Repair or Replace?
Using Inline Technology to Assess Critical Steel Transmission Mains

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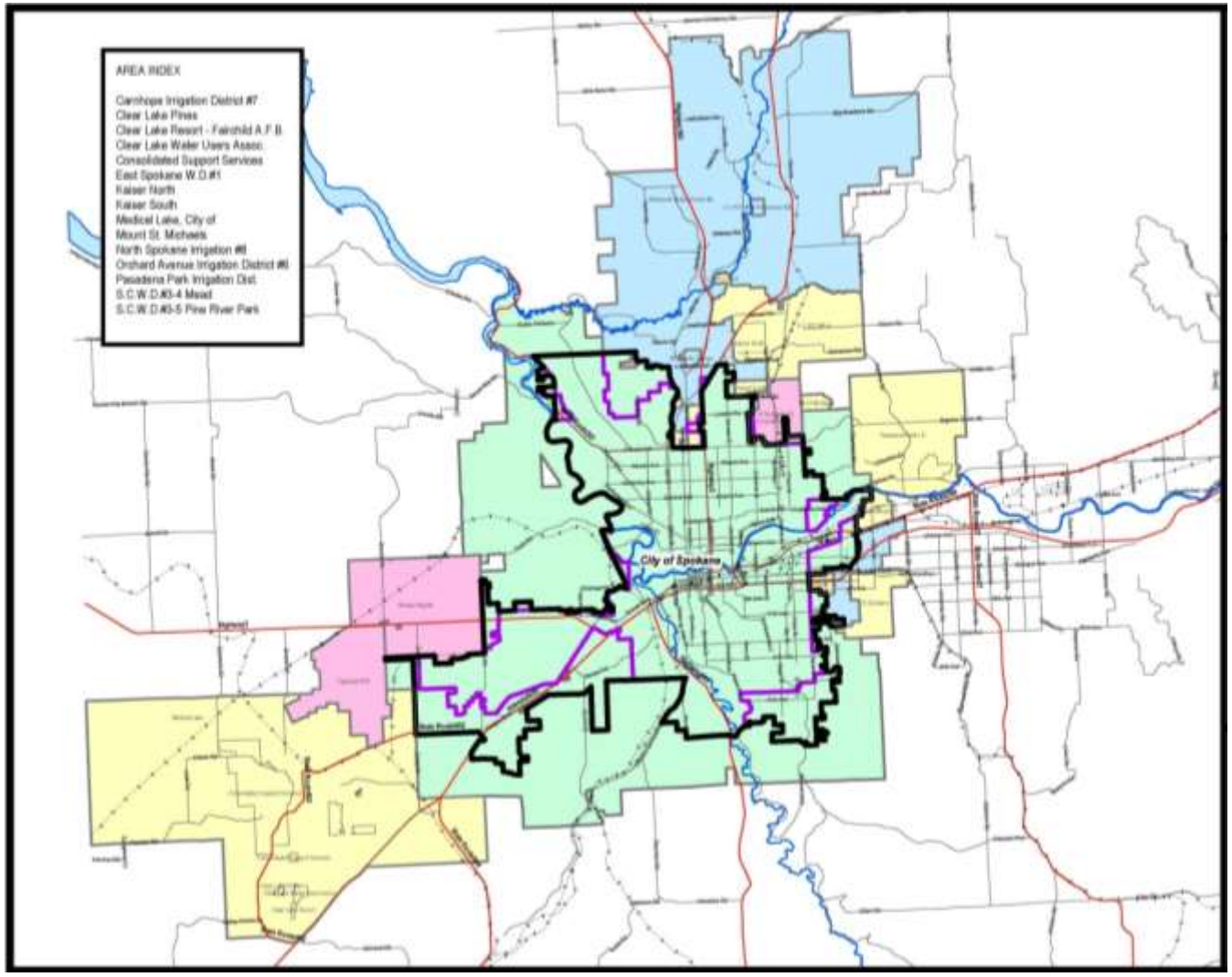
City of Spokane Water Department Overview

- Deliver up to 180 MGD to 200,000+ people
- System includes pumps, reservoirs, source wells, and over 1,000 miles of transmission and distribution pipelines ranging from 6” to 48”
  - Kalamein
  - Asbestos cement
  - Cast Iron
  - Ductile Iron
  - Steel
  - HDPE
  - PVC
  - Copper



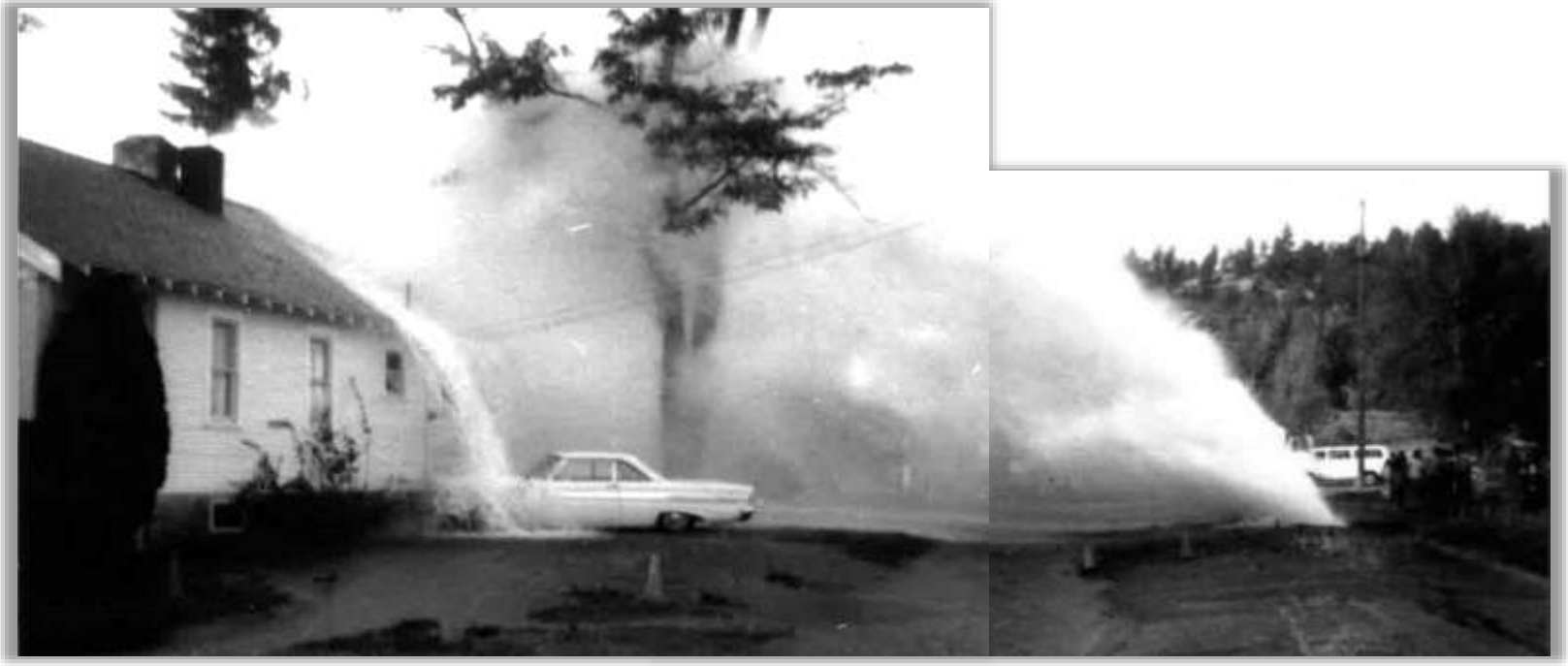
Repair and Replacement Strategy

Problem Identification

- Institutional / Historical Knowledge
- Leak and Break Data Points

Prioritization

- Age / installation date
- Pipe material
- Opportunities in street excavations



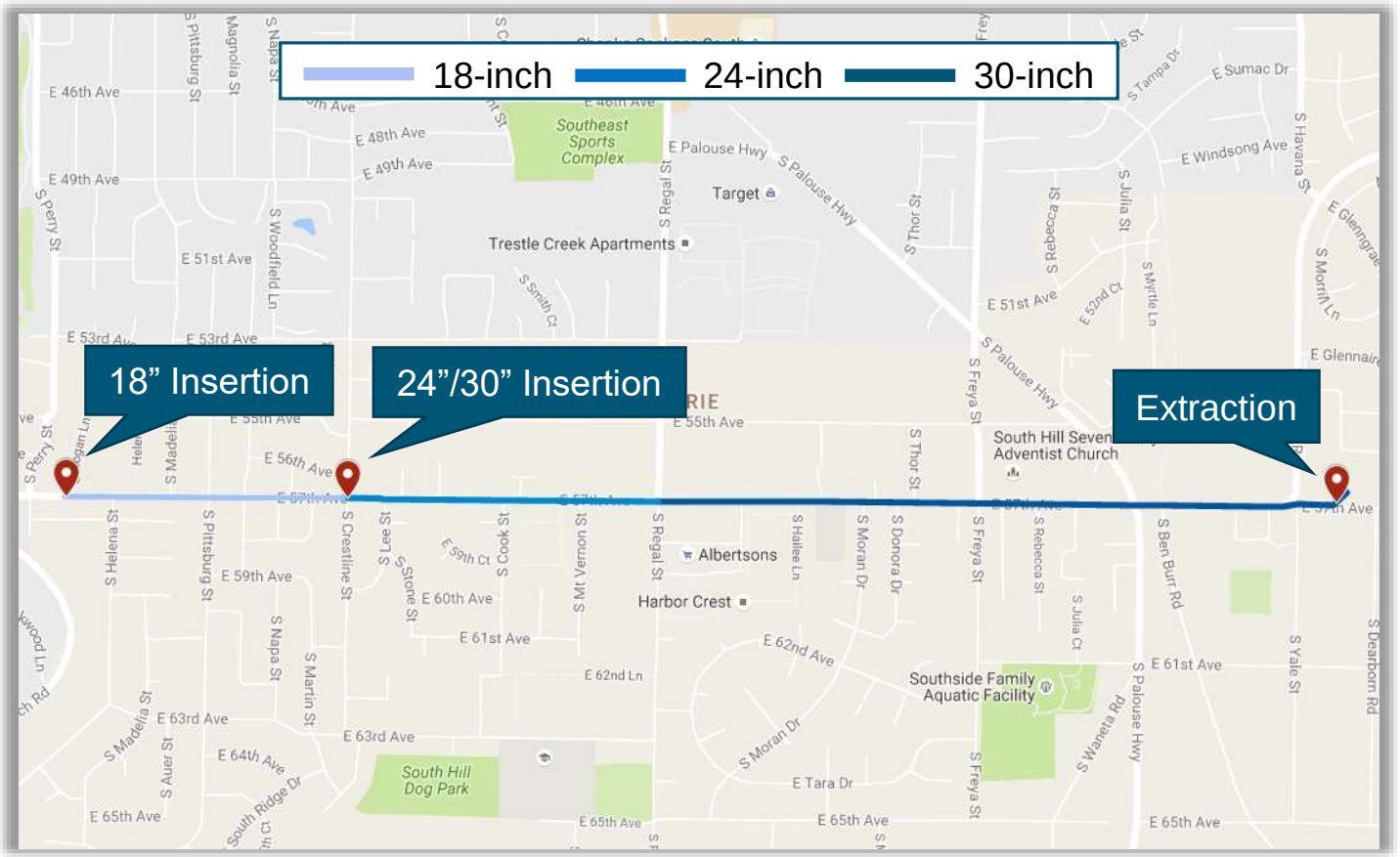
2 Critical Transmission Mains Scheduled for Replacement

Manito Transmission Main

1.1 Miles of 24-inch Steel

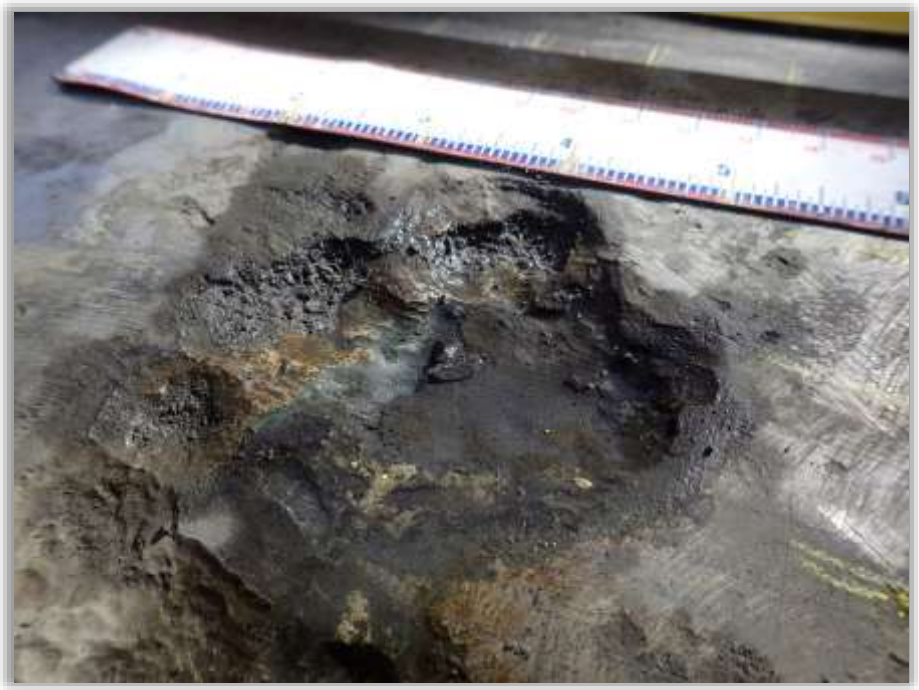
57th Avenue Transmission Main

2.0 Miles of 18/24/30-inch Steel



Assessing Steel Pipe

- Corrosion
- Manufacturing defects
- Construction damage
- Third party damage



Assess: Inspection Platforms

Leak and Air Pocket Detection

SmartBall

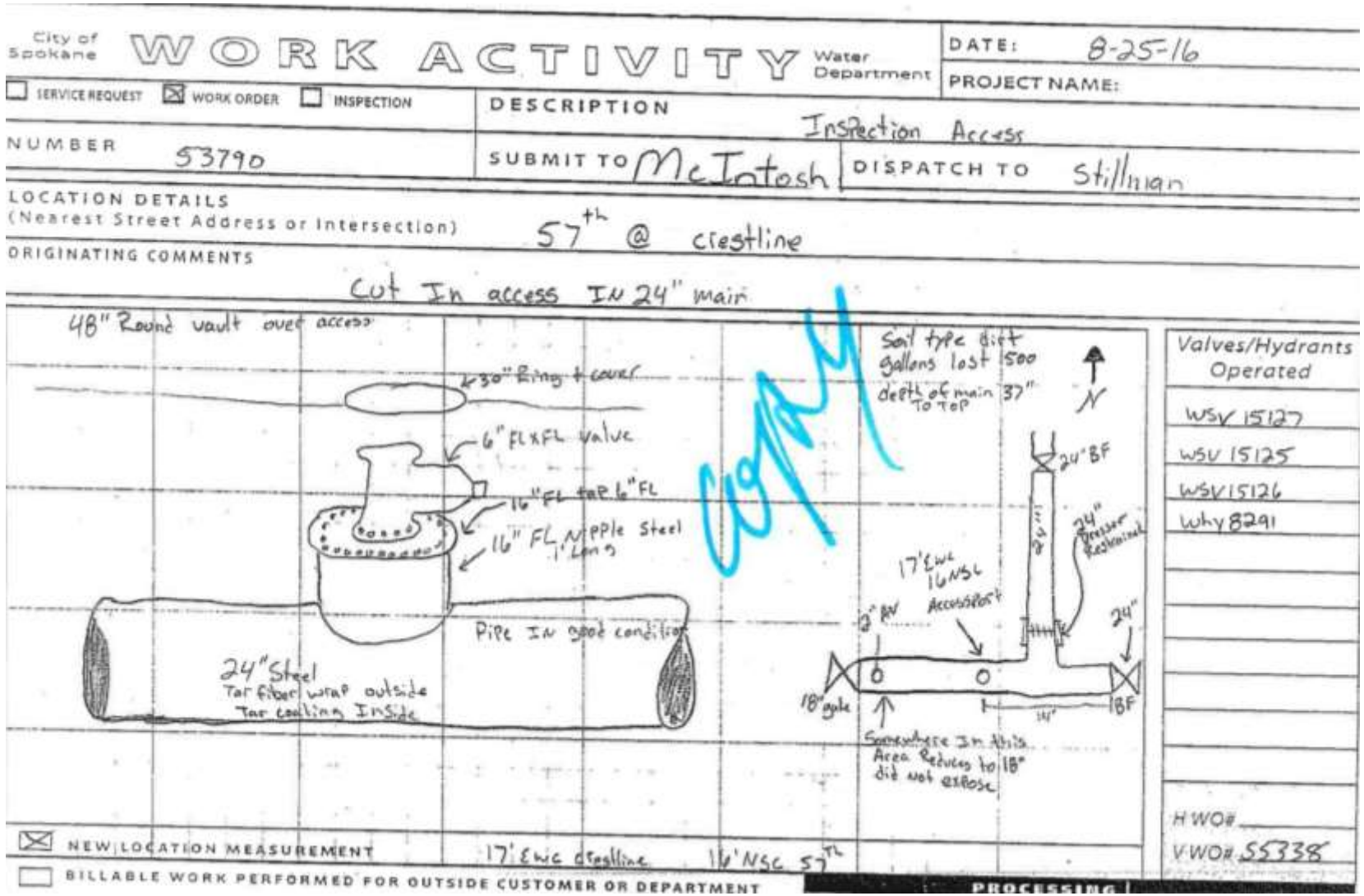
Inline acoustic inspection platform

Wall Thickness Evaluation

PipeDiver

Inline electromagnetic inspection platform

Site Preparation



City of Spokane **WORK ACTIVITY** Water Department

DATE: 8-25-16

☐ SERVICE REQUEST ☒ WORK ORDER ☐ INSPECTION

DESCRIPTION: Inspection Access

PROJECT NAME:

NUMBER: 53790

SUBMIT TO: McIntosh DISPATCH TO: Stillman

LOCATION DETAILS (Nearest Street Address or Intersection): 57th @ crestline

ORIGINATING COMMENTS: Cut In access IN 24" main

48" Round vault over access

30" Ring & cover

6" FL x FL valve

16" FL tap 16" FL

16" FL Nipple Steel 1' Long

Pipe IN good condition

24" Steel Tar fiber wrap outside Tar coating Inside

Soil type dirt
Gallons lost 500
depth of main 37" TO TOP

N

24" BF

24" Grasser Restrained

17' EWC 16 NSC

2" BV Accessport

24"

18" gate

BF

Excavation In this Area Reduced to 18" did not expose

Valves/Hydrants Operated
WSV 15127
WSV 15125
WSV 15126
Why 8291

H WO# _____

V WO# 55338

☒ NEW LOCATION MEASUREMENT 17' EWC crestline 16' NSC 57th

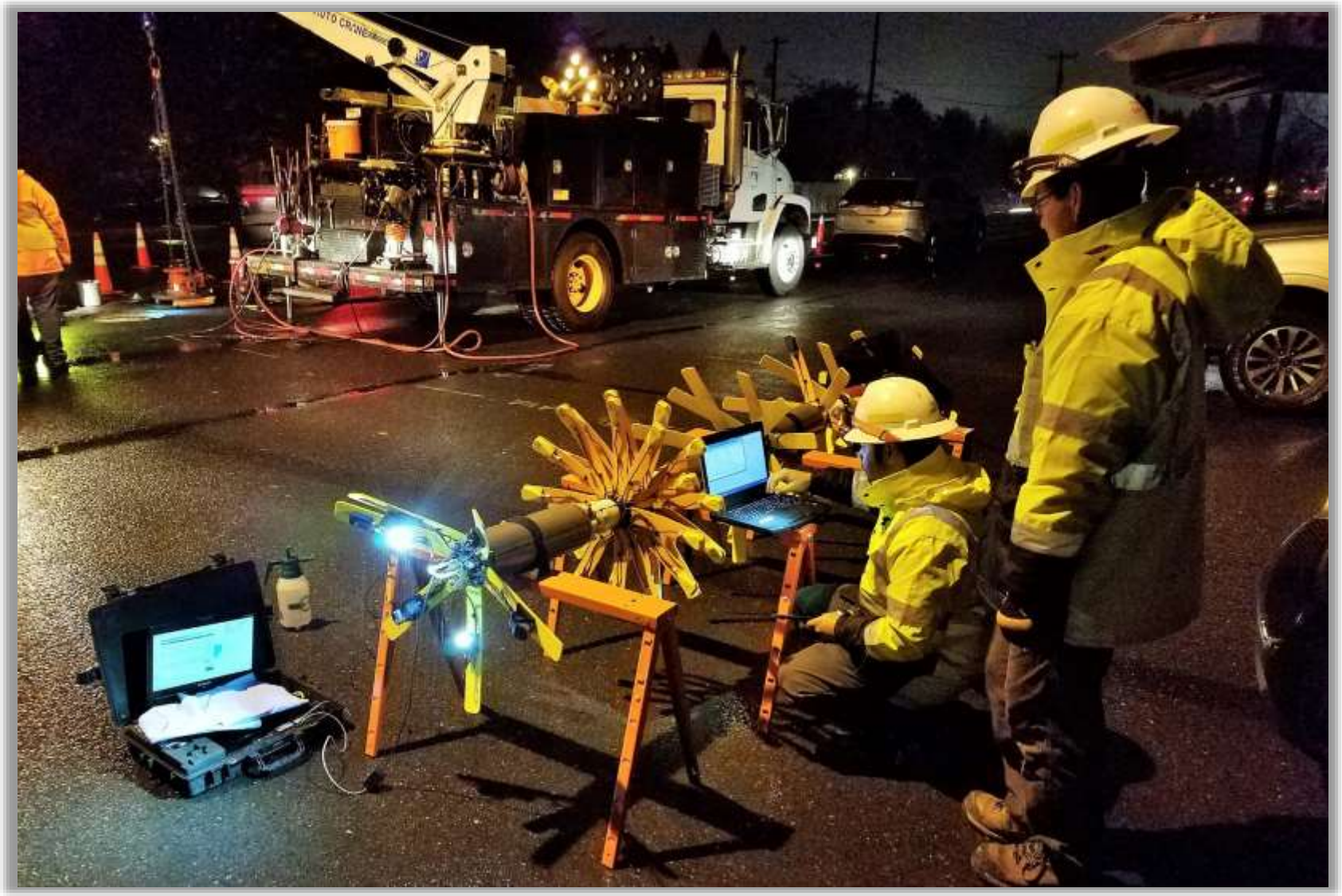
☐ BILLABLE WORK PERFORMED FOR OUTSIDE CUSTOMER OR DEPARTMENT

PROCESSING

Site and Equipment Preparation

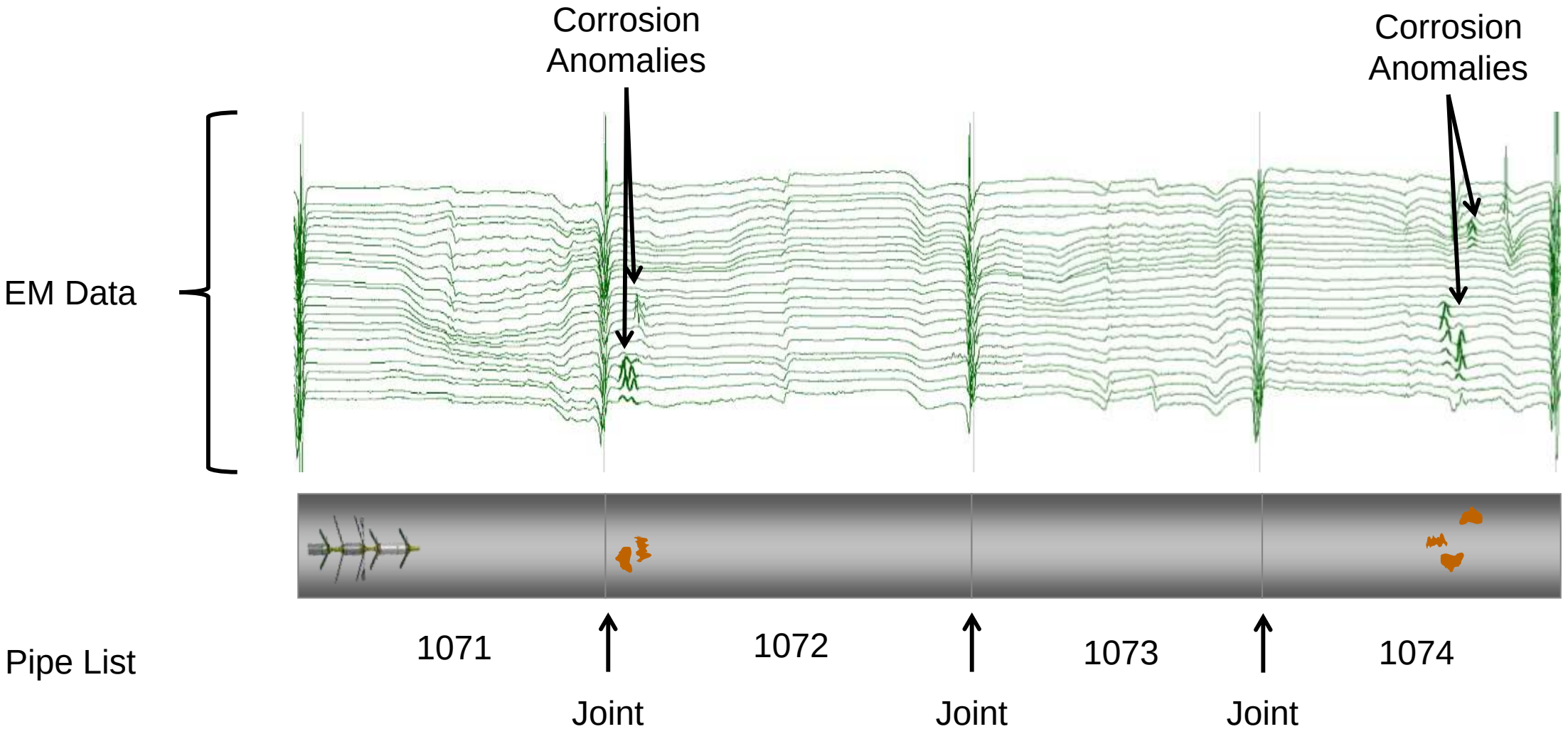
Manito SmartBall Inspection

57th Avenue PipeDiver Setup



57th Avenue PipeDiver Insertion

Electromagnetic Inspection Data Analysis



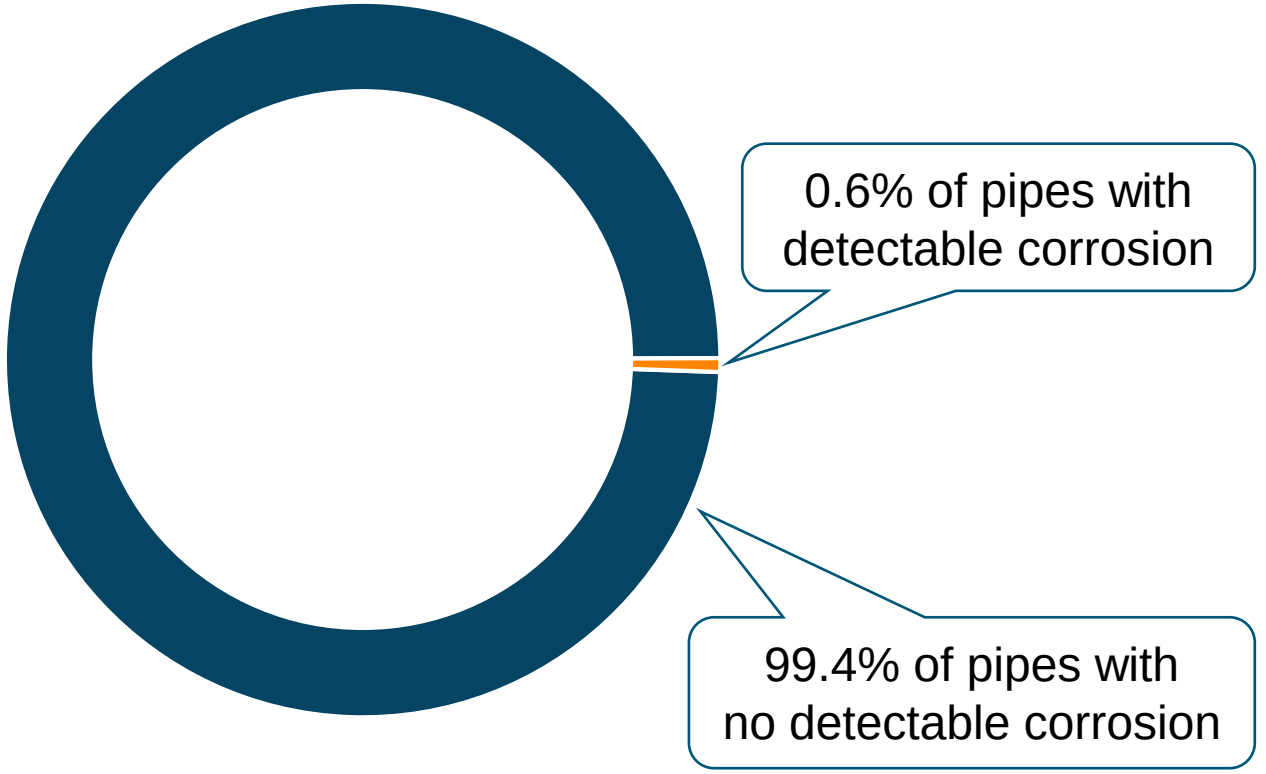
Inspection Results

Manito Transmission Main

- 202 Pipes inspected
- Zero Leaks
- Zero Electromagnetic Anomalies

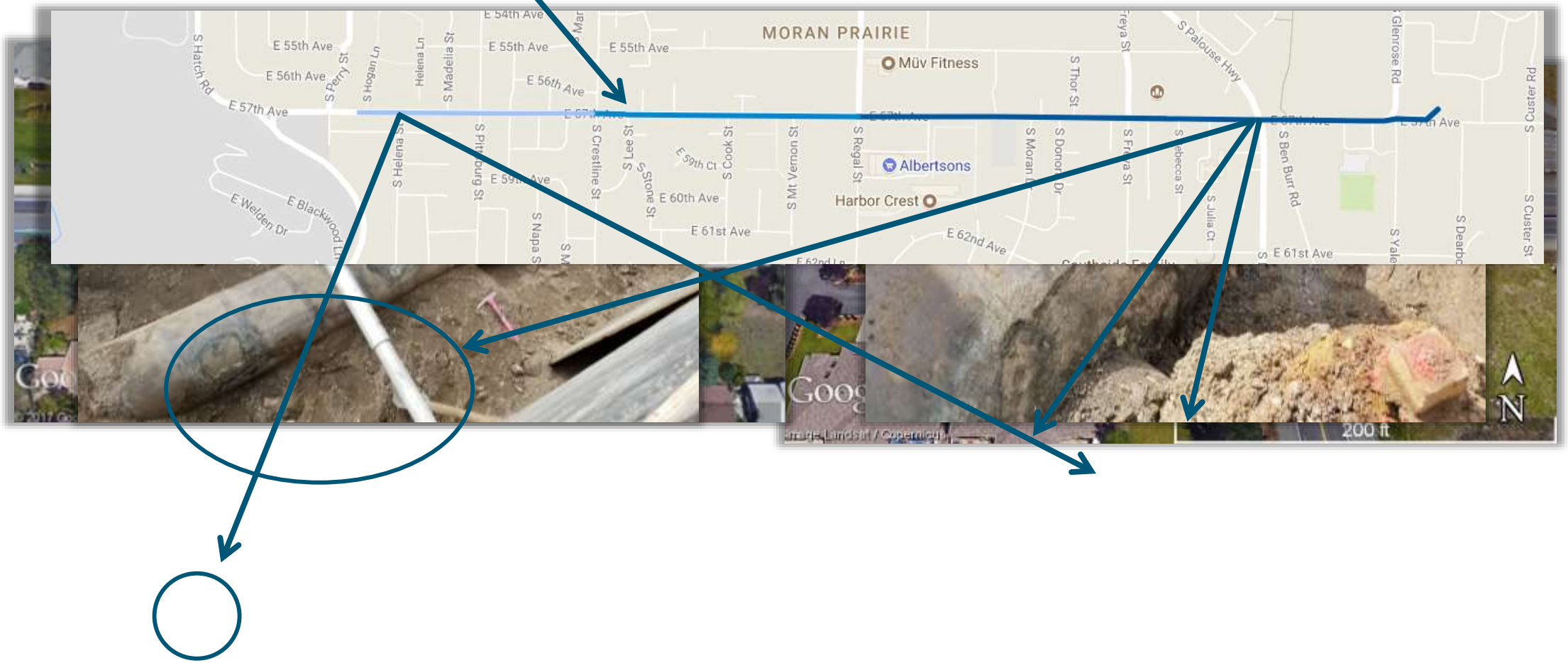
57th Avenue Transmission Main

- 282 Pipes inspected
- 1 “Leak” Detected
- 3 Pipes with Electromagnetic Anomalies



Electromagnetic Inspection Results

- Pipe 11 – S Helena St
  - 1 EM corrosion anomaly
  - Approximately 20% wall loss
- Pipe 1080 - S Lee St
  - 1 EM Anomaly not characteristic of corrosion
- Pipe 1172 – S Palouse Hwy
  - 2 EM corrosion anomalies
  - Approximately 35% and 45% wall loss
- Pipe 1174
  - 3 EM corrosion anomalies
  - Approximately 50%, 50% and 45% wall loss

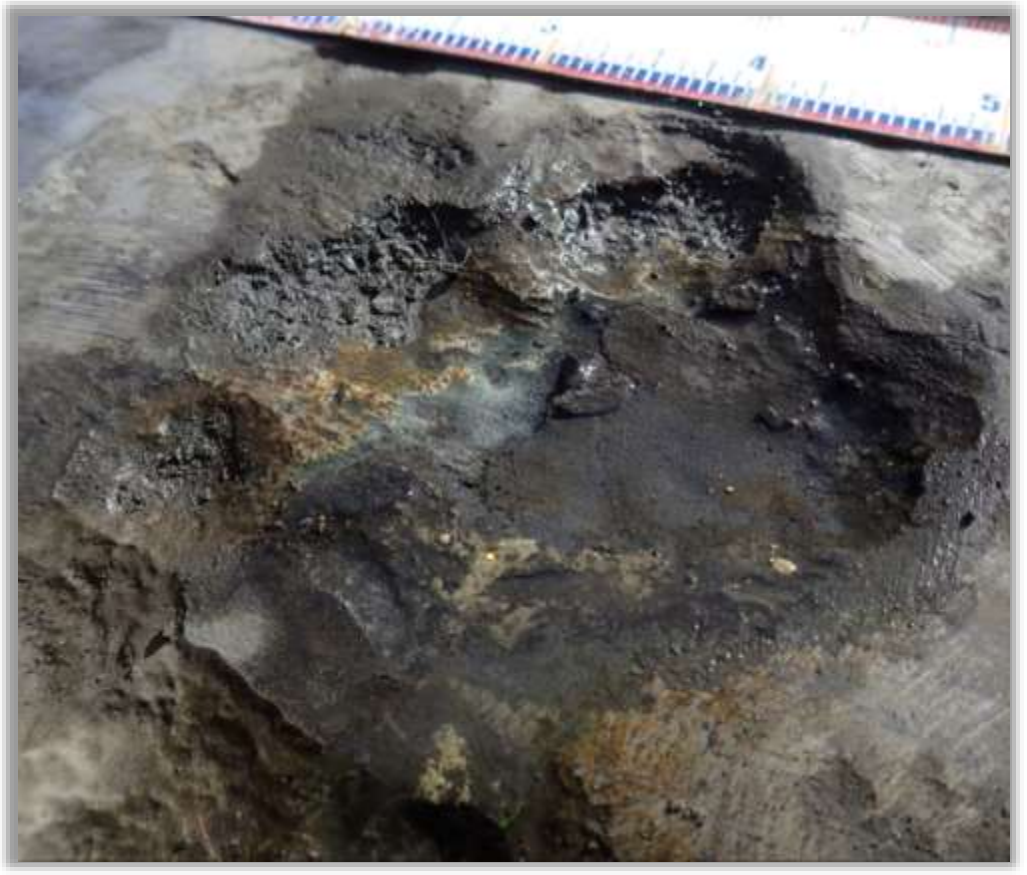


Pipe 11 - 57th Avenue and Helena

Pipe 11 - 57th Avenue and Helena

Pipe 1172 - 57th Avenue and Palouse

Pipe 1172 - 57th Avenue and Palouse



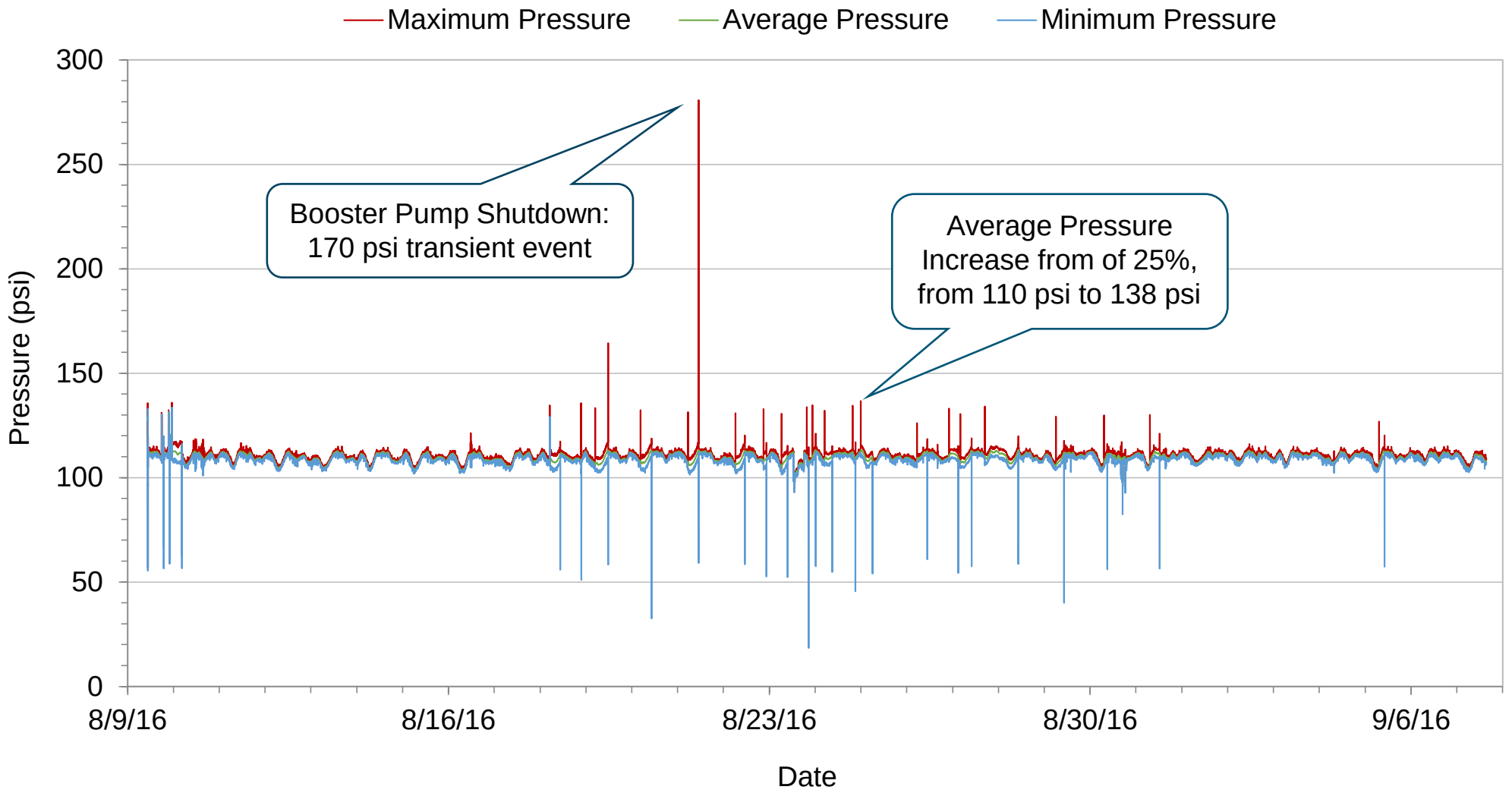
Pipe 1172 - 57th Avenue and Palouse

How much corrosion before a pipe fails?

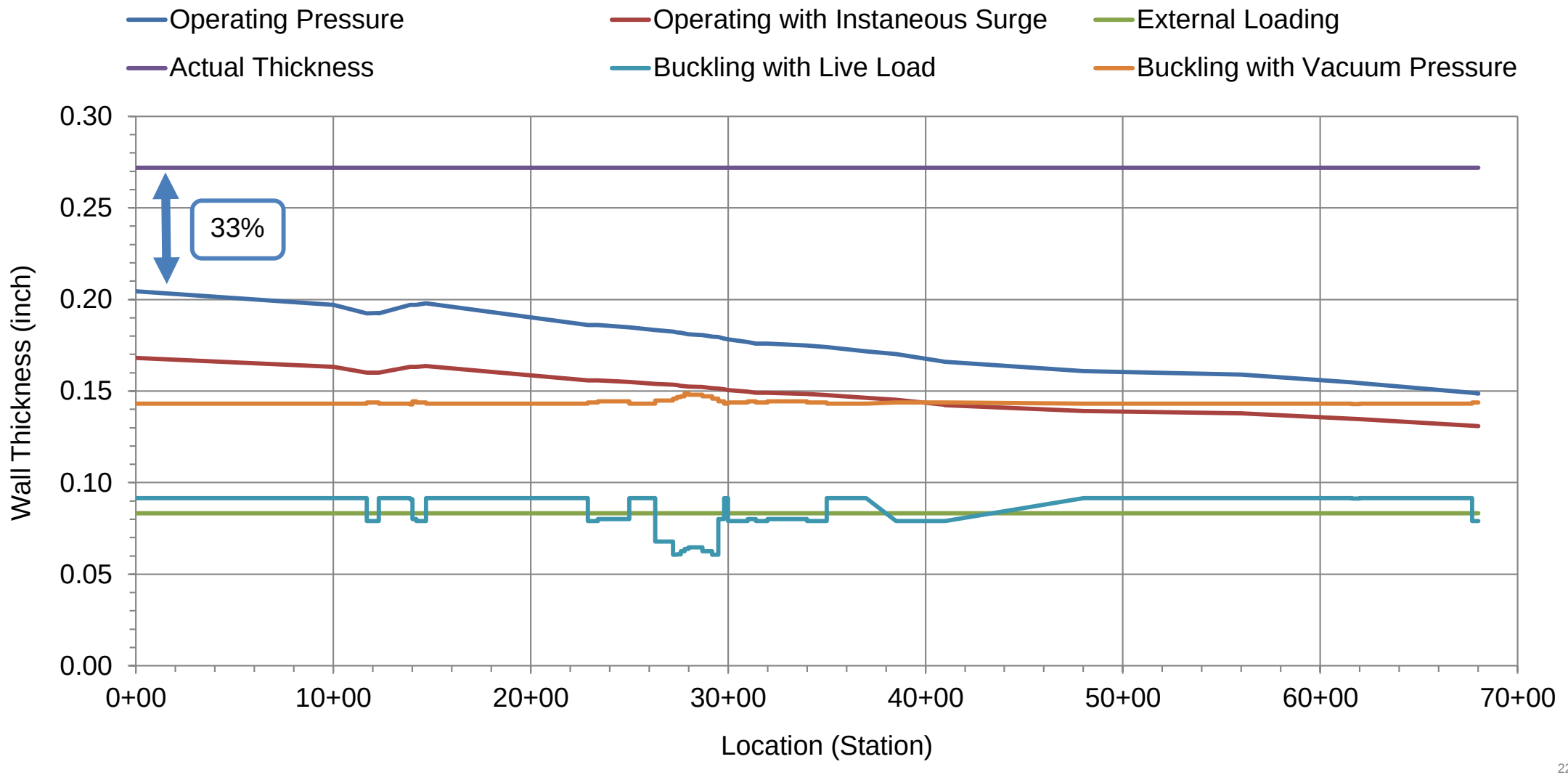
Pipeline and Diameter	Number of Distressed Pipes	Maximum Operating Pressure	Nominal Wall Thickness	AWWA M11 Required Wall Thickness	Dimensions of Corrosion Until Failure
Manito 24"	0	112 psi (281 psi surge)	0.272″	?	?
57th Avenue 18”	1	86 psi	0.180″	?	?
57th Avenue 24”	0	85 psi	0.255″	?	?
57th Avenue 30”	2	75 psi	0.270″	?	?

- Internal Pressures
- External Loading
- Design Thickness Evaluation
- Three-dimensional Finite Element Analysis

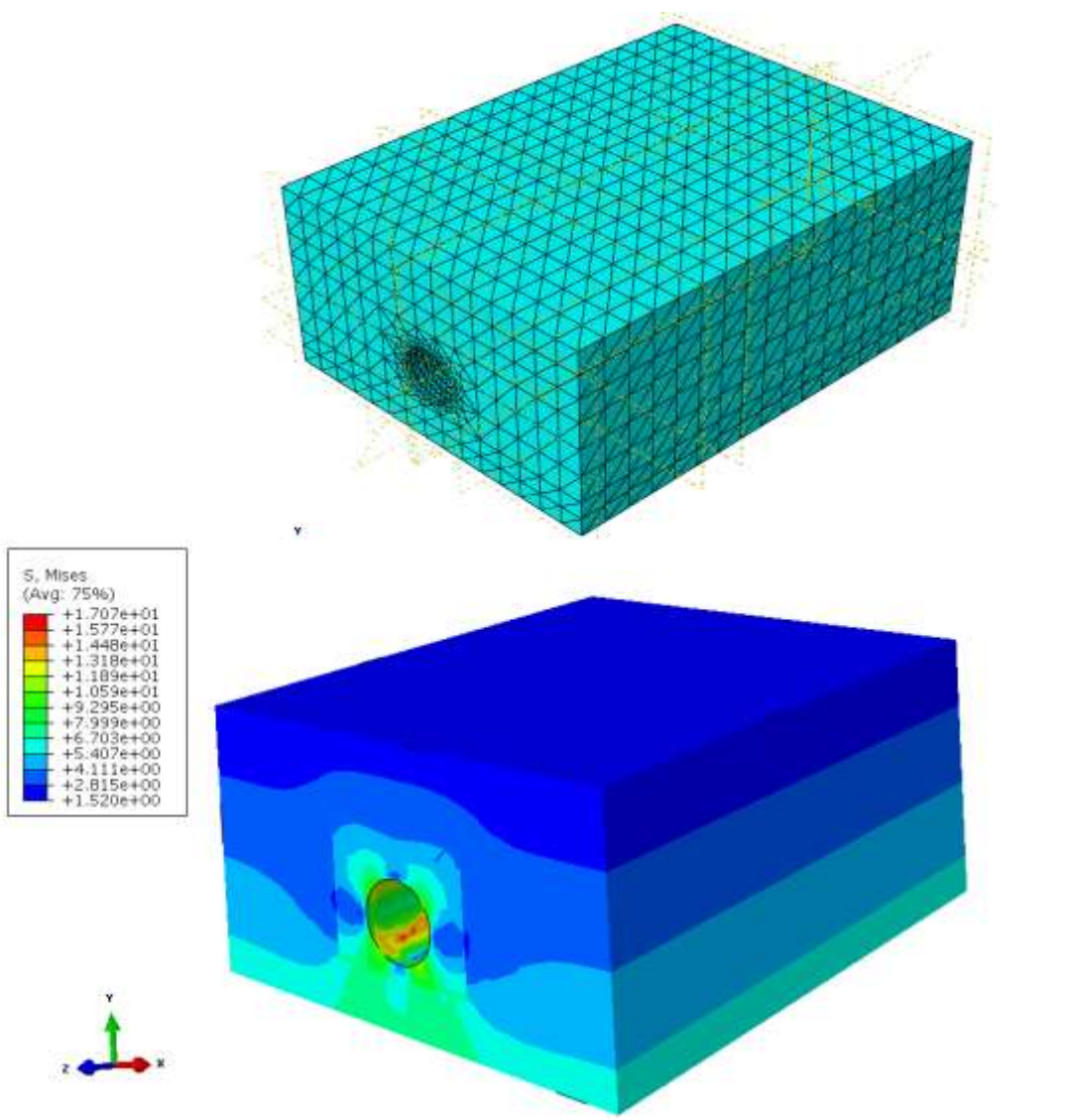
Manito Transmission Main Transient Pressure Events

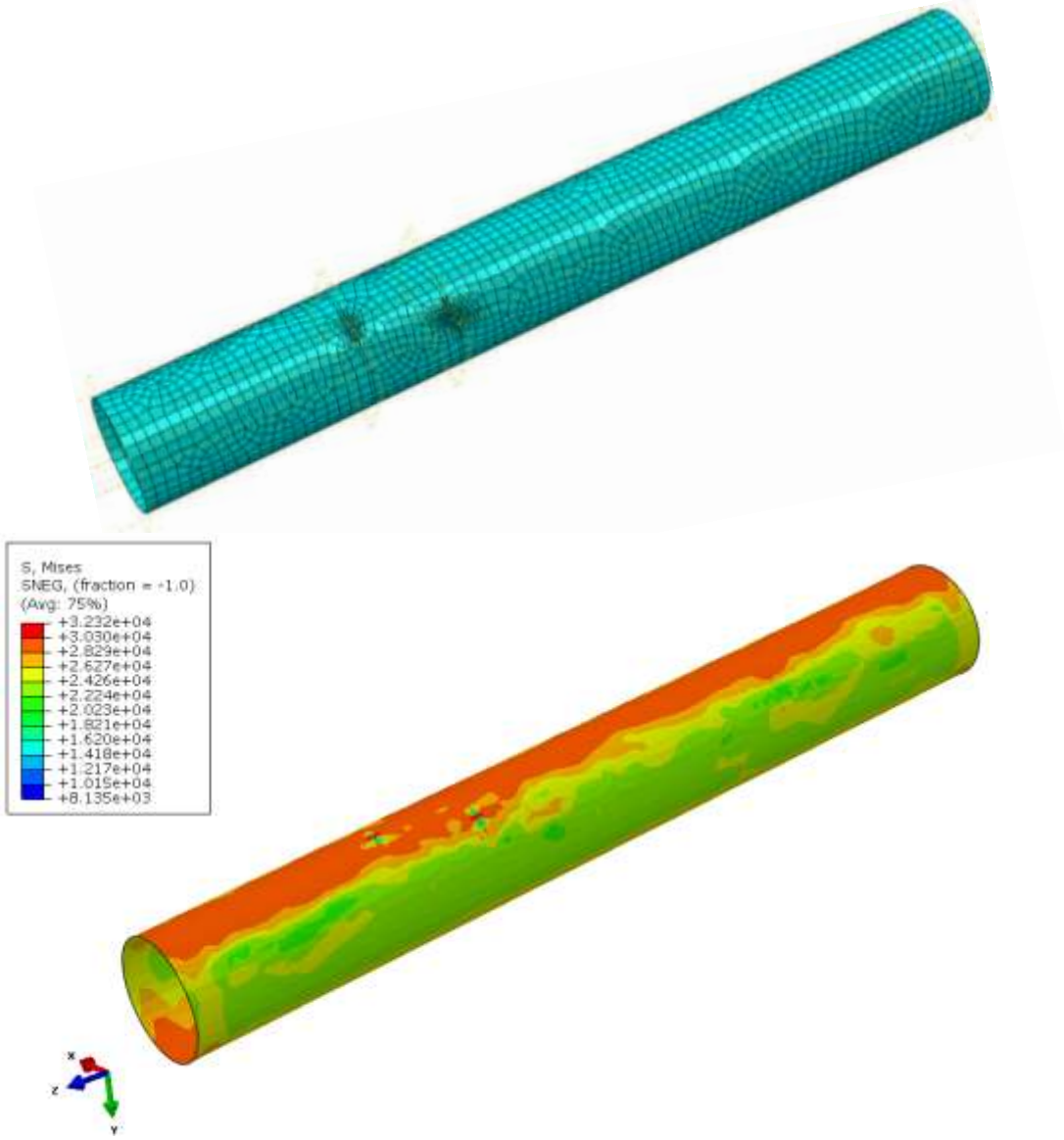


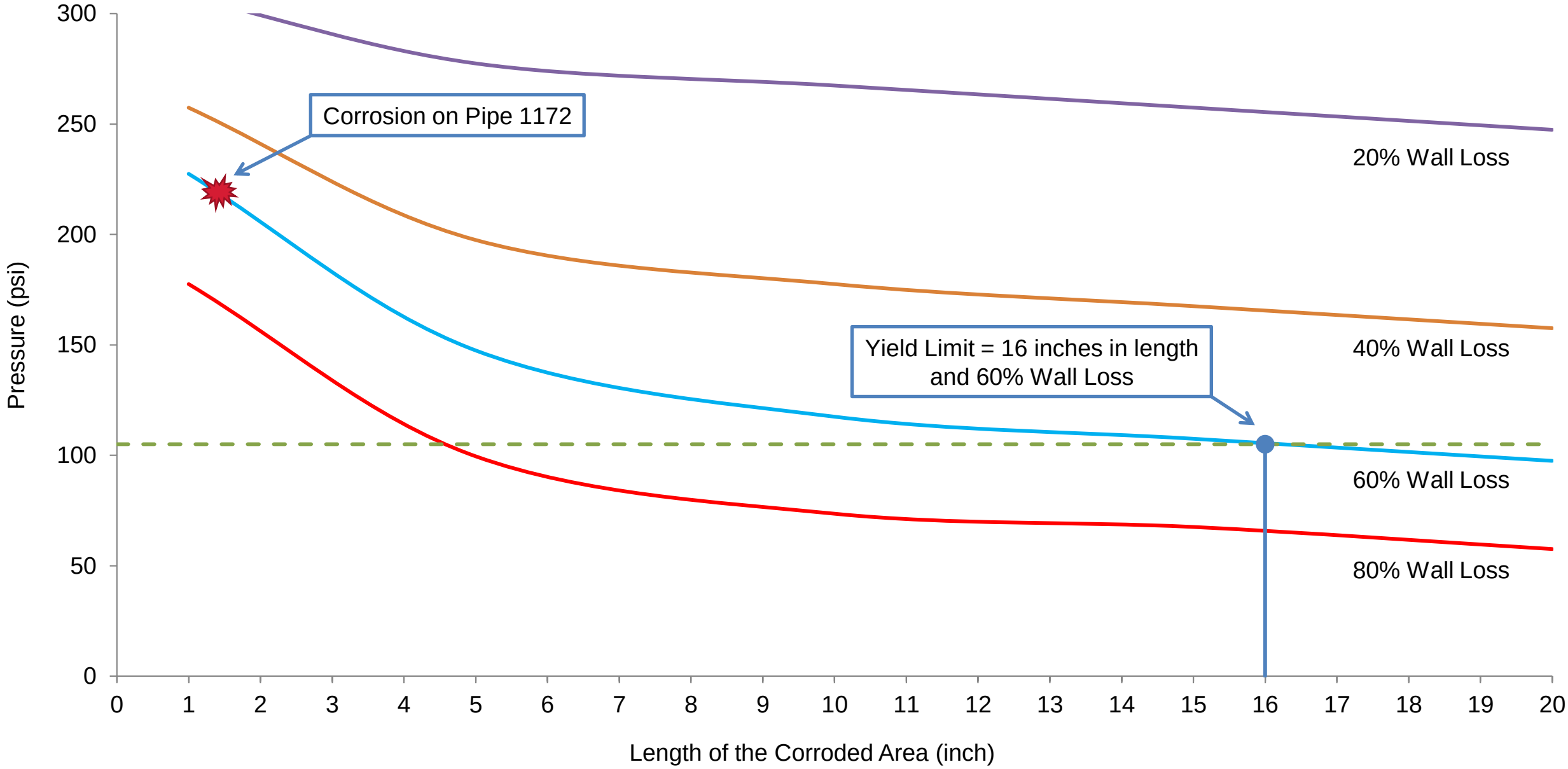
Manito AWWA M11 Design Check



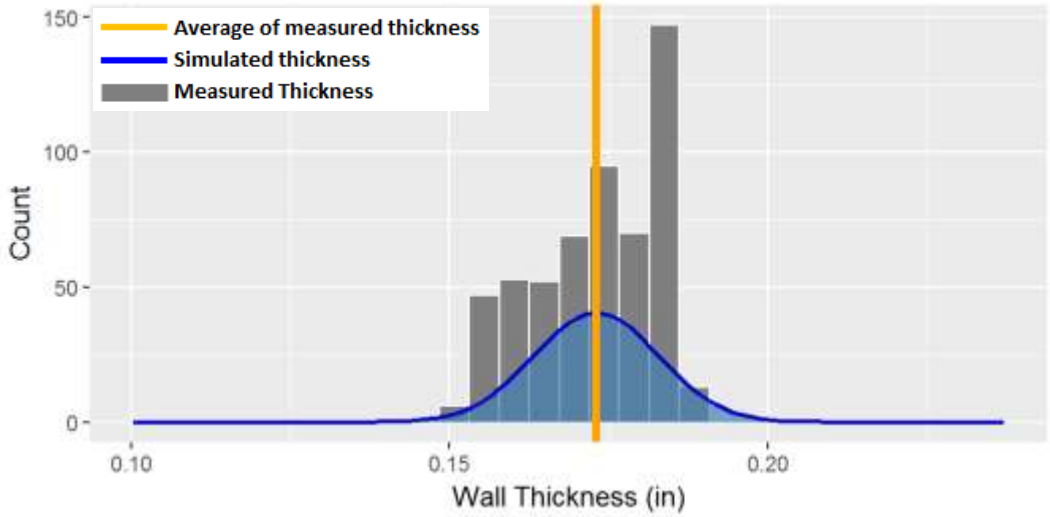
Three-dimensional Finite Element Analysis

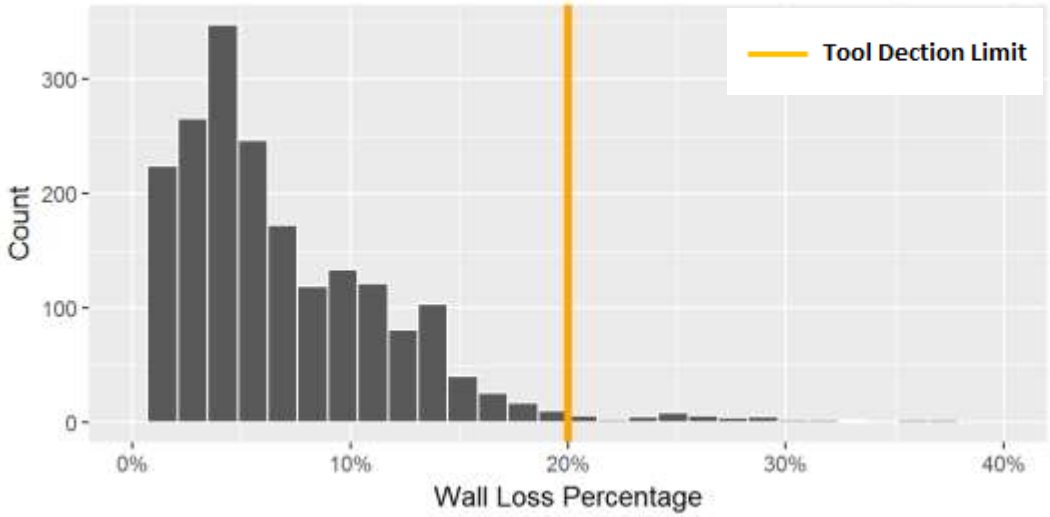


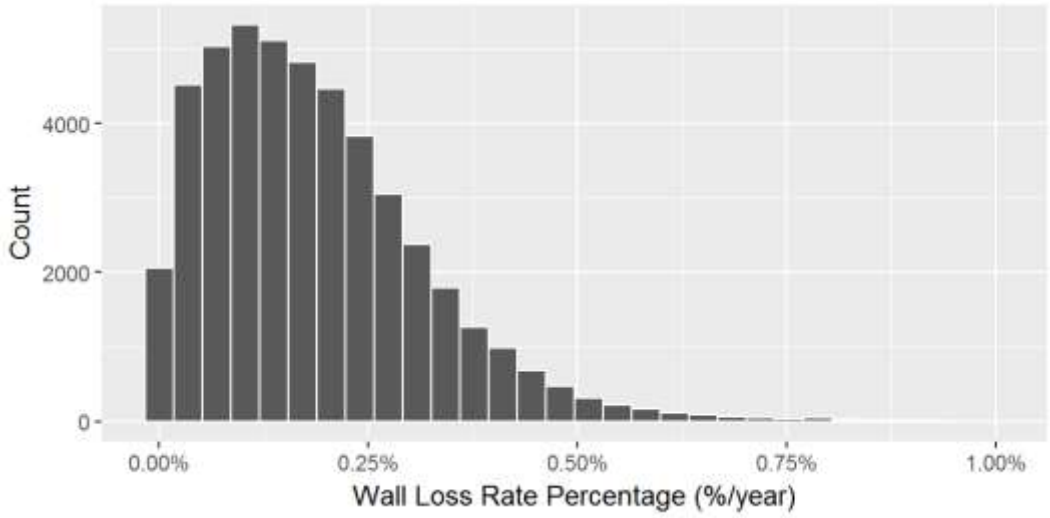



City of Spokane - 57th Avenue Transmission Main
30-inch Steel Pipe, 4 feet of Earth Cover
Pressure (psi)
300
250
200
150
100
50
0
Corrosion on Pipe 1172
20% Wall Loss
40% Wall Loss
Yield Limit = 16 inches in length
and 60% Wall Loss
60% Wall Loss
80% Wall Loss
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Length of the Corroded Area (inch)

57th Avenue Transmission Main Degradation Prediction







- Leaks possible in 4 years
- Possible to detect corrosion with current technology in 15 years

Project Costs

City Efforts Applied to Project

Data Collection
- ~ 60 labor hours

Site Visit (2) Support
- ~ 56 labor hours

Taps
- 451 labor hours
- 255 equipment hours
- 172 parts (161 salvaged/reused)

Inspection Support
- 10 days of inspection ~800 labor hours)
- Traffic Control and Permits
- Night shift

Condition Assessment Contract Value

- $507,000

Transmission Main Replacement Capital Cost Estimate

- $3.3M Manito
- $4.1M 57th Avenue

Thank You!

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