BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Hydraulic Analysis

R.J. Burnside & Associates Limited 3 Ronell Crescent Collingwood ON L9Y 4J6 CANADA
telephone (705) 446-0515 **fax** (705) 446-2399 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Technical Memorandum
Proposed Bridge Hydraulic Performance

Date: December 8, 2020 **Project No.:** 300043764.0000

Project Name: Credit Meadows Park Expansion (Former Harris Lands)

Client Name: City of Mississauga

Submitted To: Project File Report

Submitted By: Peter De Carvalho, EIT

Reviewed By: Tim Koen, P.Eng

As part of the City of Mississauga, Credit Meadows Park Expansion (Former Harris Lands), Schedule B Environmental Assessment (EA), R.J. Burnside & Associates Limited (Burnside) is reviewing options to provide a pedestrian trail within the park. The work also includes evaluating trail links connecting the former Harris Lands to the existing Credit Meadows and the residents in the area of Bancroft Drive. To improve connectivity to the adjacent lands, bridge crossings would be required over both the Credit River and Fletchers Creek.

This Technical Memorandum will outline the hydraulic impact of the various bridge structures on the park and surrounding lands by comparing pre-and post-construction conditions. Figure 1 (enclosed) shows the preliminary locations for pedestrian bridge crossings. There are three preliminary bridge locations, two of which cross the Credit River (Option 1 and 2 in Figure 1) and one which crosses Fletchers Creek.

Pre-existing HEC-RAS hydraulic models were obtained from Credit Valley Conservation (CVC) for the Credit River and Fletchers Creek. The preliminary crossing locations corresponded to the following stations within the CVC HEC-RAS hydraulic model.

Table 1 Crossing Location Stations (CVC HEC-RAS Hydraulic Model)

Preliminary Bridge Crossing	Upstream Station HEC-RAS	Downstream Station HEC-RAS
Credit River Crossing 2	20.8422	20.832
Credit River Crossing 1	21.287	21.297
Fletchers Creek Crossing	657	448

Given the location and orientation of the CVC cross sections within the project area of the Credit River, we note that refinement to the flood elevations within the project area may be possible by adding more data to the hydraulic model. Accordingly, we have refined the CVC HEC-RAS model of the Credit River by creating a new HEC-RAS model. Key methodology used in this new HEC-RAS model include the following;

- An additional 25 cross sections have been added within the project area to refine flood elevations;
- CVC Station 20.486 was used as a downstream boundary condition and applied to Burnside Cross Section 20.486. Calculated water surface elevations from the CVC model were inputted as Known Water Surface Elevations in the Burnside model;
- Peak flows from CVC HEC-RAS model at cross sections 25.078 and 21.142 have been applied to Burnside Cross Sections 22.04991 and 21.19097;
- Manning's 'n' roughness values for both the channel and over bank areas have been referenced directly from the CVC HEC-RAS model; and
- Reach lengths have been measured in the CAD environment.

The crossings for the supplementary Burnside model correspond to the following Stations.

Table 2 Crossing Location Stations (Burnside HEC-RAS Hydraulic Model)

Preliminary Bridge Crossing	Upstream Station HEC-RAS	Downstream Station HEC-RAS
Credit River Crossing 2	20.84352	20.83252
Credit River Crossing 1	21.26282	21.25009

Burnside analyzed several structure geometries with varying soffit elevations to evaluate the impact of a proposed structure and trail on the park and surrounding area. Below is a summary of the pre- and post-construction backwater flood elevations for each structure.

Credit River Crossing 1

Credit River Crossing 1 is located approximately 100 m west of the confluence of Fletchers Creek and adjacent to the Region of Peel sanitary easement. The natural top of bank elevations at this location are higher than Crossing 2, with elevations of approximately 159.5 m, which is well below the Regional Flood elevation of 161.96 m. Burnside evaluated the impact of several different bridge geometries, which set the proposed soffit elevations above the 50-year, 100-year and Regional Flood elevations

The Park 505: Fluvial Geomorphology Assessment, Final Report, completed by GeoProcess Research Associates in May 2020 identifies top of bank widths of pool and riffle sequencing within the Credit River at both potential bridge locations. Crossing #1 resides in the vicinity of GeoProcess field sections CR6 and CR7 with top widths of 30 and 30.9 m, respectively. Further, the Fluvial Geomorphology Assessment recommends the proposed abutments to be located 3.5 m beyond the top of banks. Therefore, for Crossing #1, the minimum span has been determined at 37.9m (30.9 m +3.5 m x 2). We have provided a 40 m span for this Crossing location whereby exceeding the minimum requirements by 2.1 m as illustrated on Figure 1.

We have reviewed varying soffit elevations and their response to Regional Peak flows. It has been determined that a soffit elevation above the Regional Flood Elevation provides the least hydraulic impact and is therefore the preferred option. The soffit elevation used for the simulation is 161.80 m. The results have been summarized in Table 3 below.

Table 3 Crossing 1 – Soffit = 162.00, Headwater Comparison at Station 21.27347

Design Event	Design Flow (m^3/s)	Existing Headwater Elevation (m)	Proposed Headwater Elevation (m)	Difference in Headwater Elevation (m)
2-year	90	159.95	159.96	0.01
5-year	160.3	160.49	160.49	0.00
10-year	211.1	160.71	160.71	0.00
25-year	286.2	160.95	160.95	0.00
50-year	350	161.12	161.13	0.01
100-year	420.6	161.31	161.31	0.00
Regional	694.1	161.96	161.97	0.01

As illustrated in Table 3 above, the revised HEC-RAS model with increased cross sectional data has refined the flood elevations in the vicinity of Crossing 1. Further, this refinement in flood elevations has been able to demonstrate that the proposed 40 m span, Crossing 1, has a negligible impact on the Credit River floodplain with a proposed soffit elevation of 161.97 m.

Currently, within the HEC-RAS model and associated conceptual drawings of the proposed structure, we have assumed fill to be the primary material to transition pedestrian traffic from existing ground elevations to the bridge deck itself. A detailed floodplain cut/fill analysis has not been completed under the scope of this project; however, we acknowledge that this will be a requirement at the detailed design stage. Alternatives may also be considered to elevate the tail to the bridge deck via a boardwalk type of feature at the detailed design stage.

Credit River Crossing 2

The Fluvial Geomorphology Report, completed by GeoProcess in January 2020, has identified that the optimal bridge location would be located 25 m upstream of XS-CR10 or approximately 250 m south of the confluence of the Credit River and Fletchers Creek. With a calculated bankfull width of 38 m, we have placed the bridge abutments at the recommended 3.5 m offset from the top of banks, whereby producing a total span of 45 m. This ensures that all work will be competed outside the watercourse. The crossing soffit elevation has been set to 161.60 m, which is above the Regional Flood elevation and the bridge deck was set at an elevation of 162.00 m, to transition into the natural topography.

Table 5 below summarizes the backwater flood elevations for Credit River Crossing 2:

The Burnside HEC-RAS model was used to analyze Crossing 2, with outputs summarized below on Table 4.

Table 4 Crossing 2 – Soffit = 161.68, Headwater Comparison at Station 20.85391

Design Event	Design Flow (m^3/s)	Existing Headwater Elevation (m)	Proposed Headwater Elevation (m)	Difference in Headwater Elevation (m)
2-year	90	159.5	159.5	0.00
5-year	202	159.96	159.97	0.01
10-year	264	160.16	160.16	0.00
25-year	353	160.4	160.41	0.01
50-year	428.2	160.58	160.59	0.01
100-year	510.8	160.79	160.8	0.01
Regional	732.6	161.66	161.66	0.00

As noted in Table 4 above, the proposed 45 m span crossing with the soffit elevation set above the Regional Flood elevation has minimal impact on the backwater elevation of the Credit River or surrounding area.

Currently, within the HEC-RAS model and associated conceptual drawings of the proposed structure, we have assumed fill to be the primary material to transition pedestrian traffic from existing ground elevations to the bridge deck itself. A detailed floodplain cut/fill analysis has not been completed under the scope of this project; however, we acknowledge that this will be a requirement at the detailed design stage. Alternatives may also be considered to elevate the tail to the bridge deck via a boardwalk type of feature at the detailed design stage.

Based on the hydraulic performance of both sites, Burnside notes that the proposed Credit River Crossings 1 and 2 both appear to have negligible impacts on the P-122 Expansion lands. Supporting HEC-RAS hydraulic output and digital files have been appended for reference.

Fletchers Creek Crossing

A Preliminary Site Investigation revealed a pre-existing railway corridor and bridge that crossed Fletchers Creek approximately 500 m northeast of the confluence with the Credit River. The existing bridge is no longer present, however the railbed provides an elevated trail platform and appears to provide an ideal location for the crossing of Fletchers Creek. The proposed pedestrian was modeled with a span of 28 m and bridge soffit elevation of 165.90 m. For the Fletcher's Creek crossing we have used the CVC HEC-RAS model to replicate hydraulic conditions at this crossing location.

Table 5 below summarizes the backwater flood elevations for the Fletchers Creek Crossing.

Table 5 Fletchers Creek Crossing, Headwater Comparison at Station 657

Design Event	Design Flow (m^3/s)	Existing Headwater Elevation (m)	Proposed Headwater Elevation (m)	Difference in Headwater Elevation (m)
2-year	25.13	162.67	162.68	0.01
5-year	40.77	163.05	163.05	0.00
10-year	52.91	163.29	163.29	0.00
25-year	68.74	163.56	163.57	0.00
50-year	81.03	163.75	163.76	0.01
100-year	94.88	163.94	163.95	0.01
Regional	287.05	165.89	165.88	-0.01

As shown in Table 5 above, the proposed bridge crossing has minimal impact on the backwater flood elevations upstream of the Fletchers Creek bridge crossing.

Recommended Structure Geometry

Based on our preliminary hydraulic review of site, Burnside recommends the following minimum geometries be used in the design:

Credit River Bridge – Crossing 1

- Span = 40 m
- Soffit Elevation = 162.00

Credit River Bridge – Crossing 2

- Span = 45 m
- Soffit Elevation = 161.68

Fletchers Creek Bridge

- Span = 28 m
- Soffit Elevation = 165.90 m

Supporting HEC-RAS output files and digital modelling files have been appended for reference.

If you have any questions or comments do not hesitate to contact the undersigned.

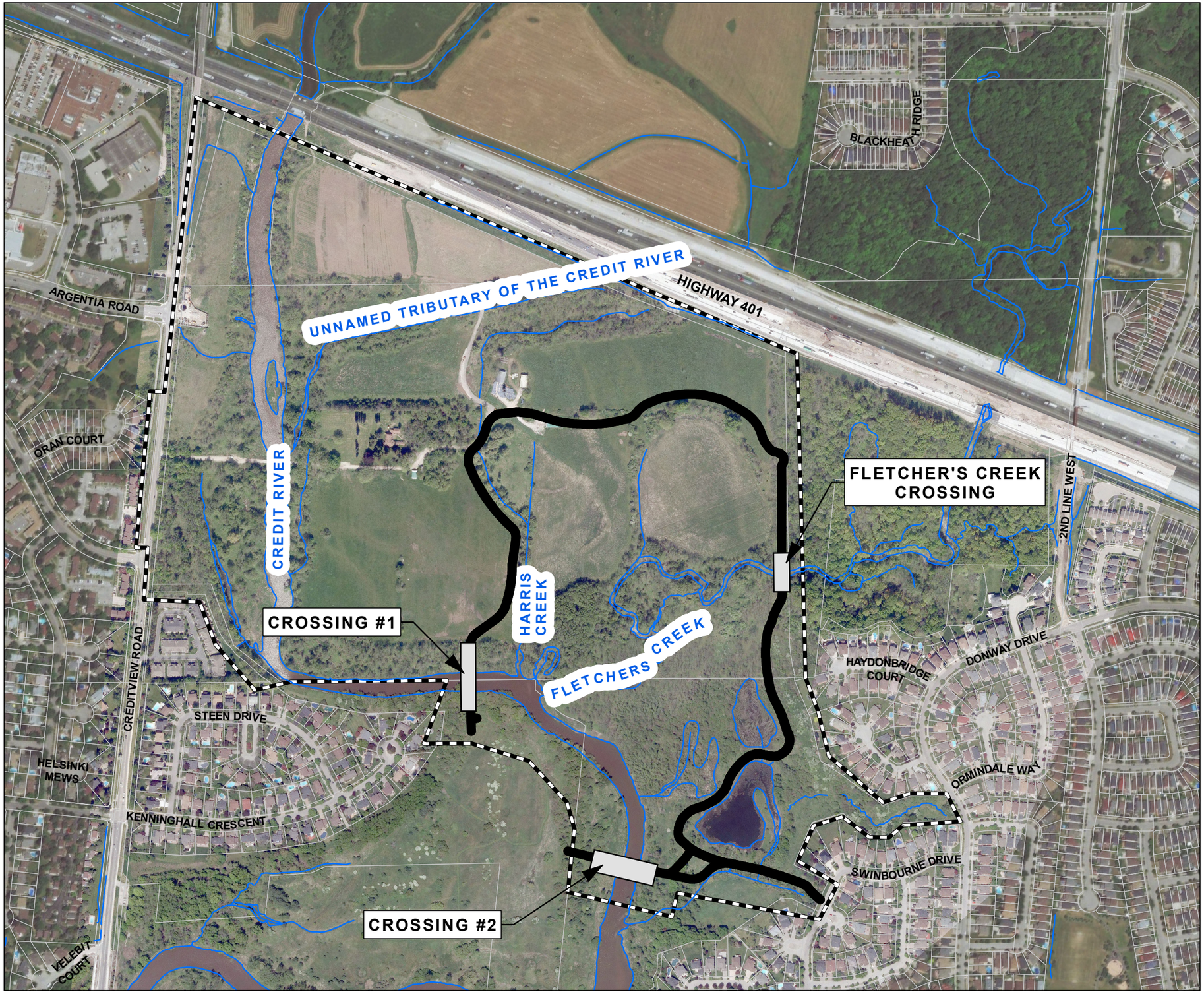
R.J. Burnside & Associates Limited

Peter De Carvalho, EIT
Engineering Assistant/Terrestrial Ecologist

Tim Koen P.Eng.
Water Resource Engineer

PD:js

Enclosure(s) Figure 1 – Existing Site



Proposed Crossing

Proposed Trail Alternatives

Watercourse

Study Area

Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario.
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. City of Mississauga.

Disclaimer:

R.J. Burnside & Associates Limited and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions

Datum: North American 1983 CSRS	
Coord. System: NAD 1983 CSRS UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Page Orientation: 308.58°	Scale Factor: 0.99960

Grid North

0 100 200 300 400 500

Metres

BURNSIDE

Client

CITY OF MISSISSAUGA

Figure Title

CREDIT MEADOWS PARK EXPANSION (FORMER HARRIS LANDS), P-122 HYDRAULIC PERFORMANCE MEMO

TRAIL ALTERNATIVES

Drawn	Checked	Date	Figure No.
HN	PD	2020/07/29	1
Scale		Project No.	
H 1:6,000		300043764	

File Path: \\elmo\Shared Work Areas\043764 (Mississauga Park 505)\13_GIS\Map\043764 Trail Alt - Hydraulic Memo.mxd Print Date: 2020/07/29 Time: 03:39 PM