

Corrosion ILI Program Summary Document

Line 5 West Straights 2018 GE MFL

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1.0 Purpose

This document will provide a summary of all aspects associated with the corrosion management program. Contents of this summary may include but it is not limited to:

- Summary of priority notification features
- Summary of the results of Lakehead system integrity remediation process

It is important to consider that this document is a working file that tracks learnings and/or status of the corrosion program. Therefore, all changes to the selection process should be included in the corresponding sections and a clear summary of the learnings and resultant actions should be documented within this document.

All sections that are not applicable to the ILI program should be deleted.

2.0 Scope

This record applies to the ILI reports indicated on the front page of this document. This document will reference Pipeline Integrity (PI) procedures and work instructions as part of the Fitness for Service (FfS) process defined further in Integrated Management System IMS-09.

3.0 Basic Inspection Remarks

Table 1 Previous Inspections

Year Month	ILI Corrosion Tool	ILI Vendor
1998 Sept	MFL	PII
2003 June	MFL	PII
2008 May	MFL	GE
2013 Aug	MFL	GE
2017 Apr	Gemini MFL	BH
2018 Mar	MFL	GE
2018 Apr	Gemini MFL	BH

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Hazard specific susceptibility ranking for the line is:

External corrosion	Low
Internal Corrosion	Low
Axial slotting corrosion	Low

4.0 Priority Notification for Imperative Condition

Were there any features reported meeting imperative condition?

☐ Yes
☒ No

If Yes, summarize actions taken for the priority notification(s).

Were there any features not reported as imperative condition that meet the imperative condition criteria?

☐ Yes
☒ No

If Yes, summarize additional actions taken to ensure a successful program.

Were the imperative condition confirmed by NDE?

☐ Yes
☐ No

Summarizes the ILI and field findings

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5.0 Inspection Report Review (PI-36) and Remarks

Prepared by: Braiden Redman Date: June 22, 2018

Approved by: Samuel Cheng Date: 7/11/2018

Complete review based on PI-36 Data Quality Review In-Line Inspection.

Step 1.0 Was the data degraded?

☐ Yes

☒ No

1.3. Inspection Quality

Inspection data was obtained for the full length (4.1 miles) of the pipeline.

The quality of the inspection data is satisfactory and this has enabled a comprehensive assessment of the pipeline to be carried out.

1.3.1. Velocity Plot

The velocity plot shows the speed of the inspection vehicle during the inspection run.

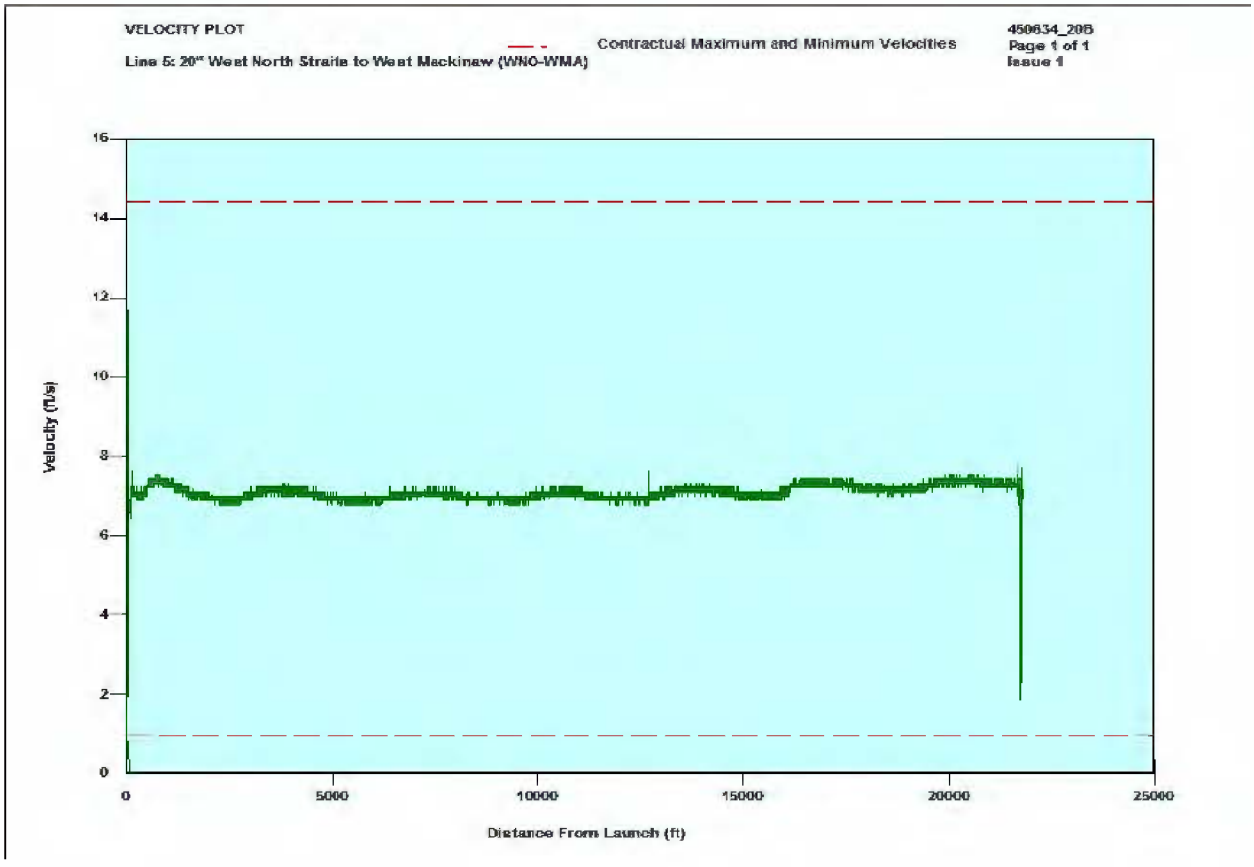
The red lines on the velocity plot indicate the specified minimum and maximum velocities for the inspection vehicle. If the vehicle travels outside of this contractual velocity window then the performance of the inspection vehicle may be degraded.

The inspection vehicle did not exceed the specified maximum velocity during the inspection survey.

The inspection vehicle's average velocity during the inspection run was 7.1 ft/s.

The velocity profile plot is presented overleaf.

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Step 2.0 Do features align with expectations?

☒ Yes

☐ No

The following table summarises the differences in the numbers of reported features between the current inspection and the previous 2017 GEMINI MFL inspection.

Feature Type	436881_20B - 27 August 2013	450634_20B - 21 March 2018	Comment
External metal loss	0	0	No changes between inspections.
Internal metal loss	0	0	No changes between inspections.
External mill/manufacturing faults	194	187	No significant changes between inspections.
Internal mill/manufacturing faults	100	105	No significant changes between inspections.
Dents	0	0	No changes between inspections.
Girth weld anomalies	0	0	No changes between inspections.
Metal objects	0	0	No changes between inspections.
Eccentric casings	0	0	No changes between inspections.
Shell repairs	0	0	No changes between inspections.
Patch repaired spools	0	0	No changes between inspections.

Use Appendix A of PI-36 as guidance.

1) No Matched features

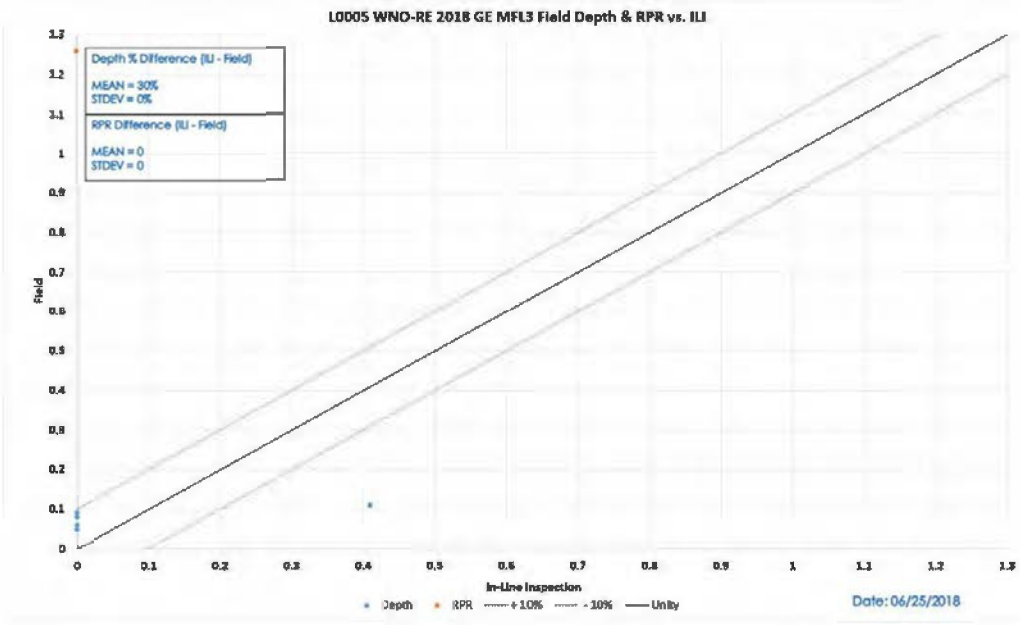
Table 2 No matched features cases in PI-36

Current ILI	2017 GE MFL	Description	# of features	Comments
2018 GE MFL	>=40%	No Match	0	No Features
2018 GE MFL	1.0<RPR <1.05	No Match	0	No Features

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2) Preliminary Unity Plot

No external metal loss ILI indications were reported in the run. Internal NDE features and grinds were trended.



3) Near miss and safety and resource (defined in WI-13) outliers of Preliminary Unity Plot

No outliers generated.

Table 3 Summary of significant outliers of Preliminary Unity plot

GW	ILI		Field		Brief Explanation
	Depth	RPR	Depth	RPR	

4) Is Orientation plot as expected?

☒ Yes

☐ No

Orientation plot has no data to display. No features are indicated to be metal loss in either 2018 GE MFL or 2017 GE MFL tool runs.

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5) Unexpected feature type?

☒ Yes

☐ No

Considering features with depths > 10% NWT, there are 22 internal and 187 external manufacturing defects reported in the 2018 GE MFL and 8 internal manufacturing defects in the 2017 GEMINI MFL. This is an increase in both internal and external manufacturing defects when compared to the 2017 run. These discrepancies can be partially attributed to differences in tool technology. In addition, the 2017 GEMINI MFL was run at a tool velocity (> 2 m/s) which resulted in reduced feature detection and sizing specifications; thus it did not report many minor features. The tables below show the change in specification.

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2. VECTRA/GEMINI Sizing Specification (0.812" at 1 m/s)

	General	Pitting	Axial Grooving	Circ. Grooving	Pinhole	Axial Slotting	Circ. Slotting
Minimum dimensions for sizing accuracy[1]	W>3A L>3A	W>A L>A	W>A L>2A	W>2A L>A	W>0.7A L>0.7A	W>0.7A L>A	W>A L>0.7A
Depth at POD=90%	0.05t	0.08t	0.10t	0.08t	0.20t	0.20t	0.10t
Depth sizing accuracy at 80% certainty	± 0.10t	± 0.10t	± 0.10t	± 0.10t	± 0.20t	± 0.20t	± 0.20t
Width sizing accuracy at 80% certainty	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm
Length sizing accuracy at 80% certainty	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm	± 0.4-in. ± 10 mm

3. VECTRA/GEMINI Sizing Specification (0.812" at 2 m/s)

	General	Pitting	Axial Grooving	Circ. Grooving	Pinhole	Axial Slotting	Circ. Slotting
Minimum dimensions for sizing accuracy[1]	W>3A L>3A	W>A L>A	W>A L>2A	W>2A L>A	W>0.7A L>0.7A	W>0.7A L>A	W>A L>0.7A
Depth at POD=90%	0.10t	0.10t	0.30t	0.12t	0.30t	0.30t	0.15t
Depth sizing accuracy at 80% certainty	± 0.13t	± 0.13t	± 0.10t	± 0.10t	± 0.25t	± 0.20t	± 0.20t
Width sizing accuracy at 80% certainty	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.6-in. ± 16 mm	± 0.6-in. ± 16 mm
Length sizing accuracy at 80% certainty	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm	± 0.5-in. ± 13 mm

In addition, seamless pipe presents conditions which, due to the manufacturing process, vary from location to location. As such, ILI anomaly detection and sizing specifications may be impacted by the level of noise observed in each section of seamless pipe. In high noise sections, the detection and sizing specification may increase up to an additional ±10% WT.

The 2013 GE MFL reported 81 internal manufacturing defects and 194 external manufacturing defects. This is an increase in both internal and external features between the 2018 MFL and 2013 GE MFL. Considering all features, the total number of reported features has not changed significantly (as can be seen in the summary table shown earlier). This demonstrates that many of these features have fluctuating depths between inspections. As stated in the final report, the

sizing of manufacturing defects is subject to inaccuracy and variability due to the sizing algorithm being tailored for metal loss features.

6) Change in density (+/- 20%) of features >=40%?

☒ Yes

☐ No

The most severe 2018 GE MFL feature is 41% NWT (only one feature). The 2017 GEMINI MFL reported this feature as 27% NWT. The 2013 GE MFL reported this feature with a 41% NWT depth. Using >= 10% NWT instead as a change in density threshold:

Tool Run	Ext. Features >= 10% Depth	Int. Features >= 10% Dept
2018 GE MFL	187	22
2017 GE MFL	0	8
2013 GE MFL	194	84

7) At least 60% of the features are >= 20% deeper or >= 20% shallower than previously reported?

☐ Yes

☒ No

No features changed by more than 20% depth. Greatest magnitude of change is 14% depth.

8) Is severity, density or unexpected feature type driving investigative dig program and expedite excavation deadlines?

☐ Yes

☒ No

End of PI-36

6.0 Consent Decree Excavation Criteria

Prepared by: Braiden Redman Date: June 22, 2018

Approved by: Samuel Cheng Date: 7/11/2018

Table 4 Consent Decree Corrosion Feature Excavation Selection

Criteria	Unmitigated features are selected for excavation (Y/N/NA)
Any corrosion feature with a depth >80% of the wall thickness of the joint where the feature is located	NA
Any corrosion feature with a Predicted Burst Pressure < the established MOP	NA
Any corrosion feature with a Predicted Burst Pressure < 1.39 MOP	NA
Any corrosion feature with a depth>50% wall thickness but < 80% WT	NA
For Line 3 outside an HCA, any corrosion feature with a depth >65% wall thickness but <80% WT	NA
Any corrosion feature with a remaining life < 5 years (Not applicable to Line 3)	NA
Any corrosion feature with a remaining life < 2 times the planned re-inspection interval	NA

No corrosion features were reported by the 2018 GEMINI MFL; only manufacturing defects were reported. No features meet criteria.

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Table 5 Remaining Unmitigated Features **(Updated on 7/11/2018)**

There are no corrosion features reported in this inspection. The deepest manufacturing defect reported is 41% NWT.

Remaining Unmitigated Features	
The worst depth (%)	N/A
The lowest Safety Factor	N/A
The shortest remaining life (years)	N/A

7.0 Consent Decree Threat Integration Excavation Selection

Prepared by: Braiden Redman Date: June 22, 2018

Approved by: Samuel Cheng Date: 7/11/2018

Two sources were used to check threat integration interaction. Pipeline listing and Threat Integration CD file. No corrosion features were reported by the tool.

Table 6 Consent Decree Threat Integration Excavation Selection

Criteria	Unmitigated features are selected for excavation (Y/N/NA)
Any dent located in the top of the pipeline that has any indication of metal loss, cracking, or a stress riser	NA
Any dent located in bottom of the pipe that has any indication of metal loss, cracking, or stress riser	NA
Any case in which a crack feature intersects or interacts with a corrosion feature and the Predicted Burst Pressure of such interacting or intersecting features determined using the CorLAS ™ model is less than 1.25 MOP	NA
Any intersecting or interacting crack/corrosion feature with a remaining life < 5 years	NA

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Any intersecting or interacting crack/corrosion feature with a remaining life < 2X planned re-inspection	NA

Explain if "N" is selected for any criterion

8.0 Summary of Consent Decree Excavation Selection

Table 7 Summary of Consent Decree Excavation Selection

Criteria	Number of Features Issued

9.0 Updates based on Statistical Analysis of field data

Prepared by: _____ Date:

Approved by: _____ Date:

Are additional digs required based on statistical analysis of field data

☐ Yes

☐ No

If Yes, update Table 4 (Remaining Unmitigated Features) and Table 6 (CMFL Remaining Unmitigated axial slotting and seam weld anomaly A/B Features (if applicable)

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