



**G.W.P. 3117-09-00**

**LAUZON PARKWAY IMPROVEMENTS  
CLASS ENVIRONMENTAL ASSESSMENT**

**FINAL  
STRUCTURAL CULVERT INSPECTION REPORT**



A member of  **MMM GROUP**

November 2013



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## 1.0 INTRODUCTION

The Ontario Ministry of Transportation, the City of Windsor and the County of Essex have initiated a Class Environmental Assessment Study to address the future requirements for Lauzon Parkway. The study includes the environmental assessment study and preliminary design for Lauzon Parkway from E.C. Row Expressway to Highway 3 as well as the environmental assessment study for County Road 42 from Walker Road to County Road 25 and a future east-west arterial from Walker Road to County Road 17. This study also includes the preparation and approval of the Sandwich South Secondary Plan.

Two structural culverts (spans greater than 3.0 m) were assessed within the study limits. This report identifies existing culvert conditions and provides recommendations for rehabilitation or replacement concurrent with the overall upgrade of Lauzon Parkway.

The findings of this culvert study are restricted to visual inspection, with references made to a previous Ontario Bridge Management System (OBMS) report generated in 2010 for one of the culverts (Sullivan Creek Drain (County) Culvert).

## 2.0 SITE INVESTIGATION AND VISUAL INSPECTION SUMMARY

Existing culvert conditions were visually inspected by MRC inspectors on August 4, 2011. The inspectors included Gideon Tjandra, P.Eng. and Connie Jia, E.I.T. Both are members of MRC's structural department.

The visual inspection was undertaken in accordance with the Ontario Structure Inspection Manual (OSIM) produced by the MTO (2000, revised April 2008). Recommendations are made in accordance with the Structure Rehabilitation Manual produced by the MTO (2007).

A key plan of both culverts is included in Appendix A. Inspection photographs are appended in Appendix B (Sullivan Creek Drain (County) Culvert) and Appendix C (McGill Drain (City) Culvert). Photographs are referenced throughout the report with prefix "B" and "C", for photographs included in Appendix B and Appendix C respectively.

### Sullivan Creek Drain (County) Culvert

General information of the Sullivan Creek Drain (County) Culvert is provided in the table below.

<b>Site No.</b>	C-17-00
<b>Structure Type</b>	Concrete non-rigid frame culvert (footing type is unknown)
<b>GPS Coordinates</b>	42.232192,-82.914615
<b>Span (m)</b>	3.8 m

<b>Height (m)</b>	Unknown (1.4 m was measured from the soffit to the top of existing sediment)
<b>Length (m)</b>	20.7 m
<b>Cover (m)</b>	0.200 m (varies, approximately 0.2 m maximum)

Observations made during the visual inspection are summarized as follows:

- The culvert runs in the east to west direction on a 45 degree skew to 10<sup>th</sup> Concession Road (see key plan in Appendix A);
- Two (2) through traffic lanes are carried by the culvert (northbound and southbound direction); gravel shoulders exist on each side of the roadway (see Photograph B1 and B2);
- Overhead utility lines run in the north to south direction just west of the culvert;
- 200 mm to 250 mm water depth was measured throughout the culvert (including the inlet and outlet);
- The 10<sup>th</sup> Concession Road asphalt wearing surface over the culvert is in good condition and appears to have been recently repaved / resurfaced;
- Both ends of the culvert are vegetated with tall grass and bushes (see Photographs B5 and B6);
- No deficiencies of the waterway were apparent at the time of inspection;
- 1.4 m was measured from the culvert soffit to the top of existing sediment at the time of inspection;
- A residential driveway just southwest of the culvert was measured to be 7 m from the culvert;
- The culvert was generally in good condition (see Photographs B9 and B10);
- Culvert wall drains were typically partially filled with sediment / debris (see Photograph B13);
- Medium scaling was noted at the east end of the culvert and exposed top slab at the east end of the culvert (see Photographs B3, B7 and B11);
- The header wall and wingwalls at the west end of the culvert were noted to be in good condition, with the exception of a minor localized area of honeycombing in the southwest wingwall (see Photographs B4 and B8);
- The culvert walls were generally in good condition, with the exception of two wide vertical cracks noted near the centre of the culvert, one in the north wall and

one in the south wall; in total 2.8 m of wide vertical crack was measured in the culvert walls (see Photograph B14);

- The culvert soffit contained localized areas of concrete deterioration that includes two (2) large areas of delamination totaling 1.4 m<sup>2</sup> and one (1) large area of spalling totaling 1.5 m<sup>2</sup>; in addition, one (1) longitudinal stained crack 2 m long was noted near the west end of the culvert (see Photographs B15, B16 and B17);
- The spalled area contained four (4) exposed longitudinal reinforcing steel bars that were severely corroded, two (2) of the bars were broken; also a longitudinal crack appeared to be present within the spalled area of the top slab; the location of this spalled area is approximately near the centre of the culvert (directly under 10<sup>th</sup> Concession Road live traffic);
- There is a distribution slab on the culvert which is visible at the east end of the culvert. The exposed portion of the slab is severely scaled; however, the condition of the slab beneath the roadway and at the west of the culvert is unknown. The reason for having the distribution slab is unknown since it is a cast-in-place culvert;
- A drainage ditch corrugated steel pipe (CSP) was present at the east end of the culvert, the CSP was formed within the south culvert wall; the CSP appeared distorted (elliptical shape) and contained several perforations in the bottom portion; the CSP opening measured 800 mm by 700 mm (span by height) (see Photograph B12).

### McGill Drain (City) Culvert

General information of the McGill Drain (City) Culvert is provided in the table below.

<b>Site No.</b>	495
<b>Structure Type</b>	Concrete rigid frame – open footing
<b>GPS Coordinates</b>	42.286706,-82.921012
<b>Span (m)</b>	3.1 m
<b>Height (m)</b>	3.2 m
<b>Length (m)</b>	26 m
<b>Cover (m)</b>	0.800 m (varies, approximately 0.8 m maximum)

Observations made during the visual inspection are summarized in the following:

- The culvert runs in the east to west direction on what appears to be little to no skew to the Lauzon Parkway (see key plan in Appendix A);

- The culvert is located just south of the Lauzon Parkway CPR structure (Site No. 160);
- Two (2) lanes of through traffic along the Lauzon Parkway are accommodated by the culvert (one northbound and one southbound); there are concrete curbs at the edge of the traffic lanes on both sides of the roadway (see Photograph C3);
- Single rail steel beam guide rails (SBGR) on wooden posts and wooden offset blocks exist on each side of the roadway at the culvert; this SBGR system extends from the Lauzon Parkway CPR structure (to the north of the culvert location) (see Photograph C1 and C2);
- The asphalt wearing surface over the culvert is in generally good condition with few transverse narrow cracks;
- A catch basin was found filled with sediment / debris just south of the culvert within the southbound lane of Lauzon Parkway (see Photograph C4);
- No deficiencies of the waterway was apparent at the time of inspection (see Photograph C5 and C6);
- The culvert ends were found in good condition (see Photograph C7 and C8);
- The retaining wall at each corner of the culvert was noted to be in good condition, with the exception of an outward rotation observed in the southwest retaining wall, an outward displacement of approximately 20 mm was measured at the top of the wall (see Photograph C9, C10 and C16);
- The culvert soffit and walls were found in generally good condition; two (2) construction joints were found stained with what appeared to be leachate at the time of inspection (see Photograph C11 to C14);
- The wall drains were found partially filled with sediment (see Photograph 15);
- 2900 mm was measured between the culvert soffit and top of water at the west culvert opening (the east culvert opening was similar);
- 300 mm of water was measured throughout the culvert; and,
- The top of the culvert footings were exposed (the existing stream bed matched the top of culvert footing along both sides of the culvert).

### **3.0 DISCUSSION AND RECOMMENDATIONS**

#### **Sullivan Creek Drain County Culvert**

In general, observed deficiencies are localized and do not pose a significant threat to the overall structural integrity of the Sullivan Creek Drain Culvert. However, areas of deterioration are likely to spread, leading to potential structural problems in the future. Punch through failure is a potential hazard to public safety at the culvert due to the



extensive spalling and damage to load carrying reinforcing steel bars. Immediate recommendations are to repair the deteriorated concrete areas in the culvert walls and soffit. The work would include injecting the vertical cracks with a flexible polyurethane epoxy resin to prevent the ingress of water and sediment and to prevent further cracking. The delaminated and spalled concrete areas in the soffit should be repaired by using conventional methods of removing and replacing the concrete. Additional reinforcing steel and dowels will be needed to repair the damaged section near the centre of the culvert. Repairs to the concrete distribution slab are recommended, as well as waterproofing the entire length of the culvert. Finally, it is recommended that steel beam guide rails be added to improve the roadside safety at the culvert in accordance to current standards.

The above recommendations were made on the assumption that the culvert will remain in place and stay in service along the existing 10<sup>th</sup> Concession Road alignment and cross-section.

For the purpose of this report, concrete repairs to maintain the structural integrity of the structure are recommended only. This recommendation is based on the existing alignment and cross-section remaining unchanged at the structure.

If the 10<sup>th</sup> Concession Road is widened for the Lauzon Parkway Extension, the culvert will need to be extended or replaced. However, given the existing condition of the culvert, a culvert extension (in addition to the culvert repairs mentioned above) would be preferred over replacing the culvert. Extension of the culvert may be done using a rigid frame box culvert section at either / both ends.

The County of Essex noted that the Sullivan Drain was inspected internally and subject to any road alterations, which is likely to favor replacement, rehabilitation is expected within a 10-year period (between 2015 and 2020).

### **McGill Drain City Culvert**

The existing condition of the culvert does not warrant any immediate structural deficiency concerns. However, waterproofing of the entire length of the top slab of the culvert is recommended.

Lauzon Parkway's alignment would remain the same at the culvert. However, the proposed upgrade of the corridor includes the potential widening of the roadway to accommodate additional traffic lanes and potentially other cross-sectional elements such as a median, a sidewalk, and a multi-use path. This would require the extension of the culvert at both ends. If a 4:1 side slope was used, a 20 m culvert extension is necessary at both ends of the culvert. Retaining walls would not be needed with this arrangement. The rigid frame box culvert extension section would match the existing culvert opening so that the hydraulic opening will remain unchanged.

## 4.0 CONSTRUCTION COST ESTIMATE

### Sullivan Creek Drain County Culvert Construction Cost Estimate

The following engineer's cost estimate is for the rehabilitation work of the existing Sullivan Creek Drain Culvert. The repairs would be done to address the structural defects.

Item	Unit	Unit Price	Quantity	Subtotal
Mobilization	LS	\$5,000	1	\$5,000
Polyurethane injection	m	\$150	7	\$1,050
Concrete removal – partial depth	m3	\$3,000	3	\$9,000
Concrete patches – form and pump – soffit	m3	\$10,000	4	\$40,000
Reinforcing steel	t	\$3,000	0.5	\$1,500
Supply and place galvanized wired reinforcing	m2	\$50	4	\$200
Culvert Waterproofing	LS	\$7,000	1	\$7,000
Remove and replace CSP	LS	\$1,000	1	\$1,000
Supply and install SBGR	LS	\$20,000	1	\$20,000
Subtotal				\$84,750
Miscellaneous and Contingency (20%)				\$16,950
Engineering and Contract Administration (20%)				\$16,950
<b>Total</b>				<b>\$118,650</b>

### McGill Drain City Culvert Construction Cost Estimate

The following engineer's cost estimate is for the rehabilitation and culvert extension work of the existing McGill Drain Culvert. The extension of the culvert would be done to accommodate the proposed widened Lauzon Parkway roadway cross-section.

Item	Unit	Unit Price	Quantity	Subtotal
Mobilization	LS	\$5,000	1	\$5,000
Granular 'A' bedding	LS	\$20,000	1	\$20,000
Concrete in culvert	m3	\$900	35	\$31,500
Reinforcing steel	t	\$3,000	3.5	\$10,500
Dowels	ea	\$30	120	\$3,600
Culvert Waterproofing	LS	\$15,000	1	\$15,000
Dewatering – dam and pump	LS	\$10,000	1	\$10,000
Subtotal				\$95,600
Miscellaneous and Contingency (20%)				\$19,120
Engineering and Contract Administration (20%)				\$19,120

<b>Total</b>	<b>\$133,840</b>
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The preliminary construction cost estimates is summarized as follows:

- Total Construction Cost Estimate: \$253,000
  - Sullivan Creek Drain County Culvert: \$119,000
  - McGill Drain City Culvert: \$134,000

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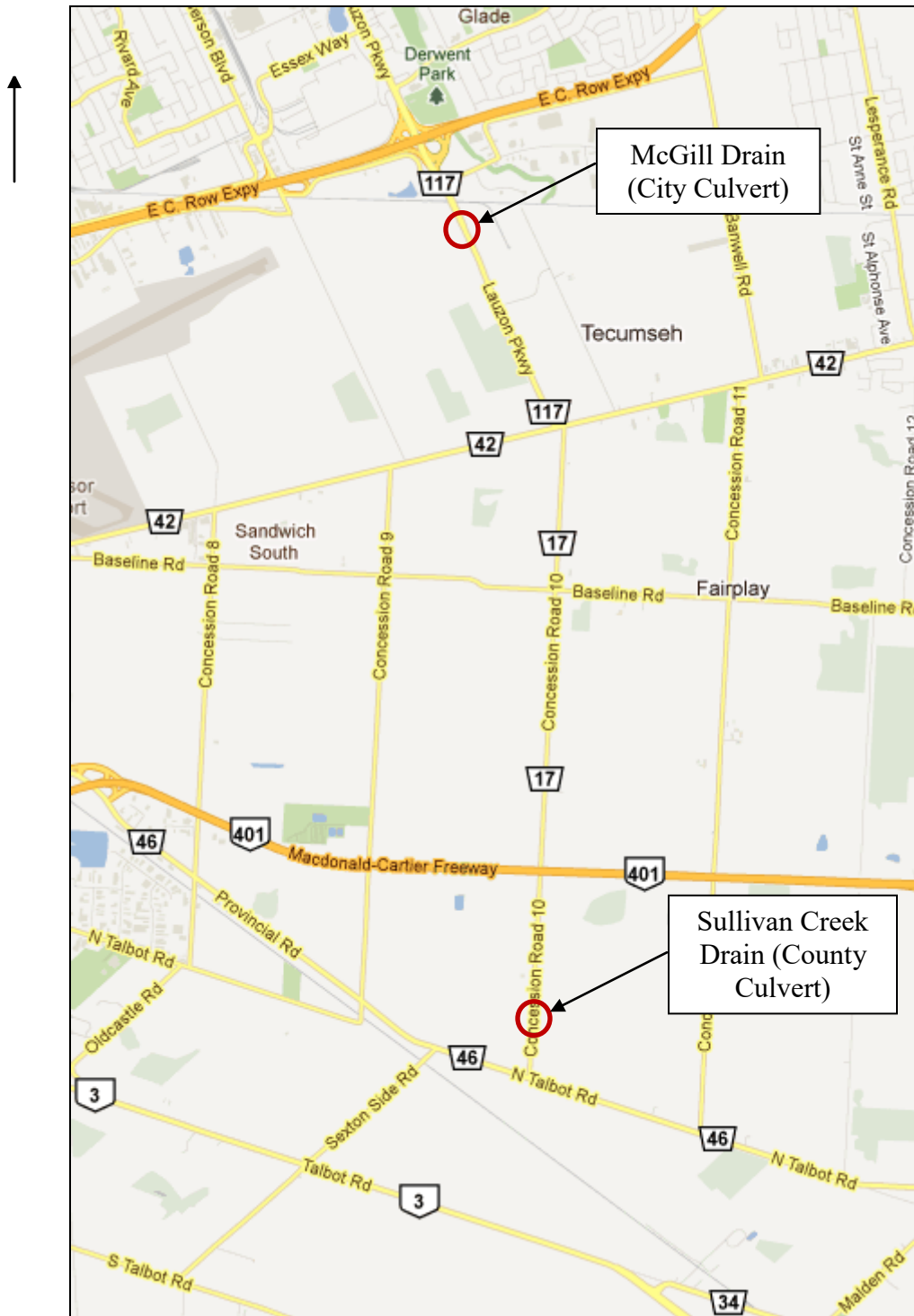


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**APPENDIX A**  
**KEY PLAN**

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**APPENDIX B  
SITE PHOTOGRAPHS  
SULLIVAN CREEK DRAIN  
(COUNTY) CULVERT**

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Photograph B1. North approach, looking south along 10<sup>th</sup> Concession Road.



Photograph B2. South approach, looking north along 10<sup>th</sup> Concession Road.



Photograph B3. East elevation.



Photograph B4. West elevation.



Photograph B5. Looking east from the culvert.



Photograph B6. Looking west from the culvert.



Photograph B7. Exposed top slab of culvert at the east end. Note the medium concrete scaling.



Photograph B8. Southwest wingwall. Note the minor honeycombing.



Photograph B9. Looking west through the culvert. Note the very severe spall in the top slab.



Photograph B10. Looking east through the culvert.



Photograph B11. East end of culvert. Note the medium concrete scaling of the top slab.



Photograph B12. Drainage ditch CSP through south culvert wall near the east end of the culvert. Note the perforations in the bottom and distorted shape.





Photograph B13. Wall drain. Typical condition. Note the sediment build-up within the pipe.



Photograph B14. Wide vertical crack within the south culvert wall. Similar crack was noted in the north culvert wall. Both are located near the centre of the culvert.



Photograph B15. Very severe concrete delamination in culvert soffit.



Photograph B16. Very severe concrete spalling. Note the corroded and broken reinforcing steel bars. Looking along the longitudinal direction. Located near the centre.



Photograph B17. Close-up view of the previous photograph. Note the longitudinal concrete crack within the top slab.



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**APPENDIX C  
SITE PHOTOGRAPHS  
MCGILL DRAIN  
(CITY) CULVERT**

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Photograph C1. Looking north from culvert along Lauzon Parkway.



Photograph C2. Looking south from culvert along Lauzon Parkway.



Photograph C3. Looking east across Lauzon Parkway. The culvert is directly below in the photograph.



Photograph C4. Catch basin filled with debris. The catch basin is located along the west curb of Lauzon Parkway just a few metres south of the culvert.





Photograph C5. Looking west from the culvert.



Photograph C6. Looking east from the culvert.



Photograph C7. West elevation.



Photograph C8. East elevation.



Photograph C9. Northwest retaining wall. Typical condition at each corner of the culvert.



Photograph C10. Southwest culvert corner on the right side and southwest retaining wall on the left side. Note the outward rotation of the retaining wall.



Photograph C11. Looking east through culvert.



Photograph C12. Looking west through culvert.



Photograph C13. Stained construction joint. Noted at two locations within the culvert. Photograph shows the typical condition.



Photograph C14. Stained construction joint. Showing the soffit of the previous photograph.



Photograph C15. Wall drain. Typical condition.



Photograph C16. Northeast wingwall.