



THE Event For The Utility Infrastructure Industry

Underground Construction Technology
International Conference & Exhibition

Condition Assessment Breakthrough for Asbestos Cement Pipes



Csaba Ékes, PhD, PGeo

SewerVUE



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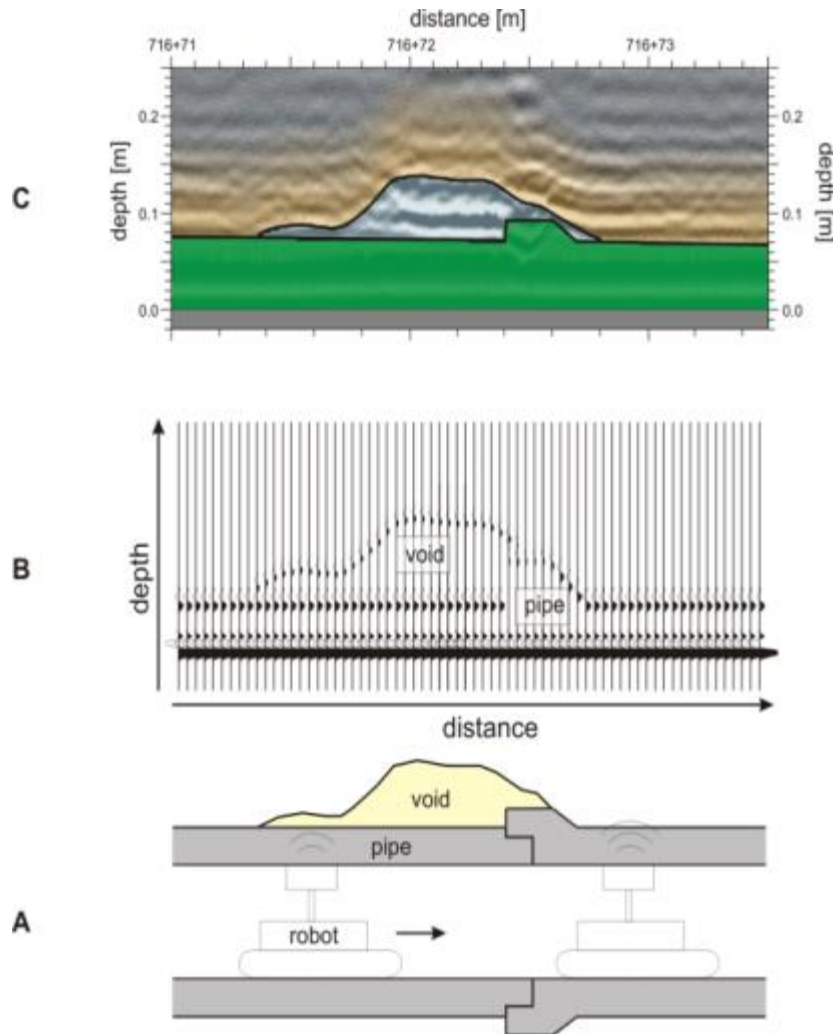
CCTV

- Visual only
- Qualitative
- Operator dependent
- Often unreliable, especially in large diameter trunks and interceptors

Is there a technology to see through the pipes and detect voids before they become sinkholes?



PPR Principle



- Ideal for gravity sewer and water pipes.
- Uses high frequency EM wave
- Reflected energy recorded for subsequent analysis.
- Antennas make direct contact with pipe wall.



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PPR Deployment





Manned entry

Used for:

- Large diameter water pipes
- Where manned entry is safe



Robotic PPR Inspection

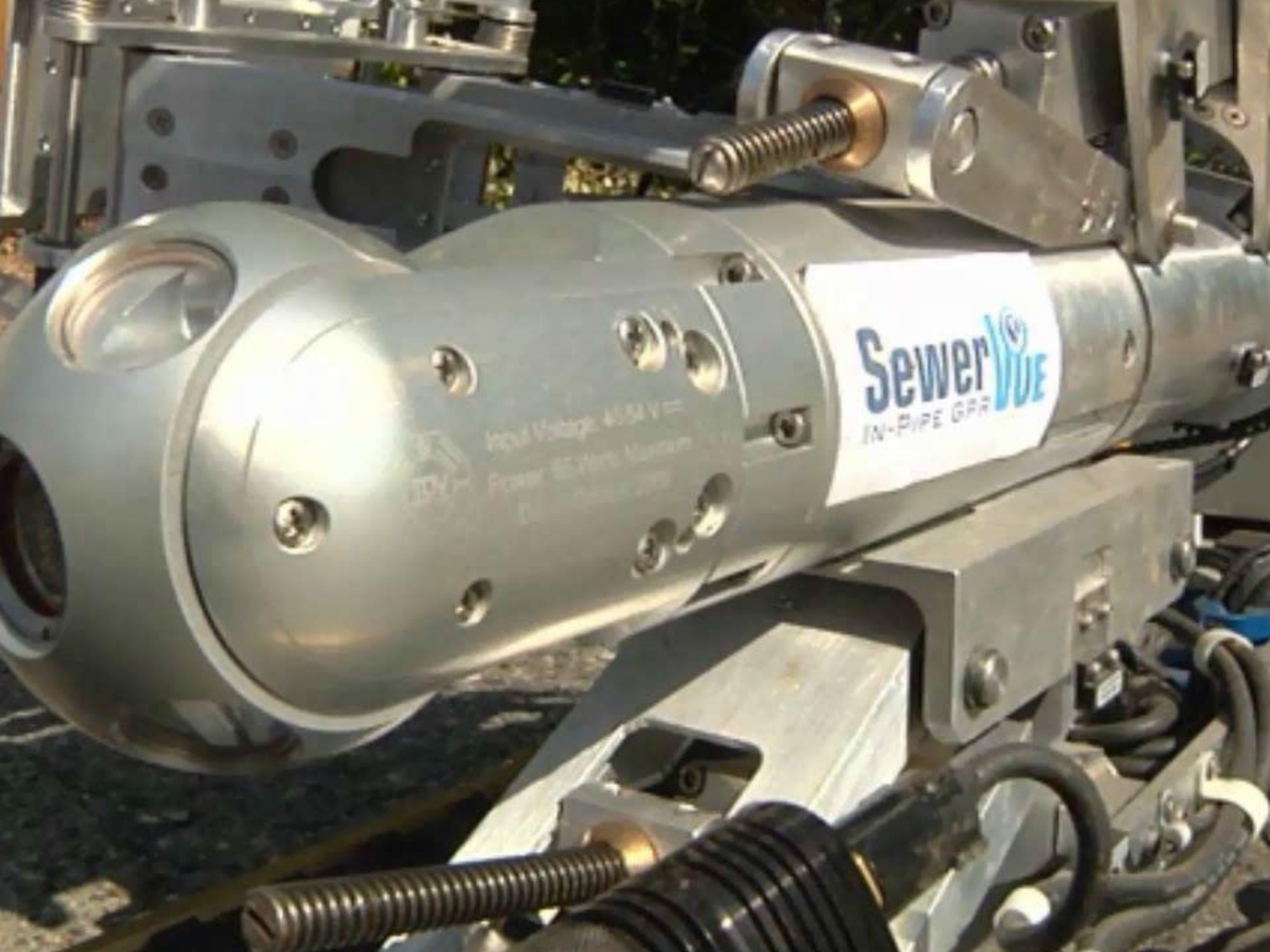


Capabilities

- “Swiss army knife”
- 21-60 inch, (520-1500 mm)
- 6000 ft deployment capability
- 30 ft/min inspection speed

Specifications

- High frequency PPR antennae
- LIDAR scanner
- CCTV (pan, tilt, zoom)
- No bypassing required



SewerVue
IN-PIPE GPR

Input Voltage: 48-54 VDC

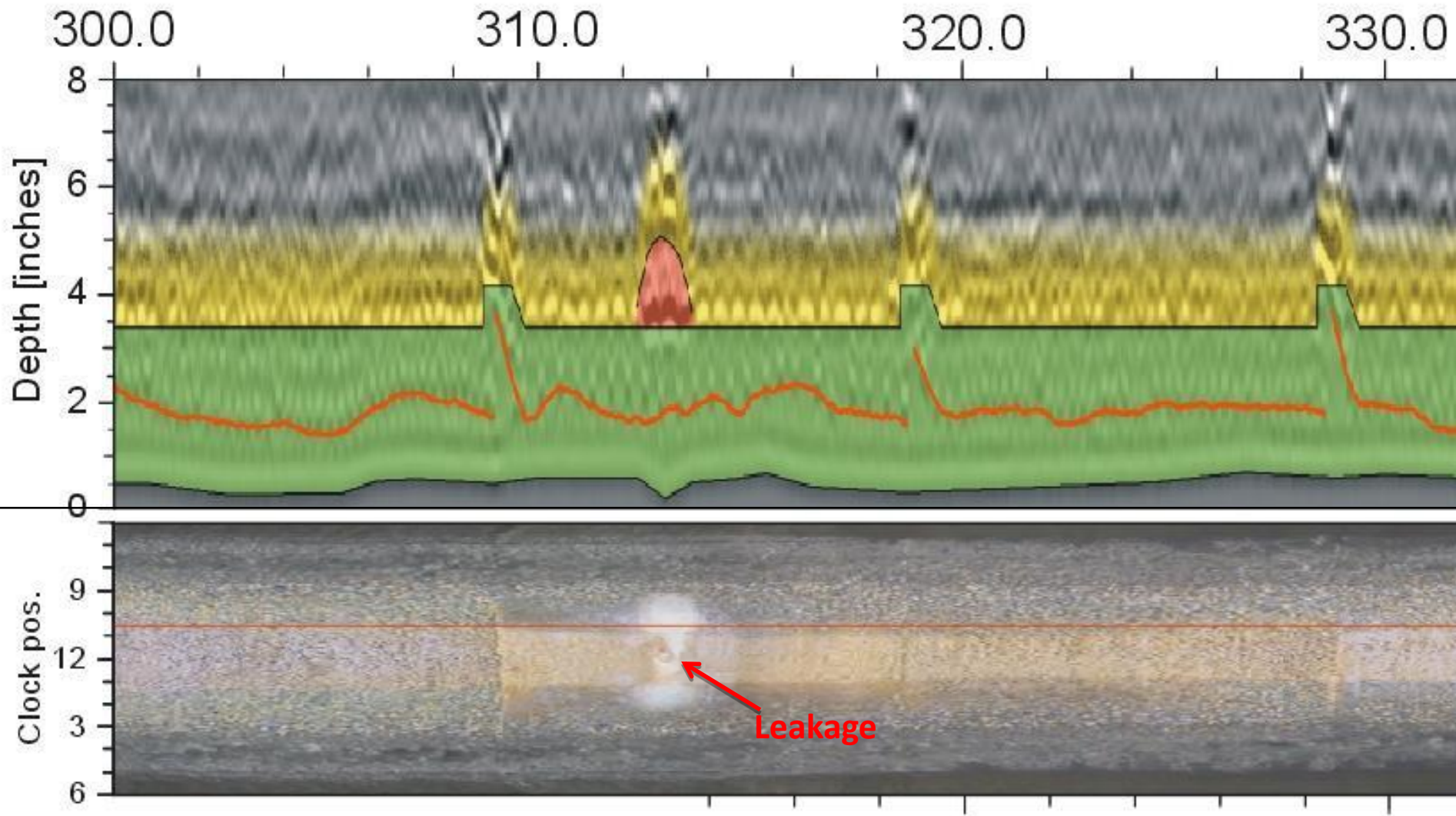
Power: 55 Watts Maximum

Date: October 2019



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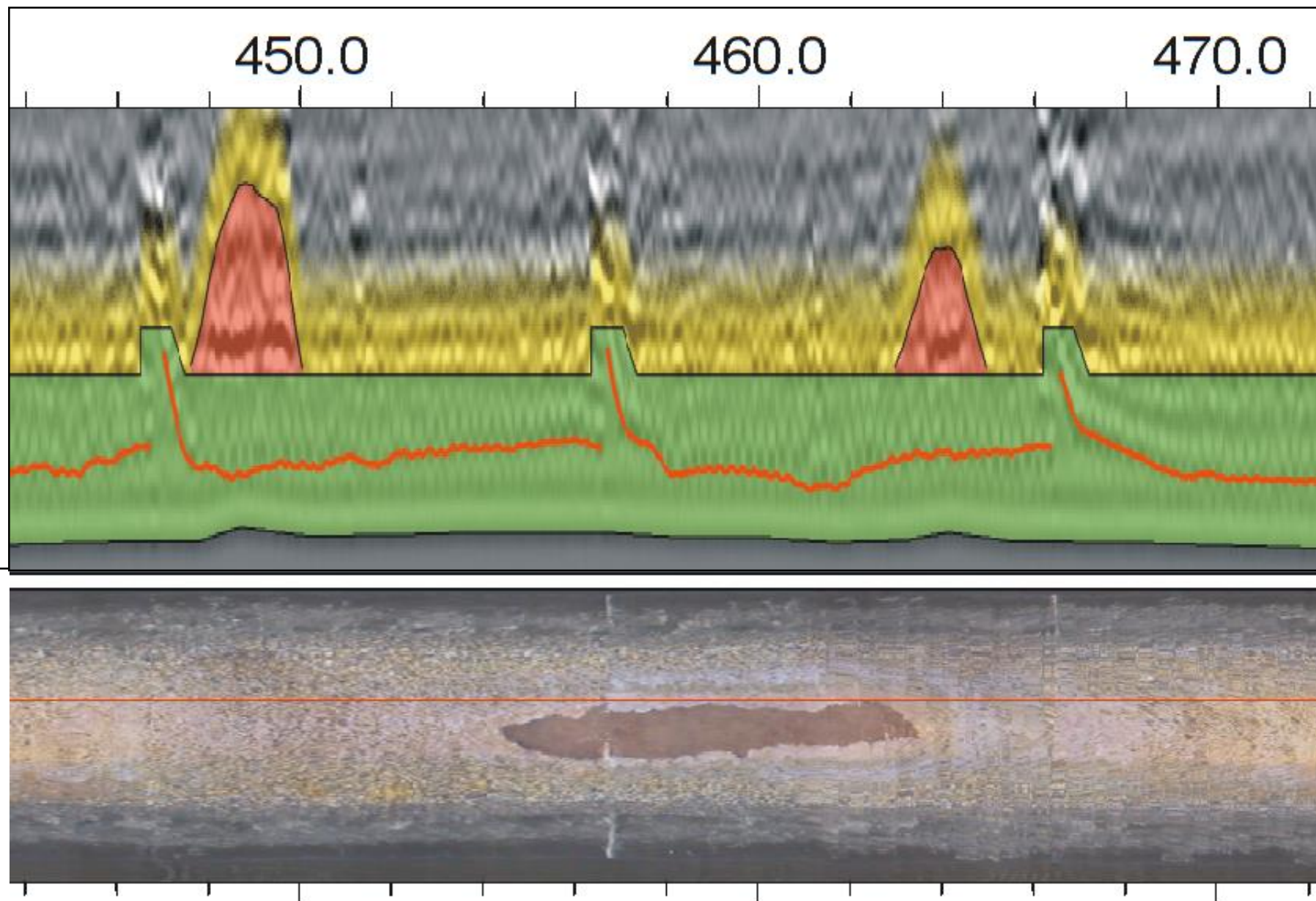
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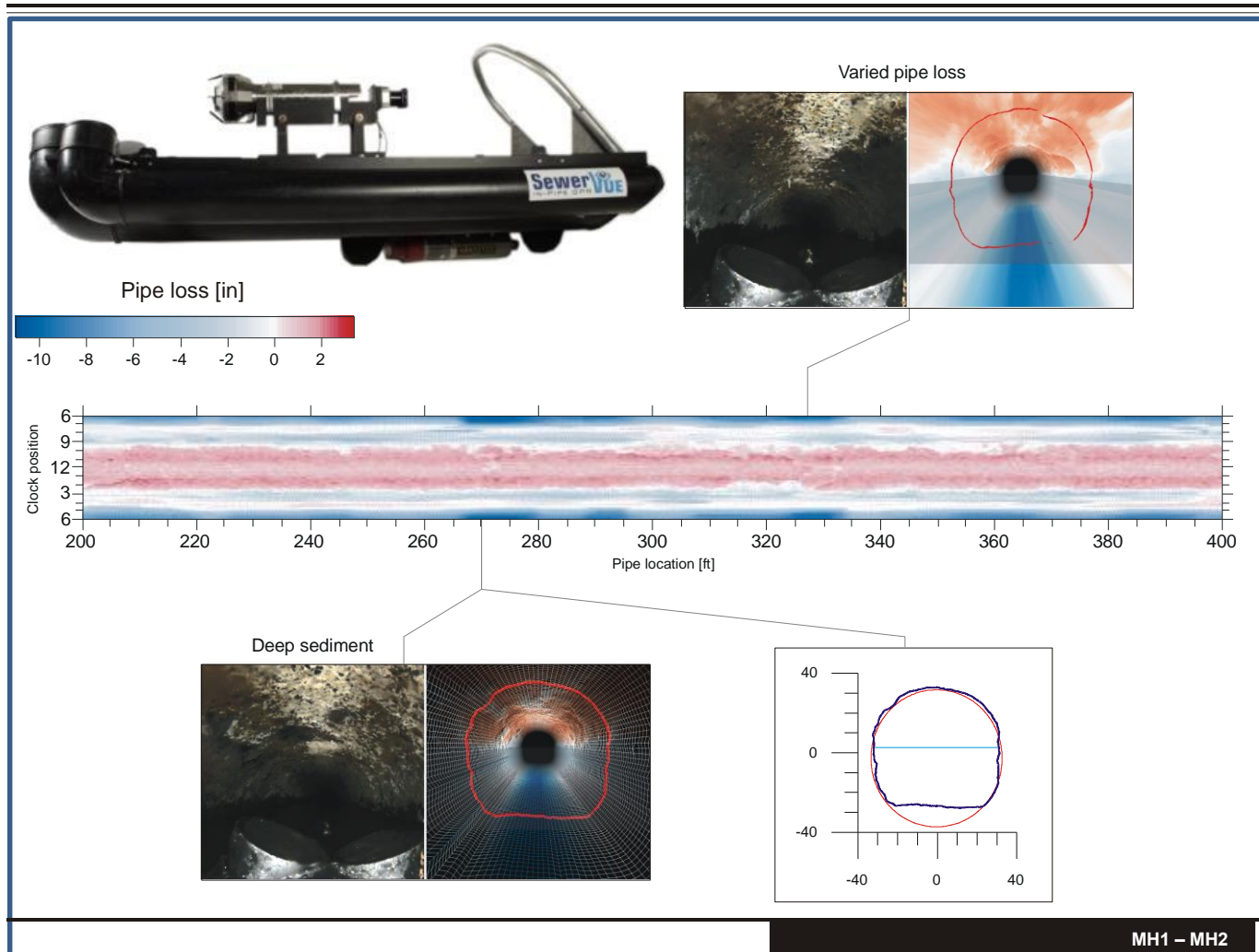


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Multi-Sensor Float

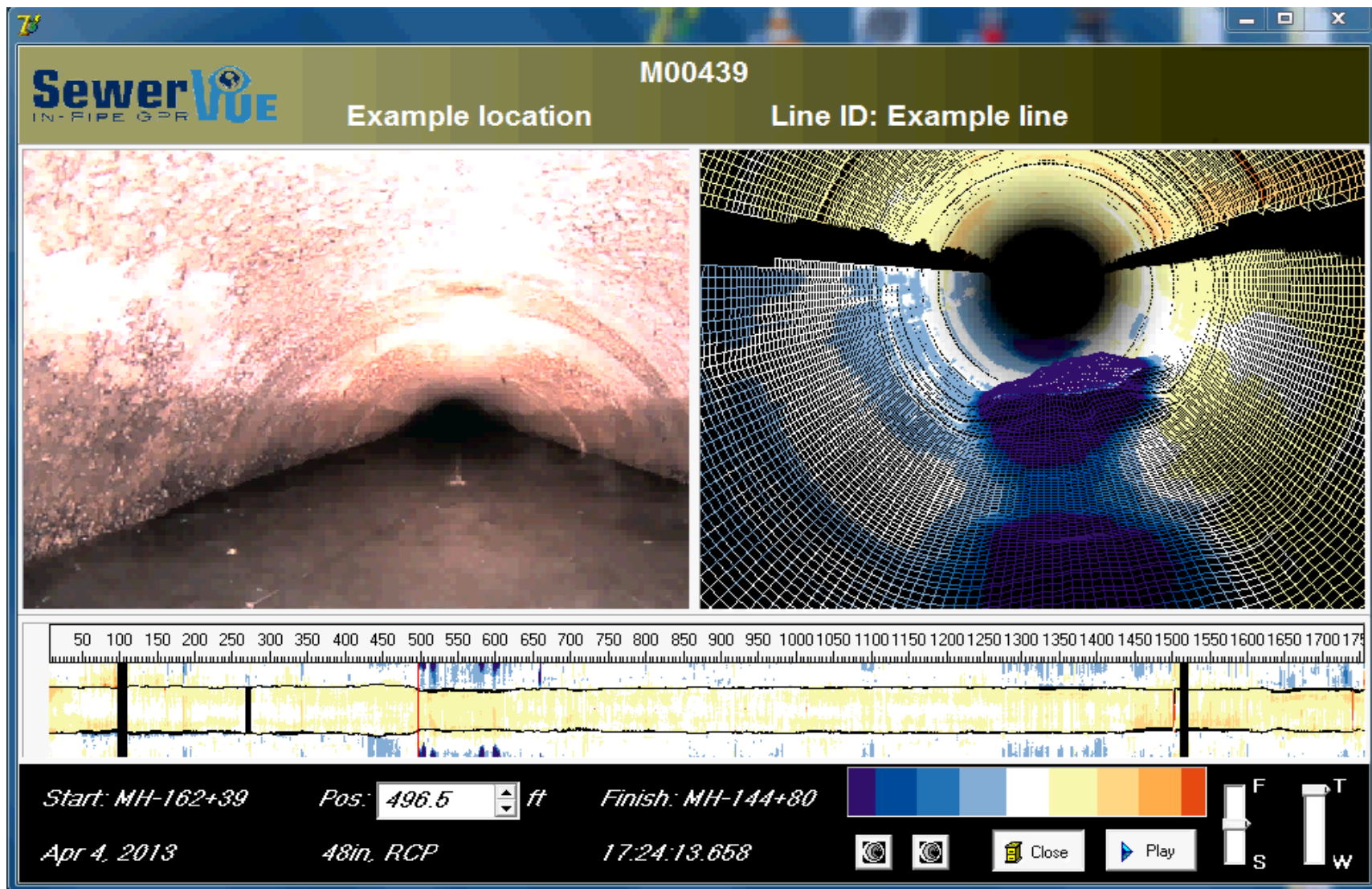




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4 in1 Viewer





Technology Comparison/Evolution

Yesterday	Today
<ul style="list-style-type: none">• CCTV	<p>CCTV & HD CCTV</p> <p>Sonar</p> <p>Laser & LIDAR</p> <p>PPR</p>
<ul style="list-style-type: none">• Visual Only• Subjective	<ul style="list-style-type: none">• Visual• Quantitative• Sediment volume• Inner pipe diameter• Corrosion / Ovality• Wall thickness, rebar cover & voids outside the pipe



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The Broadway Street Everett, WA Pipe Penetrating Radar and Multi-Sensor Condition Assessment



Everett Statistics



First sewer built in 1890

Serves 165,000 people

345 miles of sewer mains laterals and 31 lift stations

Everett Water Pollution Control Facility (EWPCF)

North portion is combined, south is sanitary only



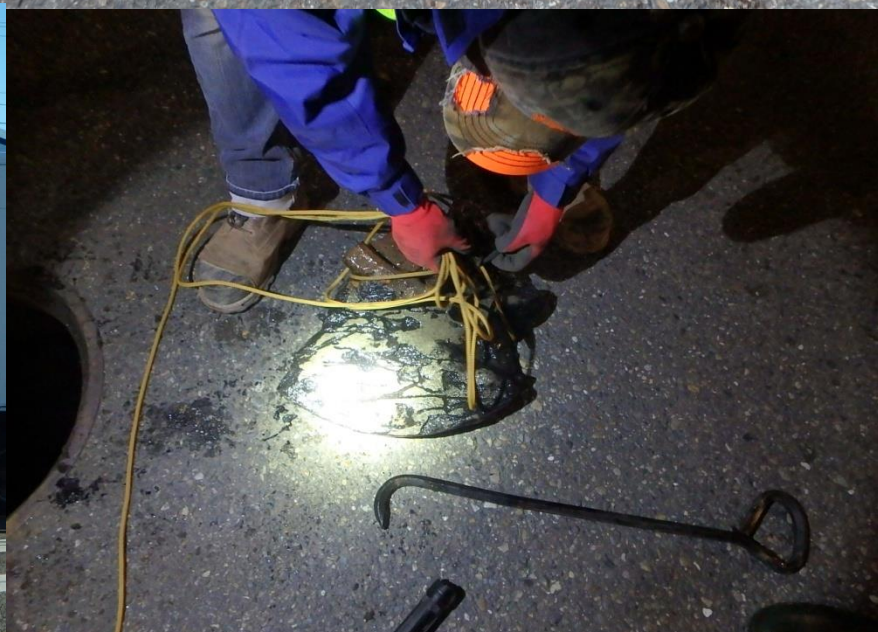
Broadway Sewer Main



Broadway St Main

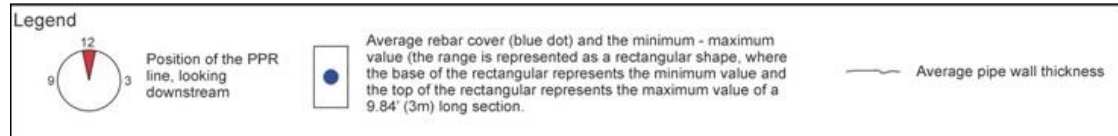
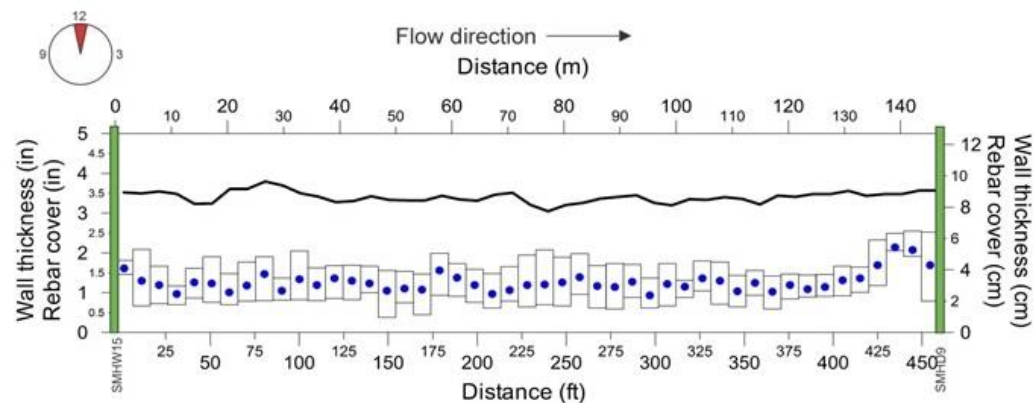
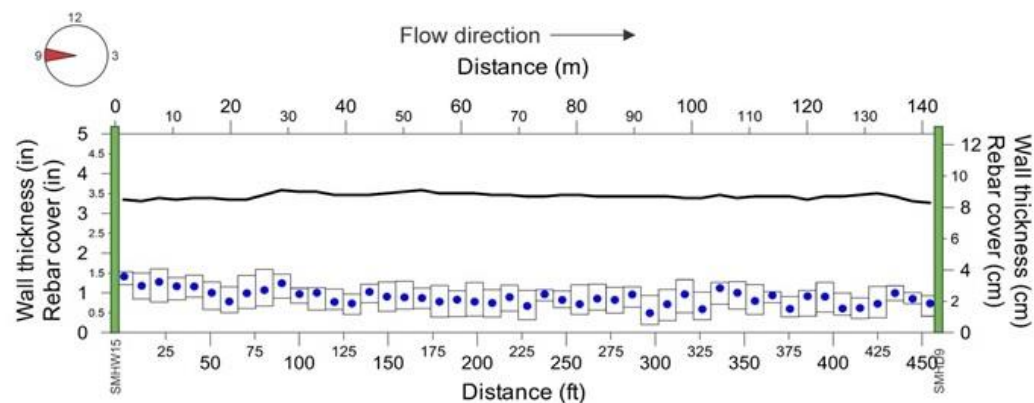
- 1430.8 ft of 30 inch RCP
 - Circular
 - 2793 ft of 36 inch brick line
 - Circular
 - 2 courses of bricks
- Task:
- Quantitative condition assessment



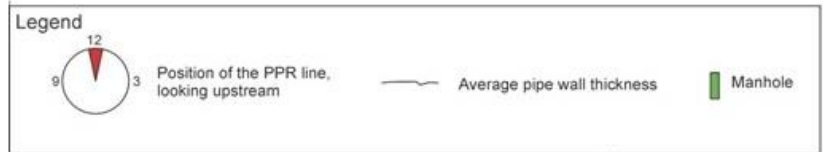
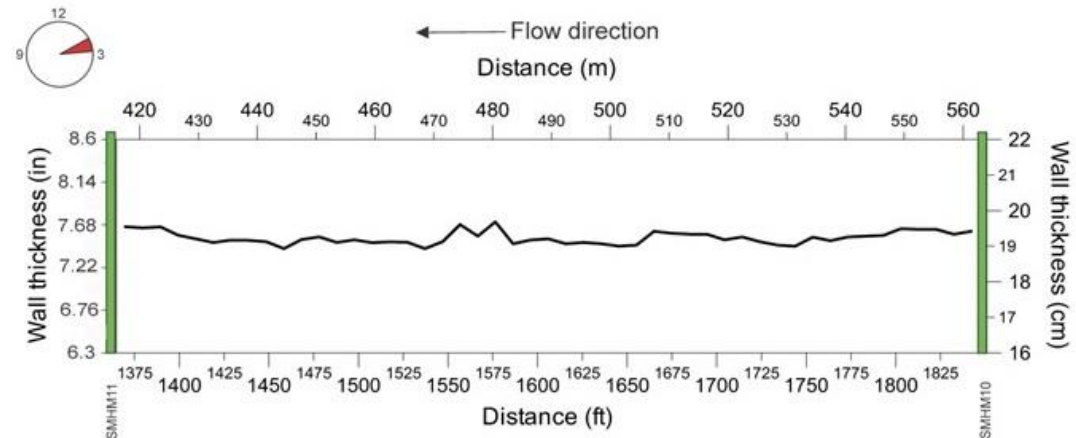
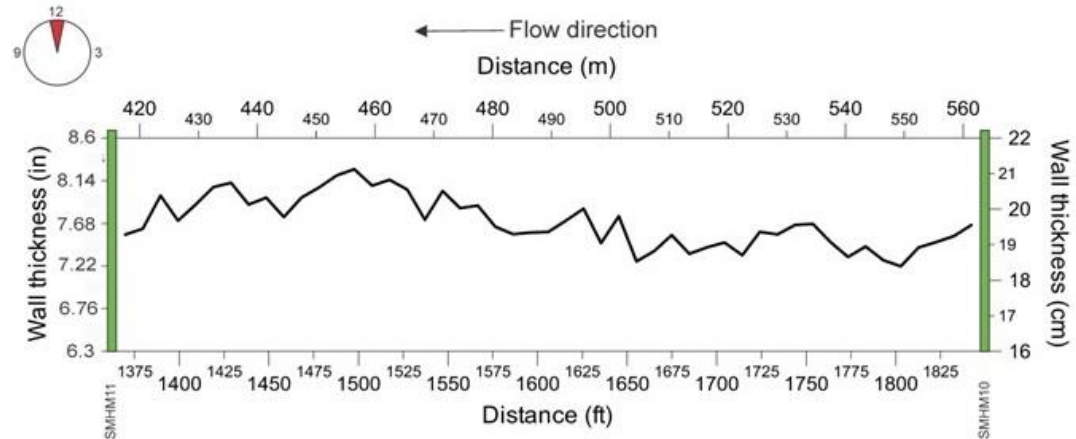




30" RCP Results

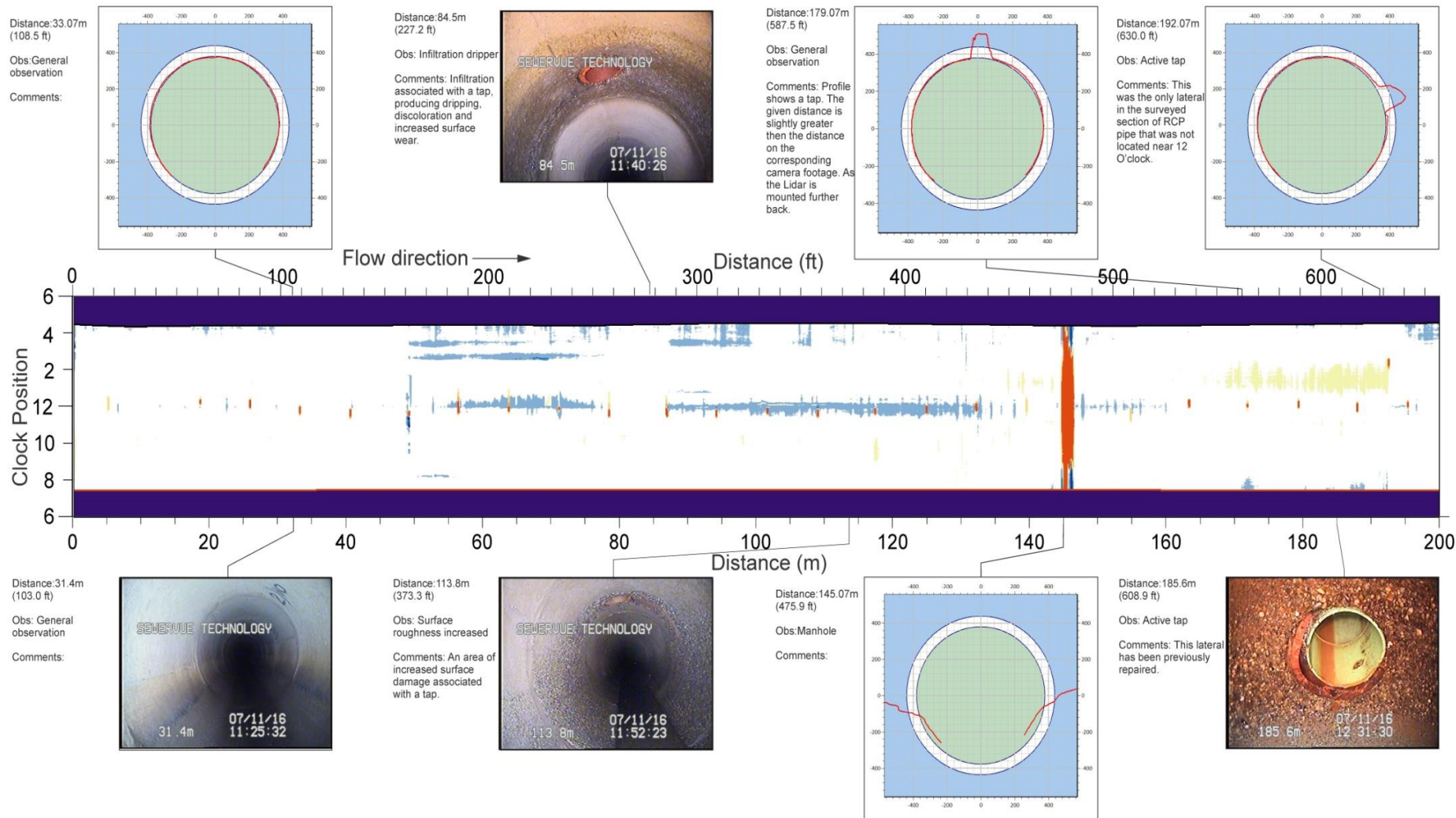


36" Brick lined pipe results

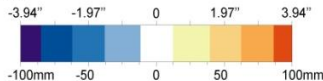




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Legend



Scale of pipe loss or build up. The reference (0") is a 34.6" (880mm) diameter pipe. The color blue means build up, the color yellow/red means pipe loss in the inspected pipe compared to the theoretical 34.6" (880mm) diameter pipe. Solid purple indicates no usable data (e.g. flow).



Measured pipe profile



760mm (29.9') and 870mm (34.3') diameter reference profiles

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SewerVUE Technology Corp.

BN

December, 2016

Sv-20161107

LiDAR Survey Overview
Broadway sewer main,
Everett

LiDAR Results, Run 1-1
30" RCP, SMH W15 to SMH E8, Downstream
Lidar Profiles, 0m-200m (0-656.2 ft)

SewerVUE
IN-PIPE GPR

7993 Enterprise St, Burnaby, V5A 1V5, CA
Web: www.sewervue.com
Ph: (1)904-421-0000



Results & Summary

- 4223.8 ft of pipe inspected
- 3 to 4 inch wall thickness for RCP, sufficient rebar cover, no significant corrosion, no voids
- Brick “wall thickness” is in 7.12 and 8.25 inch range, with varying thickness range at the 11 and 12 o’clock positions (construction artifact)
- Void type anomaly at 997 ft at 12 o’clock (6” deep and 9” wide)
- Actual diameter is 34.5”



Project Summary

Lessons learned:

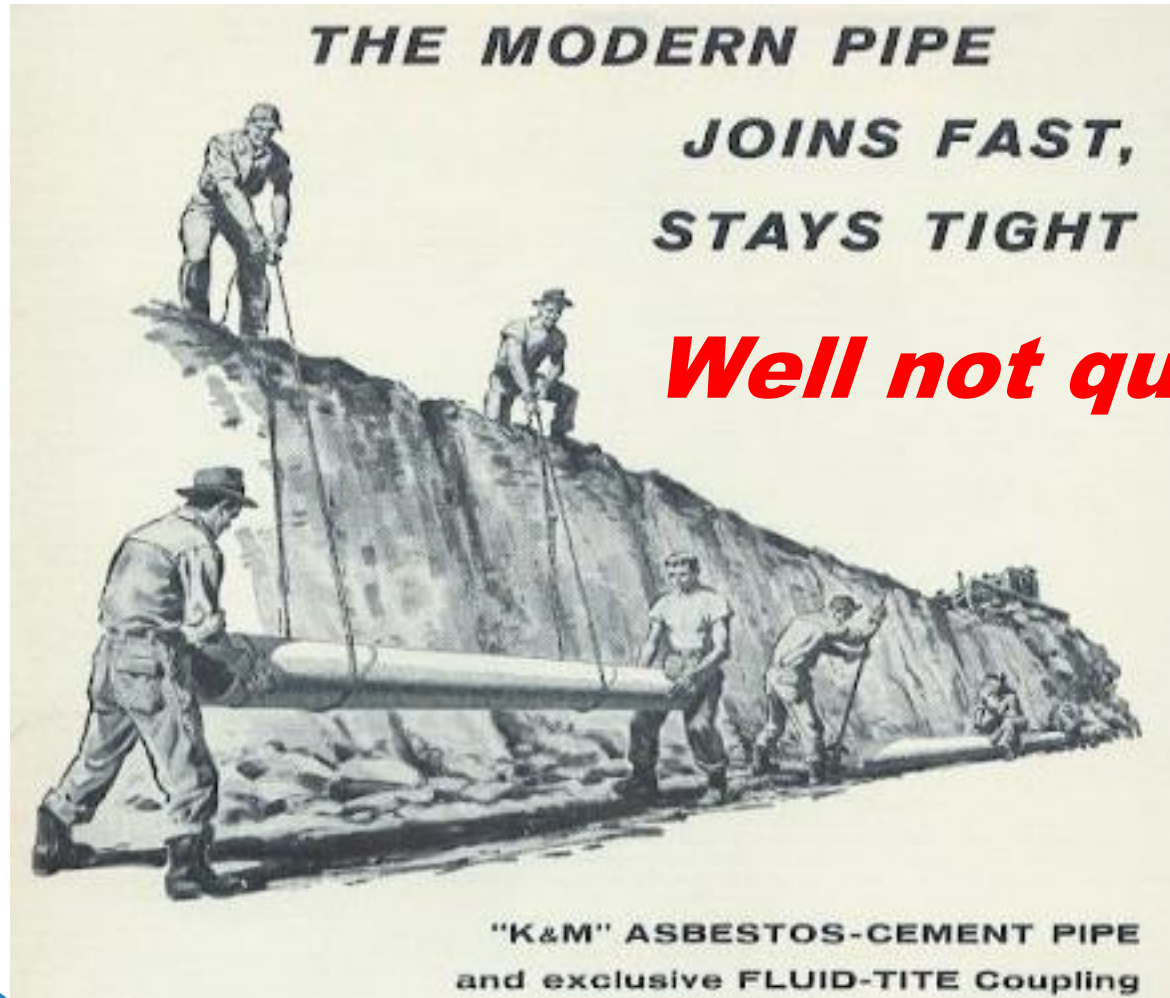
- Site visit + Good communication + Cooperative client = Long days but on time, on budget inspection and report delivery.



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Asbestos Cement Pipe Scanner (ACPS)



AC Pipe Background

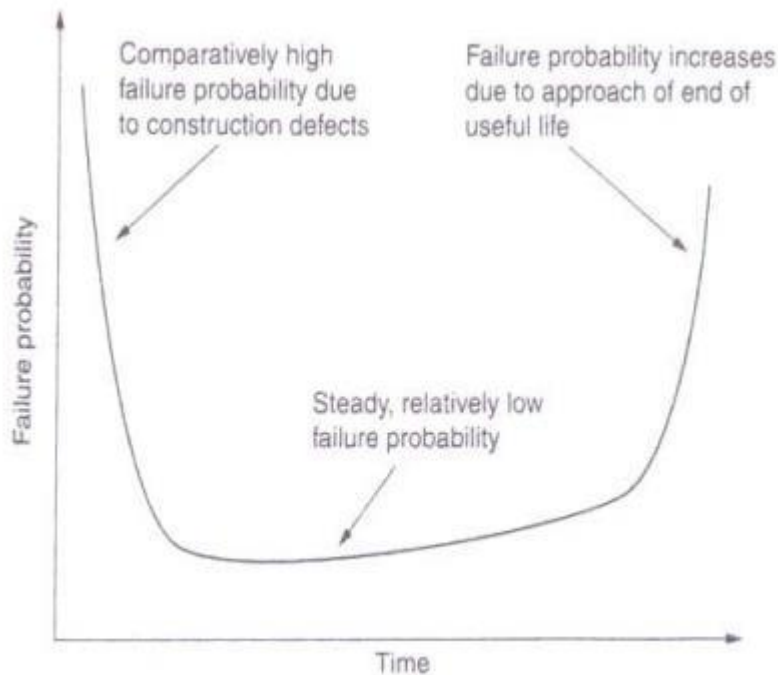


FIGURE 3.3 Bathtub curve of pipe performance with age.

- Asbestos cement (transite)
- Used between 1930s and 1990s
- 600,000 miles in the ground
- Water and sewer
- 50 + years design life

Issues:

- Corrosion and delamination
- Hazardous material
- Current testing methods (CCTV) have limited capacity

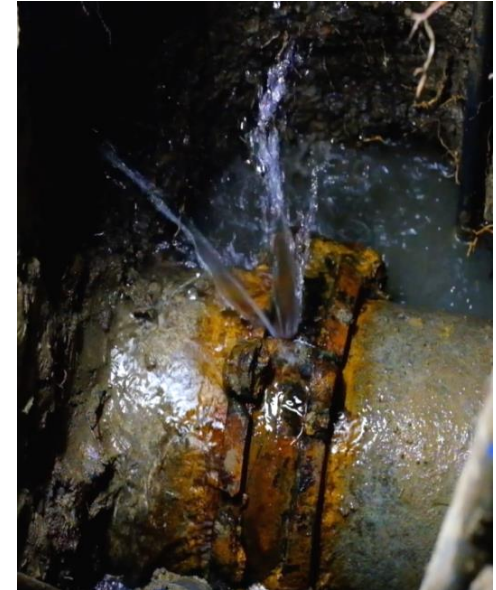
Where are we now?

- AC pipe failures (especially on the west coast) are on the rise.
- Several studies suggest that the average service life of AC pipe is 70-80 years.
- Most municipalities with AC are at this tipping point.



AC Pipes: What do I do?

- *I wasn't around when the AC Pipe went in so I don't know much about it.*
- *AC is bad; it has the word "**asbestos**" in it; please make it disappear!*
- *Well if the life expectancy is ~70 years and I am close to it – answer is easy – "replace it". **Right?***
- But some 70 year old AC pipe has been shown to be in great shape.
- Need a comprehensive **asset management** plan for your AC pipe.





Benefits of Proactive Maintenance

- Proactive pipe inspection allows for preventative maintenance, preventing catastrophic pipe failures and significantly reducing the cost of maintaining the pipe infrastructure
- Historically this inspection was carried out manually and more recently by CCTV and other inspection technologies – the effectiveness of these solutions is extremely limited
- There is currently no quantitative NDT solution on the market for non-ferrous pipe condition assessment



Current Options

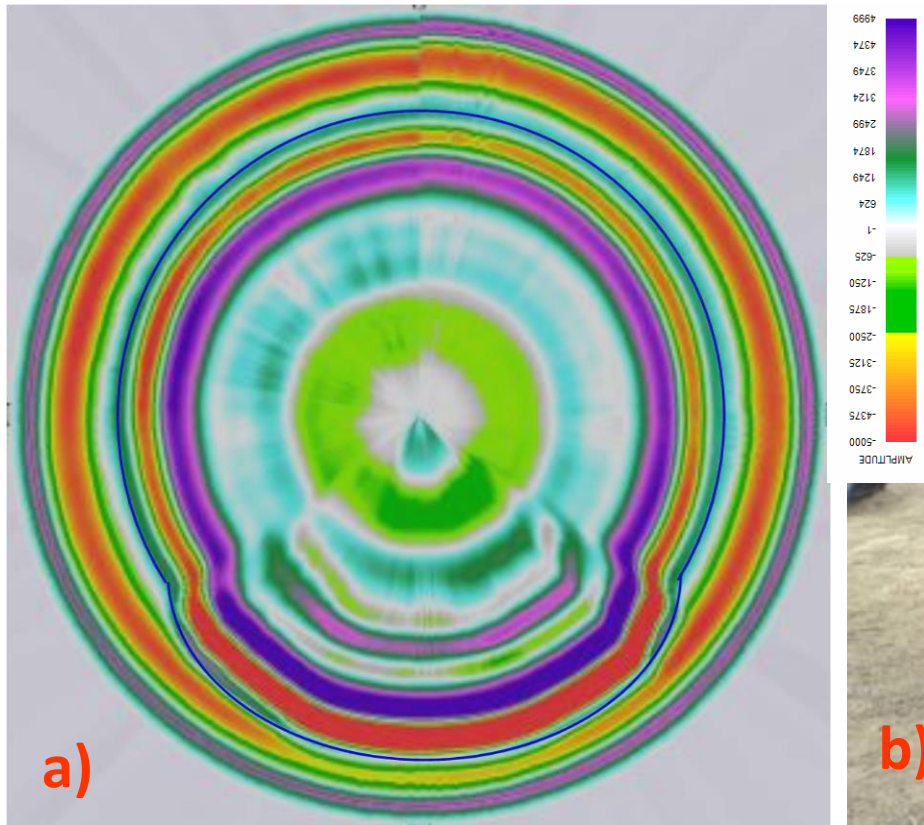
- Doing nothing
- “No tech” approach of not inspecting pipes and either repairing or replacing all the suspect ones or running them to failure
- “Low tech” approach of using CCTV only
- Echologics can provide average thickness at an undetermined clock position

Evolution of PPR for AC Pipes



- Richard Yelf, 2008
- Limited but safe access
- No size limitation
- Hand held scanner
- Good results from longitudinal and circumferential scans
- No need for confined space entry

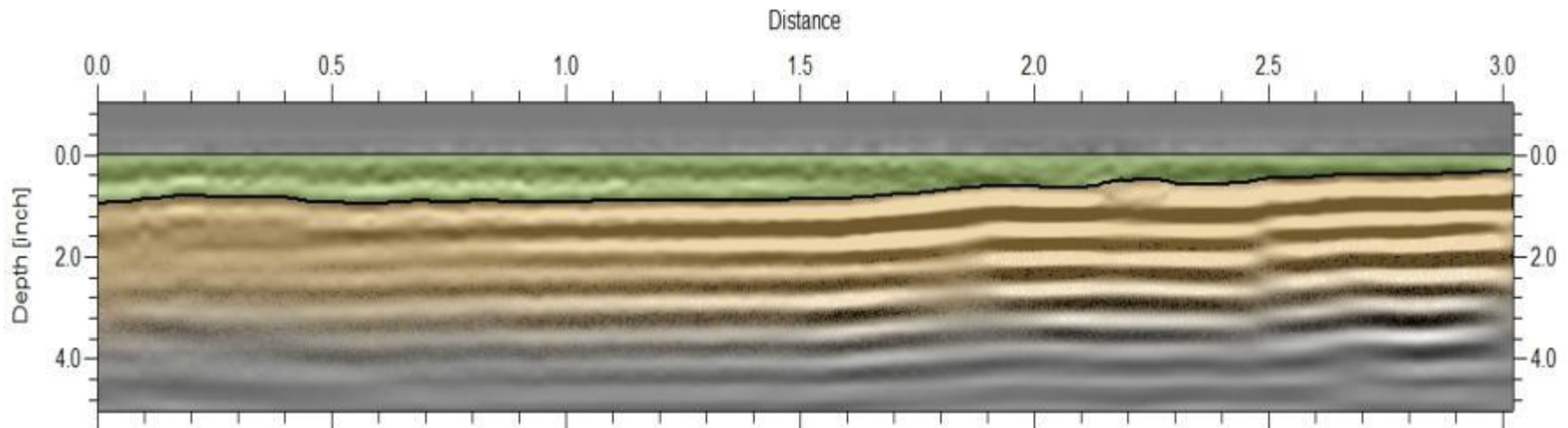
Exposed pipe pilot results



a) Radargram of a 27 in (675mm) diameter, 1.6 in (40mm) wall thickness AC pipe. The pipe was empty with an $\frac{3}{4}$ in (18.5mm) scour at the bottom.

b) Photograph of the inside the pipe in Figure (a).

SewerVUE Lab Test



- Laboratory test on 8" AC pipe sample with thinning wall



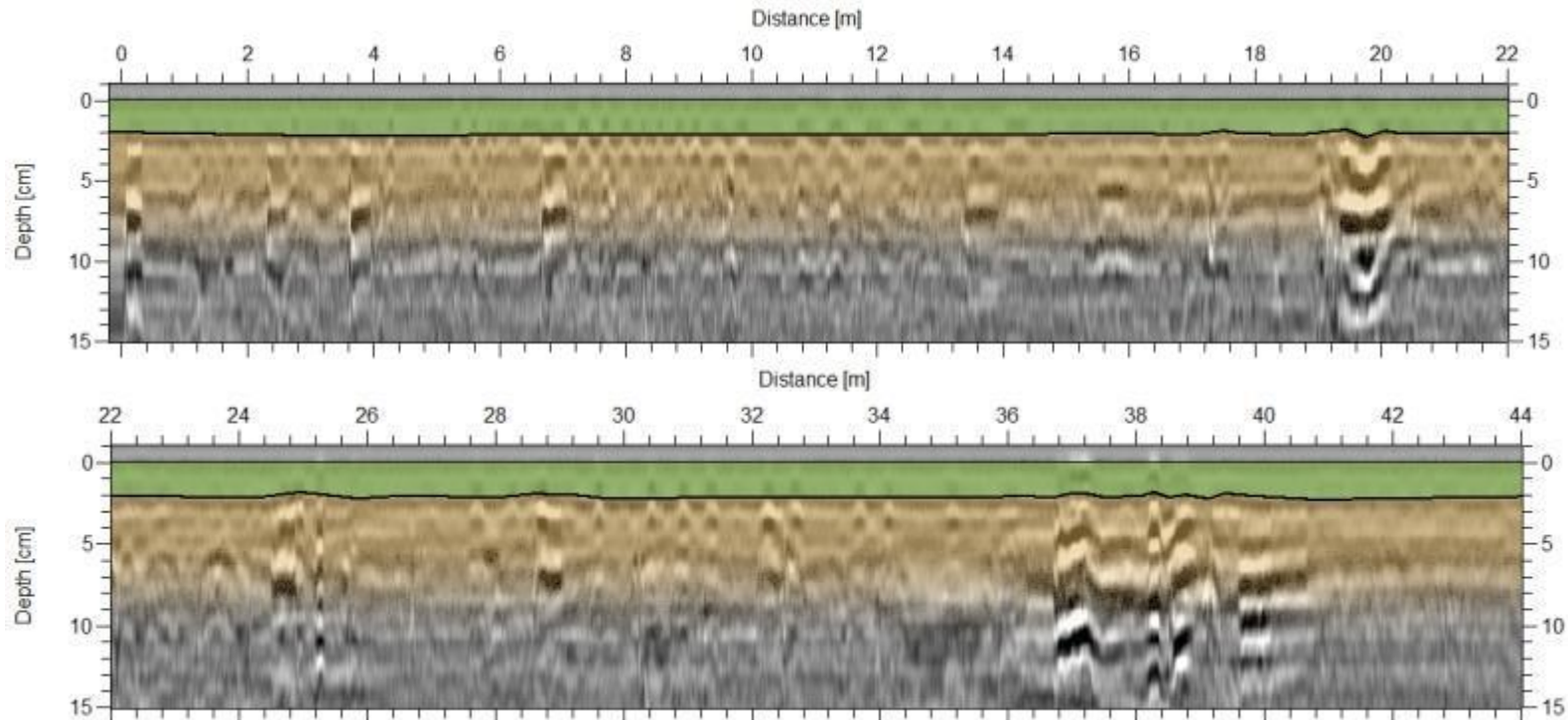
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IN-PIPE GPR

AC Pipe Results



- 10" AC sewer pipe in service
- Excellent wall thickness reading, no corrosion or voids
- Anomalies in bedding at 6 o'clock



Results & Summary

- High frequency PPR can accurately image AC pipe wall thickness
- PPR can quantify wall loss
- PPR can provide repeatable, quantitative and actionable condition information
- SewerVUE received a \$484,000 grant to commercialize the technology
- Pilots scheduled for Sacramento, CA and Phoenix, AZ



Economic Considerations

- In AC and large diameter pipes CCTV is not very useful
- Advanced Condition Assessment:
 - allows to replace/reline pipelines later and for shorter sections
 - helps prioritize sections for re-lining/replacement within an available budget
- Advanced condition assessment technology is only incrementally more expensive than traditional CCTV
- PPR should be used to inspect pipes in the poor to fair condition range for remaining service life and/or replace & rehab decisions.



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Questions and Contact



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