

CITIES INITIATIVE WEBINAR

Defer, Plan or Act: Using AI to Make Defensible Watermain Replacement Decisions

March 5, 2026



GREAT LAKES AND ST. LAWRENCE

CITIES INITIATIVE

L'ALLIANCE DES VILLES

DES GRANDS LACS ET DU SAINT-LAURENT



**PIPELINE INSPECTION
AND ASSESSMENT**

FEATURED SPEAKERS



GREAT LAKES AND ST. LAWRENCE
CITIES INITIATIVE

L'ALLIANCE DES VILLES
DES GRANDS LACS ET DU SAINT-LAURENT



R. MARK PALMER, P. ENG

President & CEO

GREENLAND® Consulting Engineers



HARRISON RICHAZ

Chief Innovation Officer

PIA-Global



MAYOR LUCAS CLEVELAND

MODERATOR

Cobourg, ON

SPECIAL REMARKS BY

Bryan Murray, P.Eng, *Director of Public Works*, Penetanguishene, ON

Andre Pepin, *Director of Environmental Services*, Midland, ON

HOUSEKEEPING



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**PLEASE REMAIN
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**PLEASE PUT
QUESTIONS IN
CHAT**

AGENDA



GREAT LAKES AND ST. LAWRENCE
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- Welcome
- Annual Conference Information
- GREENLAND® and PIA-Global Introductions
- State of Watermain Infrastructure in the Region
- Overview of the Technology
- Opportunity to Participate with AI Platform Development (2026 / 27)
- Discussion - Q&A
- Closing



CITIES INITIATIVE ANNUAL CONFERENCE 2026

Hamilton, ON | May 6-8



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STATE OF WATERMAIN INFRASTRUCTURE

Calgary

City of Calgary closes road after more water main deterioration detected

Westbound 16th Avenue N.W. exit ramp to Sarcee Trail has been closed



Amir Said · CBC News · Posted: Feb 13, 2026 5:35 PM EST | Last Updated: February 13



Listen to this article ⓘ

Estimated 3 minutes



Calgary's westbound 16 Avenue N.W. exit ramp to Sarcee Trail was closed Feb. 13, 2026, as part of the city's risk mitigation strategy, due to deterioration in sections of the Bears paw south feeder main. (Ryan McLeod/CBC)

Boil water advisory issued for Collingwood following water main break, restaurants must close

Residents urged to not consume water directly from tap until further notice

Collingwood Today Staff
Dec 12, 2025 6:15 PM



Stock image

Water Main Break Rates in the USA and Canada: A Comprehensive Study

December 2023
A Resource to Support Asset Management, Pipeline Renewal, and Replacement

Utah Water Research Laboratory
Utah State University
Professor Steven L. Barfuss, P.E.

IN-DEPTH ANALYSIS OF
400,000 MILES
OF WATER MAINS IN
THE US AND CANADA

MORE THAN **800** WATER UTILITIES SURVEYED

260,000 PIPE FAILURES ANNUALLY
11.1 BREAKS PER 100 MILES

20% OF PIPES NEED TO BE REPLACED
A \$452 BILLION SHORTFALL

FIGURE 37: BREAK RATE BY DIAMETER OF PIPE MATERIAL (DETAILED SURVEY)

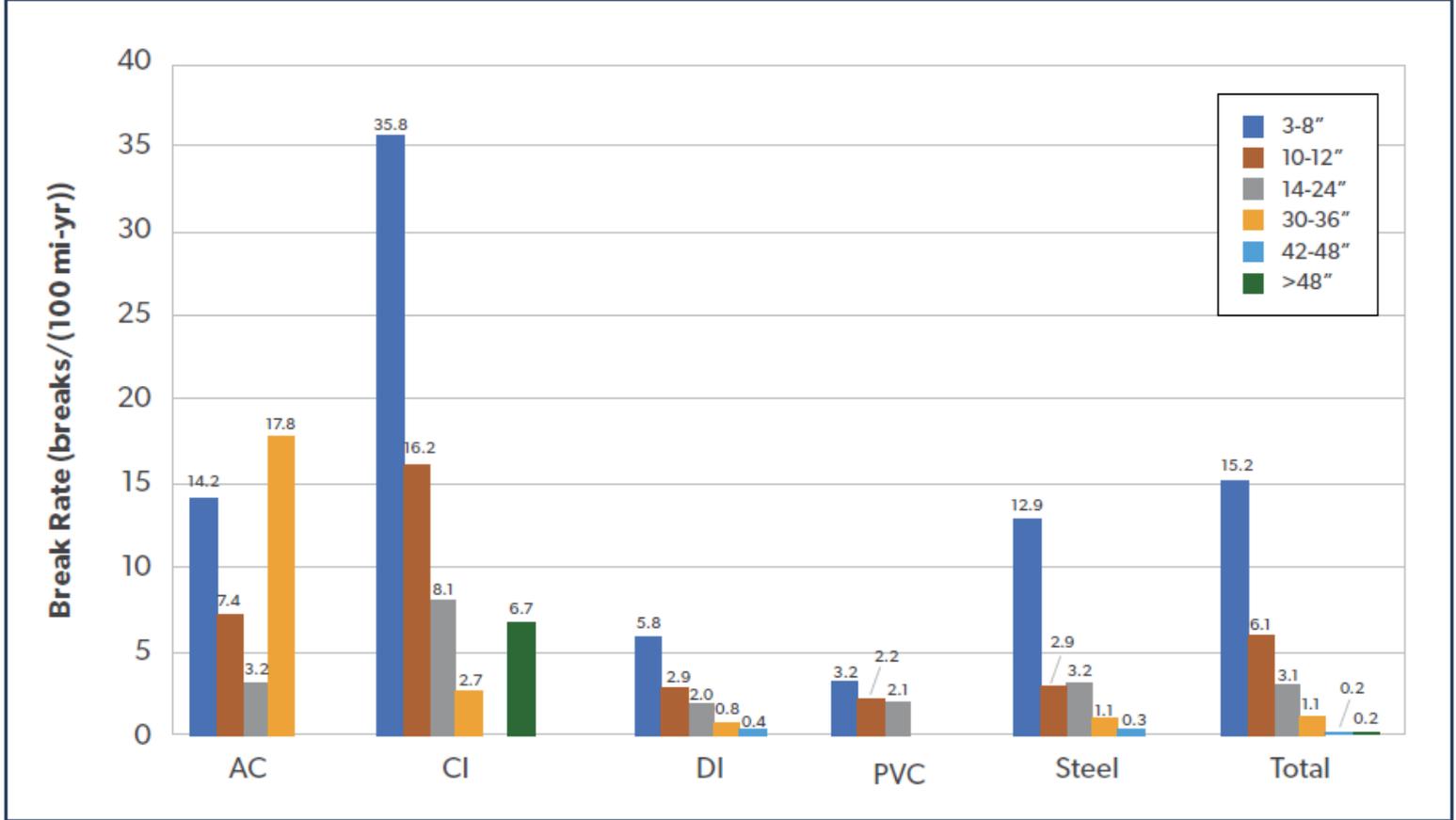


Figure 38 displays the break rates for the following size ranges: 3- to 8-inch, 10- to 12-inch, and 14- to 24-inch pipe. The objective is to focus more on the most used pipe diameters. The 14- to 24-inch sizes are commonly considered transmission mains, while 12-inch pipe and smaller is usually categorized as distribution pipe. Figure 23 indicates that 86% of all miles of water pipes are 3- to 12-inch in diameter, and a total of 68% are 3- to 8-inch in size.

FIGURE 19: PIPE DISTRIBUTION AND MOST COMMON PIPE MATERIAL BY REGION (2023 BASIC SURVEY)

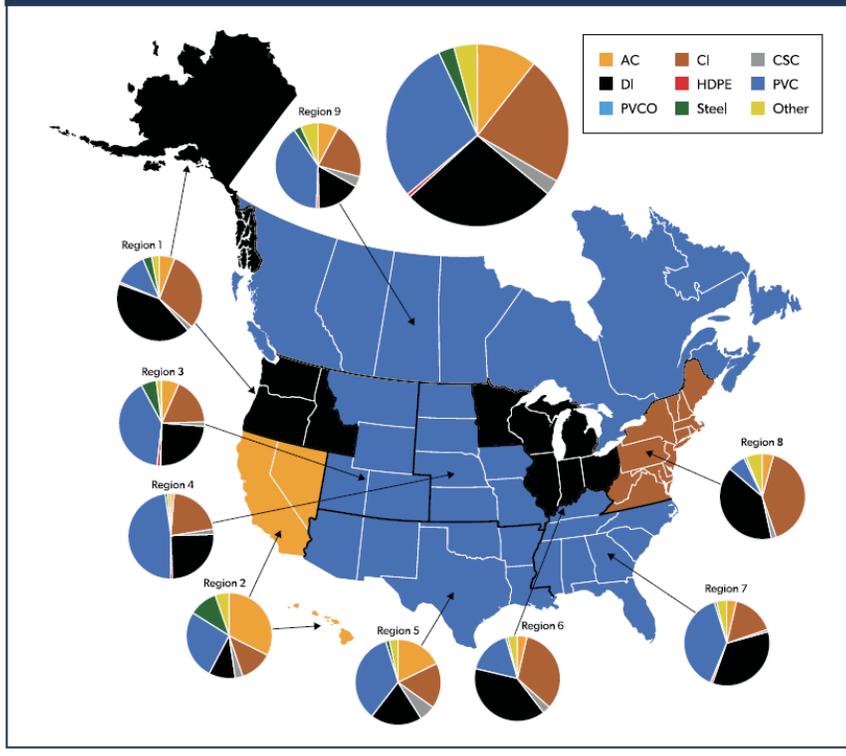


FIGURE 20: PIPE AGE DISTRIBUTION FOR ALL MATERIAL TYPES (DETAILED SURVEY)

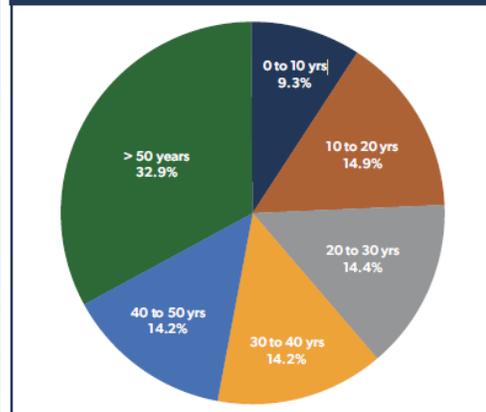
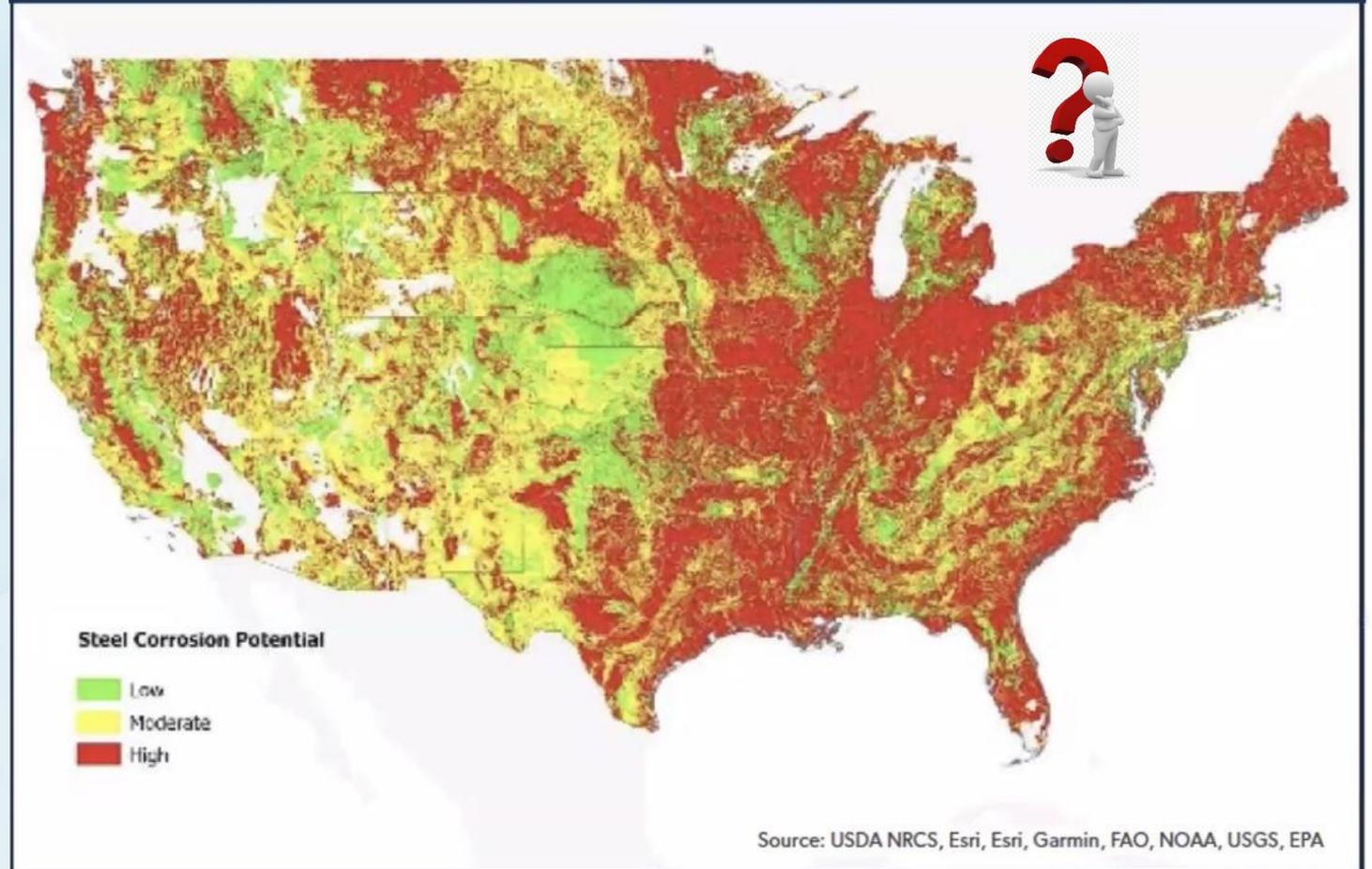


FIGURE 42: US CORROSIVE SOILS MAP (POTENTIAL FOR STEEL CORROSION)



Find And Fix: How To Address The Aging Pipeline Infrastructure Crisis

THE LAW OF FIVES

- If maintenance is not performed, then repairs equaling five times the maintenance costs are required.
- If repairs are not made, then renewal costs can reach five times the repair costs.

“Ballpark” guidelines for budgeting

Condition Rating	Action Required	Budget Requirement (% of Estimated Current Construction Cost of Modern Equivalent Asset)
Excellent	Preventative Maintenance	2% ± (= 1.5% Preventative Maintenance + 0.5% Unplanned Maintenance)
Good	Condition-based Maintenance	4% ±
Fair	Repairs	20% ±
Worn	Major Repairs / Refurbishment	60% ±
Poor	Replacement	100% +



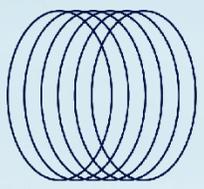
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In the context of infrastructure asset management and engineering, the "**Law of Fives**" (also known as **de Sitter's Law of Fives**) is a guiding principle for **asset management** and **service life optimization**. It illustrates the exponential cost increase of repairing concrete structures as maintenance is deferred.

AI TECHNOLOGY INTEGRATION (PART '1')

We often replace “more-good pipe” than bad. Our Team’s suite of technologies can tell you where to dig, what to expect and the best options for refurbishment. Realizing significant capital savings which can be reinvested and reprioritized.



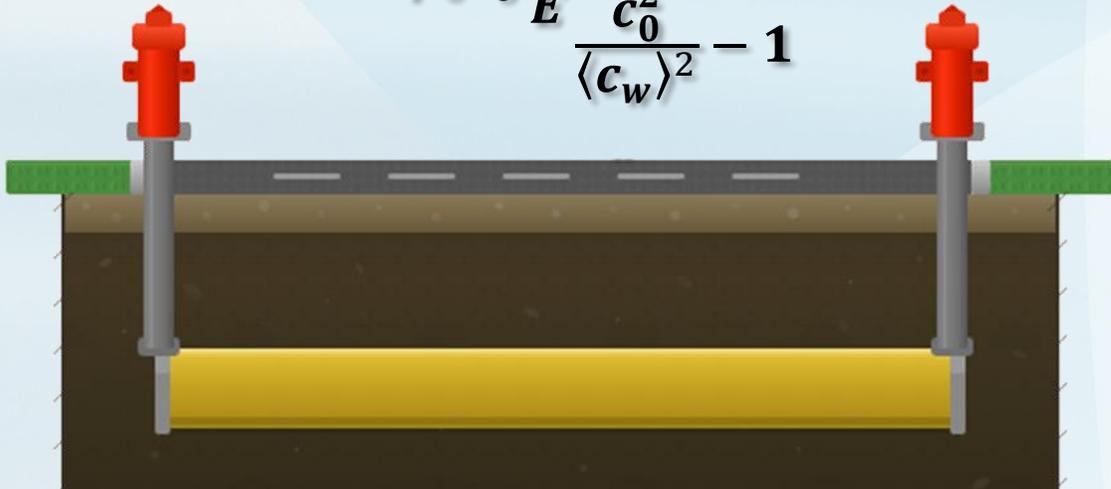


p-CATTM SONIC CONDITION ASSESSMENT SIMPLIFIED

The relationship between the speed of a wave and average wall thickness (h) over the distance traveled is well established. p-CATTM Sonic extends this to provide sub-sectional information.

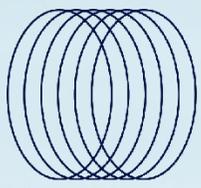
What the formula gives:

$$h \approx \rho_0 c_0^2 \frac{D}{E} \frac{1 - \nu^2}{\frac{c_0^2}{\langle c_w \rangle^2} - 1}$$



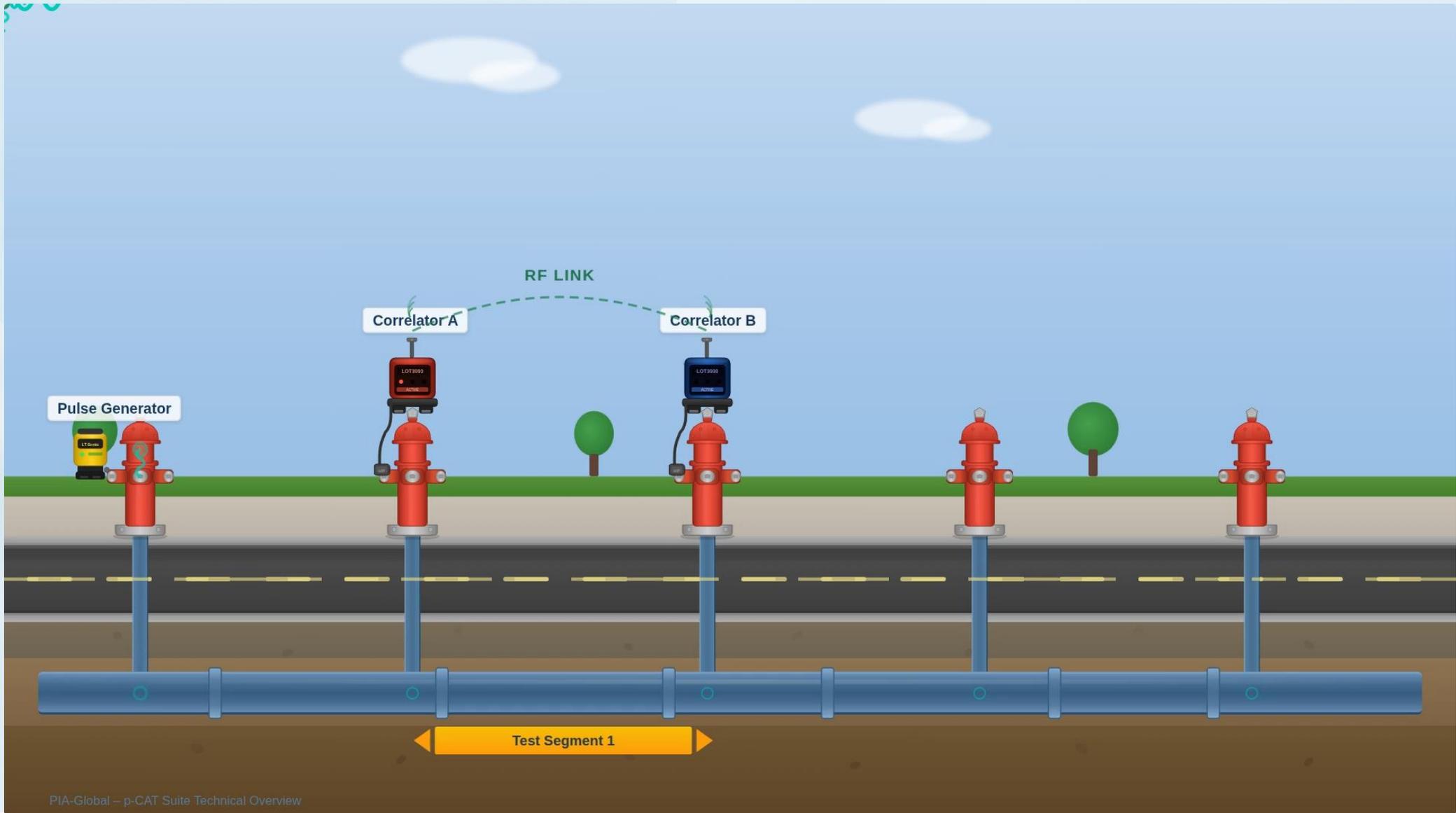
What engineers want:

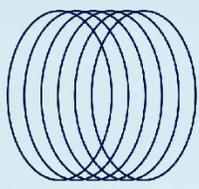




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sonic

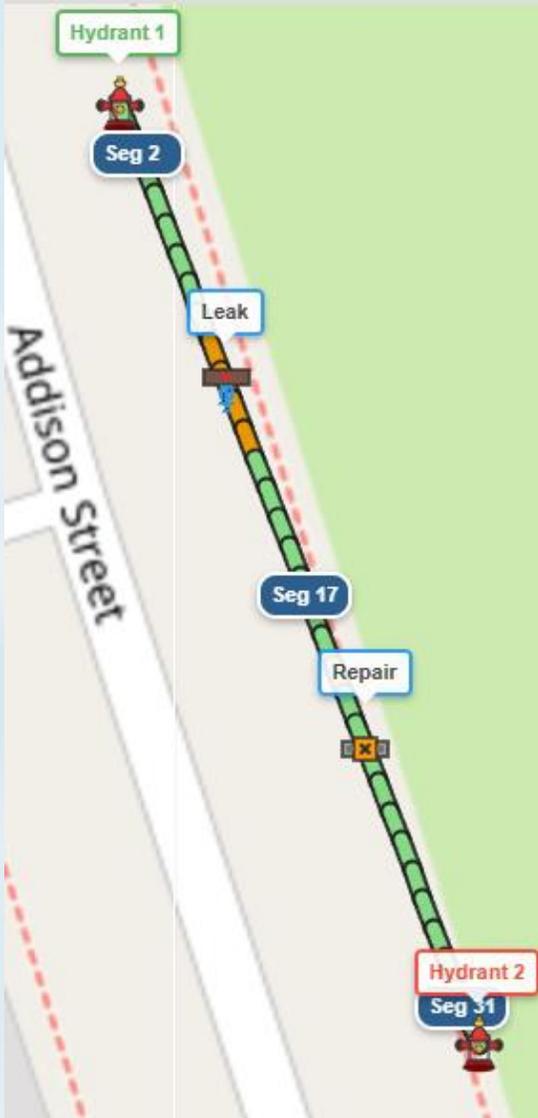
CONDITION ASSESSMENT SIMPLIFIED





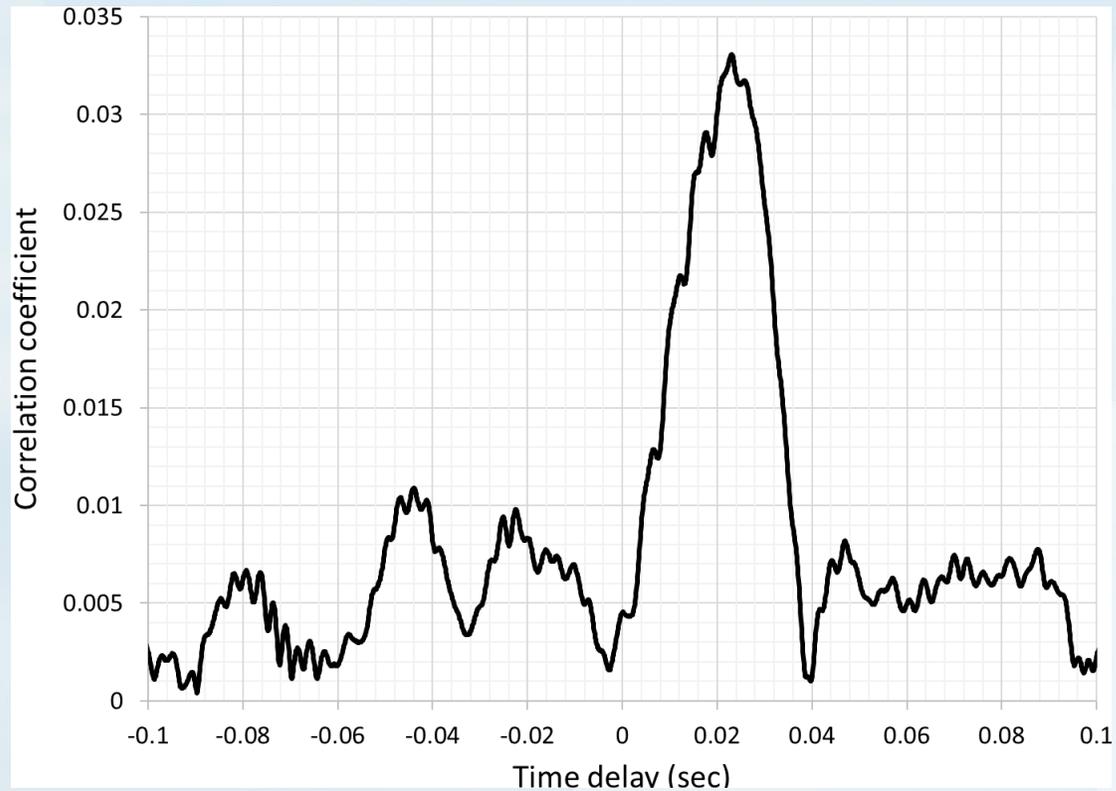
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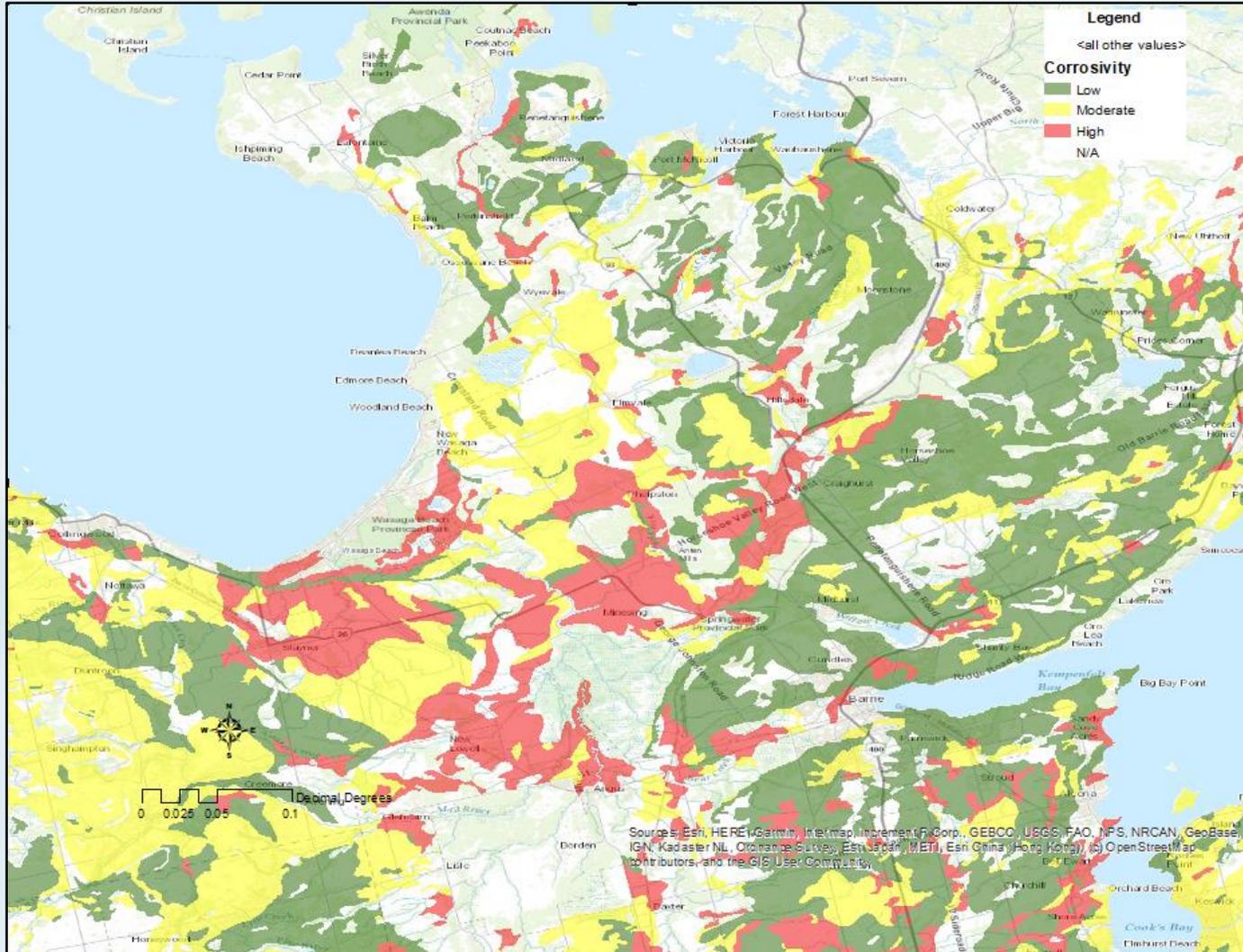


Chainage (m)	Rating	Thickness (mm)	EOL
1.79	3.4 Good	8.25	2058
3.58	3.7 Good	8.71	2070
5.37	3.7 Good	8.67	2070
7.16	3.9 Good	9.04	2074
8.95	3.6 Good	8.52	2068
10.74	3.6 Good	8.54	2069
12.54	3.0 Good	7.53	2052
14.33	3.1 Good	7.7	2053
16.12	2.6 Fair	6.99	2048
17.91	2.7 Fair	7.04	2048
19.70	2.6 Fair	7.01	2048
21.49	2.7 Fair	7.19	2049
23.28	3.5 Good	8.45	2068
25.07	3.3 Good	8.14	2057
26.86	3.5 Good	8.42	2067
28.65	3.7 Good	8.71	2070
30.44	3.3 Good	8.09	2057
32.23	3.5 Good	8.4	2067
34.02	3.6 Good	8.51	2068
35.82	3.6 Good	8.55	2069
37.61	3.3 Good	8.15	2057
39.40	3.3 Good	8.04	2056
41.19	3.6 Good	8.51	2068
42.98	3.8 Good	8.95	2073
44.77	3.6 Good	8.54	2069
46.56	3.5 Good	8.48	2068
48.35	3.4 Good	8.18	2057
50.14	3.6 Good	8.63	2070
51.93	3.6 Good	8.55	2069
53.72	3.9 Good	9.03	2074
55.51	3.8 Good	8.97	2073
57.31	3.6 Good	8.59	2069

EXAMPLE: CONFIRMATION OF TUBERCULATION IN +100 YEAR - CAST IRON (CI) WATERMAIN



EXAMPLE ONTARIO P-CAT SONIC WATERMAIN CONDITION ASSESSMENTS (2024 / 25)

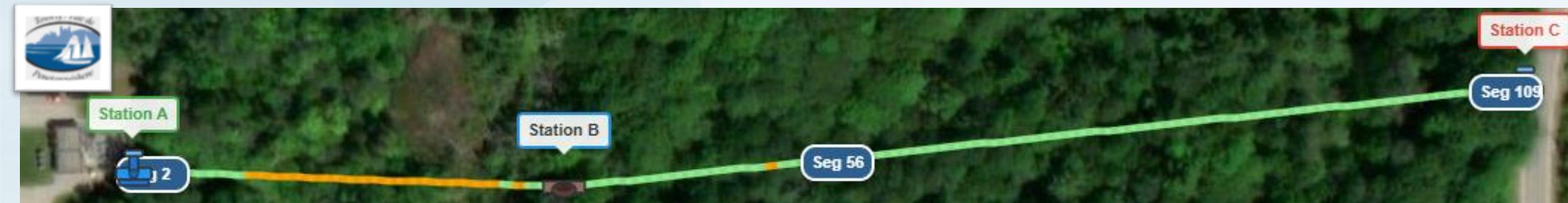


PENETANGUISHENE, ONTARIO

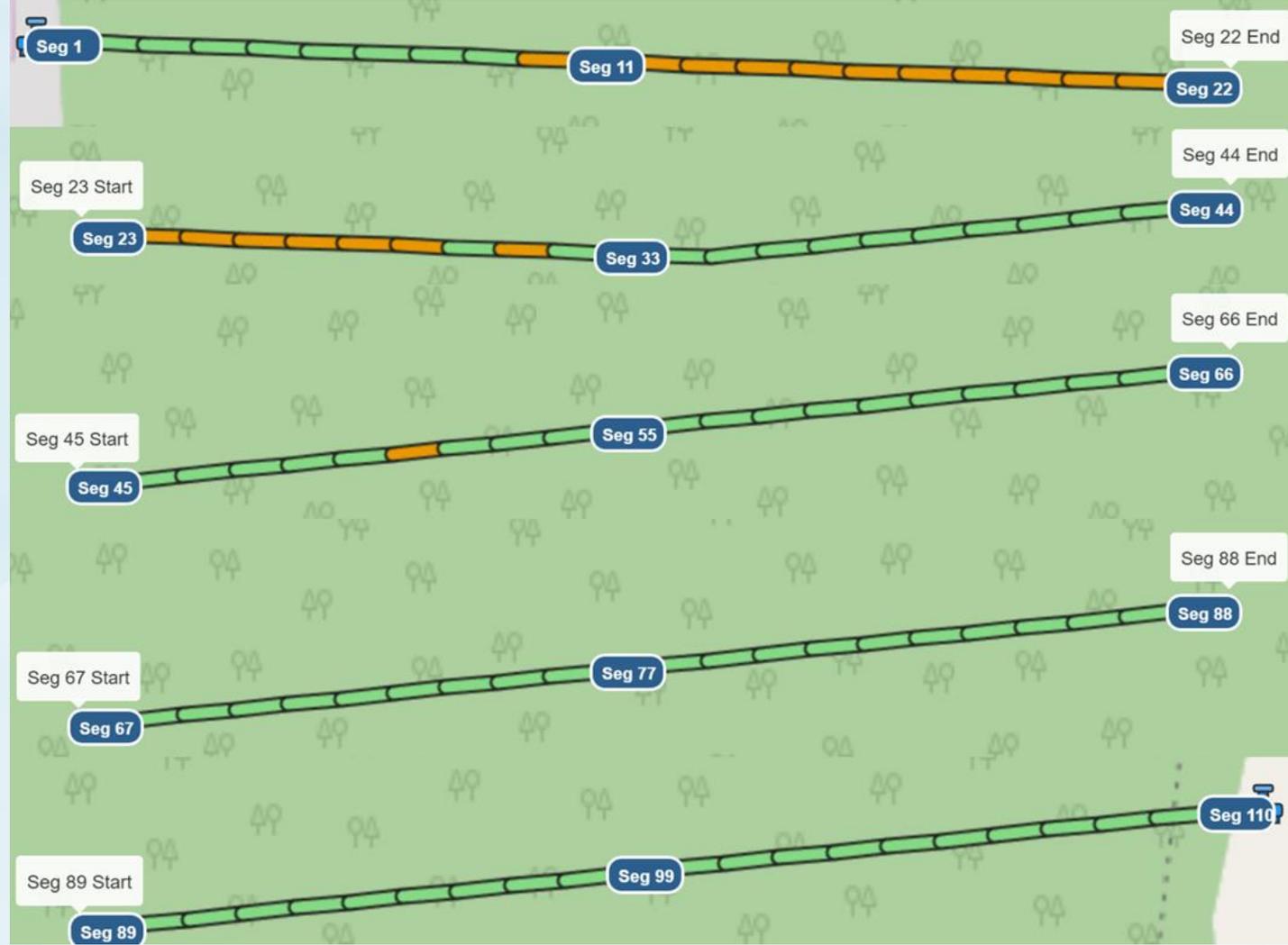
Bryan Murray, P.Eng
Director of Public Works

PENETANGUISHENE (2024): 110-YEAR-OLD 250 MM / 10" CI

- ❑ November 2024; 1-day on site.
- ❑ 400 m / 1313' across marshy terrain, with a long exposed section.
- ❑ Wall thickness loss: Only 22-31% (😊).
- ❑ **Implications:** Over time, continue to reduce operating pressure.
- ❑ **Recommendations:**
 - ❑ Initiate replacement via 2026/27 budgeting & planning process.
 - ❑ Monitor vulnerable segments.



PENETANGUISHENE (2024): 110-YEAR-OLD 250 MM / 10" CI



PENETANGUISHENE (2024): 110-YEAR-OLD 250 MM / 10" CI

Seg.	Chainage (m)	Condition	Thickness (mm)	EOL Year
1	3.64	Good	10.28	2070
2	7.27	Good	10.6	2080
3	10.91	Good	10.67	2082
4	14.54	Good	10.53	2077
5	18.18	Good	10.6	2080
6	21.81	Good	10.63	2081
7	25.45	Good	10.68	2082
8	29.09	Good	10.5	2076
9	32.72	Good	10.32	2071
10	36.36	Fair	10.06	2064
11	39.99	Fair	9.87	2059
12	43.63	Fair	10.09	2065
13	47.26	Fair	10.11	2065
14	50.90	Fair	10.13	2066
15	54.53	Fair	9.7	2055
16	58.17	Fair	9.1	2039
17	61.81	Fair	8.95	2037
18	65.44	Fair	8.85	2036
19	69.08	Fair	9.22	2041
20	72.71	Fair	9.23	2041
21	76.35	Fair	9.44	2050
22	79.98	Fair	9.37	2048
23	83.62	Fair	9.46	2050
24	87.26	Fair	8.94	2037
25	90.89	Fair	8.94	2037
26	94.53	Fair	8.99	2038
27	98.16	Fair	9.44	2050
28	101.80	Fair	9.41	2049
29	105.43	Fair	10.04	2063

Seg.	Chainage (m)	Condition	Thickness (mm)	EOL Year
30	109.07	Good	10.57	2079
31	112.71	Fair	9.8	2057
32	116.34	Good	10.34	2071
33	119.98	Good	10.43	2074
34	123.61	Good	10.28	2070
35	127.25	Good	10.98	2093
36	130.88	Good	11.74	>2126
37	134.52	Good	11.26	2125
38	138.16	Good	11.04	2096
39	141.79	Good	11.12	2099
40	145.43	Good	11.24	2124
41	149.06	Good	11.86	2126
42	152.70	Good	10.56	2078
43	156.33	Good	11.22	2123
44	159.97	Good	10.67	2082
45	163.60	Good	11.85	2126
46	167.24	Good	11.26	2125
47	170.88	Good	11.23	2124
48	174.51	Good	10.57	2079
49	178.15	Good	10.71	2083
50	181.78	Good	10.46	2075
51	185.42	Fair	10.23	2068
52	189.05	Good	10.99	2094
53	192.69	Good	10.35	2072
54	196.33	Good	10.72	2084
55	199.96	Good	10.79	2086
56	203.60	Good	11.88	2126
57	207.23	Good	10.93	2091
58	210.87	Good	11.13	2100

Seg.	Chainage (m)	Condition	Thickness (mm)	EOL Year
59	214.50	Good	10.43	2074
60	218.14	Good	10.57	2079
61	221.78	Good	10.64	2081
62	225.41	Good	10.29	2070
63	229.05	Good	11.16	2101
64	232.68	Good	11.23	2124
65	236.32	Good	11.29	>2126
66	239.95	Good	11.31	>2126
67	243.59	Good	10.71	2083
68	247.23	Good	11.76	>2126
69	250.86	Good	11	2094
70	254.50	Good	10.28	2070
71	258.13	Good	11.29	>2126
72	261.77	Good	10.29	2070
73	265.40	Good	10.67	2082
74	269.04	Good	11.18	2102
75	272.67	Good	10.8	2086
76	276.31	Good	10.75	2085
77	279.95	Good	10.56	2078
78	283.58	Good	10.42	2074
79	287.22	Good	10.88	2089
80	290.85	Good	10.29	2070
81	294.49	Good	10.89	2090
82	298.12	Good	10.65	2081
83	301.76	Good	10.36	2072
84	305.40	Good	11.61	>2126
85	309.03	Good	11.35	>2126
86	312.67	Good	11.72	>2126
87	316.30	Good	11.41	>2126

Seg.	Chainage (m)	Condition	Thickness (mm)	EOL Year
88	319.94	Good	11.86	>2126
89	323.57	Good	11.94	>2126
90	327.21	Good	11.44	>2126
91	330.85	Good	11.22	2123
92	334.48	Good	11.68	>2126
93	338.12	Good	11.1	2098
94	341.75	Good	11.78	>2126
95	345.39	Good	11.65	>2126
96	349.02	Good	11.52	>2126
97	352.66	Good	11.76	>2126
98	356.29	Good	11.83	>2126
99	359.93	Good	11.64	>2126
100	363.57	Good	11.74	>2126
101	367.20	Good	11.69	>2126
102	370.84	Good	11.73	>2126
103	374.47	Good	11.99	>2126
104	378.11	Good	11.61	>2126
105	381.74	Good	11	2094
106	385.38	Good	11.68	>2126
107	389.02	Good	10.88	2089
108	392.65	Good	10.93	2091
109	396.29	Good	11.24	2124
110	399.92	Good	11.02	2095



MIDLAND, ONTARIO

Andre Pepin

Director of Environmental Services

MIDLAND EMPLOYMENT GROWTH AREA (2025)

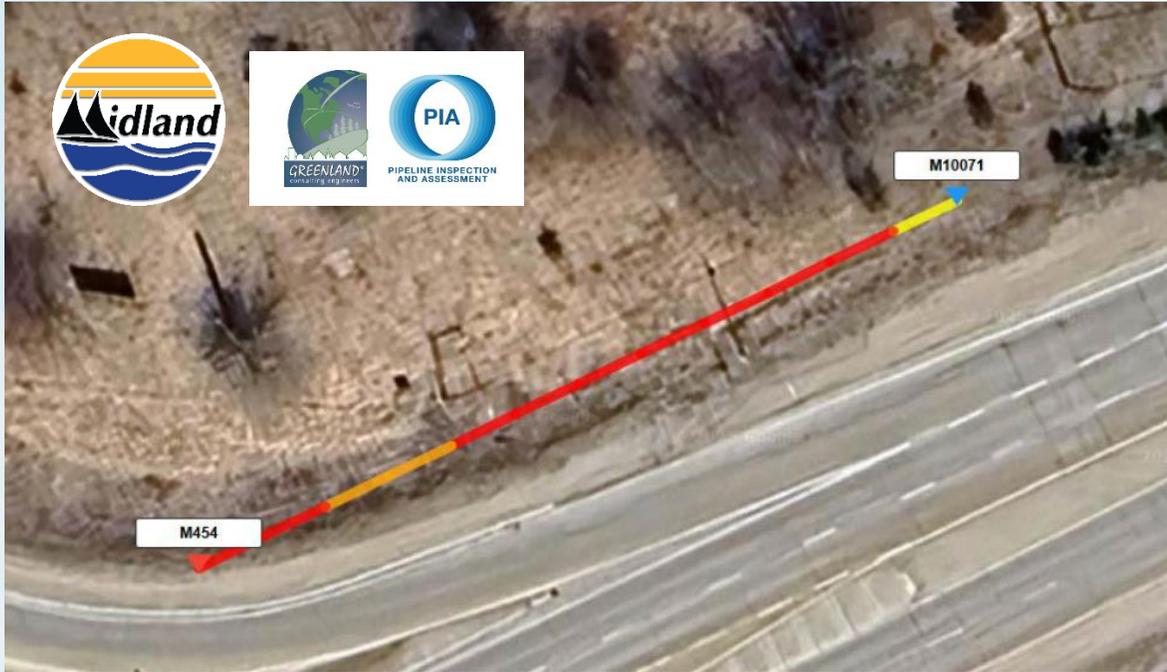


MIDLAND EMPLOYMENT GROWTH AREA (2025)

- ❑ Mixture of 250 & 300 mm / 10" & 12" AC and 250 mm / 10" DI mains.
- ❑ History of main leaks with localized repairs/replacements.
- ❑ 54% average wall thickness / stiffness loss
- ❑ **Implications:**
 - ❑ Over time, continuing reduced transmission operating pressures, high probability of additional leaks.
- ❑ **Recommendations:**
 - ❑ Re-test in 2 years to verify rate of wall losses not increasing
 - ❑ Continuous monitoring is not necessary currently.



MIDLAND EMPLOYMENT GROWTH AREA (2025)



3: PROJECT PLAN

- A. Describe your project including a high-level plan, scope, key activities, team, and deliverables.
- B. How are you going to implement your project plan?



A. High-Level Project Plan: AI-Driven Water Pipe Integrity Assessment Platform

Phase 1 (initial 6 months) in 2025/2026:

- Complete background literature review of relevant publications and research over past decade
- **Complete field testing at Evergreen Brick Works Site for watermain data inclusion in Phase 1 report.**
- Initiate project consultations with Great Lakes Basin municipalities and water utilities regarding overall project to develop the predictive AI powered platform (to be completed within 2 years).
- Attend relevant industry conferences (2 total) to present the project and as early as late 2025.
- Produce a comprehensive technical framework and architecture (Phase 1) report summarizing code details (with a preliminary functional prototype tool) and integration pathways with other relevant modeling tools, SCADA, and potential digital twin system

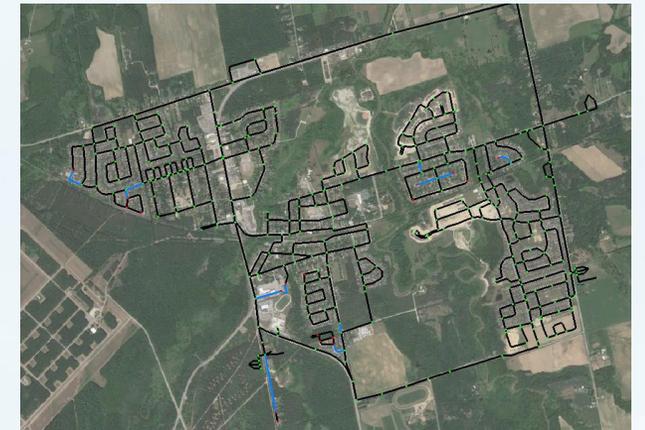


Phase 2 (Estimated 7-24 months) in 2026/2027):

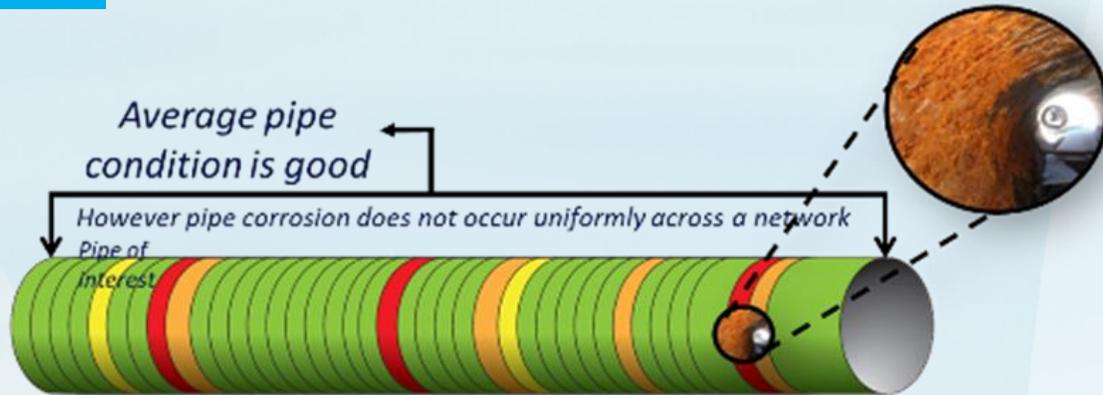
- Additional watermain condition assessments at 5 municipalities within the Great Lakes Basin.*
- Develop AI model platform using GREELAND® staff and with all field site data for defect detection and condition classification to be validated using other field data (scope to be confirmed).
- Prepare final documentation, including appended Phase 1 technical report information.



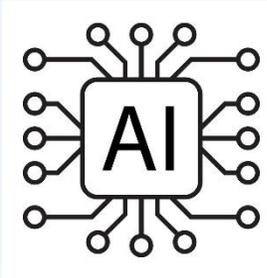
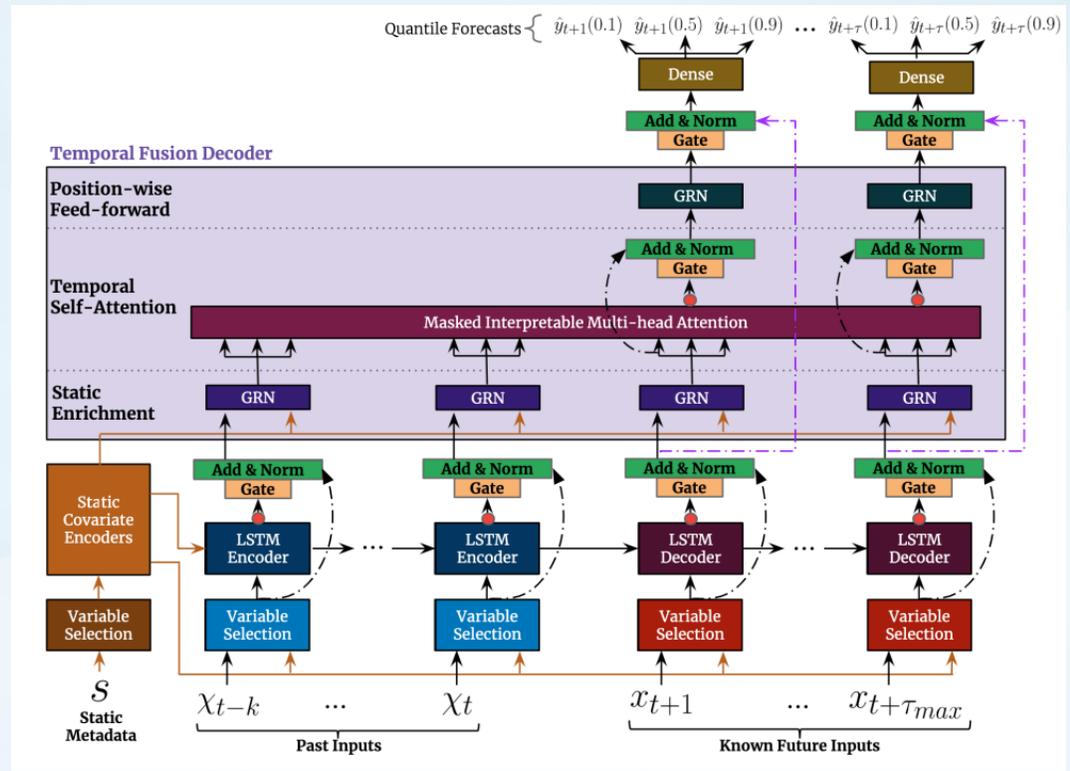
**The Great Lakes and St. Lawrence Cities Initiative has provided a letter of support to facilitate participation.*



AI TECHNOLOGY INTEGRATION (PART '2')



Pipe condition	
High priority	Low priority
Medium priority	No action required



AI DECISION SUPPORT SYSTEM / PLATFORM UPDATE



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Fuzzy-based method to evaluate soil corrosivity for prediction of water main deterioration
Sadiq, R.; Rajani, B. B.; Kleiner, Y.

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Journal of Infrastructure Systems, 10, December 4, pp. 149-156, 2004-12-01

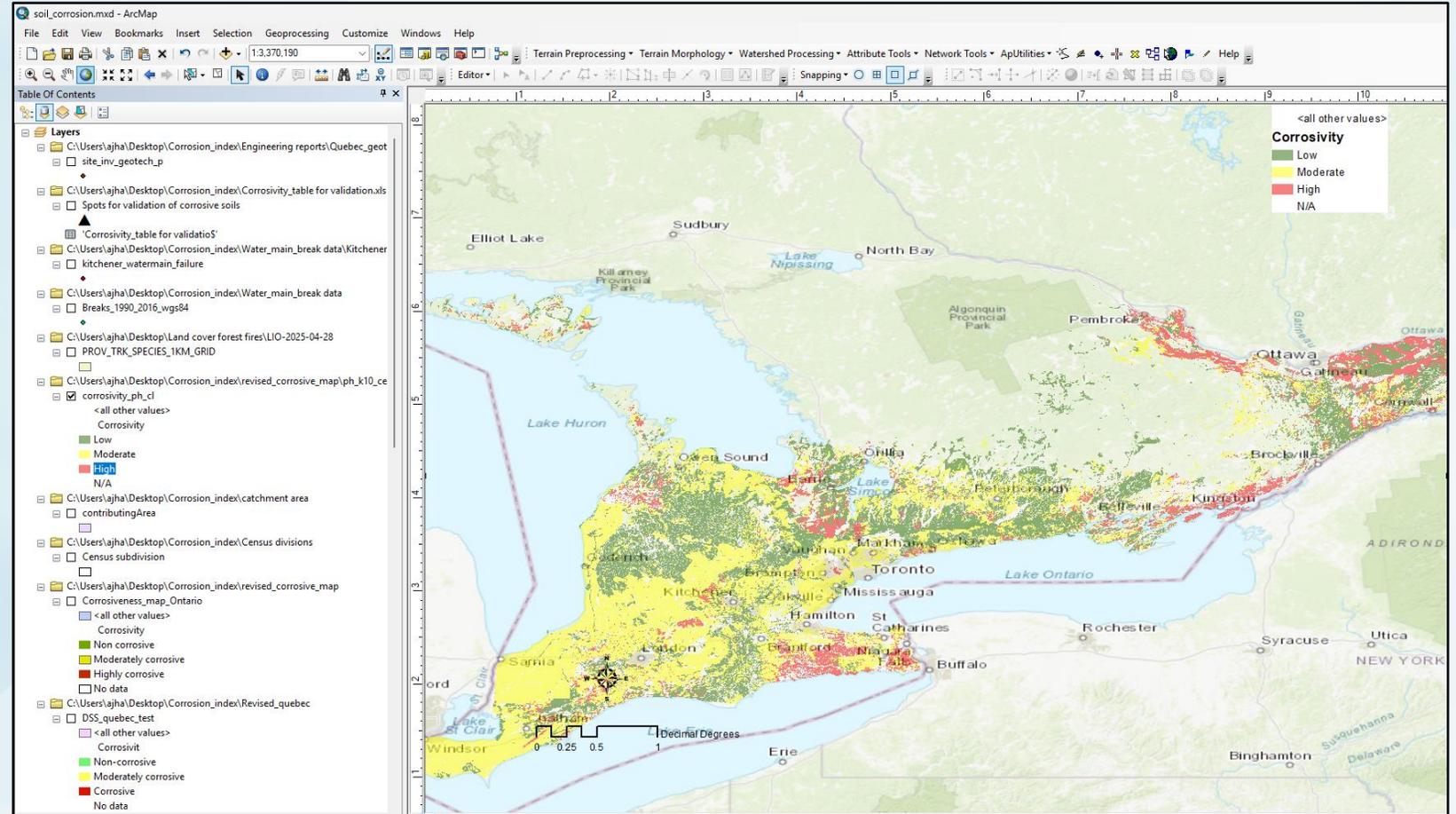
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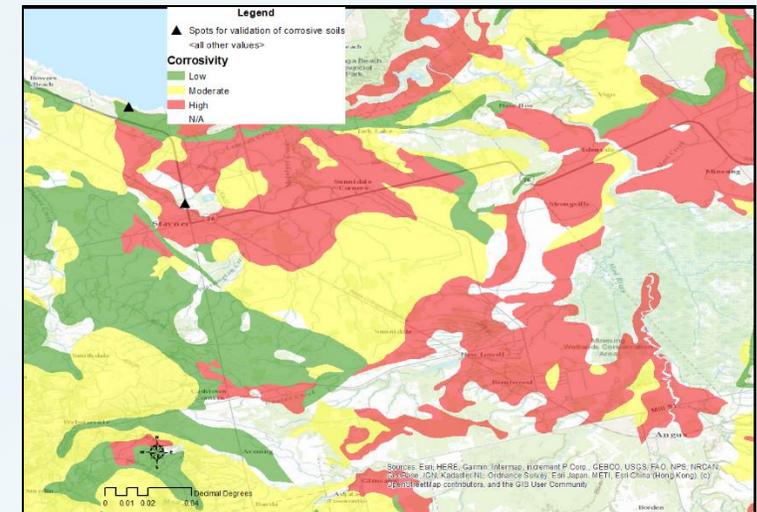
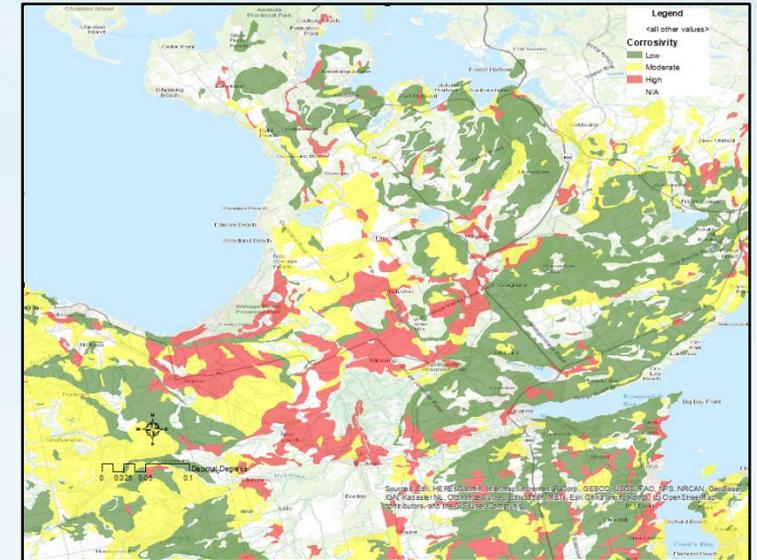
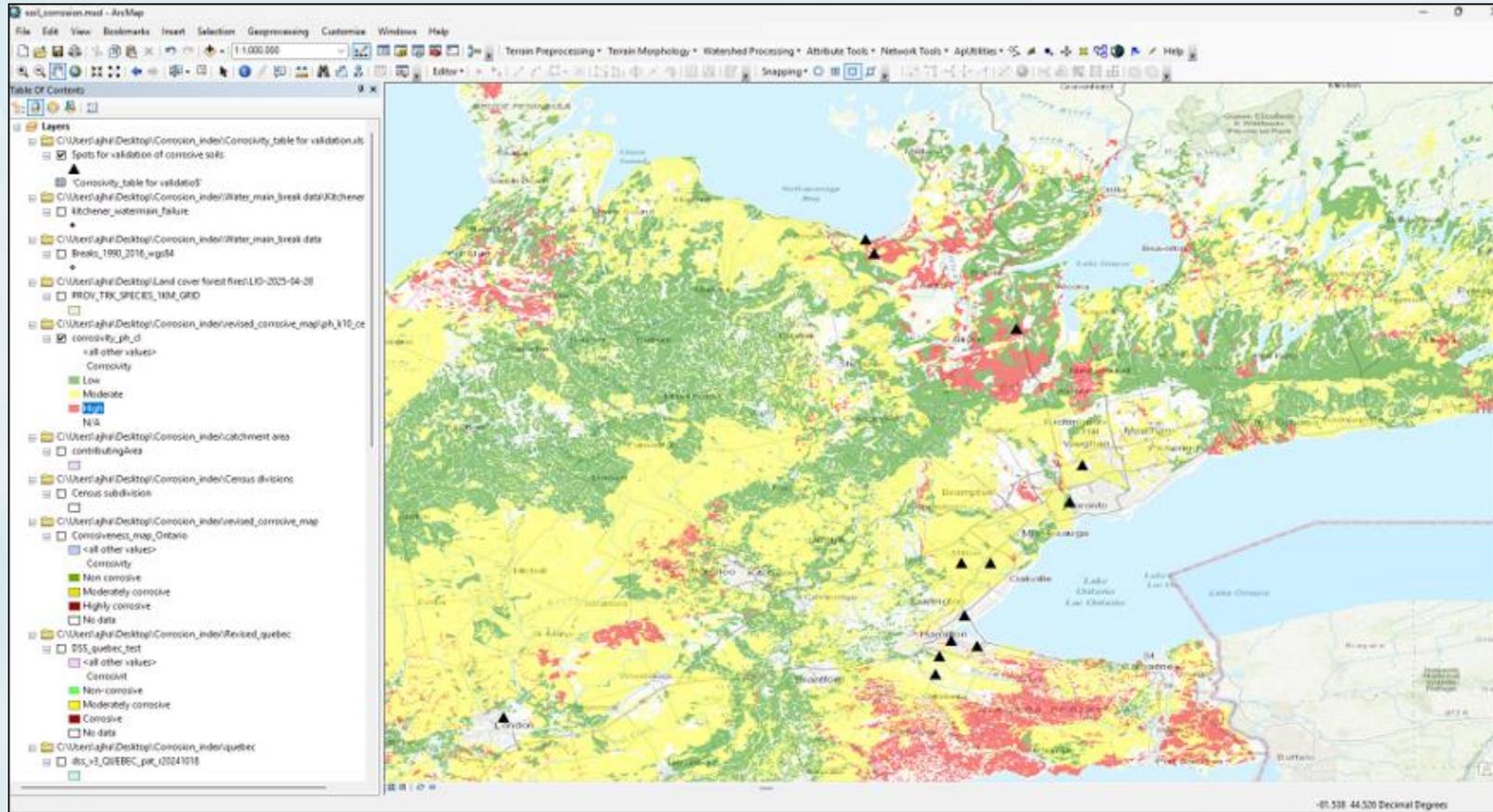
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AI DECISION SUPPORT SYSTEM / PLATFORM UPDATE

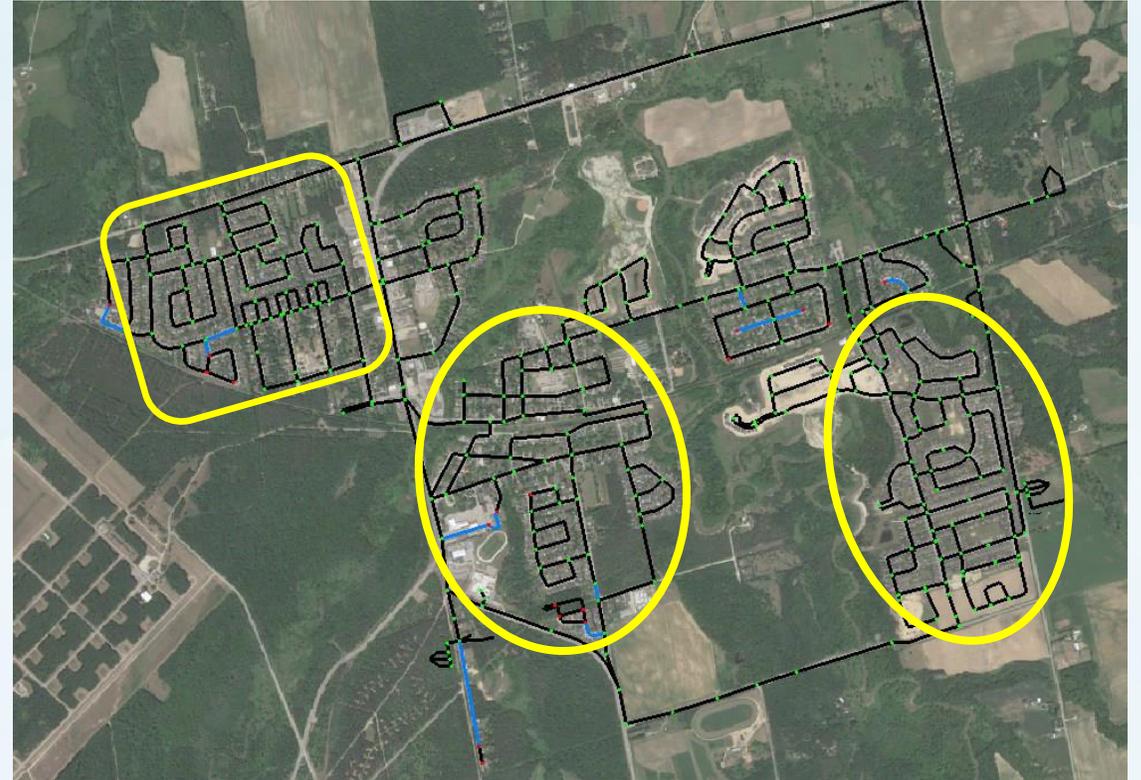


GREENLAND[®]
consulting engineers

PHASE '2': AI PLATFORM DEVELOPMENT OPPORTUNITY



- GREENLAND® is seeking up to five (5) Cities Initiative member communities to participate in piloting this approach
- Cities Initiative members will have an opportunity to express interest via a questionnaire that will be shared by email later this month



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QUESTIONS?



GREAT LAKES AND ST. LAWRENCE
CITIES INITIATIVE

L'ALLIANCE DES VILLES
DES GRANDS LACS ET DU SAINT-LAURENT

Please raise your hand or type questions in the chat!