Prepared By:

GM BluePlan ENGINEERING

City Of Guelph

Speed River Retaining Walls, North Of Speedvale Avenue Structural Condition Report

GMBP File: 118053

September 2018

CITY OF Guelph Making a Difference

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STRUCTURAL CONDITION REPORT

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1. INTRODUCTION

The City of Guelph (City) retained GM BluePlan Engineering (GMBP) to provide services laid out in the Terms of Reference for City of Guelph Project Reference No. 18-034 for an additional structure (Structure 414), as well as provide a summary structural condition report including pre-engineering capital cost estimates for completing any recommended repairs.

Structure 414 consists of approximately 1,125 m of retaining wall along the east and west sides of the Speed River, north of Speedvale Avenue. We note that retaining walls further north along the river are identified as Structure 413, which was included in the scope of work for City Project Ref No. 18-034. Structure ID 414 includes:

- Approximately 600m of retaining wall on the west side of the river to the southern extent of structure 413.
- Approximately 525m of retaining wall on the east side of the river to the southern extent of structure 413.

The current priority for the City is the condition of the approximately 350m of retaining wall directly north of Speedvale Avenue on the west side of the Speed River leading up to the Enabling Gardens of Riverside Park as shown in **Figure 1**. We understand that the structural condition of this section of retaining wall is a priority as it will affect the feasibility of constructing a multi-use trail linkage between the Enabling Gardens and existing/proposed trails on the south side of Speedvale Avenue. The City is actively engaged in a study to determine the feasibility, timing, capital cost, etc. to create the multi-use trail linkage. This report is intended to inform the City on the structural condition of the priority section of Structure 414. The remaining sections of Structure 414 will be inspected and reported on at a later date.

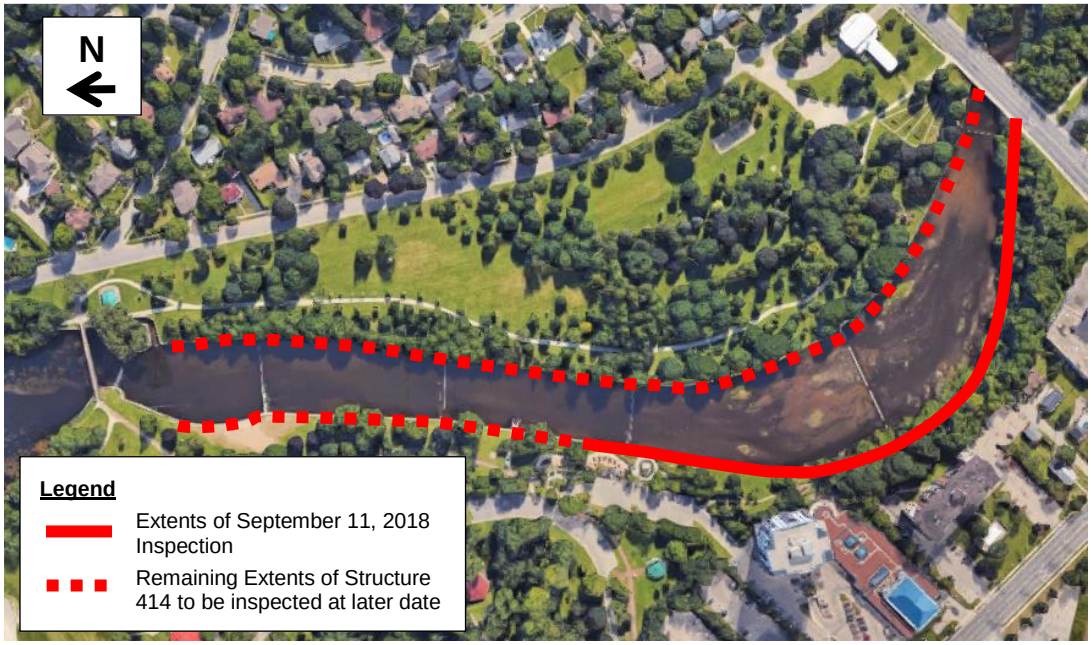


Figure 1: Extents of Structure 414 Structural Condition Inspection

2. INSPECTION SUMMARY

GMBP completed a visual structural condition inspection in accordance with the Ontario Structure Inspection Manual (OSIM, 2008) on the priority section of Structure 414 on September 11, 2018. Chainage begins at the wall immediately adjacent to the abutment of the Speedvale Avenue Bridge (Structure 108), considered to be chaingage 0+000, and continues north for approximately 400m along the wall to a final chainage of 0+400. The chainage is considered to be approximate due to significantly overgrown vegetation along the wall, making it difficult to obtain accurate measurements.

The visual inspection completed by GMBP progressed from south to north. The height of the wall, as measured from stream bed to top of wall, decreases from 2.95m at 0+000 to 1.05m at 0+400. The width of the top horizontal face of the wall was measured to be 0.43m.

The following general observations were noted throughout the retaining wall:

- Narrow to medium cracking with efflorescence throughout;
- Isolated areas of light to medium scaling throughout;
- Overgrown trees and vegetation at the southern extents of the retaining wall from 0+000 to approximately 0+270; and,
- The face of the retaining wall exhibits moss growth, indicating the buildup of moisture on the face of the wall. The growth of moss is most prevalent in areas where vegetation is overgrown and debris has accumulated in front of the wall.

Table 1 below provides a summary of specific observations noted during the visual inspection. The observations have been summarized in to approximately 50 m chainage increments. Refer to **Appendix A** for photos referenced in the table below.

Table 1: Summary of Deficiencies

Chainage	Observations	
0+000 to 0+050	**Wall Height at 0+000:** 2.95m **Wall Height at 0+050:** 2.55m	
	Comments:	**Photo**
	• Approximately 7 wide vertical cracks extending from river bottom to top of wall.	4
	• Medium cracking, delamination and spalling at connection with bridge.	3
	• Evidence of cold joint with isolated light to medium honeycombing.	3,4
0+050 to 0+100	**Wall Height at 0+050:** 2.55m **Wall Height at 0+100:** 2.05m	
	Comments:	**Photo**
	• Approximately 3 vertical cracks and 1 medium crack with efflorescence, all extending the full height of wall.	5
	• Isolated medium delamination and spalling.	6

Chainage	Observations	
0+100 to 0+150	**Wall Height at 0+100:** 2.05m **Wall Height at 0+150:** 1.65m **Comments:**	**Photo**
	• Approximately 3 wide vertical cracks and 2 narrow to medium vertical cracks with efflorescence, all extending the full height of wall.	7
0+150 to 0+200	**Wall Height at 0+150:** 1.65m **Wall Height at 0+200:** 1.40m **Comments:**	**Photo**
	• Approximately 2 wide vertical cracks and 3 narrow to medium cracks with efflorescence, all extending the full height of wall.	8
	• Severe delamination and spalling isolated around large stormwater (STM) outlet at chainage 0+160	8
0+200 to 0+250	**Wall Height at 0+200:** 1.40m **Wall Height at 0+250:** 1.10m **Comments:**	**Photo**
	• Approximately 3 narrow to medium vertical cracks with efflorescence, all extending the full height of wall.	
	• Severe delamination and spalling isolated around small STM outlet with exposed corroded rebar at approximately chainage 0+240.	9
0+250 to 0+300	**Wall Height at 0+250:** 1.10m **Wall Height at 0+300:** 1.10m **Comments:**	**Photo**
	• Approximately 1 wide vertical crack and 3 narrow to medium vertical cracks with efflorescence, all extending the full height of wall.	10
0+300 to 0+350	**Wall Height at 0+300:** 1.10m **Wall Height at 0+350:** 1.05m **Comments:**	**Photo**
	• Approximately 3 wide vertical cracks and 5 narrow to medium vertical cracks with medium spalling and efflorescence. Cracks extend the full height of wall.	11

Chainage	Observations	
0+350 to 0+400	**Wall Height at 0+350:** 1.05m **Wall Height at 0+400:** 1.05m	
	Comments:	**Photo**
	• Approximately 7 wide vertical cracks with spalling and efflorescence, all extending the full height of wall..	
	• 2 wide vertical cracks with forward rotation of the wall on one side causing a 10mm separation measured at the top of the wall.	12,15
	• Wide cracking, severe delamination and spalling around STM outlet.	13,14
	• Anchorage of STM outlet grate to concrete has been compromised due to spalled concrete.	13,14
	• Potential undermining of wall on north side of STM outlet for approximately 1m.	13
	• Wide cracking, severe delamination and spalling of the coping slab on top of wall. Vegetation growth between spalled coping slab sections with forward rotation of spalled sections.	17,18
	• Medium horizontal cracking with efflorescence throughout wall under coping slab.	17

3. SUMMARY AND RECOMMENDATIONS

Generally, the priority section of retaining wall inspected on September 11, 2018, is in good to fair condition, with isolated areas in poor condition. The areas of the wall in poor condition exhibit narrow to wide cracking, and areas of severe delamination and spalling. The following key deterioration areas are of structural concern:

- Section 0+350 to 0+400 of the wall exhibits advanced deterioration in relation to the rest of the wall inspected.
- There are some wide vertical cracks resulting in rotation of the wall, indicating differential movement on either side of the crack.
- Oergrown trees and vegetation at the southern extents of the retaining wall from 0+000 to approximately 0+270.

We recommend, at a minimum, that the key deterioration areas listed above be monitored biennially as part of the City's OSIM inspection program. This will help the City understand the rate of deterioration of this structure and aid in further assessing the remaining service life.

We also recommend that the above noted deficiencies be repaired to preserve the remaining service life of the structure. These repairs should be completed within the next 5 years. Additionally, the vegetation impacting the current and future condition of the wall should be removed immediately and this area should be maintained annually to preserve the remaining service life. Consulting with the Grand River Conservation Authority (GRCA) would be required prior to proceeding with any of this work. **Table 2** includes a high-level cost estimate of repairs.

Based on the current condition of the wall, we estimate the remaining service life to be approximately 10 to 20 years provided the above deficiencies are repaired and addressed. We note that the estimated remaining service life is based only on the results of a visual inspection and does not take into consideration the condition of buried elements, such as the foundations.

Table 2: Rehabilitation Cost Estimate

REHABILITATION					
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT OF MEASURE	UNIT PRICE	TOTAL AMOUNT
1	Mobilization, Bonding, Insurance, Demobilization, Site Access	100%	L.S.	$75,000.00	$75,000.00
2	Environmental Protection and Worksite Isolation	100%	L.S.	$50,000.00	$50,000.00
3	Concrete Removal	100%	L.S.	$15,000.00	$15,000.00
4	Crack Repairs by Mortar/Epoxy Injections	100%	L.S.	$25,000.00	$25,000.00
5	Concrete Patch Repairs in Delaminated Areas	100%	L.S.	$55,000.00	$55,000.00
6	Vegetation and Tree Removal/Maintenance	100%	L.S.	$30,000.00	$30,000.00
SUB-TOTAL COST					**$250,000.00**
Contingency (20%)					**$50,000.00**
Engineering Design, Construction Services (20%)					**$50,000.00**
TOTAL COST					**$350,000.00**

Note that the cost estimate above are based on pre-engineering level of design. Detailed design should be carried out to better detail quantities and specified repairs. Consultation with regulatory agencies, such as the GRCA, may also impact the total capital costs based on allowable construction methodologies.

4. LIMITATIONS

This report is intended exclusively for the Owner(s) named in the report. The material in it reflects our best judgment in light of the information reviewed by GM BluePlan Engineering Limited at the time of preparation. Unless otherwise agreed in writing by GM BluePlan Engineering Limited, this report shall not be used to imply warranty as to the fitness of the property for a particular purpose. This report is not a certification of compliance with past or present regulations. No portion of this report may be used as a separate entity; it is written to be read in its entirety.

This report does not include a review of codes, regulations or standards unless otherwise specified. GM BluePlan Engineering Limited did not review or analyze detailed design drawings or as-built drawings for the purposes of assessing capacity, adequacy or accuracy of any features of the subject property. As such, no warrantee or guarantee of performance, explicitly stated or implied, has been made with respect to the subject property, structural systems or appurtenances.

Please don't hesitate to contact the undersigned should further assistance be required.

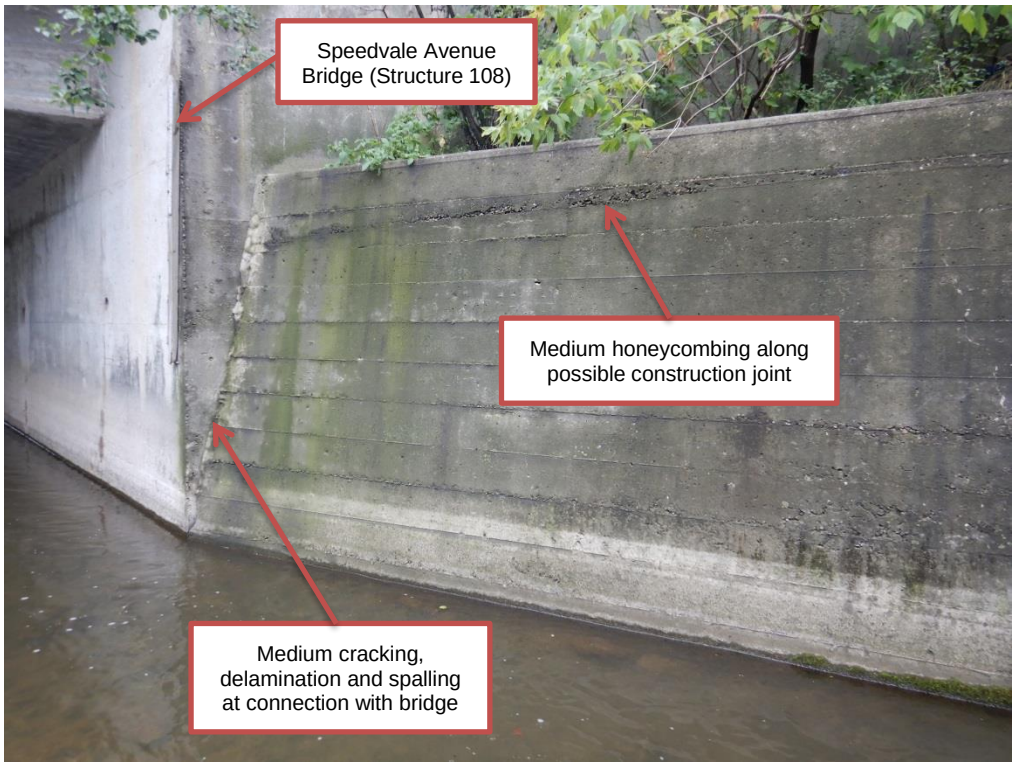
GM BLUEPLAN ENGINEERING LIMITED

Per:

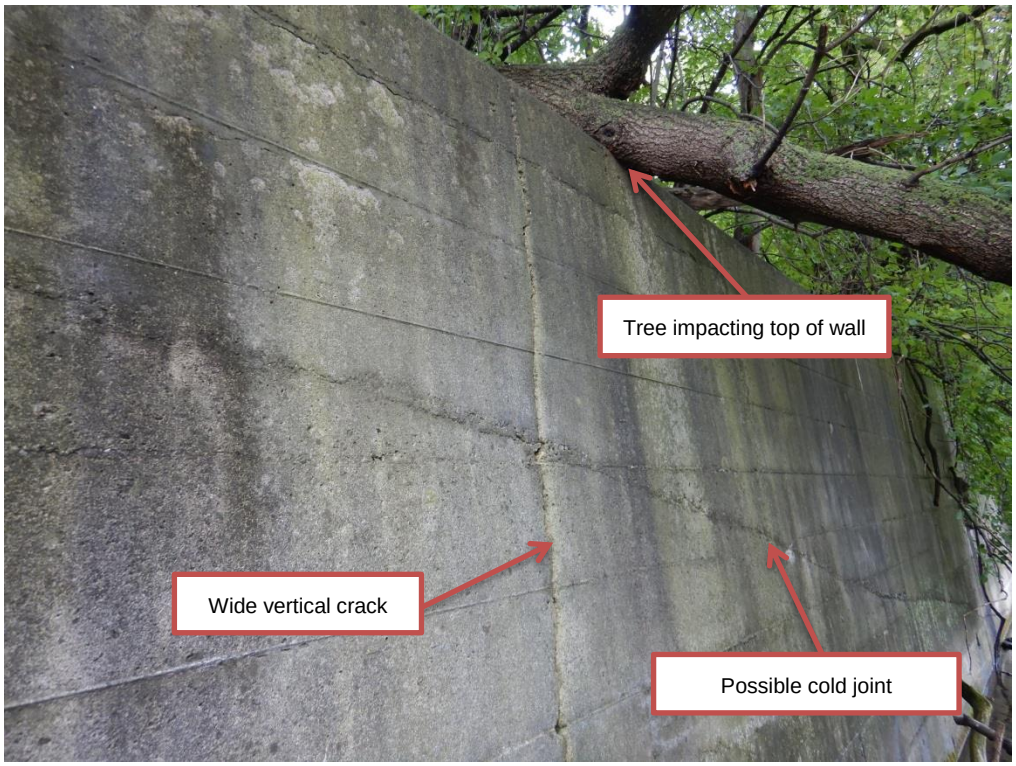
Jack Turner, P.Eng.
Project Manager

Photograph 1: Speed River, looking south (Approximate Chainage 0+150)

Photograph 2: Speed River, looking north (Approximate Chainage 0+150)



Photograph 3: Approximate Chainage 0+000



Photograph 4: Approximate Chainage 0+010

Photograph 5: Approximate Chainage 0+060

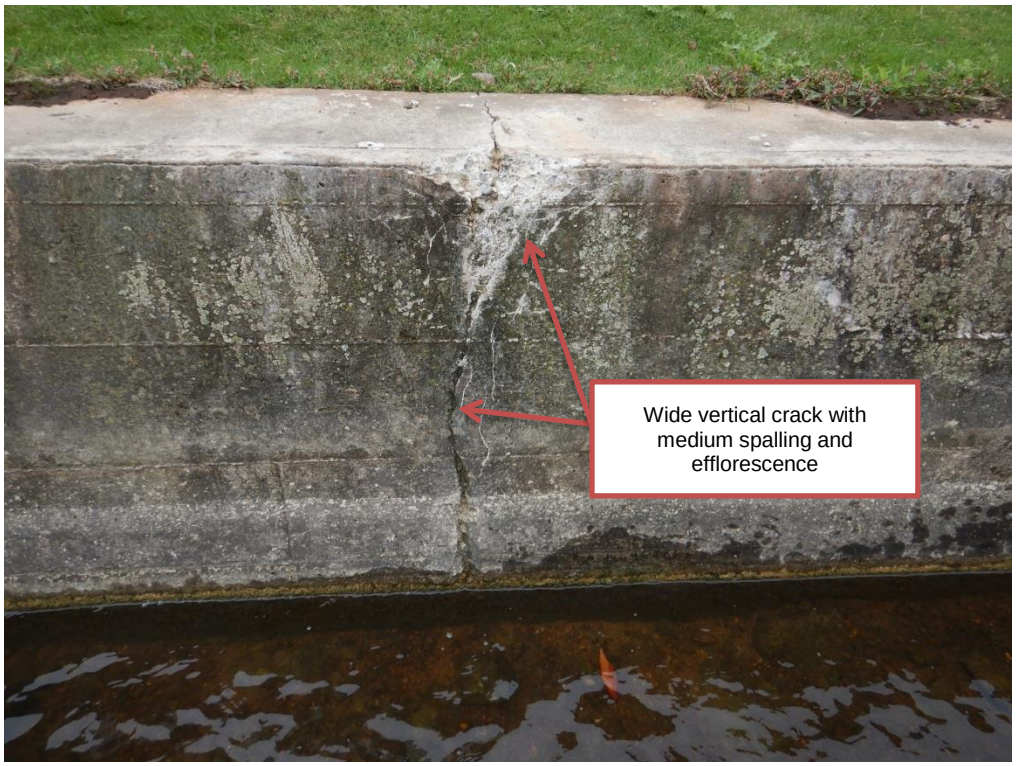
Photograph 6: Approximate Chainage 0+080

Photograph 7: Approximate Chainage 0+100

Photograph 8: Approximate Chainage 0+160

Photograph 9: Approximate Chainage 0+240

Photograph 10: Approximate Chainage 0+290



Photograph 11: Approximate Chainage 0+310

Photograph 12: Approximate Chainage 0+360

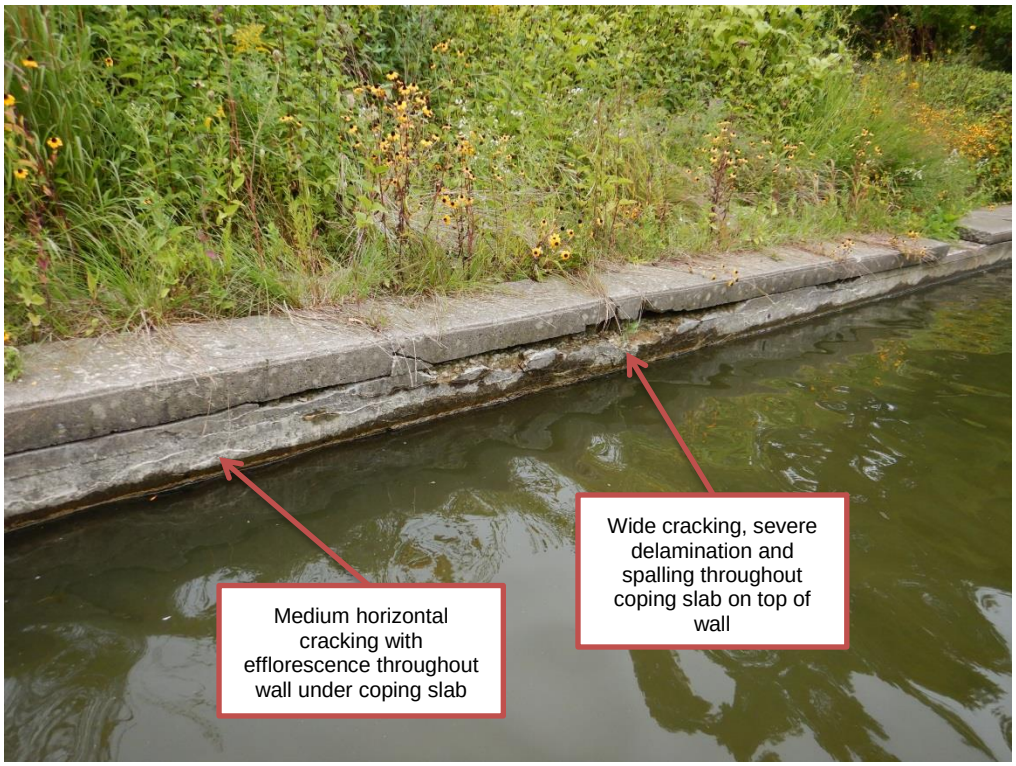
Photograph 13: Approximate Chainage 0+380

Photograph 14: Approximate Chainage 0+380, looking north

Photograph 15: Approximate Chainage 0+380

Photograph 16: Approximate Chainage 0+380

Photograph 17: Approximate Chainage 0+400



Photograph 18: Approximate Chainage 0+390