Appendix A: Field Inspection Memo

Project Memo

H353437

August 21, 2017

To: Alvaro AlmuinaTodd Comfort

From: David Jackson

cc: Madhav Baral, Melissa Alexander, Terry Kelly

City of Barrie, MTO
Harvie Essa Bryne

Drainage Design - Field Inspection Memo

1. Introduction

Hatch was retained by the City of Barrie to undertake a Schedule C Class Environmental Assessments (EAs) as part of the widening and extension of the Harvie Road, Essa Road and Bryne drive.

The project limit is illustrated as follows:

- Harvie Road between Essa and to the east side of HWY 400, extend until Big Bay Point Road;
- Essa Road between Mapleview Drive West and Coughlin Road;
- Future Bryne Drive extended from the north of Essa Road to the south of Caplan Avenue.

The field inspection documented six (6) culvert crossings and one (1) existing SWM Facility wet pond LV14, which include:

- One (1) culvert crossing at Essa Road from the Main Branch of Bear Creek
- Two (2) culvert crossings at Harvie Road from the Main Branch of Whiskey Creek
- One (1) culvert crossing at future Bryne Drive from the Tributary of Lovers Creek
- One (1) culvert crossing at Highway 400 from the Tributary of Lovers Creek
- One (1) SWM Facility Wet Pond LV14
- One (1) culvert crossing at Highway 400 from the North Tributary of Whiskey Creek

These existing culvert structures were inspected from a physical perspective to aid in the drainage design for the post-development condition. These structures have been numbered and documented within ***Exhibit 1 – Field Inspection Figure***.

2. Purpose

This technical memorandum is aimed to:

- Outline the existing culverts and drainage outlets documented during the field inspection.
- Provide field observations to establish a design basis.
- Report inspected functional conditions of existing culvert crossings and the existing drainage system outlet.

3. Observations

Table 3-1 summarizes the culverts materials and dimensions from field observation:

Table 3-1 - Culvert Location Summary

Culvert ID	Location Description	Material	Barrels	Opening	Dimension [mm]	
					Span	Rise
CV #1	Culvert Crossing @ Essa Road (Main Branch of Bear Creek)	Conc.	1	Box	1800	600
CV #2	Culvert Crossing @ Harvie Road (Main Branch of Whiskey Creek)	CSP	1	Circular	1050	1050
CV #3	Culvert Crossing @ Harvie Road (Main Branch of Whiskey Creek)	CSP	1	Circular	1200	1200
CV #4	Culvert Crossing @ Future Bryne Drive (Tributary of Lovers Creek)	CSP	2	Circular	450	450
CV #5	Culvert Crossing @ Highway 400 (Tributary of Lovers Creek) *	Conc.	1	Box	-	-
CV #6	Culvert Crossing @ Highway 400 (North Tributary of Whiskey Creek) *	Conc.	1	Box	-	-

* CV #5 and CV #6 is not accessible on site, observed visually, the dimensions of the culverts are not measured.

In addition, the existing SWM facility Pond LV14 is summarized, including the forebay, outlet structure, and downstream channel condition.

4. Photo Documentation

Culvert photos with inspection observation comments are documented below.

<table>
<tr><th colspan="2">Box Concrete Culvert @ Essa Road – Bear Creek (CV #1)</th></tr>
<tr><td>#1 – Downstream Face of the Culvert, observed water standing at the inlet</td><td>#2 – Downstream Face of Culvert, observed damage/spalling in the face</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>#3 – Heavy Vegetation at Upstream End</td><td>#4 – Heavy Vegetation at Downstream End</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">#4 – Inside the Culvert, no cracks observed within the barrel</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">Comments:
Unclear if the culvert is open bottom culvert. Heavy vegetation observed at inlet and outlet. Stable condition. No erosion observed. Water level at 0.13m D/S face. Total Bank width at 3.5-4.2m, with total depth of fill approx. 3m. Culvert structure appears to be hydraulically deficient given the inlet/outlet channel size. Standing water at the inlet and gabion erosion protection demonstrates the required size for replacement. Damage and Spralling are observed on the downstream face.

Recommendations:
- Redesign or upsize due to hydraulic concerns.
- Recommendations to be confirmed through hydraulic evaluation.</td></tr>
</table>

CSP Culvert @ Harvie Road – Whiskey Creek Main Branch (CV #2)	
#1 – Upstream Face of the Culvert	**#2 – Upstream View from the Culvert**
	
#3 – Downstream Face of the Culvert, Cobbles within the barrel	**#4 – Downstream View from the Culvert, erosion on the right side bank**
	

Comments:
Observed bank erosion at the right side bank downstream end of the culvert. The inlet of the culvert was observed to be slighely caved in. The interior of the culvert is in good condition. Debris are observed at outlet of the structure. Based on the rust mark on the culvert barrel, the water level are measured to be approx. 0.3m high. Low flow, steep bank side slope at the downstream, 2:1 on the left bank side, 1;1 on right bank side. The bottom channel width is 1m.

Recommendation
- Extend or retain the existing structure for ultimate design.
- Realign the channel to improve the conveyance downstream of the channel, given the erosion observed on the right side bank.

CSP Culvert @ Harvie Road – Whiskey Creek Main Branch (CV #3)	
#1 – Upstream Face of the Culvert	**#2 – Upstream Face of the Culvert**
	
#3 – Downstream Channel at Culvert	**#4 – Downstream Channel at Culvert**
	

Comments:
The plate are slightly caved in at the outlet of the structure. Cobbles as well as debris are observed at the inlet of the culvert. DS channel observed to be approx. 3-4 m wide, with a approx. side slope of 3:1.

Recommendations:
- To remain and replace when the future Harvie Road ultimate design is completed.
- Currently this culvert is out of the limit of the Harvie Essa Bryne Project, and was documented for completeness.

Twin CSP Culverts @ Future Bryne Drive – Lovers Creek Tributary (CV #4)	
#1 – Upstream Face of the Culvert	**#2 – Downstream Face of the Culvert**
	
#3 – Upstream Channel	**#4 – Downstream Channel**
	
#5 – Top of Roadway	**#6 – Top of Roadway**
	

Comments:
The existing culvert located at on an existing rural roadway north of the existing south section of Bryne Drive, downstream of the existing SWM pond LV14. The existing structure is in poor condition. Debris are found at the inlet and outlet of the structure. No erosion is observed onsite. Given the ponded water on top of the roadway surface, the existing culvert is undersized. The D/S channel bottom width is observed to be approx. 3m, with a side slope of 5:1 on right and left side bank.

Recommendations:
- Redesign and replace the existing structure given hydraulic deficiency.
- The future size of the culvert to be confirmed through the hydraulic evaluation based on proposed design condition**.**

Box Concrete Culvert @ Highway 400 – Lovers Creek Tributary (CV #5)

#1 – Upstream Face of the Culvert

#2 – Upstream Face of the Culvert

#3 – Upstream Channel before the Culvert

Comments:
The culvert at Highway 400 are observed to be in good condition. The upstream channel is measured to be 1-2 m wide. Heavy vegetation is observed in the upstream channel. Debris observed at the inlet. No dimension of the culvert is measured on site due to the inaccessability of the culvert on site.

Recommendations:
- Maintain the structure at this location.
- Adjustments for future ultimate condition will be required.

Box Concrete Culvert @ Highway 400 – Whiskey Creek North Tributary (CV #6)	
#1 – Upstream Face of the Culvert	**#2 – Upstream Face of the Culvert**
	
#3 – Upstream Channel before the Culvert	
	

Comments:
The culvert size is determined to be a 1.8 x 1.2m conc. box, based on visual observation from a distance of 40-50 meters. Ditch is found immediately upstream of the culvert, however, no creek is observed beyond the fence. No dimension is measured due to the inaccessibility of the culvert on site.

Recommendations:
- Maintain the structure at this location.
- Adjustments for future ultimate condition will be required.

Photos associated with the SWM pond LV14 are summarized as follows:

SWM Pond LV14	
#1 – SWM Wet Pond LV14	**#2 – Forebay of Pond LV14**
	
#3 – Pond Outlet Structure	**#4 – Lovers Creek Downstream of LV14 Pond Outlet**
	

Comments:
The SWM facility is in good condition. Diameter of the outlet pipe from the pond is approximately 800 mm. The width of the downstream channel of the outlet structure is approximately 3-3.5m wide,and a 3:1 side slope, Rip rap is placed at the bottom of the channel. Heavy vegetation is observed within the channel.

Recommendations:
- Maintain the Pond LV14, the existing structures are in good condition.
- Extension of existing pond may be required due to the increase of surface flow from future Bryne Drive.

5. Recommendations

Table 5-1 and Table 5-2 summarize the recommendations from the field inspection for both the Culvert and STM outlet locations.

Table 5-1 - Culvert Recommendations

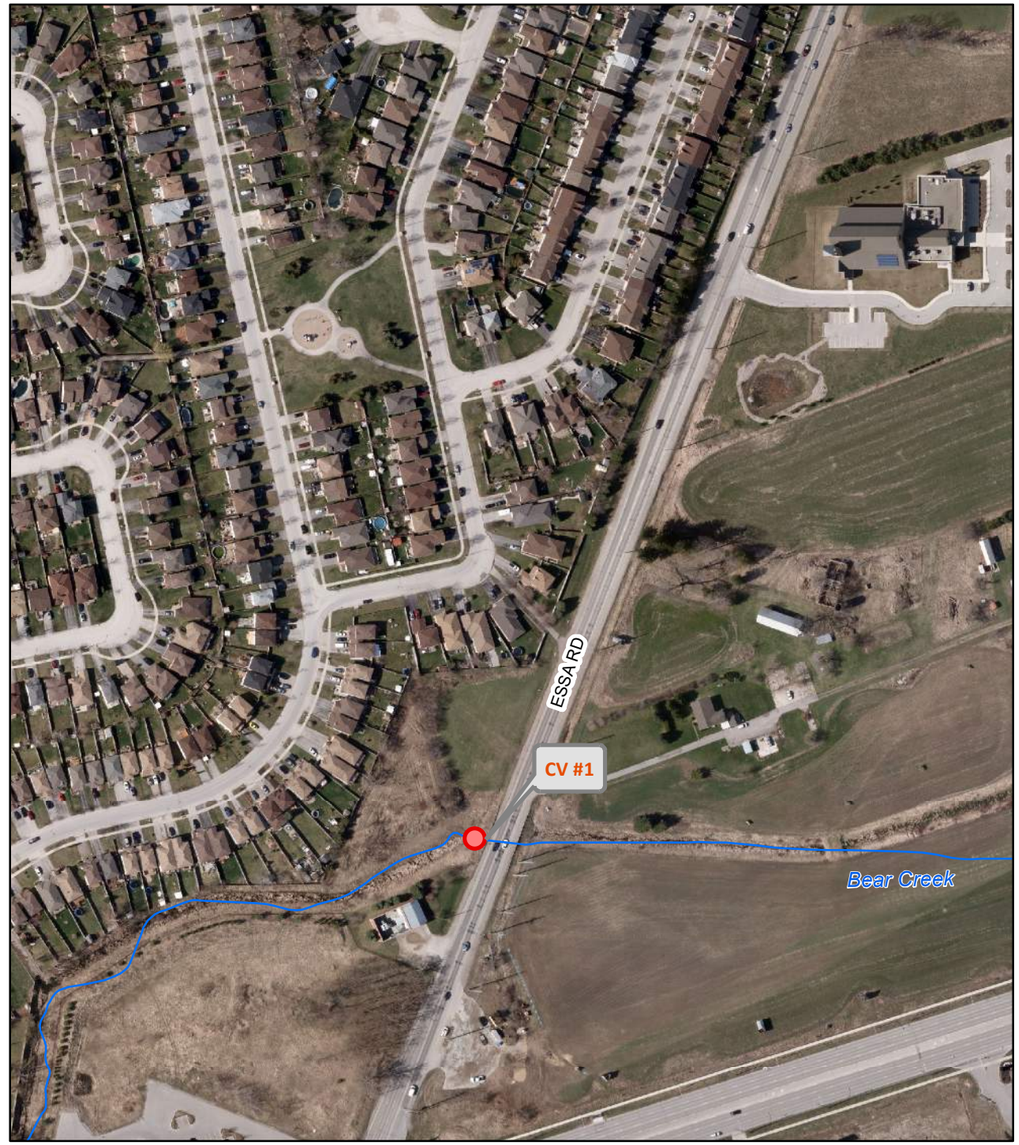
Culvert ID	Location Description	Recommendation
CV #1	Culvert Crossing @ Essa Road (Main Branch of Bear Creek)	Recommend to redesign or replace given the inlet and outlet channel size, and proposed design condition. Confirm recommendation through the hydraulic evaluation.
CV #2	Culvert Crossing @ Harvie Road (Main Branch of Whiskey Creek)	Maintain Structure possible end replacement for ultimate design. Realign the downstream channel to improve the conveyance.
CV #3	Culvert Crossing @ Harvie Road (Main Branch of Whiskey Creek)	Maintain Structure, or possible end replace for ultimate design. Out of current project design scope.
CV #4	Culvert Crossing @ Future Bryne Drive (Tributary of Lovers Creek)	Redesign and replace the existing structure given hydraulic deficiency. Proposed size of future culvert to be confirmed through the hydraulic evaluation based on proposed design condition**.**
CV #5	Culvert Crossing @ Highway 400 (Tributary of Lovers Creek) [1]	Maintain structure. Adjustments for future ultimate condition will be required.
CV #6	Culvert Crossing @ Highway 400 (North Tributary of Whiskey Creek) [2]	Maintain structure. Adjustments for future ultimate condition will be required.

Table 5-2 - Recommendations for STM outlets

SWM Pond ID	Location Description	Recommendation
SWM Pond LV14	Lovers Creek Subwatershed west of Highway 400	Maintain current SWM facility, exension of existing pond may be required based on future ultimate design.

David Jackson

DJ:dj
Attachment(s)/Enclosure
Exhibit 1 – Field Inspection Figure



- Culverts
- Watercourse
- Storm Pond

REV.	ISSUE FOR	BY	CHK'D	APP'D	DATE
0	FOR REVIEW	Init.	Init.	Init.	

HATCH

DESIGNED BY:	DRAWN BY: JZ
CHECKED BY: DJ	DISC. ENGR.
PROJ. DES. COORD.	PROJ. ENGR.

N. T. S.

HARVIE ESSA BRYNE ROAD PROJECT

Exhibit 1
Field Inspection Figure

A. GENERAL INFORMATION

Project #	H353437	**Project Description**	Barrie – HEB EA-DD
Date	2017/06/01	**Weather Conditions**	Sunny
Inspector 1	Julia Zhu	**Inspector 2 /Reviewer**	David Jackson

B. CULVERT ID / LOCATION

Culvert ID	Culvert #1	**Chainage**	N/A
Latitude	44.329597	**Longitude**	-79.710747
Description	Bear Creek @ Essa Road		

C. PHYSICAL CHARACTERISTICS

Material –

☐Corrugated Steel Pipe	☐Concrete Pipe	☐Steel Smooth Pipe
☐HDPE Pipe	☒Concrete Box	☐Wood/Timber Box
☐Stone Box	☐Concrete Pipe Arch	☐Multiplate Pipe
☐Single Span Bridge	☐Multi Span Bridge	☐Other:

Shape –

☐Round	☒Box	☐Elliptical
☐Other:		

# of Barrels	1	**Span/Diameter**	1800 (6’) [mm]
Rise	600 (24”) [mm]	**Length**	[m]
Depth of Fill	3 [m]	**Skew**	[deg]

End Treatment –

☐ Projecting Edge	☐ Mitered to Conform to Slope	☐ Straight Edge Vertical Headwall
☒ Beveled Edge with Headwall	☐ Headwall with Wingwalls	☐Other:

Open Bottom Culvert?	☐Yes	☒No

Comments – Unclear if open or closed bottom structure. Culvert filled with muck substrate.

D. ENVIRONMENTAL CONDITIONS

Watercourse Type –

☒ Permanent, Fluvial Stream/River	☐ External Drainage Ditch	☐ Railside Drainage Ditch
☐ Ephemeral Drainage	☐Other:	

Observed Flow Conditions –

	Free Flowing	*Partially Submerged*	*Submerged*	*No Flow*
Inlet	☒	☐	☐	☐
Outlet	☒	☐	☐	☐

Outlet HWL	0.127 (5”) [m]	**D/S Bankfull Width**	3.5 – 4.2 (12’ to 14’) [m]
D/S Side Slope	[2:1]		

Comments –
Substrate mud, grass vegetation, stable condition

E. VISUAL CONDITION ASSESSMENT

i) Roadbed/Track Condition –

	N/A	Potential Concern	Comments
Surface Sag	☒	☐	
Alignment Displacement	☒	☐	
Fill Slope Scour/Erosion	☒	☐	

ii) Channel Condition –

	N/A	U/S near Inlet	D/S near Outlet	Comments
Bank Erosion	☒	☐	☐	
Bank Slump	☒	☐	☐	
Flow Line Scour	☒	☐	☐	
Standing/Pooled Water	☐	☒	☐	
Perched Water	☒	☐	☐	
Debris Accumulation	☒	☐	☐	
Heavy Vegetation Growth	☐	☐	☒	

iii) Physical Culvert Condition –

	N/A	Inlet	Outlet	Barrel
Signs of Rust	☒	☐	☐	☐
Corrosion	☒	☐	☐	☐
Damage/Deformation	☐	☒	☒	☒
Holes/Perforations	☒	☐	☐	☐
Joint/Seam Defects	☒	☐	☐	☐
Cracks	☒	☐	☐	☐
Buckling	☒	☐	☐	☐
Loss of Wall Thickness	☒	☐	☐	☐
Coating/Lining Loss	☒	☐	☐	☐
Seepage/Infiltration	☒	☐	☐	☐
Spalling	☐	☐	☒	☐

iv) Culvert Appearance –

	N/A	Inlet	Comments
X-S Shape Irregularities	☒	☐	
Horizontal Displacement	☒	☐	
Vertical Displacement	☒	☐	

F. RECOMMENDATIONS

Maintenance *(Select all applicable)* **–**

☐ None ☐ Clean Flush ☐ Ditching/Realign Channel ☐ Repair Erosion/Scour
☐ Apply Liner ☐ Grout/Fill Cracks ☒ Other: Repair inlet/outlet face of the structure

Culvert Recommendation –

☒ Replace ☐ Retain and Install Extension ☐ Remove ☐ Abandon/Cap & Grout
☐ Other:

Overall Comments, Recommended Actions – Culvert structure appears to be hydraulically deficient given the inlet/outlet channel size. Standing water at the inlet and gabion erosion protection demonstrates the required size for replacement.

A. GENERAL INFORMATION

Project #	H353437	**Project Description**	Barrie – HEB EA-DD
Date	2017/06/01	**Weather Conditions**	Sunny
Inspector 1	Julia Zhu	**Inspector 2 /Reviewer**	David Jackson

B. CULVERT ID / LOCATION

Culvert ID	Culvert #2	**Chainage**	N/A
Latitude	44.3417472	**Longitude**	-79.69096
Description	Lover's Creek near Bryne Road		

C. PHYSICAL CHARACTERISTICS

Material –

☒Corrugated Steel Pipe	☐Concrete Pipe	☐Steel Smooth Pipe
☐HDPE Pipe	☐Concrete Box	☐Wood/Timber Box
☐Stone Box	☐Concrete Pipe Arch	☐Multiplate Pipe
☐Single Span Bridge	☐Multi Span Bridge	☐Other:

Shape –

☒Round	☐Box	☐Elliptical
☐Other:		

# of Barrels	2	**Span/Diameter**	450 (17") [mm]
Rise	450 (17") [mm]	**Length**	[m]
Depth of Fill	0.5 [m]	**Skew**	0 [deg]

End Treatment –

☒ Projecting Edge	☐ Mitered to Conform to Slope	☐ Straight Edge Vertical Headwall
☐ Beveled Edge with Headwall	☐ Headwall with Wingwalls	☐Other:

Open Bottom Culvert?	☐Yes	☒No

Comments – Culvert filled with muck substrate.

D. ENVIRONMENTAL CONDITIONS

Watercourse Type –

☒ Permanent, Fluvial Stream/River	☐ External Drainage Ditch	☐ Railside Drainage Ditch
☐ Ephemeral Drainage	☐Other:	

Observed Flow Conditions –

	Free Flowing	*Partially Submerged*	*Submerged*	*No Flow*
Inlet	☒	☐	☐	☐
Outlet	☒	☐	☐	☐

Outlet HWL	0.15 (6") [m]	**D/S Bankfull Width**	3 [m]
D/S Side Slope	[5:1]		

Comments –
Substrate mud, the channel bank seems to extend to the approx. 2-3m away from the centreline of the stream.

E. VISUAL CONDITION ASSESSMENT

i) Roadbed/Track Condition –

	N/A	*Potential Concern*	*Comments*
Surface Sag	☐	☒	Visible Water accumulated on road surface
Alignment Displacement	☒	☐	
Fill Slope Scour/Erosion	☐	☒	

ii) Channel Condition –

	N/A	*U/S near Inlet*	*D/S near Outlet*	*Comments*
Bank Erosion	☒	☐	☐	
Bank Slump	☒	☐	☐	
Flow Line Scour	☒	☐	☐	
Standing/Pooled Water	☒	☐	☐	
Perched Water	☒	☐	☐	
Debris Accumulation	☐	☒	☐	
Heavy Vegetation Growth	☐	☐	☒	

iii) Physical Culvert Condition –

	N/A	*Inlet*	*Outlet*	*Barrel*
Signs of Rust	☒	☐	☐	☐
Corrosion	☒	☐	☐	☐
Damage/Deformation	☐	☒	☒	☐
Holes/Perforations	☒	☐	☐	☐
Joint/Seam Defects	☒	☐	☐	☐
Cracks	☒	☐	☐	☐
Buckling	☒	☐	☐	☐
Loss of Wall Thickness	☒	☐	☐	☐
Coating/Lining Loss	☒	☐	☐	☐
Seepage/Infiltration	☒	☐	☐	☐
Spalling	☒	☐	☐	☐

iv) Culvert Appearance –

	N/A	*Inlet*	*Comments*
X-S Shape Irregularities	☐	☒	
Horizontal Displacement	☒	☐	
Vertical Displacement	☒	☐	

F. RECOMMENDATIONS

Maintenance *(Select all applicable)* –

☒ None ☐ Clean Flush ☐ Ditching/Realign Channel ☐ Repair Erosion/Scour
☐ Apply Liner ☐ Grout/Fill Cracks ☐ Other:

Culvert Recommendation –

☒ Replace ☐ Retain and Install Extension ☐ Remove ☐ Abandon/Cap & Grout
☐ Other:

Overall Comments, Recommended Actions – Culvert structure appears to be hydraulically deficient given the standing water accumulated on the top of the road surface, which indicated that water overtopped the structure during major events. Replaced the culvert with larger size is recommended.

A. GENERAL INFORMATION

Project #	H353437	**Project Description**	Barrie – HEB EA-DD
Date	2017/06/01	**Weather Conditions**	Sunny
Inspector 1	Julia Zhu	**Inspector 2 /Reviewer**	David Jackson

B. CULVERT ID / LOCATION

Culvert ID	Culvert #3	**Chainage**	N/A
Latitude	44.342680	**Longitude**	-79.687060
Description	Lover's Creek @ Hwy 400		

C. PHYSICAL CHARACTERISTICS

Material –

☐Corrugated Steel Pipe	☐Concrete Pipe	☐Steel Smooth Pipe
☐HDPE Pipe	☒Concrete Box	☐Wood/Timber Box
☐Stone Box	☐Concrete Pipe Arch	☐Multiplate Pipe
☐Single Span Bridge	☐Multi Span Bridge	☐Other:

Shape –

☐Round	☒Box	☐Elliptical
☐Other:		

# of Barrels	1	**Span/Diameter**	3600 (12') [mm]
Rise	1000-2000 [mm]	**Length**	[m]
Depth of Fill	4-5 [m]	**Skew**	[deg]

End Treatment –

☐ Projecting Edge	☐ Mitered to Conform to Slope	☐ Straight Edge Vertical Headwall
☒ Beveled Edge with Headwall	☐ Headwall with Wingwalls	☐Other:

Open Bottom Culvert?	☒Yes	☐No

Comments – Unclear if the culvert is skewed. Only the upstream face of the culvert is investigated, because of the existing property fence.

D. ENVIRONMENTAL CONDITIONS

Watercourse Type –

☒ Permanent, Fluvial Stream/River	☐ External Drainage Ditch	☐ Railside Drainage Ditch
☐ Ephemeral Drainage	☐Other:	

Observed Flow Conditions –

	Free Flowing	*Partially Submerged*	*Submerged*	*No Flow*
Inlet	☒	☐	☐	☐
Outlet	☐	☐	☐	☐

Outlet HWL	0.15 [m]	**D/S Bankfull Width**	Unknown [m]
D/S Side Slope	[3:1]		

Comments –
The culvert span seems to be the same as the channel width. The HWL is judged from the u/s face.

E. VISUAL CONDITION ASSESSMENT

i) Roadbed/Track Condition –

	N/A	*Potential Concern*	*Comments*
Surface Sag	☒	☐	
Alignment Displacement	☒	☐	
Fill Slope Scour/Erosion	☒	☐	

ii) Channel Condition –

	N/A	*U/S near Inlet*	*D/S near Outlet*	*Comments*
Bank Erosion	☒	☐	☐	No Erosion
Bank Slump	☒	☐	☐	
Flow Line Scour	☒	☐	☐	
Standing/Pooled Water	☒	☐	☐	
Perched Water	☒	☐	☐	
Debris Accumulation	☒	☐	☐	
Heavy Vegetation Growth	☐	☒	☐	

iii) Physical Culvert Condition –

	N/A	*Inlet*	*Outlet*	*Barrel*
Signs of Rust	☒	☐	☐	☐
Corrosion	☒	☐	☐	☐
Damage/Deformation	☒	☐	☐	☐
Holes/Perforations	☒	☐	☐	☐
Joint/Seam Defects	☒	☐	☐	☐
Cracks	☒	☐	☐	☐
Buckling	☒	☐	☐	☐
Loss of Wall Thickness	☒	☐	☐	☐
Coating/Lining Loss	☒	☐	☐	☐
Seepage/Infiltration	☒	☐	☐	☐
Spalling	☒	☐	☐	☐

iv) Culvert Appearance –

	N/A	*Inlet*	*Comments*
X-S Shape Irregularities	☒	☐	
Horizontal Displacement	☒	☐	
Vertical Displacement	☒	☐	

F. RECOMMENDATIONS

Maintenance *(Select all applicable)* –

☒ None ☐ Clean Flush ☐ Ditching/Realign Channel ☐ Repair Erosion/Scour
☐ Apply Liner ☐ Grout/Fill Cracks ☐ Other:

Culvert Recommendation –

☐ Replace ☐ Retain and Install Extension ☐ Remove ☐ Abandon/Cap & Grout
☐ Other:

Overall Comments, Recommended Actions – Culvert structure appears to be hydraulically deficient given the standing water accumulated on the top of the road surface, which indicated that water overtopped the structure during major events. Replaced the culvert with larger size is recommended.

A. GENERAL INFORMATION

Project #	H353437	**Project Description**	Barrie – HEB EA-DD
Date	2017/06/01	**Weather Conditions**	Sunny
Inspector 1	Julia Zhu	**Inspector 2 /Reviewer**	David Jackson

B. CULVERT ID / LOCATION

Culvert ID	Culvert #4	**Chainage**	N/A
Latitude	44.34714	**Longitude**	-79.69233
Description	Whiskey Creek @ Harvie Rd.		

C. PHYSICAL CHARACTERISTICS

Material –

☒Corrugated Steel Pipe	☐Concrete Pipe	☐Steel Smooth Pipe
☐HDPE Pipe	☐Concrete Box	☐Wood/Timber Box
☐Stone Box	☐Concrete Pipe Arch	☐Multiplate Pipe
☐Single Span Bridge	☐Multi Span Bridge	☐Other:

Shape –

☒Round	☐Box	☐Elliptical
☐Other:		

# of Barrels	1	**Span/Diameter**	1050 (40”) [mm]
Rise	1050 (40”) [mm]	**Length**	[m]
Depth of Fill	2-3 [m]	**Skew**	0 [deg]

End Treatment –

☒ Projecting Edge	☐ Mitered to Conform to Slope	☐ Straight Edge Vertical Headwall
☐ Beveled Edge with Headwall	☐ Headwall with Wingwalls	☐Other:

Open Bottom Culvert?	☐Yes	☒No

Comments – Cobbles within the Culvert barrel.

D. ENVIRONMENTAL CONDITIONS

Watercourse Type –

☒ Permanent, Fluvial Stream/River	☐ External Drainage Ditch	☐ Railside Drainage Ditch
☐ Ephemeral Drainage	☐Other:	

Observed Flow Conditions –

	Free Flowing	*Partially Submerged*	*Submerged*	*No Flow*
Inlet	☒	☐	☐	☐
Outlet	☒	☐	☐	☐

Outlet HWL	0.3 [m]	**D/S Bankfull Width**	0.8-1.0 (32”) [m]
D/S Side Slope	Left bank side [2:1]	Right bank side [1:1]	

Comments –
Low flow, approx. 300mm water depth at the rust mark on the culvert barrel

E. VISUAL CONDITION ASSESSMENT

i) Roadbed/Track Condition –

	N/A	*Potential Concern*	*Comments*
Surface Sag	☒	☐	
Alignment Displacement	☒	☐	
Fill Slope Scour/Erosion	☒	☐	

ii) Channel Condition –

	N/A	*U/S near Inlet*	*D/S near Outlet*	*Comments*
Bank Erosion	☐	☐	☒	Erosion at D/S Right Bank
Bank Slump	☒	☐	☐	
Flow Line Scour	☒	☐	☐	
Standing/Pooled Water	☒	☐	☐	
Perched Water	☒	☐	☐	
Debris Accumulation	☒	☐	☐	
Heavy Vegetation Growth	☐	☒	☐	

iii) Physical Culvert Condition –

	N/A	*Inlet*	*Outlet*	*Barrel*
Signs of Rust	☐	☒	☒	☒
Corrosion	☒	☐	☐	☐
Damage/Deformation	☒	☐	☐	☐
Holes/Perforations	☒	☐	☐	☐
Joint/Seam Defects	☒	☐	☐	☐
Cracks	☒	☐	☐	☐
Buckling	☒	☐	☐	☐
Loss of Wall Thickness	☒	☐	☐	☐
Coating/Lining Loss	☒	☐	☐	☐
Seepage/Infiltration	☒	☐	☐	☐
Spalling	☒	☐	☐	☐

iv) Culvert Appearance –

	N/A	*Inlet*	*Comments*
X-S Shape Irregularities	☒	☐	
Horizontal Displacement	☒	☐	
Vertical Displacement	☒	☐	

F. RECOMMENDATIONS

Maintenance *(Select all applicable)* **–**

☒ None ☐ Clean Flush ☐ Ditching/Realign Channel ☐ Repair Erosion/Scour
☐ Apply Liner ☐ Grout/Fill Cracks ☐ Other:

Culvert Recommendation –

☒ Replace ☒ Retain and Install Extension ☐ Remove ☐ Abandon/Cap & Grout
☐ Other:

Overall Comments, Recommended Actions – Culvert structure appears to be hydraulically sufficient to convey minor and major flow. Given the realignment of the roadway, replacement or extension of the culvert structure is recommended.