

May 10, 2017

Windlectric Inc.  
354 Davis Road, Suite 100  
Oakville, ON  
L6J 2X1  
P: 905-465-4500

Attention: Mr. Ariel Bautista

**Subject: Amherst Island Wind Project  
Culvert Protection Measures**

Dear Mr. Bautista:

Pennecon Heavy Civil Ltd. (PHCL) is writing this letter to inform Windlectric Inc. (Owner) of the preventative measures that will be taken to ensure the integrity of the culverts of the municipal roads on Amherst Island will not be compromised in any way. These preventative measures are in response to the Culvert Inspection and Summary Report produced by Stantec on May 4, 2017.

The aforementioned report indicates there is one box concrete culvert and eleven corrugated steel pipe (CSP) culverts that are recommended to be replaced. PHCL proposes to use steel plates spanning the width of the road above each of the identified culverts. The steel plates will reduce any applied load on the culverts that is caused by transporting heavy equipment or materials over the roadway.

Should you have any questions, please do not hesitate to contact the undersigned.

Sincerely,



Trevor Dwyer, P. Eng.  
Project Engineer  
Pennecon Heavy Civil Ltd.

Cc: Kevin Mouland, Lucas Evans, Tiffany Mclean-Campbell



**Stantec Consulting Ltd.**  
100-300 Hagey Boulevard  
Waterloo ON N2L 0A4  
Tel: (519) 579-4410

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May 4, 2017  
File:

Pennecon Heavy Civil  
1309 Topsoil Road  
St. John's, NL A1B 3N4

**Attention: Mr. Trevor Dwyer, P.Eng**

Dear Mr. Dwyer:

**Reference: Culvert Inspection and Summary Report**  
**Project ID #1421 Amherst Island Wind Farm – Culvert Inspection, Collection System on the Island**

We are pleased to submit herewith the Culvert Inspection, Condition Analysis and Recommendations and Summary for the above-mentioned project.

The roadway crossing culverts within the project area have been inspected. Within the project limits there are a total of ninety-eight crossing culverts inspected. Of these ninety-eight crossing culverts, there are two box concrete culverts, three concrete/CSP split culverts and ninety-three corrugated steel pipe (CSP) culverts. The Purpose of the inspection was to field review/inspect each culvert on the island that would be used for the transportation of and the delivery of the windmill parts and equipment for the proposed Wind Farm project. The intent of the inspection was to review the existing culverts, assess their condition and provide a recommendation for the replacement of any culvert that may not withstand the proposed weight of the delivery vehicles with the Wind Farm materials or equipment.

**Culvert Condition:**

On March 13, 2017 and March 14, 2017, a detailed field review of existing roadway crossing culverts was carried out. For the major roadway crossing culverts, #4, 41, 66, and 82, an individual inspection sheet was completed and has been included with this report. Please see the attached.

All of the culverts inspected varied from poor to good condition, but for some culverts the access was not available due to plugged pipes or we could not locate the culvert. The attached Culvert Inspection Form details the culvert inspection condition and our recommendations.

**Culvert Size:**

The CSP culvert sizes vary from 300mm to 1000mm, including some elliptical CSP's. Stantec's recommendations and condition assessment is captured in the attached Culvert Inspection Form.

For the concrete box culverts, Culvert #41 size is a 2500mm x 1250mm that was in poor condition with sever cracking and wall separation. Culvert #82 size is a 2500mm x 1500mm that was in good condition with the roof slab observed to be dry and free of moisture and the retaining walls are plumb, free of any sag or bowness.

May 4, 2017  
Mr. Trevor Dwyer, P.Eng  
Page 2 of 2

**Reference: Culvert Inspection and Summary Report**  
**Project ID #1421 Amherst Island Wind Farm – Culvert Inspection, Collection System on the Island**

**Summary:**

Based on the existing condition and size of the CSP and box concrete crossing culverts, it is our recommendation that 11 of the CSP, and 1 of the 2 box concrete crossing culverts are recommended to be replaced. Another 10 of the CSP's require an owner decision for replacement based on type of weight/loading that will be placed on them. The remaining concrete culverts are recommended to remain.

Should you have any questions, or require additional information, please do not hesitate to contact me.

Sincerely,

**STANTEC CONSULTING LTD.**



Peter Bright,  
Project Manager  
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Attachment:

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## AMHERST ISLAND WIND FARM CULVERT INSPECTION FORM

Contract Culvert Number	Top Surface type	Station	Location	Drawing No.	Culvert (mm)	Culvert Type	Existing Headwall	Culvert Condition	Clean Out Required	Guiderail		Extension Required	Culvert Inspection and Evaluation Recommendations
										Present	Future		
<b>SOUTH SHORE ROAD</b>													
1	Gravel	0+145	Township Road	MR200	400	CSP	NO	Generally in good condition, no signs of corrosion	no	no	no	no	Culvert is in good condition
2	Gravel	0+465	Township Road	MR201	400	CONCRETE JOINT PIPE	NO	Pipe is in poor condition due to pipe collapse	no	no	no	yes	Remove and replace culvert
3	Gravel	0+535	Township Road	MR201	300	CSP	NO	Pipe is in fair - poor condition. Inlet and outlet ends are slightly damaged.	yes	no	no	no	Corrosion occurring on bottom 20% of culvert. Outlet end is plugged. Replace prior to heavy traffic loading
4	Gravel	0+685	Township Road	MR202	1200 CSP, JOINED TO 1000 X 1200 CONC. CULVERT	CSP	YES	Concrete culvert is in poor condition. CSP Inlet has sluice gate and minor headwalls. Outlet has failing headwalls and concrete is unsound and wide tracking and separation. Inlet CSP was added to rectangular 1.2m x 1.0m existing concrete culvert.	no	no	no	no	Replace with box culvert or larger than original sectional area pipe to accommodate upstream private spring fed pond
5	Gravel	0+880	Township Road	MR202	450	CSP	NO	Culvert in good - fair condition. Minor rusting in small area at inlet end.	no	no	no	no	Leave culvert in place
6	Gravel	1+035	Township Road	MR203	450	CSP	NO	Fair - poor condition. Corrosion throughout pipe. Less than 300mm cover on pipe.	no	no	no	no	Replace culvert prior to heavy traffic loads
7	Gravel	1+085	Township Road	MR203	350	CSP	NO	Fair condition. Light to medium rusting throughout pipe. Outlet plugged	YES	no	no	no	Replace culvert prior to heavy traffic loads
8	Gravel	1+145	Township Road	MR203	350	CSP	NO	Fair condition. Light to medium rusting throughout pipe. Inlet and Outlet damaged.	no	no	no	no	Leave culvert in place, but note damage to inlet and outlet, prior to heavy traffic loading
9	Gravel	1+295	Township Road	MR204	400	CSP	NO	Fair - poor condition. Corrosion throughout pipe. Less than 300mm cover on pipe.	no	no	no	no	Replace culvert prior to heavy traffic loads
10	Gravel	1+465	Township Road	MR204	600	CSP	NO	Fair - good condition. Rust forming on bottom of pipe.	no	no	no	no	Leave in place
11	Gravel	1+645	Township Road	MR205	450	CSP	NO	Good condition.	no	no	no	no	Leave in place
12	Gravel	1+690	Township Road	MR205	450	CSP	NO	Fair condition due to medium rusting on pipe. Pipe damage at inlet end of pipe.	no	no	no	no	Leave in place
13	Gravel	1+885	Township Road	MR206	400	CSP	NO	Good condition. Less than 300mm cover on pipe.	no	no	no	no	Leave in place
14	Gravel	2+010	Township Road	MR206	450	CSP	NO	Good - fair condition. Light rusting on bottom of pipe.	no	no	no	no	Leave in place
15	Gravel	2+115	Township Road	MR207	400	CSP	NO	Fair condition. Light corrosion on 20% of pipe.	no	no	no	no	Replace culvert prior to heavy traffic loads
16	Gravel	2+180	Township Road	MR207	300	CSP	NO	Good condition, requires 300mm cover on pipe.	no	no	no	no	Leave in place
17	Gravel	2+200	Township Road	MR207	300	CSP	NO	Good condition, cracking in gravel noted. Less than 300mm cover provided.	no	no	no	no	Leave in place
18	Gravel	2+305	Township Road	MR207	400	CSP	NO	Good condition, cracking in gravel noted. Less than 300mm cover provided.	no	no	no	no	Leave in place
19	Gravel	2+505	Township Road	MR208	400	CSP	NO	Fair condition, rusting on the bottom 10% of pipe	no	no	no	no	Leave in place
20	Gravel	2+805	Township Road	MR209	400	CSP	NO	Good condition	no	no	no	no	Leave in place
21	Gravel	2+858	Township Road	MR209	400	CSP	NO	Fair condition, light corrosion on the 50% of pipe	no	no	no	no	Leave in place, but monitor since pipe may buckle under constant heavy loads
22	Gravel	2+940	Township Road	MR209	400	CSP	NO	Fair condition, light rust staining on 10% of pipe	no	no	no	no	Leave in place
23	Gravel	3+085	Township Road	MR210	400	CSP	NO	Fair condition, damage on outlet end of pipe, 10% rust staining on bottom of pipe	no	no	no	no	Leave in place
24	Gravel	3+165	Township Road	MR210	400	CSP	NO	Fair condition, moderate rusting on 20% of pipe. Less than 300mm of cover on pipe.	no	no	no	no	Leave in place
25	Gravel	3+245	Township Road	MR210	400	CSP	NO	Good condition. Less than 300mm cover	no	no	no	no	Leave in place
26	Gravel	3+418	Township Road	MR211	400	CSP	NO	Good condition. Approximately 300mm cover on pipe	no	no	no	no	Leave in place
27	Gravel	3+555	Township Road	MR211	400	CSP	NO	Good condition. Approximately 300mm cover on pipe	no	no	no	no	Leave in place
28	Gravel	3+810	Township Road	MR212	400	CSP	NO	Good condition. Minor rust staining.	no	no	no	yes	Leave in place
29	Gravel	4+010	Township Road	MR213	400	CSP / CONCRETE	NO	Good condition. Inlet end is CSP. Outlet end has concrete pipe. Appears to be 50/50 split with Concrete Pipe and CSP. Concrete pipe is disjointed and undulating.	no	no	no	yes	Replace concrete pipe portion of culvert, with CSP
30	Gravel	4+160	Township Road	MR213	400	CSP	NO	Fair condition - light rusting inside pipe. Less than 300mm cover on pipe.	no	no	no	no	Leave in place
31	Gravel		Township Road	MR213	COULD NOT LOCATE	CSP	NO	NO COMMENTS	no	no	no	yes	No comment
<b>LOWER FORTY FOOT ROAD</b>													
32	Gravel	4+545	Township Road	MR215	300	Concrete / CSP	NO	Area saturated and overgrowth - could not access. Less than 300mm cover	no	no	no	no	No comment
33	Gravel	5+318	Township Road	MR217	600	CSP	NO	Good condition	no	no	no	no	Leave in place
34	Gravel	5+320	Township Road	MR217	600, bolted connection	CSP	NO	Fair condition, 40% rusting present throughout pipe	no	no	no	no	Leave in place. Increase cover during heavy traffic loads
35	Gravel	5+455	Township Road	MR218	450	CSP	NO	Fair condition, 30% corrosion present inside of pipe. Damage / failure of approx. 2m in from west end and 3m from east end.	no	no	no	yes	Replace prior to heavy traffic loading
36	Gravel	5+780	Township Road	MR219	800	CSP	NO	Fair condition. Moderate rusting on 30% of pipe. Frozen water through pipe, unable to fully assess.	no	no	no	no	Replace prior to heavy traffic loading
37	Gravel	5+785	Township Road	MR219	500	CSP	NO	Good condition. Lime staining on obverts of pipe.	no	no	no	no	Leave in place
38	Gravel	6+090	Township Road	MR220	600	CSP	NO	Good condition. Moderate corrosion on 30% of pipe. Less than 300mm of cover provided.	no	no	no	no	Leave in place, but monitor since pipe may buckle under constant heavy loads
<b>FRONT ROAD</b>													
39A	Gravel	6+260	Township Road	NOT ON DRAWING	450	CSP	NO	Good condition. Damage at Inlet and Outlet ends, but pipe is generally in good condition	no	no	no	no	Leave in place
39B	Gravel	6+264	Township Road	MR220	400	CSP	NO	Fair condition. Moderate rusting at outlet end of pipe. Damage at Inlet and Outlet ends of pipe. Leaking at springline of pipe.	no	no	no	no	Replace pipe
40	Gravel	15+480	Township Road	MR239	600	CSP	NO	Good condition at outlet end. Could not access inlet end due to tree obstruction and skew angle of driveway.	no	no	no	no	Leave in place
41	Gravel	15+945	Township Road	MR240	2500 x 1250	CONCRETE BOX CULVERT	NO	Poor condition. Severe diagonal cracking, full height, east wall, 1.35m from north end and 3.0m from south end of culvert. Wall to slab separation east wall for 5.2m from east wall. Gap separation is 25mm. Severe cracking for 1 meter on West wall. Broken slab on North east corner.	no	no	no	no	Replace
42	Gravel		Township Road		COULD NOT LOCATE	CSP	NO	NO COMMENTS	no	no	no	no	NO COMMENTS
43	Gravel	15+095	Township Road	MR237	400	CSP	NO	Good condition. Slight damage at Inlet end of pipe.	no	no	no	no	Leave in place
44	Gravel	14+280	Township Road	MR235	300	CSP	NO	Good condition. - no photo, visual only.	no	no	no	no	Leave in place

**AMHERST ISLAND WIND FARM CULVERT INSPECTION FORM**

Contract Culvert Number	Top Surface type	Station	Location	Drawing No.	Culvert (mm)	Culvert Type	Existing Headwall	Culvert Condition	Clean Out Required	Guiderail		Extension Required	Culvert Inspection and Evaluation Recommendations
										Present	Future		
45	Gravel	N/A	Township Road		400	CSP	NO	Pipe plugged - could not access	yes	no	no	no	No comment
46	Gravel	15+988	Township Road	MR240	900 Elliptical	CSP	NO	Poor condition. Bottom of culvert disintegrated. Bolts rusted and disintegrated. Stone retaining walls on inlet and non - abutment end unable to sustain loading	no	no	no	no	Replace
47	Gravel		Township Road		COULD NOT LOCATE	CSP	NO	NO COMMENTS	no	no	no	no	NO COMMENTS
48A	Gravel	13+855	Township Road	MR233	500	CSP	NO	Good Condition	no	no	no	no	Leave in place
48B	Gravel	13+740	Township Road	MR233	400	CSP	NO	Good Condition	no	no	no	no	Leave in place
49	Gravel	13+558	Township Road	MR232	400	CSP	NO	Good Condition - Note, stone retaining walls nearby	no	no	no	no	Leave in place
50	Gravel	13+315	Township Road	MR232	600	CSP	NO	Good - fair condition - rust staining on 20% of pipe	no	no	no	no	Leave in place
51	Gravel	13+190	Township Road	MR231	750	CSP	NO	Good - fair condition - rust staining on 20% of pipe. Greater than 2.0 meters of cover.	no	no	no	no	Leave in place
52	Gravel	13+115	Township Road	MR231	ENDS WERE COMPLETELY PLUGGED. COULD NOT EVALUATE INSIDE OF PIPE	CSP	NO	NO COMMENTS	no	no	no	no	NO COMMENTS
53	Asphalt	11+890	Township Road	MR227	600	CSP	NO	Good condition. Less than 300mm cover on roadway	no	no	no	no	Leave in place
54	Asphalt	11+665	Township Road	MR226	400	CSP	NO	Good condition.	no	no	no	no	Leave in place
55	Asphalt	11+540	Township Road	MR226	400	CSP	NO	Unable to see inside pipe. Ends are crushed. Less than 300mm cover provided.	yes	no	no	no	No comment
56	Asphalt	11+170	Township Road	MR224	1600 x 1000 Elliptical	CSP	NO	Fair condition. Moderate corrosion on 40% of pipe. Greater than 600mm cover.	no	no	no	no	Replace
57	Asphalt	10+935	Township Road	MR224	400	CSP	NO	Good condition. Less than 300mm cover provided.	no	no	no	no	Leave in place
58	Asphalt	10+720	Township Road	MR223	400	CSP	NO	Blocked. Assume the pipe defect is due to depression in asphalt, parallel to plane of culvert. Less than 300 cover provided.	yes	no	no	no	Replace
59	Asphalt	10+430	Township Road	MR222	600	CSP	NO	Good condition. Less than 300mm cover provided. Crack in pavement parallel to culvert plane. Slight damage on inlet end of pipe.	no	no	no	no	Leave in place
60	Asphalt	10+190	Township Road	MR221	1000	CSP	NO	Good condition. Light rust staining, 20%, below springline of pipe. Could not see below springline of pipe due to frozen water in pipe.	no	no	no	no	Leave in place
61	Asphalt	10+192	Township Road	MR221	1000	CSP	NO	Good - fair condition. Light to moderate rusting on 20% of pipe. Could not see below springline of pipe due to frozen water in pipe.	no	no	no	no	Leave in place
<b>CONCESSION ROAD 3</b>													
62	Gravel	30+610	Township Road	MR264	400	CSP	NO	Blocked. Unable to access.	no	no	no	no	No comment
63	Gravel	30+658	Township Road	MR264	400	CSP	NO	Inlet appeared to be in Fair condition. Unable to access Outlet end. CSP requires extensions to meet R.O.W. guidelines.	no	no	no	no	No comment
64	Gravel	30+845	Township Road	MR264	400	CSP	NO	Fair Condition. Partially blocked with overburden.	no	no	no	no	Leave in place
65	Gravel	31+670	Township Road	MR267	450	CSP	NO	Fair condition. 20% rust staining	no	no	no	no	Leave in place
66	Gravel	31+860	Township Road	MR268	30 x 2400 Elliptical Bolted p	CSP	NO	Good Condition. Concrete footings in good condition, no signs of any defects at this time. Roof portion of pipe is dry, no moisture present. Bolts tight with no moisture or rust present. No cracking or deformation of pipe shape present. Greater than 1200mm of cover.	no	no	no	no	Leave in place
67	Gravel	32+150	Township Road	MR269	400	CSP	NO	Good condition	no	no	no	no	Leave in place
68	Gravel	32+280	Township Road	MR269	500	CSP	NO	Good condition. Slight damage at Inlet end of pipe. Slight rusting at outlet end of pipe.	no	no	no	no	Leave in place
69	Gravel	32+490	Township Road	MR270	600	CSP	NO	Good condition.	yes	no	no	no	Leave in place
70	Gravel	32+740	Township Road	MR271	400	CSP	NO	Good condition. Rust staining along 10% of pipe	no	no	no	no	Leave in place
71	Gravel	33+095	Township Road	MR272	400	CSP	NO	Good condition	no	no	no	no	Leave in place
72	Gravel	33+285	Township Road	MR272	400	CSP	NO	Good condition	no	no	no	no	Leave in place
73	Gravel	33+618	Township Road	MR274	500	CSP	NO	Fair condition. Slight damage / obstruction at east end of pipe. Less than 300mm cover on pipe provided.	no	no	no	no	Leave in place, monitor flows during peak flow periods
74	Gravel	33+810	Township Road	MR274	400	CSP	NO	Good condition. Pipe has been extended using larger than 400mm pipe.	no	no	no	no	Leave in place
75	Gravel	34+065	Township Road	MR275	PLUGGED / END DAMAGED	CSP	NO	Ends were plugged, could not access. East end appears damaged	no	no	no	no	No comment
76	Gravel	34+170	Township Road	MR275	400	CSP	NO	Good condition. Less than 300mm cover provided.	no	no	no	no	Leave in place
77	Gravel	34+245	Township Road	MR276	400	CSP	NO	Good condition.	no	no	no	no	Leave in place
78	Gravel	34+959	Township Road	MR278	300	CSP	NO	Good condition	no	no	no	no	Leave in place
79	Gravel	34+790	Township Road	MR277	400	CSP	NO	Fair condition. Debris throughout culvert.	yes	no	no	no	Leave in place
80	Gravel	34+900	Township Road	MR278	400	CSP	NO	Good condition - fair. Rust staining on 25% of pipe	no	no	no	no	Leave in place
81	Gravel	35+020	Township Road	MR278	400	CSP	NO	Good - poor condition. 3/4 of pipe is good. Remainder is full of corrosion	no	no	no	no	Leave in place, but monitor since pipe may buckle under constant heavy loads
<b>STELLA 40 FOOT ROAD</b>													
82	Gravel	40+560	Township Road	MR281	2500 x 1500 Pre-cast Concrete Box Culvert	PRE CAST CONCRETE		Good condition. Pre-cast segment joints at west end are different in horizontal plane, but this appears to be a product of poor installation. Roof is a b is dry and free of moisture. Retaining walls are plumb and free of sag or bowing.	no	no	no	no	Leave in place
83	Gravel	40+125	Township Road	MR280	400	CSP	RETAIN.	Fair - poor condition. Corrosion on 50% of pipe.	no	no	no	no	Replace
84	Asphalt	40+845	Township Road	MR282	500	CSP	NO	Fair condition. Moderate corrosion on 30% of pipe. Cracking and depression in asphalt, parallel to CSP.	no	no	no	no	Replace
85	Asphalt	41+340	Township Road	MR284	550	CSP	NO	Fair condition. Moderate corrosion on 40% of pipe at east end.	no	no	no	no	Leave in place but monitor while heavy traffic loads cross culvert

**AMHERST ISLAND WIND FARM CULVERT INSPECTION FORM**

Contract Culvert Number	Top Surface type	Station	Location	Drawing No.	Culvert (mm)	Culvert Type	Existing Headwall	Culvert Condition	Clean Out Required	Guiderail		Extension Required	Culvert Inspection and Evaluation Recommendations
										Present	Future		
<b>CONCESSION ROAD 2</b>													
86	Gravel	25+510	Township Road	MR261	400	CSP	NO	Both ends of culvert covered or crushed. Could not evaluate	no	no	no	no	No comment
87		26+265	Township Road	Station number may be wrong, maybe 25+265 or 25+270	400	CSP	NO	Pipe full of frozen water and damage on west end of culvert. Could not evaluate	no	no	no	no	No comment
88		24+390	Township Road	MR257	600	CSP	NO	Fair - poor condition. Corrosion on 30% of pipe. Less than 300mm cover	no	no	no	no	Replace
89		24+388	Township Road	MR257	600	CSP	NO	Fair - poor condition. Corrosion on 30% of pipe. Less than 300mm cover	no	no	no	no	Replace
90		24+105	Township Road	MR256	450	CSP	NO	Poor condition. Corrosion throughout pipe.	no	no	no	yes	Replace
91		23+790	Township Road	MR255	300	CSP	NO	Good condition.	no	no	no	no	Leave in place
92		23+218	Township Road	MR253	400	CSP	NO	Good condition. Corrosion on 10% of pipe	no	no	no	no	Leave in place
N/A		22+845	N/A	MR252	COULD NOT LOCATE	N/A	N/A	NO COMMENT	N/A	N/A	N/A	N/A	NO COMMENT
N/A		22+850	N/A	MR252	COULD NOT LOCATE	N/A	N/A	NO COMMENT	N/A	N/A	N/A	N/A	NO COMMENT
93		22+425	Township Road	MR251	900	CSP	NO	Fair condition - 75% Rust condition at springline of pipe	no	no	no	no	Replace
N/A		21+420	N/A	MR247	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

# CONCRETE CULVERT INSPECTION

*Project ID # 1421 Amherst Island Wind Farm –  
Culvert Inspection Collection System on the Island.*

Culvert No.:	<u>4</u>	Inspected by:	Kevin Culligan
Culvert Location:	<u>0+685, 3850 SOUTH SHORE RD</u>	Date:	March 13, 2017
Skew:	<u>N/A</u>	Reviewed by:	
Type:	<u>1000 CSP Joined to 1000 x 1200 Concrete Culvert</u>	Date:	
Diameter / Width:	<u>1200</u>		
Height:	<u>1200</u>		
Wall / Slab Thickness:	<u>300</u>		
Length:	<u>9700mm</u>	Inlet Elevation:	<u>N/A</u>
Flow Direction:	<u>West to East.</u>	Outlet Elevation:	<u>N/A</u>

## OBSERVATIONS:

### Inlet:

- Spring fed pond empties into sluice gate opening at 1000mm CSP location
- 1200 diameter CSP pipe extends 3.0 meters into 1200 x 1200 deteriorated box culvert which empties into Lake Ontario.

### Outlet:

- Outlet has deteriorating, separated culvert walls and headwall. Flow of water is emptied into Lake Ontario. Walls are founded on bedrock.

### Culvert Condition:

- Concrete is unsound, cracked and deteriorating beyond any heavy vehicular traffic load.
- Severe cracking in walls and disintegration and lack of foundation supporting culvert walls.
- Leaking through WIDE cracks along pour lines of culvert barrel walls

### Drainage/Flow Condition:

- Culvert is substantially blocked with rip rap rock to prevent further erosion of the culvert wall bond.
- At time of inspection there was no flow through culvert. Due to the intentional blockage inside of culvert and sluice gates at the inlet end of the culvert, it would appear that neighboring interests prefer the amount of water capacity in the private pond. With this, the culvert appears to have been sized correctly for the nominal capacities.

### Recommendations:

- This culvert has experienced several structural defects and failures, especially if subject to future traffic overloading more consequential effects will be realized. Remove and replace existing concrete culvert with similar or larger sectional area structure or CSP.



**FACING NORTH**



**FACING SOUTH**





**INLET LOOKING WEST**



**OUTLET LOOKING EAST, CRACKING AND EROSION AT HEADWALL**



**EAST HEADWALL / SOUTH WALL, WEST ELEVATION,  
CRACKING AND SEPARATION OF HEADWALL**



**EAST HEADWALL / NORTH WALL, WEST ELEVATION  
CRACKING AND SEPARATION OF HEADWALL**



**NORTH WALL BASE, WEST ELEVATION  
EROSION AND LACK OF FOUNDATION BOND**



**WEST ELEVATION, CULVERT BARREL  
LEAKING OF WIDE CRACKS**



**SOUTHWEST ELEVATION  
SEPARATION OF HEADWALL AND DETERIORATED CONCRETE WALLS**

# CONCRETE CULVERT INSPECTION

*Project ID # 1421 Amherst Island Wind Farm –  
Culvert Inspection, Collection System on the Island.*

Culvert No.:	<u>41,</u>	Inspected by:	Kevin Culligan
Culvert Location:	<u>15+945, 780 FRONT ROAD</u>	Date:	March 13, 2017
Skew:	<u>N/A</u>	Reviewed by:	
Type:	<u>Concrete Box Culvert</u>	Date:	
Diameter / Width:	<u>1300mm</u>		
Height:	<u>1000mm</u>		
Wall / Slab Thickness:	<u>600mm</u>		
Length:	<u>6900mm</u>	Inlet Elevation:	<u>N/A</u>
Flow Direction:	<u>North to South</u>	Outlet Elevation:	<u>N/A</u>

## OBSERVATIONS:

### Inlet:

- Inlet is open and free of obstructions at time of inspection.
- Culvert Inlet walls are severely cracked and separation between wall and deck slab.

### Outlet:

- Outlet walls have major overgrowth and flow obstructions.
- Walls are separating from deck slab.

### Culvert Condition:

- Culvert is in poor condition. Severe diagonal cracking, full height along east wall, at 1.35m from North end of culvert.
- Wall to slab 25mm gap separation along east wall for 5.2 meters from east end of culvert.
- Severe cracking for 2.0 meters on West wall, around to Northwest wingwall.
- Broken slab on North East corner.
- Footings, if any were inaccessible at time of inspection

### Drainage/Flow Condition:

- At time of inspection flow was stagnant.

### Recommendations:

- This culvert has experienced several structural defects and failures, especially if subject to future traffic overloading more consequential effects will be realized. Remove and replace existing concrete culvert with similar or larger sectional area structure or CSP.



**LOOKING WEST ON FRONT ROAD**



**LOOKING EAST ON FRONT ROAD**



**SOUTH WEST ELEVATION, WEST WALL  
SEVERE CRACKING AND SEPARATION**



**EAST ELEVATION, EAST WALL  
SEVERE DIAGONAL CRACKING, NORTH CRACK**



**EAST ELEVATION, CULVERT BARREL**



**EAST WALL,  
SOUTH CRACK, AND WALL TO SLAB SEPARATION**





**EAST WALL, 25mm ROOF SLAB TO WALL SEPARATION**



**EAST ELEVATION, SOUTHEAST WALL  
DISINTEGRATION OF SMALL HEADWALL**



**WEST ELEVATION, SOUTHEAST WALL  
ROOF SLAB TO WALL SEPARTION,**

# ELLIPTICAL ARCH STEEL CULVERT INSPECTION

## *Project ID # 1421 Amherst Island Wind Farm – Culvert Inspection Collection System on the Island.*

Culvert No.:	<u>66</u>	Inspected by:	Kevin Culligan
Culvert Location:	<u>31+860, 3475 Concession Rd 3</u>	Date:	March 14, 2017
Skew:	<u>N/A</u>	Reviewed by:	
Type:	<u>CSP / CONCRETE FOOTING</u>	Date:	
Diameter / Width:	<u>5200mm</u>		
Height:	<u>2400mm</u>		
Wall / Slab Thickness:	<u>Concrete Footing – 760mm x 1200deep (assumed)</u>		
Length:	<u>23.8</u>	Inlet Elevation:	<u>N/A</u>
Flow Direction:	<u>West to East</u>	Outlet Elevation:	<u>N/A</u>

### **OBSERVATIONS:**

#### Inlet:

- Clear of obstructions, frozen at the time, but appears free flowing when thawed.

#### Outlet:

- Clear of obstructions, frozen at the time, but appears free flowing when thawed.

#### Pipe Condition:

- Pipe is in good condition. No defects observed. Culvert bolts are dry and free of rust. There are no signs of cracking or leaking of steel structure. There is minor vegetative staining along bottom 400mm of the culvert arch. The connecting arch plate to the concrete footing appears to be non-galvanized / welded steel plate. As such, there is a light rust staining along this steel plate connection. The culvert still appears to maintain its original arch shape which indicates that no deformation has occurred to date.
- Concrete footing free of defects. Two (2) Very narrow cracks < 0.2mm in width observed along south footing. These appear to be shrinkage cracks resulting from lack of concrete curing procedures at time of footing pour.

#### Drainage/Flow Condition:

- Drainage flow is from West to East. There are no obstructions and water staining on pipe would indicate that water flows at less than one quarter of pipe capacity.

#### Recommendations:

- There were no defects found during time of inspection and structure is in good condition. No repairs are required.



**LOOKING SOUTH**



**LOOKING NORTH**



**LOOKING WEST**



**LOOKING EAST**



**EAST ELEVATION**



**CULVERT BARREL SECTION**



**CONCRETE FOOTING AND CONNECTION POINTS**



**BOLTED CONNECTIONS**

# PRE-CAST CONCRETE CULVERT INSPECTION

*Project ID # 1421 Amherst Island Wind Farm –  
Culvert Inspection Collection System on the Island.*

Culvert No.:	<u>82</u>	Inspected by:	Kevin Culligan
Culvert Location:	<u>40+560,</u>	Date:	March 14, 2017
Skew:	<u>N/A</u>	Reviewed by:	
Type:	<u>Pre – cast concrete</u>	Date:	
Diameter / Width:	<u>2500mm</u>		
Height:	<u>1500mm</u>		
Wall / Slab Thickness:	<u>250mm Slab, 200 Wall</u>		
Length:	<u>15.0 meters</u>	Inlet Elevation:	<u>N/A</u>
Flow Direction:	<u>East to West (assumed)</u>	Outlet Elevation:	<u>N/A</u>

## **OBSERVATIONS:**

### Inlet:

- Some overgrowth and fence line appears to be impeding water flow.

### Outlet:

- Some overgrowth, flow appears to be ok.

### Culvert Condition:

- No defects present.
- Pre-cast roof slab sections at west end are differential in horizontal plane, but this appears to be a product of either improper orientation during installation or a manufacturing defect.
- There are no signs of settlement, cracking or deflection during inspection. Culvert faces were dry and no
- signs of leaking or moisture at joint locations.

### Drainage/Flow Condition:

- At time of inspection, culvert barrel was almost completely frozen. Water marks on pre-cast sections indicate water flow through culvert during high peak flow is approximately 40% of capacity.

### Recommendations:

- There were no defects found during time of inspection and structure is in good condition. No repairs are required.





**LOOKING SOUTH**



**LOOKING WEST**



**LOOKING EAST**



**EAST ELEVATION**



**WEST ELEVATION**



**SOUTH WEST END SECTION OF PRE-CAST CULVERT BARREL**



**SOUTHEAST END SECTION OF PRE-CAST CULVERT BARREL**



**SECTION THROUGH PRE-CAST CULVERT BARREL**