DC Water's Application of Fixed Leak Detection to Monitor Water Mains Near High Profile Construction Site

[Don't] Take a Leak

Beyond the Headphones with DC Water

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Agenda

THE SITE

LEAK DETECTION

- CRITERIA
- TECHNOLOGY

ACOUSTIC LEAK DETECTION

- TECHNOLOGY COMPARISON
- TECHNOLOGY SELECTION

INSTALLATION

- PRIMAYER PHOCUS3M
- SYRINIX TRUNKMINDER
- ECHOLOGIC ECHOSHORE-TX
- AQUARIS SPECTRUM AQS-SYS

LESSONS LEARNED

Q&A

The Site

June 2014 – DC Clean
 Rivers breaks ground on the
 First Street Tunnel

Located in Bloomingdale neighborhood of Washington, DC's Ward 5





Project Background

- DCCR Project included excavation with ground freezing
- October 2015 DC Water DWS informed of ground movement





The Site: Existing Water Infrastructure Conditions

1st Street, NW

- 48-inch Ductile Iron Water Main
 - Installed in 1988
 - TR Flex Joints
 - Joint deflection tolerance of 0.5 degrees
- 6-inch Cast Iron Water Main
 - Installed in 1893





The Site: Existing Water Infrastructure Conditions

Adams Street, NW

- 36/30-inch Cast Iron Water Main
 - Installed 1904-1924





Leak Detection Criteria

- 1. Fixed Location
- 2. Continuous Monitoring
- 3. Autonomous Correlation
- Automatic Data Transfer and Alerts





Leak Detection Technologies

Acoustic Devices

- Listening Rods/Sticks
- Geophones
- Hydrophones
- Leak Noise Loggers
- Leak Noise Correlators
- Streaming Cable Inline Acoustic Leak Detectors
- Free-Floating Inline Acoustic Leak Detectors
- Acoustic Fiber Optics (AFO)
- Electromagnetic Field Detection

Thermal Detection

- Thermography
- Electromagnetic Detection
 - Ground Penetrating Radar (GPR)
- Chemical Detection
 - Tracer Gas
 - Tracer Liquids







Acoustic Leak Detection Equipment

Listening Devices

- Handheld
- Effectiveness depends on the user experience
- Time consuming



Noise Loggers

- Deployed in underground fittings or valves
- Listen for pipe noise during programmed quietest time
- Do not pinpoint location of a leak



Acoustic Leak Detection Equipment

Noise Correlators

- Measure pipe noise between 2 locations
- Leak position calculated



Correlating Logger

- Combines noise logger and correlator
- Deployed temporarily or in fixed locations
- Continuously monitors
- Detects leak generated noise patterns at specific locations along the pipe





Acoustic Leak Detection Equipment Summary

Manufacturer	Technology Name	Acoustic Category	Deployment Type	Data Transmission	Pipe Diameter	Pipe Material
Aclara/ Gutermann	STAR ZoneScan	Correlating Logger	Temporary or Fixed	Manual or Automated	2″ to 20″	 Asbestos Cement Metallic PCCP Plastics
Aquarius Spectrum	AQS-SYS	Correlating Logger	Fixed	Automated	6″ to 46″	 Asbestos Cement Metallic PCCP Plastics
Echologics	EchoShore-DX EchoShore-TX	Correlating Logger	Fixed	Automated	≤12″ 14″ to 120″	 Asbestos Cement Metallic PCCP Plastics
HWM Water/ FCS	Permalog+ Leak Noise Logger	Noise Logger	Temporary or Fixed	Manual or Automated	≤20″	 Asbestos Cement Metallic PCCP Plastics
Itron	100W/ Leak Sensor/ MLOG	Noise Logger	Fixed	Automated	≤16″	MetallicPlastics
Syrinix	BurstMinder TrunkMinder	Pressure & flow monitor Correlating Logger	Fixed	Automated	≤14″ 16″-96″	 Asbestos Cement Metallic PCCP Plastics
Vivax-Metrotech	LOG CORR	Correlating Logger	Temporary or Fixed	Manual or Automated	2″ to 20″	 Asbestos Cement Metallic PCCP Plastics



Acoustic Leak Detection Equipment Comparison – Small Diameter Water Mains

	Aclara/ Gutermann	Aquarius Spectrum	Echologics	HWM Water/ FCS	Itron	Syrinix	Vivax- Metrotech
	STAR ZoneScan	AQS-SYS	EchoShore- DX	Permalog+ Leak Noise Logger	100W/ Leak Sensor/ MLOG	TrunkMinder	LOG CORR
Correlating Logger	\checkmark	✓	\checkmark	Х	Х	\checkmark	\checkmark
Fixed Location	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Automatic Data Transmission	\checkmark	✓	✓	✓	\checkmark	\checkmark	\checkmark
Applicable on 6" WM	\checkmark	\checkmark	\checkmark	✓	\checkmark	Х	\checkmark
Applicable on Cast Iron	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark



Acoustic Leak Detection Equipment Comparison – Large Diameter Water Mains

	Aclara/ Gutermann	Aquarius Spectrum	Echologics	HWM Water/ FCS	Itron	Syrinix	Vivax- Metrotech
	STAR ZoneScan	AQS-SYS	EchoShore- TX	Permalog+ Leak Noise Logger	100W/ Leak Sensor/ MLOG	TrunkMinder	LOG CORR
Correlating Logger	\checkmark	✓	\checkmark	Х	Х	✓	\checkmark
Fixed Location	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Automatic Data Transmission	\checkmark	✓	✓	\checkmark	✓	✓	~
Applicable on 30″ & 48″ WM	Х	✓	✓	Х	Х	✓	Х
Applicable on Ductile & Cast Iron	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark



Installation – Primayer Phocus3m







Syrinix TrunkMinder





- 1. Valve Thread
- 2. Hydrophone
- 3. Potable Water Compliant Sealing Compound
- 4. Hydraulic Pressure Chamber
- 5. Pressure Sensor
- 6. Pressure Chamber Casting
- 7. Geophone
- 8. Analogue Signals Board
- 9. Digital Signals Board
- 10. Upper Cylinder Casting
- 11. Data and Power Cable Apertures

Photo courtesy of Syrinix













6-inch blow-off nozzle

Adapter

Adapter & sensors installed











	Quantity	Unit Price	Extended Price
Leak Detection Nodes	4 ea	\$18,550	\$74,200
Annual Software & Services	2 locations	\$4,000	\$8,000
Total:			\$82,200

* Standard price listed. DC Water received a promotional pilot price.



Installation – Aquarius Spectrum AQS-SYS







Installation – Aquarius Spectrum AQS-SYS





Installation – Aquarius Spectrum AQS-SYS

	Quantity	Unit Price	Extended Price
Fire Hydrant Sensors	3 ea	\$750	\$2,250
Underground Sensors	3 ea	\$1,000	\$3,000
Annual Software & Services	6 ea	\$120	\$720
Total:			\$5,970



Lessons Learned

Lessons Learned recognize mistakes observe what works document them share them

- 1. Connection and setup of unit
- 2. Power source
- 3. Communication hardware and antenna
- 4. Data Delivery
- 5. Permit Requirements





Lessons Learned: Connection + Set-up

Small Diameter Water Mains

- Typically require external contact with pipe
- Placed in valve chambers, or attached to fire hydrants
- All components bundled into a single unit
- Optional: Antenna equipped with extension cord

Large Diameter Water Mains

- Typically require contact with water column
- Limited access port locations
- Likely that a new access port would have to be installed (\$)
- Each unit consists of several separate components
- Baseline leak simulation by flushing portion of the watermain





Lessons Learned: Power Source

Small Diameter Water Mains:

- Typically battery operated
- Regulate power usage by collecting and transmitting data at preassigned times
- Average battery life: 5 years
- Battery replacement program

Large Diameter Water Mains:

- Require larger power source
- Power source options:
 - Direct connection to the power grid
 - Methanol fuel cells
 - Battery
 - Solar panels





Lessons Learned: Communication Hardware + Antenna

Communication methods:

- GSM cellular network
- GPRS/3G communication
- Satellite communication

Antenna Options:

- Extension cords to attach the antennas to the bottom of the manholes lid
- Composite manhole covers
- Antennas mounted on the manhole lid covered with traffic rated domes
- Antennas flushed with the manhole lid
- Antenna flushed with the existing grade
- Antennas mounted on a pole.







Lessons Learned: Data Delivery – Web User Interface Software

- Track leaks through web user interface
- Check compatibly with SCADA
- For more accurate leak locations, provide GIS Information

Weekly Monitoring Report		Coopies Table
Client	DC Water	☆ 7688 177
Project	1st Street Permanent Monitoring	P 7878 287 D 7893 155
Monitoring Start Date	Sentember 14, 2016	1 7894 HIT
Number of Nodes	2	10 7805 344 10 7850 610
Number of Pipe Segments Defined	1	
Total Distance Monitored	970 feet	
Monitoring Period	September 14th -September 18th	
Week	1	0 0 7
Number of Scheduled Data Canture Sessions/Node/Day	1	
Total Number of Scheduled Data Canture Sessions/Week	5	eL=0, C= 173, -400
Number of Scheduled Correlation Files Received	2	-200
Number of Correlations Performed	2	至 11 200
Current Period Network Uptime	40.0%	⁶ 400
Number of Forced Correlations/week	4.0	600
New Points of Interest Reported	0	Burst=0, InstV
Avg Temperature between Nodes at Last Correlation	84°F	10tThr=17.03, Av 40F
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Closing Statements



- Opportunity to pilot different leak detection technologies in the same environment
- No leaks have been identified to date
- Opportunity to monitor critical transmission mains nearby large construction jobs
- Critical to understand your system's need before selecting a leak detection technology



Questions + Answers

Presenters:

Sarah Ghali, P.E. – email: *sghali@dcwater.com* Marlee Franzen, P.E. – email: *mfranzen@dcwater.com*

QUESTIONS

ANSWERS

Collaborators:

Joshua Mazurek, Christopher Coit- DC Water

Sonia Oton, Gary Geck, Russel Deason – Mott MacDonald (Water Program Managers)

