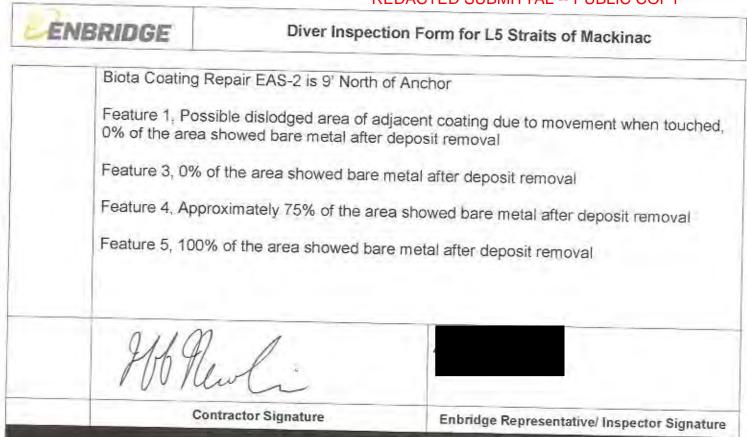


		Gener	al Information	7a	
Date:		09/30/17	Diver:	L	roy Baskett, Maurice Inger, Chad Cantrell, eorge Palmer
AFE/W	.0.#:	20011702	Company Re	p/Inspector:	eorge Falmer
Pipe Su	pport Anchor:	E-1 (E-74A/E-74B South)	Water Depth		
Longitu	de:		Latitude:		
		Diver Ins	pection Reco	rd	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Positio of the Feature (o'clock position)	n Measured Feature size (ft²)	Visual Class	ification of Feature
1	5' South	12:00	0.003 (1" X ½")	☐ Dislodged Area ⊠ Deposit	□Holiday (bare metal) □Disturbed Area
2	4' South	3:00 - 6:00	0.17 (24" X 1")	☑ Dislodged Area □ Deposit	□Holiday (bare metal) □Disturbed Area
3	Adjacent to saddle South	12:00	0.02 (2" X 1½")	□ Dislodged Area ⊠ Deposit	Holiday (bare metal)
4	2' 6" North	12:00	0.03 (3" X 1¼")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
5	14' North	3:00	0.002 (¼" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
_				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
			1	Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				□ Dislodged Area □ Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal)
oserved.	able rows as necessa Feature numbering st eo images)	ry to identify all features arts at top row (for	Biota present:	SYE:	Disturbed Area
)islodged ⊒YES ⊵	I coating observed on NO	on the lake floor:	Lake floor location wrt pipe:	in span 5'	off lake floor



and the second s	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip 09/15/2017 ØYES	Product: Next Calibration Due:	211 Coating Thickness Gauge 09/15/2018
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	185	4	10:00
North of Anchor #2	130	4	2:00
South of Anchor #1	160	4	10:00
South of Anchor #2	132	4	2:00
Average Thickness	151		

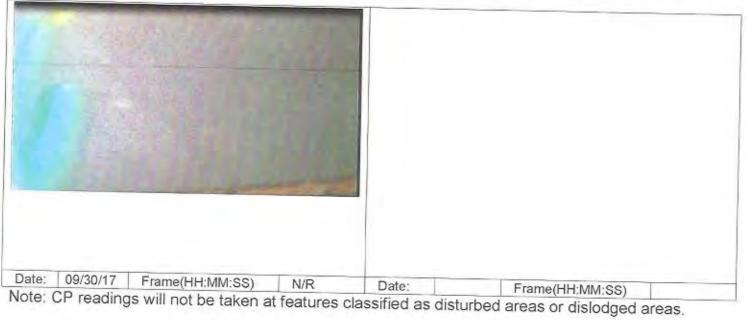


CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-289 -283	ts (for Feature # 1) CP Reading #3 (mV)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	110	(south end of feature) DFT #3 (mil) (south end of feature)	N/R
(record #2 for features < 2" k	ong; record #1	and #3 for features 2"-8" long;	record #1,	#2 and #3 for features >8" long)	
		DFT Adjacent to	100		110
Temperature (°F)	N/R	Feature (mil)	110	DFT Adjacent to Feature (mil)	112
The second s	11205	(~2" away from edge)	118	(~8"-12" away from edge)	125
Provide 1 to 2 photos of fea	-		125	1	145



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	118	DFT #2 (mil) (center of feature)	112	DFT #3 (mil) (south end of feature)	110
(record #2 for features < 2"	ong: record #	1 and #3 for features 2"-8" long	record #1	#2 and #3 for features >8" long)	
		DFT Adjacent to	150		138
Temperature (°F)	N/R	Feature (mil)	130	DFT Adjacent to Feature (mil)	125
	Person and	(~2" away from edge)	130	(~8"-12" away from edge)	150
Provide 1 to 2 photos of fe	1		115		120







CP Reading #1 (mV) (north end of feature)	-1775 -1651	otection and Coating Mea CP Reading #2 (mV) (center of feature)		CP Reading #3 (mV)	-1640
DFT #1 (mil) (north end of feature)	< 25	DFT #2 (mil) (center of feature)		(south end of feature) DFT #3 (mil)	-1633
	ong; record #1	and #3 for features 2"-8" long	tecord #1	(south end of feature) , #2 and #3 for features >8" long)	~ 23
		a second of a local second s	115	, #2 and #3 for realures >8 long)	135
Temperature (°F)	N/R	DFT Adjacent to Feature (mil)	115	DFT Adjacent to Feature (mil)	115
		(~2" away from edge)	125	(~8"-12" away from edge)	120
Provide 1 to 2 photos of fe			115	, , , , , , , , , , , , , , , , , , , ,	105
E-1 Span E-74A/E-74B Sol	in t				
Temp: 67.1 °F					

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP reading #1 indicates a 124mV difference. It is due to possible CP reading fluctuation.



CP Reading #1 (mV) (north end of feature)	-1335 -907	otection and Coating Mea CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	-164
DFT #1 (mil) (north end of feature)	< 25	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	-163
(record #2 for features < 2")	ong; record #1	and #3 for features 2"-8" long	; record #1	, #2 and #3 for features >8" long)	1
A			142		125
emperature (°F)	N/R	DFI Adjacent to Feature (mil)	82	DFT Adjacent to Feature (mil)	125
	10050	(~2" away from edge)	130	(~8"-12" away from edge)	100
Provide 1 to 2 photos of fe			83	7	100
9/80/2017 3/52/47 Phil	_	eciated with video surveillar	IC <del>O</del>		
9/30/2017 3:52:47 Pt/ E 1 Spen E-744/E-748 Soc	_	Clated with Video surveillar	IC <del>O</del> .		

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP reading #1 indicates a 428mV difference. It is due to possible CP reading fluctuation.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-1819 -1681	CP Reading #3 (mV)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	< 25	(south end of feature) DFT #3 (mil) (south end of feature)	N/R
(record #2 for features < 2*)	ong; record #1	and #3 for features 2"-8" long	: record #1.	#2 and #3 for features >8" long)	1
		I have a second s	138	and to for realizes >0 folig)	140
Temperature (°F)	N/R	DFT Adjacent to Feature (mil)	135	DFT Adjacent to Feature (mil)	140
		(~2" away from edge)	94	(~8"-12" away from edge)	135
Provide 1 to 2 photos of fe			102	- (	130

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP reading #2 indicates a 138mV difference. It is due to possible CP reading fluctuation.



		Genera	al Information		
Date:		10/01/17	Diver:	E	icott Woodward, Troy Baskett, Maurice Unger, Chad Cantrell
AFE/W.	0,#:	20011702	Company Rep	/Inspector:	
Pipe Su	•	E-2 (E-74B South/E- 74B North)	Water Depth (	and the second se	-
Longitu	de:		Latitude:		
		Diver Ins	pection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	n Measured Feature size (ft²)	Visual Class	ification of Feature
1	8' 4" North	12:00	0.05 (3¼" X 2")	Dislodged Area	☐Holiday (bare metal) ☐Disturbed Area
2	8' 4" North	3:00 - 11:00	0.38 (11" X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
3	8' 4" North	2:00 - 3:00	0.03 (5" X 1")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
4	8' 4" North	3:00 - 5:00	0.10 (7" X 2")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
5	6' North	7:00	0.29 (14" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
= 1				Dislodged Area     Deposit	Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
_				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
	1			Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
			-	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
bserved.	table rows as necess Feature numbering s deo images)	ary to identify all features starts at top row (for	Biota present:		
Easter	d coating observed	on the lake floor:	Lake floor location wrt pipe:	West side to 6:00 on	lake floor, East side buried to 5:00



### Comments/Issues/Discussion

Feature 1, Approximately 10% of the area showed bare metal after deposit removal, coating is brittle in this location, deposit is in between coating layers, Diver described a "field joint" near deposit, believed to be spiral wrap of coating (on an angle)

Feature 2, Approximately 10% of the area showed bare metal after deposit removal

Feature 3, 0% of the area showed bare metal after deposit removal

Feature 4, 0% of the area showed bare metal after deposit removal at the 5:00 location where pipe burial begins on East side of pipe Diver described the feature as continuing into the lake bed beyond measurement.

Feature 5, 0% of the area showed bare metal after deposit removal

Contractor Signature

Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	09/15/2017	Next Calibration Due:	09/15/2018
Gauge verified prior to use:	MYES INO		
Coating Thicknes	ss Inspection Data (complete	this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	240	5	10:00
North of Anchor #2	200	5	2:00
South of Anchor #1	180	5	10:00





Section of the section of the	-1522 -1438 < 25	CP Reading #2 (mV) (center of feature) DFT #2 (mil) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-1465
(north end of feature) DFT #1 (mil) (north end of feature) (record #2 for features < 2* lo	-1438 < 25	(center of feature) DFT #2 (mil)			
(north end of feature) (record #2 for features < 2" lo	-		-		-1400
Section of the section of the	ong; record #1		N/R	DFT #3 (mil) (south end of feature)	< 25
Section of the section of the		and #3 for features 2"-8" long	; record #1	,#2 and #3 for features >8" long)	-
	Temperature (°F) N/R		100 135 95	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	82 195 100
	-	(~2" away from edge)	200		120
55	- Hereit				
	1		10. 66.3 °F		-

 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:11:33
 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:11:44

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 01:11:44

Note: CP reading #1 indicates a 84mV difference. It is due to possible CP reading fluctuation.

Note: CP reading #3 indicates a 65mV difference. It is due to possible CP reading fluctuation.



CP Reading #1 (mV) (north end of feature)	-1500 -1496	CP Reading #2 (mV) (center of feature)	-1519 -1515	CP Reading #3 (mV) (south end of feature)	-1540
DFT #1 (mil) (north end of feature)	27	DFT #2 (mil) (center of feature)	< 25	DFT #3 (mil) (south end of feature)	< 25
(record #2 for features < 2" lo	ong; record #1	and #3 for features 2"-8" long	record #1,	#2 and #3 for features >8" long)	-
Temperature (°F)	N/R	DFT Adjacent to Feature (mil) (~2" away from edge)	100 175 170	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	100 105 170
Provide 1 to 2 photos of fed Included the date and time 10/1/2017 101059 PM E-215 745 South/E-745 Fro	stamps asso	ciated with video surveillan	2017年1月	:16 PM IVE-748 ) Iorth	80
Included the date and time	stamps asso	ciated with video surveillan	ce. /2017 1:11		00

 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:10:59
 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:11:16

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 01:11:16



CP Reading #1 (mV) (north end of feature)	-261 -265	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	-275
DFT #1 (mil) (north end of feature)	125	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	130
(record #2 for features < 2*	long; record #1	and #3 for features 2"-8" long	record #1,	#2 and #3 for features >8" long)	-
		DFT Adjacent to	110		90
Temperature (°F)	N/R	Feature (mil)	150	DFT Adjacent to Feature (mil)	170
		(~2" away from edge)	100	(~8"-12" away from edge)	105
Provide 1 to 2 photos of fe			90		120
for any series in	all al	A STATE		and the second	

 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:09:29
 Date:
 10/1/17
 Frame(HH:MM:SS)
 02:08:06

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 02:08:06



## Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	-253 -248	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-334
DFT #1 (mil) (north end of feature)	135	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	135
(record #2 for features < 2" )	ong; record #1	and #3 for features 2"-8" long	record #1	, #2 and #3 for features >8" long)	-
		DFT Adjacent to	105	and the second second second	115
Temperature (°F)	N/R	Feature (mil)	220	DFT Adjacent to Feature (mil)	225
		(~2" away from edge)	115 87	(~8"-12" away from edge)	230
Included the date and time 19/1/2017 1:10:01 Aw 19:419:743:51 Mus 749 Tig	2 5, m		12017 2:0	8:04 PiJ uti/E-74B Horth	
10/1/2017 1:10:04 800 7:	2 5, m	10/1	12017 2:0		

 Date:
 10/1/17
 Frame(HH:MM:SS)
 01:10:01
 Date:
 10/1/17
 Frame(HH:MM:SS)
 02:08:04

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 02:08:04



DFT Adjacent to Feature (mil) (~2" away from edge) w: sociated with video surveilla	125 140 200 225	(south end of feature) DFT #3 (mil) (south end of feature) #2 and #3 for features >8' long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)	-247 110 190 190 180 190
DFT Adjacent to Feature (mil) (~2" away from edge) W: sociated with video surveilla	125 140 200 225 nce.	,#2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)	190 180
DFT Adjacent to Feature (mil) (~2" away from edge) W: sociated with video surveilla	125 140 200 225 nce.	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	190 180
Feature (mil) (~2" away from edge) w: sociated with video surveilla	200 225 nce.	(~8"-12" away from edge)	180
(~2" away from edge) w: sociated with video surveilla	225 nce.		
w: sociated with video surveilla 10/	nce.	9≪7 £M	190
sociated with video surveilla		9-37 914	_

 Date:
 10/1/17
 Frame(HH:MM:SS)
 3:22:09
 Date:
 10/1/17
 Frame(HH:MM:SS)
 3:22:37

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 3:22:37

there is readings with her be taken at reatures classified as disturbed aleas of dislodyed aleas.

Note: CP reading #1 indicates a 19mV difference and reading #2 indicates a 21mV difference. It is due to possible CP reading fluctuation.

Note: CP reading #2 indicates CP probe contact with pipe metal. Because no bare metal was observed, we believe the CP gun probe tip penetrated the residue coating for this reading.

ENBRIDGE

		Genera	al Information		
Date:		10/26/17	Diver:	Br	ad Joanis
AFE / W.	.0.#:	20011702	Company Re	p/Inspector:	00300115
Pipe Su	oport Anchor:	E-3 (E-74B South / E- 74C)	Water Depth	and the second se	
Longitu	de:		Latitude:		
		Diver Ins	pection Reco	rd	
	Location of	Circumferential	Measured		
Feature Number	Feature (w.r.t. pipe support)	Position of the Feature		Visual Classi	ication of Feature
1	3' 8" South	12:00	0.01 (1" X 1")	Dislodged Area	□Holiday (bare metal □Disturbed Area
2	2' South	2:00	0.002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal ☐Disturbed Area
3	4' 5" North	12:00	0.03 (2" X 2")	Dislodged Area	Holiday (bare metal
				Dislodged Area	□Holiday (bare metal □Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	□Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
oserved.	table rows as necessa Feature numbering s feo images)	ary to identify all features tarts at top row (for	Biota present:	Deposit	Disturbed Area
1.00	d coating observed	on the lake floor:	Lake floor location wrt pipe:	līn span 12	" off lake floor

ENBRIDGE	Diver Inspecti	on Form for L5 Straits of Mackinac
	Commen	ts/Issues/Discussion
9/10	1 1	
rio /	ontractor Signature	Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES NO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence o	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	s < 2° long;	record #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	1.4		N/R	(NO# 10# success from a deal	N/I
		I Z away from edge)		(~8"-12" away from edge)	4 987
In	cluded the	(~2" away from edge) Provide 1 to 2 photos of a date and time stamps asso	N/R feature, be	elow:	N/

 Date:
 10/26/17
 Frame(HH:MM:SS)
 00:14:35
 Date:
 10/26/17
 Frame(HH:MM:SS)
 00:21:24

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:21:24



DFT #1 (mil) (north end of feature)     N/R     DFT #2 (mil) (center of feature)     N/R     DFT #3 (mil) (south end of feature)       (record #2 for features < 2* long; record #1 and #3 for features 2*-8" long; record #1, #2 and #3 for features >8* long)     N/R     South end of feature)       Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)	(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:			(center of feature)		DFT #3 (mil) (south end of feature)	N/I
Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:	(record #2 for featu	ires < 2" long; re	cord #1 and #3 for features 2	2*-8" long; r	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     58°     Feature (mil) (~2" away from edge)     N/R     DF I Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:			DET Adjacent to			N/I
(~2" away from edge) N/R (~8"-12" away from edge) Provide 1 to 2 photos of feature, below:	Temperature (°F)	58°			DFT Adjacent to Feature (mil)	N/I
Provide 1 to 2 photos of feature, below:				and a TT is a	(~8"-12" away from edge)	N/I
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.						N/



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
· · · · · · · · · · · · · · · · · · ·	00	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( = and) nonreage)	N/R		N/F
	1				

ENBRIDGE

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		Gen	eral Information		
Date:		10/26/17	Diver:		(evin Lewis
AFE/W.	0.#:	20011702	Company Rep	/Inspector:	
Pipe Sup	port Anchor:	E-4 (E-71A / E-71B)	Water Depth	the state of the local weak and the state of	
Longitue	All sea house and a second		Latitude:		
	-	Diver	Inspection Recor	d	and the second s
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Class	ification of Feature
1	5' 11" South	11:00	0.02 (1" X 2½")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
2	5' 11" South	1:00	0.01 (1" X 1½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
3	5' 4" South	7:00	1.50 (12" X 18")	Dislodged Area	□Holiday (bare metal □Disturbed Area
4	3' 6" South	3:00	0.03 (3" X 1½")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
5	Anchor to 6' South	360°	9.43 (72" X 62.83")	Dislodged Area	□Holiday (bare metal □Disturbed Area
6	Anchor to 6' North	360°	1,57 (72" X 62.83")	⊠ Dislodged Area □ Deposit	□Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal)
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□ Holiday (bare metal) □ Disturbed Area
			1	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)     Disturbed Area
			1	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
eatures of	table rows as necess oserved. Feature nur tailed video images)	ary to identify all nbering starts at top	Biota present:	⊠YI	
	d coating observed	on the lake floor:	Lake floor location wrt pipe:	In span	6" off lake floor



# Comments/Issues/Discussion Feature 3, Dislodged area is 12" X 18" area that is lifting Feature 5, Dislodged area is approximately 30% of area from anchor to 6' South that has outer wrap missing Feature 6, Dislodged area is approximately 5% of area from anchor to 6' North that has outer wrap missing Feature 7, Dislodged area is approximately 5% of area from anchor to 6' North that has outer wrap missing Gontractor Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	□ YES □ NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence o	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; rea	cord #1 and #3 for features 2	2*-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DET Adiacent to	N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( 1 )	00	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		1 =1	N/R		N/F
		Provide 1 to 2 photos of t ate and time stamps asso	eature, be		14/1

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	NUD	CP Reading #3 (mV)	
(north end of feature)	IN/IX	(center of feature)	N/R	(south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; ree	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/I
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
(i)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	199	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/F
	A DESCRIPTION OF				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2* long; rec	cord #1 and #3 for features :	2*-8* long; r	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	58°	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R		N/F
	1				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2° long;	record #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8° long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
	-	Provide 1 to 2 photos of 1	N/R		N/
				n video surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for featur	es < 2" long;	record #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/



		Genera	I Information	i i	
Date:		10/01/17	Diver:		George Palmer
AFE/W	.0.#:	20011702	Company Re	p/Inspector:	ocorge i dimer
Pipe Su	pport Anchor:		Water Depth		
Longitu	de:		Latitude:		
		and the second second	ection Reco		
		Diver ms.	ection Reco	rd	
Feature Number	Location of Feature (w.r.t, pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Class	sification of Feature
1	4' South	9:00	0.08 (4" X 3")	Dislodged Area	□Holiday (bare metal □Disturbed Area
2	3' South	12:00	0.04 (3° X 1 ¾")	Dislodged Area	□Holiday (bare metal □Disturbed Area
3	3' 3" North	12:00	0.01 (1½" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
			<u></u>	Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
_				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
			·	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□ Holiday (bare metal) □ Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
_				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
oserved.	able rows as necessa Feature numbering s leo images)	ary to identify all features tarts at top row (for	Biota present:	ØYE	
100 C 10 C 10 C	coating observed	on the lake floor:	Lake floor location wrt pipe:	In span	8" off lake floor



Comments/Issues/Discussion Feature 2, Approximately 25% of the area showed bare metal after deposit removal Feature 3, 0% of the area showed bare metal after deposit removal **Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip 09/15/2017 MYES LI NO	Product: Next Calibration Due:	211 Coating Thickness Gauge 09/15/2018
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	200	5	10:00
North of Anchor #2	130	5	2:00
South of Anchor #1	180	5	10:00
South of Anchor #2	190	5	2:00
Average Thickness	175		



	Cathodic P	rotection and Coating Mea	suremen	ts (for Feature # 1)	
CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	130	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	135
(record #2 for features < 2°)	ong; record #	1 and #3 for features 2"-8" long	record #1	#2 and #3 for features >8" long)	
			150		160
Temperature (°F)	N/R	Feature (mil)	180	DFT Adjacent to Feature (mil)	160
		(~2" away from edge)	190	(~8"-12" away from edge)	250
Provide 1 to 2 photos of fe	-		200		105

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.



Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



	Cathodic Pr	otection and Coating Mea	suremen	ts (for Feature # 2)	
CP Reading #1 (mV) (north end of feature)	-1592 -1585	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-1702
DFT #1 (mil) (north end of feature)	< 25	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	-1604 < 25
(record #2 for features < 2")	ong; record #1	and #3 for features 2"-8" long	; record #1	#2 and #3 for features >8" long)	
		A share the second second second	125		155
Temperature (°F)	N/R	DFT Adjacent to Feature (mil)	160	DFT Adjacent to Feature (mil)	125
		(~2" away from edge)	160	(~8"-12" away from edge)	150
Provide 1 to 2 photos of to			200		140

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.

Temp 61.9 F	

 Date:
 10/1/17
 Frame(HH:MM:SS)
 04:45:26
 Date:
 10/1/17
 Frame(HH:MM:SS)
 04:45:10

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 04:45:10

Note: CP reading #3 indicates a 98mV difference. It is due to possible CP reading fluctuation.



1)	NR
6	1
4	NR
11	-
	14
e (mil)	180
e)	14
	180
LAUDI	

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP reading #2 indicates a 51mV difference. It is due to possible CP reading fluctuation.

Note: CP reading #2 indicates probe contact with pipe metal. Because no bare metal was observed, we believe the CP gun probe tip penetrated residual coating for this reading.

ENBRIDGE

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		Ge	neral Information		
Date:		10/26/17	Diver:		Troy Baskett
AFE / W.	- the second	20011702	Company Rep	/Inspector:	iner busitett
Pipe Sup	oport Anchor:	E-6 (E-25A / E-25B)	Water Depth (f		
Longitu	de:		Latitude:		
		Diver	Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the	Measured Feature size (ft²)	Visual Cla	essification of Feature
1	5' 9" North	12:00	0.04 (4" X 1½")	Dislodged Area	□Holiday (bare metal □Disturbed Area
2	5' 1" North	12:00	0.01 (1½"X 1")	Dislodged Area	Disturbed Area     Disturbed Area     Disturbed Area
3	3' 4" North	11:00	0.002 (½" X ½")	Dislodged Area	Holiday (bare metal
4	2' 2" North	12:00	0.01 (1" X 1")	Dislodged Area	Holiday (bare metal     Disturbed Area
5	5' 8" North	10:00	0.01 (1" X 1")	Dislodged Area	Holiday (bare metal     Disturbed Area
6	2' North	3:00	0.002 (½" X ½*)	Dislodged Area	Holiday (bare metal Disturbed Area
7	1' North	1:00	0.002 (½" X ½")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
	NO FEATURES SOUTH ANCHOR			Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□ Holiday (bare metal) □ Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal)
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal)
atures obs	table rows as nec served, Feature num video images)	essary to identify all bering starts at top row	Biota present:	⊠\	
	coating observed	on the lake floor:	Lake floor location wrt pipe:	In spa	n 10" off lake floor



- la	Commen	nts/Issues/Discussion
N	D FEATURES IDENTIFIED 6' SOUTH OF ANCHOF	R
	Hole.	

	Coating Gauge	Information		
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R	
Coating Thic	kness Inspection Data (complete	this table in the absence of an	y Features)	
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock	
North of Anchor #1	N/R	N/R	N/R	
North of Anchor #2	N/R	N/R	N/R	
South of Anchor #1	N/R	N/R	N/R	
South of Anchor #2	N/R	N/R	N/R N/R	
Average Thickness	N/R			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/
(record #2 for features	s < 2" long; re	ecord #1 and #3 for features 2	*-8" long; re	cord #1, #2 and #3 for features >8* long)	
		DFT Adjacent to	N/R		
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of fe	N/R		N/I

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for features	< 2" long; ri	ecord #1 and #3 for features 2	"-8" long; re	acord #1, #2 and #3 for features >8" long)	-
Temperature (°F)	58° DFT Adjacent to Feature (mil) (~2" away from edge)		N/R		
			N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
		(~2" pwpy from odgo)	N/R		N/F
		N/R		N/R	
	Included the	Provide 1 to 2 photos of fe date and time stamps associ	ature, belo ated with v	w: ideo surveillance.	

		Frame(HH:MM:SS)		Date:	Frame(HH:MM:SS)
Note: CP	readings wil	I not be taken at feature	es classified as	disturbed areas o	r dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	rotection and Coating Meas CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
DFT #1 (mil) (north end of feature)	N/R	(center of feature) DFT #2 (mil)	N/R	(south end of feature) DFT #3 (mil)	
	s < 2" long: reg	(center of feature)		(south end of feature)	N/R
A second an ion food dates	v · z iong, rec		N/R	cord #1, #2 and #3 for features >8" long)	
Temperature ("F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( F)	50	Feature (mil) - (~2" away from edge) -	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/I
100		a state			



	Cathodic	Protection and Coating Meas	urements (	for Feature # 4)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	ures < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
	1.1.1.1.1.1.1	DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
100	-				



CP Reading #1 (mV)		rotection and Coating Meas			
(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for features	s < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
			N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
1		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F



CP Reading #1 (n (north end of feature)	nV) ure) N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of featu		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for	features < 2" long; r	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	A DATE OF L	DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
		e date and time stamps associ	ileu with v	aeo surveillance.	
			iceu with v	aeo surveillance.	



CP Reading #1 (mV)		CP Reading #2 (mV)	urements (		1.5
(north end of feature)	N/R	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for features	s < 2" long; r	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for features	s < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/R



		Gener	ral Information		
Date:		10/2/17	Diver:		Chad Cantrell, Mike Racette
AFE / W.	0.#:	20011702	Company Rep	/Inspector:	ener ourieren, mixe necette
Pipe Suj	oport Anchor:	E-7 (E-23A South / E- 23A North)	Water Depth (	the second se	
Longitu	de:		Latitude:		
		Diver In	spection Record		
-	Location of	101100111	and the second second second		
Feature Number	Feature (w.r.t. pipe support)	Circumferential Position of the Feature (0°clock position)	n Measured Feature size (ft <sup>2</sup> )	Visual Cla	assification of Feature
1	4' 9"- 5' 7" South	6:00	0.21	Dislodged Area	🗌 Holiday (bare metal
	i o o i oouu		(7½" X 4")	🖾 Deposit	Disturbed Area
2	4' South	12:00	0.06	Dislodged Area	🗌 Holiday (bare metal
	4 0000		(2" X 4")	🗵 Deposit	Disturbed Area
3	4' South	11:50	0.001	Dislodged Area	Holiday (bare metal
2	4 30uth		(1/2" X 1/4")	🖾 Deposit	Disturbed Area
4	2' South	5:00 - 6:30	0.05	Dislodged Area	🗌 Holiday (bare metal
4	2 3000	10.00	(7" X 1")	🖾 Deposit	Disturbed Area
			, , , , , , , , , , , , , , , , , , , ,	Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
			-	Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
• 4 1				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
1.1			1000 C	Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area	
					Holiday (bare metal Disturbed Area
				Dislodged Area	
				Dislodged Area     Deposit	Holiday (bare metal
-			-		Disturbed Area
				Dislodged Area	🗆 Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
			-	Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
			-	Deposit	Disturbed Area
				Dislodged Area	🗌 Holiday (bare metal)
-				🗌 Deposit	Disturbed Area
	Feature numbering s	sary to identify all features tarts at top row (for detailed			IYES 🖾 NO
Dīslodge YES ⊠I	d coating observed NO	on the lake floor:	Lake floor location wrt pipe:	In spar	n 30" off lake floor



Comments/Issues/Discussion Feature 1, Approximately 2% of the area showed bare metal after deposit removal. Sample taken of deposit, peeling some coating off with sample, believed to be outer wrap Feature 2, Approximately 75% of the area showed bare metal after deposit removal Feature 3, Approximately 25% of the area showed bare metal after deposit removal Feature 4, 0% of the area showed bare metal after deposit removal-outer wrap missing - after DFTs and CP readings, no bare metal as the diver visually thought **Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	09/15/2017	Next Calibration Due:	9/15/2018
Gauge verified prior to use:	⊠YES □ NO		
Coating Thic	kness Inspection Data (complete	this table in the absence of an	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	109	5	10:00
North of Anchor #2	109	5	2:00
South of Anchor #1	120	5	10:00
South of Anchor #2	125	5	2:00
Average Thickness	115		



CP Reading #1 (mV) (north end of feature)	-1480 -1500	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-1460
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	<25
(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 3	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	51°	DFT Adjacent to Feature (mil) (~2" away from edge)	145 100 135 85	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	150 130 99 99
0/2/2017 11:25:41 AM 7 E-23A South/E-23A No	ni ini Xili	100			



Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	-1606 -1608	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-1604 -1609
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	<25
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	51°	DFT Adjacent to Feature (mil)	95 135 125	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	110 165 115
		(~2" away from edge)	110	( o -12 away from edge)	115
8	322	-			
129					



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	-1587	CP Reading #3 (mV)	N/
(north end of feature) DFT #1 (mil)		(center of feature) DFT #2 (mil)	-1597	(south end of feature)	14/
(north end of feature)	N/R	(center of feature)	100	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	100		14
Temperature (°F)	51°	Feature (mil)	85	DFT Adjacent to Feature (mil)	12
		(~2" away from edge)	107	(~8"-12" away from edge)	13
2/2017 11,23,43 AM E-23A South/E-23A No	rth	-3-			
	rdh				



#### Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV)	-200	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	-19
(north end of feature) DFT #1 (mil)	-202	(center of feature) DFT #2 (mil)		(south end of feature)	-20
(north end of feature)	74	(center of feature)	N/R	DFT #3 (mil) (south end of feature)	135
(record #2 for feature	s < 2" long,	record #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	175		190
Temperature (°F)	51°	Feature (mil)	95	DFT Adjacent to Feature (mil)	120
		(~2" away from edge)	140	(~8"-12" away from edge)	102
			135		12
/2/2017 11:24:21 AM 7 E-23A South/E-23A Nor	a la la	Provide 1 to 2 photos of fe			
	a la la				



		Gen	eral Information		
Date:		10/26/17	Diver:		Scott Woodward
AFE/W.	0.#:	20011702	Company Rep	/Inspector:	
Pipe Sup	oport Anchor:	E-8 (E-23A North / E-23B South)	Water Depth (	ft):	
Longitu	de:	4.000	Latitude:		
		Diver	nspection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Class	sification of Feature
1	5' 7" South	7:00	0.17 (6" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
2	3' 6" South	6:00	1.0 (12" X 12" Di) 0.02 (1" X 3" D)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
3	Anchor to 6' South	360°	9.42 (72" X 62.83")	Dislodged Area	Holiday (bare metal Disturbed Area
4	3" North	6:00	0.03 (2" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
5	1' North	7:00	0.17 (5" X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal
6	Anchor to 6' North	360°	9.42 (72" X 62.83")	<ul> <li>☑ Dislodged Area</li> <li>□ Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal □Disturbed Area
				Dislodged Area Deposit	⊟Holiday (bare metal) ⊟Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	⊟Holiday (bare metal) ⊡Disturbed Area
atures of	table rows as necess oserved. Feature nur tailed video images)	ary to identify all nbering starts at top	Biota present:	NA	ES 🖾 NO
Dislodge	d coating observed ⊠NO	on the lake floor:	Lake floor location wrt pipe:	In span 2	20" off lake floor

ENBRIDGE	Diver Inspecti	ion Form for L5 Straits of Mackinac
Feature 2, Dep	oosit area (1" X 1" next to	a 1" X 2") within Dislodged area 12" X 12"
Feature 3, Dislouter wrap mis	odged area is approxima sing	ately 30% of area from anchor to 6' South that has
Feature 6, Dislouter wrap mis	odged area is approxima sing	tely 30% of area from anchor to 6' North that has
0,11	NA	
H6 9	leve-	
Co	ontractor Signature	Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	TYES NO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft	) Location on Pipe (o'clock)
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	s < 2" long;	record #1 and #3 for features 2	2*-8° long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
in the second seco		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			N/R		N/F
In	cluded the	date and time stamps asso	feature, be ciated with	n video surveillance.	

 Date:
 10/26/17
 Frame(HH:MM:SS)
 00:12:05
 Date:
 10/26/17
 Frame(HH:MM:SS)
 00:12:34

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:12:34



CP Reading #1 (mV) (north end of feature)       N/R       CP Reading #2 (mV) (south end of feature)       N/R       CP Reading #3 (mV) (south end of feature)         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" lon (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" lon Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8"-12" away from edge)         Temperature ("F)       58°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8"-12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       Includeo surveillance.	D. Decelling Hd (		ection and Coating Mea			
DFT #1 (mil) (north end of feature)     N/R     DFT #2 (mil) (center of feature)     N/R     DFT #3 (mil) (south end of feature)       (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long; record #1, #2 and #3 for features *8" long;	north end of feature			N/R	CP Reading #3 (mV) (south end of feature)	N/I
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long;         Temperature (°F)       58°         DFT Adjacent to Feature (mil) (~2" away from edge)         N/R         N/R         N/R         N/R         N/R         N/R         Provide 1 to 2 photos of feature, below:		e) N/R		N/R	DFT #3 (mil)	N/8
Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (N/R       Provide 1 to 2 photos of feature, below:	(record #2 for fe	eatures < 2" long; re-	cord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     58°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:						N/F
(~2" away from edge) N/R (~8"-12" away from edge) Provide 1 to 2 photos of feature, below:	Temperature (°F)	580		N/R	DFT Adjacent to Feature (mil)	N/I
Provide 1 to 2 photos of feature, below:	(ompointaile (1)	00		N/R	(~8"-12" away from edge)	N/
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.			( = and, nomedge,	N/R		N/I
and the second						



CP Reading #1 (mV) (north end of feature)		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feat	ures < 2" long; re	cord #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of a	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	s < 2" long;	record #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
	122	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		, and a support	AL/D		
In	cluded the	Provide 1 to 2 photos of a date and time stamps asso	N/R eature, be clated with	elow: n video surveillance.	N/I



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
(inspectatore ( ) )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( - and nom cage)	N/R		N/F
- Caller	A.				



DFT #1 (mil) (north end of feature) (record #2 for feature	NUD	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
(record #2 for feature	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	100	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/
		and the second se			



-		Ge	neral Information		
Date:		10/26/17	Diver:		Chad Cantrell
AFE / W	.0.#:	20011702	Company Rep	/Inspector:	chad califien
Pipe Su	oport Anchor:	E-9	Water Depth (		
		(E-23B South / E-23B North)	water Depth (it).		
Longitu	de:		Latitude:		
		Diver	Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Cl	assification of Feature
1	Anchor to 6' South	2009	26.70 (72" X 62.83")	Dislodged Area	Holiday (bare metal
2	3' 4" South	4:00	0.08 (6"X 2")	Dislodged Area	
3	1' South	2:00	0.01 (1" X 1")	Dislodged Area	
4	4' 4" North	9:00 - 6:00	0.10 (2" X 7")	Dislodged Area	
5	Anchor to 6' North	360°	3.14 (72" X 62.83")	Dislodged Area	Holiday (bare metal
6	1' 5" North	7:00	0.03 (2" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
7	4" North	5:00	0.04 (3" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
8	2' 4" North	5:00	0.06 (2" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
9	5' 6" North	5:00	0.04 (1½* X 4*)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
10	5' 7" North	5:30	0.08 (4" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
			1.11	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	☐ Holiday (bare metal) □ Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
R' incort	table rouge of			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
atures ob	table rows as nec served. Feature num l video images)	essary to identify all bering starts at top row	Biota present:		YES 🗆 NO
Dislodged VES 🛛	coating observed	on the lake floor:	Lake floor location wrt pipe:	b	n span 12" off lake floor

ENBRIDGE

Comments/Issues/Discussion Feature 1, Dislodged area is approximately 85% of area from anchor to 6' South that has outer wrap missing Feature 5, Dislodged area is approximately 10% of area from anchor to 6' North that has outer wrap missing **Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thic	kness Inspection Data (complete	this table in the absence of an	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	
DFT #1 (mil)		(center of feature)	IWIX	(south end of feature)	N/F
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	
(record #2 for featur	res < 2" long; re	cord #1 and #3 for features 2	*-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
100 C C C C C C C C C C C C C C C C C C	1	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			N/R		N/F
	In a list of at	Provide 1 to 2 photos of fe date and time stamps associ	ature, below	v:	
		1. F 1			



CP Reading #1 (north end of feat	(mV) ature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/I
DFT #1 (mil (north end of fea	1)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 fo	or features < 2	2" long; rec	ord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
			DFT Adjacent to	N/R	line and ite for features -o folig)	N/8
Temperature (°	°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
			(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			Provide 1 to 2 photos of fe	N/R		N/F
				atea with v	ideo surveillance.	
					ineo survemance.	



### Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of fosture)	N/R
(record #2 for features	s < 2° long; red	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F



	1-10		rotection and Coating Meas	en en incentes (		
CP Reading #1 (north end of fea	ature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mi (north end of fea	ature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 f	for features	< 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
				N/R		N/F
Temperature (	°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
			(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			Provide 1 to 2 photos of fe	N/R		N/F
	15	16				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for features	s < 2" long; ro	ecord #1 and #3 for features 2	"-8" long: re	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
				iona in t, inz and iso for realities 28 long)	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
	Included the	date and time stamps associ	ated with v	ideo surveillance.	
	Included the	date and time stamps associ	ated with v	ideo surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2° long; re	cord #1 and #3 for features 2	-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
		THE			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
	s < 2" long; re	ecord #1 and #3 for features 2	"-8" long: re	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
		III CONTRACTOR AND A	N/R	interviewers and wattor realures >8 long)	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
	4				
	Provide State				



and the second se	cathouic Pi	otection and Coating Me	salements	(for Feature # 8)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)		CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for features	s < 2° long; rec	ord #1 and #3 for features	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/R
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
		(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/R
		Provide 1 to 2 photos of		1.60m	N/R
a present					



CP Reading #1 (mV) (north end of feature)       N/R       CP Reading #2 (mV) (center of feature)       N/R       CP Reading #3 (m (south end of feature)         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features Temperature ("F)       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R       DFT Adjacent to Feature N/R         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       Provide 1 to 2 photos surveillance.	•)	N/F
DF1 #1 (mil) (north end of feature)     N/R     DFT #2 (mil) (center of feature)     N/R     DFT #3 (mil) (south end of feature)       (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features Temperature (°F)     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature N/R       Provide 1 to 2 photos of feature, below;		
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features		N/R
Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (~8"-12" away from e       Provide 1 to 2 photos of feature, below:	>8" long)	
Temperature (°F)     58°     Feature (mil) (~2" away from edge)     IN/R     DF I Adjacent to Feature (~8"-12" away from e       Provide 1 to 2 photos of feature, below:	o long/	N/F
(~2" away from edge) N/R (~8"-12" away from e Provide 1 to 2 photos of feature, below:	(mil)	N/F
Provide 1 to 2 photos of feature, below:	ge)	N/F
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.	· /	N/F
ate: 10/26/17 Frame(HH:MM:SS) 00:21:21 Date: Frame(HH:MM:SS)		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil)	AUD	(center of feature) DFT #2 (mil)		(south end of feature) DFT #3 (mil)	W/P
(north end of feature)	N/R	(center of feature)	N/R	(south and of feature)	N/F
(record #2 for features	s < 2" long; re	ecord #1 and #3 for features 2	*-8* long; re	ecord #1, #2 and #3 for features >8" long)	
	1.1.1.1	DFT Adjacent to	N/R		N/R
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
		(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/R
	2 3	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	4				

# ENBRIDGE

### REDACTED SUBMITTAL -- PUBLIC COPY

		Gener	al Information		
Date:		10/2/17, 10/3/17, 10/6/17	Diver: 10/2/17 Andrew Albers Tompkins	7 Maurice Unger, , McKenzie	10/3/17 Joe Reimer, Chad Cantrell, Mike Racette, Maurice
AFE / W.O.#: Pipe Support Anchor:		20011702	Contraction of the second s	p/Inspector:	Unger 10/6/17 Scott Woodward
		E-10 (E-28A South /	Water Depth		
		E28 North)	Huter Depti	(i.g.	
Longitu	de:		Latitude:		
		Diver Ins	pection Reco	rd	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Cla	ssification of Feature
1	4' South	3:00 - 5:00	5.54 (19" X 42")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
2	2' South	11:00	0.02 (2" X 1½")	Dislodged Area	
3	1' 8" South	10:00	0 003 (2" X ½")	Dislodged Area     Deposit	
4	1' 8" South	9:00	0.08 (3" X 4")	Dislodged Area     Deposit	
5	Adjacent to saddle South	10:00	0.05 (2½" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
6	3" North	3:00	0.03 (3" X 1½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
7	2' 6" North	12:00 - 3:00	0.28 (4" X 10")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
8	2' 6" North	6:00	0.01 (2" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
9	5' North	3:00	0,39 (7" X 8")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
9A	5' 4" North	6:00 - 9:00	0.12 (5" x 3 1/2")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
9B	5' 4" North	6:00	0.25 (6" x 6")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	⊠Holiday (bare metal) ⊡Disturbed Area
10	6' North	9:00 - 12:00	0.89 (16" X.8")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
11	7' 6" North	7:00	0.19 (3½" X 8")	Dislodged Area     Deposit	⊠Holiday (bare metal) ⊡Disturbed Area
12	7' 7" North 8' 5" North	9:00	0.10 (4¼' X 3½")	Dislodged Area     Deposit	⊠Holiday (bare metal) □Disturbed Area
13	8' 8" North	5:30	0.11 (4" X 4")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
14	9' North	11:00	0.22 (4" X 8")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
15		8:00 - 10:00	0.75 (9" X 1')	Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
16	10' North	6:00 - 8:00	2.77 (19" X:21")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)



Feature Number         Location of Feature (w.r.t. pipe support)           17         11' 6" North	Feature	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ff <sup>2</sup> )	Visual Classification of Feature		
	3:00 - 5:00	1.0 (12" X 12")	☑ Dislodged Area □ Deposit	□Holiday (bare metal □Disturbed Area		
18	11' 6" North	7:00	0 01 (1" X 1")	Dislodged Area     Deposit	Disturbed Area	
19	11' 7" North	11:00	0.15 (5½" X 4*)	□ Dislodged Area ⊠ Deposit	□Holiday (bare metal) □Disturbed Area	
20	13' North	6:00	0.03 (2* X 2*)	Dislodged Area	□Holiday (bare metal) □Disturbed Area	
21	12' 4" North	10:00 - 12:00	0.42 (1" X 5")	Dislodged Area	Holiday (bare metal) Disturbed Area	
22	12' 6" North	9:00	0.01 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>	
23	14' North	7:00	1.07 (14" X 11")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area	
24	16' 6" North	12:00	0.33 (8" X 6")	Dislodged Area     Deposit	⊠Holiday (bare metal) □Disturbed Area	
25	16' 6" North	9:00	0.17 (6" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area	
26	17' 6" North	4:00	0.001 (1" X ¼")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area	
27	17' 7" North	5:00	0.02 (3" X 1")	⊠ Dislodged Area □ Deposit	□Holiday (bare metal) □Disturbed Area	
28	17' 6" North	6:00	0.0004 (½" X 1/8")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area	
			10.7	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)	
			_	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area	
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area	
Date: 1	A REAL PROPERTY AND A REAL PROPERTY AND A			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Área	
oserved.	able rows as necessa Feature numbering st eo images)	rry to identify all features arts at top row (for	Biota present:	⊠YES		
Dislodged JYES D	d coating observed o	on the lake floor:	Lake floor location wrt pipe:	ln span 9" – 2	4" off lake floor	

ENBRIDGE

Comments/Issues/Discussion
Feature 1, Dislodged, DFTs over 40 mils
Feature 2, Deposit sample taken, 0% of the area showed bare meetal after deposit removal, possibly down to primer
Feature 3, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 4, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 5, Deposit sample taken, approximately 5% of the area showed bare metal after deposit
am
Feature 6, Deposit sample taken, approximately 3% of the area showed bare metal after depos removal
Feature 7, Deposit sample taken, approximately 5% of the area showed bare metal after depos removal
Feature 8, Deposit sample taken, 0% of the area showed bare metal after deposit removal
reature 9, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 9A, discovered after initial inspection during coating repair at F-10. The feature had
calcareous deposits, no bare metal. The feature was included in the overall repair at E-10
Feature 9B, discovered after initial inspection during coating repair at E-10. The feature had
calcareous deposits, no bare metal. The feature was included in the overall repair at E-10
Feature 10, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 11, Holiday, bare metal observed prior to removing deposit, Deposit sample taken, approximately 50% of the area showed bare metal after deposit removal
Feature 12, Holiday, bare Metal 41/2" X 31/2" upon inspection, (originally identified as Dislodged 1
5" X 1')
Feature 13, Dislodged
Feature 14, Dislodged
Feature 15, Dislodged
Feature 16, Deposit sample taken, approximately 2% of the area showed bare metal after deport removal
Feature 17, Dislodged
Feature 18, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 19, Deposit sample taken, 0% of the area showed bare metal after deposit removal Feature 20, Dislodged
Feature 21, Dislodged
Feature 22, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 23, Deposit sample taken, 0% of the area showed bare metal after deposit removal
Feature 24, Holiday, bare metal
Feature 25, Deposit sample taken, approximately 20% of the area showed bare metal after deposit removal
Feature 26, Identified as dislodged, Bare metal 0% (1st Diver identified as holiday, 2 <sup>nd</sup> Diver
verified with CP & DFT readings, no Holiday, no deposit, CP readings taken to verify-but not.
necessary due to DFTs above 40 mils)
Feature 27, Identified as dislodged, Bare metal 0% (1st Diver identified as holiday, 2nd Diver
verified with CP & DFT readings, no Holiday, no deposit, CP readings taken to verify-but not
necessary due to DF1s above 40 mils)
Feature 28, Identified as dislodged, Bare metal 0% (1st Diver identified as holiday, 2nd Diver
verified with CP & DFT readings, no Holiday, no deposit, CP readings taken to verify-but not
necessary due to DFTs above 40 mils)

		Diver Inspection Form for L5 Straits of Mackinac		
911	Mul-			
000	Contractor Signature	Enbridge Representative/ Inspector Signature		

Coating Gauge Information					
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip 09/15/2017 VES INO	Product: Next Calibration Due:	211 Coating Thickness Gauge 09/15/2018		
Coating Thicknes	ss Inspection Data (complete	this table in the absence	of any Features)		
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock		
North of Anchor #1	115	5	10:00		
North of Anchor #2	82	5	2:00		
South of Anchor #1	92	5	10:00		
South of Anchor #2	110	5	2:00		
Average Thickness	100				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	95	DFT #2 (mil) (center of feature)	80	DFT #3 (mil) (south end of feature)	80
(record #2 for feature	es < 2" long; ree	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	-
Temperature (°F)		DFT Adjacent to	80 115	DFT Adjacent to Feature (mil)	80
remperature ( F)	56°	Feature (mil)	115	(~8"-12" away from edge)	82
		(~2" away from edge) Provide 1 to 2 photos of f	115		82
	North				
0/2/2017 2:35:42 PM 10 E-28A South / E-28A N	Vorth				



CP Reading #1 (mV) (north end of feature)	-1546 -1559	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-155 -155
DFT #1 (mil) (north end of feature)	36	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	55
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	250		120
Temperature (°F)	52°	Feature (mil)	200	DFT Adjacent to Feature (mil)	200
		(~2" away from edge)	180	(~8"-12" away from edge)	210
		Provide 1 to 2 photos of t	125		180
		<u>ä</u>			
		25:41:54 :0			

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP readings #1 and #3 indicates probe contact with pipe metal. Because no bare metal was observed, we believe the CP gun probe tip penetrated residual coating for the readings.



CP Reading #1 (mV) (north end of feature)	-272 -282	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	-28
DFT #1 (mil) (north end of feature)	140	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	-29 135
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	180		115
Temperature (°F)	54°	Feature (mil)	180	DFT Adjacent to Feature (mil)	190
	100	(~2" away from edge)	200	(~8"-12" away from edge)	170
		Provide 1 to 2 photos of t	160		180
201 1 1 0/05		ETTER S			



CP Reading #1 (mV) (north end of feature)	-208 -212	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	-20
DFT #1 (mil) (north end of feature)	210	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	-21
(record #2 for featu	res < 2" long;	record #1 and #3 for features 2	2"-8" long, r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	250		160
Temperature (°F)	54°	Feature (mil)	210	DFT Adjacent to Feature (mil)	120
CONTRACTOR STATES		(~2" away from edge)	240	(~8"-12" away from edge)	190
		Provide 1 to 2 photos of 1	230		190



CP Reading #1 (mV) (north end of feature)	-1571 -1568	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-157
DFT #1 (mil) (north end of feature)	27	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	66
(record #2 for featur	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	190 125 135	DFT Adjacent to Feature (mil)	170
		(~2" away from edge)	125	(~8"-12" away from edge)	95 160
0/2/2017 2:13:17 Payl	And a	e and time stamps asso	eature, bel ciated with	video surveillance.	
0/2/2017 2:13:17 Pay -10 E-28A South / E-28A	And a	e and time stamps asso	ciated with	video surveillance.	
0/2/2017 2:13:17 Payl	And a	e and time stamps asso	ciated with	video surveillance.	



#### Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	-1569 -1568	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-155
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	<25
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	100		105
Temperature (°F)	56°	Feature (mil)	95	DFT Adjacent to Feature (mil)	94
100-00-00-00-00	1000	(~2" away from edge)	101	(~8"-12" away from edge)	98
	1	Provide 1 to 2 photos of t	103		109
ate: 10/2/17 Frame	(HH:MM:SS	23: 41: 54 <b>30</b> ) 14:17:09 Date			



CP Reading #1 (mV)	-1475	ection and Coating Mea	the same of some of		
(north end of feature)	-1475	CP Reading #2 (mV) (center of feature)	-1470	CP Reading #3 (mV)	-147
DFT #1 (mil)		DFT #2 (mil)	-1472	(south end of feature)	-148
(north end of feature)	<25	(center of feature)	25	DFT #3 (mil) (south end of feature)	<25
(record #2 for featu	ires < 2* long; red	ord #1 and #3 for features :	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	11000	DFT Adjacent to	70		73
Temperature (°F)	56°	Feature (mil)	101	DFT Adjacent to Feature (mil)	96
1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1.1	(~2" away from edge)	75	(~8"-12" away from edge)	66
		Provide 1 to 2 photos of	95		51
	Ĺ				



CP Reading #1 (mV) (north end of feature)	-210 -208	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-22
DFT #1 (mil) (north end of feature)	92	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south and of footure)	-22-
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	110		110
Temperature (°F)	56°	Feature (mil)	88	DFT Adjacent to Feature (mil)	10
		(~2" away from edge)	96	(~8"-12" away from edge)	98
	1 _ 1		76		94
2017/10/02 14:	cluded the da	Provide 1 to 2 photos of f ate and time stamps assoc	ciated with	ow. video surveillance.	

 Date:
 10/2/17
 Frame(HH:MM:SS)
 14:19:37
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



DFT #1 (mil) (north end of feature) (record #2 for feature) Temperature (°F)	80 es < 2* long; r 56°	(center of feature) DFT #2 (mil) (center of feature) ecord #1 and #3 for features 2 DFT Adjacent to	-214 84 2*-8" long; re 120	(south end of feature) DFT #3 (mil) (south end of feature) ecord #1, #2 and #3 for features >8* long)	-25 90
		the second se		cord #1, #2 and #3 for features >8" long)	
		the second se			-
Temperature (°F)	56°	Di i Aujacent to			11
		Feature (mil)	92	DFT Adjacent to Feature (mil)	11
		(~2" away from edge)	65	(~8"-12" away from edge)	84
	10	Provide 1 to 2 photos of fi	92		11



CP Reading #1 (mV) (north end of feature)	-226 -231	CP Reading #2 (mV) (center of feature)	-255 -258	CP Reading #3 (mV) (south end of feature)	-19 -19
DFT #1 (mil) (north end of feature)	48	DFT #2 (mil) (center of feature)	90	DFT #3 (mil) (south end of feature)	79
(record #2 for feature	es < 2* long; i	record #1 and #3 for features :	2"-8" long, re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	115 101 101	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	84 95 100
		(~2" away from edge) Provide 1 to 2 photos of	111	1	125
1012047至3825 PM 101 日254 (354歳) / 日264 (		date and time stamps asso	ciated with	video surveillance.	_
N2/2017 9:38:25 PM		date and time stamps asso	ciated with	video surveillance.	
N2/2017 9:38:25 PM		date and time stamps asso	ciated with	video surveillance.	



## Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	-1509 -1511	CP Reading #2 (mV) (center of feature)	-1476 -1479	CP Reading #3 (mV)	-1453
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	<25	(south end of feature) DFT #3 (mil) (south end of feature)	-1457
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	94		75
Temperature (°F)	56°	Feature (mil)	111	DFT Adjacent to Feature (mil)	89
	1980	(~2" away from edge)	100	(~8"-12" away from edge)	110
		Provide 1 to 2 photos of t	105		93
2017 DVD2 148598	59.				
2012 DVD2 14:551					
te: 10/2/17 Frame					



DFT #1 (mil) (north end of feature)     93     DFT #2 (mil) (center of feature)     <25	CP Reading #1 (mV) (north end of feature)	-374 -372	CP Reading #2 (mV) (center of feature)	-1485 -1487	CP Reading #3 (mV) (south end of feature)	-40
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       57°         DFT Adjacent to Feature (mil) (~2" away from edge)       98 100 104 109       DFT Adjacent to Feature (mil) (~8"-12" away from edge)         Provide 1 to 2 photos of feature, below:	DFT #1 (mil)		DFT #2 (mil)		DFT #3 (mil)	110
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     98 100 104 104 109     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     11 96 96 109       Provide 1 to 2 photos of feature, below:     10     11	(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     57°     Feature (mil) (~2" away from edge)     100     DF1 Adjacent to Feature (mil) (~8"-12" away from edge)     96       109     104     (~8"-12" away from edge)     96       11     Provide 1 to 2 photos of feature, below;     11			and the second	98		119
(~2" away from edge)     104 109     (~8"-12" away from edge)     96       Provide 1 to 2 photos of feature, below;     11	Temperature (°F)	57°			DFT Adjacent to Feature (mil)	96
Provide 1 to 2 photos of feature, below:		10			(~8"-12" away from edge)	96
Included the date and time stamps associated with video surveillance.		-	Provide 1 to 2 photos = 64			111
					video survemance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	72	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	84
(record #2 for featur	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	111		12
Temperature (°F)	57°	Feature (mil)	82	DFT Adjacent to Feature (mil)	85
		(~2" away from edge)	96	(~8"-12" away from edge)	11
		Provide 1 to 2 photos of f	100		10
	1				



DFT #1 (mil) (north end of feature)       105       DFT #2 (mil) (center of feature)       105       DFT #3 (mil) (south end of feature)       94         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)       94         Temperature ("F)       57°       DFT Adjacent to Feature (mil) ("2" away from edge)       125 110       DFT Adjacent to Feature (mil) ("8"-12" away from edge)       86 100         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       121	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
Image: constraint of the state of		105	DFT #2 (mil)	105	DFT #3 (mil)	94
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     125 125 110 (110 111     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     86 108 108 108 125       Provide 1 to 2 photos of feature, below:     125 111     105 (~8"-12" away from edge)     105 125	(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     57°     Feature (mil) (~2" away from edge)     125 110 111     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     100 100 100 100       Provide 1 to 2 photos of feature, below:			And and a submission of the second		1	86
(~2" away from edge)     110 111     (~8"-12" away from edge)     100 100 12       Provide 1 to 2 photos of feature, below:	Temperature (°F)	57°		and the second	DFT Adjacent to Feature (mil)	10
Provide 1 to 2 photos of feature, below:	·····	1.3			(~8"-12" away from edge)	10
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.				a man for a first start st		12





Temperature (°F)	57°	(center of feature) DFT #2 (mil) (center of feature) ord #1 and #3 for features 2 DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of the and time stamps assoc	109 120 115 120 feature, belo	(south end of feature) DFT #3 (mil) (south end of feature) ecord #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge) low: video surveillance.	70 12 12 94 10
Temperature (°F)	57°	DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of f	109 120 115 120 feature, belo	DFT Adjacent to Features >8" long) (~8"-12" away from edge)	12
Temperature (°F)	57°	DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of f	109 120 115 120 feature, belo	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	12
		Feature (mil) (~2" away from edge) Provide 1 to 2 photos of f	115 120 feature, beli	(~8"-12" away from edge)	12
Inc	cluded the dat	(~2" away from edge) Provide 1 to 2 photos of t	120 feature, beli	(~8"-12" away from edge)	
Inc	cluded the dat	Provide 1 to 2 photos of t	feature, belo	low: video surveillance.	10
Inc	cluded the dat	te and time stamps assoc	eature, bel clated with	low: video surveillance.	
te: 10/6/17 Frame	(HH:MM:SS)				



(north end of feature)	-1554 -1556	CP Reading #2 (mV) (center of feature)	-1502 -1504	CP Reading #3 (mV) (south end of feature)	-151
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	37	DFT #3 (mil) (South and of feature)	-1509
(record #2 for featur	es < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	110	(i.i.g)	110
Temperature (°F)	56°	Feature (mil)	109	DFT Adjacent to Feature (mil)	115
1		(~2" away from edge)	99	(~8"-12" away from edge)	100
	-	Provide 1 to 2 photos of t	100		100



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	71	DFT #2 (mil) (center of feature)	70	DFT #3 (mil) (south end of feature)	74
(record #2 for feat	ures < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	100		10
Temperature (°F)	57°	Feature (mil)	84	DFT Adjacent to Feature (mil)	87
and the second second		(~2" away from edge)	72	(~8"-12" away from edge)	12
		Provide 1 to 2 photos of t	115		10



## Diver Inspection Form for L5 Straits of Mackinac

CD Baadlan IId ( 11	attioule Prot	ection and Coating Mea	surements	(for Feature # 18)	
(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-293 -289	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	49	DFT #3 (mil)	N/F
(record #2 for feature	es < 2" long; red	cord #1 and #3 for features 2	2"-8" long re	(south end of feature) cord #1, #2 and #3 for features >8" long)	
			95	iona #1, #2 and #3 for realures >8 long)	110
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	115	DFT Adjacent to Feature (mil)	11
		(~2" away from edge)	110	(~8"-12" away from edge)	10
		and the second se	80		90
In	cluded the de	Provide 1 to 2 photos of f te and time stamps assoc	eature, bel	OW:	
51 251 55					
כל וכ'ז וכ					
3. C3. 55					



(north end of feature)	-170 -173	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-200
DFT #1 (mil) (north end of feature)	110	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	-20.
(record #2 for featur	res < 2" long; r	ecord #1 and #3 for features 2	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	115		11
Temperature (°F)	56°	Feature (mil)	115	DFT Adjacent to Feature (mil)	10
		(~2" away from edge)	85	(~8"-12" away from edge)	83
		Provide 1 to 2 photos of f	100		83
		P. J.			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	110	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	11
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	115		8:
Temperature (°F)	57°	Feature (mil)	115	DFT Adjacent to Feature (mil)	11
		(~2" away from edge)	112	(~8"-12" away from edge)	9
	1	Provide 1 to 2 photos of f	109		11



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	77	DFT #2 (mil) (center of feature)	76	DFT #3 (mil) (south end of feature)	87
(record #2 for featur	res < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	84		82
Temperature (°F)	57°	Feature (mil)	69	DFT Adjacent to Feature (mil)	91
		(~2" away from edge)	91	(~8"-12" away from edge)	94
		Provide 1 to 2 photos of 1	105		10
1 1 10 10 10 10 10		C. Vr III			



DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       101       DFT #3 (mil) (south end of feature)       N/         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)       N/       N/         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       105 100       DFT Adjacent to Feature (mil) (~8"-12" away from edge)       99	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-177 -180	CP Reading #3 (mV) (south end of feature)	N/I
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       105 100 100 125 79       DFT Adjacent to Feature (mil) 125 100 100 100 100         Provide 1 to 2 photos of feature, below:       Included the date and time stamps associated with video surveillance.       100 100 100 100	(north end of feature)	1.1.000	DFT #2 (mil) (center of feature)	101	DFT #3 (mil) (south end of feature)	N/1
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     105 100 125 79     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     92 125 100 100       Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.	(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long, re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)       56°       Feature (mil) (~2" away from edge)       100 125 79       DFT Adjacent to Feature (mil) (~8"-12" away from edge)       12 100 100         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.				105		95
(~2" away from edge)       125 79       (~8"-12" away from edge)       10         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       10	Temperature (°F)	56°			DFT Adjacent to Feature (mil)	12
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.		100	(~2" away from edge)		(~8"-12" away from edge)	10
Included the date and time stamps associated with video surveillance.						10
	ан <b>Улс</b> Аран 53 - 54 н -		<b>*</b>			

DET #4 /mails		(center of feature)	-347	CP Reading #3 (mV) (south end of feature)	-300
DFT #1 (mil) (north end of feature)	71	DFT #2 (mil) (center of feature)	52	DFT #3 (mil) (south end of feature)	65
(record #2 for featu	ures < 2" long; re	ecord #1 and #3 for features :	2"-8" long, re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	110	(in the sector router be to folig)	88
Temperature (°F)	56°	Feature (mil)	38	DFT Adjacent to Feature (mil)	70
	1.35	(~2" away from edge)	105	(~8"-12" away from edge)	94
		Provide 1 to 2 photos of t	100		95
	1				

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: CP reading #1 indicates probe contact with pipe metal. Because no bare metal was observed, we believe the CP gun probe tip penetrated residual coating for this reading.



CP Reading #1 (mV)	-1396	CP Reading #2 (mV)	-1230	CP Reading #3 (mV)	-138
(north end of feature)	-1398	(center of feature)	-1275	(south end of feature)	-138
DFT #1 (mil)	29	DFT #2 (mil)	30	DFT #3 (mil)	
(north end of feature)	100	(center of feature)	30	(south end of feature)	30
	1	1	84		
Tomporature (0F)	500	DFT Adjacent to	75	DET Adjacent to Easture (	85
Temperature (°F)	56°	Feature (mil)	76	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	72
		(~2" away from edge)	70	( o 12 away nom euge)	73
	1.4.14	Provide 1 to 2 photos of t	eature, bela	ow:	
7272017 2:43:36 PM 10 E-28A South / E-2				video surveillance.	
//2/2017 2:43:36 PM 10 E-28A South / E-2				video surveinance.	



CP Reading #1 (mV) (north end of feature)	-196 -200	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-150
DFT #1 (mil) (north end of feature)	73	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	-151 <25
(record #2 for feature	es < 2* long; r	ecord #1 and #3 for features 2	2*-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	80		59
Temperature (°F)	56°	Feature (mil)	75	DFT Adjacent to Feature (mil)	74
	1	(~2" away from edge)	74	(~8"-12" away from edge)	115
		Provide 1 to 2 photos of t	75		72
	Č.				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-179 -181	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	74	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long;	record #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	74		70
Temperature (°F)	56°	Feature (mil)	66	DFT Adjacent to Feature (mil)	82
		(~2" away from edge)	69	(~8"-12" away from edge)	74
	_	Provide 1 to 2 photos of t	71		10



DF1 #1 (mil) (north end of feature)       72       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)       72         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)       72         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       68 74       DFT Adjacent to Feature (mil) (~8"-12" away from edge)       70         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       70       74	(north end of feature)	-173 -175	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-16
Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       68 (~8"-12" away from edge)       70 (~8"-12" away from edge)         Provide 1 to 2 photos of feature, holow:       Provide 1 to 2 photos of feature, holow:       68 (~8"-12" away from edge)       80 (~8"-12" away from edge)		1000	DFT #2 (mil) (center of feature)		DFT #3 (mil)	-16
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     68 70     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     70       Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.     70     0	(record #2 for feature	s < 2" long; r	record #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)       56°       Feature (mil) (~2″ away from edge)       70       DFT Adjacent to Feature (mil) (~8″-12″ away from edge)       100         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       74       74		D	the second se	68	(in the second s	70
(~2" away from edge)     68     (~8"-12" away from edge)     80       Provide 1 to 2 photos of feature, below;     74     74     74       Included the date and time stamps associated with video surveillance.     74     74	Temperature (°F)	56°	Feature (mil)	and the second se	DFT Adjacent to Feature (mil)	10
Provide 1 to 2 photos of feature, below; Included the date and time stamps associated with video surveillance.			(~2" away from edge)		(~8"-12" away from edge)	80
Included the date and time stamps associated with video surveillance.						74
			and anne atamps assoc	naled with	video surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	-265 -265	CP Reading #3 (mV)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	74	(south end of feature) DFT #3 (mil)	N/I
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	"-8" long' re	(south end of feature) cord #1, #2 and #3 for features >8" long)	
, or in the lot the lo		TO COMPANY TO A STATE OF A STATE OF	76	iona #1, #2 and #3 for reatures >8 long)	11
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	78	DFT Adjacent to Feature (mil)	51
Construction of the		(~2" away from edge)	76	(~8"-12" away from edge)	74
		Provide 1 to 2 photos of f	74		72
DI VIOLOE ISUSTIS		20 A			
01 <b>7</b> 10/02 1515 115					



-		G	eneral Information	n	
Date:		10/28/17	Diver:	G	eorge Palmer
AFE / W		20011702	Company R	ep / Inspector:	eorge raimer
Pipe Suj	pport Anchor:	E-11 (E-28A North / E 28B)	- Water Depth		1
Longitude:			Latitude:		
		Dive	r Inspection Reco	ord	
Feature Number	Location of Feature (w.r.t. pipe suppo	Circumferential Position of the	Measured Feature size (ft²)		fication of Feature
1	4' 7" South	8:00	0.003 (1" X ½")	Dislodged Area	□Holiday (bare metal □Disturbed Area
2	3' 10" South	6:00	0.21 (6" X 5" Di) 0.14 (5" X 4" D)	⊠ Dislodged Area ⊠ Deposit	Holiday (bare metal)
	NO FEATURES			Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				□ Dislodged Area □ Deposit	Holiday (bare metal)
				Dislodged Area Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal)□Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
3: insert ta	ble rows as necess	any to identify all		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
atures obs	erved. Feature nur illed video images)	mbering starts at top	Biota present:	⊠YES	□ NO
islodged IYES 🛛	coating observed NO	on the lake floor:	Lake floor location wrt pipe:	In span 24	to lake floor

ENBRIDGE

 Commen	nts/Issues/Discussion
eature 2, Deposit 5" X 4" within a Dislo O FEATURES IDENTIFIED NORTH C	
 0,000	

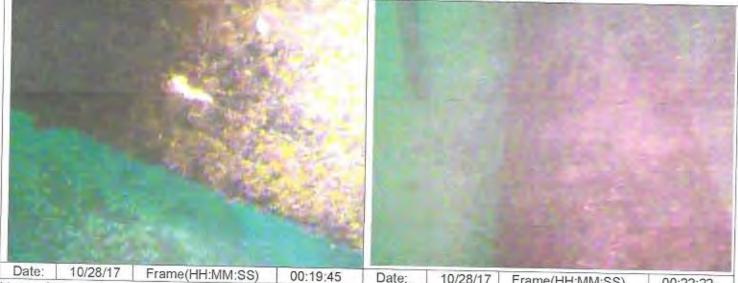
and the second second	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	ss Inspection Data (complete	e this table in the absence (	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	110
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	rotection and Coating Mea CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil)		(center of feature)		(south end of feature)	11/1
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		and the second s	N/R		N/F
Temperature (°F)	54°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
	54	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R		N/P

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.



 Date:
 10/28/17
 Frame(HH:MM:SS)
 00:19:45
 Date:
 10/28/17
 Frame(HH:MM:SS)
 00:22:22

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:22:22



# Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features :	2*-8" long; r	record #1, #2 and #3 for features >8" long)	
		1 The second se second second sec	N/R	(in the second for reduces of rolly)	N/R
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
0- 1 950054 M		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	Provide 1 to 2 photos of 1	N/R		N/F
				n video surveillance.	



# Diver Inspection Form for L5 Straits of Mackinac

(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	/IEW OF 6' NORTH ANCHOR) CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/I
(record #2 for feature	es < 2" long;	record #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1000	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/I



		Ge	eneral Information		
Date:		10/28/17	Diver:	1	Maurice Unger
AFE/W.	0.#:	20011702	Company Rep /	Inspector:	N
Pipe Sup	oport Anchor:	E-12 (E-30A / E- 30B)	Water Depth (ft)	):	
Longitude:		Latitude:			
		Dive	r Inspection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Class	ification of Feature
1	Anchor to 6' South	360"	29,87 (72" X 62.83")	☑ Dislodged Area □ Deposit	Holiday (bare metal)
2	9" - 2' South	6:00	0.25 (24" X 1½") 0.94 (27" X 5")	☑ Dislodged Area ☑ Deposit	Holiday (bare metal)
3	4' 9" North	11:00	0.03 (2" X 2")	Dislodged Area	Holiday (bare metal) Disturbed Area
4	Anchor to 6' North	360°	31.44 (72" X 62.83")	Dislodged Area	□ Holiday (bare metal □ Disturbed Area
5	5' North	3:00	0.10	Dislodged Area	Holiday (bare metal
			(5" X 3")	Deposit     Dislodged Area     Deposit	Disturbed Area
				Dislodged Area     Deposit     Deposit	Holiday (bare metal
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal □Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
eatures of	table rows as necess oserved. Feature nur tailed video images)	ary to identify all mbering starts at top	Biota present:	⊠Y	ES 🗆 NO
Dislodge UYES	d coating observed ⊠NO	on the lake floor:	Lake floor location wrt pipe:	In span	18" to lake floor



#### Comments/Issues/Discussion

Feature 1, Dislodged area is approximately 95% of area from anchor to 6' South of anchor that has outer wrap missing

Feature 2, Deposit is 27" X 5" with a Dislodged 24" X 11/2" area through the Deposit

Feature 4, Dislodged area is approximately 100% of area from anchor to 6' North of anchor that has outer wrap missing

**Contractor Signature** 

Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES INO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; i	record #1 and #3 for features 2		ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/I
		Feature (mil) (~2" away from edge)	N/R		N/I
			N/R		N/I
			N/R		N/I
Ir	icluded the	date and time stamps asso			
Ir	ocluded the				





		tection and Coating Mea	suremen	ts (for Feature # 2)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DET A Contractor	N/R		N/F
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( r)	34	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away nonredge)	N/R		N/F
	la s	-			



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
(north end of feature)	INUIS	(center of feature)	TWIS	(south end of feature)	
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/F
		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away from edge)	N/R		N/1
		and the second			





DFT #1 (mil) (north end of feature) (record #2 for featur	N/R		N/R	CP Reading #3 (mV) (south end of feature)	N/F
(record #2 for featur		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	es < 2" long; rec	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DET Adiagont to	N/R		N/F
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( 1)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of 1	N/R		N/F
-		200			





CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
	1.	DFT Adjacent to	N/R		N/
Temperature (°F)	54°	Feature (mil)	N/R	_ DFT Adjacent to Feature (mil)	N/I
rempendiare (1)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/
ALC: NOTE: N		10 12			



		Ger	neral Information		and the second
Date:		10/6/17, 10/9/17	Diver: 10/6/17 Troy Cantrell, George Pa		10/9/17 Maurice Unger, Craig Palmer
AFE/W.	0 #	20011702	Company Rep / In		Jesse Salazar
	oport Anchor:	E-13 (E-35A / E-35B)	Water Depth (ft):		78
Longitu		84.76577568	Latitude:		45.80398452
Longica	ue.		Inspection Record	1	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Cla	ssification of Feature
1	27' South	12:00	0.34 (7" X 7")	<ul> <li>□ Dislodged Area</li> <li>⊠ Deposit</li> </ul>	Disturbed Area
2	26' South	7:00 continues into lake bed	0.003 (1" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
3	25' 9" South	2:30	0.04 (3" X 2")	<ul> <li>□ Dislodged Area</li> <li>⊠ Deposit</li> </ul>	Disturbed Area
4	25' 7" South	7:00	0.002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
5	25' 7" South	6:00 - 7:30	0.28 (5" X 8")	<ul> <li>□ Dislodged Area</li> <li>⊠ Deposit</li> </ul>	Disturbed Area
6	24' 7" South	9:00	0.11 (4" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
7	24' 7" South	7:30	0.25 (6" X 6")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
8	23' 8" South	7:30	0.06 (3" X 3")	Dislodged Area     Deposit	a ⊡Holiday (bare metal) ⊡Disturbed Area
9	23' 9" South	12:30	0.13 (2 holidays that are 1* X ½")	Dislodged Are	Disturbed Area
10	24' 1"South	3:00	0.56 (16" X 5")	<ul> <li>□ Dislodged Are</li> <li>☑ Deposit</li> </ul>	Disturbed Area
11	23' 5" South	6:00 - 9:00	0.01 (1" X 1")	Dislodged Are     Deposit	Disturbed Area
12	22' 8" South	9:00	0.06 (2" X 4")	<ul> <li>□ Dislodged Are</li> <li>⊠ Deposit</li> </ul>	Disturbed Area
13	22' 11" South	7:00	0.01 (1" X 1")	Dislodged Are     Deposit	Disturbed Area
14	22' 10" South	6:00 - 7:00	0.17 (8" X 3")	□ Dislodged Are ☑ Deposit	Disturbed Area
15	22' South	11:45	0.03 (2" X 2")	☐ Dislodged Are ⊠ Deposit	Disturbed Area
16	22' 4" South	6:30 - 8:00	0.28 (10" X 4")	Dislodged Are     Deposit	ea ☐Holiday (bare meta □Disturbed Area

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		Diver In	spection Record (cont	(inued)	and the second second
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )		ication of Feature
17	21' 7" South	1:00	0.02 (3" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	⊠Holiday (bare metal) □Disturbed Area
18	21' 9" South	11:00	0.12 (3½" X 5" Di) 0.03 (2¼" X 2¼" D)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) ☐Disturbed Area
19	22' South	6:00 - 9:00	0.05 (12" X 8" Di) 0.01 (1" X 1" H)	Dislodged Area	⊠Holiday (bare metal) ⊡Disturbed Area
20	17' 6" South	3:00	0.02 (1½" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
21	17' 6" South	3:00 - 5:00	0.50 (16" X 4½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
22	17' 5" South	9:00	0.89 (16" X 8" Di) 0.29 (14" X 3" D)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
23	17' South	6:00 - 9:00	0.003 (1" x ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
24	16' South	2:00	0.01 (1½* X 1½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare meta) □Disturbed Area
25	16' South	3;30	0.24 (23" X 1½" Di) 0.003 (2" X ¼" D)	⋈ Dislodged Area ⋈ Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
26	14' 4" South	6:00	0.08 (3" X 4"Di) 0.003 (1" X ½" D)	☑ Dislodged Area ☑ Deposit	□Holiday (bare metal □Disturbed Area
27	13' South	3:00	0.01 (6" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
28	12' South	6:00	0.75 (18" X 6")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
29	10' 8" South	12:00	0.12 (4½" X 3 ¾")	Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
30	8' 4" South	2:00	1.50 (18" X.12")	☑ Dislodged Area □ Deposit	□Holiday (bare metal □Disturbed Area
31	7' 7" South	9:00 - 10:00	1.0 (12" X 12" Di) 0.17 (6" X 4" D)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area
32	South Anchor Adjacent	11:00	0.0003 (1/8" X 3/8")	<ul> <li>□ Dislodged Area</li> <li>⊠ Deposit</li> </ul>	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>
33	1' North	10:00	0.001 (½" X 3/8")	<ul> <li>□ Dislodged Area</li> <li>⊠ Deposit</li> </ul>	□Holiday (bare meta □Disturbed Area



		Diver Inspectio	n Record (con	tinued)	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Classifi	cation of Feature
34	4' 9" North	2:00	0.003 (½" X ¾")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
35	5' 2" North	6:00	0.002	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
			(½" X ½")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
-				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
-				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) ☐Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	☐Holiday (bare metal) ☐Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) ☐Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) ☐Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
1				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	⊟Holiday (bare metal) ⊡Disturbed Area
-				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	⊡Holiday (bare metal) ⊡Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
features	ert table rows as nece observed. Feature iled video images)	essary to identify all numbering starts at top row	Biota present:	⊠YE	ES 🗆 NO
	ged coating observ	ed on the lake floor:	Lake floor location wrt pipe:	In span 0 -	- 18" off lake floor

**REDACTED SUBMITTAL -- PUBLIC COPY** 



Diver Inspection Form for L5 Straits of Mackinac

#### Comments/Issues/Discussion

Feature 1, Deposit 7" X 7", no sample taken Feature 2, Holiday 1" X 1/2" within a Deposit 2" X 13" long @ 7:00 that continues on pipe into Take bed (pipe touches lake bed at 6:00) Feature 3, Deposit 3" x 2", no sample taken Feature 4, Deposit 1/2" X 1/2", no sample taken Feature 5, Deposit 5" X 8", no sample taken Feature 6, Deposit 4" X 4", no sample taken Feature 7, Deposit 6" X 6", no sample taken Feature 8, Deposit 3" X 3", no sample taken Feature 9, Holiday (A total of 2 holidays that are 1" X 1/2", next to each other) within a Deposit 15" X 3" Feature 10, Deposit 16" X 5", no sample taken Feature 11, Holiday 1" X 1" within a Deposit 5" X 16" Feature 12, Deposit 2" X 4", no sample taken Feature 13, Deposit 1" X 1", no sample taken Feature 14, Deposit 8" X 3", no sample taken Feature 15, Deposit 2" X 2", no sample taken Feature 16, Deposit 10" X 4", no sample taken Feature 17, Holiday 3" X 1" Feature 18, Deposit 21/4" X 21/4" within a 31/2" X 5" dislodged area Feature 19, Holiday 1" X 1" within a Deposit 101/2" X 2 3/4 " within Dislodged area 12" X 8" Feature 20. Deposit 11/4" X 2", no sample taken Feature 21, Dislodged 16" X 41/2" Feature 22, Deposit (3 connectected, aprox. 14" X 3") within 16" X 8" Dislodged area Feature 23, Deposit 1" X 1/2", no sample taken Feature 24, Deposit 11/2" X 11/4", no sample taken Feature 25, Deposit 2" X 1/4" within a 23" X 11/2" Dislodged area Feature 26, Deposit 1" X 1/2" within a 3" X 4" Dislodged area Feature 27, Deposit 6" X 1/4", no sample taken Feature 28, Deposit 18" X 6", no sample taken Feature 29, Deposit 41/2" X 3 3/4", no sample taken Feature 30, Dislodged area 18" X 12" Feature 31, Deposits (2 next to each other 4" X 4", 3" X 21/2") within 12" X 12" Dislodged area Feature 32, Deposit 1/8" X 3/8", no sample taken Feature 33, Deposit 1/2" X 3/8" no sample taken Feature 34, Deposit 1/2" X 3/4" no sample taken Feature 35, Deposit 1/2" X 1/2", no sample taken Enbridge Representative/ Inspector Signature Contractor Signature



	Coating Gauge	Information	
Manufacturer: Last Calibrated:	Elcometer Inspection Equip 09/15/2017	Product: Next Calibration Due:	211 Coating Thickness Gauge 09/15/2018
Gauge verified prior to use:	VES INO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	74	5	10:00
North of Anchor #2	85	5	2:00
South of Anchor #1	68	5	10:00
South of Anchor #2	74	5	2:00
Average Thickness	75		



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
(north end of feature)	IWIX	(center of feature)		(south end of feature) DFT #3 (mil)	
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature)	N/R
(record #2 for featur	es < 2" long; re	ecord #1 and #3 for features 3	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	
1.1.1.1	1	The second second second second	84		80
-	600	DFT Adjacent to Feature (mil)	84	DFT Adjacent to Feature (mil)	62
Temperature (°F)	56°	(~2" away from edge)	48	(~8"-12" away from edge)	52
		( 2 away nonnedger	66		64



(notifiend of leadine) -1313 (center of reaction) -1601 (center of reaction)	CP Reading #1 (mV)	-1524	CP Reading #2 (mV)	-1519	CP Reading #3 (mV)	-1484
Image: Construction of feature       <25	(north end of feature)	-1513	(center of feature)	-1507	(south end of feature)	-1479
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     72 65 57 (~2" away from edge)     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     75 70 88       Provide 1 to 2 photos of feature, below:     72     65     0	(north end of feature)	and the second sec	(center of feature)		(south end of feature)	<25
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     65     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     70       Provide 1 to 2 photos of feature, below:     65     80	(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     57°     Feature (mil) (~2" away from edge)     55 79     65 57     67       Provide 1 to 2 photos of feature, below:			DET Adiacont to	and the second se		
(~2" away from edge) 79 ( 8 -12 away nom edge) 80 Provide 1 to 2 photos of feature, below:	Tomas antitumo /PE)	570		and the second se		
Provide 1 to 2 photos of feature, below:	remperature ( r)	51			(~8"-12" away from edge)	
			( 2 anay nomeager	79		80
		to a set	All and a second			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; r	record #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
(record #2 for found		THE REPORT OF A LONG	N/R		11/15
and the second se	-	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F)	57°	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	es < 2" long; i	record #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
	1		N/R		N/F
Tempsonture (PE)	57°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	31	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/F



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
(north end of feature)		(center of feature)	Turte	(south end of feature)	
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; red	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	1
(144)	1	21 10 2 3 4 17 3 4 1 4 6 7 10	N/R		N/R
	F70	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F)	57°	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
		( 2 away nom edge)	N/R		N/F
	1				



DFT #1 (mil) (north end of feature)         N/R         DFT #2 (mil) (center of feature)         N/R         DFT #3 (mil) (south end of feature)         N/R           (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         N/R         N/R         N/R           Temperature (°F)         57°         DFT Adjacent to Feature (mil)         N/R         DFT Adjacent to Feature (mil)         N/R           N/R         DFT Adjacent to Feature (mil)         N/R         N/R         N/R         N/R	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N/F       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/F	DFT #1 (mil)	N/R		N/R	DFT #3 (mil) (south end of feature)	N/R
Temperature (°F)     57°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     57°     Feature (mil) (~2" away from edge)     N/R     Dr r Adjacent to reactive (mil) (~8"-12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R			DET Adjacent to	and the second se	i van de la serie a de la serie	
(~2" away from edge) N/R (~3-12 away from edge) N/R  Provide 1 to 2 photos of feature, below:	Temperature (°E)	57°		Contraction of the Contraction o		
Provide 1 to 2 photos of feature, below:	Temperature ( 1 )	0.			(~8"-12" away from edge)	
		_1	Provide 1 to 2 photos of	and the second second	ow.	-
		-	the second second			



CP Reading #1 (mV)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north end of feature) DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	$es < 2^*$ long; r	ecord #1 and #3 for features	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
(record ing for fourier			N/R		N/F
		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	57°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		(-2 away nomeuge)	N/R		N/F
	A.				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
	es < 2" long; re		2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
And a second second		and the first state of the	N/R		N/F
	57°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	57	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( - away nonneuge)	N/R		N/I
and the second second					

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	autourc Fit	otection and Coating Mea	Surementa	s (ioi reature # 5)	
CP Reading #1 (mV) (north end of feature)	-1513 -1505	CP Reading #2 (mV) (center of feature)	-1464 -1295	CP Reading #3 (mV) (south end of feature)	-149 -150
DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	<25	DFT #3 (mil) (south end of feature)	66
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
*	1		72		82
-	57°	DFT Adjacent to	72	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	58
Temperature (°F)	5/	Feature (mil)	82		80
		(~2" away from edge)	74		68

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.

	1					
Date:	10/6/17	Frame(HH:MM:SS)	00:36:47	Date:	Frame(HH:MM:SS)	

Note: CP reading #2 indicates a 169mV difference. It is due to possible CP reading fluctuation.



CP Reading #1 (mV)	N/A	CP Reading #2 (mV) (center of feature)	N/A	CP Reading #3 (mV) (south end of feature)	N/A
(north end of feature) DFT #1 (mil) (north end of feature)	N/A	DFT #2 (mil) (center of feature)	N/A	DFT #3 (mil) (south end of feature)	N/A
(record #2 for feature)	es < 2" long: r		2"-8" long; re	cord #1, #2 and #3 for features >8" long)	5.55
(record ne for reaction			N/A		N/A
Tel Contraction and		DFT Adjacent to	N/A	DFT Adjacent to Feature (mil)	N/#
Temperature (°F)	57°	Feature (mil) (~2" away from edge)	N/A	(~8"-12" away from edge)	N//
		( 2 away nom edge)	N/A		N//



Temperature (°F) 57	5 long; record	DFT Adjacent to Feature (mil) ~2" away from edge) ovide 1 to 2 photos of	71 73 45 79 feature, be	(south end of feature) DFT #3 (mil) (south end of feature) ecord #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge) low:	-1457 64 88 67 50 70
(north end of feature)     22       (record #2 for features < 2"       Temperature (°F)	long; record	(center of feature) d #1 and #3 for features DFT Adjacent to Feature (mil) ~2" away from edge) ovide 1 to 2 photos of	2"-8" long; re 71 73 45 79 f feature, be	(south end of feature) ecord #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)	88 67 50
Temperature (°F) 57	• (*	DFT Adjacent to Feature (mil) ~2" away from edge) ovide 1 to 2 photos of	71 73 45 79 feature, be	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	67 50
Temperature (°F) 57	• (*	DFT Adjacent to Feature (mil) ~2" away from edge) ovide 1 to 2 photos of	71 73 45 79 feature, be	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	67 50
- competition of ( ) /	(* Pro	Feature (mil) ~2" away from edge) ovide 1 to 2 photos of	45 79 feature, be	(~8"-12" away from edge)	50
Temperature ( 17)	(* Pro	~2" away from edge)	79 feature, be		
Include	Pro	ovide 1 to 2 photos of	feature, be	low:	70
Include	Pro d the date	ovide 1 to 2 photos of	feature, be	low:	



(north end of feature) DFT #1 (mil) (north end of feature) (record #2 for feature)	N/R	DFT #2 (mil)			
(record #2 for featur		(center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	es < 2" long; re	cord #1 and #3 for features :	2"-8" long; re	cord #1, #2 and #3 for features >8* long)	1.00
	DET	DFT Adjacent to	N/R	Contraction and a start	N/F
Temperature (°F)	57°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature ( 1)	01	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/F



DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil)	the second s	DET 49 (mail)	
1 10 5 5	0.000	(center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; reco	ord #1 and #3 for features 2	2"-8" long, re	cord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Tomas antiger (°E)	57°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	57	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away nonicage)	N/R		N/F



3

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; n	ecord #1, #2 and #3 for features >8" long)	
V - 17 - 20 - Fight State	1		N/R	The second second second	N/F
	E70	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	57°	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away nom edge)	N/R		N/F
		Æ			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; red	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	57°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F N/F N/F

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Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north end of feature) DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long, rec		2"-8" long; re-	cord #1, #2 and #3 for features >8" long)	2.0
			N/R		N/F
-		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	57°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( z away nomedge)	N/R		N/F
14	1	A			



( the sund of to other a)	-1501	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	-1475
(north end of feature) DFT #1 (mil) (north end of feature)	<25	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	<25
(record #2 for featu	res < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
1		1	88		82
		DFT Adjacent to	62	DFT Adjacent to Feature (mil)	50
Temperature (°F)	57°	Feature (mil) (~2" away from edge)	84	(~8"-12" away from edge)	66
		( 2 away nom edge)	86		96

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## Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)		ion and Coating Meas CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	54	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	60
(record #2 for feature	es < 2" long; record	d #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
franker and fer search.			100		100
	1000	DFT Adjacent to	80	DFT Adjacent to Feature (mil)	82
Temperature (°F)	57°	Feature (mil)	80	(~8"-12" away from edge)	51
		~2" away from edge)	62		74
		and time stamps asso			



CP Reading #1 (mV) (north end of feature)	-250 -243	CP Reading #2 (mV) (center of feature)	-331 -324	CP Reading #3 (mV) (south end of feature)	-287
DFT #1 (mil) (north end of feature)	72	DFT #2 (mil) (center of feature)	38	DFT #3 (mil) (south end of feature)	74
	es < 2" long;	record #1 and #3 for features 2	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	
	1	DET Adiagant to	80		120
Tomporature (°E)	57°	DFT Adjacent to Feature (mil)	100	DFT Adjacent to Feature (mil)	78
Temperature (°F)	57	(~2" away from edge)	72	(~8"-12" away from edge)	11(
	-	Provide 1 to 2 photos of 3	72		70

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

Note: Diver was mistaken when he observed the apparent holiday, and that DFT and CP readings confirm the existence of coating.



P Reading #1 (mV) north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feat	ures < 2° long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	N/R		N/I
Temperature (°F)	57°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
Temperature [ 1 ]		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of	N/R		N/



Temperature (°F) 57°	DFT #2 (mil) (center of feature) ng; record #1 and #3 for features DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of the date and time stamps asso	105 105 94 94 feature, bel		65 10! 95 94 95
Temperature (°F) 57°	DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	105 105 94 94 feature, bel	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	95 94
	Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	105 94 94 feature, bel	(~8"-12" away from edge)	95 94
Sector Contractor	Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	94 94 feature, bel	(~8"-12" away from edge)	94
Sector Contractor	(~2" away from edge) Provide 1 to 2 photos of	94 feature, bel	low:	
Included		feature, bel		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	82	DFT #2 (mil) (center of feature)	110	DFT #3 (mil) (south end of feature)	94
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	"-8" long; re	cord #1. #2 and #3 for features >8" long)	-
		DFT Adjacent to	100		110
Temperature (°F)	56°	Feature (mil)	94	DFT Adjacent to Feature (mil)	100
Temperature ( 1 )		(~2" away from edge)	110 125	(~8"-12" away from edge)	12
		Provide 1 to 2 photos of fe	eature, bel	ow:	
		- P			
	1				



(north end of feature) DFT #1 (mil)	N/D	1 1 11 1 1		fronth and of fashing)	51/5
DF1 #1 (mil)	N/R	(center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature)	N/F
(record #2 for feature	es < 2* long; re	cord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R	- the second second second	N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	Provide 1 to 2 photos of f	N/R		14/1





CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
	1	TT	N/R		N/F
		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	56°	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
	1	(~2" away from edge)	N/R		N/F
	1.0				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	120	DFT #2 (mil) (center of feature)	74	DFT #3 (mil) (south end of feature)	72
(record #2 for featur	es < 2" long, re-	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	115		13
Temperature (°F)	56°	Feature (mil)	115	DFT Adjacent to Feature (mil)	12
		(~2" away from edge)	115	(~8"-12" away from edge)	16
		Provide 1 to 2 photos of 1	110		16



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	135	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	14
(record #2 for feature	is < 2" long; red	cord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
			145		14
Townson from ISEN	56°	DFT Adjacent to Feature (mil)	135	DFT Adjacent to Feature (mil)	9
Temperature (°F)	50	(~2" away from edge)	145	(~8"-12" away from edge)	10
	-	( 2 away nom cuge)	115		13



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for features	s < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
A PERSONAL AND A PERSON AND A P	1		N/R		N/F
	F.C.9	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F)	56°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
	1	( 2 away nom edge)	N/R		N/F
	Ne.				
	X				
				Frame(HH:MM:SS)	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
1.00012.00			N/R	NOT A SAME AND AND	N/
T	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
Temperature (°F)	50	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/I

Note



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	s < 2* long; reco	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	56°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F N/F N/F
	Trent				
ate: 10/9/17 Frame	e(HH:MM:SS)	00:12:10 Date		Frame(HH:MM:SS)	

Note



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	90	DFT #2 (mil) (center of feature)	92	DFT #3 (mil) (south end of feature)	88
(record #2 for feature	s < 2" long; reco	ord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	90		105
Temperature (°F)	56°	Feature (mil)	105	DFT Adjacent to Feature (mil)	11
		(~2" away from edge)	110	(~8"-12" away from edge)	8
		Provide 1 to 2 photos of f	100		10
Contraction of the					



DFT #1 (mil) (north end of feature)       88       DFT #2 (mil) (center of feature)       88       DFT #3 (mil) (south end of feature)       96         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long;       96       96         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       120 108       DFT Adjacent to Feature >8" long; (~8"-12" away from edge)       91 120 120         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       120 120       120	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     112 120 90 (~2" away from edge)     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     90 122 (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:	DFT #1 (mil) (north end of feature)	677	(center of feature)		(south end of feature)	96
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     112 120 90 108     DFT Adjacent to Feature (mil) 90 (~8"-12" away from edge)     90 123 124       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     120 108     120 (~8"-12" away from edge)     120 123	(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 2	2*-8* long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     120     DFT Adjacent to relative (mil)       90     (~8"-12" away from edge)     12       108     Provide 1 to 2 photos of feature, below:		-			CONTRACTOR CONTRACTOR CONTRACTOR	
(~2" away from edge) 108 12 away from edge, 12 Provide 1 to 2 photos of feature, below:	T	EC°		and the second se		
Provide 1 to 2 photos of feature, below:	Temperature ( F)	50			(~8"-12" away from edge)	
			( 2 away nom cuge)	108		12

Note



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	s < 2° long, rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8° long)	
	DFT Adjacent to		N/R		N/I
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
(compendance ( ) )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
	1. 1	Provide 1 to 2 photos of f	N/R		N/I
14	hand	1-1-3/4			



DFT #1 (mil) (north end of feature) (record #2 for feature Temperature (°F)	N/R es < 2" long; rec	DFT #2 (mil) (center of feature) cord #1 and #3 for features 2	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/I
	es < 2" long; rec	cord #1 and #3 for features 2			
		and the new rent routined z	-8 long; re	cord #1, #2 and #3 for features >8" long)	
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	56°	DFT Adjacent to Feature (mil)	N/R N/R N/R	DFT Adjacent to Feature (mil)	) N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I N/I
6	aluded the a	Provide 1 to 2 photos of fe te and time stamps assoc	eature, belo	ow:	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N
(record #2 for feature:	s < 2* long, reco	ord #1 and #3 for features 2	-8" long; re	cord #1, #2 and #3 for features >8" long)	
		N/R			
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N
and an and a start of the		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of f	N/R		N
	1.123	Sec.			



Temperature (°F) 5	56°	DFT #2 (mil) (center of feature) rd #1 and #3 for features 2 DFT Adjacent to Feature (mil) (~2" away from edge) rovide 1 to 2 photos of to and time stamps assoc	N/R N/R N/R N/R eature, belo		N/F N/F N/F N/F
Temperature (°F) 5	56°	DFT Adjacent to Feature (mil) (~2" away from edge) rovide 1 to 2 photos of t	N/R N/R N/R N/R eature, belo	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/I N/I
	P	Feature (mil) (~2" away from edge) rovide 1 to 2 photos of f	N/R N/R N/R eature, belo	(~8"-12" away from edge)	N/I N/I
	P	(~2" away from edge) rovide 1 to 2 photos of t	N/R eature, belo	(~8"-12" away from edge)	N/
Includ			eature, belo		14/1

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Diver Inspection Form for L5 Straits of Mackinac

-		Gene	ral Information	l'	
Date:		10/22/17	Diver:	1.	Brad Joanis
AFE/W	- Contraction of the Contraction	20011702		ep/Inspector:	orau Joanis
Pipe Support Anchor: E Longitude:		E-14 (E-34A / E-34B South)	Water Depth		
			Latitude:	jig.	the second s
		Diver In	spection Reco	-T	
	Location of				
Feature Number	Feature (w.r.t. pipe suppor		on Measured Feature size (ft <sup>2</sup> )		ification of Feature
	NO FEATURES South of anchor			Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
	NO FEATURES North of anchor	-		Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal
				Dislodged Area	Holiday (bare metal
				Dislodged Area     Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal
				Dislodged Area	Holiday (bare metal)
				Dislodged Area     Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
				Dislodged Area     Deposit	Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
_				Dislodged Area	Disturbed Area Holiday (bare metal)
served. H	able rows as necess Feature numbering s eo images)	ary to identify all features starts at top row (for	Biota present:	⊠ Doposit	
	coating observed	on the lake floor:	Lake floor location wrt pipe:	In span 18" off I 6' North of anch	ake floor at anchor or pipe at 6 o'clock

Comments/Issues/Discussion

ENBRIDGE	Diver Inspection Form for L5 Straits of Mackinac				
No features iden	tified South of anchor tified North of anchor s at 4' 8' North of anchor				

Manufacturer: Last Calibrated: Gauge verified prior to use:	Coating Gauge Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	100
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R		



Ca	ithodic Pro	otection and Coating Meas	urements	s (for Feature # N/A)	
(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/I
DFT #1 (mil)	N/R	DFT #2 (mil)	N/R	(south end of feature) DFT #3 (mil)	
(north end of feature)		(center of feature)		Courth and offer the st	N/1
(record #2 for reature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	-
		and the second s	N/R	3/	N/I
Temperature (°F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
	00	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	
		( z away nom edge)	N/R	- ( s and in on euge)	N/I

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.



Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

NO FEATURES SOUTH OF ANCHOR

NO FEATURES NORTH OF ANCHOR

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		Gener	al Information		
Date: AFE / W Pipe Su	pport Anchor:	10/22/17 20011702 E-15 (E-34B South / E-34B North)	Diver: Br Company Rep / Inspector: Water Depth (ft):		rad Joanis
Longitu		NO(1)	Latitude:		
			pection Recor	rd .	
Feature Number	Location of Feature (w.r.t. pipe suppor	Circumferential Positio			fication of Feature
1	3' South	9:00	0.0002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
2	3' North	6:00	0.0004 (¼" X ¼")	□ Dislodged Area ⊠ Deposit	□Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
		1		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
		14		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
			1	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit     Dislodged A	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit     Dislodged Area	Holiday (bare metal)
				Deposit     Dislodged Area     Dislodged Area	□Holiday (bare metal) □Disturbed Area
3: insert ta	ble rows as necessa	ary to identify all features	and the second second	Deposit	□Holiday (bare metal) □Disturbed Area
served. F	eature numbering s o images)	tarts at top row (for	Biota present:	⊠YES	□ NO
islodged IYES 🛛	coating observed NO	on the lake floor:	Lake floor location wrt pipe:	In span 8" - 1,	2" off lake floor



 Commer	nts/Issues/Discussion
Contractor Signature	

a second and a second s	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/D
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R	1	



# Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	-
	and the second sec	DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	Provide 1 to 2 photos of t	N/R		N/F
		- marine			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 3	2"-8" long, r	ecord #1, #2 and #3 for features >8" long)	
			N/R	in the and so for features >6 long)	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
and the second sec	2.4	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	Provide 1 to 2 photos of 1	N/R		N/F
	2			video surveillance.	
a da	1			ndeo surveinance.	



		Gene	ral Information		
Date:		10/22/17	Diver:	T	Brad Joanis
AFE / W		20011702		p/inspector:	or ad Judi 112
Pipe Su	pport Anchor:	E-15 (E-348 South / E-348 North)	Water Depth (ft):		
Longitu	de:		Latitude:		
		Diver In:	spection Recor	rd	
Feature Number	Location of Feature (w.r.t. pipe suppo	of the Feature	on Measured Feature size (ft?)		sification of Feature
1	3' South	9:00	0.0002 (½" X ½")	Dislodged Area	□Holiday (bare metal □Disturbed Area
2	3' North	6:00	0.0004 (½° X ½°)	Dislodged Area	Holiday (bare metal)
_				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
		1.0		Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
-				Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
	<u></u>			Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
3' insert te	able rowe as passes			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
served. F	Feature numbering eo images)	sary to identify all features starts at top row (for	Biota present:	⊠YE	S 🗆 NO
islodged IYES 🛛	coating observed	I on the lake floor:	Lake floor location wrt pipe:	ín span 8" -	12" off lake floor

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 Commen	ts/Issues/Discussion

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence o	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	AUD.
South of Anchor #2	N/R	0.000	N/R N/R
South of Anchor #2 Average Thickness	1.0.1.0	N/R	N/R N/R



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2° long; rec	cord #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R	in the feet found to forigr	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	1.0.1	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
	-	Provide 1 to 2 photos of 1	N/R	1	N/F
		nte and time stamps asso		video surveinance,	
				video surveinance,	



## Diver Inspection Form for L5 Straits of Mackinac

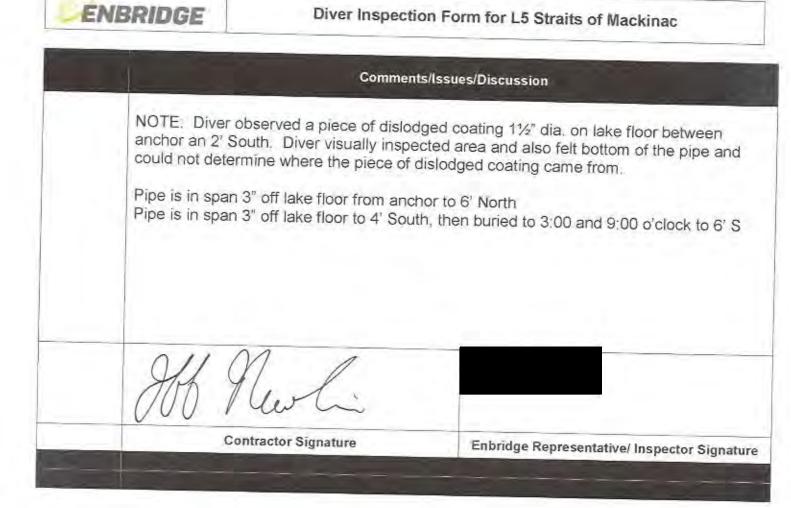
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/
(record #2 for featur	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		a false being the second second	N/R	( in the second s	N/
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	1000	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/
Alter and	-				

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		Gener	al Information		
Date: AFE / W. Pipe Sup	O.#: oport Anchor:	10/29/17 20011702 E-16 (E-32A-A / E-32A	Diver: Company Re Water Depth	ep / Inspector:	oy Baskett
Longitu		South)	Latitude:		
		Diversity			
Feature Number	Location of Feature (w.r.t. pipe support	Circumferential Position of the Feature	Measured Feature size (ft <sup>2</sup> )		fication of Feature
1	2' South	12:00	0.01	Dislodged Area	□Holiday (bare metal
2	3' North	12:00	(1" X 1") 0.02	Deposit	Disturbed Area
3	3' North	11:00	(3" X 1") 0.01 (1" X 1")	Deposit     Dislodged Area     Deposit	Disturbed Area
4	1' 6" North	12:00	0.01 (2" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area Holiday (bare metal) Disturbed Area
_				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
-			1	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
-				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
2: incast i	ble sources			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
served. F	eature numbering s eature numbering s eo images)	ary to identify all features tarts at top row (for	Biota present:	⊠YES	D NO
islodged YES 🗆	coating observed NO	on the lake floor:	Lake floor location wrt pipe:	In span 3"	off lake floor





and a second second	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	A support of the star has been as a support of the
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/D
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/I
(record #2 for feature	es < 2" long;	record #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
			N/R	interacting so tor reactines >o torig)	N/I
Temperature (°F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/I
		Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/I
		date and time stamps asso		video surveinance.	
			Area with	video surveinance.	and

 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:10:29
 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:14:14

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:14:14

(north end of feature)	Cathodic P N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/R
(record #2 for featur	es < 2" long;	record #1 and #3 for features 2	2"-8" long: r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
		and the second sec	N/R	long) and #3 for reatures >8" long)	K1/
Temperature (°F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/I
	00	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		( 2 away nonredge)	N/R	( = se smaj nom cuge)	N/I
		22			

 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:15:26
 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:18:21

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:18:21



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for feature	es < 2° long; red	cord #1 and #3 for features 2	2"-8" long: r	(south end of feature) ecord #1, #2 and #3 for features >6" long)	
1.		All starts in the second se	N/R	long)	N/F
Temperature (°F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
		Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of f	N/R		N/F

 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:16:04
 Date:
 Frame(HH:MM:SS)

 Note:
 CP
 readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long;	record #1 and #3 for features 3	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		and the second sec	N/R	(initial and so for reduites 20 long)	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	83.0	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of 1	N/R		N/F

ENBRIDGE

		G	eneral Information		
Date:		10/29/17	Diver:	5	cott Woodward
AFE / W.	0.#:	20011702	Company Re	p / Inspector:	1111
Pipe Sup	oport Anchor:	E-17 (E-32A South / E 32A North)	- Water Depth	(ft):	
Longitue	de:		Latitude:		
		Dive	r Inspection Recor	rd	
Feature Number	Location of Feature (w.r.t. pipe suppo	Position of the	Measured Feature size (ft²)	Visual Class	ification of Feature
1	5' 6" South	3:00 - 12:00	0.75 (6" X 18")	Dislodged Area	Holiday (bare metal Disturbed Area
2	Anchor to 6' Sou	uth 360°	21.99 (72" X 62.83")	Dislodged Area	Holiday (bare metal)
3	3' 6" South	9:00	0.01 (1" X 1½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
	NO FEATURE North of anche			Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
-				Dislodged Area	Holiday (bare metal
-				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
eatures ob		ssary to identify all numbering starts at top s)	Biota present:	ØYE	S 🗆 NO
	d coating observe	ed on the lake floor:	Lake floor location wrt pipe:	in span 2	4" off lake floor



	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES NO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence (	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



Temperature (°F)	56°	DFT #2 (mil) (center of feature) d #1 and #3 for features 2 DFT Adjacent to Feature (mil) (~2" away from edge) rovide 1 to 2 photos of and time stamps asso	N/R N/R N/R N/R feature, be	DFT #3 (mil) (south end of feature) ecord #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge) flow: n video surveillance.	N/F
Temperature (°F)	56°	DFT Adjacent to Feature (mil) (~2" away from edge) rovide 1 to 2 photos of 1	N/R N/R N/R N/R feature, be	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
	Pi	Feature (mil) (~2" away from edge)	N/R N/R N/R feature, be	(~8"-12" away from edge)	N/F N/F N/F
	Pi	Feature (mil) (~2" away from edge)	N/R N/R feature, be	(~8"-12" away from edge)	N/F
	Pi	(~2" away from edge)	N/R feature, be	low:	
Incl	PI	ovide 1 to 2 photos of	feature, be	elow: a video surveillance,	N/F
Incl	Pi luded the date	rovide 1 to 2 photos of and time stamps asso	feature, be ciated with	ilow: a video surveillance,	
	and and	-			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	1 (mil) DFT #2 (mil) N/P		N/R	DFT #3 (mil) (south end of feature)	
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	1.1
		DET Allessantes	N/R		N/I
Temporatura (PE)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
Temperature (°F)	30	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		( 2 away nom eage)	N/R		N/
	cluded the	date and time stamps asso	eature, be ciated with		
	ocluded the				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	I) DFT #2 (mil)		DFT #3 (mil) (south end of feature)	N/	
(record #2 for featur	es < 2" long; rece	ord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
the formation ( ) ( )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/
		e and time stamps asso	ciated with	i video surveillance.	
		e and time stamps asso	ciated with	i video surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/
(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 3	2"-8" long; n	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	I ST III.	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of t	N/R		N/
		te and time stamps asso	clated with	video surveillance.	
			clated with	video surveillance.	

ENBRIDGE

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		Gen	eral Information		
Date:		10/29/17	Diver:		Chad Cantrell
AFE/W.	0.#:	20011702	Company Re	p/Inspector:	ense control
Pipe Sup	oport Anchor:	E-18 (E-32A North / E- 32B South)	Water Depth		
Longitu	de:		Latitude:		
		Diver I	nspection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe suppor	Circumferential Position of the	Measured Feature size (ft²)		sification of Feature
1	4' 6" South	9:00	0.08 (6" X 2")	Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
2	4' 4" South	11:00	0.002 (1" X ¼")	Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
3	3' 3" South	1:00	0.01 (1" X 1½")	Dislodged Area	☐Holiday (bare metal ☐Disturbed Area
4	3' 3" South	2:30	0.002 (1" X ¼")	Dislodged Area	□Holiday (bare metal □Disturbed Area
5	3' 3" South	4:00	0.50 (6" X 12")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
6	2' North	11:00 - 9:00	0.50 (12" X 6")	Dislodged Area	Holiday (bare metal)     Disturbed Area
7	5' North	7:00	0.04 (1" X 6")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
8	Anchor to 6' North	360°	1.57 (72" X 62.83")	☑ Dislodged Area □ Deposit	Holiday (bare metal)     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
D 1				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
eatures ob	able rows as neces: served. Feature nu ailed video images)	mbering starts at top	Biota present:	⊠YE	ES 🗆 NO
Dislodged VES D	l coating observed	l on the lake floor;	Lake floor location wrt pipe:	In span 2	24* off lake floor



Comments/Issues/Discussion
----------------------------

Fea	ature 8, Dislodged area is approxima er wrap missing	ately 5% of area from anchor to 6' North that has
4	ULA 1	
	Contractor Signature	Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	and a state of the
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R YES INO	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	s Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		and the second sec	N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R DFT Ad	DFT Adjacent to Feature (mil)	N/F
	50	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			N/R		N/F
		date and time stamps asso			

 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:12:41
 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:13:29

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:13:29





DFT #1 (mil) (north end of feature) (record #2 for feature Temperature (°F)	N/R s < 2" long; rec	(center of feature) DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	
	s < 2" long; red			(south end of feature)	N/
		ord #1 and #3 for features :	2"-8" long; n	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)			N/R		N/
	58°	DFT Adjacent to Feature (mil)	N/R DFT Adjacent to Feature (mi N/R (~8"-12" away from edge)	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)		(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/



CP Reading #1 (mV (north end of feature		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature	1.	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for fea	itures < 2" long;	record #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to			N/F
Temperature (°F)	58°	Feature (mil)	N/R	Di i Adjacent to i eature (init)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/I
- 1 - 1	(market a	A State State of the			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/1
(record #2 for feature	es < 2* long;	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	-
		N/R		N/I	
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/
and the second se	and the second	the second se			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for featur	es < 2° long; re	ecord #1 and #3 for features 2	2°-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1		dauu	N/
				n video surveillance.	



# Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long;	record #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		and the second se	N/R		N/
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	24	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of 1	N/R		N/
		and a second			



## Diver Inspection Form for L5 Straits of Mackinac

P Reading #1 (mV) orth end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) orth end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featu	ires < 2" long; re	ecord #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	N/R		N/F
emperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	_	Provide 1 to 2 photos of 1	N/R		N/F
12			ciated with	n video surveillance.	
			ciated with	i video surveillance.	
			ciated with	i video surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for feature	es < 2" long; reco	ord #1 and #3 for features :	2"-8" lona: r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
			N/R	ind wit, we and wo for realities >6 long)	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of t	N/R		N/F
	1	e and time stamps asso	clated with	video surveillance.	
		e and time stamps asso	clated with	video surveillance.	
		e and time stamps asso	clated with	video surveillance.	



Date:		10/29/17	Diver:		George Palmer
AFE / W.	O.#:	20011702	Company Rep / Inspector		
Pipe Sup	port Anchor:	E-19 (E-32B South / H		and the second sec	
1121		32B North)	1	· · · · · · · · · · · · · · · · · · ·	
Longitue	le:		Latitude:		
		Div	er Inspection Recor	d.	
Feature Number	Location of Feature (w.r.t. pipe suppo	Position of the	Measured Feature size (ft²)	Visual Clas	ssification of Feature
1	5' 8" South	6:00	1.42 (12" X 17" Di) 0.58 (12" X 7" D)	Dislodged Area	Holiday (bare metal) Disturbed Area
2	3' South	8:00	0.02 (3" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
3	2' 6" South	4;00	0.002 (½" X ½")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
4	2' 6" South	6:00	0.02 (3" X 1")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
5	6' to anchor South	360°	9.42 (72" X 62.83")	Dislodged Area	
6	2' North	6:00	0.01 (1" X.1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
7	5' 5" North	8:00	0.002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
8	5' 8" North	12:00 - 9:00	0.02 (12" X ¼")	Dislodged Area     Deposit	
9	6' to anchor North	360°	9.42 (72" X 62.83")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
_				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
ľ		-		Dislodged Area     Deposit	and the second se
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
eatures o		essary to identify all numbering starts at ages)	Biota present:		YES INO
the second s	d coating observ □YES ⊠NO	ed on the lake	Lake floor location wrt pipe:	In spa	n 24" off lake floor



	Comments/Issues/Discussion
Feature 1, Deposit 12" X 7" with	in a Dislodged 12" X 17" area
Feature 5, Dislodged area is ap outer wrap missing	proximately 30% of area from anchor to 6' South that has
Feature 9, Dislodged area is ap outer wrap missing	proximately 30% of area from anchor to 6' North that has
Sottal	
Contractor Signature	e Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	TYES NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; reco	ord #1 and #3 for features 3	2*-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DET Adiacont to	N/R		N/
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
remperature ( r )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/
	Station L. C.				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long	record #1 and #3 for features	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature(1)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of	N/R		N/I
- W- The	32	and the second second			

 Date:
 10/29/17
 Frame(HH:MM:SS)
 00:19:34
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 Image: CP reading will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for featur	es < 2" long; reco	ord #1 and #3 for features	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	res < 2" long; re	cord #1 and #3 for features	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	Provide 1 to 2 photos of	N/R		N/



Temperature (°F)	56° (~:	DFT #2 (mil) (center of feature) #1 and #3 for features 2 DFT Adjacent to Feature (mil) 2" away from edge) vide 1 to 2 photos of nd time stamps asso	N/R N/R N/R N/R feature, be	DFT #3 (mil) (south end of feature) record #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F N/F N/F
Temperature (°F)	56° (~:	DFT Adjacent to Feature (mil) 2" away from edge) vide 1 to 2 photos of	N/R N/R N/R N/R feature, be	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
	56° (~: Prov	Feature (mil) 2" away from edge) vide 1 to 2 photos of	N/R N/R N/R feature, be	(~8"-12" away from edge)	N/F
	56° (~: Prov	Feature (mil) 2" away from edge) vide 1 to 2 photos of	N/R N/R feature, be	(~8"-12" away from edge)	N/F
	(~: Prov	2" away from edge) vide 1 to 2 photos of	N/R feature, be	elow:	
In	Prov	vide 1 to 2 photos of	feature, be	alow: h video surveillance.	N/F
	Prov acluded the date a	vide 1 to 2 photos of nd time stamps asso	feature, be ciated with	elow: h video surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; reco	rd #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature (1)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	rovide 1 to 2 photos of	N/R		N/I
	1.11	<ul> <li>Mail Rest</li> </ul>			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)		CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
	DFT Adjacent to		N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; reco	rd #1 and #3 for features 2	2"-8" long; n	ecord #1, #2 and #3 for features >8" long)	1.1
		DET Adiagant to	N/R		N/F
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( 1 )		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		rovide 1 to 2 photos of	N/R		N/I
	and the	Contraction of the second second			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	res < 2" long; re	cord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R DF	DFT Adjacent to Feature (mil)	N/F
	22	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	Provide 1 to 2 photos of 1	N/R		N/F



		G	eneral Information	10	
Date:		10/29/17	Diver:		Maurice Unger
AFE / W	.0.#:	20011702	Company Re	p / Inspector:	Madrice Ofiger
Pipe Sup	oport Anchor:	E-20 (E-39A / E-39B)	Water Depth		
Longitude:			Latitude:	(1.2):	
		Dive	er Inspection Reco	rd	-
Feature Number	Location of Feature (w.r.t. pipe suppo	f Circumferentia Position of the	Measured Feature		ssification of Feature
1	Anchor to 6 South		31.41 (72" X.62.83")	Dislodged Area	A light of the second sec
		9:00	0.06	and the second sec	Disturbed Area
2	5' 4" North		(3" X 3")	Dislodged Area	Holiday (bare metal) Disturbed Area
3	Anchor to 6'	360°	31.41	Dislodged Area	
9	North		(72" X 62.83")	Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
				Dislodged Area	, , , , , , , , , , , , , , , , , , , ,
			-	Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area	
	_			Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
			1.	Deposit	Disturbed Area
				Dislodged Area	□Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
1				Dislodged Area Deposit	Holiday (bare metal)
atures ob:	able rows as neces served. Feature n video images)	ssary to identify all umbering starts at top ro	w Biota present:		ES INO
)islodged ]YES 🗵	coating observe	d on the lake floor:	Lake floor location wrt pipe:	In span	24" off lake floor



	Comments/Issues/Discussion
Feature 1, Dislodged area is a has outer wrap missing	approximately 100% of area from anchor to 6' South that
Feature 3, Dislodged area is a outer wrap missing	approximately 100% of area from anchor to 6' North that has
CP Open water reading -210/- Feature 2 – No change in CP -271/-273 -249/-257 -217/-227	-220 readings to indicate on/off potentials
-210/-220 Honel	
Contractor Signatu	re Enbridge Representative/ Inspector Signature

and a strength of the strength	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	s Inspection Data (complete	e this table in the absence o	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	ection and Coating Mea CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/I
(record #2 for featur	es < 2" long; reo	ord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	_
	1		N/R	(ong)	N/F
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of 1	N/R		N/F
		te and time stamps asso	ciated with	video survemance.	
			ciated with	video survemance.	



DFT #1 (mil) (north end of feature) (record #2 for feature Temperature (°F)	N/R es < 2* long; red	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	_
	es < 2* long; ree			(south end of feature)	N/
		cord #1 and #3 for features	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
Temperature (°F)			N/R		N/I
	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
	1.54	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of	N/R		N/
		5			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/
	-	Provide 1 to 2 photos of 1	N/R		N/
	1				



-			Ger	neral Information		
Date:		10/2	9/17	Diver:		Brad Joanis
AFE/W.		20011702 Company Rep / Inspe		/ Inspector:	biad Joanis	
			(E-40A / E-40B)	Water Depth (		
Longitude:				Latitude:	4	
			Diver	Inspection Reco	rd	
Feature Number	Location of Fe (w.r.t. pipe supp		Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )		sification of Feature
1	Anchor to 6' Se	outh	3:00	1.57 (72" X 62.83")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
2	1' North		1:00	0.004 (1" X ½")	Dislodged Area	Disturbed Area     Disturbed Area     Disturbed Area
3	5' 6" North	-	6:00	0.06 (4" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area Holiday (bare metal) Disturbed Area
4	Anchor to 6' No	orth	360°	1.57 (72" X 62.83")	Dislodged Area	Holiday (bare metal)     Disturbed Area
5	5 3' 6" North		12:00	0.01 (1" X 1")	Dislodged Area	Holiday (bare metal) Disturbed Area
					Dislodged Area     Deposit	Disturbed Area
		_			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
-		-			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal)□Disturbed Area
		_			Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
		-			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
		-			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
		-			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Hollday (bare metal) □Disturbed Area
B' insert to	ble rows as second		ide dit our		Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
atures obs	able rows as neces served. Feature nu ailed video images	Imberi	ng starts at top	Biota present:	⊠Y	ES 🗆 NO
IYES 🛛	coating observe	d on th	ne lake floor:	Lake floor location wrt pipe:	ln span	7" off lake floor



	the second se	ents/Issues/Discussion
Fea	ature 1, Dislodged area is approximer wrap missing	ately 5% of area from anchor to 6' South that has
Fea	ture 4, Dislodged area is approxim er wrap missing	ately 5% of area from anchor to 6' North that has
Ope No	en water reading -197/-196 change in CP readings on deposits	to indicate on/off potentials
Fea -277	ture 2 7/-266 7/-266	
Fea	ture 3 No reading due to the CP g	un not fitting under the 7" span under pipe
Feat -271 -278	cure 5 /-260 /-267 /-250	
9	16 Newli	
	Contractor Signature	Enbridge Representative/ Inspector Signatur

and the second	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	1
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R		



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for feature	s < 2" long; re	ecord #1 and #3 for features 2	2"-8" long: r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
			N/R	long)	AUT
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	Provide 1 to 2 photos of t	N/R		N/F
		ate and time stamps asso			
e: 10/29/17 Frame	e(HH:MM:SS				



CP Reading #1 (mV)		otection and Coating Mea CP Reading #2 (mV)	a caronici		
(north end of feature)	N/R	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for feat	ures < 2" long;	record #1 and #3 for features 2	2"-8" long; r	record #1, #2 and #3 for features >8* long)	
	1.1	DFT Adjacent to	N/R		N/F
Temperature (°F)	58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
1	- C	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of t	N/R		N/F
1. 19 / - 2 1		25			



THE PLAT OF 100	(mV)	N/R	CP Reading #2 (mV)	N/R	ts (for Feature # 3) CP Reading #3 (mV)	
(north end of feat DFT #1 (mil)	(ure)		(center of feature)	INIX	(south end of feature)	N/F
(north end of feat	ture)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for	r features	< 2" long; re	ecord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
			Second a second second	N/R		N/F
Temperature (°	'F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
			(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			Provide 1 to 2 photos of 1	N/R		N/F
	-					



CP Reading #1 (mV) (north end of feature)	N/R	tection and Coating Mea CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	NI
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
	res < 2" long; re	cord #1 and #3 for features		(south end of feature) ecord #1, #2 and #3 for features >8" long)	N/F
			N/R	ecord #1, #2 and #3 for features >8" long)	- 110
Temperature (°F)	58°	DFT Adjacent to	N/R	DET Adiasantes E	N/F
i emperature ( r)	20	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R	( 0 12 away from edge)	N/F
1	poludad the de	Provide 1 to 2 photos of a ate and time stamps asso	eature, be	low:	



CD D	actioule Pr	otection and Coating Mea	surement	ts (for Feature # 5)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
(north end of feature)	DFT #1 (mil) DF end of feature) N/R DF (center)		N/R	DFT #3 (mil)	N/F
(record #2 for feature	es < 2" long; i	record #1 and #3 for features 3	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
		Contraction of the second s	N/R	(in the second rest rest rest rest rest rest rest rest	N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
1000 - CONTRACT 100	00	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( = andy nonredge)	N/R		N/F
	(Ak	date and time stamps assoc			



			Ge	neral Information		
Date:		10/	28/17	Diver:	Ke	evin Lewis
AFE / W.	D.#:	200	)11702	Company Rep /	Inspector:	6
Pipe Support Anchor: E-2 Longitude:		E-2	3 (E-45A / E-45B)	Water Depth (ft)		
				Latitude:		
			Dive	Inspection Record	<b>1</b>	
Feature Number	Location of Fea (w.r.t. pipe suppo	24.9.61	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Classi	fication of Feature
1	2' 4" to North		12:00	0.07	Dislodged Area	Holiday (bare metal)
	2 4 10 110/11			(2½" X 4")	Deposit	Disturbed Area
2	2' 2" North		12:00 - 6:00	0.02	Dislodged Area	Holiday (bare metal)
4	Z Z NORTH			(1/4" X 12")	Deposit	Disturbed Area
			5:00	0.50	I Dislodged Area	Holiday (bare metal)
3	3' 6" North			(6" X 12")	Deposit	Disturbed Area
			1:00	0.01	Dislodged Area	Holiday (bare metal)
4	3' 8" North			(8" X 1/4")	🗵 Deposit	Disturbed Area
	In the set of the		11:00	0.003	Dislodged Area	Holiday (bare metal)
5	4' 8" North		0.010.00	(2" X 1/4")	🗵 Deposit	Disturbed Area
	ind man of		1:00	0.02	Dislodged Area	Holiday (bare metal)
6	5' 8 " North			(9" X 1/4")	Deposit	Disturbed Area
			6:00 - 9:00	0.62 (5" X 18" Di)	Dislodged Area	Holiday (bare metal)
7	5' 10" North		0.00 - 5.00	0.17 (4" X 6" D)	⊠ Deposit	Disturbed Area
_	NO FEATURES	2		0.17 (4 X 0 0)	Dislodged Area	Holiday (bare metal)
	SOUTH OF ANCHOR	5			Deposit	Disturbed Area
_	Anonon				Dislodged Area	Holiday (bare metal)
					□ Deposit	Disturbed Area
		-			Dislodged Area	□Holiday (bare metal)
	14		1	· · · · · · · · · · · · · · · · · · ·	Deposit	Disturbed Area
-		-			Dislodged Area	Holiday (bare metal
			a company of the second	1	Deposit	Disturbed Area
				1	Dislodged Area	□Holiday (bare metal
			1		Deposit	Disturbed Area
1		-			Dislodged Area	Holiday (bare metal
	1				Deposit	Disturbed Area
	-	-	-		Dislodged Area	□Holiday (bare metal
					Deposit	Disturbed Area
					Dislodged Area	Holiday (bare metal
						Disturbed Area
	table rows as nece			Riota present:		
	bserved. Feature n etailed video images		ening starts at top	Biota present:		
	ed coating observe		n the lake floor:	Lake floor location wrt pipe:	In span	12" to lake floor



Diver Inspection Form for L5 Straits of Mackinac

# Comments/Issues/Discussion Feature 7, Deposit 4" X 6" is within a Dislodged 5" X 18" area NO FEATURES IDENTIFIED SOUTH OF ANCHOR NOTE: Due to a technical issue of losing power it caused the loss of Diver video (no Diver video images were captured). The photo (6' to anchor North) in report was captured by the ROV with limited visibility due to the fast current and particulates in the water. Model Model Model Model Contractor Signature Enbridge Representative/ Inspector Signature

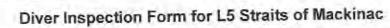
	Coating Gauge	Information	and the second sec
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	I YES INO		and so that they wanted
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
			1.00
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
(rocord and for rocard			N/R		N/F
	1000	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54°	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R		N/F
		and the second second			

 Date:
 10/28/17
 Frame(HH:MM:SS)
 2:48:40
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 3	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
(100010 112 101 10011112) - 01		I HAD STREET	N/R	-	N/F
- /051	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/I
See c	omments				
See c	comments				

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and the second	of longs (shift, \$1.00)	10 AT 10 AT 10
	JODII	and the line
- C. I	VBRIL	

and the second se		rotection and Coating Mea CP Reading #2 (mV)		CP Reading #3 (mV)	NUD
CP Reading #1 (mV) (north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for featu	res < 2" long;	record #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
THE STIFF OF OF SECOND	The second se	N/R		N/F	
Temperature (°F)	54°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
		Feature (mil) (~2" away from edge)	N/R		N/F
		Provide 1 to 2 photos of	N/R		N/F
See	comment	s			

# Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; r	record #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	The same balance and the	N/R		N/F
		DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
	-	Provide 1 to 2 photos of	N/R		N/
See o	comments				
See o	omments				

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CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
	54°	The second second	N/R		N/R
		DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
Secon	omments				
	Unino 110				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
Actor			N/R	DFT Adjacent to Feature (mil)	N/F
-	F 40	DFT Adjacent to	N/R		N/F
Temperature (°F)	54°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	( 2 away nom euge)	N/R		N/F
See c	omments				
See c	omments				

1000	1 1 1 1 1 1 1 1	1000	100 mm
	V F< 6	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ALC: NOT THE OWNER OF
- Int	VBR	C Harrison	le iles

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	nil) N/R DFT #2 (mil) N	N/R	DFT #3 (mil) (south end of feature)	N/R	
(record #2 for feature	es < 2* long; r	ecord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
Temperature ( ) /		(~2" away from edge)	N/R N/R	- 12 away nom euger	N/I
See c	omments				
See c	omments				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2° long; m	ecord #1 and #3 for features :	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	N/R		N/F
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
remperature ( 1 )	34	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/



			Gen	eral Information		
Date:		10/28/17		Diver:	F	Brad Joanis
AFE / W.	0.#:	20011702	1.	Company Rep		
Pipe Sup	oport Anchor:	E-24 (E-42 North)	South / E-42	Water Depth		
Longitu	de:			Latitude:		
			Diver l	nspection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe suppo	Pos I	umferential ition of the Feature ock position)	Measured Feature size (ft²)	Visual Class	ification of Feature
1	Anchor to 6' South		360°	28.30 (72" X 62.83")	Dislodged Area Deposit	☐ Holiday (bare metal ☐ Disturbed Area
2	Anchor to 6' North		360°	28.30 (72" X 62.83")	Dislodged Area	Holiday (bare metal
3	6" North		11:00	0.0004 (¼" X ¼")	Deposit     Dislodged Area     Deposit	Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
_					Dislodged Area Deposit	Holiday (bare metal Disturbed Area
		_			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
-					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
_					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
		_			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
atures of	table rows as nece oserved. Feature n tailed video images	umbering sta	ntify all arts at top	Biota present:	⊠YE	ES 🗆 NO
100 m	d coating observe		ke floor:	Lake floor location wrt pipe:	In span 6" -	- 24" off lake floor



#### Comments/Issues/Discussion

Feature 1, Dislodged area is approximately 90% of area from anchor to 6' South that has outer wrap missing

Feature 2, Dislodged area is approximately 90% of area from anchor to 6' North that has outer wrap missing

**Contractor Signature** 



Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES INO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; reco	rd #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	-
			N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		rovide 1 to 2 photos of 1	N/R		N/
			ciated with		



DFT #1 (mil) (north end of feature) (record #2 for feature)	NUD	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
(record #2 for featu	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	ures < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	-
			N/R		N/F
Temperature (°F)	58°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of t	N/R		N/F



DFT #1 (mil) (north end of feature)     N/R     DFT #2 (mil) (center of feature)     N/R     DFT #3 (south end of (south end of (so	(mV) ature)	N/
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for	I) ature)	N/I
Temperature (°F)     58°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to (~8"-12" away       Provide 1 to 2 photos of feature, below;	ures >8" long)	-
Temperature (°F)     58°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to (~8"-12" away       Provide 1 to 2 photos of feature, below;		N/I
(~2" away from edge) N/R (~8"-12" away Provide 1 to 2 photos of feature, below;	ature (mil)	N/I
Provide 1 to 2 photos of feature, below:	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/I
Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.		N/I
ate: 10/28/17 Frame(HH:MM:SS) 00:19:21 Date: Frame(HH:M		



		Ge	eneral Information		
Date:		10/23/17	Diver:		Kevin Lewis
AFE / W	.0.#:	20011702	Company Rep	/ Inspector:	Nevin cewis
Pipe Su	pport Anchor:	E-25 (E-47A / E-47B)	Water Depth (		
Longitu	de:		Latitude:		
		Dive	Inspection Reco	rd	
Feature Number	Location of Feature (w.r.t. pipe suppo	Position of the	Measured Feature size (ft²)	Visual Clas	sification of Feature
1	Anchor to 6' South	360°	18.85 (72" X 62.83")	Dislodged Area	Holiday (bare metal)
2	Anchor to 6' North	360°	1.57 (72" X 62.83")	Dislodged Area	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
	1		1	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐ Holiday (bare metal) ☐ Disturbed Area
_				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
	_			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	☐Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
_				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
B: incort	able rows as an	many to false de		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
atures ob	able rows as neces served. Feature n tailed video images	umbering starts at top	Biota present:	⊠Y	ES 🖾 NO
Dislodged DYES	d coating observe ⊠NO	d on the lake floor:	Lake floor location wrt pipe:	In span 6	- 12" to lake floor

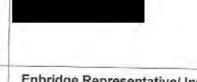


#### Comments/Issues/Discussion

Feature 1, Dislodged area is approximately 60% of area from anchor to 6' South that has outer wrap missing

Feature 2, Dislodged area is approximately 5% of area from anchor to 6' North that has outer wrap missing

**Contractor Signature** 



Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R YES INO	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thicknes	s Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV (north end of feature	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for fea	tures < 2" long;	record #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
	-		N/R	(in the second s	N/I
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/I
			ciated with		



DFT #1 (mil) (north end of featu	ure) N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
farment time		DFT #2 (mil) (center of feature)	DFT #2 (mil) (center of feature) N/R		N/F
(record #2 for	features < 2" long;	record #1 and #3 for features :	2"-8" long; r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F	) 58°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of	N/R		N/I
	20.25	A CONTRACTOR			



			Gen	eral Information		
Date:		10/	23/17	Diver:		Troy Baskett
AFE / W.	0.#:		11702	Company Rep	/inspector:	
Pipe Sup	port Anchor:	E-26 Sou	5 (E-48A / E-48B th)	Water Depth		10 C
Longitud	le:			Latitude:		
			Diver I	nspection Recor	d	
Feature Number	Location of Fe (w.r.t. pipe supp		Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Cla	ssification of Feature
1	Anchor to 6' S	outh	360°	3.14 (72" X 62.83")	Dislodged Area	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
	NO FEATUR NORTH OF ANCHOR			la sud	Dislodged Area     Deposit	
					Dislodged Area     Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal</li> <li>Disturbed Area</li> </ul>
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	a ☐ Holiday (bare metal □ Disturbed Area
				-	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	a □Holiday (bare metal □Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	a ☐Holiday (bare metal □Disturbed Area
					<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	a □Holiday (bare metal □Disturbed Area
		-			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal</li> <li>Disturbed Area</li> </ul>
					Dislodged Area	the second se
					Deposit Dislodged Area	Disturbed Area
					Dislodged Area	<ul> <li>Holiday (bare metal</li> <li>Disturbed Area</li> </ul>
			-		Dislodged Area	
					Deposit	Disturbed Area
		117			Dislodged Area	
					Deposit	Disturbed Area
					Dislodged Area	
		-		-	Deposit	Disturbed Area
					Dislodged Area     Deposit	<ul> <li>Holiday (bare metal</li> <li>Disturbed Area</li> </ul>
eatures of	table rows as nece oserved. Feature r tailed video image	umber		Biota present:		
2.0000.000	d coating observe		the lake floor:	Lake floor location wrt pipe:	In spa	an 18" off lake floor



Diver Inspection Form for L5 Straits of Mackinac

# Comments/Issues/Discussion

Feature 1, Dislodged area is approximately 10% of area from anchor to 6' South that has outer wrap missing

NO FEATURES IDENTIFIED NORTH OF ANCHOR

**Contractor Signature** 



Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES INO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		

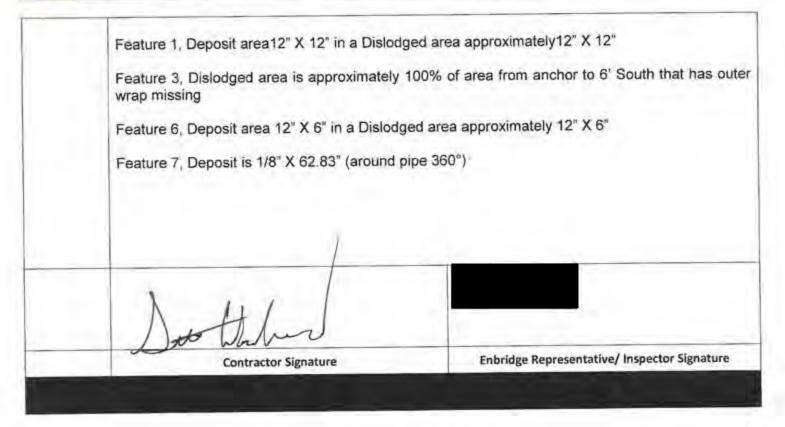


DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long: record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" lon (record #2 for features < 2" long: record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" lon Temperature (°F)       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R N/R       DFT Adjacent to Feature (mil) ("8"-12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       Included the date and time stamps associated with video surveillance.	ading #1 (mV) and of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long;         Temperature (°F)       56"         DFT Adjacent to Feature (mil) (~2" away from edge)         N/R         N/R         N/R         N/R         Provide 1 to 2 photos of feature, below;	T #1 (mil)	N/R	DFT #2 (mil)	N/R	DFT #3 (mil)	N/I
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below;	cord #2 for features	< 2° long; rec	ord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	-
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below;			the state of the s			N/F
(~2" away from edge) N/R (~8"-12" away from edge) Provide 1 to 2 photos of feature, below;	erature (°F)	56°		N/R	DFT Adjacent to Feature (mil)	N/I
Provide 1 to 2 photos of feature, below;				N/R	(~8"-12" away from edge)	N/I
Provide 1 to 2 photos of feature, below; Included the date and time stamps associated with video surveillance.						N/
A compared to the second						



		Gene	ral Information		
Date:		10/23/17	Diver:		Scott Woodward
AFE / W.	0.#:	20011702	Company Rep	o / Inspector:	
	port Anchor:	E-27 (E-48B S / E-48B N)	Water Depth (		
Longitud	le:		Latitude:		
		Diver	nspection Record		
Feature Number	Location of Feature (w.r.t. pipe support	t) Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Class	sification of Feature
1	4' South	6:00	1.0 (12" X 12")	Dislodged Area Deposit	Holiday (bare metal Disturbed Area
2	1" South	5:30	0.02 (1½" X 1½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
3	Anchor to 6' South	360*	31.42 (72" X 62.83")	Dislodged Area	Holiday (bare metal) Disturbed Area
4	Saddle North	6:00	2.01 (12" X 5")	Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
5	Saddle North	7:00	0.05 (1½" X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
6	5' North	6:00	0.50 (12" X 6")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
7	5' 10" North	360°	0.05 (1/8" X 62.83")	Dislodged Area     Deposit	Holiday (bare metal)
		· · · · · ·		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
-				Dislodged Area     Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal)
				Dislodged Area	Holiday (bare metal)
features	ert table rows as observed. Feature letailed video image	necessary to identify all numbering starts at top	Biota present:		
	ed coating obser	rved on the lake floor:	Lake floor location wrt pipe:	111 50 d	n 18" off lake floor





	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	I YES INO		
Coating Thick	ness Inspection Data (complete	this table in the absence of an	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
	N/R	N/R	N/R
South of Anchor #1 South of Anchor #2			N/R
South of Anchor #2	N/R	N/R	N/R



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	-8" long; re	cord #1, #2 and #3 for features >8" long)	1
Temperature (°F)	52	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/R N/R
remperature ( 1)		(~2" away from edge)	N/R	( 8 -12 away nomedge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		Tur
Y					



CP Reading #1 (mV (north end of feature		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature	e) N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for fea	atures < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	(
		DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F)	52	Feature (mil) (~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/R



(north end of feat	mV) N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feat		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for	features < 2" long; r	ecord #1 and #3 for features 2		cord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/I
Temperature (°F	52	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I N/I
Temperature ( )	·	(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/I
	Sec.	ane 3			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Tomoorature (PE)	52	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	52	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		1 2 away nom cuge)	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	11.2
North Contraction			N/R	a second second second second	N/F
Tomanature (PE)	52	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	52	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		1411
	and the second se				





DFT #1 (mil) (north end of feature)         N/R         DFT #2 (mil) (center of feature)         N/R         DFT #3 (mil) (south end of feature)         N/R           (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         N/R         N/R         N/R           Temperature (°F)         52         DFT Adjacent to Feature (mil)         N/R         DFT Adjacent to Feature (mil)         N/R		end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
Temperature (°F)     52     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N/R N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	(north	FT #1 (mil) end of feature)		(center of feature)	Same.		N/R
Temperature (°F)     52     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	(	record #2 for feature	es < 2" long; n	ecord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     52     Feature (mil) (~2" away from edge)     N/R     (~8"-12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R				DFT Adjacent to	N/R		
Provide 1 to 2 photos of feature, below:	Terr	perature (°F)	52		N/R		
		in.					



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	es < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DET Adiacont to	N/R		N/F
Temperature (°F)	52	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature ( 1)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
	1				



			General Information		
Date:	1.	10/23/17	Diver:		had Cantrell
AFE / W	.0.#:	20011702		ep / Inspector:	alidu Califireli
Pipe Su	pport Anchor:	E-28 (E-66A South / 66A North)	E- Water Depth		
Longitu	de:		Latitude:		
		Div	ver Inspection Reco	rd	
	Location of	01 1	1		
Feature Number	Feature (w.r.t. pipe suppo	Position of the	Feature size	Visual Class	ification of Feature
1	Anchor to 6'	360°	31.42	Dislodged Area	Holiday (bare metal
	South		(72" X 62.83")	Deposit	Disturbed Area
2	Anchor to 6'	360°	3.14	Dislodged Area	Holiday (bare metal
	North		(72" X 62.83")	Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
_				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
-				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
		-		Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
			-	Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				🗆 Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
		_	_	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area
				Dislodged Area	Holiday (bare metal)
atures ob	able rows as neces served. Feature ni ailed video images	umbering starts at top	Biota present:		Disturbed Area
	coating observe	d on the lake floor:	Lake floor location wrt pipe:	In span 12	" off lake floor



#### Comments/Issues/Discussion

Feature 1, Dislodged area is approximately 100% of area from anchor to 6' South that has outer wrap missing

Feature 2, Dislodged area is approximately 10% of area from anchor to 6' North that has outer wrap missing

NOTE: DFT gage 57 available to take readings on Dislodged areas DFTs taken due to only Dislodged areas identified South and North of anchor E-28

South at anchor 5' South of anchor	12 o'clock 139 115	3 o'clock 115 120	6 o'clock 110 115	9 o'clock 110 110	
North at anchor 5' North of anchor	110 120	115 95	105 99	115 125	

**Contractor Signature** 

Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip 10/6/2017 YES INO	Product: Next Calibration Due:	211 Coating Thickness Gauge 10/6/2018
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	110	5	10
North of Anchor #2	115	5	2
South of Anchor #1	110	5	10
South of Anchor #2	120	5	2
Average Thickness	113		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	ALIE
DFT #1 (mil) (north end of feature)	N/R	(center of feature) DFT #2 (mil)	N/R	(south end of feature) DFT #3 (mil)	N/F
	05 < 2" long: rac	(center of feature)		formula and for a	N/F
	so ve long, rec	sord #1 and #3 for features :	2"-8" long; r	record #1, #2 and #3 for features >8" long)	
Temperature		DFT Adjacent to	N/R N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	1	Provide 1 to 2 photos of t			N/F
		-			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features	2"-8" long: r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
	11.00	The rest with the survey of the	N/R	interactives so long)	N/F
Temperature (°F)	58°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
,	50	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of t	N/R		N/F
		date and time stamps asso		ndeo survemance.	
				noco survemance.	



		1	General Information		
Date:	10	0/23/17	Diver:		George Palmer
AFE / W.		0011702	Company Rep / Ins	pector:	
Pipe Sup	(E	29 -66A North / E- 5B)	Water Depth (ft):		
Longitue			Latitude:		
		Di	ver Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Cla	ssification of Feature
1	5' 9" South	12:00	0.007 (1½" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
2	5' 8" South	2:00	0.0004 (¼" X ¼")	Dislodged Area     Deposit	Holiday (bare metal)     Disturbed Area
3	Anchor to 6' South	360°	3.14 (72" X 62.83*)	Dislodged Area	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
4	3' 4" North	9:00	0.10 (5" X 3" Di) 0.01 (½" X ¼" D)	☑ Dislodged Area ☑ Deposit	Holiday (bare metal Disturbed Area
5	4' North	3:00	0.003 (¼* X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
6	4' North	7:00	0.50 (24" X 3" Di) 0.04 (24" X ¼" D)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
7	Anchor to 6' North	360°	6.28 (72" X 62.83")	Dislodged Area Deposit	□ Holiday (bare metal □Disturbed Area
				Dislodged Area Deposit	□ Holiday (bare metal □Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
			· · · · · · · · · · · · · · · · · · ·	Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
features (	I t table rows as necess observed. Feature nu or detailed video image	mbering starts at	Biota present:		
	ed coating observed o		Lake floor location wrt pipe:	In spa	an 6" off lake floor



Diver Inspection Form for L5 Straits of Mackinac

#### Comments/Issues/Discussion

Feature 3, Dislodged area is approximately 10% of area from anchor to 6' South that has outer wrap missing

Feature 4, Deposit 1/2" X 1/4" within a Dislodged area 5" X 3"

Feature 6, Deposit 24" X 1/4" with in a Dislodged area 24" X 3"

Feature 7, Dislodged area is approximately 20% of area from anchor to 6' North that has outer wrap missing

**Contractor Signature** 



Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES NO		
Coating Thic	kness Inspection Data (complete	this table in the absence of ar	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (north end of fea		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil (north end of fea	) N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 fo	r features < 2" long;	record #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/R
T	F) 54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°	F) 54	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
		Provide 1 to 2 photos of fe	N/R		N/F



Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north end of feature)	Turs	(center of feature) DFT #2 (mil)		DFT #3 (mil)	AUD
DFT #1 (mil) (north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	N/R
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	1	DFT Adjacent to	N/R	and the second sec	N/R
-	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F)	54	(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/R
		Provide 1 to 2 photos of f	and the second se		

Date: 10/23/17 Frame(HH:MM:SS) 00:18:01 Date. Plane(HI:MM:SS) Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	) N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feat	tures < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	_
			N/R		N/F
Contractor and	F 49	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54°	Feature (mil)	N/R	(~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
	s < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	1	The second s	N/R		N/F
	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away nom euge)	N/R		N/F
		7.	iated with v		



DFT #1 (mil) (north end of feature)         N/R         DFT #2 (mil) (center of feature)         N/R         DFT #3 (mil) (south end of feature)         N           (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         N/R         (south end of feature)         N           Temperature (°F)         54°         DFT Adjacent to Feature (mil)         N/R         DFT Adjacent to Feature (mil)         N/R           N/R         0/R         0/R         0/R         0/R         0/R         0/R	CP Reading #1 (mV) north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
Temperature (°F)     54°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N N N       Provide 1 to 2 photos of feature, below:	DFT #1 (mil) north end of feature)	1.	(center of feature)	100.02		N/F
Temperature (°F)     54°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N	(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2		ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     54°     Feature (mil) (~2″ away from edge)     N/R     DFT Adjacent to Feature (mil) (~8″-12″ away from edge)     N       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:			DET Adjacent to		and the second second second second	N/F
(~2" away from edge) N/R (~8 -12 away from edge) N/R N/R N Provide 1 to 2 photos of feature, below:	Temperature (°F)	54°			DFT Adjacent to Feature (mil)	N/F
Provide 1 to 2 photos of feature, below:	Temperature ( 1)	2.0			(~8°-12° away from edge)	N/F
					1	
		Included the				



DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil)			
	INTS	(center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	res < 2" long; red	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	•) 54°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
Temperature (°F)		Feature (mil)	N/R		N/F
		(~2" away from edge)	N/R		N/F
		( 2 and) non cage)	N/R		N/F



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	s < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
			N/R N/R		N/F
					N/F
	1		N/R		N/F
	- A A A A A A A A A A A A A A A A A A A				

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		Ger	neral Information		
Date:		10/23/17	Diver:	N	Naurice Unger
AFE / W.	0.#:	20011702	Company Rep	/ Inspector:	
Pipe Sup	port Anchor:	E-30	Water Depth (f	î):	
		(E-56A / E-56B)			
Longitud	le:		Latitude:		
		Diver	Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Class	ification of Feature
1	Anchor to 6' South	360°	31.42 (72" X 62.83")	Dislodged Area	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
2	2' 6" South	6:00	0.56 (9" X 9" Di) 0.005 (3"X ¼" D)	Dislodged Area	Holiday (bare metal) Disturbed Area
3	9" North	9:00	0.002 (1" X ¼")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
4	4 4" North	12:00	0.002 (½" X ½")	Dislodged Area	Holiday (bare metal) Disturbed Area
5	4 4" North	1:00	0.006 (½" X 1")	Dislodged Area     Deposit	Holiday (bare metal Disturbed Area
6	4' 4" North	3:00	0.01 (½" X 2")	Dislodged Area	Holiday (bare metal Disturbed Area
7	4' 4" North	2:00	0.002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
-				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
		-		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area	Holiday (bare metal Disturbed Area
features of		cessary to identify all umbering starts at top	Biota present:	81	YES 🗆 NO
	ed coating observe	ed on the lake floor:	Lake floor location wrt pipe:	In	span 24" off lake floor

### **REDACTED SUBMITTAL -- PUBLIC COPY**



Comments/Issues/Discussion Feature 1, Dislodged area is approximately 100% of area from anchor to 6' South that has outer wrap missing Feature 2, Deposit 3" X 1/4" within a Dislodged area 9" X 9" Note: Features 4-7 appears to be over a weld Enbridge Representative/ Inspector Signature **Contractor Signature** 

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	⊠YES □ NO		
Coating Thick	ness Inspection Data (complete	this table in the absence of an	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for features	s < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54°	Feature (mil) (~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/F
		2			



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
(north end of feature) DFT #1 (mil)		(center of feature) DFT #2 (mil)		(south end of feature) DFT #3 (mil)	
(north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	N/R
(record #2 for features	s < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
		(~2" away from edge)	N/R N/R	( 8 -12 away nomedge)	N/F
	Included the	Provide 1 to 2 photos of fe date and time stamps assoc			
	Included the				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature)	ures < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
V	1 1 1 1 1 1		N/R	Contraction of the second	N/I
-	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
Temperature (°F)	54	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/I
		( 2 away nom euge)	N/R		N/
	The second	date and time stamps assoc			



CP Reading #1 (mV)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north end of feature) DFT #1 (mil) (north end of feature)	(mil) N/R DFT #2 (mil) N/R	N/R	DFT #3 (mil) (south end of feature)	N/R	
(record #2 for feature	s < 2" long; reco		-8" long; re	ecord #1, #2 and #3 for features >8" long)	
			N/R	a star to a strate and a little	N/F
- /0=1	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	04	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		1 2 away nom cage)	N/R		N/F
		1			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feat	ures < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	1
(180010 #2 101 164			N/R	and the second second second	N/R
	E 40	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	54°	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	( 2 away nom edge)	N/R		N/F
2					



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	#1 (mil) N/R DFT #2 (mil) N/R	DFT #3 (mil) (south end of feature)	N/F		
	res < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
(IECOID #2 IOI ICAID		DFT Adjacent to	N/R	The state of the state of the state	N/F
Temperature (°F)	54°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( r)	34	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
	included the	date and time stamps associ	atea with v		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for features	s < 2" long; r	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
(record ine for realitie		DET Adiacont to	N/R		N/F
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	) N/R
remperature ( r)		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
N.	Included the	e date and time stamps associ	ated with v	video surveillance.	
			ated with v	video surveillance.	



### REDACTED SUBMITTAL -- PUBLIC COPY

		1	General Information		
Date:		11/5/17	Diver:	1	Kevin Lewis
AFE / W.	0.#:	20011702	Company Rep		
Pipe Sup	oport Anchor:	E-67 (E65A / E-65B		and the second	
Longitu	de:	1	Latitude:		
		Di	ver Inspection Record		
-		14 - 14 - 14 - 14 - 14 - 14 - 14 - 14 -			and the state
Feature Number	Location of Featur (w.r.t. pipe support)	a second and a second se	Measured Feature size (ft <sup>2</sup> )	Visual Clas	sification of Feature
1	5' South	5:00	0.25 2" X 18"	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area
2	1' South	5:00	0.50 6" X 12"	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta     Disturbed Area
3	Anchor to 6' South	360°	21.98 (72" X 62.83")	Dislodged Area	Holiday (bare meta
4	Saddle to 4' North	5:00 to 6:00	2.67 (8" X 48") 0.03 (4@ 1" X 1")	Dislodged Area	Disturbed Area
5	5' North	5:00 to 6:00	0.56 (8" X 10" DI) 0.21 (5" X 6" D)	Dislodged Area	Disturbed Area
6	Anchor to 6' North	360°	15.7 (72" X 62.83")	Dislodged Area	Holiday (bare meta     Disturbed Area
			(12 × 02.03 )	Deposit     Dislodged Area     Deposit	Disturbed Area Holiday (bare meta Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area
				Dislodged Area Deposit	Holiday (bare meta Disturbed Area
				Dislodged Area Deposit	Holiday (bare meta Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal
atures ob	table rows as neces oserved. Feature num tailed video images)	sary to identify all bering starts at top	Biota present:	□ Deposit	Disturbed Area
	d coating observed	on the lake floor:	Lake floor location wrt pipe:	and the second sec	lake floor on the South side. Ike floor on the North side



# Comments/Issues/Discussion Feature 3, Dislodged area is approximately 30% of area from anchor to 6' South that has outer wrap missing Feature 4, Deposit area (4 @ 1" X 1") within a Dislodged area (8" X 48") Feature 5, Deposit area (3" X 3", 2" X 1" and 1" X 1") within a Dislodged area (8" X 10") Feature 6, Dislodged area is approximately 50% of area from anchor to 6' North that has outer wrap missing Magnet Additional Ad

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	🗆 YES 🛛 NO		
Coating Thick	ness Inspection Data (complete	this table in the absence of any	Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/D
South of Anchor #2	N/R	N/R	N/R N/R



CP Reading #1 (mV)	- C.A. (***	CP Reading #2 (mV)		CP Peading #2 (m)()	
(north end of feature)	N/R	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature) N/R DFT #3 (mil) (south end of feature) cord #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long		N/R	
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	100
	1	I make the second second second second	N/R		N/R
Temperature (°F)	50	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
remperature(1)	50	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
	_	Provide 1 to 2 photos of fe	N/R		N/F
	1	1300			



CP Reading #1 (north end of fea		N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil (north end of fea		N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 fc	or features .	< 2" long; re	cord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
				N/R		N/R
Temperature (°	°E)	50	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
i emperature (	.,		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/R
			Provide 1 to 2 photos of fe	N/R		N/R
			2. 1			



DFT #1 (mil) (north end of feature) (record #2 for feature	N/R	(center of feature) DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/R
(record #2 for feature	as < 2" long: re			(south end of feature)	IN/IN
	ca + 2 long, le	ecord #1 and #3 for features 2	"-8" long; re	acord #1, #2 and #3 for features >8" long)	_
Temperature (°F)	50	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/F
· · · · · · · · · · · · · · · · · · ·	50	(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/F



	Cathodic F	Protection and Coating Meas	urements (	for Feature # 4)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for features	s < 2" long; re	ecord #1 and #3 for features 2	"-8" long; re	ecord #1, #2 and #3 for features >8" long)	1
Temperature (°F)	50	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F N/F
	-		N/R		N/F
		Provide 1 to 2 photos of fe	ature, belo	W:	
		date and time stamps associ		aco salvemanec.	
	1				



CP Reading #1 (mV) (north end of feature) DFT #1 (mil) (north end of feature) (record #2 for feature) Temperature (°F)	N/R N/R es < 2" long; red	CP Reading #2 (mV) (center of feature) DFT #2 (mil) (center of feature) cord #1 and #3 for features 2	N/R N/R	CP Reading #3 (mV) (south end of feature) DFT #3 (mil) (south end of feature)	N/R
(north end of feature) (record #2 for feature	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	(center of feature)	0.2658	(south end of feature)	N/R
	es < 2" long; rec	cord #1 and #3 for features 2			
			"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
	50	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/R N/R
		(~2" away from edge) -	N/R N/R	(~8"-12" away from edge)	N/R
		Provide 1 to 2 photos of fe	ature, belo	w:	
A DECK		date and time stamps associ			



CP Reading #1 ( (north end of feat		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feat		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for	r features < 2* long; r	ecord #1 and #3 for features :	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DET Adiacent to	N/R		N/R
T	50	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/R
Temperature (°F	-) 50	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( z away nom euge)	N/R		N/F
	1				



		Ger	eral Information		
Date:		10/14/17	Diver:		George Palmer, Maurice Unge
AFE / W.	.0.#:	20011702	Company Pa	p / Inspector:	Brad Joanis & Kevin Lewis
Pipe Su	pport Anchor:	W-1 (W-01A / W-01B South)	Water Depth		
Longitu	de:		Latitude:		
		Diver	Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the	Measured Feature size (ft <sup>2</sup> )		assification of Feature
1	5' North	10:00-6:00	0.83 (15" X 8")	Dislodged Area	Holiday (bare metal Disturbed Area
2	2' 4" North	10:00-4:00	0.10 (3" X 5")	Dislodged Area	Holiday (bare metal     Disturbed Area
3	1' North	12:00-6:00	1.44 (26" X 8")	Dislodged Area	Holiday (bare metal     Disturbed Area
4	North at anchor	3:00	0.10 (3" X 4 ¾")	Dislodged Area	Holiday (bare metal Disturbed Area
5	3" North	6:00	0.08 (3" X 4")	Dislodged Area	Holiday (bare metal     Disturbed Area
6	South at anchor	12:00	0.04 (6" X 1")	Dislodged Area	Holiday (bare metal     Disturbed Area
7	South at Saddle	10:00-11:00	0.15 (7" X 3")	⊠ Dislodged Area □ Deposit	Holiday (bare metal
8	2" South	6:00	0.08 (4" X 3")	Dislodged Area	Holiday (bare metal)     Disturbed Area
9	South at Saddle	1:00	0.04 (3" X 2")	Dislodged Area	Holiday (bare metal) Disturbed Area
10	12" South	11:00-7:00	0.53 (19" X 4")	Dislodged Area	Holiday (bare metal)     Disturbed Area
11	13" South	11:00	0.04 (3" X 2")	Dislodged Area	Holiday (bare metal) Disturbed Area
12	17"- 26" South	5:00-6:00	0.75 (9" X 12")	Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□ Holiday (bare metal) □Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
atures ob	table rows as neo served. Feature num divideo images)	essary to identify all bering starts at top row	Biota present:	(X)	YES 🗆 NO
Dislodged TYES D	l coating observed	f on the lake floor:	Lake floor location wrt pipe:	In span 18	3" – 24" off lake floor

### **REDACTED SUBMITTAL -- PUBLIC COPY**



Diver Inspection Form for L5 Straits of Mackinac

# Comments/Issues/Discussion Anchor to 6' South of anchor, Dislodged areas at locations throughout that has outer wrap missing Anchor to 6' North of anchor, Dislodged areas at locations throughout that has outer wrap missing Machaever to 6' North of anchor, Dislodged areas at locations throughout that has outer wrap missing Machaever to 6' North of anchor, Dislodged areas at locations throughout that has outer wrap missing Machaever to 6' North of anchor, Dislodged areas at locations throughout that has outer wrap missing Contractor Signature Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated:	Elcometer Inspection Equip 10/06/2017	Product: Next Calibration Due:	211 Coating Thickness Gauge 10/06/2018
Gauge verified prior to use:	⊠YES □ NO	Next Calibration Due:	10/06/2018
Coating Thick	ness Inspection Data (complete	this table in the absence of a	ny Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft	Location on Pipe (o'clock
North of Anchor #1	145	5	10:00
North of Anchor #2	105	5	2:00
South of Anchor #1	150	5	10:00
South of Anchor #2	100	5	2:00
Average Thickness	125		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	140	DFT #2 (mil) (center of feature)	140	DFT #3 (mil) (south end of feature)	82
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	55°	DFT Adjacent to Feature (mil)	200 125	DFT Adjacent to Feature (mil)	14
		(~2" away from edge)	135 250	(~8"-12" away from edge)	11
		Provide 1 to 2 photos of fe	eature, below	w:	
	menaneu che	date and time stamps assoc	iuteu with v	lueo survemance.	
116	1.01	1.30			



CP Reading #1 (mV	)	Protection and Coating Meas CP Reading #2 (mV)		CP Reading #3 (mV)	-
(north end of feature	)	(center of feature)	N/R	(south end of feature)	N/I
DFT #1 (mil) (north end of feature		DFT #2 (mil) (center of feature)	130	DFT #3 (mil) (south end of feature)	14
(record #2 for fea	itures < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	160		12
Temperature (°F)	55°	Feature (mil)	200	DFT Adjacent to Feature (mil)	20
		(~2" away from edge)	170	(~8"-12" away from edge)	20
		Provide 1 to 2 photos of fe	200		25
	E.	N			



CP Reading #1 (mV	()	Protection and Coating Meas CP Reading #2 (mV)			
(north end of feature	N/R	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature	) 170	DFT #2 (mil) (center of feature)	150	DFT #3 (mil) (south end of feature)	20
(record #2 for fea	atures < 2" long; i	record #1 and #3 for features 2	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	210		18
Temperature (°F)	55°	Feature (mil)	135	DFT Adjacent to Feature (mil)	20
	145	(~2" away from edge)	190	(~8"-12" away from edge)	24
		Provide 1 to 2 photos of fe	200		25
1 80					



the second second second second second	Cathodic Pro	otection and Coating Meas	urements (	for Feature # 4)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	160	DFT #2 (mil) (center of feature)	150	DFT #3 (mil) (south end of feature)	160
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	?"-8" long; re	cord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	190		200
Temperature (°F)	55°	Feature (mil)	170	DFT Adjacent to Feature (mil)	190
	1000	(~2" away from edge)	170 200	(~8"-12" away from edge)	160
		Provide 1 to 2 photos of fe			17
	Included the d	ate and time stamps associ			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	94	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	94
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	55°	DFT Adjacent to Feature (mil)	115 120	DFT Adjacent to Feature (mil)	125 115
	100	(~2" away from edge)	150 125	(~8"-12" away from edge)	105



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	92	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	84
(record #2 for feature	es < 2" long; red	cord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R         (south end of feature)         N/           #2 (mil)         N/R         DFT #3 (mil)         84           of feature)         N/R         (south end of feature)         84           3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         84           jacent to re (mil)         110         DFT Adjacent to Feature (mil)         11           from edge)         110         (~8"-12" away from edge)         11		
Temperature (°F)	55°	Feature (mil)		DFT Adjacent to Feature (mil)	11
		(~2" away from edge)	and the second se	(~8"-12" away from edge)	11
	1				95
		1			



	Cathodic Pr	otection and Coating Meas	surements (i	for Feature # 7)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	88	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	92
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	55°	DFT Adjacent to Feature (mil)	115 110	CP Reading #3 (mV) (south end of feature) DFT #3 (mil)	94 110
	1.	(~2" away from edge)	115 105	(~8~-12" away from edge)	
	C.				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	105	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	110
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	55°	DFT Adjacent to Feature (mil) (~2" away from edge)	96 105 105 110	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	108 100 108
	1				



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	88	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	90
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	55°	DFT Adjacent to Feature (mil)	98 110	DFT Adjacent to Feature (mil)	10 10
		(~2" away from edge)	110 105	(~8"-12" away from edge)	90
19 2	1				



	Cathodic Pro	otection and Coating Meas	urements (f	for Feature # 10)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	78	DFT #2 (mil) (center of feature)	86	DFT #3 (mil)	88
(record #2 for feature	s < 2" long; rec	ord #1 and #3 for features 2	Image: Proof feature       N/R       (south end of feature)         Image: Proof feature       86       DFT #3 (mil)         Image: Proof feature       86       0.00000000000000000000000000000000000	ecord #1, #2 and #3 for features >8" long)	_
Temperature (°F)	55°	DFT Adjacent to	90	CP Reading #3 (mV) (south end of feature) DFT #3 (mil) (south end of feature) ng: record #1, #2 and #3 for features >8" long) 0 25 DFT Adjacent to Feature (mil) 10 (~8"-12" away from edge) 20 below:	120
	00	(~2" away from edge)	110	(~8"-12" away from edge)	120
	-	Provide 1 to 2 photos of fe		1	100



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil)	105	DFT #2 (mil)			
(north end of feature)				(south end of feature)	104
(record #2 for featur	res < 2" long; rec	(center of feature)         N/R         (south end of feature)         N/R           DFT #2 (mil)         N/R         DFT #3 (mil)         104			
		DFT Adjacent to		CP Reading #3 (mV) (south end of feature) DFT #3 (mil) (south end of feature) g; record #1, #2 and #3 for features >8" long) 5 DFT Adjacent to Feature (mil) (~8"-12" away from edge) 0 Delow:	
Temperature (°F)	55°	Feature (mil)			
	-	(~2" away from edge)		( 8 -12 away from edge)	and the second se
		Provide 1 to 2 photos of fe		A/*	14
141 F	199.91				



CP Reading #1 (mV)	N/R	Protection and Coating Meas CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	-
(north end of feature) DFT #1 (mil)		(center of feature)	NIK	(south end of feature)	N/I
(north end of feature)	115	DFT #2 (mil) (center of feature)	115	DFT #3 (mil)	10 74 12
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	130		74
Temperature (°F)	55°	Feature (mil)	103	DFT Adjacent to Feature (mil)	12
		(~2" away from edge)	120	(~8"-12" away from edge)	12
	-	Provide 1 to 2 photos of fe	96		1( 7 12 12



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		Gene	eral Information			
Date: AFE / W	.O.#: pport Anchor:	10/20/17 20011702		p / Inspector:	Scott Woodward	
		W-2 (W-01B South / W- 01B North)	Water Depth	(ft):		
Longitu	de:		Latitude:			
	in the second	Diver I	nspection Record			
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Class	ification of Feature	
ì	3' South	5:00	0.0004 (¼° X¾")	Dislodged Area Deposit	Holiday (bare metal     Disturbed Area	
2	Anchor to 3' South	360	11.0 (36" X 62.83")	Dislodged Area	Holiday (bare metal     Disturbed Area	
3	18" North	3:00	0.02 (1½" X 2")	Dislodged Area     Deposit	Holiday (bare metal     Disturbed Area	
4	4' North	7:00	0.33 (6" X 8")	Dislodged Area	Holiday (bare metal     Disturbed Area	
5	5' North	3:00	0.17 (5" X 5")	Dislodged Area     Deposit	Holiday (bare metal Disturbed Area	
6	5' North	3:00 - 6:00	0.25 (18" X 2")	Dislodged Area	Holiday (bare metal     Disturbed Area	
				Dislodged Area Deposit	Holiday (bare metal     Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)     Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>	
			æ	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)     Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)     Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)     Disturbed Area	
				Dislodged Area Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>	
P: incert to				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area	
oserved.	able rows as riecessa Feature numbering eo images)	ry to identify all features starts at top row (for	Biota present:	⊠YES		
Dislodged	coating observed	d on the lake floor:	Lake floor location wrt pipe:	In span 12'	off lake floor	

### **REDACTED SUBMITTAL -- PUBLIC COPY**



Comments/Issues/Discussion Feature 2, Dislodged area is approximately 70% of area from anchor to 3' South of anchor that has outer wrap missing and the most concentrated area is located from 6:00 – 9:00 o'clock on east side **Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
	kness Inspection Data (complete	this table in the absence of ar	ny Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/D
South of Anchor #2	N/R	N/R	N/R N/R
Average Thickness	N/R		



CD Deadline #4 / 14	caciloule Pl		surements (	for Feature # 1)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for featu	ires < 2" long; red	cord #1 and #3 for features 2	of feature)     N/R     (south end of feature)     N/       #2 (mil) of feature)     N/R     DFT #3 (mil) (south end of feature)     N/       #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)     N/       djacent to ure (mil) / from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)     N/		
		DFT Adjacent to	N/R		N/F
Temperature (°F)	60°	Feature (mil)		CP Reading #3 (mV) (south end of feature) DFT #3 (mil) (south end of feature) record #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
		(~2" away from edge)	the second s		N/F
					N/F
1 P. C.	AND A				



CP Reading #1 (mV) (north end of feature)	N/R	Protection and Coating Meas CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	60°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F N/F
			N/R		N/I
	Included the	Provide 1 to 2 photos of fe date and time stamps associ	atad with w	W2	
	1				



CP Reading #1 (mV) (north end of feature)       N/R       CP Reading #2 (mV) (center of feature)       N/R       CP Reading #3 (mV) (south end of feature)         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       60°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8"-12" away from edge)       I	CP Reading #1 (mV) (north end of feature)       N/R       CP Reading #2 (mV) (center of feature)       N/R       CP Reading #3 (mV) (south end of feature)         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       60°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) N/R         Provide 1 to 2 photos of feature, below:       N/R	#3 (mV)		urements (	Protection and Coating Meas	Cathodic Pr	a manufacture of the second
DF1 #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       60°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R N/R       DFT Adjacent to Feature (mil) (~8"-12" away from edge)       1         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       1	DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature ("F)       60°       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R N/R       DFT Adjacent to Feature (mil) ("8"-12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.	E familium N	CP Reading #	100.00	CP Reading #2 (mV)		(north end of feature)
(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       60°         DFT Adjacent to Feature (mil) (~2" away from edge)       N/R N/R         N/R       0FT Adjacent to Feature (mil) (~8"-12" away from edge)         Provide 1 to 2 photos of feature, below:	(record #2 for features < 2" long; record #1 and #3 for features 2"-8" long; record #1, #2 and #3 for features >8" long)         Temperature ("F)       60°       DFT Adjacent to Feature (mil) ("2" away from edge)       DFT Adjacent to Feature (mil) N/R       DFT Adjacent to Feature (mil) ("8"-12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       Temperature	(mil)	DFT #3 (m	N/R	DFT #2 (mil)	N/R	DFT #1 (mil) (north end of feature)
Temperature (°F)     60°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil)       N/R     N/R     0     0     0       Provide 1 to 2 photos of feature, below:     0     0	Temperature ("F)       60°       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R N/R       DFT Adjacent to Feature (mil) ("8"-12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       DFT Adjacent to Feature (mil) ("8"-12" away from edge)	reature)	(South end of fe	-8" long: ro	ecord #1 and #3 for features 2	s < 2" long; rec	(record #2 for feature
Temperature (°F)     60°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8"-12" away from edge)       Provide 1 to 2 photos of feature, below:	Temperature (*F)       60°       Description of the start of		oru #1, #2 and #3 for lea	N/P		T	
(~2" away from edge) N/R (~8"-12" away from edge) I Provide 1 to 2 photos of feature, below:	reacting (m) ("2" away from edge) N/R Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.	Facture (mill)	CP Reading #3 (mV) (south end of feature) DFT #3 (mil) (south end of feature) (south end of feature) (record #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8"-12" away from edge)		DFT Adjacent to	60%	Temperature (°E)
Provide 1 to 2 photos of feature, below:	Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.				Feature (mil)	00	is in personal ( 1)
Provide 1 to 2 photos of feature, below:			( o is away no	the second s	( 2 away from edge)		
Included the date and time stamps associated with video surveillance.	Included the date and time stamps associated with video surveillance.	N/	<i>r</i> .	ture, below	Provide 1 to 2 photos of fee		
			eo su venunce.	red with vi	, , , , , , , , , , , , , , , , , , ,	The second	And in case of the local division of the loc
					3 2011	1	1.



CP Reading #1 (mV) (north end of feature)	N/R	rotection and Coating Meas CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	ALVE
DFT #1 (mil)	N/R	(center of feature) DFT #2 (mil)		(south end of feature) DFT #3 (mil)	N/F
(north end of feature)		(center of feature)	N/R	(couth and official and	N/F
(record #2 for realtine	es < 2 long; red	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	60°	Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe			N/F
	200				



CP Peading #4 (m)/		Protection and Coating Mea	screments (	for Feature # 5)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for featu	res < 2" long; re	cord #1 and #3 for features 2	2*-8" long; re	(south end of feature) ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R	internet and no for realities 28 long)	N/F
Temperature (°F)	60°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
		date and time stamps associ	oleo with y	aco survemante.	



CP Ponding #1 (	cuthoult P	rotection and Coating Meas	surements (	for Feature # 6)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for feature	es < 2* long; rei	cord #1 and #3 for features 2	2*-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R	(in the second rest of realistics - of rolling)	N/F
Temperature (°F)	60°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
- 3. 5		5			



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			General Information		
Date:		10/9/17, 10/13/17		in the second	Scott Woodward, Chao Cantrell
AFE / W.	0.#:	20011702	Company Rep	/inspector:	
Pipe Sup	port Anchor:	W-3 (W-5A / W-5	the second se	Construction for Arrival and Arriva	
Longitud	and the second se	(11 5) (7 11 5	Latitude:		
			ver Inspection Record		
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Clas	sification of Feature
1	7' North	12:00	0.003 (½" X ¾")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
		11:30	0.001	Dislodged Area	Holiday (bare metal
2	7' North	1.445	(1/4 X 3/4")	I Deposit	Disturbed Area
3	7' North	6:00	0.35 (5" X 10" Dī) 0.17 (5" X 5" D) 0.03 (1½" X ¾" & 3" X 1" H)	⊠ Dislodged Area ⊠ Deposit	⊠ Holiday (bare metal □Disturbed Area
4	7' 6" North	3:00	0.21 (6" X 5")	⊠ Dislodged Area □ Deposit	Holiday (bare metal     Disturbed Area
5	12' 3" North	3:00 - 8:00	10.0 (48" X 30")	Dislodged Area	Holiday (bare metal Disturbed Area
6	18' North	2:00 - 12:00	0.29 (6" X 7")	Dislodged Area	☐ Holiday (bare metal ☐ Disturbed Area
7	19' North	6:00 - 11:00	4.0 (24" X 24" Di) 0.02 (1½" X 2" D)	⊠ Dislodged Area ⊠ Deposit	☐ Holiday (bare metal ☐ Disturbed Area
8	19' North	3:30	0.0008 (¼" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
9	19' 1" North	4:00	0.007 (2" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
10	19' 1" North	4:30	0.003 (½° X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal</li> <li>Disturbed Area</li> </ul>
				Dislodged Area Deposit	☐ Holiday (bare metal ☐ Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
121				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
eatures o	table rows as nece bserved. Feature r r detailed video imag	numbering starts at	Biota present:	2	YES 🗆 NO
	d coating observed		Lake floor location wrt pipe:	In span 12	2" – 15" off lake floor

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Comment	s/Issues/Discussion
taken). The holidays and deposit were within Feature 4, Dislodged 6" X 5" area	t d 1½" X ¾"), next to a Deposit 5" X 5" (no sample n Dislodged area (5" X 10") o shows a white tag placed on the dislodged area n, within 24" X 24" Dislodged area en
Ho Real	

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	08/09/2017	Next Calibration Due:	08/09/2018
Gauge verified prior to use:	⊠YES □ NO		
Coating Thic	kness Inspection Data (complete	this table in the absence of an	ny Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	178	5	10:00
North of Anchor #2	96	5	2:00
South of Anchor #1	122	5	10:00
South of Anchor #2	96	5	2:00
Average Thickness	123		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
and the second se	es < 2" long; reco		2 - 8" lona: re	cord #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( r)		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/I



DFT #1 (mil) (north end of feature)         N/R         DFT #2 (mil) (center of feature)         N/R         DFT #3 (mil) (south end of feature)         N/R           (record #2 for features < 2* long; record #1 and #3 for features 2 - 8* long; record #1, #2 and #3 for features >8* long)         N/R         N/R         N/R         N/R         N/R           Temperature (*F)         56*         DFT Adjacent to Feature (mil) (*2" away from edge)         N/R         DFT Adjacent to Feature (mil) N/R         N/R         N/R         N/R         N/R           Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.         N/R         N/R         N/R         N/R	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N/F       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/F     N/F	DFT #1 (mil)	N/R	DFT #2 (mil)	N/R	DFT #3 (mil)	N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) N/R     N/R       Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	(record #2 for featur	es < 2° long; red	cord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	1
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil)     N/R       N/R     (~8 - 12" away from edge)     N/F       Provide 1 to 2 photos of feature, below:		-	DET Adjacent to			
(~2" away from edge) N/R (~8-12 away from edge) N/R Provide 1 to 2 photos of feature, below:	Temperature (°E)	56°		and the second se		
Provide 1 to 2 photos of feature, below:	Temperature ( 17	50		the second se	(~8 - 12" away from edge)	
				and the second second		N/F
		11. <b>R</b> E	1990			



(north end of reature)       -1636       (center of reature)       -462       (south end of reature)       -1636         DFT #1 (mil)       90       DFT #2 (mil)       N/R       DFT #3 (mil)       <25         (north end of feature)       90       DFT #2 (mil)       N/R       DFT #3 (mil)       <25         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       DFT Adjacent to Feature >8" long)         Temperature ("F)       56°       DFT Adjacent to Feature (mil)       N/R       N/R       DFT Adjacent to Feature (mil)       N/R         N/R       N/R       DFT Adjacent to Feature (mil)       N/R       N/R       N/R       N/R         Provide 1 to 2 photos of feature, below:       Included the date and time stamps associated with video surveillance.       N/R       N/R         Included the date and time stamps associated with video surveillance.       Included the date and time stamps associated with video surveillance.	CP Reading #1 (mV)	-1653	CP Reading #2 (mV)	-483	CP Reading #3 (mV)	-158:
(north end of feature)       90       (center of feature)       N/R       (south end of feature)       <23         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)	(north end of feature)	-1636	(center of feature)	-482	(south end of feature)	
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N/R N/R       Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R     N/R		90		N/R		<25
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     DFT Adjacent to Feature (mil)     N/R	(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     N/R     N/R			DET Adiacont to			
(~2" away from edge) N/R ( 0 ° 12 away from edge) N/R Provide 1 to 2 photos of feature, below:	Tomporature (°E)	56°		the second se		
Provide 1 to 2 photos of feature, below:	remperature ( r)	00			(~8 - 12" away from edge)	
						N/R
		1		1		

Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.

NOTE: CP reading #2 on this feature appears to indicate CP probe did not make complete contact to pipe metal.



DFT #1 (mil) (north end of feature)         96         DFT #2 (mil) (center of feature)         N/R         DFT #3 (mil) (south end of feature)         96           (record #2 for features < 2* long; record #1 and #3 for features 2 - 8* long; record #1, #2 and #3 for features >8* long)         96	CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     100 96 115 120     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     111 99 114 114       Provide 1 to 2 photos of feature, below:	DFT #1 (mil)	96	DFT #2 (mil)	N/R		96
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     96 115 120     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     99 114 115       Provide 1 to 2 photos of feature, below:	(record #2 for feature	es < 2° long; r	ecord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     56°     Inf Adjacent to Peature (mil) (~8 - 12" away from edge)     56°       Provide 1 to 2 photos of feature, below:     110     110			DET Adjacent to	and the second se		11
(~2" away from edge) 115 (~8 - 12 away from edge) 11 Provide 1 to 2 photos of feature, below:	Temperature (°F)	56°				
Provide 1 to 2 photos of feature, below:	remperoune ( 1)	100			(~8 - 12" away from edge)	
		Included th	e date and time stamps assor		ideo surveillance	
		W.			aco servemanee.	
				JULEO WILH V		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	100	DFT #2 (mil) (center of feature)	120	DFT #3 (mil) (south end of feature)	10
1	es < 2" long;	record #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	1.2
		DFT Adjacent to	250		20
Temperature (°F)	56°	Feature (mil)	190	DFT Adjacent to Feature (mil)	20
remperature ( r)	00	(~2" away from edge)	170	(~8 - 12" away from edge)	20
			200		20
	Included th	Provide 1 to 2 photos of for the date and time stamps assoc			
	1.20				



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/
(north end of feature) DFT #1 (mil)		(center of feature) DFT #2 (mil)		(south end of feature) DFT #3 (mil)	
(north end of feature)	155	(center of feature)	N/R	(south end of feature)	18
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features	2 - 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	200		20
Temperature (°F)	56°	Feature (mil)	200	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	21
	_	(~2" away from edge)	200	( 3 12 away nom edge)	23
		e date and time stamps asso	ciated with v	ideo surveillance.	
		e date and time stamps asso	ciated with v	ideo surveillance.	



and the summer of	cathould	Protection and Coating Meas	urements (	for reature # 7)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	120	DFT #2 (mil) (center of feature)	160	DFT #3 (mil) (south end of feature)	12
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	225		19
Temperature ("F)	56°	Feature (mil)	190	DFT Adjacent to Feature (mil)	22
		(~2" away from edge)	145	(~8 - 12" away from edge)	14
	-	Provide 1 to 2 photos of fe	180		21
ABE.					



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
	res < 2" long;	record #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/I
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
ichiperature ( 1)		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe	ature, belo	w:	
	included th	he date and time stamps assoc			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	1.1
		DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/ N/
Temperature (°F)	56°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
		Provide 1 to 2 photos of fe	N/R		N/



(north end of feature)       N/R       (center of feature)       N/R       (south end of feature)         DFT #1 (mil)       N/R       DFT #2 (mil)       N/R       DFT #3 (mil)         (north end of feature)       N/R       DFT #3 (mil)       (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long       (south end of feature)         Temperature (°F)       56°       DFT Adjacent to Feature (mil)       N/R       DFT Adjacent to Feature (mil)         (~2" away from edge)       N/R       Provide 1 to 2 photos of feature, below:       N/R       Provide 1 to 2 photos of feature, below:	N/F
(record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" lor         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8 - 12" away from edge)         Provide 1 to 2 photos of feature, below:	N/F N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	N/F N/F
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	N/F
Provide 1 to 2 photos of feature, below:	
Provide 1 to 2 photos of feature, below:	N/1
Included the date and time stamps associated with video surveillance.	_



		Gene	ral Information		
Date:	1.7	10/20/17	Diver:		Chad Cantrell
AFE / W.	.0.#:	20011702	Company Rep		
Pipe Sup	oport Anchor:	W-4 (W-2A / W-2B)	Water Depth		
Longitu	de:		Latitude:		
		Diver In	spection Recor	d	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Class	sification of Feature
1	Anchor to 5' N	360°	26.18 (60" X 62.83")	Dislodged Area	Holiday (bare metal) Disturbed Area
	NO FEATURES		(	Dislodged Area	Holiday (bare metal)
	SOUTH ANCHOR	Ē		Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
_				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
			1	Deposit	Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area	Holiday (bare metal)
				🗆 Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
- F				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
		-		Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
eatures of	table rows as necess bserved. Feature nur d video images)	ary to identify all mbering starts at top row	Biota present:	XX	ES 🗆 NO
2.00	d coating observed	on the lake floor:	Lake floor location wrt pipe:	In span	12" off lake floor

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1	Comment	ts/Issues/Discussion
	Feature #1, Dislodged area is approxima has outer wrap missing	ately 100% of area from anchor to 5' North that
	No features identified South of anchor	
	Hond	
	Contractor Signature	Enbridge Representative/ Inspector Signature
	-	

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	□ YES □ NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	DFI Adjacent to Feature (mil)		N/
Temperature (°F)	59°	Feature (mil)			N/
Construction of a second	100	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
	1	Provide 1 to 2 photos of t	N/R		N/
10		ate and time stamps asso	ciated with	i video surveillance.	

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		Ger	neral Information		
Date:		10/21/17	Diver:	G	eorge Palmer
AFE/W.	0 #-	20011702	Company Rep / In	spector:	
		W-5	Water Depth (ft):		
Pipe Sup	port Anchor:	(W-6A / W-6B)			(
Longitu	de:		Latitude:		
		Diver	Inspection Record	1	
Feature Number	Location of Feature (w.r.t. pipe suppor	t) Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Class	ification of Feature
1	4' 9" South	12:00	0.002 (½" X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
2	4' 6" South	1:00 - 3:00	0.17 (5" X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
3	2' South	12:00	0.02 (3" X 1" Di) 0.01 (1½" X 1" D)	<ul> <li>☑ Dislodged Area</li> <li>☑ Deposit</li> </ul>	☐ Holiday (bare metal) ☐ Disturbed Area
4	2' South	2:00	0.0004 (¼* X ¼*)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
5	2' South	10:00	0.0004 (¼" X ¼")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
6	6" North	12:00	0.002 (½" x ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
7	Anchor to 6' North	360°	31.41 (72" X 62.83")	Dislodged Area Deposit	□Holiday (bare metal) □Disturbed Area
8	5' North	9:00	0.01 (1" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
9	3' 4" North	3:00	0.01 (1" X 1¾")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
	11			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) ⊠Disturbed Area
	1			Dislodged Area	□Holiday (bare metal)
				Deposit	Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
features	observed. Feature	essary to identify all numbering starts at top	Biota present:	X	YES 🗆 NO
Dislod	detailed video imag ged coating obser ⊠NO	ved on the lake floor:	Lake floor location wrt pipe:	In spa	n 24" off lake floor

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Diver Inspection Form for L5 Straits of Mackinac ENBRIDGE Feature 3, Deposit 11/2" X 1" within a Dislodged area 3" X 1" Feature 7, Dislodged area is approximately 100% of area from anchor to 6' North of anchor that has outer wrap missing Enbridge Representative/ Inspector Signature **Contractor Signature** 

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Last Calibrated: Gauge verified prior to use:	YES NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	
Location	Coating Thickness (mil)	Distance from Anchor (ft	) Location on Pipe (o'clock)
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
0 . 11 . 6 Aug. bas #4	N/R	N/R	N/R
South of Anchor #1 South of Anchor #2	1110	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV)	NR	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	NR
(north end of feature) DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	NR
(nonth end of reatures < 2" lor	na: record #1	and #3 for features 2 - 8" long;	record #1.	#2 and #3 for features >8" long)	
(IECOID #2 IOI leatures <2 Ioi	19,100010111		NR		NR
		DFT Adjacent to	NR	DFT Adjacent to Feature (mil)	NR
Temperature (°F)	58	Feature (mil)	NR	(~8 - 12" away from edge)	NR
	(~2" away from edge) NR		NR		
Provide 1 to 2 photos of fea Included the date and time	stamps asso	ociated with video surveilland	ce		
Included the date and time	stamps asso	ociated with video surveilland	ce.		

Date: 10/21/17 Frame(HH:MM:SS) 00:17:30 Date: Trane(HH:MM:CO) Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV)	NR	tection and Coating Meas CP Reading #2 (mV)	NR	CP Reading #3 (mV) (south end of feature)	NR
(north end of feature)	INIX	(center of feature)		DFT #3 (mil)	
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	(south end of feature)	NR
(record #2 for features < 2" lo	ong; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	ND
ficcord we for residents	1	the state of the s	NR		NR
	NR NR	NR	DFT Adjacent to Feature (mil)	NR	
Temperature (°F)	58	(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
		( 2 away nom euge)	NR		INPA
				Frame(HH:MM:SS)	



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lo	ng; record #1 a	and #3 for features 2 - 8" long;	record #1.	#2 and #3 for features >8" long)	ND
hoore and the second second		interaction in a second shake the later	NR		NR NR
1051	58	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
Temperature (°F)	50	(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
		( 2 away nom cage)	NR		INK
Included the date and time	stamps assoc	clated with video surveilland	Je		
Included the date and time	<u>stamps assoc</u>	ciated with video surveilland			

 Date:
 10/21/17
 Frame(HH:MM:SS)
 00:19:01
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lot	ng; record #1 a	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	NR
(	1	DFT Adjacent to	NR		NR
	58	Feature (mil)	NR	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	NF
Temperature (°F)	50	(~2" away from edge) -	NR	("8-12 away nomedge)	NF
		( 2 and) nom seg-1	NR		
Included the date and time					
ncluded the date and time					

Date: 10/21/17 Frame(HH:MM:SS) 00:19:46 Date: Frame(HH:MM:CO) Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
(north end of feature) DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lor	na: record #1	and #3 for features 2 - 8" long;	record #1,	,#2 and #3 for features >8" long)	
(IECOID #2 IOI IEBIDICS - 2 IOI			NR	in the second	NR
	1. 2.	DFT Adjacent to	NR	DFT Adjacent to Feature (mil)	NR
Temperature (°F)	58	Feature (mil)	NR	(~8 - 12" away from edge)	
		(~2" away from edge) -	NR		NR
Included the date and time :	stamps asso	ociated with video surveilland			
Included the date and time :	stamps asso	ociated with video surveinand			

 Date:
 10/21/17
 Frame(HH:MM:SS)
 00:20:53
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
(north end of feature) DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lo	ng; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	AUD
fictoria ne los reasons	1	the second se	NR		NR
	58	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
Temperature (°F)	00	(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
	1 million 100	( 2 away nom coge)	NR		INC



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lo	na: record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
	1		NR		NR
the day have started		DFT Adjacent to	NR	DFT Adjacent to Feature (mil)	NR
Cemperature (°F)	58	Feature (mil) (~2" away from edge)	NR	(~8 - 12" away from edge)	NR
	1	("2 away nom edge)	NR		NR
1 -					



P Reading #1 (mV) north end of feature)	NR	tection and Coating Meas CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
FT #1 (mil)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
north end of feature)	lang- record #1	and #3 for features 2 - 8" long:	record #1.	#2 and #3 for features >8° long)	
ecord #2 for features < 2	Ung, record #1	the second se	NR		NR
	1.1.1.1.1.1	DFT Adjacent to	NR	DFT Adjacent to Feature (mil)	NR
emperature (°F)	58	Feature (mil)	NR	(~8 - 12" away from edge)	NR
		(~2" away from edge)	NR		NR
-					



north end of feature) <b>DFT #1 (mil)</b> north end of feature)	NID	(center of feature) DFT #2 (mil)	1.5	DET #2 (	
norm end or realurer	NR	(center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
record #2 for features < 2" lo	ng; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
ecold #2 for leatures < 2 for	T	and the second se	NR		NR
	58	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
emperature (°F)	50	(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
	-	( 2 away non coge)	NR		INIX



		Gene	ral Information		
Date:		10/21/17	Diver:		Maurice Unger
AFE / W.	0 #*	20011702	Company Rep	/Inspector:	
	oport Anchor:	W-6 (W-12A / W-12B)	Water Depth (1		
		W O W ILS / W ILD/	Latitude:		
Longitud	ie:	Diam'r		4	
		Diverli	nspection Record		
Feature Number	Location of Feature (w.r.t. pipe support	t) Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Clas	ssification of Feature
1	Anchor to 6' South	360°	31.42 (72" X 62.83")	Dislodged Area	□Holiday (bare metal) □Disturbed Area
	Souur	9:00	0.0004	Dislodged Area	□Holiday (bare metal)
2	2' 6" South	9.00	(¼" X ¼")	⊠ Deposit	Disturbed Area
		360°	28.27	Dislodged Area	
3	Anchor to 6'	300	(72" X 62.83")	Deposit	Disturbed Area
	North		(12 × 02.05 )	Dislodged Area	
	1		A CONTRACTOR OF A	Deposit	Disturbed Area
-				Dislodged Area	Holiday (bare metal)
				Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
			-	Dislodged Area	
				Disiougeu Arce	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
-				Dislodged Area	
	the second second			Deposit	Disturbed Area
				Dislodged Area	
		and the second sec		Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
			-	Dislodged Are	
				Deposit	Disturbed Area
				Dislodged Are	
		-		Deposit	Disturbed Area
			-	Dislodged Are	
			The second se	Deposit	Disturbed Area
-				Dislodged Are	and the second sec
				Deposit	Disturbed Area
features	ert table rows as neo observed. Feature detailed video imag	essary to identify all numbering starts at top es)	Biota present:		⊠YES □ NO
Dislod		ved on the lake floor:	Lake floor location wrt pipe:	In s	pan 9" off lake floor



Feature 1, Dislodged area is a has outer wrap missing	oproximately 100% of area from anchor to 6' South that
Feature 3, Dislodged area is a outer wrap missing	oproximately 90% of area from anchor to 6' North that has
JKg. Li	
Contractor Signate	re Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	And the second sec
Manufacturer: Last Calibrated:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Gauge verified prior to use:	I YES INO		other & America
Coating Thicknes	s Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	and the second se
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
	N/R	N/R	N/R
South of Anchor #1 South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



(north end of feature) DFT #1 (mil) (north end of feature) (record #2 for feature) Temperature (°F)	N/R s < 2" long; i 59°	DFT #2 (mil) (center of feature) record #1 and #3 for features 2 DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R	DFT #3 (mil) (south end of feature) ecord #1, #2 and #3 for features >8" long)	N/F
(record #2 for feature: Temperature (°F)	1	DFT Adjacent to Feature (mil)	N/R N/R		N/F
Temperature (°F)	1	DFT Adjacent to Feature (mil)	N/R N/R		N/F
1	59°	Feature (mil)			N/F
1	55			DFT Adjacent to Feature (mil) _ (~8 - 12" away from edge)	N/F
In	1	[ Z away non euge)	N/R	(-8 - 12 away nomedge)	N/I
In		Provide 1 to 2 photos of	N/R	1	
		- 9			

 Date:
 10/21/17
 Frame(HH:MM:SS)
 00:20:27
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featu	res < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	
		The second se	N/R	_	N/F
T	59°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	39	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	-	Provide 1 to 2 photos of	N/R		N/I



CP Reading #1 (mV)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north end of feature) DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(north end of readure)	es < 2" lona:	record #1 and #3 for features 2	2 - 8" long; n	ecord #1, #2 and #3 for features >8" long)	N/F
(100010 #2 101 1001011			N/R		
	59°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
Temperature (°F)		Feature (mil) (~2" away from edge)	N/R		N/F
		( 2 away nom euge)	N/R		N/F
				Frame(HH:MM:SS)	



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		Genera	al Information			
Date: AFE / W.O.#: Pipe Support Anchor: Longitude:		10/21/17 20011702 W-7	Diver: Company Rep / Inspector: Water Depth (ft): Latitude:		Brad Joanis	
		(W-13A / W-13B)				
		Diver Ins	spection Record			
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Positio of the Feature (o'clock position)	n Measured Feature size (ft <sup>2</sup> )	Visual Classific	cation of Feature	
1	Anchor South	11:00	0.68 (7" X 14")	Dislodged Area Deposit	Holiday (bare metal Disturbed Area	
2	8" South	11:00	0.002 (½"X ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area	
3	2' North	12:00	0.0004 (¼"X ¼")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area	
_				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area	
				Dislodged Area Deposit	Holiday (bare meta Disturbed Area	
				Dislodged Area     Deposit	Holiday (bare meta     Disturbed Area	
				Dislodged Area     Deposit	Holiday (bare meta     Disturbed Area	
				Dislodged Area     Deposit	Holiday (bare metal Disturbed Area	
				Dislodged Area     Deposit     Dislodged Area	Holiday (bare metal     Disturbed Area	
				Dislodged Area     Deposit     Dislodged Area	Holiday (bare metal Disturbed Area	
ا				Dislodged Area     Deposit     Dislodged Area	Holiday (bare metal     Disturbed Area	
IR' incort	table rows as necess	ary to identify all features		<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area	
	Feature numbering st	arts at top row (for detailed		⊠YES	□ NO	
Dislodged coating observed on the lake floor:		Lake floor location wrt pipe:	In span 24" off lake floor			

 Diver Inspection Form for L5 Straits of Mackinac

 Comments/Issues/Discussion

 Build of the second strait of the second str

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Coating Gauge Information							
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge				
Last Calibrated:	N/R	Next Calibration Due:	N/R				
Gauge verified prior to use:	I YES INO						
Coating Thic	kness Inspection Data (complete	this table in the absence of an	ny Features)				
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock				
North of Anchor #1	N/R	N/R	N/R				
North of Anchor #2	N/R	N/R	N/R				
	1	11/0	N/R				
South of Anchor #1	N/R	N/R					
South of Anchor #2	N/R	N/R	N/R				
Average Thickness	N/R						



N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
res < 2" long; re	ecord #1 and #3 for features 2	- 8° long; re	ecord #1, #2 and #3 for features >8" long)	
59	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/R N/R N/R
	Provide 1 to 2 photos of fe	ature, belo	w:	
Included the	date and time stamps associ	iated with v	ideo surveillance.	
	res < 2* long; re 59	N/R     (center of feature)       res < 2* long; record #1 and #3 for features 2       DFT Adjacent to       59       Feature (mil)       (~2" away from edge)   Provide 1 to 2 photos of features 2	N/R         (center of feature)         N/R           res < 2" long; record #1 and #3 for features 2 - 8" long; record #1 and #3 for feature (mil) N/R	N/R         (center of feature)         N/R         (south end of feature)           res < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)         DFT Adjacent to         N/R           59         DFT Adjacent to Feature (mil)         N/R         DFT Adjacent to Feature (mil)           (~2" away from edge)         N/R         DFT Adjacent to Feature (mil)



DFT #1 (mil)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featu	ires < 2" long; rec	ord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	59	DFT Adjacent to Feature (mil)		DFT Adjacent to Feature (mil)	N/F
remperature ( 1)		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		N/F
And the second se					



CP Reading #1 (mV) (north end of feature)		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feat	tures < 2" long; red	cord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	59	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
	0.250	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe	N/R		N/
	1				



		G	eneral Information		
Date: AFE / W. Pipe Sup	O.#; oport Anchor:	10/21/17 20011702 W-8	Water Depth	ep / Inspector: (ft):	Kevin Lewis
Longitue	de:	(W-18A_A / W-18A South			
gin			Latitude:		1
		Div	er Inspection Record		
Feature Number	Location Feature (w.r.t. pipe sup	Position of the	Measured Feature size (ft²)	Visual Classi	fication of Feature
1	10" South	12:00	0.002 (½" X ½")	Dislodged Area	Holiday (bare metal Disturbed Area
2	11" South to	6' 360°	26.18 (60" X 62.83")	⊠ Dislodged Area □ Deposit	Holiday (bare metal     Disturbed Area
3	16" North	1:00	0.01 (½" X 1 ¾")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
4	3' North	9:00	0.01 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
5	4' North	8:00	0.003 (½" X 1")	Dislodged Area	Holiday (bare metal Disturbed Area
6	Anchor to North	<b>5'</b> 360°	28.27 (72" X 62.83")	Dislodged Area	Holiday (bare metal     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit.</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal)     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
			1	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
D: incat	table as the			Dislodged Area Deposit	Holiday (bare metal)     Disturbed Area
atures ob:	table rows as served. Feature alled video image	necessary to identify all numbering starts at top es)	Biota present:	⊠YES	□ NO
Vislodged	coating obser	rved on the lake floor:	Lake floor location wrt pipe:	In span 24" pipe is at 6:00 o'cloc	off lake floor, k 60" South of Anchor

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Comments/Issues/Discussion Features 2, Dislodged area is approximately 80% of area 11" to 6' South of anchor that has outer wrap missing Feature 6, Dislodged area is approximately 90% of area from anchor to 6' North that has outer wrap missing **Contractor Signature** Enbridge Representative/ Inspector Signature

and the second sec	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip N/R	Product: Next Calibration Due:	211 Coating Thickness Gauge N/R
Coating Thick	mess Inspection Data (complete	this table in the absence of an	vy Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
	< 2" long; re	ecord #1 and #3 for features 2		(south end of feature) ecord #1, #2 and #3 for features >8" long)	IN/F
			N/R	cold #1, #2 and #3 for features >8" long)	-
Temperature (°F)	56	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
and a second second second		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/
	ere.k	SVALE)			



N/R       N/R       CF Reading #3 (mV)       N/R         DFT #1 (mil)       N/R       DFT #2 (mil)       N/R       (south end of feature)       N/R         (north end of feature)       N/R       DFT #2 (mil)       N/R       DFT #3 (mil)       N/R         (north end of feature)       N/R       DFT #2 (mil)       N/R       DFT #3 (mil)       N/R         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       N/R         Temperature ("F)       56       DFT Adjacent to Feature (mil)       N/R       DFT Adjacent to Feature (mil)       N/R         ("2" away from edge)       N/R       N/R       N/R       N/R       N/R	(north end of feature)       N/R       (center of feature)       N/R       CF Reading #3 (mV) (south end of feature)       N/R         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)       N/R         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       N/R         Temperature (°F)       56       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (N/R       N/R       N/R       N/R       N/R         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R	CP Reading #1 (mV)	A 100 100 100 100	Protection and Coating Meas	urements		
Image: Normal System       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)       N/R         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       N/R       N/R       N/R         Temperature (°F)       56       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       N/R       DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       N/R         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R	Image: Normal system       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)       N/R         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       N/R       N/R       N/R         Temperature ("F)       56       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (N/R       N/R       N/R       N/R       N/R         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R       N/R	(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
(record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       56       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       N/R       N/R       N/F         N/R       N/R       N/R       N/R       N/R       N/R       N/F         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R	(record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       56       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       N/R       N/R       N/R       N/R       N/R         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R       N/R	DFT #1 (mil) (north end of feature)	N/R		N/R	DFT #3 (mil)	N/F
Temperature (°F)     56     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil)     N/F       N/R     N/R     0.12" away from edge)     N/R     0.12" away from edge)     N/F       Provide 1 to 2 photos of feature, below:     0.12" away from edge)     N/F     N/F	Temperature (°F)     56     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil)     N/F       N/R     N/R     0.12" away from edge)     N/F     N/F       Provide 1 to 2 photos of feature, below:     0.12" away from edge)     N/F	(record #2 for features	s < 2" long; re	cord #1 and #3 for features 2	- 8" long: n	ecord #1 #2 and #2 for features	
Temperature (°F)     56     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) N/R     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	Temperature (°F)     56     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) N/R     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R				N/R	Tor reatures >8" long)	
(~2" away from edge) N/R (~8 - 12" away from edge) N/R Provide 1 to 2 photos of feature, below:	(~2" away from edge) N/R (~8 - 12" away from edge) N/R Provide 1 to 2 photos of feature, below:	Temperature (°F)	56		the second descent days and the	DFT Adjacent to Feature (mil)	
Provide 1 to 2 photos of feature, below:	Provide 1 to 2 photos of feature, below:			(~2" away from edge)	N/R	(~8 - 12" away from edge)	and the second division of the second divisio
Provide 1 to 2 photos of feature, below:	Provide 1 to 2 photos of feature, below:		1				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/R
(record #2 for feat	ures < 2" long; re	cord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F) 56		DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe date and time stamps associ	ature, below	N:	



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)		CP Reading #3 (mV)	
(north end of feature)	NAIX	(center of feature)	N/R	(south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/R
(record #2 for feature	s < 2" long; re	cord #1 and #3 for features 2	- 8* long; re	ecord #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	N/R	v,y,	N/F
Temperature (°F)	56	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
		Contraction (Sec.)			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/
DFT #1 (mil) (north end of feature)	N/R	(center of feature) DFT #2 (mil)	N/R	(south end of feature) DFT #3 (mil)	1.00
	s c 2" long: ro	(center of feature)		(south and of footure)	N/F
( sector in 2 for real dife.	s - 2 long, rei	cord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	1
-		DFT Adjacent to	N/R		N/I
Temperature (°F)	56	Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe			N/I
and the second se	Contract of				



CD D	Cathodic P	rotection and Coating Meas	urements (	for Feature # 6)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for features	s < 2" long; red	cord #1 and #3 for features 2	- 8" long: r	(south end of feature) ecord #1, #2 and #3 for features >8" long)	1
			N/R	long)	
Temperature (°F)	56	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
CONCERNING AND		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
			N/R		N/F
		Provide 1 to 2 photos of fe date and time stamps associ	ature, belo	W:	



		Genera	al Information								
Date:	24-21-21	10/21/17	Diver:		Troy Baskett						
AFE / W.	0,#:	20011702	Company Re	p / Inspector:	HOY DUSKELL						
Pipe Sup	oport Anchor:	W-9 (W-18A South / Water Depth (ft): W-18A North)		W-9 (W-18A South / Water Depth (ft):		(W-18A South / Water Depth (ft):		(W-18A South / Water Depth (ft):			
Longitu	de:		Latitude:								
		Diver Ins	pection Recor	ď							
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature	Measured		ssification of Feature						
1	1' North	12:00	0.01 (1° X 1 ½°)	Dislodged Area     Deposit	Holiday (bare metal)						
2	5' North	6:00	0.003 (1" X ½")	Dislodged Area							
3	3' North	6:00	0.39 (7" X 8")	Dislodged Area     Deposit							
1	NO FEATURES SOUTH ANCHOR			Dislodged Area     Deposit							
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>							
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area						
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area						
				Dislodged Area Deposit	Disturbed Area						
			· · · · · · ·	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Disturbed Area						
-				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area						
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area						
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area						
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>						
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>						
- Participant				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area						
bserved.	able rows as necessa Feature numbering s leo images)	ary to identify all features tarts at top row (for	Biota present:	×,	YES D NO						
Dislodged □YES D	I coating observed	on the lake floor:	Lake floor location wrt pipe:	In span 29	" to 36" off lake floor						

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Comment	ts/Issues/Discussion
NO FEATURES IDENTIFIED SOUTH O	FANCHOR
Hone.	
Contractor Signature	Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	YES NO		
Coating Thicknes	ss Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (m' (north end of feature	V) N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for fe	atures < 2" long; re	cord #1 and #3 for features 2	2 - 8" long; i	record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	59°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge) elow: a video surveillance.	N/I
	100	(~2" away from edge)	N/R		N/I
			N/R		N/
The street the					



				ts (for Feature # 2)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (South end of feature)	N/F
(record #2 for feature	es < 2° long; red	cord #1 and #3 for features	2- 8" long; r	record #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/F
Temperature (°F)	59°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
		(~2" away from edge)	N/R		N/F
			N/R		N/F
	100				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	NUT
DFT #1 (mil)	1 28 3 -	(center of feature)		(south end of feature)	N/F
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	_
		DFT Adjacent to	N/R		N/F
Temperature (°F)	59°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge) ow: video surveillance.	N/F
		(~2" away from edge)	N/R		N/F
	-	Provide 1 to 2 photos of 1	N/R		N/F
	6.5	and the second			

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			General Information		
Date:		10/21/17	Diver:	-	Scott Woodward
AFE/W.		20011702	Company Re	p / Inspector:	
Pipe Sup	oport Anchor:	W-10 (W-18A Nor W-18B South)	th/ Water Depth	(ft):	
Longitue	de:		Latitude:		
		D	iver Inspection Reco	rd	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft²)	Visual Cla	ssification of Feature
1	5' 4" South	7:00	0.19 (9" X 3")	Dislodged Area	☐ Holiday (bare metal
2	6' South	12:00	0.01 (3" X ½")	Dislodged Area	
3	5' South	12:00	0.16 (4 ½" X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
4	4'	12:00	0.14 (5" X 4")	Dislodged Area	
5	3' South	2:00	0.004 (¾" X ¾")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
6	Saddle South	7:30	0.07 (2° X 5")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
7	3" North	9:00	0.04 (6" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) □Disturbed Area
8	4" North	6:00	0.06 (3* X 3*)	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
9	6" North	3:00	0.02 (1" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
10	1' 2" North	3:00	0.01 (1½" X ½")	Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
11	2' North	6:00	0.13 (6" X 3")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
12	2' North		0.03 (2" X 2")	Dislodged Area     Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
13	3' 3" North	6:30	0.17 (5" X 5" Di) 0.01 (2" X 1" D)	Dislodged Area	□Holiday (bare metal) □Disturbed Area
14	3' 6" North	9:00	0.0004 (¼" X ¼")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
15	5' 8" North	9:00	0.11 (4" X 4")	Dislodged Area     Deposit	□Holiday (bare metal) □Disturbed Area
16	5' 10" North	6:00	0.25 (6" X 6")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) ⊠Disturbed Area
atures obs	able rows as neces served. Feature nu detailed video imag	imbering starts at	Biota present:	×γ	ES INO

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and the second se		5 Straits of Mackinac
Dislodged coating observed on the Toor: □YES ⊠NO	ake Lake floor location wrt pipe:	In span 18" off lake floor
	Comments/Issues/Discus	sion
Feature 13, Deposit 2	" X 1" within a Dislodged area 5'	X 5"
Ho New	l	

1

	Coating Gauge	e Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	I YES I NO	and then public	
Coating Thicknes	ss Inspection Data (complete	e this table in the absence	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft	
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	NUD	
South of Anchor #2	N/R	N/R	N/R
South of Allenot #2	IN/IN	N/R	N/R
Average Thickness	N/R	and the second second	



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2)	long; record #1 a	nd #3 for features 2 - 8" long;	record #1.	#2 and #3 for features >8" long)	-
		DFT Adjacent to Feature (mil)	NR D		NR
Temperature (°F)	56			DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of I	feature balow		NR		NR



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil)	NR
(record #2 for features < 2" lo	ng; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
		the second se	NR	T	
emperature (°F) 56 Feature (mil) NR		DFT Adjacent to Feature (mil)	NR		
		(~2" away from edge)	NR	R DFT Adjacent to Feature (mil) R (~8 - 12" away from edge)	NR
Provide 1 to 2 photos of fea	ture below		NR		NR
Server 1		- CARLA			



(north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2" lon	ng; record #1	and #3 for features 2 - 8" long;	record #1.	#2 and #3 for features >8" long)	11
		Street States and	NR	l loudines to long,	NR
Temperature (°F)	56	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	NR
10.12.104		(~2" away from edge)	NR		NR
Provide 1 to 2 photos of feat	1		NR		NR
ncluded the date and time s	tamps asso	ciated with video surveillanc	е.		_

 Date:
 10/21/17
 Frame(HH:MM:SS)
 00:17:52
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NF
(record #2 for features < 2" los	ng; record #1		record #1.	#2 and #3 for features >8" long)	
		DFT Adjacent to	NR		NR
Temperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NF
		(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of fea	turo holouu		NR		NF
3		2.3-2			



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	(south end of feature) DFT #3 (mil) (south end of feature)	NR
record #2 for features < 2" los	ng; record #1	and #3 for features 2 - 8" long:	record #1	#2 and #3 for features >8" long)	
		Conceptions of a second s	NR	line and no for realares >0 forig)	NR
emperature (°F)	56	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
rovide 1 to 2 photos of feat	1	( = only nonredge)	NR		NR
		100			

 Date:
 10/21/17
 Frame(HH:MM:SS)
 00:19:36
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.



CP Reading #1 (mV)		otection and Coating Meas	arement		
(north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil)	NF
(record #2 for features < 2" lon	ng; record #1	and #3 for features 2 - 8" long:	record #1	(south end of feature) #2 and #3 for features >8" long)	- NIC
	T	the second se	NR	#2 and #3 for reatures >8" long)	
Temperature (°F)	56	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NF
(i)	50	(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of feat	1	( 2 away from edge)	NR		NR
		1 -			
		COLUMN TWO IS NOT			
		12.00			



CP Reading #1 (mV) (north end of feature)	NR	tection and Coating Meas CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	(south end of feature) DFT #3 (mil)	NF
(record #2 for features < 2" lo	ong; record #1 a	nd #3 for features 2 - 8" long:	record #1	(south end of feature) #2 and #3 for features >8" long)	
		DFT Adjacent to	NR	ing and no ion reactines 20 long)	NR
Temperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of fea	turo bolow	,	NR		NR
		iated with video surveillanc			



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil)	NR
(record #2 for features < 2" In	ong; record #1 a	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
		DFT Adjacent to	NR		NR
emperature (°F)		the second se	DFT Adjacent to Feature (mil)	NR	
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
rovide 1 to 2 photos of fea	ohum hata	,,	NR		NR
1- )		N. Topol			



(north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil)	NR
(record #2 for features < 2" lo	ong; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
		DFT Adjacent to	NR		NR
emperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
rovide 1 to 2 photos of fea	ature helow		NR		NR
	1	1			



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NR
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2"	long; record #1	and #3 for features 2"-8" long; i	ecord #1,	#2 and #3 for features >8" long)	-
	_	DFT Adjacent to	NR		NR
emperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8"-12" away from edge)	NR
Provide 1 to 2 photos of fe	atura holow		NR		NR
		100			



NR CP Reading #2 (m (center of feature)	nV) ire)	NF
NR DFT #2 (mil) (center of feature)	100)	NF
2" long; record #1 and #3 for features 2 - 8"	>8" long)	-
DFT Adjacent		NF
56 Feature (mil)	eature (mil)	NF
(~2" away from edg	m edge)	NF
feature, below:		NR
1		



CP Reading #1 (mV) (north end of feature)	NR	ection and Coating Measu CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	(south end of feature) DFT #3 (mil) (south end of feature)	NF
(record #2 for features < 2" los	ng; record #1 a	nd #3 for features 2 - 8" long;	record #1.	#2 and #3 for features >8" long)	
		DFT Adjacent to	NR	l line (p o tong)	NR
Temperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of feat	ture below:		NR		NR
in al		iated with video surveillanc	6,		
			<u>c</u> ,		



CP Reading #1 (mV) (north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV) (south end of feature)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	DFT #3 (mil) (south end of feature)	NR
(record #2 for features < 2* lo	ong; record #1	and #3 for features 2 - 8" long;	record #1,	#2 and #3 for features >8" long)	
		DFT Adjacent to	NR		NR
emperature (°F)	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge) -	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of fea	ture below		ININ		NF
		1 and			



(north end of feature)	NR	CP Reading #2 (mV) (center of feature)	NR	CP Reading #3 (mV)	NF
DFT #1 (mil) (north end of feature)	NR	DFT #2 (mil) (center of feature)	NR	(south end of feature) DFT #3 (mil)	NF
	ng; record #1 ar	nd #3 for features 2 - 8" long:	record #1	(south end of feature) #2 and #3 for features >8" long)	
			NR	Land no for reactives >0 forg)	NR
Cemperature (°F)	56	DFT Adjacent to Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
		(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of fea	ture but		NR		NR



(north end of feature) DFT #1 (mil) (north end of feature) (record #2 for features < 2" Ion Temperature (°F)	NR g; record #1 a	(center of feature) DFT #2 (mil) (center of feature)	NR	(south end of feature) DFT #3 (mil)	NR
	g; record #1 a			(South and of footure)	NR
		nd #3 for features 2 - 8" long;	record #1.	(south end of feature) #2 and #3 for features >8" long)	
Cemperature (°F)		DFT Adjacent to	NR	and the list reductes 2 6 long)	NR
	56	Feature (mil)	NR	DFT Adjacent to Feature (mil)	NR
and the second sec	1	(~2" away from edge)	NR	(~8 - 12" away from edge)	NR
Provide 1 to 2 photos of featu	Iro bolow	,	NR		NR



(north end of feat DFT #1 (mil) (north end of feat (record #2 for featu Temperature (°F)		(center of feature) DFT #2 (mil) (center of feature)	NR		NF
(record #2 for featu		(center of reartire)	NR	(south end of feature) DFT #3 (mil)	NR
		and #3 for features 2 . P" last		(south end of feature)	NP
Tomporature (95)			NR	#2 and #3 for features >8" long)	
	56	DFT Adjacent to	NR	DFT Adjacent to Feature (mil)	NR
remperature (1)	00	Feature (mil) (~2" away from edge)	NR	(~8 - 12" away from edge)	NR
Dec 14 44 0 4	tos of feature, below:	( z away from edge)	NR	( a set only non edge)	NR



		Genera	Information		
Date:		10/22/17	Diver:	C	had Cantrell
AFE / W.O.#:			Company Rep	/ Inspector:	
Pipe Support Anchor:			Water Depth (ft): Latitude:		
J. J		Diver Inst	pection Record	1	
Feature Number	Location of Feature (w.r.t. pipe support	Circumferential Position of the Feature	Measured Feature size (ft <sup>2</sup> )	Measured Feature Visual Classification of Feature size (ft <sup>2</sup> )	
1	6' South	12:00	0.01 (½" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
2	4' South	360°	2.62 (6" X 62.83")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
3	9" South	12:00	0.01 (1" X 1½")	Dislodged Area	☐Holiday (bare metal) ☐Disturbed Area
4	1' 3" North	10:00	0.007 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
5	7" South	4:00	0.007 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐Holiday (bare metal) ☐Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				Dislodged Area     Deposit	☐Holiday (bare metal) ☐Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area	□Holiday (bare metal □Disturbed Area
				Dislodged Area     Deposit	□Holiday (bare metal □Disturbed Area
			1.000	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
observed	rt table rows as nece d. Feature numberin video images)	ssary to identify all features g starts at top row (for	Biota present:		YES 🗆 NO
Dislodged coating observed on the lake floor:			Lake floor location wrt pipe:	In span 18" off lake floor	

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Comments/Issues/Discussion					
Feature 2, Deposit is 6" wide X 62.83" (36 be banding with a piece of lathe still on pi	60° around pipe), 4' South of anchor appears to pe at 6:00				
Honor Signature	Enbridge Representative/ Inspector Signature				

	Coating Gauge	Information	and the second sec	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge	
Last Calibrated:	N/R	Next Calibration Due:	N/R	
Gauge verified prior to use:	□ YES □ NO			
Coating Thicknes	s Inspection Data (complete	e this table in the absence of	of any Features)	
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock	
North of Anchor #1	N/R	N/R	N/R	
North of Anchor #2	N/R	N/R	N/R	
	N/R	N/R	N/R	
South of Anchor #1 South of Anchor #2	N/R	N/R	N/R	
South of Allenot #2				
Average Thickness	N/R			



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
(north end of feature)	IN/IN	(center of feature)	1.11.7.5	(south end of feature) DFT #3 (mil)	
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature)	N/R
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	
A 17771		Charles in the second of the	N/R		N/F
		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	55°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		( 2 away nom cuge)	N/R		N/F
	1.00				

 Date:
 10/22/17
 Frame(HH:MM:SS)
 00:13:13
 Date:
 Frame(HH:MM:SS)

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.

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CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	
Variation	1	The second state of the second state of the	N/R		N/F
Tamparatura (°E)		DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
Temperature (°F)	55	(~2" away from edge)	N/R	(-8-12 away nomedge)	N/F



CP Reading #1 (mV) (north end of feature)	N/R	otection and Coating Mea CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	
(record ne tor tostar			N/R		N/F
Sector and	1.000	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	
Temperature (°F)	55°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		( 2 away nomeuge)	N/R		N/F
	E.				



Iteration       DFT #1 (mil)       N/R       DFT #2 (mil)       N/R       DFT #3 (mil)         (north end of feature)       N/R       (center of feature)       N/R       (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long       Temperature ("F)       55"       DFT Adjacent to Feature (mil)       N/R       DFT Adjacent to Feature (mil)         ("2" away from edge)       N/R       N/R       DFT Adjacent to Feature (mil)       ("8 - 12" away from edge)         Provide 1 to 2 photos of feature, below:       Included the date and time stamps associated with video surveillance.       Includeo surveillance.	eading #1 (mV) end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
OFT Adjacent to Feature (°F)       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8 - 12" away from edge)         Provide 1 to 2 photos of feature, below:	FT #1 (mil)		DFT #2 (mil) (center of feature)			N/F
Temperature (°F)     55°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	record #2 for features <	< 2" long; red	cord #1 and #3 for features 2	2 - 8" long; n	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     55°     Feature (mil) (~2" away from edge)     N/R     (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:				N/R		N/F
(~2" away from edge) N/R Provide 1 to 2 photos of feature, below:	(9E)				DFT Adjacent to Feature (mil)	N/I
Provide 1 to 2 photos of feature, below:	perature ("F)	55			(-8 - 12 away nom edge)	N/I
Included the date and time stamps associated with video surveillance.			Dravida 1 to 2 photos of		low:	
and the second						
Pote: 10/22/17 Erame(HH:MM:SS) 00:17:32 Date: Frame(HH:MM:SS)						



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; red	cord #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	-
(1000) 0100			N/R		N/1
-	55°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
Temperature (°F)	55	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
		Provide 1 to 2 photos of	N/R		N/
				n video surveillance.	



		Gene	ral Information		
Date:		10/22/17	Diver:		George Palmer
AFE / W.	0.#:	20011702	Company Re	p / Inspector:	seeige i ainei
Pipe Sup	oport Anchor:	W-12 (W-24A / W-24B)	Water Depth		
Longitude:			Latitude:	1.4	
		Diver In	spection Recor	rd	
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the	Measured Feature size (ft²)		ssification of Feature
1	5' 4" South	12:00	0.002 (¼" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal □Disturbed Area
2	3' 9" South	3:00	0.001 (¾* X ¼*)	<ul> <li>☑ Dislodged Area</li> <li>☑ Deposit</li> </ul>	
3	2' 3" South	3:00	0.0002 (½" X ½")	Dislodged Area     Deposit	Holiday (bare metal
4	Saddle South	12:00	0.04 (12" X ½")	Dislodged Area	Holiday (bare metal
5	6" North	12:00	0.02 (2" X 1½")	Dislodged Area	☐Holiday (bare metal ☐Disturbed Area
6	2' North	12:00	0.11 (4½" X 3½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□ Holiday (bare metal) □ Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□Holiday (bare metal) □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	□ Holiday (bare metal) □ Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
	1.0			<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
atures ob	able rows as necessa served. Feature num d video images)	ary to identify all bering starts at top row	Biota present:	NY	ES 🗆 NO
Dislodged DYES	I coating observed	on the lake floor:	Lake floor location wrt pipe:	In span	12" off lake floor

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Diver Inspection Form for L5 Straits of Mackinac

# Comments/Issues/Discussion Feature 2, Deposit area of (3 deposits ¼" X ¼" each) within a Dislodged area (2" X 2") Feature 4, Deposit 12" long X ½" wide next to saddle, appears to continue under the saddle Note: 5' North is banding, wood lathe on bottom of pipe at 4-8 o'clock Model Model Contractor Signature

	Coating Gauge	Information		
Manufacturer: Last Calibrated:	Elcometer Inspection Equip Product: N/R Next Calibration Due:		211 Coating Thickness Gau N/R	
Gauge verified prior to use: Coating Thicknes	SS Inspection Data (complete	this table in the absence of	of any Features)	
Location	Coating Thickness (mil)	Distance from Anchor (ft)		
North of Anchor #1	N/R	N/R	N/R	
North of Anchor #2	N/R	N/R	N/R	
South of Anchor #1	N/R	N/R	N/R	
South of Anchor #2	N/R	N/R	N/R	
Average Thickness	N/R			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (South end of feature)	N/F
(record #2 for feature	es < 2* long; r	ecord #1 and #3 for features 2	- 8" long; i	record #1, #2 and #3 for features >8" long)	-
		the second s	N/R		N/F
Temperature (°F)	52°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	100	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of 1	N/R		N/I
		date and time stamps asso	clated with	n video surveillance.	
		date and time stamps asso	clated with	n video surveillance.	



	Satilouic Pro	tection and Coating Mea	suremen	ts (for Feature # 2)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for featur	es < 2" long; rec	cord #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	-
		and a state of the	N/R		N/I
Temperature (°F)		DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
	1	Provide 1 to 2 photos of t	N/R		N/
100	- Partie				



(north end of feature) DFT #1 (mil) (north end of feature)		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/
	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/I
(record #2 for feature	es < 2" lona: rea	cord #1 and #3 for features 1	- 8" long: r	(South end of feature) record #1, #2 and #3 for features >8" long)	
			N/R	ecold #1, #2 and #3 for realures >8 (ong)	N/I
Temperature (°F)		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/I
remperature ( P)	52	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
	_	( 2 away from edge)	N/R		N/I
10 X - 10 - 1		1. Carlo alla			
	-c Zm				



DFT #1 (mil) (north end of feature)		(center of feature)	1.000	(south end of feature)	N/I
	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features :	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	erature (°F) 52°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
1.4		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/R
	-	Provide 1 to 2 photos of	N/R		N/



DFT #1 (mil) (north end of featur (record #2 for fe Temperature (°F)	atures < 2" long;	(center of feature) DFT #2 (mil) (center of feature) record #1 and #3 for features: DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	N/R 2 - 8" long; r N/R N/R N/R N/R	(south end of feature) DFT #3 (mil) (south end of feature) record #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
	52°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R	DFT Adjacent to Feature (mil)	
	52°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R	DFT Adjacent to Feature (mil)	
Temperature (°F)		Feature (mil) (~2" away from edge)	N/R	DFT Adjacent to Feature (mil)	
		(~2" away from edge)		(~8 - 12" away from edge)	
	Included the		N/R	( o 12 away nom cuge)	N/R
C. Locale	Included the	Provide 1 to 2 photos of			N/I
1					
		and the second se			



CD Develop HA / htt	Contraction of the local division of the	ection and Coating Mea	suremen	(	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	res < 2° long; rec	ord #1 and #3 for features 2	2 - 8" long; i	record #1, #2 and #3 for features >8" long)	
			N/R		N/F
Temperature (°F)	52°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
· · · · · · · · · · · · · · · · · · ·	52	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		( - away nom eage)	N/R		N/F
-	A Serie				

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ENBRIDGE

		Gen	eral Information		
Date:		10/22/17	Diver:		Maurice Unger
AFE / W.	.0.#:	20011702	Company Rep	/ Inspector:	indunce onget
Pipe Sup	oport Anchor:	W-13 (W-23A / W-23B)	Water Depth	and the second se	
Longitu	de:		Latitude:		
		Diver I	nspection Recor	d	-
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the	Measured Feature size (ft²)		ssification of Feature
1	Anchor to 6' South	.360°	29.84 (72" X 62.83")	Dislodged Area	Holiday (bare metal
2	1' 9" South	10:00	0.003	Dislodged Area	
4	1 9 South		(1/2" X 1")	Deposit	Disturbed Area
3	4' North	10:00	0.002	Dislodged Area	
	4 North		(1" X ¼")	Deposit	Disturbed Area
4	5' 10" North	12:00	0.03	Dislodged Area	Holiday (bare metal
	o to north		(3* X 1½")	Deposit	Disturbed Area
5	Anchor to 6'	360°	31.42	Dislodged Area	
	North		(72" X 62.83")	Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
			(	Dislodged Area	
-				Deposit	Disturbed Area
		1 m m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1		Dislodged Area Deposit	□Holiday (bare metal □Disturbed Area
				Dislodged Area	
_				Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
				Dislodged Area	
				Deposit	Disturbed Area
				Dislodged Area	
_				Deposit	Disturbed Area
				Dislodged Area	
		-		Deposit	Disturbed Area
		1 a		Dislodged Area	
			-	Deposit	Disturbed Area
			1.	Dislodged Area     Doposit	
-				Deposit Dislodged Area	Disturbed Area
_				Dislodged Area     Deposit	Holiday (bare metal) Disturbed Area
atures of	table rows as necess oserved. Feature nun talled video images)		Biota present:		YES INO
1000	d coating observed	on the lake floor:	Lake floor location wrt pipe:	In spar	n 18" off lake floor



Comments/Issues/Discussion Feature 1, Dislodged area is approximately 95% of area from anchor to 6' South that has outer wrap missing Feature 5, Dislodged area is approximately 100% of area from anchor to 6' North that has outer wrap missing **Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	N/R	Next Calibration Due:	N/R
Gauge verified prior to use:	I YES I NO		
Coating Thicknes	s Inspection Data (complete	e this table in the absence of	of any Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	N/R	N/R	N/R
North of Anchor #2	N/R	N/R	N/R
South of Anchor #1	N/R	N/R	N/R
South of Anchor #2	N/R	N/R	N/R
Average Thickness	N/R		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	55°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	22	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of 1	N/R		N/I
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			

 Date:
 10/22/17
 Frame(HH:MM:SS)
 00:24:24
 Date:
 10/22/17
 Frame(HH:MM:SS)
 00:24:33

 Note:
 CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:24:33



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DET Adiagant to	N/R		N/
Temperature (°F)	55°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
	-	Provide 1 to 2 photos of t	N/R		N/
		1			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2		record #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R	_	N/I
Temperature (°F)	55°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/I
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of	N/R		N/I
	and the second se				
	1	1.00			
	4				



Temperature (°F) 55°	(center of feature) DFT #2 (mil) (center of feature) record #1 and #3 for features DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of date and time stamps asso	N/R N/R N/R N/R feature, be	(south end of feature) DFT #3 (mil) (south end of feature) record #1, #2 and #3 for features >8" long) DFT Adjacent to Feature (mil) (~8 - 12" away from edge) elow: h video surveillance.	N/F N/F N/F N/F
Temperature (°F) 55°	DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	N/R N/R N/R N/R feature, be	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F N/F
Temperature (°F) 55°	DFT Adjacent to Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	N/R N/R N/R N/R feature, be	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F N/F
	Feature (mil) (~2" away from edge) Provide 1 to 2 photos of	N/R N/R feature, be	(~8 - 12" away from edge)	N/F
	(~2" away from edge) Provide 1 to 2 photos of	N/R feature, be	elow:	
Included the	Provide 1 to 2 photos of	feature, be	elow: h video surveillance.	N/F
Included the	Provide 1 to 2 photos of date and time stamps asso	feature, be ciated with	elow: h video surveillance.	
	1. 2. 1			



CP Reading #1 (mV) (north end of feature)		CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
(record #2 for feat	ures < 2" long; re	cord #1 and #3 for features 2	2 - 8" long: r	(south end of feature) record #1, #2 and #3 for features >8" long)	
		the second se	N/R	locate #1, #2 and #3 for leatures >8 long)	N/F
Temperature (°F)	55°	DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
	55	Feature (mil)	N/R	(~8 - 12" away from edge)	N/F
		(~2" away from edge) N/R N/R			N/F



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		G	eneral Information		
Date: AFE / W.		11/11/17 20011702	Diver: Company Re	p / Inspector:	Troy Baskett
Pipe Sup	port Anchor:	W-57 (W-63A / W-631		and the second of the last the second s	
Longitud	te:		Latitude:	1	
		Dive	er Inspection Record	R. Contraction	
Feature Number	Location of Featu (w.r.t. pipe support	Circumferential Position of the	Measured Feature size (ft²)		sification of Feature
1	3' 7" South	12:00	0.08 (3" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
2	Anchor to 6' Sout	h 360°	25.13 (72" X 62.83")	Dislodged Area	Holiday (bare metal     Disturbed Area
3	1' 3" South	2:00	0.02 (3" X 1")	Dislodged Area	Holiday (bare metal     Disturbed Area
4	1' 1" South	2:00	.007 (1" X 1")	Dislodged Area     Deposit	Holiday (bare metal     Disturbed Area
5	5' 1" South	5:00	0.007 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta)     Disturbed Area
6	5' 4" South	12:00 - 3:00	0.02 (24" X 1/8")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare meta Disturbed Area
7	4' 10" North	11:00	0.02 (2" X 1 ½")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
8	1' 6" North	11:00	0.03 (2" X 2")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
9	1' 9" North	9:00 - 2:00	0.02 (20* X 1/8*)	Dislodged Area     Deposit	Holiday (bare metal Disturbed Area
10	Anchor to 6' North	n 360°	6.28 (72" X 62.83")	Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
atures ob	table rows as nece served. Feature nun ailed video images)	ssary to identify all nbering starts at top	Biota present:	XX	
	coating observed	on the lake floor:	Lake floor location wrt pipe:	In span	8" off lake floor



Diver Inspection Form for L5 Straits of Mackinac

	Comm	ents/lssues/Discussion	
wiap missi	Dislodged area is approximat		
Open water No change	reading -266/-255 n CP readings on deposits to i	ndicate on/off potentials	
NOTE: due	to weather conditions 10° F, o m time the diver was able to g	liver was in a no chambe	r decompression dive. Due to owing two features only.
Feature 3 -262/-252 -245/-234 -245/-226			
Feature 7 -243/-293 -234/-224 -285/-275 -238/-228			
Ho	Muli	-	
	Contractor Signature	Enbridge Repre	sentative/ Inspector Signature
	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated: Gauge verified prior to use	N/R e:  YES NO	Next Calibration Due:	N/R
	Thickness Inspection Data (complete	this table in the absence of a	py Fosturas)
Locatio		Distance from Anchor (ft	and deliver and the second sec
North of Anchor #		N/R	
North of Anchor #		N/R	N/R N/R
Cault of A - 1	4		
South of Anchor #		N/R	N/R
South of Anchor #	2 N/R	N/R	N/R

Average Thickness

N/R



CP R	eading #1 (m	V)	Protection and Coating Mea			
(north	n end of featur	e) N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
(north	FT #1 (mil) end of featur		DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
1	(record #2 for fe	eatures < 2" long;	record #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
			DFT Adjacent to	N/R		N/I
Ten	nperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
			(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/F
		100	Provide 1 to 2 photos of fe			N/
			1101100 x 10 2 prioros 01 je		W-	
		Included th	e date and time stamps assoc	iated with v	ideo surveillance.	
		Included th	e date and time stamps assoc	iated with v	ideo surveillance.	



(north end of fe	(mV) ature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mi (north end of fe	il)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
		< 2" long; re	ecord #1 and #3 for features 2	2"-8" long: re	(south end of feature) cord #1, #2 and #3 for features >8" long)	
		1	1	N/R	internet in the second se	N/F
Temperature (	(°F)	49°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
			(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
			Provide 1 to 2 photos of fe	N/R		N/I



CP Reading #1 (mV) (north end of feature)				(for Feature # 3)	
	N/R N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil)		DFT #2 (mil)	N/R	(south end of feature)	N/F
(north end of feature)	N/R	(center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; re	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		and the second of the second	N/R		N/F
Temperature (°F)	) 49° Feature (mil) N/R	the second se	DFT Adjacent to Feature (mil)	N/F	
	C. C	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe	N/R		N/F
		and the second se			



	Cathodic Pr	otection and Coating Meas	urements (	for Feature # 4)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/F
	and the second	Provide 1 to 2 photos of fe			
		late and time stamps assoc	iated with v	ideo surveillance.	
			iated with v	ideo surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
	s < 2" long;	record #1 and #3 for features 2	2"-8" long: re	(south end of feature) cord #1, #2 and #3 for features >8" long)	140
	1	DFT Adjacent to	N/R	and #1, #2 and #3 for leadines >6 forig)	N/F
Temperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		N/I
			anne neini		
	Included th	ne date and time stamps associ	iated with v	v. ideo surveillance.	
	Included th	ne date and time stamps associ	iated with v	v. ideo surveillance.	



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	
(north end of feature) DFT #1 (mil)		(center of feature)	INVIX	(south end of feature)	N/F
(north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feat	ures < 2" long; red	cord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	_	(~2" away from edge)	N/R N/R	(~8"-12" away from edge)	N/F
		Provide 1 to 2 photos of fe			N/I
	Included the o	date and time stamps assoc	iated with v	ideo surveillance.	
	Included the o	date and time stamps assoc	iated with v	ideo surveillance.	



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil)	N/R	(center of feature) DFT #2 (mil)	NUD	(south end of feature) DFT #3 (mil)	
(north end of feature)		(center of feature)	N/R	(south end of feature)	N/F
(record #2 for featur	ies < 2" long; reco	ord #1 and #3 for features 2		cord #1, #2 and #3 for features >8" long)	
and the second states		DFT Adjacent to	N/R N/R	DET Adianantes Factor ( 10	N/F
Temperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8"-12" away from edge)	N/F
	1	(~2" away from edge)	N/R	( o iz away nom edge)	N/F
4. 11 1	No.	3-1			



and the second sec	Cathodic Pro	otection and Coating Meas	urements (	for Feature # 8)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; reco	ord #1 and #3 for features 2	?"-8" long; re	ecord #1, #2 and #3 for features >8" long)	-
Temperature (°F)	49°	DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/F
remperature ( F)	49	Feature (mil) (~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
		( 2 away from edge)	N/R	( , ioin cogo)	N/F
MAR AL		ate and time stamps associ	atea with vi	laeo surveillance,	
			atea with v	laeo surveillance,	
			atea with v	laeo surveillance,	



CP Reading #1 (mV)		otection and Coating Meas			
(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feat	ures < 2" long; rec	ord #1 and #3 for features 2	2"-8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	49°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-		N/R		N/F
	Included the c	Provide 1 to 2 photos of fe late and time stamps assoc	iatad with w	idaa aana illaasa	
100					



CP Reading #1 (mV) (north end of feature)	and the second sec	CD Dooding #2 (m)/)			
(north chu of realure)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (South end of feature)	N/F
(record #2 for features	s < 2" long; r	ecord #1 and #3 for features 2	2"-8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	49° Feature (mil) N/R DFT Adjacent t	DFT Adjacent to Feature (mil)	N/F		
	1111	(~2" away from edge)	N/R	(~8"-12" away from edge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		N/F
		-			





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		Gener	al Information		
Date:		10/12/17	Diver:		Kevin Lewis
AFE / W.	.0.#:	20011702	14-12/203	p / Inspector:	KEVIII LEWIS
Pipe Sup	oport Anchor:	W-58 (W-65A / W-65B)	Water Depth		
Longitu	de:		Latitude:	(11)	
		Diver In	spection Record		
	Longther of	the second se			
Feature Number	Location of Feature (w.r.t. pipe support)	Circumferential Position of the Feature (o'clock position)	Measured Feature size (ft <sup>2</sup> )	Visual Clas	sification of Feature
1	4' South	3:00	.083 (3" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
2	4' North	11:00	.007 (1" X 1*)	Dislodged Area	Holiday (bare metal     Disturbed Area
3	5' North	8:00	.0008 (1" X 3")	Dislodged Area     Deposit	Holiday (bare metal     Disturbed Area
4	3' 9" – 5' 3" South SEE COMMENTS	360° around pipe SEE COMMENTS	.048 (18" X 62.83")	Dislodged Area     Deposit	Holiday (bare metal     Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				🗆 Deposit	Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
			_	Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
_				Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
P. incod 4				Dislodged Area Deposit	<ul> <li>Holiday (bare metal)</li> <li>Disturbed Area</li> </ul>
oserved.	Feature numbering eo images)	ary to identify all features starts at top row (for	Biota present:	⊠¥E	S 🗆 NO
Dislodged YES ⊠N	coating observed o	on the lake floor; 🛛 🗆	Lake floor location wrt pipe:	In span 18	3" off lake floor

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-			Comments/	lssues/Discussio	n.
-	Feature 1, Deposit ar	ea 3" X 4", r	no sample tak	en	
	Feature 2, Deposit 1"	X 1", no sa	mple taken		
	Feature 3, Deposit ar	rea 1" X 3", r	no sample tak	en	
	verified by the followin DFT's taken on the DFT's were taken at t	ng: 18" wide are the 12, 3, 6 a 2 o'clock	a at the 10 o 9 o'clock po 3 o'clock	clock (180 mil	video recording by the Diver, the 18 e coating on each side of this area s) and 2 o'clock (160 mils) and North of the 18" wide area <b>9 o'clock</b> 140 mils
_	North of area	92 mils	125 mils	92 mils	94 mils
	Ho Mu	o Ci			ge Representative/ Inspector Signature
	Contra	Lioi Dignature			TO Depresentative / Income of the

and the second s	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip 10/6/17 SYES INO	Product: Next Calibration Due:	211 Coating Thickness Gauge 10/6/18
Coating Thic	kness Inspection Data (complete	this table in the absence of ar	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock)
North of Anchor #1	110	5	10:00
North of Anchor #2	115	5	2:00
South of Anchor #1	180	5	10.00
South of Anchor #2	160	5	10:00
Average Thickness	141		



CP Reading #1 (mV) (north end of feature)	N/R	Protection and Coating Meas CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil)	N/F
	s < 2" long; re	ecord #1 and #3 for features 2	- 8" long: re	(south end of feature) cord #1, #2 and #3 for features >8" long)	
		and the second s	N/R	and #1; #2 and #5 for realities >6 fong)	N/F
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	1000	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		N/F



and the second second	Cathodic P	Protection and Coating Meas	surements (	for Feature # 2)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil)	N/F
(record #2 for feature	s < 2" long; re	cord #1 and #3 for features 2	- 8" lona: re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/F
	1	(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/R
	-	Provide 1 to 2 photos of fe			N/F
North N					



0.0.0	Cathodic Pr	otection and Coating Measu	urements (	for Feature # 3)	
CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge) -	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fee	N/R		N/F
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100	1.4			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; r	ecord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)	54°	DFT Adjacent to Feature (mil) (~2" away from edge)	N/R N/R N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F N/F
		Provide 1 to 2 photos of fe	N/R		N/F
				Sector a	

 Date:
 10/12/17
 Frame(HH:MM:SS)
 00:44:29
 Date:
 10/12/17
 Frame(HH:MM:SS)
 00:45:04

 Note: CP readings will not be taken at features classified as disturbed areas or dislodged areas.
 00:45:04
 00:45:04

### NOT A FEATURE, SEE COMMENTS:

The 18" wide area X 360° circumference is thicker than the coating on each side of this area, verified by the DFTs listed in the Comments/Issues/Discussion section



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		Gene	ral Information		
Date:		10/10/17	Diver:		Brad Joanis
AFE / W.	0.#:	20011702	Company Rep	o / Inspector:	
Pipe Sup	port Anchor:	W-59	Water Depth (	the second s	
		(W-64A /W-64B South)	sector a spart		
Longitu	de:	1	Latitude:		
		Diver Ir	spection Record	1	
Feature Number	Location of Feature	Circumferential Position of the Feature	on Measured Feature	Visual Clas	sification of Feature
T NO STOR	(w.r.t. pipe support		size (ft <sup>2</sup> )		
1	9' South	12:00	0.006 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal     Disturbed Area
-	1	11:00	0.001	Dislodged Area	Holiday (bare metal
2	9' South	11.00	(1/2"X 1/2")	Deposit	Disturbed Area
	and the brief of	12:00	0.07	Dislodged Area	Holiday (bare metal
3	6' 10" South	12,00	(5" X 2*)	Deposit	Disturbed Area
10.001	1	12:00	0.003	Dislodged Area	Holiday (bare metal
4	6' 9" South	12.00	(1" X ½")	⊠ Deposit	Disturbed Area
	and the second second	9:00	0.01	Dislodged Area	Holiday (bare metal
5	4' South	0.00	(2" X 1")	⊠ Deposit	Disturbed Area
100	Comment and	12:00	0.003	Dislodged Area	Holiday (bare metal
6	2' 9" North	12.00	(1" X ½")	Deposit	Disturbed Area
-		12:00	0.14	Dislodged Area	□ Holiday (bare metal
7	5' 3" North	12.00	(4" X 5")	Deposit	Disturbed Area
	100 C 100 C	12:00	0.12	Dislodged Area	Holiday (bare metal
8	5' 5" North	12.00	(3" X 6")	Deposit	Disturbed Area
			(0 / 0 /	Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
-				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
			1	Dislodged Area	Holiday (bare metal
			0.00	Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
				Deposit	Disturbed Area
				Dislodged Area	Holiday (bare metal
		1		Deposit	Disturbed Area
	Feature numbering s	sary to identify all feature starts at top row (for detailed			YES 🗆 NO
	d coating observ	red on the lake floor	Lake floor location wrt pipe:	.6:00 oʻq	clock at lake floor

ENBRIDGE	Diver Inspec	ction Form for L5 Straits of Mackinac
	Commen	ts/Issues/Discussion
Hb G	lul:	
	tractor Signature	Enbridge Representative/ Inspector Signature

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	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	08/09/2017	Next Calibration Due:	08/09/2018
Gauge verified prior to use:	🖾 YES 🗆 NO		
Coating Thic	kness Inspection Data (complete	this table in the absence of an	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	100	5	10:00
North of Anchor #2	130	5	2:00
South of Anchor #1	115	5	10:00
South of Anchor #2	120	5	2:00
Average Thickness	116		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; reco	ord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)		Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/I N/
		ate and time stamps assoc	ated with b	deo survembrice.	
			oled with vi		



CP Reading #1 (north end of fea	(mV) ature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/I
DFT #1 (mil (north end of fea	I)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/I
(record #2 fo	or features	< 2" long; red		- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
			DFT Adjacent to	N/R	in the second we for realized very forig)	N/
Temperature (°	°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
C		197. L.	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
			Provide 1 to 2 photos of fe	N/R		N/
			ATE O			



DFT #3 (mil) (south end of feature)         long; record #1, #2 and #3 for features >8° long)         R       DFT Adjacent to Feature (mil) (~8 - 12" away from edge)         R       OFT Adjacent to Feature (mil) (~8 - 12" away from edge)         R       OFT Adjacent to Feature (mil) (~8 - 12" away from edge)         R       OFT Adjacent to Feature (mil) (~8 - 12" away from edge)         R       OFT Adjacent to Feature (mil) (~8 - 12" away from edge)         R       OFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
R       DFT Adjacent to Feature (mil)         R       (~8 - 12" away from edge)         R	N/F
R       DFT Adjacent to Feature (mil)         R       (~8 - 12" away from edge)         R	N/F N/F N/F
R (~8 - 12" away from edge) R re, below:	N/F
R re, below:	
re, below:	N/F



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
(north end of feature)	THIS	(center of feature)	IWIN	(south end of feature)	NIN
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for featur	es < 2" long;	record #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	1.1.1	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	_	Provide 1 to 2 photos of fe	N/R		N/F
	Included th	e date and time stamps assoc	iated with v	ideo surveillance.	



CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/F
(north end of feature)	init	(center of feature)	INNIX	(south end of feature)	IN/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; rec	cord #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Contraction of	100	(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe		A/*	
	Included the		and the second		
	included the	date and time stamps assoc	iated with vi	ideo surveillance.	
		date and time stamps assoc	iated with vi	ideo surveillance.	



CD Deceline HA (mall)		otection and Coating Meas CP Reading #2 (mV)		CP Reading #3 (mV)	1.50
CP Reading #1 (mV) (north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; rec	ord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
remperature (r)	50	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of f	N/R		N/I
1 Al	"				



(north end of feature)	N/R				
	-	(center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	es < 2" long; r	ecord #1 and #3 for features 2	2 - 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	_	Provide 1 to 2 photos of fe	N/R		N/I



OFT #1 (mil) (north end of feature)     N/R     OFT #2 (mil) (center of feature)     N/R     OFT #3 (mil) (south end of feature)     N/R       (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)     N/R     N/R     N/R       Temperature (°F)     56°     Feature (mil)     N/R     DFT Adjacent to N/R     N/R     N/R	00 D		otection and Coating Meas	avenuents f	ion realized of	
DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)       N/R         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       N/R       N/R       N/R       N/R         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) N/R       N/R       N/R       N/R       N/R         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N/R       N/R       N/R       N/R	(north end of feature)	N/R	(center of feature)	N/R		N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N// N/N       Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R     N/R		N/R		N/R	DFT #3 (mil)	N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N// N/I       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R	(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N/R       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R			and the second second second			N/I
(~2" away from edge) N/R (~8 - 12" away from edge) N/I Provide 1 to 2 photos of feature, below:	Temperature (°F)	56°				N/I
Provide 1 to 2 photos of feature, below:					(~8 - 12" away from edge)	N/I
						N/I
	and the second		- Alter St			

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		Ge	neral Information		
Date:		10/10/17	Diver:	1	Maurice Unger, Craig Palmer
AFE / W.	0.#:	20011702	Company Rep	/ Inspector:	
Pipe Sup	port Anchor:	W-60 (W-64B South / W-64	B Water Depth (1	ft):	
Longitu	le:	North)	Latitude:		
	a constant of the	Dive	r Inspection Record		
Feature Number	Location o Feature (w.r.t. pipe supp	f Circumferential Position of the	Measured Feature size (ft <sup>2</sup> )	Visual Cl	assification of Feature
1	15' South	12:00	0.02 (3" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal) Disturbed Area
2	7' 3" South	9:00	0.05 (4" X 2")	Dislodged Area     Deposit	Holiday (bare metal)
3	6' 8" South	8:30	0.02 (2 ½" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
4	6' 9" South	12:00	0.01 (1" X 1")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal)
5	Anchor to 2 South	<b>0'</b> 360°	104.71 (240" X 62.83")	Dislodged Area Deposit	Holiday (bare metal) Disturbed Area
6	Anchor Nort	th 12:00	0.05 (2" X 4")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
7	7" North	4:00	0.06 (3" X 3")	<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area Deposit	Holiday (bare metal Disturbed Area
				Dislodged Area	Holiday (bare metal     Disturbed Area
				Dislodged Area	Holiday (bare metal     Disturbed Area
				Dislodged Area	Holiday (bare metal Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	☐ Holiday (bare metal □Disturbed Area
				<ul> <li>Dislodged Area</li> <li>Deposit</li> </ul>	Holiday (bare metal Disturbed Area
				Dislodged Area     Deposit	Holiday (bare metal Disturbed Area
eatures o		necessary to identify all e numbering starts at top res)	Biota present:		
Dislodge UYES		rved on the lake floor:	Lake floor location wrt pipe:	In spar	n 6"- 18" off lake floor
			Comments/Issues/I	Discussion	

# REDACTED SUBMITTAL -- PUBLIC COPY Diver Inspection Form for L5 Straits of Mackinac Feature 5, Dislodged area is from the anchor to 20' South of anchor, 360° around the pipe With the second second

	Coating Gauge	Information	
Manufacturer: Last Calibrated: Gauge verified prior to use:	Elcometer Inspection Equip Need calibr cert dates, gage 57	Product: Next Calibration Due:	211 Coating Thickness Gauge Need dates, gage 57
Coating Thick	kness Inspection Data (complete		
Location	Coating Thickness (mil)	Distance from Anchor (ft)	
North of Anchor #1	145	5	10:00
North of Anchor #2	115	5	2:00
South of Anchor #1	115	5	10:00
South of Anchor #2	115	5	2:00
Average Thickness	122.50		

**Contractor Signature** 

Enbridge Representative/ Inspector Signature



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; reo		2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/F
Temperature (°F)		Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature ( 1)		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/1
			iated with v		
	f.				
	I.				





CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; red	cord #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	1
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/F
	Included the	date and time stamps assoc	eature, belou iated with v		
	Included the	date and time stamps assoc			



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; ree	cord #1 and #3 for features 2	2"-8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
remperature ( 1)	-	(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/I
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	4				



CP Reading #1 (mV)	1	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/R
(north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	
DFT #1 (mil)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for featur	res < 2* long;	record #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	N/F
Temperature ( P)	50	(~2" away from edge)	N/R N/R	(-8-12 away nomedge)	N/F
		Provide 1 to 2 photos of f			
	to all and all all	he date and time stamps asso	inted with v	ideo surveillance.	
	1000				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	5.3
(reserve and restriction)	1		N/R		N/F
		DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	56°	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	1	( 2 away non edge)	N/R		N/F
1 and the second		he date and time stamps assoc			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	s < 2" long;	record #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	
			N/R		N/F
		DFT Adjacent to	N/R	DFT Adjacent to Feature (mil)	N/F
and the second second second					
Temperature (°F)	56°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F

Provide 1 to 2 photos of feature, below:

Included the date and time stamps associated with video surveillance.





CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
	es < 2" long; re	ecord #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	0.1.1
			N/R		N/F
-	56°	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	50	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		( 2 away nom edge)	N/R		N/I
	Included the	e date and time stamps assoc	eature, belo iated with v		
	Included the				



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(north end of feature)	N/R	(center of feature)	N/R	(south end of feature)	N/F
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And the second sec	s < 2" long: 1	the second secon	2 - 8* long: re	ecord #1, #2 and #3 for features >8" long)	
(record in the real are	10 - 2 10 ig, i		N/R		N/F
Tommersteine (PF)	the second	DFT Adjacent to Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of f	N/R		N/F

ENBRIDGE

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		Genera	al Information			
Date:		10/10/17	Diver:			Unger, Chad Cantrel
AFE / W.	0.#:	20011702	Company Rep	/ Inspector	George F	amer
Pipe Sur	port Anchor:	W-61 (W-67A / W-67B)	Water Depth			
Longitu			Latitude:		_	
		Diver les	pection Record	-		
	Location of		Hard Constraints and the		1.1	
Feature Number	Location of Feature (w.r.t. pipe support	Circumferential Position of the Feature (o'clock position)	n Measured Feature size (ft <sup>2</sup> )	Visu	ual Classifica	ation of Feature
1	5' 9" South	6:00	0.003 (1" X ½")	Dislodged A	Area	Holiday (bare meta     Disturbed Area
2	2' South	6:00	.0008	Dislodged A	Area	Holiday (bare meta     Disturbed Area
3	Saddle North	11:30	(½" X ¼") 0.005 (1" X ¾")	Deposit	Area	Holiday (bare meta Disturbed Area
4	2" North	11:30	0.003 (½" X 1")	Dislodged A	Area	Holiday (bare meta Disturbed Area
5	4" North	11:30	0.007 (2" X ½")	Dislodged A	Area	Holiday (bare meta Disturbed Area
6	5" North	11:30	0.002 (½" X ½")	Dislodged A	Area	Holiday (bare meta Disturbed Area
7	2' 4" North	11:30	0.002 (½" X ½")	Dislodged 4	Area	Holiday (bare meta     Disturbed Area
8	3" North	4:00	0.06 (3" X 3")	Dislodged # Deposit	Area	Holiday (bare meta Disturbed Area
9	7" North	4:00	0.14 (5" X 4")	Dislodged A	\rea	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>
10	4' 2" North	3:00	0.03 (1" X 4")	Dislodged A	Vrea	Holiday (bare meta     Disturbed Area
11	5' 6" North	5:30	0.04 (3" X 2")	Dislodged A	Area	Holiday (bare meta Disturbed Area
12	2' 6"North	5:00	0.007 (1" X 1")	Dislodged A Deposit	\rea	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>
				Dislodged A     Deposit	Area	Holiday (bare meta     Disturbed Area
				Dislodged A	Area	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>
				Dislodged A	lrea	Holiday (bare meta     Disturbed Area
				Dislodged A	Area	<ul> <li>Holiday (bare meta</li> <li>Disturbed Area</li> </ul>
	Feature numbering s	sary to identify all features tarts at top row (for detailed			⊠YES	□ NO
	d coating observ	ed on the lake floor:	Lake floor location wrt pipe:	In	span 18" fi	rom lake floor

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 Diver Inspection Form for L5 Straits of Mackinac

 Comments/Issues/Discussion

**Contractor Signature** Enbridge Representative/ Inspector Signature

	Coating Gauge	Information	
Manufacturer:	Elcometer Inspection Equip	Product:	211 Coating Thickness Gauge
Last Calibrated:	10/6/17	Next Calibration Due:	10/6/17
Gauge verified prior to use:	⊠YES □ NO		
Coating Thic	kness Inspection Data (complete	this table in the absence of ar	y Features)
Location	Coating Thickness (mil)	Distance from Anchor (ft)	Location on Pipe (o'clock
North of Anchor #1	120	5	10:00
North of Anchor #2	90	5	2:00
South of Anchor #1	94	5	10:00
South of Anchor #2	96	5	2:00
Average Thickness	100		



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/R
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/R
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/F
Temperature (°F)		Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
2000 C 2000 C 200		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/F
	1	Sterne -			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; re	ecord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	100
		DFT Adjacent to	N/R		N/F
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
	1.50	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe	N/R		N/I
A CONTRACTOR	1. 6 11	and the second second			



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2 - 8" long; r	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/F
- 1 - P.P.		(~2" away from edge)	N/R N/R	(~8 - 12" away from edge)	N/F
		Provide 1 to 2 photos of fe	eature, belo	w:	
	ter	and the second se			
	Salle Bill				



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/I
(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	D-F
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	N/R N/R	DFT Adjacent to Feature (mil)	N/ N/
remperature (1)		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
			N/R		N/
	Included the o	Provide 1 to 2 photos of fo	eature, below		N/



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; r	record #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
and the second of the		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
	-	Provide 1 to 2 photos of fe	N/R		N/



Image: Normal and the active (inciding indicative)       Image: Normal and the active)	CP Reading #1 (mV)	N/R	CP Reading #2 (mV)	N/R	CP Reading #3 (mV)	N/I
N/R       N/R       N/R       (south end of feature)       N         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N       N         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) N/R       N       N         Provide 1 to 2 photos of feature, below:       N       N       N       N       N	(north end of feature)		(center of feature)	init	(south end of feature)	19/1
(record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)         Temperature (°F)       56°       DFT Adjacent to Feature (mil) (~2" away from edge)       N/R       DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       N         Provide 1 to 2 photos of feature, below:       Provide 1 to 2 photos of feature, below:       N       N		N/R		N/R		N/I
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N       Provide 1 to 2 photos of feature, below:     Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R     N/R	(record #2 for feature	es < 2" long; rec	ord #1 and #3 for features 2	2 - 8" long; re	cord #1, #2 and #3 for features >8" long)	
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)     N       Provide 1 to 2 photos of feature, below:     N/R     N/R     N/R     N/R			A REAL PROPERTY AND A REAL	N/R		N/F
(~2" away from edge) N/R (~8 - 12" away from edge) N Provide 1 to 2 photos of feature, below:	Temperature (°F)	56°			DFT Adjacent to Feature (mil)	N/I
Provide 1 to 2 photos of feature, below:				and the second sec	(~8 - 12" away from edge)	N/I
Included the date and time stamps associated with video surveillance.						



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2* long; r	record #1 and #3 for features 2	2 - 8" long; re	ecord #1, #2 and #3 for features >8" long)	
		DFT Adjacent to	N/R		N/I
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
1.		(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe	N/R		N/



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/I
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/
(record #2 for feature	es < 2" long; re	cord #1 and #3 for features 2	- 8" long; re	ecord #1, #2 and #3 for features >8" long)	-
T (0=1	500	DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/I N/I
Temperature (°F)	56°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/I
		Provide 1 to 2 photos of fe	N/R		N/
۹ مر					



Instruction       N/R       (center of feature)       N/R       (south end of feature)         DFT #1 (mil) (north end of feature)       N/R       DFT #2 (mil) (center of feature)       N/R       DFT #3 (mil) (south end of feature)         (record #2 for features < 2" long; record #1 and #3 for features 2 - 8" long; record #1, #2 and #3 for features >8" long)       N/R       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R       DFT Adjacent to Feature (mil) N/R       N/R         Temperature ("F)       56°       DFT Adjacent to Feature (mil) ("2" away from edge)       N/R       DFT Adjacent to Feature (mil) N/R       OFT Adjacent to Feature (mil) ("8 - 12" away from edge)         Provide 1 to 2 photos of feature, below: Included the date and time stamps associated with video surveillance.       Included the date and time stamps associated with video surveillance.	N/F N/F N/F N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	N/F N/F
Temperature (°F)     56°     DFT Adjacent to Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	N/F N/F
Temperature (°F)     56°     Feature (mil) (~2" away from edge)     N/R     DFT Adjacent to Feature (mil) (~8 - 12" away from edge)       Provide 1 to 2 photos of feature, below:	N/F
Provide 1 to 2 photos of feature, below:	
Provide 1 to 2 photos of feature, below:	1 1 1/1



CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	N/F
(record #2 for feature	es < 2" long;	record #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R N/R	DFT Adjacent to Feature (mil)	N/F
Temperature (°F)	56°	Feature (mil) (~2" away from edge)	N/R	(~8 - 12" away from edge)	N/F
	-	Provide 1 to 2 photos of fe	N/R		N/F
and the state					



(north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV) (south end of feature)	N/F
DFT #1 (mil) (north end of feature)	125	DFT #2 (mil) (center of feature)	N/R	DFT #3 (mil) (south end of feature)	11
(record #2 for feature	s < 2" long; r	record #1 and #3 for features 2	- 8" long; re	cord #1, #2 and #3 for features >8" long)	_
Temperature (°F)	56°	DFT Adjacent to Feature (mil)	70 170 190	DFT Adjacent to Feature (mil) (~8 - 12" away from edge)	113 200 83
		(~2" away from edge)	245		115
	100				



#### Diver Inspection Form for L5 Straits of Mackinac

CP Reading #1 (mV) (north end of feature)	N/R	CP Reading #2 (mV) (center of feature)	N/R	CP Reading #3 (mV)	N/
DFT #1 (mil) (north end of feature)	N/R	DFT #2 (mil) (center of feature)	N/R	(south end of feature) DFT #3 (mil) (south end of feature)	N/R
(record #2 for featur	es < 2" long; re		- 8" long; re	cord #1, #2 and #3 for features >8" long)	-
		DFT Adjacent to	N/R		N/
Temperature (°F)	56°	Feature (mil)	N/R	DFT Adjacent to Feature (mil)	N/
	1.00	(~2" away from edge)	N/R	(~8 - 12" away from edge)	N/
	1	Provide 1 to 2 photos of fe	N/R		N/
	and the				



## Appendix C – Coating Repairs Work Plan, Version 3



# Coating Repairs Work Plan Line 5 Dual Pipelines

United States v. Enbridge Energy et al Case 1:16 - cv-914

Consent Decree	VII. Injunctive Meas Of Mackinac, Parag		es To Prevent Spills In The Straits Investigation
Version	3.0	Version date	September 13, 2017





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#### Introduction

Paragraph 69 of the Consent Decree entered in Case 1:16-cv-00914 (ECF No. 14, 05/23/17) requires the Enbridge defendants (collectively referred to as "Enbridge") to create and complete a Biota Investigation Work Plan ("BI Work Plan") on the Dual Pipelines that cross the Straits of Mackinac. On or about August 14, 2017, Enbridge initiated the field activities of the BI Work Plan at the Straits and as of September 13, 2017 the BI Work Plan field work has been completed.

Through the BI Work Plan activities there have been several locations identified as areas with bare or potentially bare metal.

Per Paragraph 69c. Enbridge is required to submit a final report to the EPA within 60 days of completion of the BI Work Plan investigation. In particular, in the event that evidence is developed that zebra mussels and other biota have impaired, or threaten to impair, the Dual Pipelines Enbridge shall supplement the final report with a proposed work plan to address such impairments. Enbridge however, is currently unaware of any evidence linking zebra mussels or other biota to the coating repairs identified above.

Enbridge is submitting this Coating Repairs Work Plan ("CR Work Plan") in advance of the final BI Work Plan Report with the intent of receiving EPA approval for implementing coating repairs in time to allow Enbridge to complete the work in 2017.

#### **Objective**

The objective of the CR Work Plan is to ensure that all repairs are completed safely and in accordance with the Enbridge's coating procedure and in compliance with federal regulations.

#### Background

On June 13, 2017 the EPA approved Enbridge's BI Work Plan. This plan included detailed steps to complete biota sampling at various locations along the Dual Pipelines. The BI Work Plan also highlighted 18 areas of interest that would be investigated by divers as per the BI Work Plan definition (partial) included below:

Area(s) of Interest: An Area of Interest is a part of the pipeline where, based on visual inspection, (i) the normal (local) Biota is unexpectedly absent or (ii) there is evidence of possible coating damage (e.g., Dislodged Coating and/or potential Holiday).

In addition to the 18 Areas of Interest, three (3) Additional Sites were identified by the Enbridge marine contractor as being appropriate to investigate further. These Additional Sites were identified on Figures 2 and 3 of the BI Work Plan.

#### **Coating Repair Scope Of Work And Schedule**

The following locations have been identified as areas with bare or potentially bare metal:

•	Additional Site #1 (EAS-1): One area proposed for coating repair (bare metal). Additional Site #2 (EAS-2): One area proposed for coating repair (potential bare metal). Additional Site #3 (WAS-1): Four areas proposed for coating repair (bare metal).	Known at the time for inclusion in CR Work Plan - Version 1.0
٠	East Additional Sites (August Supplement): Three areas proposed for coating repair (bare metal) (North and South). Please refer to coating inspection reports titled EAS-3 and EAS-4.	Known at the time for inclusion in CR Work Plan - Version 2.0
•	Area of Interest #1 (EAOI-1): Three areas proposed for coating repair (potential	Known at the time for inclusion





bare metal).	in CR Work Plan - Version 3.0
• Area of Interest #5 (EAOI-5): One area proposed for coating repair (potential bare	(current version)
metal).	
• Area of Interest #7 (EAOI-7): One area proposed for coating repair (potential bare	
metal).	

Note: EAS and WAS represents East Additional Site and West Additional Site respectively. EAOI represents East Area of Interest.

The coating inspection reports are included in Appendix A. Thus far, there is no visual evidence or inspection data that suggests any material corrosion or impact on the integrity of the pipe at these locations as the redundant systems – external coating and the cathodic protection – continues to protect the pipelines.

Enbridge will be ready to begin the coating repair work as soon as September 14, 2017 pending approvals from the EPA and the State of Michigan. It is intended to complete the currently known coating repair scope of work in an expeditious manner however, the actual time required to complete the work is highly dependent upon the weather conditions at the Straits.

#### **Coating Repair and Coating Application Procedure**

Prior to implementing the coating repairs the following actions will be completed by the Diver:

- Visually inspect the exposed bare steel for corrosion. If deposits are present they will be removed and the underlying metal surface inspected for corrosion related impacts. Any bare metal exposed by the surface preparation (i.e. By removal of loose coating material) shall also be visually inspected for corrosion by the Diver.
- Measure the wall thickness of the pipe using a Cygnus Instruments, Dive-Underwater ultrasonic thickness gage. The Diver will be OQ trained for taking these measurements. At least five (5) pipe wall thickness measurements will be collected per area that is less than 0.25 square feet, while a total of at least eight (8) pipe wall thickness measurements taken at areas 0.25 square feet and greater.

Enbridge has determined an appropriate system and application procedure for the coating repairs on the Line 5 Straits. This procedure is based on the Manufacturer's history with underwater coating installation that dates back to 1989 and the successful full-scale application and testing of the coating repair technology at a third party laboratory (Stress Engineering Services (SES) in Waller, Texas). SES performed a series of tests in which repairs were applied to laboratory samples and a representative 20" diameter pipe from Line 5 that was supplied by Enbridge. Both patch and full 360° circumferential repairs were conducted on the samples, while they were submerged in 40°F water with a composition similar to that found in the Straits. The results of SES's testing program indicate that the coating repair system is an effective repair system. The report is included in Appendix B.

The proposed coating system for the coating repairs is as follows:

• BIO-DUR 563 epoxy filler followed by E-glass fabric impregnated with X-100 UW epoxy manufactured by Piping Repair Technology Incorporated (PRTI).

Coating repairs consist of two approved methods that include:

- Method 1 Epoxy Filler/ X-100 Epoxy/Full Circumferential Composite Wrap Repair/Stricture Banding®
- Method 2 Epoxy Filler/ X-100 Epoxy/Composite Patch Repair/Stricture Banding®

Both Method 1 (full circumferential wrap application of the epoxy impregnated fiber) and Method 2 (patch application of the epoxy impregnated fiber) are Enbridge approved methods when using the Stricture Banding® to seal the repair while it cures. SES testing showed that Method 2 without the Stricture Bandings is not acceptable.



Method 1 is more likely to be chosen when the repair is located on the side of the pipe and the repair area is larger and runs axially along the pipe. Method 2 is more likely to be chosen in situations where dive time is limited, the repair area is smaller, and the repair is located on top of the pipe.

Enbridge is currently working with the coating manufacturer to investigate the suitability of using Method 2 with a pre-cast sleeve in place of the Stricture Bandings ("Modified Method 2"). Enbridge will approach the EPA for approval of Modified Method 2 if the investigation shows the approach is effective. The table below shows the coating repair locations and the currently proposed coating repair method.

Location	Identification	Coating Repair Method
Additional Site #1	EAS-1	Method 1
Additional Site #2	EAS-2	Method 1
Additional Site #3	WAS-1	Method 1
	EAS-3	Method 1
East Additional Site		Method 1
(August Supplement)	EAS-4	or
		Modified Method 2 - if deemed acceptable through
		testing and subsequently approved by the EPA
Area of Interest #1	EAOI-1	Method 1
Area of Interest #5	EAOI-5	Method 1
Area of Interest #7	EAOI-7	Method 1

It is anticipated that permit(s) for lake floor excavation will be required for EAS-4 unless Modified Method 2 is acceptable and approved. Enbridge will provide the state of Michigan with the plan detailing the materials, methods, and procedures it will use to repair the coating areas.

The product data sheets for the BIO-DUR 563 epoxy filler and the X-100 UW epoxy are included in Appendix C. In addition, Appendix D includes a letter from the Manufacturer confirming that the materials comply with 49CFR195.559 and highlighting underwater installations that have been performed using their products since 1989.

Based on the full scale application and testing at SES, Enbridge has also developed a procedure for the application of the coating repair to the Dual Pipelines. The Enbridge procedure "Application Of Underwater Repair Coatings For Line 5 Straits" – Version 2.0 is found in Appendix E. The procedure was developed in consultation with PRTI.

The cure time for the coating system will be verified using a field trial to confirm the SES testing results that are incorporated into the coating procedure. A pipe sample will be prepared and coated concurrently with the coating repairs at WAS-1. This site represents the deepest water depth (201 feet) and therefore the location with the most challenging environment for successful coating repair. The sample will be allowed to cure at depth and retrieved to the barge after 7 days of cure. While on the barge, Shore D measurements will be completed to confirm a value of 60 or greater. Should the field trial not confirm a Shore D measurement of 60 or greater Enbridge will inform the EPA and the Independent Third Party to discuss next steps relative to the CR Work Plan.



### **Diver Training and Certification**

In order to support the successful implementation of the coating repairs, the divers will be Operator Qualified (OQ) for the work to be completed. To meet 49CFR195.559 requirements for Operator Qualifications, any contractor that is performing an OQ task is required to complete training modules and hands-on training to demonstrate they are qualified. This training process is designed to deliver the basic skills required for each task. After completion of the OQ training, the results are uploaded to ISNET to verify compliance. A list of the OQ covered tasks are listed in Appendix F.

To supplement the OQ certification process, Enbridge will also have the coating manufacturer perform specific training for the materials and coating applications that will be used for the L5 Straits underwater coating repairs. Upon successful completion of the manufacturer's training, the crew members will be issued a certificate of completion.

PRTI training consists of verbal technical training and introduction to the products, their components, and the basic installation procedure. The manufacturer also utilizes audio visual presentations of various installations, wet out procedures and technical aspects of the uses of the products. This is followed by a "hands on" application of the filler, the composite, the stricture banding and the pre cast sleeve.

The marine contractor will also perform a simulated wet trial located close to the dock to test the coating repair plan prior to completing the coating repairs.

#### **Coating Repair Work Plan Deviations**

Enbridge has identified two different deviation procedures to ensure the appropriate approvals are received. The deviation procedure outlined in Enbridge's coating repair procedure (Section 2.4, Appendix E) is assigned to the Pipeline Integrity's technical subject matter expert (SME) to sign-off on any deviations as they relate to the Coating Repair procedure. The Pipeline Integrity SME is Enbridge's Coatings Specialist and they will be responsible for evaluating all deviations requested on the coating repair procedure to ensure such deviations are supported by the Manufacturer. This information or decisions made will be communicated to the Project Manager. The Coating Inspector and Manufacturer will be on the barge overseeing the work related to the surface preparation, application and confirming/verifying of the repair. The PI SME will not be on the barge but will be available by cell phone to ensure any deviation requests are addressed.

The deviation procedure for the CR Work Plan is assigned to the Project Manager (PM). The PM will be responsible for the overall work plan related to the plan and how it is executed. The PM will consult with the key stakeholders that include but are not limited to, Pipeline Integrity, Pipeline Compliance. Any deviations required as a result of its execution will require their acceptance. The PM will not be on the barge but will be available via cell phone to ensure any deviation requests are addressed.

Deviations from this work plan shall be brought to the Project Manager (PM) for resolution.

Deviations to this CR Work Plan will also be discussed with the Independent Third Party representative.

#### **Monitoring of Coating Repair Locations**

Enbridge understands that our pipeline system, particularly the section through the Straits of Mackinac, is both an important part of the region's energy infrastructure and a point of concern for many people. Enbridge continuously monitors, maintains and modernizes Line 5 to ensure its continued safe operation.

The completed repairs related to this Line 5 CR Work Plan will be captured in Enbridge's OneSource database as part of the L5 Straits section. As such, these sites will continue to be monitored for active external corrosion using inline inspection over the life of the asset. In addition, Enbridge will also visually inspect any exposed coating repairs using a remoted operated vehicle during the scheduled underwater inspection that are completed biannually.



## Reporting

Per Paragraph 69c. Enbridge is required to submit a final report to the EPA within 60 days of completion of the BI Work Plan investigation. In particular, in the event that evidence is developed that zebra mussels and other biota have impaired, or threaten to impair, the Dual Pipelines Enbridge shall supplement the final report with a proposed work plan to address such impairments. Enbridge however, is currently unaware of any evidence linking zebra mussels or other biota to the coating repairs identified above.

In addition to the above mentioned report, Enbridge will submit a report to the EPA within 30 days of completion of the CR Work Plan. This report will include a summary of the work completed, any CR Work Plan deviations with justification, and other pertinent information.



Appendix A: Coating Inspection Reports at the Additional Sites



#### External Pipeline Inspection Form for L5 Straits of Mackinac

		Gene	ral Information				
Date:	08/15/2017		Contractor:		Bal	lard Marine Co	
AFE / W.O.#:	20008990		Company Rep	/ Inspector:	RE	DACTED	
Segment:	EAS-1		Water Depth (	ft):	R		
Longitude:	REDACTED		Latitude:		RE	DACTED	
	External	l Pipe Co	oating Inspectio	n Results	A		
General Area	⊠ Disturbed Area □Holiday	□Dislo	odged Coating	Size of anomaly (ft <sup>2</sup> ):	C /T E	48.84 (46'x 1.74	·')
Holiday 1	<ul> <li>□ Disturbed Area</li> <li>⊠ Holiday</li> </ul>	□Dislo	odged Coating	Size of anomaly (ft <sup>2</sup> ):	D	0.01 (3.0"x0.5")	
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislo	odged Coating	Size of anomaly (ft <sup>2</sup> ):	/		
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislo	odged Coating	Size of anomaly (ft <sup>2</sup> ):	/		
	□ Disturbed Area □Holiday	□Dislo	odged Coating	Size of anomaly (ft <sup>2</sup> ):	/		
Corrosion present:	□YES	⊠NO		Biota present:		⊠YES	
Dislodged coating obse	rved on the lake floo	or: □YE	ES ⊠NO	Lake floor location wrt pipe:	on	N/A (pipe is sus	pended)
	Co	omments	s/Issues/Discuss	sion			
EAS-1 within span of South End Lat: REDAC North End Lat: REDAC Center Line listed in g	TED long REDAC TED long REDAC	CTED CTED		areas of 10:00 a	nd 2	2:00.	

One (1) feature with DFT measurements below the minimum resolvable thickness of gauge was found. The Polatrak CP gun was used to confirm the existence of bare metal:

Holiday 1 presented average CP reading of -1680mV CSE (holiday confirmed). Holiday found in coating at coordinates Lat: REDACTED Long: REDACTED

No external corrosion was detected by dive team.

V	13-	REDACTED
	Contractor Signature	Enbridge Representative/ Inspector Signature



	For all	Visual sections of o	dislodged coating	g or holid	ays, provide	pictures	below.	
			and time stamps					
44 (N	and a	44 Horodonad Horodonad	08. 15. 17		101 271 04	niter e	253* narWanadan A	08. 15. 17 0
THE REAL PROPERTY.								
REDA CTED	a indukt			ulinin	REDA			
Date: 8/15/17	Frame(HH	H:MM:SS)	09:26:36	Date:	8/15/17	Frame	(HH:MM:SS)	09:27:04
			Coating Gau	ge Inforn	nation			
Manufacturer:		Elcometer	Inspection Equip	Pro	duct:		211 Coating T	hickness Gauge
Last Calibrated:		08/09/2017	7	Nex	t Calibratio	n Due:	08/09/2018	
Gauge verified pri-	or to use:	⊠YES [	□ NO					
		С	oating Thicknes	ss Inspec	ction Data			
Thickness Me	asure (mil)		oating Thicknes of Interest			(< 2 in.)	Undisturbe	ed Area (> 5 ft.)
	asure (mil) orth End #1				<mark>urbed Area</mark> 125	(< 2 in.)		ed Area (> 5 ft.) 130
	· /		of Interest		urbed Area	(< 2 in.)		
	orth End #1		of Interest 115		urbed Area 125	(< 2 in.)		130
No	orth End #1 #2		of Interest 115 109		urbed Area 125 135	(< 2 in.)		130 130
No	orth End #1 #2 #3		of Interest 115 109 115		urbed Area 125 135 136	(< 2 in.)	· · · · · · · · · · · · · · · · · · ·	130 130 140
No	orth End #1 #2 #3 uth End #4		of Interest 115 109 115 120 120 101		urbed Area 125 135 136 145	(< 2 in.)	· · · · · · · · · · · · · · · · · · ·	130 130 140 140
No Sol	orth End #1 #2 #3 uth End #4 #5		of Interest 115 109 115 120 120		urbed Area 125 135 136 145 128	(< 2 in.)		130 130 140 140 130
No Sol	orth End #1 #2 #3 uth End #4 #5 #6	Area	of Interest 115 109 115 120 120 101	Undist	urbed Area 125 135 136 145 145 128 130 133			130 130 140 140 130 134
No Sol	orth End #1 #2 #3 uth End #4 #5 #6	Area Area	of Interest 115 109 115 120 120 101 113	Undist	urbed Area 125 135 136 145 145 128 130 133	ta (A/R)	Close as	130 130 140 140 130 134
No Sol	orth End #1 #2 #3 uth End #4 #5 #6 Thickness	Area Area	of Interest 115 109 115 120 120 101 113 I Coating Thick possible to 9	Undist	urbed Area 125 135 136 145 128 130 133 pection Dates as possib	ta (A/R)	Close as	130 130 140 140 130 134 134 134
No Sor Average	orth End #1 #2 #3 uth End #4 #5 #6 Thickness	Area Area	of Interest 115 109 115 120 120 101 113 I Coating Thick possible to 9 clock	Undist	urbed Area 125 135 136 145 128 130 133 pection Dat e as possib o'clock	ta (A/R)	Close as	130 130 140 140 130 134 134 134 5 possible to 2



	Catho	dic Protec	tion and Coa	ting Meas Holiday		(if Holic	lay is found) -		
CP Reading #1 (r	mV)	-1676 -1683	CP Reading		-1674 -1681		CP Reading #3 (	mV)	-1690 -1674
Temperature (°F)	NR	DFT at H	loliday (mil)	≤ 25	DFT	Adjace	nt to Holiday (mil)	96	, 94, 95
			of dislodged c ate and time s						
2017/08/15	131021	03			201 703	BV IS I	31 051 42		
Page 8							- 100		in ve
China and							6		
Carlo -									
Service and	- (a.								
Alas Sar 1	A.	lan.	23: 41: 55	ED			A.	23: 41 :	55 😥
Date: 8/15/17	Frame(I	HH:MM:SS	) 13:02	:03 Da	ite: 8/	15/17	Frame(HH:MM:S	S) 13	3:05:42



#### External Pipeline Inspection Form for L5 Straits of Mackinac

		General Information		
	00/24/2017			
Date:	08/24/2017	Contractor:		Ballard Marine Co REDACTED
AFE / W.O.#:	20008990 EAS-2	Company Rep	-	R
Segment: Longitude:	REDACTED	Water Depth ( Latitude:	(π):	REDACTED
Longitude.				D
	Extern	al Pipe Coating Inspectio	on Results	A
Coating Condition	□ Disturbed Area □Holiday	□Dislodged Coating ⊠Other	Size of anomaly (ft <sup>2</sup> ):	0.14 (2.5" x 8")
	☐ Disturbed Area ☐Holiday	□Dislodged Coating	Size of anomaly (ft <sup>2</sup> ):	
	□ Disturbed Area □Holiday	□Dislodged Coating	Size of anomaly (ft <sup>2</sup> ):	ly
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislodged Coating	Size of anomaly (ft <sup>2</sup> ):	ly
	□ Disturbed Area □Holiday	□Dislodged Coating	Size of anomaly (ft <sup>2</sup> ):	ly
Corrosion present:	□YES	⊠NO	Biota present:	⊠YES □ NO
Dislodged coating obs	erved on the lake flo	oor: □YES ⊠NO	Lake floor location wrt pipe:	N/A (pipe is suspended)
	C	comments/Issues/Discus	sion	
EAS-2 is within span	of E-/4.			
slightly reduced thick be confirmed due to t	ness, which may he presence of a	indicate possible dislo white deposit.	dgement of oute	ea, with one small area of er wrap. This could not
•		ck for coating holiday t indicating the corrosio	•	•
	This should be pe	destructively remove erformed during the re		sit and inspect the coating so that any resulting
		REDA	CTED	
$(f)$	3~			

**Contractor Signature** 

Enbridge Representative/ Inspector Signature



		nspection (Gen				, ,	
		islodged coating and time stamps					
Chickness: No Data			EAS-2				
Temp161.20°F Date: 8/24/17 Frame(HF	ł:MM:SS)	14:11:12	Temp: 6 Date:		Frame	(HH:MM:SS)	14:38:33
T T		Coating Gaug	ge Informa	ation			
Manufact <mark>o</mark> rer:	Elcometer l	nspection Equip	Prod			211 Coating T	hickness Gauge
_ast Calibrated:	08/09/2017	<u> </u>		Calibratio	n Due:	08/09/2018	
Gauge verified prior to use:	⊠YES □	NO					
	Co	ating Thicknes	ss Inspect	ion Data			
Thickness Measure (mil)	Area						
/	135		Undistu	rbed Area	(< 2 in.)	Undisturbe	d Area (> 5 ft.)
North End #1		of Interest	Undistu	r <b>bed Area</b> 130	(< 2 in.)		<b>d Area (&gt; 5 ft.)</b>  15
North End #1 #2	1		Undistu		(< 2 in.)	,	
	1	35	Undistu	130	(< 2 in.)		115
#2	1	35  40	Undistu	130 130	(< 2 in.)		115 115
#2 #3	1	35  40  10	Undistu	130 130 140	(< 2 in.)		115 115 120
#2 #3 South End #4	1	35 40 10 17	Undistu	130 130 140 119	(< 2 in.)	· · · · · · · · · · · · · · · · · · ·	115 120 125
#2 #3 South End #4 #5		35 40 10 17 30	Undistu	130 130 140 119 94	(< 2 in.)		115 115 120 125 130
#2 #3 South End #4 #5 #6		35       40       10       17       30       70		13013014011994150127			115 115 120 125 130 135
#2 #3 South End #4 #5 #6		35       40       10       17       30       70       17		13013014011994150127			115 115 120 125 130 135
#2 #3 South End #4 #5 #6		35       40       10       17       30       70       17		13013014011994150127			115 115 120 125 130 135



#### **External Pipeline Inspection Form for L5 Straits of Mackinac**

	Catho		ction and Co (note: holiday				day is found)		
CP Reading #1 (n See note (below		-261 -291	CP Readin	ng #2 (mV	) N/R		CP Reading #3 (mV)		N/R
Temperature (°F)	NR	DFT at F	eature (mil)	≥ 70 avg.11	, DFT	Adjace	nt to Feature (mil)	≥ 94 avg	4 j.127
			of dislodged o ate and time s						
8/24/2017 2:11:12 PM EAS-2	N			and the second	124/2017 2:3	38:33 PI	1		
EAS-2					AS-2				
	2.5			ŝ.	-	U	1	4	-
State of the second	and a	and the	4		1	-	Sec.		
		the second	100				1. 1. 10		
		ALC: N	- Contraction	1	dia he			12	
		19-1-1		1	12 100	1			
Thickness: No Data			The L	T	hickness: No	o Data	i in the		
H REDAC	Silles.	1			REDACT REDACT		A Real of the		6
Temp. 61.2 °F				1000	emp: 61.9 °F				Carried Barriel
Date: 8/24/17	Frame()	HH:MM:SS	) 14:11	1.12 Г	ate: 8	/24/17	Frame(HH:MM:SS)	14	:38:33

<u>Date:</u> 8/24/17 Frame(HH:MM:SS) 14:11:12 Date: 8/24/17 Frame(HH:MM:SS) 14:38:33 Note: CP readings at this feature were recorded with the probe of Polatrak CP gun pressed firmly through the white substance covering the pipe. These readings were identical to 'open water' CP readings, which were recorded with the CP gun probe close to (but not touching) the pipe.



		Gene	ral Information			
Date:	08/29/2017		Contractor:		Ba	llard Marine Co
AFE / W.O.#:	20008990		Company Rep	/ Inspector:	RE	DACTED
Segment:	EAS-3		Water Depth (f	t):	RE	
Longitude:	REDACTED		Latitude:		RÊ	DACTED
	External P	ipe Co	oating Inspectior	Results	ED	
Coating Condition	<ul> <li>□ Disturbed Area</li> <li>⊠ Holiday</li> </ul>	Dis	slodged Coating	Size of anomal (ft <sup>2</sup> ):	ly	0.93 (8"x1.4')
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	Dis	slodged Coating	Size of anomal (ft <sup>2</sup> ):	ly	
	□ Disturbed Area □Holiday		slodged Coating	Size of anomal (ft <sup>2</sup> ):	ly	
	□ Disturbed Area □Holiday	Dis	slodged Coating	Size of anomal (ft <sup>2</sup> ):	ly	
	□ Disturbed Area □Holiday	□Dis	slodged Coating	Size of anomal (ft <sup>2</sup> ):	ly	
Corrosion present:	□YES	⊠N	0	Biota present:		⊠YES □ NO
Dislodged coating observ	red on the lake floor:	□YE	S ⊠NO	Lake floor location wrt pipe:	on	Pipe suspended
	Com	ments	s/Issues/Discuss	ion		
East Additional Site #3	(South of E-22).					
DFT measurements at t The Polatrak CP gun wa					ss c	of gauge.
Holiday 1 presented ave	erage CP reading of	of -84	18mV CSE (hol	iday confirmed)	).	
No external corrosion	was detected by	dive	team.			
			REDACT	=D		
M-	)					
Contracte	or Signature		Enbri	dge Representativ	ve/ I	nspector Signature



Vis	ual Inspect	ion (General Co	oating Co	ndition and	d Holiday	/ 1)	
		dislodged coatin and time stamp					
8/29/2017 10:35:09 AM			H: RED D: REI	DACT	4 AM		
Date: 8/29/17 Frame(HF	l:MM:SS)	10:35:09 Coating Gau	Date:	8/29/17	Frame	(HH:MM:SS)	10:35:44
Manufacturer:	Elcometer	Inspection Equip		duct:		211 Coating T	hickness Gauge
Last Calibrated:	08/09/2017			t Calibratio	n Due:	08/09/2018	
Gauge verified prior to use:							
	C	oating Thickne	ss Inspec	tion Data			
Thickness Measure (mil)	Area	of Interest	Undistu	urbed Area	(< 2 in.)	Undisturbe	d Area (> 5 ft.)
North End #1		105		85			130
#2		≤25		120			120
#3		115		115			130
South End #4		≤25		80			100
#5		≤25		80			100
#6		≤25		125			105
Average Thickness				101			114
	Additiona	I Coating Thick	ness Insp	pection Da	ta (A/R)		
		· · · · · · · · · · · · · · · · · · ·					



	Catho	dic Protec	tion and Coat	ting Meas Holiday <sup>•</sup>		f Holida	ay is found) -		
CP Reading #1 (n	nV)	-852 -886	CP Reading		804		CP Reading #3 (mV)		-834 -875
Temperature (°F)	44	DFT at H	loliday (mil)	≤ 25	DFT A	djacen	t to Holiday (mil)	80, 8	0, 125
			of dislodged c ate and time st						
8/29/2017 10:35:09 A	M				REDACT ED mp: 51.0 °F	65:44 AN			
Date: 8/29/17	Frame(I	HH:MM:SS	) 10:35:0	)9 Da	ite: 8/2	9/17	Frame(HH:MM:SS)	10	:35:44



	0			
	Gene	eral Information		
Date:	08/30/2017	Contractor:		Ballard Marine Co
AFE / W.O.#:	20008990	Company Rep		REDACTED
Segment:	EAS-4	Water Depth (	ft):	
Longitude:	RREDACTE ED	Latitude:		Rêdacte 6T
	D External Pipe C	oating Inspectio	n Results	ED
General Area	⊠ Disturbed Area □ ♀oating □Holiday	Dislodged	Size of anomaly (ft <sup>2</sup> ):	3.0 (1'6" X 2')
Holiday 1	È Disturbed Area □ ©oating ⊠Holiday	Dislodged	Size of anomaly (ft <sup>2</sup> ):	0.53 (7" X 11")
Holiday 2	□ Disturbed Area □ Coating ⊠Holiday	Dislodged	Size of anomaly (ft <sup>2</sup> ):	1.11 (1'4" X 10")
	□ Disturbed Area □ Coating □Holiday	Dislodged	Size of anomaly (ft <sup>2</sup> ):	
	□ Disturbed Area □ Coating □Holiday	Dislodged	Size of anomaly (ft <sup>2</sup> ):	/
Corrosion present:	□YES ⊠	NO	Biota present:	
Dislodged coating observe	d on the lake floor: $\Box Y$	ES ⊠NO	Lake floor locati wrt pipe:	on Pipe buried
	Comment	s/lssues/Discuss	sion	
	Common			
East Additional Site #4.				
Two (2) features with DF found. The Polatrak CP Holiday 1 presented aver Holiday 2 presented aver <b>No external corrosion v</b>	gun was used to conf rage CP reading of -9 rage CP reading of -9	irm the existen 63mV CSE (ho 58mV CSE (ho	ce of bare meta liday confirmed)	l: ).
ИJ		REDAC	ΓED	
Contractor	r Signature	Enbr	lage Representati	ve/ Inspector Signature



		n (General Coat					
		and time stamps	associate				
B/30/2017 9:17:44 AM EAST LEG CABLE CROSSING,S	XOUTH		8/30/20	17 8:55 25 A REDAC TED Prop. 52.4 - F			
Date: 8/30/17 Frame(HF	I:MM:SS)	09:17:44	Date:	8/30/17	Frame	(HH:MM:SS)	08:55:25
		Coating Gau	ge Inforn	nation			
Manufacturer:	Elcometer	Inspection Equip	Proc	duct:		211 Coating T	hickness Gauge
Last Calibrated:	08/09/2017		Nex	t Calibratio	n Due:	08/09/2018	
Gauge verified prior to use:	⊠YES [	□ NO					
	С	oating Thicknes	ss Inspec	ction Data			
Thickness Measure (mil)	Area	of Interest	Undist	urbed Area	(< 2 in.)	Undisturbe	ed Area (> 5 ft.)
North End #1		≤25	N/R (s	ee note, l	below)		N/R
#2		≤25	•	N/R	•		N/R
#3		≤25		N/R			N/R
South End #4		≤25		N/R			N/R
#5		≤25		N/R			N/R
#6		≤25		N/R			N/R
Average Thickness							
	Additiona	I Coating Thick	ness Insj	pection Dat	ta (A/R)		
Note: coating thickness in undist soil (lake bed). The pipe is below <i>Holidays'</i> for representative coat	w the level of	of the lake bed. S					



CP Reading #1 (mV)		Catho	odic Protec	tion and Coa	ting Meas Holiday 1		(if Holi	day is found) -		
Temperature (P)       44       DF1 at Holiday (IIII)       523       DF1 Adjacent to Holiday (IIII)       135         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Signal of the date and time stamps associated with video surveillance.         Main of the date and time stamps associated with video surveillance.         Main of the date and time stamps associated with video surveillance.         Main of the date and time stamps associated with video surveillance.         Main of the date and time stamps associated with video surveillance.         Main of the date and time stamps associated with video surveillance. <td colspan<="" th=""><th>CP Reading #1 (n</th><th>יV)</th><th></th><th>CP Reading</th><th></th><th>-938</th><th></th><th>CP Reading #3 (mV)</th><th>-98 -97</th></td>	<th>CP Reading #1 (n</th> <th>יV)</th> <th></th> <th>CP Reading</th> <th></th> <th>-938</th> <th></th> <th>CP Reading #3 (mV)</th> <th>-98 -97</th>	CP Reading #1 (n	יV)		CP Reading		-938		CP Reading #3 (mV)	-98 -97
Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.         Ministry of the date and time stamps associated with video surveillance.	Temperature (°F)						-		96, 84, 1 135	
#30/2017 8:58:31 AM#: EDACTDete:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:MM:SS)8:58:31Date:8/30/17Frame(HH:M:SS)8:58:31Date:8/30/17Frame(HH:M:SS)8:58:31Date:8/30/17Frame(HH:M:SS)8:58:31Bate:8:30/17Frame(HH:M:SS)8:58:31Bate:8:30/17Frame(HH:M:SS)8:58:31Bate:8:30/17Frame(HH:M:SS)8:58:31 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>										
Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 2	H:REDACT D:ED Temp: 51.7 °F				EA H: D: Ter	REDACT ED mp: 51 4 °	ABLE CP	ROSSING SOUTH		
Holiday 2	Date: 8/30/17	Frame(	HH:MM:SS	6) 8:58:31	1 Da	te: 8	3/30/17	Frame(HH:MM:SS)	9:17:40	
CP Reading #1 (mV) -981 CP Reading #2 (mV) -907 CP Reading #3 (mV)			odic Protec -981		Holiday 2		(if Holie		-94	

CP Reading #1 (n	nV)	-981 -1012	CP Reading	g #2 (mV)	-907 -933	CP Reading #3 (mV	)	-944 -974
Temperature (°F)	44	DFT at H	loliday (mil)	≤ 25	DFT A	djacent to Holiday (mil)		, 140, 95, 84
						vide pictures below. video surveillance.		
8/30/2017 10:03:31 AM EAST LEG CABLE CR H: REDACT D: ED Temp: 52.1 "F	Л			8/30 EAS	D/2017 10:14 ST LEG CAB			
Date: 8/30/17	Frame(I	HH:MM:SS	5) 10:03:3			0/17 Frame(HH:MM:SS)	10	:14:55



		General In	formation		
Date:	08/25/2017		ntractor:		Ballard Marine Co
AFE / W.O.#:	20008990			/ Inspector:	
Segment:	WAS-1		ater Depth (	ft):	
Longitude:	REDACTED	La	titude:		CT
	Extern	al Pipe Coatin	g Inspectio	n Results	ED
General Area	□ Disturbed Area □Holiday	⊠Dislodged	Coating	Size of anomaly (ft <sup>2</sup> ):	20.8 (13' x 1.6')
Holiday 1	<ul> <li>□ Disturbed Area</li> <li>⊠Holiday</li> </ul>	□Dislodged	Coating	Size of anomaly (ft <sup>2</sup> ):	0.06 (9" x 1")
Holiday 2	<ul> <li>□ Disturbed Area</li> <li>☑ Holiday</li> </ul>	□Dislodged	Coating	Size of anomaly (ft <sup>2</sup> ):	0.24 (1'2" x 2.5")
Holiday 3	<ul> <li>□ Disturbed Area</li> <li>☑ Holiday</li> </ul>	Dislodged	Coating	Size of anomaly (ft <sup>2</sup> ):	0.07 (1'7" x ½")
Holiday 4	<ul> <li>□ Disturbed Area</li> <li>☑ Holiday</li> </ul>	Dislodged	Coating	Size of anomaly (ft <sup>2</sup> ):	0.01 (1'3" x 1/8")
Corrosion present:	□YES	⊠NO		Biota present:	
Dislodged coating obs	erved on the lake flo	oor: □YES	⊠NO	Lake floor location wrt pipe:	N/A (pipe is suspended)
bare metal at the follo Holiday 1 presented a Holiday 2 presented a Holiday 3 presented a Holiday 4 presented a	of gauge were fou owing features: average CP readi average CP readi average CP readi average CP readi	und. The Po ng of -1312n ng of -1312n ng of -1365n	latrak CP ( าV CSE (h าV CSE (h าV CSE (h	gun was used to oliday confirmed oliday confirmed oliday confirmed	i). i). i).
No external corrosio area.	on was detected	by dive tea	m. A white	e deposit was f	ound at the holiday
area.	on was detected	by dive tea	m. A white		ound at the holiday



	Visu	al Inspection (Gen	eral Coa	ting Condi	tion)		
		of dislodged coating ate and time stamps					
8/25/2017 10:15:30 AM WAS-1 Thickness: No Data H:REDACT D:ED Temp: 51.7 °F			WAS-1	ss. No Data	AM		0
Date: 8/25/17 Frame(HH	:MM:SS	) 10:15:30	Date:	8/25/17	Frame	(HH:MM:SS)	10:14:46
		Coating Gaug	e Inforn	nation			
Manufacturer:		ter Inspection Equip		duct:	_		hickness Gauge
Last Calibrated:	08/09/2		Nex	t Calibratio	n Due:	08/09/2018	
Gauge verified prior to use:	⊠YES						
		Coating Thicknes	s Inspe	ction Data			
Thickness Measure (mil)	Ar	ea of Interest	Undist	urbed Area	(< 2 in.)		d Area (> 5 ft.)
North End #1		80		105			105
#2		66		110			10
#3		110		105			95
South End #4		110		94			90
#5		105		95			85
#6		105		100			85 05
Average Thickness		96		102		1	95
	Additio	nal Coating Thickn	ess Ins	pection Dat	a (A/R)		
		Within AOI &		North	V	Vithin AOI 10' 1	from North
Nort	h End	9				98	
		8			ļ	105	
Sout	h End	8	0			110	



CP Reading #1 (mV)       -1300 -1362       CP Reading #2 (mV)       -1277 -1336       CP Reading #3 (mV)       -1277 -1322         Temperature (*F)       43       DFT at Holiday (mil)       5 25       DFT Adjacent to Holiday (mil)       90, 93, 110         For all sections of disloged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         WS-1       Importance       Importance       Importance       Importance       Importance       Importance         The dnesse. No Data       Importance       Importance       Importance       Importance       Importance       Importance         The dnesse. No Data       Importance       Importance <t< th=""><th></th><th>Catho</th><th>dic Protec</th><th>ction and Coa</th><th>ting Measu Holiday 1</th><th>ements (if</th><th>Holiday is found) -</th><th></th><th></th></t<>		Catho	dic Protec	ction and Coa	ting Measu Holiday 1	ements (if	Holiday is found) -		
For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         R/25/2017 9:15:30 AM WAS1         R/25/2017 10:14:42 AM. WAS1         Image: the date and time stamps associated with video surveillance.         R/25/2017 10:14:42 AM. WAS1         Image: the date and time stamps associated with video surveillance.         R/25/2017 10:14:42 AM. WAS1         Image: the date and time stamps associated with video surveillance.         R/25/2017 10:14:42 AM. WAS1         Image: the date and time stamps associated with video surveillance.         Date:       8/25/17         Frame(HH:MM:SS)       09:15:30         Date:       8/25/17         Frame(HH:MM:SS)       09:15:30         Date:       8/25/17         C2thodic Protection and Coating Measurements (if Holiday is found)- Holiday2         CP Reading #1 (mV)       .1274 .1328         CP Reading #2 (mV)       .1283 .1237         Temperature (*F)       43         DFT at Holiday       25         DFT Adjacent to Holiday (mil)       79, 94, 100         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveilance.         R/25/2017 130/30/PM       R/25/2017 130/30/PM         MAS1 <t< th=""><th>CP Reading #1 (n</th><th>nV)</th><th></th><th>CP Readin</th><th></th><th></th><th>CP Reading #3 (</th><th>(mV)</th><th></th></t<>	CP Reading #1 (n	nV)		CP Readin			CP Reading #3 (	(mV)	
Included the date and time stamps associated with video surveillance.         V25/2017 10.14.42 AM         VAS-1         Included the date and time stamps associated with video surveillance.         VIDEO TO TO 10.14.42 AM         Thickness: No Data         Thickness: No Data <td>Temperature (°F)</td> <td>43</td> <td>DFT at H</td> <td>Holiday (mil)</td> <td>≤ 25</td> <td>DFT A</td> <td>djacent to Holiday (mil)</td> <td>90</td> <td>0, 93, 110</td>	Temperature (°F)	43	DFT at H	Holiday (mil)	≤ 25	DFT A	djacent to Holiday (mil)	90	0, 93, 110
8/25/2017 10:14:42 AM/WAS-1           Intekness: No Data           H           D           Temp: 50.0 "F           Date:         8/25/2017 10:14:42 AM/WAS-1           D-         D           Date:         8/25/2017 10:14:42 AM/WAS-1           D-         D           Date:         8/25/17           Frame(HH:MM:SS)         09:15:30           Date:         8/25/17           Frame(HH:MM:SS)         09:15:30           Date:         8/25/17           Frame(HH:MM:SS)         09:15:30           Date:         8/25/17           Frame(HH:MM:SS)         10:14:42           CP Reading #1 (mV)         -1274 -1328           CP Reading #2 (mV)         -1283 -1237           Temperature ("F)         43           DFT at Holiday (mll)         25           DFT at Holiday (mll)         25           DFT at Holiday (mll)         217           YAS-1         Yas-1           WAS-1         Yas-1           WAS-1         Yas-1           WAS-1         Yas-1           WAS-1         Yas-1           WAS-1         Yas-1           WAS-1         Yas-1									
WAS-1       WaS-1         Theoress: No Data       Theoress: No Data         Unit of the problem of t	8/25/2017 9:15:30 AM		uded the d	ate and time s		Transa and Lines	and the second se	Sec.	-
Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 2         CP Reading #1 (mV)       -1274 -1328       CP Reading #2 (mV)       -1283 -1237       CP Reading #3 (mV)       -1375 -1372         Temperature (°F)       43       DFT at Holiday (mil)       ≤ 25       DFT Adjacent to Holiday (mil)       79, 94, 100         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         8/25/2017 1:29:51 PM WAS-1       \$25/2017 1:30;99;PM WAS-1       \$25/2017 1:30;99;PM WAS-1         Inckness: No Data H: REDACT D: ED Temp: 51.4 °F	WAS-1 Thickness: No Data H REDACT D ED					S-1 kness: No E EDACT			0
Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 2         CP Reading #1 (mV)       -1274 -1328       CP Reading #2 (mV)       -1283 -1237       CP Reading #3 (mV)       -1375 -1372         Temperature (°F)       43       DFT at Holiday (mil)       ≤ 25       DFT Adjacent to Holiday (mil)       79, 94, 100         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         8/25/2017.1:29:51 PM WAS-1       \$25/2017.1:30,39.PM WAS-1       \$25/2017.1:30,39.PM WAS-1         Inickness: No Data H: REDACT D: ED Temp: 51.4 °F       Tickness: No Data H: REDACT D: D       Tickness: No Data H: REDACT D: D       Tickness: No Data H: REDACT D: D								10 A	
Holiday 2         CP Reading #1 (mV)       -1274 -1328       CP Reading #2 (mV)       -1283 -1237       CP Reading #3       -1375 -1372         Temperature (°F)       43       DFT at Holiday (mil)       ≤ 25       DFT Adjacent to Holiday (mil)       79, 94, 100         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         8/25/2017 11:29:51 PM       \$/25/2017 11:29:51 PM       \$/25/2017 11:30:39:PM       \$/25/2017 11:30:39:PM         WAS-1       \$/25/2017 11:29:51 PM       \$/25/2017 11:30:39:PM       \$/25/2017 11:30:39:PM         Inckness: No Data       H: REDACT       Fickness: No Pata       Thickness: No Pata         H: REDACT       D: ED       Thickness: No Pata       Fickness: No Pata         H: REDACT       D: ED       Thickness: No Pata       Fickness: No Pata	Date: 8/25/17	Frame(	HH:MM:SS	6) 09:15	5:30 Date	: 8/25	5/17 Frame(HH:MM:S	S) 1	10:14:42
CP Reading #1 (mV)       -1328       CP Reading #2 (mV)       -1237       (mV)       -1372         Temperature (°F)       43       DFT at Holiday (mil)       ≤ 25       DFT Adjacent to Holiday (mil)       79, 94, 100         For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.         8/25/2017 1:29:51 PM WAS-1       \$25/2017 1:30;80;PM WAS-1       \$25/2017 1:30;80;PM WAS-1         Thickness: No Data H: REDACT D; ED Temp: 51:4 °F       Thickness: No Data H: REDACTE D; ED Temp: 51:3 °F       Thickness: No Data	Date: 8/25/17							S) 1	10:14:42
For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.	Date: 8/25/17		dic Protec		ting Measu	ements (if	Holiday is found) -	ý i	
Included the date and time stamps associated with video surveillance.		Catho	odic Protec -1274	ction and Coa	ting Measu Holiday 2	ements (if -1283	Holiday is found) - CP Reading	g #3 -	1375
8/25/2017 1:29:51 PM WAS-1 Thickness: No Data H: REDACT D: ED Temp: 51.4 °F	CP Reading #1 (n	Catho nV)	odic Protec -1274 -1328	ction and Coa	ting Measu Holiday 2 ng #2 (mV)	ements (if -1283 -1237	Holiday is found) - CP Reading (mV)	g #3 -	1375 1372
Date: 8/25/17 Frame(HH:MM:SS) 13:29:51 Date: 8/25/17 Frame(HH:MM:SS) 13:30:30	CP Reading #1 (n	Catho nV) 43 For a	odic Protec -1274 -1328 DFT at H all sections	CP Readin CP Readin Holiday (mil) of dislodged of	ting Measur Holiday 2 ng #2 (mV) ≤ 25 coating or ho	ements (if -1283 -1237 DFT Adj <i>lidays, prov</i>	Holiday is found) - CP Reading (mV) acent to Holiday (mil) ide pictures below.	g #3 -	1375 1372



Thickness: No Data

H:

D:

#### External Pipeline Inspection Form for L5 Straits of Mackinac

	Catho	dic Protec	tion and Coa	ting Measu Holiday 3		Holiday is found) -	
CP Reading #1 (r	mV)	-1340 -1388	CP Reading		-1342 -1389	CP Reading #3 (mV)	-1343 -1385
Temperature (°F)	43	DFT at H	loliday (mil)	≤ 25	DFT Ad	ljacent to Holiday (mil)	95, 83, 89
						de pictures below. ideo surveillance.	
8/25/2017 9:14:35 AM WAS-1					5/2017 10:15	and the second se	
Thickness: No Data H: REDACT D: ED Temp: 50.0 °F Date: 8/25/17	Frame	HH:MM:SS)	09:14:	H D Ten	ckness: No D EDACT D np: 51.7 °F e: 8/25/11	P	10:15:41
Date. 0/23/11	Fiame(	HH:IMIM:55)	09:14:		e. 0/23/1		10.15.4
	Catho	dic Protec	tion and Coa	ting Measu Holiday 4	rements (if	Holiday is found) -	
CP Reading #1 (n	nV)	-1384 -1433	CP Readin		-1390 -1430	CP Reading #1 (mV)	-1380 -1430
Temperature (°F)	43	DFT	at Holiday (mil)	≤ 25	DFT Adj	acent to Holiday (mil)	80, 80, 90
						de pictures below. ideo surveillance.	
8/25/2017 9:14:19 AM WAS-1	Contraction of the local division of the loc			8/2	5/2017 9:14: S-1	the second se	

D:D Temp: 49.9 °F Temp: 50.0 °F 8/25/17 Date: Frame(HH:MM:SS) 09:14:19 Date: 8/25/17 Frame(HH:MM:SS) 09:14:26

H:

Thickness: No Data



		General	Information		
Date: AFE / W.O.#:	AFE / W.O.#: 20008990 Co				Ballard Marine Co
Segment:	EAOI-1		Vater Depth	(ft):	194
Longitude:	REDACTED		atitude:		REDACTED
	Extern	al Pipe Coati	ng Inspectio	on Results	
Coating Condition	⊠ Disturbed Area □Holiday	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	9.17 (3'4" X 2'9")
Feature 1	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislodgeo ⊠Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	0.01 (1" X1")
Feature 2	□ Disturbed Area □Holiday	□Dislodgeo ⊠Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	0.01 (1" X1.5")
Feature 3	□ Disturbed Area □Holiday	□Dislodged ⊠Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	0.01 (1" X1")
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	
Corrosion present:	□YES	⊠NO		Biota present:	⊠YES □ NO
Dislodged coating obs	erved on the lake flo	oor: □YES	⊠NO	Lake floor location wrt pipe:	on 6 o'clock (pipe resting on lake bed)
	C	Comments/Iss	sues/Discus	ssion	
1.5" area on the top of DFT measurements ta	of the pipe (12 o'c ndicate normal co ken with the Pola water' measurem	lock). bating thickr trak CP gur	ness throug n through t	gh the entire area he white deposit	ite deposit within a 6" X a inspected. areas deviated slightly ctronegative to indicate
Contra	2 actor Signature		REDAC		ve/ Inspector Signature
Contra					



	Visu	al Inspection (Ger	neral C	oating Condit	ion)			
For all Includ	sections led the d	of dislodged coating ate and time stamps	g or ho s assoc	lidays, provide liated with vide	pictures o surveil	below. ance.		
9/8/2017 9:01:01 AM E-AOI1, S3, B1 H: REDAC D: RED PCT TerA9 56:9 "F			E-A	EDA EDA EDA EDA EDACT 3: 57.9 °F	PM			
Date: 09/08/17 Frame(HF	H:MM:SS	6) 9:01:01	9:01:01 Date: 09/08/17 Frame			(HH:MM:SS)	12:07:06	
		Coating Gau	ge Info	ormation				
Manufacturer:		eter Inspection Equip	Р	roduct:		211 Coating Thickness Gauge		
Last Calibrated:	08/09/2017		Next Calibration Due:			08/09/2018		
Gauge verified prior to use:	⊠YES	□ NO						
		Coating Thickne	ss Insp	pection Data				
Thickness Measure (mil)	A	Area of Interest		isturbed Area	(< 2 in.)		ed Area (> 5 ft.)	
North End #1		115		105		110		
#2	150			125		110		
#3	105			98		90		
South End #4		105		95		100		
#5		105		95		100		
#6		110		100			100	
Average Thickness		115		103		101		
	Additio	onal Coating Thick	ness l	nspection Dat	a (A/R)			
		0'0	clock	OI at 12, 3, and 9 lock				
	Тор		05					
	West		25					
	1							



External Pipeline Inspection Form for L5 Straits of Mackinac

		Cath	odic Prote	ction and Coa (note: holiday				iday is found)	
CP F	Reading #1 (r	nV)	-234	CP Readin		-440		CP Reading #3 (mV)	-320
	(feature 1)	-	-281	(featu	ire 2)	-316		(feature 3)	-260
Tempe	erature (°F)	45		eature (mil)	N/R	(featu	ures 1, 2	nt to Features (mil) , and 3 respectively)	130, 145, 140
				of dislodged of ate and time s				ictures below. surveillance.	
9/8/201 E-AOI1	7 12:07:06 Pl ,S3:B1	M							
H:RED D: RED Temp: 5 Date:	ACT		HH:MM:SS	i) 12:07:0	) 06 Da	to:		Frame(HH:MM:SS)	1

Note: CP readings at this feature were recorded with the probe of Polatrak CP gun pressed firmly into the white substance coating the pipe. These readings were more electronegative than the 'open water' CP readings (-198mV / -170mV), but are not consistent with Line 5 pipe metal contact – indicating that the presence of a resistive coating on the pipe surface.



AFE / W.O.#: Segment: Longitude: Coating Condition Feature 1 Peature 2 D Hd D Hd D Hd D Hd Corrosion present: Dislodged coating observed EAOI-5 E-39 is an area of	Disturbed Area oliday Disturbed Area oliday Disturbed Area oliday Disturbed Area oliday Disturbed Area oliday Disturbed Area	<ul> <li>Pipe Coa</li> <li>Dislodg</li> <li>Other</li> <li>Dislodg</li> <li>Other</li> <li>⊠Dislodg</li> <li>Other</li> <li>□Dislodg</li> <li>□Dislodg</li> <li>□Other</li> <li>□Dislodg</li> <li>□Other</li> </ul>	-	(ft): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ):	REDA       103       REDA       /       23       /       0.1       /       0.1       /	d Marine Co CTED 3.29 (6'6"x3'7 .01 (1" X1") .01 (1" x 2")	")								
Segment:       Image: Condition       Image:	EAOI-5 REDACTED External Disturbed Area oliday Disturbed Area	<ul> <li>Pipe Coa</li> <li>Dislodg</li> <li>Other</li> <li>Dislodg</li> <li>Other</li> <li>⊠Dislodg</li> <li>Other</li> <li>Dislodg</li> <li>Other</li> <li>Dislodg</li> <li>Other</li> <li>Dislodg</li> <li>Other</li> <li>Other</li> </ul>	Water Depth ( Latitude: ting Inspectio ed Coating ed Coating ed Coating ed Coating ed Coating	(ft): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ): Size of anomaly (ft <sup>2</sup> ):	103 <b>REDA</b> 23 23 24 0. 24 0. 25 25 25 25 25 25 25 25 25 25	CTED 3.29 (6'6"x3'7 .01 (1" X1")	")								
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EAOI-5 E-39 is an area of	d on the lake floo		□YES ⊠NO Biota pres												
		Dislodged coating observed on the lake floor: □YES ⊠NO													
	Co	omments/I	ssues/Discus	sion											
size of a quarter located n to a coated circumferentia DFT measurements indicat thinner coating adjacent to CP measurements taken v from reference 'open wate contact with Line 5 pipe m Part of the white deposit b	near the top of al seam weld in ate normal coa o the white dep with the Polatra er' measureme netal.	the pipe In the pipe ating thicl posit. Tak CP gu ents, but f	(at 12 o'cloc e. kness throug un through th they were no	ck). The white de gh the entire area ne white deposit ot sufficiently elec	eposit a inspe areas ctrone	ected, with deviated sl gative to in	adjacent slightly ightly								
M3			REDACTEI	D											
Contractor	Signature		Enbr	ridge Representativ	ve/ Insp	pector Signat	ture								



#### External Pipeline Inspection Form for L5 Straits of Mackinac

		al Inspection (Ger				,			
		of dislodged coating ate and time stamps							
9/6/2017 2:45:12 Ph/ E-AOI5		-	9/6/2017 2:47:47 PM E-AOI5						
H: REDA			H R						
Date:         09/06/17         Frame(HF	I:MM:SS	s) 14:45:12	D: N=0/C           Tenip: 58:1 F           Date:         09/06/17			HH:MM:SS)	14:47:47		
		Coating Gau	ge Infor	mation					
Manufacturer:	Elcome	eter Inspection Equip				211 Coating	Thickness Gauge		
Last Calibrated:	08/09/2017		Next Calibration Due:		Due:	08/09/2018			
Gauge verified prior to use:	⊠YES	□ NO							
		Coating Thicknes	ss Inspe	ection Data					
Thickness Measure (mil)	Α	rea of Interest	Undisturbed Area (< 2 in.)			Undisturbed Area (> 5 ft.)			
North End #1		145	72			130			
#2	94		115			130			
#3	105		100			110			
South End #4	130		130			135			
#5		110		120			105		
#6		105	100			105			
Average Thickness		119	106			119			
Additior	nal Coat	ing Thickness Insp		. , .		-			
		16" from South	End	34" from \$		id 52"	from South End		
	West	135		14			145		
	Тор	105	105			120			
	East	105		12			105		

Note: An area of dislodged outer wrap was identified 2.5' from the south end of the AOI. Coating thickness in this area was 100 mil.



**External Pipeline Inspection Form for L5 Straits of Mackinac** 

			ction and Coa (note: holiday				day is found)	
CP Reading # (feature 1		-391 -326	CP Readin	g #2 (mV)	N/R		CP Reading #3 (mV)	N/R
Temperature (°F	) 50	DFT at F	eature (mil)	N/R	DFT	Adjace	nt to Features (mil)	82,72,78,78
			of dislodged of ate and time s					
9/6/2017 2:47:47								
E-AOI5								
	a - 1	- Cal	a second de					
1.00	-	The second	A 2 -	120				
A PARTY A		ST WER	Contraction of					
a free free	1	- rig	and the	1910				
1.		Ser 1		100				
1.25	Ne to		A CONTRACT	CO.				
1 A March	3	when	Mr. A	1.				
	1 C T		4	Na				
			Jai 6					
Temp: 58:1 1	Cale		Mark N					
Date: 09/06/17	Frame	(HH:MM:SS	3) 14:47:4	7 Da	te:		Frame(HH:MM:SS)	

Note: CP readings at this feature were recorded with the probe of Polatrak CP gun pressed firmly into the white substance coating the pipe. These readings were more electronegative than the 'open water' CP readings (-101mV / -061mV), but are not consistent with Line 5 pipe metal contact – indicating that the presence of a resistive coating on the pipe surface.



		General I	Information		
Date: AFE / W.O.#:	09/05/17 20008990	C		p / Inspector:	Ballard Marine Co
Segment:	EAOI-7		Vater Depth	(ft):	81
Longitude:	REDACTED		atitude:		REDACTED
	Extern	al Pipe Coati	ng Inspectio	on Results	
Coating Condition	⊠ Disturbed Area □Holiday	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	<b>y</b> 7.08 (2'5" X 2'10")
Feature 1	☐ Disturbed Area ☐Holiday	□Dislodgeo ⊠Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	<b>y</b> 0.04 (3" X2")
	□ Disturbed Area □Holiday	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	y
	☐ Disturbed Area ☐ Holiday	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	y
	<ul> <li>□ Disturbed Area</li> <li>□ Holiday</li> </ul>	□Dislodgeo □Other	d Coating	Size of anomaly (ft <sup>2</sup> ):	-
Corrosion present:	□YES	⊠NO		Biota present:	
Dislodged coating obs	erved on the lake flo	oor: 🗆 YES	⊠NO	Lake floor location wrt pipe:	N/A (pipe is suspended)
thinner coating adjac The Polatrak CP gun measurements could on the pipe surface.	ndicate normal co ent to the white de was used to test not be obtained.	pating thickr eposit. for coating	ness throug holiday thr	gh the entire area ough the white d esence of a resist	a inspected, with slightly
M_	)~				
Contra	actor Signature		Enb	ridge Representativ	ve/ Inspector Signature



#### External Pipeline Inspection Form for L5 Straits of Mackinac

_		al Inspection (Ger					
		of dislodged coating ate and time stamps					
9/5/2017 12:24:13 Pi/I E-AOI7:58,83		-		017 12:23:58 17,38,83	РИ		
H: REDAC D: REDACT Temp: 63.1 °F			D;	DA DAC -63.1 °F			
Date: 09/05/17 Frame(H	H:MM:SS	6) 12:24:13 Date: 09/05/17 Fram		Frame(	(HH:MM:SS)	12:23:58	
		Coating Gau	ge Infor	mation			
Manufacturer:		Elcometer Inspection Equip		Product:		211 Coating Thickness Gauge	
Last Calibrated:	08/09/2	3/09/2017		Next Calibration Due:		08/09/2018	
Gauge verified prior to use:	⊠YES	□ NO					
		Coating Thicknes	ss Insp	ection Data			
Thickness Measure (mil)	A	Area of Interest		turbed Area	(< 2 in.)	Undisturbed Area (> 5 ft.)	
South End #1		111		106		114	
#2		104		109		100	
#3		135		113		126	
North End #4		159		160		160	
#5		166		200		190	
#6		190		120		110	
Average Thickness		144		134		133	
Addition	nal Coat	ing Thickness Insp	pection	Data (A/R)* (	see note	below)	
		Centerline of	AOI	Adjacent to whit		e	
		134		6	3		
		104		75			
		104		/	5		

CP gun was pressed firmly into the white deposit, but valid CP readings could not be obtained.



Appendix B: Report from Stress Engineering Services



# **Evaluation of Underwater Coating Repairs for Enbridge Line 5**

## **Final Report**

SES Document No.: 1254493-PL-RP-01 (Rev 0)

8 September 2017

Prepared for: **Enbridge Pipeline** Edmonton, Alberta, Canada

Contact: REDACTED

Prepared by:

Stress Engineering Services, Inc.

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Texas Registered Engineering Firm F-195

Enbridge Pipeline Evaluation of Underwater Coating Repairs for Enbridge Line 5 – Final Report

# **Limitations of This Report**

This report is prepared for the sole benefit of the Client, and the scope is limited to matters expressly covered within the text. In preparing this report, SES has relied on information provided by the Client and, if requested by the Client, third parties. SES may not have made an independent investigation as to the accuracy or completeness of such information unless specifically requested by the Client or otherwise required. Any inaccuracy, omission, or change in the information or circumstances on which this report is based may affect the recommendations, findings, and conclusions expressed in this report. SES has prepared this report in accordance with the standard of care appropriate for competent professionals in the relevant discipline and the generally applicable industry standards. However, SES is not able to direct or control operation or maintenance of the Client's equipment or processes.

# **Executive Summary**

Stress Engineering Services, Inc. (SES) was contracted by Enbridge Pipeline to evaluate an epoxy coating repair system that is being considered for use on a section of Enbridge's Line 5, which runs through the Straits of Mackinac in Northern Michigan. The coating repair system being evaluated is a product of Piping Repair Technologies (PRT) Incorporated of Hempstead, Texas, and consists of:

- Bio-Dur<sup>™</sup> 563 SW epoxy filler used to fill any missing or removed sections of the original coating;
- Four layers of E-glass fabric saturated with a two-part X-100 UW epoxy resin, which is a mixture
  of X100-UW Epoxy Base Blue and BIO-SEAL™ X-100 Curing Agent Clear. The epoxy repair
  fabric can be applied as either a patch or a full circumferential wrap over either bare steel or the
  original inner coal-tar coating; and
- Stricture Banding<sup>®</sup> film wrapped around the repair to compress the fabric layers and hold the repair in place as it cures.

SES performed a series of tests in which repairs were applied to laboratory samples and a representative 20" diameter pipe from Line 5 that was supplied by Enbridge. Both patch and full 360° circumferential repairs were applied to the samples while they were submerged in 40°F water with a composition similar to that found in the Straits.

All repairs cured in approximately 5 to 6 days, and were found to achieve a Shore D hardness of greater than 70.

The relative adhesion of the repairs to the pipe surface was tested using ASTM 4541 methods ("Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"). Both patch and full repairs exhibited greater adhesion to the pipe surface than the original coal-tar coating.

The effect of the Stricture Banding<sup>®</sup> film was evaluated by performing repairs both with and without its use during the repair procedure. One patch repair was not wrapped with Stricture Banding<sup>®</sup>; post-test inspection revealed that this repair was well adhered at its center, but was not fully attached around the perimeter of the fabric. The resulting crevice created at the perimeter indicated that the patch may be susceptible to erosion and/or crevice corrosion during service; therefore, use of the Stricture Banding<sup>®</sup>, or some other compression method, is recommended during the curing cycle. The remaining repairs that incorporated the Stricture Banding<sup>®</sup> during installation appeared to be well suited for underwater pipeline coating repair, if they are properly applied.

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Enbridge Pipeline

Evaluation of Underwater Coating Repairs for Enbridge Line 5 – Final Report

# 1. Introduction

Stress Engineering Services, Inc. (SES) was contracted by Enbridge Pipeline to evaluate the application of an epoxy repair system that is being considered for use on a submerged length of Line 5, located in the Mackinac Straits of northern Michigan (the "Straits"). Throughout this report, the term "Pipeline #5" is intended to refer to this underwater section of the cipeline.

The proposed repair system—X-100 UW Heavy Duty Epoxy—was applied to representative pipe samples by the supplier, PLT of Hempstead, Texas. The simulated repairs were applied while the pipe was submerged in 40°F water with a mineral composition similar to that of the Straits. The hardness of the repaired areas was then tested using a Shore D durometer over 7+ days to document the curing characteristics of the epoxy. The configuration of each repair area was examined using standard metallographic techniques. Additionally, adhesion testing per ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," was conducted in both the original and repaired areas of the coating to determine their relative adhesion after full curing.

This report documents the results of SES's testing and evaluation.

# 2. Original Coating Material

A 7 ft section of 20" diameter pipe was provided to SES for the repair system evaluation. The sample pipe section (Figure 1) had a wall thickness of 0.810" and was reportedly the same construction and vintage as Pipeline #5. The pipe section provided had reportedly been in prior service, although not underwater.

The original coating reportedly consists of an inner layer of coal tar or asphalt epoxy with an outer fiberglass wrap. SES removed a section of the original coating from the pipe and analyzed its composition using Fourier transform infrared spectroscopy (FTIR). The results (Figure 2) indicate that the inner layer is a coal-tar based coating. The outer layer is similar in composition but contains excessive dissolved phase and bound water.

A cross-section through the original coating in Figure 3 shows the two layers<sup>1</sup> of the coating. Visual inspection indicated that the coating is well adhered to the pipe surface with no visible corrosion or delamination.

Stress Engineering Services, Inc.

<sup>&</sup>lt;sup>1</sup> The top white-colored layer is a mounting resin that was applied to encase the coating to maintain its integrity during metallographic preparation.

Enbridge Pipeline Evaluation of Underwater Coating Repairs for Enbridge Line 5 – Final Report

8 September 2017



Figure 1: Photograph showing as-received 20" diameter pipe sample used for full-scale repair testing.

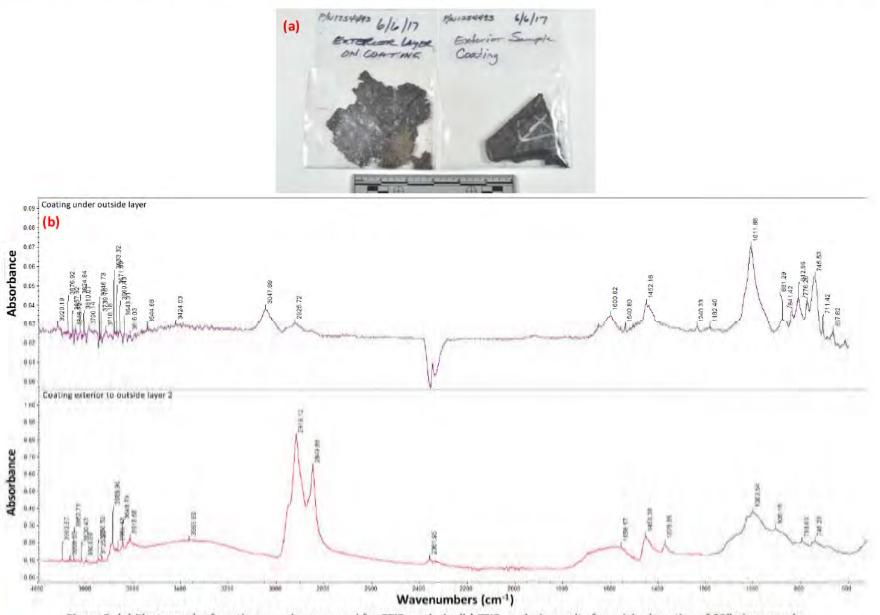


Figure 2: (a) Photograph of coating samples removed for FTIR analysis; (b) FTIR analysis results for original coating of 20" pipe sample.

Stress Engineering Services, Inc.

Encapsulating layer applied during sample preparation

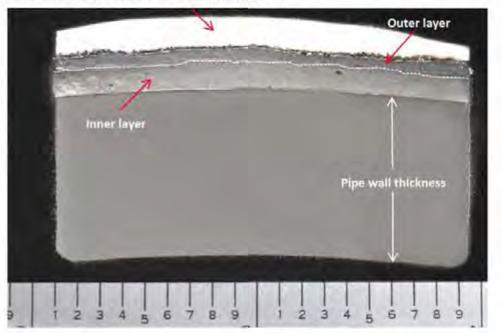


Figure 3: Metallographic cross-section through original coating. Dashed line indicates approximate boundary between inner and outer layers of coating. Numbered scale divisions are 0.1".

# 3. Laboratory Tests of Repair Coating System

Prior to conducting any repairs on the 20" diameter pipe section, SES performed small-scale tests on scrap pieces of carbon steel pipe. The outer surfaces of two 3-ft lengths of 6" diameter pipe were prepared to a NACE 2<sup>2</sup> finish.

The cure rate of an epoxy (and possibly its ability to cure) is largely a function of temperature. In general, the lower the temperature, the longer it will take for an epoxy to cure. An internet survey of Great Lakes water temperatures, including dive company websites, indicated that the temperature at the bottom of the Straits can be near 40°F, even in summer months. It is also known that 40°F is a standard test temperature for offshore oil & gas applications in the Gulf of Mexico. Thus, 40°F was selected as the coating application temperature for this test program.

Two modified chest freezers were filled with prepared water and chilled to 40°F using a combination of the freezer's compressor and dry ice (Figure 4). The water bath was maintained at 40°F throughout testing.

The repair coating system under evaluation (Figure 5) is a two-part epoxy system. First, the epoxy base (X100 – UW Epoxy Base – Blue) was mixed with curing agent (Bio-Seal X-100 Curing Agent – Clear) and applied to the surface of the pipe as a preparation layer (Figure 6(a)). The mixed epoxy was then saturated into a 12" wide, E-glass fabric that was wrapped around the pipe in at least four layers (Figure

<sup>&</sup>lt;sup>2</sup> Near-white metal abrasive blast cleaning.

6(a)-(d)). Each layer is approximately 30 mils thick. The repair was held in place for curing using Stricture Banding<sup>™</sup> (stricture), which is a thin film of transparent plastic that was wrapped around the repair and circumference of the pipe (Figure 6(e)). After curing, the stricture can be removed.

Full 360° wrap repairs were applied to the center of both sample pipes, and the repairs were allowed to cure for over one week. During the curing cycle, after an initial 72 hr waiting period, the pipe was briefly lifted from the water bath every 24 hr and the hardness of the repair was measured using a Shore D durometer. The location of the hardness tests and the cure curves for the test repairs are shown in Figure 7. Results indicated that coating hardness reached a plateau hardness after approximately 8 days. Hardness continued to increase slightly over the next few days, with a maximum reading of 85 Shore D after 9 days when the testing was suspended.



Figure 4: One of two laboratory test samples used for initial tests of repair material. A 6" pipe section is shown submerged in 40°F water prior to application of repair coating.



Figure 5: Two-part epoxy repair system provided by PRT Incorporated, Hempstead, Texas.

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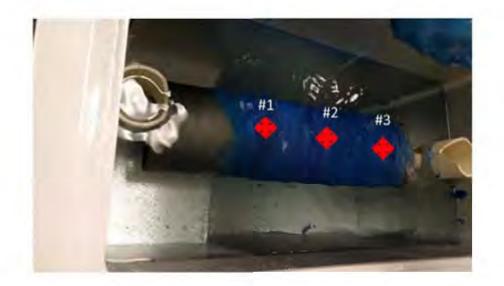
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Figure 6: Photographs showing application of laboratory epoxy repair wrap: (a) epoxy applied to bare steel; (b) and (c) fabric impregnated with two-part epoxy; (d) fiber mesh repair wrapped around pipe in four layers; and (e) stricture banding applied over repair.

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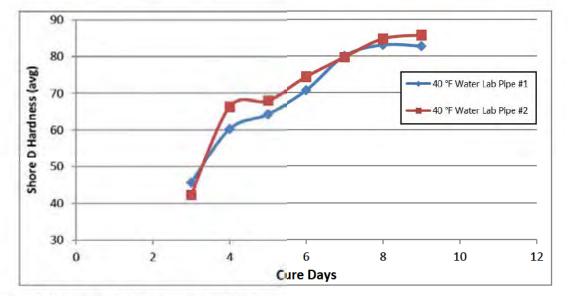


Figure 7: (a) Photograph showing locations of coating hardness measurements and (b) graph of coating hardness results during curing at 40°F.

# 4. Full-Scale Repairs of 20" Diameter Pipe

#### 4.1 Sample Preparation

The 20" pipe sample provided for this test program is shown in Figure 8 prior to repair or water exposure. To prepare the sample for testing, plastic end plates were affixed to each open end of the pipe, sealed around the circumference using expanding foam insulation, and held in place by a metal dowel running the length of the pipe. The plates were intended to limit water flow through the pipe during testing in order to minimize contamination of the test water from internal surface corrosion and

debris already present in the sample pipe<sup>3</sup>. Prior to affixing the end plates, SES attached two thermocouples to the inside surface of the pipe to monitor metal temperature during the test (Figure 9(a)).

A 2,700 gallon, insulated tank (see Figure 8 background) was filled with water obtained by reverse osmosis. Chemicals were added to simulate the Straits' water composition. The water was pumped continuously through a 10 ton water chiller and circulation pump with a 50 micron sediment filter until a temperature of 40°F was obtained. The water temperature was monitored via two temperature probes submerged in the tank, in addition to the thermocouples attached to the pipe. The temperature at the four probes was continuously recorded throughout the test procedure (Figure 9(b)).

Five separate areas on the 20" diameter pipe were prepared for repair. The schematic in Figure 10 shows the locations and variables of the different repairs. This information is also summarized below and in Table 1. Compass directions refer to the relative orientation of the pipe sample in the laboratory during testing. Clock/circumferential positions are viewed from the west end of the sample, with top dead center at 0°.

- A 16" square section of the (original) outer coating was removed from each end of the pipe along the top surface using a hand grinder and wire wheel. In the center of these squares, a 2" x 4" section of the inner coating was also removed, exposing bare steel. These areas were labeled "A" and "C" and designated as patch repairs.
- A 16" wide area of the outer coating was removed around the circumference of the pipe near the center of the sample length to provide space to apply a full 360° repair.
  - A 4" x 4" area of the inner coating was removed at the top of the pipe from this 16" wide area, exposing bare steel. This location was designated as Area "B."
  - Two 4" x 4" patches of the inner coating were removed at the north (Area "D") and south (Area "E") sides of the sample aligned with Area "B."

Figure 11 shows these prepared areas of the pipe prior to repair.

<sup>&</sup>lt;sup>3</sup> The interior of the pipe was allowed to fill with water, however, to avoid excessive buoyancy during the test.



Figure 8: Photographs showing 20" diameter pipe used for full-scale testing of epoxy repair material. Note insulated yellow water tank shown in background.

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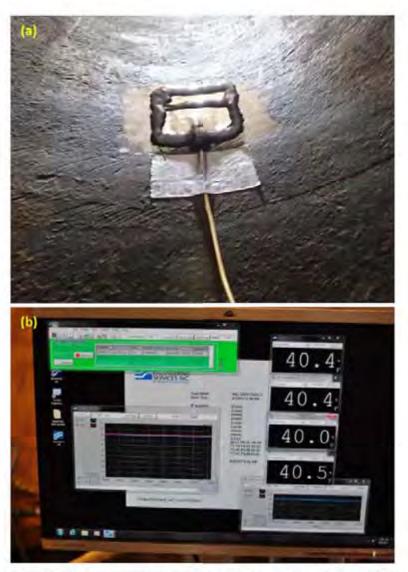


Figure 9: Photograph showing (a) thermocouple attached to inside surface of pipe and (b) temperature readout for water tank and pipe.

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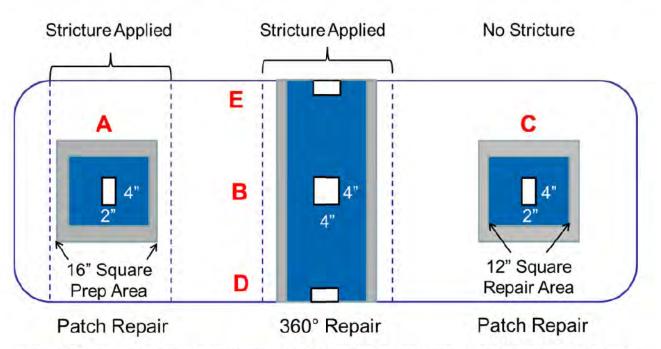


Figure 10: Schematic showing repair locations on 20" diameter full-scale pipe. Table 1 summarizes details of each repair location. (Note: Gray- and blue-shaded areas represent prepared and repaired areas, respectively. Plan view, not to scale.)

Repair Location	Axial Position	Circumferential Position	Patch/360°	Stricture?
A	West end	0*	Patch	Yes
В	Center	0°	360°	Yes
С	East end	0°	Patch	No
D	Center	90°	360°	Yes
E	Center	270°	360°	Yes

#### Table 1: Summary of Repairs Applied to 20" Pipe.

#### 4.2 Patch Repairs

The pipe sample was submerged in the insulated tank and allowed to stabilize at temperature (Figure 11). Flash rust formed in the five exposed areas during the temperature equilibration; this was removed with a wire brush prior to repair.

The exposed steel at Areas "A" and "C" was covered with a high-density epoxy filler (BIO-DUR™ 563 SW) so that the repair area was flush with the adjacent coal-tar coating. Four layers of a 12" x 12" section of X-100 UW epoxy impregnated E-glass fiber wrap were then applied over these areas. In Area "A," stricture was then wrapped around the circumference of the pipe and over the repair. In Area "C," no stricture was applied. The patch repair application at Area "A" is shown in Figure 12.

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Figure 11: Photograph showing 20" pipe in 40°F water prior to application of epoxy repairs. Repair areas are labeled per Table 1 and Figure 10. Flash rust cn exposed areas was removed prior to repair.

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Figure 12: Application of patch repair at Area "A." Photographs show (a) impregnation of 12" x 12" fabric with epoxy; (b) application of repair on pipe in water tank, (c) wrapping repair with stricture; and (d) completed repair.

#### 4.3 Full Circumferential Repair

For the next full-scale repair test, the exposed steel at Areas "B," "D," and "E" was covered with the BIO-DUR™ 563 SW epoxy filler to the approximate thickness of the original inner coal-tar coating. Four layers of a full 360° wrap repair were then applied to the pipe, covering all three test areas. A layer of stricture plastic was applied over the full circumferential repair to hold it in place during the curing cycle. The circumferential repair process is shown in Figure 1∃. Temperature data measured during the repair are shown in Figure 14.

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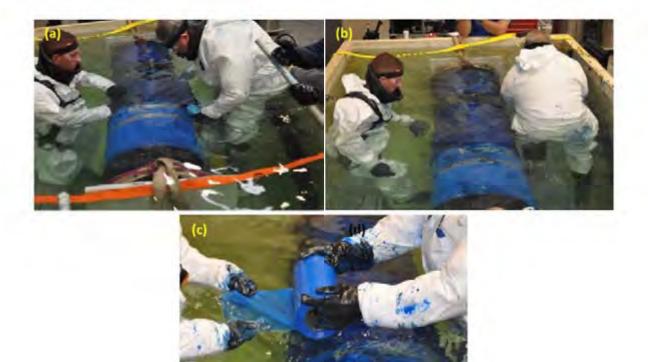
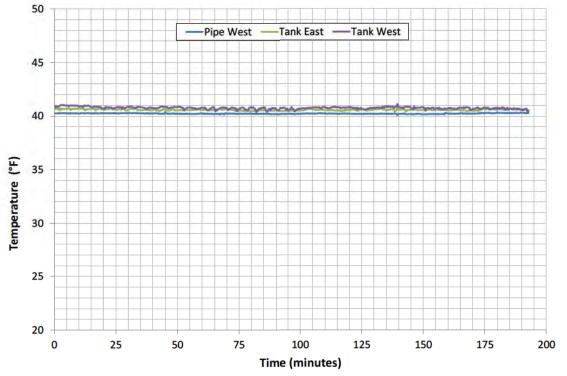
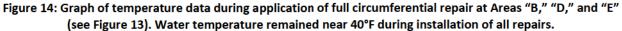


Figure 13: Application of full circumferential repair at Areas "B," "D," and "E." Photographs (a) and (b) show application of impregnated fabric around the circumference of pipe; (c) shows application of stricture.





#### 4.4 Curing Cycle

As with the laboratory repairs (see Section 3), the 20" diameter pipe was allowed to cure in the 40°F bath for 48 hours before initial durometer hardnes: testing. Figure 15 shows the water tank closed for testing and a plot of the temperature data, which remained steady at 40°F throughout the curing cycle.

Three durometer hardness readings were taken at each repair area located at the top of the pipe every 24 hours by temporarily lifting the pipe out of the water bath (Figure 16(a)). In Areas "A" and "B," the readings were made through the thin stricture banding. In Area "C," the durometer hardness was measured directly on the fiber wrap. The average hardness results are presented in Figure 16(b) and Table 2. The durometer hardness data from the laboratory test (Section 3) are included in the graph along with air curing data supplied by PRT Incorporated.

The durometer hardness data from the full-scale test plateaued in the mid-70s Shore D after approximately 5 to 6 days at temperature. No significant change in hardness was observed after 6 days, and the measurements were suspended after 8 days in the water bath. According to PRT Incorporated, a Shore D hardness of 70 is considered to reflect a full cure.

PRT Incorporated provided hardness data of repairs cured in air using both a standard and an accelerated resin. This data is included in Table 2 and Figure 15b. The accelerated resin reportedly cured more rapidly during the first few days; however, both samples were measuring in the mid-70s by day 7. The repair tests conducted at SES used only a standard resin. No accelerator was included in the epoxy.

Days	Lab 40°F Water		Full-Scale 40°F Water			Lab 40°F Air*	
After Repair	Pipe #1	Pipe #2	Area "A" Patch-Stricture	Area "B" Full Wrap	Area "C" Patch-No Stricture	Standard Resin	Accelerated Resin
2			43	41	53	47	55
3	46	42	54	58	60	50	69
4	60	66	66	67	66		
5	64	68	73	76	72		
6	71	74	73	75	76		
7	80	80	72	74	77	73	74
8	83	85	75	76	75	73	73
9	83	86				74	72
10						75	72
11						74	71
12						76	75

#### Table 2: Average Durometer Shore D Hardness Results from Test Repairs.



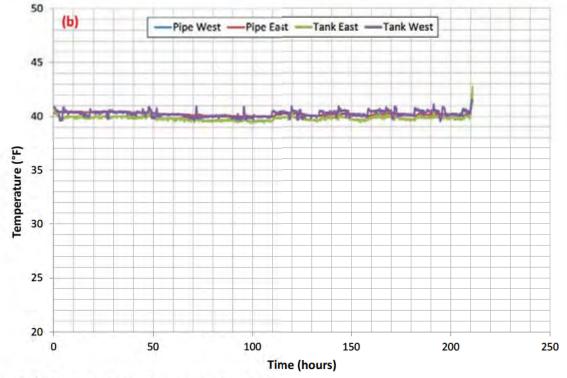


Figure 15: (a) Photograph showing water tank and (b) graph of water-bath temperature during curing period of full-scale repairs.



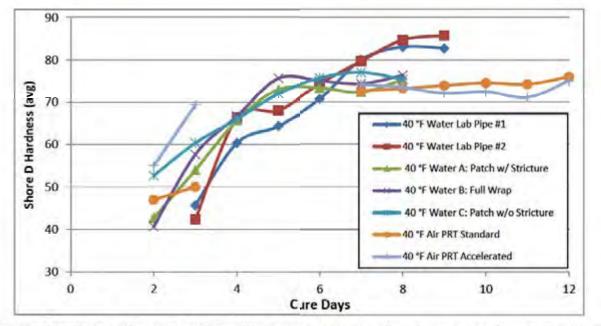


Figure 16: (a) Photograph showing 20" pipe lifted from water tank to allow durometer hardness testing. Areas "A," "B," and "C" were tested every 24 hours after an initial waiting period of 48 hours. (b) Graph of Shore D Hardness as a function of cure time.

# 5. Evaluation of Full-Scale Repairs

#### 5.1 Overall Appearance

The 20" diameter pipe sample is shown in Figure 17 after it was removed from the water bath and allowed to drain. The locations of the repairs are noted in the photograph. Repair areas "A," "B," "D,"

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and "E" are obscured by the stricture banding. Patch repair area "C" exhibits only the repair fiber wrap since no stricture was used in this area.

The full circumferential repair at the center of the pipe is shown in Figure 18(a) after the stricture was removed. The patch repair at Area "A" is shown in Figure 18(b). Both repairs appear to be well attached to the pipe, including along the perimeter of the repair patch and the edges of the circumferential wrap.

The patch repair at Area "C" is shown in Figure 19. While the majority of Area "C" appears well attached to the pipe sample, the edges of the fiber wrap layers were not completely bonded to the pipe, creating a crevice along the perimeter of the patch.



Figure 17: (a) Photograph of 20" pipe sample after removal from water bath; (b) photograph showing stricture still applied to Areas "A" and "B/D/E." Area "C" (patch repair with no stricture) is on right end. Numbered scale divisions are 0.1 feet.

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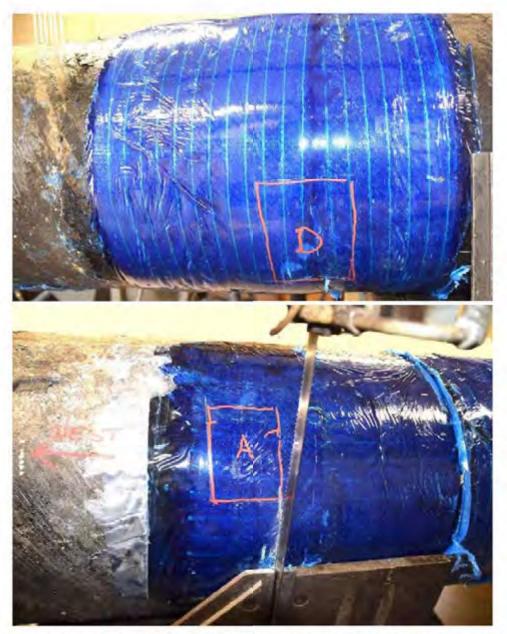


Figure 18: Full circumferential repair (Areas "B/D/E") is shown in upper photograph after stricture was removed. Patch repair Area "A" is shown in lower photograph after stricture was removed.



Figure 19: Photographs showing patch repair at Area "C" where no stricture was applied.

#### 5.2 Cross-Sections of Full-Scale Repairs

SES removed transverse sections through each of the repair areas to document the overall configuration of the repair. Additionally, smaller sections were removed from these cross-sections, mounted, and prepared using standard metallographic techniques. In order to maintain the integrity of the coatings during sample preparation, a large diameter diamond wafer saw was used to cut through the pipe wall thickness, original coating, and repair materials. It was found to not be necessary to encapsulate the samples prior to metallography; the coating layers remained intact using normal mounting and preparation techniques.

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#### 5.2.1 Patch Repair Area "A"

A cross-section through Area "A" is shown in Figure 20. As mentioned, a stricture wrap was used in this area. The resulting repair appeared to be well bonded to the pipe, including at the outer edges of the wrap. Metallographic cross-sections through the repair (Figure 21(a)) and over the original coal-tar inner coating at the perimeter of the 4" x 4" bare steel area (Figure 21(b)) showed a uniform repair thickness and good adhesion to the pipe wall surface and the original coating. There was no discernable difference in appearance between the repair epoxy filler and original coating.

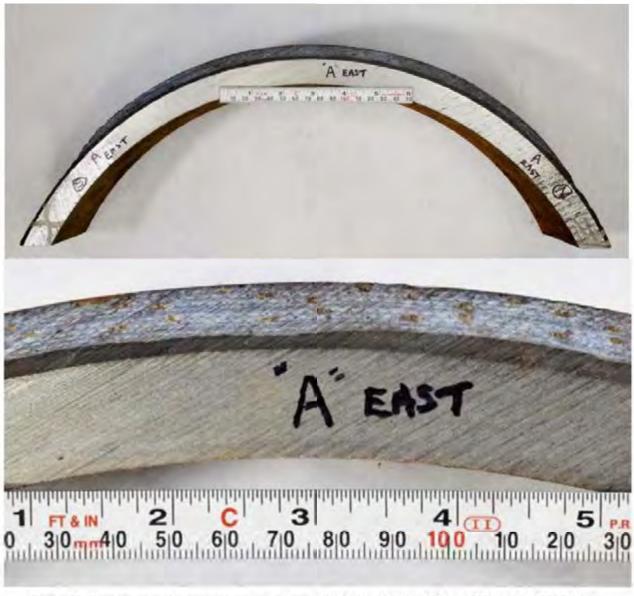


Figure 20: Photographs of rough cut cross-section through repair Area "A" (a patch repair with stricture banding).

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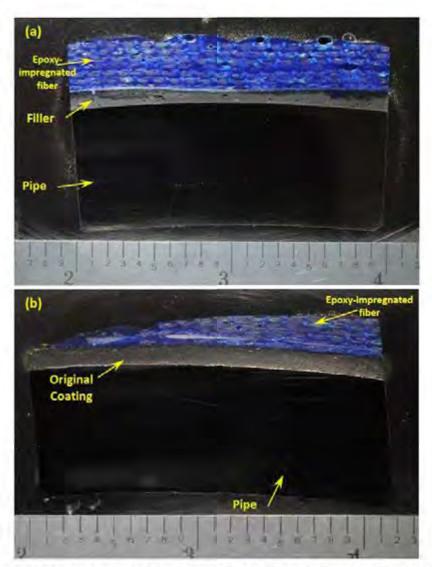


Figure 21: Metallographic cross-sections through repar Area "A." Section in upper photograph was removed through center of repair where original coating was completely removed down to bare metal. Lower photograph shows edge of repair where fiber wrap covers original coating.

#### 5.2.2 Circumferential Repair Areas "B," "D," and "E"

A cross-section through the three areas repaired with a full 360° wrap is shown in Figure 22. Closer views of each area are shown in Figure 23 to Figure 25. As with the patch repair in Area A, the full repairs appeared to be well bonded to the pipe, including at the outer edges of the wrap. Metallographic cross-sections through each area are shown in the lower photographs in Figure 23 to Figure 25, respectively. Again, the repairs were found to be relatively uniform and appeared to have good adhesion to the pipe wall, though areas of porosity were evident in the cross sections. The porosity is not extensive and does not appear to compromise the integrity of the repair.

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Figure 22: Photograph of cross-sectional ring cut from center of 20" pipe sample containing repair Areas "B/D/E."

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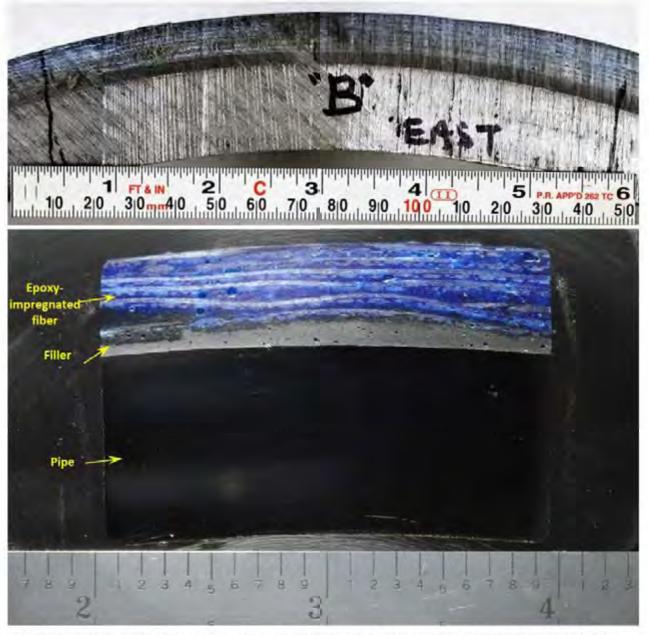


Figure 23: Metallographic cross-section of repair Area "B" located at top of pipe. A full 360° wrap and stricture was used in this repair.

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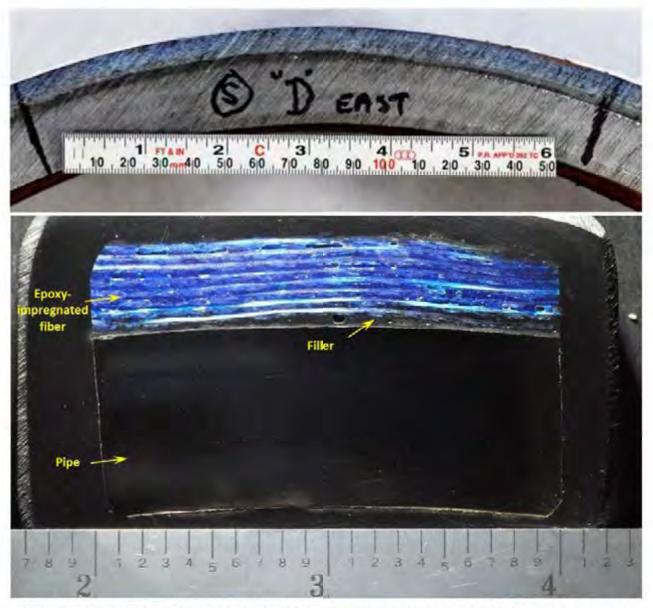


Figure 24: Metallographic cross-section of repair Area "D" located on south side (90°) of pipe. A full 360° wrap and stricture was used in this repair.

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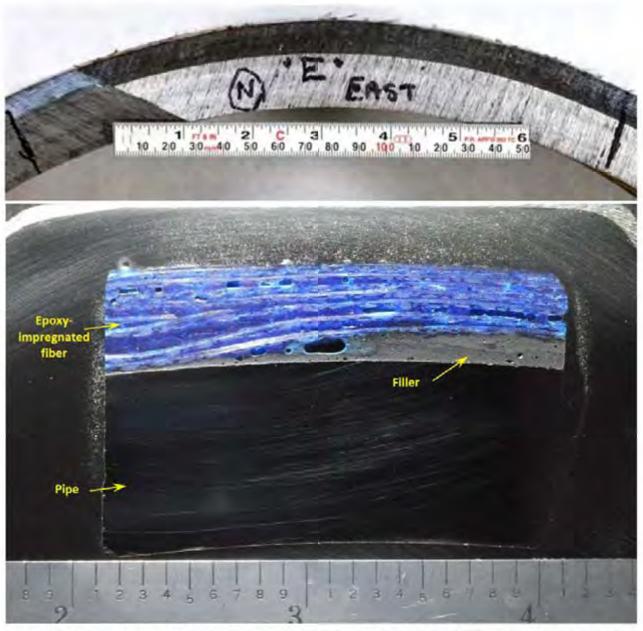


Figure 25: Metallographic cross-section of repair Area "E" located on north side (270°) of pipe. A full 360° wrap and stricture was used in this repair. (Reduction in thickness of filler material at left side of section is due to this section's being taken near edge of repair.)

#### 5.2.3 Patch Repair Area "C"

A cross-section taken through Area "C" is shown in Figure 26 along with closer views at the perimeter of the repair. A stricture wrap was not applied to this repair site. The center of the repair (where the repair was applied over bare steel) was relatively uniform and appeared to have good adhesion to the pipe wall. At the perimeter of repair, however, the wrap layers were found to be cured, but not adhered to the pipe wall. An approximately 1" length of the wrap was not bonded to the surface, which created a small crevice around the perimeter.

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A metallographic cross-section was taken through the center of Area "C" (Figure 27); this section was similar to the other repaired areas, exhibiting a relatively uniform thickness, some minor porosity, and good adhesion.



Figure 26: Rough cut cross-section through repair Area "C," a patch repair where no stricture banding was used. While center of repair was well adhered to pipe wall, perimeter of patch was disbonded from pipe.

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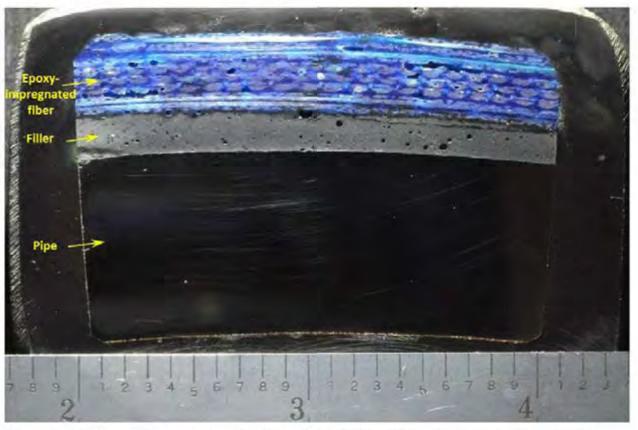


Figure 27: Metallographic cross-section through repair Area "C," a patch repair where no stricture banding was used.

# 6. ASTM D4541 Coating Adhesion Tests

Following the laboratory and full-scale repair tests, coating adhesion testing per ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," was conducted in both the original and repaired areas of the coating to determine their relative adhesion after full curing. The results of these tests are summarized in Table 3. Because minimal repair area was available for testing after the cross-sections were removed from the pipe, only three tests could be conducted at each repair location. Additionally, no minimum specified adhesion strength was provided for comparison for the repair material or original coating.

The data show that the fiber-wrap repairs were, in general, more highly adhered than the original coaltar coating on the sample pipe and that the full 360° repair areas exhibited a higher adhesion than the patch repairs. However, it should be noted that the 20″ sample pipe was not exposed to the same operational environment as Pipeline #5. This fact, along with the limited number of data points that could be obtained at each repair location, indicates that these results should be used for general comparison only.

Sample Location	Readings (psi)	Average (psi)
A - Patch repair, stricture	-/61*/553	307
B – Full repair, stricture	395/573/	484
C - Patch repair, no stricture	195/394/323	304
D – Full repair, stricture	25*/599/1,044	556
E – Full repair, stricture	816/772/629	739
Original, inner & outer layer	/208/	208
Original, inner layer only	339/290/271	300

#### Table 3: Results of ASTM D4541 Coating Pull-Off Strength Tests.

-- No valid result

\* Sample broke or cracked

# 7. Conclusions

Based on the analyses completed during this project, SES concludes the following:

- The original inner coating on the 20" pipe provided for testing was a coal-tar based coating.
- The X-100 UW epoxy fiber repairs applied to both laboratory and full-scale pipe samples bonded well to bare steel and the original coal tar coating. The repairs were able to cure in 5 to 8 days in 40°F water.
- While all repair areas exhibited good adhes on at the center of the repairs, those wrapped with
  stricture plastic during the cure cycle exhibited good adhesion throughout the width of the
  repair fabric. The patch repair that cured without a stricture wrap in place was not completely
  bonded around the perimeter of the patch. The crevice created at the edges of the patch
  indicates that the repair could be compromised by erosion and/or corrosion during service.
- The results of SES's testing program indicate that X-100 UW is an effective repair system for Pipeline #5. Patches, when secured during the curing cycle; as well as full circumferential wraps; are suitable repair options.

# 8. Sample Disposition

If metal or other types of samples were obtained by SES to complete services in this matter, these samples will be discarded in 60 days. If the Client wishes that the sample remnants be returned, the SES project manager should be contacted as soon as possible. Otherwise, samples will be disposed of at SES's discretion. Depending on space availability, samples can be stored at a designated SES facility beyond the 60 day period. Storage rates will be quoted on an individual basis.



Appendix C: Product Data Sheets

# BIO-DUR® 563 SW

REINFORCED EPOXY COATING FOR APPLICATION ABOVE OR BELOW WATER

Piping Repair Technologies

## **PRODUCT DATA SHEET**

**BIO-DUR® 563 SW** is based on a unique blend of liquid epoxy polymer and aliphatic polyamine curing agents, which is able to displace water from wet surfaces in order to make a permanent bond. The formulation is solvent free to ensure safety and maximum technical performance. Kevlar<sup>™\*</sup> fibers are incorporated for reinforcement and viscosity management to achieve high application rates even underwater.

**BIO-DUR® 563 SW** provides permanent protection under the most adverse conditions. The formula is uniquely field-friendly and uses advanced low toxicity ingredients in a high build brushable/rollable product. One of the active CP compatible products of the BIO-DUR® line where a shorter curing time is required. All colors including white are available and can be shipped "Non-Regulated" by USDOT, IATA and IMO.

\*Kevlar is a trademark of E. I. Dupont de Nemours Co.

#### **RECOMMENDED USES**

**ANTICORROSIVE COATING:** Splash zone, excellent abrasion resistance above or below water. **REPAIR COMPOUND:** Patching, leak sealing etc. above and below water.

**FIELD JOINT COMPOUND:** Rapid curing, surface tolerant and excellent cathodic disbondment properties.

**ENCAPSULATING COATING:** Smooth, dense, easily decontaminated coating for steel and concrete. **WASTEWATER:** Reinforces, smooths and protects concrete exposed to chemical or municipal waste. **CATHODIC PROTECTION:** Suitable for application on lines protected by active CP.

### **TECHNICAL INFORMATION**

VEHICLE TYPE	Epoxy/Aliphatic amines
PIGMENTATION	Color/Inert/fibrous reinforcement
COLORS	Standard White, Black, Gray; other available
FINISH	Slight texture
THINNER	Not normally required
CLEANER	MEK or acetone
MIXING RATIO	1.0/1.0 v/v
INDUCTION TIME	Not required
POT LIFE	Approx. 20 min./ 77°F
FLASH POINT	Over 200°F
SOLIDS BY VOLUME	100%
SPREADING RATE/GAL	1604 mil/sq.ft./gal; 53.5 sq.ft./gal @ 30 mils
DRY TIME, (Dust free)	2 hours at 77°F
DRY TIME, (Service)	3 hours light, 24 hours heavy service at 77°F
APPLICATION METHOD	Brush, roller, heated plural airless spray
STORAGE CONDITIONS	Normal, freezing ok
VOC.	Essentially zero
DENSITY	Base 9.6 lb/gal; Cure 13.0 lb/gal, Mix 11.3 lb/gal

### **APPLICATION NOTES**

**SURFACE PREPARATION:** Remove marine biological settlement and corrosion by >5,000 psi water jetting with or without abrasive. Conventional air/abrasive blasting works well at shallow depths however efficiency falls off sharply below 10 feet. Hand held power tools such as needle guns or grinders can give good results if applied conscientiously in small areas but will be inadequate in large areas. Plan to apply the BIO-DUR®563 SW within 45 minutes maximum after surface preparation to minimize rerusting or initial settlement of fouling slime, which interferes with initial adhesion.

Application above water requires similar high-pressure water blasting or dry abrasive blasting to yield a firm, granular surface free of loose contamination.

**MIXING PROCEDURE:** BIO-DUR® 563 SW is supplied in 2 gallon kits of 2 x 1 gallon containers each of epoxy base and curing agent. These components are formulated in contrasting colors to facilitate complete mixing. Visible streaks of either component seen during the course of mixing indicate "hotspots" of unmixed components. It is imperative to properly mix the components since unmixed "hotspots" of either base or curing agent will never cure.

Remove equal quantities of base and curing agent from their cans and place them in a clean plastic or steel container. Mixing is accomplished by stirring with a "Jiffy" type mixer in a geared down, (high torque), 1/2" electric drill. Once mixing begins, there will be about 20 minutes of working time available at 77°F. This time may be extended by keeping the components and mixture cool, rather than leaving it in a hot area.

#### **APPLICATION:**

- 1) Using a stiff brush or roller apply mixed components from a tray aiming for a coverage rate of about 50 sq.ft. per gallon.
- 2) Apply by heated plural component airless spray using the following equipment setup:

Spray Unit: Mix ratio:	Graco "King" or similar with heated hoses. 1/1 by volume
Fluid pressure:	2,500 psi
Fluid temp:	140°F
Filters:	Remove all filters
Tip size:	.031"039" orifice

**CURING BEFORE SERVICE:** BIO-DUR® 563 SW may be immersed in fresh or salt water immediately after application. It will cure to a hard film within about 3 hours and is suitable for traffic after this time. Allow at least 24 hours at 77°F before subjecting to aggressive chemical service from industrial solvents and similar materials.

#### TYPICAL PHYSICAL PROPERTIES OF THE CURED FILM:

Compressive strength:	7,380 psi (50.9 N/mm2)
Tensile strength:	6,000 psi (est.)
Flexural strength:	4,550 psi (31.4 M/mm2)
Abrasion resistance:	34.0 mg/1,000 cycles (CS17 wheels with 1,000 gram weights)
Tensile adhesion:	>2,000 psi ("Near White" SA2.5 abrasive blasted dry steel)
Tensile adhesion:	>1,000 psi (>5,000 psi water jetted steel applied/cured underwater)
Tensile adhesion:	>1,000 psi (power tool cleaned then >2,500 psi water jetted dry steel)



HEMPSTEAD, TEXAS USA 979-826-0075 mail to: <u>info@pipingrepairtechnologies.com</u> www.pipingrepairtechnologies.com



# X-100 UW Field Applied Composite Reinforcement for Dry Surface, Wet Surface or Underwater Piping Repair



- Corrosion Remediation
- Structural Reinforcement
- Leak Containment
- Abrasion Protection



An ISO 9001:2008 Certified Manufacturer

#### X-100 UW RESIN SYSTEM:

The X-100 UW resin is based on pure liquid epoxy polymers and proprietary polyamine curing agents. The X-100 UW resin system is designed for use on wet surfaces or underwater applications. It is a twocomponent, ambient temperature epoxy matrix, and is suitable for use with a variety of reinforcement fabrics. The X-100 UW resin wets out easily and is relatively fast setting, approximately 30 minutes at 77°F (25°C). No VOC and is a 100% solids epoxy resin.

#### SURFACE PREPARATION:

Remove marine biological settlement and corrosion by >5,000 psi water jetting with or without abrasive. Conventional air/abrasive blasting works well at shallow depths however efficiency falls off sharply below 10 feet. Hand held power tools such as needle guns or grinders can give good results if applied conscientiously in small areas but will be inadequate in large areas. Plan to apply the X-100 UW within 45 minutes maximum after surface preparation to minimize re-rusting or initial settlement of fouling slime, which interferes with initial adhesion.

Application above water requires similar high-pressure water blasting or dry abrasive blasting to yield a firm, granular surface free of loose contamination.

#### **MIXING PROCEDURE:**

X-100 UW is supplied in size specific, factory pre-measured kits with corresponding reinforcement fabric lengths depending upon application. Kits are comprised of a Part A epoxy base in a partially filled container and a Part B curing agent to be poured into Part A container to assure proper mix ratio. After pouring the curing agent into the base, mix thoroughly for approximately 2 minutes taking care to stir in all base material from the edges and base of the container; *unmixed material will never properly cure*. No induction or "sweat-in" time is required and the mixed material may be used immediately. Pot life and reaction time is heavily dependent on temperature, as a general guide figure that each 18°F, (10°C), variation in temperature above or below 77°F, (25°C), will respectively halve or double the pot life and cure times.

#### APPLICATION:

When saturating the reinforcement fabric, a roller or flexible spreader should be used to evenly distribute the X-100 UW material throughout the fabric. The material will thicken in cold weather and will be noticeably thicker at temperatures of 50°F and below.

#### CURING BEFORE SERVICE at 77°F (25°C):

Dry time, dust free, 8 hours; light service, 12 hours; heavy service. Low temperature curing at approximately 40°F (5°C) will require approximately 7 days. Post cured Shore D scale hardness 70+.

- CAN BE APPLIED AT FULL PRESSURE
- FACTORY PRE-MEASURED FOR FAST INSTALLATON
- EGLASS AND CARBON FIBER FABRICS AVAILABLE
- CAN BE USED ON STRAIGHT RUN PIPING, ELBOWS, TEES AND FLAT SURFACES
- ISO 9001:2008 CERTIFIED MANUFACTURER

#### **Industries Served**

- Refining
- Power Generation
- Chemical Plants
- Mining
- Industrial
- Pulp and Paper
- Liquid and Gas Transportation
- Production Facilities
- Water and Wastewater Treatment

Page 3 of 3

#### AVAILABLE PRT PRODUCT SUPPORT SERVICES

- Project assessment
- Engineering consultation
- Repair design, calculation and documentation
- Project supervision, domestic and international
- Supporting installation supplies
- # #

#### **TECHNICAL SUPPORT ASSISTANCE CONTACT:**

Jesse R. Sanders or Chris Sanders Piping Repair Technologies, Inc. Office: 979-826-0075 Jesse cell: 713-906-8650 Chris cell: 281-840-1260



Piping Repair Technologies, Inc. 40164 FM 2979 Hempstead, Texas, USA 979-826-0075 office 979-826-9498 fax Email: info@pipingrepairtechnologies.com www.pipingrepairtechnologies.com

We urge you to read the safety data sheet (SDS) before using and to call Piping Repair Technologies, Inc., as necessary for advice or information before any actual or contemplated application.

WARRANTY DISCLAIMER: The technical data given herein has been compiled for your help and guidance and is based upon our experience and knowledge. However, as we have no control over the use to which this information is put, no warranty, express or implied, is intended or given. We assume no responsibility whatsoever for coverage, performance or damages, including injuries resulting from use of this information or of products recommended herein.



Appendix D: Letter from Manufacturer



06 September, 2017

#### Re: PHMSA Regulations, 49 CFR 195.559 BIO-DUR 563SW and X-100UW Epoxy Coatings

To whom it may concern,

Further to the request for information regarding our coatings compliance with the requirements of subject regulations we are pleased to respond that individually and/or the combination of BIO-DUR 563SW and X-100 UW resins may be described as follows:

a) Individually or in combination they are designed to mitigate corrosion on buried or submerged pipelines.

b) Individually or in combination has sufficient adhesion to the metal or coated substrate to exclude and resist under film moisture.

c) Individually or in combination, the products are sufficiently flexible to resist cracking.

d) Individually or in combination the products have sufficient strength to resist damage due to handling, moderate impact and soil stress.

e) Individually and in combination the products will support any supplemental protective cathodic protection system when used properly.

The family of underwater capable epoxy coating materials being employed on this project have been in use since 1989. Variations have been created to suit specific requirements over the years, but all are 100% solids epoxies with proprietary additives to displace water from the surface. This enables these coatings to obtain high levels of adhesion to bond with the substrate. Many underwater installations have been performed all over the world by us, by our customers and by third party, end users; below is a brief summary:

- Power station pier rehabilitation, Mexico, 1998
- Nuclear installation by ROV, WA, USA, 1999
- Underwater tank installation, Australia, 2001
- Structural steel rehabilitation, U.K., 2002
- Municipal repairs, FL, USA, 2004
- Hydro Dam repairs, Wales, 2005, 2007
- Nuclear storage pool sealing, USA, 2005
- Offshore platform structural recoating, China, 2008
- Nuclear submarine repair, USA, 2008
- Reservoir penstock repairs, USA, 2009
- Municipal rehabilitation, USA, 2010
- Offshore platform riser, UAE, 2011
- Subsea pipeline reinforcement, UAE, ongoing 2014-current

Please do not hesitate to contact us if we may supply any additional information to support the statements above.

With thanks for your interest in our products,

Sincerely,

Jesse R. Sanders President and Technical Director Piping Repair Technologies, Inc.

40164 FM 2979 Hempstead, Texas 77445 / office (979) 826-0075 / Cell (713 906-8650

Email: jsanders@pipingrepairtechnologies.com

Website: www.pipingrepairtechnologies.com



Appendix E: Application of Underwater Repair Coatings for Line 5 Straits



# APPLICATION OF UNDERWATER REPAIR COATINGS FOR LINE 5 STRAITS

 Version #:
 2.0

 Version Date:
 09/08/2017

APPLICATION OF UNDERWATER REPAIR COATINGS FOR LINE 5 STRAITS

Version #: 2.0 Version Date: 09/08/2017



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APPLICATION OF UNDERWATER REPAIR COATINGS FOR LINE 5 STRAITS

Version #: 2.0 Version Date: 09/08/2017



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#### 1.0 Scope

This procedure defines the requirements for application of repair coatings to pipe previously coated with coal tar enamel (parent coating) that are located underwater (e.g., lake bottom, straits crossing). Coating repairs consist of two approved methods that include:

- Method 1 Epoxy Filler/ X-100 Epoxy/Full Circumferential Composite Wrap Repair/Stricture Banding®
- Method 2 Epoxy Filler/ X-100 epoxy/Composite Patch Repair/Stricture Banding®

#### 2.0 General

#### 2.1 Manufacturer Support

This procedure was developed with support of the product Manufacturer (Piping Repair Technologies Incorporated). The Manufacturer's instructions and technical datasheet form an integral part of this procedure and have been incorporated herein.

#### 2.2 Operator Qualifications and Training

Any contractor that is performing an OQ task is required to complete training modules and handson training to demonstrate qualifications. This training process is designed to deliver the basic skills required for each task. After completion of the OQ training, the results are uploaded to ISNET to verify compliance.

To supplement the OQ certification process, the coating manufacturer shall perform specific training for the materials and coating applications that will be used for the L5 Straits underwater coating repairs. Upon successful completion of the manufacturer's training, the Manufacturer shall issue a certificate of training or other documentation that supports the competency of the individual divers with application of the product.

**Note:** At its discretion, the coating Manufacturer may designate in writing a representative to conduct this training on its behalf.

The marine contractor will also perform a simulated wet trial located close to the dock to test the coating repair plan prior to completing the repairs.

#### 2.3 **Pipe Excavation**

If pipe is buried in the lake floor, full circumferential access at the repair area may be accomplished by water blasting or other appropriate excavation methods to allow the circumferential application of the composite wrap and/or the Stricture Banding®.

#### 2.4 Deviations

Any deviations from this procedure shall be brought to the Pipeline Integrity (PI) Coating Specialists for resolution. The PI Coating Specialist will consult with the key stakeholders that

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include, but are not limited to, the onsite Company Inspector, the Diver, and the coating Manufacturer. If the deviation is accepted, the requested deviation, key stakeholder inputs and risk assessment associated with the deviation will be uploaded into the Company's Business Information Management (BIM) system.

**Note:** No deviations will be accepted if they are not supported by the coating Manufacturer.

#### 3.0 Surface Preparation

#### 3.1 **Pre-Preparation**

The steel surface shall be cleaned using scarpers, hydroblasting cleaning, wet abrasive blasting, or pneumatic power wire wheel brush. The repair area shall be abraded using either wet abrasive blasting or pneumatic power wire wheel brush. The method shall be capable of providing a surface profile of 2.5 - 5 mils.

#### 3.2 Parent Coating

3.2.1

Feathering shall remove the sharp edge at the transition from the parent coating.

3.2.2

The parent coating shall be roughened (abraded) using a cup disk brush to remove the loosely adherent biota, coating and provide a surface for overcoating.

3.2.3

For full circumferential composite wrap repairs (Method 1), the roughening shall extend at least 6 inches from the upstream and downstream edge of the repair area and around the entire circumference of the pipe.

For composite patch repairs (Method 2), the roughening shall extend onto the parent coating at least 6 inches from the edge of the repair area.

#### 4.0 Coating Application

#### 4.1 Surface Condition for Coating

Immediately prior to coating application, the Diver shall remove any flash rust and/or accumulated debris (silt, clay, etc.) using a wire brush or other method approved by the Manufacturer.

**Note:** The surface of the pipe shall meet all preparation requirements listed in Section 3.0 before the coating application.

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#### 4.2 Preparation and Application of the Epoxy Filler

#### 4.2.1

The BIO-DUR epoxy filler shall be prepared by thoroughly mixing the BIO- DUR<sup>™</sup> 563 SW Epoxy Base – Black and the BIO – DUR <sup>™</sup> 563SW Curing Agent – White.

#### 4.2.2

The diver shall apply the BIO-DUR epoxy filler so that the bare steel is completely covered and the repair area is flush with the adjacent parent coating.

#### 4.2.3

The diver shall confirm that the thickness of the BIO-DUR epoxy filler is sufficient using a straight edge tool that bridges the adjacent parent coating on each side of the repair. If the BIO-DUR epoxy filler is below the straight edge tool, additional filler shall be added to ensure the repair area is flush with the adjacent parent coating.

### 4.3 Preparation and Application of Full Circumferential Wrap Repairs (Method 1)

4.3.1

The X-100 epoxy shall be prepared by thoroughly mixing the X100 – UW Epoxy Base – Blue and the BIO-SEAL ™ X-100 Curing Agent – Clear.

#### 4.3.2

The E-glass fabric shall be cut into approximately 12 inch wide x 12 feet long strips and impregnated with the X-100 epoxy to form the composite wraps.

#### 4.3.3

Prior to application of the composite wrap, the X-100 epoxy shall be applied to the surface of the epoxy filler and abraded adjacent parent coating.

#### 4.3.4

The composite wrap shall be applied 360 degrees around the pipe to a minimum thickness of 4 full layers and shall extend over the epoxy filler and abraded adjacent parent coating. Wider repairs will require additional side by side layups that are each 12 inches wide with a minimum two inch overlap at the seams.

#### 4.3.5

Blue Stricture Banding® will be tightly applied in the same direction as the composite wrap to a minimum of three (3) layers to assure the radial compression and retention of the repair in place during cure.

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**Note:** alternative protective wraps or encasements are allowed if approved by the coating Manufacturer.

4.3.6

The Stricture Bandings<sup>®</sup> shall extend at least 4 inches upstream and downstream of the repair.

**Note:** the Stricture Banding is applied in the same direction of the composite wrap and shall have tension in order to secure the composite wrap.

#### 4.4 Preparation and Application of Composite Repairs (Method 2)

#### 4.4.1

The X-100 epoxy shall be prepared by thoroughly mixing the X100 – UW Epoxy Base – Blue and the BIO-SEAL ™ X-100 Curing Agent – Clear.

4.4.2

The E-glass fabric shall be cut into approximately 12 inch x 12 inch patches and impregnated with the X-100 epoxy to form the composite patches.

#### 4.4.3

Composite patch repairs shall consist of a minimum of 4 layers of the patch applied directly over the epoxy filler and abraded adjacent parent coating. The patches shall be applied in 4 layer patches until the entire repair area (filler and abraded adjacent parent coating) is coated.

#### 4.4.4

Blue Stricture Banding® will be tightly applied 360 degrees around the pipe over the composite patch repairs to a minimum of three (3) layers to assure the radial compression and retention of the repair in place during cure.

**Note:** alternative protective wraps or encasements are allowed if approved by the coating Manufacturer.

#### 4.4.5

The Stricture Bandings<sup>®</sup> shall extend at least 4 inches upstream and downstream of the edge of the coating repairs.

#### 4.5 Cure Time

#### 4.5.1

After application, the coating system will be allowed to cure in place for a minimum of 7 days at 40 °F.

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**Note:** full scale testing has shown that the coating repair will reach a Shore D greater than 60 in less than 5 days at 40 °F. The Manufacturer requires a Shore D value of 60 or greater before removal of the Stricture Banding®.

4.5.2

Prior to removing the Stricture Banding<sup>®</sup>, the diver shall ensure the coating repair does not indent when pressed with a thumbnail or other device approved by the Manufacturer with moderate pressure.

#### 5.0 Quality Control

#### 5.1 Diver

The Diver shall be responsible for the quality of the coating repair work.

#### 5.2 Company Inspector

#### 5.2.1

The Company Inspector shall have access to and shall be allowed to witness or audit the Divers' work, equipment, and records.

#### 5.2.2

The competency requirements for the Company Inspector are as follows:

- a) Minimum NACE-certified CIP Level 2 (or equivalent certification such as SSPC)
- b) Trained and knowledgeable with regard to the application techniques, materials, and product data sheets covered by this specification

#### 5.2.3

The Company Inspector reserves the right to stop any or all work at any time for noncompliance with the stated requirements of this procedure, during emergency situations, or for other justifiable reasons.

<End of Document>



Appendix F: OQ Checklist

#### APPENDIX E: CONTRACTOR REQUIREMENTS E.02 OQ Covered Task Checklist Assignment

#### 

Contractor Name:	Location:	Date:	Project Name & Tracking Project Number:	Project Manager:
		5/30/2017	20008990	

Individual responsible for verifying Contractor OQs:

Individual responsible for verifying Enbridge Employee OQs: \_\_\_\_\_

PROJECT MANAGER/DESIGNEE: Place an X in the appropriate Check Person Responsible column for covered task(s) to be performed during this project by Company or Contract personnel.

NOTE: This OQ Checklist Assignment form is not all inclusive, as it may be subject to change due to project scope changes. The Project Manager/Designee is responsible for adding, deleting or modifying this list.

CONTRACTOR: For each covered task with X in the Check Person Responsible - Contractor column, the Contractor is responsible for submitting contractor OQ information to ISNetworld. Project Manager/Designee MUST receive Contractor-required OQ covered task information at least two full working days prior to work commencement (See Appendix E.03 Contractor OQ Responsibilities, Appendix E.04 ISN Verification of Contractor OQ Records and, if required, Appendix E.05 Covered Task Worker ID/Contractor Report.)

	CHECK PERSON RESPONSIBLE (Put X in	n box i	f perso	on needs to be qualified on the covered task)	
Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
Abnormal Operating Conditions (AOC)					
	group Heading Only				
	x	1:1	1:1		#1.1: Measure structure-to-soil (electrolyte) potentials
Conduct close interval survey		1:1	1:1		#1: Cathodic protection survey
		1:1	1:1		#2: Interference testing
					#3: Inspect and electrically test bonds
Inspect and test electrical isolation	x	1:1	1:1		#5: Inspect and test isolation devices
	Group Heading Only				
		1:1	1:1		#4: Maintain test leads
Repair damaged test leads		1:1	1:1		#4: Maintain test leads
Install test leads by non-exothermic welding methods		1:1	1:1		#4: Maintain test leads
Install test leads by exothermic welding methods		1:1	1:1		#4: Maintain test leads
Inspect Rectifier	Group Heading Only				
		1:1	1:1		#6: Inspect and test rectifier
Maintain Rectifier	Group Heading Only				
Troubleshoot rectifier		1:1	1:1		#7: Rectifier maintenance and repair
Repair or replace defective rectifier components		1:1	1:1		#7: Rectifier maintenance and repair
Adjustment of rectifier		1:1	1:1		#9: Rectifier adjustment
	Abnormal Operating Conditions (AOC)  Conduct Annual Surveys to Electrically Inspect Unprotected Bare Pipe Measurement of structure-to-soil potentials Conduct close interval survey Test to detect interference Inspect and perform electrical test of bonds Inspect and test electrical isolation Maintain Test Leads Verify test lead continuity Repair damaged test leads Install test leads by non-exothermic welding methods Install test leads by exothermic welding methods	Covered Task Name       Contractor         Abnormal Operating Conditions (AOC)       x         Conduct Annual Surveys to Electrically Inspect Unprotected Bare Pipe       Group Heading Only         Measurement of structure-to-soil potentials       x         Conduct close interval survey       Image: Conduct Close interval survey         Test to detect interference       Image: Conduct Close interval survey         Test to detect interference       Image: Conduct Close interval survey         Verify test lead continuity       X         Maintain Test Leads       Group Heading Only         Verify test lead continuity       Image: Conduct Close interval reading Only         Verify test lead continuity       Image: Conduct Close interval reading Close interval reading methods         Install test leads by non-exothermic welding methods       Image: Conduct Close interval reading from a rectifier to verify proper performance         Maintain Rectifier       Group Heading Only         Troubleshoot rectifier       Group Heading Only	Covered Task Name       Contractor       ugg         Abnormal Operating Conditions (AOC)       x       x         Conduct Annual Surveys to Electrically Inspect       Group Heading Only       x         Measurement of structure-to-soil potentials       x       1:1         Conduct close interval survey       1:1       1:1         Test to detect interference       1:1       1:1         Inspect and test electrical isolation       x       1:1         Maintain Test Leads       Group Heading Only       1:1         Verify test lead continuity       1:1       1:1         Inspect and test leads       1:1       1:1         Install test leads by non-exothermic welding methods       1:1       1:1         Install test leads by exothermic welding methods       1:1       1:1         Install test leads by exothermic welding methods       1:1       1:1         Install test leads by exothermic welding methods       1:1       1:1         Install test leads by exothermic welding from a rectifier to verify proper performance       1:1       1:1         Maintain Rectifier       Group Heading Only       1:1         Repair or replace defective rectifier components       1:1       1:1	Covered Task Name       Contractor       up       up <thu></thu>	Covered Task NameContractor55Enbridge EmployeeAbnormal Operating Conditions (AOC)Conduct Annual Surveys to Electrically InspectGroup Heading OnlyUnprotected Bare PipeGroup Heading Only1:11:1

control ratio	
API #     Covered Task Name     Contractor     Image: Big State     Enbridge Employee     Enbridge OQ Covered	ed Task Name
5 Inspect Buried Pipe When Exposed Group Heading Only	
5.1       Examine for mechanical damage on buried or submerged pipe       1:1       1:2       #15: External defect investigation         x       1:1       1:1       #21: Inspect/examine buried pipe	
5.2 Examine for external corrosion on buried or submerged pipe x 1:1 1:1 1:1 #21: Inspect/examine buried pipe	when exposed
5.3       Inspect the condition of external coating on buried or submerged pipe       1:1       1:2       #19: Pipe and valve coating #21: Inspect/examine buried pipe         x       x       1:1       1:1       1:1       1:1	when exposed
7 Application and Repair of External Coatings Group Heading Only	
7.1 Visual inspection of atmospheric coatings       x       1:1       1:1       #18: Atmospheric corrosion inspection	ction
7.2 Prepare surface for atmospheric coating using hand and power tools x 1:2 1:2 #20: Corrosion prevention method	ds
7.3 Prepare surface for coating by abrasive water blasting       x       1:2       1:2       1:2       1:2	
7.4 Prepare surface for coating by abrasive blasting methods other than water     1:2     1:2     #20: Corrosion prevention method	
7.5       Apply coating using hand application methods       x       1:2       1:2       1:2       1:2       1:2	
7.6 Apply coating using spray applications       1:2       1:2       #20: Corrosion prevention method	
7.7     Perform coating inspection     x     1:2     1:2     #20: Corrosion prevention method	ls
8 Measure Wall Thickness of Pipe Group Heading Only	
8.1 Measure pit depth with pit gauge x 1:1 1:1 #22: Measure wall thickness of pip	pe
8.2 Measure wall thickness with ultrasonic meter 1:1 1:1 1:1 #22: Measure wall thickness of pip	pe
8.3 Measure corroded area       x       1:1       1:1       1:1       #22: Measure wall thickness of pip	pe
9 Cathodic Protection Remediation Group Heading Only	
9.1 Install bonds         1:1         1:1         #10.1: Install bonds	
9.2     Install galvanic anodes     1:1     1:1     1:1     #10.1: Install bonds	
9.3 Install rectifiers       1:1       1:1       #8: Rectifier installation	
9.4 Install impressed current groundbeds 1:1 1:1 1:1 #1000 #10: Groundbed installation and re	epair
9.5 Repair shorted casings x 1:3 1:3 #11: Shorted casing inspection #11: Shorted casing inspection #12: Shorted casing clearing/repairs/	ir
9.6 Install electrical insulating device 1:1 1:1 Under Development	
10 Monitoring for Internal Corrosion Group Heading Only	
10.1       Insert and remove coupons       1:1       1:1       #13: Insert and remove coupons	
10.2 Monitor probes (on-line)       1:1       1:1       1:1       #14: Hydrogen foil inspection	
11 Internal Corrosion Remediation Group Heading Only	
11.0Monitoring and controlling the injection rate of the corrosion inhibitor1:21:21:2#17: Corrosion inhibitor injection	
12 Inspect Internal Pipe Surfaces Group Heading Only	
12.0       Visually Inspect internal pipe surface       1:2       1:2       #16: Defect investigation- internal	corrosion

		CHECK PERSON RESPONSIBLE (Put X in	n box il	f perso	n needs to be qualified on the covered task)	
API #	Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
14	Place and Maintain Line Markers	Group Heading Only				
14.1	Locate line	x	1:0	1:0		#46: Foreign line crossing during excavation activities #47: Line locate
	Install, inspect and maintain permanent marker		1:2	1:2		#48: Install and maintain line markers
14.5	Install, inspect and maintain temporary marker		1:2	1:2		#48: Install and maintain line markers
15	Inspect Surface Conditions of Right of Way	Group Heading Only				
15.1	Visually inspect surface conditions of right-of-way	x	1:2	1:2 1:1		#49: Right-of-way inspections #85: Leak survey following excavation activities using explosives
16	Inspect Navigable Waterway Crossing	Group Heading Only				
16.1	Inspect navigable waterway crossing	x	1:0			Performed Only by Contractor
19	Maintain Valves	Group Heading Only				
19.1	Valve body winterization or corrosion inhibition		1:1	1:2 1:1		#50: Local operation of valves #51: Valves and actuators
	Valve lubrication		1:1	1:1		#50: Local operation of valves #51: Valves and actuators
	Valve seat sealing		1:1	1:1		#50: Local operation of valves #51:Valves and actuators
	Valve stem packing maintenance		1:1	1:1		#50: Local operation of valves #51: Valves and actuators
	Adjust actuator/operator, electric		1:1	1:1		#87: Inspect and test valve and operator
	Adjust actuator/operator, pneumatic		1:1	1:1		#87: Inspect and test valve and operator
19.7	Adjust actuator/operator, hydraulic		1:1	1:1		#87: Inspect and test valve and operator
20	Inspect Valves	Group Heading Only				
20.0	Inspect mainline valves		1:1	1:1 1:1 1:2		#51: Valves and actuators #86: Remote communicated valve check #88: In-service valve repair
21	Repair Valves	Group Heading Only				
21.1	Repair valve actuator/operator, pneumatic		1:2	1:2		#87: Inspect and test valve and operator #88: In-service valve repair
21.2	Disassembly/re-assembly of valve		1:2	1:2		#87: Inspect and test valve and operator #88: In-service valve repair
21.3	Internal inspection of valve and components		1:2	1:2		#87: Inspect and test valve and operator #88: In-service valve repair
21.4	Repair valve actuator/operator, hydraulic		1:2	1:2		#87: Inspect and test valve and operator #88: In-service valve repair
21.5	Repair valve actuator/operator, electric		1:2	1:2		#87: Inspect and test valve and operator #88: In-service valve repair

		CHECK PERSON RESPONSIBLE (Put X in	n box il	f perso	n needs to be qualified on the covered task)	
			span of control ratio	n of control ratio		
API #	Covered Task Name	Contractor	Spa	Span	Enbridge Employee	Enbridge OQ Covered Task Name
	Inspect, Maintain and Calibrate Relief Valves	Group Heading Only				
22.1	Inspect tank pressure/vacuum breakers		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices #91: Pressure relief valve test
22.2	Inspect, test and calibrate HVL tank pressure relief valves		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices #91: Pressure relief valve test #CC5: Control Center: Monitor tank levels
23	Maintain/Repair Relief Valves	Group Heading Only				
23.1	Maintain/repair relief valves		1:2	1:2		#88: In-service valve repair
23.2	Inspect, test and calibrate relief valves		1:2	1:2		#91: Pressure relief valve test
24	Inspect, test and calibrate pressure limiting devices	Group Heading Only				
	Maintain/repair pressure limiting devices		1:1	1:1		#91: Pressure relief valve test
24.2	Inspect, test and calibrate pressure limiting devices		1:1	1:1		#89: Pressure control Valve (PCV) maintenance
25	Inspect, test and calibrate pressure limiting devices	Group Heading Only				
	Inspect, test and calibrate pressure switches		1:1	1:1		#92: Pressure switch calibration
25.2	Inspect, test and calibrate pressure transmitters		1:1	1:1		#93: Inspect and test pressure transmitter
26	Verify or Set Protection Parameters for Programmable Controllers and/or Instrumentation Control Loops	Group Heading Only				
	Verify or set protection parameters for programmable controllers and/or other instrumentation control loops		1:1	1:1		#90: Pressure allowable set points
	Inspect and Repair Breakout Tanks	Group Heading Only				
	Routine inspection of breakout tanks (API 653 monthly or DOT Annual)		1:0	1:1		#52: Tank inspection
27.2	API 653 inspection of in-service breakout tanks		1:0			Performed Only by Contractor
	API 510 inspection of in-service breakout tanks		1:0			Performed Only by Contractor
	Lightning, and Stray Electrical Currents	Group Heading Only				
	Launching in-line inspection devices		1:2	1:2		#54: Launching tool (pig) in scraper trap
29.2	Receiving in-line inspection devices		1:2	1:2		#55: Receiving tool (pig) in scraper trap
30	Test Overfill Protective Devices	Group Heading Only				
30.0	Test overfill protective devices		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices
31	Inspect and Calibrate Overfill Protective Devices	Group Heading Only				

		CHECK PERSON RESPONSIBLE (Put X i	n box i	f perso	n needs to be qualified on the covered task)	
API #	Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
31.0	Inspect and calibrate overfill protective devices		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices

		CHECK PERSON RESPONSIBLE (Put X in	box if	f perso	n needs to be qualified on the covered task)	
API #	Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	<b>Enbridge OQ Covered Task Name</b>
32	Monitoring Excavation Activities	Group Heading Only				
32.0	Observation of excavation activities		1:1	1:1		#56: Damage prevention during excavation activities
33	Moving In-Service Pipe	Group Heading Only				
33.1	Determine allowable line pressure in section to be moved		1:2	1:2		#58: Line lowering
33.2	Preparation for movement activities		1:2	1:2		#58: Line lowering
33.3	Moving in-service pipeline		1:2	1:2		#58: Line lowering
34	Inspect Existing Pipe Following Movement	Group Heading Only				
34.0	Inspect existing pipe following movement	x	1:2	1:2		#49: Right-of-way inspections
36	Abandoning, Safe Disconnect, Purging, and Sealing of Pipeline Facilities	Group Heading Only				
36.1	Safe disconnect of pipeline facilities		1:2	1:2		#59: Line deactivation
36.2	Purging of pipeline facilities		1:2	1:2		#59: Line deactivation
36.3	Sealing a disconnected portion of pipeline		1:2	1:2		#59: Line deactivation
37	Installation or Repair of Support Structures on Existing Aboveground Components	x				
	Install or repair support structures on existing above ground components		1:2	1:2		#82: Install or repair support structures on existing or above ground components
38	Inspection Activities for Tie-Ins, Pipe Replacement, or Other Components Connecting to an Existing Pipeline	Group Heading Only	·			
	Visually inspect pipe and pipe components prior to installation		1:2	1:2		#15: External defect investigation
	Visually inspect that welds meet DOT requirements (in accordance with API 1104)		1:0			Performed Only by Certified Weld Inspectors (API 1104 Certification)
	NDT - radiographic testing		1:0			Performed Only by Contractor
	NDT - liquid penetrant testing		1:0			Performed Only by Contractor
	NDT - magnetic particle testing		1:0			Performed Only by Contractor
38.7	NDT - ultrasonic testing		1:0			Performed Only by Contractor
	Backfilling a Trench Following Maintenance	Group Heading Only				
39.0	Backfilling a trench following maintenance		1:1	1:1		#57: Backfilling activities

		CHECK PERSON RESPONSIBLE (Put X	in box i	f perso	on needs to be qualified on the covered task)	
API #	Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
40	Perform General Pipeline Repair Activities	Group Heading Only				
40.1	Fit full encirclement welded split sleeve (oversleeve, tight fitting sleeve, etc.)		1:2	1:2		#66: Pipeline repair: Oversleeve #67: Pipeline repair: Tight fitting sleeve
40.3	Apply composite sleeve		1:2	1:2		#69: Pipeline repair: Composite sleeve
40.4	Install mechanical bolt-on split repair sleeve		1:2	1:2		#68: Pipeline repair: Plidco split repair
	Install weldable compression coupling		1:2	1:2		#70: Pipeline repair: Weld + ends coupling
40.6	Install and remove plugging machine		1:0	1:2		#71: Installation of tapping or plugging tees #74.1: Plugging a pipeline 2" and under #74.2: Plugging a pipeline 2 1/2" and larger
40.7	Installing a tap 2 inches and under on a pipeline system		1:0	1:2		#72: Pipeline repair: Tapping
40.8	Installing a tap larger than 2 inches on a pipeline system		1:0	1:2		#72: Pipeline repair: Tapping
40.9	Install and remove completion plug on pipelines larger than 2 inches		1:2	1:2		#73: Plugging
41	Conduct Pressure Tests	Group Heading Only				
41.0	Conduct pressure test		1:2	1:2		#76: Pressure testing of pipe
42	Welding on Existing Pipeline Systems	Group Heading Only				
42.7	Welding		1:0	1:0		API 1104 Code Book OMM Book 4: 02-02-04 (page 1 and page 3) #77: Welding: Side Seam Weld #78: Welding: Circumferential Fillet Weld #79: Welding: Butt weld API 1104 Code Book #80: Welding: Defective weld repair #81: Welding: Nozzle Weld
43	Operations of Pipeline Systems	Group Heading Only				
43.1	Start-up of a liquid pipeline (control center)			1:1		#CC3: Control Center: Operation of remote pumps #CC6: Control Center: Start-up of a liquid pipeline system
43.2	Shutdown of a liquid pipeline (control center)			1:1		#CC3: Control Center: Operation of remote pumps #CC7: Control Center: Shutdown of a liquid pipeline system
43.3	Monitor pressures, flows, communications, and line integrity and maintain them within allowable limits on a liquid pipeline			1:1		#CC1: Control Center: Monitor and control pressure and/or flows
43.4	Remotely operate valves on a liquid pipeline system			1:1		#CC2: Control Center: Operation of remote valves #86: Remote communicated valve check

		CHECK PERSON RESPONSIBLE (Put X				
PI #	Covered Task Name	Contractor	Span of control ratio	span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
44	CPM Leak Detection	Group Heading Only	<u>s</u>	<u> </u>		
44.3	Inspect, test and maintain flow computer for hazardous liquid leak detection			1:1		#CC4: Control Center: Monitor leak detection - Computational Pipeline Monitoring (CPM) (**Liquid Pipelines only) #CC5: Control Center: Monitor tank levels
	Inspection, testing, corrective and preventative maintenance of tank gauging for hazardous liquid leak detection		1:1			Under Development
44.5	Prove flow meters for hazardous liquid leak detection			1:1		#CC8: Control Center: Prove Flow Meters for Hazardous Liquid Leak Detection
44.6	Maintain flow meters for hazardous liquid leak detection		1:1			Under Development
44.7	Inspect, test and maintain gravitometers/densitometers for hazardous liquid leak detection		1:1			Under Development
44.8	Inspect, test and maintain temperature transmitters for hazardous liquid leak detection		1:1			Under Development
52	Leakage Survey (retained from previous version)	Group Heading Only				
52.1	Conduct vegetation survey		1:1	1:1		#84 Gas leakage survey
52.2	Conduct a leak survey with a CGD		1:1	1:1		#84 Gas leakage survey
52.3	Conduct a leak survey with a flame ionization unit		1:1	1:1		#84 Gas leakage survey
55	Fixed Gas Detection (retained from previous version)	Group Heading Only			•	
55.0	Maintain fixed gas detection equipment		1:1	1:1		#94: Station gas detection calibration
63	Operation of a Pipeline System	Group Heading Only				
63.1	Start-up of a liquid pipeline (field)		1:1	1:1		#95: Local operation of pumps (start up/shut down of a pump)
	Shutdown of a liquid pipeline (field)		1:1	1:1		#95: Local operation of pumps (start up/shut down of a pump)
63.3	Monitor pressure, flows, communications and line integrity and maintain them within allowable limits on a liquid pipeline system (field)		1:1	1:1		#89: Pressure Control Valve (PCV) maintenance #96: Pressures, flows and communications monitoring - field ops
	Locally operate valves on a liquid pipeline system		1:1	1:1		#50: Local operation of valves

		CHECK PERSON RESPONSIBLE (Put X in box if person needs to be qualified on the covered task)				
API #	Covered Task Name	Contractor	Span of control ratio	Span of control ratio	Enbridge Employee	Enbridge OQ Covered Task Name
	Date:	Signature:		-		



# Appendix D - Close-Interval-Survey of Dual Pipelines

#### Job # 03130

10 September 2003

Survey & Design, Ltd.

Hanson

6401 Bingle, Suite 123 Houston TX 77092 Tel 713 690-2116 Fax: 713 690-6025 Email murray@hansonsurvey.com

Enbridge Energy 119 North 25<sup>th</sup> Street Superior, WN 54880

Attn

Interrupted Close Interval Pipeline Survey

#### Straits of MacKinac Crossing

Dear Mr

This letter is to report on our findings and recommendations of the review of the interrupted close interval survey plots for the cathodic protection system on the pipelines at the Straits of MacKinac Crossing.

#### **INTRODUCTION**

An interrupted close interval survey was performed on the two pipelines by Hanson Survey & Design in September 2003.

The West Line was surveyed from North to South over a total distance of approximately 18,460 ft from a point 1500 feet off the north bank to a point 1000 ft from the South bank.

The East Line was surveyed from South to North over a total distance of approximately 18,170 ft over similar distances form the banks.

The survey was conducted to determine if the pipelines were protected according to the requirements of the -850 mV OFF potential criterion as defined in Section 6.2.2.1.2 of NACE Recommended Practice RP 0169 (2002 Revision) entitled

"Control of External Corrosion on Underground or Submerged Buried Piping Systems" attached.

The survey plots indicate that both pipes meet the requirement of this criterion full length.

A brief analysis of the plots show reveals the following information

Pipeline		Potentials millivolt	% of Pipe Length meeting -850 mV OFF potential	
West	>2000 ON	>1100 OFF	100 %	
East	>2000 ON	>1100 OFF	100 %	

Both pipelines are well protected and have very consistent ON and OFF potential readings full length of the portions surveyed. There is no evidence of any coating anomalies on either pipeline.

#### SUMMARY

In summary, the interrupted close interval survey plots show that the pipelines are full cathodically protected full length.

No further work is recommended at this time.

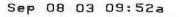
We trust this letter provides the information you require in the form you desire.

May we provide any further information please do not hesitate to contact the undersigned or Scott Dauzat, our Sales Manger at the telephone, fax or email above. We than you for this opportunity to be of service to Enbridge Energy,

Yours sincerely

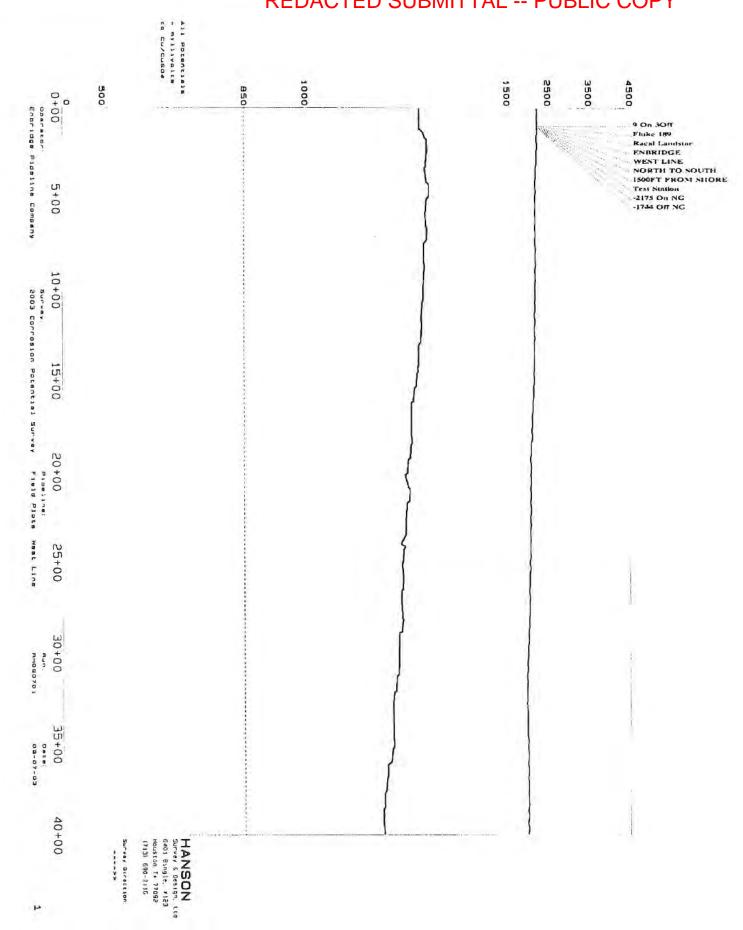
Hanson Survey & Design

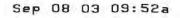
Murray Smith Engineering Manager NACE CP Specialist #5009



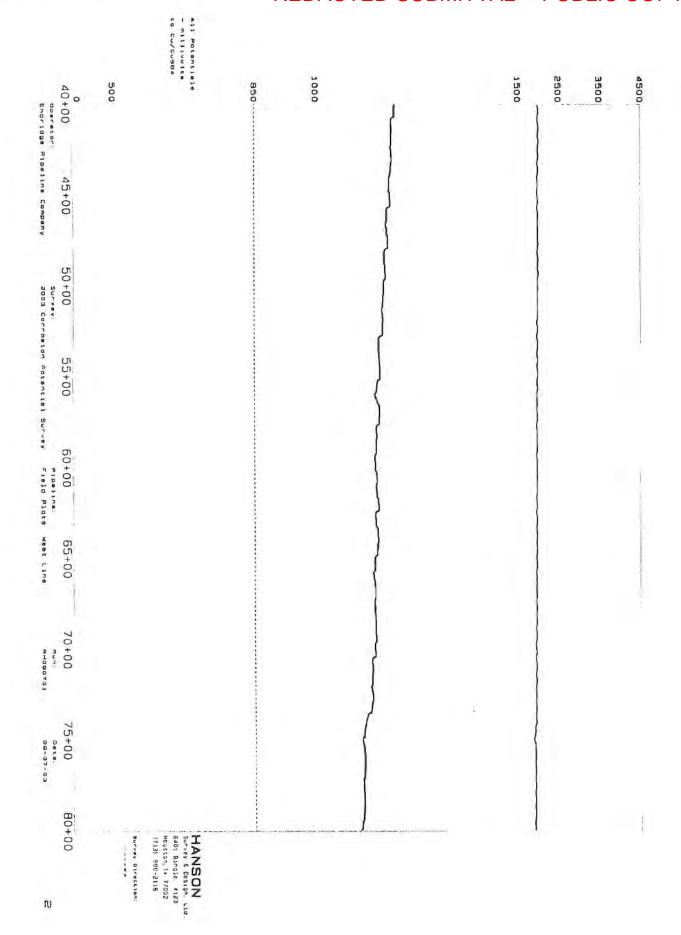
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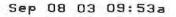




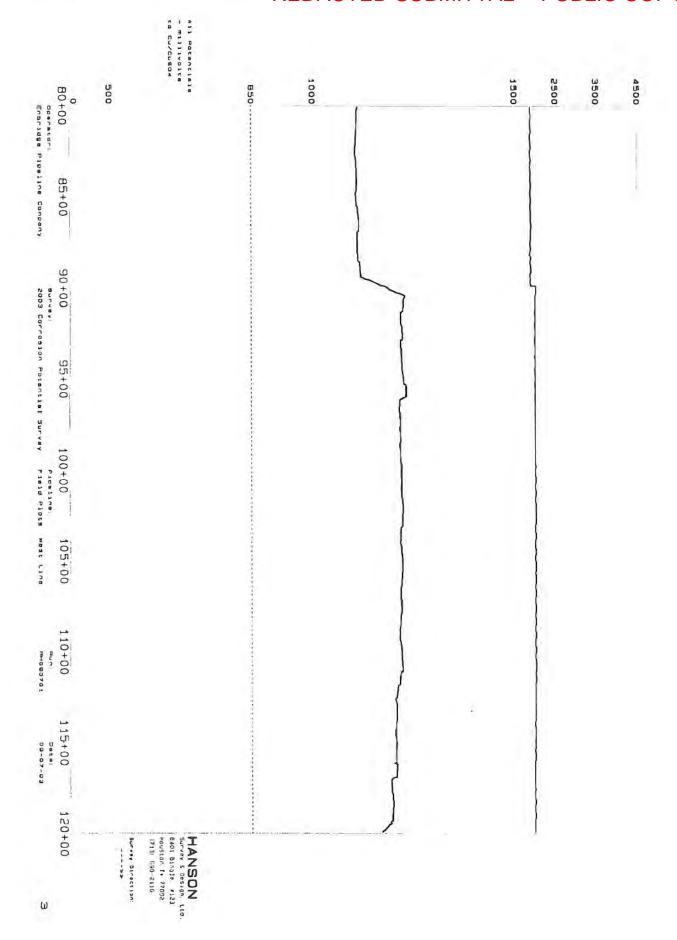
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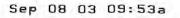


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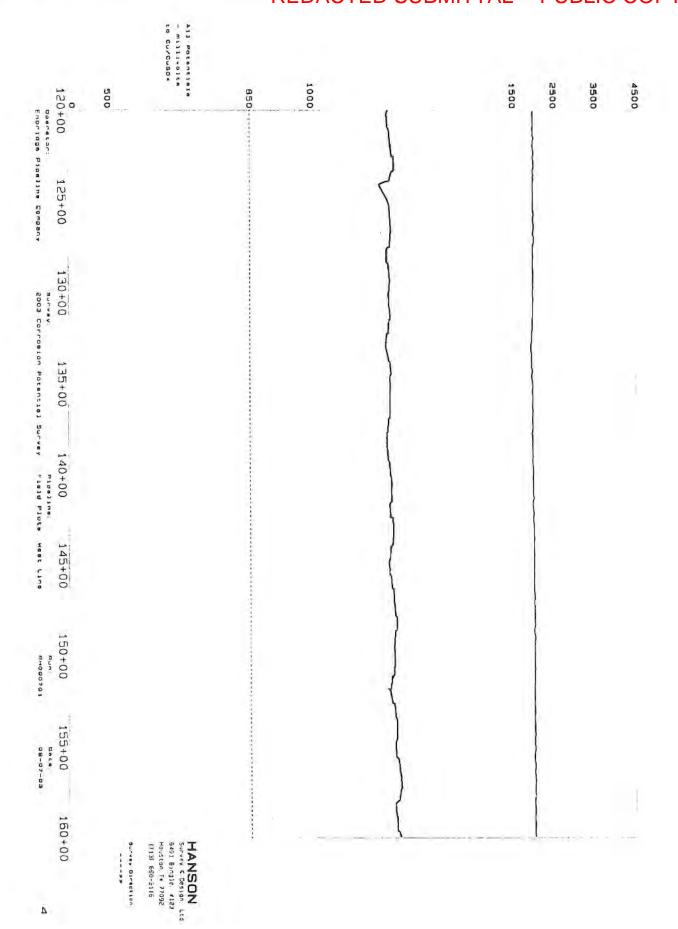
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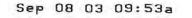




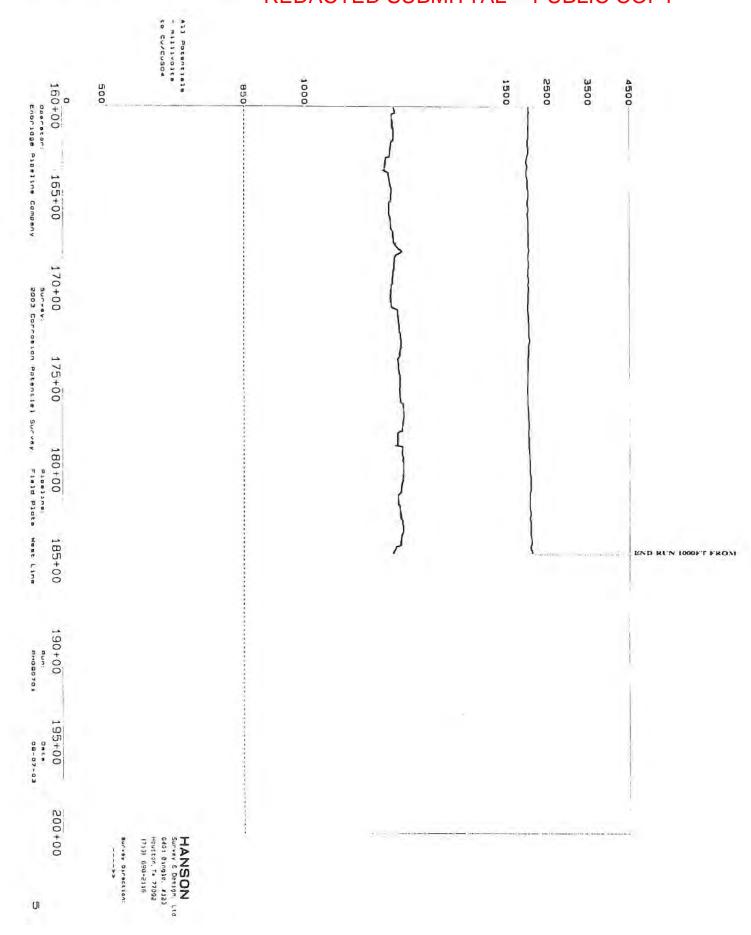
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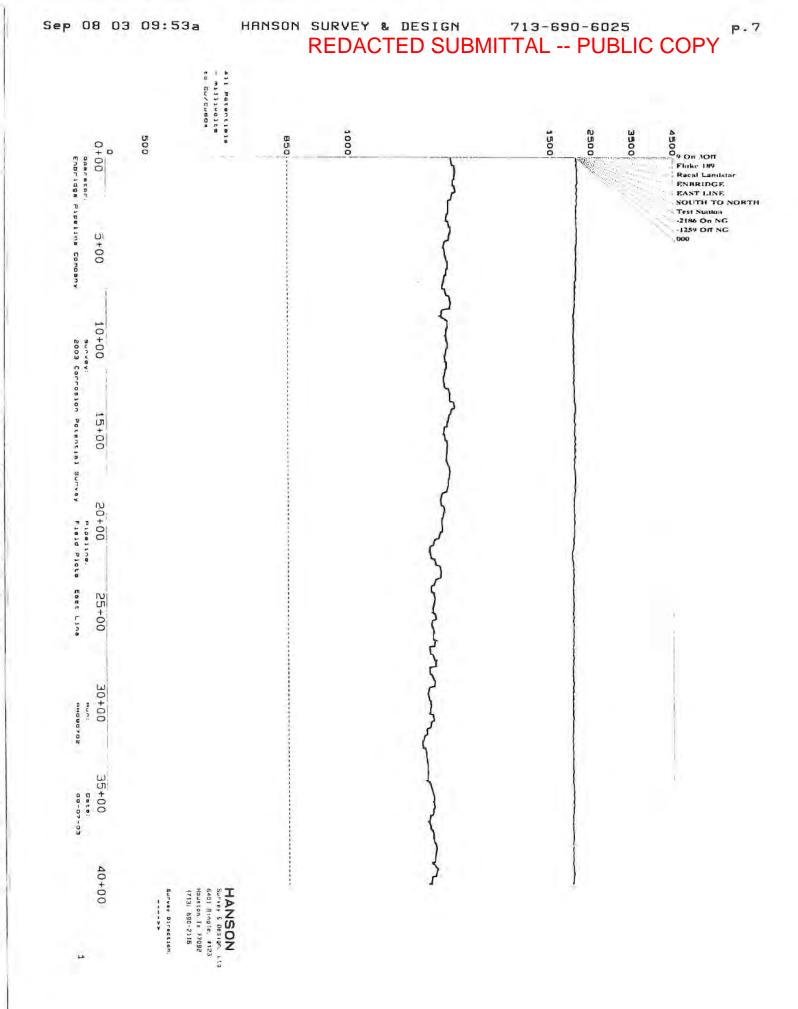
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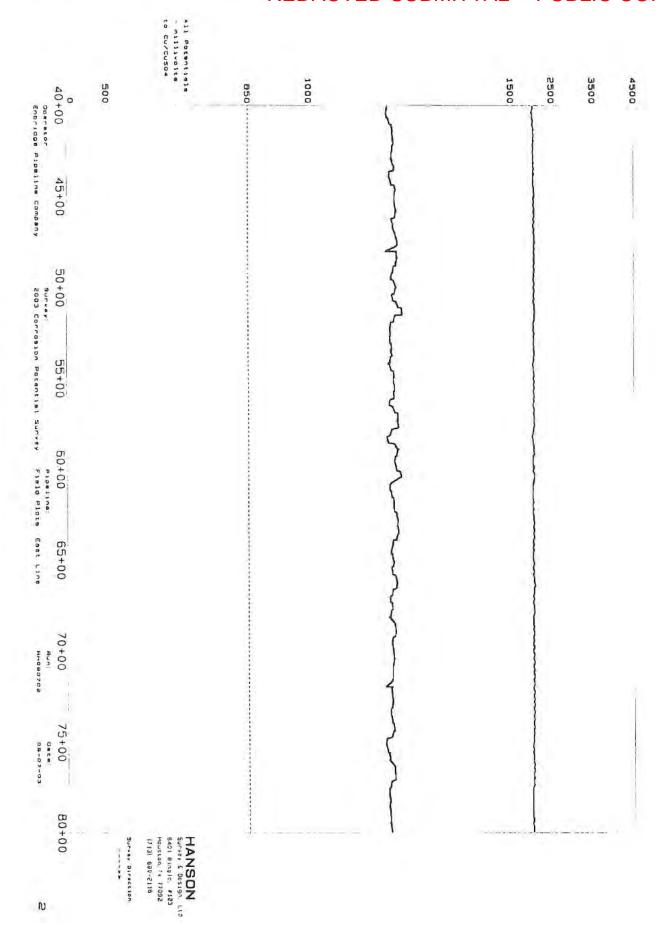


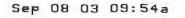


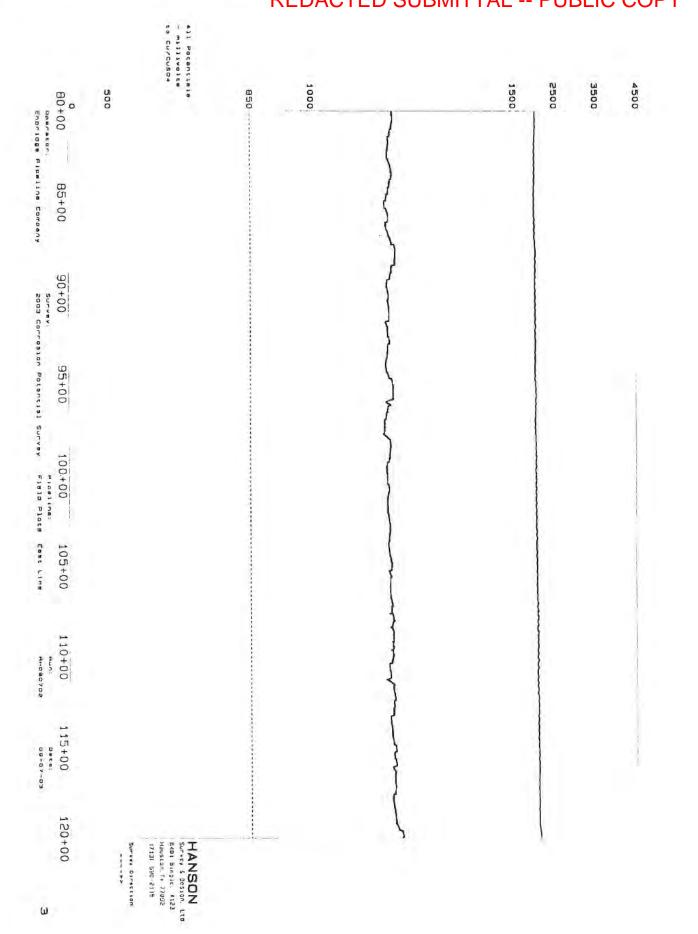




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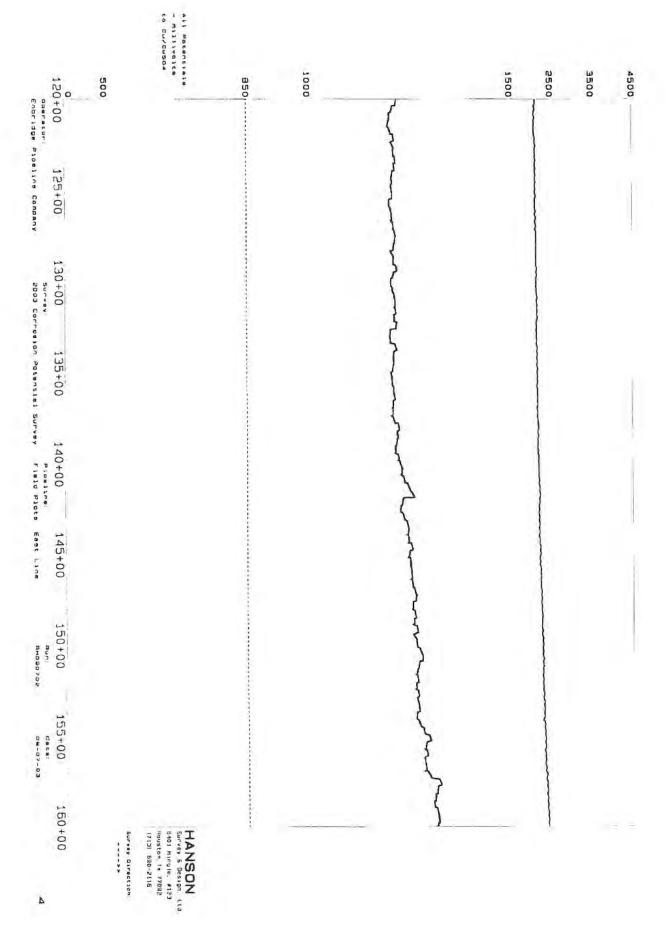


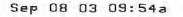




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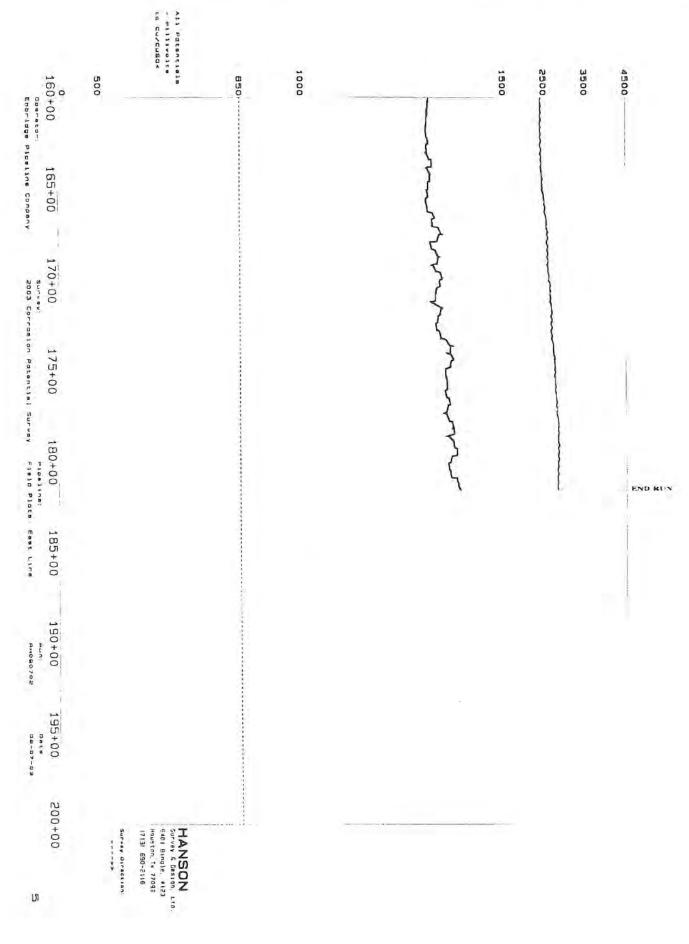


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# Appendix E – 2017 CP Surveys During Hydrotest



## Final Report: Enbridge Line 5 – Mackinac Straits Cathodic Protection Testing

Job #: 00917200474 Submitted: October 31, 2017

Prepared for: Enbridge Energy

Attention:

Corrosion Prevention Analyst II 1409 Hammond Avenue, Superior, WI 54880

> 130 Wes- Superior Street, Suite 500 Duluth, MN 55802 218.727.3141 www.LSConsulting.com



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## **SIGNATURE PAGE**

#### WRITTEN BY:

RYAN SWOR

Jun yan c SIGNATURE

OCTOBER 31, 2017

DATE

DIRECTOR OF INTEGRITY MANAGEMENT

LAKE SUPERIOR CONSULTING, LLC



## **1** Executive Summary

Enbridge requested that LSC test the effectiveness of the CP systems protecting the Line 5 pipeline across the Mackinac Straits. Line 5 is divided into two 20" pipelines between the North Straits Station and Mackinaw Station; these segments are depicted as the West Leg and East Leg. The request initiated from the opportunity to test during hydrotesting activity, where the East Leg and West Leg would be electrically isolated from both stations and the 30" Line 5 Pipeline.

LSC installed temporary low resistance bonds across the hydrotesting break points and measured the amount of DC current returning through the upstream and downstream sides of both legs, performed rectifier influence testing, performed close interval survey with all current sources and temporary bonds interrupting, and performed current requirement testing with the temporary bonds removed to determine the adequacy of protection.

The West Leg and East Leg are predominantly polarized by the Mackinaw Station Rectifier. The lowest IR-Free P/S potential encountered during testing was -1.106 VDC. Current supplied to each leg was directly measured at hydrotest break points, and exceeded current required for achieving 100 mVDC of polarization, indicating that at as-found output values, existing CP systems are adequate and functional.

## 2 Background

Enbridge requested that LSC test the effectiveness of the CP systems protecting the Line 5 pipeline across the Mackinac Straits. Line 5 is divided into two 20" pipelines between the North Straits Station and Mackinaw Station; these segments are depicted as the West Leg and East Leg. The request initiated from the opportunity to test during hydrotesting activity, where the East Leg and West Leg would be electrically isolated from both stations and the 30" Line 5 Pipeline. Electrical isolation allows for more accurate data collection and interpretation. Testing of each leg was performed approximately 1 week apart, during the water stabilization period of hydrotesting.

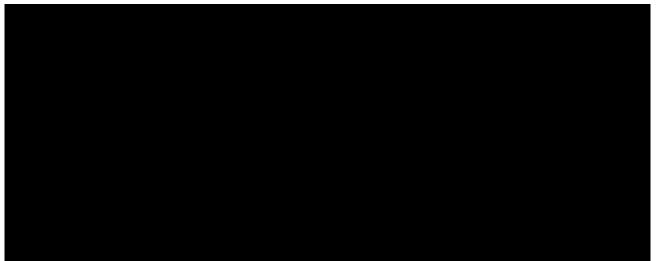


Figure 2.1 – Overview



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Figure 2.2 – North Side



Figure 2.3 – South Side

While on site, LSC:

- installed temporary low-resistance bonds across the hydrotesting break points and measured the • amount of DC current returning through the upstream and downstream sides of both legs;
- performed rectifier influence testing; •
- performed close interval survey with all current sources and temporary bonds interrupting; and •
- performed current requirement testing with the temporary bonds removed to determine the • adequacy of protection.

Additional forms of testing were discussed, such as coating conductance, however it was determined that project schedule and pipeline accessibility would be restrictive to testing effectiveness.

DURENCY



## **3** Objectives and Approach

LSC performed numerous indirect testing methods to determine the effectiveness of the CP systems protecting the East Leg and West Leg of Line 5 traversing the Mackinac Straits. Concurrent hydrotesting activities afforded the unique opportunity to test the segments while isolated from mainline Line 5 piping. The employed methods are described below, with detailed summaries included in *Appendix G—Daily Reporting*. Technician Operator Qualification and equipment calibration records are included in *Appendix H—OQs and Calibration Certifications*.

#### 3.1 West Leg

LSC technicians mobilized to Mackinaw City, MI, to commence testing activities of the West Leg on June 5, 2017, first collaborating with on-site leadership to determine testing logistics and ensure the avoidance of a delay to the principal hydrotesting schedule.

Following site safety training, a temporary bond was immediately placed across the pipeline break point within the North Straits Station to maintain the integrity of polarization (normal operating conditions of CP). Minimal current flow was measured to be returning through the bond (14 mADC), however this was anticipated, as there were other points of electrical continuity with station piping and grounding through the launcher valve, pressure transmitter, and DRA injection wiring. Local foreign operators were then contacted to plan rectifier influence testing and synchronous interruption.

Stationary Dataloggers (SDLs) with calibrated Cu/CuSO<sub>4</sub> reference electrodes were placed at multiple locations on the north and south sides of the Mackinac Straits, outside of the stations. Rectifier influence testing was completed, and current interrupters were placed at all influencing sources on an 8 second on, 2 second off cycle. Current interrupters, shunts, and SDLs were also placed at break point bonds at the North Straits Station and Mackinaw Station. After Enbridge electricians removed equipment power grounds, LSC performed fixed-cell moving-ground testing at both stations with a reference electrode placed at remote earth to ensure effective isolation from station piping, facility grounding, power grounding, and hydrotesting equipment.

LSC technicians then conducted CIS on each side of the Straits to the water's edge. Following CIS, LSC cycled the North Straits Station and Mackinaw Station rectifiers separately on a 4 second on, 1 second off cycle to determine current returning through the temporary bonds and specific amount of influence on the West Leg. Soil resistivity data was collected on each side of the straits, and both temporary continuity bonds were disconnected to allow for current requirement testing.

LSC de-energized influencing permanent current sources affecting the West Leg, set up a temporary ground bed, performed testing to ensure remote earth from the West Leg was attained for ground bed placement (voltage rise equations to determine adequate distance and then field survey to verify), disconnected station temporary bonds at the break points, and energized the temporary source at increasing current output values to determine span requirements based upon effect to the West Leg pipe-to-soil (P/S) potentials.

Prior to de-mobilization, the system was returned to as-found conditions, except for the temporary bonds across the West Leg break points, which were left in place to allow for continued CP being applied during hydrotesting activities.



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#### 3.1.1 Isolation Testing

LSC performed isolation testing numerous times throughout testing, to ensure the efficacy of collected information. Drawings and isolation strategy are depicted in *Appendix F—Hydrotest Setup Schematic and Electrical Continuity Markup*. LSC upheld contact with project and operations personnel throughout testing activities, and verified isolation daily via fixed-cell moving-ground testing with a reference electrode placed at remote earth.

#### 3.1.2 Placement of Stationary Dataloggers

LSC installed a total of 12 Mobiltex UDL1 SDLs, 10 of which measured P/S potential values, and 2 of which measured current flow through temporary bonds. These were placed at equidistant intervals across the West Leg, with structure connections run from the nearest available connection point. Locations of SDLs measuring P/S potentials are depicted in *Appendix A— Cathodic Protection Testing Map*. There were several wire breaks during testing, and LSC technicians verified functionality at the beginning of, and intermittently throughout each day. The quantity of placed P/S SDLs allowed for redundancy in the event of a wire break during CP testing (e.g., from pig tracking and/or operations personnel traversing the ROW), and further validated testing results by yielding comparable results. Data was retrieved after each critical testing activity and thoroughly reviewed by LSC engineering staff prior to moving to the subsequent steps in the testing procedure.

#### 3.1.3 Rectifier Influence Testing

LSC technicians manually cycled individual area rectifiers and recorded the start/stop times after placing SDLs. SDL information was retrieved and analyzed at corresponding times to determine the influence of each source at each of the 10 SDL locations. This information was then graphed, summarized in a table, and depicted on a map, with rings of influence representing mVDC centered around CP components. A summary of findings, along with pertinent rectifier data, is collectively assembled in *Appendix C—Rectifier Influence Testing*. All tested rectifiers were interrupted for testing purposes, as Enbridge and TransCanada have remote monitoring units with interruption capabilities, and ATC permitted LSC technicians supervised access into its substation to place a portable current interrupter.

#### 3.1.4 Temporary Bond Measurements

During normal operating conditions (with facility grounding removed from the West Leg and polarization maintained), current was measured across both temporary bonds placed at piping break points in each station. North Straits Station was found to be 1.4 mADC flowing from upstream to downstream, and Mackinaw Station was found to be 2.5 ADC flowing from upstream to downstream. Total current pickup across the test span was therefore measured to be 2.49 ADC. Equipment utilized to collect the data was Mobiltex UDL1 dataloggers and 0.01-ohm shunts. A summary of the findings is in *Appendix B—Current Response Testing*.

#### 3.1.5 Close Interval Survey

LSC technicians completed CIS on both sides of the straits, from each station fence to the water's edge, with all tested current sources and temporary bonds interrupting. Interrupted (IR-Free) P/S



potentials averaged -1.284 VDC on the north side, and -1.242 VDC on the south side of the straits. These values were relatively consistent with readings obtained from the placed SDLs. Waveforms were collected before and after survey to ensure synchronous interruption was maintained. Data was collected using Allegro dataloggers and Trimble submeter-capable GPS equipment. Graphs of collected data are in *Appendix D—Close Interval Survey*.

#### 3.1.6 Soil Resistivity Testing

Soil resistivity data was collected at two separate locations on each side of the straits, at pin spacings of 150 cm, 230 cm, 350 cm, 700 cm, and 1400 cm. Results are included in *Appendix E— Soil Resistivity Testing*. For immediate value, LSC engineering staff used this information to calculate, through voltage rise, distance to remote earth for proper placement of the temporary ground bed used in current requirement testing.

#### 3.1.7 Current Requirement Testing

After confirming the West Leg's isolation from the station and the functionality of all placed SDLs, LSC energized a portable rectifier and temporary ground bed on the south side of the Mackinac Straits using a culvert at the corners of Wilderness and Algonquin Drives (approximately 450' east of the West Leg). Temporary bonds at each side of the straits were disconnected for testing. The temporary ground bed was confirmed remote by performing anode-to-soil CIS perpendicular to the ground bed's location towards the West Leg. Calculated current requirement, based upon 100 mVDC of polarization, was 1.3 ADC. Results are included in *Appendix B—Current Requirement Testing*.

#### 3.2 East Leg

LSC technicians mobilized to Mackinaw City, MI, to commence testing activities of the East Leg on June 12, 2017, first collaborating with on-site leadership to determine testing logistics and ensure the avoidance of a delay to the principal hydrotesting schedule.

Following site safety training, soil resistivity data was collected on both sides of the straits. Cu/CuSO<sub>4</sub> reference electrodes for the SDLs were calibrated using a calibrated MC Miller IonX Reference Electrode, and temporary bonds were made at both stations upon Enbridge Operations' removal of the valves for pressure testing break points. SDLs were then placed at multiple locations on the north and south sides of the Mackinac Straits, outside of the stations. During fixed-cell moving-ground testing to confirm isolation after Enbridge electricians removed equipment power grounds, it was identified that both station rectifiers had negative drains connected below-grade to the test segment. Because of this, temporary ground wires were run to the upstream side of the North Straits Station break point, and the downstream side of the Mackinaw Station break point (to allow for accurate measurements being obtained across the break point temporary bonds).

Rectifier influence testing was completed, and current interrupters were placed at all influencing sources on an 8 second on, 2 second off cycle. Current interrupters, shunts, and SDLs were also placed at break point bonds at the North Straits Station and Mackinaw Station. LSC technicians then conducted CIS on each side of the straits to the water's edge. Following CIS, LSC cycled the North Straits Station and Mackinaw Station rectifiers separately on a 4 second on, 1 second off cycle to



determine current returning through the temporary bonds and specific amount of influence on the East Leg.

LSC de-energized influencing permanent current sources affecting the West Leg, set up a temporary ground bed, performed testing to ensure remote earth from the West Leg was attained for ground bed placement (voltage rise equations to determine adequate distance and then field survey to verify), disconnected station temporary bonds at the break points, and energized the temporary source at increasing current output values to determine span requirements based upon effect to the West Leg pipe-to-soil (P/S) potentials.

Prior to de-mobilization, the system was returned to as-found conditions, except for the temporary bonds across the East Leg break points, which were left in place to allow for continued CP being applied during hydrotesting activities.

#### 3.2.1 Isolation Testing

LSC performed isolation testing numerous times throughout testing, to ensure the efficacy of collected information. Drawings and isolation strategy are depicted in *Appendix F—Hydrotest Setup Schematic and Electrical Continuity Markup*. LSC upheld contact with project and operations personnel throughout testing activities, and verified isolation daily via fixed-cell moving-ground testing with a reference electrode placed at remote earth.

#### 3.2.2 Placement of Stationary Dataloggers

LSC installed a total of 12 Mobiltex UDL1 SDLs, 10 of which measured P/S potential values, and 2 of which measured current flow through temporary bonds. These were approximately placed at equidistant intervals across the West Leg, with structure connections run from the nearest available connection point. Locations of SDLs measuring P/S potentials are depicted in *Appendix A—Cathodic Protection Testing Map*. There were several wire breaks during testing, and LSC technicians verified functionality at the beginning of, and intermittently throughout each day. The quantity of placed P/S SDLs allowed for redundancy in the event of a wire break during CP testing (e.g., from pig tracking and/or operations personnel traversing the ROW), and further validated testing results by yielding comparable results. Data was retrieved after each critical testing activity and thoroughly reviewed by LSC engineering staff prior to moving to the next step in the testing procedure.

#### 3.2.3 Rectifier Influence Testing

LSC technicians manually cycled individual area rectifiers and recorded the start/stop times after placing SDLs. SDL information was retrieved and analyzed at corresponding times to determine the influence of each source at each of the 10 SDL locations. This information was then graphed, summarized in a table, and depicted on a map, with rings of influence representing mVDC centered around CP components. A summary of findings, along with pertinent rectifier data, is collectively assembled in *Appendix C—Rectifier Influence Testing*. All tested rectifiers were interrupted for testing purposes, as Enbridge and TransCanada have remote monitoring units with interruption capabilities, and ATC permitted LSC technicians supervised access into its substation to place a portable current interrupter.



#### 3.2.4 Temporary Bond Measurements

During normal operating conditions (with facility grounding removed from the East Leg, station rectifier negatives moved to outside the extents of the test span, and polarization maintained), current was measured across both temporary bonds placed at piping break points in each station. North Straits Station was found to be 0.53 ADC flowing from upstream to downstream, and Mackinaw Station was found to be 3.0 ADC flowing from upstream to downstream. Total current pickup across the test span was therefore measured to be 2.47 ADC. Equipment utilized to collect the data was Mobiltex UDL1 dataloggers and 0.01-ohm shunts. A summary of the findings is in *Appendix B—Current Response Testing*.

#### 3.2.5 Close Interval Survey

LSC technicians completed CIS on both sides of the straits, from each station fence to the water's edge, with all tested current sources and temporary bonds interrupting. Interrupted (IR-Free) P/S potentials averaged -1.280 VDC on the North Side, and -1.202 VDC on the south side of the straits. These values were relatively consistent with readings obtained from the placed SDLs. Waveforms were collected before and after survey to ensure synchronous interruption was maintained. Data was collected using Allegro dataloggers and Trimble submeter-capable GPS equipment. Graphs of collected data are in *Appendix D—Close Interval Survey*.

#### 3.2.6 Soil Resistivity Testing

Soil resistivity data was collected at two separate locations on each side of the straits, at pin spacings of 150 cm, 230 cm, 350 cm, 700 cm, and 1400 cm. Results are included in *Appendix E— Soil Resistivity Testing*. For immediate value, LSC engineering staff used this information to calculate, through voltage rise, distance to remote earth for proper placement of the temporary ground bed used in current requirement testing.

#### 3.2.7 Current Requirement Testing

After confirming the West Leg's isolation from the station and the functionality of all placed SDLs, LSC energized a portable rectifier and temporary ground bed on the south side of the Mackinac Straits using a culvert at the corners of Wilderness and Algonquin Drives (approximately 350' north of the East Leg). Temporary bonds at each side of the straits were disconnected for testing. The temporary ground bed was confirmed remote by performing anode-to-soil CIS perpendicular to the ground bed's location towards the East Leg. Calculated current requirement, based upon 100 mVDC of polarization, was 1.74 ADC. Results are included in *Appendix B—Current Requirement Testing*.



### **4** Discussion

LSC employed various methodologies to determine the effectiveness of Line 5 CP systems in the Mackinac Straits. Results can be summarized as follows:

	SUMMARY OF RESULTS	
	West Leg	East Leg
Current Required for 100mV of polarization	1.3 ADC	1.74 ADC
Current to Span under Normal Operating Conditions	2.49 ADC	2.47 ADC
Average CIS P/S Potential (North Side)	-1.284 VDC	-1.280 VDC
Average CIS P/S Potential (South Side)	-1.242 VDC	-1.202 VDC
Lowest P/S Potential (North Side)	-1.151 VDC	-1.236 VDC
Lowest P/S Potential (South Side)	-1.129 VDC	-1.106 VDC

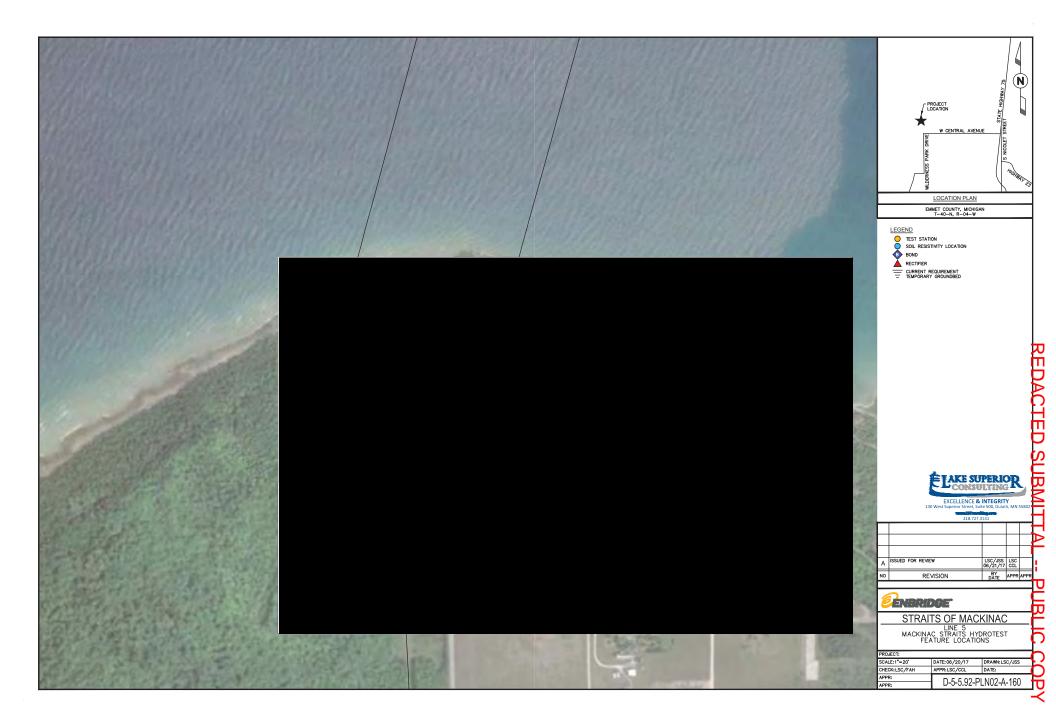
Table 4.1

As indicated in Table 4.1, both the West Leg and East Leg are predominantly polarized by the Mackinaw Station Rectifier, and the lowest IR-Free P/S potential encountered during testing was -1.106 VDC. Current supplied to each Leg was directly measured at hydrotest break points, and exceeded current required for achieving 100 mVDC of polarization, indicating that at as-found output values, existing CP systems are adequate and functional. Finally, note that P/S potential readings were obtained where piping is buried, up until the point where it traverses the straits.



# APPENDIX A - CATHODIC PROTECTION TESTING MAP







# APPENDIX B - CURRENT RESPONSE TESTING



West Leg								
Mackinaw Station - Current	Mackinaw Station - Current Direction	St. Ignace Station - Current	St. Ignace Station - Current Direction					
2.5 Amps	upstream to downstream	.0014 Amps	upstream to downstream					
Mackinaw Statio	n Rectifier Output	St. Ignace Statior	Rectifier Output					
13.52	Amps	5.7 A	mps					

Total Actual Current to Segment				
2.49 Amps				
Calculated Current Requirement				
1.3 Amps				

East Leg									
Mackinaw Station - Current	Mackinaw Station - Current Direction	St. Ignace Station - Current	St. Ignace Station - Current Direction						
3 Amps	upstream to downstream	0.53 Amps	upstream to downstream						
Mackinaw Statio	n Rectifier Output	St. Ignace Station Rectifier Output							
13.52	Amps	5.7 /	Amps						

Total Actual Current to Segment
2.47 Amps
Calculated Current Requirement
1.74 Amps

Note:

1. Current direction is indicated by product flow direction (north to south)

2. All current was measured at temporary bond location to make segment piping continuous with upstream/downstream mainline and station piping

			rrent Requirem asurements - E Segment	14	LAKE SU	ULTING R
Client:		Enbridge Energy	Project:		Line 5 Stra	aits CP Testing
Technician:		Cole Lundgren	Line:			ine 5
Date:		lune 15th, 2017	Location:		Macki	nac Straits
1.0 Pipe Char	racteristics					
Length (ft):		21120	Length (m	ı):		6437
Diameter (in)	:	20	Diameter	(m):		0.508
Surface Area	(ft <sup>2</sup> ):	110584	Surface A	rea (m²):		10274
Coating Type Coating Thick		Unknown	Max Desig	Coal Tar gn Depth:	U	Inknown
2.0 Recorded SDL	l Pipe to Soil Pot	entials IR Free P/S Po	otentials (mV)			
	Pooding #	intree 1751 e		$\Delta (m)$	$\Delta V_{avg}$ /cell	$\Lambda V (m V)$
Identifier	Reading #	V <sub>as found</sub>	V <sub>test</sub>	ΔV (mV)	Δv <sub>avg</sub> /ceii (mV)	ΔV <sub>avg</sub> (mV)
	Reading # A			ΔV (mV) 0.048	(mV)	ΔV <sub>avg</sub> (mV)
Identifier 1	A B	V <sub>as found</sub> -1.014 -0.965	V <sub>test</sub> -1.062 -0.989	0.048 0.024		ΔV <sub>avg</sub> (mV)
1	A B A	V <sub>as found</sub> -1.014 -0.965 -1.096	V <sub>test</sub> -1.062 -0.989 -1.143	0.048 0.024 0.047	(mV) - 0.04	ΔV <sub>avg</sub> (mV)
	A B A B	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087	V <sub>test</sub> -1.062 -0.989	0.048 0.024 0.047 0.028	(mV)	ΔV <sub>avg</sub> (mV)
1 2	A B A B A	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13	0.048 0.024 0.047 0.028 0.021	(mV) - 0.04 - 0.04	
1	A B A B A B B	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165	0.048 0.024 0.047 0.028 0.021 0.05	(mV) - 0.04	ΔV <sub>avg</sub> (mV) 0.031
1 2	A B A B A B A	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115 -1.089	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165 -1.118	0.048 0.024 0.047 0.028 0.021 0.05 0.029	(mV) - 0.04 - 0.04	
1 2 3	A B A B A B A B A B	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115 -1.089 -1.112	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165 -1.118 -1.148	0.048 0.024 0.047 0.028 0.021 0.05 0.029 0.036	(mV) - 0.04 - 0.04 - 0.04	
1 2 3	A B A B A B A B A B A	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115 -1.089 -1.112 -1.116	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165 -1.118 -1.148 -1.148 -1.133	0.048 0.024 0.047 0.028 0.021 0.05 0.029 0.036 0.017	(mV) - 0.04 - 0.04 - 0.04	
1 2 3 4 5	A B A B A B A B A B	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115 -1.089 -1.112	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165 -1.118 -1.148	0.048 0.024 0.047 0.028 0.021 0.05 0.029 0.036	(mV) - 0.04 - 0.04 - 0.04 - 0.03	
1 2 3 4 5 <b>3.0 Recorded</b>	A B A B A B A B A B B A B	V <sub>as found</sub> -1.014 -0.965 -1.096 -1.087 -1.109 -1.115 -1.089 -1.112 -1.116 -1.151	V <sub>test</sub> -1.062 -0.989 -1.143 -1.115 -1.13 -1.165 -1.118 -1.148 -1.148 -1.133	0.048 0.024 0.047 0.028 0.021 0.05 0.029 0.036 0.017 0.011	(mV) - 0.04 - 0.04 - 0.04 - 0.03 - 0.01	

Client:	Enbridge Energy	Project:	Line 5 Straits	CP Testing							
Technician:	Cole Lundgren	Line:	Line 5								
Date:	June 15th, 2017	Location:	Mackinac	Straits							
4.0 Calculation of	4.0 Calculation of Current Requirement to Achieve 100mV of shift										
	Calculated current requirement to achieve 100mV of polarization (mA)	17	40								
Signed Alex Riston											

			rrent Requirem asurements - W Segment	1	LAKES	ULTING R
Client:	E	Enbridge Energy	Project:		Line 5 Stra	aits CP Testing
Technician:		Ryan Swor	Line:			ine 5
Date:		, June 9th, 2017	Location:			nac Straits
1.0 Pipe Char	acteristics					
Length (ft):		21120	Length (m	n):		6437
Diameter (in)	:	20	Diameter			0.508
Surface Area		110584.06	Surface A		1	0273.60
Coating Type:	:			Coal Tar		
<b>Coating Thick</b>	ness:	Unknown	Max Desig	gn Depth:	U	Inknown
SDL	Pipe to Soil Pote	IR Free P/S Po	otentials (mV)	ΔV (mV)	ΔV <sub>avg</sub> /cell	
Identifier	neuting "					
		$V_{asfound}$	V <sub>test</sub>		(mV)	$\Delta V_{avg}$ (mV)
	A	V <sub>as found</sub> -1.083	V <sub>test</sub> -1.072	-0.011		Δv <sub>avg</sub> (mv)
1	A B				(mV) -0.017	Δv <sub>avg</sub> (mv)
1	B A	-1.083 -1.097 -1.176	-1.072 -1.074 -1.166	-0.011 -0.023 -0.010	-0.017	Δv <sub>avg</sub> (mv)
	B A B	-1.083 -1.097 -1.176 -1.171	-1.072 -1.074 -1.166 -1.162	-0.011 -0.023 -0.010 -0.009		Δv <sub>avg</sub> (mv)
1 2	B A B A	-1.083 -1.097 -1.176 -1.171 -1.196	-1.072 -1.074 -1.166 -1.162 -1.180	-0.011 -0.023 -0.010 -0.009 -0.016	-0.017 -0.010	
1	B A B A B	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021	-0.017	-0.017
1 2 3	B A B A B A	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017	-0.017 -0.010	
1 2	B A B A B A B B	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113 -1.200	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096 -1.176	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017 -0.024	-0.017 -0.010 -0.019	
1 2 3	B A B A B A B A A	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113 -1.200 -1.198	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096 -1.176 -1.185	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017 -0.024 -0.013	-0.017 -0.010 -0.019	
1 2 3 4	B A B A B A B B	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113 -1.200	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096 -1.176	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017 -0.024	-0.017 -0.010 -0.019 -0.021	
1 2 3 4 5	B A B A B A B A A	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113 -1.200 -1.198	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096 -1.176 -1.185	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017 -0.024 -0.013	-0.017 -0.010 -0.019 -0.021	
1 2 3 4 5 <b>3.0 Recorded</b>	B A B A B A B A B B	-1.083 -1.097 -1.176 -1.171 -1.196 -1.182 -1.113 -1.200 -1.198 -1.227	-1.072 -1.074 -1.166 -1.162 -1.180 -1.161 -1.096 -1.176 -1.185	-0.011 -0.023 -0.010 -0.009 -0.016 -0.021 -0.017 -0.024 -0.013 -0.027	-0.017 -0.010 -0.019 -0.021 -0.020	

Client:	Enbridge Energy	Project:	Line 5 Straits (	CP Testing							
Technician:	Ryan Swor	Line:	Line 5								
Date:	June 9th, 2017	Location:	Mackinac S	Straits							
4.0 Calculation of	4.0 Calculation of Current Requirement to Achieve 100mV of shift										
	Calculated current requirement to achieve 100mV of polarization (mA)	13	00								
Signed Alex Risto											



# APPENDIX C - RECTIFIER INFLUENCE TESTING



West Leg								Approximate SDL Location Influence Amount (Volts)												
							Side A - Largest Amount of Influence	Side B - Largest Amount of Influence											Time	of Test
Operator	Latitude	Longitude	Rectifier ID	Location Description	DC Volts	DC Amps	(Volts)	(Volts)	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	Date of Test (East	ern)
TransCanada		8	0.40	MP 0.4	39.48	12.35	-0.025	0.0	0.0	-0.025	-0.01	-0.005	-0.02	0.0	0.0	0.0	0.0	0.0	6/7/2017	19:06
TransCanada			7.07	MP 7.07	16.77	3.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6/8/2017	7:59
TransCanada			654.70	MP 654.7	48.58	7.58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6/7/2017	18:42
TransCanada			675.00	MP 675.0	19.88	15.06	-0.025	-0.01	0.0	-0.025	-0.01	0.0	-0.015	0.0	-0.01	0.0	0.0	0.0	6/7/2017	19:29
TransCanada			685.00	MP 685.0	42.20	10.40	-0.05	0.15	0.025	-0.05	-0.03	-0.01	-0.03	0.075	0.11	0.15	0.11	0.1	6/7/2017	19:10
TransCanada			689.00	MP 689.0	22.30	10.30	-0.01	0.01	0.0	-0.01	0.0	0.0	0.0	0.001	-0.01	0.01	0.01	0.01	6/7/2017	18:53
TransCanada			690.00	MP 690.0	29.40	9.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6/7/2017	18:46
Enbridge			1444.00	Hog Island	25.30	4.63	0.01	0.01	0.0	0.01	0.01	0.0	0.005	0.0	0.01	0.01	0.01	0.01	6/7/2017	18:15
Enbridge			1451.00	Cut River	36.37	2.50	0.025	0.03	0.0	0.015	0.025	0.025	0.015	0.015	0.03	0.025	0.02	0.025	6/7/2017	18:50
Enbridge			1476.00	Straights station	6.32	5.70	0.55	0.2	0.2	0.5	0.55	0.3	0.4	0.1	0.19	0.2	0.2	0.195	6/7/2017	18:20
Enbridge			1479.00	Mackinaw station	30.10	13.00	0.25	1.5	0.14	0.25	0.25	0.2	0.25	1.5	1.4	1.05	1.1	0.75	6/7/2017	18:44
Enbridge			1498.00	Topinabee	10.12	11.05	0.1	0.14	0.05	0.075	0.1	0.075	0.1	0.07	0.125	0.14	0.12	0.115	6/7/2017	18:09
ATC			ATC	ATC Substation	26.5	11.4	-1.15	0.15	-0.175	-0.65	-0.85	-1.15	-0.85	0.045	0.1	0.13	0.15	0.15	6/8/2017	14:51

Side A - Largest Amount of Influence Amount of Influence	Time of Test Date of Test (Eastern) 6/14/2017 16:00
Operator Latitude Longitude Rectifier ID Location Description DC Volts DC Amps (Volts) (Volts) A1 A2 A3 A4 A5 B1 B2 B3 B4 B5	C/14/2017 1C-00
TransCanada         0.40         MP 0.4         35.12         12.70         -0.01         0.02         0.0         0.01         -0.01         0.0 <td>6/14/2017 16:00</td>	6/14/2017 16:00
TransCanada         7.07         MP 7.07         16.54         3.70         0.0	6/14/2017 15:52
TransCanada       654.70       MP 654.7       48.93       7.53       0.0       0	6/14/2017 15:2
TransCanada       675.00       MP 675.0       19.50       15.90       -0.01       0.005       0.01       -0.01       0.00       0.0       0.005       0.0       0.01       0.00       0.00       0.00       0.00       0.005       0.01       -0.01       -0.01       0.01       0.00       0.00       0.005       0.01       0.01       -0.01       0.01       0.01       0.00       0.005       0.01       0.01       0.01       0.01       0.01       0.00       0.005       0.01	5 6/14/2017 15:18
TransCanada       685.00       MP 685.0       42.53       11.00       -0.05       0.2       -0.03       -0.03       -0.04       0.07       0.13       0.185       0.2       0.1	6/14/2017 16:0
TransCanada       689.00       MP 689.0       22.58       10.80       -0.01       0.01       0.0       -0.01       -0.01       0.0       0.0       0.01	6/14/2017 15:48
TransCanada       690.00       MP 690.0       31.60       9.90       -0.02       0.01       0.02       -0.02       -0.01       0.0       0.05       0.01       0.01       0.02       -0.02       -0.01       0.02       -0.01       0.01       0.02       -0.01       0.01	6/14/2017 15:41
Enbridge         1444.00         Hog Island         23.70         4.48         0.45         0.13         0.45         0.45         0.45         0.05         0.07         0.12         0.13         0.13	6/14/2017 14:4
Enbridge 1451.00 Cut River 35.98 3.11 0.02 0.02 0.01 0.01 0.02 0.015 0.01 0.01 0.02 0.015 0.01 0.01 0.02 0.02 0.02 0.02 0.02	6/14/2017 15:3
Enbridge         1476.00         Straights station         7.07         5.07         0.55         0.15         0.55         0.55         0.55         0.55         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.05         0.15         0	6/14/2017 14:55
Enbridge         1479.00         Mackinaw station         30.27         13.52         0.35         1.9         0.15         0.35         0.35         0.35         1.675         1.3         1.9         1.25         0.35	6/14/2017 16:2
Enbridge         1498.00         Topinabee         11.08         11.10         0.13         0.13         0.07         0.09         0.13         0.12         0.1         0.05         0.06         0.11         0.13         0.13	6/14/2017 15:00
ATC ATC Substation 26.2 11.4 -0.35 0.1 -0.15 -0.25 -0.3 -0.3 -0.3 0.04 0.05 0.1 0.0 0.	6/15/2017 7:55

			<ul> <li>East &amp; West Leg, North &amp; South Side</li> </ul>					
Operator	Latitude	Longitude	Rectifier ID	Location Description	Influence Amount (Volts)			
TransCanada			0.40	MP 0.4	-0.025			
TransCanada			7.07	MP 7.07	0			
TransCanada			654.70	MP 654.7	0			
TransCanada			675.00	MP 675.0	-0.025			
TransCanada			685.00	MP 685.0	0.2			
TransCanada			689.00	MP 689.0	-0.01			
TransCanada			690.00	MP 690.0	-0.02			
Enbridge			1444.00	Hog Island	0.45			
Enbridge			1451.00	Cut River	0.03			
Enbridge			1476.00	Straights station	0.55			
Enbridge			1479.00	Mackinaw station	1.9			
Enbridge			1498.00	Topinabee	0.14			
ATC			ATC	ATC Substation	-1.15			

#### Note:

A negative (-) number indicates an electronegative shift in potentials when the associated rectifier is turned OFF Side "A" is the North Straits Station side

Side "B" is the Mackinaw Station side

	Independence         Independence           Independence         PROJECT           Independence
C.S	REDACTED
	ELECTORISULTING ELECTORISULTING ENCILLENCE & INTEGRITY 320 West Superior Street, Swins 2000, Dolutin, MM 55800 218,727,3141 A ISSUED FOR REVIEW 05/2/07 LCC
LARGEST INFLUENCE - EAST & WEST LEG, NORTH & SOUTH S           OPERATOR         LATITUDE         LONGITUDE         RECTIFIER         LOCATION         I           TRANSCANADA         0.4         MP 0.4         DESCRIPTION         DESCRIPTION	NO REVISION BY APPRAPPRAPPRAPPRAPPRAPPRAPPRAPPRAPPRAPP

**Project Information** Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI **Rectifier Information** 

neediner information					
Operator:	TransCanada	Location Description:	MP 0.4	 _	
Rectifier ID:	0.4	GPS:			





Unit Information					
Manufacturer:	Universal	Model:	CSA/ASAI	Туре:	Air Cooled
Serial Number:	001497	Power:	AC	Phase:	1
DC Voltage:	60	DC Amps:	40	Ground Bed:	Unknown

Rectifier Measurements					
DC Voltage:	39.48	Shunt Rating:	50/50	mV Across Shunt:	12.35
DC Amps:	12.35	Course Tap:	2	Fine Tap:	6

General Comments:			
Were changes made to the original settings?	No	(If ves see description below)	
Were changes made to the original settings?	No	(If yes see description below)	
Were changes made to the original settings?	No	(If yes see description below)	
Were changes made to the original settings?	No	(If yes see description below)	
Were changes made to the original settings?	No	(If yes see description below)	
Were changes made to the original settings?	No	(If yes see description below)	

Project Information									
Date:	6/8/2016	Client/Company	Name:	Enbridge					
Project Name & No.:	Line 5 Straits – CP T	esting		00917200474		Location:	Mackinac St	raits, MI	
Rectifier Information									
Operator	: TransCanada		Locati	on Description:	MP 7.07				
Rectifier ID	: 7.07			GPS:					





ING

Unit Information					
Manufacturer:	Universal	Model:	CSA-ASAI	Туре:	Air Cooled
Serial Number:	73112	Power:	120/240	Phase:	1
DC Voltage:	40	DC Amps:	20	Ground Bed:	Unknown
Rectifier Measurements					
DC Voltage:	16.77	Shunt Rating:	50/50	mV Across Shunt:	3.7
DC Amps:	3.7	Course Tap:	7	Fine Tap:	6
General Comments:					
Were changes made to t	he original settings?	No (If	yes see description below,	)	

**Project Information** Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI **Rectifier Information** 

Recurrer information					
Operator:	TransCanada	Location Description:	MP 654.7	 _	
Rectifier ID:	654.7	GPS:			





Unit Information					
Manufacturer:	Universal	Model:	CSA-ASAI	Туре:	Air Cooled
Serial Number:	064002	Power:	AC	Phase:	1
DC Voltage:	60	DC Amps:	40	Ground Bed:	Unknown

<b>Rectifier Measurements</b>					
DC Voltage:	48.58	Shunt Rating:	50/50	mV Across Shunt:	7.48
DC Amps:	7.48	Course Tap:	2	Fine Tap:	5

Yes or No	(If yes see description below)	
	Yes or No	Yes or No <i>(If yes see description below)</i>

**Project Information** Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI **Rectifier Information** 

Operator:	TransCanada	Location Description:	MP 675.0		_			
Rectifier ID:	675.0	GPS:						





ĺ	Unit Information							
	Manufacturer:	Universal	Model:	ASAI	Туре:	Air Cooled		
	Serial Number:	151841	Power:	AC	Phase:	1		
	DC Voltage:	60	DC Amps:	40	Ground Bed:	Unknown		

Rectifier Measurements							
DC Voltage:	19.88	Shunt Rating:	50/50	mV Across Shunt:	15.06		
DC Amps:	15.06	Course Tap:	2	Fine Tap:	4		

General Comments:			
Were changes made to the original settings?	Yes or No	(If yes see description below)	

**Project Information** 6/7/2016 Client/Company Name: Date: Enbridge Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Project Name & No.: **Rectifier Information** TransCanada Location Description: MP 685.0 Operator: **Rectifier ID:** 685.0 GPS:





Unit Information					
Manufacturer:	Universal	Model:	ASAI	Туре:	Air Cooled
Serial Number:	151839	Power:	120/240	Phase:	1
DC Voltage:	60	DC Amps:	40	Ground Bed:	Unknown
Rectifier Measurements					
DC Voltage:	42.2	Shunt Rating:	50/50	mV Across Shunt:	10.4
DC Amps:	10.4	Course Tap:	4	Fine Tap:	1
General Comments:					
Were changes made to t	he original settings?	Yes or No (If	yes see description below,	)	
1					

# **Rectifier Data Sheet**

# Project Information Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Rectifier Information Image: Straits – CP Testing Location: Mackinac Straits, MI Operator: TransCanada Location: MP 689.0 Location: MP 689.0

GPS:



689.0

**Rectifier ID:** 



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Unit Information							
Manufacturer:	Universal	Model:	ASAI	Туре:	Air Cooled		
Serial Number:	151840	Power:	120/240	Phase:	1		
DC Voltage:	60	DC Amps:	40	Ground Bed:	Unknown		

Rectifier Measurements							
DC Voltage:	22	Shunt Rating:	50/50	mV Across Shunt:	10.2		
DC Amps:	10.2	Course Tap:	2	Fine Tap:	5		

General Comments:			
Wore changes made to the original settings?	Voc or No	(If was say description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	

# **Rectifier Data Sheet**

# Project Information Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Rectifier Information Operator: TransCanada Location Description: MP 690.0

GPS:



690.0

**Rectifier ID:** 



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Unit Information					
Manufacturer:	Goodall	Model:	JSAWSW-60-16 N	Туре:	Air Cooled
Serial Number:	93J1009	Power:	120/240	Phase:	1
DC Voltage:	60	DC Amps:	16	Ground Bed:	Unknown

Rectifier Measurements							
DC Voltage:	28.3	Shunt Rating:	50/20	mV Across Shunt:	21.9		
DC Amps:	6.76	Course Tap:	С	Fine Tap:	2		

General Comments:			
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	

Project Information					
Date:	6/7/2016	Client/Company Na	me: Enbridge		
Project Name & No.:	Line 5 Straits – CP T	Line 5 Straits – CP Testing		Location:	Mackinac Straits, MI
Rectifier Information					

1	Operator:	Enbridge	Location Description:	Hog Island		
	Rectifier ID:	1444	GPS:			





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Unit Information				
Manufacturer:	Model:		Туре:	
Serial Number:	Power:	Solar	Phase:	
DC Voltage:	DC Amps:		Ground Bed:	DW

<b>Rectifier Measurements</b>					
DC Voltage:	25.53	Shunt Rating:	50/50	mV Across Shunt:	4.64
DC Amps:	4.63	Course Tap:	N/A	Fine Tap:	N/A

re changes made to the original settings?	Yes or No	(If yes see description below)	

**Project Information** Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI **Rectifier Information** 

Nectiner information					
Operator:	Enbridge	Location Description:	Cut River	 _	
Rectifier ID:	1451	GPS:			





AKE SUPERIOD

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Unit Information					
Manufacturer:	Universal	Model:	ASAE	Туре:	Air Cooled
Serial Number:	011611	Power:	AC	Phase:	1
DC Voltage:	60	DC Amps:	22	Ground Bed:	Unknown

Rectifier Measurements					
DC Voltage:	36.37	Shunt Rating:	50/25	mV Across Shunt:	5
DC Amps:	2.5	Course Tap:	3	Fine Tap:	6

General Comments:			
Were changes made to the original settings?	Ves or No	(If was see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	
Were changes made to the original settings?	Yes or No	(If yes see description below)	

# **Rectifier Data Sheet**

# Project Information Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Rectifier Information Operator: Enbridge Location: Mackinac Straits, MI

GPS:

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	AC. VOLTS 200220 PH THE H
4	1176

1476

**Rectifier ID:** 



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AKE SUPERIO

Manufacturer:	Universal	Model:	AAP	Tupo	Air Cooled
				Туре:	ł
Serial Number:	880279	Power:	120/240	Phase:	1
DC Voltage:	40	DC Amps:	12	Ground Bed:	Unknown
ectifier Measurements			· · · · · · · · · · · · · · · · · · ·		
DC Voltage:	6.12	Shunt Rating:	50/15	mV Across Shunt:	20.4
DC Amps:	6.12	Course Tap:	1		
eneral Comments:		course rap.	1	Fine Tap:	4
eneral Comments:			1	Fine Tap:	4

# REDACTED SUBMITTAL -- PUBLIC COPY **Rectifier Data Sheet**

#### **Project Information** Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI **Rectifier Information** Enbridge Location Description: Mackinaw Station Operator:

GPS:

MODEL	TALET PARTNEL	=
AC VOLTS	atton bo	
AC AMPE	DC AMPS	
E DODAN	ODALL.	
CAUTION WHEN MOUNTIN	IG ON OR OVER A COMBUSTIBLE S IT 1.43mm GALVANIZED OR LEMM 150mm BEYOND THE EQUIPMENT	UNCOATED

1479

**Rectifier ID:** 



AKE SUPERIOD

Unit Information							
Manufacturer:	Goodall	Model:	CSAWSA 60-34 N	Туре:	Air Cooled		
Serial Number:	77C2309	Power:	120/240	Phase:	1		
DC Voltage:	60	DC Amps:	34	Ground Bed:	Unknown		
Rectifier Measurements							
DC Voltage:	30.1	Shunt Rating:	50/40	mV Across Shunt:	16.2		
DC Amps:	13	Course Tap:	2	Fine Tap:	4		

General Comments:		
Were changes made to the original settings?	Yes or No	(If yes see description below)

# **Rectifier Data Sheet**

**Project Information** Client/Company Name: Date: 6/7/2016 Enbridge Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Project Name & No.: **Rectifier Information** Enbridge Location Description: Topinabee Operator: **Rectifier ID:** 1498 GPS:





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AKE SUPERIOD

Unit Information					
Manufacturer:	Universal	Model:	ASAE	Туре:	Air Cooled
Serial Number:	984083	Power:	120/240	Phase:	1
DC Voltage:	40	DC Amps:	20	Ground Bed:	Unknown
Rectifier Measurements					
DC Voltage:	10.05	Shunt Rating:	50/25	mV Across Shunt:	22.1
DC Amps:	11.05	Course Tap:	1	Fine Tap:	5
General Comments:					
Were changes made to t	he original settings?	Yes or No (If	yes see description below,	)	

# **Rectifier Data Sheet**

# Project Information Date: 6/7/2016 Client/Company Name: Enbridge Project Name & No.: Line 5 Straits – CP Testing 00917200474 Location: Mackinac Straits, MI Rectifier Information Operator: ATC Location Description: ATC Substation

GPS:

	E C. TO S	1	State States
A.	0.10 \$		

ATC

**Rectifier ID:** 



**REDACTED SUBMITTAL -- PUBLIC COPY** 

AKE SUPERIOT

Unit Information					
Manufacturer:	Rio	Model:	ACP	Туре:	Air Cooled
Serial Number:	741147	Power:	120/240	Phase:	1
DC Voltage:	200	DC Amps:	50	Ground Bed:	Unknown
Rectifier Measurements					

DC Voltage:	26.5	Shunt Rating:	50/75	mV Across Shunt:	7.6			
DC Amps:	11.4	Course Tap:	1	Fine Tap:	2			

General Comments:		
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)
Were changes made to the original settings?	Yes or No	(If yes see description below)



# **Appendix F – Cathodic Protection Measurements**

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
WAS-1	1	1300		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	1	1362		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	1	1277	808	Тор	Yes	8/25/2017	Over/through deposit
WAS-1	1	1336	870	Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	1	1277		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	1	1322		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	2	1274		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	2	1328	848	Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	2	1283		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	2	1327	851	Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	2	1375	803	Тор	Yes	8/25/2017	Over/through deposit
WAS-1	2	1372	851	Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	3	1340		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	3	1388		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	3	1342		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	3	1389		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	3	1343		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	3	1385		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	4	1384		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	4	1433		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	4	1390		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	4	1430		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	4	1380		Тор	Yes	8/25/2017	Over/through deposit
WAS-1	4	1430		Bottom	Yes	8/25/2017	Over/through deposit
WAS-1	2	471		Тор	NO	9/22/2017	On deposit
WAS-1	2	509		Bottom	NO	9/22/2017	On deposit
WAS-1	2	460	199	Тор	NO	9/22/2017	On deposit
WAS-1	2	451	211	Bottom	NO	9/22/2017	On deposit
WAS-1	2	1344	855	Тор	Yes	9/22/2017	Scraped to metal
WAS-1	2	1370	848	Bottom	Yes	9/22/2017	Scraped to metal
WAS-1	2	1070	704	Тор	Yes	9/22/2017	After wire brushing
WAS-1	2	1086	724	Bottom	Yes	9/22/2017	After wire brushing
WAS-1	4	334	223	Тор	NO	9/22/2017	On deposit
WAS-1	4	360	250	Bottom	NO	9/22/2017	On deposit
WAS-1	4	1374	954	Тор	Yes	9/22/2017	Scraped to metal
WAS-1	4	1402	860	Bottom	Yes	9/22/2017	Scraped to metal
WAS-1	4	1188	777	Тор	Yes	9/22/2017	
WAS-1	4	1203	782	Bottom	Yes	9/22/2017	After wire brushing
WAS-1	3	269	172	Тор	NO	9/22/2017	On deposit
WAS-1	3	295	197	Bottom	NO	9/22/2017	On deposit
WAS-1	3	1382	846	Тор	Yes	9/22/2017	Scraped to metal
WAS-1	3	1411	826	Bottom	Yes	9/22/2017	Scraped to metal
WAS-1	3	1221	768	Тор	Yes	9/22/2017	After wire brushing
WAS-1	3	1239	779	Bottom	Yes	9/22/2017	After wire brushing
EAS-1	1	1676		Тор	Yes	8/15/2017	Over/through deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
EAS-1	1	1683		Bottom	Yes	8/15/2017	Over/through deposit
EAS-1	1	1674		Тор	Yes	8/15/2017	Over/through deposit
EAS-1	1	1681		Bottom	Yes	8/15/2017	Over/through deposit
EAS-1	1	1690		Тор	Yes	8/15/2017	Over/through deposit
EAS-1	1	1674		Bottom	Yes	8/15/2017	Over/through deposit
EAS-1	1B	298		Тор	NO	10/6/2017	Over/through deposit
EAS-1	1B	298		Bottom	NO	10/6/2017	Over/through deposit
EAS-1	1B	1616		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1B	1606		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1B	1394		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1B	1418		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1B	1390		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1B	1407		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1C	277		Тор	NO	10/6/2017	Over/through deposit
EAS-1	1C	279		Bottom	NO	10/6/2017	Over/through deposit
EAS-1	1C	1569		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1C	1578		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1C		956	Тор	Yes	10/6/2017	OFF reading, or poor pipe contact.
EAS-1	1C		998	Bottom	Yes	10/6/2017	OFF reading, or poor pipe contact.
EAS-1	1C		945	Тор	Yes	10/6/2017	OFF reading, or poor pipe contact.
EAS-1	1C		960	Bottom	Yes	10/6/2017	OFF reading, or poor pipe contact.
EAS-1	1D	1582		Тор	Yes	10/6/2017	Over/through deposit
EAS-1	1D	1602		Bottom	Yes	10/6/2017	Over/through deposit
EAS-1	1D		1133	Тор	Yes	10/6/2017	After deposit removal
EAS-1	1D	1496		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1D	1437		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1D	1439		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1D	1435		Тор	Yes	10/6/2017	After deposit removal (video)
EAS-1	1D		1127	Bottom	Yes	10/6/2017	After deposit removal (video)
EAS-1	1D	1471		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1D	1460		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1E	560		Тор	NO	10/6/2017	Over/through deposit
EAS-1	1E	554		Bottom	NO	10/6/2017	Over/through deposit
EAS-1	1E	600		Тор	NO	10/6/2017	
EAS-1	1E	591		Bottom	NO	10/6/2017	After deposit removal
EAS-1	1E	530		Тор	NO	10/6/2017	•
EAS-1	1E	501		Bottom	NO	10/6/2017	After deposit removal
EAS-1	1E	1406		Тор	Yes	10/6/2017	
EAS-1	1E	1403		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1F	512		Тор	NO	10/6/2017	
EAS-1	1F	503		Bottom	NO	10/6/2017	Over/through deposit
EAS-1	1F	1669		Тор	Yes	10/6/2017	After deposit removal
EAS-1	1F	1674		Bottom	Yes	10/6/2017	After deposit removal
EAS-1	1F	1478		Тор	Yes	10/6/2017	
EAS-1	1F	1494		Bottom	Yes	10/6/2017	

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
EAS-1	1F	1478		Тор	Yes	10/6/2017	
EAS-1	1F	1494		Bottom	Yes	10/6/2017	
EAS-2	1	261		Тор	NO	8/24/2017	No CP readings (DFT>70)
EAS-2	1	291		Bottom	NO	8/24/2017	No CP readings (DFT>70)
EAS-3	1	852		Тор	Yes	8/29/2017	ON reading from dive video
EAS-3	1	886		Bottom	Yes	8/29/2017	
EAS-3	1	804		Тор	Yes	8/29/2017	
EAS-3	1	842		Bottom	Yes	8/29/2017	
EAS-3	1	834		Тор	Yes	8/29/2017	
EAS-3	1	875		Bottom	Yes	8/29/2017	
EAS-3	1	799	620	Тор	Yes	8/29/2017	ON/OFF readings from dive video
EAS-3	1	836	666	Bottom	Yes	8/29/2017	ON/OFF readings from dive video
EAS-4	1	955		Тор	Yes	8/30/2017	
EAS-4	1	991		Bottom	Yes	8/30/2017	
EAS-4	1	938		Тор	Yes	8/30/2017	
EAS-4	1	965		Bottom	Yes	8/30/2017	
EAS-4	1	951		Тор	Yes	8/30/2017	
EAS-4	1	979		Bottom	Yes	8/30/2017	
EAS-4	2	981		Тор	Yes	8/30/2017	
EAS-4	2	1012		Bottom	Yes	8/30/2017	
EAS-4	2	907	682	Тор	Yes	8/30/2017	OFF reading from dive video
EAS-4	2	933	705	Bottom	Yes	8/30/2017	OFF reading from dive video
EAS-4	2	944	701	Тор	Yes	8/30/2017	OFF reading from dive video
EAS-4	2	974	722	Bottom	Yes	8/30/2017	OFF reading from dive video
EAOI-1		234		Тор	NO	9/8/2017	
EAOI-1		281		Bottom	NO	9/8/2017	
EAOI-1		440		Тор	NO	9/8/2017	
EAOI-1		316		Bottom	NO	9/8/2017	
EAOI-1		320		Тор	NO	9/8/2017	
EAOI-1		260		Bottom	NO	9/8/2017	
EAOI-5		391		Тор	NO	9/6/2017	
EAOI-5		326		Bottom	NO	9/6/2017	
EAOI-7	1	1155	849	Тор	Yes		Under deposit
EAOI-7	1	1158	841	Bottom	Yes		Under deposit
EAOI-7	1	1188	832	Тор	Yes		Under deposit
EAOI-7	1	1101	815	Bottom	Yes		Under deposit
EAOI-7	1	1085	832	Тор	Yes		Under deposit
EAOI-7	1	1081	814	Bottom	Yes		Under deposit
EAOI-7	1A	1235	894	Тор	Yes		Under deposit
EAOI-7	1A	1238	837	Bottom	Yes		Under deposit
EAOI-7	1A	1223	893	Тор	Yes		Under deposit
EAOI-7	1A	1269	836	Bottom	Yes		Under deposit
EAOI-7	1A	1206	886	Тор	Yes		Under deposit
EAOI-7	1A	1195	869	Bottom	Yes		Under deposit
EAOI-7	1B	1185	879	Тор	Yes	10/13/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
EAOI-7	1B	1196	870	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	1B	1281	918	Тор	Yes	10/13/2017	Under deposit
EAOI-7	1B	1277	903	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	1B	1278	932	Тор	Yes	10/13/2017	Under deposit
EAOI-7	1B	1279	918	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	1C	1511	1109	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1C	1528	1114	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1C	1485	1119	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1C	1511	1111	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1C	1505	1109	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1C	1515	1111	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1D	1359	1077	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1D	1370	1086	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1D	1355	1077	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1D	1367	1062	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1D	1365	1079	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1D	1373	1085	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1E	1174	908	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1E	1187	914	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1E	1205	914	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1E	1214	921	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1E	1186	921	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1E	1087	926	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1E	485	344	Тор	NO	10/12/2017	Over deposit pH 11
EAOI-7	1E	484	347	Bottom	NO	10/12/2017	Over deposit pH 11
EAOI-7	1E	432	359	Тор	NO	10/12/2017	Over deposit pH 11
EAOI-7	1E	437	364	Bottom	NO	10/12/2017	Over deposit pH 11
EAOI-7	1E			Тор		10/12/2017	
EAOI-7	1E			Bottom		10/12/2017	
EAOI-7	1F	1568	1133	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1F	1570	1122	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1F	1561	1125	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1F	1570	1135	Bottom	Yes		Under deposit
EAOI-7	1F	1552	1124	Тор	Yes		Under deposit
EAOI-7	1F	1558	1125	Bottom	Yes		Under deposit
EAOI-7	1F	429	310	Тор	NO		Over deposit pH 12
EAOI-7	1F	437	314	Bottom	NO		Over deposit pH 12
EAOI-7	1F	472	381	Тор	NO		Over deposit pH 12
EAOI-7	1F	478	384	Bottom	NO		Over deposit pH 12
EAOI-7	1G	272	199	Тор	NO		Under deposit
EAOI-7	1G	254	211	Bottom	NO		Under deposit
EAOI-7	1G	227	187	Тор	NO		Under deposit
EAOI-7	1G	184	189	Bottom	NO		Under deposit
EAOI-7	1G	251	187	Тор	NO		Under deposit
EAOI-7	1G	248	185	Bottom	NO	10/12/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
EAOI-7	1H	1577	1091	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1H	1571	1079	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	1H	1562	1071	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1H	1575	1074	Тор	Yes	10/12/2017	Under deposit
EAOI-7	1H	1559	1053	Bottom	Yes	10/12/2017	Under deposit
EAOI-7	11	1486	1044	Тор	Yes	10/13/2017	Under deposit
EAOI-7	11	1468	1032	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	11	1551	1063	Тор	Yes	10/13/2017	Under deposit
EAOI-7	11	1508	1055	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	11	1524	1070	Тор	Yes	10/13/2017	Under deposit
EAOI-7	11	1517	1054	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	1J	270	237	Тор	NO	10/12/2017	Under deposit
EAOI-7	1J	290	263	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1J	252	222	Тор	NO	10/12/2017	Under deposit
EAOI-7	1J	273	241	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1J	401	299	Тор	NO	10/12/2017	Under deposit
EAOI-7	1J	349	255	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1K	311	301	Тор	NO	10/12/2017	Under deposit
EAOI-7	1K	282	230	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1K	276	238	Тор	NO	10/12/2017	Under deposit
EAOI-7	1K	258	223	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1K	276	234	Тор	NO	10/12/2017	Under deposit
EAOI-7	1K	261	217	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1L	278	239	Тор	NO	10/12/2017	Under deposit
EAOI-7	1L	265	227	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1L	267	235	Тор	NO	10/12/2017	Under deposit
EAOI-7	1L	252	220	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1L	280	239	Тор	NO	10/12/2017	Under deposit
EAOI-7	1L	259	216	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1M	434	420	Тор	NO	10/12/2017	Under deposit
EAOI-7	1M	429	384	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1M	407	408	Тор	NO	10/12/2017	Under deposit
EAOI-7	1M	403	397	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1M	446	437	Тор	NO	10/12/2017	Under deposit
EAOI-7	1M	416	395	Bottom	NO	10/12/2017	Under deposit
EAOI-7	1N	1436	1011	Тор	Yes		Under deposit
EAOI-7	1N	1430	999	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	1N	1025	785	Тор	NO	10/13/2017	Invalid due to companion (high contact resistance)
EAOI-7	1N	1043	744	Bottom	NO	10/13/2017	Invalid due to companion (high contact resistance)
EAOI-7	1N	1401	963	Тор	Yes	10/13/2017	Under deposit
EAOI-7	1N	1406	967	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	10	1291	939	Тор	Yes	10/13/2017	Under deposit
EAOI-7	10	1302	989	Bottom	Yes	10/13/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
EAOI-7	10	1466	1052	Тор	Yes	10/13/2017	Under deposit
EAOI-7	10	1459	1036	Bottom	Yes	10/13/2017	Under deposit
EAOI-7	10	1212	908	Тор	Yes	10/13/2017	Under deposit
EAOI-7	10	1218	895	Bottom	Yes	10/13/2017	Under deposit
DI-E-1	1	517		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	1	484		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	1	474		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	1	456		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	1	454		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	1	434		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	1	421		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	1	419		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	1	266		Тор	NO	9/30/2017	Under deposit
DI-E-1	1	262		Bottom	NO	9/30/2017	Under deposit
DI-E-1	1	288		Тор	NO	9/30/2017	Under deposit
DI-E-1	1	282		Bottom	NO	9/30/2017	Under deposit
DI-E-1	1	291		Тор	NO	9/30/2017	Under deposit
DI-E-1	1	268		Bottom	NO	9/30/2017	Under deposit
DI-E-1	1	289		Тор	NO	9/30/2017	Under deposit
DI-E-1	1	283		Bottom	NO	9/30/2017	Under deposit
DI-E-1	3	429		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	3	421		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	3	448		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	3	443		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	3	440		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	3	429		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	3	357		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	3	334		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	3	1775		Тор	Yes	9/30/2017	Under deposit
DI-E-1	3	1651		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	3	1645		Тор	Yes	9/30/2017	Under deposit
DI-E-1	3	1665		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	3	1651		Тор	Yes	9/30/2017	Under deposit
DI-E-1	3	1642		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	3	1640		Тор	Yes	9/30/2017	Under deposit
DI-E-1	3	1633		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	4	350		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	4	342		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	4	392		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	4	362		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	4	331		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	4	323		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	4	576		Тор	NO	9/30/2017	Under deposit
DI-E-1	4	561		Bottom	NO	9/30/2017	Under deposit
DI-E-1	4	605		Тор	NO	9/30/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-1	4	587		Bottom	NO	9/30/2017	Under deposit
DI-E-1	4	1335		Тор	Yes	9/30/2017	Under deposit
	4		007	Dettern	Mara	0/20/2017	Under deposit; 907 reading either
DI-E-1	4		907	Bottom	Yes	9/30/2017	OFF or high resistance
DI-E-1	4	1640		Тор	Yes	9/30/2017	Under deposit
DI-E-1	4	1638		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	5	292		Тор	NO	9/30/2017	Over/through deposit
DI-E-1	5	285		Bottom	NO	9/30/2017	Over/through deposit
DI-E-1	5	1689		Тор	Yes	9/30/2017	Under deposit
DI-E-1	5	1692		Bottom	Yes	9/30/2017	Under deposit
DI-E-1	5	1819		Тор	Yes	9/30/2017	Under deposit
DI-E-1	5	1681		Bottom	Yes	9/30/2017	Under deposit
DI-E-2	1	1608		Тор	Yes	10/1/2017	Over/through deposit
DI-E-2	1	1615		Bottom	Yes	10/1/2017	Over/through deposit
DI-E-2	1	1611		Тор	Yes	10/1/2017	Over/through deposit
DI-E-2	1	1615		Bottom	Yes	10/1/2017	Over/through deposit
DI-E-2	1	1522		Тор	Yes	10/1/2017	Under deposit
DI-E-2	1	1438		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	1	1465		Тор	Yes	10/1/2017	Under deposit
DI-E-2	1	1400		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	2	565		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	2	557		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	2	370		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	2	372		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	2	404		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	2	396		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	2	1500		Тор	Yes	10/1/2017	Under deposit
DI-E-2	2	1496		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	2	1519		Тор	Yes	10/1/2017	Under deposit
DI-E-2	2	1515		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	2	1540		Тор	Yes	10/1/2017	Under deposit
DI-E-2	2	1535		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	3	320		Тор	NO	10/1/2017	
DI-E-2	3	321		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	3	310		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	3	313		Bottom	NO	10/1/2017	
DI-E-2	3	261		Тор	NO	10/1/2017	Under deposit
DI-E-2	3	265		Bottom	NO	10/1/2017	Under deposit
DI-E-2	3	275		Тор	NO	10/1/2017	
DI-E-2	3	267		Bottom	NO	10/1/2017	-
DI-E-2	4	268		Тор	NO	10/1/2017	
DI-E-2	4	259		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	4	274		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	4	274		Bottom	NO	10/1/2017	
DI-E-2	4	253		Тор	NO	10/1/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-2	4	248		Bottom	NO	10/1/2017	Under deposit
DI-E-2	4	334		Тор	NO	10/1/2017	Under deposit
DI-E-2	4	327		Bottom	NO	10/1/2017	Under deposit
DI-E-2	5	198		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	5	196		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	5	251		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	5	248		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	5	245		Тор	NO	10/1/2017	Over/through deposit
DI-E-2	5	231		Bottom	NO	10/1/2017	Over/through deposit
DI-E-2	5	400		Тор	NO	10/1/2017	Under deposit
DI-E-2	5	381		Bottom	NO	10/1/2017	Under deposit
DI-E-2	5	1598		Тор	Yes	10/1/2017	Under deposit
DI-E-2	5	1577		Bottom	Yes	10/1/2017	Under deposit
DI-E-2	5	255		Тор	NO	10/1/2017	Under deposit
DI-E-2	5	247		Bottom	NO	10/1/2017	Under deposit
DI-E-5	2	312		Тор	NO	10/1/2017	Over/through deposit
DI-E-5	2	306		Bottom	NO	10/1/2017	Over/through deposit
DI-E-5	2	410		Тор	NO	10/1/2017	Over/through deposit
DI-E-5	2	391		Bottom	NO	10/1/2017	Over/through deposit
DI-E-5	2	1592		Тор	Yes	10/1/2017	Under deposit
DI-E-5	2	1585		Bottom	Yes	10/1/2017	Under deposit
DI-E-5	2	1702		Тор	Yes	10/1/2017	Under deposit
DI-E-5	2	1604		Bottom	Yes	10/1/2017	Under deposit
DI-E-5	3	350		Тор	NO	10/1/2017	Over/through deposit
DI-E-5	3	348		Bottom	NO	10/1/2017	Over/through deposit
DI-E-5	3	1630		Тор	Yes	10/1/2017	Under deposit
DI-E-5	3	1681		Bottom	Yes	10/1/2017	Under deposit
DI-E-7	1	504		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	1	520		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	1	560		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	1	590		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	1	1480		Тор	Yes	10/2/2017	Under deposit
DI-E-7	1	1500		Bottom	Yes	10/2/2017	Under deposit
DI-E-7	1	1460		Тор	Yes	10/2/2017	Under deposit
DI-E-7	1	1485		Bottom	Yes	10/2/2017	Under deposit
DI-E-7	2	415		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	2	400		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	2	472		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	2	440		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	2	1606		Тор	Yes	10/2/2017	Under deposit
DI-E-7	2	1608		Bottom	Yes	10/2/2017	Under deposit
DI-E-7	2	1604		Тор	Yes	10/2/2017	Under deposit
DI-E-7	2	1609		Bottom	Yes	10/2/2017	Under deposit
DI-E-7	3	360		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	3	370		Bottom	NO	10/2/2017	Over/through deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-7	3	1587		Тор	Yes	10/2/2017	Under deposit
DI-E-7	3	1597		Bottom	Yes	10/2/2017	Under deposit
DI-E-7	4	330		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	4	340		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	4	340		Тор	NO	10/2/2017	Over/through deposit
DI-E-7	4	344		Bottom	NO	10/2/2017	Over/through deposit
DI-E-7	4	200		Тор	NO	10/2/2017	Under deposit
DI-E-7	4	202		Bottom	NO	10/2/2017	Under deposit
DI-E-7	4	198		Тор	NO	10/2/2017	Under deposit
DI-E-7	4	202		Bottom	NO	10/2/2017	Under deposit
DI-E-10	2	192		Тор	NO	10/2/2017	Over/through deposit
DI-E-10	2	200		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	2	178		Тор	NO	10/2/2017	Over/through deposit
DI-E-10	2	189		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	2	1546		Тор	Yes	10/2/2017	Under deposit
DI-E-10	2	1559		Bottom	Yes	10/2/2017	Under deposit
DI-E-10	2	1553		Тор	Yes	10/2/2017	Under deposit
DI-E-10	2	1556		Bottom	Yes	10/2/2017	Under deposit
DI-E-10	3	199		Тор	NO	10/2/2017	Over/through deposit
DI-E-10	3	209		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	3	200		Тор	NO	10/2/2017	Over/through deposit
DI-E-10	3	206		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	3	272		Тор	NO	10/2/2017	Under deposit
DI-E-10	3	282		Bottom	NO	10/2/2017	Under deposit
DI-E-10	3	285		Тор	NO	10/2/2017	Under deposit
DI-E-10	3	291		Bottom	NO	10/2/2017	Under deposit
DI-E-10	3	1249	924	Тор	Yes	11/2/2017	After deposit removal
DI-E-10	3	1236	912	Bottom	Yes	11/2/2017	-
DI-E-10	4	161		Тор	NO		Over/through deposit
DI-E-10	4	168		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	4	204		Тор	NO	10/2/2017	Over/through deposit
DI-E-10	4	206		Bottom	NO	10/2/2017	Over/through deposit
DI-E-10	4	208		Тор	NO	10/2/2017	Under deposit
DI-E-10	4	212		Bottom	NO	10/2/2017	Under deposit
DI-E-10	4	205		Тор	NO	10/2/2017	-
DI-E-10	4	213		Bottom	NO	10/2/2017	
DI-E-10	4	1363	963	Тор	Yes	11/2/2017	
DI-E-10	4	1352	937	Bottom	Yes	11/2/2017	
DI-E-10	5	199		Тор	NO	10/3/2017	
DI-E-10	5	205		Bottom	NO	10/3/2017	
DI-E-10	5	195		Тор	NO	10/3/2017	
DI-E-10	5	201		Bottom	NO	10/3/2017	
DI-E-10	5	1571		Тор	Yes	10/3/2017	
DI-E-10	5	1568		Bottom	Yes	10/3/2017	-
DI-E-10	5	1571		Тор	Yes	10/3/2017	Under deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-10	5	1575		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	6	345		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	6	350		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	6	320		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	6	314		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	6	1569		Тор	Yes	10/3/2017	Under deposit
DI-E-10	6	1568		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	6	1559		Тор	Yes	10/3/2017	Under deposit
DI-E-10	6	1563		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	6	1751	1078	Тор	Yes	11/2/2017	After deposit removal
DI-E-10	6	1738	1049	Bottom	Yes	11/2/2017	After deposit removal
DI-E-10	7	331		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	7	332		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	7	334		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	7	338		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	7	306		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	7	305		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	7	1475		Тор	Yes	10/3/2017	Under deposit
DI-E-10	7	1476		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	7	1470		Тор	Yes	10/3/2017	Under deposit
DI-E-10	7	1472		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	7	1476		Тор	Yes	10/3/2017	Under deposit
DI-E-10	7	1485		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	7	1578	954	Тор	Yes	11/2/2017	Before wire brush
DI-E-10	7	1541	969	Bottom	Yes	11/2/2017	Before wire brush
DI-E-10	7	1692	1062	Тор	Yes	11/2/2017	Before wire brush
DI-E-10	7	1682	1054	Bottom	Yes	11/2/2017	Before wire brush
DI-E-10	7	1641	1092	Тор	Yes	11/2/2017	After wire brush
DI-E-10	7	1626	1089	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	7	1642	1096	Тор	Yes	11/2/2017	After wire brush
	7	1020	1070	Dattan	Vee	11/2/2017	After wire brush. NB: "ON"
DI-E-10	7	1039	1076	Bottom	Yes	11/2/2017	reading shown is clearly an "OFF"
DI-E-10	7	1683	1122	Тор	Yes	11/2/2017	After wire brush
DI-E-10	7	1675	1115	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	8	202		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	8	203		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	8	207		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	8	209		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	8	210		Тор	NO	10/3/2017	Under deposit
DI-E-10	8	208		Bottom	NO	10/3/2017	Under deposit
DI-E-10	8	227		Тор	NO	10/3/2017	Under deposit
DI-E-10	8	224		Bottom	NO	10/3/2017	Under deposit
DI-E-10	9	226		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	9	228		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	9	238		Тор	NO	10/3/2017	Over/through deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-10	9	239		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	9	248		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	9	251		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	9	210		Тор	NO	10/3/2017	Under deposit
DI-E-10	9	212		Bottom	NO	10/3/2017	Under deposit
DI-E-10	9	215		Тор	NO	10/3/2017	Under deposit
DI-E-10	9	214		Bottom	NO	10/3/2017	Under deposit
DI-E-10	9	257		Тор	NO	10/3/2017	Under deposit
DI-E-10	9	258		Bottom	NO	10/3/2017	Under deposit
DI-E-10	9	289	289	Тор	NO	11/2/2017	Before wire brush
DI-E-10	9	275	275	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	9	338	279	Тор	NO	11/2/2017	Before wire brush
DI-E-10	9	333	268	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	9	1745	1045	Тор	Yes	11/2/2017	After wire brush
DI-E-10	9	1733	1030	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	9	1744	1048	Тор	Yes	11/2/2017	After wire brush
DI-E-10	9	1735	1053	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	10	226		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	10	231		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	10	255		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	10	258		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	10	195		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	10	198		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	10	471	348	Тор	NO	11/2/2017	Before wire brush
DI-E-10	10	458	329	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	10	494	305	Тор	NO	11/2/2017	Before wire brush
DI-E-10	10	479	313	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	10	1545	1053	Тор	Yes	11/2/2017	
DI-E-10	10	1536	1034	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	10	1550	1047	Тор	Yes	11/2/2017	
DI-E-10	10	1538	1033	Bottom	Yes	11/2/2017	
DI-E-10	10	1710	1035	Тор	Yes		After wire brush
DI-E-10	10	1702	1029	Bottom	Yes	11/2/2017	
DI-E-10	11	1509		Тор	Yes	10/3/2017	-
DI-E-10	11	1511		Bottom	Yes		After deposit removal
DI-E-10	11	1476		Тор	Yes	10/3/2017	
DI-E-10	11	1479		Bottom	Yes	10/3/2017	
DI-E-10	11	1453		Тор	Yes	10/3/2017	
DI-E-10	11	1457		Bottom	Yes	10/3/2017	
DI-E-10	12	374		Тор	NO		After deposit removal
DI-E-10	12	372		Bottom	NO	10/3/2017	
DI-E-10	12	1485		Тор	Yes	10/3/2017	
DI-E-10	12	1487		Bottom	Yes	10/3/2017	
DI-E-10	12	405		Тор	NO	10/3/2017	
DI-E-10	12	401		Bottom	NO	10/3/2017	After deposit removal

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-10	16	1532		Тор	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1540		Bottom	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1525		Тор	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1519		Bottom	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1549		Тор	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1547		Bottom	Yes	10/3/2017	Over/through deposit
DI-E-10	16	1554		Тор	Yes	10/3/2017	After deposit removal
DI-E-10	16	1556		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	16	1502		Тор	Yes	10/3/2017	After deposit removal
DI-E-10	16	1504		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	16	1511		Тор	Yes	10/3/2017	
DI-E-10	16	1509		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	16	1663	1055	Тор	Yes	11/2/2017	Before wire brush
DI-E-10	16	1664	1059	Bottom	Yes	11/2/2017	Before wire brush
DI-E-10	16	616	345	Тор	NO	11/2/2017	Before wire brush
DI-E-10	16	595	330	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	16	1610	1065	Тор	Yes	11/2/2017	After wire brush
DI-E-10	16	1599	1064	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	16	1598	1070	Тор	Yes	11/2/2017	After wire brush
DI-E-10	16	1588	1085	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	18	284		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	18	244		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	18	293		Тор	NO	10/3/2017	Under deposit
DI-E-10	18	289		Bottom	NO	10/3/2017	Under deposit
DI-E-10	19	168		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	19	177		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	19	186		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	19	189		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	19	170		Тор	NO	10/3/2017	Under deposit
DI-E-10	19	173		Bottom	NO	10/3/2017	Under deposit
DI-E-10	19	200		Тор	NO	10/3/2017	Under deposit
DI-E-10	19	203		Bottom	NO	10/3/2017	Under deposit
DI-E-10	19	379	303	Тор	NO	11/2/2017	Before wire brush
DI-E-10	19	362	292	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	19	330	287	Тор	NO	11/2/2017	
DI-E-10	19	315	274	Bottom	NO	11/2/2017	Before wire brush
DI-E-10	19	1723	1065	Тор	Yes	11/2/2017	After wire brush
DI-E-10	19	1724	1048	Bottom	Yes	11/2/2017	After wire brush
DI-E-10	19	1721	1067	Тор	Yes	11/2/2017	After wire brush
DI-E-10	19	1715	1066	Bottom	Yes	11/2/2017	
DI-E-10	22	168		Тор	NO	10/3/2017	
DI-E-10	22	171		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	22	177		Тор	NO	10/3/2017	Under deposit
DI-E-10	22	180		Bottom	NO	10/3/2017	-
DI-E-10	23	265		Тор	NO	10/3/2017	Over/through deposit

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-10	23	266		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	23	221		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	23	224		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	23	216		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	23	218		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	23	1601		Тор	Yes	10/3/2017	Under deposit
DI-E-10	23	1607		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	23	347		Тор	NO	10/3/2017	Under deposit
DI-E-10	23	347		Bottom	NO	10/3/2017	Under deposit
DI-E-10	23	300		Тор	NO	10/3/2017	Under deposit
DI-E-10	23	303		Bottom	NO	10/3/2017	Under deposit
DI-E-10	24	1396		Тор	Yes	10/3/2017	After deposit removal
DI-E-10	24	1398		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	24	1230		Тор	Yes	10/3/2017	After deposit removal
DI-E-10	24	1275		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	24	1389		Тор	Yes	10/3/2017	After deposit removal
DI-E-10	24	1383		Bottom	Yes	10/3/2017	After deposit removal
DI-E-10	25	270		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	25	274		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	25	227		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	25	230		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	25	196		Тор	NO	10/3/2017	Under deposit
DI-E-10	25	200		Bottom	NO	10/3/2017	Under deposit
DI-E-10	25	1500		Тор	Yes	10/3/2017	Under deposit
DI-E-10	25	1513		Bottom	Yes	10/3/2017	Under deposit
DI-E-10	26	179		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	26	181		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	27	173		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	27	175		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	27	165		Тор	NO	10/3/2017	Over/through deposit
DI-E-10	27	168		Bottom	NO	10/3/2017	Over/through deposit
DI-E-10	28	265		Тор	NO	10/3/2017	
DI-E-10	28	265		Bottom	NO	10/3/2017	Over/through deposit
DI-E-13	2	1524		Тор	Yes		
DI-E-13	2	1513		Bottom	Yes		
DI-E-13	2	1519		Тор	Yes		
DI-E-13	2	1507		Bottom	Yes		
DI-E-13	2	1484		Тор	Yes		
DI-E-13	2	1479		Bottom	Yes		
DI-E-13	9	1513		Тор	Yes		
DI-E-13	9	1505		Bottom	Yes		
DI-E-13	9	1464		Тор	Yes		
DI-E-13	9	1295		Bottom	Yes		
DI-E-13	9	1499		Тор	Yes		
DI-E-13	9	1509		Bottom	Yes		

Location	Feature	ON (-mV)	OFF (-mV)	Cell	Metal Contact?	CP Date	Comment
DI-E-13	11	1511		Тор	Yes		
DI-E-13	11	1507		Bottom	Yes		
DI-E-13	11	1493		Тор	Yes		
DI-E-13	11	1486		Bottom	Yes		
DI-E-13	11	1473		Тор	Yes		
DI-E-13	11	1457		Bottom	Yes		
DI-E-13	17	1501		Тор	Yes		
DI-E-13	17	1505		Bottom	Yes		
DI-E-13	17	1475		Тор	Yes		
DI-E-13	17	1482		Bottom	Yes		
DI-E-13	19	250		Тор	NO		
DI-E-13	19	243		Bottom	NO		
DI-E-13	19	331		Тор	NO		
DI-E-13	19	324		Bottom	NO		
DI-E-13	19	287		Тор	NO		
DI-E-13	19	279		Bottom	NO		
DI-W-3	3	1653		Тор	Yes		
DI-W-3	3	1636		Bottom	Yes		
DI-W-3	3	483		Тор	NO		
DI-W-3	3	482		Bottom	NO		
DI-W-3	3	1583		Тор	Yes		
DI-W-3	3	1553		Bottom	Yes		
DI-W-57	3	262		Тор	NO		
DI-W-57	3	252		Bottom	NO		
DI-W-57	3	245		Тор	NO		
DI-W-57	3	234		Bottom	NO		
DI-W-57	3	245		Тор	NO		
DI-W-57	3	226		Bottom	NO		
DI-W-57	7	243		Тор	NO		
DI-W-57	7	293		Bottom	NO		
DI-W-57	7	234		Тор	NO		
DI-W-57	7	224		Bottom	NO		
DI-W-57	7	285		Тор	NO	11/11/2017	
DI-W-57	7	275		Bottom	NO	11/11/2017	
DI-W-57	7	238		Тор	NO	11/11/2017	
DI-W-57	7	228		Bottom	NO	11/11/2017	

#### **Dive Inspection CP Measurements - Introduction:**

Enbridge executed underwater CP measurements as per the BIWP and AIWP. These measurements were recorded using the Polatrak CP Gun, which is specifically designed for underwater work. This tool contains two independent precision voltmeters, two reference electrodes, and a sharp metal electrode that is used to make electrical contact with the pipe.

This was the first diver executed underwater CP survey in Enbridge history in the Straits. As a result, Enbridge made various procedural modifications aimed at improving the quality and value of the CP measurements as the BIWP and AIWP progressed. Some of the challenges experienced and procedural modifications which resulted are discussed below:

- Pipe Contact Resistance: As a pipe-to-soil potential measurement requires good metallic contact with the pipe, any contact resistance between the Polatrak CP Gun's metal tip and the pipe will introduce reading error. Measurements conducted early in the study demonstrated instability which was attributed to high resistance contact between the CP gun and the pipe metal. In the interest of minimizing dive inspection related coating damage, Enbridge instructed divers to use 'firm pressure' when taking CP readings and to avoid using excessive pressure that could cause coating damage. As a consequence, the CP potentials became relevant as an indicator of possible existence of bare pipe metal. Enbridge instituted a criterion of -600mV (300mV more electronegative than open water readings) as a preliminary indicator of bare metal this was used to confirm diver's visual observations of coating damage or possible metal exposure. It should be noted that the -600mV CSE criterion does not independently verify good electrical contact with the pipe metal if other CP readings taken from the same feature or at the same dive site are substantially more electronegative.
- Loss of Reference Cell calibration: The Polatrak CP Gun contains two copper/copper sulphate electrodes (CSE) that are used as a voltage reference for the pipe CP measurements. These electrodes are comprised of a copper wire within a plastic barrel containing saturated copper sulphate solution that is electrolytically coupled to the environment through a porous plug. The calibration of the electrodes was found to drift after successive dives, and this was attributed to cyclical ingress and egress of lake water through the porous plug during successive dives: a process exacerbated if the reference cells contained air bubbles. In response, Enbridge instituted more frequent calibrations of the reference cells, and employed an electrolyte replenishment procedure intended to

minimize air in the reference cell. Some of the pipe-to-soil potentials recorded in the first few days of the project were affected by calibration error.

- Rectifier Interruption Status: The interpretation of CP potential readings requires consideration of voltage effects other than those across the structure to electrolyte boundary; the most common method of removing extraneous CP reading error is to simultaneously interrupt all current sources that affect CP levels on the structure of interest. Potential measurements recorded under the influence of operating cathodic protection current sources are referred to as "ON" readings; potentials recorded with current sources <u>briefly</u> deactivated are commonly called "OFF" or "Polarized" potentials. The most recent (2017) CP study discussed previously identified several rectifiers (both Enbridge and foreign) with influence on the Straits dual pipelines. To the best of the ability of Enbridge field staff, these rectifiers were simultaneously interrupted; however, some foreign CP sources were not consistently interrupted due to equipment failures and coordination issues. Enbridge regional CP staff summarized the status of rectifier interruption during each day of survey, and these have been considered in evaluating the CP potential obtained.
- Special Investigation: In order to explore the transient processes (time dependent polarization of freshly exposed metal), Enbridge dive personnel obtained additional cathodic protection readings on select dives. Where logistics and time permitted, CP readings were taken on select features before and after the power wire wheel brush was used to clean the calcareous deposit from the pipe surface. The intent of this exercise was to investigate how significantly the CP potentials were affected by the calcareous deposit, and to demonstrate the level of protection that would be immediately available to freshly exposed pipe metal surface. It was observed that completely removing calcareous deposit (using a power wire brush) could dramatically decrease the level of cathodic protection measured.

#### **Dive Inspection Summaries:**

#### <u>WAS-1:</u>

44 cathodic protection potential measurements were recorded from this location over several dives conducted on 24/08/2017 and 22/09/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 8 of these readings (which averaged -314 mV) and these have not been considered in this analysis.

#### Cathodic Protection Measurements from BIWP and AIWP

The "ON" readings (potentials recorded with the CP systems operating) ranged from -1274 mV to -1433 mV CSE (average of -1358 mV), indicating substantial availability of cathodic protection current at this site. "OFF" readings (potentials obtained with most current sources briefly deactivated) indicated a range of -803 mV to -954 mV, with an average of -852 mV CSE. One foreign CP system was not interrupted at the time these readings were taken; and this fact is estimated to produce an electropositive shift in the "OFF" readings of 33 mV at this location<sup>1</sup>. The error corrected "OFF" readings (after considering the voltage gradient produced by the foreign influence) are estimated at -836 mV (minimum) with an average of -885 mV, indicating marginal to complete levels of cathodic protection. The CP data summary table in the report body reflects these error corrected data.

Additional CP measurements were obtained immediately after a hydraulic power wire brush was used to remove calcareous deposit and residual coating material (the cup-disk brush wheel used at this site exposed large areas of bare metal). The readings obtained before the wire brushing reflect residual chemical polarization from alkaline species contained by, or trapped within, any remaining calcareous deposit; the readings after wire brushing represent the 'worst case' condition of a newly developed coating holiday (with freshly exposed bare metal). Average "ON" and "OFF" readings taken after the wire brushing were -1167 mV and -755 mV CSE, respectively. These data clearly demonstrate that the removal of the calcareous deposit decreased the effective level of CP by nearly 100mV at this location.

As all of the recorded pipe potentials involved as least some disruption of the calcareous deposits to make electrical contact between the CP gun and the pipe wall, it is believed that all CP data recorded during the 2017 BIWP and AIWP dive inspections contains some electropositive error (the CP readings may indicate lower levels of cathodic protection than would have existed before the deposits were disrupted). In order to collect accurate CP measurements that represent the actual level of cathodic protection being received by the dual pipelines under normal operating conditions, it is recommended to leave these deposits intact for the duration of the survey. Alternatively, any CP survey performed after deposit removal should be delayed until the subsequent recoating program has been completed.

<sup>&</sup>lt;sup>1</sup> The adjustments made to "OFF" potential readings recorded during the BIWP and AIWP are based upon rectifier influence testing performed by Lake Superior Consulting, and uses the methodology developed to compensate for transient interference of CIS data. Ref: "Practical Telluric Compensation for Pipeline Close Interval Survey", Paper #00741, Corrosion 2000 Symposia, NACE International, Houston TX (2000).

#### EAS-1:

48 cathodic protection potential measurements were recorded from this location over several dives conducted on 15/08/2017 and 10/06/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 12 of these readings (which averaged -458 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1390 mV to -1690 mV CSE (average of -1535 mV), indicating substantial availability of cathodic protection current at the site. "OFF" readings ranged from -945 mV to -1133 mV, with an average of -1019 mV CSE. These readings indicate complete cathodic protection in accordance with industry best practice and applicable regulations.

#### EAS-2:

2 cathodic protection potential measurements were recorded from this location during dives on 08/24/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on all 2 of these readings (which averaged -276 mV). No valid "ON" or "OFF" CP readings could be obtained at this location.

#### EAS-3:

The coating damage at this site was created by a communication cable rub that occurred on August 26, 2017 during execution of the BIWP. This exposed metal consists of one feature with an area of  $0.93 \text{ ft}^2$ .

8 cathodic protection potential measurements were recorded from this location during dives conducted on 8/29/2017.

The "ON" readings observed ranged from -799 mV to -886 mV CSE (average of -841 mV), indicating lower availability of cathodic protection current at this site compared to other dive sites. "OFF" readings obtained from dive video analysis ranged from -620 mV to -666 mV, with an average of -643 mV CSE. One foreign CP system was not interrupted at the time these readings were taken; and this fact is estimated to produce an electropositive shift in the "OFF" readings of 163 mV at this location. The error corrected "OFF" readings (after considering the voltage gradient produced by the foreign influence) are estimated at -783 mV (minimum) with an average of -806 mV, indicating marginal levels of cathodic protection. The CP data summary table in the report body reflects these error corrected data.

While there are numerous possible sources of error in the collection of 'ON' and 'OFF' CP readings by divers (discussed previously), the marginal levels of CP observed at this site are believed to be a consequence of the relatively large size of the bare metal area in conjunction with the very short time between metal exposure and the CP survey. This short timeframe (~3 days) was inadequate for calcareous deposit to form (none was observed) and appears to be inadequate for cathodic polarization to achieve a steady state. Based on observations from other dive sites, it is expected that a calcareous coating would eventually grow to cover this feature, resulting in increased chemical polarization and complete cathodic protection.

#### EAS-4:

The coating damage at this site was created by a communication cable rub that occurred on August 26, 2017 during execution of the BIWP. This exposed area consists of one feature with an area of  $1.64 \text{ ft}^2$ 

12 cathodic protection potential measurements were recorded from this location during dives conducted on 8/30/2017.

The "ON" readings observed ranged from -907 mV to -1012 mV CSE (average of -961 mV), indicating moderate availability of cathodic protection current at the site. "OFF" readings obtained from dive video analysis ranged from -682 mV to -772 mV, with an average of -703 mV CSE. One foreign CP system was not interrupted at the time these readings were taken; and this fact is estimated to produce an electropositive shift in the "OFF" readings of 162 mV at this location. The error corrected "OFF" readings (after considering the voltage gradient produced by the foreign influence) are estimated at -844 mV (minimum) with an average of -865 mV, indicating marginal to complete levels of cathodic protection. The CP data summary table in the report body reflects these error corrected data.

While there are numerous possible sources of error in the collection of 'ON' and 'OFF' CP readings by divers (discussed previously), the marginal levels of CP observed at this site are believed to be a consequence of the relatively large size of the bare metal area in conjunction with the very short time between metal exposure and the CP survey. This short timeframe (~4 days) was inadequate for calcareous deposit to form (none was observed) and appears to be inadequate for cathodic polarization to achieve a steady state. It is noted that the cathodic protection levels recorded at EAS-4 were measurably improved as compared to the smaller area of exposed metal at EAS-3. This may be attributable to the additional day of cathodic protection

that EAS-4 received. Based on observations from other dive sites, it is expected that a calcareous coating would eventually grow to cover this feature, resulting in a higher level of chemical polarization and complete cathodic protection.

#### EAOI-1:

6 cathodic protection potential measurements were recorded from this location during dives conducted on 9/8/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on all 6 of these readings (which averaged - 309mV). No valid "ON" or "OFF" readings could be obtained from this location.

#### EAOI-5:

2 cathodic protection potential measurements were recorded from this location over one dive conducted on 9/06/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on all 2 of these readings (which averaged - 359mV). No valid "ON" or "OFF" readings could be obtained from this location.

#### EAOI-7:

103 cathodic protection potential measurements were recorded from this location over several dives conducted on 10/12/2017 and 10/13/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 40 of these readings (which averaged -338 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1081 mV to -1577 mV CSE (average of -1362 mV), indicating substantial availability of cathodic protection current at the site. "OFF" readings ranged from -814 mV to -1135 mV, with an average of -992 mV CSE. The ATC rectifier was not interrupted at the time these readings were taken; and this fact is estimated to produce an electropositive shift in the "OFF" readings of 89 mV at this location. The error corrected "OFF" readings (after considering the voltage gradient produced by the ATC rectifier) are estimated at -903 mV (minimum) with an average of -1081 mV, indicating complete cathodic protection in accordance with industry best practice and all applicable regulations. The CP data summary table in the report body reflects these error corrected data.

#### <u>DI-E1:</u>

52 cathodic protection potential measurements were recorded from this location over several dives conducted on 9/30/2017. Calcareous deposits and residual coating created high resistance

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between the pipe and the tip of the Polatrak CP Gun on 36 of these readings (which averaged - 394 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1335 mV to -1819 mV CSE (average of -1653 mV), indicating substantial availability of cathodic protection current at the site. Only a single "OFF" reading of -907 mV CSE was identified, although this reading could also be the result of a high resistance contact. These readings indicate complete cathodic protection in accordance with industry best practice and all applicable regulations.

#### DI-E2:

48 cathodic protection potential measurements were recorded from this location over several dives conducted on 10/1/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 32 of these readings (which averaged - 309 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1400 mV to -1615 mV CSE (average of -1535 mV), indicating substantial availability of cathodic protection current at the site. No "OFF" readings were collected at this site.

#### <u>DI-E5:</u>

12 cathodic protection potential measurements were recorded from this location during dives conducted on 10/26/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 6 of these readings (which averaged -353 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1585 mV to -1702 mV CSE (average of -1632 mV), indicating substantial availability of cathodic protection current at the site. No "OFF" readings were obtained from this location.

#### <u>DI-E7:</u>

28 cathodic protection potential measurements were recorded from this location over several dives conducted on 10/2/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 18 of these readings (which averaged - 377 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1460 mV to -1609 mV CSE (average of -1554 mV), indicating substantial availability of cathodic protection current at the site. No "OFF" readings were obtained from this location.

#### <u>DI-E10:</u>

202 cathodic protection potential measurements were recorded from this location over several dives conducted on October 2, October 3, October 6, and November 2. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 118 of these readings (which averaged -263 mV) and these have not been considered in this analysis.

"ON" readings observed ranged from -1039mV to -1751mV (average of -1545 mV), indicating substantial availability of cathodic protection current at the site. The operating status of a foreign CP system (which can only produce electropositive measurement error at this location) could not be confirmed. Notwithstanding the possibility of electropositive measurement error, the average "OFF" reading of -1043mV indicates excellent levels of cathodic polarization. Even the most electropositive "OFF" reading obtained (-912 mV CSE) indicates complete protection in accordance with industry best practice and all regulated requirements.

Additional testing was performed immediately before and after a wire brush was used to remove calcareous deposit. The readings before the wire brush are expected to reflect residual chemical polarization from alkaline species contained by, or trapped within, the calcareous deposit; the readings after wire brushing represent the 'worst case' condition of a newly developed coating holiday (with freshly exposed bare metal). As readings after wire brushing exceeded -1030mV, it was demonstrated that effective cathodic protection could be achieved on newly bared metal within 1-3 minutes at this location.

#### DI-E13:

28 cathodic protection potential measurements were recorded from this location over several dives conducted on 10/6/2017 and 10/9/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 6 of these readings (which averaged -287 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1295 mV to -1524 mV CSE (average of -1486 mV), indicating substantial availability of cathodic protection current at the site. No "OFF" readings were collected.

F-22

#### <u>DI-W3:</u>

6 cathodic protection potential measurements were recorded from this location over several dives conducted on 10/9/2017 and 10/13/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on 2 of these readings (which averaged -483 mV) and these have not been considered in this analysis.

The "ON" readings observed ranged from -1553 mV to -1653 mV CSE (average of -1606 mV), indicating substantial availability of cathodic protection current at the site. No "OFF" readings were obtained at this location.

#### DI-W57:

14 cathodic protection potential measurements were recorded from this location during dives conducted on 11/11/2017. Calcareous deposits and residual coating created high resistance between the pipe and the tip of the Polatrak CP Gun on all 14 of these readings (which averaged - 248 mV). Valid "ON" or "OFF" readings could not be obtained at this location.

#### **Discussion:**

Cathodic protection potentials recorded during the BIWP and AIWP dive inspections generally exhibited substantial availability of cathodic protection current – as indicated by current applied 'ON' CP readings. The average of all 'ON' readings was -1442 mV CSE, which is approximately 800mV more electronegative than the expected native potential of steel in freshwater. Moderate to high levels of cathodic polarization were also observed in the majority of data – as indicated by the current interrupted 'OFF' CP readings. The average of all 'OFF' readings was -968 mV CSE, which exceeds the requirements of industry best practice<sup>i</sup> and applicable regulations<sup>ii</sup>.

It is noted that many of the CP readings obtained during the BIWP and AIWP CP survey were affected by measurement errors associated with equipment (rectifier interruption issues, CP gun calibration), procedures (long 'OFF' cycle depolarization, manual meter reading, and disruption of calcareous deposits), and problems associated with contact resistance.

The prevalence of calcareous deposits at the vast majority of dive sites provides clear indication of chemical polarization due to applied cathodic protection (ie. increase of local pH at the pipe surface). These calcareous deposits are highly resistive and impede the divers' ability to obtain cathodic protection levels without substantial disruption of the deposit. It is noted that errors due to contact resistance are always electropositive (tending to under represent actual CP levels).

#### Cathodic Protection Measurements from BIWP and AIWP

Disruption or removal of calcareous deposits for the purposes of obtaining metal contact has the adverse consequence of disrupting or removing chemical polarization. The action of cleaning the metal surface to obtain good electrical contact has the potential to negate the intended purpose of collecting cathodic protection potentials – that is, to determine the levels of cathodic protection being achieved under normal operations. Some dive sites clearly demonstrated a significant electropositive shift (loss of cathodic polarization) when a wire brush was used to clean the metal surface. While the effect is temporary (as the calcareous deposit reforms), it underscores the beneficial impact of the intact deposits and highlights the importance of scheduling CP survey at times when bare pipe has not been intentionally created by deposit removal.

While some sites demonstrated marginal levels of cathodic polarization, the absence of any detectable external corrosion metal loss demonstrates that the cathodic protection being received by the dual pipelines has been successful at preventing external corrosion over the long history of the pipelines operation.

An ROV based close interval survey (CIS) of the Dual Pipelines is recommended in 2018; this form of survey will provide a substantially more comprehensive and reliable assessment of the cathodic protection levels being achieved throughout the Straits crossing than could be achieved during this project. The proposed CIS survey will include the following elements:

- Complete inspection of the entire ROV navigable pipe span (as opposed to a few discrete dive areas);
- Rigorous rectifier interruption management;
- Reliable electrical connection to the pipeline to avoid contact resistance issues;
- A more reliable reference cell to avoid contamination issues;
- Synchronized stationary dataloggers to ensure the data has not been affected by transient phenomenon, and to permit transient error correction if required.

<sup>&</sup>lt;sup>1</sup> NACE SP0169-13, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems", NACE International, Houston TX, (2013).

<sup>&</sup>lt;sup>ii</sup> Title 49, CFR 195, "Transportation of Hazardous Liquids by Pipeline", Office of the Federal Register, Washington DC (2017).



# **Appendix G – Report on Calcareous Deposits**

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# Study of Line 5 Pipeline Mackinac Straits Crossing Bolo Polo of Constro

## The Role of Calcareous Deposits in Corrosion Control

## 1/12/2018

Prepared for:

## Enbridge Energy, Limited Partnership

Prepared by: Kevin C. Garrity, FNACE Executive Vice President Mears Group, Inc.



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#### Executive Summary

Mears Group, Inc. (Mears) has been retained by Enbridge Energy, Limited Partnership (Enbridge) to complete a study and analysis of the potential impact of calcareous deposits at coating flaws discovered at discrete locations along the Enbridge Line 5 crossing of Mackinac Straits and to opine regarding the need to remove the deposits and repair flaws (Holidays) in the pipeline coating.

This work was carried out under the direction of Kevin C. Garrity who has over forty years of experience in corrosion engineering and material science and the application of cathodic protection (CP) to buried pipelines and tanks, concrete structures, and marine structures.

The study has been completed through a review of available data and information and a compilation of applicable research and scientific information on calcareous deposit formation on pipelines subjected to cathodic protection.

The Enbridge pipeline Line 5 was installed in 1953 and is comprised of two 20-in. diameter pipelines that lie on the lakebed at a maximum water depth of 250 ft. (Figure 2.1), extending approximately 4.5 miles across the Straits of Mackinac. The two 20-in. diameter pipelines are separated by about 1,300 ft. Line 5 system transports approximately 540,000 barrels/day of crude oil and natural gas liquids (product) from Superior, Wisconsin to Sarnia, Ontario, Canada (645 mi.). The pipe is reported to have been constructed using heavy-wall pipe (0.812-in) and operates at a relatively low stress level (about 150 Psi, less than 25% of the pipe's capacity). The pipelines are reported to have an external Coal Tar Enamel protective coating (CTE) and fiber reinforced wrapping. The Operating temperature is reported to range between 43.2 °F and 83.5°F, with an average temperature of 57.9°F.

Recent analysis (by Enbridge) of select deposits removed during coating inspections has conclusively determined the material to be calcareous deposits primarily consisting of calcium carbonate and magnesium carbonate.

The information reviewed and analyzed to date indicates that the presence of calcareous deposits observed at coating flaws on Line 5 are a beneficial result of an effective external protective coating system and an effective cathodic protection system. The formation of calcium carbonate and magnesium carbonate at coating flaws results from the application of cathodic protection and serves to protect the underlying steel from corrosion at the elevated pH values consistent with the formation and adhesion of the deposits. Corrosion rates for carbon steel are significantly reduced at pH values associated with the application of effective CP and the development of calcium and magnesium carbonate at the pipe surface. This is further substantiated through the In-Line-Inspection (ILI) results which indicate no external metal loss anomalies in Line 5.

There is no technical basis for removing the calcareous deposits to affect repairs to underlying coating holidays. In fact, Industry practice has been to leave such deposits undisturbed recognizing the beneficial protective effects of calcareous deposits at coating flaws in conjunction with effective CP.

Most importantly, a review of In-Line Inspection data has shown that Line 5 is not currently experiencing external corrosion issues across that Straits and to remove the calcareous deposits may introduce unintended consequences that may adversely alter the current state of effective corrosion protection afforded Line 5. The retention of the calcareous deposits does not increase the risk of corrosion on Line 5.

 
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#### Abbreviations and Acronyms

CP	Cathodic protection
CTE	Coal Tar Enamel
CSE	Copper-Copper Sulfate Reference Electrode
SCE	Saturated calomel electrode
mV	Millivolt
V	Volt
cm	Centimeter
dm	Decimeter
m	Meter
km	Kilometer
ft	Feet
F	Fahrenheit
С	Celsius
Ω	Resistance in Ohms
Ω-cm	Resistivity in Ohms-centimeters
Sec	Second
min	Minute
рН	Potential of Hydrogen
Μ	Molar/Liter
E	Potential
mA	Milliamps
А	Ampere
psi	Pounds per square inch
Мра	Mega pascal
ILI	In-Line Inspection
-0.85V <sub>CSE</sub>	Reference to the SP0169 Standard criterion for steel at a polarized (Instant Off potential)





#### 1 Introduction

Mears Group, Inc. has been retained by Enbridge Energy, Limited Partnership (Enbridge) to complete a study and analysis of the potential impact of calcareous deposits at coating flaws discovered at discrete locations along the Enbridge Line 5 crossing of Mackinac Straits and to opine regarding the need to remove the deposits and repair flaws (Holidays) in the pipeline coating. The study, the results of which are reported here, has been completed through a review of available data and information and a compilation of applicable research and scientific information on calcareous deposit formation on pipelines subjected to cathodic protection. The following information has been reviewed and relied upon in completing this study:

- Alternatives Analysis for the Straits Pipeline Report by Dynamic Risk,
- 2013 ILI Report for Straits of Mackinac East Leg (ENO-EMA) by GE,
- 2013 ILI Report for Straits of Mackinac West Leg (WNO-WMA) by GE,
- 2016 Cathodic Protection Current Measurement Report- East Leg by BAKER HUGHES,
- 2016 Cathodic Protection Current Measurement Report West Leg by BAKER HUGHES,
- 2017 ILI Report for Straits of Mackinac East Leg (ENO-EMA) by BAKER HUGHES,
- 2017 ILI Report for Straits of Mackinac West Leg (ENO-EMA) by BAKER HUGHES,
- 2003 Hanson Survey and Design Straits of Mackinac CIS Findings,
- 2016 Enbridge line 5 Annual CP Survey by Lake Superior Consulting,
- 2017 Enbridge line 5 Mackinac Straits Cathodic Protection Testing by Lake Superior Consulting, and
- All documents listed in Bibliography.

A large body of scientific journals and treatises reporting on calcareous deposits in conjunction with cathodic protection relate to seawater exposure conditions. While this data and information has been relied upon, Mears has undertaken a study of thermodynamic behavior in fresh water reported in this document. The study confirms the applicability of the seawater scientific data to fresh water conditions similar to the Line 5 exposure conditions.

Specifically, Mears has examined the thermodynamic behavior, environment chemistry, chemistry of the calcium and magnesium carbonate as calcareous films/deposits, and the role of cathodic protection. This report offers a summary of findings, conclusions and recommendations regarding whether there is a need to remove such deposits and repair underlying coating flaws.

Our review has included an analysis of the results of In-Line-Inspection tool runs and the results of cathodic protection surveys.

The results of our study indicate that the calcareous deposit formation from the applied CP on Line 5 are both beneficial and sufficiently protective to preclude any efforts to remove the deposits and affect repairs to the underlying coating holidays. Moreover, to undertake such repairs that would require removal of the deposits may introduce unintended consequences that may adversely alter the current state of effective corrosion protection afforded Line 5.





## 2 Background of Pipeline and Environment

The Enbridge pipeline Line 5 was installed in 1953 and is comprised of two 20-in. diameter pipelines that lie on the lakebed at a maximum water depth of 250 ft. (Figure 2.1), extending approximately 4.5 miles across the Straits of Mackinac. The two 20-in. diameter pipelines are separated by about 1,300 ft. Line 5 system transports approximately 540,000 barrels/day of crude oil and natural gas liquids (product) from Superior, Wisconsin to Sarnia, Ontario, Canada (645 mi.). The pipe is reported to have been constructed using heavy-wall pipe (0.812-in) and operates at a relatively low stress level (about 150 Psi, less than 25% of the pipe's capacity). The pipelines are reported to have an external Coal Tar Enamel protective coating (CTE) and fiber reinforced wrapping. The Operating temperature is reported to range between 43.2 °F and 83.5°F, with an average temperature of 57.9°F.

Recent analysis (by Enbridge) of select deposits removed during coating inspections has conclusively determined the material to be calcareous deposits primarily consisting of calcium carbonate and magnesium carbonate.

## 2.1 Water Temperature

Water temperature of the pipe was obtained during the coating inspection performed between August 24<sup>th</sup>, 2017 and August 30<sup>th</sup>, 2017 as shown in Table 2.1.

Date	Depth (ft.)/m	Temperature (°F/°C)
August 24 <sup>th</sup>		61.2-61.9/16.2-16.6
August 29-30 <sup>th</sup>		51.0-52.4/11-11.3
August 25 <sup>th</sup>		49.9-51.7/9.9-10.9

#### Table 2.1: Reported Water Temperature Data

# 2.2 Depth of Straits of Mackinac

The depth was measured west of the bridge at 84°45' west meridian and the profile was shown in Figure 2.1.





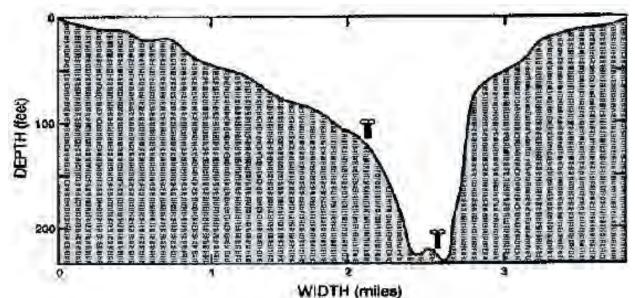


Figure 2.1: A cross section of Straits bathymetry in the Straits of Mackinac from the NOM Research Vessel Shenehon the currents meter is placed inside a spherical flotation collar above an acoustic release device and anchor<sup>1</sup>.

## 2.3 Current Velocity

A review of published data indicates that Current in the Straits tend to reverse direction between eastward and westward flowing. Historical data on current velocity was found within 10 cm/s (0.32 ft/s) in 1976 as shown in Figure 2.2 below.

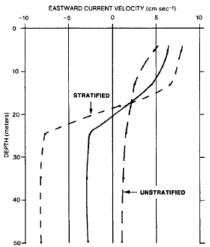


Figure 2.2: Vertical Profiles of Eastward Current Velocity. Solid Line is the Average for the Entire Recording Interval<sup>2</sup>.





Current velocity was found within 60 cm/s (2 ft/s) in 1990 as shown below in Figure 2.3.

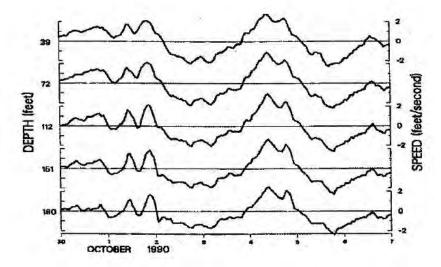


Figure 2.3: The east-directed component of current velocity through the Straits from Sept. 30 through Oct.
 8, 1990. Positive speeds (above the horizontal axis) are east-directed currents, negative speeds are west-directed. Five measurement levels are shown, with the depth below the water surface for each level shown at the left of the recordings<sup>1</sup>

# 2.4 Environment pH

In chemistry, pH is a scale used to define the relative acidity or alkalinity of an environment. It is defined as the negative logarithm of the hydrogen ion concentration. A review of historical data shows that pH in the area of interest has been found to be relatively uniform on the Lake Michigan transect and on those areas south of Bois Blanc Island where pH values range from 8.3 - 8.5 from east to west. East and north of Bois Blanc Island, surface pH values ranged from 8.10 - 8.3 with water from the Detour Passage having a pH about 8.1. Subsurface values for pH ranged as low as 7.8 at Station 37 north of Bois Blanc Island, but in general most values were not lower than 8.0<sup>3</sup>.

# 3 Formation of Calcium and Magnesium Carbonates

The beneficial role of calcareous deposit formations on coated and cathodically protected pipelines buried in soil has long been reported in the scientific literature. Calcium and magnesium carbonate form under cathodic and basic (Alkaline) conditions. When potentials are more electro positive than -1020 mV<sub>CSE</sub> the dominating reduction reaction is oxygen and water:

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

When potentials are more electro-negative than -1170  $mV_{CSE}$  the dominating reduction reaction is water hydrolysis:

$$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$$

In either case, hydroxyl ions are generated and increase the pH at the metal / electrolyte interface. As the pH increases, insoluble salts form through the following chemical reactions:





Calcium Carbonate:

$$OH^- + HCO_3^- \rightarrow CO_3^{2-} + H_2O$$
$$Ca^{2+} + CO_3^{2-} \rightarrow CaCO_3$$

Carbonate in natural water is present as a part of a pH-dependent buffer system within which the following components are in a state of dynamic equilibrium<sup>4</sup>:

 $CO_2gas \Rightarrow CO_2sol \Rightarrow H_2CO_3sol \Rightarrow HCO_3$ -sol  $\Rightarrow CO_3^2$ -sol  $\Rightarrow CO_3^2$ -sed

# Magnesium Carbonate:

 $OH^- + HCO_3^- \rightarrow CO_3^{2-} + H_2O$  $Mg^{2+} + CO_3^{2-} \rightarrow MgCO_3$ 

Another dominating chemical reaction taking place is magnesium hydroxide. This reaction is favored in solutions with a pH of 10 and higher.

# Magnesium Hydroxide:

 $Mg^{2+} + 2OH^{-} \rightarrow Mg(OH)_{2}$ 

# 4 <u>Calcareous Deposit Formation in Fresh Water</u>

As previously mentioned, much of the published scientific data is based upon seawater exposure conditions. In fresh and hard waters that contain higher concentrations of calcium and bicarbonate, the natural deposition of calcium carbonate on the steel surface provides an effective diffusion barrier to oxygen, greatly decreasing corrosion. In soft waters the corrosion rate is higher than in hard waters, but is still lower than theoretical maximum values because of the film formed on the surface and acts to some degree as a diffusion barrier<sup>5</sup>.

# 4.1 Langelier Saturation Index

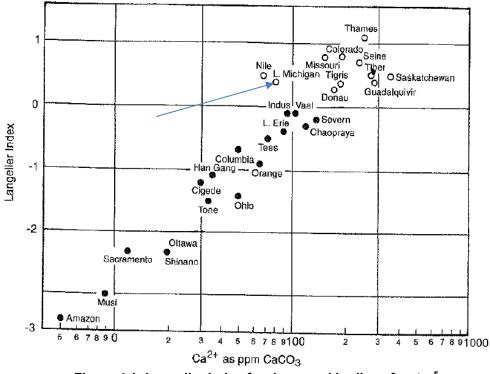
The Langelier Saturation Index is an equilibrium index utilizing thermodynamics to identify the degree of saturation of calcium carbonate in water. It is calculated by using the alkalinity, calcium concentration, total dissolved solids, pH, and water temperature. The Langelier saturation index approximates the base 10 logarithm of the calcite saturation level<sup>6</sup>.

A negative Langelier saturation index number indicates calcium carbonate formation is unfavorable. A positive number and an increasing number indicates they are favorable in formation. Lake Michigan was found to have a Langelier Index number of approximately 0.5, Figure 4.1.

As the pH increases at the metal / electrolyte interface due to the application of CP, the Langelier saturation index number will increase.









Key parameters in fresh water and sea water are shown in following Table 4.1<sup>7,8,9,10,11</sup>.

Table 4.1: Langelier Sat	uration Index for Fr	resh Water. Sea Wa	ter and Great Lakes
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Key Parameters	Fresh Water	Sea Water	Great Lakes
Resistivity	100 ohm-meter	10 ohm-meter	33 ohm-meter
Ca <sup>2+</sup> concentration	1.3 x 10 <sup>-3</sup> M	1.0 x 10 <sup>-2</sup> M	0.9 x 10 <sup>-3</sup> M
Mg <sup>2+</sup> concentration	3.5 x 10⁻⁴ M	2.5 x 10 <sup>-3</sup> M	0.47 x 10 <sup>-3</sup> M
CO <sub>3</sub> <sup>2-</sup> concentration	2.8 x 10⁻⁵ M	1.7 x 10 <sup>-4</sup> M	1.1 x 10⁻⁵ M
HCO <sub>3</sub> <sup>-</sup> concentration	2.1 x 10 <sup>-3</sup> M	1.9 x 10 <sup>-3</sup> M	1.8 x 10 <sup>-3</sup> M
pH at cathodic protection metal surface	10.75 – 11.25	10.75 – 11.25	10.75 – 11.25
K (CaCO3) Solubility Constant at 20 °C	3.8 x 10 <sup>-9</sup>	3.8 x 10 <sup>-9</sup>	3.8 x 10⁻ <sup>9</sup>
K (Mg(OH)2) Solubility Constant at 20 °C	6 x 10 <sup>-10</sup>	6 x 10 <sup>-10</sup>	6 x 10 <sup>-10</sup>
Temperature	20 °C	20 °C	20 °C
Langelier Saturation Index	1.1	1.8	0.8



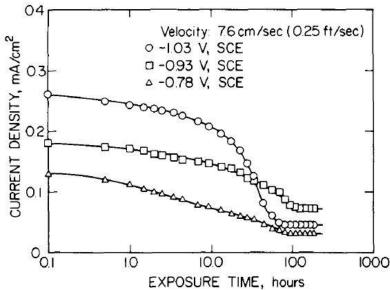


Based on the concentrations of Ca<sup>2+</sup>, Mg<sup>2+</sup>, and CO<sub>3</sub><sup>2-</sup>, pH, and solubility constants shown in Table 4.1, for pipelines with cathodic protection, calcareous deposits would thermodynamically be formed on the metal surface equally well in both fresh water and sea water. So, the chemistry difference between sea water and fresh water <u>won't adversely affect</u> the formation of calcareous deposits from a thermodynamic perspective. The thermodynamic calculation is based on the solubility constant at 20 °C. Water temperature of the pipe was found to be in the range from 9.9 °C to 16.7 °C during the coating inspection between August 24<sup>th</sup>, 2017 and August 30<sup>th</sup>, 2017. The Solubility of calcareous deposits also decreases with decreasing temperature, which results in a greater opportunity for calcareous deposits to form on the pipe. Therefore, from a thermodynamic perspective, the water temperature around pipe is not detrimental to the formation of calcareous deposits.

Based on the foregoing analysis, it can be reasonably concluded that the differences between fresh water and seawater are insignificant when compared to factors, such as velocity, temperature, time, and, metal surface pH as they affect the formation and properties of calcareous deposits. Therefore these critical factors on calcareous deposit formation in fresh water can reasonably be extrapolated by the seawater results.

## 5 <u>Critical Factors That Affect the Formation and Properties of Calcareous Deposits</u>

The formation and properties of calcareous deposits on metal surfaces are affected by variables such as cathodic potential, cathodic current densities, time, temperature, pressure, pH, chemistry, velocity, and substrate surface condition. Available published data have been reviewed and analyzed in support of this study in an effort to predict the impact of environmental and operating characteristics on the formation of calcareous deposits.



#### 5.1 Cathodic potential/Cathodic current density

Figure 5.1: Decrease in current density for steel specimens cathodically polarized in seawater with time<sup>8</sup>

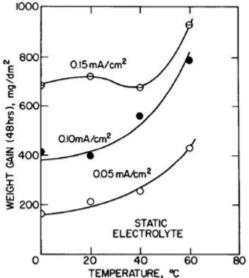




From a review of the data presented in Figure 5.1 the following conclusion are applicable:

- The current density reduction in Figure 5.1 is attributed to build up of calcareous deposits on the metal surface. It indicates that the formation of calcareous deposits restricts oxygen access to a steel surface.
- At the cathodic potential of -1.03 V<sub>SCE</sub> in Figure 5.1, the current density has a significant drop indicating the calcareous deposits formed at lower potential likely have better corrosion protection to the metal substrate.

## 5.2 Temperature/Pressure



# Figure 5.2: Weight gain (attributed to calcareous deposits) as a function of temperature and current densities<sup>8</sup>

- The fact that scaling occurs more rapidly at higher temperatures is well established as shown in Figure 5.2. The above data indicates that calcareous deposits form more readily on metal surfaces in warm waters than in cold, but as previously mentioned, thermodynamics are favorable for the formation of calcareous deposits in the Line 5 environment.
- Pressure as one factor influences the degree of saturation for various inorganic compounds in the calcareous deposits. The solubility of calcareous deposits increases with the water depth increasing, implying that a greater pH shift in the vicinity of the metal/electrolyte interface (higher cathodic current) may be necessary to form a given amount of calcareous deposits at greater depths than near the surface.

# 5.3 pH

- A Calcareous deposit is a complex compound of CaCO<sub>3</sub>, MgCO<sub>3</sub>, and Mg(OH)<sub>2</sub>. Each has a critical pH value for precipitation. CaCO<sub>3</sub> precipitates when the pH exceeds 8.1. MgCO<sub>3</sub> precipitates when pH exceeds approximately 8.5. Mg(OH)<sub>2</sub> precipitates when pH exceeds 9.5<sup>8</sup>.
- Calcareous deposits form under alkaline environments which is the case for the electrolyte adjacent to a cathodically polarized metal surface. Hartt<sup>8</sup> calculated the pH at the surface of cathodically protected steel in seawater would be ranging from 10.75 to 11.25. This pH range covers the pH threshold of calcareous deposit formation.





• From the following pH-E diagram of steel in Figure 5.3, in the pH range from 10 to 12 at the potential lower than -0.85 V<sub>CSE</sub>, the corrosion is suppressed. From the relationship between corrosion rate and pH in Figure 5.4, in the pH range from 10 to 12, the corrosion rate of Iron is less than 8 mils/year.

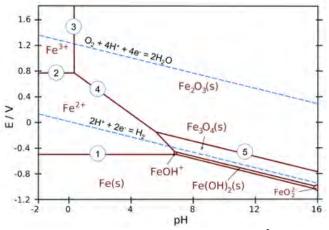


Figure 5.3: Iron Pourbaix Diagram<sup>9</sup>

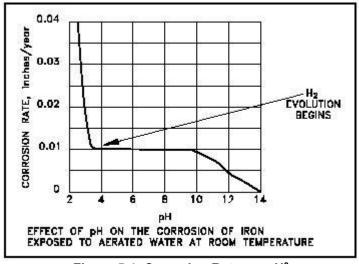


Figure 5.4: Corrosion Rate vs. pH<sup>9</sup>

# 5.4 Velocity

- Increasing relative motion between a metal and an electrolyte typically leads to enhanced reactant availability and more rapid dissipation of products. This is a consequence of reduced thickness of the diffusion barrier adjacent to the metal surface.
- The film thickness of calcareous deposits decreases with increasing velocity, even though films formed in moving water may have better inherent properties than ones deposited under quiescent circumstances.





## 5.5 Time

- The thickness of calcareous deposits increases linearly with time even during a period when cathodic current density is applied without variation to maintain a constant potential. With increased time, the deposit film increases in thickness and it becomes harder for Ca<sup>2+</sup> and Mg<sup>2+</sup> to transport through the film to form new films and the growth of the deposit eventually stabilizes.
- The electrical resistance of calcareous deposits was measured to be increasing (in the range of 10 to 10<sup>4</sup> ohm-cm<sup>2</sup>) as a function of exposure duration during cathodic polarization in synthetic seawater.

# 6 Adhesion of Calcareous Deposits on Metal Surface

Adhesion of calcareous deposits has been studied focusing on the influence of exposure time, flow rate, and applied potential.

- Calcareous deposit formation involves 1) precipitation of an initial Mg-rich layer during the first minutes of exposure, 2) individual, isolated CaCO<sub>3</sub> particle formation prior to 2000 mins of polarization, 3) progressive CaCO<sub>3</sub> particle impingement within 2000 4000 mins, and 4) presence of a uniform CaCO<sub>3</sub> outer layer (time > 4000 mins).
- The current density versus time behavior that results from this precipitation involves 1) a current density decrease during the first minutes of exposure, 2) an upper plateau of approximately constant current density to about 2000 min, 3) a transition regime of current density decay (2000 4000 mins), 4) and a lower plateau of constant current density (time > 4000 mins).
- Deposit adhesion was judged to increase with duration of exposure at -900 mV<sub>SCE</sub> to approximately 4000 mins, beyond which it is constant.
- Deposit adhesion decreases with increasing flow rate, possibly reflecting a dependence of thickness upon flow rate.
- For low applied potential a relatively thick Mg-rich inner layer and dense CaCO<sub>3</sub> outer layer can be expected; and this may enhance the adhesion of deposits to the metal surface. However, at more negative potentials a cathodic reaction involving water dissociation and hydrogen reduction occurs, and this may compromise adhesion.

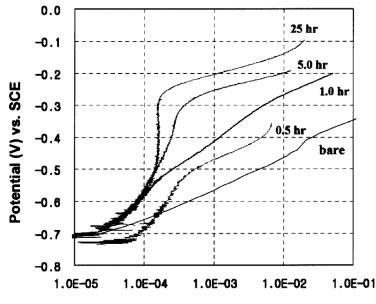
# 7 <u>Calcareous Deposit Corrosion Protection</u>

- As a results of applying cathodic protection, pH at the steel surface increase, and a protective deposits precipitate. This surface layer provides a physical barrier<sup>12</sup>.
- The calcareous deposit functions as an effective barrier to oxygen transport reducing the availability of oxygen at the pipe surface with a resultant decrease in corrosion rates.
- The formation of the calcareous deposit on the steel reduces the CP current demand due to its ability to reduce the oxygen transport to the steel surface, which leads to a low maintenance current<sup>13</sup>.





- Figure 7.1 shows the calcareous deposit coating over different immersion times. The longer immersion times resulted in a thicker calcareous deposit. Results show that passive region was increased, which indicated better corrosion resistance of the deposit<sup>14</sup>.
- Figure 7.2 shows different types of coating applied to the steel plates. Results show that no corrosion was found when the sample was coated with calcareous deposits, and was subjected to cathodic protection by a potentiostat at -1.0 V<sub>SCE</sub>, which simulated the effect of sacrificial anode placement<sup>14</sup>.



#### Current density (A/cm<sup>2</sup>)

Figure 7.1: Anodic Polarization curves of various coating deposited at 0.5 A/cm<sup>2</sup> for different times in seawater<sup>14</sup>.

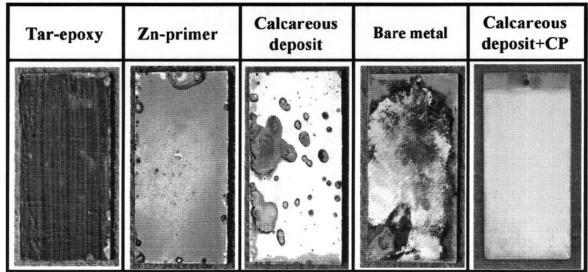


Figure 7.2: Comparison of corrosion resistance of calcareous coating with other conventional coatings, tested in 50°C seawater for 10 days<sup>14</sup>.

 
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### 8 <u>Cathodic Protection Current Density in Fresh Water and Seawater</u>

Cathodic current densities for pipe protection are shown in the following table for different environments including flowing seawater, flowing fresh water, and stationary fresh water. It should be noted that the desired cathodic current density would be lower than the values in Table 8.1, as the calcareous deposit forms<sup>15</sup>.

Reference	Environment	Desired Current Density (mA/m <sup>2</sup> )	Desired Current Density (mA/ft <sup>2</sup> )
Shirer's Corrosion Control <sup>15</sup>	Flowing seawater	300	27.87
	Air-saturated hot water	100-150	9.29-13.94
	Flowing fresh water	50-100	4.65-9.29
NACE CP3 Manual <sup>16</sup>	Seawater	32.3-161.4	3.0-15.0
	Hot water	32.3-161.4	3.0-15.0
	Flowing fresh water	32.3-64.6	3.0-6.0
Air Force Manual AFM 88-9 <sup>17</sup>	Flowing seawater	32.3-100.8	3.0-10.0
	Stationary fresh water	10.8 - 64.6	1.0-6.0

 Table 8.1: Desired Cathodic Current Density in Both Fresh Water and Sea Water

The data show that the cathodic current density required to achieve protection in fresh water is lower than that required in seawater.

#### 9 Review of Cathodic Protection on Line 5

In an effort to study the effectiveness of the existing cathodic protection systems in maintaining a level of protection consistent with the formation of protective calcareous deposits, data was reviewed from 3 CP surveys and a CPCM ILI Tool run. The data reviewed spanned the period of 2003 – 2017. A summary of the review of available cathodic protection survey data is as follows:

# 2003 Hanson Survey

- Mackinac Straits CP testing Performed on 9/10/2003
- 18,460 ft. surveyed for the West Line
- 18,170 ft. surveyed for the East Line
- 100% of pipe length meeting -850 mV OFF potential for both East and West Lines.
- Average "ON" pipe to soil readings are over -2000 mV for both East and West Lines.
- Average "OFF" pipe to soil readings are over -1100 mV for both East and West Lines.

#### 2016 Lake Superior Consulting

• Line 5 annual CP survey performed on 10/21/2016





- From MP 1099 in Superior, WI to MP 1544 near Lewiston, MI
- Approximately 659 test points were surveyed within the region, including test stations, foreign line crossing bonds, rectifiers, transitions within pumping stations and valve enclosures.
- The P/S readings at Mackinac are shown in Table 9.1.

ROW Code and Pipe	MP & Location description	Structure P/S	Structure P/S IRF
5_1480 Mackinac	1479.566 [IR Drop TS E 20"]	-4.342	-1.069
5_1480 Mackinac	1479.568 [Station Sump Tank]	-4.868	-1.090
5_1480 Mackinac	1479.575 [5-20" Pipe West Transition]	-4.621	-1.149
5_1480 Mackinac	1479.576 [5-20" Pipe East Transition]	-1.641	-1.021
5_1480 Mackinac	1479.577 [5-20" Pipe Off 5-SSV-1]	-1.223	-0.858
5_1480 Mackinac	1479.578 [5-30" Pipe Off 5-CSV-11]	-4.324	-1.124
5_1480 Mackinac	1479.579 [5-30" Pipe South Transition]	-1.853	-0.969

# Table 9.1: Historic Pipe to Soil Readings at Mackinac

# 2017 Lake Superior Consulting

- Mackinac Straits CP testing Performed on 10/31/2017
- Performed CIS with all current sources and temporary bonds interrupted. The lowest IR-Free P/S potential encountered during testing was -1.106 VDC.
- Performed current requirement testing with the temporary bonds removed. The measured current exceeded the current required for achieving 100 mV DC of polarization, indicating that existing CP systems are adequate and functional.





	West Leg	East Leg
Current required for 100 mV of polarization	1.3 A DC	1.74 A DC
Current to Span under Normal Operating Conditions	2.49 A DC	2.47 A DC
Average CIS P/S Potential (North Side)	-1.284 V DC	-1.280 V DC
Average CIS P/S Potential (South Side)	-1.242 V DC	-1.202 V DC
Lowest P/S Potential (North Side)	-1.151 V DC	-1.236 V DC
Lowest P/S Potential (South Side)	-1.129 V DC	-1.106 V DC

### Table 9.2: Summary Results from Lake Superior Consulting

# 2016 Cathodic Protection Current Measurement (CPCM)

- Performed on 9/27/2016
- Vendor Baker Hughes
- 21,806 ft. for West Line:
  - Based on the amount of DC current and the DC current density on the line it appears the line has an excellent coating system.
  - The line has a coal tar coating and it is not unusual to have low CP current density and low total CP current.
  - There is noise in the CPCM data caused by speed variations, contact quality and pipe roughness and since the CP current is very low the noise level is a significant factor in data analysis.
- 21,875 ft for East Line:
  - Based on the amount of DC current and the DC current density on the line it appears the line has an excellent coating system.
  - There is very little total CP current on this line. However, since the line has good coating it is not unusual to have very low CP current density and very low total CP current flow.

Based on the data reviewed, the CP systems associated with the Line 5 Pipeline are operating effectively and the results indicate that industry recognized criteria are being met at the locations tested. It is expected that maintaining effective CP will promote the development, retention, and maintenance of protective calcareous films at existing coating flaws.

# 10 Review of Line 5 ILI Data

In an effort to study the available corrosion history of Line 5, a review of ILI data was performed with specific attention to external metal loss corrosion. A summary of available In-Line Inspection data is as follows:





# 10.1 Enbridge Line 5: 20" Straits of Mackinac – East Pipe

## 2013 GE MFL Inspection

- Ran on 8/28/2013
- Vendor PII Pipeline Solutions
- Tool Type MagneScan MFL 3
- Technology MFL
- 21,742 feet
- 71 External Manufacturing Defects
- 61 Internal Manufacturing Defects
- 9 Internal Metal Loss Anomalies
- 0 External Metal Loss Anomalies

## 2017 BH MFL Inspection

- Ran on 4/12/2017
- Vendor Baker Hughes
- Technology MFL
- 21,648 feet
- 41 Internal Manufactured/Pipe Mill Anomalies
- No Metal Loss Anomalies

#### 10.2 Enbridge Line 5: 20" Straits of Mackinac – West Pipe

#### 2013 GE MFL Inspection

- Ran on 8/27/2013
- Vendor PII Pipeline Solutions
- Tool Type MagneScan MFL 3
- Technology MFL
- 21,816 feet
- 194 External Manufacturing Defects
- 100 Internal Manufacturing Defects
- No Metal Loss Anomalies

#### 2017 BH MFL Inspection

- Ran on 4/11/2017
- Vendor Baker Hughes
- Technology MFL
- 21,648 feet
- 24 Internal Manufactured/Pipe Mill Anomalies
- 2 Deformations
- No Metal Loss Anomalies

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Based on the data reviewed and the absence of any external metal loss anomalies in the Line 5 Straits Crossing, the combination of the quality of the protective coating and effective cathodic protection is effective in controlling corrosion and there is no technical basis to support removal of calcareous deposits and inspecting/repairing the underlying coating or inspecting the underlying pipe.

## 11 <u>Summary of Findings</u>

The information reviewed and analyzed to date indicates that the presence of calcareous deposits observed at coating flaws on Line 5 are a beneficial result of an effective external protective coating system and an effective cathodic protection system. The formation of calcium carbonate and magnesium carbonate at coating flaws results from the application of cathodic protection and serves to protect the underlying steel from corrosion at the elevated pH values consistent with the formation and adhesion of the deposits. Corrosion rates for carbon steel are significantly reduced at pH values associated with the application of effective CP and the development of calcium and magnesium carbonate at the pipe surface. This is further substantiated through the In-Line-Inspection (ILI) results which indicate no external metal loss anomalies in Line 5.

There is no technical basis for removal the calcareous deposits to affect repairs to underlying coating holidays. The pipeline is not currently experiencing external corrosion issues and to remove the deposits may introduced unintended consequences that may adversely alter the current state of effective corrosion protection afforded Line 5. The retention of the calcareous deposits does not increase the risk of corrosion on Line 5.

#### 12 **Bibliography**

<sup>9</sup> Online source.



<sup>&</sup>lt;sup>1</sup> Current flow through the Straits of Mackinac by James Saylor et al.

<sup>&</sup>lt;sup>2</sup> Water Volume Transport and Oscillatory Current Flow through the Straits of Mackinac by James Saylor et al.

<sup>&</sup>lt;sup>3</sup> Biological, chemical and physical relationships in the Straits of Mackinac by Environmental Research Laboratory (Duluth, Minn.), University of Michigan. Great Lakes Research Division

<sup>&</sup>lt;sup>4</sup> The Biology of Blue-Green Algae by N.G. Carr and B.A. Whitton

<sup>&</sup>lt;sup>5</sup> Uhlig's Corrosion Handbook. 3<sup>rd</sup> Ed. Chapter 44. Carbon Steel – Corrosion in Freshwaters. P 589-590

<sup>&</sup>lt;sup>6</sup> Corrosion-doctors.org. Accessed on November 1<sup>st</sup>, 2017.

<sup>&</sup>lt;sup>7</sup> A Study of Calcareous Deposits on Cathodically Protected Mild Steel in Artificial Seawater by Yuanfeng Yang et al.

<sup>&</sup>lt;sup>8</sup> Calcareous Deposits on Metal Surfaces in Seawater – A Critical Review by William H. Hartt et al.

<sup>&</sup>lt;sup>10</sup> Long-term trends of Great Lakes major ion chemistry by Steven Chapra et al.

<sup>&</sup>lt;sup>11</sup> National Water Summary 1990-91, Hydrologic Events and Stream Water Quality

<sup>&</sup>lt;sup>12</sup> Characteristics of Cathodic Protection And Calcareous Deposits For Type 316L Stainless Steel In Simulated Deep Sea Condition by Ki-Joon Kim and William H Hartt.

<sup>&</sup>lt;sup>13</sup> CP in Deep Water: The Importance of Calcareous Deposits and The Environmental Conditions by K.P. Fischer et al.

<sup>&</sup>lt;sup>14</sup> Evaluation of Technical Feasibility on Applying Calcareous Deposit Coatings to Ship Ballast Tanks by K.K Baek et al.

<sup>&</sup>lt;sup>15</sup> Chapter 10 Corrosion Control Vol. 2; Newness-John Wiley & Sons, by Shirer L. et al.

<sup>&</sup>lt;sup>16</sup> NACE CP3 Manual.

<sup>&</sup>lt;sup>17</sup> Air Force Manual AFM 88-9, Corrosion Control Chapter 4, p203.