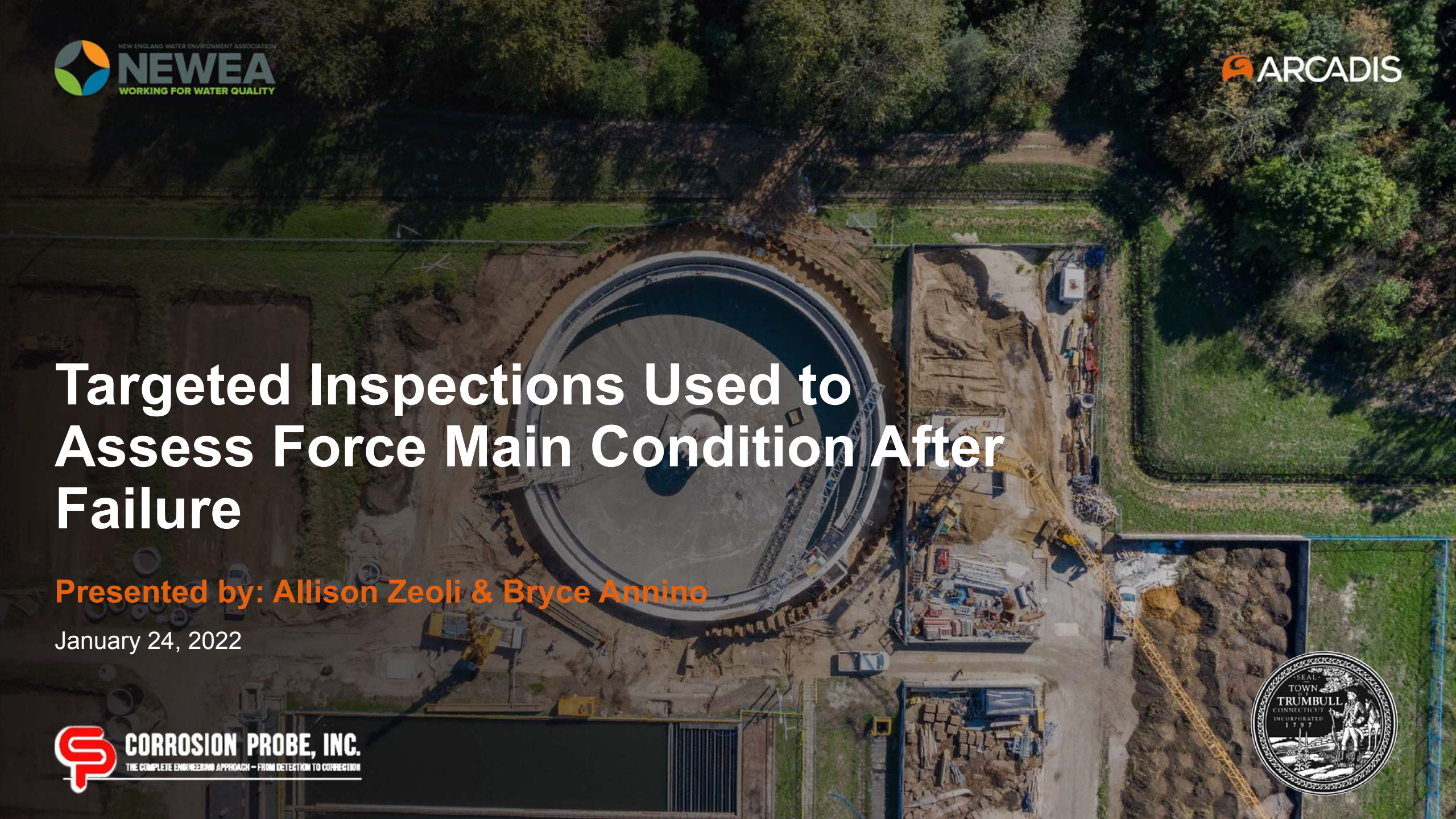


Targeted Inspections Used to Assess Force Main Condition After Failure

Presented by: Allison Zeoli & Bryce Annino

January 24, 2022

Agenda

1 Background

2 Project Approach

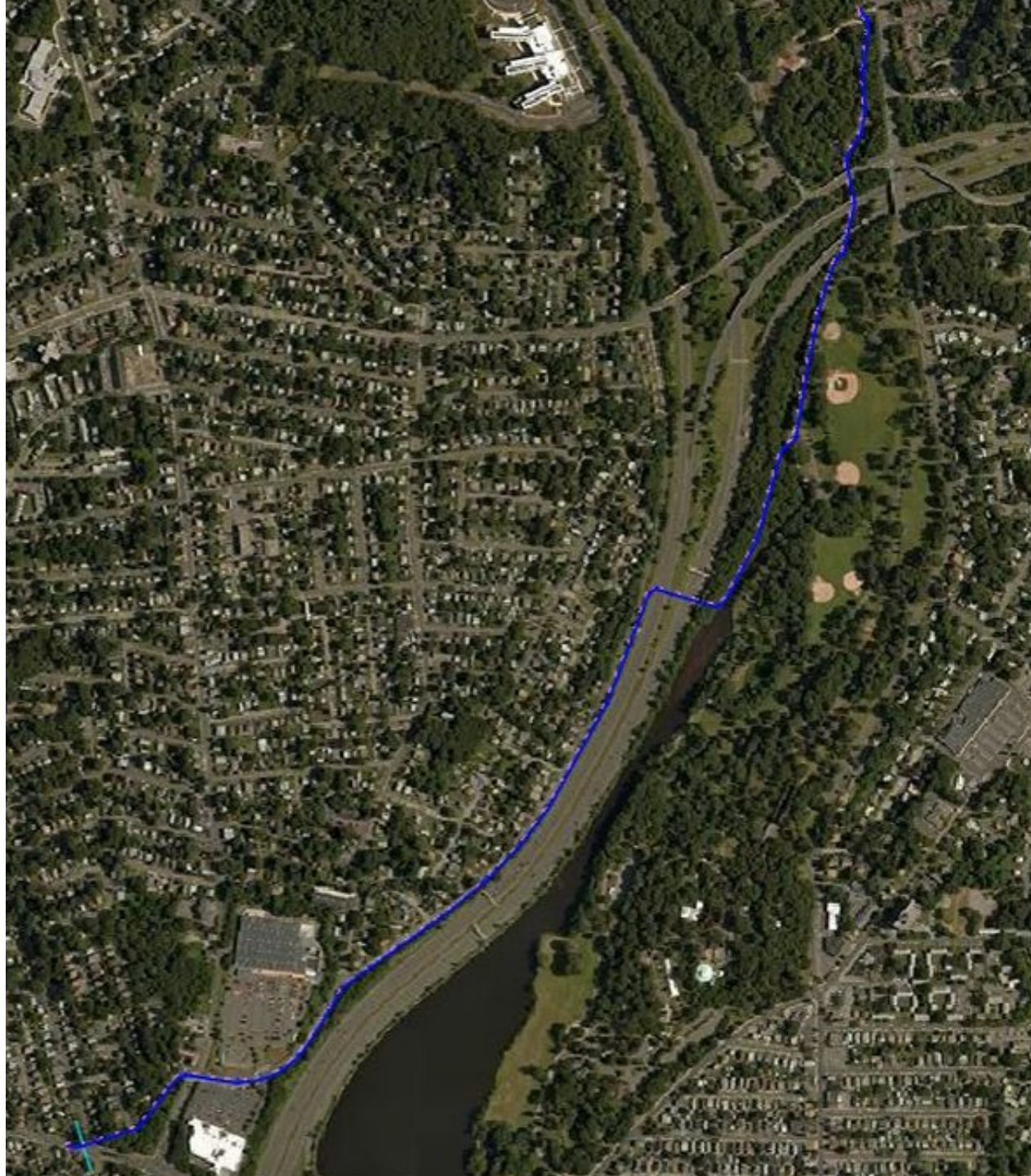
3 Testing Technology Overview

4 Outcomes and Conclusions

Background

About the Beardsley Pump Station Force Main

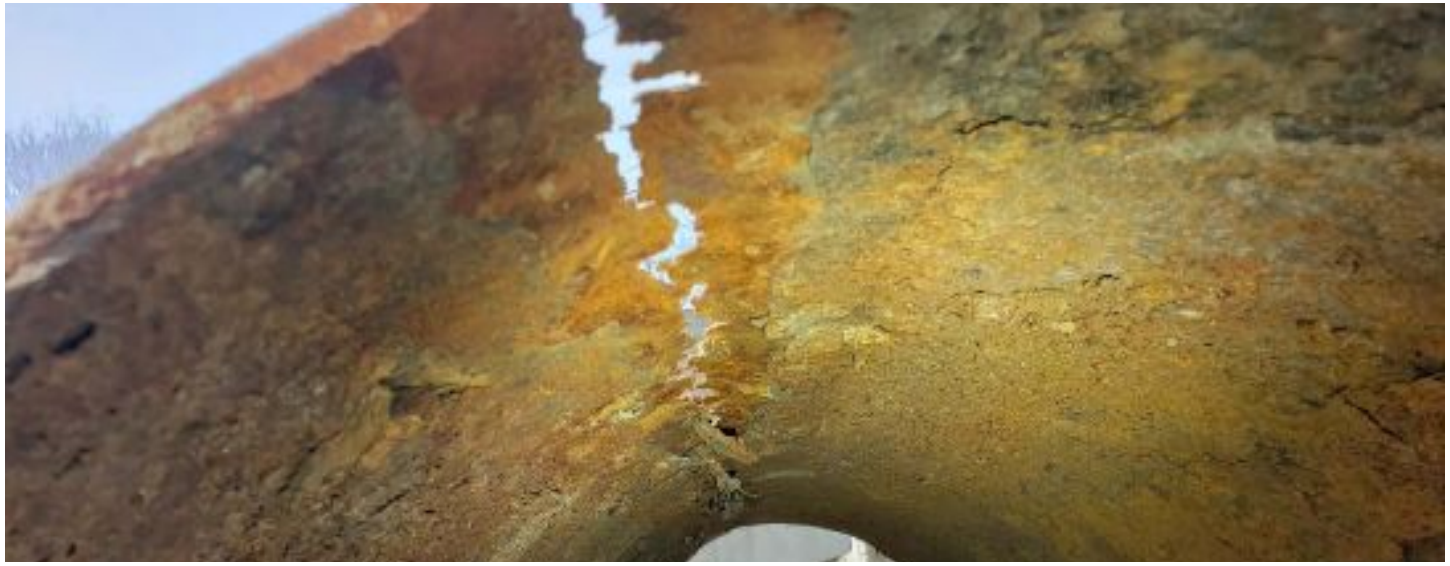
- Installed in 1970s
- Nearly 2 miles long
  - Through a Park
  - Under a River and Highway
- 20-inch Ductile Iron Pipe
- Critical Infrastructure – Conveys 2/3 of Town Total Flow



Force Main Failure

Occurred in January 2020

- Low Point in Pipeline located in Beardsley Park
- Failure occurred at the pipe invert along a 15 foot section – See top photo for active leakage
- Emergency Repair Completed
- Piping Retained for Analysis

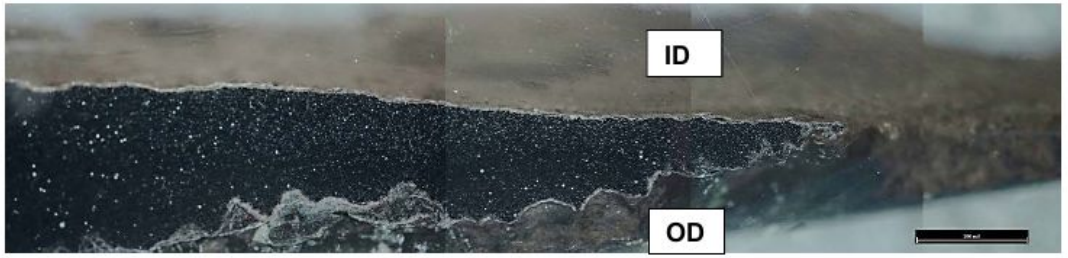


Project Approach

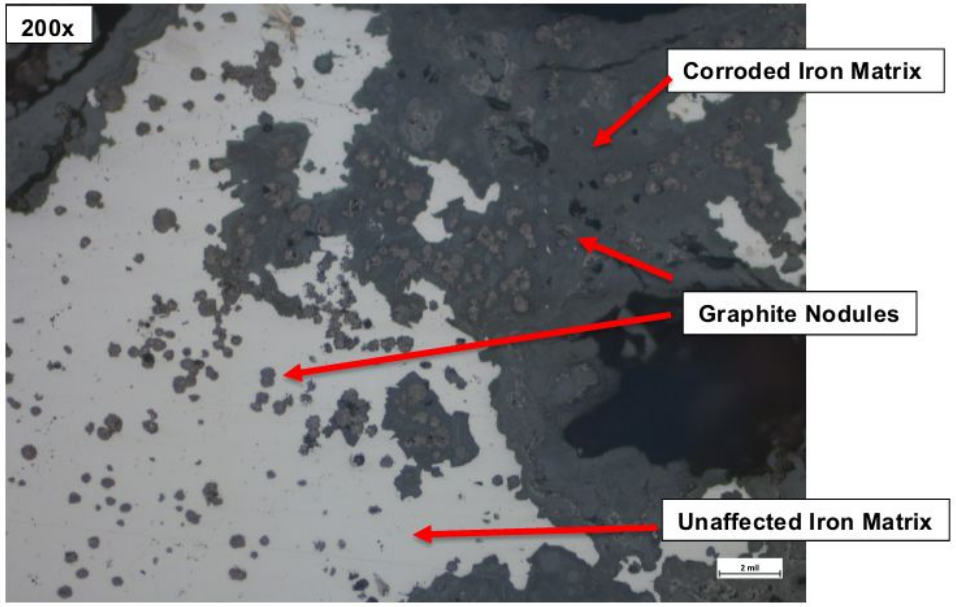
Outcome of Failure Analysis

- Root Cause of Failure determined to be graphitic corrosion combined with MIC
- Acidic environment at the invert of the pipe was the likely result of a build-up of biosolids and under-deposit corrosion associated with sulfate reducing bacteria (SRB)

- **Failure location alone does not distinguish whether the problem is systemic or localized**



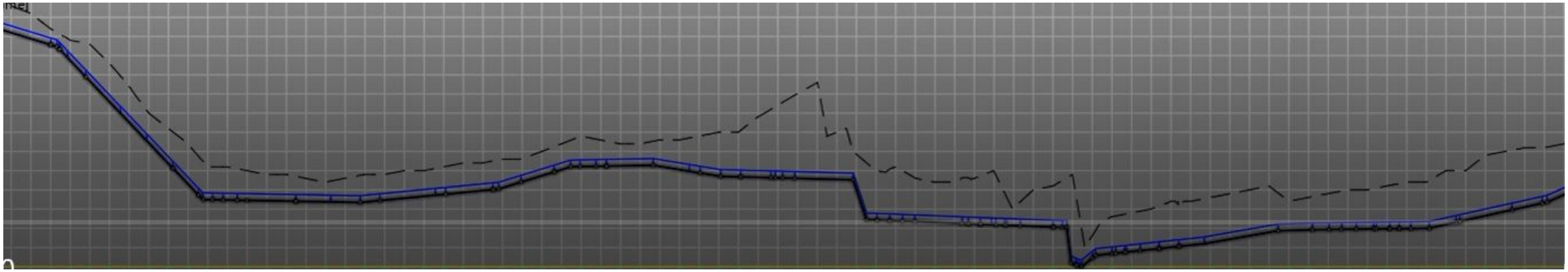
Cross Section of Pipe Invert



Presence of Graphitic Corrosion ID

Targeted Inspections Performed

- Holistic review entailed:
  - Desktop Study to Identify Potential Areas of Concern
    - Low Point in Park (Failure Location)
    - 2nd Low Point with Flat Slope (Seltsam Road)
    - High Points
  - Non Destructive Testing
    - High Points (Air Release Valves) – 2 Locations
    - Low Points via Test Pits – 4 Locations



THREE PRIMARY DAMAGE MECHANISMS

- **Wear**
  - Uncommon mode for everyone
- **Corrosion**
  - Arguably most important to understand for W/WW conveyance
- **Cracking**
  - Usually preceded by upsets, change in loads, or corrosion

i.e., Modes of failure

Types of Corrosion

Electrolytic/ Oxygen Driven (or “Common” Corrosion)	Stray Current
Galvanic Influence	**Microbiologically Influenced Corrosion (MIC)**

Testing Technology Overview

Side by Side Ultrasonic Thickness Testing and Broadband Electro-Magnetic Testing

Ultrasonic Testing (UT)

Corrosion Probe, Inc.

A signal is sent out by a transducer in contact with the external surface of the metal structure and is used to estimate wall thickness.

Composition of ductile iron piping acoustically disperses the UT signal, making the acquisition of accurate data more challenging.

Broadband Electro-Magnetic (BEM)

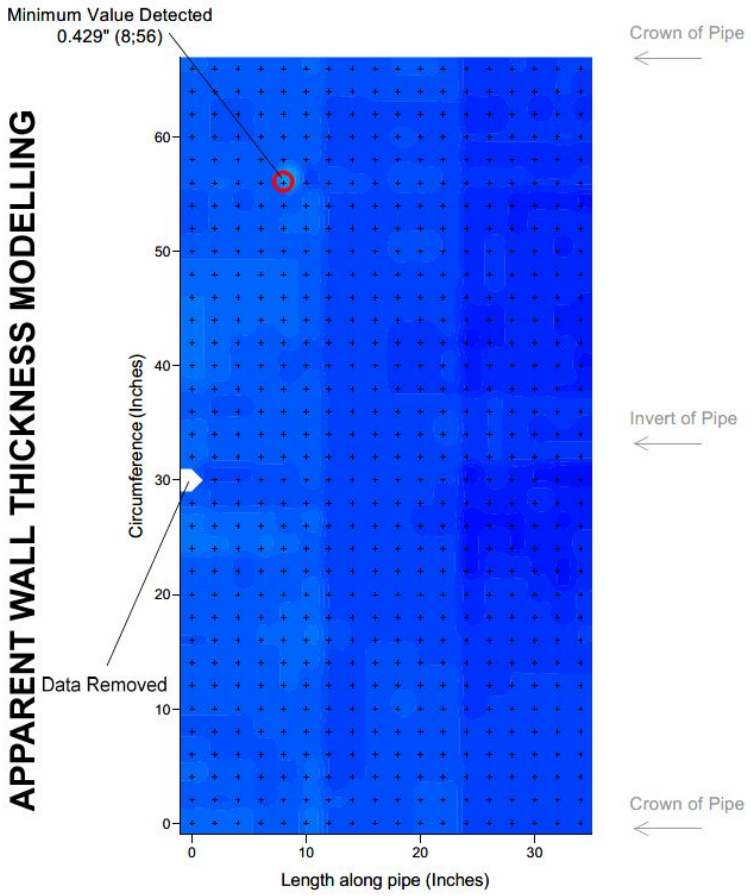
Arcadis / RockSolid

Based on the next generation of Eddy Current technology. Sensor and antenna are used to scan the complete surface area of the pipe (3 foot section).

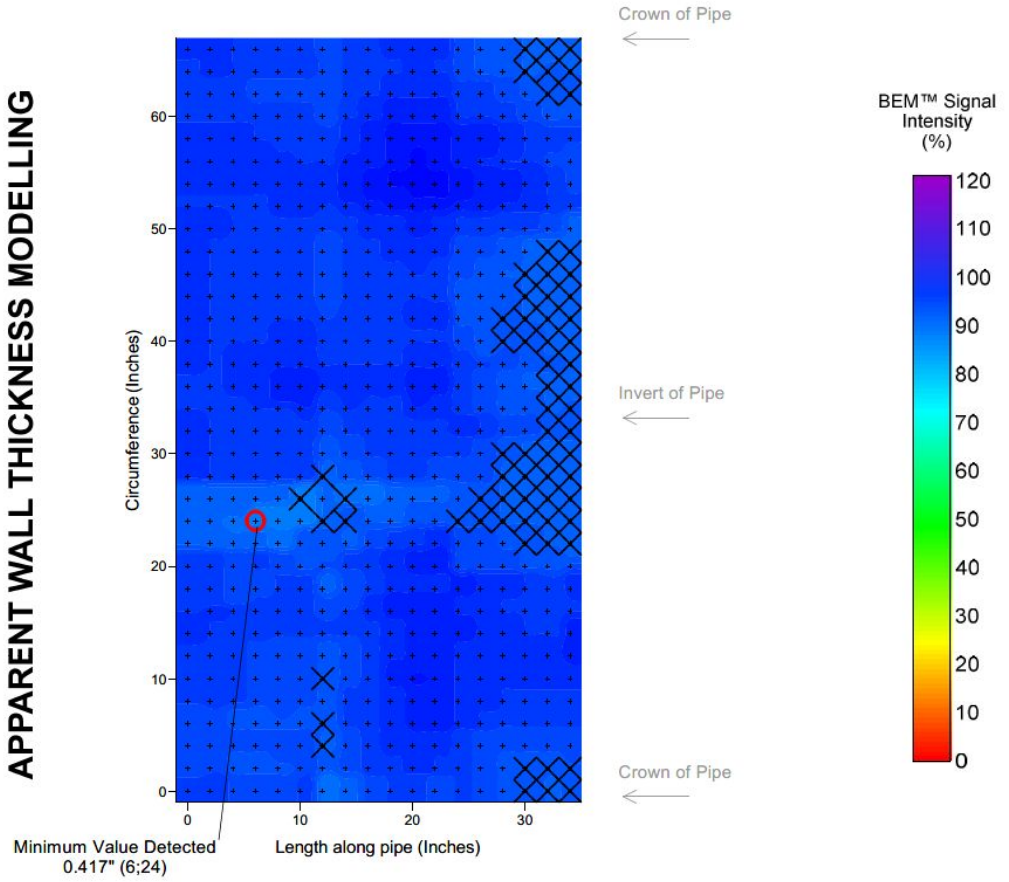
Detects flaws on both inner and outer surfaces as well as inclusions, graphitization and fractures of ferrous infrastructure.

Sample BEM Analysis

Potential pitting at top of pipe



Test Pit at Sylvan Ave



Light Blue: General Thinning at Pipe Invert

Test Pit at Eric Street

Outcomes and Conclusions

Summary of Results

Beardsley Park (First Low Point; Location of Failure)

- Sulfate Reducing Bacteria (SRB) suspected cause of failure. Slime Buildup from low velocity, acidic environment (third pump never installed at pump station; inadequate scour velocity)
- Replacement of piping recommended and design/permitting is proceeding

Seltsam (Second Low Point)

- No immediate issues identified in either the UT or BEM testing
- Neither test pit location showed sign of significant wall loss, and generally consistent wall thickness around the circumference; no rehabilitation required at this time
- Ongoing monitoring is recommended to identify changes in condition

Application of this Method for Pipeline Evaluation

- Desktop Analysis is a useful starting point for targeting areas to analyze

Target those areas with a **high likelihood of failure** based on **Background, Material Vulnerabilities, & Damage Mechanisms**

+

Plus a high consequence of failure

- Non-Destructive testing methods can be used side by side to enhance confidence in the data obtained

- Options are available for testing that allow infrastructure to remain in service

Questions?

Contact Us

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Thank you!