Ontario water sector;
- Increase the volume of work included in each individual contract;
- Develop outcome-oriented terms of reference as deliverables for the inspection projects.

The two projects identified in Appendix 'C' and 'D' will be awarded based on a sole source recommendation as per Section *14.3 Sole Source* of the City's *Procurement of Goods and Services Policy*. There are no other contractors or companies that City staff are aware of that can supply an inspection tool that can inspect varying pipe diameter (900mm to 1350mm) and varying pipe material (steel and concrete) in one mobilization. The use of the tool supplied by Pure Technologies is advantageous in that it can be inserted into the pipe at the starting point and does not require significant modifications to existing infrastructure ahead of the project.

Summary

1. Sustainable asset management strategies require condition assessments be undertaken on all infrastructure. The long-term pipeline inspection strategy provides the Water Services area with the details and framework to develop inspection projects that can help prevent ruptures in large diameter water mains. The capital budget for 2015 will be adjusted to accommodate the increased level of inspection that is recommended.
2. Undertake a project in 2014 based on the proposal for \$1,076,660.00 from Pure Technologies Ltd. to inspect the twinned section of the Arva-Huron line (Appendix 'C') and continue through to the Springbank Reservoir, providing baseline condition information for the most critical pipeline in the system. This inspection will provide Water Service staff with information on the Commissioners Rd. section prior to the widening of the road between Wharncliffe Rd. and Wonderland Rd.
3. Undertake a project in 2015 based on the proposal for \$904,900.00 from Pure Technologies Ltd. to inspect Elgin line (Appendix 'D') that connects the Elgin Middlesex Pumping Station (EMPS) to the south end of the City's water system. The inspection would examine the condition of pipe between EMPS and Commissioners Rd. E. and would also go west along Dingman Dr. to Castleton.

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Conclusions

The long-term pipeline inspection strategy requires inspection of approximately 10 km of large diameter pipeline per year.

The strategy has identified 2 critical pipelines to be inspected in 2014 and 2015.

Acknowledgements

This report was prepared with assistance from Kevin Graham, Engineer-in-Training and Matt Feldberg, Water Demand Manager.

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CC: John Simon, Division Manager, Water Operations
 Andrew Henry, Division Manager, Regional Water Supply
 Alan Dunbar, Manager III, Financial Planning & Policy
 John Freeman, Manager, Purchasing and Supply

Appendices:

- A. Sources of Financing
- B. Trunk Watermain Management Plan – Executive Summary
- C. Arva-Huron Pipeline Inspection Project (2014)
- D. Elgin Pipeline Inspection Project (2015)



APPENDIX 'B'

R.V. ANDERSON REPORT – TRUNK WATERMAIN MANAGEMENT PLAN

EXECUTIVE SUMMARY, JUNE 26, 2014

The City of London has embarked on a multi-year study to develop and implement a plan to improve the management of their trunk water mains. Initiating an ongoing assessment program to inspect all of the trunk water mains on a routine basis is an essential element of the plan. The assessments will be used to:

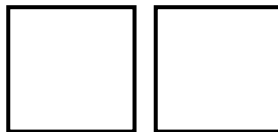
- Identify the preferred renewal strategy for the water main, such as full/partial replacement or rehabilitation and a timeline for renewal.
- Provide additional information that can be used to refine the probability of failure of the water mains based on the current condition observed through the inspections.
- Establish a baseline for comparison purposes with future inspections so that the deterioration rate for each section can be estimated over time.

The assessment program has been designed to inspect every trunk water main in the City over a period of 20 years. The City owns approximately 200 km of trunk water mains, and therefore approximately 10 km should be inspected every year. The annual cost of the proposed assessment program is estimated to be \$750,000 to \$1,000,000, excluding costs associated with constructing new chambers or internal City costs.

This report provides a more in-depth 5-year trunk water main assessment program that will result in the inspection of approximately 50 km of trunk water mains. The trunk water mains that are on the first 5 years of the assessment program are in two general categories:

1. Old trunk water mains that have exceeded their expected useful life but have not exhibited any signs of a decrease in the service that they are providing. The assessments of these sections will be used to identify if there is the opportunity to defer the replacement of some portions of the water main based on their current condition.
2. The most critical trunk water mains in the City with the highest consequence of failure. The assessments of these sections will support a proactive approach to risk management of the trunk water mains.

This report also provides recommendations that the City can consider to mitigate the consequences associated with the failure of a trunk water main, such as developing standard operating procedures to isolate sections in the event of a failure and eliminating service connections from trunk water mains.



APPENDIX ‘C’

Arva-Huron, Cross-City Feeder Main & Commissioners Pipeline Inspection

These transmission mains make up 20 km or 10% of the large diameter water mains in the city and send water from the Arva Pumping Station directly to the Springbank Reservoir. These transmission mains are some of the largest in our system, ranging in size from 900mm to 1350mm. Therefore, maintaining and inspecting these mains are our top priority, as a main break would be costly and detrimental to our water supply system.

This project has been discussed with Pure Technologies, and due to their past successful experiences with similar projects in the city of London utilizing their PipeDiver technology, we are suggesting that this inspection method be used for the inspection to take place.

The photos below show the PipeDiver tool that will provide information on corrosion and the condition of the pre-stressing wires:



PipeDiver Tool

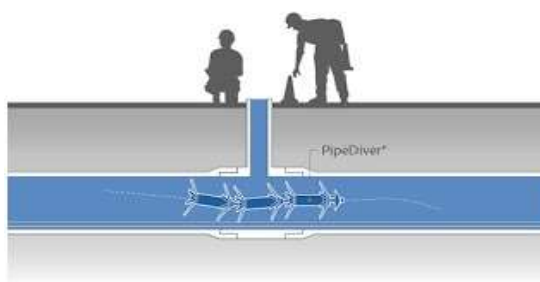


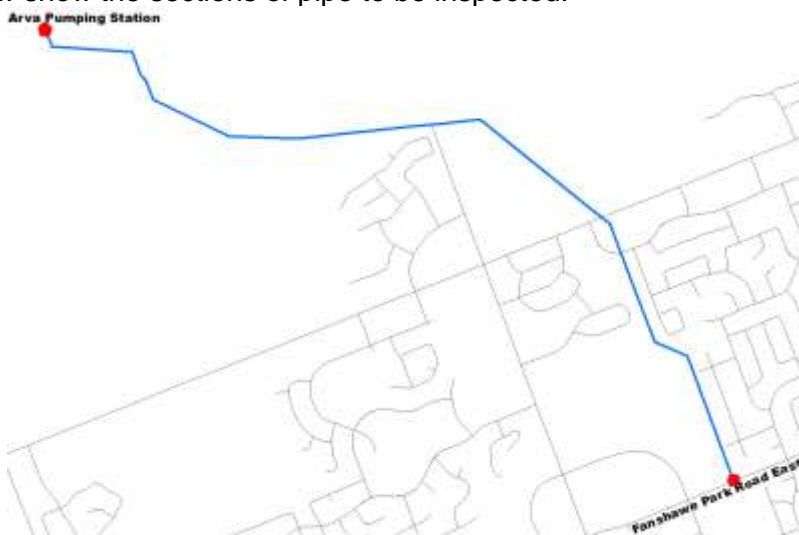
Diagram of PipeDiver inserted in flow of pipe

Due to challenges faced in the system as a result of the bends and varying pipe sizes & types, the inspection will be divided into the following sections:

1. Arva-Huron Main – 4.5km of 1050mm concrete pressure pipe heading south from the Arva Pumping Station to Fanshawe Park Road East.
2. Cross-City Feeder Main – Combination of 7km of 1350mm, 1200mm & 1050mm concrete pressure pipe from Fanshawe Park Road East to South Street.
3. Cross-City Feeder Main & Commissioners Road East Main – Combination of 4.8km of 1050mm & 900mm concrete pressure pipe from South Street to Wharncliffe Road.
4. Commissioners Road West Main – 4.1km of 900mm bar-wrapped pipe from Wharncliffe Road to the Springbank Reservoirs.

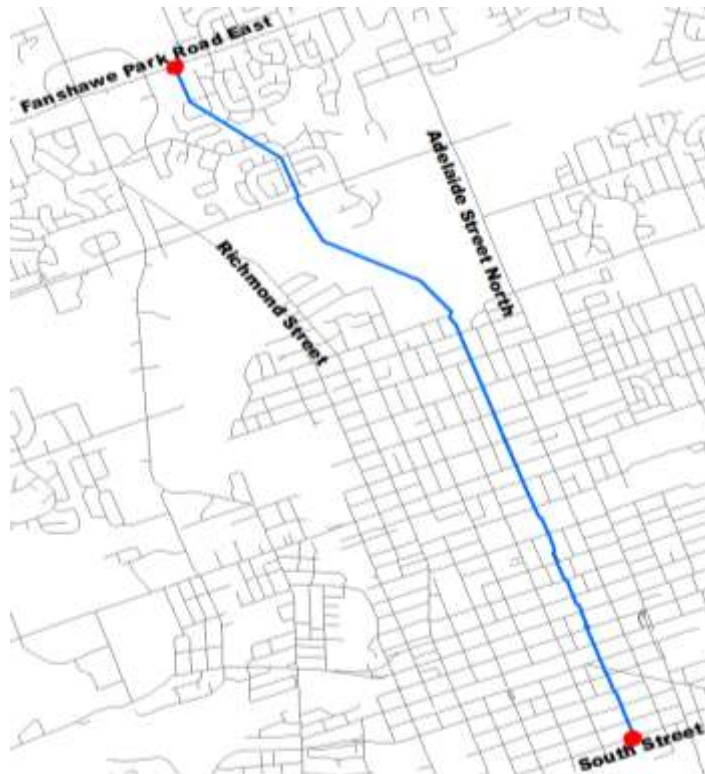
The City has obtained an estimate of \$1,076,660.00 (excluding H.S.T.) from Pure Technologies to perform the condition assessment using their PipeDiver Technology.

The photos below show the sections of pipe to be inspected:

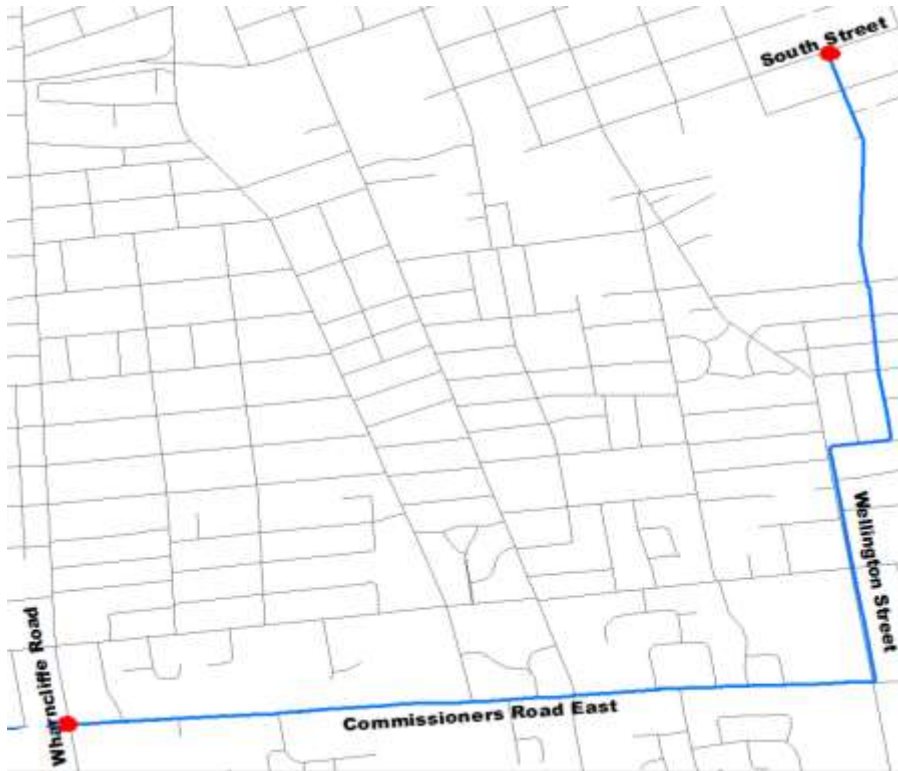


#1 – Arva-Huron Main

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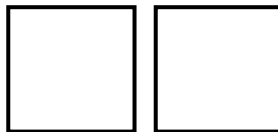
#2 – Cross-City Feeder Main



#3 – Cross-City Feeder Main and Commissioners Road East Main



#4 – Commissioners Road West Main



APPENDIX ‘D’

Elgin, Jackson & Castleton Pipeline Inspection

These transmission mains make up 25 km of the system and supply water to the southeast zone of the City through the main heading north along Highbury Avenue which will connect the Southeast Reservoir to the distribution system. These mains are the only means for getting water from the Elgin Middlesex Pumping Station (EMPS) to the City, and it is crucial that we have an understanding of their condition in order to avoid a disruption and a costly rupture.

The three sections of pipes that are planned to be inspected are:

1. Elgin Main – 10km of 1050mm steel watermain and 4.3km of concrete pressure pipe heading north along Highbury Avenue from EMPS to Dingman Drive.
2. Jackson Main – 7.8km of 900mm concrete pressure pipe heading north along Highbury Avenue under Highway 401 and up to Commissioners Road East at Jackson Road.
3. Castleton Main – 2.7km of 900mm concrete pressure pipe heading east along Dingman Drive from Highbury Avenue to Castleton Road.

The City has already obtained an estimate of \$904,900.00 (excluding H.S.T.) from Pure Technologies to perform the condition assessment using their PipeDiver Technology.

The photos below show the section of pipe to be inspected.

Note: The callouts in the below image “PCJ” and “PDC” indicate the retrieval points of the PipeDiver and the end of the Jackson and Bradley Main runs, respectively.

Elgin, Jackson & Castleton Pipeline Inspection Project Limits

