

CITY of NOVI CITY COUNCIL

**Agenda Item 1
August 12, 2019**

SUBJECT: Consideration of approval to award condition assessment services to Xylem for inspection of PCCP water main, including the valve assessment and the installation of the extraction tap, in the amount of \$645,110, and amend the budget.

SUBMITTING DEPARTMENT: Department of Public Works, Water and Sewer Division

CITY MANAGER APPROVAL:

EXPENDITURE REQUIRED	\$ 592,610.00	592-592.00-816.080
	\$ 52,500.00	592-592.00-976.080
	\$ 645,110.00	Total
AMOUNT BUDGETED	\$ 481,950.00	592-592.00-816.080
	\$ 100,000.00	592-592.00-976.080
APPROPRIATION REQUIRED	\$ 110,660.00	592-592.00-816.080
	\$ 0	592-592.00-976.080
LINE ITEM NUMBER	592-592.00-816.080	
	592-592.00-976.080	

BACKGROUND INFORMATION:

The City of Novi has approximately 5.8 Miles of Prestressed Concrete Cylinder Pipe (PCCP), which is a common pipe material for large diameter water mains. This pipe, however, can fail catastrophically if it develops a defect, resulting in a serious water main break. A break of this nature occurred in October 2017 on 14 Mile, east of Novi, where the water main failure impacted the water service of seven communities and took five days to repair. This event helped reinforce the importance of proper inspection and maintenance of this type of water main. Following the 2017 water main break, the Great Lakes Water Authority recognized the need to inspect the remainder of the PCCP in the area. Their chosen inspection method involves the use of specialized equipment that can identify specific defects within the pipe. This inspection is a proprietary method conducted by Xylem (fka Pure Technologies) that involves passing two pieces of equipment (Smart Ball and Pipe Diver) through the water main while it is in use. Refer to the attached presentation provided to City Council at the July 8, 2019 meeting for further information regarding this inspection methodology. The results of the inspection can identify specific areas of concern, and can estimate the criticality of any defects. This inspection was completed earlier this year, and the Water and Sewer Division expects the report to be shared with all affected communities in the near future.

Novi has chosen to follow GLWA's expertise and use Xylem to inspect Novi's PCCP using the same inspection method. Xylem has provided the attached proposal for the inspection, which also includes two tasks required as preparation prior to the inspection; 1) the assessment of the valves that will need to be operated during the inspection, and 2) the installation of an extraction point allowing the removal of the inspection equipment. A summary of the fees is provided below:

Task Description	Total Cost
Pipe Inspection (Smart Ball/Pipe Diver)	\$560,700
Valve Assessment	\$31,910
Extraction Point Installation	\$52,500
TOTAL	\$645,110

The pipe inspection will be completed in two steps. First, the Smart Ball will be used to inspect all 5.8 miles of the PCCP main, identifying leaks within the pipe. Second, the Pipe Diver will be used to inspect approximately 4.5 miles of the PCCP main, and will provide the specific information related to the integrity of the pipe. The remainder 1.3 miles of pipe is too small to accommodate the Pipe Diver. Following an initial site investigation, it was determined that additional water main could be inspected south of Grand River once it was realized the valves are large enough to pass the inspection equipment. Therefore, this additional length of inspection has been added to the initial scope. Additionally, the assessment of the valves along the inspection route was added to the scope, which will help ensure the valves will function properly. The assessment will also identify any repairs that may be required prior to the inspection.

Following the inspection, Xylem will provide a report summarizing the inspections and analysis, and will provide recommendations to proactively manage the water mains and develop a plan for future rehabilitation projects as appropriate.

Staff has reviewed the scope of services proposal and recommends approval. The inspection is expected to be completed fall of 2019.

RECOMMENDED ACTION: Approval to award condition assessment services to Xylem for inspection of PCCP water main, including the valve assessment and the installation of the extraction tap, in the amount of \$645,110, and amend the budget.

RESOLUTION

NOW, THEREFORE BE IT RESOLVED that the following Budget Amendment for the condition assessment services to Xylem for inspection of PCCP water main is authorized:

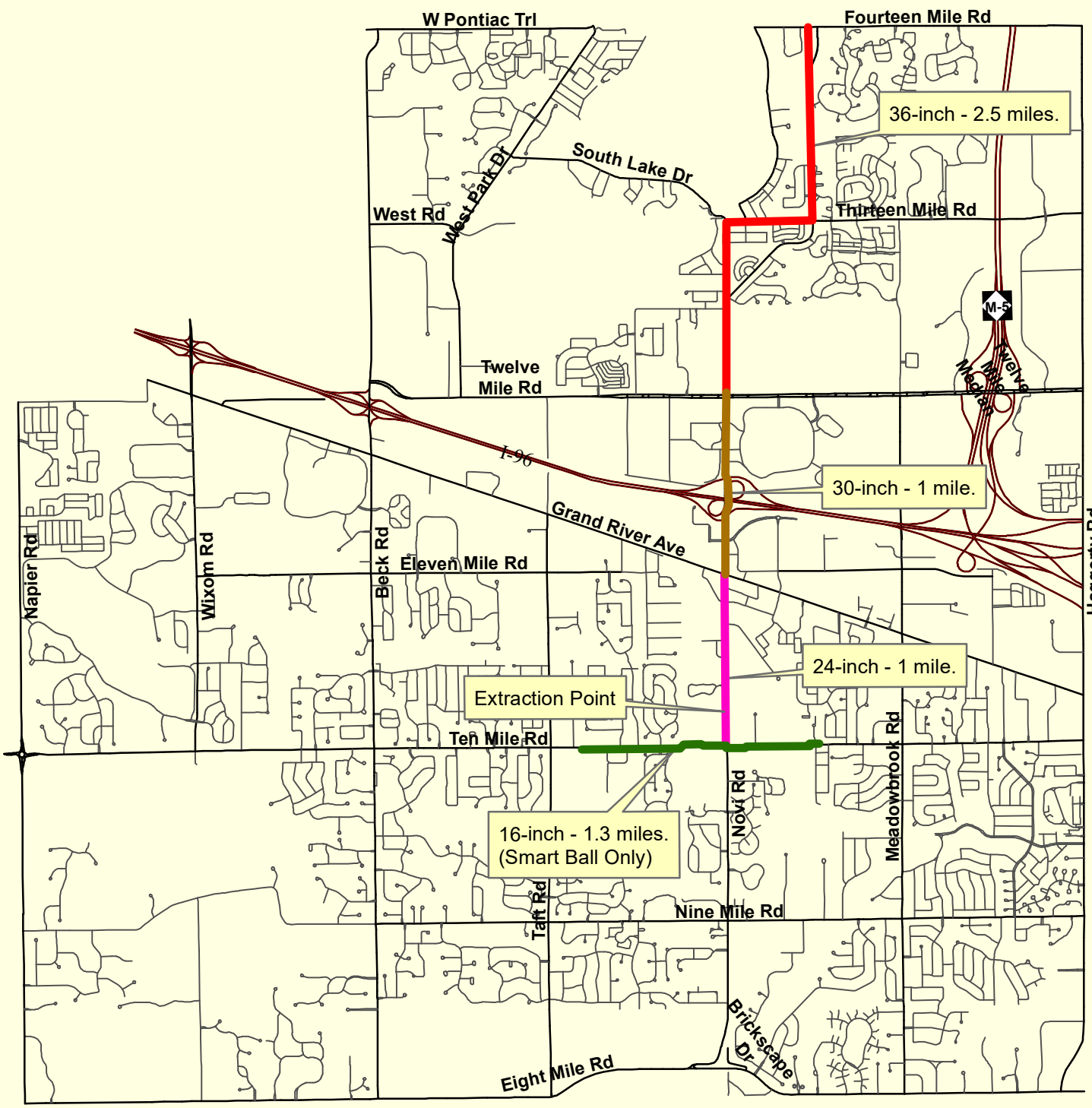
	INCREASE (DECREASE)
WATER & SEWER FUND	
APPROPRIATIONS	
Other Services & Charges	110,660
TOTAL APPROPRIATIONS	<u>\$ 110,660</u>
Net Increase (Decrease) to Fund Balance	<u><u>\$ (110,660)</u></u>

I hereby certify that the foregoing is a true and complete copy of a resolution adopted by the City Council of the City of Novi at a regular meeting held on August 12, 2019.

Cortney Hanson
City Clerk

City of Novi

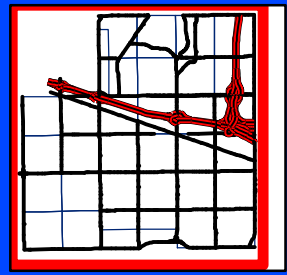
PCCP Transmission Mains



Map Author: Croy
 Date: August 2019
 Project:
 Version #: v3.0

MAP INTERPRETATION NOTICE

Map information depicted is not intended to replace or substitute for any official or primary source. This map was intended to meet National Map Accuracy Standards and use the most recent, accurate sources available to the people of the City of Novi. Boundary measurements and area calculations are approximate and should not be construed as survey measurements performed by a licensed Michigan Surveyor as defined in Michigan Public Act 132 of 1970 as amended. Please contact the City GIS Manager to confirm source and accuracy information related to this map.



City of Novi

Engineering Division
 Department of Public Services
 26300 Lee BeGole Drive
 Novi, MI 48375
cityofnovi.org

Feet

0 900 1,800 3,600 5,400

1 inch = 4,400 feet



Budgetary Proposal

Condition Assessment of Various PCCP Transmission Mains

Prepared for:

City of Novi, Michigan



Prepared by:



Pure Technologies U.S. Inc.
June 19, 2018 (rev. July 8, 2019)

PROPOSED SERVICES

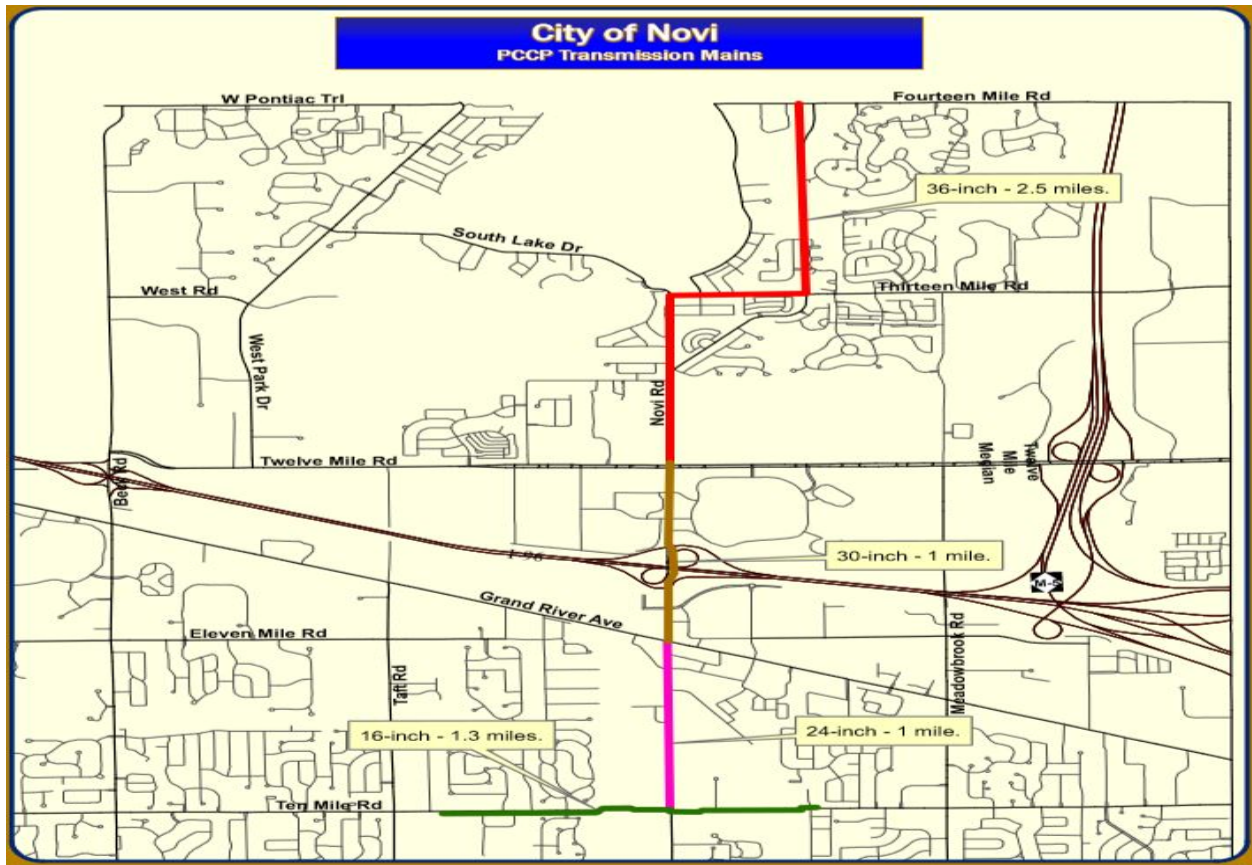


Figure 1: Pipeline Overview

SmartBall Acoustic Leak Detection

The SmartBall device is an internal free-swimming acoustic leak and gas pocket detection tool ideally suited for large diameter transmission pipelines. The SmartBall tool is composed of a water-tight, aluminum core that contains a power source, electronic components and instrumentation (including an acoustic sensor, accelerometer, magnetometer, GPS synchronized ultrasonic transmitter, and temperature sensors). The core is encapsulated inside a protective outer foam spherical shell. The outer foam shell provides additional surface area to propel the device and it also eliminates any noise the device might generate while traversing the pipeline. The SmartBall tool is inserted into the water flow of a live pipeline and it simply travels the pipeline – propelled by the hydraulic flow - and is captured at a point downstream. The device records acoustic activity and positional data as it traverses the pipeline, which is evaluated to report the presence, approximate size, and location of leaks and gas pockets.



Figure 2: SmartBall Inspection Platform

The SmartBall tool contains sensors needed to produce reliable, reproducible data in normal pipeline operating conditions. Pure Technologies has also developed appropriate analysis

software and can generate reports that allow accurate determination of the locations of detected anomalies. Given the battery life of the SmartBall tool, many miles of pipeline can be tested during a single deployment. Pure Technologies utilizes a proprietary SmartBall Receiver (SBR) to track the location of the device as it traverses the pipeline.

PipeDiver Electromagnetic Inspections

Assessing the condition of a PCCP transmission main is a challenging task that is best performed using a combination of non-destructive testing technology and engineering. The primary goal of an inspection of PCCP is to provide an understanding of the condition of the structural component that provides a pipe's strength—the prestressing wire. PureEM™, an electromagnetic inspection technology, provides a non-destructive method of evaluating the baseline condition of the prestressing wire wraps in a PCCP. Electromagnetic inspections ascertain a magnetic signature for each pipe to identify anomalies that are produced by zones of prestressing wire breaks in a PCCP transmission main. Various characteristics associated with an anomaly (length, magnitude, phase shift, etc.) are evaluated to provide an estimate of the number of broken wire wraps in a PCCP transmission main. Combined with a Video option, we can see improved correlation and visual assessment of the condition of the pipe interior.



Figure 3: PipeDiver Inspection Platform

The PipeDiver platform is a free-swimming tool that serves as a delivery mechanism for PureEM technology. The tool consists of a several modules, which contain computers, batteries and electronics. The system is neutrally buoyant and has flexible petals that are used to center the tool within the pipe and provide propulsion. Its flexible design allows for the PipeDiver platform to navigate valves and bends in the pipeline, while travelling long distances. Data is recorded and interpreted by an experienced analyst to pinpoint and quantify locations of distress.

The PipeDiver tool can be inserted and extracted from the pipeline in a number of ways; the pipe can be in service or more commonly is depressurized. As the PipeDiver tool travels with the flow it is tracked from the surface to track the progression of the inspection and aid in post-processing and defect location.

External Verification

Following the electromagnetic inspection, excavations of individual pipe sections is often required to repair the pipeline or to determine the root cause of pipeline deterioration. If such an excavation is required, it is important to confirm that the correct section of pipe was excavated. Pure Technologies can support the City of Novi to locate and verify pipe sections to be repaired or replaced. One (1) post inspection mobilization is included in the budgetary pricing for external verification. If additional mobilizations are required there will also be an additional cost.



Figure 4: External EM Verification Equipment

Transient Pressure Monitoring

Hydraulic pressure transients (also known as surges or water hammers) occur in pipelines when the pressure conditions in the system change due to variances in pressure or flow (e.g. pump on/off cycles or the rapid closure of a valve). The magnitude of a transient is related to several factors that include, but are not limited to, the flow rate within the pipeline, the time (how fast) in which the change in steady-state condition occurs, and a pipe’s hoop stiffness. During a transient event, the kinetic energy within the pipeline (velocity of the water), is converted into potential energy (pressure in the pipe) and strain energy (deformation/strain in the pipe wall) by the propagation of transient pressure waves. A transient pressure wave can travel through the pipeline at speeds greater than 3,000 feet per second and can cause damaging pressure events and vacuum conditions, which can lead to permanent damage within the pipe wall, and failure within the pipe system.

Traditional pressure monitors collect data in intervals of seconds or minutes; however, the most severe transients may occur within a fraction of a second. A transient pressure monitor addresses this issue by continuously monitoring the pressure in the pipeline. Under normal operating conditions, the monitor only records data every few minutes (based on a user-defined interval); however, when a transient occurs, the device detects the transient pressure event and begins sampling at a higher rate (again, based on user-defined criteria). This functionality provides periodic pressure readings as well as data on transient events.

Pure Technologies will install one Telog Instruments, Inc. (Telog) Pressure Impulse Recorder to collect pressure data for up to 30 days, which can be programmed to record the minimum, average, and maximum background operating pressure every 5 minutes (under a defined range of acceptable operating pressure). Should a transient event exceed a pre-defined change in pressure, the sampling rate increases to once every 50 milliseconds (20 readings per second). The Telog pressure monitors are also capable of recording negative pressures in the pipelines as low as negative -15.0 psi as well as positive pressures in the pipelines as high as 300 psi. Pure Technologies will then remove the recorder and incorporate the results in the final report. Transient monitoring will be performed concurrently with project planning and implementation to maintain project schedule.

Engineering Analysis and Risk Assessment (PCCP)

Pure Technologies proposes the use of Finite Element Analysis (FEA) to assess the structural integrity of any damaged PCCP pipes detected during the electromagnetic inspection. FEA is used to evaluate the risk associated with operating the distressed pipes. FEA is the best analytical tool for evaluating the impact of increasing numbers of broken wire wraps on a pipe’s performance. During the FEA, all the properties of the constituent materials are modeled, including the non-linearity of the concrete core and the interaction between each layer of the composite pipe wall. Contiguous wire wraps are “broken” and, at varying levels of internal pressure, the stress and strain in the components are computed. These stresses and strains are used to develop the FEA performance curve. The maximum number of broken

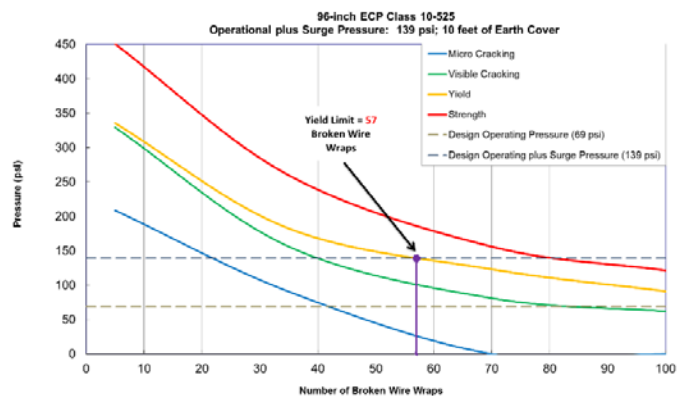


Figure 5: Pipeline Condition Curve

prestressing wire wraps required for a pipe to experience theoretical Limits that predict pipe performance is calculated using the FEA performance curve.

This proposal assumes the development of one (1) finite element analysis performance curve to evaluate the pipe design for different external loading conditions. Should there be a need for additional evaluation we have included pricing per each curve in the Proposed Fee and Payment Schedule below.

In addition to the finite element analysis, the structural evaluation will review the PCCP design to determine if it satisfies the contemporary American Water Works Association (AWWA) C301 and current AWWA C304 design standards. The design will be evaluated at both the design and current loading conditions. The combination of the finite element analysis and the design standard analyses will be used to perform a failure risk analysis for the pipes with broken wire wraps and establish repair priorities, based on the results of the electromagnetic inspection.

Draft and Final Condition Assessment Report will be delivered following the inspections and subsequent analysis. The report will include methodology and results of the inspection, structural modeling, and recommendations for proactive management of the transmission mains.

ADVANTAGES OF CONDITION ASSESSMENT AND PROACTIVE PIPELINE MANAGEMENT

The main advantages of performing proactive condition assessment and pipeline management are:

1. Extending the life of pipeline assets: Only 4 percent of PCCP pipe sections in the United States and Canada inspected by Pure Technologies were identified to have deterioration. By identifying and fixing the at-risk pipe sections, the remaining useful life of existing pipeline assets can be safely extended. This can be performed at a cost far less than capital replacement of a pipeline. As part of an internal analysis, Pure Technologies determined that condition assessment and repair of a pipeline can be performed for approximately 5 percent of the capital replacement cost.
2. Avoiding Pipeline failure: Large diameter pipe failures cause a significant disruption to the utility and can have significant financial implications. An AWWA study documented that the average cost of a large diameter pipe failure is over \$1.7 million (mean of \$500,000). Condition assessment and repair can be used to fix problematic pipe and avert these failures and associated costs.
3. System Reliability: Understanding the condition of pipeline assets allows utilities to make intelligent decisions to maintain a high degree of certainty that the distribution system will safely deliver water.

PROJECT DELIVERABLES

1. A detailed Project Plan will be submitted to the City of Novi prior to the inspection in electronic PDF format. The project plan will be provided approximately two weeks prior to the inspection, dependent on the receipt of project data.
2. A Draft Report (electronic PDF) will be generated and delivered to the City of Novi within 10 weeks of completion of the deployment area inspection. The engineering report will contain the information outlined below:

- SmartBall – Identification and location of any leaks and/or air pockets in the pipeline as well as ARV installation recommendations.
 - PipeDiver - Identification and location of the estimated number of broken prestressing wire wraps within each PCCP pipe section inspected.
 - Pure Technologies will also provide transient pressure monitoring and structural modeling (FEA curves) to determine the significance of any defects detected.
 - Pure Technologies typically provides a presentation summarizing draft results to stakeholders to facilitate review of the draft report.
3. A Final Report will be submitted within two weeks of the receipt of comments from the City of Novi summarizing the findings and recommendations based on the proposed inspections. The Final Report shall be delivered in electronic format (PDF format), and if adequate survey coordinates of the structures and pipeline are available or can be obtained during the inspection, it shall include an electronic map of the section of the pipeline inspected.

PROJECT SCHEDULE

The proposed schedule for the inspection is based on receiving a Notice to Proceed:

- | | |
|-----------------------------|---|
| • Site Visit | 1-3 weeks after NTP |
| • Project Planning Document | 2 weeks prior to inspection |
| • Field Inspection | 1-3 weeks from Project Plan approval |
| • Draft Report | 10 weeks following completion of inspection |
| • Review Period | 2 weeks from receipt of the Draft Report |
| • Final Report | 2 weeks from receipt of comments |

PROJECT RESPONSIBILITIES

To facilitate the inspection the City of Novi shall be responsible for:

- Ensuring the pipeline is available for the duration of the inspections, coordinating the installation of the accesses and providing access to the pipeline during the inspection.
- Providing all available documentation for the pipelines to be inspected, including, but not limited to plan and profile drawings, pipe laying schedules, and pipe design specifications for the original installations as well as any modifications. Documentation must be clearly legible for notes and dimensions to aid in proper planning of field work.
- Notification to any landowners as required for access.
- The cost of support services such as traffic control, removal of appurtenances, excavation, tapping services, and valve operation are not included in this proposal and will be provided by the client unless agreed upon otherwise.
- Provide personnel familiar with the pipeline system available during site reconnaissance and field work.
- Dewatering of the appurtenance vaults (as needed) to accommodate the SmartBall, PipeDiver insertion/extraction equipment and SmartBall Receivers.

- Access locations to deploy the SmartBall tool and PipeDiver unit.
- Maintain adequate flows for the duration of the SmartBall and PipeDiver inspections.
- Depressurize and/or dewater the pipeline as necessary to accommodate deployment of the SmartBall and PipeDiver tools.

Pure Technologies will be responsible for:

- Reviewing all information provided by the City of Novi regarding the pipeline to be inspected.
- Attending site visits with knowledgeable personnel to ensure that the sites are suitable for insertion and extraction of the inspection tools.
- Providing all data collection equipment, tools, and trained technicians as necessary to operate the equipment.
- Collection the specific data for the identified pipeline.
- Performing a comprehensive review and analysis of the data.
- Delivering a Draft and Final Inspection Report that details the results of the inspection.
- Aiding with locating and verifying individual pipe sticks reported to have damage with the use of external EM verification equipment.

PROPOSED BUDGETARY PRICING

PCCP Transmission Main Condition Assessment			
Deliverable	Unit Cost	Quantity	Total
Planning, Setup, & Mobilization: Includes PipeDiver and SmartBall inspection. <i>This item will be invoiced upon delivery of the Planning Document.</i>	\$78,750	1	\$78,750
SmartBall Acoustic Inspection of all PCCP: Includes acoustic data collection & analysis. <i>This item will be invoiced upon the completion of the SmartBall field work.</i>	\$15,750	5.8 miles	\$91,350
PipeDiver EM Inspection of the 36 and 30-inch PCCP: Includes electromagnetic data collection & analysis. <i>This item will be invoiced upon the completion of the PipeDiver field work.</i>	\$78,750	3.5 miles	\$275,625
PipeDiver EM Inspection of the 24-inch PCCP: Includes electromagnetic data collection & analysis. <i>This item will be invoiced upon the completion of the PipeDiver field work.</i>	\$78,750	1 mile	\$78,750
Transient Pressure Monitoring: Includes 30 days of pressure monitoring data and analysis. <i>This item will be invoiced upon delivery of the Draft Condition Assessment Report.</i>	\$5,250	1	\$5,250
Engineering Analysis & Report: Includes Structural Evaluation, one FEA performance curve, Draft and Final PipeDiver and SmartBall Condition Assessment Report. <i>This item will be invoiced upon delivery of the Draft Condition Assessment Report.</i>	\$30,975	1	\$30,975
Total:			\$560,700.00

Optional Services Condition Assessment			
Deliverable	Unit Cost	Quantity	Total
External Verification: <i>Includes one Mobilization for external pipe verification.</i>	Included	-	Included
Additional Pipes for External Verification: <i>Included on a per pipe basis</i> <i>This item will be invoiced upon completion of the field work</i>	\$2,100	-	TBD
Additional FEA Performance Curves (per pipe class)	\$9,975	-	TBD
Total:			TBD

Note:

1. Standby charges: For standby time of the on-site inspection team once the field team mobilizes to the site. *This item will be invoiced upon the completion of the field work should delays occur. Additional cost for the associated technologies follow; PipeDiver/\$15,750.00/day, SmartBall \$5,250/day.*
2. The cost of support services such as excavation, tapping services, traffic control, removal of flanges, and valve operation are not included in this proposal.
3. This proposal is subject to the attached Conditions of Engagement unless amended by a mutually agreed upon binding contract.

CONDITIONS OF ENGAGEMENT FOR THE PROVISION OF SERVICES (North America)

The Proposal is issued upon and is subject to these Conditions of Engagement. If the Proposal is accepted by the Client, these Conditions of Engagement, the Proposal and the Client's acceptance thereof will form part of the Contract between the Client and Pure.

1. DEFINITIONS

In these Conditions of Engagement, the following definitions apply:

- Client means any person or persons, firm or company engaging Pure to provide the Services.
- Contract means the agreement awarded to Pure as a result of the Proposal.
- Pure means Pure Technologies Ltd., Pure Technologies U.S. Inc., Pure Engineering Services Inc., or any of their affiliates, as the case may be, which submitted the Proposal and is a party to the Contract.
- Proposal means Pure's offer to carry out the Services and includes all related correspondence plus agreed written variations or amendments thereto.
- Services mean those services of whatever nature to be supplied by Pure under the Contract.
- Site means the facility, land, installation or premises to which Pure is granted access for the purposes of the Contract and may include any combination of the foregoing.

2. PURE'S OBLIGATIONS

- 2.1 Pure will perform the Services in accordance with the procedures described in the Proposal, using reasonable skill, care and diligence and consistent with industry standards.
- 2.2 Pure will ensure that the equipment used in performing the Services is in a good and functional state.

3. CLIENT'S OBLIGATIONS

- 3.1 The Client will provide to Pure full, good faith co-operation to assist Pure in providing the Services. Unless otherwise specified in the Proposal and without limiting the generality of the foregoing, the Client will at its own expense:
- (i) ensure, if required, access to private land will be given to Pure and that any official permits or permissions required for Pure to have access to the Site or carry out the Services are obtained and are in force for the duration of the Services;
 - (ii) inform Pure in writing of any special circumstances or danger which the execution of the Services may entail or which are inherent in the Site, including the existence and identity of any known hazardous substance or material;
 - (iii) perform such additional duties and responsibilities and provide such information and resources as are described in the Proposal.
- 3.2 The description of the Services and related compensation amount set out in the Proposal will be based upon information that the Client shall have provided to Pure, and assumptions that Pure shall have identified in the Proposal. The Client acknowledges that if any such information provided by Client is materially incomplete or inaccurate, or if the assumptions identified by Pure are not correct, then the parties will modify the Proposal to reflect the actual information, assumptions, and Services required, and the compensation to Pure will be adjusted accordingly using the change order process set out in the Contract, or if there is no such process, on an equitable basis.

4. PROPRIETARY AND CONFIDENTIAL INFORMATION

- 4.1 All reports generated in the performance of the Services and delivered by Pure to the Client will become the property of the Client.
- 4.2 Pure's equipment which is made available to the Client in connection with the Contract and the raw data generated in the performance of the Services will remain the sole and exclusive property of Pure. The Client will not acquire any proprietary rights in Pure's equipment, systems, software, technology, inventions (whether or not patentable), patents, patent applications, documentation, specifications, designs, data, databases, methods, processes or know-how ("Pure Technology"). Any modifications or improvements to the Pure Technology made during the performance of the Services will be the sole and exclusive property of Pure.
- 4.3 Both parties agree to keep confidential all documentation and information provided by the other during the performance of the Contract. The obligations set out in this clause 4.3 will remain in full force and effect after any termination or expiry, as the case may be, of the Contract.

5. LIABILITY AND WARRANTIES

- 5.1 Pure will indemnify the Client against any expense, demand, liability, loss, claim or proceeding whatsoever in respect of personal injury to or the death of any person, or any loss, destruction or damage to any tangible property and arising directly or indirectly from the negligence of Pure, its employees, servants or agents except to the

extent caused by the negligence of the Client or any person for whom the Client is responsible. The Client will similarly indemnify Pure.

- 5.2 Pure will not be liable for any loss of production, loss of use of property, loss of revenue or profit, equipment downtime, business interruption, loss of goodwill, loss of anticipated savings, cost of procurement of substitute goods or services, or for any consequential, indirect, incidental, or special loss or damage suffered by the Client or any third party, or for any punitive damages, even if advised of the possibility thereof and notwithstanding the failure of essential purpose of any remedy.
- 5.3 Pure's cumulative liability under the Contract, whether in contract, tort (including negligence), or otherwise, will in no event exceed the aggregate consideration paid by the Client to Pure for the portion of the Services that gave rise to the liability, provided, however, that this clause 5.3 shall not limit Pure's indemnification obligations under these Conditions of Engagement.
- 5.4 The report(s) and any other recommendations or advice made by Pure relating to the pipeline or the Services will not constitute a warranty of the quality, capacity, safety or fitness for purpose of the pipeline. The Client will indemnify Pure against any liability to the Client or to third parties that may arise from reliance upon or application or use of the final report or recommendations or advice made by Pure in relation to the pipeline or Services.
- 5.5 Pure's warranties for the Services will be set out in the Contract. Pure disclaims all implied or statutory warranties or conditions, including of merchantability, merchantable quality, durability, or fitness for particular purpose to the extent allowed by applicable law. This means Pure's warranty obligations will be limited to what is expressly set out in the Contract.

July 29, 2019

Mr. Ben Croy and Mr. Scott Roselle
 City of Novi - Field Services Complex
 26300 Lee BeGole Drive
 Novi, Michigan 48375

**Subject: Novi Road PCCP Transmission Main Inspection
 Task 7 - Civil Work for new Extraction Tap near 10 Mile Rd & Novi Rd**

Dear Mr. Croy:

Pure Technologies U.S. Inc. (Pure Technologies) is available to further assist the City of Novi with preparation for the PCCP Transmission Main Inspection by assisting with civil work. This includes coordination of subcontractors and materials for the construction of a new permanent access manhole, 18-inch gate valve, and 18-inch tap near along the 24-inch watermain located north east of the 10 Mile Rd & Novi Rd intersection.

Allowances below have been estimated based on our project experience and verbal feedback from local contractors. Once the details of the extraction location have been finalized, Pure Technologies will obtain three (3) separate written quotes from local vendors to perform the detailed work and will forward to the City for their review. Actual amount billed will may be adjusted based on the level of effort actually performed. However, this budget is intended to serve as a “not to exceed allowance” unless a change order is agreed to in writing.

Table 1 – Proposed Hot Tap Cost Breakdown

Task Description	Estimated Unit Cost	Quantity	Total
Civil Work:			
Expose Main for Outside Diameter Measurement	\$3,000/day	1	\$3,000
Excavate Main for Installation of Tapping Sleeve	\$3,000/day	1	\$3,000
6-ft diameter Vault	\$2,500/ea	1	\$2,500
Installation of vault	\$1,000/ea	1	\$1,000
Backfill of flowable fill into vault around	\$1,000/ea	1	\$1,000
Maintain Excavation for Duration of Tapping and Testing Procedures	\$500/day	2	\$1,000
Backfill around excavation around vault	\$2,000/ea	1	\$2,000
Civil Work Subtotal:			\$13,500
Tapping Work:			
Tapping sleeve: 24-inch PCCP x 18-inch outlet and associated hardware	\$5,000/ea	1	\$5,000
18-inch Gate Valve: Class 150 psi flanged fittings	\$7,000/ea	1	\$7,000

18-inch Blind Flange with 4-inch NPT threaded tap with 4-inch plug: Class 150 psi	\$1,000/ea	1	\$1,000
Hot Tapping	\$16,000/ea	1	\$16,000
Tapping Work Subtotal:			\$29,000
Project Management:			
Pure Technologies Management of Subcontractors	\$255/hr	16	\$4,080
Travel Direct Expenses (mileage, per diem)	\$1,500	1	\$1,500
10% Contingency	\$4,420	1	\$4,420
Project Management Subtotal:			\$10,000
GRAND TOTAL Not-to-Exceed:			\$52,500

The allowances below have been organized into three categories: Civil Work, Tapping Work, and Project Management. The Civil Work is work associated with exposing the PCCP to verify the outside diameter prior to the fabrication of the tapping sleeve, as well as all work associated with excavating around the pipe and installing the vault, backfilling, and restoring the site to the original conditions. The tapping work involves the installation of the tapping sleeve, gate valve, blind flange, and all hardware associated with these appurtenances as well as the hot tapping of the 24-inch PCCP main. Pure Technologies has also included time for project management and contractor oversight.

It is our understanding the City of Novi will provide the following assistance for this task:

- Providing all required permits
- Providing authorities having jurisdiction the required notification for the work being performed
- Inspection and approval of the final product
- Traffic Control

We welcome any discussion to further refine the approach for the construction of the extraction tap. It is our intention to provide these services to further streamline the PCCP PipeDiver and SmartBall inspection. Please advise if you have any questions regarding this proposal and scope.

Sincerely,

Heather A. Schuchard
 Program Manager
 1001 Woodward Ave, Suite 500
 Detroit, MI 48226 USA
 M: 760.889.8970
heather.schuchard@xylem.com



July 29, 2019

Mr. Ben Croy and Mr. Scott Roselle
 City of Novi - Field Services Complex
 26300 Lee BeGole Drive
 Novi, Michigan 48375

**Subject: Novi Road PCCP Transmission Main Inspection
 Task 6 – Valve Assessment & Support**

Wachs Water Services (Wachs) is pleased to submit our proposal to the CITY OF NOVI for a valve assessment, testing and information management program in the CITY OF NOVI’S water distribution system. We believe that our experience performing similar services successfully in more than 300 utilities, uniquely qualifies the Wachs Water Services team as the most experienced and the right choice to deliver these important services to the CITY OF NOVI.

The Wachs Water Services Team stands ready to perform valve assessment and as-needed repair services. It is our understanding this task is important to be completed in advance of the Pure Technologies SmartBall and PipeDiver PCCP transmission main pipeline inspection. A summary of the proposed cost breakdown can be found in Table 1.

Table 1 – Proposed Valve Assessment Cost Breakdown

Scope of Work	Unit Price	Quantity	Total Price
Valve Assessment			
Crew Mobilization	\$2,500	1	\$2,500
30” Butterfly Valve Assessment	\$150	9	\$1,350
20” – 24” Butterfly Valve Assessment	\$130	8	\$1,040
16” Gate Valve Assessment	\$250	8	\$2,000
24” Gate Valve Assessment	\$280	1	\$280
8” Blow Off Valve Assessment	\$400	14	\$4,200
8” – 12” Sideline Valve Assessment	\$60	100	\$6,000
Project Management and Oversight	\$255	8	\$2,040
		Subtotal	\$19,410
Optional			
As-Needed Confined Space Entries	\$100	85 ¹	\$8,500
As-Needed Minor Repairs ²	\$250	16	\$4,000
		Subtotal	Between \$0 - \$12,500
		GRAND TOTAL	Between \$19,410 - \$31,910

Overall Summary

The CITY OF NOVI desires to initiate this Professional Services agreement for a Valve Assessment, and Rehabilitation Program which serves three primary purposes:

- To evaluate and improve the operability of valves in the water distribution system through hands on field activities

¹ Estimated 1 confined space entry per large inline valve (~3 hours each)

² Minor repairs would include structure repair, uncovering and raising lids, correcting misaligned valve boxes, tightening bolts, replacing bolts. All materials to be furnished by Novi. Major repair such as gear replacement would require a re-mobilization and new cost estimate for Novi.

- To document, integrate and analyze locational, operational and physical information of valves in the water distribution system through professional services activities
- To define and refine the scope and value of an ongoing system wide program through consulting activities

This agreement is for a one-year valve program that will address 111 large and small diameter valves. This agreement is renewable as agreed upon by CITY OF NOVI and Wachs Water Services. It is anticipated that this work will take approximately 8-10 days to complete.

Type ³	30"	24" or 20"	16"	8"	8" – 12"
Butter Fly	9	8	-	-	-
Gate Valve	-	-	8	-	-
Blow Offs	-	-	-	14	
Sideline Valves	-	-	-	-	100

The Valve count above was developed using available record drawings and feedback from City staff. In addition, allowances have been included to perform confined space entries and minor repairs (if needed). Actual amount billed will be based on the asset size/type actually found in the field and numbers may be adjusted. However, this will not exceed these allowances unless a change order is agreed to in writing.

Program Description

The CITY OF NOVI desires Wachs to develop, plan and execute a valve assessment and rehabilitation program. This program will include the following activities: locate, identify, assess, clean out, inspect, exercise, record mapping grade GPS data, document, create a deliverable database, create work orders and analyze the results of the valves in the CITYOF NOVI water distribution system. The following scope of services details specific functions to be provided by Wachs Water Services (hereinafter as "WACHS").

SPECIFIC FUNCTIONS OF WACHS WATER SERVICES

Locate the Valve

The CITY OF NOVI will provide WACHS with a minimum of two copies of their most current water distribution maps for the project area. WACHS will locate all water distribution valves using the following guidelines:

- WACHS will search for all valves visually using the maps provided.
- WACHS will search for water valves shown, but not identified by visual inspection, using a magnetic locator, probing rods and other tools.
- If the valve cannot be located after searching for twenty minutes, the valve will be labeled "cannot locate" and documented as a work order creating a mapping grade GPS position at the location where searched and otherwise treated as a standard valve assessment.

³ All types and sizes will be verified as part of the inspection. Additional upstream sideline valves may need assessed if first valve off Pure inspection line is not functioning/working.

Identify the Valve

Each valve will be identified by its corresponding identification number. In cases where Asset ID's are not available, WACHS will create a temporary asset identification number as agreed with the CITY OF NOVI at the Project startup meeting.

Access the Valve

The valve cover shall be removed by WACHS in order to access the valve. If, after attempting to remove the valve cover it is clear that the cover is "stuck" the cover will be broken, the valve accessed, and the cover replaced. Covers are to be provided by the CITY OF NOVI.

Clean Out Valve Box/Vault

WACHS will vacuum out debris or pump out water from the box/vault in order to allow access to the valve operating nut and bonnet bolts where possible. In every case the operating nut must be exposed and clearly visible (not under water or debris) when the valve is exercised. In order to provide this service WACHS will provide a vacuum and water pump with every work crew. The CITY OF NOVI will provide a location for discarding materials vacuumed out of the valve structures.

Inspection

WACHS will execute a visual inspection of the valve and valve structure. This inspection will be conducted from street level and is intended to discover discrepancies that are readily visible from above ground. The specific inspection information to be documented is noted in the documentation section.

Valve Exercising

WACHS will exercise each valve a minimum of two full cycles. (Exercise is defined as a full cycle, from open to shut to open again). All valves will be exercised with the minimum torque required so as to minimize the possibility of damaging the valve. WACHS will utilize a microprocessor controlled valve turner on larger valves or valves that are initially difficult to turn. Wachs will share, as part of coordinating work startup our operating guidelines for the following:

- 4" and smaller gate valves
- butterfly valves of various sizes
- 6" to 12" gate valves
- 16" and larger gate valves that are not geared
- 16" and larger geared valves
- Controlling torque using hydraulic valve turning devices
- Valves found in the wrong position
- Procedures for valves that do not cycle at the proposed torque limit
- Procedures for large valves with inoperable bypass valves

Out of Position - Valve Protocol

Out of position valves create unintended dead ends and water quality problems requiring hydrants to be flushed when they are re-opened. The CITY OF NOVI may choose to review out of position valves and request WACHS to open these valves to improve system hydraulics. Hydrants may be required to be flushed under these conditions and will be manually documented and these activities are included in the daily crew rate for additional services. WACHS and the CITY OF NOVI will agree to a standard operating protocol to be executed when out of position valves are encountered for both open and closed valves PRIOR to startup of field operations.

Valve Marking

Valve lid covers will be marked, as the inspection and exercising process is completed, with blue marking paint. The mark is intended to provide field evidence of work completed at an individual valve and will also assist any future crews in locating the valve in a timely manner.

Equipment and Software

WACHS agrees to provide the necessary materials, equipment and labor to complete the Valve Assessment Program. WACHS will have microprocessor-controlled valve turner available so larger valves or valves that are initially difficult to turn can be safely operated. Wachs will use an industrial vacuum with at least a 12 cu. ft. holding capacity and a water pump with a minimum pumping capacity of 100 GPM for valve box and vault cleanouts to make valve operating nuts visible and accessible PRIOR to operating the asset.

GPS Equipment

WACHS will utilize mapping grade GPS survey instruments for collecting coordinate and observational data for this program. Specific software systems for data collection, post processing, filtering and editing positional data, including version information will be shared and coordinated with the CITY OF NOVI data and information personnel in advance of the work startup.

Valve Exercising Equipment

WACHS will make available to operations personnel in advance of work startup a list of the make, model, year and operating system version for proposed hydraulic valve turning equipment. We will identify software system used for creating torque charts – including version.

Vacuuming and Pumping Equipment

WACHS will make available to operations the make, model, year of the industrial vacuum with at least a 12cu.ft. holding capacity and a pump with a minimum pumping capacity of 100 GPM

Mapping Software

WACHS will identify the software system to be utilized to create supporting map documents listed under the Reports section, including software versions. This will be coordinated in advance of work startup.

Business Systems

WACHS will analyze CITY OF NOVI'S current business systems and processes (GIS and CMMS for work order management) and subsequently provide MS Access databases and a personal geodatabase deliverable for CITY OF NOVI to integrate project data into these systems. It is critical that all project data reside in the planned final resting place and is accurate and usable for ongoing planning and asset management implementation by CITY OF NOVI stakeholders.

GPS Data

All the water valves encountered in this program are to be GPS mapped with mapping grade (sub-meter) accuracy and the attribute data will be delivered in a database compatible with CITY OF NOVI's existing data schema. Coordinate data shall be field collected with autonomous GPS readings and subsequently differentially corrected via post-processing. Wachs shall further refine positions through filtering and inspection to eliminate noise, problematic satellite geometry and multipath degradation. Point valve features shall be collected at an epoch of 1 second with a minimum occupation of 20 seconds. Specific parameters include:

- Elevation mask: 15 degrees above the horizon
- Coordinate system: as agreed with CITY OF NOVI GIS group
- Satellites: ≥ 4
- Position Dilution of Precision (PDOP): < 6
- Minimum number of raw positions collected: 20

At a minimum, and in addition to database attribute requirements, the following coordinate data items shall be generated as a result of this process.

- PDOP value
- HDOP value
- Correction Status
- Date Recorded
- Time Recorded
- Total Positions
- Filtered Positions
- Horizontal Precision
- Vertical Precision
- Standard Deviation
- .cor File Name
- X-coordinate
- Y-coordinate

Documentation and Deliverable Database

Data will be documented on each valve and will be agreed upon in advance of work startup with the CITY OF NOVI. WACHS will provide applicable valve data in a spatially accurate format compliant with the CITY OF NOVI's existing data structure. Metadata, including a detailed citation describing field data collection practices, equipment settings, post processing procedures, base stations used for differential correction and expected accuracy, are to be submitted with final data deliveries. The database shall contain the information agreed with the CITY OF NOVI and at a minimum the following attribute data:

- A Unique Identification Number
- Date of Operation
- Valve Size
- Valve Type
- Use of valve
- Valve Structure
- Boolean indicating whether vacuumed/pumped
- Operating Nut Depth
- Boolean indicating whether exercised
- Close Direction
- Number of Turns
- Final Torque
- Torque chart for larger valves or valves that are difficult to turn
- Valve Condition (operable, inoperable)
- Valve discrepancies (categories and details)
- Structure discrepancies (categories and details)
- Other value added attribute items as agreed

Before field operations commence, a meeting to be attended by WACHS and the CITY OF NOVI will be held to reach alignment on specific data schemas to be employed. (NOTE: This meeting may be

held via phone conference). It is at this juncture that Wachs and the CITY OF NOVI will reach agreement on which specific features will be collected, the format this feature data will conform to, and the final resting place for all collected and calculated information within the CITY OF NOVI's data infrastructure so that it can be appropriately mapped and accessed by the CITY OF NOVI staff. In addition, WACHS will integrate field collected GIS data into the CITY OF NOVI's enterprise data infrastructure.

ADDITIONAL PROGRAM OBJECTIVES

GIS QA / QC Plan

WACHS includes a detailed QA / QC plan identifying quality checkpoints throughout the program lifecycle. At a minimum, we will utilize leading edge methods for developing mapping grade horizontal accuracy and accurate attribute data.

Work Orders

WACHS will create work orders for all required repairs that are needed in order to bring the valves in the system up to 100% operability. These work orders will be captured and managed in a database to be provided by WACHS work orders will specifically note the discrepancy of the valve and the repair activity required to return the valve to full operability. Work orders will contain, at a minimum, the following information:

- Valve ID
- Map number
- Specific valve discrepancy (category and details)
- Specific repair activity required to return the valve to full operability

Scheduling

WACHS will develop an overall schedule of work to be approved by CITY OF NOVI prior to the commencement of work. CITY OF NOVI shall approve the work schedule before allowing WACHS to proceed.

Safety

WACHS will abide by all OSHA safety regulations in the fulfillment of this scope of services. WACHS shall provide all traffic control services necessary to ensure a safe working environment for the fulfillment of the contract. **As a requirement to perform this scope of work safely, each truck crew will have a minimum of two (2) crew members.** All work vehicles will be equipped with amber warning lights, strobe lights, directional arrow board lights, communications equipment and will clearly identify WACHS. If necessary, WACHS will switch to night time operations if traffic control and safety become a factor in the completion of services.

Professionalism

WACHS will ensure that all activities are conducted in a professional manner. At a minimum WACHS will ensure all personnel are in an approved uniform; all field equipment is maintained clean and neat; all trucks are clearly identified with WACHS' name and contact phone number and written procedures for field operations and information management processes are contained within the vehicle in an operations manual.

Evaluation Presentation

WACHS will evaluate and analyze the results of the program and develop an evaluation presentation for the CITY OF NOVI. This evaluation presentation will include an analysis of the results of the program, findings, learning's, suggestions and recommendations for the CITY OF NOVI.

Deliverables

At a minimum the following deliverable reports will be presented to the CITY OF NOVI;

- Validated database compliant with ESRI ArcGIS
- A list of recommended valve repairs
- Work orders for these repairs
- Summary report

We look forward to providing our valve and hydrant assessment services. Please advise if you have any questions regarding this proposal and scope.

Sincerely,

Deryck Freudeman
Wachs Water Services, a Xylem Brand
North Central Region BDM
614.290.6382

Department of Public Works Water and Sewer Division

Pre-Stressed Concrete Pipe Assessment and Inspection Program 2019



Pre-Stressed Concrete Cylinder Pipe from GLWA Break 14 Mile Main Break



PCCP Overview



- PCCP is commonly found in water mains
- PCCP can range in size from 16" to 20' diameter
- A prestressed wire is wrapped helically around the pipe providing resistance to internal pressure and external loads
- Designed to handle high pressures



Types of PCCP Failures

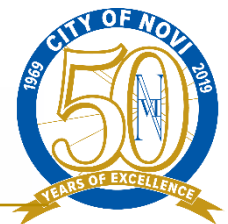
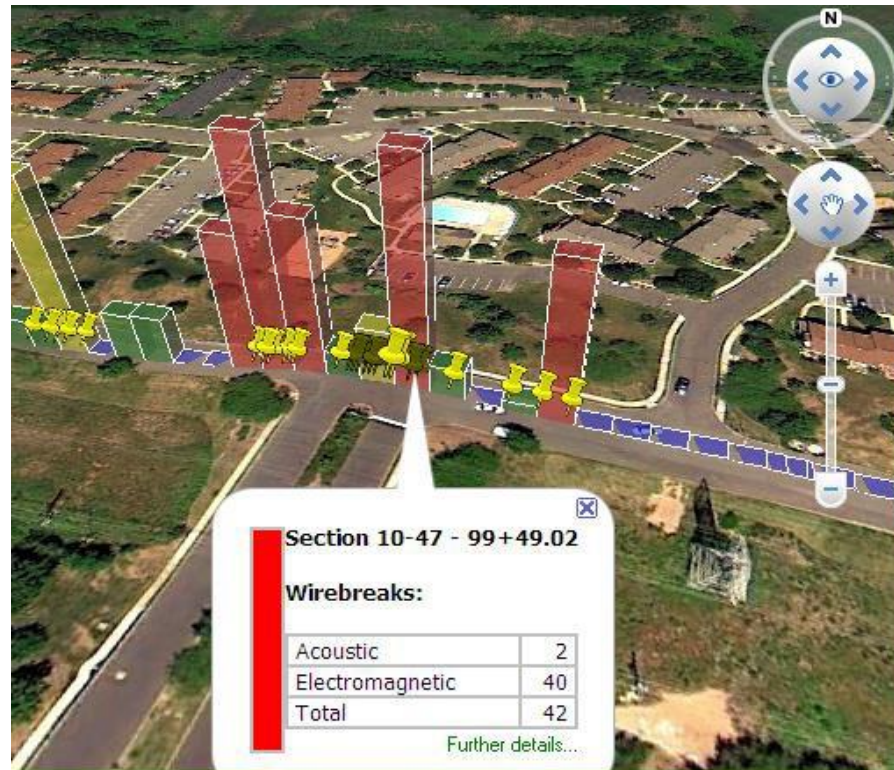
Corrosion



Hydrogen Embrittlement



Our goal is to reduce your capital expenditures by focusing repair/rehab/replacement on bad pipe



PCCP Inspection Toolbox

- Transient pressure monitoring
- Leak and air pocket detection (Smart Ball)
- Structural pipe wall inspections - counting wire breaks (Pipe Diver)
 - Electromagnetics
 - Visual and Sounding
 - Forensic investigation and design review
 - Structural assessment
 - Remaining useful life
- Acoustic fiber optic (AFO) monitoring for wire breaks – (Option)



In-line Acoustic Leak & Gas Pocket Detection



- Free Swimming/ Non-Tethered Hydrophone
- Technology
- Locates leaks and gas pockets in transmission or force mains
- Launch and retrieve in live flow through
- 4" openings

Structural Pipe Inspection

External



Diameter: Any
Pipe segments
excavated to
springline
Manned system

Free-Swimming



Diameter: 16"+
Pipeline In Service
Free swimming
*SONAR
*CCTV recording

PCCP Pipe Inspection Proposal

- SmartBall – Identification and location of any leaks and/or air pockets in the pipeline as well as ARV installation recommendations.
- PipeDiver - Identification and location of the estimated number of broken prestressing wire wraps within each PCCP pipe section inspected.
- Xylem will also provide transient pressure monitoring and structural modeling (FEA curves) to determine the significance of any defects detected.
- Pure Technologies typically provides a presentation summarizing draft results to stakeholders to facilitate review of the draft report.



Summary

- Budgeted in 2019-2020 FY
- Scheduled to start fall 2019
- Preventive and proactive maintenance with the goal to prevent a catastrophic failure
- Failures result in \$\$\$ and loss of service
- Projects can be planned and more cost effective with control of service maintained
- Same program GLWA just completed first phase of inspection

