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February 20, 2017

RE: City of Saint Paul
2017 Water Main Pipe Condition Assessment
SEH No. STPWU 140197 14.00

Richard Hibbard, PE
Project Engineer
Saint Paul Regional Water Services
1900 Rice Street
Saint Paul, MN, 55113

Dear Richard:

Thank you for your interest in SEH's professional services to non-invasively assess the condition of the City's water main pipes (pipes). SEH teams with Echologics, a division of Mueller Company, to use their Echo Shore tool (tool) to complete the City's assessment. We will provide these services in accordance with your standard agreement format herein called the Agreement.

Summary
The City wants to assess the condition of 11,363 linear feet of pipe in 2017, of which approximately 3,229 is greater than 16", located in various streets and neighborhoods as shown in Exhibit 1. During this trip to Minnesota, the tool will assess the condition of pipes in other Minnesota Cities, but at this point, we don't have a final count of cities using the tool in 2017. Working in more than one City per trip allows us to spread the tool's mobilization cost among multiple Cities. This reduces the cost that any one City will pay for an assessment of its pipes.

Benefits
Choosing to apply this tool to the City's pipes provides the following immediate benefits:

1. Reduce the amount of money the City spends to create potable water.
2. Reduce the amount of electricity the City uses to distribute potable water.
3. Reduce the cost the City might spend to excavate and restore the area around a leak by catching the leak in its earliest stages.
4. Allow the City to better coordinate pipe rehabilitation with capital improvement plans for other infrastructure occupying the right-of-way or easement.
5. Allow the City to better understand how much of its pipe network may need rehabilitation.

Deliverables
Below is a list of deliverables we will provide to the City at the conclusion of the assessment. We will submit a draft report to the City within 6-8 weeks of completing field work. At this time, we don't have an exact date of the field work as it is dependent on the final Echologics schedule based on all of the Minnesota cities participating. We do anticipate this work taking place in the spring/summer, 2017. A final schedule will be provided to you as soon as it becomes available.

1. An update to the City GIS shape file or geodatabase (geodatabase) for each reach of pipe. We define a reach of pipe as between fire hydrants or main line valves. The update will add the following attributes to the shape file or geodatabase.

    a) An estimate how much pipe wall has been lost to-date.

    b) An estimate of the pipe's corrosion rate.

    c) An estimate of the pipe's remaining wall thickness.

2. A written report summarizing the results of the condition assessment, including percent wall loss, and leak detection containing the following information.

    a) A discussion of the purpose of leak detection and condition assessment.

    b) A discussion of the background of leak detection and condition assessment.

    c) A discussion of the methodology of leak detection and condition assessment.

    d) A description of the instrumentation used to complete the work.

    e) Tabulation of condition assessment results.

    f) Description of deficiencies the crew found in the field along the pipe network.

    g) An appendix showing the measured results for each reach of pipe.

    h) An appendix containing a summary tabulation of condition assessment ranked from worst to best.

The scope does not include a remaining service life analysis, which is an optional task provided that can be provided by Echologics. If you desired that analysis, it would be an additional fee of approximately $14,300 based on the footage of pipe included in your program.

Estimated Costs

We will complete our work for an estimated fee of $67,800.00. This cost includes all reimbursable expenses. We will invoice the City for our work on a lump sum basis as work is completed. We have provided you with the lower mobilization rate which assumes we have at least one other city using the tool this year.

The estimated fee includes time for SEH staff to complete the following tasks prior to Echologics starting their work – site visit to perform a visual inspection of all valves to make sure they are cleaned and operable, review of locations for potential traffic control items, etc. Additionally, at the conclusion of the field work, SEH provides the GIS mapping update to the City as part of the fee. Finally, SEH is on site on an infrequent, periodic basis (as needed) during the field work to coordinate all crew activities with Utility forces and observe the general progress of the work.

Exhibit 2 enclosed with this letter is Echologics Technical Requirements, Specifications, and Constraints. Exhibit 2 outlines the work we assume will be undertaken by City forces at their own expense. Asking us to accomplish work in Exhibit 2 will cause an additional expense.

Also, since we cannot guarantee that the other Minnesota Cities will proceed with their projects, it is understood that the City may elect to reconsider proceeding with the project depending on any potential increase in the mobilization costs.

We look forward to serving the City's Water Services Department and applying our expertise assessing the condition of the City's water main pipes. Please contact me with questions and comments at 612.255.8747 or dhutton@sehinc.com.

Sincerely,

SHORT ELLIOTT HENDRICKSON INC.

David E. Hutton, PE
Senior Professional Engineer

Enclosure
c: Michael Livermore, Echologics
Mike Kraemer, SEH
Jen Schumann, SEH
Paul Pasko, SEH

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Exhibit 1

ASSET ID	STREET	DIAMETER	MATERIAL	INSTALLATION YEAR	LENGTH (FT)	LENGTH (MI)
860430	CLEVELAND AVE N	12	CI	1915	412	0.08
860400	CLEVELAND AVE N	12	CI	1909	952	0.18
200160	CLEVELAND AVE N	12	CI	1963	1275	0.24
860580	CLEVELAND AVE N	12	CI	1914	26	0.00
860550	CLEVELAND AVE N	12	CI	1914	334	0.06
860530	CLEVELAND AVE N	12	CI	1914	825	0.16
860635	CLEVELAND AVE N	12	CI	1963	340	0.06
				CLEVELAND TOTAL	4164	0.79
955780	COMO AVE	12	CI	1971	842	0.16
149051	FAIRVIEW AVE N	16	CI	1890	578	0.11
400204	LONDIN LN	12	CI	1968	898	0.17
1315620	EDGCUMBE RD	12	CI	1930	1885	0.36
1315660	EDGCUMBE RD	12	CI	1930	90	0.02
1315700	EDGCUMBE RD	12	CI	1930	110	0.02
1315680	EDGCUMBE RD	16	CI	1929	48	0.01
1315720	EDGCUMBE RD	16	CI	1929	66	0.01
1315740	EDGCUMBE RD	12	CI	1930	145	0.03
1315760	EDGCUMBE RD	16	CI	1929	40	0.01
1491750	EDGCUMBE RD	16	CI	1928	88	0.02
				EDGCUMBE TOTAL	2472	0.47
2270800	JACKSON ST	20	CI	1936	1288	0.24
2270620	JACKSON ST	20	CI	1936	1121	0.21
				JACKSON TOTAL	2409	0.46
				OVERALL TOTAL	11363	2.15

EXHIBIT 2

7. Technical Requirements, Specifications, and Constraints

7.1. Operational Requirements

7.1.1. Owner shall supply an experienced crew for operation of all Owner owned apparatus. The size of the crew depends on the details of the job. Echologics is not responsible for any operation or modification of Owner owned apparatus.

7.1.2. All fittings must be cleaned, exercised and in safe working condition prior to survey. Closed valves or other appurtenances must not be passing water. Hydrants must not be leaking. If cleaning cannot be performed prior to site-work, on site cleaning must be arranged by Client on request.

7.1.3. Client shall provide traffic management (including man power and equipment) as and when required. Echologics is not responsible for any traffic control requirements, unless explicitly included in this proposal. It is expected that the client will be proficient in all local laws and regulations.

7.1.4. If indicated as a requirement during the Project Planning phase, Echologics shall supply one crew member trained as a confined space entrant. All other aspects of confined space entry shall be of the responsibility of Client, unless explicitly included in this proposal.

7.1.5. Fall protection, including supply of fall prevention equipment and harnesses, shall be of the responsibility of Client.

7.1.6. Echologics shall follow any Lock out Tag and Tag out procedures specified by Client. Client is responsible for informing Echologics of any such procedures in effect at the work sites applicable for this project.

7.1.7. All required information regarding the pipes to be tested must be provided in advance to Echologics. The information must be up to date and in a form that can be easily interpreted. This includes as-built drawings, repair history, nominal pipe information, GIS information, pressure and flow information, locations of PRVs, pumps, reservoirs, cross-connections, reducers, tie-ins, valves, services, backflow preventers, hydrants, corp valves, and any other possible noise producing apparatus.

7.1.8. If De-chlorination / Chlorination and/or backflow preventers are required, these shall be the responsibility of Client.

7.2. General Technical Specifications and Constraints

7.2.1. Fluid temperature must be between 33º and 100º F (0.5º and 38º C)

7.2.2. Liquid flow velocities above 5 ft/s (1.5 m/s) may result in turbulence in the line, introducing noise which can reduce the sensitivity of leak detection, and prevent collection of pipe integrity testing data. Echologics recommends that Client take steps to ensure velocities are below these levels, but will conduct testing nonetheless if Client elects to leave them at higher levels.

7.2.3. Operating pressure must be between 15 and 150psi (100 to 1000 kpa). Pressures outside of this range will require special consideration.

7.2.4. Large air pockets cannot be present in the pipe. Purging of all air may be required.

7.2.5. Significant amounts of dispersed air (milky water) can skew results. Purging of dispersed air may be required.

7.2.6. All forms of non-destructive testing involve an inherent and unavoidable level of uncertainty. The results provided by Echologics are not guaranteed. The methods used for leak detection and condition assessment are highly dependent on input parameters therefore it is not possible to certify the results. Echologics is not responsible any actions taken or recommendations made by Client based on the results of the report.

7.3. Leak Detection Technical Specifications and Constraints

7.3.1. Acceptable pipe materials are: Pit Cast Iron, Spun Cast Iron, Steel, Ductile Iron, Asbestos Cement, Reinforced or Bar-wrapped Concrete, PVC, PE and other Plastics

7.3.2. Surface mounted sensors can be magnetically attached to appurtenances such as line valves, hydrant secondary valves or to the top of the pipe at a maximum sensor-to-sensor spacing of 1000ft (300m)

7.3.3. Longer sensor-to-sensor spacing will require the use of hydrophones

7.3.3.1. Suitable access is required to attach or adapt a 1.5” NPT female fitting to a valved fitting such as a corp valves, air blow offs, fire hydrants or tapped blind flanges.

7.3.3.2. The maximum sensor-to-sensor spacing for Hydrophone sensors is 2500ft (750m)

7.3.4. Vertical access is required to lower the sensor down from the surface. Angled or broken valve chamber are not suitable.

7.3.5. The connection point must be free of dirt and debris and in good working order

7.3.6. Performance specifications are based on a sensor spacing of 330ft (100m)

7.3.7. Performance specifications assume that accurate information has been provided regarding and pipe location including locations of bends and elevation changes.

7.3.8. Performance specifications assume that accurate information regarding pipe type (material) and diameter has been provided.

7.3.9. Diameters may range from 1” to 120” (25mm to 3050mm) in diameter. Larger mains are possible but special consideration must be taken.

7.3.10. Leaks location accuracies depend on sensor spacing, pipe material consistency, and other factors, but are generally within 10 ft (3 m) of its actual position when accurate information for pipe type and diameter is provided.

7.3.11. Sensitivity to small leaks varies depending on pipe diameter and material, as well as sensor spacing and the presence of noise inside the pipe. Leaks as small as 2.5 GPM (9.5 l/m) can consistently be located, and leaks as small as 0.5 GPM (2 l/m) can be located under good conditions.

7.4. Condition Assessment Technical Specifications and Constraints

7.4.1. Acceptable pipe materials are: Pit Cast Iron, Spun Cast Iron, Steel, Ductile Iron, Asbestos Cement and Reinforced or Bar-wrapped Concrete

7.4.2. Surface mounted sensors can be magnetically attached to appurtenances such as line valves, hydrant secondary valves or to the top of the pipe at a maximum sensor-to-sensor spacing of 500ft (150m)

7.4.3. Longer sensor-to-sensor spacing will require the use of hydrophones

7.4.3.1. Suitable access is required to attach or adapt a 1.5” NPT female fitting to a valved fitting such as a corp valves, air blow offs, fire hydrants or tapped blind flanges.

7.4.3.2. The maximum sensor-to-sensor spacing for Hydrophone sensors is 1500ft (450m)

7.4.4. Vertical access is required to lower the sensor down from the surface. Angled or broken valve chamber are not suitable.

7.4.5. For every location, there must be a local fitting where liquid temperature and pressure can be measured. Fittings include fire hydrants, pitot taps, sampling stations and other similar appurtenances.

7.4.6. The connection point must be free of dirt and debris and in good working order

7.4.7. Diameters may range from 1” to 60” (25mm to 1525mm) in diameter. Larger mains are possible but special consideration must be taken.

7.4.8. Concrete, Mortar and Bitumen linings are acceptable if the thickness is specified

7.4.9. PVC, PE and other plastic mains are not suitable for acoustic condition assessment.

7.4.10. Performance specifications are based on a sensor spacing of 330ft (100m)

7.4.11. Performance specifications assume that accurate information has been provided regarding and pipe location including locations of bends and elevation changes.

7.4.12. Performance specifications assume that accurate information regarding pipe type (material) and diameter has been provided.

7.4.13. Accuracy of average pipe wall thickness calculations varies depending on many factors, including the consistency of the pipe materials, accuracy of the design information provided, accuracy of the pipe alignment information provided, consistency of the fluid’s bulk modulus, and consistency of the water’s temperature. In most cases, accuracies shall fall within the following ranges:

7.4.13.1. For metallic mains, average minimum pipe wall thickness will be provided within 0.15” (3.8mm). For metallic mains with lining, this will be provided as an equivalent structural thickness.

7.4.13.2. For asbestos cement mains, the average minimum structural wall thickness will be provided within 0.15” (3.8mm)

7.4.13.3. For Reinforced and Bar-wrapped concrete mains, the average minimum structural stiffness will be provided within 7200 kpsi or 50Gpa

7.4.14. For liquids other than potable or raw water, a bulk modulus calibration must be performed when needed. Normally at the outset of testing and any other

times during the testing when the bulk modulus may change (during a rain event for sewer force mains)