Prepared By:

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City of Guelph

Norwich Street Bridge Class Environmental Assessment Project File (Schedule B)

GMBP File: 116046-1

September 2017

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EXECUTIVE SUMMARY

The City of Guelph (City) is evaluating alternatives to address the deteriorating condition of the Norwich Street bridge over the Speed River, located on the former Norwich Street between Cardigan Street and Arthur Street North. The Study Area is generally the section of the pedestrian path crossing the Speed River at this location, including the existing bridge.

The City has initiated a Schedule B Municipal Class Environmental Assessment (EA) study with the following key objectives:

- Consider a reasonable range of appropriately planned potential solutions;
- Consider impacts to all aspects of the environment (social, cultural, natural environment, technical and economic);
- Select a preferred solution through a transparent decision-making process; and,
- Encourage public participation throughout the process.

Problem/Opportunity Statement

The following needs have been identified with the respect to the existing condition of the Norwich Street bridge:

- The existing bridge is 134 years-old and is in poor condition;
- There are deficiencies and issues including: severe corrosion, loss of section on the floor beams and pin connections, warping of the top chord of the trusses, severe sections of delamination and disintegration of the abutments and wing walls, and the possible undermining of the northwest abutment footing; and,
- Support of the existing sanitary and water main crossing the Speed River needs to be addressed.

The City of Guelph plans to explore how to best maintain this heritage and utility crossing while balancing social, cultural, natural environment, technical and economic responsibilities.

Consultation

The City engaged in a thorough and comprehensive public consultation process involving federal, provincial, municipal and community group organizations as well as the public and First Nations and Métis groups. There were five formal points of contact with these groups:

- Notice of Study Commencement
- Cyclist and Pedestrian Intercept Survey
- Public Information Centre (PIC) #1
- Public Information Centre (PIC) #2
- Notice of Study Completion

In addition to physical mail outs, notifications were sent via email and posted on the City of Guelph's website. Notices were also published in the Guelph Mercury.

Throughout the process, all groups were invited to attend the PICs to provide comments as well as contact members of the project team directly to provide comments or to ask questions.

Impact and Evaluation of Alternatives

The alternative solutions considered are:

- Alternative 1: Sympathetic Rehabilitation of the Existing Bridge
- Alternative 2: Installation of a New Bridge Structure between the Existing Trusses
- Alternative 3: Sympathetic Replacement of the Existing Bridge
- Alternative 4: Bridge Removal (without Replacement)
- Alternative 5: Do Nothing

For all of the alternatives carried forward, there will need to be consideration given to a permanent support structure for the watermain and sanitary sewer pipes located south of the existing bridge and currently supported by the closed pedestrian bridge. Additionally, the abutments and retaining walls (substructure) are in need of repairs or replacement. Depending on the selected preferred alternative, there are two possible options that could be pursued to address the deteriorated substructure. The options and generic scope of work are as follows:

Replacement of substructure:

- superstructure to be removed
- abutments, footings and close proximity retaining walls to be removed
- construct new footings, abutments and retaining walls
- install new superstructure

Rehabilitation of substructure:

- underpinning of west abutment to repair scour/undermining at upstream end
- localized concrete removal to sound concrete and repair
- localized removal and repair to northwest wingwall

Alternatives 4 and 5 do not address the requirements or objectives of the City and are strongly opposed by the public and other stakeholders. Therefore, these alternatives have been screened out and removed from further consideration for the comparative assessment and evaluation.

The remaining alternatives were evaluated against criteria developed for the Socio-Economic, Cultural, Natural and Technical Environments. The evaluation of the alternatives revealed:

- Alternative 1 is not preferred as it results in a greater likelihood of additional closures for repairs in the near future, would not address current maintenance issues with the bridge and would require substantial reinforcement of existing elements to meet current design standards.
- Alternative 2 is preferred as it maintains the existing steel trusses as an architectural feature of the bridge, retains the heritage elements of the bridge, removes the bridge deck from the existing substructure that is in poor condition, can be designed to current pedestrian bridge loading and has a relatively low cost based on the life-cycle analysis.
- Alternative 3 was not preferred as it would remove the existing heritage trusses from the bridge and result in the largest capital cost.

Recommended Alternative

Alternative 2 offers the City the best opportunity to maintain the existing trusses as it preserves them in place as primarily an aesthetic feature. By installing a self-supporting structure, the existing trusses and supporting structure would only be required to carry their own weight, which represents a significant reduction in total load to be carried by the elements. The new structure would be able to provide a safe crossing over the Speed River and be designed to better accommodate drainage, salting and sanding of the deck and pedestrian barriers.

The bridge structure should be designed as a pedestrian crossing, designed for pedestrian and maintenance vehicle loading as well as appropriate deflection limits as per CSA S6-14 (the Canadian Highway Bridge Design Code) and the Ontario Ministry of Transportation's Structural Manual. The City has expressed the desire to maintain this structure only as a pedestrian crossing. Therefore, there is no need to provide any allowances for highway traffic loading of the Canadian Highway Bridge Design Code.

The existing watermain and sanitary sewer located south of the existing trusses are currently supported by the Norwich Street pedestrian bridge, which is currently closed. This bridge structure should be removed and replaced with a structure to support the watermain and sanitary sewer pipes. Appropriate fencing and signage will need to be provided to prohibit public access to the structure.

Impacts and mitigation measures for each of the recommended alternatives have been provided for the Socio-Economic, Cultural, Natural and Technical Environments.

Additional recommendations of the Class EA study are:

- The City should develop a maintenance plan for the bridge, which includes mitigating impacts to the natural environment.
- Considerations will need to be made for how to support the water and sanitary sewer utilities south of the Norwich Street bridge.
    - The support structure should not be accessible by the public.
    - The structure should be designed to minimize viewing obstructions.
    - Alternatively, it should be reviewed whether the utilities can be relocated to underneath the Norwich Street bridge.
- Any restoration works to the trusses or name plates of the Norwich Street bridge will require a heritage permit from the City of Guelph.
- The City should clarify the extent of repairs to the retaining walls that line the Speed River for detailed design and construction.

Next Steps

The following steps are recommended following completion of the Class EA study:

- Implementation of details including detailed design, agency approvals and tendering of the project for construction.
- Coordination with utilities to locate services as well as develop and implement mitigation measures (i.e., protection of existing utilities, temporary utilities during construction, etc.)
- Construction.

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APPENDICES

CITY OF GUELPH

NORWICH STREET BRIDGE CLASS ENVIRONMENTAL ASSESSMENT
PROJECT FILE (SCHEDULE B)

GMBP FILE: 116046-1

SEPTEMBER 2017

1. INTRODUCTION

The City of Guelph (City) is evaluating alternatives to address the deteriorating condition of the Norwich Street bridge over the Speed River, located on the former Norwich Street between Cardigan Street and Arthur Street North. The Study Area is generally the section of the pedestrian path crossing the Speed River at this location, including the existing bridge. Refer to **Figure 1** for a location plan of the Study Area.

Figure 1: Study Area

The existing bridge is a half through Pratt truss (pony truss) bridge located approximately 70 m east of Cardigan Street on the former Norwich Street road allowance, and was built in 1882. It is constructed of a timber deck on riveted steel with a span of 17.0 m and a travelled width of 3.7 m. Refer to **Figure 2** for a photograph of the existing structure.

Figure 2: Photograph of Existing Norwich Street Bridge

The Norwich Street bridge was used as a vehicular bridge linking the east and west areas of what is now known as the Goldie Mill Neighbourhood. Historically, this crossing site facilitated the movement of materials across the Speed River serving the needs of nearby mills and foundries. This structure is the only surviving iron and steel truss bridge of the many that once existed in the City of Guelph. For these reasons, the City designated the entire steel and iron structure of the Norwich Street bridge, as well as the date plates, in 1998 (By-law 1998-15786). The bridge was closed to vehicle traffic in approximately 2003 following the recommendations of a bridge evaluation. It has since served as a pedestrian bridge for trails along the Speed River. We note that the date plate on the northwest side of the bridge is missing. A plaque describing the bridge is located on the north truss.

Prior to closing the bridge to vehicle traffic, a 5 tonne load limit was in place on the Norwich Street bridge. We have not completed any structural calculations on the load capacity of the existing structure; however, it can be reasonably assumed that the current load limit would be no more than 5 tonnes due to ongoing deterioration and no meaningful structural repairs having been completed since it was designated as a heritage structure in 1998. It is very likely that the current load limit for the structure would be less than 5 tonnes.

A steel pedestrian truss footbridge, known as the Norwich Street pedestrian bridge, is located south of the Norwich Street bridge. The superstructure of this bridge is independent of the Norwich Street bridge, and was not a part of the designation bestowed upon the Norwich Street bridge in 1998. This structure is currently closed to pedestrian traffic, and is not considered within the Study Area of this study; however, this footbridge supports an existing watermain and sanitary sewer. Ultimately, the removal of the footbridge is not considered within the scope of this study, but the preferred alternative will need to consider how the watermain and sanitary sewer are supported upon implementation.

The City has initiated a Schedule B Municipal Class Environmental Assessment (EA) study with the following key objectives:

- Consider a reasonable range of appropriately planned potential solutions;
- Consider impacts to all aspects of the environment (social, cultural, natural environment, technical and economic);
- Select a preferred solution through a transparent decision-making process; and,
- Encourage public participation throughout the process.

The Purpose of this report (Project File) is to document the Schedule B Class EA process, including public consultation, the evaluation and assessment of alternatives against social, cultural, natural environment, technical and economic criteria, as well as the selection of the preferred solution.

2. MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT PROCESS

Municipal infrastructure projects are subject to the Ontario Environmental Assessment Act (EA Act). The Class Environmental Assessment is an approved self-assessment process under the EA Act for a specific group or "class" of projects. Projects are considered approved subject to compliance with an approved Class EA process. The Municipal Class EA (Municipal Engineers Association October 2000, as amended in 2007, 2011 & 2015) applies to municipal infrastructure projects including roads, water and wastewater.

The Municipal Class EA outlines a comprehensive planning process (illustrated in **Figure 3**) that provides a rational approach to consider the environmental and technical advantages and disadvantages of alternatives and their trade-offs in order to determine a preferred alternative for addressing the problem (or opportunity), as well as consultation with agencies, directly affected stakeholders and the public throughout the process. The key principles of successful environmental assessment planning include:

- Consultation;
- Consideration of a reasonable range of alternatives;
- Consideration of effects on natural, social, cultural, and economic environments and technical components;
- Systematic evaluation;
- Clear documentation; and
- Traceable decision making.

The classification of projects and activities under the Municipal Class EA is as follows:

Schedule A – Includes normal or emergency operational and maintenance activities, which are limited in scale and have minimal adverse environmental effects. These undertakings are pre-approved and the proponent can proceed without further assessment and approval.

Schedule A+ – Introduced in 2007, these minor projects are pre-approved. The public is to be advised prior to the implementation of the project.

Schedule B – Includes projects which have the potential for adverse environmental effects. This includes improvements to, and minor expansions of existing facilities. These projects are approved subject to a screening process which includes consulting with stakeholders who may be directly affected and relevant review agencies.

Schedule C – Includes the construction of new facilities and major expansions to existing facilities. These undertakings have the potential for significant environmental effects and must proceed under the planning and documentation procedures outlined in the Municipal Class EA document.

This study is proceeding as a Schedule 'B' process, in accordance with the requirements of the Municipal Class EA process, which includes Phases 1 and 2, depicted on **Figure 3**:

- Phase 1 consists of identifying the problem or opportunity.
- Phase 2 involves identifying reasonable alternatives to the problem or opportunity, compiling an inventory on the natural, social and economic environment, evaluating each alternative and recommending a preferred alternative that will address the problem, and provide any measures necessary to mitigate potential environmental impacts. Public and agency consultation is required at this stage before the preferred solution is selected to ensure all possible impacts are identified, and assessed as part of the evaluation process.

Once the Preferred Solution is selected and confirmed by Council, the final Project File is made available for public review during a 30-calendar day period. A Notice of Completion is submitted to review agencies and the public at this time.

If concerns are raised during the 30 calendar-day review period that cannot be resolved through discussions with the Municipality, then members of the public, interested groups or technical agencies may request the Minister of the Environment and Climate Change (MOECC) to issue a Part II Order (i.e. bump-up) for the project, thereby requiring an elevated scope of study. A Part II Order request requires submission of a written request to the Minister, prior to the end of the 30-calendar day review period, outlining the unresolved issue and requesting the Minister to review the matter.

Part II Order requests are submitted to:

The Honourable Glen Murray
Minister of the Environment and Climate Change
77 Wellesley St. W.
Toronto, Ontario M7A 2T5
Fax: 416-314-8452
gmurray.mpp@liberal.ola.org

Copies of the request must also be sent to the Director of the Environmental Approvals Branch at the MOECC at the address below:

Attn: Ms. Agatha Garcia-Wright
Director, Environmental Approvals Branch
Ministry of the Environment and Climate Change
Floor 12A, 2 St. Clair Avenue W
Toronto, ON M4V 1L5
EAASIBgen@ontario.ca

For further information regarding Part II Order requests and process, please go to:

https://www.ontario.ca/environment-and-energy/class-environmental-assessments-part-ii-order

The decision whether a Part II Order (i.e. bump-up) is appropriate or necessary rests with the Minister. If no Part II Order requests are outstanding by the end of the 30-calendar day review period, the project is considered to have met the requirements of the Class EA, and the proponent may proceed to design and construct the project subject to resolving any commitments documented in the Project File during the subsequent design phases and obtaining any other outstanding environmental approvals.

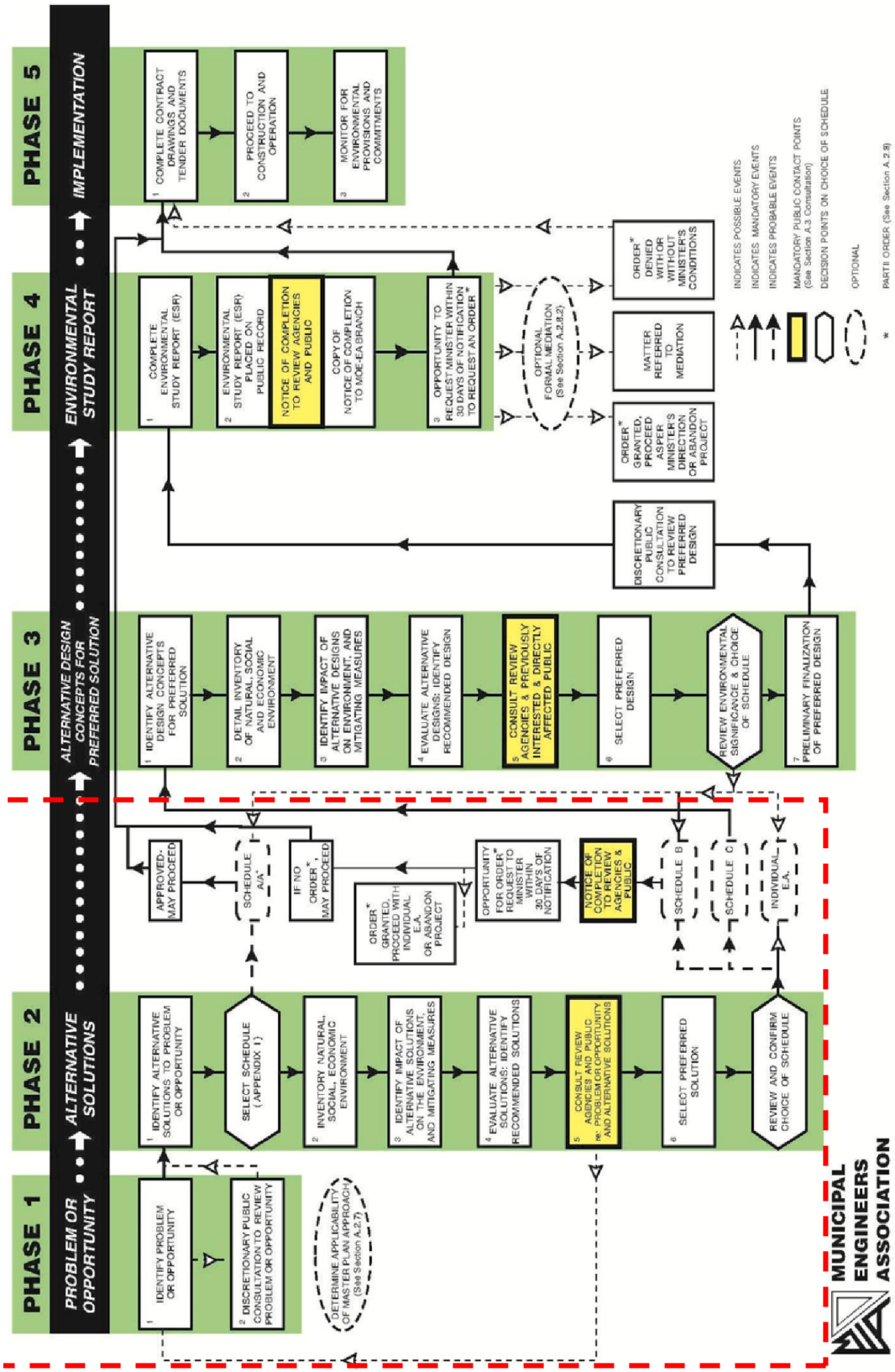
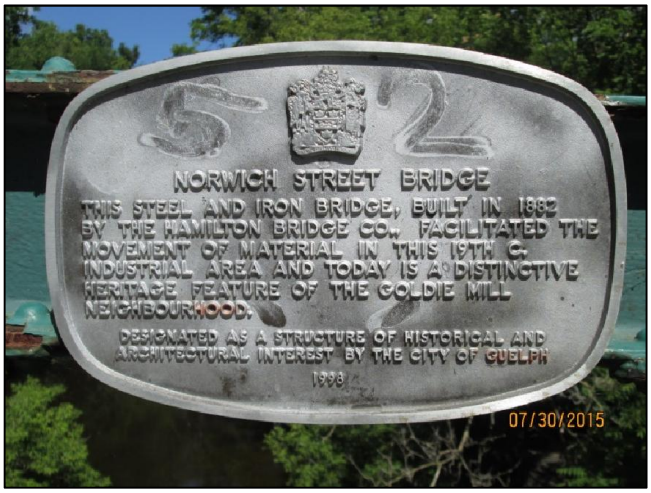


Figure 3: Municipal Class Environmental Assessment Process

3. PROBLEM / OPPORTUNITY STATEMENT

Structural inspections have identified the need for repairs or replacement of the Norwich Bridge due to its poor condition. The bridge was constructed in 1882 by the Hamilton Bridge Company, and is an historical pony truss bridge located approximately 70 m east of Cardigan Street on the former Norwich Street road allowance. It has a span of approximately 17 m and a travelled width of 3.7 m. This structure was used for vehicle traffic until approximately 1998, when it was limited to pedestrian traffic only. The bridge, including its date plates, is designated as a heritage structure under the Ontario Heritage Act, in accordance with By-law Number (1998)-15786. Additionally, a sanitary sewer and water main are suspended from the closed pedestrian bridge adjacent to the Norwich Street bridge.



Problems identified with the Norwich Street bridge include:

- The existing bridge is 134 years-old and is in poor condition;
- There are deficiencies and issues including: severe corrosion, loss of section on the floor beams and pin connections, warping of the top chord of the trusses, severe sections of delamination and disintegration of the abutments and wing walls, and the possible undermining of the northwest abutment footing; and,
- Support of the existing sanitary and water main crossing the Speed River needs to be addressed.

The City of Guelph plans to explore how to best maintain this heritage and utility crossing while balancing social, cultural, natural environment, technical and economic responsibilities.

4. EXISTING CONDITIONS

4.1 Socio-Economic Environment

4.1.1 Land Use

The Study Area is set within an urban landscape on the edge of the City of Guelph's downtown core. Adjacent landscapes include parkland, multi-use trails, an active rail corridor, the Speed River, attached and detached residences and high-rise apartment buildings.

The Speed River is a prominent watercourse through the City of Guelph and within the Grand River Conservation Authority's (GRCA) watershed. The watercourse at the Study Area is channelized by large concrete retaining walls on either bank of the river. Upstream of the site, the banks of the watercourse are subject to erosion issues. The Speed River is subject to a cool-water timing window for in-water works (works not permitted from March 15 to June 30), and its narrow floodplain is characterized by wooded vegetation within urban parkland upstream and downstream of the subject area.

4.1.2 Official Plans and Policies

The City of Guelph Official Plan is used to guide land use and activities by establishing goals, objectives and policies while considering the greater Guelph community. This includes the social, economic and natural environments. The following summarizes a review of Guelph's Official Plan:

- The City of Guelph will encourage and develop a system of publicly accessible parkland, open space and trails.
- The existing bridge is considered essential transportation infrastructure.
- The existing bridge is located within a Significant Natural Area and is within the Regulatory Floodplain for the One Zone Floodplain. No development is permitted within the One Zone Floodplain; however, this area may be used for outdoor recreation and open space conservation areas.
- Any permitted infrastructure must consider the Natural Heritage System and minimize impact, where feasible.
- Any construction within or across surface water features or fish habitat must occur during the appropriate Ministry of Natural Resources and Forestry (MNRF) timing windows, and best management practices should be employed during construction.
- Opportunities to restore permanent and intermittent stream and fish habitat are encouraged.

We note that the Norwich Bridge is not identified as a pedestrian or cyclist crossing in the following documents:

- City of Guelph Official Plan maps
- City of Guelph Cycling Master Plan Schedule 1: Proposed Cycling Network map
- City of Guelph City Wide Trail Master Plan Tail Network

4.1.3 Source Water Protection

The Grand River Source Protection Plan (SPP) was reviewed for the City of Guelph and in consultation with online mapping information provided by the GRCA. The Study Area is located within a Wellhead Protection Area B, with a vulnerability of 10. The study area is not located within 100 m of a municipal well. Refer to **Figure 4** below.

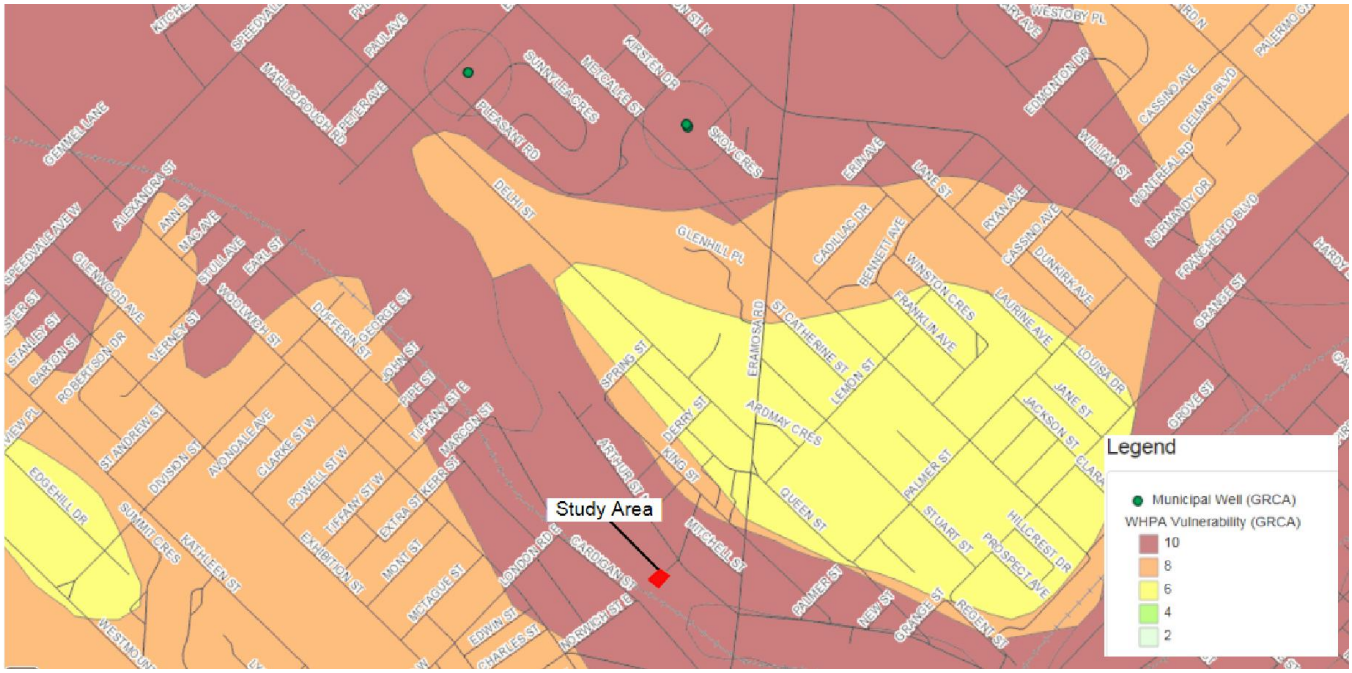


Figure 4: Source Water Protection, Wellhead Protection Area Vulnerability in Study Area (Source: GRCA)

4.2 Cultural Environment

4.2.1 Cultural Heritage

Refer to **Appendix A** for the "Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist" for the Norwich Street Bridge.

The Norwich Street bridge is designated under Part IV of the Ontario Heritage Act under the City's By-law Number (1998)-15786. A Cultural Heritage Evaluation and Heritage Impact Assessment was completed by Archaeological Services Inc. (ASI) to establish the cultural heritage significance of the Norwich Street bridge and assess impacts of the proposed undertaking in consideration of its determined heritage value. The complete report is provided in **Appendix B**. The heritage significance of the structure is due to the following:

- Its design, associated and contextual value given the relative rarity of comparable structures in the City.
- The associations with the Hamilton Bridge Company and the industrial history of the City.
- Its continued association with the settlement, growth and economic development in this part of the City.

As part of the assessment of impacts to the heritage value, nine options were considered based on the *Ontario Heritage Bridge Program* (1991). **Table 1** below depicts a conversion from these nine options to the Alternatives found in **Section 6.1** being considered within this environmental assessment.

Table 1: Ontario Heritage Bridge Program Conversion to EA Alternatives

Ontario Heritage Bridge Program (1991) Options	Corresponding EA Alternative	Desirability from Heritage Conservation Perspective
1 – Retention of existing bridge and restoration of missing or deteriorated elements	1	High
2 – Retention of exiting bridge with no major modifications	-	High
3 – Retention of existing bridge with sympathetic modification	2	High
4 – Retention of existing bridge with sympathetically designed new structure in proximity	-	High
5 – Retention of existing bridge no longer in use for vehicle purposes	-	Moderate
6 – Relocation of bridge to appropriate new site for continued use or adaptive re-use	3	Moderate
7 – Retention of bridge as heritage monument for viewing purposes only	3	Moderate
8 – Replacement or removal of existing bridge with salvage elements of heritage bridge	3	Low
9 – Replacement or removal of existing bridge with full documentation	3	Low

Following the evaluation of the options above, Option 3/Alternative 2 is preferred from a heritage resource perspective. This Alternative has no impact given that alterations would be sympathetic to heritage attributes. This would include the construction of a structure within the trusses of the Norwich Street Bridge, removing the load bearing strain off the current bridge and thus extending its lifespan. The new structure should be designed to cast minimal shadows on the trusses of the heritage structure.

4.2.2 Archaeology

Following the Standards and Guidelines for Consultant Archaeologists, administered by the Ministry of Tourism, Culvert and Sport (MTCS), a Stage 1 Archeological Assessment was completed by ASI. This assessment included background research into the Study Area and was used to determine the archaeological site potential. The complete report is provided in **Appendix C**. The assessment generally identified the following:

- Parts of the Study Area have been subjected to deep soil disturbance events from the construction of the existing bridge, right-of-way, and sewer infrastructure, and do not possess archaeological potential. These areas do not require further assessment.
- Some lands within the Study Area adjacent to the river are sloped in excess of 20 degrees, and do not possess archaeological potential. These areas do not require further assessment.
- The remainder of the Study Area retains archaeological potential. These areas will require Stage 2 archaeological assessment. Refer to the green shaded area at the northeast end of the Study Area as shown in **Figure 5** below.
- Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Figure 5: Results of Property Inspection
(Source: ASI Stage 1 Archaeological Assessment Report – Figure 8)

Recommendations from the Stage 1 Archaeological Assessment report included that if the area outside the slope at the northwest corner of the existing bridge be impacted by the selected preferred alternative, a Stage 2 assessment would be required.

4.3 Natural Environment

Aboud & Associates Inc. (Aboud) completed a review of the natural heritage of the Study Area as part of their scoped Environmental Impact Study (EIS). The full study is provided in **Appendix D**, and is summarized as follows.

4.3.1 Background Review

The following is a summary of the background review completed as part of the EIS report:

- Investigation in the Natural Heritage Information Centre (NHIC) identified three provincial Species at Risk (SAR) protected under the Endangered Species Act, 2007 (ESA) and one other species identified as rare within approximately 1 km of the Study Area.
- No SAR occurrence records were provided by the MNRF for this site based on a request for information response dated July 7, 2016.
- No habitat for SAR birds was present in the Study Area based on a review of the 2001-2005 Ontario Breeding Bird Atlas.
- A review of the Ontario Reptile and Amphibian Atlas identified 28 species that are known to occur within a 10 km x 10 km square area containing the Study Area, including four SAR under the ESA. Nesting or overwintering habitat was not identified in the Study Area; however, overwintering habitat may be present in the watercourse for Common Snapping Turtle. Twelve reptile/amphibian species considered Locally Significant by the City of Guelph and seventeen species considered Significant Species in Wellington County were noted for the Study Area.
- A review of the Atlas of the Mammals of Ontario (1994) identified twenty-nine species that are known to occur within 10 km of the Study Area, including one SAR. Two mammal species are considered Locally Significant by the City of Guelph, and two are considered Significant Species by the County of Wellington.

4.3.2 Trees and Vegetation

The following is a summary of the trees and vegetation review completed as part of the EIS:

- Four ecological communities were identified within the Study Area including Dry Fresh Mixed Meadow Ecosite (MEMM3) in recently disturbed areas, Fresh Manitoba Maple Deciduous Forest (FODM4-5) along the open areas within the floodplain and adjacent to the river, Parkland (CGL_2) within the park and trails on the west side of the river and Shallow Aquatic (SA) within the river.
- None of the ecological communities are listed as provincially rare communities.
- A botanical field inventory was completed, during which 43 species were identified (21 native and 22 exotic species).
- One native species inventoried was ranted as Imperiled (S2) in Ontario (Cup Plant, *Silphium perforliatum*); however, the specimen in the Study Area is of the variety grown in gardens and should not be considered rare or protected within Ontario.
- A tree inventory was completed, listing Manitoba Maple (71%), Black Walnut (13%), White Spruce (8%), American Elm (4%) and Austrian Pine (4%) as the species within the Study Area

4.3.3 Wildlife Habitat

The following is a summary of the wildlife habitat review completed as part of the EIS:

- Of the species observed incidentally during the site review, none are listed as Special Concern both provincially and federally.
- Two areas of Significant Wildlife Habitat were identified within the Study Area: Waterfowl Stopover and Staging (Aquatic) and Turtle Wintering Area.

4.3.4 Aquatic Habitat

The following is a summary of the aquatic habitat review completed as part of the EIS:

- During the aquatic assessment, a number of small, unidentified fish were observed within the watercourse throughout the Study Area.
- The watercourse within the Study Area is of moderate habitat quality for fish, with significant shaded sections reducing thermal impacts.
- Water control structures upstream and downstream create full or partial barriers, limiting fish movement.
- The watercourse is classified as a coolwater system, meaning that in-water works are not permitted between March 15 and June 30.

Natural Environment Crossing Alternative Analyses

- Alternative 1 and 2 would have the lowest impact based on the limited number of trees that would need to be trimmed to facilitate crane usage to rehabilitate the existing structure and minimal in water work to repair the substructure. Alternative 1 and 2 are the preferred alternatives from a Natural Heritage perspective.
- Alternatives 3 and 4 would require more work within the river to remove and rebuild the abutments and portions of the retaining walls. Reconstructing the west abutment outside the high water mark would be considered an unknown. This is not to say removing it would not provide a benefit by creating a more naturalized channel, however, since the speed river is already so modified, the benefits would be quite minimal.

4.4 Technical Environment

4.4.1 Utilities

The utilities in the Study Area will need to be considered as they will impact the construction method available. Based on our investigation, the following are utilities that may impact construction:

- Watermain and sanitary sewer pipes exist just to the south of the existing bridge and are currently hung from the now closed pedestrian bridge.
- Utility poles carrying aerial utilities are immediately to the north of the existing heritage bridge.
    - The primary hydro lines (three at the top of the poles) are 13,860 volt lines. The next line down is the system neutral. All four (4) lines require any machinery and labourers to remain 3 metres (10 feet) away at all times.
    - The next line down the poles we believe are street lighting which would likely require a minimum of 1 metre (3 feet) clearance. Guelph Hydro could not confirm this at the time of the EA.
    - The lowest line is believed to be Rogers Cable.

The power feed to this area comes through four different transformer stations and could potentially be de-energized to allow for closer proximity to the power lines to allow for the use of cranes. However, based on the system configuration and other construction works at the time of bridge construction, the power lines at the bridge may not be able to be de-energized to allow for safe completion of construction activities. Coordination with Guelph Hydro will be required during detailed design through to construction completion.

While utility locates for design purposes were acquired during this EA study, the detailed design team should confirm all utilities in the area before construction.

4.4.2 Structural

The following structural deficiencies were noted in the recent visual inspections of the Norwich Street bridge:

- The deck is showing signs of moderate rotting and rutting, creating and uneven surface that could soon pose tripping hazards to pedestrians.
- Several of the riveted steel members show signs of corrosion and “pack rusting”, which is causing scalloping or warping of the top plate of the top chords of the trusses.

- The expansion joints are severely corroded, and were previously encased in concrete due to their deteriorated condition. Due to the concrete encasement, the bridge is no longer able to move longitudinally to accommodate thermal expansion and contraction.
- Scour and potential undermining of the northwest footing was observed.
- Severe corrosion and loss of section was noted on the steel floor beams.
- The pin connections are severely corroded, which may be concealing more serious defects in the pins themselves as well as the eye-bars that connect to the pins.

Structural Loading Considerations:

- According to the CAN/CSA S6-14 Standard (Canadian Highway Bridge Design Code) the live load to be applied to pedestrian bridges would cause a pedestrian load in excess of 25 tonnes over the current span.
- It was estimated by Triton Engineering Services Limited (Triton) that the original design of the Norwich Street Bridge in 1882 was for approximately 9 tonnes. Based on the condition of the structure in 2002, Triton determined a 2002 vehicular load capacity of approximately 4 tonnes. This does not account for further deterioration of the bridge 15 years later or repairs completed in 2003.
- While pedestrian loads and a vehicular loads are not directly relatable due to various design considerations (location of truck wheels versus pedestrian uniform loads, vehicle impact factors, etc.), the existing structure as originally designed would not likely be theoretically able to support current code pedestrian loads. Considering the current structure condition, if a full current code pedestrian design load were to be applied to the structure it would exceed the theoretical capacity of the bridge.
- Based on the above, it will be extremely difficult and expensive to rehabilitate the existing bridge to be able to support current day code loading.
- A load posting to limit the number of patrons on the bridge could be added, however, load postings are often ineffective. Enforcement of a load posting would be also be difficult.

March 2002 – Bridge Evaluation Report

Triton Engineering Services Limited (Triton) completed a Bridge Evaluation Report for the Norwich Street Bridge in March 2002. Excerpts from this report are provided in **Appendix E.** A summary of the findings of this report are as follows:

- The bridge has been posted for a restricted load limit of 5 tonnes, equivalent to a light delivery truck, since 1976, when the bridge was under the jurisdiction of the MTO.
- It is estimated that the bridge was originally designed to carry 9 tonnes, and 120 years later severe corrosion has reduced the safe carrying capacity to a weary 4 tonnes, at best.
- There was a partial collapse of the bridge in 1948 reportedly caused by a weakening of the west abutment by flood waters. The west abutment and wingwalls were subsequently reconstructed.
- In 1994, the vehicle bridge required significant strengthening of the compression chords near the end posts and reconstruction of the tension tie connections to maintain a minimum 5 tonne load carrying capacity.
- Based on a November 2000 detailed visual inspection by Triton, several knee braces were replaced in 2001 to improve the stability of the trusses and timber curbs were added for protection of the trusses."
- This type of bridge structure has very little redundancy in terms of load carrying capacity and failure of a truss component under vehicular load would likely result in a complete collapse of the structure. Compounding the problem is that steel components fabricated in the 1800s are considered to be very brittle in nature and catastrophic failure could occur with little or no advance warning, possibly resulting in severe injury or death.
- Preservation of the bridge for heritage reasons will be very costly. Preservation for an indefinite period will require replacement/strengthen of some components, partial dismantling and reconstruction of the bridge, and application of corrosion inhibiting coatings.
- Environmental regulations related to the removal and application of protective coatings add significant costs to the long term preservation of the structure.
- To reduce long term costs and to preserve the bridge in light of its heritage designation, it is recommended that the existing bridge be dismantled, restored in a shop environment, and reassembled for display in a benign environment, such as a park, where it would not be subject to road salts or aggressive chemicals.

2015 – Safety Critical Report

Engineered Management Systems Inc. (EMSI) completed an Ontario Structure Inspection Manual (OSIM) inspection in 2015 that informed a report titled "Safety Critical Report 002 – 2015". Excerpts from this report are provided in **Appendix E.** A summary of the findings of this report are as follows:

- Severe to very severe corrosion at several connections located along the bottom chords. It is estimated that the loss of section at these connections is 50-60 % impacting the ends of diagonals, bottom chords and verticals. The floor beams and some bolts also exhibit severe to very severe corrosion.
- The bottom chords at the end of the truss (bearing area) are not completely visible and the extent of deterioration cannot be estimated; however, severe to very severe corrosion is noted at all four ends.
- A structure evaluation and remedial measures are immediately required (failure of even one connection along the bottom chord may trigger a sudden partial or total collapse of the entire truss).
- Coating deterioration has resulted in severe deterioration of structural steel and corrosion will accelerate (some components are already beyond repair).
- The condition of the entire structure should be monitored by maintenance crews and any abnormal behaviour should be reported to the City technical staff.

September 2015 – Structural Inspection and Design Alternatives

Following the 2015 EMSI Safety Critical Report, the City engaged the services of GM BluePlan Engineering Ltd. (GMBP) to complete a visual inspection and letter report titled "Norwich Street Pedestrian Bridges, Structural Inspection and Design Alternatives (Structures 00009-1 and 00009-2)" dated September 18, 2015. Structure 00009-1 is the Norwich Street bridge. Excerpts from these reports are provided in **Appendix E.** A summary of the findings of these reports are as follows:

- Major deficiencies with the structure included severe corrosion and loss of section on the floor beams, severe corrosion of identified pin connections, and warping of the top plate of the top chord. The abutments and wingwalls have severely delaminated sections with disintegration, and the northwest footing may be undermined.
- The pin connections and floor beams at the middle bays of the bridge are the area of greatest concern The amount of corrosion is difficult to assess based on the visual inspection completed; however, there were several areas of severe corrosion with loss of section noted, with the top flange of one floor beam noted to be completely missing in one area.
- Immediate and sudden failure may be possible in these heavily corroded areas. It is recommended that the City take action immediately.
- Six (6) rehabilitation alternatives are discussed including: Historic Restoration, Sympathetic Restoration, Sympathetic Restoration with a new Bridge Deck, Sympathetic Restoration with a new Bridge Structure, Replacement, and Removal.
- Based on the deteriorated condition of the structure, it is believed that it would be in the City's best interest to pursue options that involve constructing a stand-alone bridge structure while maintaining the historic trusses with minor restoration works (sympathetic restoration with new bridge deck or sympathetic restoration with new bridge structure options).

4.4.3 Hydrology/Hydraulics

A HEC-RAS model of the Speed River from the Guelph Lakes Dam to Gordon Street was obtained by GMBP from the GRCA. This model was last updated in August 2016 to reflect additional topographic data obtained downstream of the Norwich Street bridge (filename: "Speed R4 August2016"). A brief hydrologic and hydraulic review of the existing bridge structure was completed to provide water surface elevation levels at the bridge under various design flow conditions. It should be noted that GMBP did not complete a thorough review of the model to verify hydrologic parameters, cross section data or other aspects of the model.

Pre-consultation discussions with staff from the GRCA occurred in 2016 regarding works to the bridge. It was noted during the discussions that any changes to the existing Norwich Street bridge should ensure that there is no increase in

the upstream or downstream water levels after the bridge work (if any) is completed as compared to existing conditions.

There are very few guidelines available that provide criteria for hydraulic performance of pedestrian bridges. As a reference, we have considered typical design criteria for roadway bridges and culverts as a comparison, as these structures often convey pedestrian and cyclist traffic in addition to vehicle traffic. The MTO Highway Drainage Design Standards (2008) WC-1 Design Flows (Bridges and Culverts) recommends that bridges with spans greater than 6.0 m, serving local access roads, are be designed to convey the 25 Year design flow and have consideration for the "Regional Flood Flow" for high flow conditions.

Hydrology

Flow rates provided in the HEC-RAS model are provided in **Table 2** below.

Table 2: Peak Flow Rates for Study Area

Design Storm	Flow Rate (m^3/s)
2 Year	81.9
5 Year	114.0
10 Year	134.0
20 Year	155.0
50 Year	181.0
100 Year	200.0
Regional – Original	512.0
Regional – GRHS	480.0

Hydraulic Analysis

As previously noted, the reference criteria for the bridge include the following:

- There is to be no increase in the upstream or downstream water elevations under all storm events following any works to the structure.
- The bridge should safely convey, at a minimum, the flow generated during a 25 Year design storm event.

The plan "ERI 2016 Update (revised Norwich Bridge)" was run to determine the flood elevations at River Sta. 25100.5 BR U Norwich St. The revisions to this plan involved updating the bridge cross-section to account for an open barrier style that would allow flow to pass through. The results of the model are provided in **Table 3** below.

Table 3: Results of the HEC-RAS Model at River Sta. 25100.5 BR U Norwich St

Design Storm	Water Surface Elevation under Existing Conditions (m)
2 Year	317.25
5 Year	317.70
10 Year	317.97
20 Year	318.21
50 Year	318.82
100 Year	318.82
Regional – Original	319.64
Regional – GRHS	319.74

The geometry file of the HEC-RAS model provides a soffit elevation for the Norwich Street bridge of 318.82 m. As shown above, the existing bridge theoretically has capacity to convey the 25, 50 and 100 Year design flow events without overtopping; however, under a Regional Flow condition, the road would theoretically be overtopped. Based on the results of the HEC-RAS model, the existing bridge is sized to convey a 100 Year design flow event, meaning that it is sufficiently sized to meet the minimum design standard for a bridge on a local road previously referenced. Excerpts from the HEC-RAS model are provided in **Appendix F**.

It should be noted that the Norwich Street bridge is modelled with a top of deck elevation of 319.30 m. This allows for a total deck height of approximately 0.48 m. In terms of the existing structure, this depth is comprised of the existing wood stringers and wood deck.

As the existing bridge abutments are retaining walls that extend upstream and downstream of the bridge, any proposed works to the Norwich Street bridge will not likely impact the characteristics of the crossing below the invert of the existing bridge.

Summary and Recommendations

Based on the above modelling and analysis, the following summarizes the results and recommendations of the above.

- The existing bridge is sufficiently sized to convey up to the 100 Year design flow.
- Water overtops the existing bridge during the Regional Flow.
- The cross-sectional flow area between the existing river bed and soffit elevation of the existing bridge should be maintained as part of any proposed works.
- The “open” bridge style should be maintained as part of any proposed works
- There are not anticipated to be any measurable changes in flood elevations or flow characteristics provided the above criteria are met.
- Should Alternative 3 be selected as the preferred alternative and the west abutment be moved west outside of the high water mark, flooding implications would need to be reviewed.

4.4.4 Transportation and Traffic

The Norwich Street bridge is a key pedestrian and cyclist link for the Goldie Mill Neighbourhood and Downtown. The bridge also provides connection for the neighbourhood to the Downtown Trail, and allows for a safe crossing of the Speed River away from vehicle traffic. Since the bridge was converted to strictly pedestrian and cyclist use, Norwich Street has been reconstructed west of the bridge so that the roadway dead ends at Cardigan Street. As previously mentioned, the City does not have any plans to reconstruct Norwich Street so that vehicle traffic can use the Norwich Street bridge.

Traffic data provided on the 2015 OSIM Inspection Report completed by Engineered Management Systems Inc. indicates that the Annual Average Daily Traffic (AADT) to be 200 users per day. It is estimated that this figure may reference a traffic count from when the bridge was open to vehicle traffic, as the City does not keep pedestrian and cyclist traffic count data and field observations by GMBP during site visits indicate that the daily usage by pedestrians and cyclists is much higher than this amount. Therefore, the bridge appears to be relatively well used and is a vital pedestrian crossing.

We believe that the majority of active transportation across the Norwich Street Bridge originates from the Goldie Mill Neighbourhood. Based on discussions with users during our site visits, the destination for the majority of the traffic is the downtown core, schools and the adjacent parklands for work and leisure purposes.

Approximately 240 m south of the Norwich Street bridge is the Eramosa Road bridge across the Speed River. The Eramosa Road bridge carries four lanes of vehicle traffic and two pedestrian sidewalks that are approximately 1.6 m wide.

The next crossing of the Speed River north of the Norwich Street bridge is the Speedvale Avenue Bridge over the Speed River, which is approximately 1.5 km north of the study area; however, we understand that the City is assessing a site at Emma Street and Earl Street for another pedestrian bridge crossing. This location would be approximately 1.1 km north of the Norwich Street bridge.

5. CONSULTATION

5.1 Key Points of Contact

Consultation during the decision-making process is a key feature of the Municipal Class EA process. The Schedule B Municipal Class EA process has two mandatory points of contact: the Notice of Study Commencement and Notice of Study Completion. These points of contact are summarized in **Table 4** below:

Table 4: Summary of Points of Contact for EA Process

Point of Contact	Distribution	Purpose
Notice of Study Commencement **(June 2016)**	• Sent by mail to all residents within the defined catchment area in August 2016 (completed by City staff) • Published on the City of Guelph website on July 20, 2016 • Published in the Guelph Mercury Tribune in July 2016.	Introduce the study and problem statement to the public.
Cyclist and Pedestrian Intercept Survey **(September 2016)**	• No distribution or public notice	To obtain preliminary and informal comments from active transportation users of the Norwich Street Bridge prior to the first Public Information Centre.

Point of Contact	Distribution	Purpose
Public Information Centre #1 **(September 2016)**	• Sent by mail to all residents within the defined catchment area in September 8, 2016 (completed by City staff) • Published on the City of Guelph website on July 20, 2016 • Published in the Guelph Mercury Tribune on two separate dates during September 2016	Invite the public to provide input on the problem statement, alternative solutions being considered and evaluation criteria for the alternative solutions. The City elected to host this open house for the general public; notices were not sent to agency contacts.
Public Information Centre #2 **(May 2017)**	• Sent by mail to all residents within the defined catchment area on May 4, 2017 • Published on the City of Guelph website on prior to the date of PIC. • Published in the Guelph Mercury on two separate dates in May 2017	Invite the public and agencies to review the alternative solutions considered and the preferred solutions.
Notice of Study Completion **(September 2017)**	• Sent by mail to all residents within the defined catchment area on September 22, 2017 • Published on the City of Guelph website on September 21, 2017 • Published in the Guelph Mercury on September 21st and 28th, 2017	Advise on the completion of the planning process and commencement of the 30-calendar day public review period of the Project File

5.2 Cyclist and Pedestrian Intercept Survey

In order to fully appreciate the existing use of the Norwich Street bridge, project staff surveyed existing active transportation users of the bridge. Project staff posed a short list of open-ended questions to pedestrians and cyclists at the existing bridge on September 10 and 15, 2016. Additionally, staff provided an information handout designed to summarize the study and identify contact information. Refer to **Appendix G** for a copy of the handout and questions asked to active transportation users.

The purpose of this survey was to:

- Provide a coarse estimation of the level of use of the Norwich Street bridge;
- Identify characteristics of the existing bridge and crossing that people are passionate about; and
- Identify potential issues and concerns with closing or removing the Norwich Street bridge.

The survey was not intended to be statistically valid. Rather, it was designed to elicit input from those who are regular users of the adjacent trail networks and existing bridge.

5.3 Public Information Centre #1

The first Public Information Centre (PIC) was held on September 21, 2016 at Guelph City Hall from 2:00-4:00 p.m. and 7:00-9:00 p.m. The PIC was a drop-in, open house format with members of the Project Team available to review information with attendees and answer any questions. The purpose of the PIC was to:

- Introduce the study to the public and review the problem/opportunity;
- Provide an overview of the background information available to date;
- Introduce the evaluation criteria that will be used to evaluate the alternative solutions; and,
- Identify the next steps in the process.

This PIC was held jointly with the first PIC for another Municipal Class EA assessment within the City (the Ward to Downtown Pedestrian Bridges Schedule B EA). In total, approximately 90 people attended the PIC for the Norwich Street Bridge assessment or both assessments. We note that attendees that did not indicate the PIC they were attending on the sign in sheet are assumed to have attended both PICs. There may also have been attendees that attended a PIC they did not indicate on the sign in sheet. The level of attendance and feedback was considered to be a success by the Project Team.

Display boards and comments received during the first PIC have been included in **Appendix G**. In general, the comments received supported the approach by the City and the criteria to be used for the evaluation of alternatives. There was resounding support for having a bridge in this location, and several concerns with safety if pedestrians and cyclists were required to use Eramosa Road permanently. While the majority of comments appeared to only support restoration of the existing bridge, there were a number of comments that were supportive of replacement of the bridge with a new structure similar in style to the existing bridge. Comments noted how important this structure is for active living and connectivity for the Goldie Mill Neighbourhood and the strong desire to keep this bridge closed to vehicle traffic. Some comments raised concerns about the lack of lighting in the area.

5.4 Public Information Centre #2

The second PIC was held on May 17, 2017 at Guelph City Hall from 6:30-8:00 p.m. The PIC was a drop-in, open house format with members of the Project Team available to review information with attendees and answer any questions. The purpose of the PIC was to:

- Introduce the alternatives considered;
- Outline our evaluation of the alternatives;
- Introduce our recommended preferred alternative,
- Identify the next steps in the process.

In total, approximately 15 people attended this PIC. The level of attendance and feedback was considered to be a success by the Project Team.

Display boards and comments received during the second PIC have been included in **Appendix G**. In general, the comments received supported the approach by the City and the criteria to be used for the evaluation of alternatives. There was a majority support for the selected preferred alternative. It was noted that the heritage trusses should not be overshadowed by the new superstructure design, and that construction should take place in the summer while schools are not in session and the traffic on Eramosa Road is reduced.

5.5 Agency Consultation

The following agencies were notified of the Notice of Study Commencement and requested to provide feedback or information that may be relevant to the study:

- Guelph Junction Railway (GJR)
- Aboriginal Affairs and Northern Development Canada – Consultation and Accommodation Unit (CAU)
- Ministry of Aboriginal Affairs
- Department of Fisheries and Oceans Canada (DFO)
- Environment Canada
- Ministry of the Environment and Climate Change (MOECC)
- Ministry of Natural Resources and Forestry (MNRF)
- Ministry of Tourism, Culture and Sport (MTCS)
- Grand River Conservation Authority (GRCA)
- Hydro One
- Bell Canada
- Guelph Hydro
- Rogers

- Telus
- Union Gas

As well, the following municipal bodies were notified of the Study Commencement and requested to provide feedback or information that may be relevant to the study:

- Guelph Fire Department
- Guelph Police Services
- Guelph-Wellington EMS

Relevant agency feedback that was received is summarized below. A full list of agency contacts and full summary of correspondence is provided in **Appendix H**.

5.5.1 Utilities

- Union gas stated that they do not have any infrastructure within the study area.
- There is an existing sanitary sewer and watermain south of the Norwich Street bridge, which are supported by the closed pedestrian bridge.
- Overhead utilities are present on the north side of the Norwich Street bridge.
- Design locations should be completed during the detailed design phase, and field locates should be completed prior to construction to confirm the presence and location of utilities.

5.5.2 MOECC

- The checklist developed by the Municipal Engineers Association (MEA) must be completed and provided within the project file.
- A list of First Nation and Métis contacts was provided by the MOECC.
- If the project is located within a source water protection vulnerable area, determine whether any project activity is a prescribed drinking water threat.

5.5.3 GJR

- Any construction activities adjacent to GJR tracks must maintain a clearance of 3.0 m from the track rails.
- If construction vehicles are required to cross GJR tracks, GJR must be notified in advance.
- Flagging may be required during material delivery or crane operations.
- GJR had no additional comments.

5.5.4 GRCA

- Any proposed works would be subject to O. Reg. 150/06 requiring permission from the GRCA to undertake the works.
- If the project proceeds after completion of the Class EA, the following plans will be required:
    - Detailed erosion and sediment control plan
    - Dewatering and diversion plan, if applicable
    - Construction staging and sequencing plan
    - Site restoration and rehabilitation plan
- The need for targeted surveys of turtles and related mitigation measures should be discussed with the MNRF.
- A bird survey is recommended in order to determine whether birds are nesting on the existing structure and to ensure compliance with the Federal Migratory Bird Convention Act.

5.6 Stakeholder Consultation

Property owners within a defined catchment area were mailed the Notice of Study Commencement, notices of PIC 1 and PIC 2 and Notice of Study Completion by the City. Refer to **Figure 6** below for the approximate catchment area.

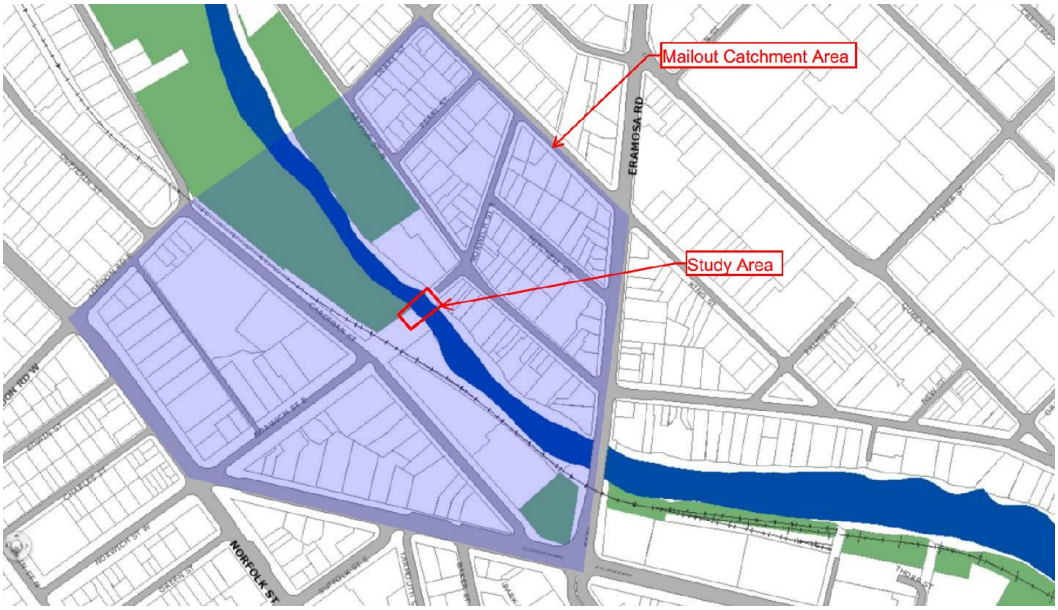


Figure 6: Mailout Catchment Area (Source: City of Guelph online GIS)

Along with comments received during the PICs, several comments were received by the Project Team via email. These comments, along with responses, have been summarized in **Appendix I**.

In general, comments were almost exclusively against a closure or removal of the existing bridge. Most comments stated that the heritage look was important to them, as well as the significance of the last remaining steel truss heritage bridge in Guelph. Numerous comments alluded to the desire that the Norwich Street bridge remain closed to vehicular traffic, something that the City intends to maintain as part of this assessment.

5.7 First Nations and Métis Communities Consultation

After consultation with the MOECC regarding First Nation and Métis consultation, the following organizations were contacted at the onset of the project with the Notice of Study Commencement, notice of PIC #2 and the Notice of Study Completion:

- Six Nations of the Grand River Territory
- Haudenosaunee Confederacy Chiefs Council
- Mississaugas of the New Credit
- Métis Nation of Ontario, Métis Consultation Unit

To date, representatives from these organizations have not contacted the Project Team. The City will welcome discussions with these organizations should they indicate an interest in the Class EA study, or in the future implementation of the Recommended Alternatives.

6. IMPACT AND EVALUATION OF ALTERNATIVE SOLUTIONS

6.1 Alternative Solutions

The alternative solutions represent different approaches or strategies to address the needs of the project, taking into consideration the all aspects of the environment. Under the provisions of the Municipal Class EA process, all reasonable alternative solutions require consideration to ensure that there is adequate justification to proceed with the improvements and that the need for the project is clearly demonstrated. The alternative solutions are assessed against their ability to reasonably address the identified problems and opportunities.

The City has already closed the Norwich Street bridge to vehicular traffic, and has implemented a trial network around this structure. The City does not desire to re-open this crossing to vehicle traffic and based on public feedback the public overwhelmingly support this view. Therefore, reopening the crossing to vehicular traffic will not be considered within this EA study.

The alternative solutions being considered are:

- Alternative 1: Sympathetic Rehabilitation of the Existing Bridge
- Alternative 2: Installation of a New Bridge Structure between the Existing Trusses
- Alternative 3: Sympathetic Replacement of the Existing Bridge
- Alternative 4: Bridge Removal (without Replacement)
- Alternative 5: Do Nothing

This section reviews the alternatives considered, provides preliminary costs for the alternatives and summarizes the general advantages and disadvantages associated with each alternative.

For all of the alternatives carried forward, there will need to be consideration given to a permanent support structure for the watermain and sanitary sewer pipes located south of the existing bridge and currently supported by the closed pedestrian bridge. As this work is required regardless of the alternative selected, it has not been discussed in greater detail within this section.

Additionally, the abutments and retaining walls (substructure) are in need of repairs or replacement. Depending on the selected preferred alternative, there are two possible options that could be pursued to address the deteriorated substructure. The options and generic scope of work are as follows:

Replacement of substructure:

- superstructure to be removed
- abutments, footings and close proximity retaining walls to be removed
- construct new footings, abutments and retaining walls
- install new superstructure

Rehabilitation of substructure:

- underpinning of west abutment to repair scour/undermining at upstream end
- localized concrete removal to sound concrete and repair
- localized removal and repair to northwest wingwall

Advantages and disadvantages of each option are described in associated with in the alternatives in the sections below.

6.1.1 Alternative 1: Sympathetic Rehabilitation of the Existing Bridge

Based on the visual structural review completed by GMBP in 2015, a significant rehabilitation effort would be required to repair this structure. Although the bridge once carried vehicle traffic, there are several key structural concerns that would need to be addressed as part of a rehabilitation project to maintain this structure as a pedestrian crossing.

As the steel trusses themselves are designated under the Ontario Heritage Act (2005 as amended), any repairs to the structural steel elements would need to consider the aesthetics of the repairs. Bolts and welding have replaced riveted construction as the preferred construction techniques due to manufacturing consistency, strength, speed and labour required during installation. Restoration using rivets to maintain the same aesthetics as the existing structure would present the same difficulties in planning and executing the work as present with bolting or welding, with the added challenge of using a construction technique that is no longer widely used in bridge and building construction. It is believed that the added costs for a riveted steel rehabilitation project are not warranted to mitigate the nominal change in appearance of the bridge. Therefore, Rehabilitation with riveted construction is not a preferred alternative, and has not been carried forward for analysis.

It is estimated that most repairs could be completed by reinforcing existing members with steel plates, or replacing isolated members with identical steel members. Due to the age of the steel used in the trusses, welding may not be possible to strengthen members that are left in place. Bolts could be use, and could mimic the appearance of rivets, as shown in **Figure 7 and Figure 8** below. This would help to reduce changes in aesthetics to the bridge and soften the appearance of any rehabilitation works; however, this would not address the brittle nature of the existing steel, which is an undesirable property to have in structural design.

Figure 7: As viewed from the surface, bolts used adjacent to existing rivets to mimic the appearance of rivets

Figure 8: As viewed from the opposite side, these bolts resemble a typical threaded bolt and nut assembly

The repairs required to a number of steel elements are difficult to estimate due to the level of corrosion and paint covering most of these elements. Sympathetic rehabilitation would require sandblasting to remove the existing coatings and corroded steel. This would require an environmental containment system to ensure that no deleterious material enters the watercourse below the bridge. Alternatively and likely more cost effective would be to dismantle the bridge, clean, repair and restore in a shop environment and reinstall on site.

For these reasons, rehabilitation works would be difficult to scope. Significant contingencies for both time and schedule would be recommended for construction. As well, rehabilitation in either case would likely require the bridge to be closed for a prolonged duration during construction.

A bridge rehabilitated using these techniques may have a remaining useful life of approximately 15 to 25 years, depending on the scope of rehabilitation.

The substructure would need to be rehabilitated and repaired in order to maintain the ability to support the pony truss bridge and the applied loading by pedestrians and cyclists.

Additionally, the existing structure is unlikely to be able to support pedestrian loads as specified in the current Canadian Highway Bridge Design Code. Similar to road way bridges, a load rating could be applied to the structure however we are unsure how this would be effectively enforced. The MTO enforces vehicular load postings, but for pedestrians, the City's bylaw enforcement department would have to monitor and issue fines to violators. If the occupancy of the bridge exceeds the posting by a certain number of people, determining who is fined and how to enforce the load limit would be difficult if not impossible. Maintenance vehicles could be prevented from crossing the bridge through the use of bollards and signage.

This alternative would require the installation of an alternative structure to support the watermain and sanitary sewer, once the pedestrian footbridge to the south of the Norwich Street bridge was removed.

6.1.2 Alternative 2: Installation of a New Bridge Structure between the Existing Trusses

The Norwich Street bridge crossing would be reconfigured to allow for a new bridge structure to convey pedestrian and cyclist traffic while maintaining the historic steel trusses, but not relying on the steel trusses as load carrying members. Refer to **Figure 9 and Figure 10** below, which show a similar historic steel truss bridge that was retrofitted so that traffic is conveyed on a Fibre Reinforced Polymer (FRP) bridge deck that does not rely on the steel trusses for structural support. An alternative design would be a concrete deck on steel girders that can be economically constructed. In comparison to **Figure 9 and Figure 10**, the deck would not require the tall curbs at the sides with pedestrian hand rails either included on the new deck or the existing structure. The exact structural system used to alleviate the existing bridge from the pedestrian and cyclist loads would be determined in the detailed design phase and would be designed to current standards for pedestrian bridges,

Figure 9: Similar truss bridge with FRP deck, where the steel trusses carry only their own weight

Figure 10: From the sides, the truss structure resembles a normal steel truss bridge

In either case, the existing wood deck and wood stringers would be removed to reduce the weight carried by the steel trusses while providing a cavity to place the new deck support system. The trusses could then be repaired and remain in place as an aesthetic feature supporting only their own self-weight. As the Norwich Bridge is a prominent feature of the area, providing scenic views of the Speed River, a bridge structure with an open barrier system would be most appropriate so that views are not obstructed.

A new bridge structure may need to be founded on a deep foundation system (e.g., caissons, piles) behind the existing abutments. This would alleviate loads on the deteriorating concrete retaining walls that line the Speed River. The foundation system would need to be positioned so that it does not interfere with the foundation system of the retaining walls. Therefore, a structure with a span larger than the existing Norwich Street bridge would be required.

The heritage bridge would be repaired, but not to the full extend as Alternative 1. The substructure would need to be rehabilitated and repaired in order to maintain the ability to support the pony truss bridge. Based on the existing condition of the substructure, we estimate after repairs are completed that the substructure and original bridge would have a remaining useful life of approximately 25 to 35 years.

The new structure placed between the trusses of the existing structure, on new pile foundations, would have a design life of 75 years.

This alternative would require the installation of an alternative structure to support the watermain and sanitary sewer, once the pedestrian footbridge to the south of the Norwich Street bridge was removed.

6.1.3 Alternative 3: Sympathetic Replacement of the Existing Bridge

The Norwich Street bridge would be replaced approximately in its present location. The bridge would be designed to current standards for pedestrian bridges, improving functionality and aesthetics. As the steel trusses are heritage elements, they would be replaced in identical fashion using modern construction techniques. Welding and bolts that mimic rivet connections would be used to maintain the heritage appearance of the structure.

As the City does not wish to re-open this crossing to vehicle traffic, the crossing width could be maintained and the capacity would not need to increase from the current structure. Refer to **Figure 11 and Figure 12** for an example of a steel truss bridge that was replaced in this fashion. Note that the new bridge was designed to carry vehicle traffic to current standards, requiring that the size of some structural elements be increased. For the Norwich Street bridge, the possibility of reducing the size of structural elements may be feasible as the current bridge member sizes are likely larger than those required for pedestrian bridge loading.

Figure 11: Historic steel truss bridge at the end of its useful life requiring replacement

Figure 12: New steel truss bridge constructed with welded connections to mimic previous structure

In order to facilitate a sympathetic replacement, alternatives to expedite the construction schedule could be explored. These could include measuring, fabricating and assembling the new bridge structure in a staging area so that it may be lifted into place once the existing bridge was removed. This would reduce the length of time required for the bridge to be out of service.

Additionally, the substructure would need to be either repaired or replaced. Repairs would be similar to those mentioned in Alternative 1 and would have a remaining service life of approximately 15-25 years. At that point the bridge substructure would likely need to be replaced.

Replacement of the substructure is recommended and full be carried forward as this would allow the span to be increased to move the west abutment outside the banks of the normal flows within the Speed River. Replacement of the substructure and superstructure would combine to extend this crossings remaining useful life to approximately 75.

The existing heritage structure could then be removed, reconditioned and place along a local trail or park for viewing.

This alternative would allow the bridge to be widened or shifted to the south slightly to support the watermain and sanitary sewer, once the pedestrian footbridge to the south of the Norwich Street bridge was removed.

6.1.4 Alternative 4: Bridge Removal (without Replacement)

This alternative would require the City to develop an appropriate bridge removal and pedestrian pathway closure strategy. Repairs to the concrete retaining walls that continue upstream and downstream of the existing bridge would be required. The west substructure could be left in place; however, it constricts the water flow and would be recommended for removal.

As the Norwich Street Pedestrian Bridge is also closed, the removal of the Norwich Street bridge would completely remove pedestrian and cyclist access across the Speed River at this location.

This alternative would require the installation of an alternative structure to support the watermain and sanitary sewer, once the pedestrian footbridge to the south of the Norwich Street bridge was removed.

6.1.5 Alternative 5: Do Nothing

This alternative would see the status quo maintained in the short term; however, the bridge is nearing the end of its service life and, therefore, this alternative would ultimately lead to closure of the Norwich Street bridge. Selection of this alternative would eventually lead to the selection of one of the alternatives described in the subsequent sections.

Although the “Do Nothing” alternative would have no (or low) capital costs in the short-term, this is more accurately portrayed as a ‘deferred cost’ since the bridge would likely need to be closed near future.

This alternative would require the installation of an alternative structure to support the watermain and sanitary sewer, once the pedestrian footbridge to the south of the Norwich Street bridge was removed.

6.2 Summary of Alternatives

A summary of the advantages and disadvantages of the alternatives solutions is provided in **Table 5** below.

Table 5: Summary of Advantages and Disadvantages of Alternative Solutions

Alternative	Advantages	Disadvantages
Alternative 1: Sympathetic Restoration of the Existing Bridge	• Low capital costs in short-term • Low impacts to natural environment • Low impacts to heritage value • No adjustments to existing trail network	• Lower remaining useful life of structure as compared to other alternatives • Requires additional structure to support adjacent utilities • Greater contingencies required during construction leading to the potential for significant cost increases • Existing poor condition substructure remains in place

Alternative	Advantages	Disadvantages
Alternative 2: Installation of a new Bridge Structure between the Existing Trusses	• Low capital costs in long-term • Low impacts to natural environment • Low impacts to heritage value • No adjustments to existing trail network • Extends the life of the heritage structure beyond Alternative 1 as the concern for public safety is removed.	• More expensive than Alternative 1 in short-term • May require alternative materials to the existing wood deck, which may alter the perception of the bridge • Requires additional structure to support adjacent utilities • Would require a new foundation system to support the new structure • Existing poor condition substructure remains in place
Alternative 3: Sympathetic Replacement of the Existing Bridge	• Improvements to safety can be easily made • Allows for slight realignments so that adjacent utilities can be supported by new structure • Opportunity to incorporate design improvements to the bridge • Existing structure can be removed and displayed elsewhere for viewing • New structure could be built in staging area and lifted into place for reduce construction duration • Provides opportunity to move west abutment outside of normal flows/high water mark removing river constriction	• Highest capital cost in short-term • Completely removes existing heritage structure from location • Long-term closure during construction required • Greatest potential for overhead utility conflicts during construction • Would likely require a Stage 2 Archeological Assessment
Alternative 4 – Bridge Removal (without Replacement)	• Low capital costs in short and long-term • Removes safety issue due to deteriorated bridge condition • Existing structure can be removed and displayed elsewhere	• Severs a highly utilized pedestrian link across the Speed River • Completely removes existing heritage structure from location • Requires additional structure to support adjacent utilities
Alternative 5 – Do Nothing	• Lowest capital costs in short and long-term	• Leads to one of the above alternatives in the next 1-10 years depending on future structural inspections and rate of deterioration of bridge condition

6.3 Preliminary Costs

Preliminary cost estimates were prepared for the capital works associated with each alternative. Maintenance costs have not been included; however, maintenance costs for a rehabilitated structure would be substantially more than those required for a new bridge structure, or for the option where a new structure is installed between the existing steel trusses.

Preliminary capital cost estimates have been summarized in **Table 6** below. These costs also do not include other expenses (property, engineering, contingencies, utility relocation, HST, etc.).

Capital costs for Alternative 5 reflect the deferred costs associated with a "do nothing" approach. Eventually, the bridge would require closure under this Alternative, at which time the City would need to decide how to proceed, likely with one of the other alternatives being considered.

Table 6: Preliminary Capital Cost Estimates

Alternative	Capital Cost
Alternative 1: Sympathetic Restoration of the Existing Bridge	$ 700,000
Alternative 2: Installation of a new Bridge Structure between the Existing Trusses	$ 775,000
Alternative 3: Sympathetic Replacement of the Existing Bridge	$ 1,200,000
Alternative 4: Bridge Removal (without Replacement)	$ 3250,000
Alternative 5: Do Nothing (Close Bridge)	$ 550,000

Note: the above cost estimates contain an allowance for approximately 10% contingency, but do not account for engineering design, construction inspection, or taxes.

6.4 Assessment and Evaluation of Alternatives

The selection process for the Preferred Alternative Solution involves two steps: Assessment of Alternatives (Step 1) and Evaluation of Alternatives (Step 2). These steps are described below, with the results provided in **Table 7**.

Alternatives 4 and 5 do not address the requirements or objectives of the City and are strongly opposed by the public and other stakeholders. Therefore, these alternatives have been screened out and removed from further consideration for the comparative assessment and evaluation.

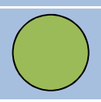
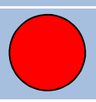
6.4.1 Assessment of Alternatives

The potential benefits and impacts of each alternative are assessed against social, cultural, natural, technical and economic factors. The assessment is based on the existing environmental conditions compiled through field visits and secondary source information, as summarized in **Section 4**. The preliminary assessment was made available to stakeholders in March 2017 for review and comment.

6.4.2 Evaluation of Alternatives

A comparative examination of the advantages and disadvantages of the alternatives was completed based on the assessment. The evaluation was carried out using the Reasoned Argument method, comparing differences in impacts and providing a clear rationale for the selection of the preferred alternative.

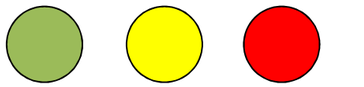
Table 7: Assessment and Evaluation of Alternative Solutions

Factor/Criteria	Alternative 1 Sympathetic Restoration of the Existing Bridge	Alternative 2 Installation of a new Bridge Structure between the Existing Trusses	Alternative 3 Sympathetic Replacement of the Existing Bridge
Socio-Economic Environment • **Property Impacts** • **Impacts to Businesses and Adjacent Land Uses** • **Community Connectivity and Mobility including Cyclist/Pedestrian Movement** • **Visual Impacts** • **Public Safety**	• No property acquisitions required. • Longer-duration closure for construction requiring more pedestrian and cyclist traffic movements to Eramosa Road bridge, which is less pedestrian and cyclist friendly. • Maintains the existing crossing as a connecting link between the adjacent neighbourhood and downtown. • Maintains travelled width of current structure. • No impacts to adjacent property or businesses upon completion of construction. • Major restorations would primarily take place below the bridge deck, minimizing aesthetic changes that are visible. • Greater likelihood of additional closures in the near future for additional repairs to the bridge.	• No property acquisitions required. • Moderate-duration closure for construction requiring more pedestrian and cyclist traffic movements to Eramosa Road bridge, which is less pedestrian and cyclist friendly. • Maintains the existing crossing as a connecting link between the adjacent neighbourhood and downtown. • May narrow the travelled width on new structure. • No impacts to adjacent property or businesses upon completion of construction. • Maintains existing bridge trusses as architectural feature with moderate restoration. • Appearance of bridge would change with addition of new structure between trusses. • Minor vertical adjustments would be required to the trail network at the approaches to the bridge.	• No property acquisitions required. • Could require a shorter-duration closure if new structure is constructed in a staging area reducing pedestrian and cyclist traffic detours to Eramosa Road bridge, which is less pedestrian and cyclist friendly. • Extended closure would occur if abutments where reconstructed. • Maintains the existing crossing as a connecting link between the adjacent neighbourhood and downtown. • Opportunities to widen the travelled width of the structure can be explored. • Views of river and surrounding area could be enhanced as a part of the replacement. • No impacts to adjacent property or businesses upon completion of construction. • Look of new structure could be significantly different from existing.
			
Cultural Environment • **Built Heritage** • **Archaeological Potential**	• Retains bridge structure elements that are deemed to have heritage value. • Major restoration works on heritage elements would need to be reviewed to ensure they are consistent with the heritage construction style. • No anticipated impacts to areas with archaeological potential.	• Retains bridge structure elements that are deemed to have heritage value. • Moderate structural repairs to heritage elements required to extend life of structure. • No anticipated impacts to areas with archaeological potential.	• Results in the removal of the bridge trusses that are deemed to have heritage value. • Heritage elements could be salvaged for incorporation into the new structure or to be put on display at another location. • A Stage 2 Archaeological Assessment would be required to extend the west bridge abutment outside of the watercourse.
			

Factor/Criteria	Alternative 1 Sympathetic Restoration of the Existing Bridge	Alternative 2 Installation of a new Bridge Structure between the Existing Trusses	Alternative 3 Sympathetic Replacement of the Existing Bridge
Natural Environment • **Aquatic Habitat and Fish Passage** • **Vegetation** • **Wildlife and Habitat** • **Species at Risk**	• Minor clearing of vegetation in vicinity of structure is required to facilitate works. • No permanent changes to in-water footprint or changes to fish passage, though some temporary works may be required during construction. • Although no nests were observed, the existing structure could be a potential nesting area for birds if rehabilitated.	• Minor clearing of vegetation in vicinity of structure is required to facilitate works. • No permanent changes to in-water footprint or changes to fish passage, though some temporary works may be required during construction. • Although no nests were observed, the existing structure could be a potential nesting area for birds if rehabilitated.	• Minor clearing of vegetation in vicinity of structure is required to facilitate works. • No permanent changes to in-water footprint or changes to fish passage, though some temporary works may be required during construction. • Although no nests were observed, the new structure may provide potential nesting areas for birds. • Replacement of abutments and footings would have short term impacts to the river. • Opportunities to improve hydraulic characteristics by increasing structure span.
			
Technical Environment • **Design Standards** • **Utilities** • **Constructability** • **Geometry**	• Rehabilitation may not be able to resolve all structural issues with bridge such as the pin connections, bearings and structural capacity issues. • Salting of the bridge during winter months will continue to deteriorate steel elements and cause coating failure. • Minimal opportunity for design improvements to railings, deck and approaches. • Minimal impacts to existing utilities assuming the structure is repaired in place. • An additional structure is required to support the water and sanitary utilities south of the bridge. • Additional strengthening is required to meet current design standards for pedestrian bridge loading.	• Trusses would no longer support pedestrian loads, which would increase their useful life. • Existing deck is near the end of its useful life, so its removal is at an opportune time. • Coordination with Guelph Hydro for use of a crane on site would likely be required. • Independent foundations may be required beyond the existing concrete abutments, so superficial/preventative repairs to the existing abutments and channel walls may be explored. • An additional structure is required to support the water and sanitary utilities south of the bridge. • New structure can be designed to current standards for pedestrian bridge loading.	• New structure would be designed to current code standards. • Full replacement of substructure may be required. • Coordination with Guelph Hydro for use of a crane on site would likely be required. • Opportunities to support the adjacent water and sanitary utilities from the new structure could be explored. • New structure can be designed to current standards for pedestrian bridge loading. • The adjacent utilities could potentially be supported from the new structure, which would improve site lines and views of the downstream watercourse.
			

Factor/Criteria	Alternative 1 Sympathetic Restoration of the Existing Bridge	Alternative 2 Installation of a new Bridge Structure between the Existing Trusses	Alternative 3 Sympathetic Replacement of the Existing Bridge
Economic Considerations • **Capital and Life Cycle Costs** • **Structure Longevity**	• Capital Cost = $ 700,000 • Maintenance costs would initially be moderate and increase significantly over time as other structural members continue to deteriorate. • Lowest immediate capital cost delaying substructure and super structure replacement. • Next major rehabilitation or replacement anticipated in 15 to 25 years (estimated remaining service life).	• Capital Cost = $ 775,000 • Maintenance costs would be minimal in the short-term and gradually increase over time (if timber components are utilized) or remain relatively constant until first significant repair in 30-50 years. • Remaining useful life of structure depends on repairing abutments and preventing further deterioration. • Estimated useful life of new superstructure would be 75 years. • Substructure and heritage structure would likely require additional repairs or complete replacement in the next 25 -35 years.	• Capital Cost = $ 1,200,000 • Largest capital cost in the short term, but provides opportunity for maximized design life. • Maintenance costs would be minimal in the short-term and gradually increase over time (if timber components are utilized) or remain relatively constant until first significant repair in 30-50 years. • Has the highest capital cost, however next major rehabilitation would be estimated in 50 years.
			
CONCLUSION			
		Alternative 2 is the most preferred alternative.	

Evaluation Legend:



7. RECOMMENDED ALTERNATIVE

7.1 Description of Recommended Alternative

Based on the Assessment and Evaluation of Alternatives presented in **Section 5**, the preferred solution recommended for approval by Council is Alternative 2: Installation of a New Bridge Structure between the Existing Trusses. High level drawings of the existing structure and Alternative 2 can be found in **Appendix J**.

This alternative offers the City the best opportunity to maintain the existing trusses as it preserves them in place as primarily an aesthetic feature. By installing a self-supporting structure, the existing trusses and supporting structure would only be required to carry their own weight, which represents a significant reduction in total load to be carried by the elements. The new structure would be able to provide a safe crossing over the Speed River and be designed to better accommodate drainage, salting and sanding of the deck and pedestrian barriers.

The bridge structure should be designed as a pedestrian crossing, designed for pedestrian and maintenance vehicle loading as well as appropriate deflection limits as per CSA S6-14 (the Canadian Highway Bridge Design Code) and the MTO's Structural Manual. The City has expressed the desire to maintain this structure only as a pedestrian crossing. Therefore, there is no need to provide any allowances for highway traffic loading of the Canadian Highway Bridge Design Code.

The existing watermain and sanitary sewer located south of the existing trusses are currently supported by the Norwich Street pedestrian bridge, which is currently closed. This bridge structure should be removed and replaced with a structure to support the watermain and sanitary sewer pipes. Appropriate fencing and signage will need to be provided to prohibit public access to the structure.

7.2 Environment Impacts and Mitigation Measures

7.2.1 Socio-Economic Environment Impacts and Mitigation

During construction of the new bridge structure, the pedestrian and cyclist path will be closed to traffic. Given the nature of the existing structure and proposed works and the tight corridor, there do not appear to be any efficient opportunities to stage construction so that pedestrians and cyclists can continue to use the crossing. A new pedestrian bridge may be able to be lifted into place to replace the existing closed bridge, however this would add significant cost, additional construction duration, and would still need to be closed during various tasks within construction to ensure public safety.

During construction, consultation and coordination with GJR regarding staging areas and construction equipment access on the west banks of the Speed River is required. Any staging that occurs on the east side of the Speed River will need to ensure that access to the parking lot on the north side of Norwich Street East is maintained.

The design for the Recommended Alternative should provide for enhanced views of the Speed River. Consideration for additional commemorative opportunities to highlight the history of the crossing should be given. The addition of lighting to the bridge and along pedestrian path to the trails to the west was commented on numerous times by the public and should also be assessed for inclusion in the detailed design.

Should pedestrian access not be provided across the speed river at this location, considerations will also need to be given to those residents/businesses that use the parking lot on the northeast of the bridge, however reside in the west side of the river. The City should consider issuing 24 hour, 7 day a week parking permits to allow those who have parking passes for the Norwich Street East parking lot to park along Cardigan Street during construction.

Based on the activities described in the "Tables of Drinking Water Threats" under the Clean Water Act (CWA, 2006), we do not foresee any activities during construction that would pose a risk to drinking water; however, this would need to be reviewed prior to construction as part of the design process. Mitigation measures to limit fuel storage and

refueling should form part of the design process to be followed during construction. Once construction is complete, the City should review the application of road salt on the bridge.

7.2.2 Cultural Environment Impacts and Mitigation

Repairs to the existing trusses shall be designed to mimic the style of the heritage features where possible. Efforts should be made during the design phase to limit shadowing of these elements.

A permit will need to be obtain to allow any modification to the existing bridge.

There are areas of archaeological potential within the Study Area. This area should not be disturbed when planning the detailed design and construction of the Recommended Alternative without a Stage 2 Archaeological Assessment being completed.

7.2.3 Natural Environment Impacts and Mitigation

Water Processes

Based on the proposed construction activities for the Recommended Alternative, there is very low potential for impacts to groundwater. Minor works in the water will be required to complete abutment repairs and underpinning of footings. Therefore, impacts to surface water expected to be minimal.

Trees

A total of 44 trees were identified within 30 m of the Norwich Street bridge. Trees within 30 m of the proposed works have the potential to be injured or destroyed as part of construction activities. During detailed design, a Tree Preservation and Compensation plan should be completed to provide recommendations on preservation or removal and to prescribe protection measures for retained trees. While Manitoba Maple provides some value as overhanging riparian vegetation along the Speed River, the removal of Manitoba Maple from within the area of impact combined with compensation of native, non-invasive trees is considered a net benefit to the tree community. Compensation for tree removal should occur at a rate of 3:1 in accordance with City policies or as determined through consultation with City Planning staff and the GRCA.

Aquatic Habitat & Fish Passage

The Speed River in the Study Area is classified as coolwater fish habitat. Impacts to aquatic habitat could include sedimentation from construction, construction below the high water mark, impacts to fish habitat and water quality changes due to pedestrian bridge maintenance. The flow and characteristics of the watercourse will not be altered by the proposed works. The removal of invasive species and restoration of riparian habitat, where possible, along the Speed River would serve to improve fish habitat by providing cover within this reach of the Speed River, and would be an overall benefit.

Vegetation

The majority of the herbaceous vegetation to be removed consists of non-native and weedy species. Removal of invasive species and restoration of riparian areas would provide an overall benefit to vegetation in the area of the pedestrian bridges.

Significant Wildlife Habitat

The Speed River is identified as a Waterfowl Overwintering area. Species that have been observed in the river, and adjacent riparian area, include Mallard and Canada Goose. Both species are considered tolerant to humans, and development disturbance in the short term. The proposed works are unlikely to permanently impact this habitat due to the presence of the existing structure.

Species at Risk

No species at risk listed as threatened or endangered or their regulated habitat were identified in the Study Area. The addition of pedestrian bridges may convey a benefit to Barn Swallow, by providing suitable nesting habitat below the pedestrian bridges.

Wildlife & Wildlife Habitat

Potential wildlife impacts generally include the potential to harm or harass migratory birds during the migratory bird nesting season and wandering wildlife within the construction area. Recommended mitigation for these impacts include the avoidance of any clearing or grading during the general nesting season (April 1-August 31) where possible, and the clear delineation of the work space through the installation of silt and sediment and tree protection fencing to avoid potential entry by wandering wildlife. Benefits to wildlife include the addition of the bridges, which may provide nesting habitat for birds that nest on man-made structures (e.g., Barn Swallow, Northern Rough-winged Swallow).

In advance of construction, a bird survey should be completed to determine if birds are nesting in or around the structure.

Significant Valleylands:

Valleylands occur to either side of the Speed River. Impacts to valleylands include the potential for increased erosion on slopes adjacent to the Speed River during construction, impacts to unstable landforms and potential loss of stabilizing roots from trees that may require removal. The restoration of riparian vegetation after construction may provide a benefit to valleylands through the installation of vegetation to provide greater slope stabilization.

Restoration, Compensation and Invasive Species Management Strategy

A comprehensive restoration, compensation and invasive species mitigation strategy should be developed as part of the detailed design and implementation of the Recommended Alternative. This will inform the design process to re-establish native vegetation communities along the Speed River within the Study Area following construction, and limit the likelihood of invasive species becoming dominant within the newly disturbed areas.

7.2.4 Technical Environment Impacts and Mitigation

The new bridge structure will need to maintain the existing hydraulic characteristics of the Speed River. Use of an open-style pedestrian barrier system and maintaining an overall deck thickness of approximately 0.5 metres would be recommended. Significant variations from these specifications would need to be confirmed during detailed design.

It is likely that the new deck structure would be installed with a crane. Coordination with Guelph Hydro and telecommunications companies in the area will be required. It is likely that power can be isolated within the Study Area limits to allow for safe installation of elements.

The new foundation system for the proposed bridge deck will need to consider the extents of the existing abutment walls and foundations. Subsurface investigations using hydro-vac excavations may be appropriate during the preliminary design stage.

To minimize maintenance costs for the new structure, considerations should be given to integral or semi-integral abutment designs to eliminate expansion joints. Expansion joints are easily clogged with debris, often are not properly maintained and require replacement every 15-20 years.

Efforts should be made to control surface runoff from the bridge so that water does not discharge directly into the Speed River. Considerations for curbing, sewers and/or discharge to vegetated areas should be given during the design phases of the project.

As the heritage trusses would no longer support live loads, and the total dead load they support would be greatly reduced, it is expected that repairs to these elements not be as intensive as a complete rehabilitation. Considerations for stability of the trusses should be given in the construction of the new bridge deck.

7.3 Additional Recommendations

The following are additional recommendations to be considered by the City:

- The City should develop a maintenance plan for the bridge, which includes mitigating impacts to the natural environment.
- Considerations will need to be made for how to support the water and sanitary sewer utilities south of the Norwich Street bridge.
    - The support structure should not be accessible by the public.
    - The structure should be designed to minimize viewing obstructions.
    - Alternatively, it should be reviewed whether the utilities can be relocated to underneath the Norwich Street bridge.
- Any restoration works to the trusses or name plates of the Norwich Street bridge will require a heritage permit from the City of Guelph / under the Ontario Heritage Act.
- The City should clarify the extent of repairs to the retaining walls that line the Speed River for detailed design and construction.

8. NEXT STEPS

The following steps are recommended following completion of the Class EA study:

- Implementation details including detailed design, agency approvals and tendering of the project for construction.
- Coordination with utilities to locate services as well as develop and implement mitigation measures (i.e., protection of existing utilities, temporary utilities during construction, etc.)
- Construction.