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CANADIAN WATER AND WASTEWATER ASSOCIATION

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*City of Saskatoon/South Saskatchewan River
(Tourism Saskatoon)*



**THE PARIS OF THE PRAIRIES LEADS THE WAY FOR
PIPELINE MANAGEMENT**

Presentation Overview

- Program Background
- What is PipeDiver Ultra?
- Inspection Results
- Structural Analysis
- Summary/Recommendations



Saskatoon Water System

- Supplies water to 320,000 residents
- 1,192 km of watermain
- Long-term asset management plan has contributed to reduced watermain breaks

198 in 2020 compared to a 239 10-year average

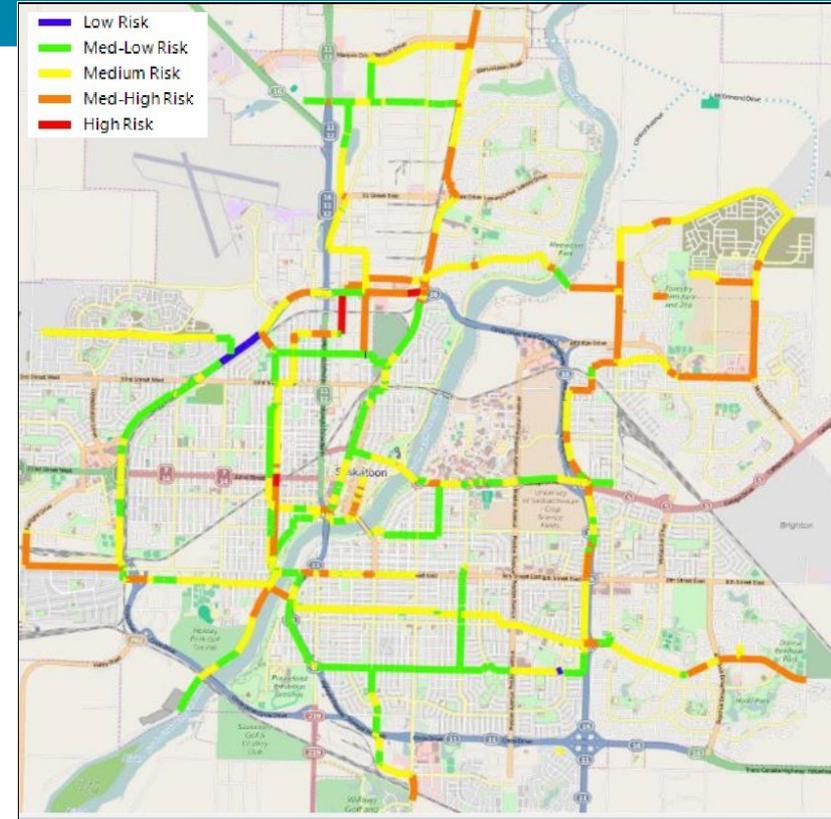


Water Main breaks per year



Condition Assessment Program

- As part of this program, in 2020 the City inspected 7.8 km of large diameter steel water mains
- Expansion to the City's overall inspection program
 - Had focused on AWWA C301 PCCP
- Driven by new high-resolution free swimming inspection technology for metallic pipelines

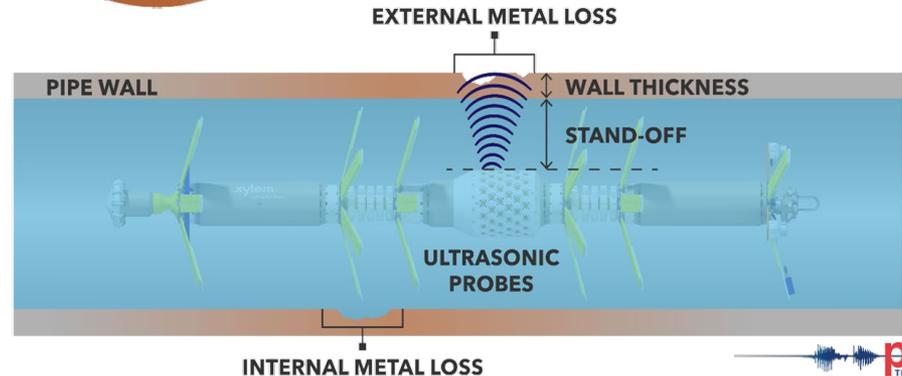


City of Saskatoon Primary Water Mains
Risk Map (119 km)



What is PipeDiver Ultra?

- High-resolution, free-swimming ultrasonic technology
- Measures pipe wall thickness on metallic pipelines
- Differentiates internal/external defects
- Also measures out-of-roundness

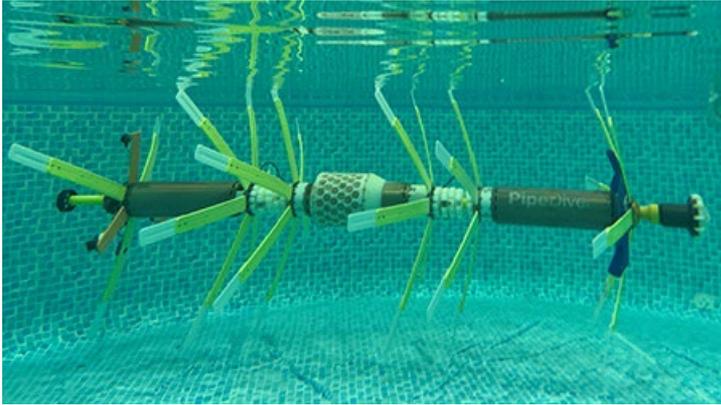


Project Background

- Pipelines:
 - 1050mm Acadia Fill Main (6.35km)
 - 600mm 1st Ave PWM (1.43km) Steel Watermains
- Inspections: PipeDiver Ultra, Smartball, Sahara & Transient Pressure Monitoring



Inspection Preparation



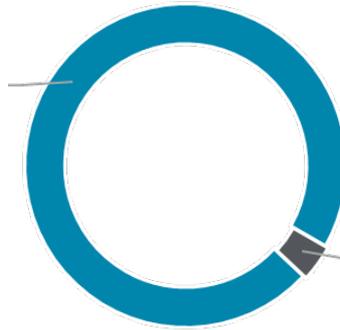
**Preparing PipeDiver Ultra for the inspections
(left: tool balancing; right: onsite insertion)**



PipeDiver Ultra Inspection Results

600-millimetre 1st Avenue Primary Water Main - 136 Total Pipes 1.43km

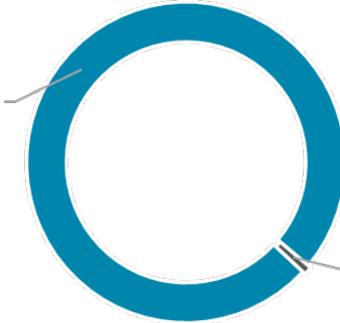
131 Pipes with no defects;
where 106 pipes have out-of-roundness >3 %



5 Pipes with defects; where 5 pipes have out-of-roundness >3%.

1050-millimetre Acadia Fill Main - 612 Total Pipes 6.35km

607 Pipes with no defects;
where 415 pipes have out-of-roundness >3 %

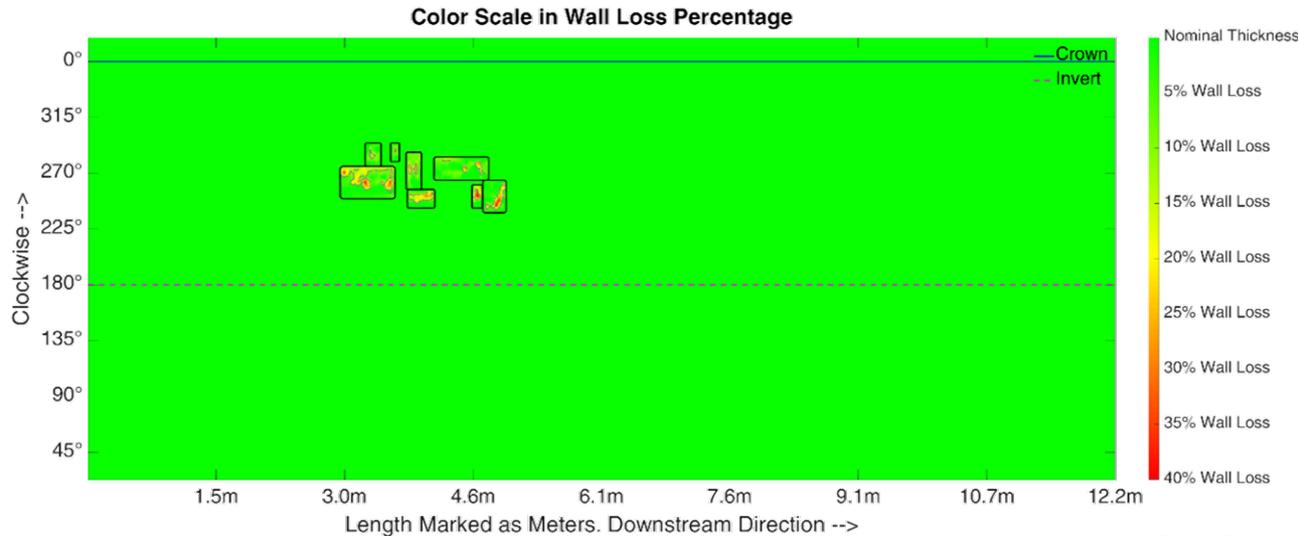


5 Pipes with defects;
where 4 pipes have out-of-roundness >3%.



Corrosion Defects – 1st Ave PWM

- Defects ranged from 5cm to 64cm long and from 18% to 45% maximum wall loss
- All external defects
- Pipe 10135 had 45% wall loss



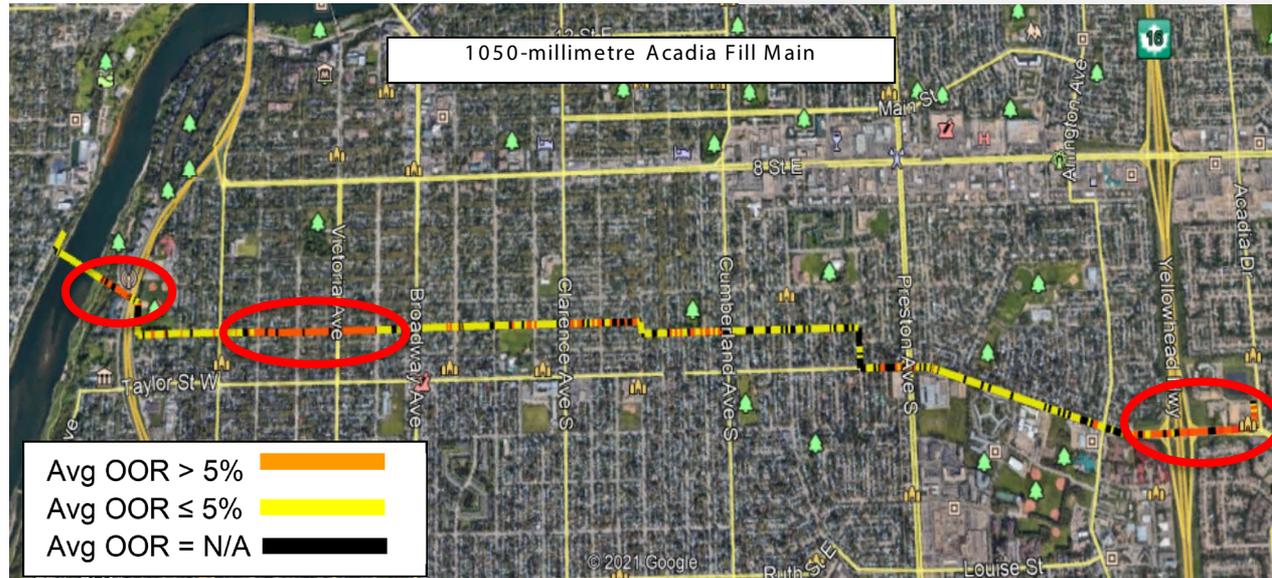
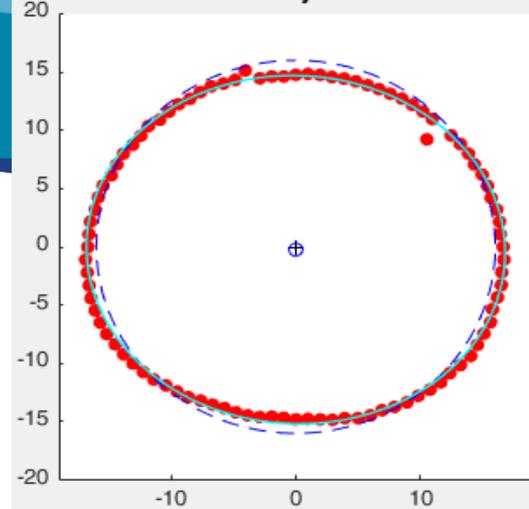
Corrosion Defects – Acadia Fill Main

- Defects ranged from 5cm to 61cm long and from 15% to 40% maximum wall loss
- All external defects
- Pipe 10573 had 40% wall loss



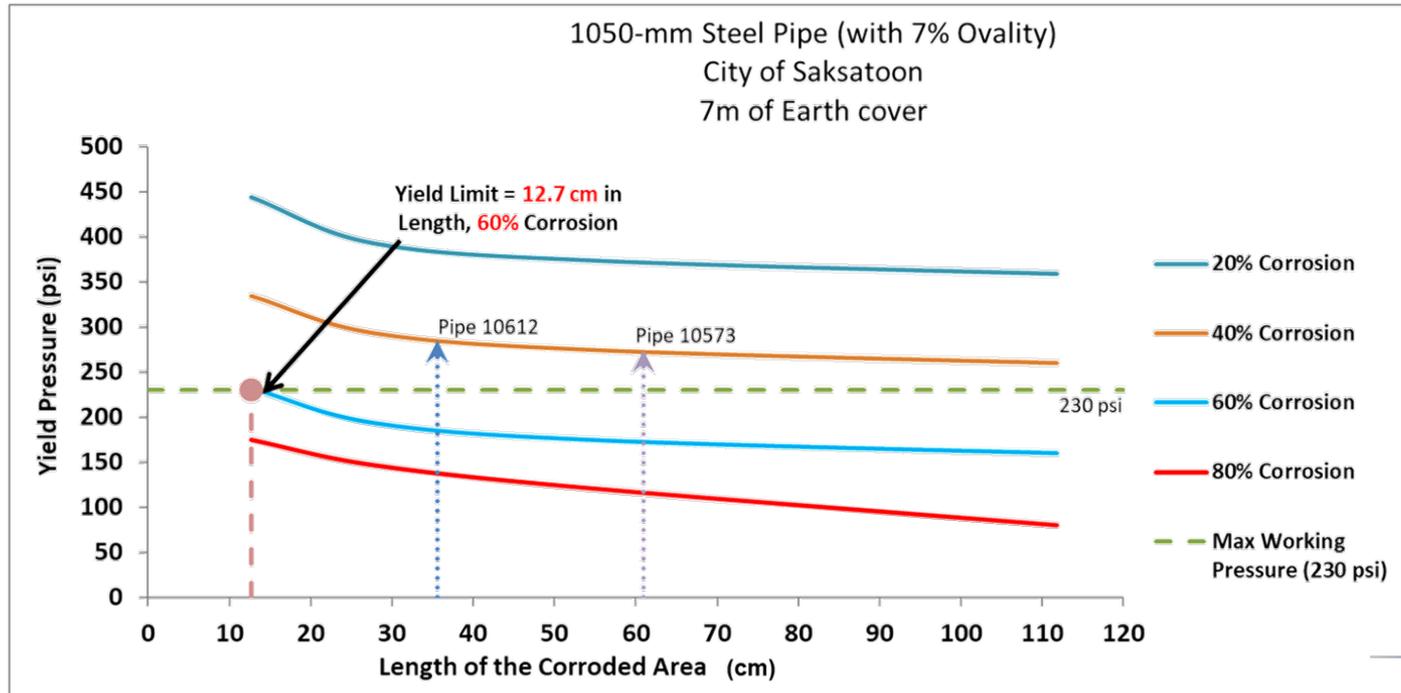
Out-of-Roundness

- Can cause coating cracking and impacts the structural integrity
- Over 5% OOR on a significant amount of pipes
 - 1st Ave PWM:
 - 40 pipes >5% (29% of pipes)
 - 7% greatest (9 pipes)
 - Acadia Fill Main:
 - 228 pipes >5% (35% of pipes)
 - 12% greatest (3 pipes)



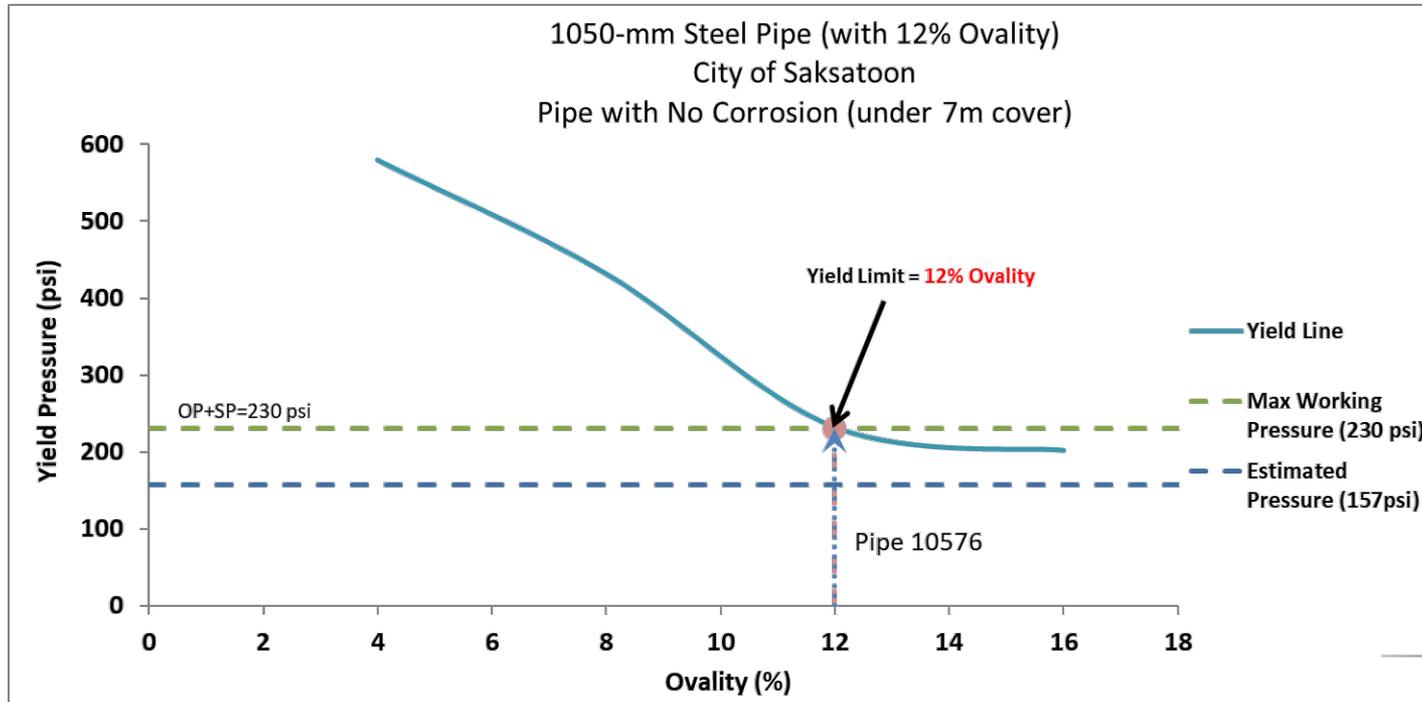
Structure Analysis – FEA

Acadia Fill Main defects did not meet the yield limit
at max pressure of 230psi (operating + surge)



Structure Analysis – FEA

Acadia Fill Main Pipe 10576 (12% OOR, 7m DOC) met the yield limit
at a max pressure of 230psi (conservative; 160psi more realistic)



Remaining Useful Life Analysis

Assists with re-inspection intervals and estimated pipeline life expectancy

Table 6.2: Summary of RUL Results for 1 st Avenue Primary Water Main Pipes				
Pipe Number	Catalog Based RUL	RUL to Structural Failure (Years)		
		5 th Percentile	50 th Percentile	95 th Percentile
Pipe 10060	36	> 100	> 100	> 100
Pipe 10094	36	87	> 100	> 100
Pipe 10112	36	> 100	> 100	> 100
Pipe 10120	36	59	> 100	> 100
Pipe 10135	36	37 years	87	> 100

Pipe 10135: 5% chance it will structurally fail in 37 years

Table 6.2: Summary of RUL Results for Acadia Fill Main Pipes				
Pipe Number	Catalog Based RUL	RUL to Structural Failure (Years)		
		5 th Percentile	50 th Percentile	95 th Percentile
Pipe 10374	54	60	92	> 100
Pipe 10459	54	95	> 100	> 100
Pipe 10564	54	23	52	87
Pipe 10573	54	< 1	16	50
Pipe 10612	54	12	46	> 100

Pipe 10573: 5% chance it will structurally fail in 1 year, 50% chance in 16 years



Summary

- In 2020, the City inspected a total of 7.8 km of large diameter steel water transmission main
- 1st Ave PWM:
 - 1.43 km inspection (136 pipes); 5 pipes with defects
 - Wall loss area ranging from 25cm² to 500cm²; 15% to 45% deep
 - OOR: 40 pipes >5% (29% of pipes); 7% greatest
- Acadia Fill Main:
 - 6.35km inspection (612 pipes); 5 pipes with defects
 - Wall loss area ranging from 50cm² to 2500cm²; 15% to 40% deep
 - OOR: 228 pipes >5% (35% of pipes); 12% greatest
- External defects; none require immediate repair or replacement (but, close!!!)
- The City of Saskatoon now has the data to make informed decisions and mitigate risk on two critical steel water mains.





Thank you!

